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(54) **FAN UNIT**

(57) The invention relates to a fan unit, comprising a casing (1) with a central interior opening (3) which is provided with a centrifugal impeller (4) rotationally driven by a motor, the centrifugal impeller (4) has a set of blades (9) arranged around the central interior opening (3), and inclined with respect to the radial direction of the centrifugal impeller (4), the centrifugal impeller (4) has an inner edge (10) adjacent to the central interior opening (3) and an outer edge (11) on the periphery of the centrifugal impeller (4), in which the blades (9) have an arched configuration extending transversely between the inner edge (10) adjacent to the central interior opening (3) and the outer edge (11) arranged on the periphery of the centrifugal impeller (4), the blades (9) having a convex configuration positioned towards the inner part of the centrifugal impeller (4), and the fan unit additionally comprises measurement means configured to measure the air flow driven by the centrifugal impeller (4) based on the energy consumption of the motor.

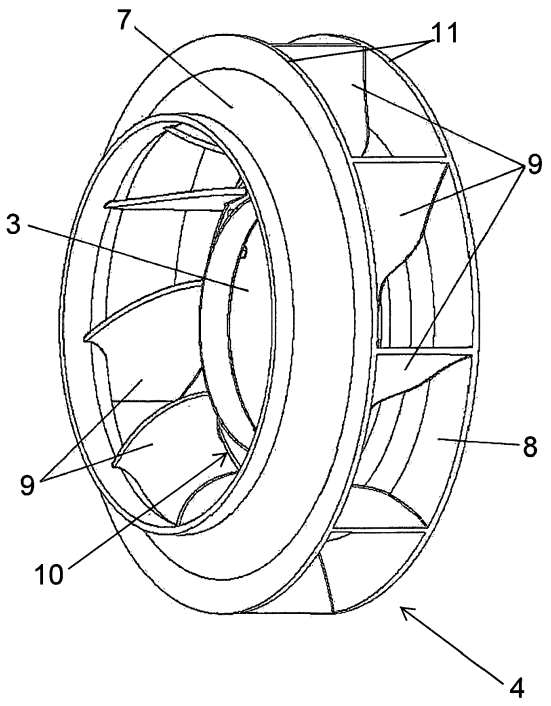

Fig. 2

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Description

Field of the Art

[0001] The present invention relates to air blower fans and in particular to radial type fans, proposing a fan unit equipped with a centrifugal impeller having a structural formation that provides a functional advantage in efficiency in relation to the air flow that is driven and the electrical energy consumption to drive this flow, where the air flow can be determined from the energy consumption of the motor driving the centrifugal impeller, without the need to use external sensors.

State of the Art

[0002] Radial fan units are know, which include a centrifugal impeller that is rotationally driven by a motor, such that on rotating said centrifugal impeller drives an air flow from a central interior opening and projects it outwards to the periphery; for this purpose the centrifugal impeller is equipped with a set of blades arranged around the central interior opening to radially extract air from said central interior opening and project it outwards to the periphery.

[0003] In said centrifugal impellers the position and configuration of the blades are fundamental factors in determining the air driving capacity of the centrifugal impeller, which therefore decisively affects the performance of the fan unit; consequently said factors are essential in the structural design of centrifugal impellers.

[0004] To this regard, centrifugal impellers with blades that curve forward are conventionally known, where the air driving blades are uniformly arranged in an inclined position in the direction of rotation and with respect to the radial direction of the centrifugal impeller, with an arched configuration in the transverse direction from the inner edge to the outer edge according to the position of the centrifugal impeller, the blades having a convex configuration positioned towards the outer periphery of the centrifugal impeller.

[0005] In centrifugal impellers with blades that curve forward, the air flow measurement is obtained directly by measuring the energy consumption of the motor driving the centrifugal impeller and according to the characteristic flow/energy consumption curve of the fan unit. Although centrifugal impellers of this type allow the air flow to be measured directly based on the energy consumption of the motor, they have a low efficiency in terms of flow/pressure with respect to the energy consumption driving the centrifugal impeller.

[0006] On the other hand, centrifugal impellers with blades that curve backward are known, where the blades driving the air are also uniformly arranged in an inclined position in the direction of rogation and with respect to the radial direction of the centrifugal impeller, with an arched configuration in the transverse direction from the inner edge to the outer edge according to the position of the centrifugal impeller, but in this case the blades have a convex configuration positioned towards the inner periphery of the centrifugal impeller.

[0007] In this embodiment external flow measurement sensors are needed to measure the air flow that is driven by the centrifugal impeller, increasing the complexity and cost of the fan unit. This is because when using centrifugal impellers of this type with blades that curve backward, air flow cannot be measured directly based on the measurement of the energy consumption of the motor driving the centrifugal impeller, as the characteristic flow/energy consumption curve of centrifugal impellers of this type has a maximum point, such that for the same energy consumption there are two different operational flow rates, it being impossible to determine which flow rate the fan unit is operating at, external sensors therefore being required.

Object of the Invention

[0008] The invention proposes a fan unit with a radial configuration incorporating a centrifugal impeller developed with a structural formation presenting features for driving air that are advantageous in terms of efficiency, allowing the air flow to be measured indirectly based on the energy consumption of the fan unit without the need for external sensors.

[0009] The fan unit comprises a casing with a central interior opening which is provided with a centrifugal impeller rotationally driven by a motor. The centrifugal impeller has a set of blades arranged around the central interior opening, and inclined with respect to the radial direction of the centrifugal impeller. The centrifugal impeller has an inner edge adjacent to the central interior opening and an outer edge on the periphery of the centrifugal impeller.

[0010] According to the invention, the blades have an arched configuration extending transversely between the inner edge adjacent to the central interior opening and the outer edge arranged on the periphery of the centrifugal impeller, the blades having a convex configuration positioned towards the inner part of the centrifugal impeller.

[0011] The fan unit additionally comprises measurement means configured to measure the air flow driven by the centrifugal impeller based on the energy consumption of the motor.

[0012] In particular, the transversely arched configuration of the blades has a curvature with a radius comprised between half and double the radius of the centrifugal impeller, which has proved in experiments to result in an air flow that favors the flow-energy consumption combination, such that better performance is achieved with respect to that of conventional centrifugal impellers with blades having a more pronounced curvature, with a radius of at least 85 millimeters, which are also more costly to manufacture.

[0013] A fan unit is thereby attained with a centrifugal

impeller in which the structural features of the configuration of the blades determine conditions rendering the functional air driving behavior more efficient in comparison with air driven by conventional centrifugal impellers, improving the performance of the fan unit.

[0014] Thus, the fan unit object of the invention presents a centrifugal impeller resulting in features giving it its own identity and making it preferable with respect to other fan units with conventional impellers for the same application.

Description of the Drawings

[0015]

Figure 1 shows a section view of the fan unit of the invention.

Figure 2 shows a perspective view of a centrifugal impeller with the features of the invention.

Figure 3 is a front view of said centrifugal impeller from Figure 2.

Figure 4 is a diametrical section view of the centrifugal impeller according to section IV-IV noted on Figure 3.

Figure 5 is a partial enlarged view of the centrifugal impeller according to section V-V noted on Figure 4.

Figure 6 shows a comparative graph with the characteristic flow/energy consumption curves of the fan unit of the invention, a conventional fan unit with a centrifugal impeller with blades that curve forward and a conventional fan unit with a centrifugal impeller with blades that curve backward.

Detailed Description of the Invention

[0016] The object of the invention relates to a fan unit with a radial configuration incorporating a centrifugal impeller with a structural formation that improves the efficiency and performance of fan units incorporating conventional centrifugal impellers for the same application.

[0017] As observed in the section view in Figure 1, the fan unit comprises a casing (1) in which there is arranged or directly built a volute-type air duct (2) having a central interior opening (3) which is provided with a centrifugal impeller (4) rotationally driven by a motor (5), specifically a brushless electric motor. The air is taken in through one of the sides of the fan unit towards the central interior opening (3) in the direction axial to the centrifugal impeller (4), and the air is let out in the direction radial to the centrifugal impeller (4) through the fan unit discharge outlet (6).

[0018] The centrifugal impeller (4) comprises two annular elements (7) and (8) that are axially arranged parallel to one another, blades (9) arranged around the central interior opening (3) being intercalated between the annular elements (7) and (8), and the centrifugal impeller (4) having an inner edge (10) adjacent to the central interior opening (3) and an outer edge (11) arranged on the periphery of the centrifugal impeller (4). The blades (9) extend from the central interior opening (3) of the centrifugal impeller (4) to the outer periphery of the centrifugal impeller (4), in an inclined position with respect to the radial direction of the centrifugal impeller (4) and according to a tangential arrangement with respect to the central interior opening (3).

[0019] According to the present invention, the blades (9) have an arched configuration extending transversely between the inner edge (10) adjacent to the central interior opening (3) and the outer edge (11) on the periphery of the centrifugal impeller (4), the blades (9) having a convex configuration positioned towards the inner part of the centrifugal impeller (4).

[0020] The fan unit additionally comprises measurement means associated with the motor (5) driving the centrifugal impeller (4), said measurement means being particularly configured to measure the air flow driven by the centrifugal impeller (4) based on the energy consumption of the motor (5).

[0021] In addition, the transversely arched configuration of the blades (9) is based on a curvature with a radius (r) comprised between half and double the radius (Rr) of the centrifugal impeller (4), i.e., the curvature of the radius (4) of the blades (9) is comprised in the range [0.5*Rr < r < 2*Rr]. This selection of the radius together with the structural configuration of the blades (9) defined by the invention allows improved behavior of the fan unit to be achieved as shown in the experimental results in Figure 6.

[0022] Said Figure 6 shows a comparative graph with three characteristic flow (Q)/energy consumption (Wa) curves. The first curve (C_0) drawn in a solid line shows the characteristic curve of a conventional fan unit with a centrifugal impeller with blades that curve backward; the second curve (C_1) drawn in a line with dots shows the characteristic curve of the fan unit of the invention; the third curve (C_3) drawn in a dashed line shows the characteristic curve of a conventional fan unit with a centrifugal impeller with blades that curve forward.

[0023] From the comparison between the second and third curves (C_2, C_3), it can be observed that for the same flow rate, the energy consumption of the fan unit of the invention is much lower than the energy consumption of a conventional fan unit with a centrifugal impeller with blades that curve forward. On the other hand, the first curve (C_0) reaches a maximum point (M) after which the energy consumption goes from increasing to decreasing, and therefore, there are two different flow rates for the same energy consumption of the motor driving the centrifugal impeller. This particularity of the first curve (C_0) characteristic of a conventional fan unit with blades that curve backward makes it impossible for the flow rate to be measured directly based on the energy consumption, which means that external flow rate sensors are needed for efficient measurement. However, the second curve (C_1) characteristic of the fan unit of the invention always shows increasing energy consumption as the driven air

flow is increased, such that a specific air flow value always unequivocally corresponds to a specific energy consumption value.

[0024] Accordingly, the configuration of the blades (9) of the centrifugal impeller (4) of the invention allows the functional behavior of the fan unit to be improved, achieving a suitable driven air flow-energy consumption ratio, as with conventional fan units provided with blades that curve backward. In addition, operating conditions are achieved in which the driven air flow always increases as energy consumption increases, as with conventional fan units provided with blades that curve forward, such that air flow can be measured precisely and reliably based on the energy consumption without having to use external sensors such as those required for equivalent conventional fan units with blades that curve backward.

Claims

1. A fan unit, comprising a casing (1) with a central interior opening (3) which is provided with a centrifugal impeller (4) rotationally driven by a motor (5), the centrifugal impeller (4) has a set of blades (9) arranged around the central interior opening (3), and inclined with respect to the radial direction of the centrifugal impeller (4), the centrifugal impeller (4) has an inner edge (10) adjacent to the central interior opening (3) and an outer edge (11) on the periphery of the centrifugal impeller (4), **characterised in that** the blades (9) have an arched configuration extending transversely between the inner edge (10) adjacent to the central interior opening (3) and the outer edge (11) arranged on the periphery of the centrifugal impeller (4), the blades (9) having a convex configuration positioned towards the inner part of the centrifugal impeller (4), and **in that** the fan unit additionally comprises measurement means configured to measure the air flow driven by the centrifugal impeller (4) based on the energy consumption of the motor (5).

2. The fan unit according to claim 1, **characterized in that** the arched configuration of the blades (9) has a curvature with a radius (r) comprised between half and double the radius (Rr) of the centrifugal impeller (4).

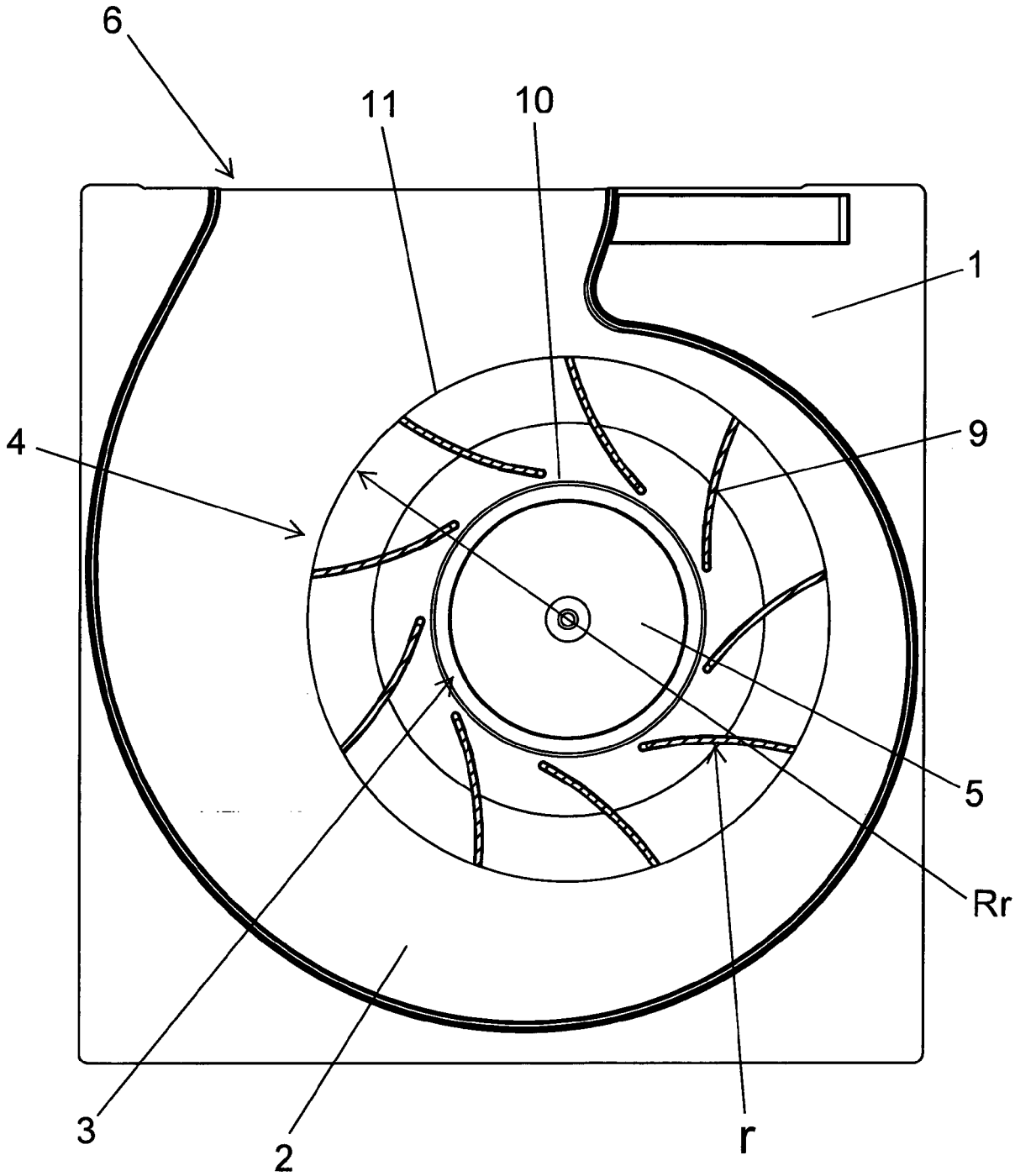

Fig. 1

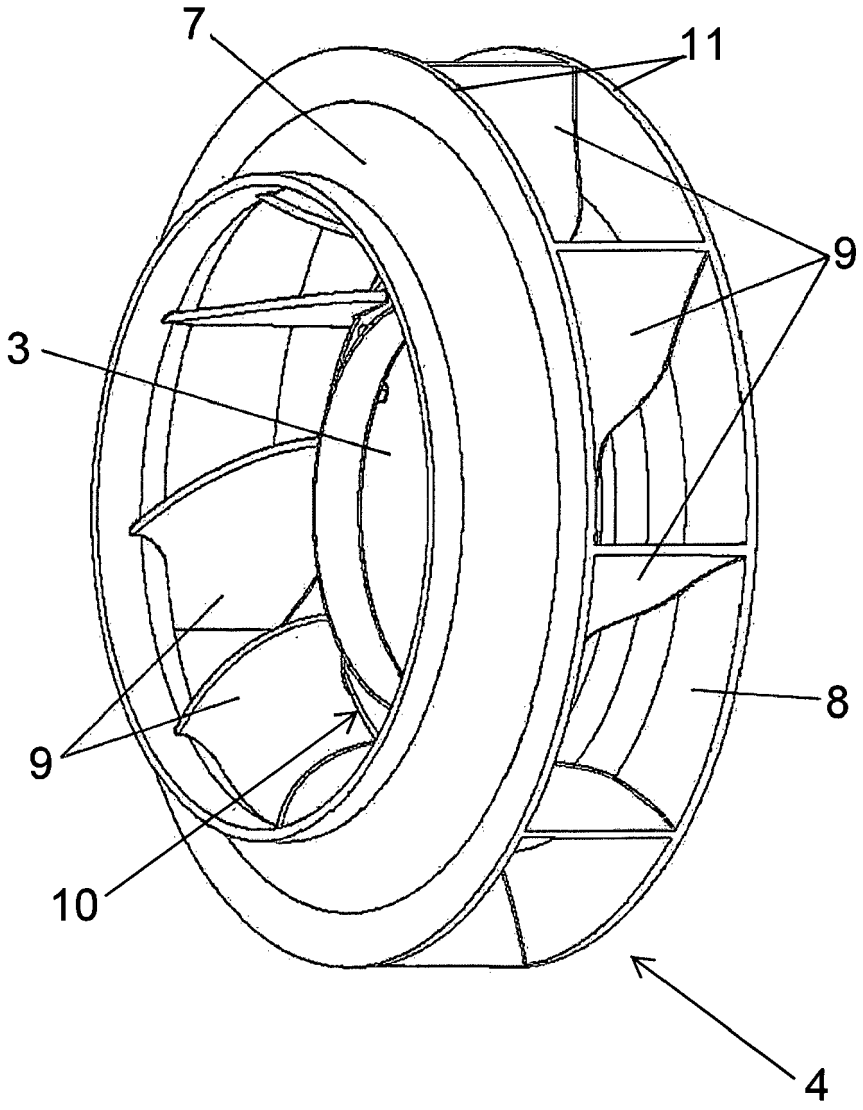

Fig. 2

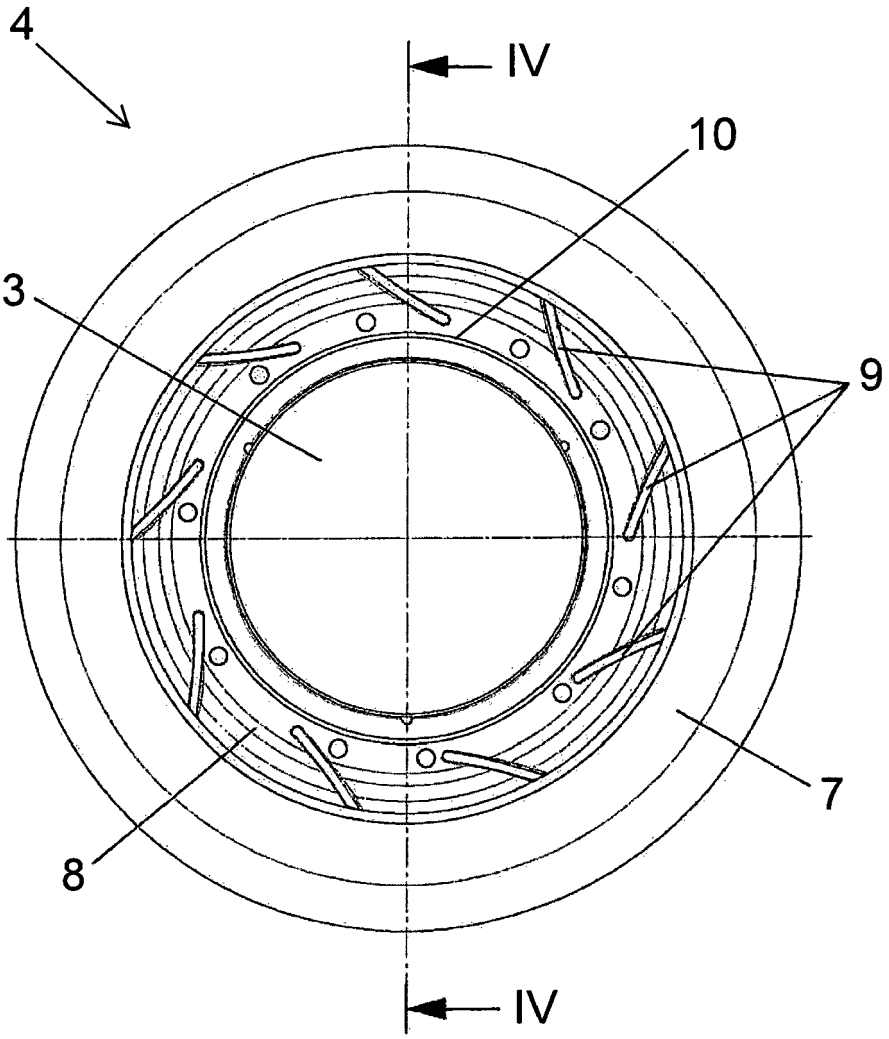

Fig. 3

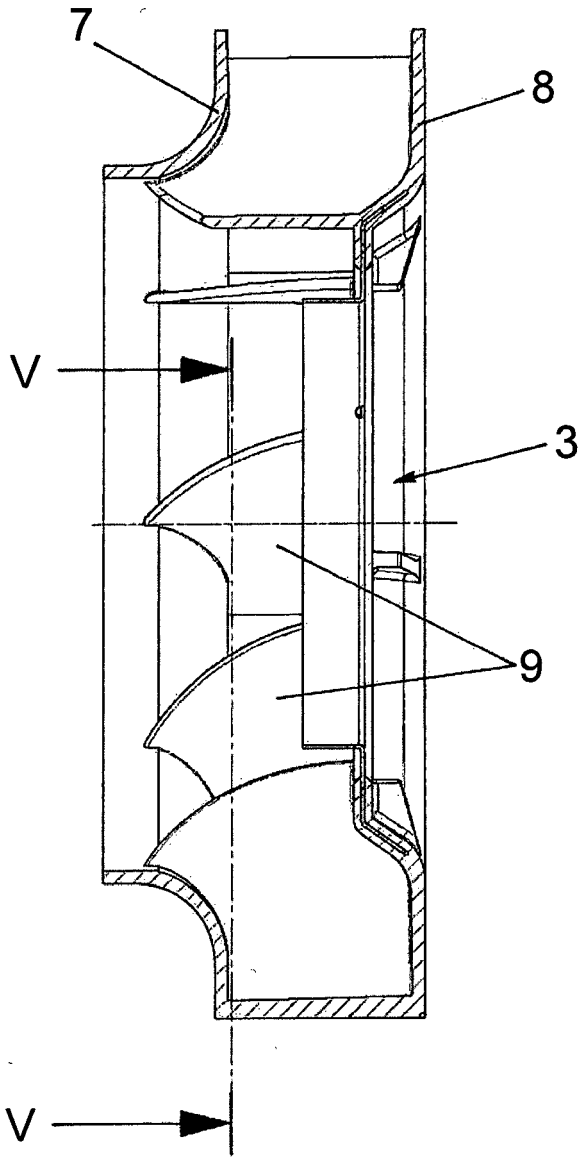

Fig. 4

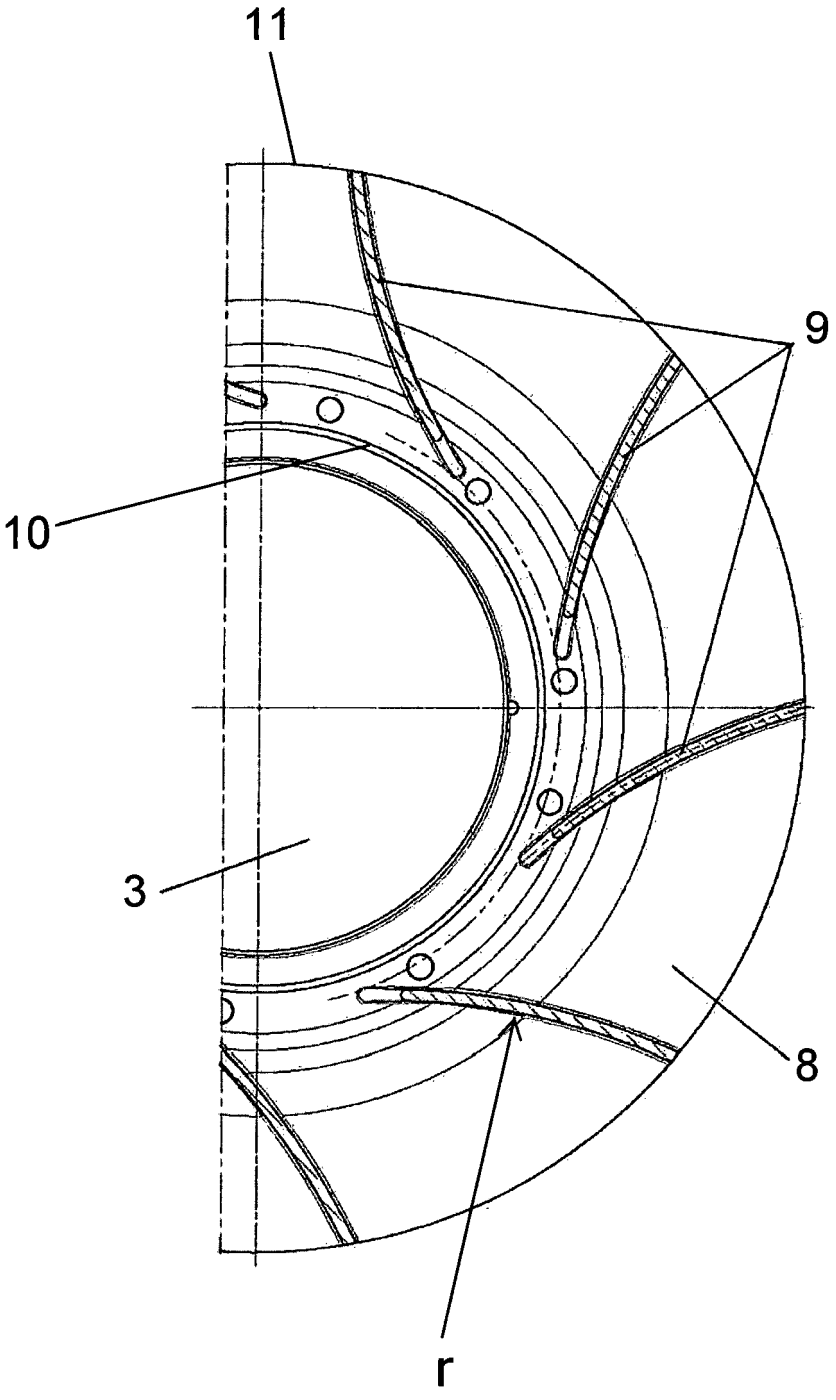

Fig. 5

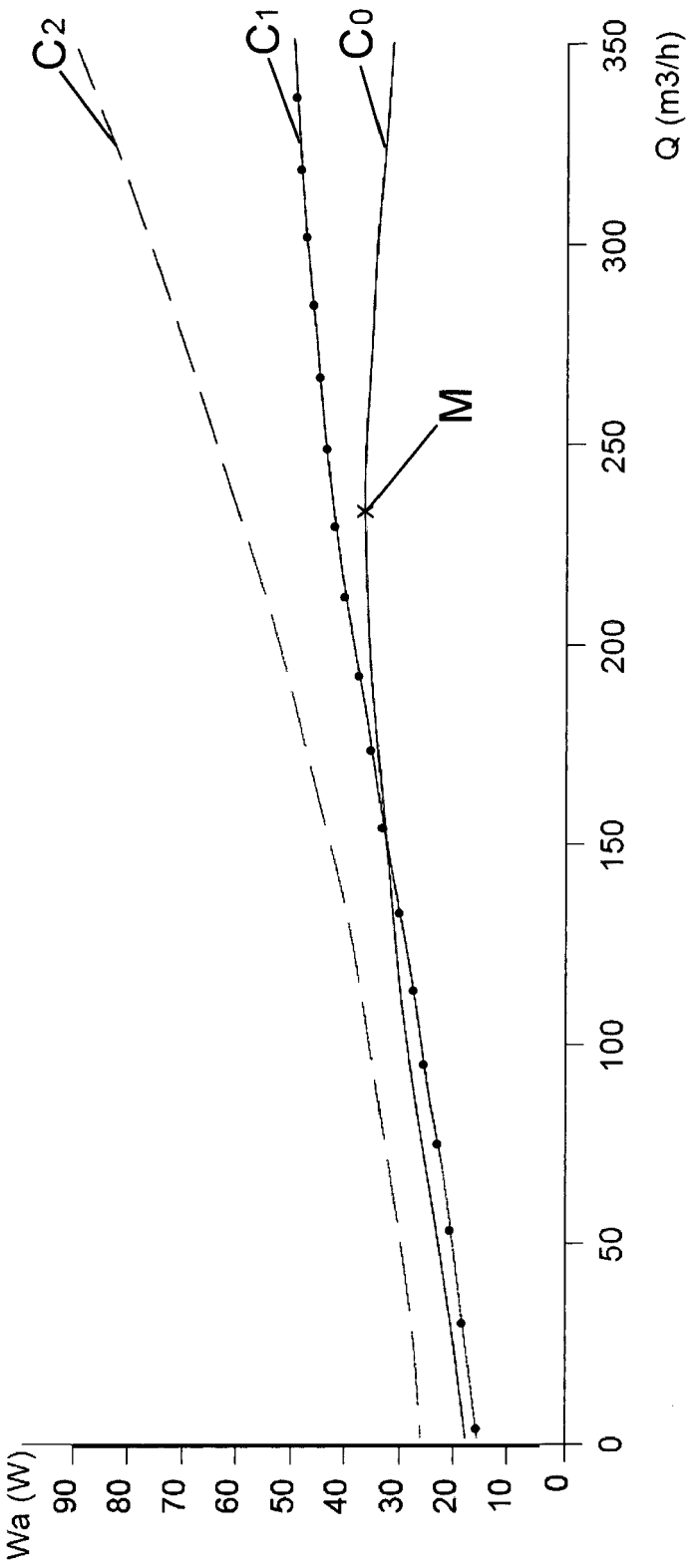
C2
C1
C0
M
Wa (W)
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
Q (m3/h)

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 16 38 0007

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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
Munich	22 September 2016	Di Giorgio, F

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