US012384502B2

(12) United States Patent
Saruwatari et al.

(10) Patent No.: US 12,384,502 B2
(45) Date of Patent: Aug. 12, 2025

(54) OUTBOARD MOTOR AND BOAT

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 561 days.

(21) Appl. No.: **17/899,678**

(22) Filed: **Aug. 31, 2022**

(65) **Prior Publication Data**

US 2023/0278689 A1 Sep. 7, 2023

(30) **Foreign Application Priority Data**

Mar. 3, 2022 (JP) 2022-032382

(51) **Int. Cl.**
B63H 20/10 (2006.01)
B63H 20/32 (2006.01)

(52) **U.S. Cl.**
CPC ***B63H 20/10*** (2013.01); ***B63H 20/32*** (2013.01)

(58) **Field of Classification Search**
CPC B63H 20/10; B63H 20/32
See application file for complete search history.

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(57) ABSTRACT

An outboard motor includes a tilt shaft, an engine assembly, and a cowl. The tilt shaft defines a horizontal tilt axis during a tilting action of the outboard motor. At least a portion of the engine assembly is above the tilt axis in a tilt-down state of the outboard motor. The cowl accommodates at least a portion of the engine assembly. The tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other. A portion of the cowl is between the first shaft and the second shaft.

13 Claims, 7 Drawing Sheets

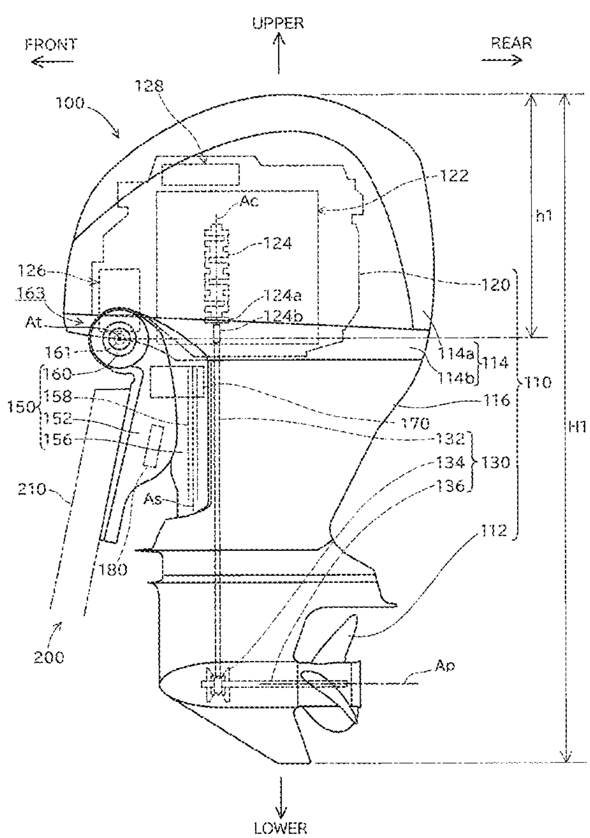
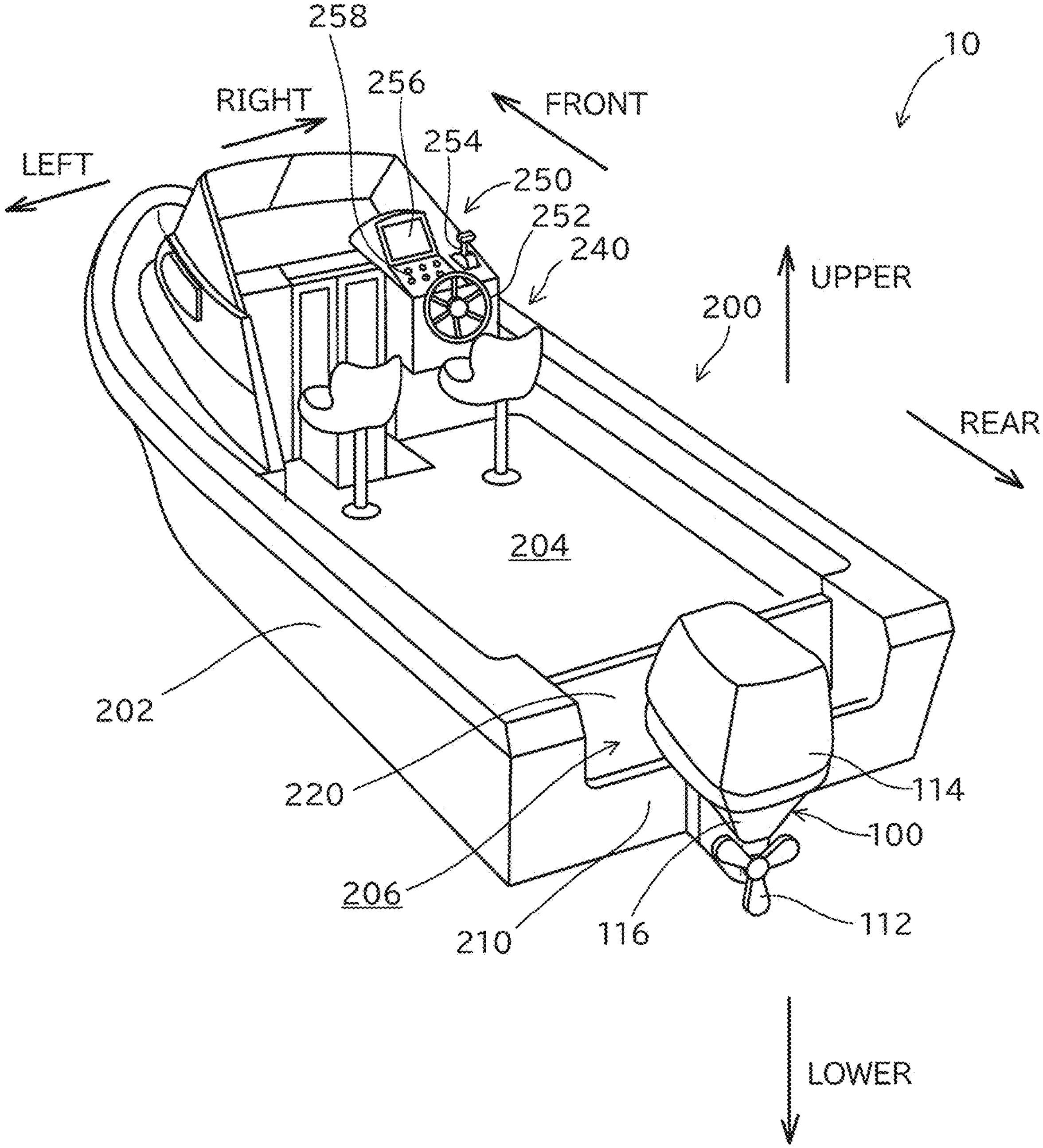


FIG.1



258
256
254
250
252
240
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220
206
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116
114
100
112
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FIG.2

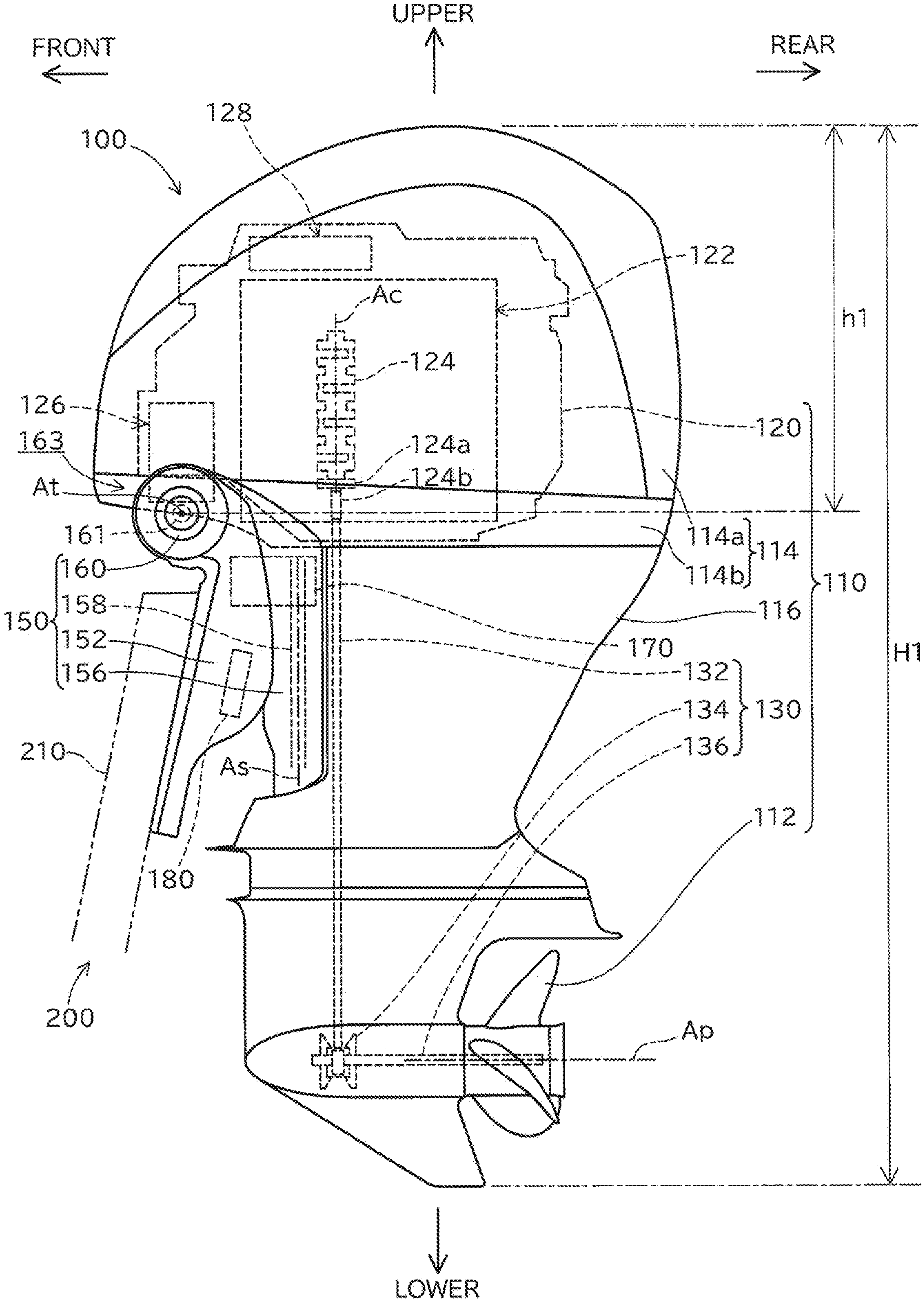
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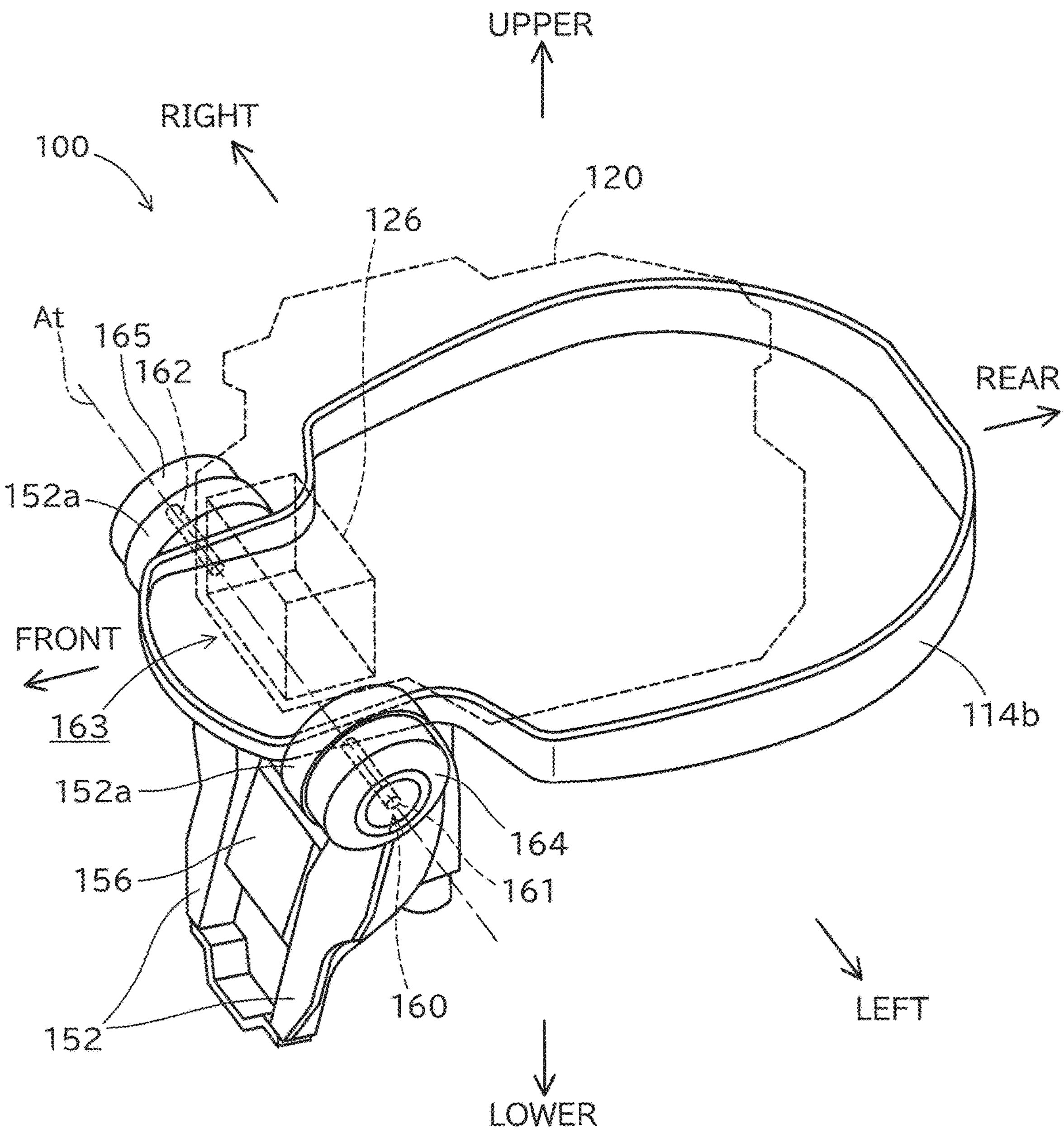
FIG.3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160
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FIG.4

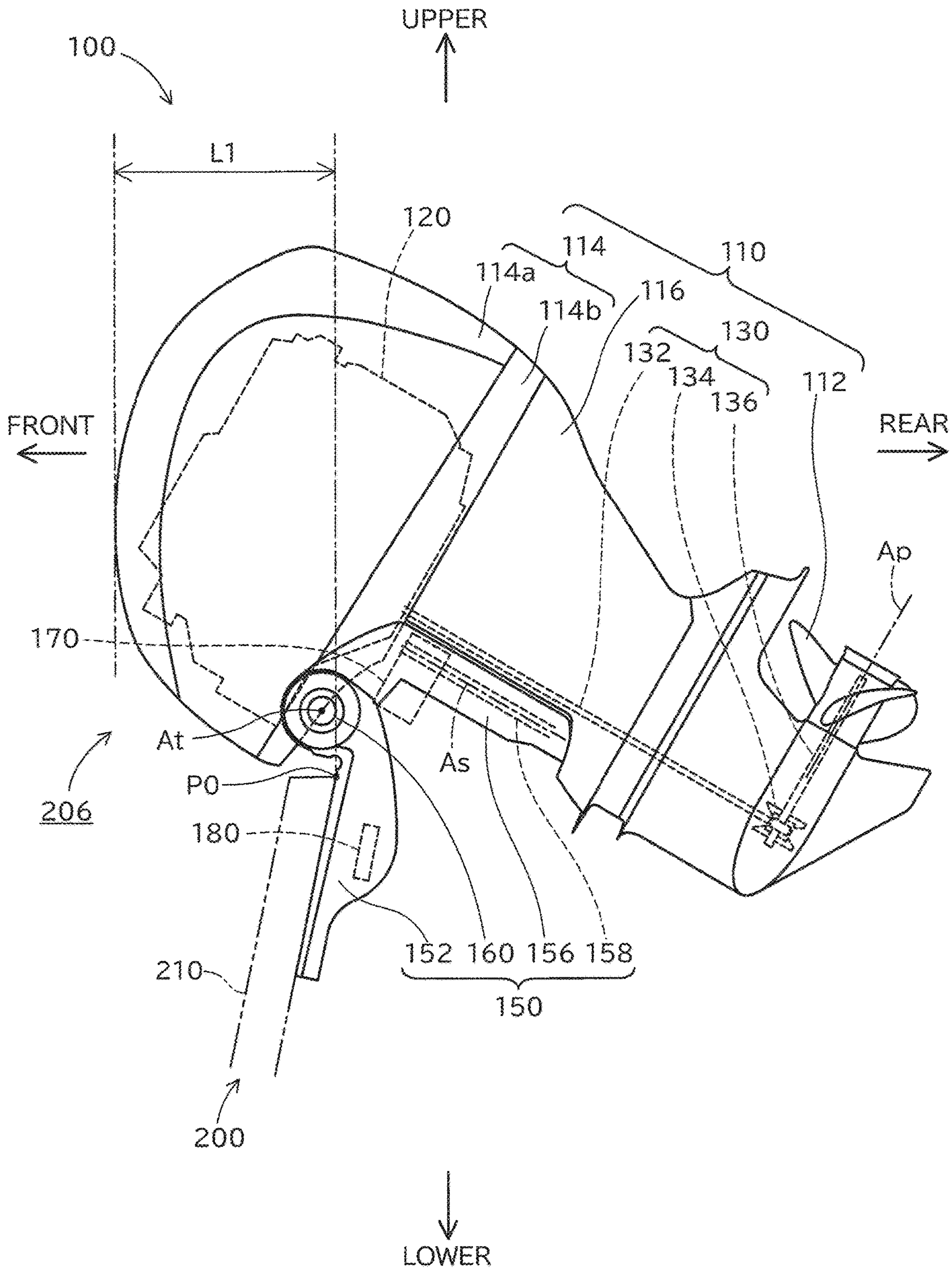

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FIG.5

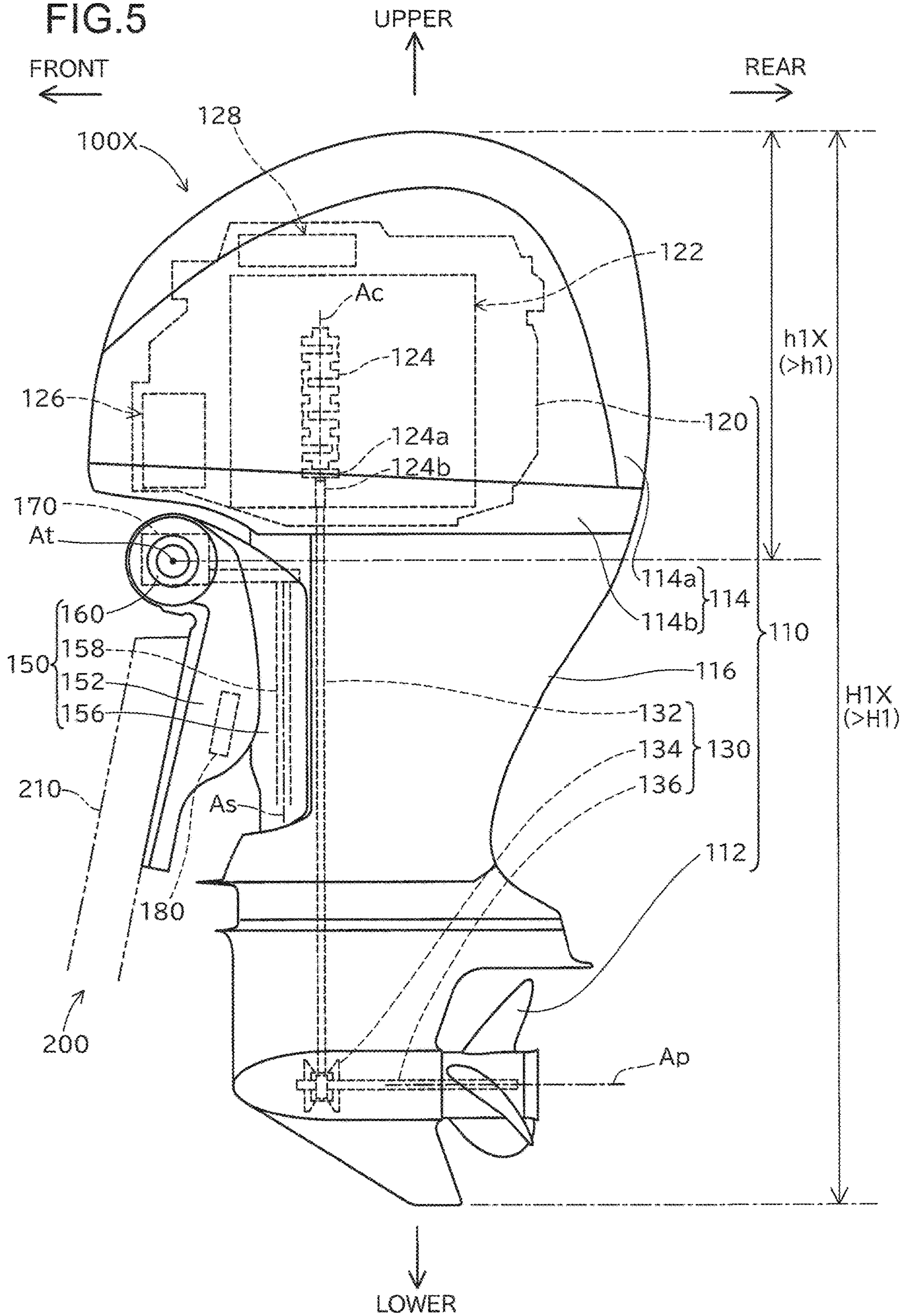
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FIG.6

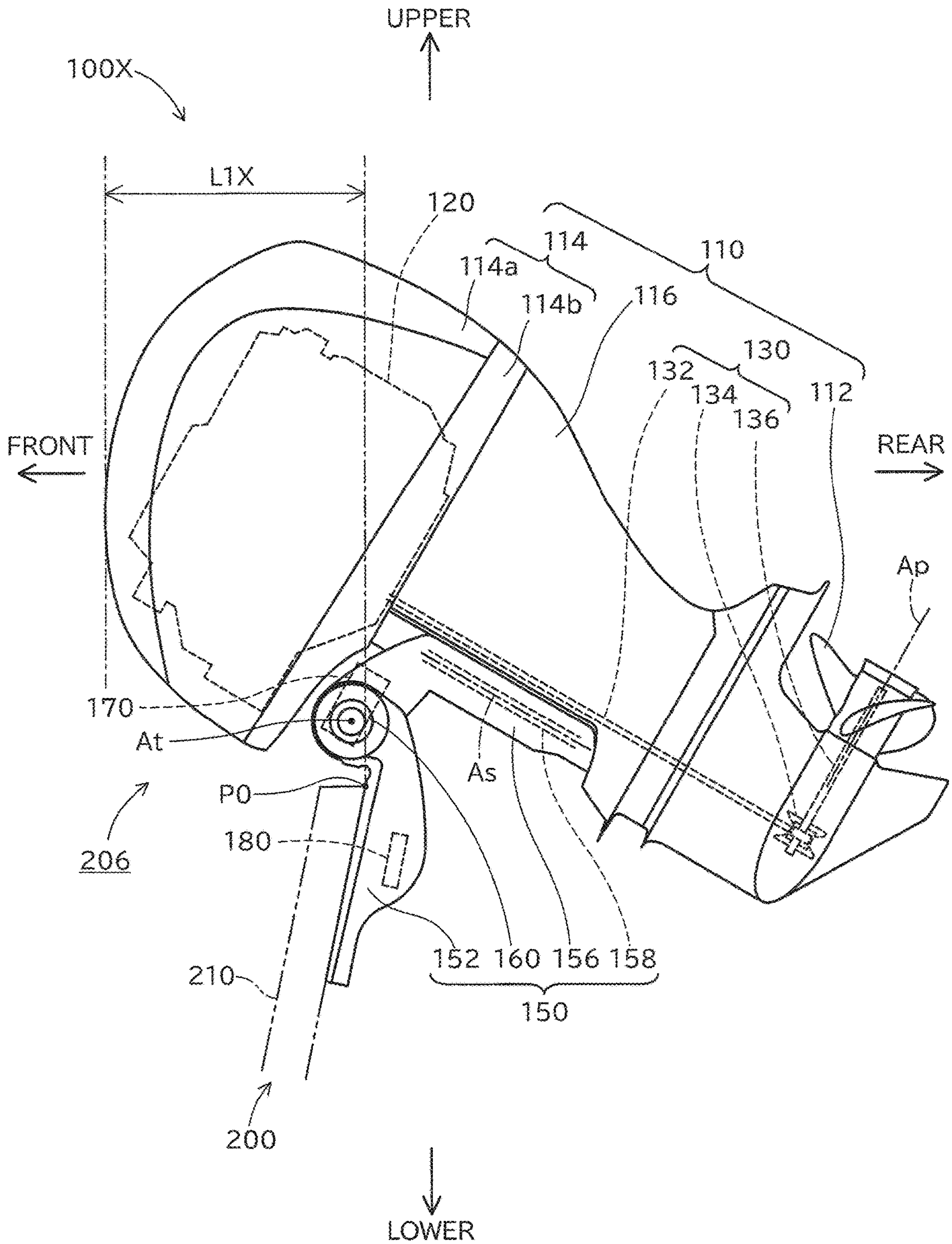
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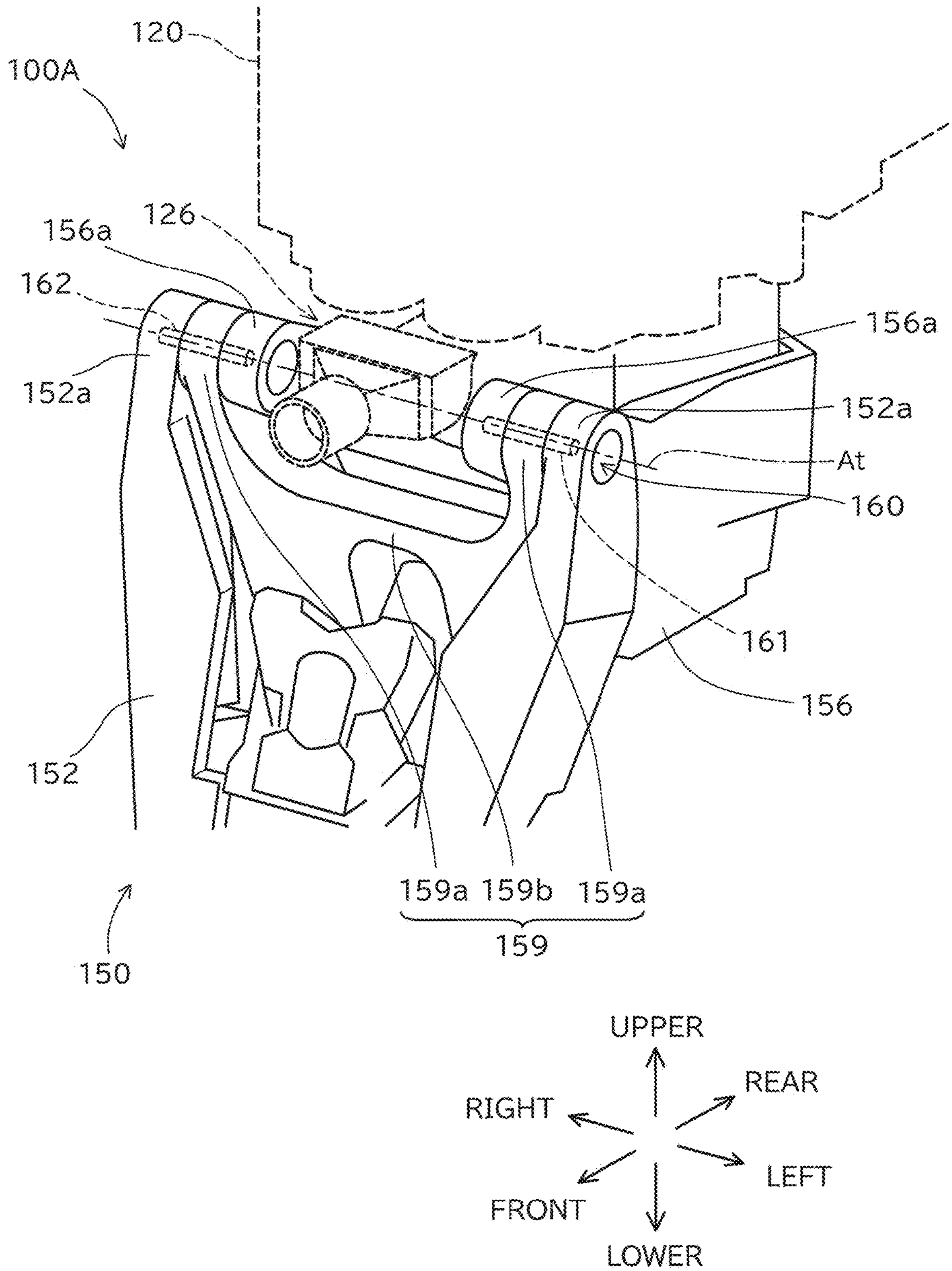
FIG.7



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OUTBOARD MOTOR AND BOAT

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under to Japanese Patent Application No. 2022-32382, filed Mar. 3, 2022. The contents of this application are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present disclosure relates to an outboard motor and a boat.

2. Description of the Related Art

A boat includes a hull and an outboard motor attached to a rear portion of the hull. The outboard motor is a device that generates thrust to propel a boat.

The outboard motor is able to conduct a tilting action which is a rotation about a horizontal tilt axis (e.g., see JP2017-87999A). Due to the tilting action, the outboard motor can change the angle around the tilt axis in a range from the tilt-down state in which the propeller is located under the water surface to the tilt-up state in which the propeller is located above the water surface.

In the tilt-down state of the outboard motor, at least a portion of the engine assembly and at least a portion of the cowl accommodating the engine assembly are above the tilt axis. Therefore, as the tilt-down state is changed to the tilt-up state, these portions move forward and enter the upper space of the rear end of the hull (hereinafter referred to as the "rear end upper space"). In other words, the rear end upper space capable of receiving the above-described portions of the outboard motor when the outboard motor tilts up is secured in the hull.

SUMMARY OF THE INVENTION

In order to effectively utilize the space in the hull, it is preferable to reduce the amount of intrusion of the outboard motor into the rear end upper space when the outboard motor tilts up. Conventional outboard motors have room for improvement in reducing the amount of intrusion of the outboard motor into the rear end upper space when the outboard motor tilts up.

Preferred embodiments of the present invention disclose technologies able to solve the above-described problems.

Preferred embodiments of the present invention may be implemented in, e.g., the following aspects.

According to a preferred embodiment of the present invention, an outboard motor includes a tilt shaft, an engine assembly, and a cowl. The tilt shaft defines a horizontal tilt during a tilting action of the outboard motor. At least a portion of the engine assembly is above the tilt axis in a tilt-down state of the outboard motor. The cowl accommodates at least a portion of the engine assembly. The tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other. A portion of the cowl is between the first shaft and the second shaft.

In the outboard motor, a portion of the cowl that accommodates the engine assembly is between the first shaft and the second shaft of the tilt shaft, so that the position of the cowl is able to be set relatively downward, and as a result, the position of the engine assembly is set relatively downward. Therefore, a height of the portion of the outboard motor located above the tilt axis is relatively low. Thus, the outboard motor is able to relatively reduce the amount of intrusion of the outboard motor into the rear end upper space of the hull when the outboard motor tilts up. Further, since the total height of the outboard motor is relatively low, it is possible to reduce the weight of the outboard motor.

In the above-described outboard motor, a portion of the engine assembly may be between the first shaft and the second shaft. The present configuration is able to set the position of the engine assembly farther downward, thus further lowering the height of the portion of the outboard motor located above the tilt axis. Therefore, the present configuration is able to further reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and further reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, the engine assembly may include an electrical component and an intake system component, and the portion of the engine assembly between the first shaft and the second shaft may include at least one of the electrical component and the intake system component. With the present configuration, it is possible to locate a portion the engine assembly between the first shaft and the second shaft of the tilt shaft without drastically changing the configuration of the engine assembly.

In the above-described outboard motor, the engine assembly may include an engine main body including a crank shaft including a spline. In the tilt-down state of the outboard motor, at least a portion of the spline may be lower than at least a portion of the tilt shaft. The present configuration is able to greatly lower the engine main body, and thus the engine assembly, to such a level that at least a portion of the spline of the crank shaft is lower than at least a portion of the tilt shaft, thus effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, in the tilt-down state of the outboard motor, at least a portion of the spline may be lower than the tilt axis. The present configuration is able to greatly lower the position of the engine main body, and thus the engine assembly, to such a level that at least a portion of the spline of the crank shaft is lower than the tilt axis, thus further effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to further effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and further effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, the engine assembly may include an engine main body including a crank shaft including a journal. In the tilt-down state of the outboard motor, at least a portion of the journal may be lower than at least a portion of the tilt shaft. The present configuration is able to greatly lower the position of the engine main body, and thus the engine assembly, to such a level that at least a portion of the journal of the crank shaft is lower than at least a portion of the tilt shaft, thus extremely effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to extremely effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and extremely effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, in the tilt-down state of the outboard motor, at least a portion of the journal may be lower than the tilt axis. The present configuration is able to greatly lower the position of the engine main body, and thus the engine assembly, to such a level that at least a portion of the journal of the crank shaft is lower than the tilt axis, thus extremely effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to extremely effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and extremely effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, the first shaft and the second shaft may be connected to each other below the first shaft and the second shaft. The present configuration is able to stabilize the position of the tilt shaft, and as a result, further stabilize the tilting action of the outboard motor in which the tilt shaft includes the first and second shafts which are spaced apart and coaxial with each other.

According to another preferred embodiment of the present invention, an outboard motor includes a tilt shaft and an engine assembly. The tilt shaft defines a horizontal tilt axis during a tilting action of the outboard motor. At least a portion of the engine assembly is above the tilt axis in a tilt-down state of the outboard motor. The engine assembly includes an engine main body including a crank shaft including a spline. The tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other. A portion of the outboard motor is between the first shaft and the second shaft. In the tilt-down state of the outboard motor, at least a portion of the spline is lower than at least a portion of the tilt shaft.

Since a portion of the outboard motor is between the first shaft and the second shaft of the tilt shaft, the outboard motor is able to greatly lower the position of the engine main body, and thus the position of the engine assembly, to such a level that at least a portion of the spline of the crank shaft is lower than at least a portion of the tilt shaft, thus effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the above-described outboard motor, in the tilt-down state of the outboard motor, at least a portion of the spline may be lower than the tilt axis. The present configuration is able to greatly lower the position of the engine main body, and thus the engine assembly, to such a level that at least a portion of the spline of the crank shaft is lower than the tilt axis, thus further effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to further effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and further effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

According to yet another preferred embodiment of the present invention, an outboard motor includes a tilt shaft and an engine assembly. The tilt shaft defines a horizontal tilt axis during a tilting action of the outboard motor. At least a portion of the engine assembly is above the tilt axis in a tilt-down state of the outboard motor. The engine assembly includes an engine main body including a crank shaft including a journal. The tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other. A portion of the outboard motor is between the first shaft and the second shaft. In the tilt-down state of the outboard motor, at least a portion of the journal is lower than at least a portion of the tilt shaft.

Since a portion of the outboard motor is between the first shaft and the second shaft of the tilt shaft, the outboard motor is able to greatly lower the position of the engine main body, and thus the position of the engine assembly, to such a level that at least a portion of the journal of the crank shaft is lower than at least a portion of the tilt shaft, thus effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to effectively reduce the amount of intrusion of the outboard motor into the rear end upper space when the outboard motor tilts up, and effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

In the tilt-down state of the above-described outboard motor, at least a portion of the journal may be lower than the tilt axis. The present configuration is able to greatly lower the position of the engine main body, and thus the engine assembly, to such a level that at least a portion of the journal of the crank shaft is lower than the tilt axis, thus further effectively reducing the height of the portion of the outboard motor located above the tilt axis. Accordingly, the present configuration is able to further effectively reduce the amount of intrusion of the outboard motor into the hull when the outboard motor tilts up, and further effectively reduce the weight of the outboard motor by further reducing the total height of the outboard motor.

It should be noted that preferred embodiments of the present invention may be implemented in various aspects, e.g., in the form of an outboard motor and a boat equipped with an outboard motor and a hull, among other aspects.

The above and other elements, features, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of the preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view schematically illustrating a configuration of a boat according to a first preferred embodiment of the present invention.

FIG. **2** is a side view schematically illustrating a configuration of an outboard motor.

FIG. **3** is a perspective view schematically illustrating a configuration of a portion of the outboard motor.

FIG. **4** is a side view illustrating a configuration of the outboard motor in the tilt-up state.

FIG. **5** is a side view illustrating a configuration of an outboard motor of a comparative example.

FIG. **6** is a side view illustrating a configuration of the outboard motor of the comparative example in the tilt-up state.

FIG. **7** is a perspective view schematically illustrating a configuration of a portion of an outboard motor according to a second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** is a perspective view schematically illustrating a configuration of a boat **10** according to a first preferred embodiment of the present invention. FIG. **1** and the other figures to be described below show arrows representing directions relative to the position of the boat **10**. More specifically, each figure shows arrows respectively representing the front direction (FRONT), the rear direction (REAR), the left direction (LEFT), the right direction (RIGHT), the upper direction (UPPER), and the lower direction (LOWER). The front-rear direction, the left-right direction, and the upper-lower direction (vertical direction) are mutually perpendicular.

The boat **10** includes a hull **200** and an outboard motor **100**.

The hull **200** is a portion of the boat **10** for occupants to ride in. The hull **200** includes a hull body **202** having a living space **204**, a pilot seat **240** installed in the living space **204**, and an operating device **250** installed near the pilot seat **240**. The operating device **250** includes, e.g., a steering wheel **252**, a shift throttle lever **254**, a monitor **256**, and an input device **258**. The hull **200** includes a partition wall **220** to partition the rear end of the living space **204** and a transom **210** positioned at the rear end of the hull **200**. In the front-rear direction, a space (hereinafter referred to as "rear end upper space **206**") is provided between the transom **210** and the partition wall **220**.

FIG. **2** is a side view schematically illustrating a configuration of the outboard motor **100**. FIG. **3** is a perspective view schematically illustrating a partial configuration of the outboard motor **100**. The outboard motor **100** in the reference attitude will be described below unless otherwise specified. The reference attitude is an attitude in which the rotational axis Ac of the crank shaft **124**, which will be described below, extends in the upper-lower direction, and the rotational axis Ap of a propeller shaft **136** extends in the front-rear direction. The front-rear direction, the left-right direction, and the upper-lower direction are defined based on the outboard motor **100** in the reference attitude.

The outboard motor **100** generates thrust to propel the boat **10**. The outboard motor **100** is attached to the transom **210** at the rear of the hull **200**. The outboard motor **100** includes an outboard motor main body **110**, a suspension device **150**, a steering device **170**, and a tilting device **180**.

The outboard motor main body **110** includes an engine assembly **120**, a propeller **112**, a power transmission mechanism **130**, a cowl **114**, and a casing **116**.

The engine assembly **120** includes plurality of parts including an engine main body **122** as a main part. In addition to the engine main body **122**, the engine assembly **120** includes an intake system component **126** (e.g., throttle bodies and superchargers) and an electrical component **128** (e.g., fuse box, ECU, and steering CU). The engine assembly **120** is disposed at a relatively upper position in the outboard motor **100**.

At least a portion of the engine assembly **120** is accommodated within the cowl **114**. The cowl **114** includes a lower cowl **114***b* defining the lower portion of the cowl **114** and an upper cowl **114***a* defining the upper portion of the cowl **114**. The upper cowl **114***a* is detachably attached to the lower cowl **114***b*.

The engine main body **122** is a prime mover to generate power. The engine main body **122** includes, e.g., an internal combustion engine. The engine main body **122** includes a crank shaft **124** to convert reciprocating motion of a piston (not shown) into rotational motion. The crank shaft **124** has a rotational axis Ac that extends in the upper-lower direction. The crank shaft **124** includes a journal **124***a* which supports the crank shaft **124** at a bearing portion of a crank case (not shown), and a spline **124***b* including a plurality of vertical grooves to connect with the drive shaft **132** described below.

The propeller **112** is a rotating body including a plurality of blades. The propeller **112** is at a relatively lower position in the outboard motor **100**. The propeller **112** generates thrust due to rotation thereof.

The power transmission mechanism **130** transmits power generated in the engine assembly **120** to the propeller **112**. At least a portion of the power transmission mechanism **130** is accommodated in the casing **116**. The power transmission mechanism **130** includes a drive shaft **132**, a shift mechanism **134**, and a propeller shaft **136**.

The drive shaft **132** is a rod-shaped member and is disposed below the crank shaft **124** of the engine main body **122** in an attitude extending in the upper-lower direction. The upper end of the drive shaft **132** is connected to the spline **124***b* provided at the lower end of the crank shaft **124**. Therefore, the drive shaft **132** rotates together with the rotation of the crank shaft **124**.

The propeller shaft **136** is a rod-shaped member and is disposed at a relatively lower position in the outboard motor **100** in an attitude extending in the front-rear direction. The rear end of the propeller shaft **136** projects to the outside of the casing **116**, and the propeller **112** is attached to this rear end. The propeller **112** rotates together with the rotation of the propeller shaft **136** around the rotational axis Ap.

The shift mechanism **134** is connected to the lower end of the drive shaft **132** and to the front end of the propeller shaft **136**. The shift mechanism **134** includes, e.g., a plurality of gears and a clutch to switch the engagement of the gears, and transmits the rotation of the drive shaft **132** to the propeller shaft **136** in such a manner that the rotation direction is able to be switched. When the shift mechanism **134** transmits the rotation of the drive shaft **132** to the propeller shaft **136** as a rotation in the normal rotation direction, the propeller **112** rotating in the normal rotation direction together with the propeller shaft **136** generates thrust in the forward direction. On the contrary, when the shift mechanism **134** transmits the rotation of the drive shaft **132** to the propeller shaft **136** as a rotation in the reverse rotation direction, the propeller **112** rotating in the reverse rotation direction together with the propeller shaft **136** generates a thrust in the rearward direction.

The suspension device **150** suspends the outboard motor main body **110** from the hull **200**. The suspension device **150** includes a pair of left and right clamp brackets **152**, a tilt shaft **160**, a swivel bracket **156**, and a steering shaft **158**.

The pair of left and right clamp brackets **152** are disposed behind the hull **200** in a state separated from each other in the left-right direction, and are fixed to the transom **210** of the hull **200** by using, e.g., bolts. Each clamp bracket **152** includes a cylindrical supporting portion **152***a* provided with a through hole extending in the left-right direction.

The tilt shaft **160** is a rod-shaped member. At least a portion of the tilt shaft **160** is rotatably supported in the through hole of the supporting portion **152***a* of the clamp bracket **152**. The tilt axis At, which is the center line of the tilt shaft **160**, defines an axis in the horizontal direction (left-right direction) during a tilting action of the outboard motor **100**. The configuration of the tilt shaft **160** will be described below in detail.

The swivel bracket **156** is sandwiched between the pair of clamp brackets **152**, and is supported by the supporting portion **152***a* of the clamp bracket **152** via the tilt shaft **160** in such a manner that the swivel bracket **156** is able to rotate around the tilt axis At. The swivel bracket **156** is rotationally driven about the tilt axis At with respect to the clamp bracket **152** by the tilting device **180** including an actuator such as a hydraulic cylinder. The tilting device **180** is, e.g., disposed below the tilt shaft **160** in the space between the pair of clamp brackets **152**.

The steering shaft **158** is a rod-shaped member. The steering shaft **158** is supported by the swivel bracket **156** so as to be rotatable about the steering axis As, which is the center line of the steering shaft **158**, in an attitude extending in the upper-lower direction. The steering shaft **158** is rotationally driven about the steering axis As with respect to the swivel bracket **156** by the steering device **170** including an actuator such as a hydraulic cylinder. The steering device **170** is, e.g., disposed below the tilt shaft **160** in a space between the pair of clamp brackets **152**.

The outboard motor main body **110** is fixed to the steering shaft **158**. Therefore, when the steering shaft **158** rotates around the steering axis As with respect to the swivel bracket **156**, the outboard motor main body **110** fixed to the steering shaft **158** also rotates around the steering axis As. This changes the direction of the thrust generated by the propeller **112** relative to the direction of the hull **200**, thus steering the boat **10**.

When the swivel bracket **156** rotates around the tilt axis At with respect to the clamp bracket **152**, the steering shaft **158** supported by the swivel bracket **156** and the outboard motor main body **110** fixed to the steering shaft **158** also rotate around the tilt axis At. This achieves the tilting action of rotating the outboard motor main body **110** in the upper-lower direction with respect to the hull **200**. Due to this tilting action, the outboard motor **100** is able to change the angle around the tilt axis At of the outboard motor main body **110** in the range from the tilt-down state in which the propeller **112** is located under the water surface (the state in which the outboard motor **100** is in the reference attitude) to the tilt-up state in which the propeller **112** is located above the water surface. The tilting device **180** also performs a trimming action to adjust the attitude of the boat **10** during travel by adjusting the angle around the tilt axis At of the outboard motor main body **110**.

FIG. **4** is a side view illustrating the configuration of the outboard motor **100** in the tilt-up state. In the outboard motor **100** in the tilt-down state shown in FIG. **2**, the position along the upper-lower direction (vertical directional position) of at least a portion of the engine assembly **120** and at least a portion of the cowl **114** accommodating the engine assembly **120** is above the vertical directional position of the tilt axis At. Therefore, as shown in FIG. **4**, these portions move forward and enter the rear end upper space **206** of the hull **200** in accordance with the transition from the tilt-down state to the tilt-up state. In other words, the rear end upper space **206** able to receive the portion of the outboard motor **100** when the outboard motor **100** tilts up is secured in the hull **200**. Hereinafter, in the outboard motor **100** in the tilt-up state, the distance along the front-rear direction from the reference point P**0**, which is the rear end point of the upper surface of the transom **210**, to the most forward end position of the outboard motor **100** is referred to as the amount of intrusion L**1** of the outboard motor **100** in the tilt-up state.

Next, a detailed configuration around the tilt shaft **160** in the outboard motor **100** of the first preferred embodiment of the present invention will be described. As shown in FIG. **3**, the tilt shaft **160** includes a first shaft **161** and a second shaft **162** which are spaced apart from each other and coaxial with each other. Each of the first shaft **161** and the second shaft **162** is a rod-shaped member extending in the left-right direction. The first shaft **161** is supported by the supporting portion **152***a* of the left clamp bracket **152**, and the second shaft **162** is supported by the supporting portion **152***a* of the right clamp bracket **152**.

Further, the tilt shaft **160** includes a first cap **164** that is disk-shaped or substantially disk-shaped on the outside (left side) of the supporting portion **152***a* of the left clamp bracket **152**, and a second cap **165** that is disk-shaped or substantially disk-shaped on the outside (right side) of the supporting portion **152***a* of the right clamp bracket **152**. The first cap **164** is connected to the first shaft **161** and rotates together with the first shaft **161**. The second cap **165** is connected to the second shaft **162** and rotates together with the second shaft **162**.

A space **163** exists between the first shaft **161** and the second shaft **162** of the tilt shaft **160**. This space **163** overlaps the first shaft **161** and the second shaft **162** in the left-right direction view. A portion of the cowl **114** (lower cowl **114***b*) accommodating the engine assembly **120** is disposed in this space **163**. In other words, a portion of the cowl **114** overlaps the first shaft **161** and the second shaft **162** in the left-right direction view. Further, in the present preferred embodiment, the intake system component **126** as an element of the engine assembly **120** is disposed in the space **163** between the first shaft **161** and the second shaft **162**.

As described above, in the outboard motor **100** of the present preferred embodiment, a portion of the engine assembly **120** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**. As a result, the position of the engine assembly **120** is set relatively downward to reduce the amount of intrusion L**1** of the outboard motor **100** into the hull **200** when the outboard motor **100** tilts up. This point will be described in detail below.

FIG. **5** is a side view illustrating a configuration of an outboard motor **100**X of a comparative example. FIG. **6** is a side view illustrating a configuration of the outboard motor **100**X of the comparative example in the tilt-up state. In the outboard motor **100**X of the comparative example, the tilt shaft **160** is not divided into the first shaft **161** and the second shaft **162**. Therefore, the cowl **114** and the engine assembly **120** are positioned relatively high so as to avoid interference with the tilt shaft **160**. Thus, the height h**1**X of the portion of the outboard motor **100**X located above the tilt axis At is relatively high. As a result, as shown in FIG. **6**, the amount of intrusion L**1**X of the outboard motor **100**X into the hull **200** when the outboard motor **100**X tilts up is relatively large. In addition, the outboard motor **100**X is relatively heavy since the total height H**1**X of the outboard motor **100**X is also relatively high.

On the contrary, in the outboard motor **100** of the present preferred embodiment, since a portion of the engine assembly **120** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**, the position of the engine assembly **120** is set relatively downward. As shown in FIG. **2**, in the present preferred embodiment, the position of the engine assembly **120** is set downward to such a level that the vertical directional position of at least a portion of the spline **124***b* of the crank shaft **124** comes to be lower than the vertical directional position of at least a portion of the tilt shaft **160**. It is more preferable that the position of the engine assembly **120** is set downward to such a level that the vertical directional position of at least a portion of the spline

124*b* of the crank shaft **124** comes to be lower than the vertical directional position of the tilt axis At. It is also more preferable that the position of the engine assembly **120** is set downward to such a level that the vertical directional position of at least a portion of the journal **124***a* of the crank shaft **124** comes to be lower than the vertical directional position of at least a portion of the tilt shaft **160**. It is still more preferable that the position of the engine assembly **120** is set downward to such a level that the vertical directional position of at least a portion of the journal **124***a* of the crank shaft **124** comes to be lower than the vertical directional position of the tilt axis At.

As described above, in the outboard motor **100** of the present preferred embodiment, since the position of the engine assembly **120** is set relatively downward, the height hi of the portion of the outboard motor **100** located above the tilt axis At is relatively low. Therefore, according to the outboard motor **100** of the present preferred embodiment, as shown in FIG. **4**, the amount of intrusion L**1** of the outboard motor **100** into the hull **200** when the outboard motor **100** tilts up is relatively small. In addition, the weight of the outboard motor **100** is reduced since the total height H**1** of the outboard motor **100** is also relatively low.

In the outboard motor **100** of the present preferred embodiment, the intake system component **126** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**. In this manner, it is possible to implement a configuration in which a portion of the engine assembly **120** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160** without drastically changing the configuration of the engine assembly **120**.

FIG. **7** is a perspective view schematically illustrating a configuration of a portion of an outboard motor **100**A according to a second preferred embodiment of the present invention. Hereinafter, in the configurations of the outboard motor **100**A of the second preferred embodiment, the same configurations as those of the outboard motor **100** of the first preferred embodiment described above are omitted as appropriate by assigning the same reference numerals.

The outboard motor **100**A of the second preferred embodiment differs from the outboard motor **100** of the first preferred embodiment in that the suspension device **150** includes a connecting member **159**. The connecting member **159** includes a pair of cylindrical supporting portions **159***a* having through holes extending in the left-right direction, and a connecting portion **159***b* connecting the pair of supporting portions **159***a* to each other. Each supporting portion **159***a* of the connecting member **159** is sandwiched between the supporting portion **152***a* of the clamp bracket **152** and the supporting portion **156***a* of the swivel bracket **156**. The connecting member **159** is supported by the supporting portion **152***a* of the clamp bracket **152** via the tilt shaft **160** (the first shaft **161** and the second shaft **162**) in each supporting portion **159***a*.

As described above, in the outboard motor **100**A of the second preferred embodiment, the suspension device **150** includes the connecting member **159**. Therefore, the first shaft **161** and the second shaft **162** of the tilt shaft **160** are connected to each other through the connecting member **159** below the first shaft **161** and the second shaft **162**. Therefore, the outboard motor **100**A of the second preferred embodiment is able to stabilize the position of the tilt axis At in a configuration in which the tilt shaft **160** includes the first shaft **161** and the second shaft **162** which are spaced apart and coaxial with each other, thus further stabilizing the tilting action of the outboard motor **100**A.

The technology disclosed herein is not limited to the above-described preferred embodiments, and can be modified into various forms without departing from the spirit of the technology, and the following modifications are also possible.

The structure of the boat **10** of the above-described preferred embodiments are merely examples and can be varied in various ways. For example, in the above-described preferred embodiments, the intake system component **126** as an element of the engine assembly **120** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**, but the electrical component **128** may be disposed between the first shaft **161** and the second shaft **162** in place of the intake system component **126** or together with the intake system component **126**. This also provides a configuration in which a portion of the engine assembly **120** is disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160** without drastically changing the configuration of the engine assembly **120**. Components or portions other than the intake system component **126** and the electrical component **128** of the engine assembly **120** may be disposed between the first shaft **161** and the second shaft **162**.

A portion of the engine assembly **120** may not be disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**, but at least a portion of the cowl **114** may be disposed therebetween. Such a configuration is able to also set the position of the cowl **114** relatively downward, thus set the position of the engine assembly **120** relatively downward, and make the amount of intrusion L**1** of the outboard motor **100** into the hull **200** when the outboard motor **100** tilts up relatively small, thus reducing the weight of the outboard motor **100** by reducing the total height of the outboard motor **100**.

Portions of the outboard motor **100** other than the portions described above may be disposed between the first shaft **161** and the second shaft **162** of the tilt shaft **160**. Such a configuration also lowers the height of the portion of the outboard motor **100** positioned above the tilt axis At to relatively reduce the amount of intrusion L**1** of the outboard motor **100** into the hull **200** when the outboard motor **100** tilts up, thus reducing the weight of the outboard motor **100** by reducing the total height of the outboard motor **100**.

In the second preferred embodiment, the first shaft **161** and the second shaft **162** of the tilt shaft **160** are connected to each other via the connecting member **159**, but the first shaft **161** and the second shaft **162** may be connected to each other via other portions of the tilt shaft **160** without using the connecting member **159**.

While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

What is claimed is:

1. An outboard motor comprising:

a tilt shaft defining a horizontal tilt axis during a tilting action of the outboard motor;

an engine assembly at least a portion of which is above the tilt axis in a tilt-down state of the outboard motor; and

a cowl accommodating at least a portion of the engine assembly; wherein

the tilt shaft includes a first shaft and a second shaft spaced apart and coaxial with each other; and

a portion of the cowl is between the first shaft and the second shaft.

2. The outboard motor according to claim **1**, wherein a portion of the engine assembly is between the first shaft and the second shaft.

3. The outboard motor according to claim **2**, wherein

the engine assembly includes an electrical component and an intake system component; and

the portion of the engine assembly between the first shaft and the second shaft is at least one of the electrical component and the intake system component.

4. The outboard motor according to claim **1**, wherein

the engine assembly includes an engine main body including a crank shaft including a spline; and

in the tilt-down state of the outboard motor, at least a portion of the spline is lower than at least a portion of the tilt shaft.

5. The outboard motor according to claim **4**, wherein, in the tilt-down state of the outboard motor, at least a portion of the spline is lower than the tilt axis.

6. The outboard motor according to claim **1**, wherein

the engine assembly includes an engine main body including a crank shaft including a journal; and

in the tilt-down state of the outboard motor, at least a portion of the journal is lower than at least a portion of the tilt shaft.

7. The outboard motor according to claim **6**, wherein, in the tilt-down state of the outboard motor, at least a portion of the journal is lower than the tilt axis.

8. The outboard motor according to claim **1**, wherein the first shaft and the second shaft are connected to each other below the first shaft and the second shaft.

9. An outboard motor comprising:

a tilt shaft defining a horizontal tilt axis during a tilting action of the outboard motor; and

an engine assembly at least a portion of which is above the tilt axis in a tilt-down state of the outboard motor; wherein

the engine assembly includes an engine main body including a crank shaft including a spline;

the tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other;

a portion of the outboard motor is between the first shaft and the second shaft; and

in the tilt-down state of the outboard motor, at least a portion of the spline is lower than at least a portion of the tilt shaft.

10. The outboard motor according to claim **9**, wherein, in the tilt-down state of the outboard motor, at least a portion of the spline is lower than the tilt axis.

11. An outboard motor comprising:

a tilt shaft defining a horizontal tilt axis during a tilting action of the outboard motor; and

an engine assembly at least a portion of which is above the tilt axis in a tilt-down state of the outboard motor; wherein

the engine assembly includes an engine main body including a crank shaft including a journal;

the tilt shaft includes a first shaft and a second shaft which are spaced apart and coaxial with each other;

a portion of the outboard motor is between the first shaft and the second shaft; and

in the tilt-down state of the outboard motor, at least a portion of the journal is lower than at least a portion of the tilt shaft.

12. The outboard motor according to claim **11**, wherein, in the tilt-down state of the outboard motor, at least a portion of the journal is lower than the tilt axis.

13. A boat comprising:

a hull; and

the outboard motor according to claim **1** attached to a rear portion of the hull.

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