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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 transversally curved portion, defining a concavity (23) facing the advancement direction of the blades (21) within said conduit (C).

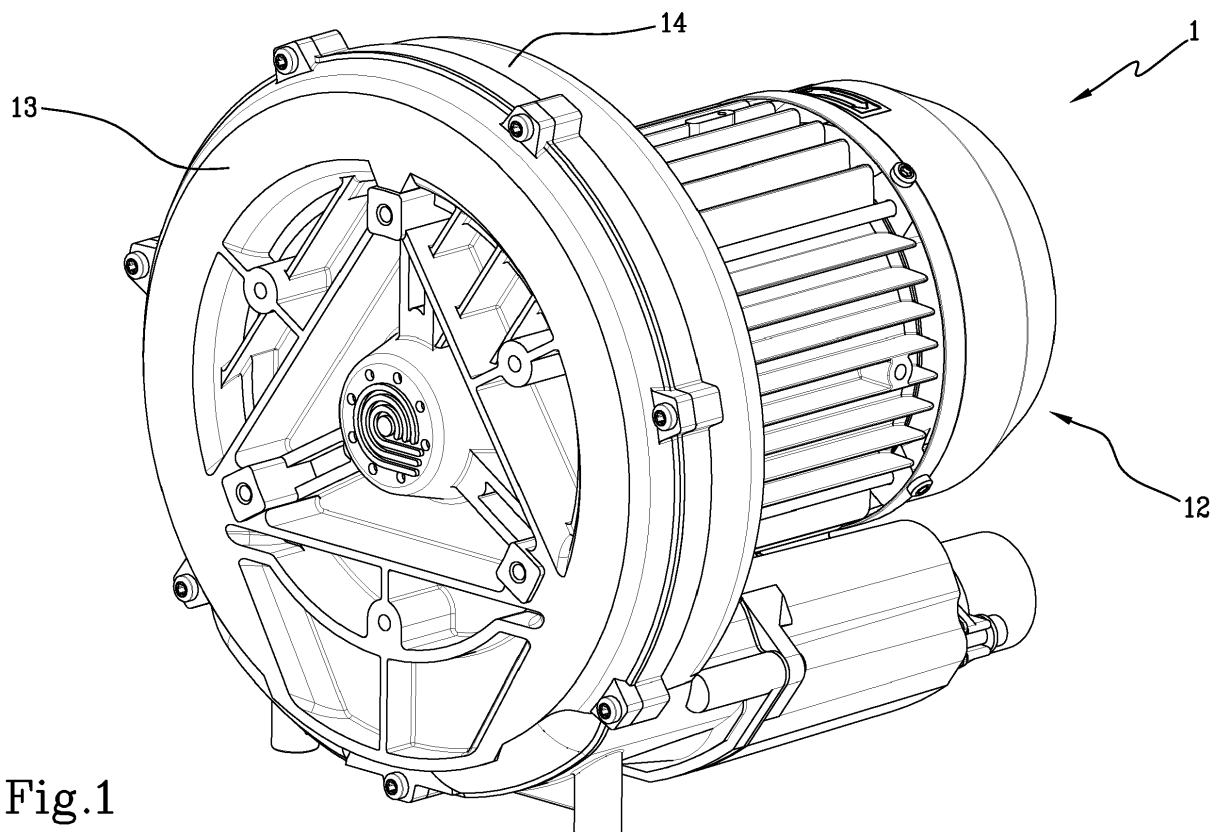


Fig.1

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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. These machines can operate both as vacuum pumps and as compressors.

[0005] The operation of this type of machines is based on the principle of the fluid flow by means of swirls (or turbulence) produced by the thrust developed by the impeller blades within the annular conduit, during rotation.

[0006] In detail, during rotation, the blades push the fluid forwards and, due to the mentioned centrifugal thrust, also outwards.

[0007] The walls of the annular conduit then deviate the fluid again between one blade and another.

[0008] The joint action of the blades and the walls of the annular conduit define a helical motion in the fluid itself.

[0009] Currently, the impellers used in side-channel machines are provided with rectilinear radial blades.

[0010] 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. 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.

[0011] Such technical task is reached by the side-channel blower / aspirator obtained according to claim 1.

[0012] 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.

[0013] With reference to the mentioned figures, 1 indicates the side-channel blower / aspirator according to the invention.

[0014] The proposed machine 1 comprises an impeller 2 improved with respect to machines of the prior art.

[0015] 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.

[0016] 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, have a particular curvature.

[0017] 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.

[0018] 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.

[0019] 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". 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.

[0020] 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.

[0021] 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.

[0022] 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 to the delivery mouth.

[0023] In this first section, there is a free space between the blades 21 in rotation and the internal wall of the annular conduit, 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.

[0024] The annular conduit C further has a second section, which goes from the delivery mouth to the suction mouth, 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.

[0025] As shown in the appended figures, the impeller

2 according to the invention is equipped with blades 21 comprising at least one transversally curved portion, defining a relative substantially curved section.

[0026] In detail, such blades 21 each define a concavity 23 facing the advancement direction of the blades 21 within the conduit.

[0027] In practice, the blades 21 of the impeller 2 according to the invention, instead of being rectilinear, are laterally curved, defining curved transversal sections and a concave front surface 23, at least in the aforementioned portion (see in detail figures 5 and 6).

[0028] In other words, consider a diametral plane of the impeller 2 which passes through a prefixed point of the front surface 23 of a blade 21 of the impeller 2.

[0029] The section (or intersection) of the blades 21 of the impeller 2 taken along a plane perpendicular to the diametral plane and parallel to the axis of rotation of the impeller 2 defines, at the front surface 23 itself, a curved and not rectilinear line.

[0030] The longitudinal section of each blade 21 may be rectilinear or curved, as explained below.

[0031] More precisely, 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. 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.

[0032] In more detail, each blade 21 includes a proximal portion 210 (i.e. more internal) joined to the central body 24 at its circumferential portion 25.

[0033] In the preferential embodiment of the invention, shown in the appended figures, the blades 21 have a transversal curvature along their entire longitudinal extension; even more preferably, such curvature affects the whole transversal extension of the individual blade 21.

[0034] Alternatively, the blades may each be provided with one rectilinear portion and at least one curved portion, the latter being for example a longitudinal distal portion comprising the free end of the relative blade or the aforementioned proximal portion or even a median portion, etc.

[0035] According to a further, non-preferential, variation, the blades may be formed by a plurality of curved sections, defining cuspidal joining zones. The curved or partially curved conformation of the blades 21 allows the machine 1 to operate more efficiently with respect to the prior art, for the reasons illustrated below.

[0036] During the use of this type of machine, the air that is found inside the annular channel tends to move away from the impeller blades in the transversal direction to the blades, i.e. substantially parallel (or oblique) to the axis of rotation (see arrows E of figure 6).

[0037] Thanks to the curvature of the blades 21 according to the invention, the part of air thrust in the lateral direction with respect to the impeller, i.e. which would tend to move sideways away from the blades 21, is instead intercepted by the blades 21 themselves and pro-

jected forwards.

[0038] More precisely, the component of the fluid's motion field substantially perpendicular to the radial directions, is in part deviated in the circumferential direction already by the actual blade 21 before the fluid is subject to the action of the closing walls of the conduit.

[0039] In practice, thanks to the curvature, which extends transversally in the blade 21, the latter can intercept the air flows which would tend to laterally escape from the blade 21 itself.

[0040] In this way, a prevailing part of the volume of air included in the annular channel C 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.

[0041] Note that known impeller blades, being rectilinear or formed by straight segments, are not able to "capture" air flows moving in the transversal direction within the annular conduit.

[0042] In the preferred embodiment of the invention, the blades 21 of the impeller 2 are placed tangentially to the aforementioned circumferential portion 25 of the central body 24.

[0043] In detail, the mentioned proximal portion 210 of the blade 21 extends from the circumferential portion 25 outwards and along a tangential direction to the circumferential portion 25 itself.

[0044] In other words, the proximal (or "base") portion 210 of the blade 21 has a curvature such that it is tangential to the circumferential portion 25.

[0045] This aspect is particularly advantageous, in terms of efficiency of use of the proposed machine 1, for the reasons illustrated below.

[0046] 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.

[0047] In detail, part of the fluid contained in the annular conduit, 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).

[0048] The blades 21 of the impeller 2 according to the invention, being equipped at the base 210 of the aforementioned tangential bend at the joining circumference between blades 21 and central body 24, are able to intercept the aforementioned retrograde fluid and push it forwards, increasing the efficiency of the machine 1.

[0049] According to a preferential embodiment of the invention, each blade 21, as well as the transversal curvature described above, has a second curvature along its longitudinal extension (see for example figures 3 and 4).

[0050] In other words, the section (or intersection) of the blades 21 of the impeller 2 taken along an ideal plane

perpendicular to the axis of rotation of the impeller 2 defines, at the front surface 23, a curved and not rectilinear line. In this "double curvature" version, each proposed impeller blade has the longitudinal curvature along its whole extension, in particular along its whole longitudinal extension.

[0051] In detail, the curvature is such as to define, in each blade 21, a curved profile (or longitudinal section), still with concavity facing the rotation direction.

[0052] Thanks to the second curvature, the blade 21 is able to intercept and project forwards the air flows which would tend to radially escape from the blade 21 itself.

[0053] Therefore, yet again, the invention allows improved efficiency of the machine 1 with respect to the prior art.

[0054] Optionally, the blades 21 have a curvature such as to be tangential to a respective diametral plane which passes through the axis of the central body; in detail, the tangency point is located in the rear convex part of the blade 21.

[0055] 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.

[0056] 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, which lies in a plane of symmetry of the impeller 2 perpendicular to the axis of rotation.

[0057] Such an annular portion 26 is 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, for example, substantially half way along their length.

[0058] 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.

3. The machine according to claim 1 or claim 2, wherein each (21) of said blades have said curvature in the transversal direction along the whole transversal extension.

4. The machine (1) according to at least one of the preceding claims, wherein said blades each comprise at least one longitudinally curved portion which defines a concavity (23) facing said advancement direction.

5. The machine (1) according to the preceding claim, wherein each of said blades (21) is equipped with a longitudinal curvature along its whole longitudinal extension.

6. The machine (1) according to at least one of the preceding claims, wherein the impeller (2) comprises a central body (24) from which said blades (21) extend, which are arranged tangentially to a circumferential portion (25) of the central body (24).

7. The machine according to the preceding claim, wherein the impeller (2) comprises a central body (24) from which said blades (21) extend, each blade (21) being provided with a proximal portion (210) joined to a circumferential portion (25) of the central body (24), said proximal portion (210) of the blade (21) being curved so as to be tangential to said circumferential portion (25) of the central body (24).

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).

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** the blades (21) comprise at least one transversally curved portion, 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 blades (21) each have a transversal curvature along their entire longitudinal extension.

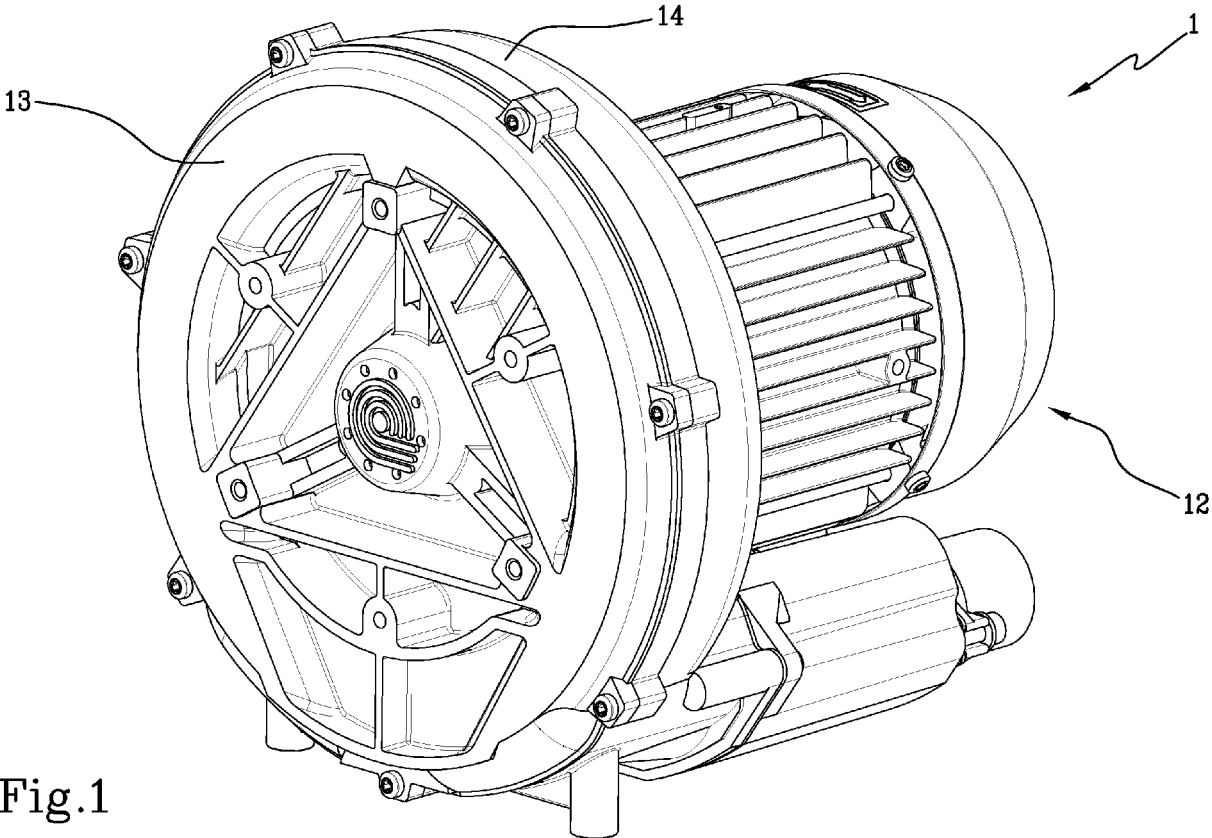


Fig.1

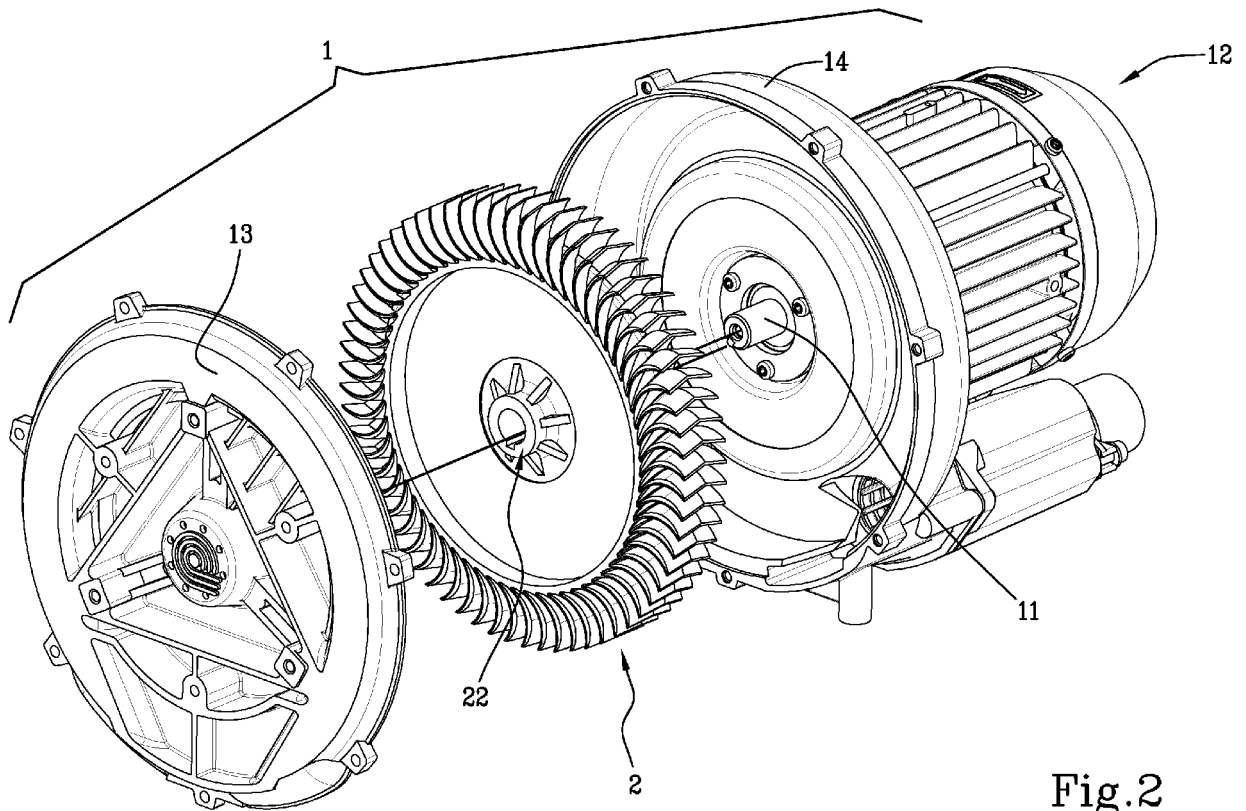
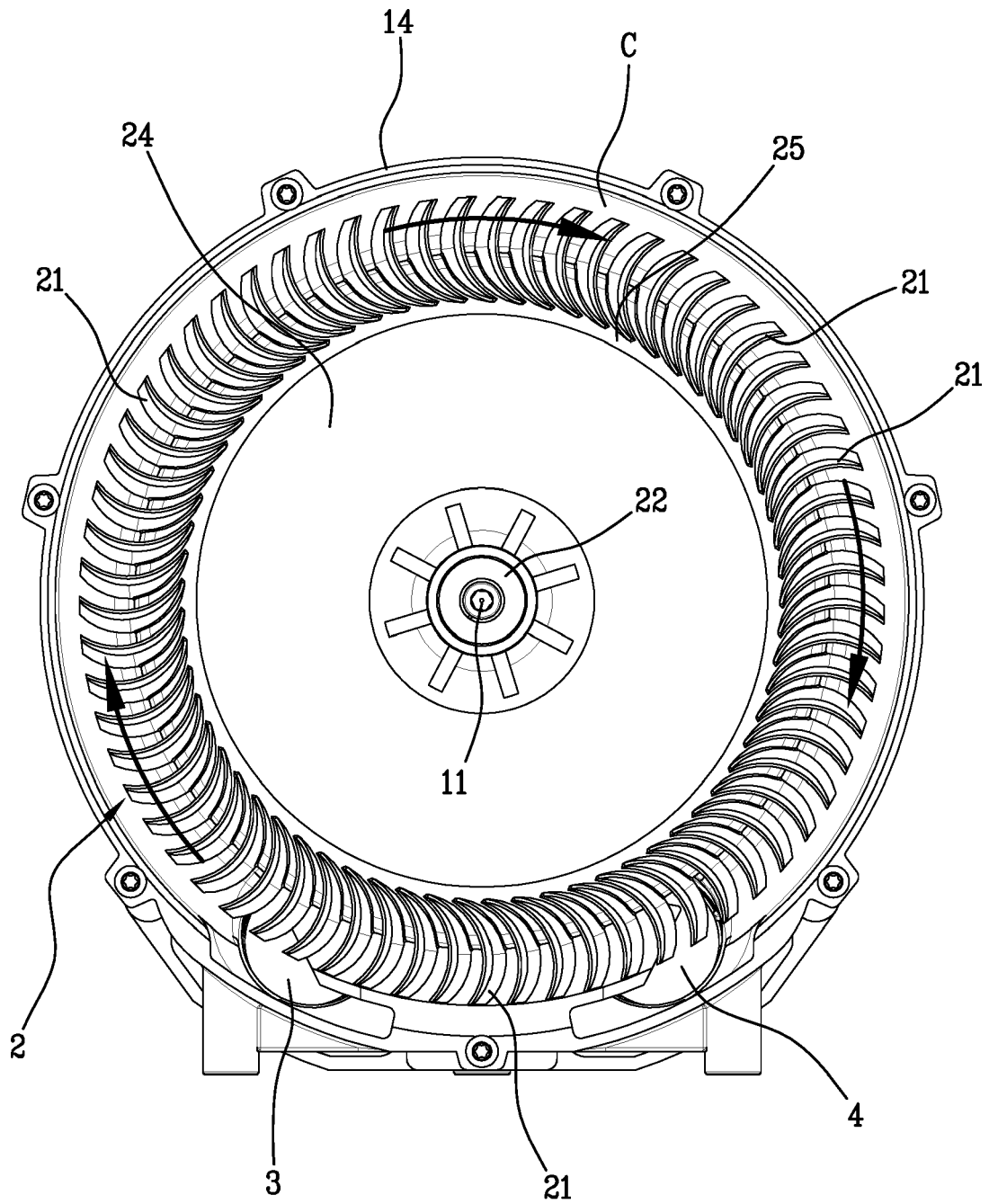


Fig.2

Fig.3



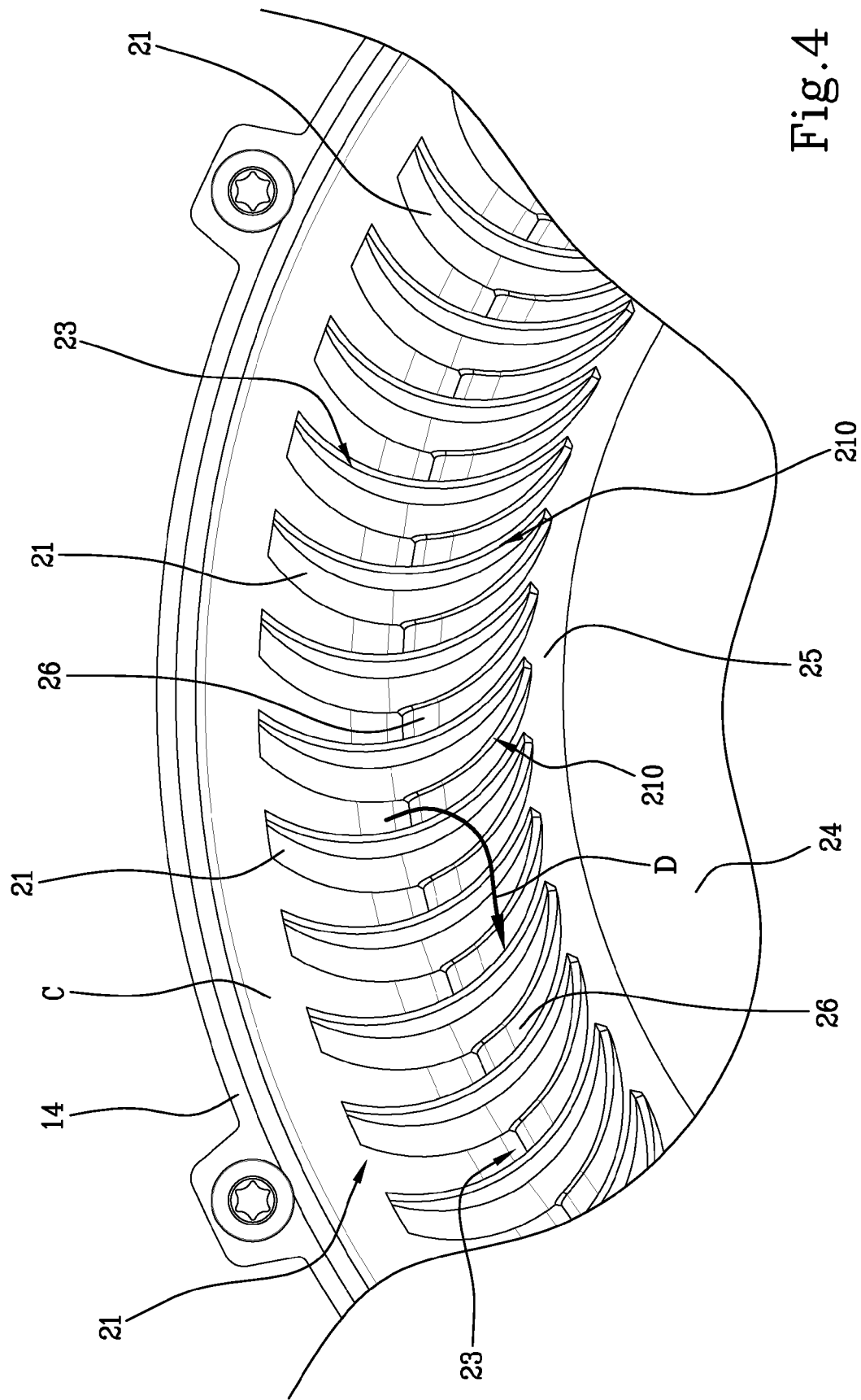


Fig. 4

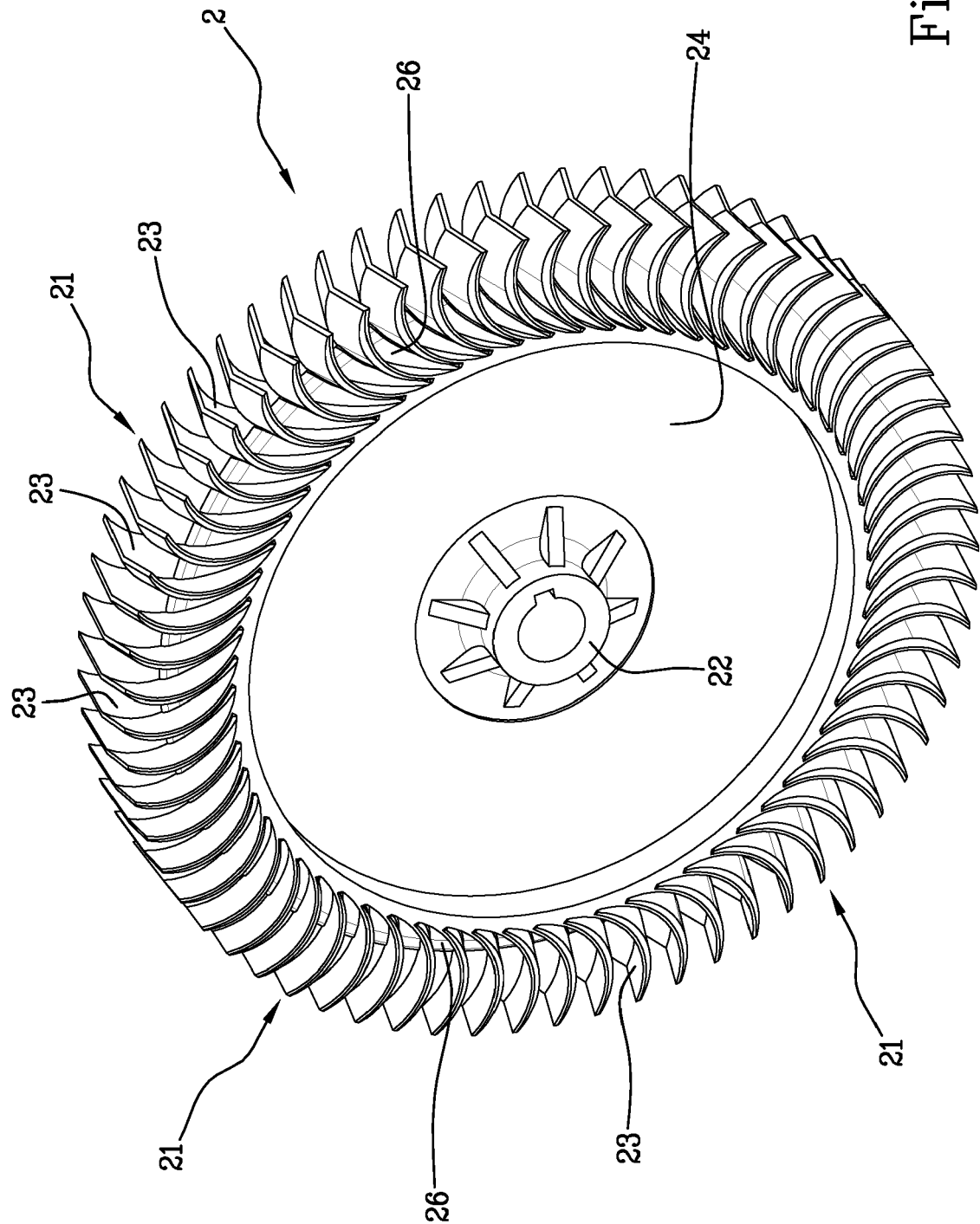


Fig.5

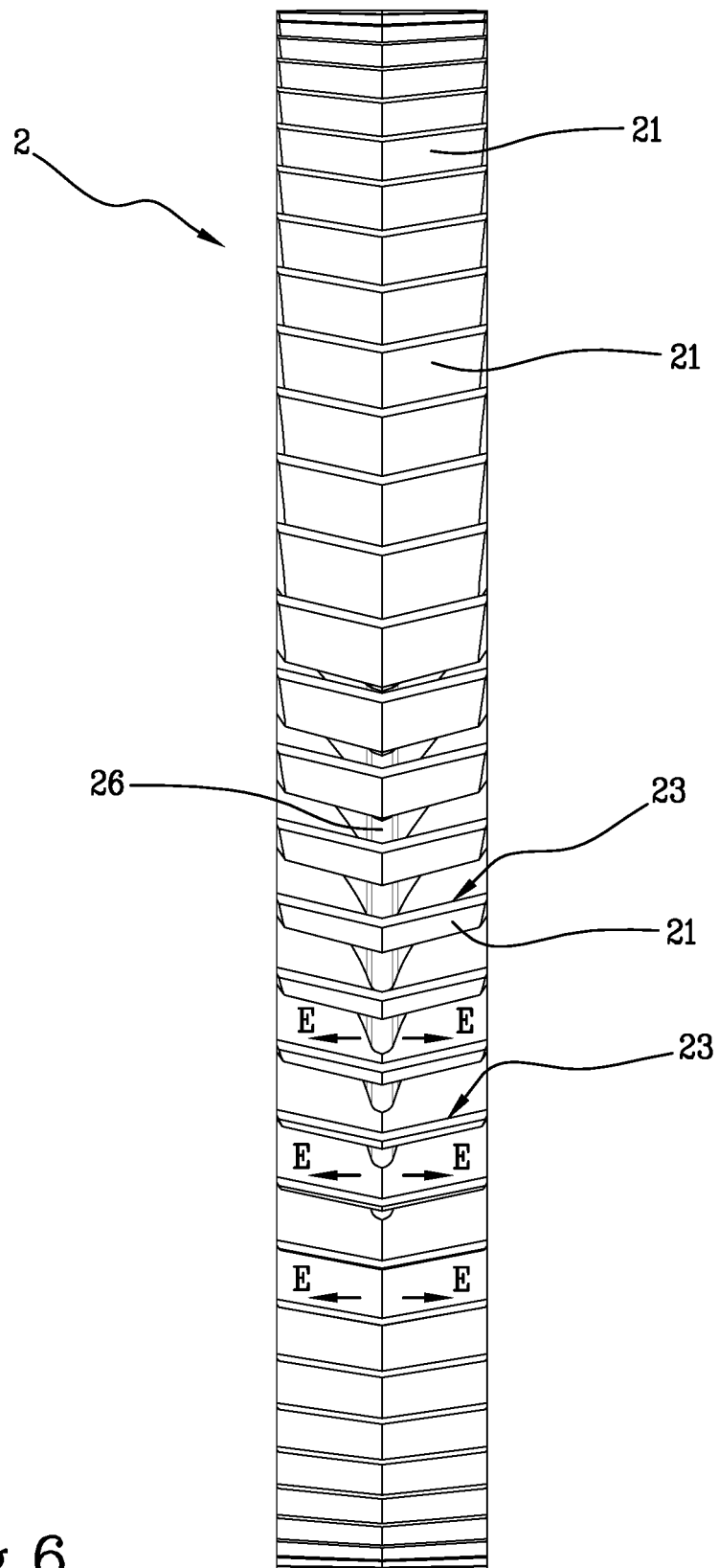


Fig.6



EUROPEAN SEARCH REPORT

Application Number
EP 16 15 3459

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A			TECHNICAL FIELDS SEARCHED (IPC) F04D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 August 2016	Examiner Di Giorgio, F
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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