The invention relates to a rudder propeller drive comprising a driving motor (1), the output shaft of which can be effectively connected to a shaft of a propeller by means of a drive train. The propeller shaft is accommodated in a rudder propeller housing that can be mounted outside a hull, while the propeller on the propeller shaft is located outside the rudder propeller housing. A lubricating and/or cooling device is provided for the propeller shaft and/or for drive train areas mounted in front of the propeller shaft. The drive train encompasses a hydrodynamic clutch (3) or a hydrodynamic torque converter which is combined with or integrated into the lubricating and/or cooling device in such a way that the hydrodynamic clutch or the hydrodynamic torque converter and the lubricating and/or cooling device use a joint amount of functional fluid.
RUDDER PROPELLER DRIVE, AND RUDDER PROPELLER DRIVING METHOD

[0001] The present invention relates to a rudder propeller drive according to the preamble of Claim 1 and a rudder propeller driving method therewith.

[0002] For example, a rudder propeller drive with a drive motor, in particular, specified in the preamble of Claim 1, is known from DE 200 21 466 U1. Also known from practice is the use of hydrodynamic clutches in connection with ship drives, i.e., embedded in the drivetrain of a driving unit. The hydrodynamic clutch is also an autonomous element, however, with a closed casing and a fluid filling with its own fluid, oil for example.

[0003] The present invention has and achieves the objective of refining a known rudder propeller drive in such a manner that it is particularly inexpensive to manufacture and operate.

[0004] This objective is achieved with a rudder propeller drive with a drive motor, the output shaft of which can be functionally connected to a shaft of a propeller via a drivetrain, the propeller shaft being accommodated in a rudder propeller housing that can be mounted outside a hull, and the propeller on the propeller shaft being situated outside the rudder propeller housing, a lubricating and/or cooling device being provided for the propeller shaft and/or for drivetrain areas upstream of the propeller shaft, the drivetrain further containing a hydrodynamic clutch or a hydrodynamic torque converter, which is combined with the lubricating and/or cooling device or integrated into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter and the lubricating and/or cooling device use a common functional fluid supply.

[0005] The functional fluid of the lubricating and/or cooling device and the functional fluid of the hydrodynamic clutch or hydrodynamic torque converter can thereby be advantageously realized with one and the same fluid supply.

[0006] An advantageous refinement is that the lubricating and/or cooling device contains the interior of the rudder propeller housing, it being further preferred that functional fluid be contained in the interior of the rudder propeller housing and/or that the hydrodynamic clutch or the hydrodynamic torque converter be in fluidic contact with the interior of the rudder propeller housing. The latter can be advantageously realized by situating the hydrodynamic clutch or the hydrodynamic torque converter in the interior of the rudder propeller housing or in an extension of the rudder propeller housing inside the ship's hull. Such an extension is referred to structurally as a conical support tube or a support cone.

[0007] Yet another preferable configuration of the invention consists in combining the hydrodynamic clutch or the hydrodynamic torque converter with the lubricating and/or cooling device or integrating the lubricating and/or cooling device into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter ensures a conveyance of the functional fluid in the lubricating and/or cooling device.

[0008] It can be further advantageously provided that the hydrodynamic clutch contains several hydrodynamic clutch units or the hydrodynamic torque converter contains several hydrodynamic converter elements. Alternatively or additionally, it can be provided that an elastic clutch and/or a shiftable clutch be installed in the drivetrain.

[0009] Additionally, the drive motor can be advantageously situated inside the hull.

[0010] In a rudder propeller driving method according to the invention, it is provided that an output shaft of a drive motor is functionally connected to a shaft of a propeller via a drivetrain, which propeller shaft is accommodated in a rudder propeller housing located outside a hull and which propeller is situated on the propeller shaft outside the rudder propeller housing, the propeller shaft and/or drivetrain areas upstream of it being lubricated and/or cooled with a functional fluid, the drivetrain containing a hydrodynamic clutch or a hydrodynamic torque converter to which functional fluid is fed that is part of the same supply of functional fluid used for lubricating and/or cooling the propeller shaft and/or drivetrain areas upstream of the propeller shaft.

[0011] An advantageous refinement is that the lubricating and/or cooling device contains the interior of the rudder propeller housing, and that the hydrodynamic clutch or the hydrodynamic torque converter is in fluidic connection with the interior of the rudder propeller housing, wherein, in particular, functional fluid can be contained in the interior of the rudder propeller housing, wherein, further, preferably the hydrodynamic clutch or the hydrodynamic torque converter is situated in the interior of the rudder propeller housing or in an extension of the interior of the rudder propeller housing, such as a conical support tube or a support cone inside the hull.

[0012] Preferably, it can be further provided that the hydrodynamic clutch or the hydrodynamic torque converter is combined with the lubricating and/or cooling device or integrated into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter ensures a conveyance of the functional fluid in the lubricating and/or cooling device.

[0013] According to individual configurations, the invention creates a ship drive in the form of a rudder propeller, for example, with an integrated vertically-arranged drive motor and, particularly advantageously, with a hydrodynamic clutch or hydrodynamic torque converter integrated into the interior of the rudder propeller housing, which is a component of lubrication and cooling devices, or into an extension of the housing. The integration of the hydrodynamic clutch or the hydrodynamic torque converter into the interior of the rudder propeller housing or an extension thereof results in the possibility of constructing a compact drive system. By positioning the hydrodynamic clutch or the hydrodynamic torque converter inside the functional fluid filling, in particular, the oil filling of the rudder propeller housing, the lubricant and coolant of the drivetrain for the rudder propeller and the filling for the hydrodynamic clutch or the hydrodynamic torque converter can be realized with one and the same fluid. This makes a seal of the hydrodynamic clutch or the hydrodynamic torque converter against the environment of the type that is necessary for a conventionally arranged hydrodynamic clutch or hydrodynamic torque converter unnecessary. The extension mentioned above refers to a conical support tube or to a support cone.

[0014] Hydrodynamic clutches or hydrodynamic torque converters have a natural pumping effect from the inside to the outside. This pumping effect can be used by the invention to implement the exchange of fluid, in particular, the exchange of lubricant, between the underwater part of the rudder propeller drive, generally very well cooled by the surrounding navigation water, for example, seawater, and the
upper part, which is cooled poorly or not at all. In designs known today, separate pumps are necessary for this purpose. [0015] The hydrodynamic clutch or the hydrodynamic torque converter can also be constructed as a so-called double clutch or double converter, whereby twice the transmittable torque results for the same clutch or converter diameter. The torque in a given direction of revolution can also be increased by using a hydrodynamic clutch with blades at an angle in the tangential direction in the pump and turbine wheel of the hydrodynamic clutch. This preferably takes place in the forward direction, which is responsible for the propeller thrust. The inclined position of the blades results in a lower transmittable torque in the opposite direction of revolution, i.e., for backward thrust, but that is required only in limited operating situations of the rudder propeller drive.

[0016] Further advantages of the invention are:

[0017] vibration decoupling of drive machine and working machine with a compact overall space,

[0018] outstanding acoustic isolation of the drive motor from the mechanical structure (rudder propeller and ship), whereby particularly quiet operation is possible,

[0019] reduction of the starting torque of the drive motor, i.e., achievement of an optimally or especially small starting torque of the drive motor,

[0020] lubrication/cooling of the rudder propeller and filling of the hydrodynamic clutch or the hydrodynamic torque converter with only one fluid and, thus, reduction of the variety of operating materials,

[0021] exploitation of the pumping effect of the hydrodynamic clutch or the hydrodynamic torque converter for circulating the lubricating/cooling agent or fluid, and, thus, elimination of a corresponding pumping device,

[0022] elimination of seals and, thus, wear parts on the clutch and, therefore, considerable savings for maintenance and service, and

[0023] protection of the rudder propeller against overload shocks due, for example, to ship grounding, foreign objects in the water, ice and the like.

[0024] Additional preferred and/or advantageous implementations of the invention follow from the claims and combinations thereof, as well as from the entirety of the present application documents.

[0025] The invention will be described below in detail below based on embodiment examples with reference to the drawings, in which

[0026] FIG. 1 shows a first embodiment example of a rudder propeller drive a schematic longitudinal section.

[0027] FIG. 2 shows a second embodiment example of rudder propeller drive a schematic longitudinal section.

[0028] FIG. 3 shows a third embodiment example of rudder propeller drive a schematic longitudinal section, and

[0029] FIG. 4 shows a fourth embodiment example of a rudder propeller drive a schematic longitudinal section.

[0030] The invention is explained in detail with reference to the embodiment and application examples described below and represented in the drawings only for the sake of example, i.e., it is not limited to these embodiment and application examples or to the combinations of characteristics within these embodiment and application examples. Method and device characteristics also follow, respectively, from device and method characteristics.

[0031] Individual characteristics that are specified and/or illustrated in connection with a concrete embodiment example are not limited to this embodiment example or the combination with the other characteristics of this embodiment example, but can instead be combined, within the scope of that which is technically possible, with any other variants, even if they are not separately discussed in the present documents.

[0032] Identical reference characters in the individual figures and figures of the drawing designate identical or similar or similarly functioning components. With reference to the representations in the drawing, those characteristics that are not furnished with a reference character will also become clear, independently of whether such characteristics are described below. On the other hand, characteristics that are contained in the present description but not visible or not shown in the drawings are immediately understandable to a person skilled in the art.

[0033] FIG. 1 schematically shows, in a longitudinal section, a first embodiment example of a rudder propeller drive R with a drive motor 1 and a rudder propeller housing G mounted on a hull 2. A rudder propeller drive R with a “simple” hydrodynamic clutch 3, i.e., one pump wheel 3a and one turbine wheel 3b, is shown. The hydrodynamic clutch is illustrated and shown in connection with the embodiment examples is understood to be merely an example, and in place of a hydrodynamic clutch, a hydrodynamic torque converter can also be used within the scope of the present invention and achieve the same results and advantages. Whenever a hydrodynamic clutch is referenced below, it is immediately clear to a person skilled in the art that a hydrodynamic torque converter, with the respective technical adaptations, can be provided without this being reiterated at every individual point. While the slippage of the rotational speed in a conventional hydrodynamic clutch is constant or is adjusted by the amount of functional fluid, the transmission of torque in the torque converter is adjusted, but this is not done by changing the filling with functional fluid, but rather by adjusting guide vanes.

[0034] The representation of a rudder propeller drive R with a propeller P in a nozzle D is also only for the sake of example here. The use with a vertically arranged drive motor 1, such as an electric motor is likewise to be understood as an example. Hydrodynamic clutch 3 can equally well be used in a rudder propeller drive R driven mechanically in some other way, for example, using a bevel gear in the drivetrain A.

[0035] Additional components of the [rudder propeller drive] are an oil-filled interior space 4 of a rudder propeller housing G, a vertical axis 5, drivetrain A, a rudder propeller housing base steerable about vertical axis 5, a vertical shaft 7 of drivetrain A, an underwater part 8 of rudder propeller housing G with a gearbox (not shown), a propeller shaft 9, an azimuth adjusting drive 10 and a nozzle D.

[0036] In this embodiment example of rudder propeller drive R, hydrodynamic clutch 3 is used inside of oil-filled rudder propeller housing G, which in concrete terms has an extension E towards the interior of hull 2, in which extension E hydrodynamic clutch 3 is accommodated. Thereby the oil, which can be referred to in general as a lubricating and cooling fluid, or simply a functional fluid B, simultaneously constitutes the functional fluid B or medium for hydrodynamic clutch 3, since interior 4 of rudder propeller housing G transitions into interior 4 of extension E. In more precise terms, hydrodynamic clutch 3 operates from the same supply of functional fluid as a lubricating and/or cooling device SK that is essentially formed of rudder propeller housing G with a
supply of functional fluid B. Such an extension E is, for example, a structure such as conical support tube or a support cone.

[0037] The pumping effect of hydrodynamic clutch 3 is additionally shown in FIG. 1 by means of arrows F. This pumping effect is used completely or in part to circulate the functional fluid B, such as oil, in rudder propeller housing G, which is normally done by an additional impeller or an external pump.

[0038] An arrangement of hydrodynamic clutch 3 or a hydrodynamic torque converter, usable alternatively, on propeller shaft 9 is also possible in principle.

[0039] Insofar as components and parts are labeled in FIGS. 2-4, the same reference characters as for FIG. 1 are used. To avoid repetition, only differences of the embodiment examples in accordance with FIGS. 2-4 with respect to the embodiment example in accordance with FIG. 1 will be described and explained.

[0040] In a schematic longitudinal section analogous to FIG. 1. FIG. 2 shows a rudder propeller drive R with a double hydrodynamic clutch 3, i.e., with two pump wheels 3a and two turbine wheels 3b as an additional embodiment example. A clutch with more than two pump wheels 3a and turbine wheels 3b is equally conceivable, however.

[0041] In a schematic longitudinal section analogous to FIGS. 1 and 2, yet another embodiment example of a rudder propeller drive R is shown in FIG. 3, with a hydrodynamic clutch 3 and an openly rotating propeller P, i.e., without a nozzle D as in the first and second embodiment examples.

[0042] In a schematic longitudinal section analogous to FIGS. 1-3, FIG. 4 illustrates a rudder propeller drive R with a hydrodynamic clutch 3 in a twin propeller design, i.e., with two propellers P.

[0043] As already explained above, concrete reference was made in the description of embodiment examples to a hydrodynamic clutch, which is only to be understood as an example. Instead of a hydrodynamic clutch, a hydrodynamic torque converter can also be used in the sense of the invention. Since a hydrodynamic torque converter is, thus, also suitable in principle to be used in the present application, a person skilled in the art can easily provide devices and methods with a hydrodynamic torque converter, possibly with the necessary adaptations of apparatus and method, instead of the hydrodynamic clutch used as an example, without being inventive on his own and without departing from the scope of the present invention.

[0044] The invention has been presented based on the embodiment examples in the description and the drawing only for the sake of example and is not limited thereto, but rather comprises all variations, modifications, substitutions and combinations that a person skilled in the art can derive from the present documents, in particular, within the scope of the claims and the general presentations in the introduction to this description, as well as the descriptions of embodiment examples, and combine with his expert knowledge and prior art. In particular, all individual characteristics and implementation possibilities of the invention and its embodiment examples can be combined.

LIST OF REFERENCE CHARACTERS

[0045] 1 Drive motor
[0046] 2 Hull
[0047] 3 Hydrodynamic clutch
[0048] 3a Pump wheel
[0049] 3b Turbine wheel
[0050] 4 Oil-filled interior space of the rudder propeller housing
[0051] 4' Interior space 4' of the extension
[0052] 5 Vertical axis
[0053] 6 Rudder propeller housing steeple about the vertical axis
[0054] 7 Vertical shaft of the drivetrain
[0055] 8 Underwater part of the rudder propeller housing with gearbox
[0056] 9 Propeller shaft
[0057] 10 Azimuth adjustment drive
[0058] A Drivetrain
[0059] B Functional fluid
[0060] D Nozzle
[0061] E Extension
[0062] F Arrows
[0063] G Rudder propeller housing
[0064] P Propeller
[0065] R Rudder propeller drive
[0066] SK Lubricating and/or cooling device

1. Rudder propeller drive with a drive motor, the output shaft of which can be functionally connected to a shaft of a propeller via a drivetrain, wherein the propeller shaft is accommodated in a rudder propeller housing that can be mounted outside a hull, and the propeller on the propeller shaft is located outside the rudder propeller housing, wherein a lubricating and/or cooling device is contained for the propeller shaft and/or for drivetrain areas upstream of the propeller shaft,

wherein
the drivetrain contains a hydrodynamic clutch or a hydrodynamic torque converter that is combined with the lubricating and/or cooling device or integrated into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter and the lubricating and/or cooling device use a common supply of functional fluid.

2. Rudder propeller drive according to claim 1, wherein the lubricating and/or cooling device contains the interior of the rudder propeller housing.

3. Rudder propeller drive according to claim 2, wherein the functional fluid is contained in the rudder propeller housing.

4. Rudder propeller drive according to claim 2, wherein the hydrodynamic clutch or the hydrodynamic torque converter is fluidically connected to the interior of the rudder propeller housing.

5. Rudder propeller drive according to claim 4, wherein the hydrodynamic clutch or the hydrodynamic torque converter is located in the interior of the rudder propeller housing.

6. Rudder propeller drive according to claim 4, wherein the hydrodynamic clutch or the hydrodynamic torque converter is located in an extension of the interior of the rudder propeller housing inside the hull.

7. Rudder propeller drive according to claim 1, wherein the hydrodynamic clutch or the hydrodynamic torque converter is combined with the lubricating and/or cooling device or integrated into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter ensures a conveyance of the functional fluid in the lubricating and/or cooling device.

8. Rudder propeller drive according to claim 1, wherein the hydrodynamic clutch contains several hydrodynamic clutch...
units or the hydrodynamic torque converter contains several hydrodynamic converter elements.

9. Rudder propeller drive according to claim 1, wherein an elastic clutch is additionally installed in the drivetrain.
10. Rudder propeller drive according to claim 1, wherein a shiftable clutch is additionally installed in the drivetrain.
11. Rudder propeller drive according to claim 1, wherein the drive motor lies inside the hull.
12. Rudder propeller driving method, wherein an output shaft of a drive motor is functionally connected to a shaft of a propeller by means of a drivetrain, which propeller shaft is accommodated in a rudder propeller housing located outside a hull, and which propeller on the propeller shaft is located outside the rudder propeller housing, wherein the propeller shaft and/or drivetrain areas upstream of the propeller shaft is/are lubricated and/or cooled using a functional fluid,

wherein
the drivetrain contains a hydrodynamic clutch or a hydrodynamic torque converter to which functional fluid is fed that is part of the same supply of functional fluid used for lubricating and/or cooling the propeller shaft and/or drivetrain areas upstream of the propeller shaft.
13. Rudder propeller drive method according to claim 12, wherein the lubricating and/or cooling device contains the interior of the rudder propeller housing, and the hydrodynamic clutch or the hydrodynamic torque converter is fluidically connected to the interior of the rudder propeller housing.
14. Rudder propeller method according to claim 13, wherein the functional fluid is contained in the rudder propeller housing.
15. Rudder propeller drive method according to claim 14, wherein the hydrodynamic clutch or the hydrodynamic torque converter is located in the interior of the rudder propeller housing.
16. Rudder propeller drive method according to claim 14, wherein the hydrodynamic clutch or the hydrodynamic torque converter is located in an extension of the interior of the rudder propeller housing inside the hull.
17. Rudder propeller drive method according to claim 12, wherein the hydrodynamic clutch or the hydrodynamic torque converter is combined with the lubricating and/or cooling device or integrated into the lubricating and/or cooling device in such a manner that the hydrodynamic clutch or the hydrodynamic torque converter ensures a conveyance of the functional fluid in the lubricating and/or cooling device.

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