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"Water Craft with Water Jet Driving Apparatus"

The present invention relates to water jet driving apparatus for water craft, particularly shallow water craft.

A known water jet driving device for driving and steering
5 in particular flat-bottomed water craft has a pump mounted
in a housing which is pivotal about a substantially vertical
axis. The pump sucks in water at the bottom and ejects it
obliquely downwardly.

Ideally, jet driving apparatus should have high efficiency
10 both at cruising speed and in the starting state, a low weight
and a small demand for space being desirable at the same
time.

The invention provides a water craft having a water
jet driving apparatus comprising a flow guide unit mounted
15 for rotation about a substantially vertical axis, and a centrifugal
pump in the flow guide unit, the pump being arranged to suck
water from the bottom of the craft through a suction opening
of the flow guide unit, to convey the water through a spiral
duct in the flow guide unit, and to eject the water obliquely
20 downwards from an ejection opening of the flow guide unit,
the axis of rotation of the centrifugal pump being inclined
with respect to the rotation axis of the flow guide unit
and lying in a vertical plane which is at an angle to the
direction of ejection of water from the ejection opening
25 of the flow guide unit (generally the direction of the craft).

The flow guide unit is preferably mounted in the hull of the craft, and the suction and ejection openings of the unit preferably do not project beneath the bottom of the craft.

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

Figure 1 is a schematic vertical section through a water jet driving apparatus in a water craft; and

10 Figure 2 is a diagrammatic representation of a plan view of a flow guide unit forming part of the driving apparatus.

A housing 2 constituting a flow guide unit having a spiral duct 52 is mounted in the hull 1 (Fig. 1)

of a flat-bottomed shallow water craft and is pivotal about a vertical pivot axis 3. In Fig.2 only the outer circumference of the pivotal housing 2 is illustrated. The housing 2 contains a centrifugal pump 51; only the spiral duct 52 and the rotor shaft 53 of the centrifugal pump 51 are shown, since such pumps are well known. The spiral duct 52 is so received by the pivotal housing 2 that the shaft 53 (and thereby the axis 54 of rotation of the pump rotor) is inclined to the pivot axis 3 as well as to the direction of travel 55 of the craft, as shown in Fig.2. The centrifugal pump sucks in water at the bottom, through a suction opening of the housing 2, as indicated by the arrows 56 in Fig.1, and ejects it through a nozzle 57 in the direction of the arrows 58, thereby imparting a thrust to the craft. The discharge direction of the ejection nozzle 58 is, of course, generally opposite to the direction of travel 55. Thus the axis 54 of rotation is also inclined to the outlet direction of the nozzle 57, as can be seen from Fig.2. Owing to this arrangement a small enclosed space is obtained and a low flow resistance for the water sucked-in. The centrifugal pump is arranged just above the bottom of the craft. The suction opening may be covered by a grating (not shown), in order to prevent foreign bodies from entering..

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The pivotal housing 2 may consist entirely or partly of foamed synthetic resin. The mounting of the pivotal housing 2 is indicated diagrammatically by a bearing 11. A seal 12 is diagrammatically
5 illustrated. In practice all known measures are to be taken into account for the mounting and sealing.

The pivotal housing 2 is rotatable through 360° by a steering motor (not shown) by way of a transmission 14 such as a gearwheel drive or a
10 worm drive. The centrifugal pump is driven by a driving motor (not shown) which is mounted in the hull 1 or on the pivotal housing. The driving motor rotates the pump rotor shaft 53 by way of known
suitable driving elements and by way of a Cardan shaft
15 59 and a universal joint 60. The pivotal housing 2 is so constructed and assembled in the water craft that it matches accurately the section of the hull and is substantially flush with the bottom of the craft.

The advantageous form of the nozzle 57
20 becomes clear from Fig.2. in which a₁ denotes the length of nozzle which would be obtained if the pump axis 54 were vertical; a₂ denotes the length of nozzle which would be obtained if the pump axis
54 were inclined in a vertical plane parallel to
25 the outlet direction of the nozzle 57 (therefore substantially parallel to the direction of travel of

the craft); and a_3 denotes the length of the nozzle when the axis 54 is inclined in a vertical plane 61 which is at an angle to the direction of the nozzle (or the direction of travel). Corresponding
5 enlargements are also obtained in the height of the nozzle (in the projection of Fig.1).

The last-mentioned inclined arrangement of the axis 54 brings the following advantages compared with the other two arrangements.

10 Diversion of the water out of the plane of the spiral duct 52 into the plane of the nozzle 57 is unnecessary. With the space requirement remaining the same, an increase of the thrust power is obtained, or conversely for the same thrust
15 power the housing 2 requires a smaller space. One can achieve a smaller ejection angle, i.e. the angle between the hull and the issuing water jet may be maintained smaller. Owing to the oblique positioning of the spiral duct 52, better in-flow of the water
20 into the suction opening is obtained. An accumulation surface transverse to the direction of travel is produced in an advantageous manner. This produces an increase of pressure in the entire suction opening, so that the pressure rises for the same power input;
25 this has the consequence of a higher thrust.

The jet driving apparatus described above has the advantage that it is protected against damage upon touching the ground and is suitable for small and easily manoeuvrable craft. It takes up a small space and has a low weight. The pump is self-priming and is insensitive against the ingress of sand and other contaminants. Also manoeuvrability is satisfactory, because the thrust jet is steerable all around in a stepless manner.



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CLAIMS

1. A water craft having a water jet driving apparatus comprising a flow guide unit mounted for rotation about a substantially vertical axis, and a centrifugal pump in the
5 flow guide unit, the pump being arranged to suck water from the bottom of the craft through a suction opening of the flow guide unit, to convey the water through a spiral duct in the flow guide unit, and to eject the water obliquely downwards from an ejection opening of the flow guide unit,
10 the axis ^{of rotation} of the centrifugal pump being inclined with respect to the rotation axis of the flow guide unit and lying in a vertical plane which is at an angle to the direction of ejection of the water from the ejection opening.
2. A water craft as claimed in claim 1, in which the flow
15 guide unit is mounted in the hull of the craft.
3. A water craft having a water jet driving apparatus substantially as described with reference to, and as shown in, the accompanying drawings.

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