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WATER JET PROPULSION BOAT AND BOAT

Abstract

A water jet propulsion boat includes a boat body and first and second sponsons on a first side of a rear portion of the boat body. A lower surface of the second sponson is higher than a lower surface of the first sponson, and a rear end of the second sponson is rearward of a rear end of the first sponson.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority to Japanese Patent Application No. 2024-

018241 filed on Feb. 9, 2024. The entire contents of this application are hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The technologies disclosed herein relate to water jet propulsion boats and boats.

2. Description of the Related Art

[0003] Water jet propulsion boats are equipped with a boat body and generate propulsion of the boat body by generating a water flow directed rearward of the boat body. Water jet propulsion boats are equipped with sponsons at the rear portion of the left and right walls of the boat body (see, e.g., JP 2003-205888 A).

[0004] A sponson can reduce the turning radius of a water jet propulsion boat by generating resistance between the water jet propulsion boat and the water when the water jet propulsion boat turns. However, there is room for water jet propulsion boats to further reduce the turning radius.

SUMMARY OF THE INVENTION

[0005] Example embodiments of the present invention disclose technologies that can solve one or more of the above-mentioned problems.

[0006] The technologies of example embodiments of the present invention disclosed herein can be implemented, e.g., in the following example embodiments.

[0007] A water jet propulsion boat according to an example embodiment of the present invention includes a boat body, a first sponson on a first side of a rear portion of the boat body, and a second sponson on the first side of the rear portion of the boat body. A lower surface of the second sponson is higher than a lower surface of the first sponson, and a rear end of the second sponson is rearward of a rear end of the first sponson.

[0008] Since this water jet propulsion boat includes the first sponson and the second sponson, the resistance between the water jet propulsion boat and the water increases when the water jet propulsion boat turns so that the turning radius of the water jet propulsion boat can be reduced compared to a water jet propulsion boat including only the first sponson, for example.

[0009] The technologies disclosed herein can be implemented in various example embodiments, e.g., as water jet propulsion boats, boats, methods for manufacturing water jet propulsion boats, and methods for manufacturing boats.

[0010] Since the water jet propulsion boat includes the first sponson and the second sponson, the resistance between the water jet propulsion boat and the water increases when the water jet propulsion boat turns so that the turning radius of the water jet propulsion boat can be reduced compared to a water jet propulsion boat including only the first sponson, for example.

[0011] The above and other elements, features, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of the example embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a side view schematically illustrating a water jet propulsion boat.

[0013] FIG. **2** is an enlarged side view of a rear portion of a boat body in an example embodiment of the present invention.

[0014] FIG. **3** is a rear view of the water jet propulsion boat in an example embodiment of the present invention during straight travel.

[0015] FIG. **4** is a rear view of the water jet propulsion boat in an example embodiment during turning.

[0016] FIG. **5** is a rear view of the water jet propulsion boat of another example embodiment of the

present invention during straight travel.
[0017] FIG. **6** is an enlarged side view of the rear portion of the boat body in a modified example embodiment.
[0018] FIG. **7** is an enlarged side view of the rear portion of the boat body in another modified example embodiment.
[0019] FIG. **8** is an enlarged side view of the rear portion of the boat body in another modified example embodiment.
DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS
[0020] FIG. **1** is a side view schematically illustrating a water jet propulsion boat **10**. In each of the following figures, arrows representing each direction with respect to the position of the water jet propulsion boat **10** are indicated as appropriate. More specifically, each figure shows arrows representing the front direction (FRONT), rear direction (REAR), left direction (LEFT), right direction (RIGHT), upper direction (UPPER), and lower direction (LOWER), respectively, as appropriate. The front-rear direction, left-right direction, and upper-lower (vertical) direction are orthogonal to each other. FIG. **1** also shows a waterline W of the water jet propulsion boat **10** when it is travelling straight ahead.
[0021] The water jet propulsion boat **10** in the present example embodiment is, e.g., a personal watercraft (PWC). The water jet propulsion boat **10** includes a boat body **20**, a drive device **30**, a jet propulsion mechanism **40**, a jet stream adjustment mechanism **50**, a displacement mechanism **60**, a steering device **70**, a control device (ECU) **80**, a first sponson **91**, and a second sponson **92**.
[0022] The boat body **20** is the main structure of the water jet propulsion boat **10**. The boat body **20** includes a hull **21**, a deck **22**, and a seat **23**. The hull **21** defines a bottom of the boat body **20**. The deck **22** defines a top portion of the boat body **20**. The seat **23** is disposed in the center or substantial center of the boat body **20** in the front-rear direction. The seat **23** can be used to seat a user (crew member), not shown.
[0023] The drive device **30** is located at a lower portion of the boat body **20**. The drive device **30** includes an engine **31**, a crank shaft **32**, and a coupling **33**. The engine **31** may be a spark-ignition multi-cylinder internal combustion engine. The crank shaft **32** is a rotation shaft that outputs a drive torque generated by the engine **31**. The crank shaft **32** extends rearward from the engine **31**. The coupling **33** connects the crank shaft **32** to an impeller shaft **45** described below. The coupling **33** transmits the drive torque of the crank shaft **32** to the impeller shaft **45**.
[0024] The jet propulsion mechanism **40** is located in the rear portion of the hull **21** of the boat body **20**. The jet propulsion mechanism **40** includes an impeller housing **43**, an impeller **44**, an impeller shaft **45**, a stator blade **46**, and a nozzle **47**. The jet propulsion mechanism **40** includes a flow path **41** therein.
[0025] The flow path **41** is located in the rear portion of the hull **21** of the boat body **20** and in a center portion in the left-right direction. One end of the flow path **41** opens downward from the hull **21** as a water inlet **42** for intaking water. The flow path **41** extends rearward from the water inlet **42**. The other end **49** of the flow path **41** opens rearward from the hull **21**.
[0026] The impeller housing **43** is a cylindrical or substantially cylindrical body extending in the front-rear direction. The impeller housing **43** protrudes from the other end **49** of the flow path **41** rearward of the hull **21**. The impeller **44** is housed within the impeller housing **43**. The impeller **44** is connected to a rear end portion of the impeller shaft **45**. The impeller **44** rotates integrally with the impeller shaft **45** about the central axis of the impeller shaft **45**. The stator blade **46** is located behind the impeller **44** in the impeller housing **43**. The nozzle **47** has a cylindrical shape. The nozzle **47** is fixed to the rear end of the impeller housing **43**. The rear end of the nozzle **47** is open as a jetting port **48** for ejecting water.
[0027] When the drive torque generated by the engine **31** is transmitted to the impeller shaft **45** and the impeller **44** rotates accordingly, water from outside of the boat body **20** is drawn into the flow path **41** through the water inlet **42**. The water drawn into the flow path **41** is supplied by the

impeller **44** to the stator blade **46**. The water supplied by the impeller **44** is rectified by passing through the stator blade **46**. The rectified water passes through the nozzle **47** and is ejected from the jetting port **48** to the rearward of the boat body **20**. In this way, the jet propulsion mechanism **40** generates a jet stream directed rearward of the boat body **20**.

[0028] The jet stream adjustment mechanism **50** includes a deflector **51** and a reverse gate **52**. The displacement mechanism **60** includes a deflector moving mechanism **61** and a reverse gate moving mechanism **65**.

[0029] The deflector **51** is substantially cylindrical (conical) in shape, with an inner diameter thereof decreasing toward the rear. The deflector **51** is positioned behind the nozzle **47**. The deflector **51** covers the jetting port **48** of the nozzle **47**. The jet stream ejected from the jetting port **48** passes through the deflector **51** and is ejected from the outlet **53**. The deflector **51** is rotatable about a vertical and horizontal axis behind the jetting port **48**. Depending on its rotational position, the deflector **51** can change the left-right direction and the upper-lower direction of the jet stream ejected from the jetting port **48** to the rearward of the boat body **20**. The deflector moving mechanism **61** displaces the deflector **51** in response to operation by the steering device **70**.

[0030] The reverse gate **52** is located behind the deflector **51**. The reverse gate **52** is displaceable to a forward movement position, a neutral position, and a backward movement position. The forward movement position is the position that does not cover the outlet **53** of the deflector **51**. The neutral position is a position that partially covers the outlet **53** of the deflector **51**. The backward movement position is the position that covers the entire outlet **53** of the deflector **51**.

[0031] The steering device **70** includes, e.g., a steering handle. The user of the water jet propulsion boat **10** can grasp the grips provided at both ends of the steering handle and rotate the steering handle. When the user rotates the steering handle, the deflector **51** can be rotated left or right via the displacement mechanism **60**. The steering device **70** includes a plurality of manual operators (not shown). The user can start and stop the engine **31**, rotate the deflector **51** in the upper-lower direction, or rotate the reverse gate **52** by operating the manual operators.

[0032] The ECU **80** includes, e.g., a CPU, a multi-core CPU, or a programmable device (e.g., field programmable gate array (FPGA) and programmable logic device (PLD)). The ECU **80** operates the deflector moving mechanism **61** and the reverse gate moving mechanism **65** in response to operations by, e.g., the steering device **70**.

[0033] FIG. **2** is an enlarged side view of the rear portion of the boat body **20** according to an example embodiment of the present invention. The first sponson **91** is provided on a side of the rear portion of the boat body **20**. The second sponson **92** is provided on a side of the rear portion of the boat body **20**. Specifically, the first sponson **91** protrudes outwardly from a side of the rear portion of the hull **21** of the boat body **20**. The second sponson **92** protrudes outwardly from a side of the rear portion of the hull **21** of the boat body **20**. The first sponson **91** extends substantially in the front-rear direction. The second sponson **92** extends substantially in the front-rear direction. The first sponson **91** is preferably provided on both the left side and the right side of the boat body **20**. The second sponson **92** is preferably provided on both the left side and the right side of the boat body **20**.

[0034] As shown in FIG. **2**, the second sponson **92** is positioned above the first sponson **91**. In other words, a lower surface S**2** of the second sponson **92** is positioned higher than the lower surface S**1** of the first sponson **91**. The lower surface S**2** of the second sponson **92** is positioned higher than the upper surface of the first sponson **91**. The lower surface S**2** of the second sponson **92** is spaced apart from the upper surface of the first sponson **91** in the upper-lower direction. The rear end of the second sponson **92** is positioned rearward of the rear end of the first sponson **91**. In the present example embodiment, the front portion of the first sponson **91** and the front portion of the second sponson **92** are connected to each other. In other words, in the present example embodiment, the first sponson **91** and the second sponson **92** are formed as one piece, or separate pieces connected together.

[0035] The first sponson **91** includes a first fin **911** (see FIG. **3**). The first fin **911** includes a downwardly protruding portion at an outward end farthest outward from the boat body **20** in the left-right direction. The first fin **911** extends in the front-rear direction. The second sponson **92** includes a second fin **921** (see FIG. **3**). The second fin **921** includes a downwardly protruding portion at an outward end farthest outward from the boat body **20** in the left-right direction. The second fin **921** extends in the front-rear direction.

[0036] The lower surface S**1** of the first sponson **91** generates a resistance between the water jet propulsion boat **10** and the water to prevent the water jet propulsion boat **10** from skidding when the water jet propulsion boat **10** turns. Similarly, the lower surface S**2** of the second sponson **92** generates a resistance between the water jet propulsion boat **10** and the water to prevent the water jet propulsion boat **10** from skidding when the water jet propulsion boat **10** turns. Specifically, the lower surface S**1** of the first sponson **91** comes into contact with the water when the water jet propulsion boat **10** turns, thus generating resistance between the water jet propulsion boat **10** and the water to reduce the turning radius of the water jet propulsion boat **10**. Similarly, the lower surface S**2** of the second sponson **92** comes into contact with the water when the water jet propulsion boat **10** turns, thus generating resistance between the water jet propulsion boat **10** and the water to reduce the turning radius of the water jet propulsion boat **10**. In the present example embodiment, since the water jet propulsion boat **10** includes the first sponson **91** and the second sponson **92**, the resistance between the water jet propulsion boat **10** and the water increases when the water jet propulsion boat **10** turns so that the turning radius of the water jet propulsion boat **10** can be reduced accordingly compared to a water jet propulsion boat including only a first sponson, for example.

[0037] In the water jet propulsion boat **10** of the present example embodiment, the turning radius of the water jet propulsion boat **10** can be further reduced because the first sponson **91** includes a first fin **911** and the second sponson **92** includes a second fin **921**. That is, in the water jet propulsion boat **10**, each of the first fin **911** and the second fin **921** comes into contact with the water when the water jet propulsion boat **10** turns, thus increasing the resistance between the water jet propulsion boat **10** and the water and more effectively reducing the turning radius of the water jet propulsion boat **10**.

[0038] As shown in FIG. **2**, the front end of the second sponson **92** is positioned forward of the rear end of the first sponson **91**. In other words, the first sponson **91** and the second sponson **92** face each other in the upper-lower direction. The rear end of the first sponson **91** is positioned forward of the transom **25** at the rear end of the boat body **20**. The rear end of the second sponson **92** is positioned forward of the transom **25** at the rear end of the boat body **20**. The first sponson **91** is arranged such that the front end and the rear end are aligned horizontally, or the front end is positioned higher than the rear end when the water jet propulsion boat **10** is travelling straight ahead. The second sponson **92** is arranged such that the front end and the rear end are aligned horizontally, or the front end is positioned higher than the rear end when the water jet propulsion boat **10** is travelling straight ahead. The first sponsons **91** and the second sponsons **92** may be parallel or substantially parallel with each other when viewed in the left-right direction.

[0039] FIG. **3** is a rear view of the water jet propulsion boat **10** during straight travel. As shown in FIG. **3**, the first sponson **91** on the left side of the boat body **20** and the first sponson **91** on the right side of the boat body **20** are symmetrical about the centerline CL of the boat body **20** in the left-right direction. Similarly, the second sponson **92** on the left side of the boat body **20** and the second sponson **92** on the right side of the boat body **20** are symmetrical about the centerline CL of the boat body **20** in the left-right direction. The lower surface S**1** of the first sponson **91** is located so as to be lower than the waterline W when the water jet propulsion boat **10** is travelling straight ahead. The lower surface S**2** of the second sponson **92** is located so as to be higher than the waterline W of the water jet propulsion boat **10** when the water jet propulsion boat is travelling straight ahead. In the left-right direction, the outward end of the second sponson **92** farthest outward from the boat

body **20** is at the same or substantially the same location as the outward end of the first sponson **91** farthest outward from the boat body **20**. In other words, the first sponson **91** and the second sponson **92** project outward to the same or substantially the same location or position as each other in the left-right direction.

[0040] FIG. **4** is a rear view of the water jet propulsion boat **10** during turning. FIG. **4** shows the water jet propulsion boat **10** banked (tilted) to the left. In other words, FIG. **4** shows the state of the water jet propulsion boat **10** when turning to the left. The lower surface S**2** of the second sponson **92** on the left side of the boat body **20** comes into contact with the water when the bank angle reaches a certain angle when the water jet propulsion boat **10** turns to the left. That is, the water jet propulsion boat **10** includes two sponsons, the first sponson **91** and the second sponson **92**, that come into contact with the water when the bank angle reaches or exceeds a certain angle. The above "certain angle" is not particularly limited, but it is preferably about 20 degrees or more and about 40 degrees or less. The action of the water jet propulsion boat **10** when turning to the right is the same as when turning to the left.

[0041] As shown in FIGS. **3** and **4**, the lower surface S**2** of the second sponson **92** does not come into contact with the water when the water jet propulsion boat **10** is travelling straight ahead, but does come into contact with the water when turning and the bank angle exceeds a certain angle. Therefore, the sponsons **90** can reduce the turning radius of the water jet propulsion boat **10** while maintaining a light travelling performance or resistance of the water jet propulsion boat **10** when traveling straight ahead. Furthermore, even when the water jet propulsion boat **10** is turning, the lower surface S**2** of the second sponson **92** does not come into contact with the water when the bank angle is less than a certain angle. Therefore, the sponsons **90** can maintain a light travelling performance or resistance when the water jet propulsion boat **10** is turning gently.

[0042] FIG. **5** is a rear view of the water jet propulsion boat **10***a* according to another example embodiment during straight travel. In the following, portions of the water jet propulsion boat **10***a* of the present example embodiment that are common to the water jet propulsion boat **10** of the example embodiments described above will be marked with the same symbols, and their description will be omitted as appropriate.

[0043] The water jet propulsion boat **10***a* of the present example embodiment differs from the water jet propulsion boat **10** of the example embodiments described above in the shape and dimensions of the sponsons. Specifically, in the left-right direction, the outward end of the second sponson **92***a* farthest outward from the boat body **20***a* extends farther from the centerline CL of the boat body **20***a* than the outward end of the first sponson **91***a* farthest outward from the boat body **20***a*. In other words, the second sponson **92***a* projects farther outward than the first sponson **91***a* in the left-right direction.

[0044] The water jet propulsion boat **10***a* of the present example embodiment also has the same effects as the water jet propulsion boat **10** of the above described example embodiments. That is, because the water jet propulsion boat **10***a* includes the first sponson **91***a* and the second sponson **92***a*, there is a resistance between the water jet propulsion boat **10***a* and the water increases when the water jet propulsion boat **10***a* turns so that the turning radius of the water jet propulsion boat **10***a* can be reduced compared to a water jet propulsion boat including only the first sponson, for example. According to the water jet propulsion boat **10***a* of the present example embodiment, the second sponson **92***a* projects farther outward than the first sponson **91***a* in the left-right direction. Therefore, the first and second sponsons can contact the water even at a relatively shallow bank angle, e.g., compared to a configuration in which the first and second sponsons project outward to the same location as each other in the left-right direction.

[0045] The technologies disclosed herein are not limited to the above-described example embodiments and may be modified in various ways without departing from the gist of the present invention, including the following modifications.

[0046] FIG. **6** is an enlarged side view of the rear portion of the boat body **20***b* in a modified

example embodiment. In the following, portions of the boat body **20***b* in the present example embodiment that are common to the boat body **20** of the example embodiments described above will be marked with the same symbols, and their description will be omitted as appropriate.

[0047] In the example embodiment shown in FIG. **6**, the first sponson **91***b* and the second sponson **92***b* are not formed as or connected to be one piece. In other words, the first sponson **91***b* and the second sponson **92***b* are entirely separate and spaced apart from each other. The front end of the second sponson **92***b* is positioned rearward of the front end of the first sponson **91***b*. Thus, the first and second sponsons are separate from each other.

[0048] FIG. **7** is an enlarged side view of the rear portion of the boat body **20***c* in another modified example embodiment. In the following, portions of the boat body **20***c* in the present example embodiment that are common to the boat body **20** of the example embodiments described above will be marked with the same symbols, and their description will be omitted as appropriate.

[0049] In the present example embodiment shown in FIG. **7**, the first sponson **91***c* and the second sponson **92***c* are not formed as or connected to be one piece. In other words, the first sponson **91***c* and the second sponson **92***c* are entirely separate and spaced apart from each other. The front end of the second sponson **92***c* is positioned rearward of the rear end of the first sponson **91***c*. In other words, the first sponson **91***c* and the second sponson **92***c* do not overlap each other in the upper-lower direction. Thus, the front end of the second sponson may be positioned more rearward than the rear end of the first sponson. In other words, the first and second sponsons may not overlap each other in the upper-lower direction.

[0050] FIG. **8** is an enlarged side view of the rear portion of the boat body **20***d* in another modified example embodiment. In the following, portions of the boat body **20***d* in the present example embodiment that are common to the boat body **20** of the example embodiments described above will be marked with the same symbols, and their description will be omitted as appropriate.

[0051] In the present example embodiment shown in FIG. **8**, in addition to the first sponson **91***d* and the second sponson **92***d*, a third sponson **93** is provided on a side of the rear portion of the boat body **20***d*. The third sponson **93** includes a third fin **931**, which is a downwardly protruding portion at the outward end of the third sponson **93** farthest outward from the boat body **20***d* in the left-right direction. Thus, the water jet propulsion boat may include three or more sponsons.

[0052] In the above example embodiments, the engine **31** is illustrated as the drive source of the drive device **30**, but an electric motor or the like may be provided together with or instead of the engine **31**.

[0053] In the left-right direction, the outward end of the second sponson may be closer to the centerline of the boat body than the outward end of the first sponson.

[0054] In the above example embodiments, the first sponson **91** is arranged such that the front end and the rear end are aligned horizontally, or the front end is positioned higher than the rear end, but the first sponson may be arranged such that the front end is positioned lower than the rear end.

[0055] In the above example embodiments, the second sponson **92** is arranged such that the front end and the rear end are aligned horizontally, or the front end is positioned higher than the rear end, but the second sponson may be arranged such that the front end is positioned lower than the rear end.

[0056] In the above example embodiments, the first sponson **91** and the second sponson **92** are parallel or substantially parallel with each other when viewed in the left-right direction, but the first and second sponsons may not be parallel or substantially parallel with each other when viewed in the left-right direction.

[0057] In the above example embodiments, a PWC is shown as an example of the application of the technologies disclosed herein, but the technologies disclosed herein can be applied to vessels in general, such as sport boats, for example.

[0058] While example embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without

departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

Claims

1. A water jet propulsion boat comprising: a boat body; a first sponson provided on a first side of a rear portion of the boat body; and a second sponson provided on the first side of a rear portion of the boat body; wherein a lower surface of the second sponson is higher than a lower surface of the first sponson; and a rear end of the second sponson is rearward of a rear end of the first sponson.
2. The water jet propulsion boat according to claim 1, wherein the lower surface of the first sponson is located so to be below a waterline of the water jet propulsion boat when the water jet propulsion boat is travelling straight; and the lower surface of the second sponson is located so to be above the waterline of the water jet propulsion boat when the water jet propulsion boat is travelling straight.
3. The water jet propulsion boat according to claim 1, wherein a front end of the second sponson is forward of the rear end of the first sponson.
4. The water jet propulsion boat according to claim 1, wherein an outward end of the second sponson farthest outward from the boat body is at a same location as an outward end of the first sponson farthest outward from the boat body in a left-right direction.
5. The water jet propulsion boat according to claim 1, wherein an outward end of the second sponson farthest outward from the boat body is farther from a centerline of the boat body than an outward end of the first sponson farthest outward from the boat body in a left-right direction.
6. The water jet propulsion boat according to claim 1, wherein the first sponson is oriented such that the front end and the rear end are aligned horizontally, or the front end is higher than the rear end.
7. The water jet propulsion boat according to claim 1, wherein the second sponson is oriented such that a front end and the rear end are aligned horizontally, or the front end is higher than the rear end.
8. The water jet propulsion boat according to claim 1, wherein the first sponson and the second sponson are parallel or substantially parallel to each other when viewed in a left-right direction.
9. The water jet propulsion boat according to claim 1, wherein the first sponson and the second sponson are not parallel to each other when viewed in a left-right direction.
10. The water jet propulsion boat according to claim 1, wherein the rear end of the first sponson and the rear end of the second sponson are forward of a transom positioned at a rear end of the boat body.
11. A boat comprising: a boat body; a first sponson on a first side of a rear portion of the boat body; and a second sponson on the first side of the rear portion of the boat body; wherein a lower surface of the second sponson is higher than a lower surface of the first sponson; and a rear end of the second sponson is rearward of a rear end of the first sponson.