(57) Abrégé/Abstract:
The invention relates to a curved rudder fin and a ship provided with at least one such fin for controlling the ship. According to the invention, the curve of the fin matches the flow of the water in the vicinity of said rudder fin, which occurs when the rudder fins have
(57) Abrégé(suite)/Abstract(continued):
no propeller mounted before them in the direction of travel of the ship, or when a propellor is mounted before, said propellor is not operational but is idling, for example.
9

ABSTRACT

The invention concerns a twisted rudder blade. According to the invention it is proposed that the twist of the blade is adapted to the configuration of the flow of the water in the region of the respective rudder blade if no propeller in operation is disposed in front of the rudder blades in the direction of travel of the ship.
Aloys Wobben
Argestrasse 19, 26607 Aurich

Lateral ship’s rudder

The present invention concerns a rudder blade for a ship and a ship having at least one rudder blade according to the invention.

If the flow along the hull of a ship as it moves is considered, it can then be clearly seen that, at a tapering stern of the ship, the flow does not extend exactly parallel to the line of the keel of the ship but follows the configuration of the stern of the ship.

A rudder of conventional design, that is to say expressed in simple terms a flat plate, which is mounted laterally displaced from the line of the keel in the stern region of the ship and is oriented in the zero-degree position exactly parallel to the line of the keel would therefore have an afflux flow thereagainst at an inclined angle and thus gives rise to a flow resistance. That flow resistance signifies higher fuel consumption and thus a higher level of environmental pollution or with the same fuel consumption or the same engine power a low speed and thus a longer travel time and thus in turn higher fuel consumption and more severe environmental pollution.

It is known from US No 5 415 122 for a rudder blade to be adapted to a propeller-generated flow. In that case the flow directions produced by the propeller are taken into consideration and the rudder suitably adapted in a multiplicity of profiles in the chord direction. For example Table 1 of that publication specifies a reduction in an angle of the rudder blade with an increasing height (Y-position) of the respective profile, starting from the axis of the propeller disposed in front thereof. That specific configuration of a rudder blade also takes account in particular of the effects due to turbulence due to the rudder.

The object of the present invention is to provide a rudder blade which is particularly advantageous in terms of flow, for mounting in the region of the stern of a ship laterally beside the keel line.

That object is attained by a rudder blade which is twisted in itself, wherein the twisting is adapted to the configuration of the flow of the water
at the stern of the ship, that is to say in the region of the mounting location of the rudder blades. The advantages of these rudder blades are higher efficiency for the rudder blades, which leads to smaller rudder blades, and also an improved afflux flow in respect of the propeller (insofar as there is one).

That effect according to the invention is achieved when, at a rudder position of zero degrees, that is to say a rudder emplacement which is set to precisely straight-ahead travel, the afflux flow angle at the rudder is also precisely zero degrees.

As the flow (at any event at the surface of the water) exactly follows the configuration of the hull in the stern region of the ship, the precise angle of incidence of the rudder blade at its top side (the side towards the hull) is naturally dependent on the geometrical configuration of the stern. The twisting gradually decreases towards its underside (as the side facing away from the hull of the ship).

In the present case the rudder blade is twisted in its upper region (near the hull) through about 10 degrees while in its lower region (remote from the hull) it is twisted through about 2 degrees. Those values were ascertained on the specific example of a predetermined hull shape firstly by simulation and then empirically. Since, as mentioned hereinbefore, the twist is dependent on the hull geometry, a twist of up to 20 degrees is certainly thought not to be unrealistic in the region of the rudder blade which is near the hull (the upper region). Ranges of up to 5 degrees can certainly be considered in the lower region (remote from the hull).

In that respect however it is to be borne in mind that that twist must always be in relation to the keel line, that is to say towards the hull centre. The rudder blade is therefore always twisted inwardly.

In accordance with the invention there is proposed a ship having at least one twisted rudder blade arranged for controlling the ship, wherein the twist of the blade is adapted to the configuration of the flow of the water in the region of the respective rudder blade if no propeller in operation is disposed in front of the rudder blades in the direction of travel of the ship. Therefore the rudder blade is adapted to the flow of the water
relative to the ship, wherein that flow is not generated by a propeller mounted in front thereof. Rather it is the flow resulting from the movement of the ship through the water that is primarily of significance. Other flows are not taken into consideration or do not occur. In accordance with an aspect therefore no propeller is disposed in front of the rudders. If a propeller is to be disposed at an upstream position in another embodiment, the propeller is not in operation. In other words, it is not driven but is for example in an idle condition.

In accordance with an embodiment therefore there are proposed at least two rudder blades which are provided laterally displaced with respect to the keel line, wherein the twisting of the blade is adapted to the configuration, caused by the geometry of the hull, of the flow of the water in the region of the respective rudder blade. The movement of the ship through the water affords relative to the ship a flow which in terms of its magnitude approximately corresponds to the speed of the ship through the water. The specific configuration of the flow is determined primarily by the geometry of the hull of the ship, insofar as it is in the water. The rudder blades are adapted to that flow.

The term twisting of the rudder blade is used to denote rotational displacement of the rudder blade about a longitudinal axis thereof. The respectively specified torsion angles are however specified as the angle of the rudder blade at the respective height relative to the keel line and can also be referred as the angle of incidence.

In accordance with an embodiment the rudder blades have an angle of incidence relative to the keel line so that the respective rudder blade faces towards the keel line in the direction of flow in forward movement of the ship. Due to the hull shape converging rearwardly towards the stern and if the rudders are arranged as usual in the stern region of the ship the flow of the water also converges rearwardly – relative to the ship – when the ship is making headway through the water. This embodiment takes account of that effect. Accordingly, when travelling straight-ahead, the rudder blades also face towards the keel line and thus towards the centre of the ship.
In accordance with a configuration the angle of incidence relative to the keel line of the respective rudder blade decreases with increasing distance from the hull of the ship. The rudder blade is accordingly so twisted that, in the proximity of the hull, there is a greater angle of incidence which then decreases with increasing distance from the hull of the ship, that is to say rearwardly.

In accordance with an embodiment the angle of incidence or the twist angle is between 2 degrees and 20 degrees. In that respect the greater value is usually in the proximity of the ship's hull and the smaller value is at the lower end of the rudder blade. For example the angle can drop from the ship's hull from 20 degrees at the hull or in the proximity of the hull to 5 degrees at the lower end, or in another example from 10 degrees to 2 degrees.

In accordance with a configuration the angle of incidence or twist angle in the region near the hull is between 10 degrees and 20 degrees and in the region remote from the hull it is between 2 degrees and 5 degrees.

Preferably two Rudders are respectively arranged symmetrically on the two sides of the keel line. Accordingly one rudder is at the right in the direction of travel and thus at the starboard side of the ship and a counterpart thereto is on the opposite side of the keel line, but otherwise at the same location. Such two rudders are preferably also of a mutually symmetrically configuration, namely of a mirror-image symmetrical configuration.

Preferably at least one Magnus rotor is provided as the drive for the ship. Such a Magnus rotor generates forward propulsion for the ship, utilising the Magnus effect. For example use is made of a cylinder which stands vertically and which rotates at high speed and around which the wind flows. Depending on the respective wind direction and direction of rotation, the result is forward propulsion for the ship. Accordingly there is no drive by propeller movement and the flow of the water in the hull region is directed substantially in accordance with the movement of the ship through the water and the flow profile is determined by the geometry of the ship's hull. The rudder blades are correspondingly designed. Further
advantageous effects can also occur if other kinds of drive are used, which do not or do not substantially engage into the flow of the water in the hull region. In accordance with the invention a propeller can also be provided for example as auxiliary propulsion. In that case however the design of the rudder blade or blades is preferably implemented when the propeller is not driven and which for this for example is in the idle condition.

In accordance with the invention a rudder blade is also claimed, which is provided for use with a ship.

Four drawings accompany this description. They are identified as Figure 4, Figure 3, Figure 2 and Figure 1.

Figure 4 of the drawing shows the stern region of the ship with two rudder blades which are arranged on both sides laterally beside the keel line of the ship. One of the rudder blades is arranged at the left, that is to say on the port side of the keel line, while the second rudder blade is arranged at the right, that is to say at the starboard side of the keel line. Whether the ship is a pure sailing ship, as the present drawing could indicate, or whether there is also at least one propeller with a further rudder blade (for example precisely at the keel line) is completely immaterial for the present invention but is not out of the question.

Figure 3 of the drawing shows a further stern view of the ship, although from a somewhat modified perspective. It can be clearly seen from this drawing that the port (left) rudder blade is twisted towards the right, that is to say towards the keel line, while the starboard (right) rudder blade is twisted to the left, that is to say also towards the keel line. It can further be clearly seen that the angle of incidence or the twist angle of each rudder blade decreases with increasing distance from the hull. In the specific embodiment however it does not reach zero degrees even at the lower end (remote from the hull) of the rudder blade, but still always involves an angle of 2 degrees.

It can also be seen from Figures 3 and 4 that no propeller is disposed in front of the rudders. No propeller at all is present in the illustrated embodiment.
Figure 2 shows only the two rudder blades without the hull (disposed thereabove). The twisting can once again be clearly seen in this drawing. The view in this drawing is again directed from the rear onto the stern of the ship.

Figure 1 also shows only the rudder blades according to the invention, but as a view from below, so that the ship's keel would be seen between those rudder blades. The twist at the trailing edge of the rudder blades (downwardly in the Figure) can be particularly clearly seen here.
7

CLAIMS

1. A ship comprising at least one twisted rudder blade arranged for controlling the ship, wherein the twist of the blade is adapted to the configuration of the flow of the water in the region of the respective rudder blade if no propeller in operation is disposed in front of the rudder blades in the direction of travel of the ship.

2. A ship according to claim 1 wherein there are provided at least two rudder blades laterally displaced with respect to the keel line, wherein the twist of the blade is adapted to the configuration, caused by the geometry of the hull, of the flow of the water in the region of the respective rudder blade.

3. A ship according to claim 1 or claim 2 wherein the rudder blades have an angle of incidence towards the keel line so that the respective rudder blade faces towards the keel line in the direction of flow in forward travel of the ship.

4. A ship according to one of the preceding claims wherein an or the angle of incidence relative to the keel line of the respective rudder blade decreases with an increasing distance from the ship’s hull.

5. A ship according to one of the preceding claims wherein an or the angle of incidence or twist angle is between 2 degrees and 20 degrees.

6. A ship according to one of the preceding claims wherein an or the angle of incidence or twist angle is between 10 degrees and 20 degrees in the region near the hull and between 2 degrees and 5 degrees in the region remote from the hull.

7. A ship according to one of the preceding claims wherein two rudders are respectively arranged symmetrically on the two sides of the keel line.

8. A ship according to one of the preceding claims wherein at least one Magnus rotor is provided as the drive for the ship.
9. A twisted rudder blade, wherein the twist of the blade is adapted to the configuration of the flow of the water in the region of the mounting location of the respective rudder blade if no propeller in operation is disposed in front of the rudder blades in the direction of travel of the ship.

10. A twisted rudder blade according to claim 9, wherein there are provided at least two rudder blades laterally displaced with respect to the keel line, wherein the twist of the blade is adapted to the configuration, caused by the geometry of the hull, of the flow of the water in the region of the mounting location of the respective rudder blade.