TITLE: RUDDER RESISTANCE REDUCING METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to heat sink technology and more particularly, to rudder performance technology and more particularly, to a rudder resistance reducing method, which utilizes a negative pressure to guide in gas for generating air bubbles, reducing the resistance of the rudder of a boat.

2. Description of the Related Art:

A boat, except the boat body, has attachments and gears hung on the outside of the boat body. For example, a boat **10** shown in FIG. 1 comprises a boat body **11**, a propeller **13** pivotally connected to the boat body **11** below the water line **12**, and an attachment, for example, a rudder **14** arranged at the boat **10** at a rear side relative to the propeller **13** for controlling the steering direction of the boat.

Referring to FIG. 2, during rotation of the propeller **13** of the aforesaid boat **10**, a flow of water is produced that passes through the rudder **14**. As the rudder **14** is disposed at the downstream of the flow of water caused by the propeller **13**, a resistance will be produced against the steering direction of the board. Further, because the rudder **14** is a requisite attachment of the boat **10**, resistance will be inevitably produced against the rudder **14** during rotation of the propeller **13** to cause a high-speed flow of water.

Conventional methods for reducing the aforesaid resistance are commonly to modify the streamline design of the rudder or surface treatment without affecting the structural strength of the rudder. However, these methods cannot

achieve a significant effect in reducing the rudder resistance.

Therefore, it is desirable to provide a measure for reducing rudder resistance in an economic manner, minimizing fuel gas consumption.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a rudder resistance reducing method, which uses an air bubble generator in front of the rudder for generating bubbles during rotation of the propeller of the boat to cause a high-speed flow of water without changing the original design of the boat, enabling the air bubbles to isolate contact between the high-speed flow of water and the rudder, thereby reducing rudder resistance and saving energy consumption.

To achieve the main object, a rudder resistance reducing method comprises the steps of:

a) providing a boat comprising a propeller rotatable to drive the boat to steer and a rudder installed in the boat body at a rear side relative to the propeller;

b) installing an air bubble generator in the boat at a front side relative to the rudder, the air bubble generator comprising an air tube arranged at the water face of the rudder and defining at least one gas inlet and opposing pairs of gas release outlets;

c) providing a gas guide device comprising at least one guide pipe, the at least one guide pipe having a bottom end thereof connected to the at least one gas inlet of the air tube and a top end thereof terminating in an intake hole;

d) employing Bernoulli's principle to produce a negative pressure in the gas release outlets for sucking in outside air for generating air bubbles during rotation of the propeller to cause a high-speed flow of water;

e) enabling the intake flow of air or gas to be guided by the at least one guide pipe into the at least one gas inlet of the air tube and then discharged out of the gas release outlets to mix with water and to produce multiple air bubbles; and

f) utilizing the air bubbles thus produced to isolate a part of the high-speed flow of water and the rudder and to reduce friction contact between the high-speed flow of water and the rudder and to further reduce the resistance of the rudder against the high-speed flow of water.

Further, a gas guide device is used for guiding air or gas into the air bubble generator. The gas guide device uses a supplementary measure to guide engine waste gas or low pressure gas from the steam turbine into the gas guide device for generating air bubbles.

Further, the gas guide device further compresses a pressure device for pumping a gas into the gas guide device. The pressure device can be selected from an air compressor, an air blower, an engine, a steam turbine and a turbo of the boat.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing illustrating an arrangement of a rudder in a conventional boat.

FIG. 2 is a schematic drawing illustrating a flow of water caused and passed over the rudder during rotation of the propeller according to the prior art.

FIG. 3 is a schematic drawing illustrating air bubbles generated in the flow of water caused and passed over the rudder during rotation of the propeller in accordance with the present invention.

FIG. 4 is a schematic drawing illustrating the arrangement of the gas guide device in the boat in accordance with the present invention.

FIG. 5 is a sectional view taken in an enlarged scale along line 5-5 of FIG. 4.

FIG. 6 is an enlarged view of the major part which is No. 6 of FIG. 5, illustrating generation of air bubbles in the negative pressure.

FIG. 7 is an exploded elevational view of the air bubble generator shown in FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Further features and benefits of the present invention will be apparent from the following detailed description of the preferred embodiment taken in conjunction with the annexed drawings. However, it is to be understood that the invention is applicable to any of a variety of boats. The present preferred embodiment is simply an example but not a limitation.

Referring to FIGS. 3 to 6, when compared to the surface resistance of the rudder **14** of the prior art design shown in FIG. 2, multiple air bubbles **50**, as shown in FIG. 3, are generated in the flow of water that is produced during steering of the board to reduce rudder resistance. The rudder resistance reducing method in accordance with the preferred embodiment of the present invention, as shown in FIGS. 4 and 5, comprises the steps of:

a) providing a boat **10** comprising a boat body **11**, a propeller **13** pivotally mounted in the boat body **11**, a power engine **131** for rotating the propeller **13**

to cause a high-speed flow of water **F**, and a rudder **14** installed in the boat body **11** at a rear side relative to the propeller **13**;

b) installing an air bubble generator **20** in the boat body **11** at a front side relative to the rudder **14**, wherein the air bubble generator **20**, as shown in FIGS. 6 and 7, comprises an air tube **21**, which is, for example, but not limited to, a circular tube arranged at the water face of the rudder **14** and defines at least one gas inlet **211** and opposing pairs of gas release outlets **212** in, for example, circular shape; the air tube **21** can be formed integral with the rudder **14** and processed to provide the gas release outlets **212** during fabrication of the boat **10**, or alternatively, the air tube **21** can be separately made and then affixed to the water face of the rudder **14** without destructing the structural strength of the rudder **14**;

c) providing a gas guide device **30**, which, as shown in FIG. 4, comprises at least one guide pipe **31** that has its bottom end connected to the at least one gas inlet **211** of the air tube **21** and its top end terminating in an intake hole **32** that is disposed in the boat body **11** or above the water line **12**;

d) employing Bernoulli's principle to produce a negative pressure in the gas release outlets **212** for sucking in outside air for generating air bubbles **50** during rotation of the propeller **13** and steering of the boat body **11** to cause the aforesaid high-speed flow of water **F** that strikes the water face of the rudder **14**; as the high-speed flow of water **F** flows at a high speed during rotation of the propeller **13**, a high negative pressure can be produced in the gas release outlets **212** to suck in outside air for generating air bubbles **50** without power consumption;

e) enabling the intake flow of air to be guided by the at least one guide pipe **31** into the at least one gas inlet **211** of the air tube **21** and then discharged out of the gas release outlets **212** to mix with water and to produce multiple air bubbles **50**; and

f) utilizing the air bubbles **50** thus produced, as shown in FIG. 3, to isolate a part of the high-speed flow of water **F** and the rudder **14** and to reduce friction contact between the high-speed flow of water **F** and the rudder **14** and to further reduce the resistance of the rudder **14** against the high-speed flow of water that is produced during rotation of the propeller **13**.

As the resistance of water is about 700 to 800 times greater than air, using the air bubbles **50** to reduce contact between the high-speed flow of water **F** and the rudder **14** can effectively reduce the resistance, the more the isolation of the contact between the high-speed flow of water **F** and the rudder **14** the better the resistance reducing effect will be.

Based on the aforesaid technical measure for generating air bubbles **50**, the invention simply needs to install an air bubble generator **20** in front of the rudder **14** without using any power drive or changing the original design of the boat.

Referring to FIG. 4, the existing resources of the boat body **11** may be utilized for pumping air or gas into the at least one guide pipe **31** of the gas guide device **30**, for example, a pressure device **34** may be connected to the at least one guide pipe **31** of the gas guide device **30** and a control valve **33** may be set between the at least one guide pipe **31** and the pressure device **34**. The pressure device **34** is adapted for pumping air, engine waste gas or waste gas

from the steam turbine in the boat body **11** into the at least one guide pipe **31**.

Further, the pressure device **34** can be the existing air compressor, air blower, engine or steam turbine in the boat body **11**. The resource recycling of directly guiding the waste gas from the engine or steam turbine of the boat **10** does not require any extra resources or increase the cost. Further the waste gas from the engine or steam turbine can also be used to drive a turbo for pumping air or gas toward the gas release outlets **212**. Further using an air flow or the like to make the pressure device **34** requires less power to pump air or gas for generating air bubbles **50** that isolate contact between the high-speed flow of water **F** and the rudder **14** to reduce rudder resistance. Thus, using a small amount of power can achieve multiple times of power. Further, the pressure device **34** can be prepared by using existing resources to directly guide air or gas or to compress air or gas into the gas release outlets **212**.

In conclusion, by means of arranging an air bubble generator **20** in the boat body **11** at a front side relative to the rudder **14** and employing the Bernoulli's principle in hydrodynamics that an increase in the velocity of a stream of fluid results in a decrease in pressure, the invention guides in air or gas to generate air bubbles **50** for isolating contact between the high-speed flow of water **F** and the rudder **14** to reduce rudder resistance.

Although a particular embodiment of the invention has been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What the invention claimed is:

1. A rudder resistance reducing method, comprising the steps of:

a) providing a boat **10** comprising a propeller **13** rotatable to drive said boat **10** to steer and a rudder **14** installed in a boat body **11** at a rear side relative to said propeller **13**;

b) installing an air bubble generator **20** in said boat **10** at a front side relative to said rudder **14**, said air bubble generator **20** comprising an air tube **21** arranged at the water face of said rudder **14** and defining at least one gas inlet **211** and opposing pairs of gas release outlets **212**;

c) providing a gas guide device **30** comprising at least one guide pipe **31**, said at least one guide pipe **31** having a bottom end thereof connected to said at least one gas inlet **211** of said air tube **21** and a top end thereof terminating in an intake hole **32**;

d) employing Bernoulli's principle to produce a negative pressure in said gas release outlets **212** for sucking in outside air for generating air bubbles **50** during rotation of said propeller **13** to cause a high-speed flow of water **F**;

e) enabling the intake flow of air/gas to be guided by said at least one guide pipe **31** into said at least one gas inlet **211** of said air tube **21** and then discharged out of said gas release outlets **212** to mix with water and to produce multiple air bubbles **50**; and

f) utilizing the air bubbles **50** thus produced to isolate a part of the high-speed flow of water **F** and said rudder **14** and to reduce friction contact between the high-speed flow of water **F** and said rudder **14** and to further reduce the resistance of said rudder **14** against the high-speed flow of water **F**.

2. The rudder resistance reducing method as claimed in claim 1, wherein the intake hole **32** at the top end of said at least one guide pipe **31** is disposed in the boat **10** or above the water line **12**.

3. The rudder resistance reducing method as claimed in claim 2, wherein said gas guide device **30** uses a supplementary measure to guide engine waste gas or low pressure gas from the steam turbine into said at least one guide pipe **31** of said gas guide device **30** for generating air bubbles **50**.

4. The rudder resistance reducing method as claimed in claim 3, wherein said gas guide device **30** further compresses a pressure device **34** for pumping a gas into said at least one guide pipe **31** toward said at least one gas release outlet **212**, said pressure device **34** being selected from an air compressor, an air blower, an engine, a steam turbine and a turbo of the boat **10**.