Embodiments of the present invention are provided in order to further improve performance of a rudder of a latest ship. That is, embodiments of the present invention provide a rudder for ships, a steering method, and a ship capable of effectively using energy of a propeller vortex flow and further decreasing an area of a rudder and a blade thickness.

Solution to Problem

[0009]

According to a first aspect of the present invention, there is provided a rudder for ships, including: an upper rudder and a lower rudder which are vertically disposed behind and on an axis of a propeller disposed at a stern, in which the upper rudder and the lower rudder are able to be independently turned to a port side and a starboard side from the axis of the propeller; and an upper steering machine and a lower steering machine which are able to independently turn the upper rudder and the lower rudder, wherein the upper steering machine includes an upper steering shaft, a lower end thereof is fixed to the upper rudder, which is attached to the inside of a housing provided on the stern so as to be rotatable about the turning axis via first bearings, and a seal which seals a gap between the upper steering shaft and the housing, the lower steering machine includes a lower steering shaft, a lower end thereof is fixed to the lower rudder, which is attached to the insides of a through-hole of the upper rudder and the upper steering shaft so as to be rotatable about the turning axis via a second bearing, and seals which seal gaps between the upper steering shaft and the through-hole and between the upper steering shaft and the lower steering shaft.

[0010]

The rudder for ships includes an upper steering machine and a lower steering machine which are able to independently turn the upper rudder and the lower rudder.

[0011]

A thickness distribution of the lower rudder is thinner than that of the upper rudder.

[0012]

In a case where a rotation direction of the propeller is the clockwise direction when viewed from a rear side, the upper rudder has an airfoil shape suitable for a propeller vortex flow flowing from the port side to the starboard side, and the lower rudder has an airfoil shape suitable for a propeller vortex flow flowing from the starboard side to the port side.

[0013]

The upper rudder and the lower rudder have the airfoil shapes or camber lines of the airfoil shapes different from each other.

[0014]

In addition, according to a second aspect of the present invention, there is provided a steering method, including: preparing the above-described rudder for ships; and independently turning the upper rudder and the lower rudder to a port side and a starboard side from the axis of the propeller.

[0015]

During deceleration or deceleration turning, one of the upper rudder and the lower rudder is turned to the port side, and the other thereof is turned to the starboard side.

[0016]

Moreover, according to a third aspect of the present invention, there is provided a ship including the above-described rudder for ships.

Advantageous Effects of Invention

[0017]

According to embodiments of the present invention, the upper rudder and the lower rudder are disposed at the propeller center (behind and on the axis of the propeller), and thus, it is possible to effectively recover energy of the propeller vortex flow by the upper rudder and the lower rudder.

[0018]

Particularly, when a ship goes straight ahead or turns, in the rudder for ships as per embodiments of the present invention, the upper rudder and the lower rudder are independently turned to obtain appropriate steering angles, and thus, it is possible to always realize a steering angle suitable for recovery of energy of the propeller vortex flow at any rotational speed of the propeller. As a result, compared to one rudder in which the upper rudder and the lower rudder are integrated with each other, in the rudder for ships as per embodiments of the present invention, it is possible to generate high lift and decrease a total rudder area.

[0019]

Compared to the one rudder in which the upper rudder and the lower rudder are integrated with each other, a rudder area of the upper rudder and the lower rudder is approximately halved, and thus, a design load of the upper rudder and the lower rudder decreases. Accordingly, a blade thickness

decreases, and it is possible to improve rudder single body performance.

[0020]

Therefore, according to embodiments of the present invention, it is possible to effectively use the energy of the propeller vortex flow and decrease the area and the blade thickness of the rudder.

Brief Description of Drawings

[0021]

Fig. 1 is a side view illustrating an embodiment of a rudder for ships of the present invention.

Fig. 2 is a sectional view taken along line A-A of Fig. 1.

Fig. 3A is a schematic plan view of Fig. 1.

Fig. 3B is an explanatory view of a fluid force generated in an upper rudder when a ship goes straight ahead.

Fig. 3C is an explanatory view of a fluid force generated in a lower rudder when a ship goes straight ahead.

Fig. 4A is a view illustrating positions of the upper rudder and the lower rudder when a ship goes straight ahead.

Fig. 4B is a view illustrating positions of the upper rudder and the lower rudder when a ship turns left.

Fig. 4C is another view illustrating positions of the upper rudder and the lower rudder when a ship turns left.

Fig. 5A is a view illustrating a deceleration mode of 90°.

CLAIMS

1. A rudder for ships, comprising:

an upper rudder and a lower rudder which are vertically disposed behind and on an axis of a propeller disposed at a stern,

wherein the upper rudder and the lower rudder are able to be independently turned to a port side and a starboard side from the axis of the propeller; and

an upper steering machine and a lower steering machine which are able to independently turn the upper rudder and the lower rudder,

wherein the upper steering machine includes an upper steering shaft, a lower end thereof is fixed to the upper rudder, which is attached to the inside of a housing provided on the stern so as to be rotatable about the turning axis via first bearings, and a seal which seals a gap between the upper steering shaft and the housing,

the lower steering machine includes a lower steering shaft, a lower end thereof is fixed to the lower rudder, which is attached to the insides of a through-hole of the upper rudder and the upper steering shaft so as to be rotatable about the turning axis via a second bearing, and seals which seal gaps between the upper steering shaft and the through-hole and between the upper steering shaft and the lower steering shaft.

2. The rudder for ships according to claim 1,

wherein a thickness distribution of the lower rudder is thinner than that of the upper rudder.

3. The rudder for ships according to claim 1,

wherein in a case where a rotation direction of the propeller is the clockwise direction when viewed from a rear side,

the upper rudder has an airfoil shape suitable for a propeller vortex flow flowing from the port side to the starboard side, and

the lower rudder has an airfoil shape suitable for a propeller vortex flow flowing from the starboard side to the port side.

4. The rudder for ships according to claim 1,

wherein the upper rudder and the lower rudder have the airfoil shapes or camber lines of the airfoil shapes different from each other.

5. A steering method, comprising:

preparing a rudder for ships according to any one of claims 1 to 4; and

independently turning the upper rudder and the lower rudder to a port side and a starboard side from the axis of the propeller.

6. The steering method according to claim 5,

wherein during deceleration or deceleration turning, one of the upper rudder and the lower rudder is turned to the port side, and the other thereof is turned to the starboard side.

7. A ship comprising the rudder for ships according to any one of claims 1 to 4.