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(54) **SIDE-CHANNEL BLOWER/ASPIRATOR WITH AN IMPROVED IMPELLER**

(57) The side-channel blower / aspirator (1), comprises an impeller (2) equipped with a plurality of blades (21) and a casing (13, 14), in which the impeller (2) is enclosed and within which an annular conduit (C) is defined in which the blades (21) rotate.

The blades (21) comprise at least one portion which has a face (200) comprising a plurality of planes (201, 202, 203, 204, 205) at an angle to one another, defining a concavity (23) facing the advancement direction of the blades (21) within said conduit (C).

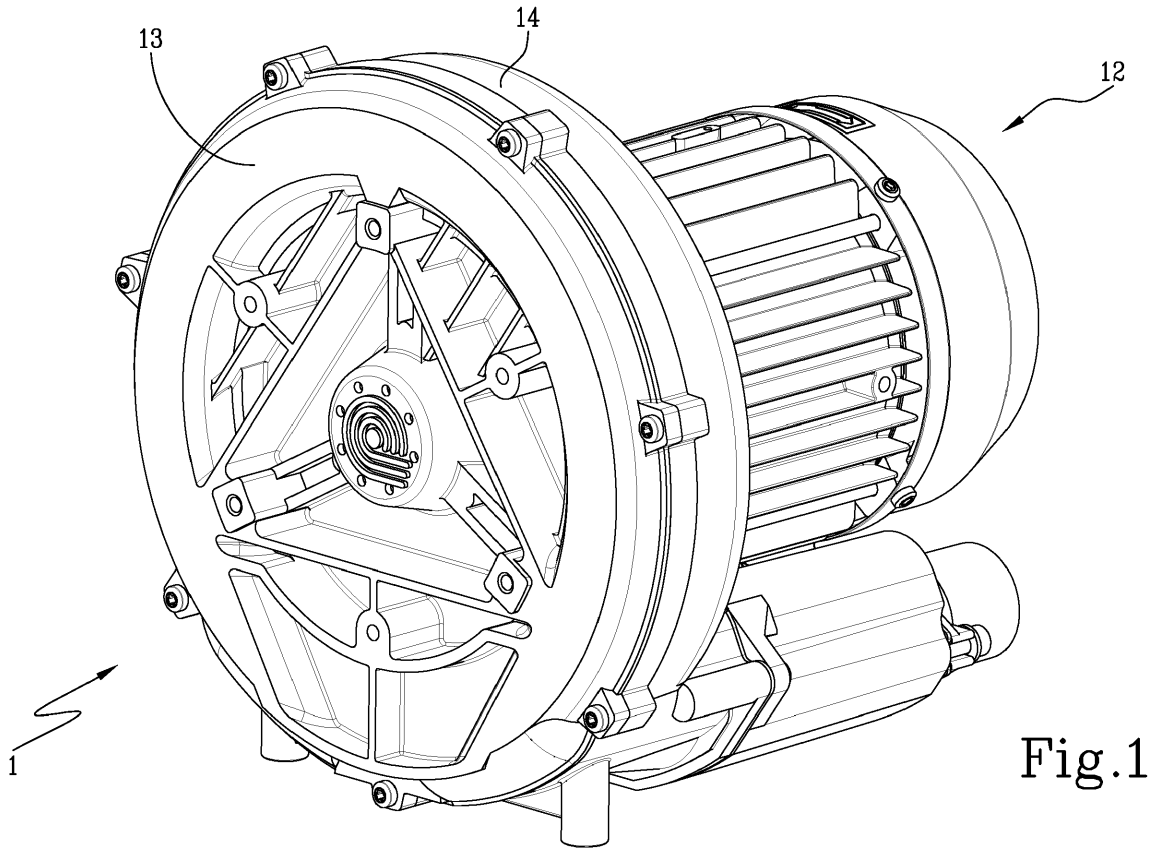

Fig.1

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Description

[0001] The present invention relates to a side-channel blower / aspirator with an improved impeller.

[0002] Side-channel (or even air ring) blowers / aspirators provided with an impeller that has a central body from which a plurality of peripheral blades extend are known.

[0003] The impeller is enclosed into a casing in which an annular conduit is defined, in which the impeller blades rotate.

[0004] The annular conduit has a suction mouth, through which a fluid (normally air) is aspirated and a delivery mouth through which the fluid is expelled.

[0005] These machines can operate both as vacuum pumps and as compressors.

[0006] The operation of this type of machines is based on the principle of the fluid flow caused by the thrust developed by the impeller blades within the annular conduit, during rotation.

[0007] In detail, during rotation, the blades push the fluid forwards and, due to the mentioned centrifugal thrust, also outwards.

[0008] The walls of the annular conduit then deviate the fluid again between one blade and another.

[0009] The joint action of the blades and the walls of the annular conduit define a helical motion in the fluid itself.

[0010] Currently, the impellers used in side-channel machines are provided with rectilinear radial blades.

[0011] The Applicant, following research and experimentation activities, has observed that the shape of known impeller blades does not allow the operating principle described above to be exploited with full efficiency.

[0012] The technical task underpinning the present invention is therefore to propose a side-channel blower / aspirator with an improved impeller that makes it able to offer better performance levels with respect to the known art.

[0013] Such technical task is reached by the side-channel blower / aspirator obtained according to claim 1.

[0014] Further characteristics and advantages of the present invention will become more apparent from the following indicative, and hence non-limiting, description of a preferred, but not exclusive, embodiment of the machine according to the invention, as illustrated in the accompanying drawings, in which:

- figure 1 is an axonometric view of the machine according to the invention;
- figure 2 is an exploded view of the machine of figure 1;
- figure 3 is a front view of the machine, wherein the containment casing of the improved impeller has been uncovered;
- figure 4 is an enlarged detail of the previous figure, wherein an upper zone of the casing, the impeller and the annular conduit afforded in the casing itself are shown;
- figure 5 is an axonometric view of the impeller; and
- figure 6 is a front view of the impeller.

[0015] With reference to the mentioned figures, 1 indicates the side-channel blower / aspirator according to the invention.

[0016] The proposed machine 1 comprises an impeller 2 improved with respect to machines of the prior art.

[0017] The impeller 2 is provided with a plurality of peripheral blades 21 and is equipped with a central hub 22, fitted onto a shaft 11 (see in particular figure 2), which is placed in rotation by motor means of the known type, for example the electric motor 12 represented in figures 1 and 2.

[0018] As will be explained in detail below and as can be seen from the appended figures, the blades 21 of the impeller 2 are not rectilinear like those of the prior art but, on the contrary, they have a concavity 23 on the front part, i.e. at the face turning towards the rotation direction (see in particular figure 4).

[0019] In detail, the blades 21 comprise at least one portion which has a front face 200 including a plurality of planes 201, 202, 203, 204, 205 (i.e. flat surfaces) at an angle to one another, defining the aforementioned concavity 23, which faces the advancement direction of the blades 21 (compare figures 4 and 5).

[0020] The advantages offered by such a special conformation of the blades 21 will be better understood following the description of some general aspects of the machine 1 in which such an impeller 2 is used.

[0021] The impeller 2 according to the invention is enclosed in a casing 13, 14 which internally defines an annular conduit C within which the blades 21 rotate, in the direction indicated by the arrow in figure 3.

[0022] In more detail, the two parts of the channel C which are ideally separated by the plane orthogonal to the axis of rotation of the impeller 2 coinciding with the plane of symmetry of the machine 1, are called "side channels".

[0023] As shown in figure 2, the casing is preferably made of two half-shells 13, 14, sealingly fixed, one of which is connected to the electric motor 12, while the other one constitutes a front cover.

[0024] According to an aspect of the prior art, the aforementioned annular conduit C has a suction mouth 3 for aspirating fluid (in particular air) taken externally to the machine 1 and a delivery mouth 4 for allowing the fluid to exit from the machine 1 itself (see figure 3).

[0025] In practice, through the action of the blades 21 of the impeller 2, the fluid is aspirated by the suction mouth 3 and, after crossing the annular conduit C, is expelled through the delivery mouth 4.

[0026] The annular conduit C has a first section which, with respect to the advancement direction of the blades 21 in the conduit, goes from the suction mouth 3 to the delivery mouth 4.

[0027] In this first section, there is a free space between

the blades 21 in rotation and the internal wall of the annular conduit C, to allow, during use, the formation, within the fluid, of the main motion internal to the machine 1 mentioned during the discussion of the prior art.

[0028] The annular conduit C further has a second section, which goes from the delivery mouth 4 to the suction mouth 3, within which, preferably, the blades 21 skim the internal walls of the section itself so as to limit the passage of fluid from the delivery mouth 4 to the suction mouth 3.

[0029] As shown in the appended figures, in the preferential embodiment of the invention, the impeller 2 is equipped with blades 21 which each include at least one portion comprising numerous segments 211, 212, 213, 214, 215 at an angle to one another, each equipped with one of said planes 201, 202, 203, 204, 205, so as to define the aforementioned front concavity 23.

[0030] Each segment may comprise a quadrangular plate 211, 212, 213, 214, 215.

[0031] Preferably, the blades are formed entirely by a series of plate-shaped segments 211, 212, 213, 214, 215, joined two by two, through junction lines at which a relative internal angle is formed, which is clearly less than 180 degrees.

[0032] In the depicted version, each blade 21 includes five segments 211, 212, 213, 214, 215, however, versions are possible in which there are a different number from five blade 21 segments, or in which different blades 21 or different groups of blades 21 have different numbers of segments, etc..

[0033] A version of the invention is not excluded in which not all the impeller blades 21 comprise the front concavity 23.

[0034] The impeller 2 may comprise a central body 24, preferably axial symmetric, for example discoidal, at the centre of which the aforementioned hub 22 is afforded and from which the blades 21 extend.

[0035] The blades 21 originate from a circumferential portion 25 of the central body 24 and extend outwards, substantially lying in the plane of the central body 24 itself.

[0036] In more detail, each blade 21 includes a proximal segment 211 (i.e. more internal) joined to the central body 24 at its circumferential portion 25.

[0037] In particular, such a proximal segment 211 may be sloping backwards with respect to the rotation direction, and defines an obtuse angle at the front with the aforementioned circumferential portion 25.

[0038] Each successive (and therefore more external) segment in the series that defines the blade 21, lies on a plane sloping forwards with respect to the previous segment, i.e. the segment to which it is joined and is more internal.

[0039] In practice, the second segment 212 which originates from the aforementioned proximal segment 211, is sloping forwards with respect to the latter, defining therewith an angle positioned to the front of the blade, and so on for the gradually more external segments 213, 214, until the distal segment 215 which has a free end (see again figure 4).

[0040] According to a non-preferential variation, the blades may include curved portions, defining longitudinally and/or transversally curved sections.

[0041] The particular conformation of the blades 21 allows the machine 1 to operate more efficiently with respect to the prior art, for the reasons illustrated below.

[0042] As explained above, during the use of this type of machines, the air found inside the annular channel receives, from the impeller 2, both a thrust forwards (see arrow A of figure 4) and a centrifugal thrust (see arrow B), i.e. away from the centre of rotation of the impeller 2 itself.

[0043] Thanks to the presence of the front concavity 23 of the blades 21 according to the invention, the part of air thrust in the centrifugal direction, which would tend to move radially away from the blades 21, is instead intercepted by the blades 21 themselves and projected forwards.

[0044] More precisely, the radial component of the fluid's motion field is in part deviated in the circumferential direction already by the actual blade before the fluid is subject to the action of the closing walls of the annular conduit C.

[0045] In this way, a prevailing part of the volume of air included in the annular channel is thrust forwards by the blades 21, allowing the machine 1 according to the invention to obtain improved performance levels with respect to known machines.

[0046] Note that known impeller blades, being totally rectilinear, are not able to "capture" air flows moving in the centrifugal direction within the annular conduit.

[0047] As mentioned above, during the use of the machine 1, within the annular conduit C swirls of fluid are developed due to the action of the blades 21 of the impeller 2.

[0048] In detail, part of the fluid contained in the annular conduit C, furthest from the centre of rotation, tends to move forwards in the rotation direction along an ascending curve; instead, part of the fluid closer to the centre of rotation follows a descending curve until it moves in the retrograde direction upon reaching the internal area affected by the base of the blades 21 (see arrow D in figure 4).

[0049] The blades 21 of the impeller 2 according to the invention, being equipped at the base of the aforementioned proximal segment 211 which bends "backwards" as defined above, are able to intercept the aforementioned retrograde fluid and push it forwards, increasing the efficiency of the machine 1.

[0050] Preferably, each blade 21 is contained in one of the two semi-spaces defined by an ideal diametral plane that joins the axis of the central body 24 to the joining zone between the blade 21 and the central body 24.

[0051] As shown in the figures, in particular in figures 4 and 5, the impeller 2 proposed may include a portion with an annular progression 26, i.e. a geometric surface of revolution about the axis of rotation.

[0052] Such an annular portion 26 is adjacent to or incorporated into the blades 21 and extends starting from the circumferential portion 25 mentioned various times of the impeller, in a radial direction and ends at a shorter distance than the longitudinal extension of the blades 21.

[0053] Finally, by way of non-exhaustive example, the impeller 2 proposed may be made of die-cast aluminium or a polymeric material by injection moulding.

Claims

1. A side-channel blower / aspirator (1), comprising at least one impeller (2) equipped with a plurality of blades (21) and a casing (13, 14), in which said impeller (2) is enclosed and within which an annular conduit (C) is defined in which said blades (21) rotate, **characterised in that** said blades (21) comprise at least one portion which has a face (200) comprising a plurality of planes (201, 202, 203, 204, 205) at an angle to one another, defining a concavity (23) facing the advancement direction of the blades (21) within said conduit (C).

2. The machine (1) according to the preceding claim, wherein said face comprises at least three of said planes (201, 202, 203, 204, 205).

3. The machine (1) according to at least one of the preceding claims, wherein said portion comprises numerous segments (211, 212, 213, 214, 215) at an angle to one another, each of which is equipped with one of said planes (201, 202, 203, 204, 205), so as to define said concavity (23).

4. The machine (1) according to the preceding claim, wherein the blades (21) are formed by respective series of plate-shaped segments (211, 212, 213, 214, 215), joined two by two through junction lines, at which a relative non-flat angle is formed.

5. The machine (1) according to at least one of the preceding claims, wherein the impeller (2) comprises a central body (24), from a circumferential portion of which said blades (21) extend.

6. The machine (1) according to the preceding claim and claim 3 or claim 4, wherein the blades (21) comprise a proximal segment (211) which originates from said circumferential portion (25) and, with respect to it, is sloping in the opposite direction to the advancement one.

7. The machine (1) according to the preceding claim and claim 4, wherein within said series, each segment (212, 213, 214, 215) other than the proximal segment (211), lies on a plane which is sloping forwards with respect to the more internal segment to which it is joined.

8. The machine (1) according to at least one of the preceding claims, wherein the impeller (2) comprises a central body (24) axial symmetric to which said blades (21) are joined at respective joining zones, each blade (21) being completely contained within one of the two semi-spaces defined by an ideal diametral plane which joins the axis of the central body (24) to the joining zone between the blade (21) and the central body (24).

9. The machine (1) according to any one of the preceding claims, wherein said blades (21) each comprise at least one longitudinally curved portion.

10. The machine (1) according to any one of the preceding claims, wherein said blades (21) each comprise at least one transversally curved portion.

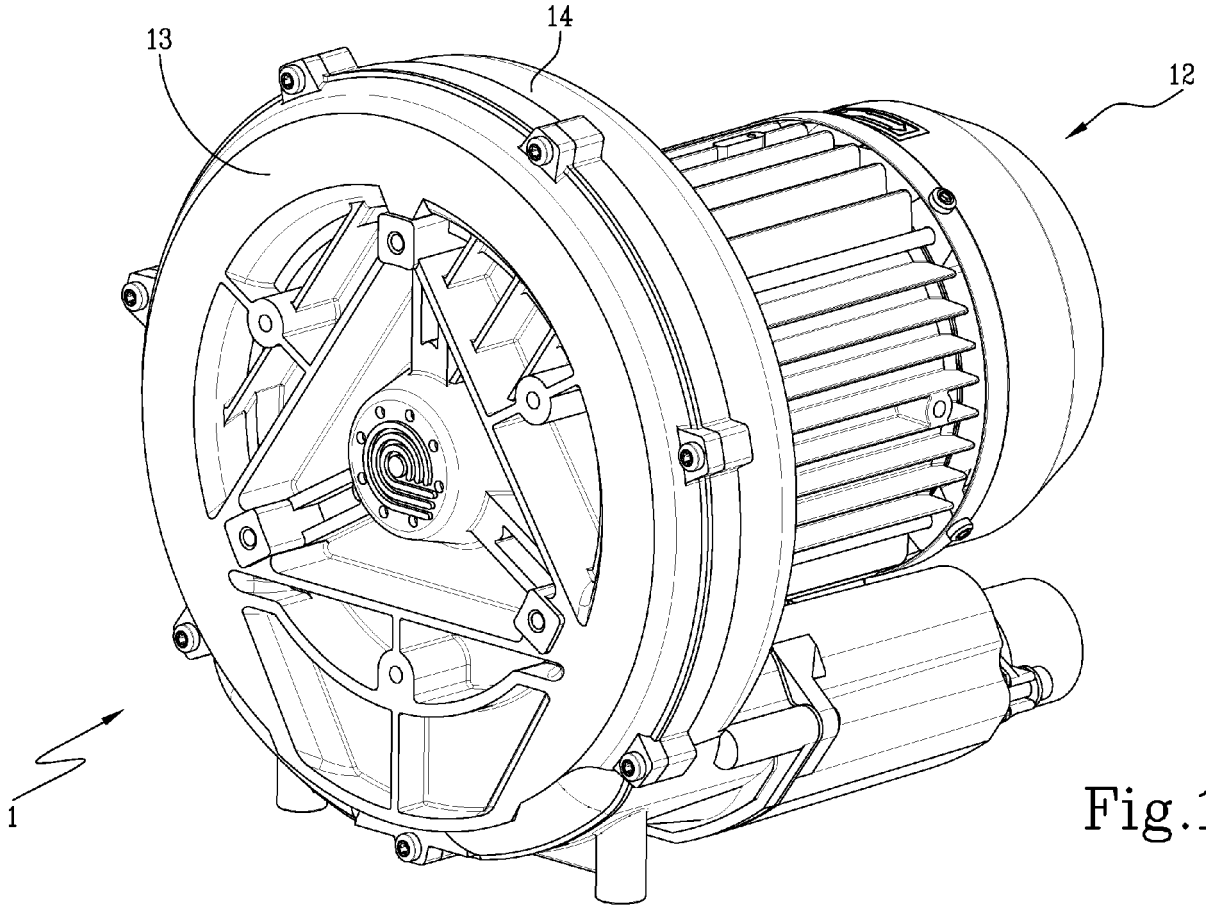

Fig.1

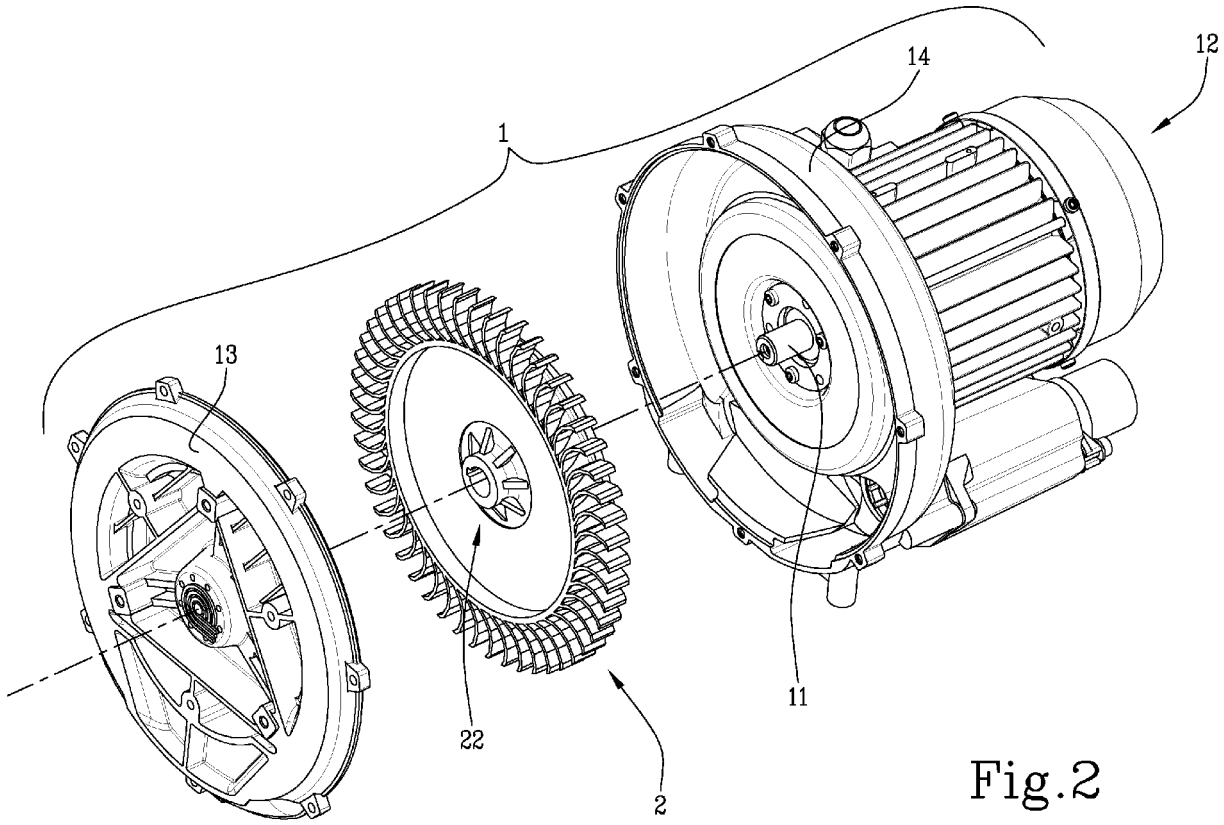

Fig.2

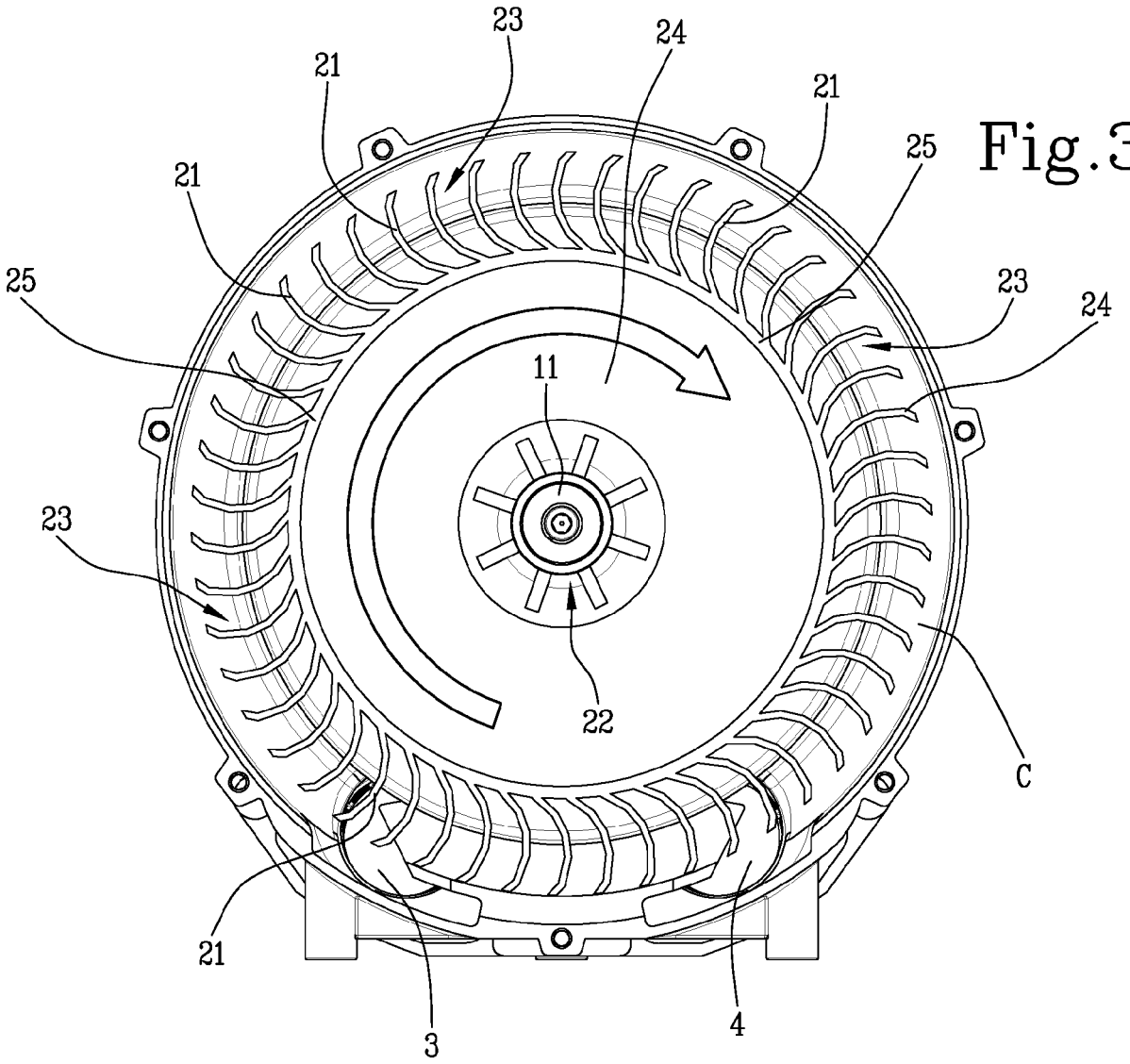

Fig.3

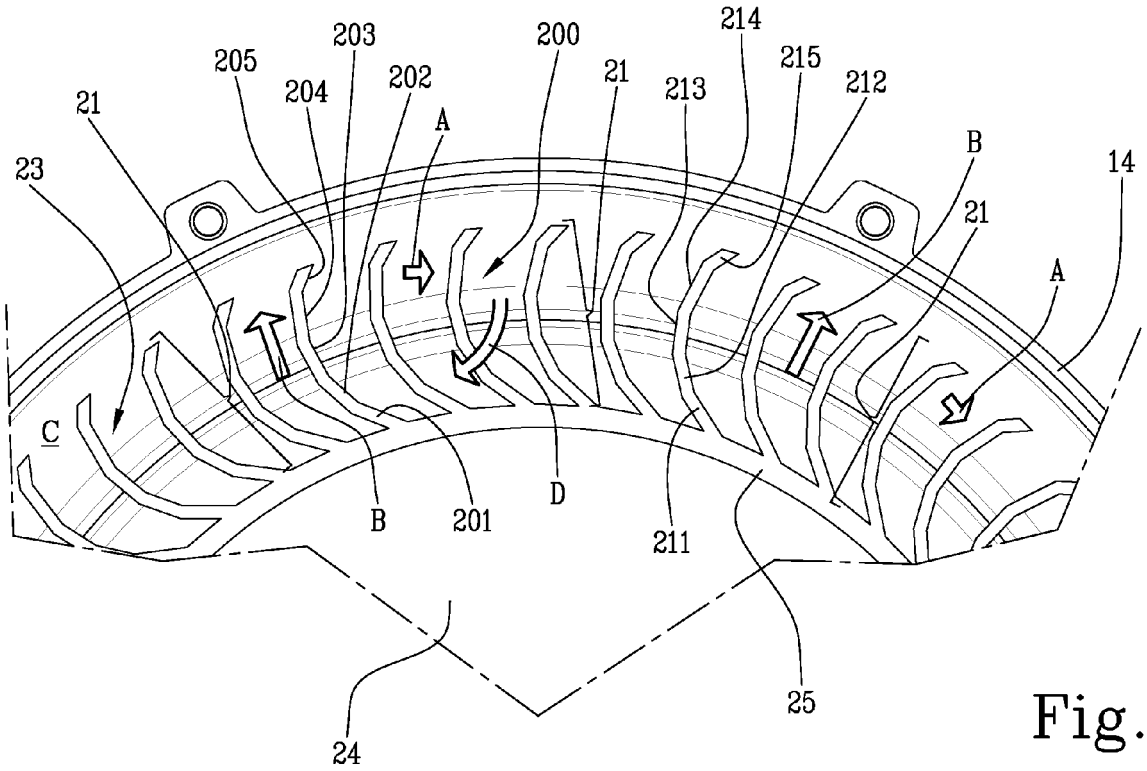
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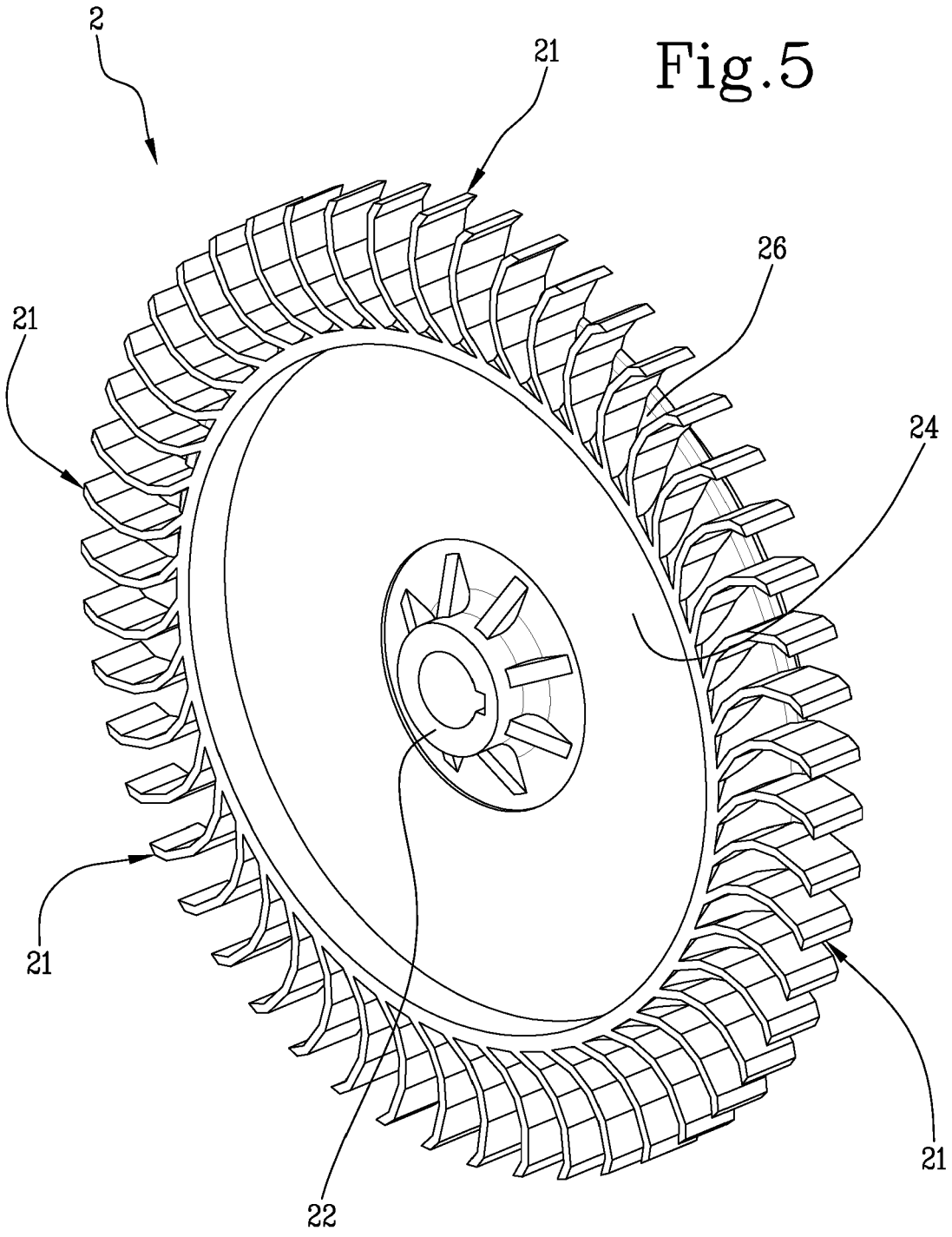
Fig.4

Fig.5



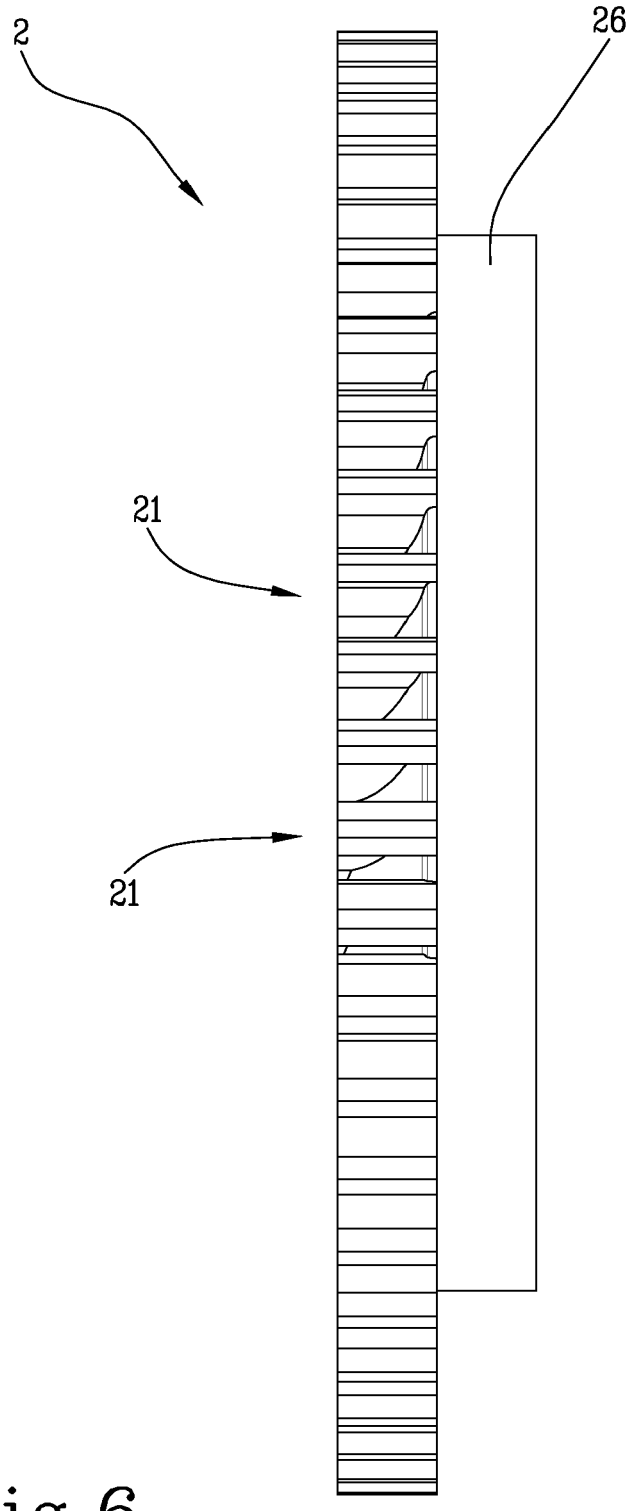


Fig.6

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 3463

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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	3 August 2016	Di Giorgio, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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