THRUSTER UNIT AND METHOD FOR INSTALLATION OF A THRUSTER UNIT

The present invention is related to a thruster for installation in the hull of a vessel, where the thruster comprises a tunnel element and at least one thruster unit, and where the tunnel element, when arranged in the hull, at least constitutes a part of the through tunnel in the vessel's hull. The present invention also relates to a method for mounting and demounting a thruster unit which is a part of the thruster on a vessel, where the thruster comprises at least one thruster unit and at least one tunnel element, and where the vessel comprises a hull through which the tunnel element is arranged.

In thrusters of this kind, usually in the form of a propeller device arranged in a tunnel in the vessel's hull, the propeller device or devices are, in accordance with the current state of the art, mounted when the vessel is built. In these known propeller devices, which are based on oil-lubricated bearings and gearwheels, it is not possible to remove the propeller device for service, repair or to replace the propeller device, should this be necessary, without going into dock. In such cases, major work must usually be carried out on the vessel's hull in order to be able to remove the propeller device, and this is time-consuming and costly.

The object of the present invention is therefore to provide a thruster unit which allows a simple mounting and demounting of the thruster unit, where the mounting and demounting of the thruster unit can be carried out without the vessel going into dock.

This is achieved according to the invention as it is defined in the attached independent claims. Additional embodiments of the invention are disclosed in the respective dependent claims.

According to a first aspect of the present invention, there is provided a vessel comprising a hull and a thruster, which thruster comprises at least one thruster unit and at least one tunnel element which constitutes at least a part of a through tunnel in the hull, and where the at least one thruster unit and the at least one tunnel element are constructed with cooperating fastening devices for detachable fastening of the at least one thruster unit in the at least one tunnel element, the cooperating fastening devices comprising a plurality of cavities which are provided in the tunnel element, and a plurality of brackets comprising a projecting fastening member, c h a r a c t e r i s e d i n that the at least one thruster unit comprises a propeller with propeller blades and an inner propeller ring surrounding the propeller blades, the propeller blades being attached to the inner propeller ring, the at least one

thrusters unit further comprising an outer propeller ring surrounding the inner propeller ring, the inner propeller ring being rotatably disposed in relation to the outer propeller ring, the fastening member of the brackets having a shape that is complementary to the cavities and being arranged in the cavities, the brackets further being designed for demountable fastening to the outer propeller ring of the thruster unit with the aid of one or more fastening means, such that the thruster unit can be mounted in the tunnel element by passing the thruster unit axially in through the tunnel until it reaches the brackets, and then fastning the thruster unit to the brackets with said fastening means and such that the thruster unit can be demounted from the brackets and passed axially out of the tunnel.

According to a second aspect of the present invention, there is provided a method for mounting and demounting a thruster unit which is a part of a thruster on a vessel, which thruster comprises at least one thruster unit and at least one tunnel element, and where the vessel further comprises a hull with a through tunnel, which tunnel element at least partly constitutes a part of the tunnel when the tunnel element is arranged in the hull, the at least one thruster unit comprising a propeller with propeller blades and an inner propeller ring surrounding the propeller blades, the propeller blades being attached to the inner propeller ring, the at least one thrusters unit further comprising an outer propeller ring surrounding the inner propeller ring, the inner propeller ring being rotatably disposed in relation to the outer propeller ring,
c h a r a c t e r i s e d i n that the method comprises arranging a plurality of brackets, each with a projecting fastening member, in corresponding cavities in the tunnel element before the thruster unit is passed to the mounting point in the tunnel element, which projecting fastening member and corresponding cavity have a complementary shape, the following steps being carried out when a thruster unit is mounted in the tunnel element:

- passing the thruster unit axially through the tunnel to the brackets in the tunnel element;
- mounting the brackets to the outer propeller ring of the at least one thruster unit with fastening means;

and the following steps being carried out when the thruster unit is demounted from the tunnel element:

- demounting the brackets in the tunnel element from the outer propeller ring of the at least one thruster unit;
- passing the thruster unit axially out of the tunnel.

A thruster is provided for generating a thrust on a vessel equipped with a hull, the thruster comprising at least one tunnel element and at least one thruster unit. The tunnel element, when arranged in the hull, constitutes at least a part of a through tunnel in the hull. Furthermore, the at least one thruster unit and the at least one tunnel element are preferably constructed with cooperating fastening devices for detachably fixing the at least one thruster unit in the at least one tunnel element such that the at least one thruster unit can be passed in through the tunnel and mounted to the at least one tunnel element or demounted from the at least one tunnel element and passed out of the tunnel.

The axial extent of the tunnel will naturally vary depending on the design of the vessel's hull and where in the hull the tunnel is arranged. It will therefore be

Described below is a single embodiment of the invention which must not be regarded as limiting for the present invention.

Figures 1-4 show a thruster unit ~~30~~ which is a part of a thruster that is intended to be used in the hull of a vessel. More specifically, the thruster is designed to be arranged in a through tunnel in the hull of the vessel. Optionally, the thruster may constitute the whole of the through tunnel in the vessel's hull.

The thruster consists of a thruster unit 12 and a tunnel element 14. The tunnel element 14 is arranged fixedly in the vessel's hull in such a way that it constitutes a part of the through tunnel, or if the through tunnel is short, the tunnel element 14 may possibly constitute the whole tunnel.

The thruster unit 12 comprises a propeller with propeller blades 34 that are attached to a propeller hub 32 and an inner propeller ring 40 at the outer edge 35 of the propeller blades. An outer propeller ring 41 surrounds the inner propeller ring 40. The inner propeller ring 40 is rotatably disposed in relation to the outer propeller ring 41. Another alternative is to construct the tunnel element 14 with a rotatable ring such that the thruster unit then comprises only one ring. This one ring comprises the first fastening device ~~16~~ and the outer edge 35 of the propeller blades is fastened to the inside of the ring.

Either the inner propeller ring 40 or the outer propeller ring 41 is further provided with a first fastening device ~~16~~ comprising a first fastening face 26. The tunnel element 14 is provided with a corresponding fastening device 17 comprising a second fastening face 27. The first fastening face 26 and the second fastening face 27 are designed in such a way that they can be brought into contact with each other and mounted together.

For this purpose, i.e., the mounting together of the first and the second fastening face, holes 36 are provided in the first fastening device and corresponding holes 37 are provided in the second fastening device 17. A fastening means such as bolts, screws or the like can then be used to mount the thruster unit 12 to the tunnel element 14. In this way, the thruster unit may easily be mounted and later, if necessary, demounted from the tunnel element 14.

It is also possible to provide the end of the through tunnel through which the thruster unit 12 is introduced into the tunnel element 14 with tunnel inlet 45. An example of such a tunnel inlet is shown in Figures 5-8.

The tunnel inlet 45 is configured with an inner wall 47 that partly faces in towards the centre axis of the tunnel inlet, an outer wall 48, an inner edge 50 which will rest against the tunnel element 14, the thruster unit 12 or the hull of the vessel when mounted, and an outer edge.

The inner wall 47 is configured such that the water that flows into the through tunnel in the vessel's hull will be given an optimally favourable flow pattern. Preferably, the inner wall has a curved shape when seen in a section taken in a section through the tunnel inlet 45 at right angles to the centre axis of the tunnel inlet, as can clearly be seen in Figure 7.

The outer wall 48 is constructed with reinforcements 52 around the whole circumference of the tunnel inlet 45. In the embodiment shown in the figures, these reinforcements 52 constitute a corrugated reinforcement around the circumference of the tunnel element. The corrugated reinforcements 52 have wave crests 53 which form wave ridges 55 where the thickness of the tunnel element in a radial direction is greatest.

The reinforcements 52 are preferably provided with holes 56 so that the tunnel inlet 45 can be mounted to, and optionally later demounted from, the tunnel inlet 14 or the thruster unit 12 or optionally in the hull of the vessel with the aid of a fastening means such as bolts, screws or the like.

By means of this invention, where the tunnel element 14 and the thruster unit 12 are so constructed that the thruster unit can be introduced axially into the tunnel element 14, and where the tunnel element 14 and the thruster unit 12 are made with corresponding fastening devices ~~16,~~ 17, the thruster unit 12 can be easily mounted and later optionally demounted from the tunnel element 14. In addition, a tunnel inlet 45, which is adapted to the individual thruster, can be mounted to and optionally demounted from the thruster or the vessel's hull so as to generate optimal conditions for the water flow into or out of the through tunnel in the vessel's hull.

Figures 9 and 10 show an alternative way of fastening the thruster unit 12 to the tunnel element 14. In Figure 9, the tunnel element 14 is shown with brackets 60 mounted in cavities in the tunnel element 14. The brackets 60 are demountably fastened to the thruster unit 12, preferably with the aid of bolts, screws or similar fastening means. It should be noted that only the part of the thruster unit 12 to which the bracket 60 is mounted is shown in Figure 9.

Figure 10 shows in more detail the bracket 60 and how the thruster unit 12 is fastened to the tunnel element 14. A cavity 58 is provided in the tunnel element 14. An annular support element 63 which may have varying rigidity is preferably