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A ship's propulsion arrangement as well as a method and means related thereto

The present invention relates to an installation arrangement for a ship's propulsion assembly as disclosed in the preamble of claim 1, wherein the propulsion assembly comprises a modular housing structure i.e. a motor unit located outside the ship's hull. Said motor unit comprises a motor and a propeller and it is fitted to a structure connected to the ship, especially to an arm shaped structure extending outwards from the ship. The present invention also relates to a method as disclosed in the preamble of claim 8, according to which method the motor unit of the ship's propulsion device is installed to a structure connected to the ship and, respectively, removed therefrom, especially to an arm structure extending outwards from the ship. The present invention also relates to a connector plug arrangement as disclosed in the preamble of claim 10 specifically for transferring, in difficult conditions of use, electricity and/or flowing medium between two devices that can be interconnected and, respectively, be detached from each other, which connector plug arrangement is developed to realize the installation arrangement and, respectively, the installation method according to the present invention.

Ship's propulsion arrangements, wherein a propeller is fitted to a structure separate from the ship's hull are well known in the maritime field. In most cases the structure, as such, can be turned and by turning the structure the propeller stream can be directed into a desired direction. Thus, an arrangement built in this manner at the same time functions as the ship's propulsion system and as the ship's main steering device. An especially favorable embodiment of such a propeller arrangement includes a separate housing structure, a so called "pod", which in most cases is designed in a favorable shape with respect to the streaming water, in which pod the drive motor

for the propeller, in most cases an electric motor, is arranged. As an example of such an arrangement the propulsion system brought into the market under the applicant's trademark "Azipod" (TM) can be mentioned. Functionally, this kind of structure brings about a number of considerable advantages and for this reason such propulsion arrangements nowadays are adapted for the most different types of vessel.

This kind of propulsion devices have until now been installed so that the motor, the propeller shaft attached thereto and other kinds of functionally vital devices are arranged to an already existing housing structure at the end of the shaft structure, which housing structure is then closed watertight. However, this kind of installation on site is in some cases impractical, and thus an arrangement comprising a modular motor unit, which as such is connected to a separate arm portion of the propulsion device, is generally disclosed in an earlier Finnish patent application number FI-20000191 by the same applicant.

The object of the present patent application is to achieve an especially practical arrangement for the installation of one or, respectively, two or several motor units especially of modularly structure to a structure within the ship, especially but not exclusively to an arm structure extending outwards from the ship, which arm structure further favorably can be turned in relation to the ship.

Like all technical devices, also the propulsion arrangements of a ship at also certain intervals demand such maintenance, which most appropriately is carried out in dry conditions. Thus, there is a demand for installing the motor unit to and, respectively, for detaching it from the ship, so that the motor unit can easily and safely be overhauled and brought back to the ship. In this context there exists also need for testing of the devices.

Another object of the present invention is thus to disclose such an arrangement, which makes the installing and, respectively, the removing of the motor unit easier.

An object of the present invention is further to disclose such an arrangement, which renders the testing, attaching and, respectively, removing of the motor unit possible without opening the motor unit.

Another object of the present invention is to disclose such an arrangement, which renders a quick change of spare parts possible so that the entire motor unit can be changed as a complete module.

Another object of the present invention is to achieve such an arrangement, where the need for devices requiring separate maintenance or special feeding arrangements has been minimized.

The above objects are achieved according to the present invention as is disclosed in the appended claims. Thus, an arrangement according to the present invention is characterized therein that said housing structure comprises, at the end opposite to said propeller, first fitting means arranged for fitting said housing structure longitudinally to corresponding second fitting means arranged at said structure connected to the ship.

Correspondingly, the method according to the present invention is characterized therein that said motor unit is fitted to a fitting piece included in said structure, which structure is connected to the ship, or respectively removed therefrom, wherein said fitting or removal is effected by means of a generally longitudinal displacement in the direction of the motor's shaft so that cooperating connector plug means at said fitting piece and, respectively, at one end wall of the motor unit are essentially simultaneously brought to constitute a

connection between said structure connected to the ship and said motor unit, for supplying electric power to the motor or, respectively, brought to open such connection.

Correspondingly, the connector plug means according to the present invention is characterized therein that the arrangement comprises flexible fitting and transition means embedded in an insulating material, where the insulating material also forms resilient means for said fitting and adaptation means.

The present invention will now be described in more detail with reference to some favorable embodiments thereof and to the appended drawings, wherein

Figure 1 discloses as a general perspective view a general motor unit arrangement, in which one motor unit is installed to a arm structure extending outwards from a ship (not shown) according to one embodiment of the present invention,

Figure 2 discloses as a side view the arrangement according to Figure 1,

Figure 3 discloses in a corresponding view from above the arrangement according to Figures 1 and 2,

Figure 4 discloses as a perspective view the arm structure according to one embodiment of the present invention, which is thus intended for one motor unit,

Figure 5 discloses as a view from directly behind the arm structure with a fitting device arrangement according to Figure 4,

Figure 6 discloses as a side view the arm structure according to Figure 5,

Figure 6a discloses as a partially enlarged view the fitting of a connector plug means to the arm structure according to Figure 5,

Figure 7 discloses as a view from below the arm structure according to Figure 5,

Figure 8 discloses as a front view schematically the connector plug means arrangement according to one embodiment of the present invention,

Figure 9 discloses as a side view schematically the arrangement according to Figure 8,

Figure 10 discloses as a perspective view a separately formed lower part (upside down) of the arm structure, the lower part functioning as a fitting piece for one motor unit,

Figure 11 discloses as a corresponding perspective view the arm structure connecting to Figure 10 (likewise upside down),

Figure 12 discloses as a perspective view an arm structure arrangement for two motor units according to another embodiment of the present invention,

Figure 13 discloses as a front view (or, respectively, from the back) the arm structure according to Figure 12,

Figure 14 discloses as a corresponding side view the arm structure according to Figures 12 and 13,

Figure 15 discloses as a side view a single connector plug means arrangement according to one embodiment of the present invention, and

Figure 16 discloses as a sectional view the connector plug according to Figure 15.

In accordance with Figure 1 an arrangement according to the present invention generally includes a motor unit 1 comprising a housing structure, having an electric motor, as known per se, which in Figure 2 has been generally outlined by reference 25. To said motor is attached a longitudinal shaft 26 having a thrust bearing 24 at one end. To the opposite end 2 of the propeller shaft 26 a propeller is fitted, as known per se, which in Figure 2 is disclosed by reference 5. In a preferred embodiment according to the present invention the motor unit 1 has been fitted to an arm structure 3, which especially favorably, as known per se, has been turnably fitted, e.g., by means of an adapter ring 4 as shown in the Figure, to the bottom of the ship's hull (not shown). Figure 2 further discloses that the motor unit 1 has been fitted, at the end which is opposite to the propeller 5, to a favorably separately arranged adaptor piece of said arm structure 3 i.e. to a lower part 6 thereof, which part in accordance with the present invention is provided with installation holes 8 for fastening bolts (not shown) which are to be installed from outside at an end wall 7 of the motor unit from the outside. Favorably, the arrangement is such that said end wall 7 of the closed motor unit 1 also constitutes a wall for said lower part 6 of said arm structure 3 so that water streaming into the interior 21 of said lower part 6 also from that direction cools the motor unit 1 and especially said thrust bearing 24 of the shaft 26.

Figure 2 further discloses that the lower part 6 of the arm structure suitably has at least one maintenance opening 9 which usually is left open, which opening preferably at the same time functions as a cooling water opening so that the water outside the device can flow into the lower part 6 and out therefrom. Favorably, one or several separate cooling water openings 10, known per se, are arranged at said lower part 6 to open into a housing for said thrust bearing 24 of

said motor unit 1. Suitably, said bearing is provided with cooling flanges and according to one embodiment of the present invention it is arranged immediately at said end wall 7 of the motor unit 1 favorably to extend into the interior of said lower part 6, where said cooling water openings at the same time favorably function as said installation holes for said bolts. Figure 3 further discloses that the assembly as a whole and especially the arm portion 3 suitably is designed so that it presents a water stream interfering cross-sectional surface which is as small as possible.

An arm arrangement 3 according to one preferable embodiment of the present invention is disclosed in Figure 4 as a perspective view, in Figure 5 respectively as a view from the direction of the motor unit to be installed, in Figures 6 and 6A as a side view, and in Figure 7 as a view from below. In said arm arrangement 3 a peripheral rim 20 of the lower part 6 of the arm structure 3 is suitably evenly provided with holes 11 for fastening bolts for the motor unit. According to one especially preferable embodiment of the present invention the position of these fastening holes 11 is standardized so that every motor unit 1 of suitable size for the ship is provided with identical series of fastening holes 11. Correspondingly, the motor unit's 1 other fastening and installation arrangements 12 are also arranged at standard positions, i.e. preferably at one end 7 of the motor unit 1. Thus any motor unit 1 can in an essentially identical manner be fastened either to a single-end arm structure 3 according to Figure 5 or, respectively, to a double-end arm structure according to Figures 12 to 14 as described below in more detail. Due to the arrangement according to the present invention a standard-size motor unit 1 can be installed without opening the motor unit 1, since all the measures required for attaching it, such as installing and tightening of fastening bolts, can be carried out from the direction of the lower part 6 of the arm structure 3.

Figures 5 and 6a further disclose a detail of an especially preferable embodiment of the present invention, i.e. a connector plug means arrangement 12 generally disclosed in Figures 8 and 9. By means of the connector plug arrangement according to the present invention, one especially preferable embodiment of which is later disclosed, all the supply arrangements and connections required for the functioning of the motor unit 1, e.g., electric power supply 13, couplings 14 required for controlling the function of the motor unit, as well as piping 15 for lubrication, cooling or the like can be coupled at one single coupling stage preferably simultaneously with the fitting of the motor unit. Thus, the coupling of the motor unit can be carried out as one single work phase, which enables, e.g., a very rapid replacement of a possibly damaged motor unit with a spare motor unit 1. The same advantage is naturally already attained during the first installation, where a delivered standard motor unit 1 can be installed at the ship very rapidly.

The arrangement according to the present invention brings about also another advantage, i.e. a very easy pre-installation testing of a manufactured, detached or serviced motor unit 1. Since all the couplings required for the functioning and controlling of the motor unit 1 are simultaneously connected with one single "plug-and-play"-manoeuvre this type of coupling can be carried out practically anywhere, e.g., when testing the motor. Since there are no operations carried out inside the closed motor unit afterwards it is absolutely certain that the tested motor is in working condition.

Figures 8 and 9 disclose an example of a common standard connector plug arrangement according to one embodiment of the present invention. The Figures show that the thoroughpass and coupling unit 12 can suitably as such be equipped with a seal 16 of its own, and preferably so that a separate installation area arranged for each connector plug is further surrounded with a separate seal 16a. Connector plugs 18, e.g., the ones

disclosed in more detail in Figures 15 and 16, which plugs as such also comprise a dampproof seal 17, can be fitted to this type of assembly, so that the motor unit's 1 corresponding connector plug means (not shown) which are inserted into said connector plug 18 in one single simultaneous operation constitute a reliable connection for all feeding, operational and controlling functions.

Figures 10 and 11 disclose that the arrangement according to the present invention can further suitably be realized so that the lower part 6 of the arm arrangement 3 is arranged as a separate adaptor piece, which includes said standard connecting devices 8, 11, 12 for the motor unit. In this case the lower part 6 is suitably fitted to a proper, preferably turnable arm structure 3 connected to the ship so that the arm 3 and lower part 6 together form a shape-locking fit, e.g., by using separate form parts 19 and/or by interrelated design of the parts.

Figures 12 to 14 disclose in more detail an alternative embodiment of the arm structure 3 according to the present invention. In this case the lower part 6a of the arm assembly is two sided so that one motor unit 1 at any given time can be attached, at the end 7 which is opposite the propeller 5, to respectively opposite spaced fastening surfaces 20, 20a. These fastening surfaces 20, 20a are suitably arranged identically with regard to the holes 11 for the fastening bolts and, e.g., to the location of the connector plug means arrangement 12 so that a standard motor unit 1 can be installed at each end of the assembly. In this case the installation holes 8 for the bolts are favorably arranged at the suitably essentially cylindrical lower part 6a of the arm assembly 3 are arranged either as sunk into the outer surface of the lower part 6a, or so that the fastening and the tightening of the bolts to the end wall 7 of the motor unit 1 is carried out from the interior 21 of the lower part.

According to a preferable embodiment of the present invention the cooling arrangement for the bearing 24 opposite to the propeller 5 of the motor unit 1 is realized so that the bearing 24, as known per se, is cooled with water flushing through the lower part 6, 6a of the arm assembly 3. For this purpose the lower part 6, 6a is provided, e.g., with flow openings 9, 10, whose function can further be intensified with suitable pump or the like means (not shown). By arranging the cooling for the bearing 24 directly to the surrounding water a technically difficult oil circulation cooling arrangement for the bearings 24 can thus usually be omitted as unnecessary.

For the realization of a general arrangement according to the present invention a special connection arrangement 18 has further been developed, which is disclosed in more detail in Figures 15 and 16. This arrangement comprises at least somewhat flexible and preferably also as such slightly elastic oppositely cooperating coupling tongues 22, as known per se, in between which the coupling tongue of the cooperating counterpart (not shown), e.g., a counterpart complementing the connecting arrangement 12 of the end wall 7 of the motor unit 1, is pressed to constitute especially an electric connection. As distinct from the previously known, the connector plug arrangement according to the present invention is implemented so that the part of insulating material 17 used as a dampproof seal for the coupling, which insulating part favorably is provided with lip seals 23, at the same time functions as an elastic part for the coupling tongues 22. Thus, the insulation part 17 according to the connecting arrangement according to the present invention at the same time both seals and ensures the connection between the coupling tongues by pressing the coupling tongues 22 towards each other from both sides of the coupling tongue of the cooperating counterpart.

Above the invention has mainly been disclosed in context with an arm structure which extends outwards from the ship and which favorably also is, e.g., vertically turnable. However,

for a person skilled in the art it is clear that the present invention can be implemented also in many other ways within the scope of the appended claims. Thus. it is clear, e.g., that a corresponding arrangement can also be implemented in a case where the motor unit is installed to a fixed structure in a ship, e.g., replacing a removed conventional propeller assembly, directly to the hull of a ship or to a separate adaptor piece corresponding to a lower part 6 attached to the hull of the ship.

Claims

1. An installation arrangement for a ship's propulsion assembly comprising a modular housing structure i.e. a motor unit (1) located outside the ship's body, said housing structure comprising a motor (25) and a propeller (5), the housing structure being intended for fitting to a structure (3) connected to the ship, characterized in that said housing structure (1) comprises, at the end (7) opposite to said propeller (5), first fitting means arranged for fitting said housing structure (1) longitudinally to corresponding second fitting means (6, 6a, 8, 11, 12, 20, 20a) arranged at said structure (3) connected to the ship.
2. An arrangement as defined in claim 1, characterized in that said housing structure (1) is fitted as an essentially closed motor unit structure, from the fitting means (6, 6a, 11, 20, 20a) of which at least some (12) also constitute thoroughpass channels (13, 14, 15) for wiring/piping for supplying, control and monitoring functions for the motor (25) and related devices located in said housing structure (1).
3. An arrangement as defined in claim 1 or 2, characterized in that the fitting means (12) of the housing structure (1) are arranged at an end wall (7) of the housing structure (1) opposite to the propeller (5).
4. An arrangement as defined in any one of claims 1 to 3, characterized in that said fitting means (6, 6a, 8, 11, 12, 20, 20a) arranged at said structure (3) connected to the ship include essentially plug-like means (13, 14, 15, 18), which function together with corresponding means arranged at said housing structure (1) to constitute said thoroughpass channels (13, 14, 15).
5. An arrangement as defined in claim 4, characterized

r i z e d in that said plug-like devices (18) include flexible fitting and transformation means (22) embedded in an insulating material (17), where said insulating material (17) at the same time forms resilient means for said fitting and adaptation means (22), and favorably so that the insulating material (17) also functions as a primary insulator against the space outside (21) for electricity or a flowing medium passing through the plug arrangement (18).

6. An arrangement as defined in any one of claims 1 to 5, c h a r a c t e r i z e d in that the fitting means (8, 11, 12, 20, 20a) arranged at said structure (3) connected to the ship include a fitting piece (6, 6a), which on one side, or in an opposite disposition on both sides, comprise installation fittings (8, 11, 20, 20a), for the housing structure's fastening means, favorably flange means (20, 20a) for installation bolts to be installed from the direction of the fitting piece (6, 6a) to the housing structure (1), or for similar fastening means.

7. An arrangement as defined in any one of claims 1 to 6, c h a r a c t e r i z e d in that a bearing (24) for a shaft (26) of said motor (25) in the housing structure (1) is arranged so that the cooling of said bearing (24) can at least partially be realized by means of the water outside the propulsion device, favorably so that the bearing is arranged to the proximity of said end wall (7), when said fitting piece (6, 6a) of said structure connected to the ship, especially of an arm structure (3) extending outwards from the ship is, respectively, arranged to include water flow openings (10) for guiding cooling water to the inside (21) of said fitting piece and/or to said bearing (24).

8. A method for a installing a motor unit (1) of a propulsion device to a structure connected to a ship, especially to an arm structure (3) extending outwards from the ship, and, respectively, for removing said unit therefrom, c h a r a c -

terized in that said motor unit (1) is fitted to a fitting piece (6, 6a) included in said structure or separately arranged at said structure, which structure is connected to the ship, or respectively removed therefrom, wherein said fitting or removal is effected by means of a generally longitudinal displacement in the direction of the motor's shaft (26) so that cooperating connector plug means (18) at said fitting piece (6, 6a) and, respectively, at one end wall (7) of the motor unit (1) are essentially simultaneously brought to constitute a connection (13) between said structure (3) connected to the ship and said motor unit (1), for supplying electric power to the motor or, respectively, brought to open such connection.

9. A method as defined in claim 8, characterized in forming or, respectively, in opening any connections (14, 15) required for controlling of other functions of the motor unit or the like or for supplying any medium thereto, in parallel with forming the electric power supply (13), favorably by using parallel, essentially corresponding connector plug means (18).

10. A connector plug arrangement (18) for transmitting at difficult conditions especially electricity and/or a flowing medium between two devices that can be interconnected and, respectively, detached from each other, characterized in that the arrangement comprises flexible fitting and transition means (22) embedded in an insulating material (17), where the insulating material (17) also forms resilient means for said fitting and adaptation means.

11. An arrangement as defined in claim 10, characterized in that said insulating material (17) also functions as a insulator against the space outside (21) for the electricity or flowing medium passing through the plug arrangement (18).