



(11)

EP 4 410 664 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

07.08.2024 Bulletin 2024/32

(21) Application number: **22875837.1**

(22) Date of filing: **14.09.2022**

(51) International Patent Classification (IPC):

B63H 25/50 ^(2006.01) **B63H 21/21** ^(2006.01)
B63H 25/42 ^(2006.01) **G05D 3/00** ^(2006.01)

(52) Cooperative Patent Classification (CPC):

B63H 21/21; B63H 25/42; B63H 25/50; G05D 3/00

(86) International application number:

PCT/JP2022/034411

(87) International publication number:

WO 2023/053966 (06.04.2023 Gazette 2023/14)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

(30) Priority: **29.09.2021 JP 2021159280**

(71) Applicant: **NHK Spring Co., Ltd.**

Yokohama-shi, Kanagawa 236-0004 (JP)

(72) Inventors:

- **SHIRAO Masato**
Yokohama-shi, Kanagawa 236-0004 (JP)
- **KAMIYA Takafumi**
Yokohama-shi, Kanagawa 236-0004 (JP)
- **TOKUSHIGE Jun**
Yokohama-shi, Kanagawa 236-0004 (JP)
- **SATO Marino**
Yokohama-shi, Kanagawa 236-0004 (JP)

(74) Representative: **V.O.**

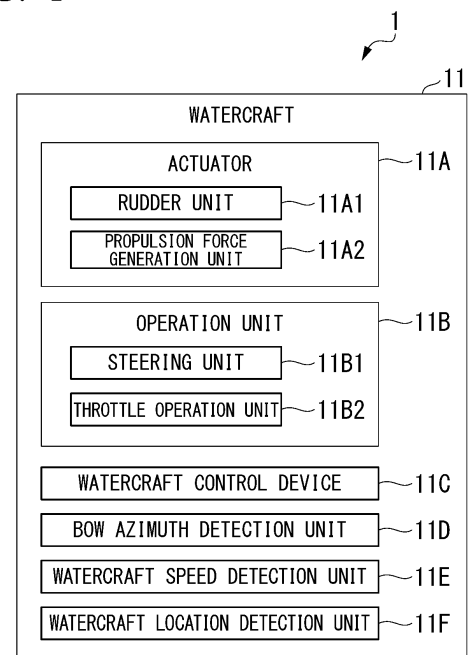
P.O. Box 87930

2508 DH Den Haag (NL)

(54) **SHIP MANEUVERING SYSTEM, SHIP CONTROL DEVICE, SHIP CONTROL METHOD, AND PROGRAM**

(57) A watercraft maneuvering system includes an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment, an operation unit configured to receive an input operation of a watercraft operator, and a watercraft control device configured to operate the actuator. When the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft.

FIG. 1



EP 4 410 664 A1

Description

[Citation List]

[Technical Field]

[Patent Document]

[0001] The present invention relates to a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program.

[0002] Priority is claimed on Japanese Patent Application No. 2021-159280, filed September 29, 2021, the content of which is incorporated herein by reference.

[Background Art]

[0003] Patent Document 1 describes technology for enabling a watercraft to be operated with the feeling of a car. In the technology described in Patent Document 1, a brake pedal for limiting a movement speed of a watercraft body is provided in the watercraft body. Moreover, in the technology described in Patent Document 1, an output direction of an outdrive device is reversed if the brake pedal is strongly depressed (i.e., a backward propulsion force is generated if the brake pedal is strongly depressed when the watercraft is moving forward) and the watercraft decelerates. Furthermore, in the technology described in Patent Document 1, if a moving watercraft is put into a stationary state by depressing the brake pedal and the brake pedal is continuously depressed, fixed point holding control of the watercraft is performed.

[0004] That is, in the technology described in Patent Document 1, the watercraft operator should depress the brake pedal to put the moving watercraft into a stationary state.

[0005] As disclosed in Patent Document 2, if the watercraft operator simply stops an engine or disengages a clutch to stop the watercraft, the watercraft will continue sailing with inertia and move a considerable distance before the watercraft stops. Moreover, as disclosed in Patent Document 2, when the watercraft is sailing at a full forward movement speed, the watercraft operator performs an operation in which the clutch is put into backward movement and the engine speed is slightly increased to stop the watercraft in a short distance.

[0006] That is, in the technology described in Patent Document 2, to bring the moving watercraft to a stationary state, the watercraft operator should perform an operation for slightly increasing the engine speed by putting the clutch into the backward movement.

[0007] That is, in the technologies described in Patent Documents 1 and 2, the watercraft operator should perform an input operation for bringing the moving watercraft to a stationary state without continuing to move by inertia. In other words, in the technologies described in Patent Documents 1 and 2, the watercraft operator should perform an input operation for counteracting an inertial force occurring in the watercraft when the watercraft transitions from a moving state to a stationary state.

5 **[0008]**

[Patent Document 1]

Japanese Patent No. 6642898

[Patent Document 2]

Japanese Unexamined Patent Application, First Publication No. H5-124586

[Summary of Invention]

15 [Technical Problem]

[0009] In view of the above-described problems, the present invention provides a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program capable of eliminating any need for a watercraft operator's input operation for counteracting an inertial force and/or a moment of inertia occurring in a watercraft during the transition from an operating state of an actuator to a stopped state of the actuator.

[Solution to Problem]

[0010] According to an aspect of the present invention, there is provided a watercraft maneuvering system including: an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment; an operation unit configured to receive an input operation of a watercraft operator; and a watercraft control device configured to operate the actuator, wherein, when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft.

[0011] According to an aspect of the present invention, there is provided a watercraft control device provided in a watercraft maneuvering system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, wherein, when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit

to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft.

[0012] According to an aspect of the present invention, there is provided a watercraft control method for use in a watercraft control device provided in a watercraft maneuvering system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, the watercraft control method including: a first step of operating the actuator in accordance with an input operation received by the operation unit; and a second step of operating the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator.

[0013] According to an aspect of the present invention, there is provided a non-volatile storage medium storing a program for causing a computer, which is mounted in a watercraft control device provided in a watercraft maneuvering system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, to execute: a first step of operating the actuator in accordance with an input operation received by the operation unit; and a second step of operating the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator.

[Advantageous Effects of Invention]

[0014] According to the present invention, it is possible to provide a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program capable of eliminating any need for a watercraft operator's input operation for counteracting an inertial force and/or a mo-

ment of inertia occurring in a watercraft during the transition from an operating state of an actuator to a stopped state of the actuator.

5 [Brief Description of Drawings]

[0015]

FIG. 1 is a diagram showing an example of a watercraft maneuvering system including a watercraft to which a watercraft control device of a first embodiment is applied.

FIG. 2 is a diagram showing an example of behavior of the watercraft of the first embodiment when an operation unit receives an input operation for moving the watercraft forward and then receives an input operation for stopping the forward movement of the watercraft.

FIG. 3 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives the input operation for moving the watercraft forward and then receives the input operation for stopping the forward movement of the watercraft.

FIG. 4 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives an input operation for moving the watercraft backward and then receives an input operation for stopping the backward movement of the watercraft.

FIG. 5 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives an input operation for turning the watercraft clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft.

FIG. 6 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives an input operation for turning the watercraft counterclockwise in place and then receives an input operation for stopping the in-place counterclockwise turning of the watercraft.

FIG. 7 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives an input operation for moving the watercraft forward and turning the watercraft clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft.

FIG. 8 is a flowchart for describing an example of a process executed by the watercraft control device of the first embodiment when the operation unit receives an input operation for moving the watercraft backward and turning the watercraft counterclockwise and then receives an input operation for stop-

ping the backward movement and counterclockwise turning of the watercraft.

FIG. 9 is a flowchart for describing an example of a process executed by a watercraft control device of a second embodiment when an operation unit receives an input operation for moving a watercraft forward and then receives an input operation for stopping the forward movement of the watercraft.

FIG. 10 is a flowchart for describing an example of a process executed by the watercraft control device of the second embodiment when the operation unit receives an input operation for moving the watercraft backward and then receives an input operation for stopping the backward movement of the watercraft.

FIG. 11 is a flowchart for describing an example of a process executed by the watercraft control device of the second embodiment when the operation unit receives an input operation for turning the watercraft clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft.

FIG. 12 is a flowchart for describing an example of a process executed by the watercraft control device of the second embodiment when the operation unit receives an input operation for turning the watercraft counterclockwise in place and then receives an input operation for stopping the in-place counterclockwise turning of the watercraft.

FIG. 13 is a flowchart for describing an example of a process executed by the watercraft control device of the second embodiment when the operation unit receives an input operation for moving the watercraft forward and turning the watercraft clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft.

FIG. 14 is a flowchart for describing an example of a process executed by the watercraft control device of the second embodiment when the operation unit receives an input operation for moving the watercraft backward and turning the watercraft counterclockwise and then receives an input operation for stopping the backward movement and counterclockwise turning of the watercraft.

FIG. 15 is a diagram showing an example of a watercraft maneuvering system including a watercraft to which a watercraft control device of a third embodiment is applied.

FIG. 16 is a diagram for describing behavior of a watercraft of a comparative example when an operation unit receives an input operation for moving the watercraft forward and then receives an input operation for stopping the forward movement of the watercraft.

FIG. 17 is a flowchart for describing a process executed in the watercraft of the comparative example.

[Description of Embodiments]

[0016] A watercraft control method of a comparative example will be described and then embodiments of a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program of the present invention will be described.

[0017] FIG. 16 is a diagram for describing behavior of a watercraft R11 of a comparative example when an operation unit receives an input operation for moving the watercraft R11 forward and then receives an input operation for stopping the forward movement of the watercraft R11. FIG. 17 is a flowchart for describing a process executed in the watercraft R11 of the comparative example.

[0018] In the comparative example shown in FIGS. 16 and 17, in step SR1 of FIG. 17, for example, a watercraft control device of the watercraft R11 determines whether or not the operation unit has received the input operation for moving the watercraft R11 forward. When the operation unit has not received an input operation for moving the watercraft R11 forward, step SR1 is iteratively executed. On the other hand, when the operation unit has received the input operation for moving the watercraft R11 forward, the process proceeds to step SR2.

[0019] In step SR2, the watercraft R11 generates a propulsion force for moving the watercraft R11 forward. As a result, as shown in FIG. 16(C), the watercraft R11 moves forward (i.e., the watercraft R11 moves in an upward direction of FIG. 16).

[0020] Subsequently, in step SR3 of FIG. 17, for example, the watercraft control device of the watercraft R11 determines whether or not the operation unit has received an input operation for stopping the forward movement of the watercraft R11. When the operation unit has not received the input operation for stopping the forward movement of the watercraft R11, step SR3 is iteratively executed. On the other hand, when the operation unit has received the input operation for stopping the forward movement of the watercraft R11, the process proceeds to step SR4.

[0021] In step SR4, the watercraft R11 stops the generation of a propulsion force in the upward direction of FIG. 16. As a result, an inertial force in the upward direction of FIG. 16 for trying to continue the forward movement (headway) is generated and the watercraft R11 performs the movement in the upward direction of FIG. 16 (or makes the headway).

[0022] In the watercraft R11 of the comparative example, the watercraft operator should perform an input operation for counteracting the inertial force to suppress this headway.

<First embodiment>

[0023] Hereinafter, a first embodiment of a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage me-

dium storing a program of the present invention will be described.

[0024] FIG. 1 is a diagram showing an example of a watercraft maneuvering system 1 including a watercraft 11 to which a watercraft control device 11C of the first embodiment is applied.

[0025] The watercraft control device 11C of the first embodiment, for example, can be applied to any type of watercraft 11 such as a personal watercraft (PWC) (a water-motorcycle) having functions similar to those of the PWC described in FIG. 1 of Japanese Patent No. 5196649, a watercraft not equipped with a jet propulsion device (for example, a watercraft equipped with an outboard motor, a watercraft including an inboard/outboard motor or an inboard engine, a large watercraft including a side thruster, or the like described in Japanese Patent No. 6198192 or Japanese Unexamined Patent Application, First Publication No. 2007-22284, or the like).

[0026] In the example shown in FIG. 1, the watercraft maneuvering system 1 includes a watercraft 11. The watercraft 11 includes an actuator 11A, an operation unit 11B, the watercraft control device 11C, a bow azimuth detection unit 11D, a watercraft speed detection unit 11E, and a watercraft location detection unit 11F.

[0027] The actuator 11A includes a rudder unit 11A1 and a propulsion force generation unit 11A2. The rudder unit 11A1 has a function of causing the watercraft 11 to generate a moment. The propulsion force generation unit 11A2 has a function of generating a propulsion force of the watercraft 11.

[0028] In an example in which the watercraft 11 is a PWC, the actuator 11A includes, for example, an engine, a nozzle, a deflector, a trim actuator, a bucket, a bucket actuator, and the like described in FIG. 1 of Japanese Unexamined Patent Application, First Publication No. 2019-171925.

[0029] In the example shown in FIG. 1, the operation unit 11B receives the input operation of the watercraft operator of the watercraft 11. The operation unit 11B includes, for example, a steering unit 11B 1 and a throttle operation unit 11B2. The steering unit 11B 1 receives an input operation of the watercraft operator who operates the rudder unit 11A1. The throttle operation unit 11B2 receives an input operation of the watercraft operator who operates the propulsion force generation unit 11A2.

[0030] In an example in which the watercraft 11 is a PWC, the steering unit 11B 1 and the throttle operation unit 11B2, for example, are configured like a steering handle device described in FIG. 1 of Japanese Patent No. 5196649, a steering unit described in FIG. 1 of Japanese Unexamined Patent Application, First Publication No. 2019-171925, and the like.

[0031] In the example shown in FIG. 1, the watercraft control device 11C operates the actuator 11A on the basis of the input operation of the watercraft operator of the watercraft 11 received by the operation unit 11B or the like.

[0032] Specifically, the watercraft control device 11C

can operate the actuator 11A so that the propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 forward. The watercraft control device 11C can operate the actuator 11A so that the propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 backward.

[0033] Moreover, the watercraft control device 11C can operate the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 in place.

[0034] Furthermore, the watercraft control device 11C can operate the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a propulsion force for moving the watercraft 11 forward and causes the watercraft 11 to generate a moment for turning the watercraft 11. The watercraft control device 11C can operate the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a propulsion force for moving the watercraft 11 backward and causes the watercraft 11 to generate a moment for turning the watercraft 11.

[0035] The bow azimuth detection unit 11D detects a bow azimuth of the watercraft 11. The bow azimuth detection unit 11D includes, for example, an azimuth sensor. The azimuth sensor calculates the bow azimuth of the watercraft 11 using, for example, geomagnetism.

[0036] In another example, the azimuth sensor may be a device (a gyrocompass) in which a north-pointing device and a damping device are added to a gyroscope that rotates at a high speed so that north is indicated all the time.

[0037] In yet another example, the azimuth sensor may be a Global Positioning System (GPS) compass that includes a plurality of GPS antennas and calculates the bow azimuth from a relative locational relationship of the plurality of GPS antennas.

[0038] In the example shown in FIG. 1, the watercraft speed detection unit 11E detects a speed of the watercraft 11. The watercraft speed detection unit 11E may be, for example, a water pressure detection type for detecting a log speed of the watercraft 11 or a GPS measurement type for detecting a ground speed of the watercraft 11.

[0039] The watercraft location detection unit 11F detects a location of the watercraft 11. The watercraft location detection unit 11F includes, for example, a GPS device. The GPS device calculates location coordinates of the watercraft 11 by receiving signals from a plurality of GPS satellites.

[0040] FIG. 2 is a diagram showing an example of behavior of the watercraft 11 of the first embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 forward and then receives an input operation for stopping the forward movement of the watercraft 11. FIG. 3 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives the input operation for moving the wa-

tercraft 11 forward and then receives the input operation for stopping the forward movement of the watercraft 11.

[0041] In the examples shown in FIGS. 2 and 3, in step S11 of FIG. 3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 forward. When the operation unit 11B has not received the input operation for moving the watercraft 11 forward, step S11 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 forward, the process proceeds to step S12.

[0042] In step S12, the watercraft control device 11C operates the actuator 11A so that the propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 forward. As a result, as shown in FIG. 2(C), the watercraft 11 moves forward (i.e., the watercraft 11 moves in the upward direction of FIG. 2).

[0043] Subsequently, in step S13 of FIG. 3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the forward movement of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the forward movement of the watercraft 11, step S13 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the forward movement of the watercraft 11, the process proceeds to step S14.

[0044] In step S14, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 forward. As a result, an inertial force (headway) in the upward direction of FIG. 2 for trying to continue forward movement occurs. Therefore, in the examples shown in FIGS. 2 and 3, in step S14, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a downward direction of FIG. 2) to a direction of the inertial force occurring in the watercraft 11 (the upward direction of FIG. 2). Specifically, in step S14, the watercraft control device 11C causes the actuator 11A to generate a propulsion force in the downward direction of FIG. 2 without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the propulsion force in the downward direction of FIG. 2. As a result, as shown in FIGS. 2(A) and 2(B), it is possible to suppress the movement (headway) of the watercraft 11 in the upward direction of FIG. 2 due to the inertial force occurring in the watercraft 11.

[0045] Although a magnitude of the propulsion force generated by the actuator 11A in the opposite direction (the downward direction of FIG. 2) is set to a constant value in the examples shown in FIGS. 2 and 3, a magnitude of the propulsion force generated by the actuator 11A in the opposite direction (the downward direction of FIG. 2) may be changed with a magnitude of an inertial force occurring in the watercraft 11 in other examples.

[0046] In the examples shown in FIGS. 2 and 3, subsequently, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the forward movement of the watercraft 11 in step S13) in step S15 of FIG. 3. Specifically, in step S15, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to a first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move in the upward direction of FIG. 2 due to the inertial force (headway) of the watercraft 11), step S15 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move in the upward direction of FIG. 2 due to the inertial force (headway) of the watercraft 11), the process proceeds to step S16.

[0047] In step S16, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force in the downward direction of FIG. 2.

[0048] Although a fixed value is used as the "first threshold value" in the examples shown in FIGS. 2 and 3, a variable value may be used as the "first threshold value" in other examples. For example, when a ratio of the magnitude of the propulsion force generated by the actuator 11A in the opposite direction (the downward direction of FIG. 2) to the magnitude of the inertial force occurring in the watercraft 11 is smaller, a larger value may be used as the "first threshold value."

[0049] That is, in the examples shown in FIGS. 2 and 3, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 forward while the actuator 11A is generating the propulsion force for moving the watercraft 11 forward (i.e., in the state shown in FIG. 2(C)), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the downward direction of FIG. 2) to a direction of the inertial force occurring in the watercraft 11 (the upward direction of FIG. 2).

[0050] Moreover, in the examples shown in FIGS. 2 and 3, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft 11 on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (the time when YES is determined in step S13 of FIG. 3).

[0051] In other words, in the examples shown in FIGS.

2 and 3, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step S13 of FIG 3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the downward direction of FIG. 2) to the direction of the inertial force occurring in the watercraft 11 (the upward direction of FIG. 2).

[0052] Therefore, in the examples shown in FIGS. 2 and 3, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0053] FIG. 4 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 backward and then receives an input operation for stopping the backward movement of the watercraft 11.

[0054] In the example shown in FIG. 4, in step S21, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 backward. When the operation unit 11B has not received the input operation for moving the watercraft 11 backward, step S21 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 backward, the process proceeds to step S22.

[0055] In step S22, the watercraft control device 11C operates the actuator 11A so that the propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 backward. As a result, the watercraft 11 moves backward.

[0056] Subsequently, in step S23, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the backward movement of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the backward movement of the watercraft 11, step S23 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the backward movement of the watercraft 11, the process proceeds to step S24.

[0057] In step S24, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 backward. As a result, an inertial force (headway) for trying to continue backward movement occurs. Therefore, in the example shown in FIG. 4, in step S24, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a back-

ward direction of the watercraft 11). Specifically, in step S24, the watercraft control device 11C causes the actuator 11A to generate a forward propulsion force of the watercraft 11 without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the forward propulsion force of the watercraft 11. As a result, it is possible to suppress the movement (headway) of the watercraft 11 in the backward direction due to the inertial force occurring in the watercraft 11.

[0058] Subsequently, in step S25, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the backward movement of the watercraft 11 in step S23). Specifically, in step S25, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to the first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move backward due to the inertial force (headway) of the watercraft 11), step S25 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move backward due to the inertial force (headway) of the watercraft 11), the process proceeds to step S26.

[0059] In step S26, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force in the forward direction of the watercraft 11.

[0060] That is, in the example shown in FIG. 4, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 backward while the actuator 11A is generating the propulsion force for moving the watercraft 11 backward, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11).

[0061] In the example shown in FIG. 4, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (the time when YES is determined in step S23 of FIG 3).

[0062] In other words, in the example shown in FIG. 4, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step S23 of FIG 3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11).

[0063] Therefore, in the example shown in FIG. 4, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0064] FIG. 5 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives an input operation for turning the watercraft 11 clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft 11.

[0065] In the example shown in FIG. 5, in step S31, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for turning the watercraft 11 clockwise in place. When the operation unit 11B has not received the input operation for turning the watercraft 11 clockwise in place, step S31 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for turning the watercraft 11 clockwise in place, the process proceeds to step S32.

[0066] In step S32, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise in place. As a result, the watercraft 11 turns clockwise in place.

[0067] Subsequently, in step S33, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for stopping the in-place clockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the in-place clockwise turning of the watercraft 11, step S33 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the in-place clockwise turning of the watercraft 11, the process proceeds to step S34.

[0068] In step S34, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 clockwise in place. As a result, a moment of inertia for trying to continue the in-place clockwise turning occurs. Therefore, in the example shown in FIG. 5, in step S34, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate the moment in

the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step S34, the watercraft control device 11C causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 11B to receive an input operation for causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the excessive in-place clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0069] Subsequently, in step S35, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the in-place clockwise turning of the watercraft 11 in step S33). Specifically, in step S35, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to a first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to excessively turn clockwise in place due to the moment of inertia of the watercraft 11), step S35 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to excessively turn clockwise in place due to the moment of inertia of the watercraft 11), the process proceeds to step S36.

[0070] In step S36, the watercraft control device 11C causes the actuator 11A to stop the generation of the counterclockwise moment.

[0071] That is, in the example shown in FIG. 5, when the operation unit 11B has received the input operation for stopping the generation of the moment for turning the watercraft 11 clockwise in place while the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 clockwise in place, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0072] Moreover, in the example shown in FIG. 5, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (the time when YES is determined in step S33).

[0073] In other words, in the example shown in FIG. 5,

when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in step S33), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0074] Therefore, in the example shown in FIG. 5, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0075] FIG. 6 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives an input operation for turning the watercraft 11 counterclockwise in place and then receives an input operation for stopping the in-place counterclockwise turning of the watercraft 11.

[0076] In the example shown in FIG. 6, in step S41, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for turning the watercraft 11 counterclockwise in place. When the operation unit 11B has not received the input operation for turning the watercraft 11 counterclockwise in place, step S41 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for turning the watercraft 11 counterclockwise in place, the process proceeds to step S42.

[0077] In step S42, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 counterclockwise in place. As a result, the watercraft 11 turns counterclockwise in place.

[0078] Subsequently, in step S43, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for stopping the in-place counterclockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the in-place counterclockwise turning of the watercraft 11, step S43 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the in-place counterclockwise turning of the watercraft 11, the process proceeds to step S44.

[0079] In step S44, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 counterclockwise in place. As a result, a moment of inertia for trying to continue the in-place counterclockwise turning occurs. Therefore, in the example shown in FIG. 6, in step S44, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to

generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step S44, the watercraft control device 11C causes the watercraft 11 to generate a clockwise moment without any need for the operation unit 11B to receive an input operation for causing the watercraft 11 to generate a clockwise moment. As a result, it is possible to suppress the excessive in-place counterclockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0080] Subsequently, in step S45, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the in-place counterclockwise turning of the watercraft 11 in step S43). Specifically, in step S45, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to a first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to excessively turn counterclockwise in place due to the moment of inertia of the watercraft 11), step S45 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to excessively turn counterclockwise in place due to the moment of inertia of the watercraft 11), the process proceeds to step S46.

[0081] In step S46, the watercraft control device 11C causes the actuator 11A to stop the generation of the clockwise moment.

[0082] That is, in the example shown in FIG. 6, when the operation unit 11B has received the input operation for stopping the generation of the moment for turning the watercraft 11 counterclockwise in place while the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 counterclockwise in place, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0083] Moreover, in the example shown in FIG. 6, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stop-

ping the operation of the actuator 11A (the time when YES is determined in step S43).

[0084] In other words, in the example shown in FIG. 6, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in step S43), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0085] Therefore, in the example shown in FIG. 6, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0086] FIG. 7 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft 11.

[0087] In the example shown in FIG. 7, in step S51, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise. When the operation unit 11B has not received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, step S51 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the process proceeds to step S52.

[0088] In step S52, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 forward and causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise. As a result, the watercraft 11 moves forward and turns clockwise.

[0089] Subsequently, in step S53, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, step S53 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the process proceeds to step S54.

[0090] In step S54, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 forward and

the generation of a moment for turning the watercraft 11 clockwise. As a result, an inertial force for trying to continue the forward movement and a moment of inertia for trying to continue the clockwise turning occur. Therefore, in the example shown in FIG. 7, in step S54, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step S54, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11 and causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the forward movement of the watercraft 11 due to the inertial force occurring in the watercraft 11 and the excessive clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0091] Subsequently, in step S55, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11 in step S53). Specifically, in step S55, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to the first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move forward due to the inertial force of the watercraft 11 and the watercraft 11 is likely to turn clockwise due to the moment of inertia of the watercraft 11), step S55 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move forward due to the inertial force of the watercraft 11 and the watercraft 11 is unlikely to turn clockwise due to the moment of inertia of the watercraft 11), the process proceeds to step S56.

[0092] In step S56, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force of the watercraft 11 and the generation of the counterclockwise moment.

[0093] That is, in the example shown in FIG. 7, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for

moving the watercraft 11 forward and the generation of the moment for turning the watercraft 11 clockwise while the actuator 11A is generating the propulsion force for moving the watercraft 11 forward and the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 clockwise, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0094] Moreover, in the example shown in FIG. 7, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (the time when YES is determined in step S53).

[0095] In other words, in the example shown in FIG. 7, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step S53) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0096] Therefore, in the example shown in FIG. 7, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0097] FIG. 8 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the first embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise and then receives an input operation for stopping the backward movement and counterclockwise turning of the

watercraft 11.

[0098] In the example shown in FIG. 8, in step S61, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise. When the operation unit 11B has not received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise, step S61 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise, the process proceeds to step S62.

[0099] In step S62, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 backward and causes the watercraft 11 to generate a moment for turning the watercraft 11 counterclockwise. As a result, the watercraft 11 moves backward and turns counterclockwise.

[0100] Subsequently, in step S63, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11, step S63 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11, the process proceeds to step S64.

[0101] In step S64, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 backward and the generation of a moment for turning the watercraft 11 counterclockwise. As a result, an inertial force for trying to continue the backward movement and a moment of inertia for trying to continue the counterclockwise turning occur. Therefore, in the example shown in FIG. 8, in step S64, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (the forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step S64, the watercraft control device 11C causes the actuator 11A to generate a forward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a clockwise moment without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the forward propulsion force of the watercraft 11 and causing the watercraft 11 to generate the clockwise moment. As a result, it is possible to suppress the backward movement of the watercraft 11

due to the inertial force occurring in the watercraft 11 and the excessive counterclockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0102] Subsequently, in step S65, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 11B has received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11 in step S63). Specifically, in step S65, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A is greater than or equal to the first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move backward due to the inertial force of the watercraft 11 and the watercraft 11 is likely to turn counterclockwise due to the moment of inertia of the watercraft 11), step S65 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move backward due to the inertial force of the watercraft 11 and the watercraft 11 is unlikely to excessively turn counterclockwise due to the moment of inertia of the watercraft 11), the process proceeds to step S66.

[0103] In step S66, the watercraft control device 11C causes the actuator 11A to stop the generation of the forward propulsion force of the watercraft 11 and the generation of the clockwise moment.

[0104] That is, in the example shown in FIG. 8, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 backward and the generation of the moment for turning the watercraft 11 counterclockwise while the actuator 11A is generating the propulsion force for moving the watercraft 11 backward and the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 counterclockwise, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0105] Moreover, in the example shown in FIG. 8, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of

the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the elapsed time from the time when the operation unit 11B receives the input operation for stopping the operation of the actuator 11A (the time when YES is determined in step S63).

[0106] In other words, in the example shown in FIG. 8, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step S63) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0107] Therefore, in the example shown in FIG. 8, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

<Second embodiment>

[0108] Hereinafter, a second embodiment of a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program of the present invention will be described.

[0109] A watercraft maneuvering system 1 of the second embodiment is configured like the watercraft maneuvering system 1 of the first embodiment described above, except for matters to be described below. Therefore, according to the watercraft maneuvering system 1 of the second embodiment, effects similar to those of the watercraft maneuvering system 1 of the first embodiment described above can be achieved, except for the matters to be described below.

[0110] The watercraft maneuvering system 1 including a watercraft 11 to which a watercraft control device 11C of the second embodiment is applied is configured like the watercraft maneuvering system 1 of the first embodiment shown in FIG. 1.

[0111] FIG. 9 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when an operation unit 11B receives an input operation for moving the watercraft 11 forward and then receives an input operation for stopping the forward movement of the watercraft 11.

[0112] In the example shown in FIG. 9, in step SA1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for moving the watercraft 11 forward. When the operation unit 11B has not received the input operation for moving the watercraft 11 forward, step SA1 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 forward, the process proceeds to step SA2.

[0113] In step SA2, the watercraft control device 11C operates an actuator 11A so that a propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 forward. As a result, the watercraft 11 moves forward.

[0114] Subsequently, in step SA3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for stopping the forward movement of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the forward movement of the watercraft 11, step SA3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the forward movement of the watercraft 11, the process proceeds to step SA4.

[0115] In step SA4, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 forward. As a result, an inertial force (headway) for trying to continue the forward movement occurs. Therefore, in the example shown in FIG. 9, in step SA4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates the propulsion force in an opposite direction (a backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a forward direction of the watercraft 11). Specifically, in step SA4, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11. As a result, it is possible to suppress the forward movement (headway) of the watercraft 11 due to the inertial force occurring in the watercraft 11.

[0116] Subsequently, in step SA5, the watercraft control device 11C monitors a speed of the watercraft 11. Specifically, in step SA5, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by a watercraft speed detection unit 11E has decreased to a second threshold value or less. When the speed of the watercraft 11 has not decreased to the second threshold value or less (i.e., when the watercraft 11 continuously moves forward due to the inertial force (headway) of the watercraft 11), step SA5 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the second threshold value or less (i.e., when it can be estimated that the forward movement of the watercraft 11 due to the inertial

force (headway) of the watercraft 11 has ended), the process proceeds to step SA6.

[0117] In step SA6, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force of the watercraft 11.

[0118] That is, in the example shown in FIG. 9, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 forward while the actuator 11A is generating the propulsion force for moving the watercraft 11 forward, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11).

[0119] Moreover, in the example shown in FIG. 9, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) on the basis of the speed of the watercraft 11.

[0120] In other words, in the example shown in FIG. 9, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step SA3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11).

[0121] Therefore, in the example shown in FIG. 9, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0122] FIG. 10 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 backward and then receives an input operation for stopping the backward movement of the watercraft 11.

[0123] In the example shown in FIG. 10, in step SB1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for moving the watercraft 11 backward. When the operation unit 11B has not received the input operation for moving the watercraft 11 backward, step SB1 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 backward, the process proceeds to step SB2.

[0124] In step SB2, the watercraft control device 11C operates the actuator 11A so that a propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 backward. As a result, the watercraft 11 moves backward.

[0125] Subsequently, in step SB3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for stopping the backward movement of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the backward movement of the watercraft 11, step SB3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the backward movement of the watercraft 11, the process proceeds to step SB4.

[0126] In step SB4, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 backward. As a result, an inertial force (headway) for trying to continue the backward movement occurs. Therefore, in the example shown in FIG. 10, in step SB4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates the propulsion force in an opposite direction (a forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a backward direction of the watercraft 11). Specifically, in step SB4, the watercraft control device 11C causes the actuator 11A to generate a forward propulsion force of the watercraft 11 without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the forward propulsion force of the watercraft 11. As a result, it is possible to suppress the backward movement (headway) of the watercraft 11 due to the inertial force occurring in the watercraft 11.

[0127] Subsequently, in step SB5, the watercraft control device 11C monitors a speed of the watercraft 11. Specifically, in step SB5, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by the watercraft speed detection unit 11E has decreased to a second threshold value or less. When the speed of the watercraft 11 has not decreased to the second threshold value or less (i.e., when the watercraft 11 continuously moves backward due to the inertial force (headway) of the watercraft 11), step SB5 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the second threshold value or less (i.e., when it can be estimated that the backward movement of the watercraft 11 due to the inertial force (headway) of the watercraft 11 has ended), the process proceeds to step SB6.

[0128] In step SB6, the watercraft control device 11C causes the actuator 11A to stop the generation of the forward propulsion force of the watercraft 11.

[0129] That is, in the example shown in FIG. 10, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 backward while the actuator 11A is generating the propulsion force for moving the

watercraft 11 backward, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11).

[0130] Moreover, in the example shown in FIG. 10, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) on the basis of the speed of the watercraft 11.

[0131] In other words, in the example shown in FIG. 10, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step SB3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11).

[0132] Therefore, in the example shown in FIG. 10, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0133] FIG. 11 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when the operation unit 11B receives an input operation for turning the watercraft 11 clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft 11.

[0134] In the example shown in FIG. 11, in step SC1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for turning the watercraft 11 clockwise in place. When the operation unit 11B has not received an input operation for turning the watercraft 11 clockwise in place, step SC1 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for turning the watercraft 11 clockwise in place, the process proceeds to step SC2.

[0135] In step SC2, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise in place. As a result, the watercraft 11 turns clockwise in place.

[0136] Subsequently, in step SC3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for

stopping the in-place clockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the in-place clockwise turning of the watercraft 11, step SC3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the in-place clockwise turning of the watercraft 11, the process proceeds to step SC4.

[0137] In step SC4, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 clockwise in place. As a result, a moment of inertia for trying to continue the in-place clockwise turning occurs. Therefore, in the example shown in FIG. 11, in step SC4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step SC4, the watercraft control device 11C causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 11B to receive an input operation for causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the excessive in-place clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0138] Subsequently, in step SC5, the watercraft control device 11C monitors an angular speed of the watercraft 11. Specifically, in step SC5, the watercraft control device 11C determines whether or not the angular speed of the watercraft 11 calculated on the basis of a bow azimuth detected by the bow azimuth detection unit 11D has decreased to a third threshold value or less. When the angular speed of the watercraft 11 has not decreased to the third threshold value or less (i.e., when the in-place clockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 continues), step SC5 is iteratively executed. On the other hand, when the angular speed of the watercraft 11 has decreased to the third threshold value or less (i.e., when it can be estimated that the in-place clockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to step SC6.

[0139] In step SC6, the watercraft control device 11C causes the actuator 11A to stop the generation of the counterclockwise moment.

[0140] That is, in the example shown in FIG. 11, when the operation unit 11B has received the input operation for stopping the generation of the moment for turning the watercraft 11 clockwise in place while the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 clockwise in place, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0141] Moreover, in the example shown in FIG. 11, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11 on the basis of an angular speed of the watercraft 11.

[0142] In other words, in the example shown in FIG. 11, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in step SC3), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0143] Therefore, in the example shown in FIG. 11, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0144] FIG. 12 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when the operation unit 11B receives an input operation for turning the watercraft 11 counterclockwise in place and then receives an input operation for stopping the in-place counterclockwise turning of the watercraft 11.

[0145] In the example shown in FIG. 12, in step SD1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for turning the watercraft 11 counterclockwise in place. When the operation unit 11B has not received the input operation for turning the watercraft 11 counterclockwise in place, step SD1 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for turning the watercraft 11 counterclockwise in place, the process proceeds to step SD2.

[0146] In step SD2, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 counterclockwise in place. As a result, the watercraft 11 turns counterclockwise in place.

[0147] Subsequently, in step SD3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received an input operation for stopping the in-place counterclockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the in-place counterclockwise turning of the watercraft 11, step SD3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the in-place counterclockwise turning of the watercraft 11, the process proceeds to step SD4.

[0148] In step SD4, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 counterclockwise in place. As a result, a moment of inertia for trying to continue the in-place counterclockwise turning occurs. Therefore, in the example shown in FIG. 12, in step SD4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step SD4, the watercraft control device 11C causes the watercraft 11 to generate a clockwise moment without any need for the operation unit 11B to receive an input operation of causing the watercraft 11 to generate a clockwise moment. As a result, it is possible to suppress the excessive in-place counterclockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0149] Subsequently, in step SD5, the watercraft control device 11C monitors an angular speed of the watercraft 11. Specifically, in step SD5, the watercraft control device 11C determines whether or not the angular speed of the watercraft 11 calculated on the basis of a bow azimuth detected by the bow azimuth detection unit 11D has decreased to the third threshold value or less. When the angular speed of the watercraft 11 has not decreased to the third threshold value or less (i.e., when the in-place counterclockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 continues), step SD5 is iteratively executed. On the other hand, when the angular speed of the watercraft 11 has decreased to the third threshold value or less (i.e., when it can be estimated that the in-place counterclockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to step SD6.

[0150] In step SD6, the watercraft control device 11C causes the actuator 11A to stop the generation of the clockwise moment.

[0151] That is, in the example shown in FIG. 12, when the operation unit 11B has received the input operation for stopping the generation of the moment for turning the watercraft 11 counterclockwise in place while the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 counterclockwise in place, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0152] Moreover, in the example shown in FIG. 12, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11 on

the basis of an angular speed of the watercraft 11.

[0153] In other words, in the example shown in FIG. 12, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in step SD3), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0154] Therefore, in the example shown in FIG. 12, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0155] FIG. 13 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft 11.

[0156] In the example shown in FIG. 13, in step SE1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise. When the operation unit 11B has not received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, step SE1 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the process proceeds to step SE2.

[0157] In step SE2, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 forward and causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise. As a result, the watercraft 11 moves forward and turns clockwise.

[0158] Subsequently, in step SE3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, step SE3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the process proceeds to step SE4.

[0159] In step SE4, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 forward and the generation of a moment for turning the watercraft 11

clockwise. As a result, an inertial force for trying to continue the forward movement and a moment of inertia for trying to continue the clockwise turning occur. Therefore, in the example shown in FIG. 13, in step SE4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step SE4, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11 and causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the forward movement of the watercraft 11 due to the inertial force occurring in the watercraft 11 and the excessive clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0160] Subsequently, in step SE5, the watercraft control device 11C monitors a speed of the watercraft 11. Specifically, in step SE5, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by the watercraft speed detection unit 11E has decreased to a fourth threshold value or less. When the speed of the watercraft 11 has not decreased to the fourth threshold value or less (i.e., when the watercraft 11 moves forward due to the inertial force of the watercraft 11 and the watercraft 11 continuously turns clockwise due to the moment of inertia of the watercraft 11), step SE5 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the fourth threshold value or less (i.e., when it can be estimated that the forward movement of the watercraft 11 due to the inertial force of the watercraft 11 and the clockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to step SE6.

[0161] In step SE6, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force of the watercraft 11 and the generation of the counterclockwise moment.

[0162] That is, in the example shown in FIG. 13, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 forward and the generation of the moment for turning the watercraft 11 clockwise while the actuator 11A is generating the propulsion force for moving the watercraft 11 forward and the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 clockwise, the watercraft control device 11C operates the actuator 11A without any need

for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0163] Moreover, in the example shown in FIG. 13, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the speed of the watercraft 11.

[0164] In other words, in the example shown in FIG. 13, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step SE3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0165] Therefore, in the example shown in FIG. 13, the watercraft operator's input operation for counteracting the inertial force and the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0166] FIG. 14 is a flowchart for describing an example of a process executed by the watercraft control device 11C of the second embodiment when the operation unit 11B receives an input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise and then receives an input operation for stopping the backward movement and counterclockwise turning of the watercraft 11.

[0167] In the example shown in FIG. 14, in step SF1, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise. When the operation unit 11B has not received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise, step SF1 is iteratively executed. On the other hand, when the operation unit

11B has received the input operation for moving the watercraft 11 backward and turning the watercraft 11 counterclockwise, the process proceeds to step SF2.

[0168] In step SF2, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 backward and causes the watercraft 11 to generate a moment for turning the watercraft 11 counterclockwise. As a result, the watercraft 11 moves backward and turns counterclockwise.

[0169] Subsequently, in step SF3, for example, the watercraft control device 11C determines whether or not the operation unit 11B has received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11. When the operation unit 11B has not received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11, step SF3 is iteratively executed. On the other hand, when the operation unit 11B has received the input operation for stopping the backward movement and counterclockwise turning of the watercraft 11, the process proceeds to step SF4.

[0170] In step SF4, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 backward and the generation of a moment for turning the watercraft 11 counterclockwise. As a result, an inertial force for trying to continue the backward movement and a moment of inertia for trying to continue the counterclockwise turning occur. Therefore, in the example shown in FIG. 14, in step SF4, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in step SF4, the watercraft control device 11C causes the actuator 11A to generate a forward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a clockwise moment without any need for the operation unit 11B to receive an input operation for causing the actuator 11A to generate the forward propulsion force of the watercraft 11 and causing the watercraft 11 to generate a clockwise moment. As a result, it is possible to suppress the backward movement of the watercraft 11 due to the inertial force occurring in the watercraft 11 and the excessive counterclockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0171] Subsequently, in step SF5, the watercraft control device 11C monitors the speed of the watercraft 11. Specifically, in step SF5, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by the watercraft speed detection unit 11E has decreased to the fourth threshold value or less.

When the speed of the watercraft 11 has not decreased to the fourth threshold value or less (i.e., when the watercraft 11 moves backward due to the inertial force of the watercraft 11 and the watercraft 11 continuously turns counterclockwise due to the moment of inertia of the watercraft 11), step SF5 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the fourth threshold value or less (i.e., when it can be estimated that the backward movement of the watercraft 11 due to the inertial force of the watercraft 11 and the counterclockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to step SF6.

[0172] In step SF6, the watercraft control device 11C causes the actuator 11A to stop the generation of the forward propulsion force of the watercraft 11 and the generation of the clockwise moment.

[0173] That is, in the example shown in FIG. 14, when the operation unit 11B has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 backward and the generation of the moment for turning the watercraft 11 counterclockwise while the actuator 11A is generating the propulsion force for moving the watercraft 11 backward and the actuator 11A is causing the watercraft 11 to generate the moment for turning the watercraft 11 counterclockwise, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the forward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0174] Moreover, in the example shown in FIG. 14, the watercraft control device 11C sets a period in which the actuator 11A is operated so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11 on the basis of the speed of the watercraft 11.

[0175] In other words, in the example shown in FIG. 14, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in step SF3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 11B to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the forward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the backward direc-

tion of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (clockwise) to the direction (counterclockwise) of the moment of inertia occurring in the watercraft 11.

[0176] Therefore, in the example shown in FIG. 14, the watercraft operator's input operation for counteracting the inertial force and the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

<Third embodiment>

[0177] Hereinafter, a third embodiment of a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program of the present invention will be described.

[0178] A watercraft maneuvering system 1 of the third embodiment is configured like the watercraft maneuvering system 1 of the first embodiment described above, except for matters to be described below. Therefore, according to the watercraft maneuvering system 1 of the third embodiment, effects similar to those of the watercraft maneuvering system 1 of the first embodiment described above can be achieved, except for the matters to be described below.

[0179] FIG. 15 is a diagram showing an example of the watercraft maneuvering system 1 including a watercraft 11 to which a watercraft control device 11C of the third embodiment is applied.

[0180] In the example shown in FIG. 15, the watercraft maneuvering system 1 includes the watercraft 11 and an input device 12. The watercraft 11 includes an actuator 11A, an operation unit 11B, the watercraft control device 11C, a bow azimuth detection unit 11D, a watercraft speed detection unit 11E, a watercraft location detection unit 11F, and a communication unit 11G. The actuator 11A is configured like the actuator 11A shown in FIG. 1. The operation unit 11B is configured like the operation unit 11B shown in FIG. 1. The watercraft control device 11C is configured like the watercraft control device 11C shown in FIG. 1. The bow azimuth detection unit 11D is configured like the bow azimuth detection unit 11D shown in FIG. 1. The watercraft speed detection unit 11E is configured like the watercraft speed detection unit 11E shown in FIG. 1. The watercraft location detection unit 11F is configured like the watercraft location detection unit 11F shown in FIG. 1. The communication unit 11G communicates with the input device 12.

[0181] The input device 12 is provided separately from the watercraft 11. That is, the input device 12 can be used by a watercraft operator of the watercraft 11, for example, at a location away from the watercraft 11. The input device 12 includes an operation unit 12A and a communication unit 12B. The operation unit 12A receives an input operation of the watercraft operator of the watercraft 11. The communication unit 12B transmits infor-

mation indicating the input operation of the watercraft operator of the watercraft 11 received by the operation unit 12A to the watercraft 11. The communication unit 11G of the watercraft 11 receives information indicating the input operation transmitted by the communication unit 12B of the input device 12. The watercraft control device 11C of the watercraft 11 operates the actuator 11A on the basis of the input operation received by the operation unit 12A of the input device 12.

[0182] In the process executed by the watercraft control device 11C of the third embodiment when the operation unit 12A of the input device 12 receives an input operation for moving the watercraft 11 forward and then receives an input operation for stopping the forward movement of the watercraft 11, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for moving the watercraft 11 forward in the step corresponding to step S11 of FIG. 3. When the operation unit 12A has not received the input operation for moving the watercraft 11 forward, the step corresponding to step S11 of FIG. 3 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for moving the watercraft 11 forward, the process proceeds to the step corresponding to step S12 of FIG. 3.

[0183] In the step corresponding to step S12 of FIG. 3, the watercraft control device 11C operates the actuator 11A so that a propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 forward. As a result, as shown in FIG. 2(C), the watercraft 11 moves forward (i.e., the watercraft 11 moves in the upward direction of FIG. 2).

[0184] Subsequently, in the step corresponding to step S13 of FIG. 3, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received an input operation for stopping the forward movement of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the forward movement of the watercraft 11, the step corresponding to step S13 of FIG. 3 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the forward movement of the watercraft 11, the process proceeds to the step corresponding to step S14 of FIG. 3.

[0185] In the step corresponding to step S14 of FIG. 3, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 forward. As a result, an inertial force (headway) in the upward direction of FIG. 2 for trying to continue forward movement occurs. Therefore, in the watercraft maneuvering system 1 of the third embodiment, in the step corresponding to step S14 of FIG. 3, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (the downward direction of FIG. 2) to a direction of the inertial force occurring in the watercraft 11 (the upward direction of FIG. 2). Specifically,

in the step corresponding to step S14 of FIG. 3, the watercraft control device 11C causes the actuator 11A to generate a propulsion force in the downward direction of FIG. 2 without any need for the operation unit 12A to receive an input operation of causing the actuator 11A to generate the propulsion force in the downward direction of FIG. 2. As a result, as shown in FIGS. 2(A) and 2(B), it is possible to suppress the movement (headway) of the watercraft 11 in the upward direction of FIG. 2 due to the inertial force occurring in the watercraft 11.

[0186] Subsequently, in the step corresponding to step S15 of FIG. 3, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 12A of the input device 12 receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 12A has received the input operation for stopping the forward movement of the watercraft 11 in the step corresponding to step S15 of FIG. 3). Specifically, in the step corresponding to step S15 of FIG. 3, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 12A receives the input operation for stopping the operation of the actuator 11A is greater than or equal to a first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move in the upward direction of FIG. 2 due to the inertial force (headway) of the watercraft 11), the step corresponding to step S15 of FIG. 3 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move in the upward direction of FIG. 2 due to the inertial force (headway) of the watercraft 11), the process proceeds to the step corresponding to step S16 of FIG. 3.

[0187] In the step corresponding to step S16 of FIG. 3, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force in the downward direction of FIG. 2.

[0188] That is, in the watercraft maneuvering system 1 of the third embodiment, when the operation unit 12A of the input device 12 has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 forward (when YES is determined in the step corresponding to step S13 of FIG. 3) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the downward direction of FIG. 2) to a direction of the inertial force occurring in the watercraft 11 (the upward direction of FIG. 2).

[0189] Therefore, in the watercraft maneuvering system 1 of the third embodiment, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the

operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0190] Moreover, in the watercraft maneuvering system 1 of the third embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the inertial force occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

[0191] In the process executed by the watercraft control device 11C of the third embodiment when the operation unit 12A of the input device 12 receives an input operation for turning the watercraft 11 clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft 11, for example, the watercraft control device 11C of the third embodiment determines whether or not the operation unit 12A of the input device 12 has received the input operation for turning the watercraft 11 clockwise in place in the step corresponding to step S31 of FIG. 5. When the operation unit 12A has not received the input operation for turning the watercraft 11 clockwise in place, the step corresponding to step S31 of FIG. 5 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for turning the watercraft 11 clockwise in place, the process proceeds to the step corresponding to step S32 of FIG. 5.

[0192] In the step corresponding to step S32 of FIG. 5, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise in place. As a result, the watercraft 11 turns clockwise in place.

[0193] Subsequently, in the step corresponding to step S33 of FIG. 5, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received an input operation for stopping the in-place clockwise turning of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the in-place clockwise turning of the watercraft 11, the step corresponding to step S33 of FIG. 5 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the in-place clockwise turning of the watercraft 11, the process proceeds to the step corresponding to step S34 of FIG. 5.

[0194] In the step corresponding to step S34 of FIG. 5, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 clockwise in place. As a result, a moment of inertia for trying to continue the in-place clockwise turning occurs. Therefore, in the watercraft maneuvering system 1 of the third embodiment, in the step corresponding to step S34 of FIG. 5, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the wa-

tercraft 11. Specifically, in the step corresponding to step S34 of FIG. 5, the watercraft control device 11C causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 12A to receive an input operation of causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the excessive in-place clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0195] Subsequently, in the step corresponding to step S35 of FIG. 5, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 12A of the input device 12 receives the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 12A has received the input operation for stopping the in-place clockwise turning of the watercraft 11 in the step corresponding to step S33 of FIG. 5). Specifically, in the step corresponding to step S35 of FIG. 5, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 12A receives the input operation for stopping the operation of the actuator 11A is greater than or equal to a first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to excessively turn clockwise in place due to the moment of inertia of the watercraft 11), the step corresponding to step S35 of FIG. 5 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to excessively turn clockwise in place due to the moment of inertia of the watercraft 11), the process proceeds to the step corresponding to step S36 of FIG. 5.

[0196] In the step corresponding to step S36 of FIG. 5, the watercraft control device 11C causes the actuator 11A to stop the generation of the counterclockwise moment.

[0197] That is, in the watercraft maneuvering system 1 of the third embodiment, when the operation unit 12A of the input device 12 has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in the step corresponding to step S33 of FIG. 5), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0198] Therefore, in the watercraft maneuvering system 1 of the third embodiment, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0199] Moreover, in the watercraft maneuvering sys-

tem 1 of the third embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the moment of inertia occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

[0200] In the process executed by the watercraft control device 11C of the third embodiment when the operation unit 12A of the input device 12 receives an input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft 11, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise in the step corresponding to step S51 of FIG. 7. When the operation unit 12A has not received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the step corresponding to step S51 of FIG. 7 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the process proceeds to the step corresponding to step S52 of FIG. 7.

[0201] In the step corresponding to step S52 of FIG. 7, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 forward and causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise. As a result, the watercraft 11 moves forward and turns clockwise.

[0202] Subsequently, in the step corresponding to step S53 of FIG. 7, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the step corresponding to step S53 of FIG. 7 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the process proceeds to the step corresponding to step S54 of FIG. 7.

[0203] In the step corresponding to step S54 of FIG. 7, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 forward and the generation of a moment for turning the watercraft 11 clockwise. As a result, an inertial force for trying to continue the forward movement and a moment of inertia for trying to continue the clockwise turning occur. Therefore, in the watercraft maneuvering system 1 of the third embodiment, in the step corresponding to step S54 of FIG. 7, the watercraft control device 11C operates the actuator 11A so that the

actuator 11A generates a propulsion force in an opposite direction (a backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in the step corresponding to step S54 of FIG. 7, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 12A to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11 and causing the watercraft 11 to generate a counterclockwise moment. As a result, it is possible to suppress the forward movement of the watercraft 11 due to the inertial force occurring in the watercraft 11 and the excessive clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0204] Subsequently, in the step corresponding to step S55 of FIG. 7, the watercraft control device 11C monitors an elapsed time from the time when the operation unit 12A of the input device 12 has received the input operation for stopping the operation of the actuator 11A (i.e., the time when it is determined that the operation unit 12A has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11 in the step corresponding to step S53 of FIG. 7). Specifically, in the step corresponding to step S55 of FIG. 7, the watercraft control device 11C determines whether or not the elapsed time from the time when the operation unit 12A receives the input operation for stopping the operation of the actuator 11A is greater than or equal to the first threshold value. When the elapsed time is not greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is likely to move forward due to the inertial force of the watercraft 11 and the watercraft 11 is likely to turn clockwise due to the moment of inertia of the watercraft 11), the step corresponding to step S55 of FIG. 7 is iteratively executed. On the other hand, when the elapsed time is greater than or equal to the first threshold value (i.e., when it can be estimated that the watercraft 11 is unlikely to move forward due to the inertial force of the watercraft 11 and the watercraft 11 is unlikely to excessively turn clockwise due to the moment of inertia of the watercraft 11), the process proceeds to the step corresponding to step S56 of FIG. 7.

[0205] In the step corresponding to step S56 of FIG. 7, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force of the watercraft 11 and the generation of the counterclockwise moment.

[0206] That is, in the watercraft maneuvering system 1 of the third embodiment, when the operation unit 12A of the input device 12 has received the input operation for stopping the generation of the actuator 11A while the

watercraft control device 11C is operating the actuator 11A (when YES is determined in the step corresponding to step S53 of FIG. 7), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A generates the propulsion force in the opposite direction (the backward direction of the watercraft 11) to the direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0207] Therefore, in the watercraft maneuvering system 1 of the third embodiment, the watercraft operator's input operation for counteracting the inertial force and the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0208] Moreover, in the watercraft maneuvering system 1 of the third embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the inertial force and the moment of inertia occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

<Fourth embodiment>

[0209] Hereinafter, a fourth embodiment of a watercraft maneuvering system, a watercraft control device, a watercraft control method, and a non-volatile storage medium storing a program of the present invention will be described.

[0210] A watercraft maneuvering system 1 of the fourth embodiment is configured like the watercraft maneuvering systems 1 of the second and third embodiments described above, except for matters to be described below. Therefore, according to the watercraft maneuvering system 1 of the fourth embodiment, effects similar to those of the watercraft maneuvering systems 1 of the second and third embodiments described above can be achieved, except for the matters to be described below.

[0211] The watercraft maneuvering system 1 of the fourth embodiment is configured like the watercraft maneuvering system 1 of the third embodiment shown in FIG. 15.

[0212] In a process executed by a watercraft control device 11C of the fourth embodiment when an operation unit 12A of an input device 12 receives an input operation for moving a watercraft 11 forward and then receives an input operation for stopping the forward movement of the watercraft 11, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for moving the watercraft 11 forward in the step corresponding to step SA1 of FIG. 9. When the operation unit 12A has not

received the input operation for moving the watercraft 11 forward, the step corresponding to step SA1 of FIG. 9 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for moving the watercraft 11 forward, the process proceeds to the step corresponding to step SA2 of FIG. 9.

[0213] In the step corresponding to step SA2 of FIG. 9, the watercraft control device 11C operates the actuator 11A so that a propulsion force generation unit 11A2 of the actuator 11A generates a propulsion force for moving the watercraft 11 forward. As a result, the watercraft 11 moves forward.

[0214] Subsequently, in the step corresponding to step SA3 of FIG. 9, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received an input operation for stopping the forward movement of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the forward movement of the watercraft 11, the step corresponding to step SA3 of FIG. 9 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the forward movement of the watercraft 11, the process proceeds to the step corresponding to step SA4 of FIG. 9.

[0215] In the step corresponding to step SA4 of FIG. 9, the watercraft control device 11C causes the actuator 11A to stop the generation of the propulsion force for moving the watercraft 11 forward. As a result, an inertial force (headway) for trying to continue forward movement occurs. Therefore, in the watercraft maneuvering system 1 of the fourth embodiment, in the step corresponding to step SA4 of FIG. 9, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11). Specifically, in the step corresponding to step SA4 of FIG. 9, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 without any need for the operation unit 12A to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11. As a result, it is possible to suppress the forward movement (headway) of the watercraft 11 due to the inertial force occurring in the watercraft 11.

[0216] Subsequently, in the step corresponding to step SA5 of FIG. 9, the watercraft control device 11C monitors the speed of the watercraft 11. Specifically, in the step corresponding to step SA5 of FIG. 9, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by a watercraft speed detection unit 11E has decreased to a second threshold value. When the speed of the watercraft 11 has not decreased to a second threshold value (i.e., when the watercraft 11 continuously moves forward due to the inertial force (headway) of the watercraft 11), the step corresponding

to step SA5 of FIG. 9 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the second threshold value (i.e., when it can be estimated that the forward movement of the watercraft 11 due to the inertial force (headway) of the watercraft 11 has ended), the process proceeds to the step corresponding to step SA6 of FIG. 9.

[0217] In the step corresponding to step SA6 of FIG. 9, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force.

[0218] That is, in the watercraft maneuvering system 1 of the fourth embodiment, when the operation unit 12A of the input device 12 has received the input operation for stopping the generation of the propulsion force for moving the watercraft 11 forward (when YES is determined in the step corresponding to step SA3 of FIG. 9) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11).

[0219] Therefore, in the watercraft maneuvering system 1 of the fourth embodiment, the watercraft operator's input operation for counteracting the inertial force occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0220] Moreover, in the watercraft maneuvering system 1 of the fourth embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the inertial force occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

[0221] In the process executed by the watercraft control device 11C of the fourth embodiment when the operation unit 12A of the input device 12 receives an input operation for turning the watercraft 11 clockwise in place and then receives an input operation for stopping the in-place clockwise turning of the watercraft 11, for example, the watercraft control device 11C of the fourth embodiment determines whether or not the operation unit 12A of the input device 12 has received the input operation for turning the watercraft 11 clockwise in place in the step corresponding to step SC1 of FIG. 11. When the operation unit 12A has not received the input operation for turning the watercraft 11 clockwise in place, the step corresponding to step SC1 of FIG. 11 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for turning the watercraft 11 clockwise in place, the process proceeds to the step corresponding to step SC2 of FIG. 11.

[0222] In the step corresponding to step SC2 of FIG. 11, the watercraft control device 11C operates the actu-

ator 11A so that the actuator 11A causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise in place. As a result, the watercraft 11 turns clockwise in place.

[0223] Subsequently, in the step corresponding to step SC3 of FIG. 11, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received an input operation for stopping the in-place clockwise turning of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the in-place clockwise turning of the watercraft 11, the step corresponding to step SC3 of FIG. 11 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the in-place clockwise turning of the watercraft 11, the process proceeds to the step corresponding to step SC4 of FIG. 11.

[0224] In the step corresponding to step SC4 of FIG. 11, the watercraft control device 11C causes the actuator 11A to stop the generation of a moment for turning the watercraft 11 clockwise in place. As a result, a moment of inertia for trying to continue the in-place clockwise turning occurs. Therefore, in the watercraft maneuvering system 1 of the third embodiment, in the step corresponding to step SC4 of FIG. 11, the watercraft control device 11C operates the actuator 11A so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in the step corresponding to step SC4 of FIG. 11, the watercraft control device 11C causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 12A to receive an input operation for causing the watercraft 11 to generate the counterclockwise moment. As a result, it is possible to suppress the excessive in-place clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0225] Subsequently, in the step corresponding to step SCS of FIG. 11, the watercraft control device 11C monitors an angular speed of the watercraft 11. Specifically, in the step corresponding to step SCS of FIG. 11, the watercraft control device 11C determines whether or not the angular speed of the watercraft 11 calculated on the basis of a bow azimuth detected by a bow azimuth detection unit 11D has decreased to a third threshold value or less. When the angular speed of the watercraft 11 has not decreased to the third threshold value or less (i.e., when the watercraft 11 continuously turns clockwise in place due to the moment of inertia of the watercraft 11), the step corresponding to step SCS of FIG. 11 is iteratively executed. On the other hand, when the angular speed of the watercraft 11 has decreased to the third threshold value or less (i.e., when it can be estimated that the in-place clockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to the step corresponding to step SC6 of FIG. 11.

[0226] In the step corresponding to step SC6 of FIG. 11, the watercraft control device 11C causes the actuator 11A to stop the generation of the counterclockwise moment.

[0227] That is, in the watercraft maneuvering system 1 of the fourth embodiment, when the operation unit 12A of the input device 12 has received the input operation for stopping the operation of the actuator 11A while the watercraft control device 11C is operating the actuator 11A (when YES is determined in the step corresponding to step SC3 of FIG. 11), the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0228] Therefore, in the watercraft maneuvering system 1 of the fourth embodiment, the watercraft operator's input operation for counteracting the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0229] Moreover, in the watercraft maneuvering system 1 of the fourth embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the moment of inertia occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

[0230] In the process executed by the watercraft control device 11C of the fourth embodiment when the operation unit 12A of the input device 12 receives an input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise and then receives an input operation for stopping the forward movement and clockwise turning of the watercraft 11, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise in the step corresponding to step SE1 of FIG. 13. When the operation unit 12A has not received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the step corresponding to step SE1 of FIG. 13 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for moving the watercraft 11 forward and turning the watercraft 11 clockwise, the process proceeds to the step corresponding to step SE2 of FIG. 13.

[0231] In the step corresponding to step SE2 of FIG. 13, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force for moving the watercraft 11 forward and causes the watercraft 11 to generate a moment for turning the watercraft 11 clockwise. As a result, the watercraft 11 moves forward and turns clockwise.

[0232] Subsequently, in the step corresponding to step

SE3 of FIG. 13, for example, the watercraft control device 11C determines whether or not the operation unit 12A of the input device 12 has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11. When the operation unit 12A has not received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the step corresponding to step SE3 of FIG. 13 is iteratively executed. On the other hand, when the operation unit 12A has received the input operation for stopping the forward movement and clockwise turning of the watercraft 11, the process proceeds to the step corresponding to step SE4 of FIG. 13.

[0233] In the step corresponding to step SE4 of FIG. 13, the watercraft control device 11C causes the actuator 11A to stop the generation of a propulsion force for moving the watercraft 11 forward and the generation of a moment for turning the watercraft 11 clockwise. As a result, an inertial force for trying to continue the forward movement and a moment of inertia for trying to continue the clockwise turning occur. Therefore, in the watercraft maneuvering system 1 of the fourth embodiment, in the step corresponding to step SE4 of FIG. 13, the watercraft control device 11C operates the actuator 11A so that the actuator 11A generates a propulsion force in an opposite direction (a backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (a forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11. Specifically, in the step corresponding to step SE4 of FIG. 13, the watercraft control device 11C causes the actuator 11A to generate a backward propulsion force of the watercraft 11 and causes the watercraft 11 to generate a counterclockwise moment without any need for the operation unit 12A to receive an input operation for causing the actuator 11A to generate the backward propulsion force of the watercraft 11 and causing the watercraft 11 to generate the counterclockwise moment. As a result, it is possible to suppress the forward movement of the watercraft 11 due to the inertial force occurring in the watercraft 11 and the excessive clockwise turning of the watercraft 11 due to the moment of inertia occurring in the watercraft 11.

[0234] Subsequently, in the step corresponding to step SE5 of FIG. 13, the watercraft control device 11C monitors a speed of the watercraft 11. Specifically, in the step corresponding to step SE5 of FIG. 13, the watercraft control device 11C determines whether or not the speed of the watercraft 11 detected by the watercraft speed detection unit 11E has decreased to a fourth threshold value or less. When the speed of the watercraft 11 has not decreased to the fourth threshold value or less (i.e., when the watercraft 11 moves forward due to the inertial force of the watercraft 11 and the watercraft 11 continuously turns clockwise due to the moment of inertia of the watercraft 11), the step corresponding to step SE5 of FIG.

13 is iteratively executed. On the other hand, when the speed of the watercraft 11 has decreased to the fourth threshold value or less (i.e., when it can be estimated that the forward movement of the watercraft 11 due to the inertial force of the watercraft 11 and the clockwise turning of the watercraft 11 due to the moment of inertia of the watercraft 11 has ended), the process proceeds to the step corresponding to step SE6 of FIG. 13.

[0235] In the step corresponding to step SE6 of FIG. 13, the watercraft control device 11C causes the actuator 11A to stop the generation of the backward propulsion force of the watercraft 11 and the generation of the counterclockwise moment.

[0236] That is, in the watercraft maneuvering system 1 of the fourth embodiment, when the operation unit 11B has received the input operation for stopping the operation of the actuator 11A (when YES is determined in the step corresponding to step SE3 of FIG. 13) while the watercraft control device 11C is operating the actuator 11A, the watercraft control device 11C operates the actuator 11A without any need for the operation unit 12A to receive the input operation so that the actuator 11A generates the propulsion force in an opposite direction (the backward direction of the watercraft 11) to a direction of the inertial force occurring in the watercraft 11 (the forward direction of the watercraft 11) and causes the watercraft 11 to generate the moment in the opposite direction (counterclockwise) to the direction (clockwise) of the moment of inertia occurring in the watercraft 11.

[0237] Therefore, in the watercraft maneuvering system 1 of the fourth embodiment, the watercraft operator's input operation for counteracting the inertial force and the moment of inertia occurring in the watercraft 11 during the transition from the operating state of the actuator 11A to the stopped state of the actuator 11A can be eliminated.

[0238] Moreover, in the watercraft maneuvering system 1 of the fourth embodiment, even if the watercraft operator who is away from the watercraft 11 cannot ascertain the inertial force and the moment of inertia occurring in the watercraft 11, the state of the watercraft 11 can appropriately transition from the operating state of the actuator 11A to the stopped state of the actuator 11A.

[0239] Although modes for carrying out the present invention have been described using embodiments, the present invention is not limited to the embodiments and various modifications and substitutions can also be made without departing from the scope and spirit of the present invention. The configurations described in the above-described embodiments and examples may be combined.

[0240] Also, all or some of the functions of the parts provided in the watercraft maneuvering system 1 according to the above-described embodiment may be implemented by recording a program for implementing the functions on a computer-readable recording medium and causing a computer system to read and execute the program recorded on the recording medium. Also, the "computer system" described here is assumed to include an

operating system (OS) and hardware such as peripheral devices.

[0241] Moreover, the "computer-readable recording medium" refers to a flexible disk, a magneto-optical disc, a read only memory (ROM), a portable medium such as a compact disc (CD)-ROM, or a storage unit such as a hard disk embedded in the computer system. Further, the "computer-readable recording medium" may include a computer-readable recording medium for dynamically retaining the program for a short time period as in a communication line when the program is transmitted via a network such as the Internet or a communication circuit such as a telephone circuit and a computer-readable recording medium for retaining the program for a given time period as in a volatile memory inside the computer system serving as a server or a client when the program is transmitted. Moreover, the above-described program may be a program for implementing some of the above-described functions. Furthermore, the above-described program may be a program capable of implementing the above-described function in combination with a program already recorded on the computer system.

[Reference Signs List]

[0242]

- 1 Watercraft maneuvering system
- 11 Watercraft
- 11A Actuator
- 11A1 Rudder unit
- 11A2 Propulsion force generation unit
- 11B Operation unit
- 11B1 Steering unit
- 11B2 Throttle operation unit
- 11C Watercraft control device
- 11D Bow azimuth detection unit
- 11E Watercraft speed detection unit
- 11F Watercraft location detection unit
- 11G Communication unit
- 12 Input device
- 12A Operation unit
- 12B Communication unit

Claims

1. A watercraft maneuvering system comprising:

an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment; an operation unit configured to receive an input operation of a watercraft operator; and a watercraft control device configured to operate the actuator, wherein, when the operation unit has received an input operation for stopping an operation of

the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft.

2. The watercraft maneuvering system according to claim 1, wherein the watercraft control device sets a period in which the actuator is operated for the at least one function of the actuator generating the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft and causing the watercraft to generate the moment in the opposite direction to the direction of the moment of inertia occurring in the watercraft on the basis of an elapsed time from the time when the operation unit receives the input operation for stopping the operation of the actuator.

3. The watercraft maneuvering system according to claim 1, wherein the watercraft control device sets a period in which the actuator is operated for the at least one function of the actuator generating the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft and causing the watercraft to generate the moment in the opposite direction to the direction of the moment of inertia occurring in the watercraft on the basis of a speed or an angular speed of the watercraft.

4. The watercraft maneuvering system according to claim 1,

wherein the watercraft maneuvering system includes the watercraft and an input device provided separately from the watercraft, wherein the watercraft includes the actuator and the watercraft control device, wherein the input device includes the operation unit, and

wherein, when the operation unit of the input device has received the input operation for stopping the operation of the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit of the input device to receive the input operation for the at least one function of the actuator generating the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft and causing the watercraft to generate the moment in the opposite di-

rection to the direction of the moment of inertia occurring in the watercraft.

5. The watercraft maneuvering system according to claim 1, wherein, when the operation unit has received an input operation for stopping the generation of the propulsion force for moving the watercraft forward or backward while the actuator is generating the propulsion force for moving the watercraft forward or backward, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation so that the actuator generates the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft. 5
6. The watercraft maneuvering system according to claim 1, wherein, when the operation unit has received an input operation for stopping generation of a moment for turning the watercraft in place while the actuator is generating the moment for turning the watercraft in place, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation so that the actuator causes the watercraft to generate the moment in the opposite direction to the direction of the moment of inertia occurring in the watercraft. 10 15 20 25
7. The watercraft maneuvering system according to claim 1, wherein, when the operation unit has received an input operation for stopping the generation of the propulsion force for moving the watercraft forward and a moment for turning the watercraft while the actuator is generating the propulsion force for moving the watercraft forward and is causing the watercraft to generate the moment for turning the watercraft, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation so that the actuator generates the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft and causes the watercraft to generate the moment in the opposite direction to the direction of the moment of inertia occurring in the watercraft. 30 35 40 45
8. The watercraft maneuvering system according to claim 1, wherein, when the operation unit has received an input operation for stopping the generation of the propulsion force for moving the watercraft forward and a moment for turning the watercraft while the actuator is generating the propulsion force for moving the watercraft backward and is causing the watercraft to generate the moment for turning the watercraft, the watercraft control device operates the actuator without any need for the operation unit to receive the 50 55

input operation so that the actuator generates the propulsion force in the opposite direction to the direction of the inertial force occurring in the watercraft and causes the watercraft to generate the moment in the opposite direction to the direction of the moment of inertia occurring in the watercraft.

9. A watercraft control device provided in a watercraft maneuvering system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, 10 15

wherein, when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator, the watercraft control device operates the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft.

10. A watercraft control method for use in a watercraft control device provided in a watercraft maneuvering system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, the watercraft control method comprising: 30 35 40

a first step of operating the actuator in accordance with an input operation received by the operation unit; and

a second step of operating the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator. 45 50 55

11. A non-volatile storage medium storing a program for causing a computer, which is mounted in a watercraft control device provided in a watercraft maneuvering 55

system including an actuator having a function of generating a propulsion force of a watercraft and a function of causing the watercraft to generate a moment and an operation unit for receiving an input operation of a watercraft operator and configured to operate the actuator, to execute: 5

a first step of operating the actuator in accordance with an input operation received by the operation unit; and 10
a second step of operating the actuator without any need for the operation unit to receive the input operation for at least one function of the actuator generating the propulsion force in an opposite direction to a direction of an inertial force occurring in the watercraft and causing the watercraft to generate the moment in an opposite direction to a direction of a moment of inertia occurring in the watercraft when the operation unit has received an input operation for stopping an operation of the actuator while the watercraft control device is operating the actuator. 20

25

30

35

40

45

50

55

FIG. 1

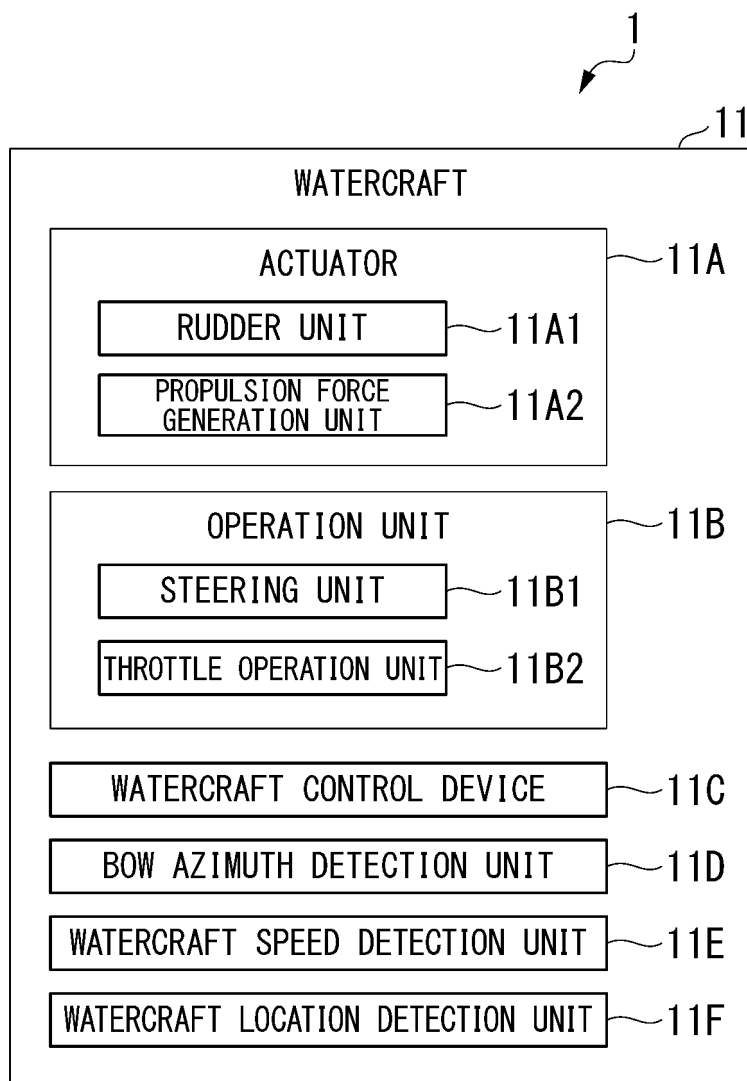


FIG. 2

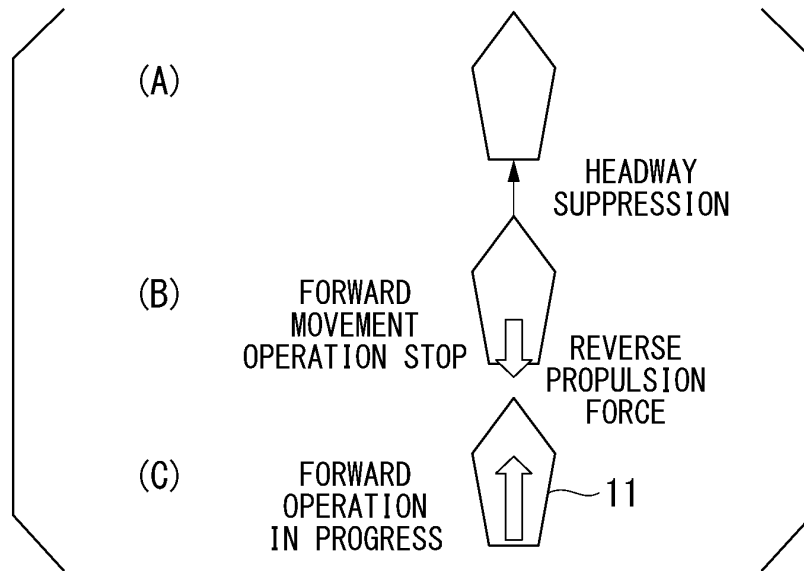


FIG. 3

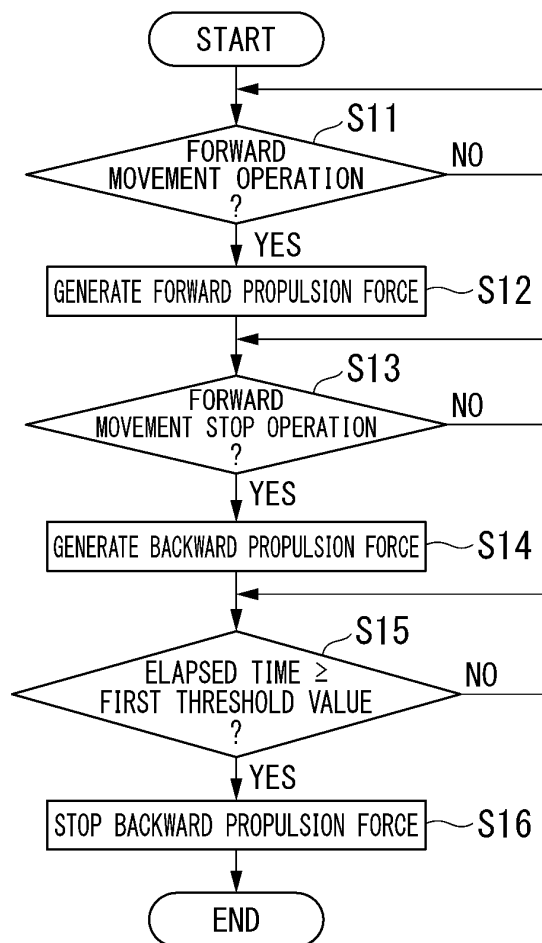


FIG. 4

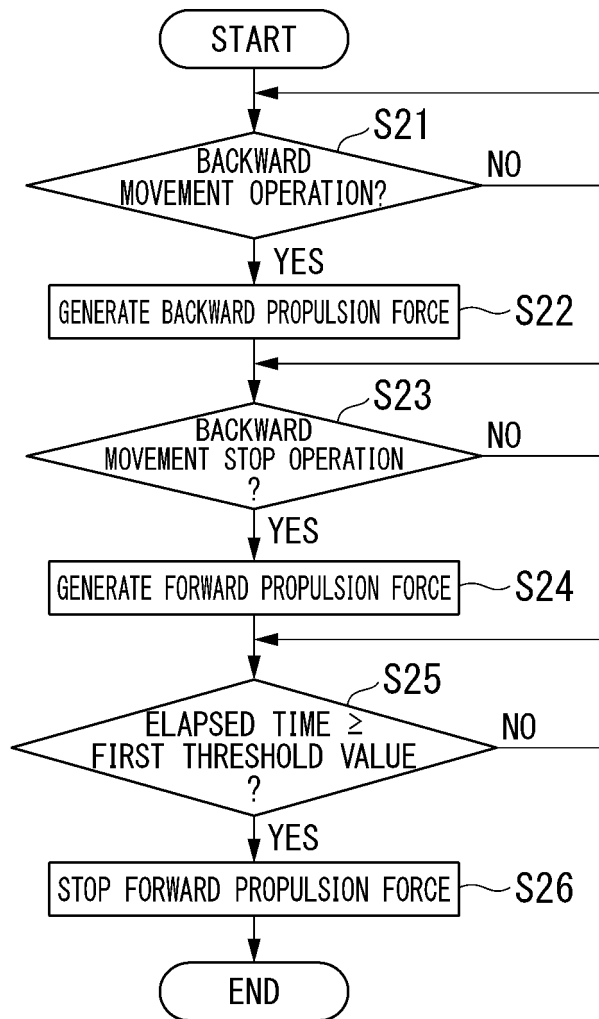


FIG. 5

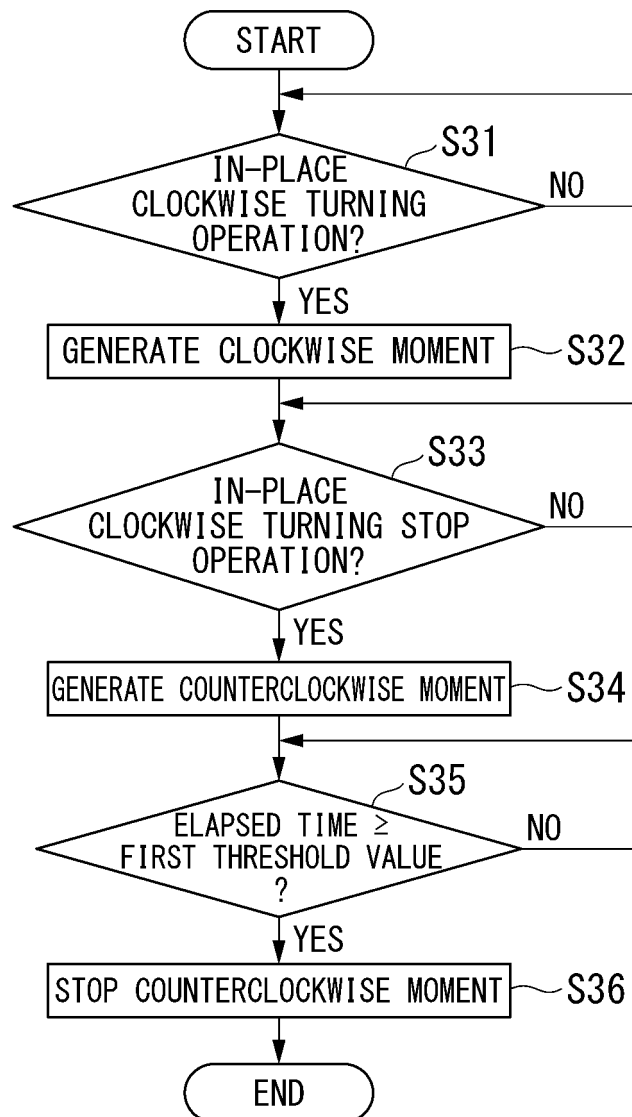


FIG. 6

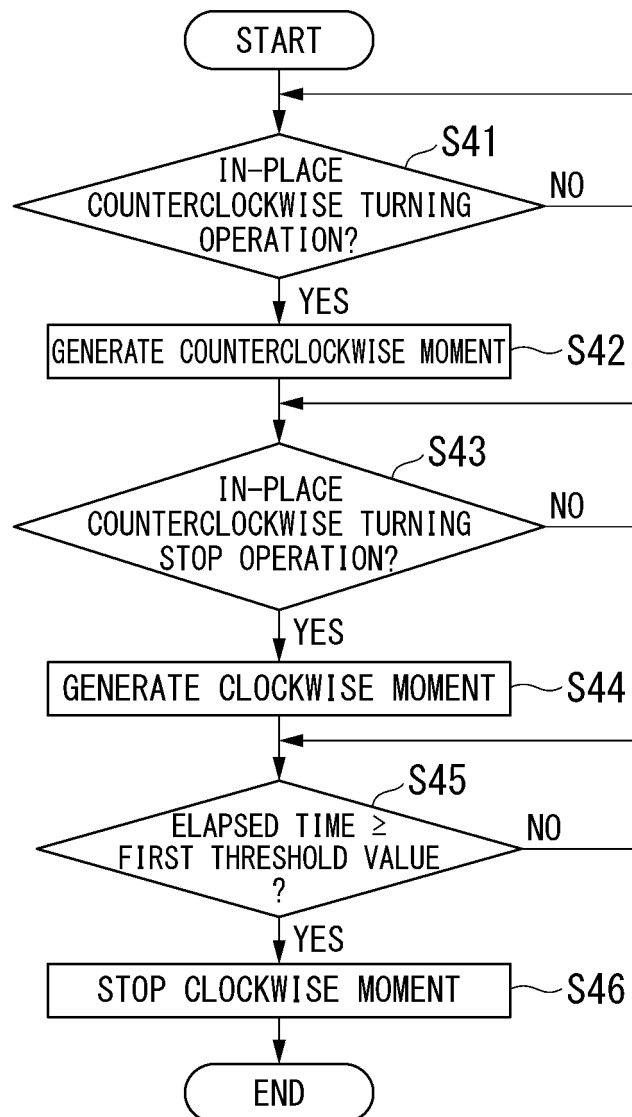


FIG. 7

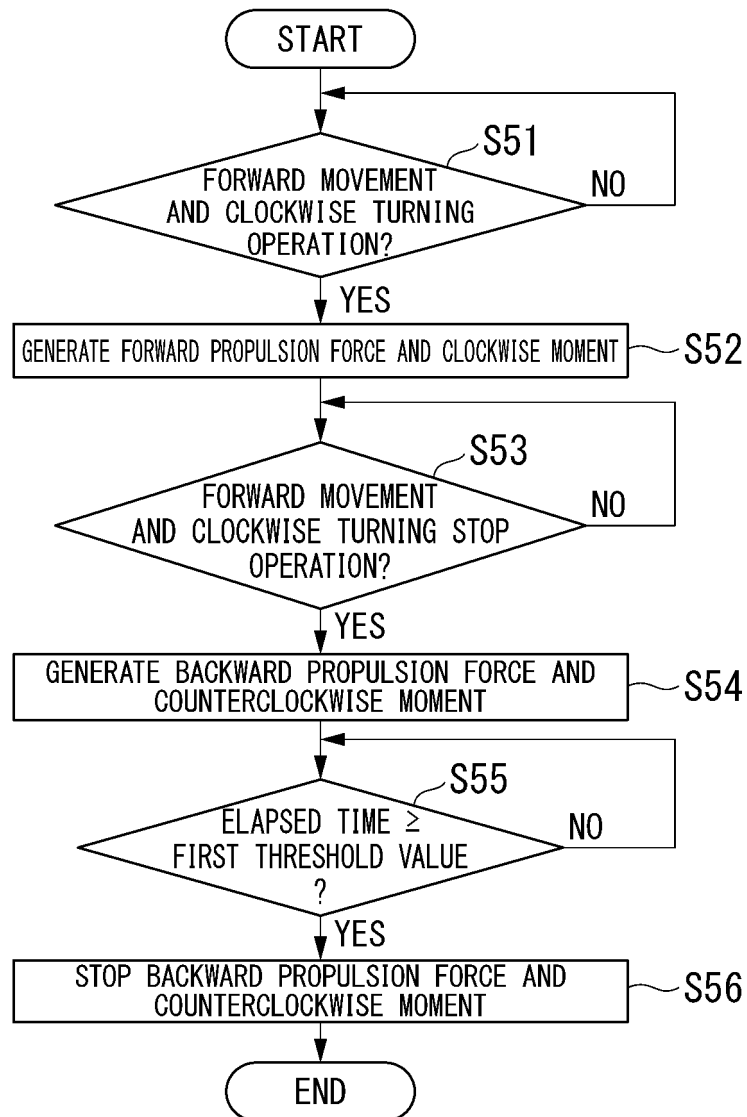


FIG. 8

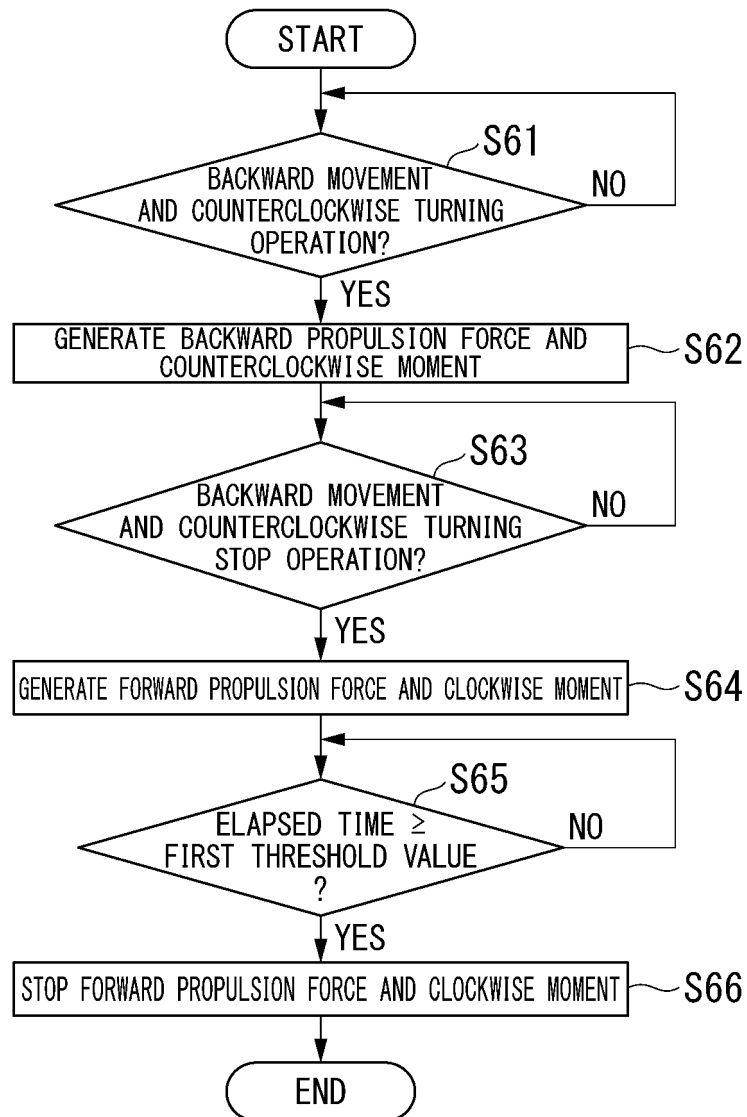


FIG. 9

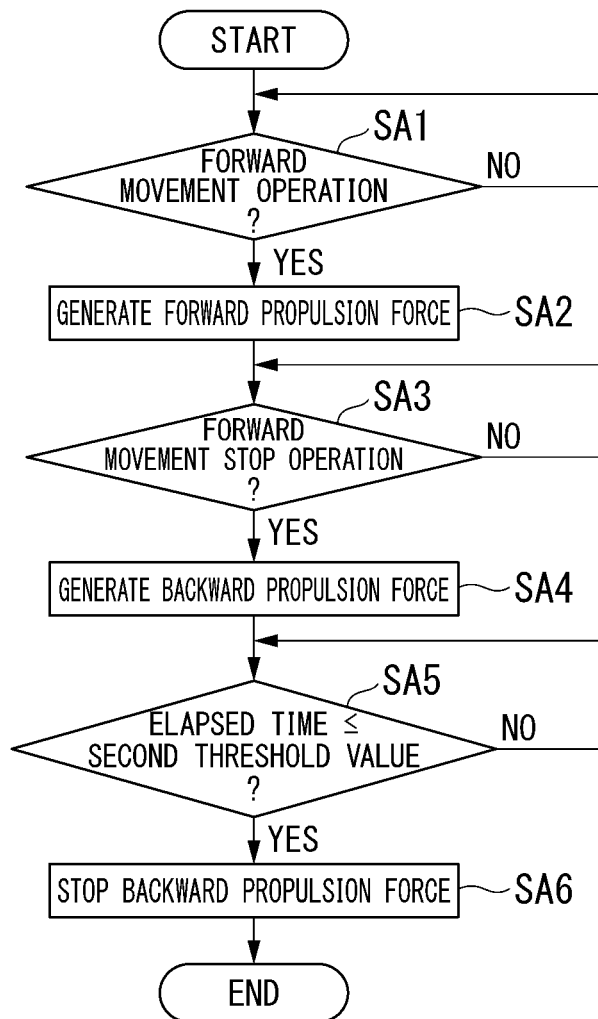


FIG. 10

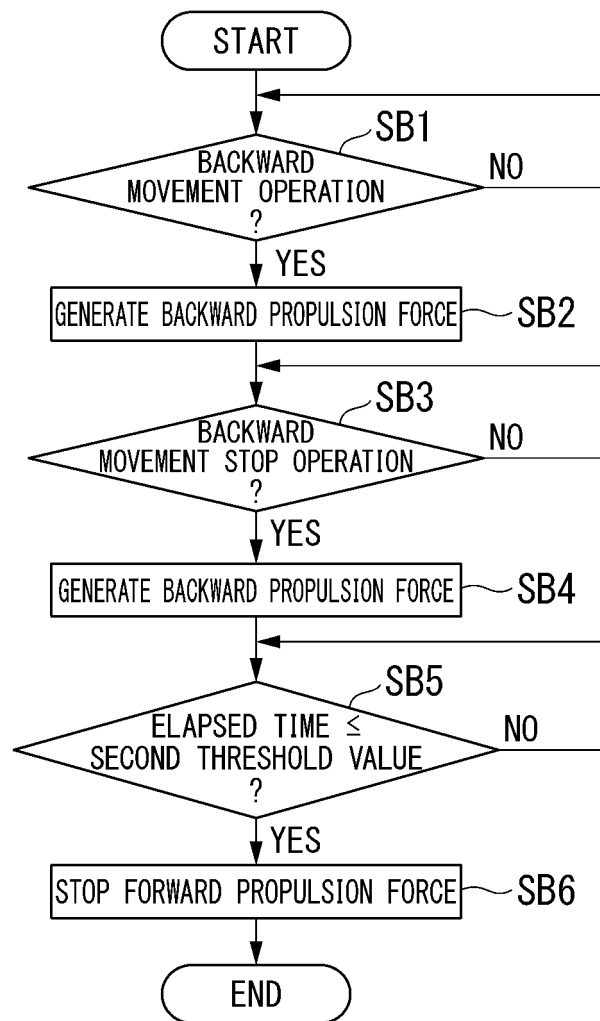


FIG. 11

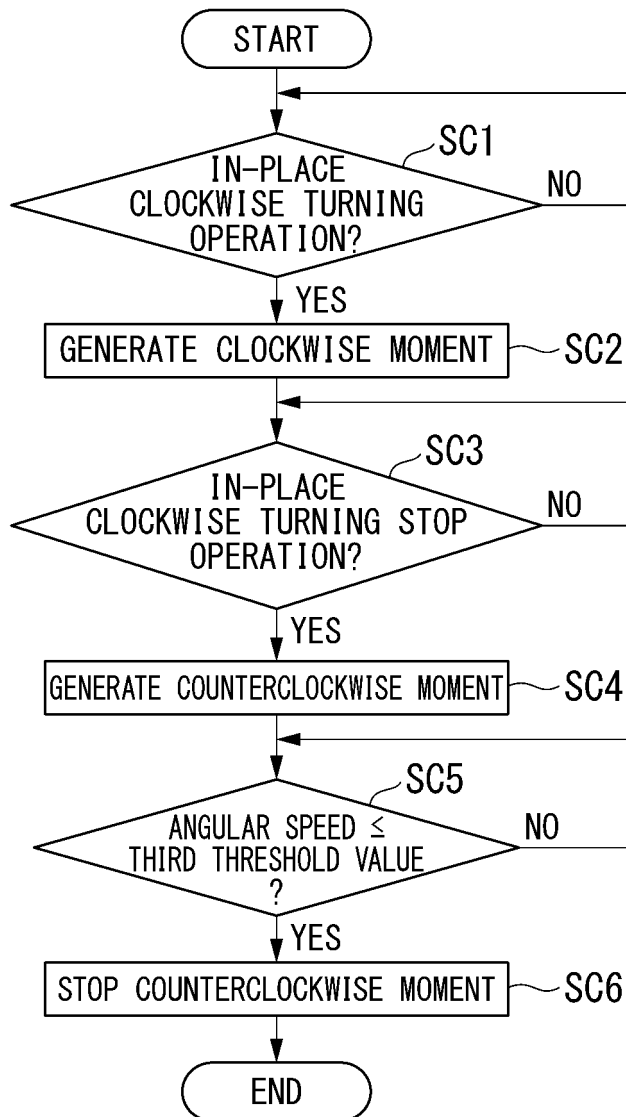


FIG. 12

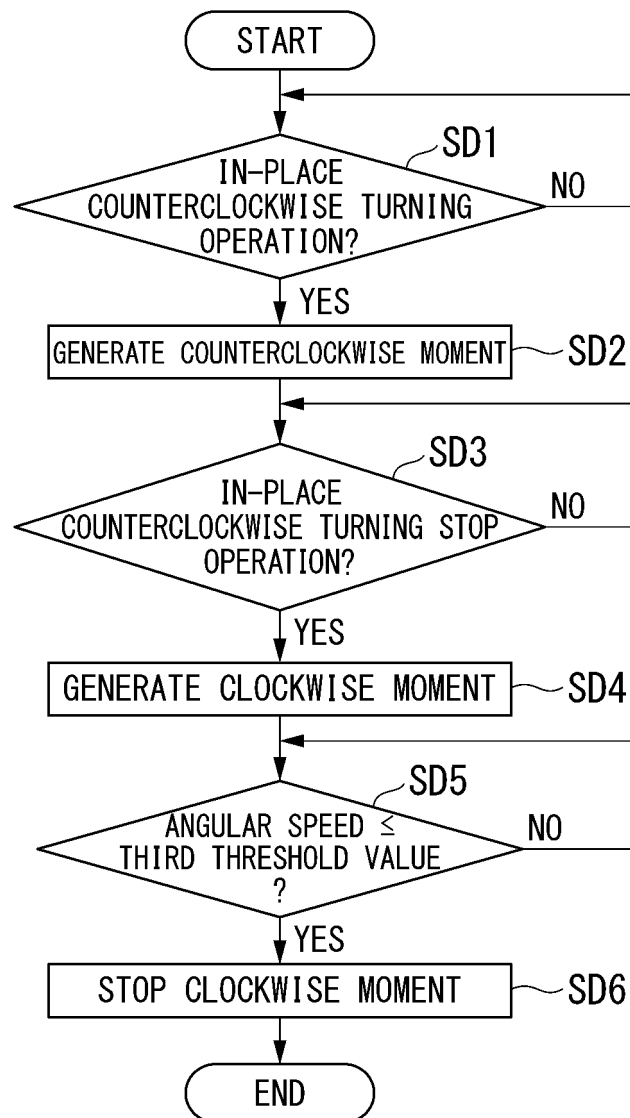


FIG. 13

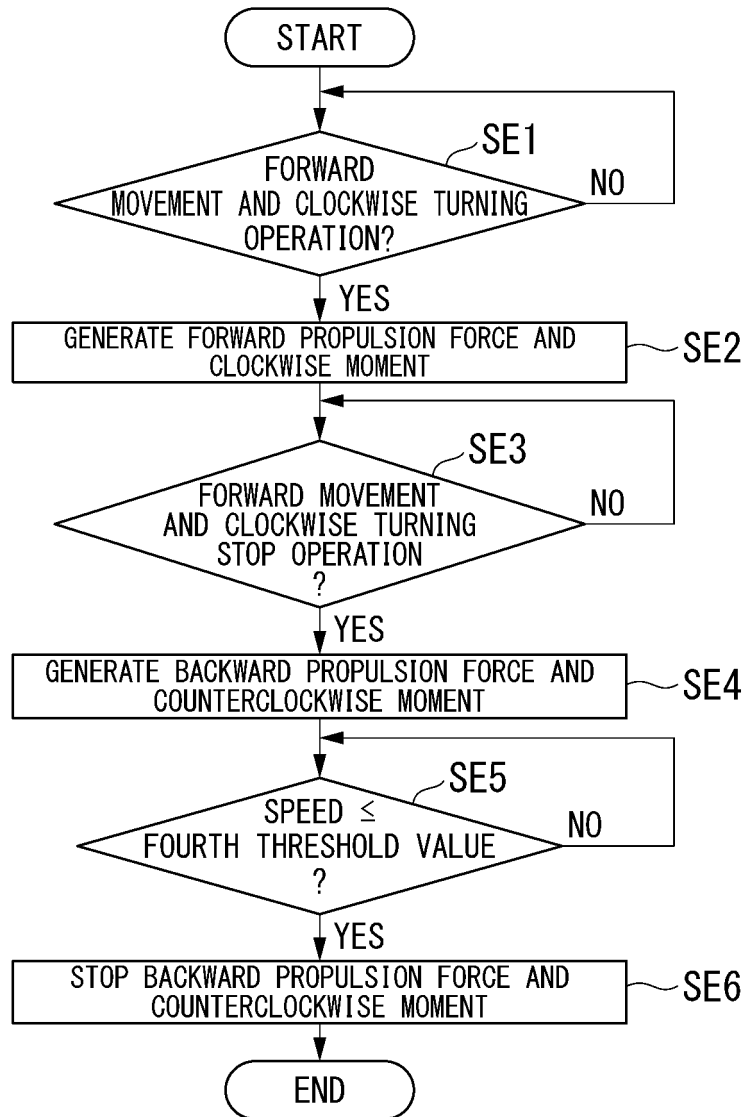


FIG. 14

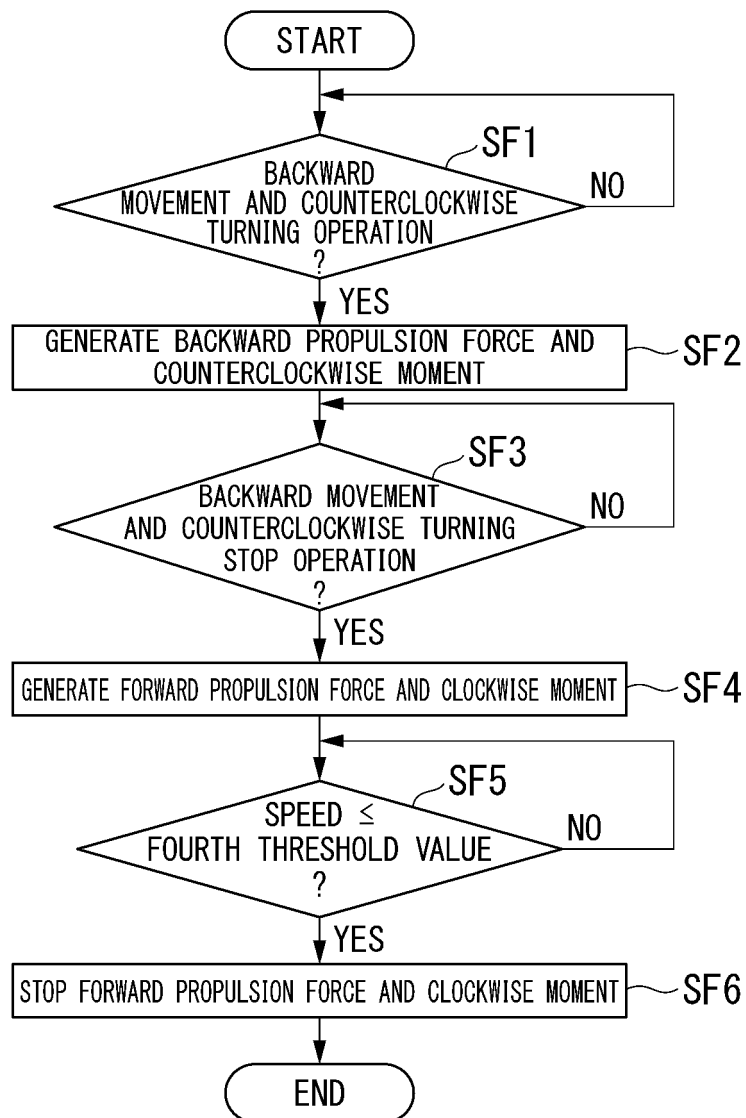


FIG. 15

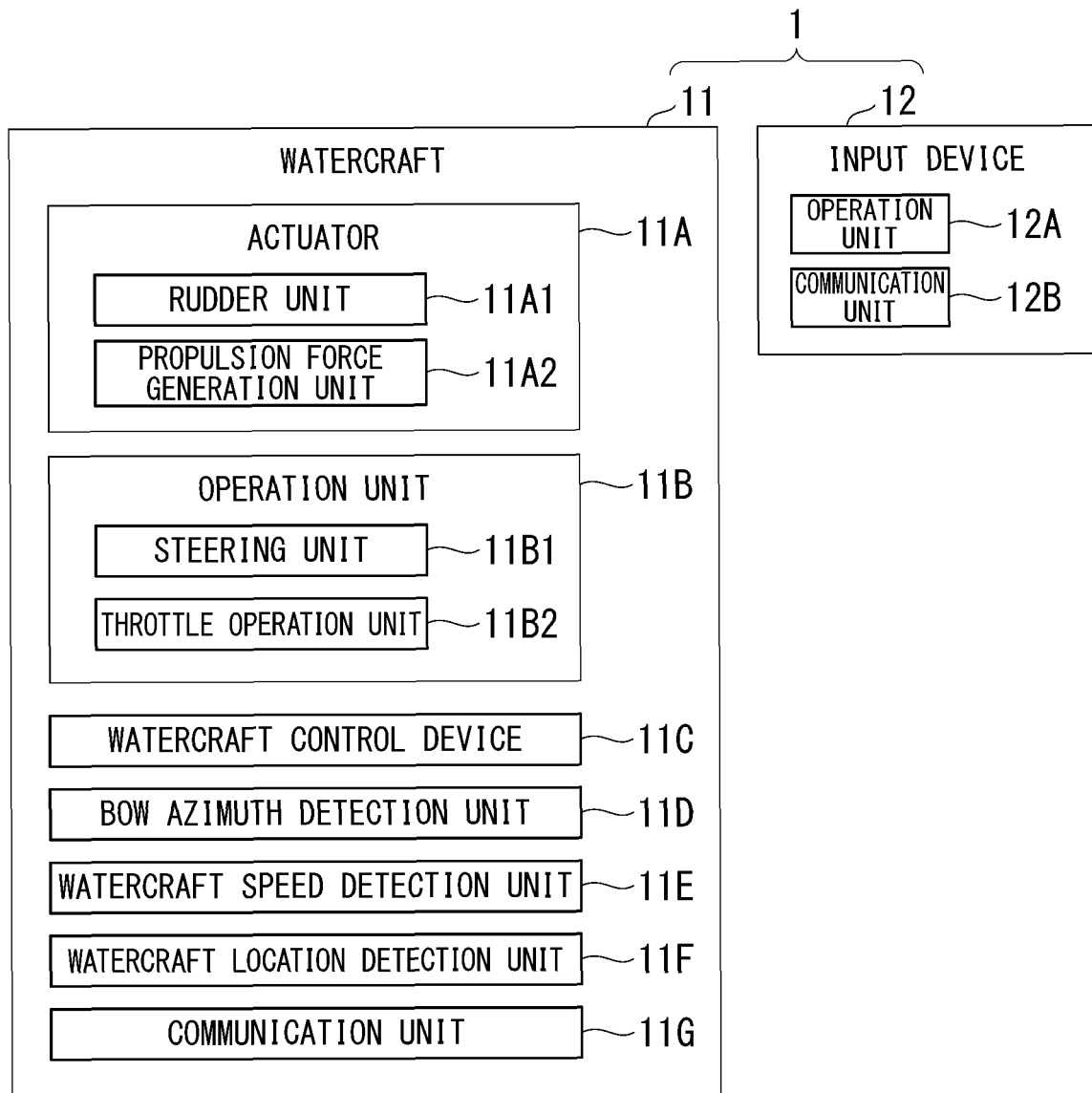


FIG. 16

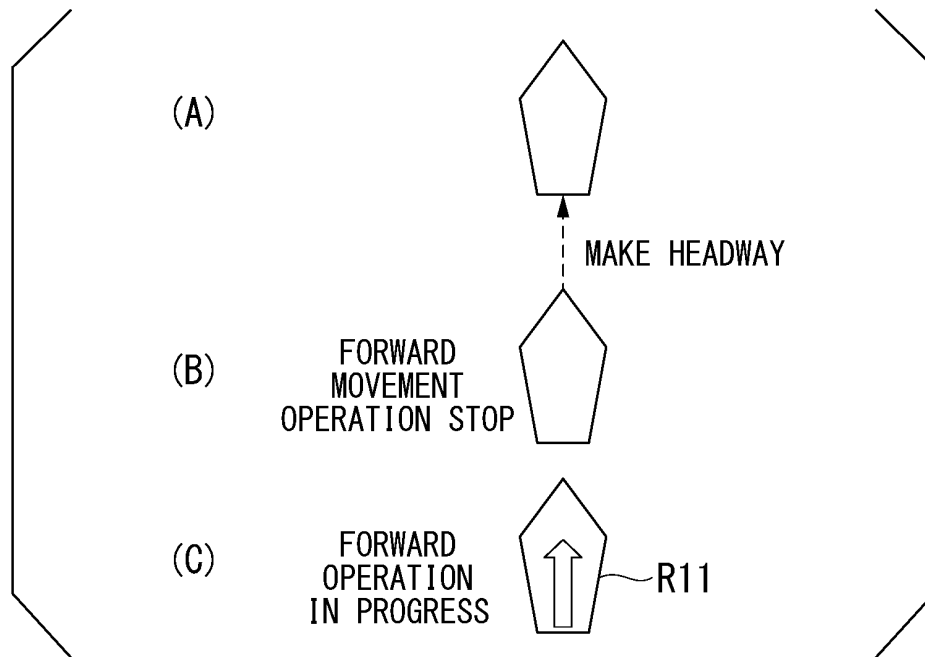
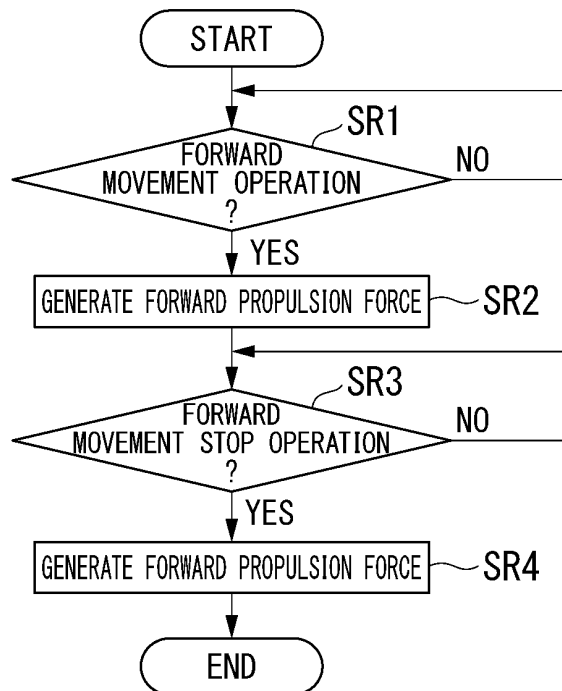


FIG. 17



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/034411

A. CLASSIFICATION OF SUBJECT MATTER

B63H 25/50(2006.01)i; **B63H 21/21**(2006.01)i; **B63H 25/42**(2006.01)i; **G05D 3/00**(2006.01)i
 FI: B63H25/50; B63H21/21; B63H25/42 G; G05D3/00 T

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B63H25/50; B63H21/21; B63H25/42; G05D3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2022
 Registered utility model specifications of Japan 1996-2022
 Published registered utility model applications of Japan 1994-2022

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2018-192923 A (JAPAN HAMUWAAJI KK) 06 December 2018 (2018-12-06) paragraphs [0023]-[0058], fig. 1-6	1, 6-11
Y	paragraphs [0023]-[0058], fig. 1-6	2-5
Y	JP 2017-171086 A (YAMAHA MOTOR CO LTD) 28 September 2017 (2017-09-28) paragraphs [0011]-[0099], fig. 1-11	2-3, 5
Y	JP 2000-6891 A (MIYAZAKI, Kennosuke) 11 January 2000 (2000-01-11) paragraphs [0017]-[0037], fig. 1-8	4
A	US 2010/0076633 A1 (MURRU, Marco) 25 March 2010 (2010-03-25)	1-11
A	US 2008/0096447 A1 (DE MASI, Douglas D.) 24 April 2008 (2008-04-24)	1-11
A	US 6361385 B1 (BOMBARDIER MOTOR CORPORATION OF AMERICA) 26 March 2002 (2002-03-26)	1-11

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

10 November 2022

Date of mailing of the international search report

22 November 2022

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
 Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/034411

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2018-192923 A	06 December 2018	(Family: none)	
JP 2017-171086 A	28 September 2017	US 2017/0274972 A1 paragraphs [0023]-[0110], fig. 1-11	
JP 2000-6891 A	11 January 2000	(Family: none)	
US 2010/0076633 A1	25 March 2010	WO 2008/135815 A1	
US 2008/0096447 A1	24 April 2008	(Family: none)	
US 6361385 B1	26 March 2002	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2021159280 A [0002]
- JP 6642898 B [0008]
- JP H5124586 A [0008]
- JP 5196649 B [0025] [0030]
- JP 6198192 B [0025]
- JP 2007022284 A [0025]
- JP 2019171925 A [0028] [0030]