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**Datasheet for the decision  
of 24 September 2007**

**Case Number:** T 0572/07 - 3.2.07

**Application Number:** 96920332.2

**Publication Number:** 0830237

**IPC:** B24D 3/06

**Language of the proceedings:** EN

**Title of invention:**

Cutting tool having textured cutting surface

**Applicant:**

NORTON COMPANY

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 54, 56

**Keyword:**

"Novelty - yes (res judicata)"

"Inventive step - no"

**Decisions cited:**

T 1047/00

**Catchword:**

Res judicata (reasons points 1, 2.1.2, 2.2)



Case Number: T 0572/07 - 3.2.07

**DECISION**  
of the Technical Board of Appeal 3.2.07  
of 24 September 2007

**Appellant:** NORTON COMPANY  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 30 October 2006  
refusing European application No. 96920332.2  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** H. Meinders  
**Members:** P. O'Reilly  
I. Beckedorf

## **Summary of Facts and Submissions**

- I. European application No. 96920332.2 was refused for the first time by the examining division for lack of novelty.
- II. The applicant filed an appeal against that decision.
- III. In its decision T 1047/00 (not published in OJ EPO) the present Board 3.2.07 in a different composition dealt with the question of novelty for the present application. The Board found that the subject-matter of claim 1 of the application as amended in those proceedings was novel. The Board decided to remit the case to the examining division for further prosecution.
- IV. The application was refused by the examining division for a second time for lack of inventive step.
- V. The appellant (applicant) filed the present appeal against that decision.
- VI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request, first auxiliary request or second auxiliary request, all filed with letter of 17 September 2007.
- VII. Oral proceedings were held before the Board on 24 September 2007.
- VIII. The independent claim of the application according to the main request reads as follows:

"1. An abrasive tool comprising:  
a) core (6) having at least one cutting surface plane (4);  
b) superabrasive grain (1) having at least one flat surface (2) and being arranged in a single layer on the cutting surface plane (4); and  
c) a metal bond (3) brazed to the cutting surface plane (4) of the core (6) and the superabrasive grain (1);  
wherein the cutting surface plane (4) of the core (6) has textured indentations, the textured indentations being sized to contain the single layer of superabrasive grain (1) having average radius (r) oriented such that any flat surface (2) of the superabrasive grain (1) is inclined at an angle of at least 15° relative to the cutting surface plane (4), and the textured indentations have a maximum depth (D) such that  $r/2 \leq D \leq 3r/2$  wherein r is the average radius of the smallest grains within the selected grade of the abrasive and D is the maximum depth orthogonal to the plane of the cutting surface for the indentations, and in that a majority of the superabrasive grain (1) consists of particles having at least one opposing set of flat surfaces (2) and in that the superabrasive grain (1) is a diamond grit of 25 to 1000 microns in diameter, and wherein the superabrasive grains are brazed by the metal bond such that a flat surface of the grain is bonded to a flat surface of the textured indentation."

The independent claim of the first auxiliary request reads as follows (amendments when compared to claim 1 of the main request are depicted in bold):

"1. An abrasive tool comprising:  
a) core (6) having at least one cutting surface plane (4);  
b) superabrasive grain (1) having at least one flat surface (2) and being arranged in a single layer on the cutting surface plane (4); and  
c) a metal bond (3) brazed to the cutting surface plane (4) of the core (6) and the superabrasive grain (1);  
wherein the cutting surface plane (4) of the core (6) has textured indentations, **which have a V-shape in cross-section and provide an angle of opening of 120°**, the textured indentations being sized to contain the single layer of superabrasive grain (1) having average radius (r) oriented such that any flat surface (2) of the superabrasive grain (1) is inclined at an angle of at least 15° relative to the cutting surface plane (4), and the textured indentations have a maximum depth (D) such that  $r/2 \leq D \leq 3r/2$  wherein r is the average radius of the smallest grains within the selected grade of the abrasive and D is the maximum depth orthogonal to the plane of the cutting surface for the indentations, and in that a majority of the superabrasive grain (1) consists of particles having at least one opposing set of flat surfaces (2) and in that the superabrasive grain (1) is a diamond grit of 25 to 1000 microns in diameter, and wherein the superabrasive grains are brazed by the metal bond such that a flat surface of the grain is bonded to a flat surface of the textured indentation."

The independent claim of the second auxiliary request reads as follows (amendments when compared to claim 1 of the main request are depicted in bold):

"1. An abrasive tool comprising:  
a) core (6) having at least one cutting surface plane (4);  
b) superabrasive grain (1) having at least one flat surface (2) and being arranged in a single layer on the cutting surface plane (4); and  
c) a metal bond (3) brazed to the cutting surface plane (4) of the core (6) and the superabrasive grain (1);  
wherein the cutting surface plane (4) of the core (6) has textured indentations, the textured indentations being sized to contain the single layer of superabrasive grain (1) having average radius (r) oriented such that any flat surface (2) of the superabrasive grain (1) is inclined at an angle of at least 15° relative to the cutting surface plane (4), and the textured indentations have a maximum depth (D) such that  $r/2 \leq D \leq 3r/2$  wherein r is the average radius of the smallest grains within the selected grade of the abrasive and D is the maximum depth orthogonal to the plane of the cutting surface for the indentations, and in that a majority of the superabrasive grain (1) consists of particles having at least one opposing set of flat surfaces (2) and in that the superabrasive grain (1) is a diamond grit of 25 to 1000 microns in diameter **consisting of predominating near-perfect crystals and rare low-grade, imperfect crystals**, and wherein the superabrasive grains are brazed by the metal bond such that a flat surface of the grain is bonded to a flat surface of the textured indentation."

IX. The document cited in the present decision is the following:

D1: US-A-5 011 511

X. The arguments of the appellant may be summarised as follows:

(i) The subject-matter of claim 1 of the main request involves an inventive step. The subject-matter of the claim is distinguished over the disclosure of the embodiment of figure 4 of D1 by the features that:

a) any flat surface of the superabrasive grain is inclined at an angle of at least  $15^\circ$  relative to the cutting surface plane;

b) the textured indentations have a maximum depth (D) such that  $r/2 \leq D \leq 3r/2$  wherein r is the average radius of the smallest grains within the selected grade of the abrasive and D is the maximum depth orthogonal to the plane of the cutting surface for the indentations; and

c) the superabrasive grain is a diamond grit of 25 to 1000 microns in diameter.

It is already acknowledged in the preceding decision T 1047/00 which deals with the application in suit that feature a) is not disclosed in D1.

Feature b) is not disclosed in D1 since figure 4 of the document does not allow any dimensions of the indentations to be deduced. The specified range ensures a good fit for the diamond grit.

Feature c) is not disclosed in D1 in relation to the embodiment of figure 4. The particle size range specified in D1 is for pulverulent material as opposed to the granular particles mentioned elsewhere in D1. Since the description of figure 4 indicates that relatively large abrasive particles are used in this embodiment these particles cannot be the smaller pulverulent particles for which the size range is specified. There is no hint in D1 towards the range specified in feature c).

- (ii) The subject-matter of claim 1 of the first auxiliary request involves an inventive step.

The angle of  $120^\circ$  specified in the feature introduced into claim 1 of this request corresponds to the angle between the faces of a diamond. The angle thus provides a good seat. The angle visible in figure 4 of D1 is nearer to  $90^\circ$  and thus does not lead the skilled person to the extra feature of this claim.

- (iii) The subject-matter of claim 1 of the second auxiliary request involves an inventive step.

The claim includes the extra feature that the diamonds are predominantly near-perfect. Near-perfect diamonds have flat faces which enhance the meniscus effect when the brazing is carried out.



## Reasons for the Decision

### *Main request*

#### 1. *Novelty*

1.1 The preceding decision T 1047/00 dealt with the question of novelty for the present application. A conclusion was reached concerning a claim containing features which are also present in claim 1 of the present request. The conclusion reached was that the subject-matter of that claim was novel over the disclosure of D1 (see point 1.2 of the reasons). The matter of novelty is hence *res judicata*.

1.2 Therefore, the subject-matter of claim 1 is novel in the sense of Article 54 EPC.

#### 2. *Inventive step*

2.1 The closest prior art document is represented by D1, in particular the embodiment of figure 4. The appellant argued that claim 1 is distinguished over the disclosure of this document by the features that:

a) any flat surface of the superabrasive grain is inclined at an angle of at least 15° relative to the cutting surface plane;

b) the textured indentations have a maximum depth (D) such that  $r/2 \leq D \leq 3r/2$  wherein r is the average radius of the smallest grains within the selected grade of the abrasive and D is the maximum depth orthogonal to the plane of the cutting surface for the indentations; and

c) the superabrasive grain is a diamond grit of 25 to 1000 microns in diameter.

2.1.1 Feature a) was present in the claims considered in the decision T 1047/00. In that decision the conclusion was reached that this feature was not disclosed in D1 (see point 1.2.2 of the reasons). The matter of novelty for this feature is hence *res judicata*. Therefore this feature is not disclosed in D1.

2.1.2 A feature having a wording similar to that of feature b) was also considered in the cited decision and found to be disclosed in D1. However, the definition of the radius  $r$  given in the claim considered in that decision was different to the definition now given in the claim presently under consideration. The difference is significant so that the matter of the disclosure in D1 of the feature as now specified cannot be considered to be *res judicata*. The difference is that in the claim on which the preceding decision was based  $r$  was defined to be the average radius of the superabrasive grains within the selected grade, whereas according to claim 1 of the present request it is defined to be the average radius of the smallest grains within the selected grade. The amendment brings the definition of the indentation depth into line with the disclosure on page 7, lines 9 to 15 of the application as originally filed.

Irrespective of whether the depth of the indentations visible in figure 4 of D1 falls within the range given in the equation, it is not disclosed in D1 that the depicted grains are the smallest in the selected grade. Therefore this feature in its present wording must also

be considered to be novel compared to the disclosure of D1.

2.1.3 The range specified in feature c) overlaps with a range stated in column 6, lines 56 to 58 of D1. In this part of the description of D1 it is stated that: "The size of pulverulent abrasive material can be in the range 0,5  $\mu\text{m}$  to 100  $\mu\text{m}$ ." In the document in column 2, lines 49 and 50 reference is made to "pulverulent and/or other abrasive material" and further in lines 61 and 62 of the same column to "a mixture of pulverulent and granular particles". In claim 8 of D1 there is again a reference to "pulverulent and granular particles". The conclusion may be drawn that there are two types of particles of which the pulverulent are the smaller ones. In the embodiment of figure 4 it is stated that the particles are "relatively large particles". This reference implies that the particles used in this embodiment are not the pulverulent particles for which D1 gives a range of 0,5  $\mu\text{m}$  to 100  $\mu\text{m}$ . Therefore feature c) must also be considered to be novel compared to the disclosure of D1.

2.2 In the preceding decision T 1047/00 the obviousness of the provision of feature a) was considered and it was found to be obvious (see point 2 of the decision reasoning). The obviousness of providing this feature together with the remaining features of that claim is therefore *res judicata*. This would no longer be the case for a claim which differs from that claim by containing further features which influence the obviousness of the provision of feature a) and thus invalidate that finding. In the present case the further features, i.e. features b) and c), have no effect on that finding since there

has not been shown to be an interaction between features b) and c) and feature a).

Therefore, the provision of feature a) must still be considered to be obvious for the skilled person.

2.2.1 With regard to feature b) this feature now refers to the smallest grains in the selected grade. Abrasive grains are selected by a sieving process which results in the selected grains having a range of sizes corresponding to the grade.

The selected range for the depth D of the indentations is intended to ensure that on the one hand the grains do not have a size such that they are so deep in the indentation that they cannot have an abrasive effect and on the other hand that the grains are not so relatively large that the metal bonding of a flat surface of the grains is ineffective to maintain the grains in position when they are subjected in use to forces which will be parallel to the cutting surface plane.

It is clear for D1 that there is a practical requirement that the grains should not be set too deep in the indentation so that they have no abrasive action, i.e. the size of the grains cannot be less than the depth of the indentation. This is the case for the grains depicted in the embodiment of figure 4.

D1 for the embodiment of figure 4 also specifies that the abrasive particles "are form-lockingly connected" (see column 6, line 32). In order to achieve such a connection it is clearly necessary that the size of the grains cannot be too much greater than depth of the

indentations since otherwise the locking effect is lost. This is also the case for the grains depicted in figure 4.

The Board also notes that the range specified in the claim for the depth of the indentations relative to the average radius of the grains applies only to the smallest grains so that there may be a high percentage of grains in the selected grade which have a size which is much larger relative to the depth of the indentations. This means that any effect alleged for the range of the depth of the indentations specified in claim 1 does not necessarily apply to all or even a majority of the grains.

Therefore no inventive step can be derived from the provision of feature b).

2.2.2 Feature c) specifies a wide range for the absolute grain size. In D1 there is a range given for the pulverulent abrasive material. In the embodiment of figure 4 it is specified that the particles are relatively large. This must mean that they are relatively large compared to the size of the grains of pulverulent material. The range for the grain size specified in claim 1 is up to a factor of 10 greater than the upper limit indicated in D1 for the pulverulent material. The relatively large size specified for the particles of the embodiment of figure 4 could reasonably be expected to fall at least close to the range specified in claim 1 which is relatively large compared to range specified for the pulverulent material disclosed in D1. In this respect the appellant has been unable to indicate any effect achieved by the grains having the specified range.

Indeed, it must be expected that the skilled person will normally select a grain size, i.e. coarser or finer, dependent upon the intended application of the abrasive tool and so would arrive at a tool including grains within the range specified in claim 1 in accordance with his ordinary skill.

Therefore no inventive step can be derived from the provision of feature c).

- 2.3 Therefore, the subject-matter of claim 1 of the main request does not involve an inventive step in the sense of Article 56 EPC.

*First auxiliary request*

3. *Inventive step*

- 3.1 Compared to claim 1 of the main request claim 1 of this request further adds the feature that the textured indentations have a V-shape in cross-section and provide an angle of opening of  $120^\circ$ . The appellant explained that this angle corresponded to the angles between the faces of a diamond. No evidence was offered for this explanation. The effect of this feature in the case of diamond is shown in figure 2 of the patent application. The faces of the diamond grit are parallel to the sides of the indentation which could maximise the bonding effect of the metal bond.

- 3.2 In D1, which mentions diamond grit, the embodiment of figure 4 provides a form-locking fit as already mentioned above. A form-locking fit implies that the grit has the same form as the indentation. Such a form-

lock is shown in figure 4 in which the sides of the grit match the sides of the indentation. D1 is also concerned with metal solders (see column 3, lines 37 to 40 and claim 12). Although figure 4 does not apparently show an angle of  $120^\circ$ , since it appears to be closer to  $90^\circ$  in cross-section, it is evident to the skilled person that it is intended that the sides of the indentation should match the faces of the grit so as to produce a form-lock. According to the appellant diamond is known to have an angle between faces of  $120^\circ$ . It is therefore clear that the angle between the faces in the embodiment of figure 4 would be  $120^\circ$  in order to form-lockingly accommodate the mentioned diamond grit.

- 3.3 The extra feature of claim 1 of this request therefore would be obvious for the skilled person. No synergistic effects have been proven for the combination of this feature with the remaining features of the claim.

Therefore, the subject-matter of claim 1 of the first auxiliary request does not involve an inventive step in the sense of Article 56 EPC.

### *Second auxiliary request*

#### 4. *Inventive step*

- 4.1 Compared to claim 1 of the main request claim 1 of this request adds the feature that the diamond grit consists of predominating near-perfect crystals and rare low-grade, imperfect crystals. According to the appellant near-perfect crystals are ones that have near-perfect flat faces so that the meniscus affect is maximised (see

page 6, lines 13 to 18 of the application as originally filed).

It is well known that parallel surfaces maximise the meniscus effect. The meniscus effect is a surface tension effect. The standard manner of measuring of the surface tension of a liquid involves measuring the forces generated between two parallel plates which have a small quantity of the liquid therebetween. It may also be noted that the appellant has offered no evidence to support its allegations regarding the shape of the crystals enhancing the meniscus effect. Since figure 4 of D1 is a two-dimensional drawing it cannot disclose the nature of the faces of the indentations and grains. Nevertheless, the fact that the cross-sections show straight lines for each of these is consistent with the view that the skilled person would attempt to provide flat faces for the grains which are aligned with the sides of the indentations.

- 4.2 The provision of the extra feature of claim 1 of this request would hence have been obvious to the skilled person.

Therefore, the subject-matter of claim 1 of the second auxiliary request does not involve an inventive step in the sense of Article 56 EPC.



**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

G. Nachtigall

H. Meinders