

Description

Propulsion Unit for a Ship

Technical Field

This invention refers to a propulsion unit with a new structure to propel a ship.

Background art

Up to now the propulsion unit generally used to move a ship is a propeller, and the structure that rotating the propeller in one direction advances the ship, and rotating it in the opposite direction reverses the ship, is well known.

For a conventional propeller type propulsion unit for a ship, based on the rotation of a propeller, the blade of the propeller, which is set up inclining relative to the rotation axis line of the propeller, generates a component force to push the water backward of the propulsive direction, and because of this a backward directed water current is generated, and such water current is constructed to provide a forward propulsive force to the ship as a counterforce.

Although there are many applications for patents for propulsion units for ships of the propeller type, an example of such patent application is disclosed for a ship with a pod type propulsion unit. The technology disclosed is that the pod type propulsion unit is installed together at a position backward of the main propeller of the ship, and it does not interfere with the main propeller (e.g., refer to patent document 1).

However, in the patent document 1 above, especially if the steering angle of a pod type propulsion unit is engaged when sailing at high speed, as indicated in Drawing 8, there was a problem that severe cavitation occurs around the upper half of strut S (so-called, as its function is that of a rudder). If such cavitation occurs, the bubbles generated by the cavitation flow downstream and when such bubbles enter the high-pressure area, they are crushed and disappear (burst). Since the disappearance of the bubbles is instantaneous, it is accompanied by a significant impact causing a noise and hull vibration. Overcoming the problem requires increasing the design strength of the strut and therefore there was a problem as this increases the production cost. Also, it was pointed out as a problem that if this situation continues for a long time, the strut would be subject to continuous and repeated stress, and the strut's surface would erode since it would be washed away gradually due to metal fatigue, and in the worst case this may lead to destruction of the strut.

Therefore, in order to provide a pod type propulsion unit that can eliminate (or decrease) the cavitation effect generated around the strut of a pod type propulsion unit and a ship which has such pod type propulsion unit, for example, as indicated in patent document 2, the strut 11, the section of which is an airfoil profile shape, the pod 12, which is installed below strut 11 with a propeller shaft 4 to which the motive power from the driving means is transmitted, and the pod type propulsion unit 10, which has a pod propeller 14, which is installed on propeller shaft 4, with the technology, the

characteristics of which are that the strut 11 is fixed to the ship's hull and the pod 12 is set up to rotate freely against the aforesaid strut 11, are proposed.

By using the technology in patent document 2, it is constructed such that only the pod can rotate independently from the ship's hull, the strut is fixed to the ship's hull, the steering angle is not engaged, different from before, and thus the cavitation is not generated when sailing at high speed, and therefore, it is possible to eliminate the noise and impact pressure generated when the bubbles generated by the cavitation are crushed, and the noise and hull vibration can be decreased.

Patent document 1 Patent application publication No. 2003-231497

Patent document 2 Patent application publication No. 2011-098654

However, even if the technology as indicated in patent document 2 is used, the same as for a propeller type propulsion unit, water located backward of the propulsive direction of the main propeller blades is pushed backward of the propulsive direction by the rotation of the propeller blades, and as a result, in the water near the surface of the front side of the propulsive direction of the main propeller blades a negative pressure area is inevitably generated.

Then, if the pressure of this negative pressure area becomes below steam pressure, the water would boil even if the temperature of the water does not reach 100 °C, and as a result the cavitation phenomenon is caused and the so-called bubbles are generated.

As described in patent document 2, the generation of cavitation may cause corrosion of the propeller and the noise known as cavitation noise, and this has been recognized as a problem for a long time. However, a solution for this problem had nearly been abandoned as an inevitable feature necessarily generated by a propulsion unit that uses a propeller.

As mentioned above, even if the technology described in patent document 2 is used, the generation of cavitation by rotation of the main propeller cannot be prevented, and although it is possible to restrain the cavitation generated by the main propeller more effectively by means of a pod, it is very clear that generation of cavitation caused by rotation of the main propeller cannot be prevented.

Disclosure of the invention

The purpose of this invention is in consideration of the aforesaid situation and the main purpose of this invention is to provide a propulsion unit for ships with a new structure that can propel a ship without using a propeller.

Also, another purpose of this invention is to provide a propulsion unit for ships with a new structure that does not generate cavitation when propelling the ship.

The characteristics of the propulsion unit for a ship related to this invention, according to No. 1 embodiment, is that it has the propulsion unit's main body that rotates around the rotation axis extending along the propulsive direction of the ship, the inlet port set on the surface of the propulsion unit's main body, the outlet port set on the surface of the aforesaid propulsion unit's main body, and the circulation path connecting the aforesaid inlet port and outlet port, and that the inlet port is set

ahead of the outlet port in the aforesaid propulsive direction, such outlet port is set on the outer side of the inlet port in the radial direction from the aforesaid rotation axis, the circulation path inclines backwards from the propulsive direction at least at the opening part of the outlet port and by discharging water from the outlet port, which is absorbed at the inlet port, by the rotation around the rotation axis of the propulsion unit's main body, the aforesaid ship is propelled.

Also, for the propulsion unit for a ship related to this invention, according to No. 2 embodiment, it is characteristic that the aforesaid propulsion unit's main body is constructed that its section intersecting perpendicularly with the aforesaid axis is a circular shape.

Also, for the propulsion unit for a ship related to this invention, according to No. 3 embodiment, it is characteristic that the aforesaid propulsion unit's main body presents a spindle or droplet shape, the central axis line of which is the aforesaid rotation axis.

Also, for the propulsion unit for a ship related to this invention, according to No. 4 embodiment, it is characteristic that the aforesaid propulsion unit's main body is constructed, including at least the hemispherical shape part, the central axis line of which is the aforesaid rotation axis.

Also, for the propulsion unit for a ship related to this invention, according to No. 5 embodiment, it is characteristic that the aforesaid circulation path has the extending part that is substantially parallel to the aforesaid rotation axis at the opening part of the aforesaid inlet port.

Also, for the propulsion unit for a ship related to this invention, according to No. 6 embodiment, it is characteristic that the aforesaid circulation path presents a folding structure that the opening part of the inlet port and the opening part of the outlet port are connected at the prescribed obtuse angle.

Also, for the propulsion unit for a ship related to this invention, according to No. 7 embodiment, it is characteristic that the aforesaid circulation path presents a curved structure that the opening part of the inlet port and the opening part of the outlet port are connected smoothly by the part extending in a curved shape.

Also, for the propulsion unit for a ship related to this invention, according to No. 8 embodiment, it is characteristic that the aforesaid circulation path is constructed by the path that connects the aforesaid inlet port and outlet port in a substantially straight extended line configuration.

Also, for the propulsion unit for a ship related to this invention, according to No. 9 embodiment, it is characteristic that the aforesaid propulsion unit's main body is fixedly set up at the forward part of the aforesaid ship.

Also, for the propulsion unit for a ship related to this invention, according to No. 10 embodiment, it is characteristic that the aforesaid propulsion unit's main body is installed at the tip of the drive shaft extending forward from the forward part of the aforesaid ship.

Also, for the propulsion unit for a ship related to this invention, according to No. 11 embodiment, it is characteristic that one (1) drive shaft is fixedly set up along the central axial line of the aforesaid ship as the aforesaid drive shaft.

Also, for the propulsion unit for a ship related to this invention, according to No. 12 embodiment, it is characteristic that a plural number of shafts are fixedly set up parallel to the central axial line of the ship as the aforesaid drive shafts.

Also, for the propulsion unit for a ship related to this invention, according to No. 13 embodiment, it is characteristic that the aforesaid propulsion unit's main body is fixedly set up beneath the central part of the aforesaid ship, except for the forward part and backward part of the ship.

Also, for the propulsion unit for a ship related to this invention, according to No. 14 embodiment, it is characteristic that such propulsion unit has the housing installed beneath the aforesaid central part of the aforesaid ship and such propulsion unit's main body is installed in the aforesaid housing as a rotating body.

Also, for the propulsion unit for a ship related to this invention, according to No. 15 embodiment, it is characteristic that the driving source, which drives the aforesaid propulsion unit's main body in a rotating manner, is built in the aforesaid housing.

Also, for the propulsion unit for a ship related to this invention, according to No. 16 embodiment, it is characteristic that the means of transmission, which transmits the motive power from the driving source accommodated in the aforesaid ship to the aforesaid propulsion unit's main body, is built in the aforesaid housing.

Also, for the propulsion unit for a ship related to this invention, according to No. 17 embodiment, it is characteristic that the aforesaid housing is installed beneath the central part of the aforesaid ship as a unit rotating around the vertical axis line.

Also, for the propulsion unit for a ship related to this invention, according to No. 18 embodiment, it is characteristic that the aforesaid housing is driven around the vertical axis in a rotating manner by the driving source built in the aforesaid ship and the aforesaid propulsion unit's main body installed in the aforesaid housing provides the propulsive force to move the aforesaid ship forward under the situation that such main body is directed forward of the aforesaid ship, and provides the propulsive force to move the aforesaid ship backward under the situation that such main body is directed backward of the aforesaid ship.

Also, for the propulsion unit for a ship related to this invention, according to No. 19 embodiment, it is characteristic that a deflection member, that deflects the discharge direction of water discharged from the aforesaid outlet port backward of the propulsion direction, is further provided.

Also, for the propulsion unit for a ship related to this invention, according to No. 20 embodiment, it is characteristic that the aforesaid deflecting member is installed in the propulsion unit's main body.

Also, for the propulsion unit for a ship related to this invention, according to No. 21 embodiment, it is characteristic that the fins for rectification are installed on the outer periphery of the aforesaid housing, extending along the aforesaid rotation axis.

Also, for the propulsion unit for a ship related to this invention, according to No. 22 embodiment, it is characteristic that the grooves for rectification are formed on the outer periphery of the aforesaid housing, extending along the aforesaid rotation axis.

Also, for the propulsion unit for a ship related to this invention, according to No. 23 embodiment, it is characteristic that the outlet port and inlet port are fixedly set up with the relationship of one-to-one.

Also, for the propulsion unit for a ship related to this invention, according to No. 24 embodiment, it is characteristic that a plural number of the aforesaid inlet ports are formed in the aforesaid propulsion unit's main body.

Also, for the propulsion unit for a ship related to this invention, according to No. 25 embodiment, it is characteristic that the outlet port and inlet ports are fixedly set up with the relationship of one-to-many.

Also, for the propulsion unit for a ship related to this invention, according to No. 26 embodiment, it is characteristic that only one (1) input port is formed in the aforesaid propulsion unit's main body.

Brief description of the drawings

Drawing 1 is the front elevation view, which indicates roughly the external shape of a ship, in which No. 1 embodiment of the propulsion unit for a ship related to this invention is installed.

Drawing 2 is the sectional view of the front part of the propulsion unit for a ship indicated in Drawing 1, by taking a partial cross section.

Drawing 3 shows the generation status of the propulsive force of the propulsion unit for a ship indicated in Drawing 1.

Drawing 4 is the sectional view of the front part of the propulsion unit for a ship, to show the variation No. 1 of the propulsion unit for a ship related to No. 1 embodiment, by taking a partial cross section.

Drawing 5 is the sectional view of the front part of the propulsion unit for a ship, to show the variation No. 2 of the propulsion unit for a ship related to No. 1 embodiment, by taking a partial cross section.

Drawing 6 is the sectional view of the front part of the propulsion unit for a ship, to show the variation No. 3 of the propulsion unit for a ship related to No. 1 embodiment, by taking a partial cross section.

Drawing 7 is the bottom view, which shows embodiment No. 2 of the propulsion unit for a ship relating to this invention.

Drawing 8 is the front elevation view, which shows No. 3 embodiment of the propulsion unit for a ship relating to this invention.

Drawing 9 is the front elevation view, which shows that after the propulsion unit for a ship indicated in the drawing 8 is turned 180° around the vertical axis line, when the ship is propelled backward.

Drawing 10 is the sectional view of the front part, which shows the construction of No. 4 embodiment of the propulsion unit for a ship relating to this invention, by taking a partial cross section.

Drawing 11 is the longitudinal sectional view showing that the propulsion unit in No. 4 embodiment indicated in Drawing 10 is installed in the housing in which the fins for rectification are installed.

Drawing 12 is the longitudinal sectional view showing that the propulsion unit in No. 4 embodiment indicated in Drawing 10 is installed in the housing on which the grooves for rectification are formed.

Drawing 13 is the longitudinal sectional showing the construction of No. 5 embodiment of the propulsion unit for a ship relating to this invention.

Best mode for carrying out the invention

We set forth below the mode for carrying out the propulsion unit for a ship relating to this invention, with reference to the attached drawings:

Firstly, we explain in detail the structure of the propulsion unit for a ship 10 relating to No. 1 embodiment of this invention, by referring to Drawings 1 to 3 in the attached drawings.

Drawing 1 is the front elevation view showing the arrangement state of No. 1 embodiment of the propulsion unit for a ship (hereinafter referred to only as the "Propulsion Unit"), and Drawing 2 is the sectional view of the front part (that is the front part sectional view), by taking a partial cross section, and Drawing 3 is the drawing showing the power direction of the water current (that is the generation state of the propulsive force) discharged from the outlet port of the propulsion unit's main body.

As indicated in Drawing 1, in No. 1 embodiment, one (1) Propulsion Unit 10 is fixedly set up at the bow of the ship 100, that is the part below waterline of the forward part, along the central axis line of the ship 100 and with a state of protruding forward. This Propulsion Unit 10 is fixedly set up to rotate around the rotation axis X, which is specified to extend along the central axis line of the ship 100 in this embodiment that is the propulsive direction of the ship 100 by the driving source 110, which is built in the ship 100.

Furthermore, the propeller 120 and the rudder 130 are installed at the stern of the ship 100, the same as a normal ship's structure. This propeller 120 is used when the ship 100 goes backwards, or is steered delicately, etc. and when the ship takes a long linear route, the ship navigates by using the Propulsion Unit 10 fixedly set ahead of the ship, and such Propulsion Unit 10 and the propeller 120 are used selectively according to various conditions during sailing.

This Propulsion Unit 10 is constructed to have the propulsion unit's main body 12, which rotates around the aforesaid rotation axis X, and the shaft 14, which is fixed in the propulsion unit's main body 12, as one united body, having the same axis, and extending backward of the propulsion direction. The rear end part of the shaft 14 is incorporated in the ship 100, maintaining a water-proof structure, and the shaft 14 is connected to the aforesaid driving source 110.

On the other hand, the propulsion unit's main body 12 is constructed by the outer peripheral surface 12a in a substantially hemispherical shape, the central axis line of which is the rotation axis X, and the edge face 12b, which is defined as the face intersecting perpendicularly with the aforesaid rotation axis X, and the edge face 12b is fixedly set up, being located backwards with respect to the propulsion direction of the outer peripheral surface 12a of the substantially hemispherical shape. That is, the aforesaid shaft 14 is installed, extending backwards with respect to the propulsion direction from the edge face 12b. Also, the outer peripheral surface 12a is constructed by a hemispherical shaped part and the cylindrical shape part connecting with the hemispherical shape part integrally.

One (1) inlet port 16 is formed with opening the port at the apex part located at the forefront with respect to the propulsion direction of the outer peripheral surface 12a of the substantially hemispherical shape of this propulsion unit's main body 12, with the state that the axis of the inlet port 16 is on the same axis of rotation as axis X. That is, the inlet port 16 and rotation axis X are fixedly set up on the same axis, in other words, the central position of inlet port 16 is the alienation of the distance "0" from the rotation axis X or the closest point with rotation axis X.

On the other hand, the circular conical surface 12c is formed over the whole circumference of the outer peripheral edge of the outer peripheral surface 12a of this propulsion unit's main body 12. On this circular conical surface 12c, 4 outlet ports 18 are fixedly set up with opening the ports, and these 4 outlet ports 18 are set up with equivalent angles (that is, in this embodiment, the state alienating each other at 90°). The circular conical surface 12c is set to incline at a specific angle from the rotation axis X, for example, 60° inclination in this embodiment.

Thus, since each outlet port 18 has an opening port at the circular conical surface 12c, which is located on the outer peripheral edge of the outer peripheral surface 12b, the central point of each outlet port 18 is substantially located at the most backward point in the propulsion direction from the inlet port 16, and is fixedly set up at the location of the most distant point from the rotation axis X.

Also, in this propulsion unit's main body 12, the circulation path 20, which connects the inlet port 16 and the outlet port 18 whereby the communicating with each other, is formed. That is in this embodiment, the circulation path 20 has the common part 20a, one edge of which is linked to the inlet port 16 and 4 branching parts 20b, the edges of which, are linked to each outlet port 18. The common part 20a of the circulation path 20 is open at the inlet port 16 and substantially regulated as the part extending parallel to the rotation axis X. In this embodiment, the sectional shape of the circulation path 20 is designed to present a circle shape.

On the other hand, each branching part 20b is linked along the shaft line, which meets at right angles with the circular conical surface 12c, and as a result each branching part 20b is set at an angle of $(90^\circ - \alpha)$ to the rotation axis X, and in this embodiment each branching part 20b inclines at an angle of 30° . Also, the other edges of the 4 branching parts 20b commonly connect to the other edge of the aforesaid common part 20a. In other words, in the circulation path 20, the common part 20a and each branching part 20b join at an obtuse angle, and in this embodiment it has a folding structure, joining at an angle of 120° .

As mentioned above, the shaft 14 that links to the driving source 110 built in the ship 100 is integrally installed at the center of one edge face 12b of the propulsion unit's main body 12. Therefore, in this embodiment, the central axis line of the propulsion unit's main body 12 and the rotation axis X are in the identical situation. As for the connection method of the shaft 14 and the propulsion unit's main body 12, it is possible to connect by a detachable fixing method, such as nut and locking tools, or by a fixed method, such as by welding or gluing, and in brief both are integrally

installed and if the propulsion unit's main body 12 rotates, with the rotation of the shaft 14, any existing methods are possible.

For a ship with a propulsion unit 10 as mentioned above, when the driving source 110 starts and the shaft 14 drives in a rotating manner, the propulsion unit's main body 12, which is integrally linked to shaft 14, also rotates around the axis X.

Concretely speaking, if the propulsion unit's main body 12 of the Propulsion Unit 10 rotates around the rotation axis X in the water, the water entering in the circulation path 20 rotates with the propulsion unit's main body 12 around the rotation axis X and the centrifugal force affects the water inside the circulation path 20.

Since the centrifugal force increases in proportion to the square of the distance, if we compare the centrifugal force acting on the water around the inlet port 16, which is located at the same axis position as the rotation axis X, and the centrifugal force acting on the water around the outlet port 18, which is formed on the circular conical surface 12c located further along the centrifugal force direction from the rotation axis X, the latter becomes bigger. In other words, a stronger centrifugal force is achieved at the outlet port 18 than at the inlet port 16.

Thus, a stronger force is generated to discharge (emit) the water inside the circulation path 20 at the side of the outlet port 14 as long as the propulsion unit's main body 12 is rotating.

Thus, according to the rotation of the propulsion unit's main body 12, water moves from the inlet port 12 to the outlet port 14 in the circulation path 20. That is, the water in the circulation path 20 is discharged (emitted) from the outlet port 14 outside the propulsion unit's main body 12, and at the same time the water around the inlet port is absorbed from the inlet port 12 to the circulation path 20.

As indicated in Drawing 3, the force F_c that directs outside in a radial direction at the surface that crosses at right angles with the rotation axis X as a centrifugal force, as well as the force F_e that discharges water along the extension direction E of the branching part 20b, which links to the outlet port 18, affect the water discharged from the outlet port 18, and therefore as a consequence, if F_c and F_e are considered as vectors, the water is discharged (emitted) from the outlet port 18 by the resultant force of both vectors, F_g , as a discharge force.

If this discharging force F_g is resolved by vectors in the opposite direction of the propulsion direction (that is the extension direction of the rotation axis X) and the direction crossing at right angles with such opposition direction, the direction Y, the force is resolved to the opposite of the propulsion direction, F_{gy} and the force directed outside of the radial direction, crossing at right angles with such opposite direction, F_{gx} . The force directing in the opposite direction of the propulsion direction, F_{gy} is working as the propulsive force for the ship 100. Thus, in this embodiment, since the propulsive force, F_{gx} is generated by the rotation of the propulsion unit's main body 12, the ship 100 is propelled along the propulsion direction heading to the left side in the drawing.

The discharging force F_g , which operates the outlet port 18, is the resultant force of the so-called 3 dimensional vectors, for which the aforesaid centrifugal force F_c , the force F_e , which operates along the extension direction of the branching section 20b of the circulation path 20, and the rotation force accompanied with the rotation of the propulsion unit's main body 12 (the force along the direction crossing at right angles with the drawing surface in the Drawing) operate at the same time. However, since it is sufficient to explain the generation of the propulsive force F_{gx} in the direction along the rotation axis, we exclude the description concerning the rotation force on purpose.

It goes without saying that this invention is deformable in various ways within the scope that such deformation does not deviate from the subject matter of this invention, without limiting the construction of the aforesaid embodiments. For example, the number of arrangements of the branching parts and other numerical values used in the explanation are examples, and it goes without saying that such numbers are not limited to the numbers stated.

Although we explain below various examples of changes and other embodiments, with respect to parts that are the same as those in the aforesaid No. 1 embodiment, we mark with the same signs and omit any explanation.

For example, with respect to the materials to construct the propulsion unit's main body 12, there is no specific limitation and it is possible to adopt suitable materials according to the purpose of use and use conditions, such as metal, ceramic, or synthetic resins. Since the propulsion unit's main body 12 of this embodiment is a simple form and easy to process, there is no limitation to the production method such as by drill processing, production by lost wax, and also it is possible to make the propulsion unit's main body 12 from various kinds of materials.

Furthermore, although in the aforesaid embodiment the sectional shape of the circulation path 20 is formed as a circular shape, it is not necessary to limit this to a circular shape and other sectional shapes, such as an elliptical shape or a polygon, could be used.

Although we explained that the shape of the propulsion unit's main body 12 is substantially a hemispherical shape combining the hemispherical shape part and cylindrical part, the propulsion unit's main body of this invention is not limited to such shape, for example, a purely hemispherical shape, or spindle or droplet shape can be used. In summary, there is no problem if the cross-section crossing at right angles with the rotation axis X is formed as a circular shape, since it is possible to prevent the generation of cavitation effectively by adopting such a shape.

Also, in the aforesaid embodiment, although we explained that the circulation path 20 presents a folding structure bended at the prescribed obtuse angle, the Propulsion Unit of this invention is not limited to such structure, but as indicated in No. 1 example of the transformation in Drawing 4, it is possible to construct a structure that presents the bending structure smoothly connected with the common part 20a and each branching part 20b by the part extending in a curve shape, and also as indicated in the example of transformation No. 2 in Drawing 5, it is possible to form the structure that the circulation path 20 can connect with the inlet port and the outlet port in a straight line. Also, as indicated in the example of transformation No. 3 in Drawing 6, it is possible to form the outlet port 18 directly on the outer peripheral surface 12a, without setting up the circular conical surface 12c on the propulsion unit's main body 12. Furthermore, although it is not indicated in the drawing, it is possible to form the outlet port 18 with opening the port at the edge face 12b of the propulsion unit's main body 12.

In the aforesaid No. 1 embodiment, although we explained that one (1) propeller 10 is fixedly set up at the forward part of the ship 100, this invention is not limited to this construction, and as indicated in the bottom view as No. 2 embodiment in Drawing 7, it is possible to set up a couple of Propulsion Units 10, the central axis lines of which are parallel to the rotation axis X, at the forward part of the ship 100, or it is also possible to install 3 or more Propulsion Units 10. Thus, by constructing the No. 2 embodiment, it is possible to generate high output and propel at high speed. By driving either the right or left Propulsion Unit 10, easier steering is possible.

In the aforesaid No. 1 embodiment, although we explained that the Propulsion Unit 10 is fixedly set up at the forward part of the ship 100, this invention is not limited to this construction and as indicated in No. 3 embodiment in Drawing 8, it is possible to fixedly set up at the central part,

excluding the forward part and backward part of the ship 100. The point is that there is no restriction about the mounting position of the Propulsion Unit 10 on the ship.

Concretely, in No. 3 embodiment, as indicated in Drawing 8, the Propulsion Unit 10 is installed at the housing 22 under the prominent state toward the front of the propulsive direction from the approximately elliptical shaped housing 22 installed nearly at the central part of the bottom of the ship 100. Although the inner part of the housing 22 is not described in the Drawing, the driving source is built in the housing 22 in order to drive the propulsion unit's main body 12 in the rotary manner. This housing 22 is constructed to rotate around the vertical axis line by the driving source 110 built in the ship 100.

Thus, by constructing No. 3 embodiment, it is possible to generate the same propulsive force as that generated in the No. 1 embodiment, and as indicated in Drawing 8, it is possible to propel (that is advance) the ship 100 forwards (toward the left in the drawing) and by rotating the housing 22 around the vertical axis line by 180° , as indicated in Drawing 9, it is possible to reverse the Propulsion Unit 10 and set up it toward the right in the drawing, and as a result, it is possible to propel (that is go backwards) the ship 100 backwards (toward the right in the drawing).

Of course, by rotating the housing 22 around the vertical axis line by 90° , it is possible to propel (lateral motion) the ship 100 toward the cross direction (that is the direction crossing at right angles with the drawing surface in the Drawing).

Although we explained that the driving force of the Propulsion Unit 10 is built in the housing 22 in the aforesaid No. 3 embodiment, this invention is not limited to this construction and it is possible to construct that a transmission mechanism (not indicated in the drawing) that transmits the driving force from the driving source 110 built in the ship 100 to the shaft 14 is built in the housing 22 and the Propulsion Unit 10 is propelled by the driving source 110 in the ship 100.

Also, in the aforesaid No. 1 embodiment, as indicated in Drawing 3, although it was constructed that the ship 100 is propelled based on the propulsive force of water F_{gx} discharged from the outlet port 18, in order to generate a stronger propulsive force and ensure the stability of the propulsive direction, as indicated in No. 4 embodiment in Drawing 10, the deflecting member 24, which deflects the discharging direction of the water current discharged from the outlet port to the reverse direction of the propulsive direction, is installed on the outer peripheral backward part of the propulsion unit's main body 12. This deflecting member 24 presents a cylindrical shape and is installed at the backward part of the outer peripheral surface 12a of the propulsion unit's main body 12, extending parallel to the rotation axis X and attached like a skirt in order not to prevent the water current flowing around the propulsion unit's main body 12, continuously and smoothly connected from the outer peripheral surface 12a. Also, for the materials for this deflecting member 24, it is possible to adopt the same materials for the propulsion unit's main body 12, but other materials can be used.

As explained above, since the deflecting member 24 is further provided in No. 4 embodiment, the water current discharged from the outlet port 18 bumps against the deflecting member 24 and because of this, the water current is forced to head backwards of the propulsive direction and as a result acquires a stronger propulsive force and stability for the propulsive direction.

Also, at the outer periphery of housing 42, the fins for rectification 28, which extend along the central axis, are installed over the whole periphery at equal angles. As a consequence, as indicated in Drawings 8 and 9, under the situation that the Propulsion Unit 10 in No. 4 embodiment is installed in housing 42, as indicated in Drawing 11, the water discharged from the outlet port 18 is deflected to backwards of the propulsive direction by the deflecting member 24 and when going through the

space between the deflecting member 24, which rotates together with the propulsion unit's main body 12, and the housing 42, which functions as a fixed system in comparison with the propulsion unit's main body 12, the water current is further organized by the fins for rectification 28 and its propulsive force increases.

On the other hand, different from the construction indicated in Drawing 11, the grooves for rectification 30 extending along the central axis are formed over the whole periphery at equal angles. Thus, as indicated in Drawings 8 and 9, under the situation that the Propulsion Unit 10 in No. 4 embodiment is installed in housing 42, as indicated in the Drawing 12, the water discharged from outlet port 18 is deflected to backwards of the propulsive direction by the deflecting member 24 and when going through the space between deflecting member 24 and housing 42, the water current is further organized by the grooves for rectification 30 and the propulsive force increases, the same as that in Drawing 11.

Here, although we explained in the aforesaid embodiments that the inlet port 16 and outlet port 18 are formed in a relationship of one-to-four, that is one-to-many, in the propulsion unit's main body 12, this invention is not limited to such construction, and as indicated in No. 5 embodiment in Drawing 13, if each is constructed to be many-to-many, for example, four-to-four in the propulsion unit's main body 12 and both are connected as a one-to-one relationship, it is possible to achieve the same effect as that of the aforesaid No.1 embodiment. These arrangements of logarithms of the inlet port 16 and outlet port 18 are definitive examples, and in No. 5 embodiment, in short, this is fine if the provision is a plural number logarithm.

In the aforesaid embodiments, although we explained that the Propulsion Unit 10 is fixedly set up at the forward part or central part of the ship 100, this invention is not limited to such arrangement, and same as a normal propeller turning type propulsion machine, it is possible to set up the Propulsion Unit 10 at the backward part of the ship 100 in lieu of a propeller turning type propulsion set-up and it goes without saying that it is possible to fixedly set up the Propulsion Unit 10 to co-exist with a propeller turning type propulsion installation.

Industrial applicability

According to the propulsion unit for a ship related to this invention, it is possible to propel the ship without a propeller and also this realizes excellent performance without creating cavitation when propelling a ship.

Scope of Claim

1. It is characteristic for the propulsion unit for a ship that the it has the propulsion unit's main body that rotates around the rotation axis, extending along the propulsive direction of the ship and the inlet port set on the surface of this propulsion unit's main body and the outlet port set on the surface of the aforesaid propulsion unit's main body and the circulation path connecting the aforesaid inlet port and the aforesaid outlet port, and that the aforesaid inlet port is set ahead of the outlet port in the aforesaid propulsive direction, the aforesaid outlet port is set on the outer side of the inlet port in the radial direction from the aforesaid rotation axis, the circulation path inclines backwards from the propulsive direction at least at the opening part of the outlet port, and by discharge of water from the outlet port, which is absorbed from the inlet port, by the rotation around the rotation axis of the propulsion unit's main body, the aforesaid ship is propelled.
2. It is characteristic for the propulsion unit for a ship described in claim 1 that the aforesaid propulsion unit's main body is constructed that its section intersecting perpendicularly with the aforesaid axis is a circular shape.
3. It is characteristic for the propulsion unit for a ship described in claim 2 that the aforesaid propulsion unit's main body presents a spindle or droplet shape, the central axis line of which is the aforesaid rotation axis.
4. It is characteristic for the propulsion unit for a ship described in claim 2 that the aforesaid propulsion unit's main body is constructed, including at least the hemisphere shape part, the central axis line of which is the aforesaid rotation axis.
5. It is characteristic for the propulsion unit for a ship described in claim 1 that the aforesaid circulation path has the extending part that is substantially parallel to the aforesaid rotation axis at the opening part of the aforesaid inlet port.
6. It is characteristic for the propulsion unit for a ship described in claim 5 that the aforesaid circulation path presents a folding structure that the opening part of the inlet port and the opening part of the outlet port are connected at the prescribed obtuse angle.
7. It is characteristic for the propulsion unit for a ship described in claim 5 that the aforesaid circulation path presents a curved structure that the opening part of the inlet port and the opening part of the outlet port are connected smoothly by the part extending in a curved shape.
8. It is characteristic for the propulsion unit for a ship described in claim 1 that the aforesaid circulation path is constructed by the path that connects the aforesaid inlet port and outlet port in a substantially straight extended line configuration.

9. It is characteristic for the propulsion unit for a ship described in claim 1 that the aforesaid propulsion unit's main body is fixedly set up at the forward part of the aforesaid ship.

10. It is characteristic for the propulsion unit for a ship described in claim 9 that the aforesaid propulsion unit's main body is installed at the tip of the drive shaft extending forward from the forward part of the aforesaid ship.

11. It is characteristic for the propulsion unit for a ship described in claim 10 that one (1) drive shaft is a fixedly set up along the central axis line of the aforesaid ship as the aforesaid drive shaft.

12. It is characteristic for the propulsion unit for a ship described in claim 10 that a plural number of shafts are fixedly set up parallel to the central axial line of the ship as the aforesaid drive shafts.

13. It is characteristic for the propulsion unit for a ship described in claim 1 that the aforesaid propulsion unit's main body is a fixedly set up beneath the central part of the aforesaid ship, excluding the forward part and backward part of the ship.

14. It is characteristic for the propulsion unit for a ship described in claim 13 that such propulsion unit has the housing installed beneath the aforesaid central part of the aforesaid ship and such propulsion unit's main body is installed in the aforesaid housing as a rotating body.

15. It is characteristic for the propulsion unit for a ship described in claim 14 that the driving source, which drives the aforesaid propulsion unit's main body in a rotating manner, is built in the aforesaid housing.

16. It is characteristic for the propulsion unit for a ship described in claim 14 that the means of transmission, which transmits the motive power from the driving source accommodated in the aforesaid ship to the aforesaid propulsion unit's main body, is built in the aforesaid housing.

17. It is characteristic for the propulsion unit for a ship described in claim 14 that the aforesaid housing is installed beneath the central part of the aforesaid ship as a unit rotating around the vertical axis line.

18. It is characteristic for the propulsion unit for a ship described in claim 17 that the aforesaid housing is driven around the vertical axis in a rotating manner by the driving source built in the aforesaid ship and the aforesaid propulsion unit's main body installed in the aforesaid housing provides the propulsive force to move the aforesaid ship forward under the situation that such main body is directed forward of the aforesaid ship,

and provides the propulsive force to move the aforesaid ship backward under the situation that such main body is directed backward of the aforesaid ship.

19. It is characteristic for the propulsion unit for a ship described in claim 1 that the deflection member, that deflects the discharge direction of water discharged from the aforesaid outlet port backward of the propulsion direction, is further provided.

20. It is characteristic for the propulsion unit for a ship described in claim 19 that the aforesaid deflecting member is installed in the propulsion unit's main body.

21. It is characteristic for the propulsion unit for a ship described in claim 14 that the fins for rectification are installed on the outer periphery of the aforesaid housing, extending along the aforesaid rotation axis.
22. It is characteristic for the propulsion unit for a ship described in claim 14 that the grooves for rectification are formed on the outer periphery of the aforesaid housing, extending along the aforesaid rotation axis.
23. It is characteristic for the propulsion unit for a ship described in claim 1 that the outlet port and inlet port are fixedly set up with the relationship of one-to-one.
24. It is characteristic for the propulsion unit for a ship described in claim 23 that a plural number of the aforesaid inlet ports are formed in the aforesaid propulsion unit's main body.
25. It is characteristic for the propulsion unit for a ship described in claim 1 that the outlet port and inlet ports are fixedly set up with the relationship of one-to-many.
26. It is characteristic for the propulsion unit for a ship described in claim 1 that only one (1) input port is formed in the aforesaid propulsion unit's main body