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(54) **IMPELLER OF BLOWER**

(57) An impeller (1) of blower comprises several vanes (2) mounted between an upper edge board (4) and a lower edge board (5) of the impeller. The vane (2) has at least one concave pressing rib (21) along its transverse. The concave pressing rib (21) has a through hole (22) at its end which is near the end of the vane (2). When the impeller (1) of blower operates, part of air at the front

surface of the vane (2) flows through the through hole (22) at the end of the concave pressing rib (21) to the rear surface of the vane (2) along the direction of the concave pressing rib (21). The pressure at the front surface and the rear surface of the vane (2) can be balanced to reduce the resistance of the air and to increase the amount of ventilation. Therefore the efficiency is increased.

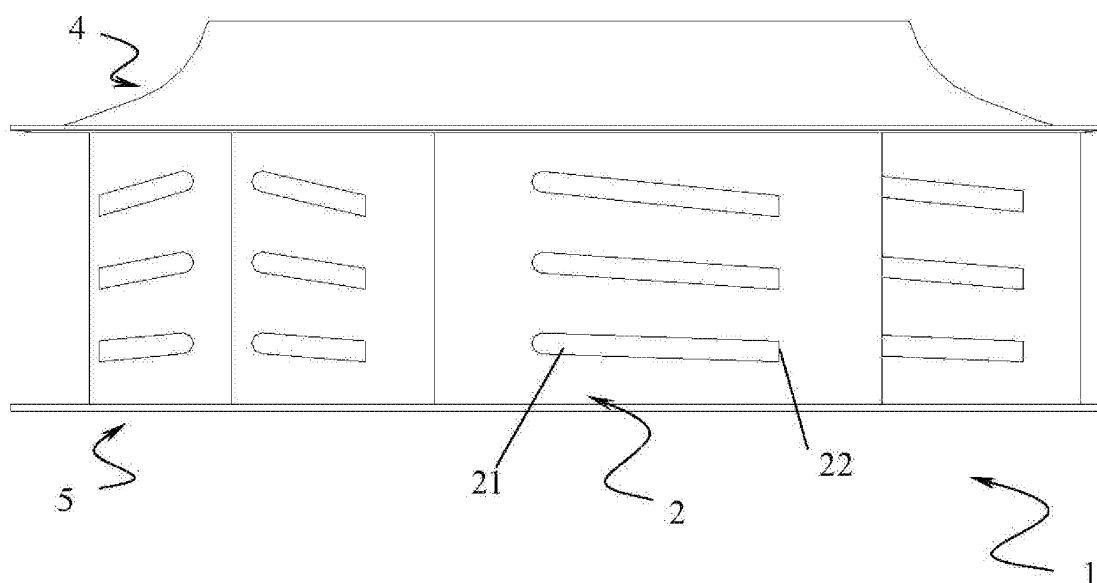


Fig.5

Description**Technical field**

[0001] This invention relates to an impeller, in particular a fan impeller.

Technical Background

[0002] Fan, a device that could provide wind-source powers, is widely applied in various circumstances, especially as a critical and non-substitutive role in the areas of heating & ventilation system, air purifying & filtering system, and wind powered energy system, etc.; among them, centrifugal fan, for its unique air intake / exhaust structure principle and its mature fabrication process, has been widely applied in the heating & ventilation, air-handling, and cleaning etc., such as FFU (Fan Filter Unit) system, FCU (Fan Control Unit) system, and so on.

[0003] Design philosophy and product structure of traditional fans could no longer satisfy in particular the requirements of some special application areas like medical treatment, communication, environmental protection, pharmaceutical food, and aerospace avionics etc., which means people are demanding higher standards of fans for their efficiency, energy saving, environmental protection, noise reduction and safety.

[0004] As we all know, when a centrifugal fan is running, differences in the pressures and turnover rates in the transverse and radial directions of impellers shall result in irregular air flow and inter collisions of airs between the impellers, and unavoidably the noises, which would become louder especially along with the enhancement of rotation speed and diameter of the fan.

[0005] As shown in Fig. 1, the air flowing situation in one blade slot of a centrifugal fan with backward curved blades. Wherein, the air flowing density of the front surface 26 of the blade 2 is higher than that of back surface 27, which causes the air flow displacement is generated at the blade end tip 25 near the back surface 27. Said air flow displacement may disturb the air flow direction in the normal running of the fan, which leads to not only noises, but also distinctly less ventilation volume at the end tip 25 than that at the mid part 24.

[0006] Fig. 2 shows a swirl type backflow. As the fan impeller rotates clockwise, air 3 shall flow in from the blade's beginning tip 23, and generate the air pressures respectively on the front surface 26 and back surface 27 of the blade. The pressure on the front surface shall increase gradually from the beginning tip to the end tip of the blade, and reversely, the pressure on the back surface shall decrease from the blade's beginning tip to the end tip, thus a low pressure area 28 is generated at the end tip 25 near the back surface 27. In order to balance the intensity of air pressure, the surrounding air shall flow back to the low pressure area 28 from the blade end tip 25, then a swirl backflow 31 is generated at the blade end tip 25; near the back surface 27. The generation of backflow 31 shall not only lead to greater air resistance, but consume more energy, reduce the ventilation volume at the blade end tip 25, and affect the operation efficiency of fan, and meanwhile, more noises shall be generated by either the inter collisions of backflow air or its collision with the blade.

[0007] In the prior art, we would deploy some cambered outwards press crimp on the blades of fan impeller, or optimize the bending degree of blade, both of which would help to reduce fan's running noises in certain but not distinct degree, and without avoiding the reduction of working efficiency of a running fan.

Invention Summary

[0008] To solve these problems, and to reduce noises and promote efficiency for a running fan, the present invention provides a fan impeller with some blades mounted between the upper and base plates of the impeller, wherein, at least one cambered inwards press crimp is arranged on the blade along the transverse direction of the said blade, said cambered inwards press crimp has a through hole near the blade end tip, and said through hole is at 1/5 ~ 1/3 (e.g. 1/5, 1/4, 1/3 etc.) of the blade length from the blade end tip.

[0009] In the present invention, said blade can be any one of back curved blade, back straight blade, radial straight blade, front curved blade, and front straight blade.

[0010] In the present invention, the cross section of said cambered inwards press crimp can be semicircle, rectangle, or other common geometric shapes.

[0011] In addition, in the present invention, the quantity and/or width and/or depth of said press crimp, and/or the size of said through hole shall increase along with the increasing of the height of said blade.

[0012] By adopting said technical solution of the present invention, when the fan impeller operates, the air shall flow in from the beginning tip of the blade, and generate the air pressures respectively on the front and back surfaces of the blade. The pressure on the front surface shall increase gradually from the beginning tip to the end tip of the blade, and reversely, the pressure on the back surface shall decrease from the beginning tip to the end tip of the blade, thus a low pressure area is generated at the end tip near the back surface. Since the cambered inwards press crimp is arranged

on the blade and the through hole is arranged at the end of press crimp, a part of the air on the front surface of the blade shall flow, along the cambered inwards press crimp, to the low pressure area on the back surface of the blade from the through hole at the end of press crimp, then the pressures on the front and back surfaces of the blade are balanced, the generation of air flow displacement is avoided, which will not only reduce noises from inter collisions of air, decrease the air resistance, but also increase the ventilation volume and promote the work efficiency.

Notes to the Attached Drawings

[0013]

Fig. 1 Diagrammatic drawing of air flow direction in the current radial flow type fan's blade slot;

Fig. 2 Diagrammatic drawing of swirl type backflow in the current radial flow type fan's blade slot;

Fig. 3 Structure drawing for the blade in a preferred living example for this invention;

Fig. 4 Top and partial views for the blade in a preferred living example for this invention;

Fig. 5 Structure drawing for the blade in a preferred living example for this invention;

Fig. 6 Diagrammatic drawing of air flow direction for the blade in a preferred living example for this invention;

1 ~ Fan Impeller;

2 ~ Blade;

3 ~ Air;

4 ~ Upper Plate;

5 ~ Base Plate;

21 ~ Cambered Inwards Press crimp;

22 ~ Through Hole;

23 ~ Beginning Tip of Blade;

24 ~ Mid Part of Blade;

25 ~ End Tip of Blade;

26 ~ Front Surface of Blade;

27 ~ Back Surface of Blade;

28 ~ Low Pressure Area;

29 ~Introverted Angle;

20 ~ Joint Part;

31 ~ Swirl Type Backflow;

32 ~ Makeup Air Flow.

Embodiments

[0014] This invention shall be furthermore detailed as following with reference to the attached Figures and the practical application examples.

[0015] Please refer to the Figs. 3, 4 & 5 simultaneously, a preferred embodiment for the present invention provides a fan impeller 1 used for FFU. The fan impeller 1 comprises a upper plate 4, a base plate 5, and seven back curved blades 2. The back curved blades 2 are mounted between the upper plate and base plate, and are fastened respectively with the upper plate and base plate by the joint parts 20. Among them, as shown in the A-A Section View in Fig. 4, the back curved blade 2 is provided with three cambered inwards press crimps 21 which are of semicircle shaped cross sections; each press crimp has a through hole 22 near the end tip 25 of the blade, and the through hole is 1/5 of the blade length from the end tip 25; and the back curved blade 2 shall also have an introverted angle 29 at its beginning tip 23, as shown in the partially magnified View B of Fig. 4.

[0016] In this preferred embodiment, the upper plate 4 and base plate 5 of fan impeller 1 and the blade 2 could be made of aluminum plates, steel (iron) plates, or plastic etc. Choose the type and specification for the fan based on its using conditions or parameters, including the elements of form and size etc. After shaping individually the upper plate 4, base plate 5 and blade 2, assemble the finished product of fan impeller 1 with blade 2, upper plate 4 and base plate 5 with special tools and by riveting.

[0017] Based on the above arrangement, as shown in Fig. 6, when the fan impeller 1 provided by this preferred

embodiment operates, the air 3 shall flow in from the beginning tip 23 of blade, and generate the air pressures respectively on the front surface 26 and back surface 27 of the blade. The pressure on the front surface 26 shall increase gradually from the beginning tip 23 to the end tip 25, and reversely, the pressure on the back surface 27 shall decrease from the beginning tip 23 to the end tip 25, thus a low pressure area 28 is generated at the end tip 25 near the back surface 27. Since the cambered inwards press crimp 21 is arranged on the blade 2 and the through hole 22 is arranged at the end of press crimp 21, a part of the air on the front surface 26 shall flow, as make up air flow 32 and along the cambered inwards press crimp 21, to the low pressure area 28 on the back surface 27 from the through hole 22 at the end of press crimp, then the pressures on the front and back surfaces of the blade will be balanced, the generation of air flow displacement will be avoided. Thus, this will not only reduce noises from inter collisions of air, decrease the air resistance, but also increase the ventilation volume and promote the work efficiency.

[0018] In the other practical embodiments, the blade also can be any one of back curved blade, back straight blade, radial straight blade, front curved blade, and front straight blade. Blades can be also connected with upper and base plates by compression jointing, welding, and bonding etc., while the cross section of cambered inwards press crimp could be also in other common geometric shapes, like rectangle, triangle, and round etc.

[0019] In the other practical embodiments, quantity and/or width and/or depth of the press crimp, and/or size of through hole shall also increase along with the increasing of the height of the blade.

[0020] Furthermore, please refer to Table 1 for comparison of effects between the preferred embodiment for this invention and the prior art:

Table 1

Rotation Speed (r/min)	Static Outlet Pressure (Pa)	Standard Ventilation Volume (m ³ /h)		Work Efficiency (%)	
		Radial Straight Blade x 7; Cambered Inwards Press crimp x 3; w/ Hole	Radial Straight Blade x 7; w/o Cambered Inwards Press crimp; w/o Hole	Radial Straight Blade x 7; Cambered Inwards Press crimp x 3; w/ Hole	Radial Straight Blade x 7; w/o Cambered Inwards Press crimp; w/o Hole
1200	100	3795.4	3739.9	46.07	45.02
1100	150	2988.2	2913.6	53.37	52.64
1000	100	2969.4	2912.1	52.57	51.53
1000	200	1402	1247.7	46.78	44.39
900	50	2893.1	2829.5	43.73	42.26
900	150	1570.4	1476.3	50.76	48.22
800	50	2470.6	2423	46.66	45.36

[0021] It can be seen in Table 1 that the fan impeller provided by the preferred embodiment of this invention, conditioned by the same rotation speed and static outlet pressure, and would have distinctly better standard ventilation volume and work efficiency than the fan impeller of the prior art.

[0022] The embodiment of this invention is of comparatively good applicability, and has never been limited in any form for this invention. Any technician familiar with this field might achieve equally effective application examples by giving transformation or decoration to the technical contents revealed above, but any modification, or equal variation and decoration to the embodiment above, based on the technical essentials of this invention, yet not exceeding the content of technical solution in this invention, shall be still within the scope of technical solution in this invention.

Claims

1. A fan impeller, with some blades mounted between the upper plate and base plate of said impeller, **characterized in that**, at least one cambered inwards press crimp is arranged on the blade along the transverse direction of said blade, said cambered inwards press crimp has a through hole near the end tip of blade.
2. The fan impeller in accordance with Claim 1, wherein said through hole is at 1/5~1/3 of the blade length from said end tip of blade.

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3. The fan impeller in accordance with Claim 2, wherein said through hole is at $1/4 \sim 1/3$ of the blade length from said end tip of blade.
- 5 4. The fan impeller in accordance with Claim 3, wherein the cross section of said cambered inwards press crimp is semicircle, rectangle, or other common geometric shapes.
5. The fan impeller in accordance with Claim 4, wherein said blade has an introverted angle at the beginning tip of the blade.
- 10 6. The fan impeller in accordance with anyone of the above claims, wherein said blade is any one of back curved blade, back straight blade, radial straight blade, front curved blade, and front straight blade.

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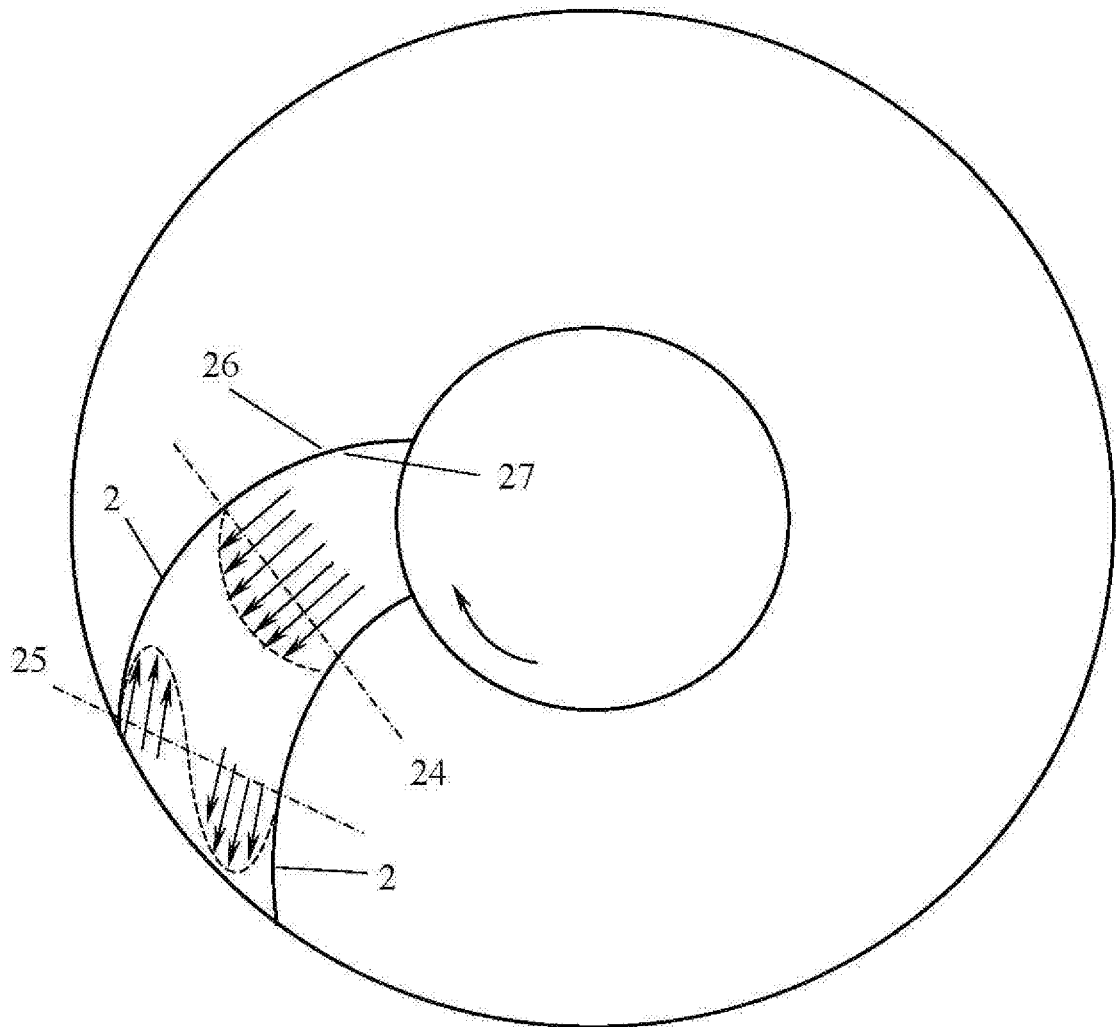


Fig.1

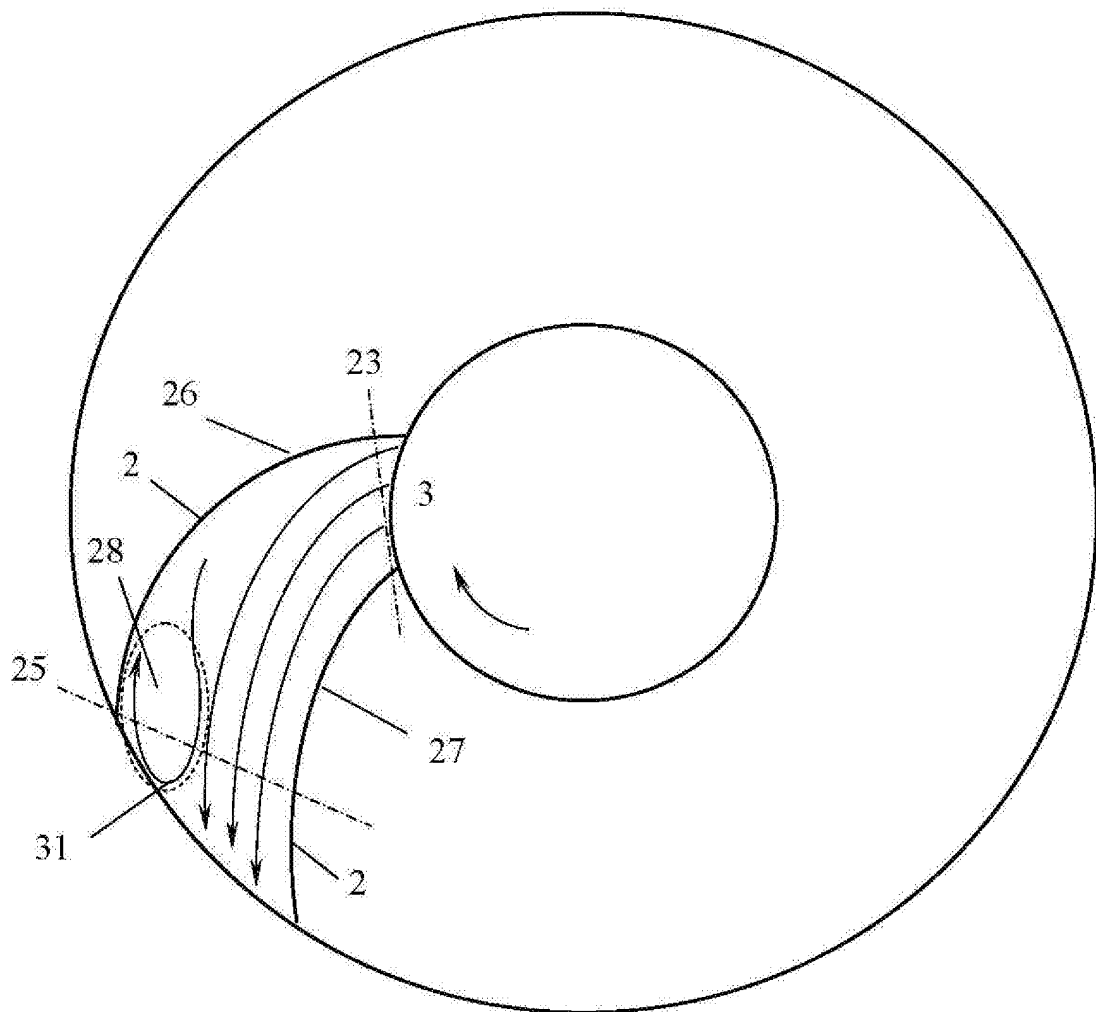


Fig.2

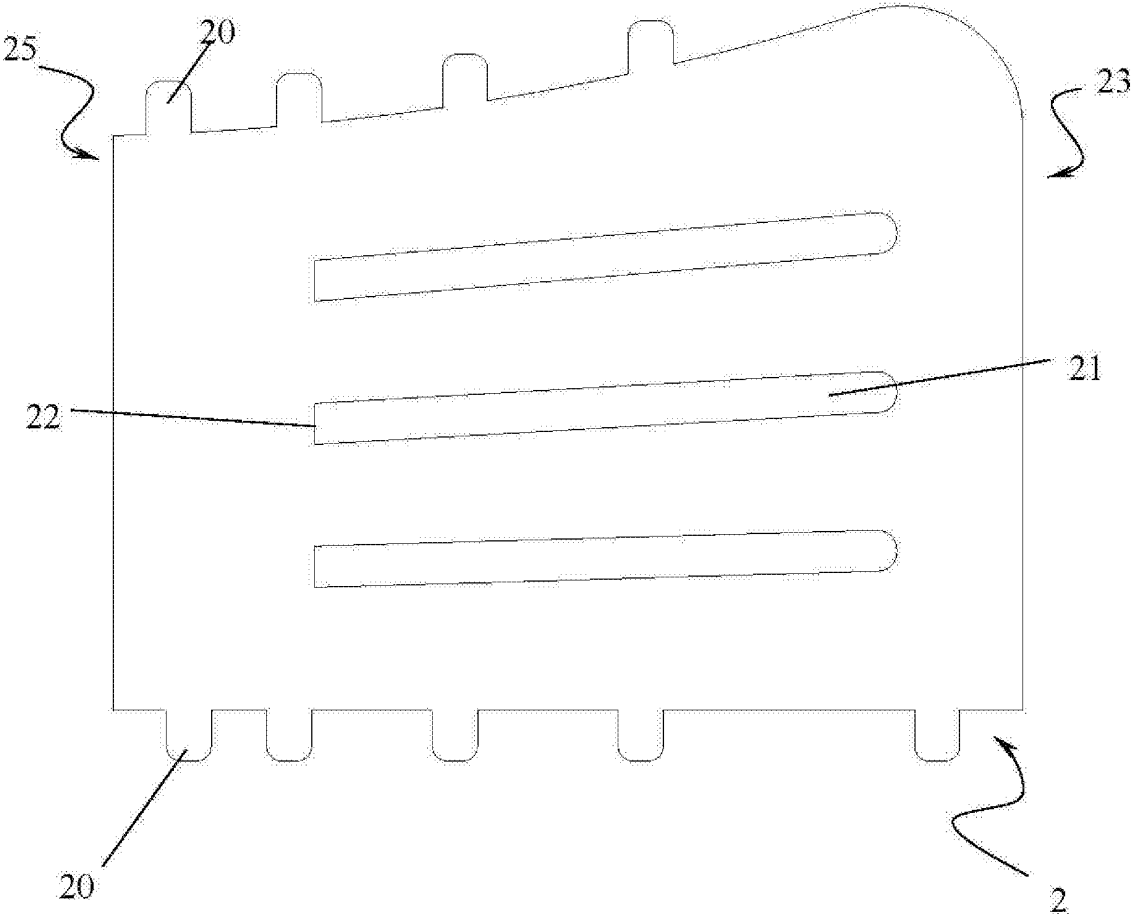


Fig.3

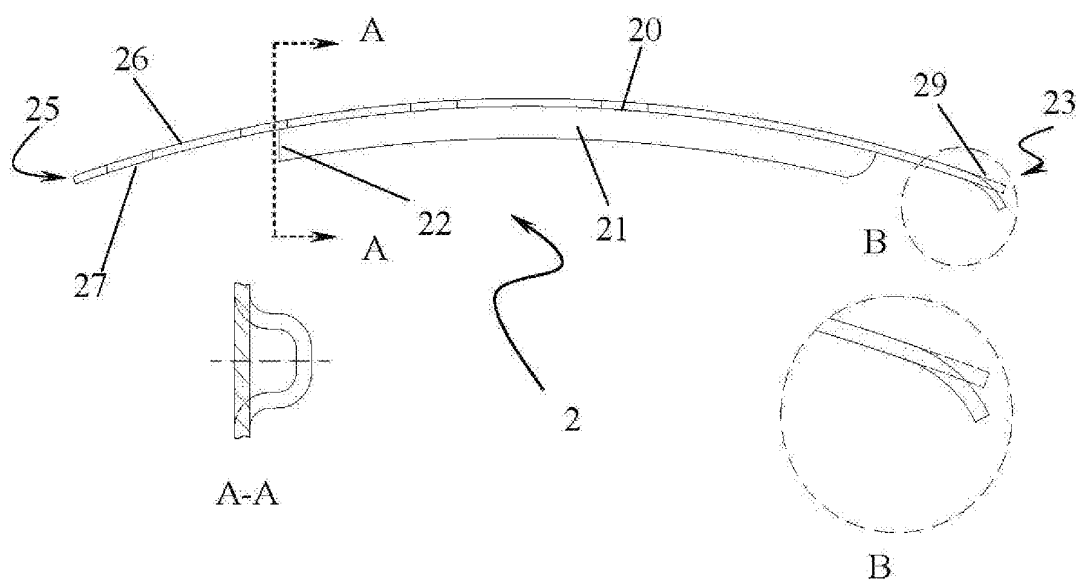


Fig.4

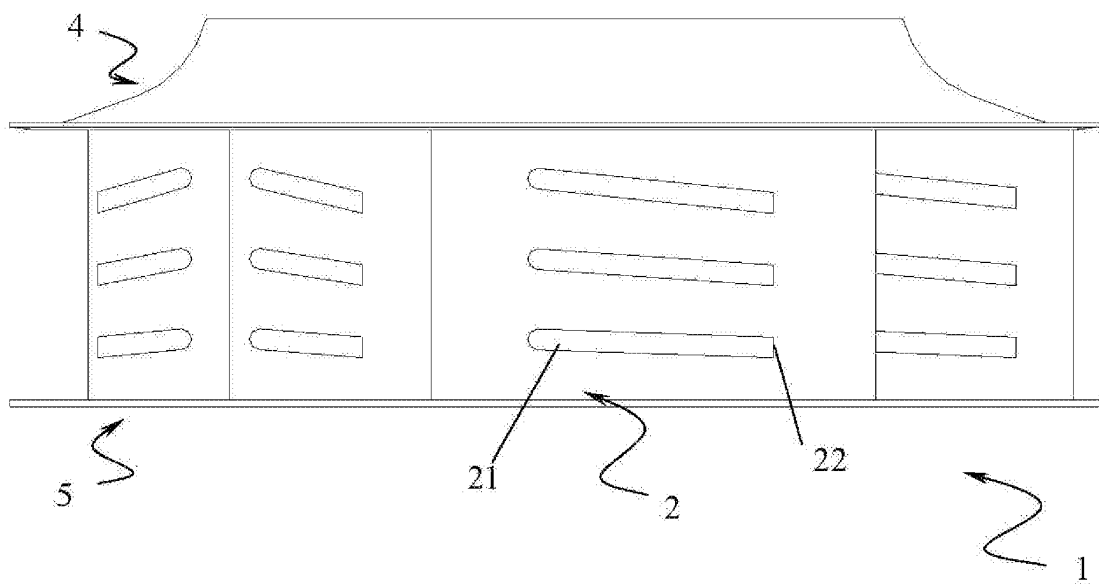


Fig.5

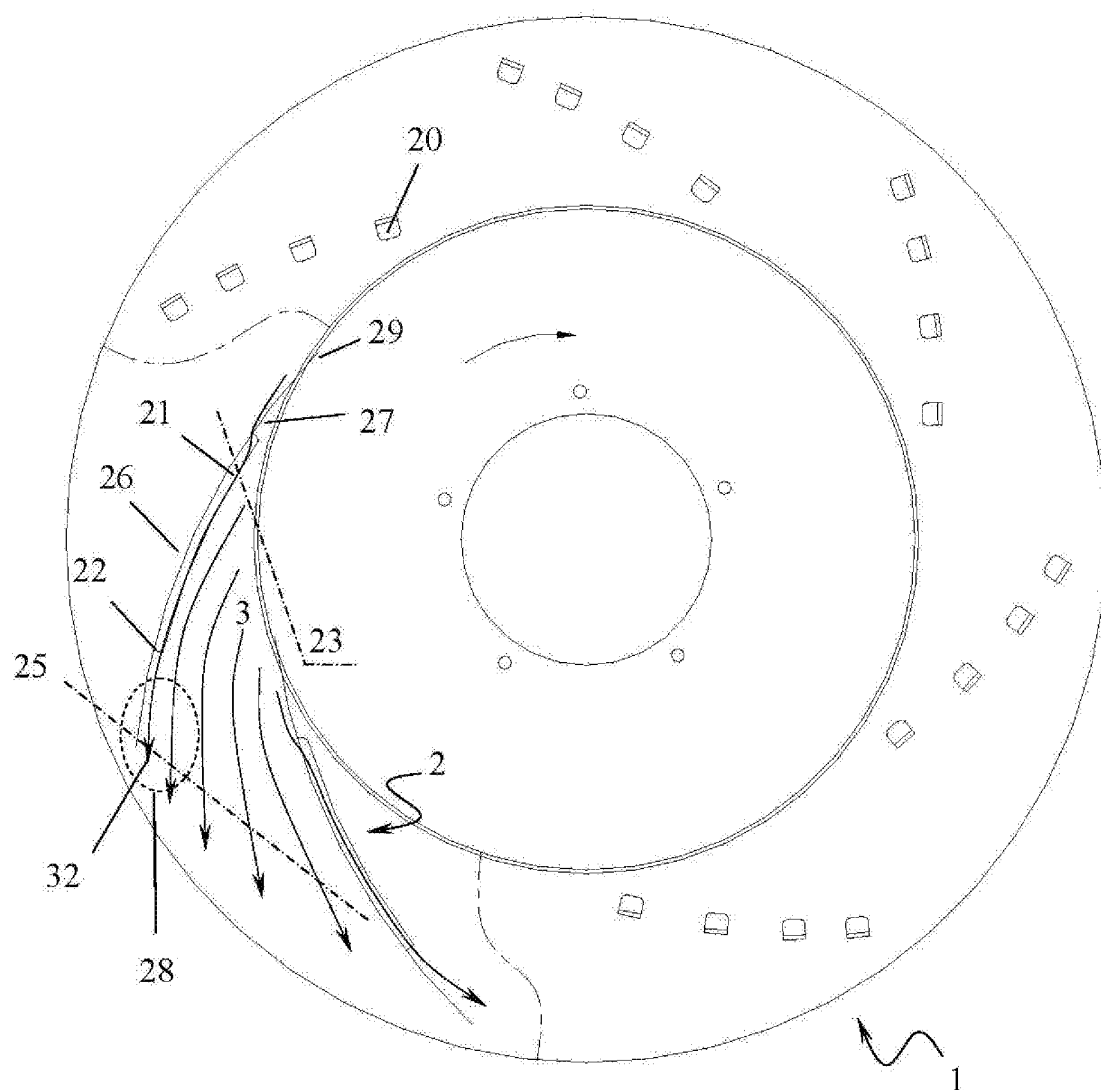


Fig.6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/001376

A. CLASSIFICATION OF SUBJECT MATTER

F04D29/30(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F04D29/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI; EPODOC; PAJ; CNKI; CNPAT: CONCAVE, HOLLOW, GROOVE, RIB, REINFORCEMENT, VANE, BLADE, BLOWER, FAN, IMPELLER

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CN2787889Y(LIANG, Jingquan) 14 June 2006 (14.06.2006) the whole document	1-6
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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“P” document published prior to the international filing date but later than the priority date claimed	

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08 February 2010(08.02.2010)Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/001376

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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