

WATER JET PROPULSION OF WATERCRAFT

The invention relates to a water jet propulsion device for watercraft, particularly shallow draught watercraft.

Water jet propulsion devices are known in which water is driven through a flow guide from an inlet to an outlet in the bottom of the craft. They are provided for driving or for driving and steering. In the latter case, the flow guide can be pivotable about an axis which is substantially vertical. The pivoting axis of the bend and the axis of rotation of the pump can be arranged coaxially or eccentrically with respect to each other. The pump shaft can also be installed at an angle. (See US Patent Specification 3 098 464, German Offenlegungsschrift 2 737 454, UK Patent Application 2 010 763A.)

In such propulsion devices, the water jet tends to hug the bottom of the craft behind the outlet and thus entrains large quantities of water from the surroundings. This results in a loss of thrust and in lowering of the craft.

It would thus be desirable to be able to ensure that the jet detaches itself more readily from the vessel and thus has no or almost no detrimental action.

The present invention provides a watercraft including a flow guide which extends within the hull from a suction inlet in the bottom to an exit tube leading to a discharge outlet in the bottom, a thrust generator in the flow guide arranged
5 to draw in water through the suction inlet and to propel the water through the exit tube so as to eject an obliquely downwardly directed water jet through the discharge outlet, and means for introducing a gas into the exit tube, downstream of the thrust generator, only through a port or ports provided
10 in the wall of the exit tube above the level of the longitudinal median axis thereof.

Preferably, a duct connects the exit tube to the ambient air. If the flow guide is pivotable, the duct can advantageously rotate with the exit tube, avoiding the possibility of air
15 being drawn in by the thrust generator.

The introduction of air or another gas in accordance with the invention brings the following advantage. The exit angle of the water jet is maintained and friction against the ship's hull is reduced; this results in an enhanced thrust.

20 The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows in diagrammatic form a watercraft with a water jet propulsion device;

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Figure 2 is a sectional diagrammatic view of one embodiment of a water jet propulsion device in a watercraft; and

Figure 3 is a sectional diagrammatic view of another embodiment.

Figure 1 shows in diagrammatic form a watercraft 1 with a
5 water jet propulsion device 2. This substantially comprises
a flow guide unit 3 in which a propeller pump 4 is supported.
The pump 3 is driven by a motor 5 via driving elements described
below. The unit 3 is pivotable about a vertical axis 6 and
is driveably supported for pivoting. The propeller of the
10 pump 4 is supported by a shaft arranged at an angle to the
pivoting axis. The exit tube 7 of the flow guide unit 3
is orientated downwardly at an angle. The watercraft is
driven by the ejected water jet 8 and is steered by pivoting
of the unit 3. However, the water jet tends not to travel
15 downwardly at an angle but tends to hug the hull, thus resulting
in the above-described disadvantages.

The additional means described in detail below, with reference
to Figures 2 and 3, make it easier for the water jet to travel
downwardly at an angle, as indicated in broken line at 9
20 in Figure 1.

Figure 2 shows a propulsion device in which, by contrast
to the system according to Figure 1, the propeller pump is
arranged parallel but eccentrically with respect to the pivoting

axis 6 of the unit 3. The pump is driven by the motor 5 through a universal shaft 11, a bevel gear transmission 12, a spur gear transmission 13, and a propeller shaft 14 on which the propeller 10 of the pump is disposed. (Embodiments can, however, also be envisaged in which the propeller shaft is co-axial with the pivoting axis.) The unit 3 can be pivoted about the axis 6 by a motor 15 via a gear transmission 16. A suitable bearing 17 and a seal 18 are provided. The various components and their principles of operation are known and they are therefore shown only in schematic form.

The propeller pump 10 draws water in through the suction inlet 19 and ejects it through the exit tube 7 in the desired direction controlled by pivoting the unit 3. In order to prevent the jet 9 from hugging the hull, the casing 20 of the propulsion device is provided with an inlet aperture 21 and the unit is provided with at least one port 22 above the level of the longitudinal median axis of the exit tube 7. Together they form at least one duct through which air is able to pass from the outside into the exit tube 7. The port 22 shown in Figure 2 opens in the wall of the exit tube directly above its longitudinal median axis. The gap 23 between the casing 20 and the unit 3 functions as an annular groove which ensures that air is able to enter through the port (or ports) 22 in any position of the unit. Apart from the presence of the aperture 21, the gap 23 is sealed with respect to the exterior on the one hand by the water and on the other hand

by the seal 18. If necessary, a plurality of inlet apertures, an additional annular groove, and additional seals can be provided.

5 The above-described supply of air ensures that the water jet 9 does not hug the hull but in actual fact leaves it downwardly at an angle as indicated in broken line in Figure 1.

The embodiment illustrated in Figure 3 differs from that of Figure 2 by virtue of the fact that the pump shaft 25, on which the impeller of a centrifugal pump 24 is disposed,
10 is mounted at an angle to the pivoting axis 6. Torque is transmitted via a universal shaft 26. A suitable gear transmission, for example a bevel gear transmission, can be provided instead.

The inlet aperture 27 is disposed higher in the casing so that air enters an annular chamber 28 which is disposed above
15 the flow guide unit 29. From there, a port 30 enters the exit tube. The annular chamber 28 is sealed as in the previous embodiment. Air supply in this case also ensures that the water jet 9 leaves the hull downwardly at an angle.

It is advantageous for several reasons, for example to reduce
20 noise, if the inlet aperture 21 or 27 or the inlet apertures is or are connected to the gas exhaust of the motor 5, which may, for example, be an internal combustion engine, a gas or steam turbine, or a steam engine.

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CLAIMS

1. A watercraft including a flow guide which extends within the hull from a suction inlet in the bottom to an exit tube leading to a discharge outlet in the bottom, a thrust generator
5 in the flow guide arranged to draw in water through the suction inlet and to propel the water through the exit tube so as to eject an obliquely downwardly directed water jet through the discharge outlet, and means for introducing a gas into the exit tube, downstream of the thrust generator, only through
10 a port or ports provided in the wall of the exit tube above the level of the longitudinal median axis thereof.
2. A watercraft as claimed in claim 1, in which the said means communicates between the exit tube and the ambient air.
- 15 3. A watercraft as claimed in claim 1, including a motor having a gas exhaust, in which the said means communicates between the exit tube and the exhaust.
4. A watercraft as claimed in any of claims 1 to 3, in which the said means comprises a duct communicating with the or
20 each port.
5. A watercraft as claimed in any of claims 1 to 4, in which the said means introduces gas into the exit tube through a port directly above the longitudinal median axis thereof.



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6. A watercraft substantially as described with reference to, and as shown in, Figure 2 or Figure 3 of the accompanying drawings.

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