

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen
(D) [] No distribution

D E C I S I O N
of 23 May 2003

Case Number: T 0978/00 - 3.2.2

Application Number: 92903559.0

Publication Number: 0568584

IPC: C22C 29/08

Language of the proceedings: EN

Title of invention:
Corrosion resistant cemented carbide

Patentee:
SANDVIK AKTIEBOLAG

Opponent:
CERATIZIT S.A.

Headword:
-

Relevant legal provisions:
EPC Art. 56
EPC R. 67

Keyword:
"Inventive step (no)"
"Reimbursement of appeal fee (no)"

Decisions cited:
-

Catchword:
-



Case Number: T 0978/00 - 3.2.2

DECISION
of the Technical Board of Appeal 3.2.2
of 23 May 2003

Appellant:
(Opponent)

CERATIZIT S.A.
Route de Holzem, B.P. 51
L-8201 Mamer (LU)

Representative:

Kihn, Pierre Emile Joseph
Office Ernest T. Freylinger S.A.
234, route d'Arlon
B.P. 48
L-8001 Strassen (LU)

Respondent:
(Proprietor of the patent)

SANDVIK AKTIEBOLAG
S-811 81 Sandviken (SE)

Representative:

Weber, Dieter, Dr. Dipl.-Chem.
Weber, Seiffert, Lieke
Postfach 61 45
D-65051 Wiesbaden (DE)

Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 19 October 2000
rejecting the opposition filed against European
patent No. 0 568 584 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: R. Ries
E. Dufrasne

Summary of Facts and Submissions

- I. European patent No. 0 568 584 was granted on 20 November 1996 on the basis of European patent application No. 92 903 559.0.
- II. The grant was opposed by the present appellant (CERATIZIT SA) on the grounds that its subject matter lacked novelty and did not involve an inventive step (Article 100(a) EPC), and that the patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100(b) EPC).
- III. With its decision posted on 19 October 2000 the opposition division held that the patent and the invention to which it related met the requirements of the EPC and rejected the opposition.
- IV. An appeal against this decision was filed by the opponent on 12 December 2000. In the appeal proceedings, *inter alia*, the following documents were referred to:

D1: WO-A-80/02569 & EP-A-0028620

D5: A. Bayoumi: "The effect of cemented carbide binder composition on tool wear encountered in surfacing green lumber" in: Wood and Fibre Science 20(4) (1988), pages 457 to 476

D7a: "Introduction to SANDVIK HARD MATERIALS AND SANDVIK DANIT", paper presented at the "First International Symposium on Tooling for the Wood Industry, held on 26/27 July 1990 at Velvet Cloak Inn, in Raleigh, North Carolina", pages 1 to 5, appendices 1 to 3

D9: "Some Characteristics of Very-fine-Grained Hardmetals" MPR 1987, July/August, pages 512 to 514

D28: "Quantitative Microscopy", edited by: R. T. De Hoff and F. N. Rhines, McGraw Hill, 1968, pages 237, 238

Moreover, amongst others, the following declarations and affidavits were considered:

D13: Declaration of Mr Kaiser

D14: Attestation of Mr Barbier of CERATIZIT SA

D21: First declaration of Mr Rasmussen dated 9 November 1999

D22: Declaration of Mr Uhrenius dated 8 November 1999

D35: Second declaration of Mr Rasmussen dated 25 February 2003

V. Oral proceedings were held before the Board of Appeal on 23 May 2003. At the end of the oral proceedings, the following requests were made:

- The appellant (opponent) requested that the decision under appeal be set aside and that the European patent No. 0 568 584 be revoked in its entirety. Moreover, it was requested that the appeal fee be reimbursed because of procedural violations.
- The respondent (patentee) requested that the appeal be dismissed, or that the decision be set aside and the patent be maintained in amended form according to one of the three auxiliary requests submitted with its letter of 20 June 2000.

The appellant's previous written request that the patentee should bear (some of) the costs of the appellant, was withdrawn.

The independent claims 1 to 3 read as follows:

"1. Use of a sintered cemented carbide alloy with improved corrosion and oxidation resistance consisting of 96-98 weight-% hard material comprising WC and <0.8% VC and/or ZrN, the remainder being a monophase binder-phase based on Ni, said binder-phase containing, in weight-%, Co 30-70, Cr 3-15, W max 30, Mo max 15, Al max 2, Mn max 10, Si max 2, Cu max 10, Fe max 20, Ag max 5, Au max 10 and optionally any of 0.1-10 weight-% TiN and/or TiCN, balance Ni, the total carbon content, in weight-%, being $6.13 - (0.061 \pm A) \times (100 - \text{hard material in weight-\%})$ for concentrations of Mo+Cr between 3 and 15 weight-% where $A = 0.008$, preferably $A = 0.005$ and $6.13 - (0.058 \pm B) \times (100 - \text{hard material in weight-\%})$ for concentrations of Mo+Cr between 16 and 30 weight-% where $B = 0.007$, preferably $B = 0.005$, the

mean grain size of WC being <0.9 , preferably $<0.7 \mu\text{m}$, for cutting of chipboard, medium density fibreboard and particle board."

"2. Use of a sintered cemented carbide alloy with improved corrosion and oxidation resistance consisting of 91-96 weight-% hard material comprising WC and $<0.8\%$ VC and/or ZrN, the remainder being a monophase binder-phase based on Ni, said binder-phase containing, in weight-%, Co 30-70, Cr 3-15, W max 30, Mo max 15, Al max 2, Mn max 10, Si max 2, Cu max 10, Fe max 20, Ag max 5, Au max 10 and optionally any of 0.1-10 weight-% TiN and/or TiCN, balance Ni, the total carbon content, in weight-%, being $6.13 - (0.061 \pm A) \times (100 - \text{hard material in weight-\%})$ for concentrations of Mo+Cr between 3 and 15 weight-% where $A = 0.008$, preferably $A = 0.005$ and $6.13 - (0.058 \pm B) \times (100 - \text{hard material in weight-\%})$ for concentrations of Mo+Cr between 16 and 30 weight-% where $B = 0.007$, preferably $B = 0.005$, the mean grain size of WC being <0.9 , preferably $<0.7 \mu\text{m}$, for cutting of solid dry wood."

"3. Use of a sintered cemented carbide alloy with improved corrosion and oxidation resistance consisting of 80-97 weight-% hard material comprising WC and $<0.8\%$ VC and/or ZrN, the remainder being a monophase binder-phase based on Ni, said binder-phase containing, in weight-%, Co 30-70, Cr 3-15, W max 30, Mo max 15, Al max 2, Mn max 10, Si max 2, Cu max 10, Fe max 20, Ag max 5, Au max 10 and optionally any of 0.1-10 weight-% TiN and/or TiCN, balance Ni, the total carbon content, in weight-%, being $6.13 - (0.061 \pm A) \times (100 - \text{hard material in weight-\%})$ for concentrations of Mo+Cr between 3 and 15 weight-% where $A = 0.008$, preferably $A = 0.005$ and $6.13 - (0.058 \pm B) \times (100 - \text{hard material$

in weight-% for concentrations of Mo+Cr between 16 and 30 weight-% where $B = 0.007$, preferably $B = 0.005$, the mean grain size of WC being <0.9 , preferably $<0.7 \mu\text{m}$, in tools for machining of printed electronic circuit boards and similar composite material."

VI. The appellant argued as follows:

According to the declarations of Mr Rasmussen (D21 and D35), the DC hardmetal grades referred to in document D7a exhibited the same chemical composition as the cemented tungsten carbide to be used according to the patent claims (called DZ grades). Except for the carbon content which had not been determined, own tests by Mr Barbier (D14) confirmed that the composition of the binder phase of DC03 actually fell within the elemental ranges defined in the opposed patent. Hence, the cemented tungsten carbide set out in claims 1 and 2 differs from the DC-grades only by a mean grain size of less than $0.9 \mu\text{m}$ whereas the DC-grades - according to the patentee - exhibit a mean grain size of $1.0 \mu\text{m}$ or more. However, the beneficial effect on the mechanical properties of cemented tungsten carbides and on its resistance to wear when machining medium density fibreboard (MDF) and printed circuit boards was well known, e.g. from document D7a, page 3. It has, therefore, been obvious to the person skilled in the art to use DC-grades having a WC grain size decreased down to the sub-micrometre range if the overall performance of the cemented hardmetal tool for cutting wood products was to be improved.

Reducing the mean grain size to less than $0.7 \mu\text{m}$ (first auxiliary request) or, more preferably, to less than $0.5 \mu\text{m}$ to further improve the hardmetal's properties

does not involve an inventive step either for the same reasons already mentioned above. Compared with the broader range, the confinement of the total carbon range stipulated in claims 1 to 3 of the second auxiliary request does not bring about a surprising effect. It merely ensures that the formation of brittle secondary phases is avoided and is therefore selected for the same reasons set out in document D1, pages 6 and 7. It has certainly no effect on the corrosion resistance as alleged by the patentee. The mentioning of the grain size of the initial WC-powder stipulated in the claims of the third auxiliary request is not relevant and does not add inventive matter either. The patent is therefore to be revoked under Article 100(a) EPC.

As to the reproducibility of the cemented carbide used in the patent, the originally filed patent specification neither discloses a method to determine the total carbon content nor advocates - amongst several alternative methods each leading to different results - one specific method for measuring exactly the true mean WC grain size in the final product. Consequently, the patent at issue does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (see T 225/93). Revocation of the patent is therefore requested also under Article 100(b) EPC.

Turning to procedural matters it is to be noted that the minutes of the oral proceedings before the opposition division do not correctly reflect the arguments submitted by the parties. Moreover, new arguments and facts submitted by the patentee for the first time have been introduced during the oral

proceedings. The opposition division had not correctly acknowledged the declaration of Mr Rasmussen and disregarded or misquoted technical information given in documents D7a and D1. The patentee's false and misleading statements during the opposition procedure contributes to a lengthening of the procedure and to costs for the opponent which could have been avoided. The reimbursement of the appeal fee is justified pursuant to Rule 67 EPC.

VII. The respondent argued as follows:

The closest prior art is reflected by document D7a which refers to the Sandvik cemented carbide grades DC03 and D05 for cutting particle board, MDF with melamine or hard woods. However, D7a fails to disclose whether the DC-grades exhibit

(a) a mean WC grain size of less than $0.9 \mu\text{m}$ and

(b) a total carbon content falling within the range claimed in the patent at issue.

D7a specifies the WC grain size of DC03 and DC05 as being "fine" (cf. D7a, appendix no. 3) which means a WC mean grain size in the range of 1.0 to $1.3 \mu\text{m}$. There is no evidence that a grain size smaller than $1.0 \mu\text{m}$ i.e. in the sub-micrometre range, in particular of less than $0.9 \mu\text{m}$ has been actually selected in the DC grades, even if D7a generally remarks that some manufacturers have already envisaged the production of very fine grain size grades down to the submicrometre range in order to increase the hardness.

Moreover, there is no proof of the appellant's allegation that the total carbon content of the DC-grades falls within the claimed range. The appellant has obviously misinterpreted the declaration of Mr Rasmussen (D21) declaring that the DC-grades and DZ-grades have the same chemical contents of WC, Cu, Ni, Cr₃C₂ and Mo in the preparation process. However, Mr Rasmussen also clarifies that this statement related to the starting materials and that the WC grain size and the total carbon content of both grades were not the same (D35).

As to document D1, only example 7 discloses a cemented carbide tool for cutting damp wood rather than dried solid wood, particle board and MDF as claimed in the patent. D7a points out that the WC-Co grades cannot be used for cutting damp wood because of inadequate corrosion resistance of the binder. In consequence thereof, D1 proposes on page 26 the variants 7 and 9 which have a Co-free, Ni-Cr-Mo binder phase. This technical teaching cannot, however, be simply read across to cutting tools for machining dry wood, MDF or printed circuit boards where the chemical attack is different and which is done - according to the patent and contrary to D1 - with a WC binder phase including large amounts of cobalt. Moreover, document D1 teaches to keep the total carbon content of the sintered hard metal within a narrow interval to obtain a single phase and tough binder i.e. to improve the toughness rather than the resistance to the corrosion of the binder by various chemical contained in the wood. It is therefore concluded that the person skilled in the art, who is confronted with the problem of providing a cemented carbide for cutting dried solid wood, particle board or MDF, was not induced to adhere to the narrow range of

the total carbon content disclosed in document D1. The subject matter according to claims 1 to 3 of the patent therefore, involves an inventive step.

To analyse the total carbon content of the final cemented carbide, well established standard procedures exist in this field of technology. For example, a commonly used standard apparatus (Leco CS 444) determines the carbon content with high accuracy having an error below 0.02%. Also the quantitative estimation of the mean WC grain size for the production control and research falls within the normal competence of the expert. One standard technique that is sufficiently accurate, simple to apply and which has also been used in the patent is the grain size determination by Jeffries' procedure (planimetric method (cf. D28)). Hence, there is no need to describe explicitly one specific method for determining the carbon content and the mean grain size in the final cemented carbide of the patent, as alleged by the appellant. The ground of lack of sufficiency of disclosure in the patent at issue is therefore unfounded.

Reasons for the Decision

1. The appeal complies with Rule 65(1) EPC and is, therefore, admissible.
2. *The closest prior art*
 - 2.1 It was agreed by the parties that documents D1 and D7a, both stemming from the patentee (SANDVIK AB), represent the most pertinent prior art. In order to assess

inventive step, it is necessary to establish the nearest state of the art.

2.2 Like the disputed patent, document D7a addresses the problems associated with the machining of dried solid wood, MDF, particle board and green wood with cemented tungsten carbide tools. To give one clue to the understanding of the main wear mechanism the cutting tool undergoes when machining wood, the chemical and abrasive attack affecting the tool life were investigated. It was found that the conventionally used Co-binder material was corroded and oxidised by numerous chemical materials, particularly organic acids, contained in the wood materials. Since the binder was preferentially dissolved through the chemical attack of the extractives in the wood, the hard WC grains became dislodged and, after a critical time, broke away by the mechanical forces acting upon the tool during cutting. In order to cope with the degradation of the binder phase, the cemented carbide grades DC03 comprising 97% WC and 3% of an oxidation-corrosion resistant binder-phase were developed (cf. D7a, pages 3, 4, point "Corrosion and oxidation resistant cemented carbide grades"; appendix 3). In particular, the DC03 grade was recommended for the machining of particle boards and MDF with melamine (cf. D7a, page 4, paragraph 3) which complies with the claimed use according to claim 1 of the patent at issue.

2.3 It was common ground to all parties and to the Board that both the DC-grades disclosed in document D7a (DC03, DC05) and the cemented tungsten carbide grades used in the disputed patent (referred to by the patentee as DZ-grades DZ03, DZ05) actually exhibit the

same composition with respect to WC, Co, Ni, Cr₃C₂, and Mo. It was further undisputed that the DC-grades have been available to the public before the priority date of the patent. Reference is made in this context to the declarations of Mr Rasmussen (D21, D35), the declaration of Mr Kaiser (D13) and the test results reported by Mr Barbier (D15). Consequently, document D7a represents the closest prior art.

2.4 However, document D7a is silent about the mean WC grain size and the total carbon content of grade DC03.

3. *Problem and solution*

In the light of the closest prior art according to document D7a, the technical problem underlying the patent at issue consists in designing an improved cemented tungsten carbide grade which exhibits an even better resistance to corrosion and oxidation and to abrasive wear when cutting chipboard, MDF, particle board, or PECB, thus showing a performance and longevity superior to that of the DC03 grade.

The solution to this problem consists in using a cemented carbide having

(I) a mean WC (sub-micrometre) grain size of less than 0.9 μm and

(ii) a total carbon content within the ranges specified by the formulae according to claims 1 to 3.

This solution to the problem is, however, obvious to a person skilled in the art, as is shown in the following.

4. *Inventive step (main request)*

It has been accepted common ground to all parties that the physical and mechanical properties of tungsten carbide hard metals are governed essentially by the mean grain size of the WC, as well as by the concentration and the composition of the binder phase (cf. also document D1, page 2, second paragraph). As to feature (i), it is well known to the person skilled in the art that the hardness of the cemented carbide cutting tool and its resistance to abrasive wear increases as the WC grain size is decreased. This interrelationship is reflected by the passage given on page 3, lines 18 to 25 of document D7a. It is corroborated by the experimental results and conclusions disclosed in document D5, in particular page 47, Conclusion, point 1, and by document D9, page 512, first column, paragraph 1 and column 2, lines 10 to 16 which indicate that the wear resistance of sub-micrometre grain size hardmetals is superior to that of conventional hardmetals in cutting applications.

Putting into practice this basic technical knowledge and acting accordingly, the skilled reader, therefore, would be prompted to reduce the WC grain-size to the sub-micrometre range (i.e. to less than 1 μm or even less than 0.9 μm) in order to increase the hardness and abrasion resistance of the cemented WC hard metal cutting tool. Doing so does not involve an inventive step.

Turning to feature (ii), the patent specification emphasises on page 2, lines 46 to 51 the necessity to keep the concentration of carbon within a narrow

interval to obtain a mono-phase binder devoid of brittle carbides. In consequence thereof, the cemented tungsten carbide workpiece exhibits a high resistance to corrosion and oxidation and retains a high toughness. The formula specifying in all claims the target carbon content which is identical with that disclosed in document D1, page 6, last paragraph, reflects the required balance between the carbon concentration, the "strong carbide formers" chromium, molybdenum and the WC hard phase. If, on the one side, the total carbon content is "overbalanced" (i.e. falls outside the claimed carbon range), the binder phase incurs the risk of forming deleterious secondary brittle carbides. If, on the other side, the carbon is "underbalanced", the degradation of WC grains is promoted.

Likewise, document D1 proposes hard metal grades which exhibit a high toughness and resistance to corrosion and oxidation and which can be used for cutting damp wood rather than dried solid wood or MDF as claimed (see D1, example 8). Although the Ni-Cr-Mo binder phase disclosed in D1 example 8 differs from the one claimed in the patent at issue in that it is Co-free, the total carbon content is nevertheless kept within narrow limits due to the same technical reasons, i.e. to prevent the formation of deleterious secondary brittle carbides, (cf. D1, page 6, third paragraph to page 7, second paragraph). The expert reader would have noted that other components making up the binder phase (such as nickel or cobalt) do not participate in the carbide formation and therefore are not taken into account when determining the target carbon content by the formula in D1. He would have concluded that the formula represents an independent technical feature which is

valid for a wide variety of hardmetal binder-phase compositions irrespective of whether the binder material is based on nickel or cobalt or both. Contrary to the patentee's allegation, the man skilled in the art would, therefore, transfer this technical teaching from document D1 also to other cemented carbide grades, including the cemented WC-hardmetals claimed in the disputed patent and restrict the total carbon content of the cemented tungsten carbide to same range specified already by the formula given in document D1 so that a tough mono-phase binder phase free of secondary brittle phases is obtained in the claimed grade.

In view of these considerations, the subject matter at least of claims 1 and 3 does not involve an inventive step, because it results way from an obvious combination of the technical teaching given in documents D7a and D1.

5. *Inventive step: auxiliary requests*

5.1 In the first auxiliary request, the mean grain size of tungsten carbide is restricted to $< 0.7 \mu\text{m}$ in all claims. As the beneficial effect of a "sub-micrometer" WC grain size is known *per se*, it is only routine work for the expert to single out the most effective grain size. Therefore, the subject matter of claims 1 to 3 of the first auxiliary request does not involve an inventive step.

5.2 In the second auxiliary request, the total carbon range $= 6.13 - (0.061 \pm A) \times (100 - \text{hard material } (\%))$ has been confined in all claims by selecting "**A = 0.005**" and in $6.13 - (0.061 \pm B) \times (100 - \text{hard material } (\%))$ by selecting

"**B = 0.005**". As to the patentee, this focussing of the total carbon target content represents an enhanced safety measure to guard even more effectively against the formation of harmful brittle secondary phases in the binder.

However, no surprising or additional effect is associated with this restriction of the total carbon content. The limitation merely constitutes efforts which are directed to the optimisation of a specific parameter area that is known *per se* and already suggested in document D1. Doing so does not constitute an inventive step (cf. Case Law of the Boards of Appeal of the EPO, 4th edition 2001, I.D.6.16). Hence, claims 1 to 3 of the second auxiliary request are not allowable.

- 5.3 Compared with the claims as granted, claims 1 to 3 of the third auxiliary request include the wording "**...and the grain size of the WC powder being $<0.8\mu\text{m}$, preferably $<0.6\mu\text{m}$, ...**". Since, in the patentee's view, the WC-grain size of the final products resulted from the raw material (i.e. the grain size of the initially used WC-powder) and the processing conditions (sintering temperature, pressure, holding time etc), this feature was regarded as being a "product-by-process" feature.

The Board is unable to detect any inventive matter in instructing the skilled person to select a starting WC-powder grain size so that the optimum sub-micrometer WC grain size in the final product is successfully obtained. The important parameter is the mean WC grain size of the final product rather than the WC-grain size of the input material. Hence, claims 1 to 3 of the

third auxiliary request do not comprise patentable matter either.

- 5.4. Having arrived at the conclusion that the patent cannot be maintained for the ground of lack of inventive step of the subject matter claimed according to the main and auxiliary requests, there is no need to deal with the other grounds raised by the appellant, such as novelty or insufficiency of disclosure.

6. *Reimbursement of the appeal fee*

The appellant argued that several procedural violations during the opposition proceedings justified the reimbursement of the appeal fee.

In reply to these arguments, it is first to be noted that during the oral proceedings each party is entitled to present its own position, including arguments not already submitted during the written procedure.

Further, the Board considers that it is within the normal scope of competences of the opposition division to evaluate the content of submitted documents and to appreciate their relevance or not in reaching its decision.

The appellant also alleged false or misleading statements made by the patentee. The Board does not share this opinion and considers said statements as the regular expression of the patentee's arguments, without any effect either on the length of procedure nor on the required costs for the opponent.

Finally, as to the alleged errors in the minutes of the oral proceedings, the Board considers that - even if convincingly established - they would not have affected the decision. Moreover, the minutes are not part of the decision and, as such, are not directly open to appeal.

The Board therefore concludes that none of the issues raised by the appellant is to be rated as being a substantial procedural violation under Rule 67 EPC and rejects the appellant's request for reimbursement of the appeal fee.

Order

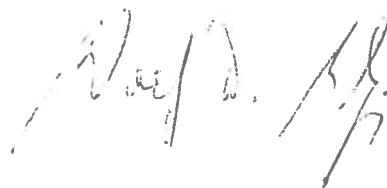
For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.
3. The request for reimbursement of the appeal is rejected.

The Registrar:


V. Commare

The Chairman:


W. D. Weiß

