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(54) BLADE MECHANISM FOR A FAN AND FAN WITH SUCH BLADE MECHANISM

(57) The invention relates to a blade mechanism (10) for a fan which comprising a base (1) and a plurality of blades (2) arranged around the base (1), wherein the blades (2) are connected with the base (1). The outer contour of the blade (2) has a raised portion (7) at the distal end away from the base (1), and the blade mechanism (10) has a flow blocking member (3) arranged between at least two adjacent blades (2), the height of the distal end of the flow blocking member (3) away from the base (1) is greater than or equal to the height of the raised portion (7) in a direction perpendicular to the rotation direction of the blade (2). Through the invention, the static pressure of the fan blade is increased, the static pressure-airflow curve of the fan blade is improved, and the performance of the fan blade is improved.

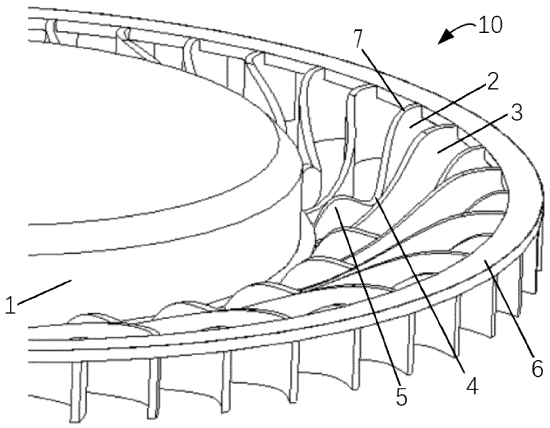

Fig. 1

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Description

FIELD

[0001] The present invention relates to a blade mechanism for a fan. The present invention also relates to a fan with such a blade mechanism.

BACKGROUND

[0002] In a centrifugal fan, a P-Q curve is usually used to reflect the performance of the fan, where P represents the static pressure of the fan, and Q represents the airflow through the fan. The larger the P value and the larger the Q value is, the better the P-Q curve is, and thus the better the fan performance is.

[0003] In order to optimize the P-Q curve of the fan, a major improvement is the design of the fan blades.

SUMMARY

[0004] The object of the present invention is to improve the static pressure characteristics of the fan blades and at the same time increase the airflow rate of the fan blade, and increase the air volume.

[0005] Said object is achieved by a blade mechanism for a fan and a fan with such a blade mechanism proposed according to the present invention.

[0006] The present invention proposes a blade mechanism for a fan, which includes a base and a plurality of blades arranged around the base, wherein the blades are connected with the base. According to the present invention, the outer contour of the blade has a raised portion at the distal end away from the base, and the blade mechanism has a flow blocking member arranged between at least two adjacent blades, the height of the distal end of the flow blocking member away from the base is greater than or equal to the height of the raised portion in a direction perpendicular to the rotation direction of the blades.

[0007] The airflow is hindered by the raised portion, thereby increasing the static pressure of the fan blade. In addition, since the height of the distal end of the flow blocking member is greater than or equal to the height of the raised portion, the flow blocking member blocks the raised portion of the blade in the direction perpendicular to the blade. As a result, the blocking effect on the airflow can be further enhanced, thereby further increasing the static pressure of the fan blade.

[0008] In an embodiment of the invention, the outer contour of the blade has a groove in the middle in the extending direction from the base to the distal end away from the base. Due to the groove, the airflow through the blades is increased.

[0009] In an embodiment of the present invention, the blade mechanism has a protrusion. The protrusion may be provided at a proximal end of the outer contour of the blade close to the base. Alternatively or additionally, the protrusion is provided on the base. By means of the protrusion, air turbulence is induced, thereby increasing the airflow rate.

[0010] In an embodiment of the present invention, the flow blocking member does not completely block the groove and the protrusion in a direction perpendicular to the blades. Thus, in the direction perpendicular to the blades, the grooves and the protrusions can be at least partially exposed so as to exert their respective functions.

[0011] In an embodiment of the present invention, the height of the flow blocking member gradually increases from its proximal end close to the base to its distal end away from the base. As a result, the contour curve of the flow blocking member is smoothed, which is beneficial to the aerodynamic properties and is easy to manufacture.

[0012] In an embodiment of the present invention, the blade mechanism further comprises an outer edge portion, the outer edge portion is provided on the outer side of the blade and connected with the blade, and the flow blocking member is connected with the outer edge portion only at its distal end. This means that the flow blocking member may not extend to the base. As a result, the size of the flow blocking member can be reduced, thereby reducing the weight of the blade mechanism.

[0013] In an embodiment of the invention, the flow blocking member is connected with the outer edge portion both at its distal end, and at its proximal end with the base. In this way, the mechanical stability of the flow blocking member is enhanced, and the overall stability of the blade mechanism is also increased.

[0014] According to another aspect, the present invention also relates to a fan having the blade mechanism as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other advantages and designs of the present invention will be described in detail below with reference to the accompanying drawings, wherein:

FIG. 1 shows a partial view of a blade mechanism for a fan according to an exemplary embodiment of the present invention;
FIG. 2 shows an overall view of a blade mechanism for a fan according to an exemplary embodiment of the present invention;
FIG. 3 shows the comparison of experimental results between the present invention and the prior art.

DETAILED DESCRIPTION

[0016] Corresponding numerals and symbols in the different figures generally refer to corresponding regions unless otherwise indicated. The drawings are drawn to clearly illustrate relevant aspects of the embodiments and are not necessarily drawn to scale. The edges of features drawn in the figures do not necessarily indicate

the end of the range of the feature.

[0017] In the following description, various specific details are shown in order to provide an in-depth understanding of various examples of embodiments in accordance with the description. The embodiments may be obtained without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations have not been shown or described in detail so as not to obscure aspects of the embodiments.

[0018] References to "an example" or "an embodiment" within the framework of this specification are intended to indicate that a particular configuration, structure or characteristic described in relation to the embodiment is included in at least one embodiment. Thus, phrases such as "in an example," "in an embodiment," etc., which may appear in various aspects of this specification are not necessarily referring to the same embodiment. Furthermore, the particular configurations, structures or characteristics may be combined in any suitable manner in one or more embodiments.

[0019] The headings/reference numerals used here are provided for ease of reading only, and thus do not limit the scope of protection or the scope of the embodiments. Identical or similar elements are identified with the same reference numerals.

[0020] Exemplary embodiments according to the present invention will be described in detail below with reference to FIGS. 1 to 3. Referring first to FIGS 1 to 2, there is shown a blade mechanism 10 for a fan in accordance with the present invention. The blade mechanism 10 includes a base 1 and a plurality of blades 2 arranged around the base 1, wherein the blades 2 are connected with the base 1. According to the design of the present invention, the outer contour of the blade 2 has a raised portion 7 at the distal end away from the base 1, and the blade mechanism 10 has a flow blocking member 3 arranged between at least two adjacent blades 2, and the height of the distal end of the flow blocking member 3 away from the base 1 is greater than or equal to the height of the raised portion 7 in the direction perpendicular to the rotation direction of the blade 2.

[0021] In order to improve the P-Q curve of the fan blade, in the prior art, those skilled in the art are often limited to focusing on how to increase the airflow rate, but do not try to increase the static pressure of the fan blade, because the traditional concept is that the effect of ventilation and cooling will be reduced if the air blowing of the fan is blocked. The present invention breaks through the limitation of traditional concepts, and proposes for the first time that the raised portion 7 is provided at the distal end of the blade 2, and the flow blocking member 3 is added between at least two adjacent blades 2, so as to increase the static pressure of the fan blade, and further the P-Q curve of the fan blade is significantly improved, and the performance of the fan blade is greatly improved. By means of the raised portion 7, the airflow generated by the fan is obstructed as it flows through the blades 2, thereby increasing the static pressure of the fan blades. In the prior art, the outer contour of the distal end of the blade is generally designed to be rounded and smoothed to facilitate aerodynamics and facilitate manufacturing. The present invention breaks the inherent concept and creatively proposes to provide the raised portion 7 at the distal end of the blade 2, thereby increasing the static pressure of the fan blade. In addition, since the height of the distal end of the flow blocking member 3 is greater than or equal to the height of the raised portion 7, the flow blocking member 3 blocks the raised portion 7 of the blade 2 in the direction perpendicular to the blade 2. Thereby, the blocking effect on the airflow can be further enhanced, thereby further increasing the static pressure of the fan blade 2. The increase in static pressure improves the P-Q curve (i.e., the static pressure-airflow curve) of the fan blade, which improves the performance of the fan blade.

[0022] In an embodiment of the present invention, the height of the blocking member 3 gradually increases from its proximal end close to the base 1 to its distal end away from the base 1. In this way, the profile curve of the flow blocking member 3 is smoothed, which is favorable for the aerodynamic properties and facilitates the manufacture. However, it is also possible for the contour of the flow blocking member 3 to vary in other ways, for example in a step-like manner. The present invention does not limit this.

[0023] In an embodiment of the present invention, the blade mechanism 10 further includes an outer edge portion 6, which is provided on the outer side of the blade 2 and connected with the blade 2, and the flow blocking member 3 is only at its distal end connected with the outer edge portion 6. This means that the flow blocking member 3 can extend only a distance from the outer edge portion 6 towards the base 1 without extending to the base 1. Through this design, the size of the flow blocking member 3 can be reduced, thereby reducing the weight of the blade mechanism 10. However, in this case, for the sake of mechanical stability, the extending length of the flow blocking member 3 should not be too long, for example, less than one third of the extending length of the blade 2.

[0024] In an embodiment of the invention, the flow blocking member 3 is connected both at its distal end with the outer edge portion 6 and at its proximal end with the base 1. That is, the flow blocking member 3 extends from the outer edge portion 6 to the base 1. In this way, the mechanical robustness of the flow blocking member 3 is enhanced, and the overall robustness of the blade mechanism 10 is also enhanced.

[0025] In the embodiment shown in FIG. 1, the flow blocking member 3 is plate-shaped. In other embodiments, the flow blocking member 3 can also be in any other shape, as long as it can increase the static pressure of the fan blade. The flow blocking member 3 may be arranged parallel to the blades 2. However, the flow blocking member 3 can also be arranged slightly oblique-

ly with respect to the blade 2.

[0026] It should be pointed out that the flow blocking member 3 can be arranged between every two adjacent blades 2, that is, arranged alternately with the blades 2. However, it is also feasible that a flow blocking member 3 is provided at intervals of several, such as three or four blades 2, that is to say, there may be one, two or more blades 2 between two flow blocking members 3. The number of blades 2 between every two flow blocking members 3 may be the same or different.

[0027] In addition, in the present invention, the blade 2 and/or the flow blocking member 3 may extend in the radial direction, or may extend obliquely with respect to the radial direction. The plane, in which the blade 2 and/or the flow blocking member 3 is located, can be a completely flat plane, or it can have a small curvature so as to present a wave shape. It is also possible to overlap several blades 2 together to form multiple blades, such as double blades or triple blades, to increase the mechanical strength and, for wavy blades, the wave effect.

[0028] In an embodiment of the invention, the outer contour of the blade has a groove 4 in the middle in the extending direction from the base 1 to the distal end away from the base 1. Due to the groove 4, the resistance of the airflow through the blade 2 is significantly reduced, thereby increasing the airflow through the blade 2. In the prior art, in order to improve the flow rate of the air and also to facilitate the manufacture, a protrusion is often provided in the middle of the blade. The present invention breaks through this conventional inertial thinking. Specifically, instead of the protrusion, a groove 4 is provided in the present invention. The air flow through the blade 2 is increased by means of the groove 4, thereby increasing the airflow rate from the opposite side, which helps to improve the P-Q curve of the fan blade and improve its performance.

[0029] In an embodiment of the present invention, the blade mechanism 10 has protrusions 5. Here, the protrusions 5 can be provided at the proximal end of the outer contour of the blade 2 close to the base 1. Alternatively or additionally, the protrusions 5 can also be provided on the base 1. By means of the protrusions 5, a disturbance or turbulence of the air is induced, thereby increasing the airflow rate. In the prior art, as mentioned above, the protrusions 5 are usually arranged in the middle of the blade 2. In contrast, in the present invention, by arranging the protrusions 5 at the proximal end of the outer contour of the blade 2 close to the base 1 or on the base 1, the middle of the blade is reserved for setting groove 4. Compared with the prior art, the present invention significantly improves the airflow rate through the combination of the protrusion 5 and the groove 4.

[0030] It should be noted that the groove 4 and the protrusion 5 may be arranged on a common blade 2, or may be arranged on different blades 2 respectively. That is, some blades 2 may have both grooves 4 and protrusions 5, while other blades 2 may have only grooves 4 or only protrusions 5. In addition, the same blade 2 may have one or more grooves 4. Likewise, the same blade 2 may have one or more protrusions 5.

[0031] In an embodiment of the present invention, the flow blocking member 3 does not completely block the groove 4 and the protrusion 5 in the direction perpendicular to the blade 2. This means that, in a direction perpendicular to the blade 2, the groove 4 and the protrusion 5 can be at least partially exposed so as to exert their respective functions. In a further embodiment, in the direction perpendicular to the blade 2, the groove 4 and the protrusion 5 are completely exposed, which can fully play their respective roles.

[0032] The present invention also relates to a fan having the blade mechanism 10 as described above. The various designs and advantages described above for the blade mechanism 10 also apply accordingly to the fan according to the present invention. The present invention will not be repeated here.

[0033] Referring to FIG. 3, it shows the comparison of experimental results between the present invention and the prior art. The experimental results show that, compared with the prior art, after adopting the present invention, the static pressure of the fan blade 2 is increased by at least 5.4%, and the airflow rate is increased by at least 1.4%. It can be seen from FIG. 3 that the P-Q curve (i.e., the static pressure-airflow curve) of the fan blade 2 is improved by the present invention, thereby improving the performance of the fan blade.

[0034] It should be noted that the present invention can be applied to any centrifugal fan, regardless of whether the blades 2 are forward-type blades, backward-type blades, or radialtype blades. The application fields of the present invention include industrial and commercial fields, household fields, etc., for example, it can be applied to masks or various household appliances.

[0035] Many modifications and other embodiments of the disclosures set forth herein will come to mind to those skilled in the art to which the disclosures pertain from the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the embodiments of the present disclosure are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the present disclosure. Additionally, while the above description and associated drawings describe example embodiments in the context of certain example combinations of components and/or functions, it should be appreciated that various combinations of components and/or functions may be provided by alternative embodiments without departing from the scope of the present disclosure. In this regard, for example, other combinations of components and/or functions than those expressly described above are also contemplated to be within the scope of the present disclosure. Although specific terms are employed herein, they are used in a generic and descriptive sense only and are not intended to be limiting.

List of reference numbers

[0036]

1	base
2	blade
3	flow blocking member
4	groove
5	protrusion
6	outer edge portion
7	the raised portion
10	blade mechanism

Claims

1. A blade mechanism (10) for a fan, comprising a base (1) and a plurality of blades (2) arranged around the base (1), wherein the blades (2) are connected with the base (1), **characterized in that**, an outer contour of the blade (2) has a raised portion (7) at a distal end away from the base (1), and the blade mechanism (10) has a flow blocking member (3) arranged between at least two adjacent blades (2), a height of a distal end of the flow blocking member (3) away from the base (1) is greater than or equal to a height of the raised portion (7) in a direction perpendicular to a rotation direction of the blade (2).

2. The blade mechanism (10) according to claim 1, **characterized in that**, the outer contour of the blade (2) has a groove (4) in the middle in an extending direction from the base (1) to the distal end away from the base (1).

3. The blade mechanism (10) according to claim 2, **characterized in that**, the blade mechanism (10) has a protrusion (5).

4. The blade mechanism (10) according to claim 3, **characterized in that**, the protrusion (5) is provided at a proximal end of the outer contour of the blade (2) close to the base (1).

5. The blade mechanism (10) according to claim 3, **characterized in that**, the protrusion (5) is provided on the base (1).

6. The blade mechanism (10) according to any one of claims 3-5, **characterized in that**, the flow blocking member (3) does not completely block the groove (4) and the protrusion (5) in a direction perpendicular to the blades (2).

7. The blade mechanism (10) according to claim 6, **characterized in that**, a height of the flow blocking member (3) gradually increases from its proximal end close to the base (1) to its distal end away from the base (1).

8. The blade mechanism (10) according to claim 7, **characterized in that**, the blade mechanism (10) further comprises an outer edge portion (6), wherein the outer edge portion (6) is provided on an outer side of the blade (2) and connected with the blade (2), and the flow blocking member (3) is connected with the outer edge portion (6) at its distal end.

9. The blade mechanism (10) according to claim 8, **characterized in that**, the flow blocking member (3) is connected with the base (1) at its proximal end.

10. A fan having a blade mechanism (10) according to any one of the preceding claims.

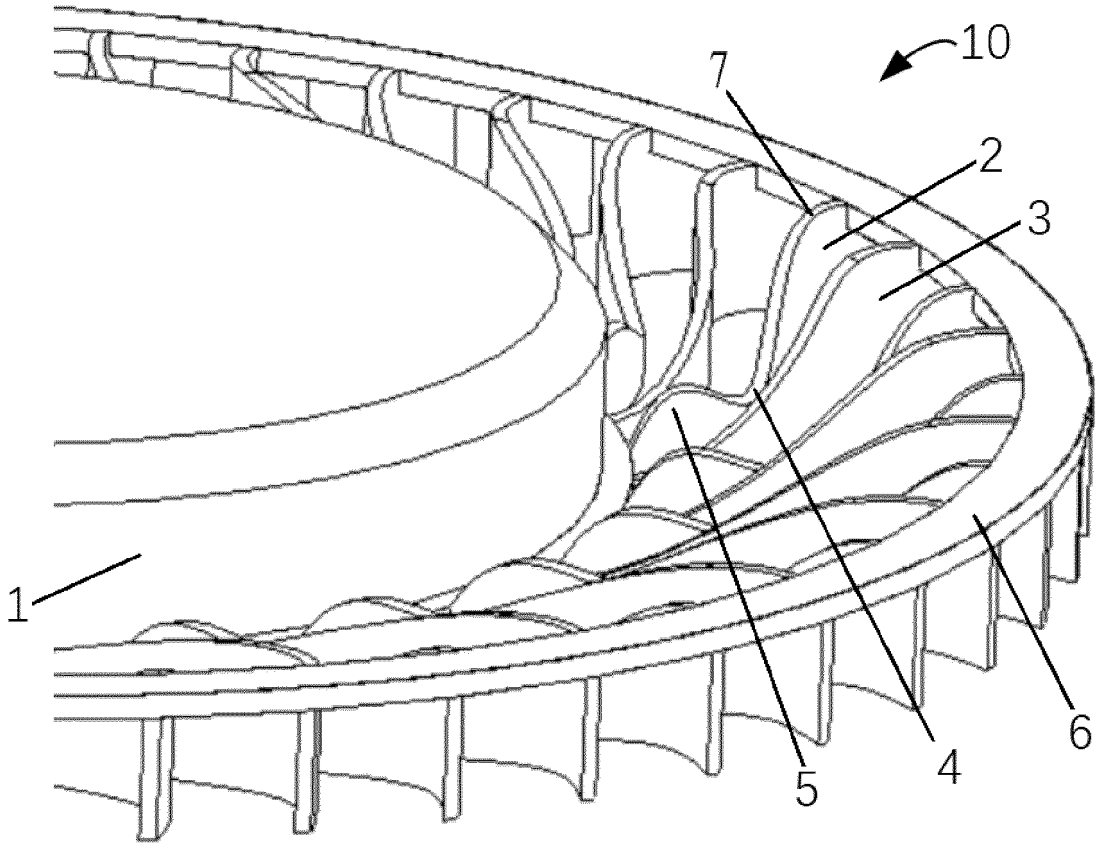

Fig. 1

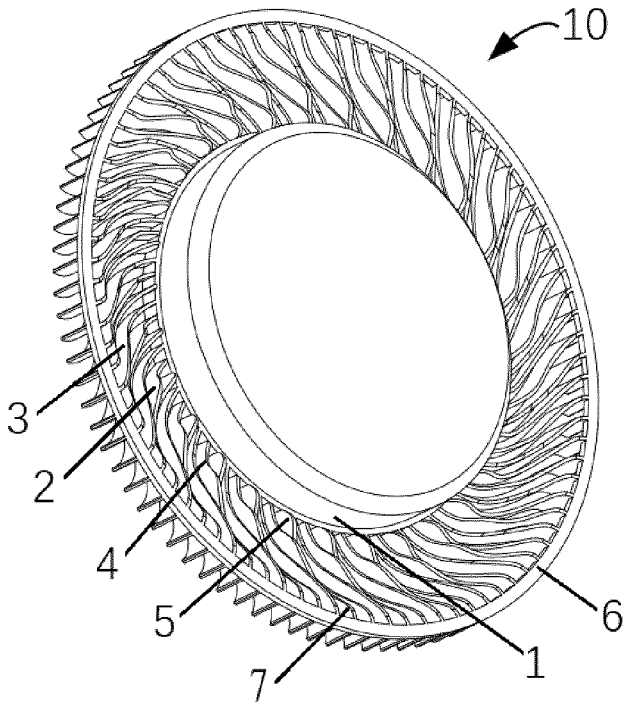
10
3
2
4
5
7
1
6

Fig. 2

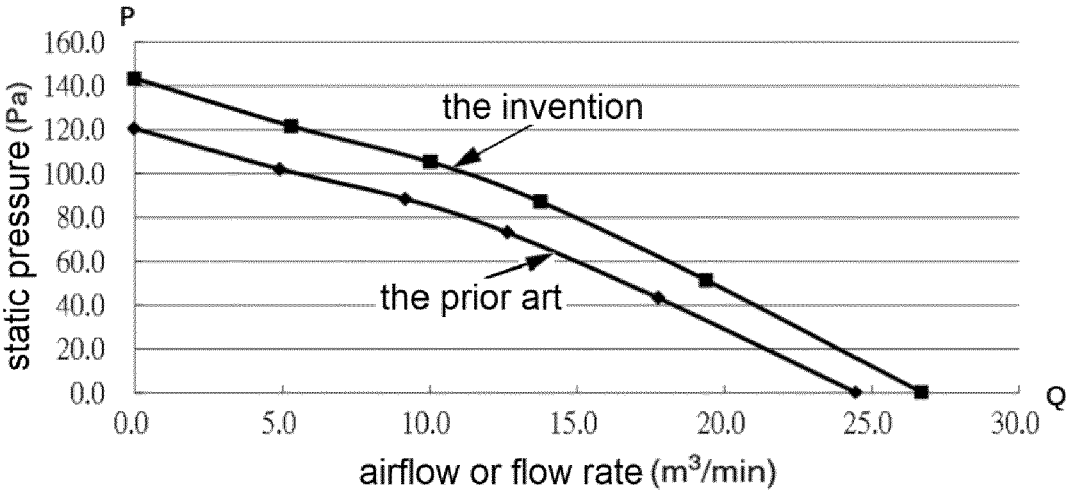
P
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
static pressure (Pa)
the invention
the prior art
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Q
airflow or flow rate (m3/min)

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 2624

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 August 2023	Lovergine, A

CATEGORY OF CITED DOCUMENTS

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