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(54) **Improved abrasive wheel for the finishing of surfaces**

(57) A description is given of an abrasive wheel (100) with a central support (2) for grinding machine comprising a plurality of disks (1) in abrasive material, perforated centrally, attached to said support (2) by means of Seeger rings and arranged coaxially thereon, in packed form, each of said abrasive disks (1) having radial cuts (8).

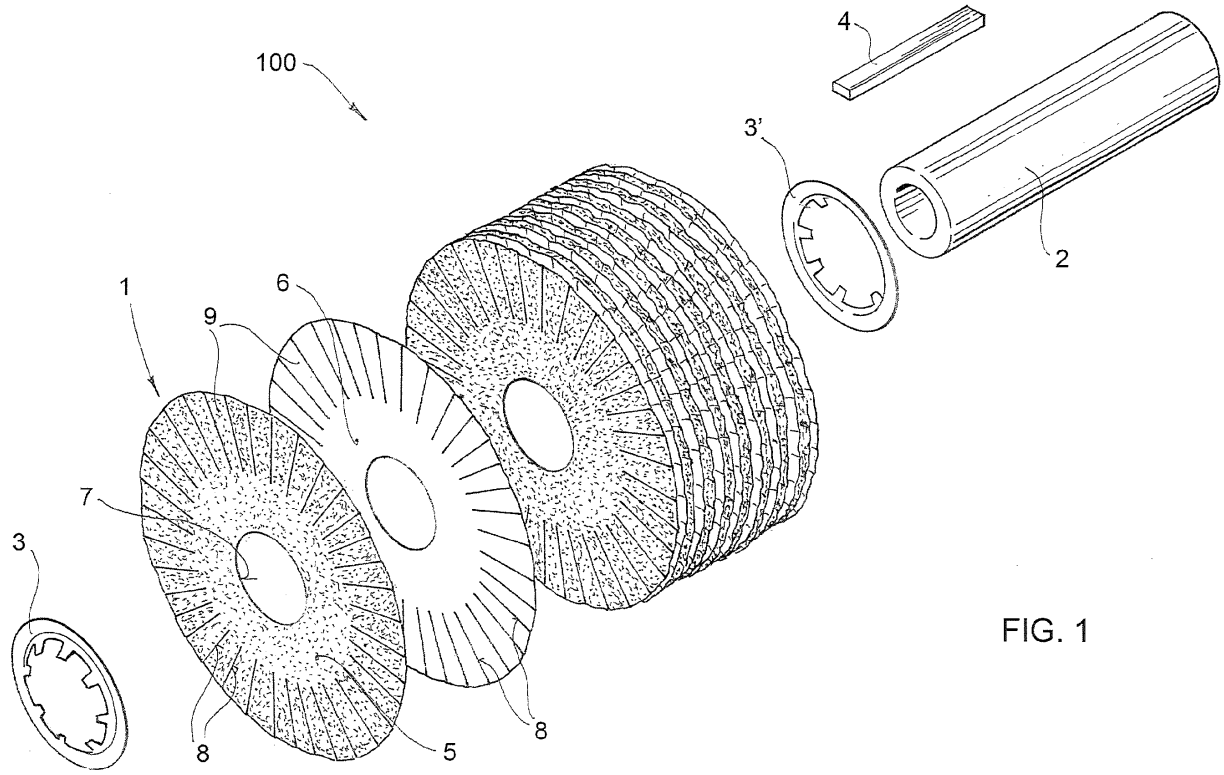

FIG. 1

EP 2 602 059 A2

Description

[0001] The present invention relates to a device to be used as flexible abrasive tool for the finishing of surfaces, such as for example the grinding and satin finishing of metal, sandpapering in the sector of wood or of painted surfaces, to be performed by means of grinding machines.

[0002] More particularly the present invention relates to abrasive wheels with abrasive disks with radial cuts and central hole, provided with an improved adaptability to objects with surfaces having an irregular geometry and/or profile.

[0003] The use is known of abrasive materials for the surface finishing of metal, painted or wooden articles, particularly shaped in order to be able to be mounted on machines so as to perform the finishing faster.

[0004] Particularly widespread as finished form of these abrasive materials is that of slatted wheels with shank (or with central hole) where a plurality of leaves, also defined as slats, each one having an abrasive face and made up of a material such as abrasive cloth or abrasive nonwoven textile, are arranged around the shank in such a way that each leaf, and the respective abrasive face, is aligned with the axis of the shank, forming a respective radius of said wheel.

[0005] Each one of these leaves is mounted therefore around the shank (or a hub) and restrained thereto along the side which is parallel to said shaft (or to said hub). This shank (or hub) is in turn designed in order to be mounted on a grinding machine.

[0006] This type of slatted wheel is particularly suitable for machining shaped surfaces with irregular profile in that said leaves can adapt easily to any shape of the part to be finished.

[0007] However the Applicant has found that these slatted wheels have a limit of adaptability to irregular surfaces in that in some cases it is not possible to reach all the points of the irregular surface, resulting in an incomplete finishing.

[0008] This means it is necessary, very often, to subject the part to further runs on this wheel with a consequent lengthening of the machining times and an increase in the costs of production of the finished part.

[0009] Moreover the mounting of these abrasive leaves or slats around the shaft entails considerable times of assembling seeing that in order to have a permanent attachment they have to be restrained one by one to said shaft.

US 2002/086630 describes an abrasive wheel composed of three perforated disks having the abrasive face turned on the same side and provided with radial cuts forming "splinters": between one splinter and the other (or between one cut and the other) there is a respective recess or cavity without abrasive material. The disks are rendered integral one with the other by means of the use of appropriate metal flanges placed at the end of the pack of disks which will later be mounted on an appropriate shaft.

[0010] This device is disadvantageous since the formation of the "splinters" entails the elimination of part of the abrasive material of the disk, resulting in a costly device due to the great deal of scrap.

[0011] Moreover the use of attachment flanges, which are generally metal, can make the tool excessively heavy, above all in the case of disks of large dimensions, as well as render almost impossible any balancing of said tool on the grinding machine.

[0012] US 5,560,744 describes a polishing wheel composed of a plurality of disks without cuts, centrally perforated and packed coaxially on a shaft, where each disk is formed by a non-abrasive polishing material or textile. These disks are grouped one with the other and made integral with the support shaft by means of the use of metal clinch rings.

[0013] The object of the present invention is that of overcoming the disadvantages which the prior art suffers by providing abrasive wheels having an improved efficiency of surface finishing and of removal of the material, which are also provided with a greater adaptability.

[0014] A further object is that of providing abrasive wheels as above, which can also be made with a simple, fast (e.g. shorter times of assembling) and economical process (e.g. lower costs of production).

[0015] These objects are achieved by the abrasive wheel in accordance with the invention having the features listed in the appended independent claim 1.

[0016] Advantageous embodiments of the invention are disclosed by the dependent claims.

[0017] An object of the present invention relates to a grinding abrasive wheel, to be mounted on grinding machines, which is formed by a central support and a plurality of abrasive disks, perforated centrally, which are arranged coaxially, in packed form, on said central support whereto they are attached, preferably by means of Seeger rings placed at the start and at the end of the plurality of disks and a fillet inserted forcedly in the space defined between the hole of every disk and the external diameter of the support.

[0018] Each one of said abrasive disks is also made up of a sheet of abrasive material having at least one abrasive face which has radial cuts on at least one annular portion of the surface of said disk, so as to form a plurality of flexible radial fins, in contact one with the other and adjacent one to the other, without recesses between one fin and the other (and between one cut and the other).

[0019] Each one of said radial cuts is placed along the direction of a respective radius which starts from the centre of the disk so as to result in radial cuts in a sunburst arrangement.

[0020] The aforementioned disks are also arranged coaxial one with the other and packed in such a way as to place in contact the abrasive face of each disk with the abrasive face of the adjacent disk so as to allow the simultaneous finishing of opposite faces of the part subjected to the treatment of finishing.

[0021] Further features of the invention will be made clearer by the following detailed description, referred to one of its embodiments purely by way of a non-limiting example illustrated in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of an abrasive wheel in accordance with the present invention;
Figure 2 is a plan view of a disk of abrasive material which forms the abrasive wheel of Fig. 1.

As illustrated in Fig. 1, the abrasive wheel, denoted overall by reference numeral 100, is formed substantially by a plurality of abrasive disks 1, provided with a central hole 7, and mounted coaxially on a hollow shaft or spindle 2, in packed form, so as to be in contact one with the other.

[0022] The pack of disks 1 is made integral with the shaft 2 by means of a pressure attachment achieved by means of two Seeger rings 3, 3' to be placed at the start and at the end of the pack, and of a fillet 4 to be inserted forcedly in the play between the hole of each disk 1 and the external diameter of the shaft 2 provided for performing the insertion of the disks 1 on the shaft 2. The function of the fillet 4 is that of preventing a possible relative rotation between the shaft 2 and the disks 1.

[0023] This type of attachment is preferred, seeing that it does not entail an excessive weighting of the abrasive wheel 100. Moreover it allows the attachment to the central support 2, and packing one in relation to the other, of a high number of disks 1.

[0024] It is however possible to perform the fixing of the disks 1 to the shaft 2 with alternative attachment means, for example by pouring an adhesive resin in the space between shaft 2 and disks 1, or, applicable even if the shaft 2 is not provided, by using screws or bolts which traverse the pack of disks 1, after having appropriately perforated them, and using relative attachment nuts.

The disks 1 are preferably arranged on the shaft in an alternating manner so as to place in contact each abrasive face 5 with another abrasive face of another adjacent disk 1, and each non-abrasive face 6 in contact with another non-abrasive face of another adjacent disk 1, as illustrated in Fig. 1.

[0025] Each abrasive disk 1 has a plurality of radial cuts 8 in an annular portion of the circle of the disk 1 turned towards the exterior of the shaft 2 and distal with respect thereto, leaving without cuts a more internal annular zone which surrounds the hole 7 of each disk 1, as illustrated in Fig. 2.

[0026] The external annular portion carved with the cuts 8 is preferably 2/3 with respect to the overall area of the perforated disk 1, even if according to the diameter of the disk it is possible to provide a greater or smaller extension of the carved annular portion with respect to the non-carved one.

[0027] The cuts 8 are radial with respect to the disk 1 and perpendicular to the longitudinal axis of the shaft 2 which represents the axis of rotation of the abrasive wheel 100.

[0028] Said cuts 8 then give rise to a plurality of fins or slats 9, adjacent and in contact one with the other, also arranged perpendicularly with respect to the axis of rotation of the abrasive wheel 100. There are not therefore recesses between the fins 9 (and between the cuts 8) of a respective disk 1.

[0029] In the wheel 100 of the present invention the abrasive surface 5 of each disk 1 is therefore perpendicular to the shaft 2 and therefore to the axis of rotation of the wheel 100, while in the slatted wheels of the prior art the abrasive surface is in the same plane of the axis of rotation of the shaft (shank) of these wheels.

[0030] Without wishing to be tied to any theory, it is presumable that the different arrangement of the abrasive surfaces with respect to the axis of rotation of the wheel of the present invention with respect to the known ones results in an abrasive wheel with fins 9 provided with a greater versatility of movement and deflexion with respect to the slats of the known wheels, therefore enabling the reaching of a higher and improved adaptability, an improved removal of the material and an improved efficiency of surface finishing.

[0031] The improved efficiency of removal of the material and finishing is due moreover also to the arrangement of the abrasive surfaces in contact one with the other which allow machining on opposite faces of the part being treated, also saving on the times necessary for the complete finishing of the part.

[0032] Between some abrasive disks 1 and the next one, preferably between each abrasive disk 1 and the adjacent one 1, a rigid ring may be intercalated, in paper or another material, of limited diameter, corresponding for example to that of the rings 3, 3'. Said rigid ring is preferably placed between the two abrasive faces of two respective adjacent disks, while said ring may be optional between the two non-abrasive faces of two adjacent disks. In fact these rigid rings have not only the purpose of stiffening the central part of the pack of disks 1 but also of allowing an easier opening of the abrasive faces 5 of adjacent disks in such a way as to guarantee that at least some of the abrasive slats 9 work on opposite faces of the part being treated.

[0033] The material wherefrom the abrasive disk 1 is formed can be made up of an abrasive cloth, an abrasive paper or an abrasive nonwoven textile, which can have one or both faces abrasive, preferably one.

[0034] Starting from this material, the abrasive wheel 100 of the present invention is obtained by forming, in one or more successive phases of punching, the disks 1 of appropriate diameter, the holes 7 and the cuts 8 with formation of the slats 9, and subsequent packing of the disks 1 on the shaft 2 and attachment of the same by means of Seeger rings as mentioned above.

[0035] This process is extremely easy to perform and faster with respect to the known processes where the assembling of the slats on the shaft or on the support is

fairly long and complex since each leaf has to be attached around the shaft, or each disk has to be carved appropriately and then attached to the shaft by means of flanges. Moreover the abovementioned attachment with Seeger rings allows the restraining to the central support, and packing one in relation to the other, of a very high number of disks, higher with respect to the attachment with flanges. See for example US2002/086630.

[0036] The packing of the disks may be done in such a way that they are in random angular positions (and therefore with the fins 9 of a disk staggered with respect to those of the adjacent disk) or packed in such a way as to have the fins 9 aligned vertically along the pack of disks 1. The latter arrangement is preferred.

[0037] The shaft 2 can be made in any material, preferably in rigid plastic such as for example nylon. Moreover said hollow shaft 2 can also be a pin, a tube, a nucleus or a core without departing from the scope of the present invention, provided it is suitable for being coupled to a grinding machine.

[0038] The present abrasive wheel therefore exhibits a series of advantages with respect to the known abrasive wheels of the art in that it has an improved efficiency of removal of the material and surface finishing thanks to its greater adaptability, and can be made with a simple process, with shorter times of assembling and lower costs of production.

[0039] More particularly the present abrasive wheel exhibits the following combination of advantages:

- greater capacity of removal of the material and finishing of parts having shaped surfaces with irregular profile in that the fins can adapt easily to any shape of the part to be finished;
- shorter machining times because it is no longer necessary to subject the part to further finishing runs given the greater efficiency in finishing;
- shorter times of production of the wheel given the facility of mounting and attachment of the disks to the support;
- smaller quantity of scrap of abrasive material due to the absence of recesses between the radial cuts;
- lower weight of the abrasive wheel given the absence of metal flanges in order to make the pack of disks integral with the shaft.

[0040] The present invention is not limited to the particular embodiment described previously and illustrated in the accompanying drawings, but instead numerous detail changes may be made thereto within the reach of the person skilled in the art, without thereby departing from the scope of the same invention, as defined in the appended claims.

Claims

1. Abrasive wheel (100) comprising a central support (2) and a plurality of abrasive disks (1) provided with central hole (7), coaxially arranged on said central support (2) and attached one to the other in a packed form so as to form a pack of disks (1), each of said abrasive disks (1) being made up of a sheet of abrasive material having at least one abrasive face (5), and provided with a plurality of radial cuts (8) forming, on an external annular portion of the disk (1), a plurality of adjacent radial fins (9), in contact one with the other,
said wheel (100) being **characterised in that** said disks (1) are attached to said support (2) by means of Seeger rings (3, 3') placed at the start and at the end of the plurality of disks (1), and a fillet (4) forcedly inserted between the hole (7) of each disk (1) and the external diameter of the support (2),
said disks (1) being arranged moreover in an alternating manner so as to place the abrasive face (5) of each disk (1) in contact with the abrasive face (5) of an adjacent disk.

2. Abrasive wheel (100) according to claim 1 wherein each radial cut (8) of each abrasive disk (1) is arranged in a sunburst configuration along a respective radius of the circle of said disk (1).

3. Abrasive wheel (100) according to claim 1 or 2 wherein said external annular portion with cuts (8) is about 2/3 with respect to the overall area of the perforated disk (1).

4. Abrasive wheel (100) according to any one of the preceding claims wherein said abrasive disks (1) with radial cuts (8) are packed in random angular positions or packed in such a way as to have the fins (9) aligned vertically along the pack of disks (1).

5. Abrasive wheel (100) according to any one of the preceding claims **characterised in that** rigid rings, in paper or another material, having diameter equal to or smaller than that of the zone of the disk (1) without cuts (8) are intercalated, between said abrasive disks (1).

6. Abrasive wheel (100) as defined in any one of the preceding claims wherein the material with which the abrasive disks (1) are made is selected from among an abrasive cloth, an abrasive paper or an abrasive nonwoven textile.

7. Use of an abrasive wheel as defined in claims 1-6 as abrasive tool of grinding machines.

8. Grinding machine comprising at least one abrasive wheel as defined in claims 1-6.

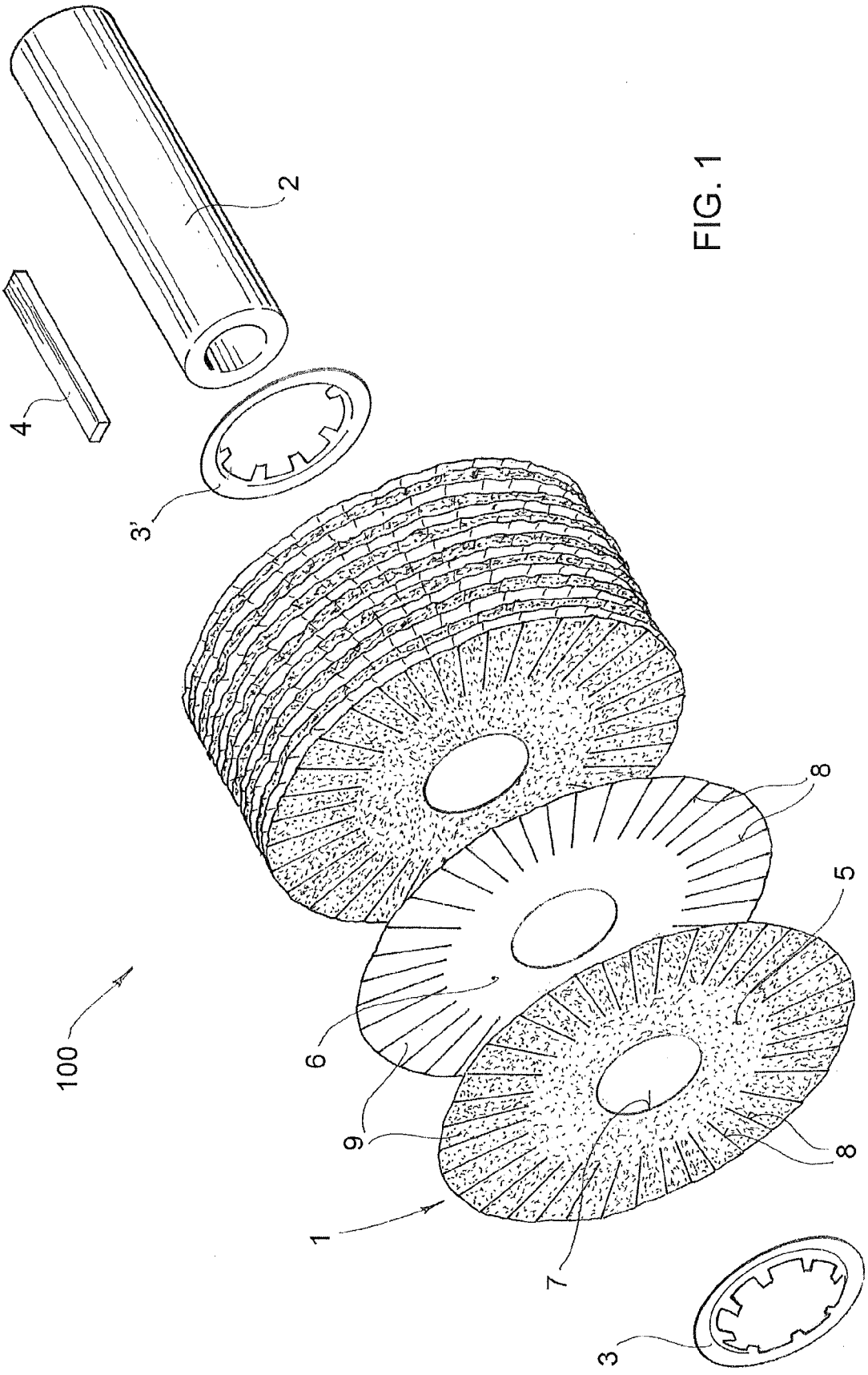

FIG. 1

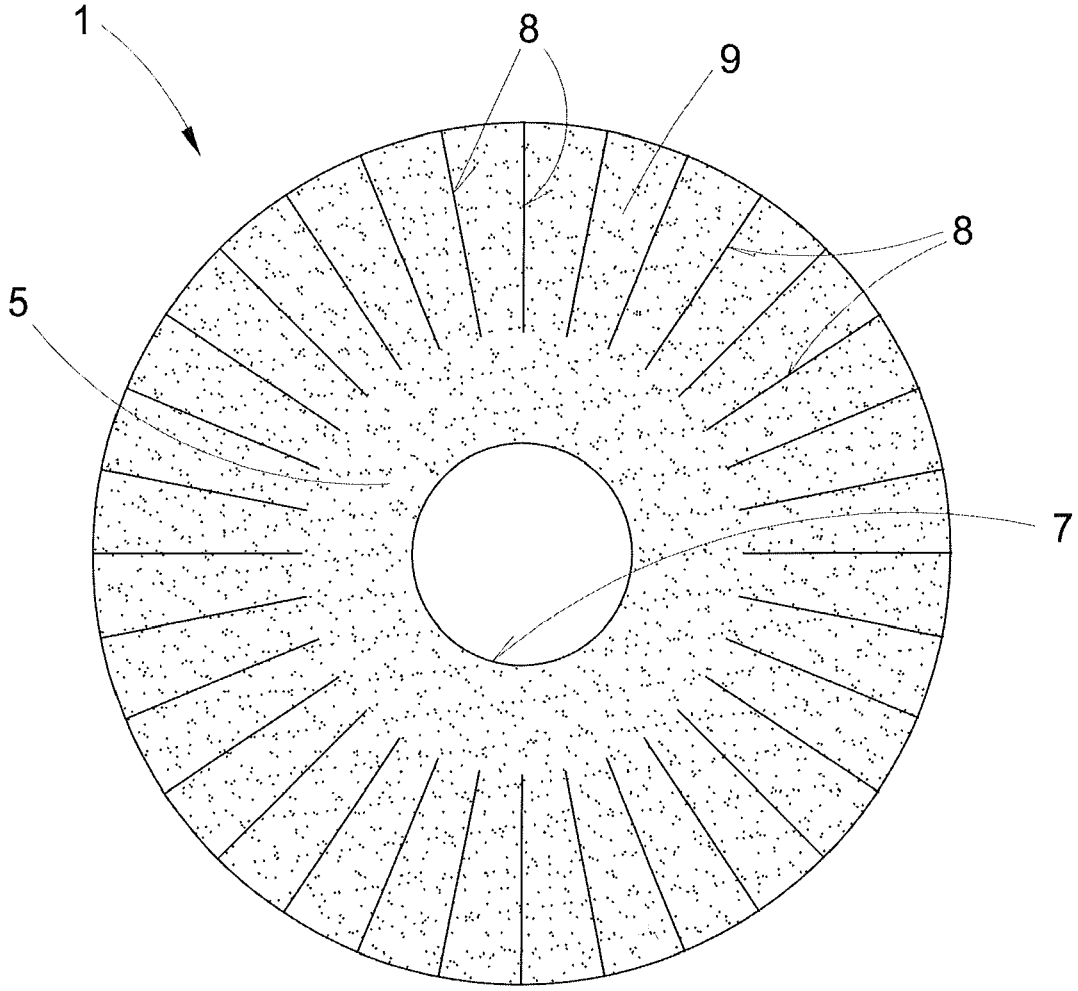

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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