

This Sheet Has Been Replaced



Title: Waterjet propulsion unit.

The invention relates to a water jet propulsion unit, comprising a jet tube, open at its upper and lower end, and accommodating therein a rotatingly driven propulsion means with in the outflow opening of the unit a rotatable grid of essentially mutually parallel guide plates crossing the axis of the propulsion element under an acute angle.

Such a waterjet propulsion unit is known in itself from the French patent specification 1478733; the propulsion means as used therein is a thrust propeller. This known unit comprises an outer drum around a circular opening in the bottom of the vessel, extending conically upwardly with therein a jet tube, converging downwardly, and with therebelow the grid guide plates.

Such a device is, at best, only suited for handling small powers. The inflow of the water at the upper end of the jet tube will be accompanied by heavy turbulences, resulting in a very low propeller efficiency and cavitation of the propeller. The plane of the exit grid essentially coincides with the plane of the bottom of the vessel so that a great amount of water will be pumped around: part of the outflowing water will be mixed with the inflowing water so that the efficiency of the propulsion unit will be still worse.

The invention aims to provide a propulsion unit as described hereinabove which, having a high efficiency, is suitable to handle high powers. According the invention this aim is obtained in that the jet tube is, outside the inlet end, surrounded by a guide surface with a spherically curvature cross-section, and ends at the outlet end in a converging chamber of which two opposite walls include with the axis of the propulsion means an acute angle, said chamber carrying at the outflow end the guide plate grid of which the plates are parallel with the horizontal end edges of said walls, the whole being rotatable, together with the grid, around the axis of the propulsion means.



The upper surround of the jet tube as proposed by the invention ensures a smooth inflow of the water therein, eliminating turbulences and propeller cavitation. The water which flows out of the jet tube does not directly hit the guide plates but flows firstly in the, converging, chamber in which the water is already given a direction which includes an angle with the axis of the propulsion means. By this the "pumping around", which occurs in the unit according to the prior art, is prevented.

10 Preferably the propulsion means is a propulsion propeller with fixed or variable pitch. It is also possible to use a "mixed flow" propeller or a pumping disc.

In a preferred embodiment the chamber is fixed to the jet tube and rotatable, together therewith, around the axis of the propulsion means by means of drive means, acting on the jet tube.

Contrary to the prior art according to which the guide grid can be rotated by means of a submerged set of gears, in the proposed embodiment the rotating of the jet tube is effected by driving its support, thus in the dry zone within the vessel.

Contrary to the prior art in a preferred embodiment of the invention the jet tube is surrounded by an essentially cylindrical drum of which the lower plane essentially coincides with the plane of guide plate grid. By this measure a better guiding of the water, which is sucked in around the jet tube, up to the upper end of the jet tube is obtained.

Furthermore preferably the guide plates comprise a first part lying near to the outflow opening of the chamber, parallel with the chamber valves which cross the axis of the propulsion means, and a second part, lying further within the chamber and crossing the said axis under a smaller angle.

The invention is elucidated on the hand of the drawing. Therein shows:

fig. 1 a schematical cross-section through a unit according to the invention in a direction parallel to the planes of the guide plates;

fig. 2 a similar cross-section in a direction perpendicular thereto;



fig. 3 a schematic lower view of the unit according to the invention;

fig. 4 a schematic upper view of such a unit;

fig. 5a shows in cross-section, and fig. 5b in lower view a practical realisation of the device according to the invention. In these figures parts, which have already been shown in preceding figures, are denoted with reference numerals as used therein with the prefix "5".

The unit shown in the drawings comprises a cylindrical drum 2 of which the lower edge 4 is sealingly connected to the bottomplane 6 of a vessel, not further shown, and provided with this unit. At its upper end the drum 2 is closed by closed supporting structure 8, which prevents surrounding water in the space 10 of the drum from penetrating into the vessel and which furthermore provides a rotating support for the various components of the propulsion unit.

These further components comprise a cylindrical jet tube 12 of which the upper, inlet end 14 is surrounded by a guide surface 16 with spherical cross-section, which is via suitable connecting elements, schemically shown by the broken line 18, connected to the jet tube 12. At the lower end 20 the jet tube 14 merges into a guide chamber 22 with essentially rectangular cross-section of which two mutually parallel planes, 24a, 24b, are parallel to the axis 26 of the chamber 12 while the two other planes, 28a, 28b, enclose an acute angle with this axis. The chamber 22 carries at the lower end a grid 30 which is made up of individual guide plates 32, each comprising a first part 34, essentially parallel to the walls 28a, 28b and, starting therefrom, a part 36 which encloses with the axis 26 a smaller angle.

The jet tube 12 is connected, by means of a number of supporting strips 38, to a central supporting plate 40 which is suspended in the cover plate 8. Through this supporting plate 40 goes the shaft 42 which carries at its lower end the propulsion propeller 40 which closely fits within the jet tube 12.

The shaft 42 is coupled to a driving motor (not shown), and is supported at its lower end, near to the propeller 42, in a



bearing 46 which is connected by means of radial arms 48 to the jet tube 12.

The figures 5a and 5b show a cylindrical drum 502 supported by the upper carrying structure 508; the space, enclosed by this drum 502, is denoted with 510 and in this space lies the jet tube 512, of which the upper end 514 is surrounded by the guide surface 516 with spherical cross-section. At the lower end the jet tube 512 merges into the guide chamber 512 with the grid 530, made up of individual guide plates 532 which have a structure as described hereinbefore.

The propeller 542 is supported by the shaft 544 which is connected to the output shaft of a transmission 550 of which the input shaft 552 is connected to the driving engine (not shown).

The drawing also shows the curved guide plates 554 which guide the inflowing water along the inner edge of the jet tube 512 to the jet tube 512. They extend into the radial ring-shaped shielding plate 556 which merges into a conical, downwardly directed, end part 558.

The shaft sleeve 552 is carried by the upper supporting plate 560 upon which rests the transmission 550 and which is connected, via the outer supporting ring 562 and a short upstanding cylindrical part 564, to the upper plate 508. The complete comprising jet tube 512 with guide chamber 522 and the curved shielding plates 554 depends from the carrying cylinder 570 with, protruding therefrom, the radial supporting ring 566, carried by the bearing 568 and provided with a ring gear 570; a gear 572 on the output shaft of the setting motor 574 meshes therewith and the ring gear drives via the gear 576 the position detector 578 which supplies digital information relating to the orientation of the jet tube, and therewith the orientation of the propulsion unit.

The above described measures result into a propulsion unit with properties which are markedly better than same of the prior art.

C L A I M S

1. Water jet propulsion unit, comprising a jet tube, open at its upper (inlet) and lower (outlet) end, and accommodating therein a rotatingly driven propulsion means with in the outflow opening of the unit a rotatable grid of essentially mutually parallel guide plates crossing the axis of the propulsion element under an acute angle, characterized in that the jet tube is, outside the inlet end, surrounded by a guide surface with a spherically curvature cross-section, and ends at the outlet end in a converging chamber of which two opposite walls include with the axis of the propulsion means an acute angle, said chamber carrying at the outflow end the guide plate grid of which the plates are parallel with the horizontal end edges of said walls, the whole being rotatable, together with the grid, around the axis of the propulsion means.

2. Unit according to claim 1, characterized in that the propulsion means is a propulsion propeller.

3. Unit according to claims 1-2, characterized in that the chamber is fixed to the jet tube and can be rotated, together therewith, by drive means acting upon the jet tube.

4. Unit according to claims 1-3, characterized in that the jet tube is surrounded by an essentially circle-cylindrical drum, of which the lower plane essentially coincides with the plane of the guide plate grid.

5. Unit according to claims 1-4, characterized in that the plates of the guide plate grid comprise a first part, lying near to the outflow opening of the chamber, parallel to the chamber walls which cross the axis of the propulsion means, and a second part, lying further inwardly of the chamber and crossing said axis under a smaller angle.

