

A motor unit for a ship

The present invention relates to a propulsion unit arrangement for a ship, said arrangement including a motor housing in the water, a motor located in said housing, associated control devices as well as a propeller arranged at the motor's shaft.

A conventional motor arrangement for a ship comprises a motor arranged within the ship's hull and a propeller arranged on the end of a motor shaft which extends in a watertight manner through the ship's hull. As the propeller rotates it brings water surrounding the ship into motion and thus creates a reaction force which thrusts the ship forwards. Said motor can be a directly employed diesel engine or like combustion engine or, favorably, an electric motor to which necessary electric power is supplied by a conventional combustion engine, a gas turbine, a nuclear power plant or the like. The steering of such ships is conventionally being arranged so that a pivoting rudder is provided in the propeller's wake, said rudder deflecting the wake and thus creating a lateral force component in relation to the longitudinal direction of the ship.

Other types of so called propulsion units are also known, wherein the propeller as such can be pivoted for the purpose of steering the ship. This pivoting motion can be accomplished by means of a rather complicated shaft arrangement, or in such a way that the propeller is arranged at the shaft of a motor which as such is arranged to be rotatable around a vertical axis. This latter arrangement is called an azimuthing propulsion device, and such a device is described in, for example, the applicant's Finnish patent No. 76977, which device is being marketed by the applicant under the trademark AZIPOD.

Until now all arrangements implemented for ships have the feature in common that the motors per se, as well as other

devices and means, are adapted to constitute an essentially integral part of the ship right from the stage of building the ship. Thus, any thorough repair or replacement of the motor can hardly take place unless the ship is docked, after which substantial portions of the ship is dismantled for enabling the replacement to be done. Thus, the only repair job that is somewhat simply and easily accomplished, is usually the task of replacing a damaged propeller, whilst it always will take a long time indeed to perform other, more extensive repairs.

A further disadvantage of motor arrangements which are implemented separately for each ship, is that since a motor is being built separately for each ship in any case, the number of motor alternatives tends to increase, and thus full advantage cannot be taken of long serials. The production costs are affected in an unfavorable manner by the complexity of such arrangements and short serials.

An arrangement according to the present invention has been developed in order to eliminate these disadvantages and other ones caused by multiformity, the characteristic features of which arrangement are disclosed in the appended claims. Thus, the general arrangement according to the present invention is characterized in that the ship's propulsion arrangements include a separate motor housing which is arranged to form such a separate modular motor unit which can be attached to the ship by means of fastening means.

A multitude of significant advantages are achieved by using such a modular arrangement, particularly in connection with the aforementioned azimuthing propulsion system, which advantages are presented below in more detail with reference to different embodiments of the present invention. In the specification exemplifying references are made to the attached drawings, where

Fig. 1 as a schematic section discloses an example of an embodiment of a modular motor arrangement in connection with an azimuthing propulsion system,

Fig. 2 in a corresponding manner discloses a favorable embodiment of a modular motor unit, the embodiment comprising two essentially identical motor units,

Fig. 3 in a corresponding manner discloses a solution wherein a modular motor unit according to the present invention is arranged as a fixed propulsion means in the stern of a ship, thus replacing a conventional propeller arrangement, and

Fig. 4 discloses a solution wherein a motor unit is installed in such a manner, that the propeller shaft is aligned off the horizontal.

Referring to Fig. 1, a modular motor unit 1 according to the present invention generally comprises an electric motor 2 having a shaft 3 provided with a propeller 4. An outer casing 5 of the motor unit is favorably arranged so that the motor 2 gets its cooling directly through the casing 5 from the surrounding water 6 surrounding, as explained in more detail in a co-pending patent application. The motor shaft 3 is mounted in bearings 7 in both ends of the motor in a manner known per se, in connection with which bearings gaskets, known per se, are suitably arranged so that the interior 8 of the motor favorably is fully isolated from the surrounding water 6 and suitably also from the interior 10 of a mounting assembly 9.

The motor unit includes fastening means, suitably in the form of a flange 11, by which the motor unit can be attached to corresponding flange means 16, 16a, 16b arranged on said mounting assembly 9, or in the case according to Fig. 3 directly to means 16c arranged at the ship's hull 12. In order to render the attachment as effective as possible Fig.1 shows

schematically using reference number 13 that connections to the motor 2, such as a power supply, control and monitoring means, any lubricating and/or cooling means etc., preferably are connected via a central connector to mounting assembly 10 or to the ship's hull 12, respectively.

Several considerable advantages are achieved by a general arrangement according to the present invention. Firstly, the motor unit can be given an extremely compact design. Since the device in question to a large extent is a standard set-up, which as such is applicable to a multitude of uses, the motor unit 2, which in itself contains even complex technology, can be produced in long series without any significant consideration of the final use. This also ensures that the supply of spare parts for the motor unit can be very extensive, to start with having complete units as such available as goods in stock at the most important shipyards or even carried on board the ship.

Due to its compact design the arrangement according to the present invention provides a significantly smaller cross section in the flow direction, compared to present ones, which provides a better propulsion efficiency with a smaller propeller. It is also usually possible to use smaller bearings 7. One important advantage is also the fact that it is easy to implement redundancy.

From the aspects of product delivery and maintenance, the arrangement according to the present invention enables rapid production and shorter stock turnover time. Maintenance is fast and simple due to inter-changeability and standard models, which is a significant advantage considering the fact, that ship lay days for maintenance or repair can become extremely expensive.

Favorably, the arrangement disclosed in Fig. 1 functionally represents the azimuthing propulsion system described above,

i.e. the whole assembly 9 is rotatable around a vertical axis A-A. Thus, the assembly including the motor replaces the propeller-rudder assembly of more old fashioned technology and, among other things, provides clearly better efficiency and improved turning characteristics compared to that. The assembly 9 in the embodiment according to Fig. 1 comprises a preferably essentially hollow and suitably at least to some extent curved body part attached by flanges to arrangements for turning, power supply, and control, which are known per se in the art and which are referred to only allusively by reference number 14. Due to the curved mounting assembly the whole device turns in an optimal way in a similar manner as the azimuthing propulsion devices known thus far.

Cooling directly through the outer casing 5 of the motor unit 1, as implemented according to a co-pending patent application, can be implemented particularly well by the arrangement according to the present invention, wherein a symmetry required for balanced cooling is easily achieved. Due to the modular structure, there are no such external parts of the unit which would cause discontinuance locations in regard to cooling, and thus access is provided everywhere for the surrounding water 6 to act as a coolant. Along with said arrangement a conventional air cooling including ducts and special arrangements can be omitted. Thus, production of the motor unit is facilitated and speeded up, and the weight of the unit will be small, and thus the size of any production equipment required for the production of the unit can be reduced as well.

A particularly favorable solution is presented in Fig. 2, wherein two modular motor units 1 and 1a are used attached to a common rotatable assembly 9a. These motor units 1 and 1a can each have a separate power supply or a common one. According to one embodiment the two motors 2 and 2a in tandem can, if necessary, further be mechanically interconnected by a clutch generally referred to as 15. Alternatively, the motors 1 and

1a also can be operated in opposite directions. Thus, the arrangement here offers the possibility of both a common control of the two motors 2, 2a as well as individual control so that each motor is driven on controls of its own.

In the embodiments in Figures 1 and 2 described above, as well as in the one in Fig. 4 to be discussed later, the motor units 1, 1a according to the present invention are been attached to rotatable arm assemblies to provide an azimuthing propulsion system. Fig. 3, on the other hand, discloses a solution where a modular motor unit 1 according to the present invention is attached directly to the ship's hull, thus replacing a conventional propeller assembly. Also in this case a considerable number of the advantages offered by the modular structure can be achieved.

Finally, Fig. 4 shows that a modular motor unit according to the present invention in some special applications also can be mounted so that the direction of the motor shaft differs from the horizontal.

Above some favorable embodiments of the present invention have been disclosed by way of example, but for a person skilled in the art it will be clear that the invention is not limited to those alone, but that it can be modified in many different ways within the scope of the appended claims.

Claims

1. A propulsion unit arrangement for a ship, said arrangement including a motor housing located in the water (6) as well as a motor (2, 2a) arranged therein, and further including control devices related thereto and a propeller (4) arranged at the motor's shaft (3, 3a), c h a r a c t e r i z e d in that said motor housing is arranged as a separate modular motor unit (1), which is attachable to a ship (12) by means of fastening means (11, 16, 16a, 16b, 16c).
2. An arrangement according to claim 1, c h a r a c t e r i z e d in that said fastening means include flange means (11, 16, 16a, 16b, 16c), by means of which said modular motor unit (1) can be attached to a separate support system arranged onto the ship (12), favorably so that said flange means (11 and 16, 16a, 16b, 16c, respectively) have connection means (13) for power supply, control and similar functions for said motor (2, 2a).
3. An arrangement according to claim 1 or 2, c h a r a c t e r i z e d in that said support means arranged at the ship (12) comprise an assembly (9) which is rotatable around a vertical axis (A-A), said assembly being attached to the ship (12) through the ship's essentially horizontal bottom, whereby said rotatable assembly (9) at its upper end includes turning gear (14) for turning said assembly (9) particularly in connection with steering the ship (12), as well as slip-ring or the like means for conveying the motor's power supply and/or control and/or the like functions to said one or more motor units (1, 1a) arranged at said assembly (9).
4. An arrangement according to claim 3, c h a r a c t e r i z e d in that said assembly (9) comprises an essentially curved supporting beam having said flange means (16) at one end for attaching said motor unit (1, 1a) to said assembly (9).

5. An arrangement according to claim 3 or 4, characterized in that said assembly (9) comprises an essentially vertical central body (9a) as well as several flange means (16a, 16b) arranged thereto, suitably two opposite flange means, to each of which flange means (16a, 16b) one motor unit (1, 1a), respectively, can be attached suitably so that said shafts (3, 3a) of said motors (2, 2a) will be located in essentially a common horizontal plane and suitably so that said shafts, if necessary, can be clutched to each other (15).
6. An arrangement according to any one of claims 3 to 5, characterized in that said flange means (16, 16a, 16b) of said assembly (9) are arranged so that the motor unit's (1, 1a) propeller shaft (3, 3a) extends essentially horizontally.
7. An arrangement according to any one of claims 3 to 5, characterized in that said flange means (16) of said assembly (9) are arranged so that the propeller shaft of the at least one motor unit (1) extends in a direction which differs from the horizontal direction.
8. A unit according to claim 1 or 2, characterized in that said flange means (16c) arranged for the attachment of said motor unit (1) are arranged permanently to the ship's (12) hull, suitably to a protrusion arranged on said hull.
9. A unit according to any one of the preceding claims 1 to 8, characterized in that said motor unit (1, 1a) includes an electric motor (2, 2a), which preferably to essential portions is cooled through the units' casing structure

(5) directly to a medium (6) located outside said unit.

10. A unit according to claim 9, characterized in that said motor unit (1, 1a) is provided with additional means for setting in motion a medium inside said motor unit (1, 1a) in order to enhance a heat transfer between said motor (2, 2a) and said medium (6) located outside said unit.