STEERING AND PROPULSION ARRANGEMENT FOR SHIP

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Related US Application Data
Division of application No. 10/543,582, filed on Aug. 11, 2005, now abandoned, filed as 371 of international application No. PCT/FI04/00024, filed on Jan. 19, 2004.

ABSTRACT
A large ship having a hull about 100 meters or more in length, so that the ship is suited for transoceanic traffic, with a narrow wedge-like bow and the broadest part of the underwater hull being located amidships, includes at least one steerable rudder propeller device at the forebody of the ship. The steerable rudder propeller device(s) at the forebody of the ship substantially provide(s) the steering and control of the ship and produce(s) a part of the propulsive force pushing the ship forward at least substantially within all speed ranges. In harbour maneuvering, the steerable rudder propeller device(s) at the forebody of the ship provide(s), as needed, at least about 20% of the ship's total propulsive power. When steering ahead in sea traffic, the steerable rudder propeller device(s) at the forebody of the ship provide(s) at most about 10% of the ship’s total propulsive power.
STEERING AND PROPULSION ARRANGEMENT FOR SHIP


BACKGROUND OF THE INVENTION

[0002] The present invention relates to a steering and propulsion arrangement in a large ship suited for transoceanic traffic, which arrangement comprises a number of propulsion devices situated partly at the rear and partly at the forebody of the ship.

[0003] From prior art are known steerable rudder propeller devices, which are driven either by a mechanical force transmission means or an electric motor arranged inside the device. The device enables the turning of the propeller device about its vertical axis, and the propulsive force of the propeller can thus be turned in desired direction. In addition, the propeller's rotational speed and direction of rotation may be adjusted and/or the angle of propeller blades changed.

[0004] Rudder propeller devices have been arranged at the forebody for instance in ferries that move in two directions. In these vessels the forebody and rear of the hull have been nearly identical. This kind of a hull configuration is not suitable for other types of vessels. Further, rudder propeller devices have been utilized in various kinds of landing crafts, the rear of which has generally been designed conveniently so that it enables the landing. In this case the rudder propellers, if any, at least some of which extend deeper down than the bottom of the vessel, are made retractable so that they can be protected when the aim is to steer the vessel as long as possible ashore.

[0005] During the centuries the hull of large ships suited for transoceanic traffic has developed so that it is characterised by a bow being typically narrow like a wedge, the broad part of the underwater hull being located amidships and the propellers being traditionally situated at the rear of the vessel. Large ships refer here to ships, whose length is about 100 meters or more, whereby particularly such ship types as large cruisers are included, but also for instance icebreakers etc. The manoeuvring of such vessels into harbour requires considerable propulsive efficiency at the forebody of the vessel. The present equipment used for manoeuvring the bow produces propulsion, however, only sideways and can be used only when the vessel does not move or moves at low speed. However, some special arrangements are known where a rudder propeller or the like is mounted in a specific recess made to the bottom of the vessel's front part. These solutions surely improve the manoeuvrability of the vessel when harbour manoeuvring is concerned, but in practice they are not applicable to steering ahead at higher speeds.

[0006] Rudder propeller devices have been arranged also at the rear of large ships to either partially or completely replace the actual rudder. When large ships provided with such rudder propellers steer for instance in a fairly narrow passage, lateral drift might become a problem tending to impair the manoeuvrability of the ship due to the considerable lateral surface thereof.

[0007] A purpose of the present invention is to provide a novel steering and propulsion arrangement for large ships that normally move in one direction and are suited for transoceanic traffic, in which arrangement the above described problems are as far as possible eliminated. An aim is that the solution can with advantage be utilised in various modes of operation and steering of a ship.

SUMMARY OF THE INVENTION

[0008] According to the invention the forebody of the ship is provided with one or more steerable rudder propeller devices, which are arranged so as to substantially provide the steering and control of the ship, to produce a substantial part of the propulsive force pushing the ship forward at least substantially within all speed ranges, and in addition, arranged so that they do not extend, at least not significantly, below the base line of the ship. The base line of the ship refers here to the lowest hull section determining the draught of the ship.

[0009] The solution according to the invention provides the bow of the ship with steerable propulsive power. The ship bow can be manoeuvred when the ship stands still or in harbour. When steering ahead, the propulsion of the fore propeller device is directed forward, whereby a considerable auxiliary power in forward direction is provided. If a malfunction occurs in the propeller device at the rear of the ship, the rudder propeller device at the front is still able to steer the vessel safely ahead.

[0010] In addition, with the invention savings can be made in the constructions costs, as the rudder propeller device at the front replaces the traditional bow-thrusters and reduces the power demand of the propeller devices at the rear.

[0011] The invention facilitates the manoeuvring of the bow when the ship does not move or moves ahead. The propulsive force produced by the rudder propeller device can be fully directed, whereas a stationary bow-thruster produces only a transverse force.

[0012] In large vessels the manoeuvring of the bow makes the power demand so high that as many as 4-6 bow-thrusters of the present kind would be required at the forebody. These devices are used only for harbour manoeuvring. A rudder propeller device arranged at the forebody can have more power and 2-3 devices could replace even six bow-thrusters.

[0013] In addition, it is advantageous for large vessels, if a part of the propulsive power pushing the vessel forward is produced at the front. If one does not want to increase the draught of a large ship, the diameter of the propellers is limited. This results in a situation, where the ship needs to be provided with several propellers. To arrange several propellers at the rear would be complicated, and rudder propeller devices arranged at the front would make the situation easier, as they produce a part of the propulsive force.

[0014] Owing to the invention the vessel's ability to survive damage in the propulsion devices or powerhouse has improved. For moving the ship ahead and manoeuvring it in problematic situations there are now propulsion devices available also at the front, in addition to the propulsion devices at the rear. Further, in contrast to rudder propellers arranged at the rear of the ship only, the steering of the ship...
by means of rudder propellers situated at the front can be dynamic so that no lateral drift occurs when the ship steers in a passage.

[0015] In a practical embodiment at the forebody of the ship, i.e. in the underwater section of the hull at a distance from the baseline of the ship, there is an area, which is designed sufficiently flat so that it enables the mounting and free turning of said one or more rudder propeller devices. In addition, the bottom of the ship hull from said area towards the stern is smoothly shaped so that the rudder propeller devices, while the ship is moving ahead, can be directed according to the shape of the ship hull, whereby the flow behind the rudder propeller device towards the hull surface can be minimized accordingly. In case the ship is provided with a bulb, said area is situated behind the bulb.

[0016] The rudder propeller devices at the forebody of the ship are dimensioned and arranged to be driven so that they cover, as needed, at least about 20% of the ship's total propulsive power in so-called harbour manoeuvring. Further, when steering ahead in sea traffic the rudder propeller devices at the forebody cover preferably at most about 10% of the ship's total propulsive power. Thus it can be secured that in harbour manoeuvring there is as much power available as in manoeuvring arrangements provided with fore propeller passages. On the other hand, in normal steering ahead much lower power levels are sufficient so as to make the flow no longer hit the hull, which is advantageous from hydrodynamic point of view. Higher power levels are possibly required in so-called “take home” situations, in which a part of the other power supply is for some reason not in use.

[0017] In order to ensure sufficient fore propeller power there are preferably at least two rudder propeller devices at the forebody of the ship. The rudder propeller devices as such may be mounted at the forebody either side by side, one after the other or overlapping each other.

[0018] In practice all the propulsion devices of the ship are permanently situated outside the ship hull. By such an arrangement it can be ensured that the ship's propulsion devices do not significantly decrease the displacement of the ship.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In the following the invention is described by way of example with reference to the attached drawings, in which

[0020] FIG. 1 shows a ship, seen from the side, where conventional propeller devices are situated at the front;

[0021] FIGS. 2-4 show how a rudder propeller device according to the invention, seen from the side, is arranged at the front of the ship, whereby the bow is shaped in a different manner; and

[0022] FIGS. 5-8 show how one or several rudder propellers, seen from below, are arranged at the front of the ship.

DETAILED DESCRIPTION

[0023] In a conventional solution according to the case shown in FIG. 1 there are three propeller devices arranged at the front of the ship on both sides, which devices affect only in the lateral direction of the ship, and contribute to the manoeuvring of the ship to quay and to its bringing off the quay respectively, and possibly to performing manoeuvring movements in the harbour area. When a large ship is concerned, the bow-thrusters require a lot of power, which is of no use in the ship's normal steering ahead.

[0024] FIGS. 2-4 show how rudder propeller devices are arranged at the forebody of a vessel. Free turning of the rudder propeller device requires space and therefore the underwater hull requires modifications in comparison with traditional solutions. FIG. 2 shows the use of a rudder propeller in a ship lacking a bulb. In FIG. 3 there is a small bow bulb and in FIG. 4 a large deep bulb.

[0025] FIGS. 5-8 show how one or several rudder propeller devices can be arranged at the forebody either one after the other, side by side or overlapping each other. By adjusting the turning angle of the device the propulsion of the propeller is directed as the situation requires. Thus the ship can be steered ahead or astern, to quay, or the drift of the bow can be corrected in side wind or in curve.

[0026] Thus the invention utilizes a known rudder propeller device already in general use, which device enables the directing of the propeller's propulsion around the vertical axis of the propeller device. The propeller is rotated either by a mechanical force transmission means or an electric motor arranged inside the device, which are known as such and are therefore not shown in detail.

[0027] By one or several rudder propeller devices according to the invention arranged at the forebody of the ship the bow can be manoeuvred by turning the propeller device. The bow of the ship can be manoeuvred when the ship does not move at all or moves ahead. When steering ahead the propulsion of the rudder propeller device is directed so that significant propulsive efficiency forward is produced. When steering ahead the flow of the rudder propeller device is aligned with the hull surface so that the flow does not occur directly against the hull surface.

[0028] When rudder propeller devices are arranged according to the invention at the forebody of a large ocean-going vessel, traditional bow-thrusters are not needed at all. The power relating to the rudder propeller devices situated at the front reduces the need of propulsive efficiency at the rear.

[0029] Owing to the invention the vessel's ability to survive damage in the propulsion devices or powerhouse has improved. For moving the ship ahead and manoeuvring it in problematic situations there are propulsion devices available also at the front, in addition to the propulsion devices at the rear.

[0030] The invention facilitates the manoeuvring of the bow both when the ship does not move and when it moves ahead. The propulsion provided by the rudder propeller device can be fully directed, whereas a traditional bow-thruster provides only a transverse force.

[0031] The invention is not limited to the above-described embodiments, but several modifications are conceivable within the scope of the appended claims.

1-5. (canceled)

6. A method of operating a large ship having a hull about 100 meters or more in length, so that the ship is suited for transoceanic traffic, with a narrow wedge-like bow and the broadest part of the underwater hull being located amid-
ships, said ship comprising at least one propulsion device at the rear of the ship and at least one steerable rudder propeller device at the forebody of the ship and arranged so that it does not extend significantly below the base line of the ship, said method comprising:

employing said at least one steerable rudder propeller device at the forebody of the ship to substantially provide the steering and control of the ship and to produce a part of the propulsive force pushing the ship forward at least substantially within all speed ranges,

in harbour manoeuvring, employing said at least one steerable rudder propeller device at the forebody of the ship to provide, as needed, at least about 20% of the ship's total propulsive power, and

when steering ahead in sea traffic, employing said at least one steerable rudder propeller device at the forebody of the ship to provide at most about 10% of the ship's total propulsive power.

7. A method according to claim 6, wherein at the forebody of the ship in the underwater section of the hull at a distance from the base line of the ship, there is an area, which is designed sufficiently flat so that it enables the mounting and free turning of said at least one steerable rudder propeller device, and that the bottom of the ship hull from said area towards the stern is smoothly shaped so that said at least one steerable rudder propeller device, while the ship is moving ahead, can be directed according to the shape of the ship hull, whereby the flow behind said at least one steerable rudder propeller device towards the hull surface can be minimized accordingly.

8. A method according to claim 7, wherein the ship is provided with a bulb and said area is situated behind the bulb.

9. A method according to claim 6, wherein there are at least two steerable rudder propeller devices at the forebody of the ship.

10. A method according to claim 6, wherein all the propulsion devices of the ship are permanently situated outside the ship hull.

11. A method according to claim 6, wherein said at least one steerable rudder propeller device is mounted to the forebody of the ship in a region of the hull that is above the base line of the ship, and the lowest point of the hull in a transverse section through said region of the hull is in said region of the hull.

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