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(54) **AN OUTBOARD MOUNTING ASSEMBLY AND A TRANSOM ARRANGEMENT COMPRISING SAID OUTBOARD MOUNTING ASSEMBLY**

(57) A transom arrangement comprising an outboard engine arrangement provided with an electric motor having an output shaft for outboard propulsion, and comprising an outboard mounting assembly for mounting the outboard engine arrangement to a transom of a boat. The outboard mounting assembly comprises a mounting bracket having at least one upper arm comprising an upper mounting point connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement, and at least one lower arm comprising a lower mounting point connected to a forward side of the outboard engine arrangement in front of the center of gravity. A steering stability line defined by a line through the upper mounting point and the lower mounting point may be slanted rearwards. A center of pressure may be situated rearward of the steering stability line and may be situated horizontally between the mounting points.

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Description

[0001] The invention relates to an outboard mounting assembly and a transom arrangement comprising said outboard mounting assembly.

[0002] Outboard motors are widely known for propulsion of boats in fresh or offshore waters. Traditionally, combustion type engines are used. More recently, electric motors are applied in outboard engine arrangements, e.g. driven by increasing performance of rechargeable batteries and other electric storage devices such as fuel cells, as well as by environmental needs. In a traditional outboard engine arrangement setup, the engine is on top of the assembly, whilst a propeller is at the bottom. In use, said propeller, driven by the engine, may generate a thrust or force in a propulsion direction. To mount these outboard motors to the transom of a boat, outboard mounting assemblies are used. These outboard mounting assembles need to securely fasten the outboard motor to the transom, while at the same time provide movability to the outboard motor, to allow for steering the boat. With particular regard to high-power outboard motors (such as higher than 100 kW), stability is one of the most important aspects of an outboard mounting assembly.

[0003] Therefore, it is an aim of the present invention to minimize, solve or alleviate one or more of the abovementioned disadvantages. In particular, the invention aims at providing an outboard mounting assembly having improved stability properties.

[0004] Thereto, according to an aspect of the invention, an outboard mounting assembly for mounting an outboard engine arrangement to a transom of a boat according to claim 1 is provided. The outboard mounting assembly may be configured to cooperate with an outboard engine arrangement provided with an electric motor having an output shaft for output propulsion. The outboard mounting assembly comprises a mounting bracket having at least one upper arm comprising an upper mounting point, which, in use, is connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement, and at least one lower arm comprising a lower mounting point, which, in use, is connected to a forward side of the outboard engine arrangement in front of the center of gravity.

[0005] According to another aspect of the invention, a transom arrangement according to claim 2 is provided. The transom arrangement may comprise an outboard engine arrangement provided with an electric motor having an output shaft for outboard propulsion, and comprising an outboard mounting assembly for mounting the outboard engine arrangement to a transom of a boat. The outboard mounting assembly comprises a mounting bracket having at least one upper arm comprising an upper mounting point connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement, and at least one lower arm comprising a lower mounting point connected to a forward side of the outboard engine arrangement in front of the center of gravity.

[0006] Within a traditional setup, the upper mounting point will be closer to the electric motor and may thus be carrying the bulk of the weight of the outboard engine arrangement. The lower mounting point will be closer to the propeller providing the forward thrust. This means that the lower mounting point may transfer the bulk of the forward oriented force of the outboard engine arrangement to the boat. Generally, a traditional outboard engine arrangement is provided with a steering axis between the outboard engine arrangement and the boat to which the outboard engine arrangement is connected. The steering axis provides the ability to steer, but in combination with the applied forward thrust, the outboard engine arrangement has the tendency to twist around the steering axis, making the setup more instable.

[0007] By providing a mounting bracket, the lower mounting point will be closer to the boat and may thus be closer to a steering axis. Since most force to the boat may be transferred via this lower mounting point, the proximity of this mounting point to the steering axis means that the moment or torque in a horizontal plane on the outboard engine arrangement will be smaller. This will mitigate the twisting of the outboard engine arrangement around the steering axis. In addition to that, the use of such a mounting bracket places the upper mounting mount further from the steering axis than the lower mounting point. Since this upper mounting point may transfer little forward thrust to the boat, the upper mounting point does not cause the outboard engine arrangement to twist. Instead the forces applied by the bracket to the outboard engine arrangement may be used to stabilize the outboard engine arrangement, that is to say to resist twisting. Because of the longer distance to the steering axis as opposed to the lower mounting point, less force is needed by the upper mounting point to provide sufficient moment or torque to ensure said stability. In short, the lower mounting point is used for transferring the forward force or thrust to the boat, while the upper mounting point is used to stabilize the outboard engine arrangement against twisting around the steering axis.

[0008] The twisting of the outboard engine arrangement about the steering axis may be exacerbated by a moment or torque in the propulsion direction caused by the weight of the outboard mounting assembly. But since the upper mounting point and the lower mounting point are on opposite sides of the outboard engine arrangement, the outboard mounting assembly will prevent the outboard engine arrangement from exerting any such moment or torque in the propulsion direction. This also increases the stability of the outboard mounting assembly.

[0009] Further, a transom arrangement or outboard mounting assembly according to claim 3 may be provided. The outboard engine arrangement may comprise an adapter plate for supporting the electric motor, wherein the upper mounting point is connected to the adapter

plate. The adapter plate may support the electric motor and an invertor for driving the electric motor and because of that may carry the majority of the weight of the outboard engine arrangement.

[0010] Also, a transom arrangement or outboard mounting assembly according to claim 4 may be provided. The outboard engine arrangement may comprise a drive shaft coupled to the output shaft of the electric motor and a shaft housing for accommodating the drive shaft, wherein the lower mounting point, in use, is connected to the shaft housing. The outboard engine arrangement may further comprise splined coupler (which can be straight) coupling the drive shaft to the output shaft of the electric motor. The drive shaft may form the mechanical connection between the electric motor and a propeller for outboard propulsion.

[0011] Further, a transom arrangement or outboard mounting assembly according to claim 5 may be provided. The outboard mounting assembly may comprise an upper motor mount connecting the at least one upper arm at its upper mounting point to the outboard engine arrangement, wherein the upper motor mount has a pressure surface which, in use, contacts the upper mounting point of the at least one upper arm and is substantially vertical and parallel to a propulsion direction of the outboard engine arrangement. The upper motor mount, e.g. as specified in claim 6, may comprise an elastic buffer, e.g. a rubber buffer, between the outboard engine arrangement and the upper mounting point of the at least one upper arm; in some cases, the buffer is configured to dampen vibrations in a direction parallel to the pressure surface. The pressure surface of the upper motor mount may provide a steering moment or torque to the outboard engine arrangement. Since the upper motor mount is further away from the boat than the lower motor mount, the upper motor mount is more suitable for providing such a steering moment. The vibrations are dampened in a plane parallel to the pressure surface, that is, in the propulsion direction and in the vertical direction.

[0012] Also, a transom arrangement or outboard mounting assembly according to claim 7 may be provided. The outboard mounting assembly may comprise a lower motor mount connecting the at least one lower arm at its lower mounting point to the outboard engine arrangement. To enhance steering stability when operating the outboard engine arrangement mounted on a boat, the lower motor mount might have a pressure surface which, in use, contacts the lower mounting point of the at least one lower arm and is substantially perpendicular to a propulsion direction of the outboard engine arrangement. The pressure surface may enhance steering stability when the outboard engine arrangement is mounted on a boat and operated. As said before, in a traditional outboard motor setup, the lower motor mount may transfer the bulk of the forward oriented force of the outboard engine arrangement to the boat. By having the pressure surface of the lower motor mount perpendicular to the propulsion direction, the best power transfer between motor mount and mounting bracket is achieved.

[0013] Further, a transom arrangement or outboard mounting assembly according to claim 8 may be provided. The outboard mounting assembly may comprise a steering shaft housing and a steering shaft rotatable within the steering shaft housing and around a steering axis; in some embodiments the mounting bracket is connected to the steering shaft. The outboard mounting assembly may further comprise a transom plate configured to be mounted on the transom of the boat, and/or to a jack plate on the transom of the boat; in some cases, the steering shaft housing might be fixedly connected to the transom plate. The outboard mounting assembly may further comprise a steering head fixedly connected to the steering shaft and extending at least radially away from the steering axis, and/or a steering cylinder assembly connected to the steering head and configured to move the steering head. The steering cylinder assembly may comprise a steering cylinder connected to the steering head and a motor connected to the steering cylinder for rotating said steering cylinder. When the steering shaft rotates within the steering shaft housing, the mounting bracket and thus the outboard engine arrangement also rotates, providing the ability to steer the boat. The rotation may be effected by rotating the steering head.

[0014] Also, a transom arrangement or outboard mounting assembly according to claim 9 may be provided. The outboard mounting assembly may further comprises a tilt/trim unit comprising a tilt/trim shaft and a tilt/trim sleeve connected to the mounting bracket and being rotatable around the tilt/trim shaft and a tilt/trim axis, wherein the tilt/trim unit is configured to keep the outboard engine arrangement at a constant or stable angle with the horizontal while boating, e.g. in an upright position.

[0015] In some cases, the tilt/trim sleeve may be embodied as a socket integrated with the mounting bracket and/or may otherwise be integrated with the mounting bracket. A bushing may be provided between the tilt/trim sleeve and the steering shaft. In operation, e.g. as specified in claim 10, the tilt/trim sleeve may be placed at a lower level than the upper mounting point of the at least one upper arm, and the difference between a height of the tilt/trim shaft and a height of the upper mounting point of the at least one upper arm may be less than 100 mm, less than 70 mm, and/or less than 50 mm.

[0016] In certain embodiments, e.g. as specified in claim 11, the tilt/trim shaft may be fixedly connected to a first end of the steering shaft, and the tilt/trim unit may further comprise at least one tilt/trim cylinder connecting a second end of the steering shaft to the outboard engine arrangement. The steering shaft may comprise a cross member at or near its second end, and the at least one tilt/trim cylinder may connect the cross member to the mounting bracket. The tilt/trim unit may further comprise a controller configured to control the at least one tilt/trim cylinder such that the outboard engine arrangement is kept at a constant angle with the horizontal while boating.

[0017] Also, a transom arrangement or outboard mounting assembly according to claim 12 may be provided. The mounting bracket may be such that, a steering stability line defined by a line through the upper mounting point and the lower mounting point is slanted rearwards. A center of pressure of the outboard engine arrangement may be situated rearward of the steering stability line. The center of pressure may be defined by a point where the total sum of force vectors acting on the outboard engine arrangement, The center of pressure may be situated horizontally between the upper mounting point and the lower mounting point. In use, a distance in a horizontal plane between the steering stability line and the center of pressure may be between 100 and 500 mm, e.g. as specified in claim 13.

[0018] By having the center of pressure rearward of the steering stability line and horizontally between the upper and lower mounting points, the stability of the outboard mounting assembly is improved. The more distance between the center of pressure and the steering stability line, the more stable the outboard mounting assembly will be.

[0019] The mounting bracket may be produced by any suitable method using any suitable material, including without limitation sand or die cast, e.g., from an alloy comprising aluminum. Such a cast may be economically and reliably manufactured, also in larger quantities. Aluminum is a lightweight though strong metal, ideally suited for supporting the outboard engine arrangement.

[0020] Also, a transom arrangement or outboard mounting assembly according to claim 14 may be provided. The at least one upper arm may comprise a first upper arm and a second upper arm; in some cases, the first and the second upper arms extend around the outboard engine arrangement on opposite sides. The at least one lower arm may comprise a first lower arm and a second lower arm; in some cases e.g. as specified in claim 15, the first and the second lower arms are arranged on opposite sides of the outboard engine arrangement. The mounting bracket may further comprise a cross beam connecting the first upper arm with the second upper arm and/or the first lower arm with the second lower arm. The cross beam may, at least partially, be situated above the steering shaft housing.

[0021] Further advantageous embodiments according to the invention are described in the following claims.

[0022] It should be noted that the technical features described above or below may each on its own be embodied in a transom arrangement or outboard mounting assembly, i.e. isolated from the context in which it is described, separate from other features, or in combination with only a number of the other features described in the context in which it is disclosed. Each of these features may further be combined with any other feature disclosed, in any combination.

[0023] The invention will be further elucidated on the basis of exemplary embodiments which are represented in the drawings. The exemplary embodiments are given by way of non-limitative illustration of the invention. In the drawings:

Fig. 1 shows a schematic side view of an example of a transom arrangement and an outboard mounting assembly according to an aspect;
Fig. 2 shows a cross-sectional view along line II-II in in Fig. 1;
Fig. 3 shows a side view in the direction of arrow III of the example of the outboard mounting assembly of Fig. 2, without the outboard engine arrangement.

[0024] In the figures identical or corresponding parts are represented with the same reference numerals. The drawings are only schematic representations of embodiments of some embodiments, which are given by manner of non-limited examples.

[0025] Figure 1 shows a schematic side view of an example of a transom arrangement and an outboard mounting assembly 1 according to an aspect. The transom arrangement comprises an outboard engine arrangement 2 and the outboard mounting assembly 1 for mounting the outboard engine arrangement 2 to a transom of a boat. The outboard engine arrangement 2 is provided with an electric motor 10 having an output shaft 12 for outboard propulsion. The outboard mounting assembly 1 is configured to cooperate with the outboard engine arrangement 2. The outboard mounting assembly 1 comprises a mounting bracket 14 having at least one upper arm 16, 17 comprising an upper mounting point 18 connected to a rearward side of the outboard engine arrangement 2 behind a center of gravity of the outboard engine arrangement 2, and at least one lower arm 20, 21 comprising a lower mounting point 22 connected to a forward side of the outboard engine arrangement 2 in front of the center of gravity.

[0026] Figure 2 shows the example of figure 1 in a cross-sectional view along line II-II in in Fig. 1.

[0027] Fig. 3 shows a side view in the direction of arrow III of the example of the outboard mounting assembly 1 of Fig. 2, without the outboard engine arrangement 2.

[0028] Certain characteristics of the transom arrangement and outboard mounting assembly 1 have been described above, and the examples illustrated in the drawings and described herein can provide some or all of those characteristics.

[0029] In the illustrated example, the outboard engine arrangement 2 further comprises an adapter plate 24 for supporting the electric motor 10; as illustrated, the upper mounting point 18 is connected to the adapter plate 24. The adapter plate 24 supports the electric motor 10 and may support an invertor for driving the electric motor 10. Because of that, the adapter plate 24 may carry the majority of the weight of the outboard engine arrangement 2. Since the outboard engine arrangement 2 comprises an electric motor 10, different parts are needed as compared to a combustion engine. The adapter plate 24 may support all these needed parts. This clears the space

below the adapter plate and makes it possible for the upper arm 16, 17 to reach the adapter plate 24 at the rearward side of the outboard engine arrangement 2.

[0030] The outboard engine arrangement 2 further comprises a drive shaft 26 coupled to the output shaft 12 of the electric motor 10 and a shaft housing 28 for accommodating the drive shaft 26; in the illustrated embodiment the lower mounting point 22, in use, is connected to the shaft housing 28. The outboard engine arrangement 2 further comprises a splined coupler (which can be straight) coupling the drive shaft 26 to the output shaft 12 of the electric motor 10. The splined coupler is put around both the output shaft 12 and the drive shaft 26 as a sleeve, thus providing a mechanical connection between both shafts 12, 26. The drive shaft 26 may form the mechanical connection between the electric motor 10 and a propeller for outboard propulsion.

[0031] The outboard mounting assembly 1 comprises an upper motor mount 30 connecting the at least one upper arm 16, 17 at its upper mounting point 18 to the outboard engine arrangement 2, wherein the upper motor mount 30 has a pressure surface 32 which, in use, contacts the upper mounting point 18 of each of the at least one upper arm 16, 17 and is substantially vertical and parallel to a propulsion direction of the outboard engine arrangement 2. The upper motor mount 30 comprises an elastic buffer, e.g. a rubber buffer 34, between the outboard engine arrangement 2 and the upper mounting point 18 of the at least one upper arm 16, 17, wherein the buffer is configured to dampen vibrations in a direction parallel to the pressure surface 32. Said direction may also be substantially vertical. As shown in figure 2, the rubber buffer 34 is a tubular rubber element. On a radial inner side of the tubular rubber buffer is a threaded tube, which is bolted to the mounting bracket 14. On the radial outer side of the tubular rubber buffer 34 is an upper mount housing, which is bolted to the adapter plate 26. The pressure surface 32 of the upper motor mount 30 may provide a steering moment or torque to the outboard engine arrangement 2. Since the upper motor mount 30 is further away from the boat than the lower motor mount 36, the upper motor mount 30 is more suitable for providing such a steering moment. The vibrations are dampened in a plane parallel to the pressure surface 34, that is, in the propulsion direction and in the vertical direction.

[0032] The outboard mounting assembly 1 comprises a lower motor mount 36 connecting each of the at least one lower arm 20, 21 at its lower mounting point 22 to the outboard engine arrangement 2; To enhance steering stability when operating the outboard engine arrangement 2 mounted on a boat, the lower motor mount 36 has a pressure surface 38 which, in use, contacts the lower mounting point 22 of each of the at least one lower arm 20, 21 and is substantially perpendicular to a propulsion direction of the outboard engine arrangement 2. As noted, the lower motor mount 36 may transfer the bulk of the forward oriented force of the outboard engine arrangement 2 to the boat. Disposing the pressure surface 38 of the lower motor mount 36 perpendicular to the propulsion direction enhances the power transfer between lower motor mount 36 and mounting bracket 14.

[0033] The outboard mounting assembly 1 further comprises a steering shaft housing 40 and a steering shaft 42 rotatable within the steering shaft housing 40 and around a steering axis 44; in some cases, the mounting bracket 14 is connected to the steering shaft 42. The outboard mounting assembly 1 further comprises a transom plate 46 configured to be mounted on the transom of the boat, or to a jack plate on the transom of the boat. The steering shaft housing 40 can be is fixedly connected to the transom plate 46. The outboard mounting assembly 1 further comprises a steering head 48 fixedly connected to the steering shaft 42 and extending at least radially away from the steering axis 44. By rotating the steering shaft 42 within the steering shaft housing 40, the mounting bracket 14 and thus the outboard engine arrangement 2 may also rotate. This will provide the ability to steer the boat by rotating the outboard engine arrangement 2 with respect to the transom of the boat. The rotation may be effected by rotating the steering head 48 around the steering axis 44

[0034] The outboard mounting assembly 1 may further comprise a steering cylinder assembly connected to the steering head 48 and configured to rotate the steering head 48. The steering cylinder assembly may comprises a steering cylinder 68 connected to the steering head 48 and a motor 70 connected to the steering cylinder 68 for rotating said steering cylinder 68. The steering cylinder 68 may form a worm-and-gear type connection, or similar connection, with the steering head 48 which transforms the rotation of the steering cylinder 68 around its longitudinal axis, in a rotation of the steering head 48 around the steering axis 44.

[0035] The outboard mounting assembly 1 further comprises a tilt/trim unit 50 comprising a tilt/trim shaft 52 and a tilt/trim sleeve 54 connected to the mounting bracket 14 and being rotatable around the tilt/trim shaft 52 and a tilt/trim axis 56. The tilt/trim unit 50 is configured to keep the outboard engine arrangement 2 at a constant or stable angle with the horizontal while boating, e.g. in an upright position. Thus, for example, if the boat attitude increases under thrust from the engine 10, the tilt/trim unit 50 can rotate the outboard engine arrangement 2 to ensure that the propeller for outboard propulsion will maintain an optimum (or at least appropriate), angle with the water, at which angle the most thrust is generated. Through the tilt/trim unit 50, this angle can be kept constant.

[0036] As shown in the figures, the tilt/trim sleeve 54 is embodied as a socket integrated with the mounting bracket 14 and/or may otherwise be integrated with the mounting bracket 14. A bushing 55 is provided between the tilt/trim sleeve 54 and the steering shaft 42. The bushing 55 will provide a clearance between the tilt/trim sleeve 54 and the connected mounting bracket 14, on the one hand, and the steering shaft housing 40 with the steering

axis 44 rotating therein, on the other.

[0037] In operation, the tilt/trim sleeve 54 is placed at a lower level than the upper mounting point 18 of each of the at least one upper arm 16, 17; in an aspect, the difference between a height of the tilt/trim shaft 52 and a height of the upper mounting point 18 of the at least one upper arm 16, 17 may be less than 100 mm, less than 70 mm, and/or less than 50 mm. Again, because the adapter plate 24 may support all needed parts for the electric motor 10, the space below the adapter plate 24 is cleared from those parts. This means that the adapter plate 24, and thus the upper mounting point 18, may be as close as possible in a vertical direction to the tilt/trim shaft 52, which enhances the stability of the outboard mounting assembly 1.

[0038] As shown in the figures, the tilt/trim shaft 52 can be fixedly connected to a first end of the steering shaft 42. The tilt/trim unit 50 further comprises at least one tilt/trim cylinder 58 connecting a second end of the steering shaft 42 to the outboard engine arrangement 2. The steering axis 44 comprises a cross member 45 at or near its second end, and the at least one tilt/trim cylinder 58 connects the cross member 45 to the mounting bracket 14. The tilt/trim cylinder 58 may be any suitable linear actuator able to generate enough force to keep the outboard engine arrangement 2 at the constant angle with the horizontal. The clearance provided by the bushing 55 creates the space to accommodate the at least one tilt/trim cylinder 58. In some cases, two tilt/trim cylinders 58 may be used, one on either side of the steering shaft housing 40. The tilt/trim unit 50 may further comprise a controller 66 configured to control the at least one tilt/trim cylinder 58 such that the outboard engine arrangement 2 is kept at the constant angle with the horizontal while boating. This may be done in known ways.

[0039] In the example shown in the figures, a steering stability line 60 defined by a line through the upper mounting point 18 and the lower mounting point 22 is slanted rearwards. A center of pressure 62 of the outboard engine arrangement 2 defined by a point where the total sum of force vectors acting on the outboard engine arrangement 2, is situated rearward of the steering stability line 60. The center of pressure 62 may be situated horizontally between the upper mounting point 18 and the lower mounting point22. In use, a distance in a horizontal plane between the steering stability line 60 and the center of pressure 62 may be between 100 and 500 mm. By having the center of pressure 62 rearward of the steering stability line 60 and horizontally between the upper and lower mounting points 18, 22, the stability of the outboard mounting assembly 1 is improved. The more distance between the center of pressure 62 and the steering stability line 60, the more stable the outboard mounting assembly 1 will be. The distance in a horizontal plane is of course limited by the dimension of the outboard engine arrangement 2.

[0040] The mounting bracket 14 may be a sand or die cast, e.g., made of an alloy comprising aluminum. Such a cast may be economically and reliably manufactured, also in larger quantities. Aluminum is a lightweight though strong metal, ideally suited for supporting the outboard engine arrangement 2.

[0041] As shown in the figures, the at least one upper arm 16, 17 comprises a first upper arm 16 and a second upper arm 17, wherein the first and the second upper arms 16, 17 extend around the outboard engine arrangement 2 on opposite sides. Having two upper arms 16, 17 on opposite sides will provide a better weight distribution of the outboard engine arrangement 2 between them, thereby increasing the stability of the outboard mounting assembly 1.

[0042] Also as shown, the at least one lower arm 20, 21 comprises a first lower arm 20 and a second lower arm 21, wherein the first and the second lower arms 20, 21 are arranged on opposite sides of the outboard engine arrangement 2. The mounting bracket 14, having two upper arms 16, 17 and two lower arms 20, 21 can service as a kind of yoke around the outboard engine arrangement 2.

[0043] The mounting bracket 14 further comprises a cross beam 64 connecting the first upper arm 16 with the second upper arm 17 and/or the first lower arm 20 with the second lower arm 21. The cross beam 64 gives the mounting bracket 14 more stiffness, thereby providing additional stability to the outboard mounting assembly 1. The cross beam 64, at least partially, can be situated above the steering shaft housing 40. In this way the cross beam 64 does not interfere with the tilt/trim cylinder 58.

[0044] According various embodiments, at least the following numbered transom arrangement embodiments and outboard mounting assembly embodiments may be provided as indicated below.

1. An outboard mounting assembly embodiment for mounting an outboard engine arrangement to a transom of a boat, the outboard mounting assembly being configured to cooperate with an outboard engine arrangement provided with an electric motor having an output shaft for output propulsion, the outboard mounting assembly comprising a mounting bracket, the mounting bracket comprising at least one upper arm comprising an upper mounting point, which, in use, is connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement, and at least one lower arm comprising a lower mounting point, which, in use, is connected to a forward side of the outboard engine arrangement in front of the center of gravity.

2. A transom arrangement embodiment, comprising an outboard engine arrangement provided with an electric motor having an output shaft for outboard propulsion, and comprising an outboard mounting assembly for mounting the outboard engine arrangement to a transom of a boat, the outboard mounting assembly comprising a mounting bracket, the mounting bracket comprising at least one upper arm

comprising an upper mounting point connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement, and at least one lower arm comprising a lower mounting point connected to a forward side of the outboard engine arrangement in front of the center of gravity.

3. The transom arrangement or outboard mounting assembly according to any of the preceding embodiments, wherein the outboard engine arrangement further comprises an adapter plate for supporting the electric motor, and wherein the upper mounting point is connected to the adapter plate.

4. The transom arrangement or outboard mounting assembly according to any of the preceding embodiments, wherein the outboard engine arrangement further comprises a drive shaft coupled to the output shaft of the electric motor and a shaft housing accommodating the drive shaft, wherein the lower mounting point, in use, is connected to the shaft housing.

5. The transom arrangement or outboard mounting assembly according to embodiment 4, wherein the outboard engine arrangement further comprises a straight and splined coupler coupling the drive shaft to the output shaft of the electric motor.

6. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein the outboard mounting assembly comprises an upper motor mount connecting the at least one upper arm at its upper mounting point to the outboard engine arrangement, wherein the upper motor mount has a pressure surface which, in use, contacts the upper mounting point of the at least one upper arm and is substantially vertical and parallel to a propulsion direction of the outboard engine arrangement.

7. The transom arrangement or outboard mounting assembly according to embodiment 6, wherein the upper motor mount comprises an elastic buffer, e.g. a rubber buffer, between the outboard engine arrangement and the upper mounting point of the at least one upper arm, wherein the buffer is configured to dampen vibrations in a direction parallel to the pressure surface.

8. The transom arrangement or outboard mounting assembly according any one of the preceding embodiment, wherein the outboard mounting assembly comprises a lower motor mount connecting the at least one lower arm at its lower mounting point to the outboard engine arrangement, wherein the lower motor mount has a pressure surface which, in use, contacts the lower mounting point of the at least one lower arm and is substantially perpendicular to a propulsion direction of the outboard engine arrangement, the pressure surface enhancing steering stability when the outboard engine arrangement is mounted on a boat and operated.

9. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein the outboard mounting assembly further comprises a steering shaft housing and a steering shaft rotatable within the steering shaft housing and around a steering axis, wherein the mounting bracket is connected to the steering shaft.

10. The transom arrangement or outboard mounting assembly according to embodiment 9, wherein the outboard mounting assembly further comprises a transom plate configured to be mounted on the transom of the boat, or to a jack plate on the transom of the boat, wherein the steering shaft housing is fixedly connected to the transom plate.

11. The transom arrangement or outboard mounting assembly according to embodiment 9 or 10, wherein the outboard mounting assembly further comprises a steering head fixedly connected to the steering shaft and extending at least radially away from the steering axis, and a steering cylinder assembly connected to the steering head and configured to rotate the steering head.

12. The transom arrangement or outboard mounting assembly according to embodiment 11, wherein the steering cylinder assembly comprises a steering cylinder connected to the steering head and a motor connected to the steering cylinder for rotating said steering cylinder.

13. The transom arrangement or outboard mounting assembly according to any one of embodiments 9-12, wherein the outboard mounting assembly further comprises a tilt/trim unit comprising a tilt/trim shaft and a tilt/trim sleeve connected to the mounting bracket and being rotatable around the tilt/trim shaft and a tilt/trim axis, wherein the tilt/trim unit is configured to keep the outboard engine arrangement at a constant or stable angle with the horizontal while boating, e.g. in an upright position.

14. The transom arrangement or outboard mounting assembly according to embodiment 13, wherein the tilt/trim sleeve is embodied as a socket integrated with the mounting bracket.

15. The transom arrangement or outboard mounting assembly according to embodiment 13 or 14, wherein a bushing is provided between the tilt/trim sleeve and the steering shaft.

16. The transom arrangement or outboard mounting assembly according to any one of embodiments 13-15, wherein, in operation, the tilt/trim sleeve is placed at a lower level than the upper mounting point of the at least one upper arm, and wherein the difference between a height of the tilt/trim shaft and a height of the upper mounting point of the at least one upper arm is less than 100 mm.

17. The transom arrangement or outboard mounting assembly according to embodiments 16, the difference between the height of the tilt/trim shaft and the height of the upper mounting point of the at least one

upper arm is less than 70 mm.

18. The transom arrangement or outboard mounting assembly according to embodiments 16, the difference between the height of the tilt/trim shaft and the height of the upper mounting point of the at least one upper arm is less than 50 mm.

19. The transom arrangement or outboard mounting assembly according to any one of embodiments 13-18, wherein the tilt/trim shaft is fixedly connected to a first end of the steering shaft, wherein the tilt/trim unit further comprises at least one tilt/trim cylinder connecting a second end of the steering shaft to the outboard engine arrangement.

20. The transom arrangement or outboard mounting assembly according to embodiment 19, wherein the steering axis comprises a cross member at or near its second end, and wherein the at least one tilt/trim cylinder connects the cross member to the mounting bracket.

21. The transom arrangement or outboard mounting assembly according to embodiment 19 or 20, wherein the tilt/trim unit further comprises a controller configured to control the at least one tilt/trim cylinder such that the outboard engine arrangement is kept at a constant angle with the horizontal while boating.

22. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein a steering stability line defined by a line through the upper mounting point and the lower mounting point is slanted rearwards, and wherein a center of pressure of the outboard engine arrangement is situated rearward of the steering stability line, wherein the center of pressure is defined by a point where the total sum of force vectors acting on the outboard engine arrangement.

23. The transom arrangement or outboard mounting assembly according to embodiment 22, wherein, in use, a distance in a horizontal plane between the steering stability line and the center of pressure is between 100 and 500 mm.

24. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein the mounting bracket is a sand or die cast, preferably made of an alloy comprising aluminum.

25. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein the at least one upper arm comprises a first upper arm and a second upper arm, wherein the first and the second upper arms extend around the outboard engine arrangement on opposite sides.

26. The transom arrangement or outboard mounting assembly according to any one of the preceding embodiments, wherein the at least one lower arm comprises a first lower arm and a second lower arm, wherein the first and the second lower arms are arranged on opposite sides of the outboard engine arrangement.

27. The transom arrangement or outboard mounting assembly according to embodiment 25 or 26, wherein the mounting bracket further comprises a cross beam connecting the first upper arm with the second upper arm and/or the first lower arm with the second lower arm.

28. The transom arrangement or outboard mounting assembly according to embodiment 9 and 27, wherein the cross beam, at least partially, is situated above the steering shaft housing.

[0045] The invention is not restricted to the embodiments described above. It will be understood that many variants are possible.

[0046] These and other embodiments will be apparent for the person skilled in the art and are considered to fall within the scope of the invention as defined in the following claims. For the purpose of clarity and a concise description features are described herein as part of the same or separate embodiments. However, it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described.

Legend

[0047]

1 -	outboard mounting assembly
2 -	outboard engine arrangement
10 -	electric motor
12 -	output shaft
14 -	mounting bracket
16 -	first upper arm
17 -	second upper arm
18 -	upper mounting point
20 -	first lower arm
21 -	second lower arm
22 -	lower mounting point
24 -	adapter plate
26 -	drive shaft
28 -	shaft housing
30 -	upper motor mount
32 -	pressure surface (of the upper motor mount)
34 -	rubber buffer
36 -	lower motor mount
38 -	pressure surface (of the lower motor mount)
40 -	steering shaft housing
42 -	steering shaft
44 -	steering axis
45 -	cross member (of the steering shaft)
46 -	transom plate
48 -	steering head
50 -	tilt/trim unit
52 -	tilt/trim shaft
54 -	tilt/trim sleeve
55 -	bushing

56 - tilt/trim axis
58 - tilt/trim cylinder
60 - steering stability line
62 - center of pressure
64 - cross beam
66 - controller
68 - steering cylinder
70 - motor (of steering cylinder assembly)

Claims

1. An outboard mounting assembly for mounting an outboard engine arrangement to a transom of a boat, the outboard mounting assembly being configured to cooperate with an outboard engine arrangement provided with an electric motor having an output shaft for output propulsion, the outboard mounting assembly comprising

- a mounting bracket, the mounting bracket comprising:
  - at least one upper arm comprising an upper mounting point, which, in use, is connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement; and
  - at least one lower arm comprising a lower mounting point, which, in use, is connected to a forward side of the outboard engine arrangement in front of the center of gravity.

2. A transom arrangement comprising an outboard engine arrangement provided with an electric motor having an output shaft for outboard propulsion, and comprising an outboard mounting assembly for mounting the outboard engine arrangement to a transom of a boat, the outboard mounting assembly comprising:

- a mounting bracket, the mounting bracket comprising:
  - at least one upper arm comprising an upper mounting point connected to a rearward side of the outboard engine arrangement behind a center of gravity of the outboard engine arrangement; and
  - at least one lower arm comprising a lower mounting point connected to a forward side of the outboard engine arrangement in front of the center of gravity.

3. The transom arrangement or outboard mounting assembly according to any of the preceding claims, wherein the outboard engine arrangement further comprises an adapter plate for supporting the electric motor, and wherein the upper mounting point is connected to the adapter plate.

4. The transom arrangement or outboard mounting assembly according to any of the preceding claims, wherein the outboard engine arrangement further comprises a drive shaft coupled to the output shaft of the electric motor and a shaft housing for accommodating the drive shaft, wherein the lower mounting point, in use, is connected to the shaft housing.

5. The transom arrangement or outboard mounting assembly according to any one of the preceding claims, wherein the outboard mounting assembly comprises an upper motor mount connecting the at least one upper arm at its upper mounting point to the outboard engine arrangement, wherein the upper motor mount has a pressure surface which, in use, contacts the upper mounting point of the at least one upper arm and is substantially vertical and parallel to a propulsion direction of the outboard engine arrangement.

6. The transom arrangement or outboard mounting assembly according to claim 5, wherein the upper motor mount comprises an elastic buffer between the outboard engine arrangement and the upper mounting point of the at least one upper arm, wherein the buffer is configured to dampen vibrations in a direction parallel to the pressure surface.

7. The transom arrangement or outboard mounting assembly according any one of the preceding claims, wherein the outboard mounting assembly comprises a lower motor mount connecting the at least one lower arm at its lower mounting point to the outboard engine arrangement, wherein the lower motor mount has a pressure surface which, in use, contacts the lower mounting point of the at least one lower arm and is substantially perpendicular to a propulsion direction of the outboard engine arrangement, the pressure surface enhancing steering stability when the outboard engine arrangement is mounted on a boat and operated.

8. The transom arrangement or outboard mounting assembly according to any one of the preceding claims, wherein the outboard mounting assembly further comprises a steering shaft housing and a steering shaft rotatable within the steering shaft housing and around a steering axis, wherein the mounting bracket is connected to the steering shaft.

9. The transom arrangement or outboard mounting assembly according to claim 8, wherein the outboard mounting assembly further comprises a tilt/trim unit comprising a tilt/trim shaft and a tilt/trim sleeve con-

nected to the mounting bracket and being rotatable around the tilt/trim shaft and a tilt/trim axis, wherein the tilt/trim unit is configured to keep the outboard engine arrangement at a constant angle with the horizontal while boating.

10. The transom arrangement or outboard mounting assembly according to claim 9, wherein, in operation, the tilt/trim sleeve is placed at a lower level than the upper mounting point of the at least one upper arm, and wherein the difference between a height of the tilt/trim shaft and a height of the upper mounting point of the at least one upper arm is less than 100 mm, preferably less than 70 mm, more preferably less than 50 mm.

11. The transom arrangement or outboard mounting assembly according to claim 9 or 10, wherein the tilt/trim shaft is fixedly connected to a first end of the steering shaft, wherein the tilt/trim unit further comprises at least one tilt/trim cylinder connecting a second end of the steering shaft to the outboard engine arrangement.

12. The transom arrangement or outboard mounting assembly according to any one of the preceding claims, wherein a steering stability line defined by a line through the upper mounting point and the lower mounting point is slanted rearwards, and wherein a center of pressure of the outboard engine arrangement is situated rearward of the steering stability line.

13. The transom arrangement or outboard mounting assembly according to claim 12, wherein, in use, a distance in a horizontal plane between the steering stability line and the center of pressure is between 100 and 500 mm.

14. The transom arrangement or outboard mounting assembly according to any one of the preceding claims, wherein the at least one upper arm comprises a first upper arm and a second upper arm, wherein the first and the second upper arms extend around the outboard engine arrangement on opposite sides.

15. The transom arrangement or outboard mounting assembly according to any one of the preceding claims, wherein the at least one lower arm comprises a first lower arm and a second lower arm, wherein the first and the second lower arms are arranged on opposite sides of the outboard engine arrangement.

Fig. 1

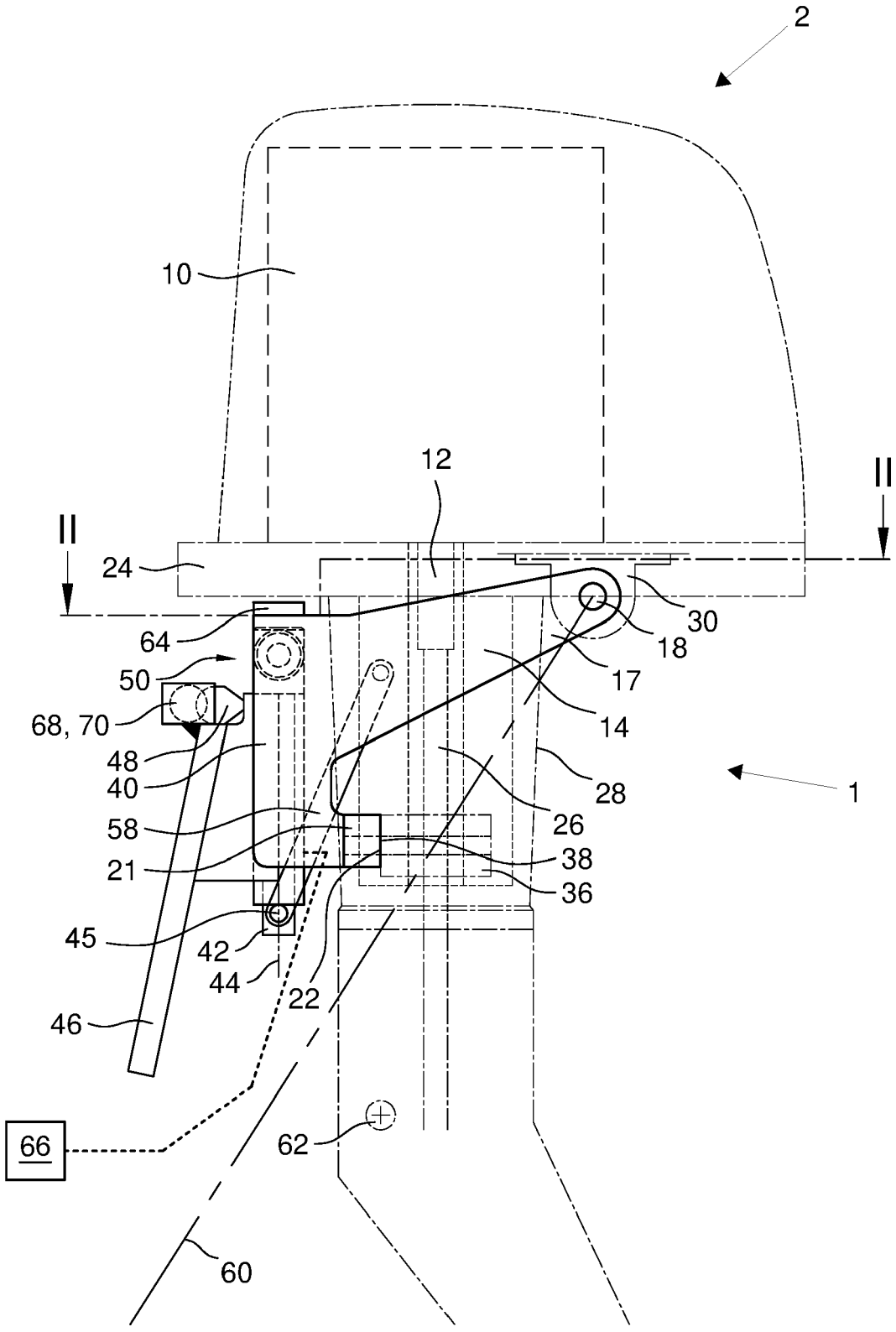
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Fig. 2

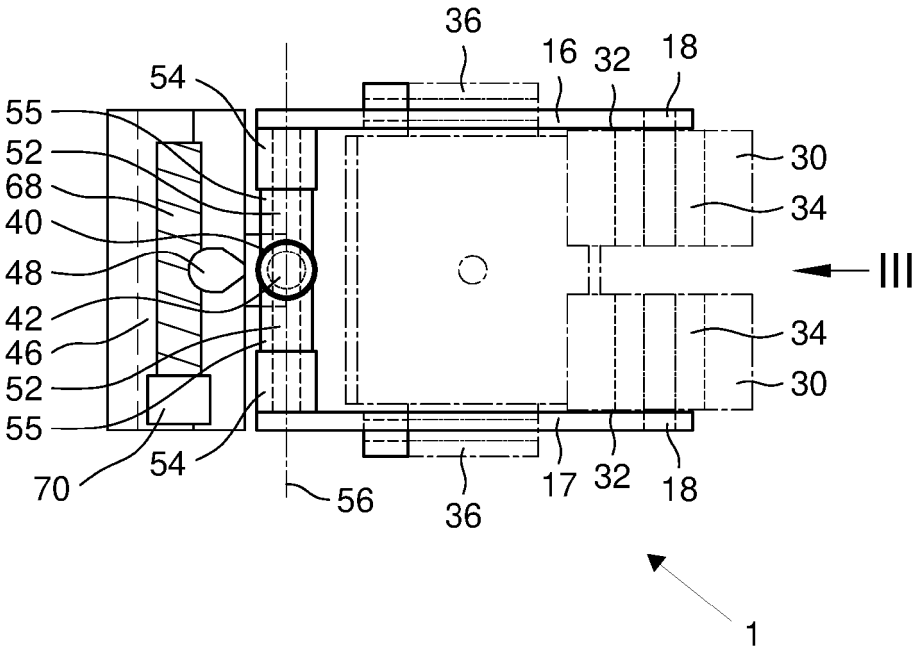
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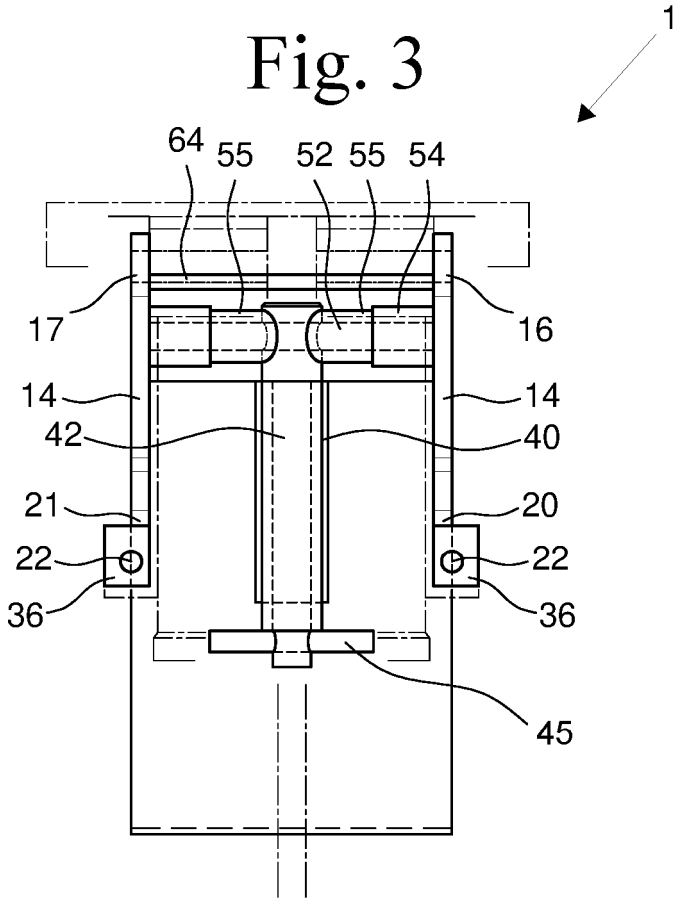
Fig. 3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EUROPEAN SEARCH REPORT

Application Number
EP 20 19 7885

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 9 969 475 B1 (WAISANEN ANDREW S [US]) 15 May 2018 (2018-05-15) * figures 1-25 * -----	1-15	INV. B63H20/00 B63H20/10 B63H20/12 B63H21/17 B63H21/30

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	22 March 2021	Freire Gomez, Jon

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 9969475 B1	15-05-2018	NONE	

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