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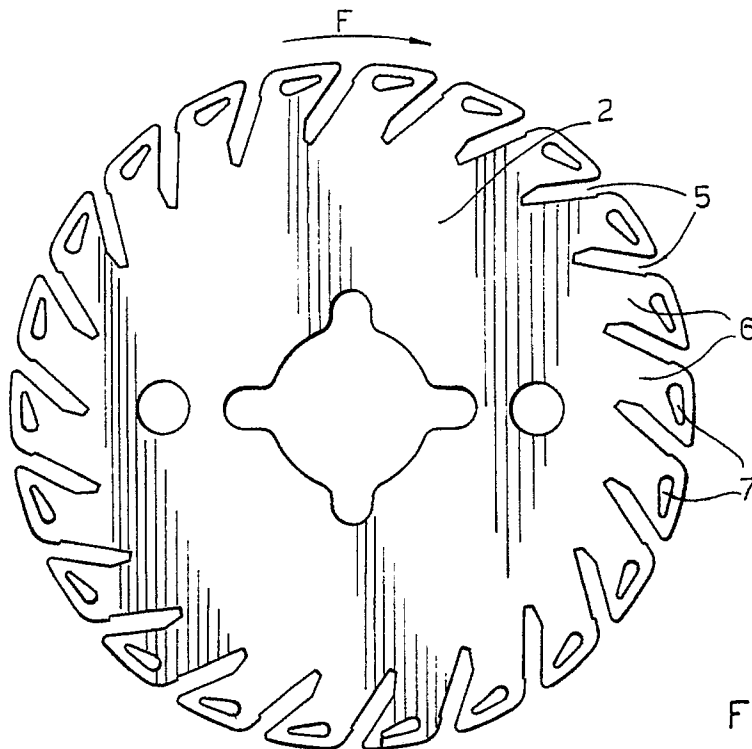
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54 **Fan impeller.**

57 The invention relates to a fan impeller comprising at least two radial disks with circular contour provided with a plurality of open slots (5) on the outer edge of the disks, each of them suitable for receiving a respective axial blade (3), which is locked by the rolling of the disks, at least one

through hole (7), with a shape elongated in the direction of the circumference of the disk, being provided between each pair of consecutive slots (5) of a disk (2), to allow the squashing of the material of the outer edge of the disk following the rolling of the same.



**FIG. 2**

**EP 0 440 048 A1**

## FAN IMPELLER

The present invention relates to impellers, for example for crossflow fans, to a disk for such impellers and the related method of assembly.

An impeller for fans or compressors comprises at least two radial disks and a plurality of peripheral axial fins or blades with curved contour.

Usually the blades are mounted on the disks, by being inserted radially into corresponding slots cut on the disks and opening onto the periphery of the same, and then being suitably locked.

In particular, the blades are suitably shaped at the points of connection with the disks, for example being squashed so that they can be inserted into the slots and remain axially locked.

The radial locking of the blades takes place by folding, by a disk rolling process, a projection foreseen in correspondence with one side of the peripheral opening of each slot onto the other side of the opening itself.

With this system the curving of the blades cannot be varied during the rolling of the disks.

One aim of the invention is to provide a fan impeller which can be simply and securely assembled and which has the possibility of varying the curve of the blades, and therefore the air flow of the same, during the disk rolling process.

In order to achieve this aim, the fan impeller according to the invention has a substantially circular contour, with a plurality of slots open on the outer contour, each being suitable for receiving a corresponding blade, at least one through hole being foreseen between each pair of consecutive slots near the peripheral edge of the disk, suitable for receiving the material overhanging during the rolling of the disk, which causes the occlusion of the slot openings.

During rolling a decrease in the diameter of the disk and warping of the slots are produced, with a consequent variation of the curve of the blades inserted in the latter, which is a function of the rolling pressure.

In accordance with a further aspect of the invention, on one side of each slot a small tooth is foreseen, suitable for locking the blade radially before rolling, in order to prevent it coming out accidentally.

The blades used in the fan impeller, in accordance with the invention, have simple notches in correspondence with the connection points with the disks, suitable for receiving the bottom of each respective slot, in order to ensure the axial locking of the blades themselves.

Further characteristics of the invention will be explained more clearly by the detailed description which follows, which refers to one of its merely

exemplary, and therefore not restrictive, embodiments, illustrated in the appended drawings, in which:

Figure 1 is a perspective view of a fan impeller according to the invention;

Figure 2 is a plan view of a disk of the impeller in figure 1, before rolling;

Figure 3 is a plan view of a blade of the impeller in figure 1, before assembly;

Figure 4 is a descriptive view illustrating a part of the disk subjected to differentiated rollings.

In figure 1 a fan impeller is illustrated, shown as a whole with reference number 1, consisting of three radial disks 2, two terminal and one intermediate, and of a plurality of axial blades 3, located at regular intervals and at the same inclination on the walls of the disks 2, near their outer edges.

During working, the impeller 1 is set in rotation in the direction of the arrow F, by means of a shaft 4 projecting axially from one of the terminal disks 2.

Each disk 2, as can be seen more clearly from the plan view in figure 2, has an exactly circular outer contour and a plurality of open slots 5 on the outer contour of the disk.

The slots 5 are equidistant and are all at the same inclination with respect to the radial direction. For the sake of simplicity the slots 5 will also be called radial.

Between each pair of adjacent slots 5 a type of tooth 6 is formed, in which a hole 7 is made, situated near the outer contour of the disk and substantially elongated in the direction of the circumference of the disk itself.

Each hole 7 has two lengths 8 which are rectilinear or have a large bending radius and which are joined by two circular lengths 9, 10, of different diameters, in such a way as to determine a decreasing span of the hole 7 in the direction of the arrow F, that is in the direction of the rotation of the disk.

Each slot 5 has a substantially constant width, growing narrower in correspondence with its respective bottom 11.

On one of the two sides of each slot 5 (the front one, with reference to the direction of the rotation of the disk 2) a small tooth 12 is foreseen, suitable for radially locking the blade 3 before rolling.

The blade 3 has a curved contour and has notches 13 whose width is slightly superior to the thickness of the disks 2, in correspondence with the connecting points with the disks themselves, in such a way that they fit into the bottom 11 of the corresponding slot 5 and axially lock the blade.

On the part opposite each notch 13 on the blade 3 a corresponding undercutting 14 of greater width is foreseen, suitable for receiving the material from the edge of the disk which closes the opening of the slot 5 after the rolling process, as will be described more clearly below.

The rolling process of the disk 2, shown in diagrammatic form in figure 4, is carried out by means of a roller 15, illustrated with a broken line in various positions, which is pressed against the peripheral edge of the disk at a determined pressure.

In this figure three blades 3 are illustrated in succession from left to right, locked to the disk 2 with increasing rolling pressures, to show the possibility of varying the curve of the blade according to the rolling pressure used.

Rolling produces a decrease in the original outer diameter of the disk, which increases with the increase in the pressure used.

During rolling, squashing of the back face of each tooth 6 is produced, which tends to close at least partially the corresponding elongated hole 7 foreseen on the tooth itself, and folding of its front face, which tends to close the opening of the corresponding slot 5, together with warping of the slot itself.

Obviously the holes 7 foreseen on the teeth 6 are illustrated in the appended figures solely as an example, and therefore they can be of any other shape, on the understanding that their function of receiving excess material after rolling remains the same. Similarly, each hole 7 can be substituted by more than one hole of smaller dimensions.

Of course the invention is not limited to the particular embodiment previously described and illustrated in the appended drawings, but many modifications in details can be made to it which are within reach of the technician in the field.

## Claims

1. A disk for a fan impeller having a circular peripheral contour and a plurality of slots (5) which open onto the outer contour of the disk, in such a way that between each pair of adjacent slots (5) a tooth is determined (6), each slot (5) being suitable to receive a corresponding blade (3) of the impeller, and to lock it following rolling of the outer contour of the disk, characterized in that at least one through hole (7) is foreseen in correspondence with each tooth (6), suitable for allowing the squashing of the corresponding tooth (6) during the rolling of the disk.
2. A disk according to claim 1, characterized in that said hole (7) is elongated in the direction

of the circumference of the disk and is situated near the outer edge of the same.

3. A disk according to claim 2, characterized in that said hole (7) is wider at the part facing the back face of the corresponding tooth (6).
4. A disk according to claim 2 or 3, wherein said hole (7) has two lengths (8) which are substantially rectilinear or have a large bending radius, joined by two circular terminal lengths (9, 10), preferably with different diameters.
5. A disk according to any one of the previous claims, characterized in that on one of the sides of each slot (5) a small tooth (12) is foreseen for radially locking the corresponding blade (3).
6. A fan impeller comprising at least two coaxial disks according to any one of the claims from 1 to 5 and a plurality of blades (3) inserted radially into the corresponding notches (5) on the disks and locked by means of the rolling of the outer edge of the disks.
7. An impeller according to claim 6, characterized in that each blade (3) has a respective notch (13) in correspondence with the points of connection with the disks (2), whose width is at least equal to the thickness of the disks, suitable for housing the bottom (11) of the corresponding slot, to axially lock the blade (3).
8. An impeller according to claim 7, characterized in that on the side opposite each of the said notches (13) a corresponding notch (14) is foreseen, whose width preferably is larger and whose depth is preferably less than that of the notch (13).
9. A process for the realization of a fan impeller according to claim 6, consisting in radially inserting in the slots (5) at least two coaxial disks (2), according to claim 1, respective blades (3), and in carrying out rolling of the outer edge of the disks, in such a way as to close the openings of the slots (5), and to ensure the locking of the blades.
10. A process according to claim 9, characterized in that the curve of the blade (3) can be varied on the basis of the rolling pressure used.

FIG. 1

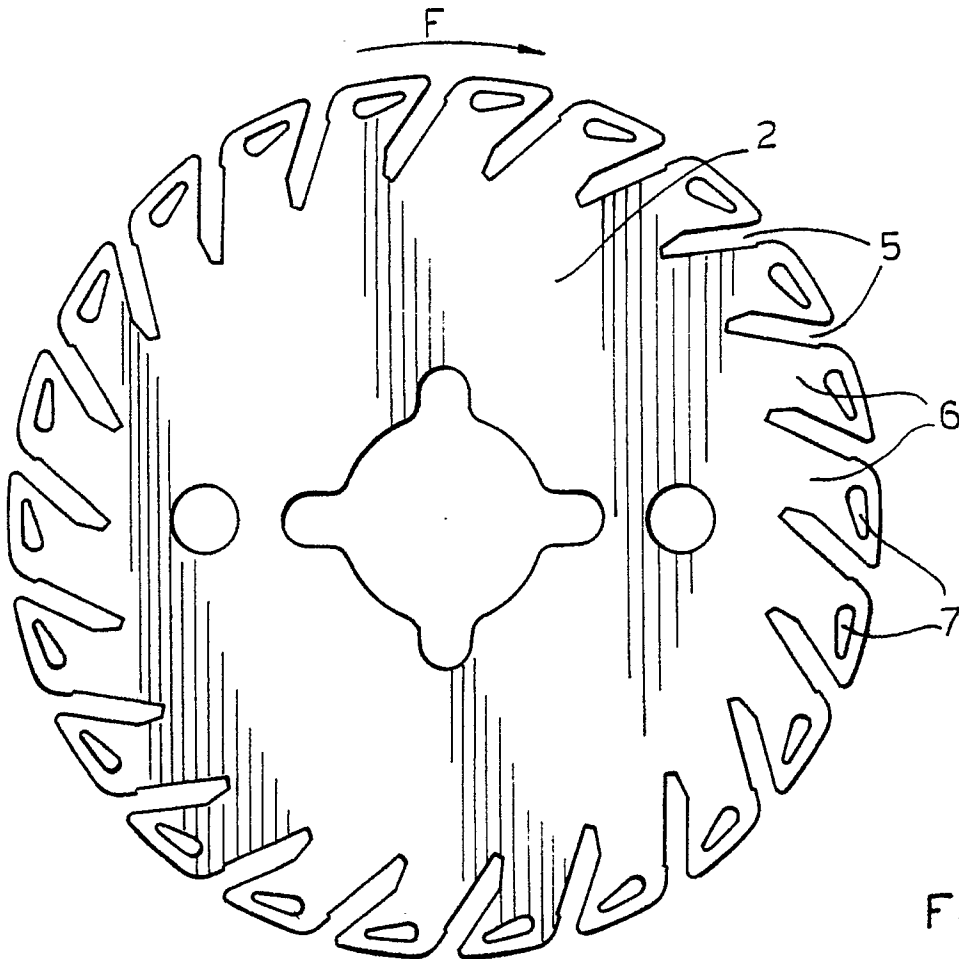
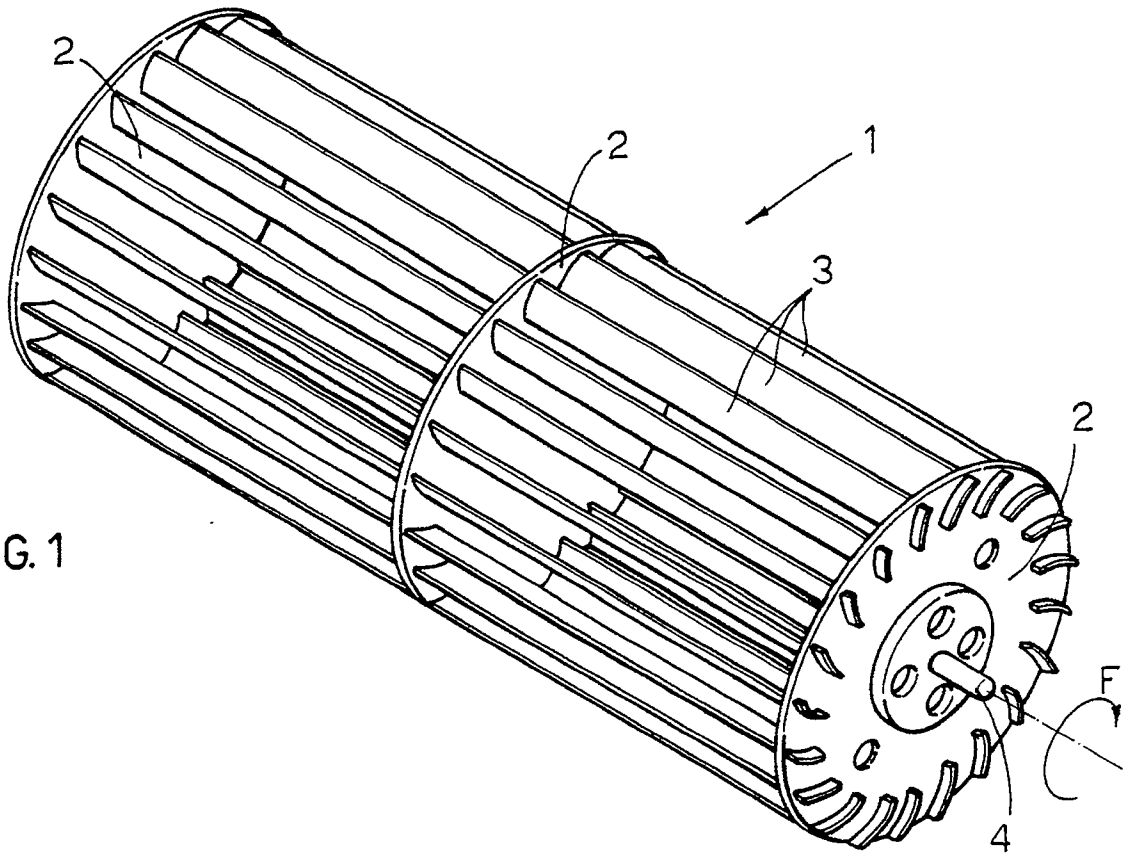
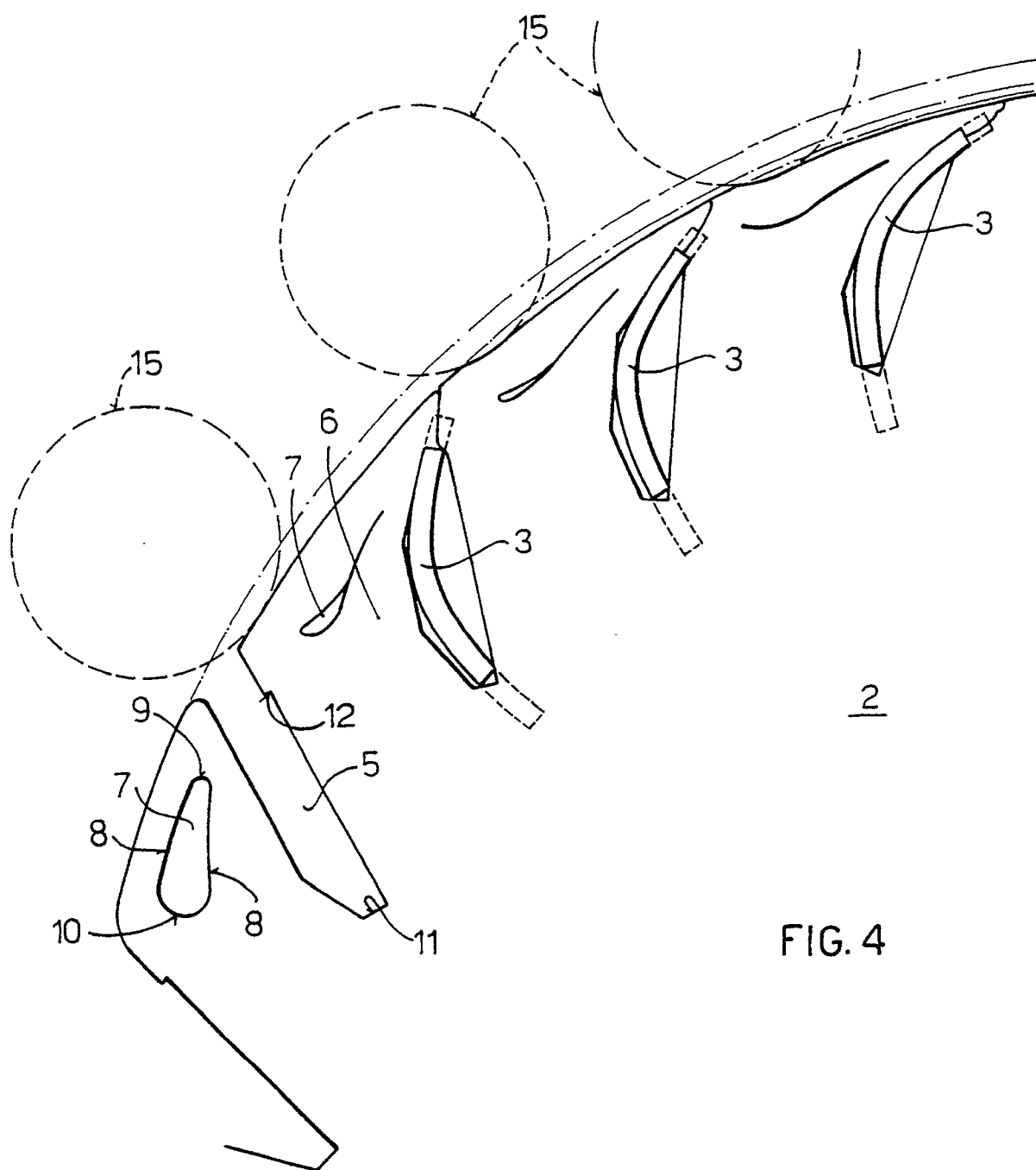
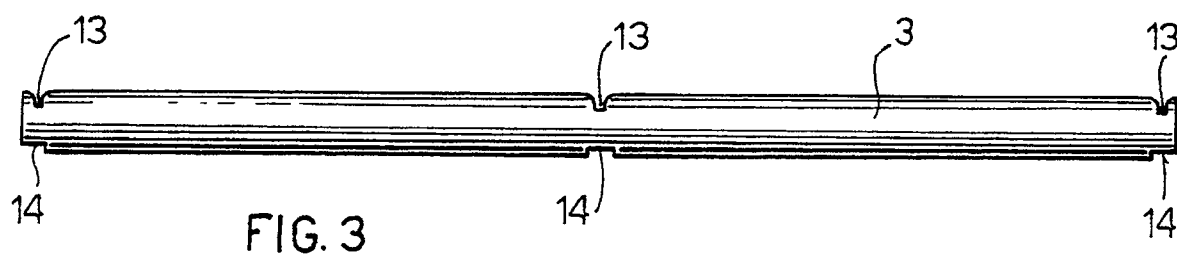


FIG. 2





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 91100545.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	PATENT ABSTRACTS OF JAPAN, unexamined applications, M field, vol. 6, no. 163, August 26, 1982 THE PATENT OFFICE JAPANESE GOVERNMENT page 122 M 152 * Kokai-No. 57-79 297 (AKAISHI) *	1,9	F 04 D 29/28 F 04 D 17/04
Y		5	
A		2-4, 6-8,10	
X	PATENT ABSTRACTS OF JAPAN, unexamined applications, M field, vol. 8, no. 154, July 18, 1984 THE PATENT OFFICE JAPANESE GOVERNMENT page 9 M 310 * Kokai-No. 59-49 395 (NIHON SAABO) *	1,9	
A		2-8,10	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
Y	PATENT ABSTRACTS OF JAPAN, unexamined applications, M field, vol. 5, no. 172, October 31, 1981 THE PATENT OFFICE JAPANESE GOVERNMENT page 109 M 95 * Kokai-No. 56-98 599 (HITACHI) *	5	F 04 D 17/00 F 04 D 29/00
A		1	
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 06-05-1991	Examiner WERDECKER
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