(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 532 579 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.12.2012 Bulletin 2012/50

(51) Int Cl.:
B63H 1/20 *(2006.01)*

(21) Application number: **12004358.3**

(22) Date of filing: **08.06.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **10.06.2011 TR 201105698**

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(54) **Propeller having dismountable blades**

(57) A vessel propeller (1) comprising a cylindrical hub (2) rotatable about a rotation axis and a plurality of blades (3) provided radially around the hub (2) with a certain pitch angle. The propeller is characterized in that the hub (2) comprises a blade connection housing (4) helically formed on the cylindrical surface of the hub (2) for the demountable connection of each blade (3) to the hub; each blade (2) comprises a hub connector (5) to be placed in the respective connection housing (4); and plurality of external connecting members (6) extending axially along the hub thickness for rigidly connecting the hub (2) and plurality of blades (3).

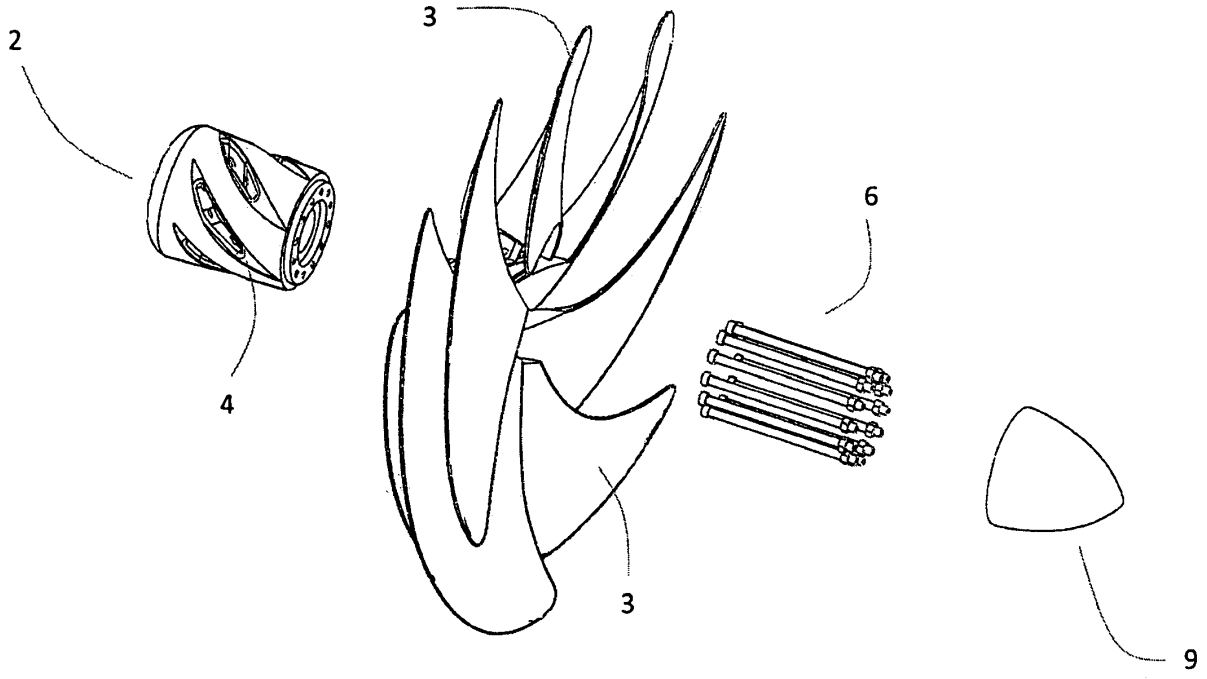

Figure 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a vessel propeller having demountable blades.

BACKGROUND OF THE INVENTION

[0002] The propulsion required for the movement of marine vessels sailing afloat such as boats, ships and under water such as submarines is provided by propellers. Propellers, in general, consist of a central hub and plurality of blades combined with the hub. The surfaces of the propeller blades are generally helicoidal and the flowing water is caught by the leading edge of the blade and compressed on the helicoidal surface to form a pressure and then it accelerates over the blade and leaves from the trailing edge. The course of the fluid on blade surface, and hence the water compression on blade surface affect the amount of thrust to be obtained.

[0003] Propellers are conventionally cast in one piece and produced after being machined. In other words, the blades are integrally produced with the hub. This structure has some disadvantages: For example, blades, in general, are not allowed to overlap for the removal of the propellers from the cast mold, and for the surface machining after molding; and therefore such blades can get slightly higher than surface area ratio 1:1, generally being under value of 1 (e.g. 0,950). Another disadvantage of the known propellers is that in case one of the blades is damaged due to mechanical fatigue, external impacts, or some other reasons, the entire propeller needs to be replaced. Moreover, blades must be provided along hub thickness (i.e. along the axis of the hub) in order to obtain maximum thrust from the blades arranged radially around the hub. Production cost of such a complicated structure is high, since a detailed planning before and during operation is required; moreover, huge benches or machine tracks are needed so as to meet the size of the entire propeller.

[0004] US 4930987 discloses a propeller with demountable blades. The blades are in fact integrally connected to the hub having a dismountable structure each piece of which is integrated with a blade. The disadvantage of the propeller disclosed in US 4,930,987 is that, when one of the blades is to be replaced, the hub needs to be replaced partially, as well. Thus, this necessity leads to the loss of hub material, apart from blade material.

[0005] US 3764228 discloses a propeller with replaceable blades. The hub is disintegrated and each blade is integrated to these hub parts. In other words, as in US 4,930,987, when one of the blades is to be replaced, the hub needs to be replaced partially as well.

[0006] US 1122925 has a similar disadvantage. The blades are integrated into the parts of the hub. Moreover, none of the above mentioned prior art references provides an adequately rigid blade-hub connection. Possible consequences of this disadvantage include increased propeller vibration, occurring unbalanced centrifugal forces, noisy operation of the propeller, leading to reduced propeller efficiency.

DESCRIPTION OF THE INVENTION

[0007] The object of the present invention is to provide a propeller having demountable blades, with an increased connection rigidity and efficiency.

[0008] The present invention relates to a vessel propeller comprising a cylindrical hub rotatable about a rotation axis and a plurality of blades provided radially around the hub with a certain pitch angle. The propeller is **characterized in that** the hub comprises a blade connection housing helically formed on the cylindrical surface of the hub for the demountable connection of each blade to the hub; each blade comprises a hub connector to be placed in the respective connection housing; and plurality of external connecting members extending axially along the hub thickness for rigidly connecting the hub and plurality of blades.

[0009] Thus, it is possible to have a propeller, whose blades can be rigidly connected to the hub in a demountable manner, without the need for disintegrating the hub.

[0010] The connection of blades to the hub is preferably achieved by means of bolts or nuts. Therefore, holes formed axially along the hub thickness around rotation axis of the hub are provided in order for the bolts to pass therethrough. Similarly, hub connectors are provided with holes in order for the bolts to pass therethrough.

[0011] In a preferred embodiment of the invention, the curve of the blade connection housings formed helically on the external cylindrical surface of the hub is formed such that the same connecting member can be used for connecting two consecutive blades to the hub, when it is passed axially through the hub. However, in any case, it is preferable that a blade is connected to the hub by means of multiple connecting members.

BRIEF DESCRIPTION OF THE FIGURES

[0012] In order for the embodiment and advantages thereof, together with the additional elements to be better understood, the following figures should be taken into account while evaluating.

Fig. 1 is a disintegrated view of the propeller according to the invention.

Fig. 2 is a bottom perspective view of propeller blade.

Fig. 3 is a longitudinal sectional view of the propeller hub.

Fig. 4 is a side view of the propeller hub.

DETAILED DESCRIPTION OF THE INVENTION

[0013] As seen in Fig. 1, the propeller (1) according to the invention comprises a hub (2) having a cylindrical form and rotatable around a rotation axis by means of a shaft (not shown) coupled to an engine (not shown); and blades (3) arranged radially around the said hub (2) with a certain pitch angle. In the middle of the hub (2) there is provided a shaft fitting cavity (10), into which the shaft mounted. Each blade (3) is rigidly connected to the hub in a demountable manner by means of connecting members (6). Therefore, a plurality of longitudinal blade connection housings (4) are formed on external cylindrical surface of the hub (2), in the same number as that of blades. As can be seen in figures, blade connection housings (4) are arranged along the longitudinal direction of the hub (2) from one end to another, and on the external surface of the hub (2) in helix form. In this case, each housing (4) extends such that it will make a helix angle (14) with respect to the longitudinal direction of the hub.

[0014] Each blade (3) comprises a hub connector (5) mounted to the respective housing (4). The hub connectors (5) are arranged at the edge (12) of the blade connecting with the hub (2). The hub connectors (5) are structured in protrusion form in proximity of the leading edge (16) of the blade (3), preferably right underside of it. The hub connector (5) can be produced together with the blade (3), i.e. in one piece, alternatively, it can be produced individually and fixed to joining edge (12) of blade with the hub (2) by welding, for example. The geometric form of the blade connection housings (4) provides a perfect match with the external geometric form of the connectors (5); thus, the outer form of the connectors (5) perfectly fits in the inner form of the housings (4). When a blade connector (5) is fitted in the housing (4) provided in the hub (3), joining edge (12) of blade with the hub provided on the blade connector (5) perfectly fits on joining surfaces (13) of hub with the blade surrounding blade connection housings (4). These joining surfaces (13) of hub with the blade are formed such that a slight recess is formed on the external cylindrical surface of the hub.

[0015] Each hub connector (5) comprises a plurality of connecting member openings (8) provided along the width of the respective connector, the openings (8) being away from one another. These openings (8) extend parallel to the longitudinal axis of the hub (2). According to the preferred embodiment of the invention, the number of openings (8) of each hub connector is three; and these are provided along the longitudinal direction of the connectors (5), one in front, another in the middle, and the other in the rear part.

[0016] As can be seen in Fig. 3, connecting member holes (7), which are circularly arranged around hub rotation axis and which extend along hub thickness (15) in the inner wall of the hub (2) are provided. The continuity of connecting member holes (7) along hub thickness (15) is interrupted by the housings (4). That is, longitudinal axis of the connecting member holes (7) passes through the housing cavity. The distance of connecting member holes (7) from the axis of the hub (2) and their radial locations with respect to hub axis are arranged such that each connecting member opening (8) fits in the corresponding connecting member hole (7) in the housing (4), when connectors (5) are fitted in the housings (4) in the hub (2).

[0017] Since the hole (7) and openings (8) overlap after connectors (5) are fitted in the housings (4) in the hub (2), the connecting members (6) are passed through the hole on frontal surface (11) of the hub (2), and the connecting members (6) are made to get out of the hole on the other surface (11) of the hub (2), also the connecting members (6) are mechanically fastened in a rigid manner. Thus, the connection of each blade (3) to the hub (2) is provided in demountable manner.

[0018] Advantageously, each connecting member (6) contributes to the fastening of more than one blade (3) to the hub (2). As the blade connection housings (4) are helically opened on the outer surface of the hub (2), consecutive housings (4) at least partially overlap along the axial direction. In particular, at least one connecting member hole (7) of the consecutive housings (4) is coaxially provided in the same direction.

[0019] Thus, a connecting member used for fastening a blade in a housing is also used for fastening another blade to the hub (2) in a subsequent housing. In particular, advantageously, as seen in Fig. 4, that the same connecting member (6) passes through the connecting member hole in front part of a housing and through the connecting member hole in the rear part of a subsequent housing increases the rigidity of blade-hub connection. In such a case, the connecting member (6) providing the fastening of the blade by passing through the hole in front part of the housing supports the leading edge (16) of the respective blade whereas the connecting member (6) providing the fastening of the blade by passing through the hole at the rear part of the housing supports the trailing edge (17) of the respective blade. As a matter of fact the water entering into and getting out of the blade creates a moment, thereby forming an associated force in blade-hub connection sections (in front and rear parts of the housings).

[0020] According to the preferred embodiment of the invention, the connecting member (6) used for connecting the blades (3) to the hub is a bolt (with a cylindrical straight body and with screw and nut at its end), and the mechanical rigidity of the said bolt connection is provided by a corresponding nut. Some other external connecting member known in the art can be used instead of bolt, e.g. a stud etc. After the bolts are inserted, a hub housing (9) is engaged to the frontal surface of the propeller (1) facing the water in a way that it will cover the diameter of the hub.

Claims

1. A vessel propeller (1) comprising a cylindrical hub (2) rotatable about a rotation axis and a plurality of blades (3) provided radially around the hub (2) with a certain pitch angle, **characterized in that** the hub (2) comprises a blade connection housing (4) helically formed on the cylindrical surface of the hub for the demountable connection of each blade (3) to the hub (2); each blade (3) comprises a hub connector (5) to be placed in the connection housing (4); and plurality of external connecting members (6) extending axially along the hub thickness (15) for rigidly connecting the hub (2) and plurality of blades (3).

2. A propeller according to claim 1, **characterized by** comprising connecting member holes (7) circularly arranged around hub rotation axis and extending along the hub thickness (15) in the inner wall of the hub (2), the axial continuity of the connecting member holes (7) being interrupted by the housings (4).

3. A propeller according to claim 2, **characterized in that** at least one connecting member hole (7) of the consecutive blade connection housings (4) are coaxially provided in the same direction.

4. A propeller according to claim 1, **characterized in that** each hub connector (5) comprises plurality of connecting member openings (8) provided along the width of the respective hub connector (5), the connecting member openings (8) being away from one another such that each corresponds to each connecting member hole (7) when hub connector (5) is placed in the corresponding blade connection housing (4).

5. A propeller according to claim 1, **characterized in that** the connecting member (6) comprises a bolt or a drift pin.

6. A propeller according to claim 5, **characterized in that** the connecting member (6) comprises a nut in order to be mechanically fixed in a rigid manner.

7. A propeller according to claim 1, **characterized in that** the geometric form of the blade connection housings (4) is designed to match the external geometric form of the connectors (5).

8. A propeller according to any one of the preceding claims, **characterized in that** each blade (3) comprises a joining edge (12) on which respective blade connector (5) is provided.

9. A propeller according to any one of the preceding claims, **characterized in that** the hub (2) comprises joining surfaces (13) configured by forming a recess on the external cylindrical surface of the hub (2), the joining surfaces (13) surrounding the blade connection housings (4); wherein joining edges (12) of the blades (3) perfectly fits on joining surfaces (13) of the hub (2).

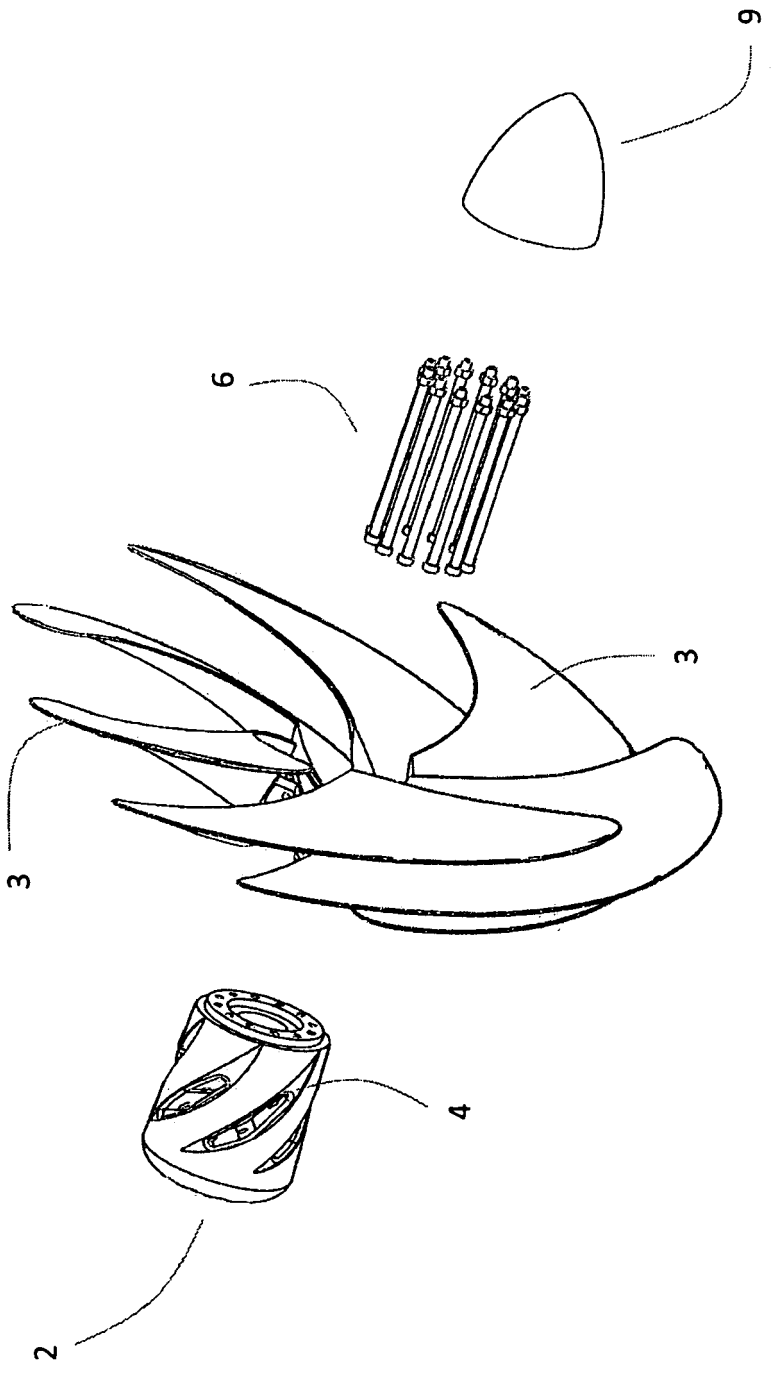

Figure 1

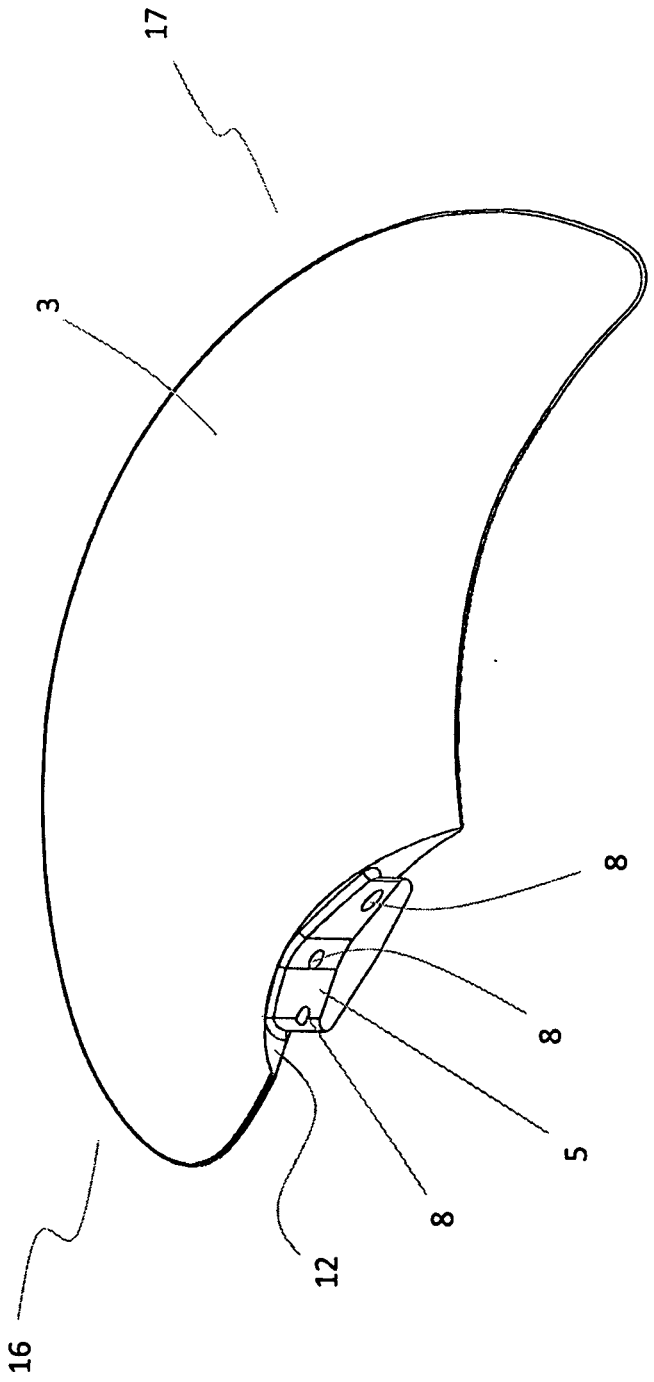

Figure 2

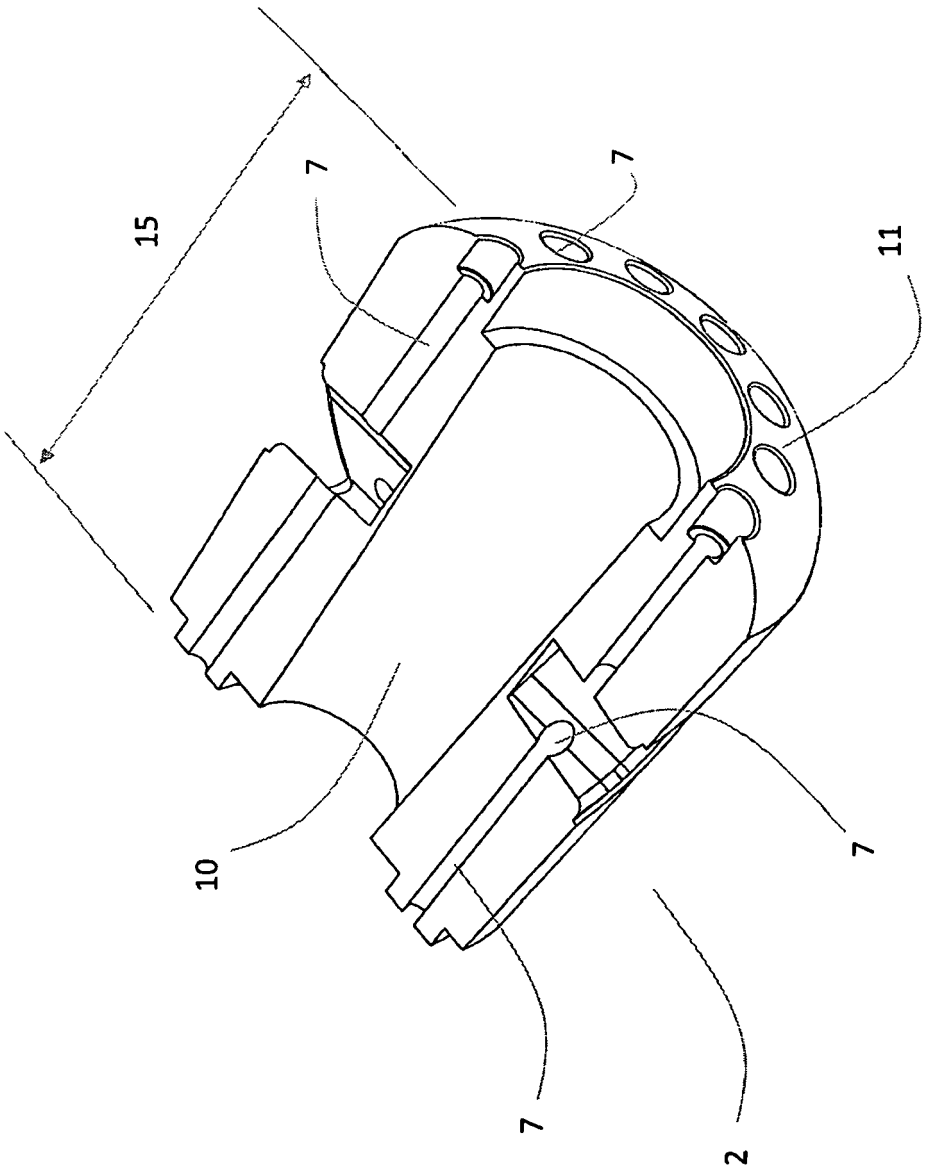

Figure 3

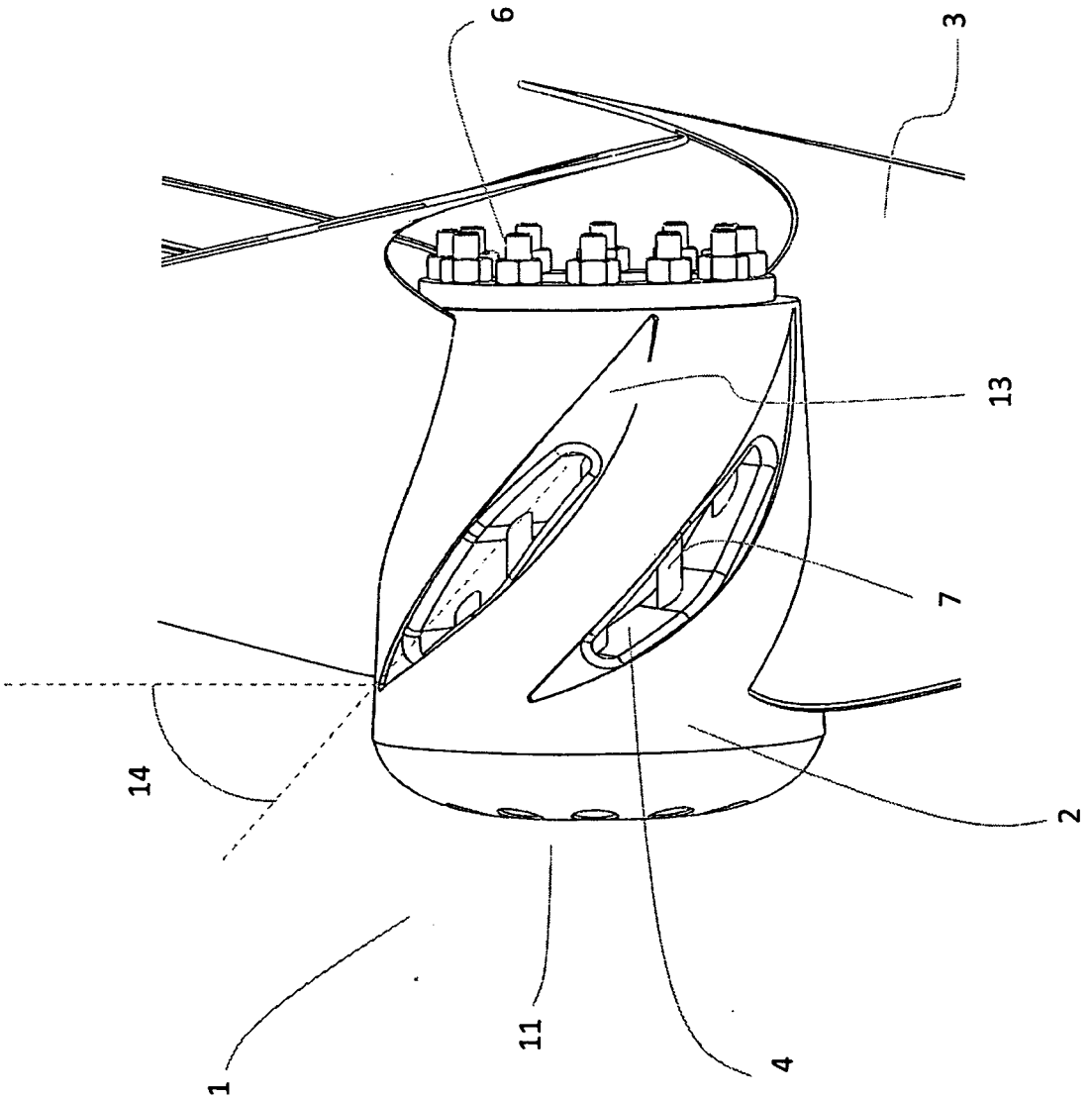

Figure 4

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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 4358

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 894 708 A2 (FUERSTLICH HOHENZOLLERNSCHE WE [DE]) 3 February 1999 (1999-02-03) * abstract * * paragraphs [0007], [0031] - [0039] * * figures 1-7 *	1,5,7-9	INV. B63H1/20
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A	US 4 150 921 A (EASTMAN MARK E [US] ET AL) 24 April 1979 (1979-04-24) * figures 1, 2 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B63H
F04D
B64C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 October 2012	Weber, Ingo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 00 4358

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01-10-2012

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- US 3764228 A **[0005]**
- US 1122925 A **[0006]**