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D E C I S I O N
of 23 July 2002

Case Number: T 1041/99 - 3.2.7

Application Number: 95929515.5

Publication Number: 0738198

IPC: B24D 3/18

Language of the proceedings: EN

Title of invention:
Method and abrasive article produced thereby

Applicant:
Milacron Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Inventive step (no, main request)"
"Extension beyond the content of the application as filed (yes, auxiliary requests)"

Decisions cited:
T 0181/82

Catchword:
-

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Case Number: T 1041/99 - 3.2.7

D E C I S I O N
of the Technical Board of Appeal 3.2.7
of 23 July 2002

Appellant: Milacron Inc.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 16 June 1999 refusing European patent application No. 95 929 515.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. Burkhart
Members: P. A. O'Reilly
E. Lachacinski

Summary of Facts and Submissions

I. The appellant (applicant) filed an appeal against the decision of the Examining Division to refuse the European patent application No. 95 929 515.5.

II. The Examining Division held that the subject-matter of claims 1 to 8 of the only request did not involve an inventive step. The Examining Division cited the following prior art documents:

D1: US-A-5 203 886

D2: EP-A-0 468 486

D3: US-A-5 178 644

D4: WO-A-95 08 417

III. During the examining proceedings the appellant himself referred to a prior art made available to the public by sale by the appellant. This is hereinafter referred to as "prior sale".

IV. The appellant requests that the decision of the Examining Division be set aside and that a patent be granted on the basis of the main request corresponding to the form of the application on which the Examining Division took their decision. This request contains the following independent method claim:

"1. A method for producing an improved vitreous bonded abrasive article comprising the steps of preparing a blend, cold pressing the blend in a mold to the desired shape, size and density to form a cold molded article,

removing the cold molded article from the mold and firing the cold molded article to produce the vitreous bonded abrasive article wherein the blend comprises:
a) aluminium oxide grains;
b) non-metallic, inorganic thermally conductive, solid particles having a thermal conductivity greater than the thermal conductivity of the abrasive grains and an average particle size at least twice the average particle size of the abrasive grains;
c) a vitreous matrix precursor which forms a vitreous matrix that binds together the abrasive grains and forms a bond with the thermally conductive solid particles that is weaker than the bond the matrix forms with the abrasive grains and
d) an organic, open cell producing, solid pore inducer that, subsequent to the pressing step, produces spring back of the cold molded article in an amount at least equal to the smallest particle size of the particle size range of the pore inducer."

As a first auxiliary request filed with the appeal the appellant requests that a patent be granted on the basis of a set of claims in which the independent method claim has, in addition to features of claim 1 as set out above, the extra wording "for high metal removal rates" inserted after "improved vitreous bonded abrasive article" and the wording "having a minimum average particle size of one hundred microns" inserted after the word "grains" in feature (a).

In a submission dated 4 March 2002. the appellant further offered to amend "for high metal removal rates" in the first auxiliary request to "for use in high metal removal rate grinding operations". This offer may be seen as a second auxiliary request.

V. In a communication from Board accompanying the summons to oral proceedings the Board expressed the provisional opinion that the subject-matter of claim 1 of the main request lacked an inventive step in view of the documents D1 and D3, as well as the prior sale.

With respect to the auxiliary requests the Board expressed the provisional opinion that the amendment to add the wording "having a minimum average particle size of one hundred microns" was not allowable in view of Article 123(2) EPC since this feature was not disclosed in the application as originally filed. The application as originally filed referred to some ranges and examples expressed in US mesh sizes and no evidence had been presented as to how the US mesh sizes would correspond to micron units as used in the amendment.

VI. After receipt of the summons to oral proceedings the appellant announced his intention not to attend the appointed oral proceedings, being content have the decision taken on the basis of the papers alone. Whereupon the Board cancelled the oral proceedings.

VII. In the grounds for the appeal and in a submission made in response to the provisional opinion of the Board the appellant essentially argued as follows:

Document D1 does not disclose that a larger sized second abrasive would be beneficial. The provision in accordance with the invention of non-metallic, inorganic thermally conductive, solid particles having at least twice the average particle size of the abrasive grains has produced unexpectedly good performance characteristics.

It is correct to say that the provision of such abrasive particles having at least twice the average particle size of the abrasive grains is known from the prior sale. However, it is untenable to suggest that the provision of this feature in a different type of product would produce benefits. In this respect it should be noted that small changes in compositions of abrasive articles produce significant effects on the articles.

The feature of claim 1 that "the vitreous matrix that binds together the abrasive grains and forms a bond with the thermally conductive solid particles that is weaker than the bond the matrix forms with the abrasive grains" is not disclosed in document D1. Moreover, the appellant has discovered that performance may be enhanced by allowing the solid particles to act as heat sinks which fall away taking heat from the grinding wheel.

Although document D1 mentions the use of walnut shells, there is no disclosure that springback will occur. The occurrence of springback could depend upon many factors. If springback occurred in the method disclosed in document D1 then it would have been mentioned in the document as the document gives details of volume changes of the final product. Document D4 cannot be used as evidence of the existence of a springback effect since this document was published after the priority date of the present patent.

Document D3 relates to a different technical field to that of the invention since document D3 is concerned with the minimisation of shrinkage during firing. Out of the thirty-nine examples contained therein only two

disclose aluminum oxide abrasive grains and non-metallic, inorganic thermally conductive, solid particles having an average particle size at least twice the average particle size of the abrasive grains. In these examples the size of the alumina particles are too small for high metal removing rate grinding operations as envisaged in the present invention. Moreover, document D3 is silent regarding springback.

The prior sale does not disclose springback of the cold molded article in an amount at least equal to the smallest particle size of the particle size range of the pore inducer. Documents D1 and D3, although disclosing walnut shells as pore inducers, do not disclose that springback is desirable or could be produced by said shells. Document D4 is illustrative of the state of the art at the priority date of the present application and indicates that springback is to be avoided, wherever possible. The examples in the description of the application in suit show that a synergistic effect occurs as a result of the combination of features of the invention.

Claim 1 of the both the first and second auxiliary requests is based on the application as originally filed which, in particular, discloses a range of 105 to 485 microns and specific examples of 185 and 260 microns. This amendment distinguishes the invention from the disclosure of document D2 which discloses a lower size for the aluminium oxide particles. The application as originally filed also provides support for the addition of the wording "for high metal removal rates" and for "for us in high metal removal grinding operations" at a number of specific places in the description.

Reasons for the Decision

1. *Main request*

1.1 Closest prior art

The closest prior art is represented by document D1 which discloses:

A method for producing an improved vitreous bonded abrasive article comprising the steps of preparing a blend, cold pressing the blend in a mold to the desired shape, size and density to form a cold molded article, removing the cold molded article from the mold and firing the cold molded article to produce the vitreous bonded abrasive article wherein the blend comprises:

(a) aluminium oxide grains;

(b) non-metallic, inorganic thermally conductive, solid particles (silicon carbide) having a thermal conductivity greater than the thermal conductivity of the abrasive grains and an average particle size greater than the average particle size of the abrasive grains;

(c) a vitreous matrix precursor (Bond A) which forms a vitreous matrix that binds together the abrasive grains and forms a bond with the thermally conductive solid particles and

(d) an organic, open cell producing, solid pore inducer (walnut shells) that, subsequent to the pressing step, produces spring back of the cold

molded article.

1.2 Problem to be solved

According to the patent in suit the problem to be solved is avoid the occurrence of "burn" at high metal removal rates, exhibit lower power consumption and exhibit increased penetration of grinding fluid into the interface between a grinding wheel and the workpiece (see for instance page 10, lines 8 to 16).

1.3 Solution to the problem

In accordance with claim 1 of the main request the problem is solved by the provision of the following features:

(i) the solid particles have an average particle size at least twice the average particle size of the abrasive grains;

(ii) the bond formed by the matrix precursor with the thermally conductive solid particles is weaker than the bond the matrix forms with the abrasive grains and

(iii) the solid pore inducer, subsequent to the pressing step, produces spring back of the cold molded article in an amount at least equal to the smallest particle size of the particle size range of the pore inducer.

1.4 This solution to the problem is obvious for the following reasons:

With regards to distinguishing feature (i) document D1 indicates not only that the size of the thermally conductive solid particles may be the same as the abrasive alumina grains, but also that they may be greater or lesser (see column 5, lines 40 to 45). So, although document D1 does not provide a teaching to provide the thermally conductive particles with an average size at least twice that of the abrasive grains, there is no indication of a prejudice against doing this and furthermore the document gives a hint in the direction of providing the thermally conductive particles larger than the abrasive grains. This feature is moreover known from the prior sale, as is admitted by the appellant. The skilled person considering this prior sale would understand that thermally conductive particles when provided along with abrasive grains should be provided with an average size at least twice that of the abrasive grains. The appellant has claimed that this feature produces unexpectedly good performances. However, the appellant has produced no evidence in this respect. Moreover, any unexpectedly good performance due to this feature will already being known to the skilled person as a result of its presence in the prior sale. Therefore, the arguments of the appellant with respect to an unexpectedly good performance are not convincing and not supported by evidence.

With regards to feature (ii) the Board would first note that it not clear what effect the mere comparison of the bonding strengths of the abrasive grains and the thermally conductive particles may have. The appellant has argued that heat is removed by allowing the particles which act as a heat sink to fall away. However, the claim gives no indication of the strength

of bonding of the thermally conductive particles, stating merely that it is less than for the abrasive grains. Thus, the effect alleged by the appellant does not appear to necessarily result from the method being claimed.

The vitreous precursor used in the embodiments of the application in suit is set out as Bond A on page 19, lines 11 to 13. The composition of this bond is similar to the bonds set out in the examples of document D1 in Table I, column 4, lines 35 to 48. It cannot be considered that the bonds set out in document D1 would necessarily result in the second abrasive mentioned in column 5, lines 40 to 54 having a weaker bond than the first abrasive. Nevertheless, the similarity of the compositions indicates that there would be no technical prejudice to the person skilled in the art in providing a bonding composition of the type necessary to achieve the bonding strength relationship specified in feature (ii). This feature is part of the appellant's admitted prior sale since appellant bases his arguments for a surprising effect on a comparison with the prior art as exemplified in Examples Nos. 1 and 2. These examples used the same vitreous bond (Bond A) as the Examples Nos. 3, 4 and 5 which are examples of the invention. The appellant has argued that the skilled person would not seek to provide this feature in a method as disclosed in document D1. However, in the view of the Board this feature would be obvious to the skilled person, since it is admitted by the appellant to belong to the prior art when the thermally conductive particles are twice the size of the abrasive grains. Thus, the skilled person when considering thermally conductive particles as used in document D1 would know from the prior sale that these should not be bonded so

strongly as the aluminum oxide abrasive grains. Any allegedly surprising effects which could be gained from this feature, and none have been proven, would already have occurred in the prior sale and therefore would not be surprising to the skilled person.

With regards to feature (iii) this feature has been argued by the appellant as being the most important feature. The description of the application contains comparative tests purporting to show that this feature solves the above mentioned problems. The Board would first observe that the feature as set out in claim 1 is very broad. The amount of springback for the article as a whole need only be equal to the size of the smallest particle of the pore inducer. The definition of the pore inducer in the claim however does not define and hence limit this smallest size. Thus, the claim can, dependent upon the size of the pore inducer particles, include any amount of springback other than zero. In the description the only comparison wherein the amount of springback is specified is Grinding Test No. 1 in which Examples Nos. 1 (prior art) and 3 are compared. In Grinding Test No. 2 there is no indication of the amount of springback. This means that there is only one comparative example to support a claimed range of effectively unlimited scope. In the opinion of the Board a single example cannot support such a broad range. Moreover, it is the constant jurisprudence of the Boards of Appeal that comparative tests to support an inventive step must be carried out in comparison with the closest prior art (cf. T 181/82). In the present case this has not been done.

In the opinion of the Board springback must have occurred in products as described in D1. Document D4 is

published later than that priority date of the application in suit though it has an earlier application date. The appellant has stated in his submission of 4 March 2002 that document D4 is "illustrative of the state of the art at the priority date of the present patent". The Board can agree with this view. In document D4 the matter of springback in products including walnut shells is discussed. According to document D4, in the paragraph bridging pages 1 and 2, springback is a problem in pore inducers such as, amongst others, walnut shells. In Table II on page 9 a figure of 4.6% (after 0.5 minutes) for the amount of springback is mentioned. This is far larger than the amount mentioned in the example of the invention (0.4% after 2 minutes and 0.8% after 8 minutes). In the opinion of the Board therefore the inclusion of walnut shells will inevitably lead to springback. This would also apply to the articles produced in accordance with the teaching of document D1. The arguments of the appellant that D1 teaches away from the use of walnut shells if Figure 1 of the document is considered are not relevant, since the feature is already disclosed in this document. Moreover, Figure 1 of document D1 shows the situation concerning the use of walnut shells compared to bubble alumina with respect to firing, i.e. at a different stage in the method to that when springback occurs, which is just after cold pressing.

As document D1 does not state the size of the smallest walnut shell particles nor the specific amount of springback it cannot however be considered to disclose completely feature (iii) of claim 1 but rather just the presence of springback. Nevertheless, as already indicated above the claim covers virtually any amount

of springback. In Table II of document D1 the walnut shells are stated to have a particle size of 200 microns. The grinding wheel in which they are used is stated to be 0.5 inches thick (column 7, line 35). Thus, the amount of springback required to fulfil the requirement set out in claim 1 would be 1.6%. In document D4 the particle size of the walnut shells was 150-250 microns (page 8, line 6) which indicates that the size of 200 microns used in document D1 corresponds to the normal. Whilst the amount of springback which would result from the method disclosed in D1 is not disclosed therein it may be seen that there would not be any technical impediment against its realisation.

Thus, in the opinion of the Board each of the apparent distinguishing features of claim 1 over the disclosure of document D1 was obvious to the person skilled in the art.

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

2. *First and second auxiliary requests*

2.1 Amendments

According to the appellant a basis for the amendments to the independent claims of these requests may be found on page 13, line 10 of the description wherein a preferable range for the aluminium oxide abrasive grains of 36 to 150 mesh is given which corresponds to 105 to 485 microns. Further examples of 185 and 260 microns are also given. The Board however is unable to agree that this range and/or the examples provides a

basis for specifying "at least 100 microns". No reference to an example or start of a range of 100 microns may be found in the application as filed. The amendment therefore adds to the content of the application as filed and hence does not conform with Article 123(2) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Goergmaier A. Burkhart