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(54) WATER CRAFT, e.g. TUGS

(71) We, SCHOTTEL - WERFT JOSEF BECKER GMBH & Co KG formerly known as Schottel-Werft Josef Becker KG, a German Body Corporate, of 5401, Spay/Rhein, West Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a water craft having a thrust generator, e.g. a rudder propeller, arranged under the front half of the craft, such as a tug.

What is desired is a craft in which the rudder propeller or other thrust generator is arranged so that it can be raised while the craft is afloat. Accordingly, good transmission of thrust reaction from the thrust generator to the hull of the craft has to be provided.

The present invention provides a water craft having a thrust generator arranged under the front half of the hull of the craft and being retractable into a well in the hull, the thrust generator being fixed to a support having a peripheral wall encompassed by the peripheral wall of the well, the transverse dimensions of the thrust generator being smaller than the corresponding transverse dimensions of the well wall, the support wall being releasably fixed at one end to the well wall, and adjacent the other end the space between the two walls being bridged by one or more thrust blocks for taking the reaction of the thrust generator.

For good transmission of thrust reaction to the hull of the water craft, it is preferable for the support wall to be fixed at its upper end to the well wall, e.g. by a flange, and therefore for the space between the walls adjacent its lower end to be bridged by the thrust block(s). The thrust block may be annular or there may be a number of blocks distributed around the support wall.

Assembly and disassembly is facilitated by thrust blocks comprising two members having faces which bear against each other and are inclined so that the support wall can be raised. Preferably, the said members are adjustable with respect to each other to eliminate play. The said members may be adjusted during the assembly and then rigidly fixed e.g. welded, to a wall cooperating with them. Alternatively, one or both of the members may be adjustably fixed, e.g. bolted, to a respective wall so as to be further adjustable later on.

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

Figure 1 is diagrammatic side view of a tug;

Figure 2 is diagrammatic front view of the tug;

Figure 3 is a section through part of the tug, on an enlarged scale;

Figure 4 illustrates a detail on an enlarged scale; and

Figure 5 shows a modified detail.

The tug 1 illustrated is capable of towing and pushing and is driven by two rudder propellers 2 (Figure 2) which are rotatable through 360° for controlling the vessel and are arranged near each other ahead of the middle of the vessel at about one-third of the entire length of the vessel measured from the bow. Accordingly the water inflow towards the propeller and the outflow underneath the hull can occur freely. The propellers 2 are arranged in so-called Kort fairings 3. A protection device 4 is provided in front of the propellers, while at the stern there is a stabilizing fin 5 which acts as a balancing surface for transverse manoeuvring. The protection device and the stabilizing fin serve as supports, preventing damage to the propellers 2, when the vessel is taken out of the water.

The rudder propellers 2 are driven by a motor 6 (or respective motors) arranged astern of the propellers, in the rear half of the vessel. Transmission of torque from the motor 6 to each rudder propeller 2 occurs first through an elastic coupling 7 and a shaftline 8 to a clutch 9 cooperating with a disc brake (not shown) which is automatically operated when the clutch 9 disconnects the motor from the propeller. The brake serves to take up the angular momentum of the

propeller so that the vessel can be quickly braked, which is a precious manoeuvering facility when entering ports where stopping and alterations in speed are often required.

The clutch 9 is connected to the rudder propeller 2 by means of a universal-joint shaft 10. The entire rudder propeller substantially comprises a fixed in-board housing 11 and an out-board housing 12 which is mounted for rotation through 360° in the in-board housing 11. The torque is transmitted in a known manner from the universal-joint shaft 10 through a bevel drive (not shown) located in the in-board housing 11, a substantially vertical shaft which leads to the out-board housing 12, a bevel drive (not shown) disposed in the out-board housing 12, and a substantially horizontal propeller shaft which carries the propeller. The rotary motion of the out-board housing is controlled from the control room through a mechanical transmission device or an electrical-hydraulic or pneumatic remote control. A remote controlled unit 13 is diagrammatically illustrated. The remote controlled unit acts in a known manner on the out-board housing 12 *via* a drive (not shown).

The rudder propellers are each retractable into a well which substantially comprises a cylindrical wall 14 which constitutes a single piece with a hull 15, e.g. by being welded to it. The well wall 14 has a flange 16 at its upper end. An inner support wall 17 is arranged substantially coaxially with the well wall 14 and is radially spaced from it. At its upper end, the support wall 17 also comprises a flange which matches with the abovementioned flange 16, both flanges being releasably fixed to each other by screwing. A bottom 18 is provided at the lower end of the support wall 17 and closes the hull 15 of the vessel. The upper end of the well is located above the water-line when the vessel is empty or unloaded. The in-board housing 11 of the rudder propeller is inserted and fixed in the support constituted by the bottom 18 and the wall 17. A rib structure 19 ensures rigidity or stiffness of the support.

The radial intermediate space between the outer and the inner walls 14, 17 is bridged by at least one annular thrust-block or several thrust-blocks 20, of which two possible embodiments are illustrated in Figures 4 and 5.

In Figure 4, a plate-like member 21 is fixed in (or on) the support wall 17, being welded to it, the member 21 having its radially outer surface inclined with respect to the well wall 14. The direction of the inclination is described below. A counter-support member 22 is introduced from the outside through an aperture in the well wall 14 and fixed by welding to the wall 14. The member 22 comprises two parts, viz. an outer part 23 consisting of a material which can be welded and an inner wedge 24 consisting of a material adapted to perform a support function, in particular a corrosion resistant material. The inclinations of the cooperating surfaces of the member 21 and the wedge 24 are oriented so that the support wall 17 together with the rudder propeller 2 can be raised. To this end the transverse dimensions of the well wall are larger than the corresponding transverse dimensions of the propeller 2. The members 21 and 22 are adjusted during assembly before the outer part 23 is welded to the wall 14.

In the embodiment shown in Figure 5, the outer part 25 of the member 22 is again welded to the well wall 14, but the wedge 26 is fixed so as to be subsequently adjustable, being bolted to the outer part 25. In this connection Figure 5 illustrates a simple form making use of known adjusting screws which is complicated but facilitates subsequent adjusting.

The arrangement of the rudder propellers in the front part of the vessel makes it possible to fit tow hooks on the rear end of the vessel so as to obtain maximum distance between the two hooks and the propellers. This ensures great stability and reliability in all possible working conditions.

WHAT WE CLAIM IS:—

1. A water craft having a thrust generator arranged under the front half of the hull of the craft and being retractable into a well in the hull, the thrust generator being fixed to a support having a peripheral wall encompassed by the peripheral wall of the well, the transverse dimensions of the thrust generator being smaller than the corresponding transverse dimensions of the well wall, the support wall being releasably fixed at one end to the well wall, and adjacent the other end the space between the two walls being bridged by one or more thrust blocks for taking the reaction of the thrust generator.

2. A water craft as claimed in claim 1, in which the upper end of the support wall is releasably fixed to the well wall.

3. A water craft as claimed in claim 1 or 2, in which the or each thrust block comprises two members having faces which bear against each other and are inclined with respect to the said walls, one member being fixed to the support wall and the other member being fixed to the outer well wall, the inclination of the faces being directed so that the support can be raised together with the thrust generator.

4. A water craft as claimed in claim 3, in which the said members are adjustable with respect to each to eliminate play.

5. A water vessel as claimed in any of claims 1 to 4, including a motor and transmission means for transmitting torque from the motor to the thrust generator, the transmission means including a clutch in combina-

propeller so that the vessel can be quickly braked, which is a precious manoeuvering facility when entering ports where stopping and alterations in speed are often required.

The clutch 9 is connected to the rudder propeller 2 by means of a universal-joint shaft 10. The entire rudder propeller substantially comprises a fixed in-board housing 11 and an out-board housing 12 which is mounted for rotation through 360° in the in-board housing 11. The torque is transmitted in a known manner from the universal-joint shaft 10 through a bevel drive (not shown) located in the in-board housing 11, a substantially vertical shaft which leads to the out-board housing 12, a bevel drive (not shown) disposed in the out-board housing 12, and a substantially horizontal propeller shaft which carries the propeller. The rotary motion of the out-board housing is controlled from the control room through a mechanical transmission device or an electrical-hydraulic or pneumatic remote control. A remote controlled unit 13 is diagrammatically illustrated. The remote controlled unit acts in a known manner on the out-board housing 12 *via* a drive (not shown).

The rudder propellers are each retractable into a well which substantially comprises a cylindrical wall 14 which constitutes a single piece with a hull 15, e.g. by being welded to it. The well wall 14 has a flange 16 at its upper end. An inner support wall 17 is arranged substantially coaxially with the well wall 14 and is radially spaced from it. At its upper end, the support wall 17 also comprises a flange which matches with the abovementioned flange 16, both flanges being releasably fixed to each other by screwing. A bottom 18 is provided at the lower end of the support wall 17 and closes the hull 15 of the vessel. The upper end of the well is located above the water-line when the vessel is empty or unloaded. The in-board housing 11 of the rudder propeller is inserted and fixed in the support constituted by the bottom 18 and the wall 17. A rib structure 19 ensures rigidity or stiffness of the support.

The radial intermediate space between the outer and the inner walls 14, 17 is bridged by at least one annular thrust-block or several thrust-blocks 20, of which two possible embodiments are illustrated in Figures 4 and 5.

In Figure 4, a plate-like member 21 is fixed in (or on) the support wall 17, being welded to it, the member 21 having its radially outer surface inclined with respect to the well wall 14. The direction of the inclination is described below. A counter-support member 22 is introduced from the outside through an aperture in the well wall 14 and fixed by welding to the wall 14. The member 22 comprises two parts, viz. an outer part 23 consisting of a material which can be welded and an inner wedge 24 consisting of a material adapted to perform a support function, in particular a corrosion resistant material. The inclinations of the cooperating surfaces of the member 21 and the wedge 24 are oriented so that the support wall 17 together with the rudder propeller 2 can be raised. To this end the transverse dimensions of the well wall are larger than the corresponding transverse dimensions of the propeller 2. The members 21 and 22 are adjusted during assembly before the outer part 23 is welded to the wall 14.

In the embodiment shown in Figure 5, the outer part 25 of the member 22 is again welded to the well wall 14, but the wedge 26 is fixed so as to be subsequently adjustable, being bolted to the outer part 25. In this connection Figure 5 illustrates a simple form making use of known adjusting screws which is complicated but facilitates subsequent adjusting.

The arrangement of the rudder propellers in the front part of the vessel makes it possible to fit tow hooks on the rear end of the vessel so as to obtain maximum distance between the two hooks and the propellers. This ensures great stability and reliability in all possible working conditions.

WHAT WE CLAIM IS:—

1. A water craft having a thrust generator arranged under the front half of the hull of the craft and being retractable into a well in the hull, the thrust generator being fixed to a support having a peripheral wall encompassed by the peripheral wall of the well, the transverse dimensions of the thrust generator being smaller than the corresponding transverse dimensions of the well wall, the support wall being releasably fixed at one end to the well wall, and adjacent the other end the space between the two walls being bridged by one or more thrust blocks for taking the reaction of the thrust generator.

2. A water craft as claimed in claim 1, in which the upper end of the support wall is releasably fixed to the well wall.

3. A water craft as claimed in claim 1 or 2, in which the or each thrust block comprises two members having faces which bear against each other and are inclined with respect to the said walls, one member being fixed to the support wall and the other member being fixed to the outer well wall, the inclination of the faces being directed so that the support can be raised together with the thrust generator.

4. A water craft as claimed in claim 3, in which the said members are adjustable with respect to each to eliminate play.

5. A water vessel as claimed in any of claims 1 to 4, including a motor and transmission means for transmitting torque from the motor to the thrust generator, the transmission means including a clutch in combina-

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tion with a friction brake which automatically comes into action when the clutch is disengaged.

6. A water craft substantially as described herein with reference to, and as shown in, the accompanying drawings.

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