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Datasheet for the decision of 12 June 2007

Case Number: T 1354/05 - 3.2.07

Application Number: 97940880.4

Publication Number: 0925152

IPC: B24D 3/28

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Title of invention:
Grinding Wheel

Applicant:
NORTON COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 84, 123(2)
EPC R. 27(1)(b)

Keyword:
"Extension beyond content of application as originally filed (no)"
"Clarity (yes)"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1354/05 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 12 June 2007

Appellant: NORTON COMPANY
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 April 2005 refusing European application No. 97940880.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
I. Beckedorf

Summary of Facts and Submissions

I. The applicant lodged an appeal against the decision of the Examining Division to refuse the European patent application No. 97 940 880.4.

The Examining Division held that the subject-matter of independent claim 6 as filed with letter of 25 June 2004 extended beyond the content of the application as originally filed and lacked novelty over D1 (GB-A-2 154 917). Furthermore, the subject-matter of independent claim 8 was considered to lack an inventive step in view of D1 or D4 (EP-A-0 358 137) and the general knowledge of the skilled person. Additionally, dependent claim 9 was considered not to comply with Article 84 EPC.

II. With a communication accompanying the summons to oral proceedings, the Board presented its preliminary opinion with respect to claims 1 to 5, 7, 8 (claim 9 having been deleted), and 10 to 12 underlying the impugned decision and maintained on appeal, as well as claim 6 as filed together with the grounds of appeal dated 12 August 2005.

The Board firstly invited the appellant to clarify its request.

The Board further stated that claim 8 appeared to contravene Article 123(2) EPC and that claims 1, 3, 4, 6, 8, 11 and 12 appeared not to meet the requirements of Article 84 EPC. Claims 1 and 6 appeared to meet the requirements of Article 123(2) and of Rule 29(2) EPC.

Although the claims on file did not appear to be formally allowable the Board also made substantive remarks with respect to them, as regards novelty and inventive step, referring to D1 as well as to D4. Claim 6 appeared to lack novelty over D1. Claim 1 appeared to either lack novelty or inventive step over D1 and claim 8 appeared to lack inventive step over D4.

III. With letter dated 8 May 2007 the appellant submitted a new main request and auxiliary requests 1 to 3 in combination with further arguments concerning the objections raised by the Board in its communication.

IV. Oral proceedings before the Board were held on 12 June 2007 during which the appellant withdrew its requests dated 8 May 2007. Documents D1 and D4 were discussed.

The appellant requested that the case be remitted to the first instance on the basis of claims 1 to 7 as filed during the oral proceedings and the description as filed during the oral proceedings, pages 1, 1a, 2, 3, 3a, 4 to 11, with the figures 1 to 4 as originally filed.

V. Independent claims 1 and 5 according to this single request read as follows:

"1. A molded conditioning wheel (10) adapted for rough grinding operations, whereby the conditioning wheel (10) is made by in-situ molding a grinding wheel from a mixture of abrasive particulate and an organic bond material, and whereby the conditioning wheel (10) further comprises:
a curved peripheral surface (18); and

a plurality of surface irregularities integrally molded with the said wheel, wherein the surface irregularities consist of protuberances (20) extending orthogonally from the curved peripheral surface (18), and wherein the surface irregularities comprise said mixture of abrasive particulate and organic bond material and are spaced in a predetermined pattern along the curved peripheral surface (18) to define a textured grinding face."

"5. A method of forming a molded conditioning wheel (10) adapted for rough grinding operations, the method comprising the steps of:
placing at least one liner (22) having a plurality of convex, or concave discontinuities (24) spaced in a predetermined pattern along its surface into a conditioning wheel mold, said at least one liner being disposed about an inner curved surface corresponding to the curved peripheral surface (18) of the conditioning wheel to be made, whereby the mold containing said at least one liner is filled with a mixture of abrasive particulate and an organic bond material, and then molding the mixture to form a conditioning wheel having a curved peripheral surface (18) having a plurality of surface irregularities comprising said mixture of abrasive particulate and organic bond, such that irregularities are formed, which are spaced in said predetermined pattern along said peripheral surface (18), to define a textured grinding face."

VI. The appellant argued essentially as follows:

Claim 1 is based on claims 1 and 2 in combination with page 5, lines 4 to 15 and page 6, lines 6 and 7 and figure 1 of the application as originally filed (corresponding to the published WO-A-98 10897).

Claim 5 is based on claim 8 (the terms "substantially" thereof were deleted) in combination with page 6, lines 3 to 5 and lines 15 to 16; page 6, lines 6 and 7; page 7, line 28 to page 8, line 7; and page 10, line 22 to page 11, line 2 of the application as originally filed.

The dependent claims 2 to 4 and 6 to 7 are based on claims 3 and 4 and claims 10 and 11, respectively, of the application as originally filed.

The description has been adapted to the new set of claims and D4 has been identified and briefly discussed in the description to meet the requirements of Rule 27(1)b) EPC. Thus the requirements of Article 123(2) EPC and of Article 84 EPC are also met.

D1 is no longer relevant as it does not relate to a conditioning wheel being integrally molded from a mixture of particulate abrasive and organic bond material.

D4 cannot suggest a conditioning wheel having a plurality of protuberances extending orthogonally from the curved peripheral surfaces according to claim 1 since the abrasive grains, when pouring the mixture into the mold, even though they will enter the

perforations of the grid-like structure and become perpendicularly oriented with respect to the outer surface of the formed abrasive body (see column 1, line 56 to column 2, line 14; column 3, lines 23 to 32; and figures 1 to 3), they do not form protuberances which are comprised of particulate abrasive material and organic bond material and which extend orthogonally from the surface. Likewise the process for making abrasive bodies using the grid-like structure of D4 cannot suggest to use a liner having a plurality of convex or concave discontinuities along its surface for making conditioning wheels. Therefore the subject-matter of claims 1 and 5 of the single request is novel and involves an inventive step over the process of D4.

Reasons for the Decision

1. *Admissibility of amendments (Article 123(2) and 84 EPC)*

1.1 Claim 1 is based on claims 1 and 2 in combination with page 5, lines 4 to 15 and page 6, lines 6 and 7 and figure 1 of the application as originally filed (corresponding to the published WO-A-98 10897).

Claim 5 is based on claim 8 (the terms "substantially" thereof were deleted) in combination with page 6, lines 3 to 5 and lines 15 to 16; page 6, lines 6 and 7; page 7, line 28 to page 8, line 7; and page 10, line 22 to page 11, line 2 of the application as originally filed.

The dependent claims 2 to 4 and 6 to 7 also referring to conditioning wheels are based on claims 3 and 4 and

claims 10 and 11 of the application as originally filed, respectively.

1.2 Independent claims 1 and 5 are considered to comprise all the essential features. Claim 1 now defines that the wheel **is made by in-situ molding a grinding wheel from a mixture of abrasive particulate and an organic bond material** and that the plurality of surface irregularities are molded integrally with the said wheel **and that they comprise said mixture of abrasive particulate and organic bond material** while claim 5 defines the steps of **placing at least one liner (22) having a plurality of convex, or concave discontinuities (24) spaced in a predetermined pattern along its surface into a grinding wheel mold, said at least one liner is disposed about an inner curved surface corresponding to the curved peripheral surface (18) of the conditioning wheel to be made, that the mold containing said at least one liner is filled with a mixture of abrasive particulate and an organic bond material and is then molded to form a conditioning wheel having a curved peripheral surface (18) having a plurality of surface irregularities comprising said mixture of abrasive particulate and organic bond, such that irregularities are formed, which are spaced in said predetermined pattern along said peripheral surface (18), to define a textured grinding face**.

An inconsistency between the **convex or concave** discontinuities of the liner according to process claim 5 and the subject-matter of original dependent claim 12, which defined that the liner comprises a perforated annulus, has been removed by deleting said dependent claim.

Thus the amendments made to claims 1 to 7 are considered to meet the requirements of Article 123(2) EPC and of Article 84 EPC.

1.3 Pages 1, 1a, 3, 3a and 4 to 11 of the description have only been amended in order to incorporate a short description of the relevant prior art document D4 and to provide a clear counterpart to claims 1 and 5 and to remove all the sentences "without departing from the spirit and scope of the present invention" (compare point 5 of the reasons of the impugned decision), necessary for compliance with Rule 27(1)b) and Article 84 EPC, without being at odds with the requirements of Article 123(2) EPC.

Page 2 of the application as filed remained unchanged but was re-filed to submit a complete description.

Therefore, the newly filed description pages 1, 1a, 2 to 3, 3a and 4 to 11 are also considered to meet the formal requirements mentioned above.

2. *Novelty (Article 54 EPC)*

In this context the Board remarks that the feature "protuberances (20) extending orthogonally from the curved peripheral surface" of claim 1 is interpreted as meaning that the axis running in the direction of the height of said protuberances (20) is substantially perpendicular to a tangent of the curved peripheral surface at a point of intersection of the said protuberances with the said curved surface (compare

original application, page 5, second full paragraph; figures 1 and 2).

2.1 D1 discloses a molded grinding wheel 10 which is formed by embedding a flat disk 20 and a cylindrical ring 22 both of perforated metal into a backing material 18 by molding such that the edges of said ring and said disk are in mating engagement and provide intersecting surfaces forming a corner (see claim 8 and page 3, lines 69 to 78). Said disk 20 and ring 22 are then machined (to expose their surfaces) and cleaned. Then abrasive particles are bonded to the exposed surfaces of said ring 22 and said disk 20 by electroplating (see page 2, lines 54 to 76; page 2, line 126 to page 3, line 48; page 3, line 91 to page 4, line 88; figures 1 to 4 and 8 to 10).

Hence the process according to D1 does **not** result in a grinding wheel comprising surface irregularities consisting of protuberances comprising a mixture of abrasive particles and organic bond material being integrally moulded with the wheel.

2.2 D4 discloses a process for making in-situ molded ready-to-use abrasive bodies 26 (i.e. abrasive bodies not needing dressing) using an abrasive mixture consisting of abrasive grains and a binder, preferably a resin, in a mold 1 (see column 1, lines 26 to 42; column 3, lines 23 to 32; claim 1). Said mold comprises a profiled surface 18 having a perforated structure (e.g. a grid cloth or a screen print grid, or a non-woven material) which allows that the abrasive grains when pouring the abrasive mixture into said mold enter the perforations of the grid-like structure and become

perpendicularly oriented with respect to the outer surface of the abrasive bodies 26 (see column 1, line 56 to column 2, line 14; figures 1 to 3).

Consequently, the abrasive bodies according to D4 do **not** have surface irregularities consisting of protuberances extending orthogonally from the curved peripheral surface which are comprised of abrasive particulate and organic bond material. Furthermore, D4 does not explicitly disclose a grinding wheel, let alone a conditioning wheel being adapted for rough grinding operations or a process for making the same.

2.3 The Board therefore concludes that the subject-matter of claims 1 and 5 is novel with respect to the products and processes disclosed in these documents. The Board has verified that none of the other documents on file disclose all features of these claims. Claims 1 and 5 of the appellant's request therefore meet the requirement of Article 54 EPC.

3. *Inventive step (Article 56 EPC)*

Document D4 is considered to represent the closest prior art for the subject-matter of claims 1 and 5 because it is the only document in the proceedings disclosing an abrasive body having integrally molded surface irregularities (compare point 2.2 above).

Claim 1

3.1 The molded conditioning wheel according to claim 1 differs from the abrasive body of D4 in that it

a) is a molded conditioning wheel adapted for rough grinding operations, and
b) it has surface irregularities consisting of protuberances extending orthogonally from the curved peripheral surface which are comprised of abrasive particulate and organic bond material.

3.2 The problem to be solved starting from D4 can thus be considered to be the provision of a molded conditioning wheel which does not need a post-mold "dressing" step and which allows the application of a high contact pressure per unit area between the wheel and workpiece (see present application, page 2, second paragraph to page 3, third paragraph; page 9, second paragraph).

3.3 The Board is convinced that the problem referred to above is solved by the molded conditioning wheel of claim 1.

3.4 The Board considers that the subject-matter of claim 1 is not rendered obvious for the following reasons.

3.4.1 Nothing in D4 speaks against using the disclosed technology for the production of conditioning wheels; in fact D4 (column 3, lines 25, 26) suggests the production of abrasive discs. However, due to the teaching of D4 to use a perforated structure (e.g. a grid cloth, a screen print grid or a non-woven material; see column 2, lines 1 to 14 and claims 1 and 2) the resulting abrasive wheel according to D4 will always have a textured surface comprising a majority of protruding abrasive grains and a minority of protruding molded organic bond material in combination with a small amount of protruding smaller abrasive grains

which are coated with said bond material. This assumption takes into account that the incorporated abrasive particulate material has a certain grit size which has a Gaussian distribution.

In the Boards view this distribution further implies that the size of the perforations of said perforated structure has to be matched to said grit size. The size of the perforations thus has to be selected such that the majority of the abrasive grains fit into these perforations because otherwise the desired goal, i.e. that the uppermost layer comprises abrasive grains having - protruding - sharp edges and corners which are perpendicularly oriented with respect to the outer surface of the molded abrasive bodies, cannot be achieved (see D4, column 1, line 56 to column 2, line 14; figures 1 to 3). This distribution further implies, however, that the remaining smaller size abrasive grains - which largest dimension is smaller than the size of said perforations - have such a size that it is to be excluded that a plurality of these smaller abrasive grains in mixture with bond material would fit into a single one of these perforations.

3.4.2 The textured surface according to D4 represents from a macroscopic viewpoint a uniform surface which does not increase the contact pressure between the abrasive body surface and the workpiece and which thus does not solve the technical problem of the present application as specified in point 3.2 above.

Furthermore, in view of the above, it is also not guaranteed that even if there were a number of grains together with bond material contained in said

perforations, this would result in a protuberance extending orthogonally to the peripheral surface.

There is no hint at all in D4 to change the macroscopic topography of the abrasive body surface, let alone in the manner claimed in claim 1.

3.5 The Board therefore concludes that the molded conditioning wheel according to claim 1 involves an inventive step (Article 56 EPC).

The same holds true for the dependent product claims 2 to 4 which define preferred embodiments of the molded conditioning wheel of claim 1.

Claim 5

3.6 Taking account of point 2.2 above the process for making the molded conditioning wheel according to claim 5 differs from the process for making abrasive bodies of D4 in that it
a) results in a conditioning wheel adapted for rough grinding operations,
b) comprises the step of placing at least one liner having a plurality of convex or concave discontinuities spaced in a predetermined pattern along its surface into a grinding wheel mold, and
c) that the resulting wheel has a curved peripheral surface having a plurality of surface irregularities comprising abrasive particulate and organic bond material.

3.7 The problem to be solved starting from D4 can thus be considered to be the provision of a process for forming

a molded conditioning wheel which does not need a post-mold "dressing" step and which allows to apply a high contact pressure per unit area between the wheel and workpiece (see present application, page 2, second paragraph to page 3, third paragraph; page 9, second paragraph).

3.8 The Board is convinced that the problem referred to above is solved by the process for forming the molded conditioning wheel as defined in claim 5. Due to the use of the at least one liner having a plurality of convex or concave discontinuities spaced in a predetermined pattern a plurality of protuberance-like irregularities comprising the mixture of abrasive particulate and organic bond are formed, which are spaced in a predetermined pattern along the curved peripheral surface of the molded conditioning wheel.

3.9 Obviousness

The Board is of the opinion that it is questionable whether the person skilled in the art, attempting to solve the problem underlying the present application (see point 3.7 above), would have considered document D4 at all.

3.9.1 In any case, D4 is silent with respect to the technical problem of increasing the contact pressure between the abrasive body and workpiece. The same holds true with respect to forming a conditioning wheel, let alone of using a liner having convex or concave discontinuities spaced in a predetermined pattern, in the mold.

3.9.2 It is much more likely that the skilled person when aiming to improve a conditioning wheel would start from a document dealing with such a wheel. But even if the person skilled in the art would have considered document D4 and would have formed a molded conditioning wheel by selecting the required grit size for rough grinding operations, the resulting wheel would not have the claimed structure of protuberance-like irregularities obtained by the process according to claim 5. Such a structure is fundamentally different from the irregularities resulting from the process according to D4, consisting of a majority of protruding abrasive grains and a minority of organic bond material, which irregularities do not allow to increase the contact pressure between the abrasive body and the workpiece (compare point 3.4.1 above).

There is no suggestion in D4 to alter the surface topography at all, particularly in the manner as required by claim 5.

3.10 The process according to claim 5 thus involves an inventive step (Article 56 EPC).

This applies for corresponding reasons to the dependent process claims 6 and 7 which define preferred embodiments of the process of claim 5.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

Description:
pages 1, 1a, 2, 3, 3a, 4 to 11 as filed during the oral proceedings of 12 June 2007

Claims:
1 to 7 as filed during the oral proceedings of 12 June 2007

Drawings:
figures 1 to 4 as originally filed.

The Registrar: The Chairman:

G. Nachtigall H. Meinders