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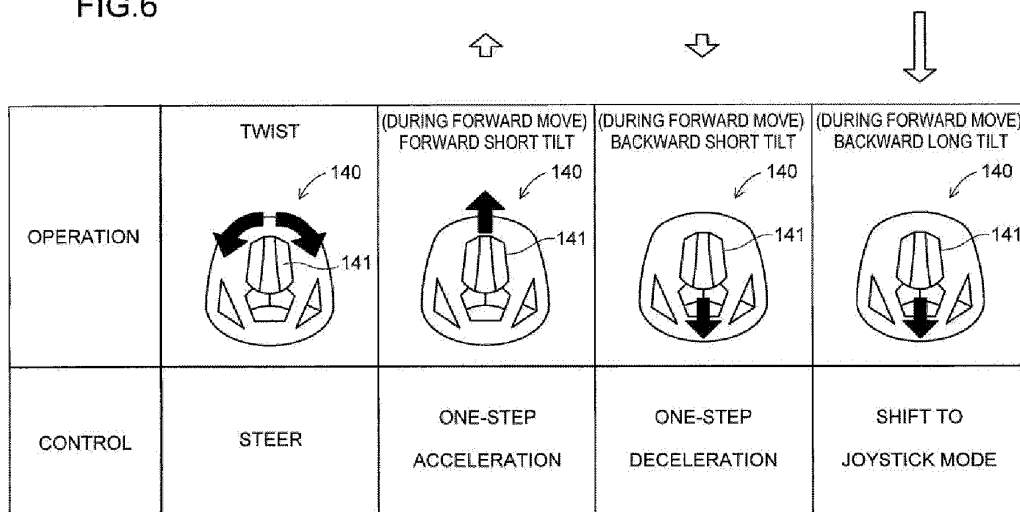
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(54) **BOAT MANEUVERING DEVICE, BOAT AND BOAT MANEUVERING METHOD**

(57) A boat maneuvering system includes an operating unit including an operating element, and a controller that controls a magnitude and a direction of a propulsion force generated by a propulsion device of a boat in response to an operation on the operating unit. When a hold start operation is performed on the operating unit during boat maneuvering using the operating element, the controller shifts to a first boat maneuvering state to

perform a hold control to hold a control index that is at least either one of an index correlated with the magnitude of the propulsion force generated by the propulsion device and a velocity of the boat. When a steering operation is performed on the operating element in the first boat maneuvering state, the controller changes the direction of the propulsion force generated by the propulsion device while maintaining the first boat maneuvering state.

FIG.6



## Description

**[0001]** The present invention relates to a boat maneuvering device, a boat and a boat maneuvering method.

**[0002]** Boats are maneuvered by using, for example, a remote controller and a steering wheel. For example, there are known boats that may be maneuvered with an operating element (e.g., joystick) during low-speed propulsion.

**[0003]** There are conventionally discussed techniques that, in order to improve the boat maneuverability with the operating element, perform a hold control to hold the output signal of the operating element at the time when a predetermined switch is pressed during boat maneuvering with the operating element (e.g., see JP S60-166043 U).

**[0004]** It is the object of the present invention to provide boat maneuvering device, a boat and boat maneuvering method being able to make fine adjustments to boat maneuvering during the hold control.

**[0005]** According to the present invention said object is solved by a boat maneuvering device having the features of independent claim 1. Moreover, said object is solved by a boat maneuvering method having the features of independent claim 15. Furthermore, said object is solved by a boat according to claim 14. Preferred embodiments are laid down in the dependent claims.

**[0006]** The present disclosure may be implemented as the following aspects, for example.

(1) A boat maneuvering device disclosed in this description includes an operating unit including an operating element, and a controller that controls a magnitude and a direction of a propulsion force generated by a propulsion device of a boat in response to an operation on the operating unit. When a hold start operation is performed on the operating unit during boat maneuvering using the operating element, the controller shifts to a first boat maneuvering state to perform a hold control to hold a control index that is at least either one of an index correlated with the magnitude of the propulsion force generated by the propulsion device and a velocity of the boat. When a steering operation is performed on the operating element in the first boat maneuvering state, the controller changes the direction of the propulsion force generated by the propulsion device while maintaining the first boat maneuvering state.

With this boat maneuvering device, when the hold start operation is performed on the operating unit during boat maneuvering using the operating element, the first boat maneuvering state is set to perform the hold control to hold the control index that is at least either one of the index correlated with the magnitude of the propulsion force generated by the propulsion device and the velocity of the boat, and therefore there is no need to continuously perform the operation on the operating element to maintain

the velocity of the boat and the boat maneuverability may be improved. Furthermore, with this boat maneuvering device, when the steering operation is performed on the operating element in the first boat maneuvering state, the direction of the propulsion force generated by the propulsion device is changed while the first boat maneuvering state is maintained so that the desired course may be selected even in the first boat maneuvering state and the boat maneuverability using the operating element may be further improved.

(2) The above-described boat maneuvering device may have a configuration such that the steering operation is at least either one of a twisting operation of the operating element and a tilting operation of the operating element in a steering direction. The use of this configuration may achieve a more intuitive steering operation in the first boat maneuvering state where the hold control is performed and may further improve the boat maneuverability using the operating element.

(3) The above-described boat maneuvering device may have a configuration such that, when an acceleration or deceleration operation is performed on the operating element in the first boat maneuvering state, the controller changes the magnitude of the control index held during the hold control. The use of this configuration may achieve fine adjustments to the velocity of the boat even in the first boat maneuvering state and may further improve the boat maneuverability using the operating element as the magnitude of the control index held during the hold control is changed when the acceleration/deceleration operation is performed on the operating element in the first boat maneuvering state.

(4) The above-described boat maneuvering device may have a configuration such that the controller changes the magnitude of the control index held during the hold control in steps in accordance with the number of times of the acceleration or deceleration operation in the first boat maneuvering state. The use of this configuration may achieve easy fine adjustments to the velocity of the boat even in the first boat maneuvering state and may further improve the boat maneuverability using the operating element.

(5) The above-described boat maneuvering device may have a configuration such that an acceleration operation is an operation to tilt the operating element in a traveling direction of the boat and a deceleration operation is an operation to tilt the operating element in a direction opposite to the traveling direction of the boat. The use of this configuration may achieve a more intuitive acceleration/deceleration operation in the first boat maneuvering state where the hold control is performed and may further improve the boat maneuverability using the operating element.

(6) The above-described boat maneuvering device may have a configuration such that, when an auto-

matic boat maneuvering start operation is performed on the operating unit in the first boat maneuvering state, the controller shifts to a second boat maneuvering state where, in addition to the hold control, an automatic boat maneuvering control is performed to hold a bearing or course of the boat. The use of this configuration may achieve a shift to the second boat maneuvering state where, in addition to the hold control, the automatic boat maneuvering control is performed to hold the bearing or course of the boat and may further improve the boat maneuverability using the operating element.

(7) The above-described boat maneuvering device may have a configuration such that the controller shifts to the first boat maneuvering state when the steering operation is performed on the operating element in the second boat maneuvering state and returns to the second boat maneuvering state when the steering operation on the operating element is stopped. The use of this configuration may achieve a temporary steering operation in the second boat maneuvering state where, in addition to the hold control, the automatic boat maneuvering control is performed to hold the bearing or course of the boat and may further improve the boat maneuverability using the operating element.

(8) The above-described boat maneuvering device may have a configuration such that the controller stops the hold control when a hold stop operation is performed on the operating element in the first boat maneuvering state. The use of this configuration may stop the hold control at the desired timing and may further improve the boat maneuverability using the operating element.

(9) The above-described boat maneuvering device may have a configuration such that the hold stop operation is an operation to tilt the operating element backward for a predetermined time or more while the boat moves forward and is an operation to tilt the operating element forward for a predetermined time or more while the boat moves backward. The use of this configuration may achieve a more intuitive hold stop operation and may further improve the boat maneuverability using the operating element.

(10) The above-described boat maneuvering device may have a configuration such that, when the velocity of the boat is less than a predetermined value in the first boat maneuvering state, the controller shifts to a third boat maneuvering state where, in addition to the hold control, a pattern control is performed to alternately switch between an on state where the propulsion device generates the propulsion force and an off state where the propulsion device does not generate the propulsion force and, when the velocity of the boat is the predetermined value or more, the controller returns to the first boat maneuvering state. The use of this configuration may achieve a shift from the first boat maneuvering state, in which

the hold control is performed, to the third boat maneuvering state, in which the boat maneuvering is performed at a lower speed, and may further improve the boat maneuverability using the operating element.

(11) The above-described boat maneuvering device may have a configuration such that the hold start operation is an operation to press a predetermined switch for a predetermined time or more. The use of this configuration may prevent an unintended shift (improper operation) to the first boat maneuvering state and may further improve the boat maneuverability using the operating element.

(12) The above-described boat maneuvering device may have a configuration such that the operating element is a joystick including a stick portion gripped and operated by an operator and a support portion supporting the stick portion to enable a tilting operation and a twisting operation. The use of this configuration may further improve the boat maneuverability using the joystick.

(13) Another boat maneuvering device disclosed in this description includes an operating unit including an operating element, and a controller that controls a magnitude and a direction of a propulsion force generated by a propulsion device of a boat in response to an operation on the operating unit. When a hold start operation is performed on the operating unit during boat maneuvering using the operating element, the controller shifts to a first boat maneuvering state to perform a hold control to hold a control index that is at least either one of an index correlated with the magnitude of the propulsion force generated by the propulsion device and a velocity of the boat. When an operation is performed on the operating element in the first boat maneuvering state, the controller changes at least either one of the magnitude and the direction of the propulsion force generated by the propulsion device while maintaining the first boat maneuvering state.

With this boat maneuvering device, when the hold start operation is performed on the operating unit during boat maneuvering using the operating element, the first boat maneuvering state is set to perform the hold control to hold the control index that is at least either one of the index correlated with the magnitude of the propulsion force generated by the propulsion device and the velocity of the boat, and therefore there is no need to continuously perform the operation on the operating element to maintain the velocity of the boat and the boat maneuverability may be improved. Furthermore, with this boat maneuvering device, when the operation is performed on the operating element in the first boat maneuvering state, at least either one of the magnitude and the direction of the propulsion force generated by the propulsion device is changed while the first boat maneuvering state is maintained so that

the desired course may be selected even in the first boat maneuvering state and the boat maneuverability using the operating element may be further improved.

(14) A boat disclosed in this description includes a boat body, the propulsion device attached to the boat body, and the above-described boat maneuvering device. With this boat, the boat maneuverability using the operating element may be further improved.

**[0007]** The technique disclosed in this description may be implemented in various forms, for example, in the form of a boat maneuvering device, a boat including a boat maneuvering device, or a boat maneuvering method.

**[0008]** With the boat maneuvering device disclosed in this description, the boat maneuverability using the operating element may be further improved.

#### BRIEF DESCRIPTION OF DRAWINGS

##### **[0009]**

FIG. 1 is an explanatory diagram schematically illustrating a configuration of a boat according to the present embodiment.

FIG. 2 is a block diagram illustrating a configuration of a boat maneuvering device.

FIG. 3 is an explanatory diagram illustrating an external configuration of a joystick.

FIG. 4 is a flowchart illustrating a boat maneuvering mode switching process.

FIG. 5 is a transition diagram of a boat maneuvering mode during the boat maneuvering mode switching process.

FIG. 6 is an explanatory diagram illustrating control contents in response to operations on the joystick in a joystick hold mode.

#### DETAILED DESCRIPTION

##### THE PREFERRED EMBODIMENTS

**[0010]** FIG. 1 is an explanatory diagram schematically illustrating a configuration of a boat 10 according to the present embodiment. FIG. 1 illustrates arrows indicating the front (FRONT), the rear (REAR), the left (LEFT), and the right (RIGHT), respectively, with respect to the position of the boat 10.

**[0011]** As illustrated in FIG. 1, the boat 10 includes a boat body 20, an outboard motor 30, and a boat maneuvering device or system 100. The boat body 20 is a part of the boat 10 which a crew gets on.

**[0012]** The outboard motor 30 is a device that generates the propulsion force for propelling the boat 10. The outboard motor 30 is attached to a rear portion of the boat body 20 via a bracket, for example. The outboard motor 30 includes a power source 32, such as an engine or motor, which generates the driving force, and a pro-

pulsion force generating mechanism 34, such as a propeller, which is driven by the driving force from the power source 32 to generate the propulsion force. The outboard motor 30 includes a steering mechanism and a shift mechanism, both of which are not illustrated. The steering mechanism rotates the outboard motor 30 around a steering axis. The shift mechanism switches among a forward moving state where the driving force from the power source 32 is transmitted to the propulsion force generating mechanism 34 in the direction in which the boat 10 moves forward, a backward moving state where the driving force from the power source 32 is transmitted to the propulsion force generating mechanism 34 in the direction in which the boat 10 moves backward, and a neutral state where the driving force from the power source 32 is not transmitted to the propulsion force generating mechanism 34. According to the present embodiment, the boat 10 includes the two outboard motors 30. The outboard motor 30 is an example of a propulsion device.

**[0013]** The boat maneuvering device 100 is a device or system that operates the boat 10. FIG. 2 is a block diagram illustrating a configuration of the boat maneuvering device 100. As illustrated in FIGS. 1 and 2, the boat maneuvering device 100 includes an operating unit 110 that receives an operation by the operator. The operating unit 110 is provided in, for example, a wheelhouse of the boat 10. The operating unit 110 includes a steering wheel 120, a remote controller 130, a joystick 140, an automatic boat maneuvering button 150, and a monitor 160.

**[0014]** The steering wheel 120 is an operating device that performs a steering operation of the boat 10. The remote controller 130 is an operating device including, for example, a throttle lever to perform a shift operation and a propulsion force change operation of the boat 10. The monitor 160 includes, for example, a liquid crystal display to display various images (operational images, etc.) regarding the boat 10. The monitor 160 may include a touch panel.

**[0015]** The joystick 140 is an operating device that operates the boat 10 in a joystick mode, and the like, described below. The joystick 140 is an example of an operating element.

**[0016]** FIG. 3 is an explanatory diagram illustrating an external configuration of the joystick 140. As illustrated in FIGS. 2 and 3, the joystick 140 includes a stick portion 141 held and operated by the operator and a support portion 142 supporting the stick portion 141 to enable a tilting operation and a twisting operation. The stick portion 141 is biased by a biasing member such as a spring to automatically return to a neutral state (the state where the stick portion 141 is in an upright position) when no operating force is applied. The stick portion 141 may be tilted in at least two directions to the front and back from the neutral state. The stick portion 141 may be tilted in three or more directions or may be tilted in all directions. The stick portion 141 enables a twisting operation in

clockwise and counterclockwise directions.

**[0017]** In the joystick mode, when the stick portion 141 is tilted, the magnitude and/or direction of the propulsion force generated by the outboard motor 30 is controlled in accordance with the tilt direction and amount of the stick portion 141. For example, when the stick portion 141 is tilted forward, the direction of the propulsion force generated by the outboard motor 30 is controlled to move the boat 10 forward. Conversely, when the stick portion 141 is tilted backward, the direction of the propulsion force generated by the outboard motor 30 is controlled to move the boat 10 backward. The control is performed such that the larger the tilt amount of the stick portion 141, the larger the propulsion force generated by the outboard motor 30. When the stick portion 141 is twisted (rotated), the direction of the propulsion force generated by the outboard motor 30 is controlled such that the boat 10 is steered in accordance with the rotation direction and amount of the stick portion 141.

**[0018]** The joystick 140 further includes various buttons 143. The various buttons 143 include a joystick button 144, a set point button 145, and a propulsion force adjustment button 146. The joystick button 144 is a button to perform, for example, the operation to shift to the joystick mode described below. The set point button 145 is a button to perform, for example, the operation to shift to a set point mode described below. As described below, the set point mode is a collective term for a stay point mode, a drift point mode, and a fish point mode, and the set point button 145 includes buttons corresponding to the respective modes.

**[0019]** The automatic boat maneuvering button 150 is a button to perform the operation to shift to an automatic boat maneuvering mode described below. As described below, the automatic boat maneuvering mode is a collective term for a bearing hold mode and a course hold mode, and the automatic boat maneuvering button 150 includes buttons (a bearing hold button 151 and a course hold button 152) corresponding to the respective modes.

**[0020]** The boat maneuvering device 100 further includes a controller 180. The controller 180 includes, for example, a CPU, a multi-core CPU, a programmable device (field programmable gate array (FPGA), programmable logic device (PLD), etc.). The controller 180 controls the operation of the boat 10. For example, the controller 180 controls the magnitude and the direction of the propulsion force generated by the outboard motor 30 of the boat 10 in response to the operation on the operating unit 110. The controller 180 controls the magnitude and the direction of the propulsion force generated by the outboard motor 30 in response to the operation on the joystick 140.

**[0021]** The controller 180 includes a storage device 182. The storage device 182 includes, for example, a ROM, a RAM, a hard disk drive (HDD), a solid state drive (SSD), etc. The storage device 182 stores various types of programs and data and is used as a work area for executing various processes and a storage area of data.

For example, the storage device 182 stores a computer program for executing a boat maneuvering mode switching process described below. The computer program is provided in the state of being stored in a computer-readable recording medium (not illustrated), such as a CD-ROM, DVD-ROM, or USB memory or is provided in the state of being acquirable from an external device (e.g., a server in the cloud) via a communication interface (not illustrated) and is stored in the storage device 182 in the state of being operable on the boat maneuvering device 100.

**[0022]** Next, the boat maneuvering mode switching process executed by the controller 180 of the boat maneuvering device 100 will be described. The boat maneuvering mode switching process is a process to switch the boat maneuvering mode of the boat 10. FIG. 4 is a flowchart illustrating the boat maneuvering mode switching process, and FIG. 5 is a transition diagram of the boat maneuvering mode during the boat maneuvering mode switching process.

**[0023]** According to the present embodiment, the controller 180 sets the boat maneuvering mode to a normal boat maneuvering mode M0 by default (S110). The normal boat maneuvering mode M0 is a mode for boat maneuvering by primarily using the steering wheel 120 and the remote controller 130.

**[0024]** In the normal boat maneuvering mode M0, the controller 180 monitors whether a joystick mode start operation has been performed by the operator (S120) and, when the joystick mode start operation has been performed (S120: YES), shifts the boat maneuvering mode from the normal boat maneuvering mode M0 to a joystick mode M1 (S130, see a1 in FIG. 5). The joystick mode M1 is a mode for boat maneuvering using the joystick 140. The joystick mode M1 is used, for example, when the boat 10 is propelled at a relatively low speed (e.g., approximately 10 km/h or less). In the joystick mode M1, the driving force generated by the power source 32 of the outboard motor 30 may be limited to a predetermined value or less. For example, when the power source 32 includes an engine, the engine speed may be limited to approximately 2000 rpm or less in the joystick mode M1. The above-described joystick mode start operation is, for example, a short press of the joystick button 144. A short press is an operation to press the button for a predetermined time or less. According to the present embodiment, the shift is made to the joystick mode M1 only when the joystick mode start operation is performed in a state where a predetermined requirement is satisfied. The state where the predetermined requirement is satisfied refers to, for example, the state where the propulsion force generated by the outboard motor 30 is zero.

**[0025]** In the joystick mode M1, the controller 180 monitors whether a joystick mode stop operation has been performed by the operator (S140) and, when the joystick mode stop operation has been performed (S140: YES), shifts the boat maneuvering mode from the joystick mode M1 to the normal boat maneuvering mode M0 (S110, see

a2 in FIG. 5). The joystick mode stop operation is, for example, a short press of the joystick button 144.

**[0026]** In the joystick mode M1, the controller 180 monitors whether a hold start operation has been performed by the operator (S150) and, when the hold start operation has been performed (S150: YES), shifts the boat maneuvering mode from the joystick mode M1 to a joystick hold mode M10 (S160, see a3 in FIG. 5). In the joystick hold mode M10, the output signal of the joystick 140 at the time of the hold start operation (the signal indicating the tilt state of the stick portion 141) is held. Thus, the controller 180 performs a hold control to hold the index (e.g., throttle valve opening degree, engine speed, or motor output) correlated with the magnitude of the propulsion force generated by the outboard motor 30. In the joystick hold mode M10, the operator does not need to apply the force to the stick portion 141 to continuously tilt the stick portion 141 and may execute boat maneuvering with his/her hands off the stick portion 141, which may reduce the onerousness for boat maneuvering. The above-described hold start operation is, for example, a long press of the joystick button 144. A long press is an operation to press the button for a predetermined time or more. According to the present embodiment, the joystick mode M1 shifts to the joystick hold mode M10 only when the hold start operation is performed in a state where a predetermined requirement is satisfied. The state where the predetermined requirement is satisfied refers to, for example, the state where the stick portion 141 of the joystick 140 is tilted substantially forward or substantially backward. The joystick hold mode M10 and a joystick hold combined mode M11 described below are collectively referred to as a joystick hold mode group. The boat maneuvering state in the joystick hold mode M10 is an example of a first boat maneuvering state.

**[0027]** According to the present embodiment, in the joystick hold mode M10, an operation is performed on the joystick 140 so that fine adjustments may be made to boat maneuvering. FIG. 6 is an explanatory diagram illustrating control contents in response to operations on the joystick 140 in the joystick hold mode M10.

**[0028]** When the twisting (rotating) operation is performed on the stick portion 141 as a steering operation in the joystick hold mode M10, the controller 180 changes the direction of the propulsion force generated by the outboard motor 30 such that the boat 10 is steered in accordance with the rotation direction and amount of the stick portion 141. The steering operation may be not only the twisting operation of the stick portion 141 but also other operations (e.g., the operation to tilt the stick portion 141 in the steering direction).

**[0029]** When a forward short tilting operation is performed on the stick portion 141 as an acceleration operation while the boat 10 moves forward, the controller 180 increases the magnitude of the index (e.g., throttle valve opening degree, engine speed, motor output, etc.) correlated with the magnitude of the propulsion force generated by the outboard motor 30 in steps in accordance

with the number of times of the acceleration operation to increase the velocity of the boat 10. A short tilt is the operation to tilt the stick portion 141 for a predetermined time or less. For example, the magnitude of the above-described index increases in one step and the boat 10 accelerates in one step when the acceleration operation is performed once, and the magnitude of the above-described index increases in two steps and the boat 10 accelerates in two steps when the acceleration operation is performed twice.

**[0030]** When a backward short tilting operation is performed on the stick portion 141 as a deceleration operation while the boat 10 moves forward, the controller 180 decreases the magnitude of the index correlated with the magnitude of the propulsion force generated by the outboard motor 30 in steps in accordance with the number of times of the deceleration operation to decrease the velocity of the boat 10. For example, the magnitude of the above-described index decreases in one step and the boat 10 decelerates in one step when the deceleration operation is performed once, and the magnitude of the above-described index decreases in two steps and the boat 10 decelerates in two steps when the deceleration operation is performed twice.

**[0031]** The acceleration/deceleration operation while the boat 10 moves backward is an operation opposite to the acceleration/deceleration operation while the boat 10 moves forward. Specifically, the acceleration operation while the boat 10 moves backward is a backward short tilting operation of the stick portion 141, and the deceleration operation while the boat 10 moves backward is a forward short tilting operation of the stick portion 141.

**[0032]** As described above, according to the present embodiment, when the steering operation or the acceleration/deceleration operation is performed on the joystick 140 in the joystick hold mode M10, the controller 180 executes steering and acceleration/deceleration of the boat 10 while maintaining the joystick hold mode M10. Therefore, the operator may make fine adjustments to boat maneuvering in the joystick hold mode M10.

**[0033]** In the joystick hold mode M10, the controller 180 monitors whether the hold stop operation has been performed by the operator (S170) and, when the hold stop operation has been performed (S170: YES), shifts the boat maneuvering mode from the joystick hold mode M10 to the joystick mode M1 (S130, see a4 in FIG. 5). The hold stop operation is, for example, a short press of the joystick button 144. According to the present embodiment, as illustrated in FIG. 6, the backward long tilting operation of the stick portion 141 while the boat 10 moves forward and also the forward long tilting operation of the stick portion 141 while the boat 10 moves backward are recognized as a hold stop operation. A long tilt is an operation to tilt the stick portion 141 for a predetermined time or more.

**[0034]** In the joystick hold mode M10, the controller 180 monitors whether a joystick cancel condition is satisfied (S180) and, when the joystick cancel condition is

satisfied (S180: YES), shifts the boat maneuvering mode from the joystick hold mode M10 to the normal boat maneuvering mode M0 (S110, see a5 in FIG. 5). The joystick cancel condition includes that, for example, the operation has been performed on the remote controller 130 or the steering wheel 120, the power source 32 of the outboard motor 30 has stopped, and an error such as a communication error of the joystick 140 has occurred. A shift to the normal boat maneuvering mode M0 when the joystick cancel condition is satisfied is made in not only the joystick hold mode M10 but also the joystick mode M1.

**[0035]** In the joystick hold mode M10, the controller 180 monitors whether a combined mode start condition is satisfied (S190) and, when the combined mode start condition is satisfied (S190: YES), shifts the boat maneuvering mode from the joystick hold mode M10 to the joystick hold combined mode M11 (S200, see a6 to a8 in FIG. 5). The joystick hold combined mode M11 is a mode that, together with the joystick hold mode M10, forms the joystick hold mode group and that executes other controls in addition to the above-described hold control (control to hold the index correlated with the magnitude of the propulsion force generated by the outboard motor 30).

**[0036]** As illustrated in FIG. 5, according to the present embodiment, three modes, that is, a joystick hold + bearing hold mode M13, a joystick hold + course hold mode M14, and a joystick hold + pattern shift mode M15 are prepared as the joystick hold combined mode M11.

**[0037]** The joystick hold + bearing hold mode M13 is a mode for executing a bearing hold control to hold the bearing of the boat 10 in addition to the above-described hold control. In this mode, the controller 180 controls the magnitude and the direction of the propulsion force generated by the outboard motor 30 such that the bearing of the boat 10 is held. According to the present embodiment, as illustrated in FIG. 5, the joystick hold + bearing hold mode M13 includes, in addition to the hold control and the bearing hold control described above, a mode (joystick hold + bearing hold + pattern shift mode) for also executing the pattern control described below. The joystick hold + course hold mode M14 is a mode for executing, in addition to the above-described hold control, a course hold control to hold the course of the boat 10. In this mode, the controller 180 controls the magnitude and the direction of the propulsion force generated by the outboard motor 30 to hold the course of the boat 10. According to the present embodiment, as illustrated in FIG. 5, the joystick hold + course hold mode M14 includes, in addition to the hold control and the course hold control described above, the mode (joystick hold + course hold + pattern shift mode) for also executing the pattern control described below. In this description, the bearing hold control and the course hold control are collectively referred to as an automatic boat maneuvering control, and the joystick hold + bearing hold mode M13 and the joystick hold + course hold mode M14 are collectively referred to as a joystick hold automatic boat maneuvering

mode M12. A combined mode start condition for a shift from the joystick hold mode M10 to the joystick hold automatic boat maneuvering mode M12 includes, for example, that the automatic boat maneuvering button 150 (the bearing hold button 151 or the course hold button 152) has been pressed. A boat maneuvering state in the joystick hold automatic boat maneuvering mode M12 is an example of a second boat maneuvering state, and the press of the automatic boat maneuvering button 150 is an example of an automatic boat maneuvering start operation.

**[0038]** The joystick hold + pattern shift mode M15, included in the joystick hold combined mode M11, is a mode for executing, in addition to the above-described hold control, a pattern control to alternately switch between an on state where the outboard motor 30 generates the propulsion force and an off state where the outboard motor 30 does not generate the propulsion force. According to this mode, the boat 10 may be maneuvered at an extremely low speed. The combined mode start condition for a shift from the joystick hold mode M10 to the joystick hold + pattern shift mode M15 includes, for example, that the velocity of the boat 10 is less than a predetermined value (e.g., less than approximately 3 km/h). The boat maneuvering state in the joystick hold + pattern shift mode M15 is an example of a third boat maneuvering state.

**[0039]** In the joystick hold combined mode M11, as in the joystick hold mode M10, the controller 180 monitors whether the hold stop operation has been performed by the operator (S210) and, when the hold stop operation has been performed (S210: YES), shifts the boat maneuvering mode from the joystick hold combined mode M11 to the joystick mode M1 (S130, see a4 in FIG. 5). Moreover, in the joystick hold combined mode M11, as in the joystick hold mode M10, the controller 180 monitors whether the joystick cancel condition is satisfied (S220) and, when the joystick cancel condition is satisfied (S220: YES), shifts the boat maneuvering mode from the joystick hold combined mode M11 to the normal boat maneuvering mode M0 (S110, see a5 in FIG. 5).

**[0040]** In the joystick hold combined mode M11, the controller 180 monitors whether a single mode return condition is satisfied (S230) and, when the single mode return condition is satisfied (S230: YES), shifts the boat maneuvering mode from the joystick hold combined mode M11 to the joystick hold mode M10 (S160, see a9 to a11 in FIG. 5).

**[0041]** For example, in the joystick hold automatic boat maneuvering mode M12, included in the joystick hold combined mode M11, the single mode return condition includes that the active automatic boat maneuvering button 150 (the bearing hold button 151 or the course hold button 152) has been pressed. That is, in the joystick hold + bearing hold mode M13, the press of the bearing hold button 151 is recognized as a single mode return condition. Similarly, in the joystick hold + course hold mode M14, the press of the course hold button 152 is

recognized as a single mode return condition.

**[0042]** Furthermore, in the joystick hold automatic boat maneuvering mode M12, the single mode return condition includes that the steering operation on the joystick 140 (at least either one of the twisting operation of the stick portion 141 and the tilting operation of the stick portion 141 in the steering direction) has been performed. Therefore, when the steering operation is performed on the joystick 140 in the joystick hold automatic boat maneuvering mode M12, the boat maneuvering mode shifts to the joystick hold mode M10. Thus, the automatic boat maneuvering control is temporarily stopped, and the steering control is executed in response to the steering operation on the joystick 140. Then, when the steering operation on the joystick 140 is stopped, it is determined that the combined mode start condition is satisfied (S190: YES), and the boat maneuvering mode shifts to the joystick hold combined mode M11. As described above, the steering operation is performed on the joystick 140 during boat maneuvering in the joystick hold combined mode M11 and thus a manual steering operation is temporarily performed, and then the steering operation on the joystick 140 is stopped to enable a return to automatic boat maneuvering, which may improve the boat maneuverability.

**[0043]** For example, in the joystick hold + pattern shift mode M15, included in the joystick hold combined mode M11, the single mode return condition includes that the velocity of the boat 10 is a predetermined value or more (e.g., approximately 3 km/h or more).

**[0044]** As illustrated in FIG. 5, according to the present embodiment, it is possible to make a direct shift between the joystick hold + bearing hold mode M13 and the joystick hold + course hold mode M14 (see a12 and a13 in FIG. 5). Specifically, when the course hold button 152 is pressed in the joystick hold + bearing hold mode M13, a shift is made to the joystick hold + course hold mode M14. Conversely, when the bearing hold button 151 is pressed in the joystick hold + course hold mode M14, a shift is made to the joystick hold + bearing hold mode M13.

**[0045]** As illustrated in FIG. 5, according to the present embodiment, a set point mode M2 is set as a boat maneuvering mode. As described above, the set point mode M2 is a collective term for the stay point mode, the drift point mode, and the fish point mode. The stay point mode is a mode for holding the position and bearing of the boat 10, the fish point mode is a mode for holding the position of the boat 10, and the drift point mode is a mode for holding the bearing of the boat 10. When the set point button 145 is pressed in the joystick mode M1, a shift is made to the set point mode M2 (see a14 in FIG. 5), and when the set point button 145 is pressed in the set point mode M2, a shift is made to the joystick mode M1 (see a15 in FIG. 5). Similarly, when the set point button 145 is pressed in the joystick hold mode M10 and the joystick hold combined mode M11, a shift is made to the set point mode M2 (see a16 in FIG. 5).

**[0046]** The controller 180 repeatedly performs the above-described process. When a predetermined end condition is satisfied (e.g., a primary switch of the boat 10 is in the off state), the boat maneuvering mode switching process by the controller 180 ends.

**[0047]** The technique disclosed in this description is not limited to the embodiment described above and may be modified to various forms without departing from the spirit thereof and for example may be modified as described below.

**[0048]** The configuration of the boat 10 according to the above embodiment is merely an example and may be modified in various ways. For example, according to the above embodiment, the boat 10 includes the two outboard motors 30, but the boat 10 may include the one outboard motor 30, or the boat 10 may include the three or more outboard motors 30.

**[0049]** According to the above embodiment, a part of the elements included in the operating unit 110 may be omitted, or the operating unit 110 may include other elements. The configuration of the joystick 140 according to the above embodiment is merely an example and may be modified in various ways. According to the above embodiment, the operating unit 110 includes the joystick 140 as an operating element, but the operating unit 110 may include an operating element other than the joystick 140.

**[0050]** The content of the boat maneuvering mode switching process according to the above embodiment is merely an example and may be modified in various ways. For example, according to the above embodiment, the index (e.g., throttle valve opening degree, engine speed, motor power, etc.) correlated with the magnitude of the propulsion force generated by the outboard motor 30 is held during the hold control, but along with or instead of it, the velocity of the boat 10 may be held.

**[0051]** According to the above embodiment, in the joystick hold mode M10, both the steering operation and the acceleration/deceleration operation for the joystick 140 are possible, but at least either one of the steering operation and the acceleration/deceleration operation for the joystick 140 may be possible. Specifically, in the joystick hold mode M10, when an operation is performed on the joystick 140, the controller 180 may change at least either one of the magnitude and the direction of the propulsion force generated by the outboard motor 30 while maintaining the joystick hold mode M10.

**[0052]** According to the above embodiment, the start and stop operation of each boat maneuvering mode and the shift condition for each boat maneuvering mode are merely examples and may be modified in various ways. According to the above embodiment, a part of the boat maneuvering modes may be omitted or other boat maneuvering modes may be included.

**Claims**

1. A boat maneuvering device (100) for a boat (10) comprising:

an operating unit (110) including an operating element (140); and  
 a controller (180) configured to control a magnitude and a direction of a propulsion force generated by a propulsion device (30) of the boat (10) in response to an operation on the operating unit (110), wherein  
 the controller (180) is configured to shift to a first boat maneuvering state to perform a hold control to hold a control index that is at least either one of an index correlated with the magnitude of the propulsion force generated by the propulsion device (30) and a velocity of the boat (10), when a hold start operation is performed on the operating unit (110) during boat maneuvering using the operating element (140), and the controller (180) is configured to change at least either one of the magnitude and the direction of the propulsion force generated by the propulsion device (30) while maintaining the first boat maneuvering state, when an operation is performed on the operating element (140) in the first boat maneuvering state.

2. The boat maneuvering device (100) according to claim 1, wherein the steering operation is at least either one of a twisting operation of the operating element (140) and a tilting operation of the operating element (140) in a steering direction.

3. The boat maneuvering device (100) according to claim 1 or 2, wherein the controller (180) is configured to change the magnitude of the control index held during the hold control, when an acceleration or deceleration operation is performed on the operating element (140) in the first boat maneuvering state.

4. The boat maneuvering device (100) according to claim 3, wherein the controller (180) is configured to changes the magnitude of the control index held during the hold control in steps in accordance with the number of times of the acceleration or deceleration operation in the first boat maneuvering state.

5. The boat maneuvering device (100) according to claim 3 or 4, wherein the acceleration operation is an operation to tilt the operating element (140) in a traveling direction of the boat (10) and the deceleration operation is an operation to tilt the operating element (140) in a direction opposite to the traveling direction of the boat (10).

6. The boat maneuvering device (100) according to any one of claims 1 to 5, wherein the controller (180) is configured to shift to a second boat maneuvering state where, in addition to the hold control, an automatic boat maneuvering control is performed to hold a bearing or course of the boat (10), when an automatic boat maneuvering start operation is performed on the operating unit (110) in the first boat maneuvering state.

7. The boat maneuvering device (100) according to claim 6, wherein the controller (180) is configured to shift to the first boat maneuvering state when the steering operation is performed on the operating element (140) in the second boat maneuvering state and returns to the second boat maneuvering state when the steering operation on the operating element (140) is stopped.

8. The boat maneuvering device (100) according to any one of claims 1 to 7, wherein the controller (180) is configured to stop the hold control when a hold stop operation is performed on the operating element (140) in the first boat maneuvering state.

9. The boat maneuvering device (100) according to claim 8, wherein the hold stop operation is an operation to tilt the operating element (140) backward for a predetermined time or more while the boat (10) moves forward and is an operation to tilt the operating element (140) forward for a predetermined time or more while the boat (10) moves backward.

10. The boat maneuvering device (100) according to any one of claims 1 to 9, wherein the controller (180) is configured to shift to a third boat maneuvering state where, in addition to the hold control, a pattern control is performed to alternately switch between an on state where the propulsion device (30) generates the propulsion force and an off state where the propulsion device (30) does not generate the propulsion force, when the velocity of the boat (10) is less than a predetermined value in the first boat maneuvering state, and, the controller (180) is configured to return to the first boat maneuvering state, when the velocity of the boat (10) is the predetermined value or more.

11. The boat maneuvering device (100) according to any one of claims 1 to 10, wherein the hold start operation is an operation to press a predetermined switch for a predetermined time or more.

12. The boat maneuvering device (100) according to any one of claims 1 to 11, wherein the operating element is a joystick (140) including a stick portion (141) gripped and operated by an operator and a support portion supporting the stick portion (141) to enable a tilting operation and a twisting operation.

13. The boat maneuvering device (100) according to any one of claims 1 to 12, wherein the controller (180) is configured to change the direction of the propulsion force generated by the propulsion device (30) while maintaining the first boat maneuvering state, when a steering operation is performed on the operating element (140) in the first boat maneuvering state. 5

14. A boat (10) comprising: 10  
 a boat body (20);  
 the propulsion device (30) attached to the boat body (20); and  
 the boat maneuvering device (100) according to any one of claims 1 to 13. 15

15. A boat maneuvering method for a boat (10) having an operating unit (110) including an operating element (140) and a propulsion device (30), wherein the method comprises: 20

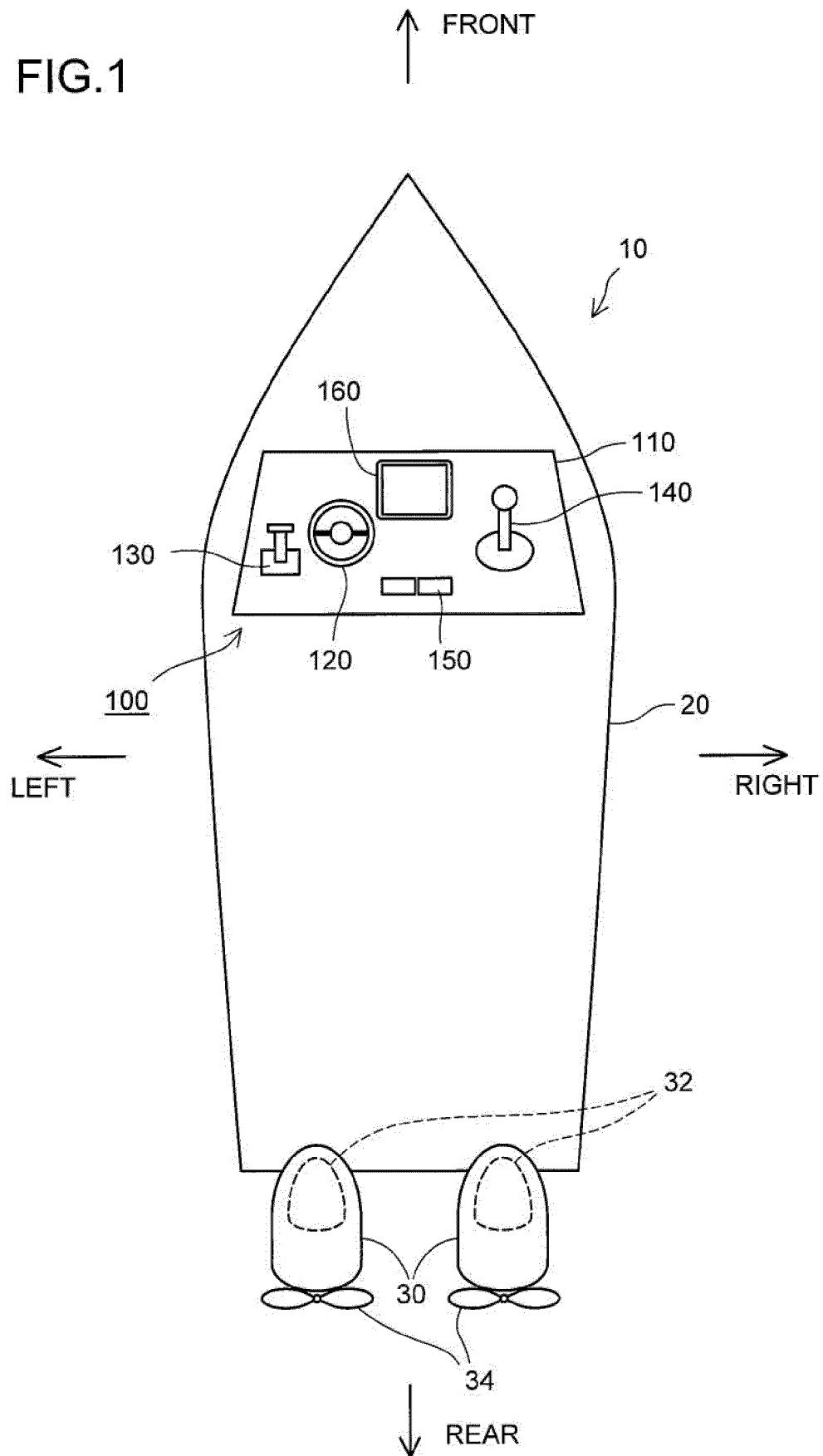
controlling a magnitude and a direction of a propulsion force generated by a propulsion device (30) of the boat (10) in response to an operation on the operating unit (110), and 25  
 shifting to a first boat maneuvering state to perform a hold control to hold a control index that is at least either one of an index correlated with the magnitude of the propulsion force generated by the propulsion device (30) and a velocity of the boat (10), when a hold start operation is performed on the operating unit (110) during boat maneuvering using the operating element (140), 30  
 and  
 changing at least either one of the magnitude and the direction of the propulsion force generated by the propulsion device (30) while maintaining the first boat maneuvering state, when an operation is performed on the operating element (140) in the first boat maneuvering state. 35 40

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FIG.1



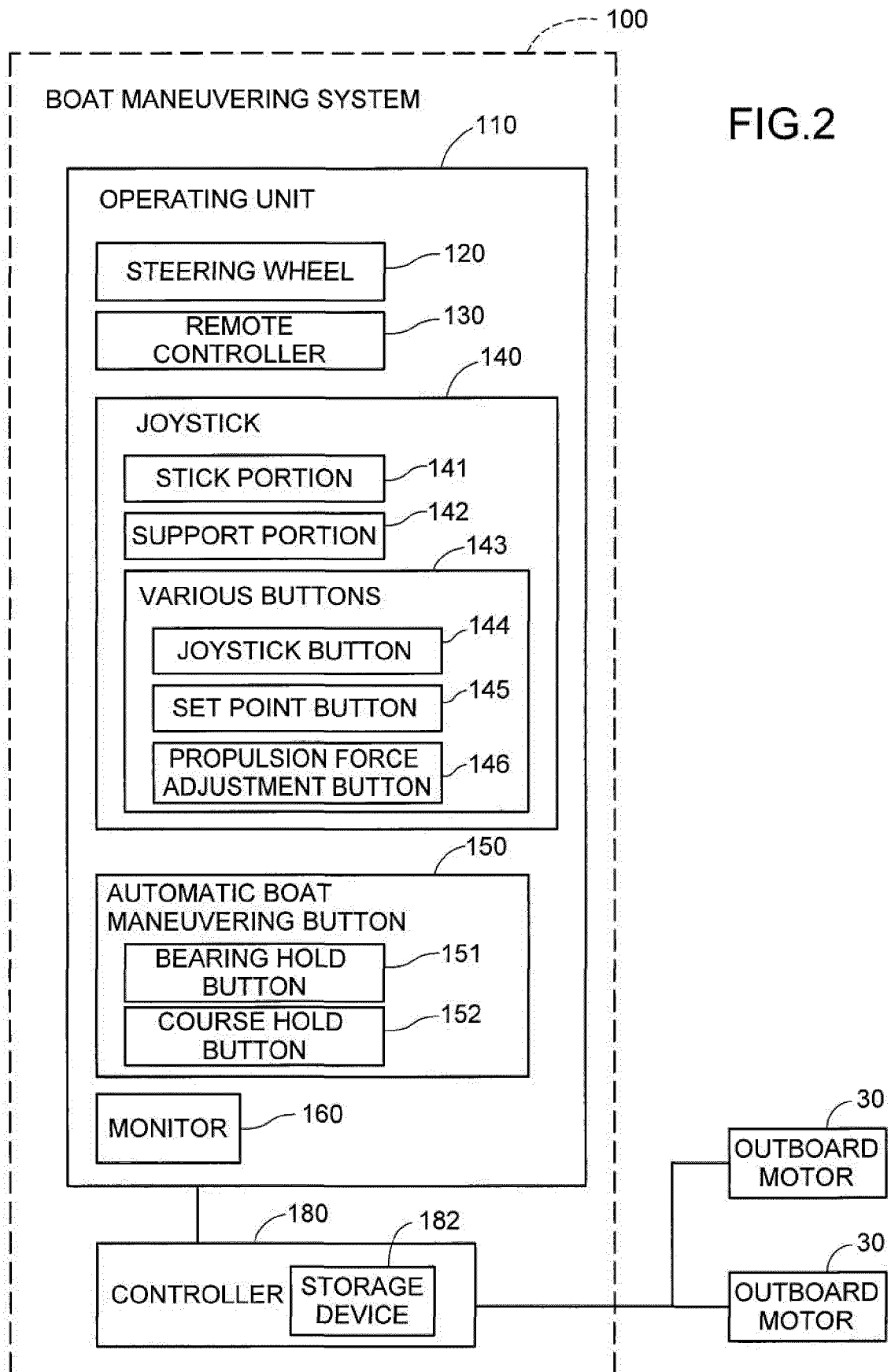


FIG.3

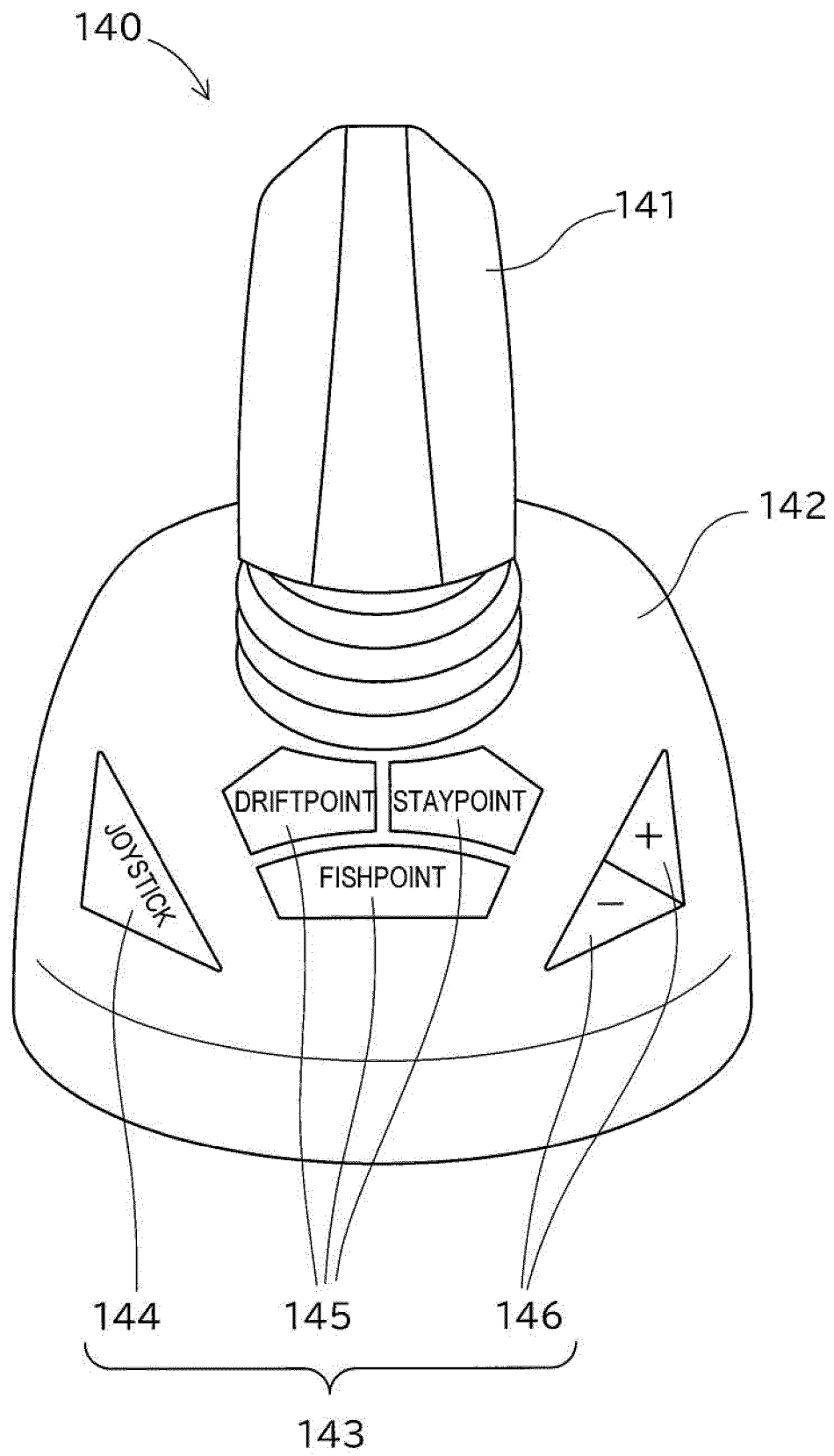


FIG.4

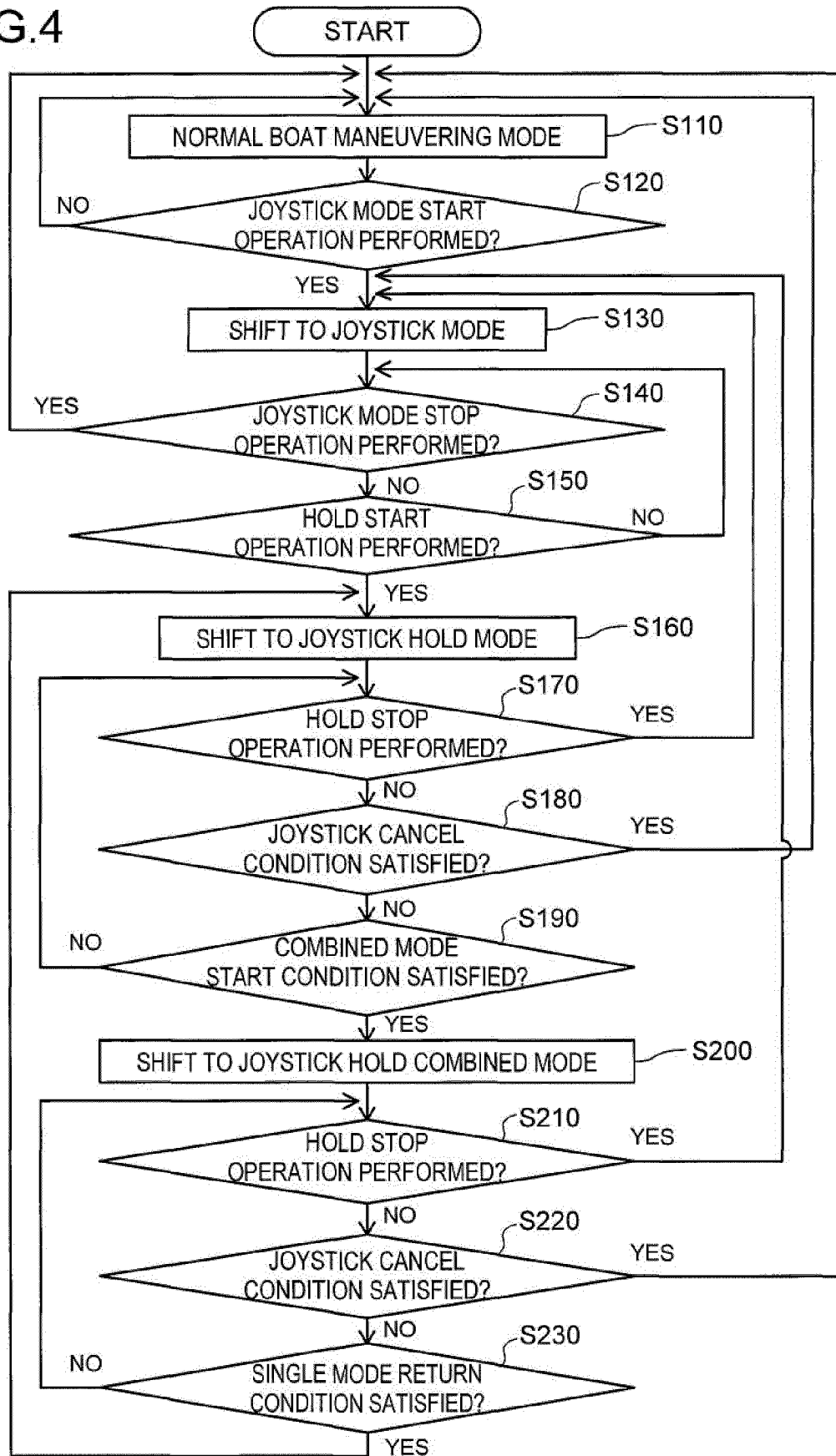


FIG.5

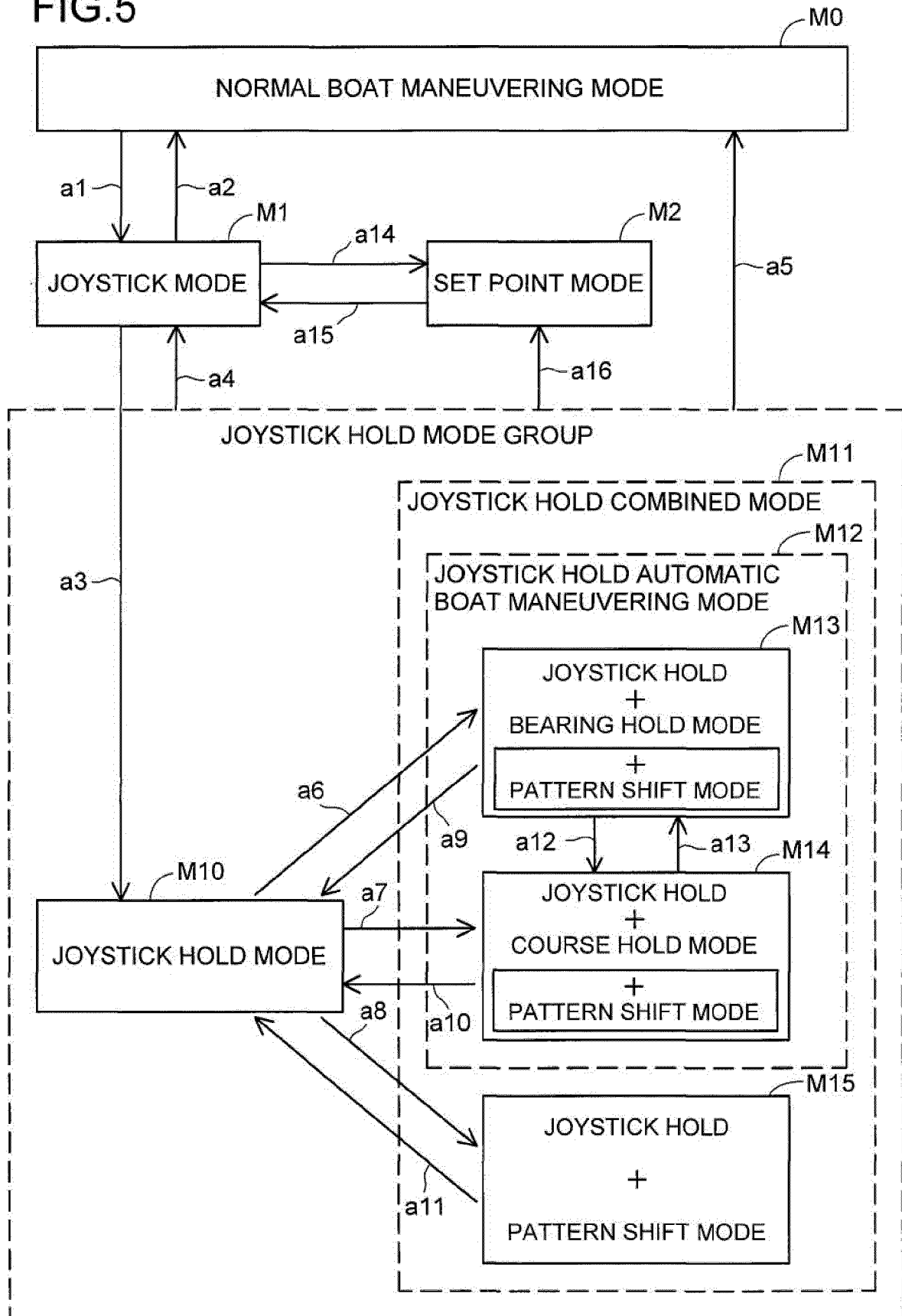
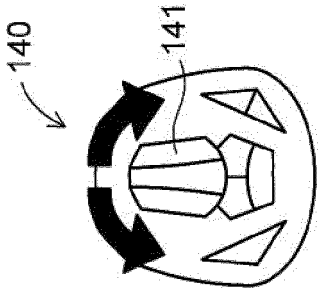
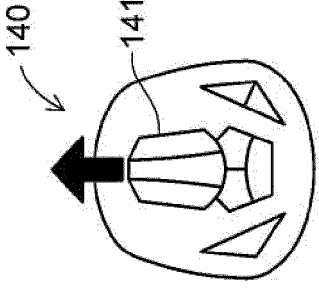
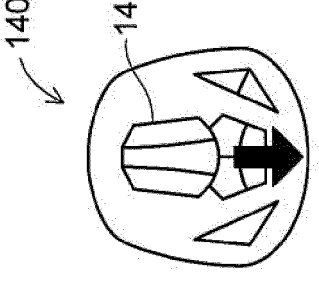
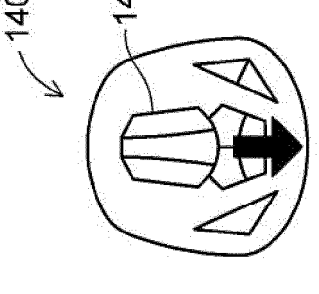


FIG.6



|           |                                                                                                  |                                                                                                                                        |                                                                                                                                        |                                                                                                                                       |                           |
|-----------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| OPERATION | <p>TWIST</p>  | <p>(DURING FORWARD MOVE)<br/>FORWARD SHORT TILT</p>  | <p>(DURING FORWARD MOVE)<br/>BACKWARD SHORT TILT</p>  | <p>(DURING FORWARD MOVE)<br/>BACKWARD LONG TILT</p>  | SHIFT TO<br>JOYSTICK MODE |
| CONTROL   | STEER                                                                                            | ONE-STEP<br>ACCELERATION                                                                                                               | ONE-STEP<br>DECELERATION                                                                                                               |                                                                                                                                       |                           |



## EUROPEAN SEARCH REPORT

Application Number

EP 22 20 8064

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29-06-2023

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