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WATER JET PROPULSION BOAT AND BOAT

Abstract

A water jet propulsion boat includes a boat body including a keel, and a cavity in a front portion of the keel extending in a left-right direction of the boat body.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority to Japanese Patent Application No. 2024-020176 filed on Feb. 14, 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. Known boats are provided with a keel extending from the bow to the stern of the boat body in the center of the width direction on the bottom surface of the boat body (see, e.g., Japanese Patent No. 4169543).

[0004] Generally, as keels become more sharp or narrow, the seaworthiness and straight-line travelling stability of the boats are improved, but it tends to become more difficult to turn the boat smoothly.

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 disclosed herein can be implemented, e.g., in the following example embodiments.

[0007] A water jet propulsion boat according to an example embodiment includes a boat body including a keel, and a cavity in a front portion of the extending in a left-right direction of the boat body.

[0008] According to this water jet propulsion boat, when the water jet propulsion boat turns, water around the bottom of the boat body passes through the cavity. Therefore, the water jet propulsion boat can easily turn smoothly by reducing the resistance of the water applied to the bottom of the boat body when turning.

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

[0010] 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

[0011] FIG. **1** is a side view schematically illustrating a water jet propulsion boat according to an example embodiment of the present invention.

[0012] FIG. **2** is an explanatory view illustrating a cavity and its surroundings according to an example embodiment of the present invention.

[0013] FIG. **3** shows a cross-section of the boat body taken along line III-III of FIG. **2**.

[0014] FIG. **4** shows a cross-section of the boat body taken along line IV-IV of FIG. **2**.

[0015] FIG. **5** is an explanatory view illustrating a cavity and its surroundings according to another example embodiment of the present invention.

[0016] FIG. **6** shows a cross-section of the boat body taken along line IV-IV of FIG. **2**.

[0017] FIG. **7** is a side view schematically illustrating a water jet propulsion boat according to another example embodiment of the present invention.

[0018] FIG. **8** is a side view schematically illustrating a water jet propulsion boat according to a modified example embodiment.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

[0019] FIG. **1** is a side view schematically illustrating a water jet propulsion boat **10** according to an example embodiment of the present invention. 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 the waterline W of the water jet propulsion boat **10** when it is travelling.

[0020] The water jet propulsion boat **10** according to 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**, and a control device (ECU) **80**.

[0021] The boat body **20** is the main structure of the water jet propulsion boat **10**. The boat body **20** includes a keel **26** extending from the bow to the stern in the center of the boat body bottom in the left-right direction. The keel extends from the bow to the stern at the centerline location of the boat body at the bottom of the boat body. The keel is coupled to bow and stern members. The keel corresponds to the backbone of the boat body. The keel herein may include a portion of the stem in the boat body. As will be described in detail below, a cavity **29** is provided at the front portion of the keel **26** in the boat body **20**.

[0022] The boat body **20** includes a boat main body **27** and a plate **28**. The boat main body **27** includes a hull **21**, a deck **22**, and a seat **23**. The hull **21** defines the bottom of the boat body **20**. The deck **22** defines the 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. The plate **28** connected to the lower portion of the boat main body **27**. The plate **28** is positioned at the front portion of the keel **26**.

[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** is a spark-ignition multi-cylinder internal combustion engine. The crank shaft **32** is a rotating shaft that outputs the 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 the 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**, stator blade **46**, and a nozzle **47**. The jet propulsion mechanism **40** includes a flow path **41** therein.

[0025] The flow path **41** is provided in the rear portion of the hull **21** of the boat body **20** and in the 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** to intake 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 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 the rear end 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 jet outlet **48** to eject 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 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 jet outlet

48 to the rearward of the boat body **20**. In this way, the jet propulsion mechanism **40** can generate 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 the inner diameter decreasing toward the rear. The deflector **51** is positioned behind the nozzle **47**. The deflector **51** covers the jet outlet **48** of the nozzle **47**. The jet stream ejected from the jet outlet **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 jet outlet **48**. Depending on its rotational position, the deflector **51** can change the left-right direction and the upper-lower direction of the jet stream that is ejected from the jet outlet **48** to the rearward of the boat body **20**. The deflector moving mechanism **61** displaces the deflector **51** in response to operations 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 does not cover the outlet **53** of the deflector **51**. The neutral position partially covers the outlet **53** of the deflector **51**. The backward movement position covers the entire outlet **53** of the deflector **51**.

[0031] The steering device **70** includes, e.g., a steering wheel. A 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 explanatory view of the cavity **29** and its surroundings in the present example embodiment. FIG. **2** shows the cavity **29** and its surroundings when viewed in the left-right direction. As shown in FIG. **2**, the cavity **29** is provided in the boat body **20** and penetrates or extends through the boat body **20** in the left-right direction. The cavity **29** is located at the front portion of the keel **26** in the boat body **20**. In other words, the cavity **29** is located near or adjacent to the lower surface of the boat body **20**. The cavity **29** in this example embodiment has a shape that extends in the front-rear direction. According to this example embodiment of the water jet propulsion boat **10**, when the water jet propulsion boat **10** turns, water around the bottom of the boat body **20** passes through the cavity **29**. Therefore, the water jet propulsion boat **10** can easily turn smoothly by reducing the resistance of the water applied to the bottom of the boat body **20** when turning.

[0034] The cavity **29** is defined by a space located between the boat main body **27** and the plate **28**. As shown in FIG. **2**, the plate **28** includes a front end portion **281**, a rear end portion **282**, and a middle portion **283**. The front end portion **281** is the front side of the plate **28**. The rear end portion **282** is the rear side of the plate **28**. The middle portion **283** is located between the front end portion **281** and the rear end portion **282**. The front end portion **281** and the rear end portion **282** of the plate **28** are connected to the lower portion of the boat main body **27**. When viewed in the left-right direction, an upper contour line of the plate **28** has or includes a curved shape. In addition, when viewed in the left-right direction, a lower contour line of the plate **28** has or includes a curved shape. In other words, the plate **28** has or includes a curved shape so that the middle portion **283** protrudes downwardly when viewed in the left-right direction. Because the plate **28** has such a structure, the middle portion **283** of the plate **28** is separate and spaced apart from the boat main

body **27** in the upper-lower direction. This provides the space between the boat main body **27** and the plate **28**.

[0035] Since the water jet propulsion boat **10** creates the cavity **29** by attaching the plate **28** to the boat main body **27**, it is not necessary, e.g., to provide the cavity by piercing a portion of the boat main body from the left side to the right side. As a result, the water jet propulsion boat **10** can be manufactured relatively easily, because the process of piercing a portion of the boat main body from right to left, e.g., is not required at the time of manufacturing the water jet propulsion boat **10**. Furthermore, the cavity **29** can be provided without reducing the strength of the boat main body **27** because it is not necessary to pierce a portion of the boat main body **27**.

[0036] The plate **28** is attached to the boat main body **27** by, e.g., bolts. In other words, the plate **28** is removably connected to the boat main body **27**. This makes it possible, e.g., to replace the plate **28** with another plate that has a different shape than the plate **28**, and to change the characteristics of the water jet propulsion boat **10** accordingly.

[0037] As shown in FIG. **1**, at least a portion of the cavity **29** is located below the waterline W when the water jet propulsion boat **10** is travelling. A portion of the front side of the cavity **29** may be located above the waterline W when the water jet propulsion boat **10** is travelling. Because a portion of the front side of the cavity **29** is located above the waterline W, the water jet propulsion boat **10** can reduce water resistance on the bottom of the boat body **20** when traveling straight ahead and improve propulsive efficiency.

[0038] As shown in FIG. **2**, when viewed in the left-right direction, the angle θ**1** between the rear end portion **282** of the plate **28** and the boat main body **27** is less than the angle θ**2** between the front end portion **281** of the plate **28** and the boat main body **27**. In other words, the distance between the boat main body **27** and the plate **28** is shorter on the rear side of the cavity **29** than on the front side of cavity **29**. This structure reduces or prevents the water jet propulsion boat **10** from turning more than intended when turning.

[0039] FIG. **3** shows a cross-section of the boat body **20** of the present example embodiment taken along line III-III of FIG. **2**. FIG. **3** shows a cross-section of the boat body **20** that intersects the front-rear direction, e.g., orthogonal to the front-rear direction. FIG. **3** shows the centerline CL, which is the centerline of the boat body **20** in the left-right direction.

[0040] The cross-section intersecting the front-rear direction at the plate **28** is bounded by a straight section L**1**, a curved section C**1**, and a curved section C**2**. The straight section L**1** extends in the left-right direction and faces the boat main body **27** in the upper-lower direction. The left end of the straight section L**1** is located to the left of the centerline CL, and the right end of the straight section L**1** is located to the right of the centerline CL. The left end of the curved section C**1** intersects the left end of the straight section L**1**. The right end of the curved section C**1** is located lower than the left end of the curved section C**1** and near the centerline CL. The curved section C**1** is curved so that the middle portion from the left end to the right end protrudes to the lower left. The right end of the curved section C**2** intersects the right end of the straight section L**1**. The left end of the curved section C**2** is located lower than the right end of the curved section C**2** and near the centerline CL. The curved section C**2** is curved so that the middle portion from the left end to the right end protrudes to the lower right. The right end of the curved section C**1** and the left end of the curved section C**2** intersect near the centerline CL, and the intersection of the right end of the curved section C**1** and the left end of the curved section C**2** forms a corner E**1**. That is, the plate **28** has a cross-section intersecting the front-rear direction with a central portion located near the centerline CL and projecting downward. More precisely, the cross-section intersecting the front-rear direction of the plate **28** is triangular or substantially triangular in shape with the corner E**1** located near the centerline CL and projecting downward. Because of this structure of the plate **28**, the water jet propulsion boat **10** can improve the seaworthiness when traveling straight ahead.

[0041] FIG. **4** shows a cross-section of the boat body **20** according to an example embodiment taken along line IV-IV of FIG. **2**. FIG. **4** shows a cross-section of the boat body **20** that intersects

the upper-lower direction of the boat body **20**. The cross-section shown in FIG. **4** shows a portion of the boat main body **27** that defines a rearward contour line **290** of the cavity **29**. FIG. **4** shows the centerline CL of the boat body **20** in the left-right direction.

[0042] When viewed in the upper-lower direction, the rearward contour line **290** of the cavity **29** includes a central portion located near the left-right centerline CL of the boat body **20** and that projects forward. More particularly, when viewed in the upper-lower direction, the rearward contour line **290** of the cavity **29** includes a corner E**2** located near the left-right centerline CL of the boat body **20** and that projects forward. In other words, the portion of the boat body **20** defining the rearward contour line **290** of the cavity **29** continuously narrows in the left-right direction toward the front. Because the boat body **20** has such a structure, the water jet propulsion boat **10** can reduce the resistance of water applied to the bottom of the boat body **20** when traveling forward, thus improving propulsion efficiency.

[0043] FIG. **5** is an explanatory view illustrating a cavity **29***a* and its surroundings according to another example embodiment. In the following, portions of the boat body **20***a* of the another 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.

[0044] The boat body **20***a* of the present example embodiment differs from the boat body **20** in the shape of the plate. Specifically, when viewed in the left-right direction, the upper contour line of the plate **28***a* has a shape including a portion that bends at an angle of more than about 90 degrees and less than about 180 degrees. When viewed in the left-right direction, the upper contour line of the plate **28***a* includes a corner E**3** that is bent by an angle θ**3** and a corner E**4** that is bent by an angle θ**4**. Due to this structure of the plate **28***a*, the middle portion **283** of the plate **28***a* is separated and spaced apart from the boat main body **27** in the upper-lower direction, as in the case of the boat body **20**. This defines a space between the boat main body **27** and the plate **28***a*. The angles θ**3** and **04** are both between about 90 and about 180 degrees. Since both the angle θ**3** and the angle θ**4** are between about 90 and about 180 degrees, the plate **28***a* can be more gently curved than, e.g., in the case where the angle θ**3** or the angle θ**4** is less than 90 degrees. This enables the water jet propulsion boat to reduce the resistance of water on the bottom of the boat body **20***a* when traveling straight ahead, thus improving propulsion efficiency.

[0045] The water jet propulsion boat provided with the boat body **20***a* of the present example embodiment also has the same effects as the water jet propulsion boat **10** of the above example embodiments. That is, according to the water jet propulsion boat of the present example embodiment, when the water jet propulsion boat turns, water around the bottom of the boat body **20***a* passes through the cavity **29***a*. Therefore, the water jet propulsion boat can easily turn smoothly by reducing the resistance of the water applied to the bottom of the boat body **20***a* when turning.

[0046] FIG. **6** shows a cross-section of the boat body **20***b* of another example embodiment taken along line III-III of FIG. **2**. In the following, portions of the boat body **20***b* of the another 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] The boat body **20***b* of the present example embodiment differs from the boat body **20** in the shape of the cross-section intersecting the front-rear direction of the plate. Specifically, in the boat body **20***b*, the cross-section of the plate **28***b* intersecting the front-rear direction is surrounded by a curved section C**1**, a curved section C**2**, and a curved section C**3**. The curved section C**3** extends in the left-right direction and faces the boat main body **27** in the upper-lower direction. The left end of the curved section C**3** is located to the left of the centerline CL, and the right end of the curved section C**3** is located to the right of the centerline CL. The curved section C**3** is curved so that the middle portion from the left end to the right end protrudes upward. The left end of the curved section C**1** intersects the left end of the curved section C**3**. The right end of the curve C**2** intersects the right end of the curved section C**3**. In other words, in the boat body **20***b*, the plate **28***b* has a

cross-section intersecting the front-rear direction with a central portion located near the centerline CL and that projects upward.

[0048] The water jet propulsion boat provided with the boat body **20***b* of the present example embodiment also has the same effects as the water jet propulsion boat **10** of the example embodiments described above. That is, according to the water jet propulsion boat of the present example embodiment, when the water jet propulsion boat turns, water around the bottom of the boat body **20***b* passes through the cavity **29***b*. Therefore, the water jet propulsion boat can easily turn smoothly by reducing the resistance of the water applied to the bottom of the boat body **20***b* when turning.

[0049] FIG. **7** is a side view schematically illustrating a water jet propulsion boat **10***c* according to another example embodiment. In the following, portions of the water jet propulsion boat **10***c* of this 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.

[0050] The water jet propulsion boat **10***c* of the present example embodiment differs from the water jet propulsion boat **10** in its boat body structure. Specifically, the water jet propulsion boat **10***c* includes a boat body **20***c*. A plurality of cavities **29***c* are provided in the front portion of the keel **26** in the boat body **20***c*, which are aligned in the front-rear direction. The boat body **20***c* includes a boat main body **27** and a plate **28***c*. The plate **28***c* is connected to the lower portion of the boat main body **27** so that no gap is provided between the plate **28***c* and the boat main body **27**. The plate **28***c* includes a plurality of cavities **29***c* that penetrate or extend in the left-right direction. The plurality of cavities **29***c* are, for example, circular when viewed in the left-right direction.

[0051] The water jet propulsion boat **10***c* of the present example embodiment also has the same effects as the water jet propulsion boat **10** of the example embodiments described above. That is, according to the water jet propulsion boat **10***c* of the present example embodiment, when the water jet propulsion boat **10***c* turns, water around the bottom of the boat body **20***c* passes through the cavities **29***c*. Therefore, the water jet propulsion boat **10***c* can easily turn smoothly by reducing the resistance of water applied to the bottom of the boat body **20***c* when turning.

[0052] 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.

[0053] FIG. **8** is a side view schematically illustrating a water jet propulsion boat **10***d* according to a modified example embodiment. In the following, portions of the water jet propulsion boat **10***d* of the modified 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.

[0054] The water jet propulsion boat **10***d* according to the modified example embodiment differs from the water jet propulsion boat **10** in its boat body structure. Specifically, the water jet propulsion boat **10***d* includes a boat body **20***d*. The boat body **20***d* includes a boat main body **27** and an attachment **128**. The attachment **128** is connected to the lower portion of the boat main body **27** so that no gap is provided between the attachment **128** and the boat main body **27**. The attachment **128** is located at the front portion of the keel **26**. In other words, the water jet propulsion boat **10***d* according to the modified example embodiment includes the attachment **128** instead of the plate **28** in the water jet propulsion boat **10** of the example embodiments described above. The attachment **128** includes a plurality of notches from the front end to the rear end when viewed in the left-right direction. Therefore, the lower contour line of the attachment **128** has a shape in which convex and concave portions are repeated from the front to the rear when viewed in the left-right direction. That is, gaps **129** are provided in the portion of the attachment **128** where the concave portion is located.

[0055] The water jet propulsion boat **10***d* according to the modified example embodiment also has

the same effects as the water jet propulsion boat **10** of the example embodiments described above. That is, according to the water jet propulsion boat **10***d*, when the water jet propulsion boat **10***d* turns, water around the bottom of the boat body **20***d* passes through the gaps **129**. Therefore, the water jet propulsion boat **10***d* can easily turn smoothly by reducing the resistance of water applied to the bottom of the boat body **20***d* when turning.

[0056] 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**.

[0057] In the above example embodiments, a portion of the front side in the cavity **29** is located above the waterline W when the water jet propulsion boat **10** is travelling, but the configuration is not necessarily limited thereto, e.g., the entire cavity may be located below the waterline when the water jet propulsion boat is travelling.

[0058] In the above example embodiments, the boat body **20** of the water jet propulsion boat **10** includes a plate **28**, but the configuration is not necessarily limited thereto, and the boat body of the water jet propulsion boat may include a cavity having a different structure.

[0059] In the above example embodiments, the upper contour line in the plate **28***a* includes a corner E**3** and a corner E**4** when viewed in the left-right direction, but there may be one corner or three or more corners.

[0060] The shape of the plate in the water jet propulsion boat is not limited to the above example embodiments but can be modified in various ways.

[0061] 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.

[0062] 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 including a keel; and a cavity in a front portion of the keel extending in a left-right direction of the boat body.

2. The water jet propulsion boat according to claim 1, wherein at least a portion of the cavity is below a waterline of the water jet propulsion boat when the water jet propulsion boat is travelling.

3. The water jet propulsion boat according to claim 2, wherein a portion of a front side of the cavity is above the waterline when the water jet propulsion boat is travelling.

4. The water jet propulsion boat according to claim 1, wherein the cavity is adjacent to a lower surface of the boat body.

5. The water jet propulsion boat according to claim 1, wherein the boat body includes: a boat main body; and a plate including a front end portion and a rear end portion each connected to a lower portion of the boat main body, and a middle portion between the front end portion and the rear end portion spaced apart from the boat main body in an upper-lower direction of the boat body; wherein the cavity defines a space between the boat main body and the plate.

6. The water jet propulsion boat according to claim 5, wherein, when viewed in the left-right direction, an upper contour line of the plate includes a curved shape or a shape including a portion bent at an angle of more than about 90 degrees and less than about 180 degrees.

7. The water jet propulsion boat according to claim 5, wherein, when viewed in the left-right direction, a lower contour line of the plate includes a curved shape.

8. The water jet propulsion boat according to claim 5, wherein the plate has a cross-section intersecting the front-rear direction such that a central portion of the plate located adjacent a

centerline of the boat body in the left-right direction projects downward.

9. The water jet propulsion boat according to claim 8, wherein the plate has a cross-section intersecting the front-rear direction that is triangular or substantially triangular in shape, and includes a corner located adjacent the centerline of the boat body in the left-right direction and that projects downward.

10. The water jet propulsion boat according to claim 5, wherein, when viewed in the left-right direction, an angle between the rear end portion of the plate and the boat main body is less than an angle between the front end portion of the plate and the boat main body.

11. The water jet propulsion boat according to claim 5, wherein the plate is removably connected to the boat main body.

12. The water jet propulsion boat according to claim 1, wherein, when viewed in an upper-lower direction of the boat body, a rearward contour line of the cavity includes a center portion adjacent to a left-right centerline of the boat body and that projects forward.

13. The water jet propulsion boat according to claim 12, wherein, when viewed in the upper-lower direction, the rearward contour line of the cavity includes a corner adjacent to the left-right centerline of the boat body and that projects forward.

14. The water jet propulsion boat according to claim 1, wherein the cavity extends in a front-rear direction of the boat body.

15. The water jet propulsion boat according to claim 1, wherein the cavity includes a plurality of cavities in the front portion of the keel that are aligned in a front-rear direction of the boat body.

16. A boat comprising: a boat body including a keel; and a cavity in a front portion of the keel extending in a left-right direction of the boat body.