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(54) **COMPOSITE PROPELLER BLADE STRUCTURE**

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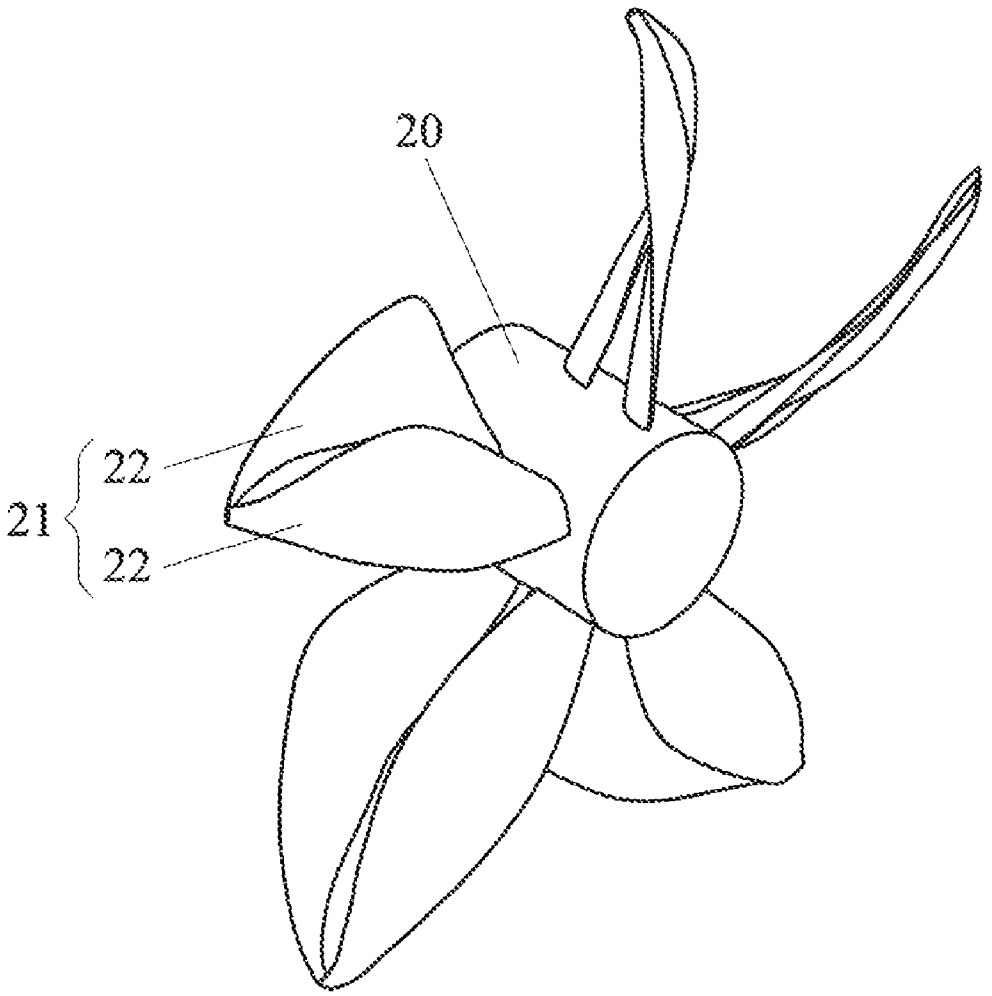
(57) **ABSTRACT**

A composite propeller blade structure includes at least a rotation shaft and a rotation surface on which plural blades are formed, and characterized in that: each of the blades is composed of plural blade units; and in the equivalent radius cross section of each of the blades, the installed location of a front edge of the blade unit at the downstream is defined as following: in the rotation axial direction, which is located behind a rear edge of the adjacent blade unit at the upstream, and the maximum distance thereof is not greater than 25% of the radius of the adjacent blade unit at the upstream; and in the circumferential direction, located at the pressure surface side defined on the nose-trail line of the adjacent blade unit at the upstream, and the maximum range thereof is not greater than (360°/2N), wherein N is the quantity of the blades.



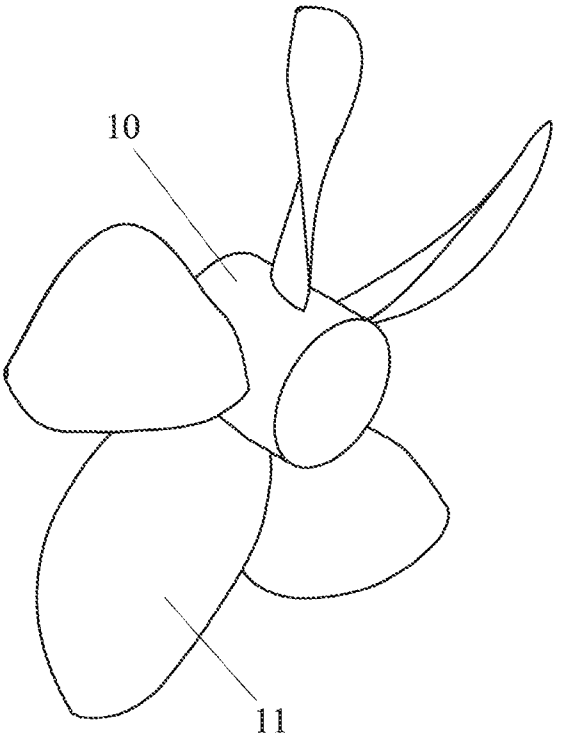


FIG.1
(Related Art)

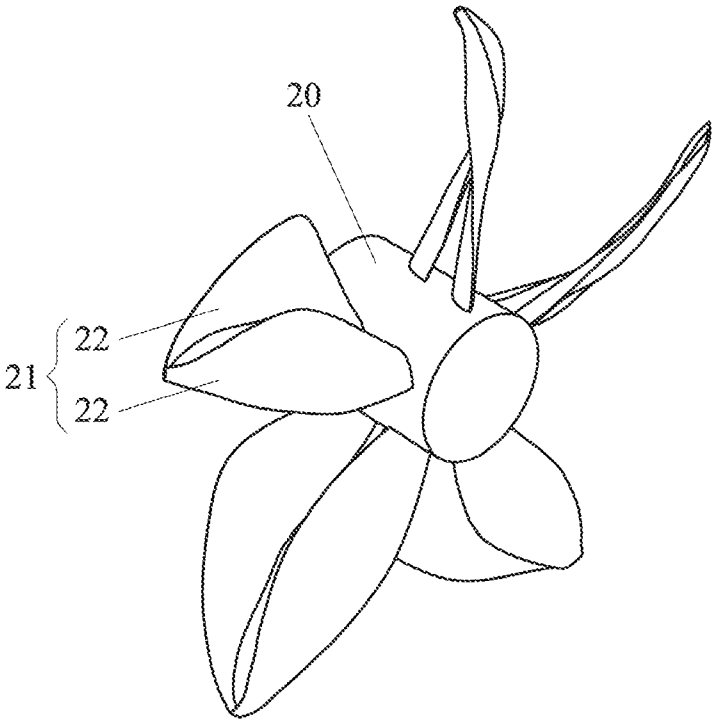


FIG.2

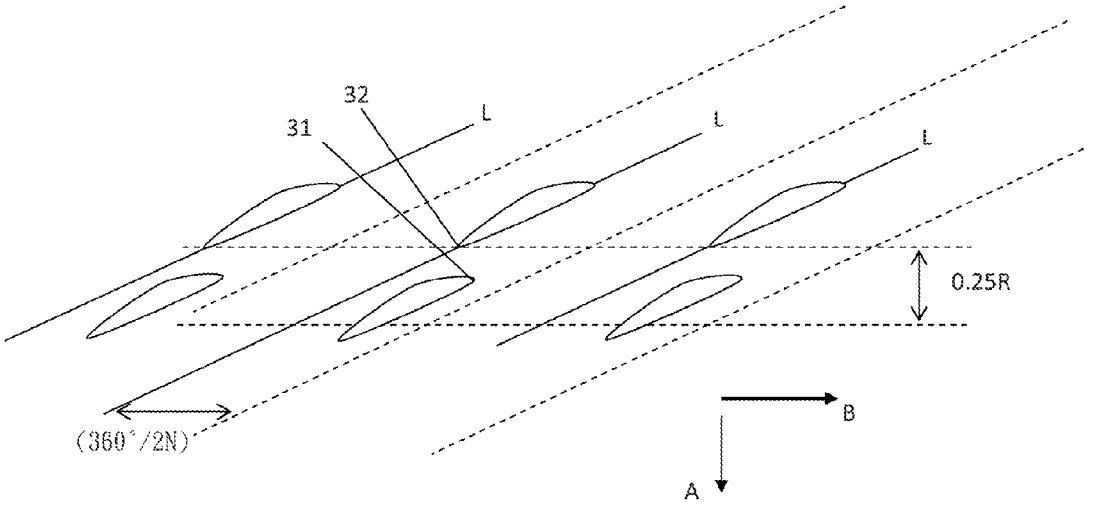


FIG.3

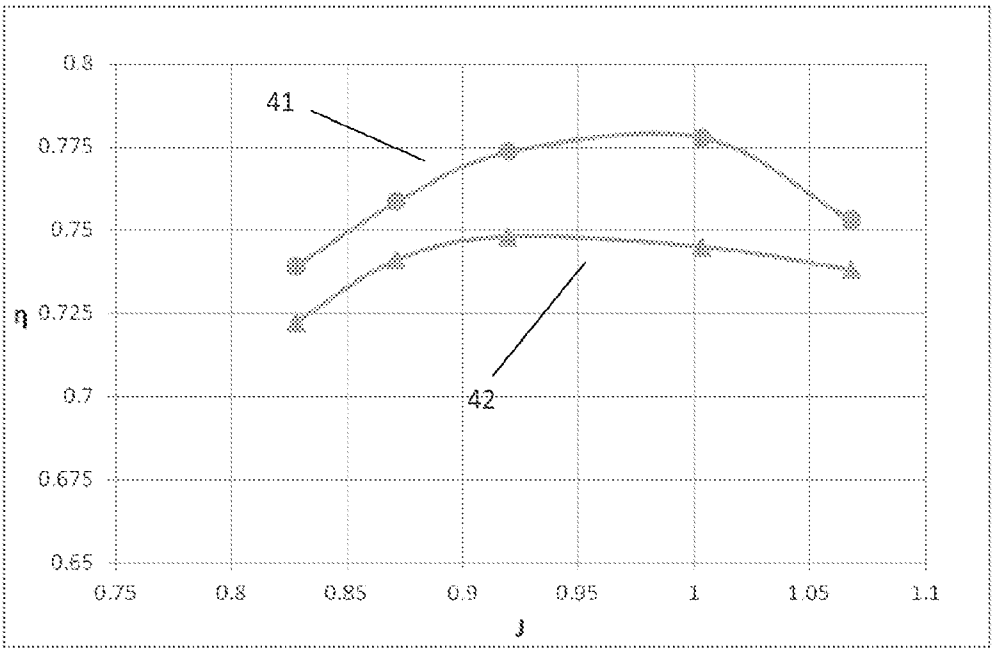


FIG.4

COMPOSITE PROPELLER BLADE STRUCTURE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a propeller blade used in a liquid fluid, especially to a composite propeller blade structure.

[0003] 2. Description of Related Art

[0004] A propeller blade is commonly used in various fields, including being applied as a thruster in a boat or a submarine for the purpose of driving. As such, the performance of a propeller blade structure being boosted plays an important role regarding to cost controlling, work efficiency and energy saving.

[0005] A typical propeller blade structure includes at least a rotation shaft and a rotation surface correspondingly formed relative to the rotation shaft, and plural blades having the same configuration are formed on the rotation surface. The existed technology for adjusting the dimension and angle of the blade for achieving the best performance has faced a bottleneck, so further performance boosting is unable to be carried out.

[0006] Accordingly, the present invention provides a composite propeller blade structure for boosting the performance of the propeller blade.

SUMMARY OF THE INVENTION

[0007] The present invention is to provide a composite propeller blade structure for boosting the performance of the propeller blade.

[0008] Accordingly, the present invention provides a composite propeller blade structure including at least a rotation shaft and a rotation surface correspondingly formed relative to the rotation shaft, and plural blades are formed on the rotation surface, which is characterized in that: each of the blades is composed of plural blade units, wherein the distance between any two adjacent blades is greater than the distance between any two adjacent blade units, and the suction side of the blade unit at the downstream is located in the position closer to the pressure side of the blade unit at the upstream rather than the suction side of the blade unit at the upstream. Accordingly in the equivalent radius cross section of each of the blades, the installed location of a front edge of the blade unit at the downstream is defined as following: in the rotation axial direction, which is located behind a rear edge of the adjacent blade unit at the upstream, and the maximum distance defined in the rotation axial direction and between the front edge of the blade unit at the downstream and the rear edge of the adjacent blade unit at the upstream is not greater than 25% of the radius of the adjacent blade unit at the upstream; and in the circumferential direction, the installed location of the front edge of the blade unit at the downstream is located at the pressure surface side defined on the-nose-trail line of the adjacent blade unit at the upstream, and the maximum range defined in circumferential direction between the front edge of the blade unit at the downstream and the nose-tail line of the adjacent blade unit at the upstream is not greater than 360°/2N, wherein N is the quantity of the blades.

[0009] According to an alternative of the composite propeller blade structure provided by the present invention, in any of the blades, an area formed on the smallest blade unit is larger than 50% of an area formed on the biggest blade unit.

[0010] According to an alternative of the composite propeller blade structure provided by the present invention, in any of the blades, a radius formed on the smallest blade unit is larger than 60% of a radius formed on the biggest blade unit.

[0011] According to an alternative of the composite propeller blade structure provided by the present invention, in any of the blades, a strengthening structure is installed for connecting the adjacent blade units.

[0012] According to an alternative of the composite propeller blade structure provided by the present invention, each of the blades is composed of two, three or more of the blade units.

[0013] According to an alternative of the composite propeller blade structure provided by the present invention, in any of the blades, the geometric shape of the blade unit can be the same or different.

[0014] In comparison with related art, the composite propeller blade structure provided by the present invention has advantages of effectively boosting the performance of the propeller blade, better energy consuming efficiency, reasonable production cost and easy to be practiced.

BRIEF DESCRIPTION OF DRAWING

[0015] FIG. **1** is a perspective view showing a conventional propeller blade structure;

[0016] FIG. **2** is a perspective view showing a composite propeller blade structure according to the present invention;

[0017] FIG. **3** is a schematic view illustrating the cross sectional relative positions of the blade units in the equivalent radius according to the present invention; and

[0018] FIG. **4** is a schematic view illustrating a higher efficiency being provided according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Preferred embodiments of the present invention will be described with reference to the drawings.

[0020] The present invention discloses a composite propeller blade structure including at least a rotation shaft and a rotation surface correspondingly formed relative to the rotation shaft, and plural blades are formed on the rotation surface, which is characterized in that: each of the blades is composed of plural blade units, wherein the distance between any two adjacent blades is greater than the distance between any two adjacent blade units, and the suction side of the blade unit at the downstream is located in the position closer to the pressure side of the blade unit at the upstream rather than the suction side of the blade unit at the upstream. Accordingly, in the equivalent radius cross section of each of the blades, the installed location of a front edge of the blade unit at the downstream is defined as following: in the rotation axial direction, which is located behind a rear edge of the adjacent blade unit at the upstream, and the maximum distance thereof is not greater than 25% of the radius of the adjacent blade unit at the upstream; and in the circumferential direction, located at the pressure surface side defined on the nose-trail line of the adjacent blade unit at the upstream, and the maximum range thereof is not greater than (360°/2N), wherein N is the quantity of the blades; a pressure gradient varying from the positive pressure towards the negative pressure is formed between the pressure side and the suction side, so the speed of a fluid between the pressure side and the suction side can be increased thereby raising the propelling force. According to the present invention, a design of adopting plural blade units

is provided for replacing the conventional art of each blade being composed of single blade unit, and with the relative locations of the plural blade units, the performance of the propeller blade is able to be effectively boosted, and advantages of better energy consuming efficiency, reasonable production cost and easy to be practiced are provided.

[0021] Please refer to FIG. **1**, which is a perspective view showing the conventional propeller blade structure; the conventional propeller blade structure includes a rotor **10** and plural blades **11** having the same configuration and installed on a rotation surface of the rotor **10**, wherein each of the blades **11** is composed of single blade unit.

[0022] Please refer to FIG. **2**, which is a perspective view showing the composite propeller blade structure according to the present invention; the composite propeller blade structure includes a rotor **20** and plural blades **21** having the same configuration and installed on a rotation surface of the rotor **20**, wherein each of the blades **21** is composed of plural blade units **22**; according to this embodiment, each of the blades **21** is composed of two blade units or can also be composed of more than two blade units, e.g. three blade units. Wherein, the distance between any two adjacent blades is greater than the distance between any two adjacent blade units. In addition, the arrangement or the geometric shape of the blade units of each blade on the composite propeller blade can be the same or different.

[0023] Please refer to FIG. **3**, which is a schematic view illustrating the cross sectional relative positions of the blade units in the equivalent radius according to the present invention; as shown in FIG. **3**, in the equivalent radius cross section of each of the blades, the installed location of a front edge of the blade unit at the downstream **31** is defined as following: in the rotation axial direction A, which is located behind a rear edge of the adjacent blade unit at the upstream **32**, and the maximum distance thereof is not greater than 25% of the radius R of the adjacent blade unit at the upstream (0.25R); and in the circumferential direction B, located behind the nose-tail line L of the adjacent blade unit at the upstream, and the maximum range thereof is not greater than (360°/2N), wherein N is the quantity of the blades.

[0024] According to another preferred embodiment of the composite propeller blade structure provided by the present invention, a strengthening structure is installed on each of the blades for connecting the adjacent blade units; the material of which the strengthening structure is made can be the same as or different from the material of which the blade unit is made; the strengthening structure can be integrally formed with the blade units.

[0025] According to another preferred embodiment of the composite propeller blade structure provided by the present invention (not shown in figures), in any of the blades, the blade units at the upstream and at the downstream can be formed with different areas, wherein an area A**2** formed on the smallest blade unit is larger than 50% of an area A**1** formed on the biggest blade unit.

[0026] According to another preferred embodiment of the composite propeller blade structure provided by the present invention (not shown in figures), in any of the blades, the blade unis at the upstream and at the downstream can be formed with different radiuses, for example, a radius R**2** formed on the smallest blade unit is larger than 60% of a radius R**1** formed on the biggest blade unit.

[0027] Please refer to FIG. **4**, which is a schematic view illustrating a higher efficiency being provided according to the present invention; wherein J is defined as the propeller operating condition Va/nD (Va is the advance speed, n is the rotation speed in revolutions per second, and D is the diameter of the propeller), η is the propelling efficiency; as shown in FIG. **4**, according to the composite propeller blade structure provided by the present invention, the efficiency characteristic curve **41** is much higher than the efficiency characteristic curve **42** of the conventional propeller blade structure; as such, the composite propeller blade structure provided by the present invention has advantages of consuming less energy and greatly boosting the performance of the propeller blade.

[0028] The applicant of the present invention has been using the computer to calculate and analyze the data obtained by fluid dynamics, with the massive scale of calculation and research, the applicant has found that: with the composite propeller blade structure, the geometric shape and the relative location of the adjacent blades plays an important role regarding to performance, the solution provided by the present invention has successfully boosted the performance, other attempts of modifying or copying the solution provided by the present invention would not provide the same result and may cause poorer performance.

[0029] Although the present invention has been described with reference to the foregoing preferred embodiment, it will be understood that the invention is not limited to the details thereof. Various equivalent variations and modifications can still occur to those skilled in this art in view of the teachings of the present invention. Thus, all such variations and equivalent modifications are also embraced within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A composite propeller blade structure, including:

at least a rotation shaft and a rotation surface correspondingly formed relative to the rotation shaft; and

a plurality of blades formed on the rotation surface, each of the blades being composed of a plurality of blade units,

wherein a distance between any two adjacent blades is greater than a distance between any two adjacent blade units, and a suction side of the blade unit at downstream is located in the position closer to a pressure side of the blade unit at upstream rather than the suction side of the blade unit at the upstream. Accordingly, in an equivalent radius cross section of each of the blades, a installed location of a front edge of the blade unit at the downstream is defined as following: in a rotation axial direction, which is located behind a rear edge of an adjacent blade unit at the upstream, and a maximum distance defined in the rotation axial direction and between the front edge of the blade unit at the downstream and the rear edge of the adjacent blade unit at the upstream is not greater than 25% of the radius of the adjacent blade unit at the upstream; and in a circumferential direction, a installed location of the front edge of the blade unit at the downstream is located at the pressure surface side defined on a nose-trail line of the adjacent blade unit at the upstream, and a maximum range defined in circumferential direction and between the front edge of the blade unit at the downstream and the nose-tail line of the adjacent blade unit at the upstream is not greater than 360°/2N, wherein N is the quantity of the blades.

2. The composite propeller blade structure according to claim **1**, wherein in any of the blades, an area formed on the smallest blade unit is larger than 50% of an area formed on the biggest blade unit.

3. The composite propeller blade structure according to claim **1**, wherein in any of the blades, a radius formed on the smallest blade unit is larger than 60% of a radius formed on the biggest blade unit.

4. The composite propeller blade structure according to claim **1**, wherein in any of the blades, a strengthening structure is installed for connecting the adjacent blade units.

5. The composite propeller blade structure according to claim **1**, wherein each of the blades is composed of two blade units.

6. The composite propeller blade structure according to claim **1**, wherein each of the blades is composed of three blade units.

7. The composite propeller blade structure according to claim **1**, wherein the blades are formed with the same configuration.

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