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(54) PROPULSION DEVICE FOR MULTI-SHAFT SHIP

(57) An appendage 8 for reducing a hub vortex is arranged, through a support 7 extending from a hull 2, behind a propeller (wing propeller) 4 having no rudder behind the propeller. The appendage 8 is in the form of a spindle having a circular cross-section in a direction perpendicular to a central axis of the spindle along a hull and having a rear portion with gradually reduced diameters toward a rear end. The appendage 8 has a maximum diameter and a length along a hull which are 10-40% inclusive and 40-70% inclusive of the diameter of the propeller (wing propeller) 4, respectively.

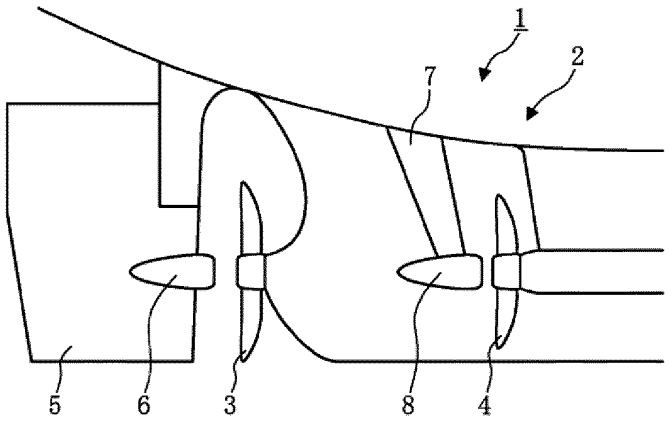

FIG. 2

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Description

Technical Field

[0001] The present invention relates to a propulsion device for a multi-propeller ship.

Background Art

[0002] Conventionally known is a propulsion device for a ship using a propeller comprises appendages on a rudder behind the propeller for reducing a hub vortex generating along with rotations of the propeller to enhance propulsion efficiency. For example, undermentioned Patent Literature 1 discloses an enhanced propulsion device for a ship comprising a bulb and a pair of opposed fins on a front edge of a rudder behind a propeller at a position axially of the propeller. Undermentioned Patent Literature 2 discloses a two-propeller-two-rudder twin skeg ship with a bulb and a fin on a rudder behind a propeller at portside and starboard side, respectively.

Citation List

Patent Literature

[0003]

Patent Literature 1: JPH 11-139395A
Patent Literature 2: JP 2015-166218A

Summary of Invention

Technical Problems

[0004] If the rudder is arranged just behind the propeller, attachment of the appendage or appendages such as the bulb and/or the fins on the rudder can provide arrangement of the appendage or appendages behind the propeller.
However, some types of ships have no rudder behind a propeller. More specifically, a rudder in a single-propeller ship is arranged behind a single propeller whereas a three-propeller ship often has no rudders behind wing propellers, provided that a rudder arranged behind a central propeller provides sufficient maneuverability and such single rudder on the central propeller suffices.
Some two-propeller ships each with two propellers at portside and starboard side of a stern have single central rudders backward (two-propeller-one-rudder ship); in this case, there are no rudders straight behind the propellers. This applies also in ships each with four or more propellers. After all, some multi-propeller ships each with two or more propellers have a propeller or propellers with no rudder therebehind and there is no structure or structures behind such propeller or propellers suitable for arrangement of the bulb and/or the fins as mentioned in the above. Thus, some types of multi-propeller ships have a propeller or propellers for which appendages cannot be arranged to reduce the hub vortex, which has been a factor for hindered enhancement of propulsion efficiency.

[0005] The invention was made in view of the above and has its object to provide a propulsion device for a multi-propeller ship capable of enhancing propulsion efficiency in the multi-propeller ship.

Solution to Problems

[0006] The invention is directed to a propulsion device for a multi-propeller ship comprising an appendage arranged, through a support extending from a hull, behind a propeller with no rudder therebehind to reduce a hub vortex.

[0007] It is preferable in the propulsion device for the multi-propeller ship according to the invention that said appendage is in the form of a spindle having a circular cross-section in a direction perpendicular to a central axis thereof along a hull and having a rear portion with diameters gradually reduced toward a rear end.

[0008] It is preferable in the propulsion device for the multi-propeller ship according to the invention that said appendage has a maximum diameter being 10-40% inclusive of a diameter of said propeller and has a length along the hull being 40-70% inclusive of the diameter of said propeller.

[0009] The propulsion device for the multi-propeller ship according to the invention may be applied to wing propellers of a three-propeller ship.

Advantageous Effects of Invention

[0010] A propulsion device for a multi-propeller ship according to the invention can exhibit an excellent effect that propulsion efficiency of propellers in the multi-propeller ship can be enhanced.

Brief Description of Drawing

[0011]

Fig. 1 is a schematic view showing an example of an overall structure of a multi-propeller ship to which the invention is applied;
Fig. 2 is a view showing an embodiment of the propulsion device for the multi-propeller ship according to the invention and is an enlarged view of a relevant part in Fig. 1; and
Fig. 3 is a view showing a modification of the embodiment of the propulsion device for the multi-propeller ship according to the invention.

Description of Embodiment

[0012] An embodiment of the invention will be described with respect to the attached drawing.

[0013] Figs. 1-3 show an embodiment of a propulsion device for a multi-propeller ship according to the invention. The embodiment illustrated is a case where the invention is applied to a three-propeller ship. As shown in Fig. 1, the multi-propeller ship (three-propeller ship) 1 is provided with three propellers, i.e., a propeller (central propeller) 3 arranged centrally at a stern of a hull 2, a propeller (wing propeller) 4 arranged at portside of the stern and that at starboard side of the stern.

[0014] As shown in Fig. 2, arranged behind the central propeller 3 is a rudder 5 on which a bulb-shaped appendage 6 is arranged at an axial height of the center propeller 3. The appendage 6 is, for example, in the form of a spindle having a circular cross-section in a direction perpendicular to a central axis thereof along the hull and having a rear portion with gradually reduced diameters toward a rear end and is adapted to protrude from a front edge of the rudder 5 toward the central propeller 3. By the appendage 6, the hub vortex generating in association with rotations of the central propeller 3 is suppressed.

[0015] In the three-propeller ship 1 according to the embodiment, no rudder is arranged behind each of the wing propellers 4; instead, a support 7 is provided for arrangement of the appendage 8 behind the wing propeller 4.

[0016] The support 7 is a plate member extending from a bottom of the hull 2 to behind the wing propeller 4. To make every effort not to increase hull resistance, the support 7 is shaped to extend vertically along the hull and has a streamlined cross-section along a horizontal plane. Supported on a lower end of the support 7 is the appendage 8 at a height axially of the wing propeller 4.

[0017] Just like the above-mentioned appendage 6, the appendage 8 is configured to be in the form of a spindle having a circular cross-section in a direction perpendicular to a central axis thereof along the hull and having a rear portion with gradually reduced diameters toward a rear end. The central axis is set to be aligned with an axis of the wing propeller 4. In the embodiment, the appendage 8 suppresses the hub vortex generating behind the wing propeller 4.

[0018] In order to effectively reduce the hub vortex due to rotation of the wing propeller 4, it is preferable that a maximum diameter of the appendage 8 near a front end thereof is 10-40% inclusive, more preferably 20-30% inclusive, of the diameter of the wing propeller 4. It is preferable that a length of the appendage 8 along the hull is 40-70% inclusive, more preferably 50-60% inclusive, of the diameter of the wing propeller 4.

[0019] It has been revealed by cistern tests conducted by the applicant that, when the bulb-shaped appendage 6 was arranged on the rudder 5 behind the central propeller 3 and the appendages 8 with the diameter and the length which were about 25% and about 56% of the diameter of the wing propellers 4, respectively, were arranged behind the wing propellers 4 at portside and starboard side as shown in Figs. 1 and 2, power of the overall three-propeller ship 1 summing up the powers of the central propeller 3 and the two wing propellers 4 is reduced by 6% or so in comparison with a case of no appendages 6 and 8. Alternatively, only the appendages 8 may be arranged behind the wing propellers 4, respectively, with no appendage on the rudder 5 behind the central propeller 3; in this case, the reduction in power of the overall three-propeller ship 1 was 4% or so.

[0020] On the supports 7, appendages 9 in the form of fins protruding at portside and starboard side may be provided in place of the appendages 8 shaped as mentioned in the above. Alternatively, the appendages 9 as shown in Fig. 3 may be provided in addition to the appendages 8 as shown in Fig. 2. An appendage or appendages in any shape may be arranged on the support or supports 7, provided that it or they can reduce the hub vortex behind the wing propeller or propellers 4.

[0021] Thus, in the embodiment, arrangement of the support 7 behind the wing propeller 4 makes it possible to arrange the appendage 8 behind the wing propeller 4 with no rudder therebehind to thereby effectively reduce the hub vortex along with rotations of the wing propeller 4.

[0022] As mentioned in the above, in the embodiment, the appendage 8 or 9 for reducing the hub vortex is arranged, through the support 7 extending from the hull 2, behind the propeller (wing propeller) 4 with no rudder arranged therebehind, which can reduce the hub vortex even for the propeller (wing propeller) 4 with no rudder therebehind.

[0023] Further, in the embodiment, the appendage 8 may be in the form of a spindle having circular cross-section in a direction perpendicular to a central axis thereof along the hull and a rear portion with gradually reduced diameters toward a rear end, which can more effectively reduce the hub vortex generating due to the rotation of the propeller (wing propeller) 4.

[0024] In the embodiment, the appendage 8 may be configured to have a maximum diameter which is 10-40% inclusive of a diameter of the propeller (wing propeller) 4 and has a length along the hull which is 40-70% of the diameter of the propeller (wing propeller) 4, which can especially effectively reduce the hub vortex generating due to the rotation of the propeller (wing propeller) 4.

[0025] Thus, the above-mentioned embodiments can enhance propulsion efficiency of a propeller or propellers in a multi-propeller ship.

[0026] It is to be understood that a propulsion device for a multi-propeller ship according to the invention is not limited to the above embodiment and that various changes and modifications may be made without departing from the scope of the invention.

Reference Signs List

[0027]

1 multi-propeller ship (three-propeller ship)
2 hull
4 propeller (wing propeller)

7 support
8 appendage
9 appendage

Claims

1. A propulsion device for a multi-propeller ship comprising an appendage arranged, through a support extending from a hull, behind a propeller with no rudder therebehind to reduce a hub vortex.

2. The propulsion device for the multi-propeller ship as claimed in claim 1 wherein said appendage is in the form of a spindle having a circular cross-section in a direction perpendicular to a central axis thereof along the hull and having a rear portion with gradually reduced diameters toward a rear end.

3. The propulsion device for the multi-propeller ship as claimed in claim 2 wherein said appendage has a maximum diameter which is 10-40% inclusive of a diameter of said propeller and a length along the hull which is 40-70% inclusive of the diameter of said propeller.

4. The propulsion device for the multi-propeller ship as claimed in any one of claims 1-3 applied to wing propellers of a three-propeller ship.

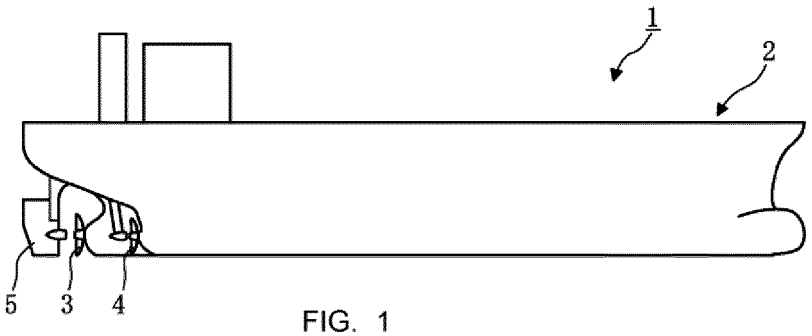

FIG. 1

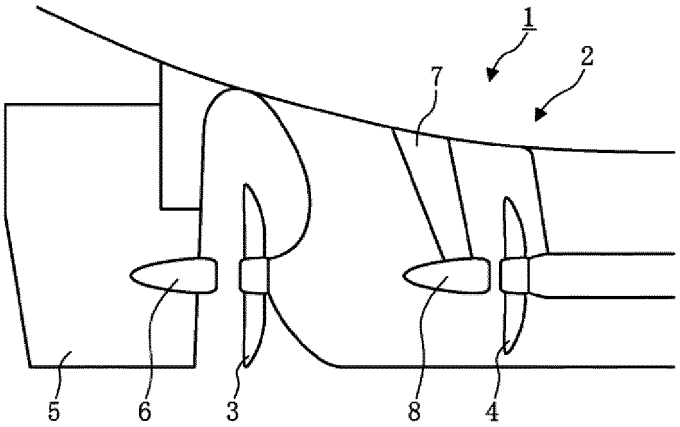

FIG. 2

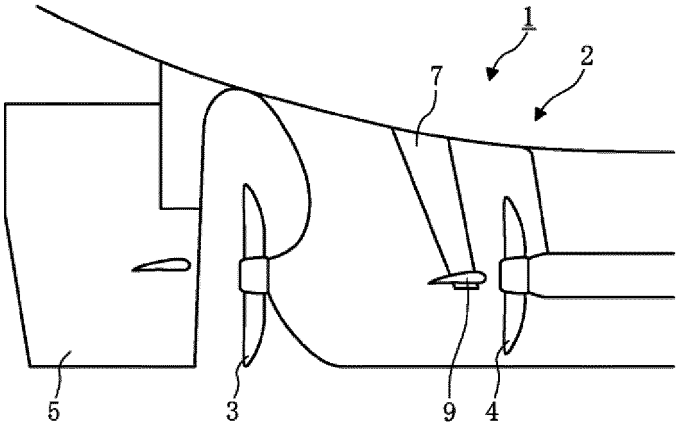

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/063353

A. CLASSIFICATION OF SUBJECT MATTER
B63H5/07(2006.01)i, *B63H1/28*(2006.01)i, *B63H5/08*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63H5/07, B63H1/28, B63H5/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2013-132937 A (Mitsubishi Heavy Industries, Ltd.), 08 July 2013 (08.07.2013), paragraphs [0033] to [0040], [0048] to [0055]; fig. 2, 3, 5 (Family: none)	1-3 4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 July 2016 (08.07.16)	19 July 2016 (19.07.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2015166218 A **[0003]**