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Datasheet for the decision of 14 May 2019

Case Number: T 1528/15 - 3.2.03

Application Number: 10185684.7

Publication Number: 2287355

IPC: C23C14/06, C22C29/00, C23C16/34, C23C30/00

Language of the proceedings: EN

Title of invention:
Fine grained cemented carbide with refined structure

Patent Proprietor:
Sandvik Intellectual Property AB

Opponents:
Ceratizit Austria GmbH
Atlas Copco Secoroc AB

Headword:

Relevant legal provisions:
EPC Art. 76(1), 83, 56
RPBA Art. 12(4)

Keyword:
Divisional application - subject-matter extends beyond content of earlier application (no)
Sufficiency of disclosure - reproducibility (yes)
Inventive step - non-obvious solution
Late-filed facts - submitted with the statement of grounds of appeal

Decisions cited:
G 0002/10

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 1528/15 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 14 May 2019

Appellant: (Opponent 1)	Ceratizit Austria GmbH Metallwerk-Plansee-Strasse 71 6600 Reutte (AT)
Representative:	Ciesla, Dirk IP Department Plansee Group Plansee Group Service GmbH 6600 Reutte (AT)
Respondent: (Patent Proprietor)	Sandvik Intellectual Property AB 811 81 Sandviken (SE)
Representative:	WSL Patentanwälte Partnerschaft mbB Kaiser-Friedrich-Ring 98 65185 Wiesbaden (DE)
Party as of right: (Opponent 2)	Atlas Copco Secoroc AB 737 25 Fagersta (SE)
Representative:	Rehse, Helen Valea AB Box 1098 405 23 Gothenburg (SE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 17 June 2015 rejecting the opposition filed against European patent No. 2287355 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	G. Ashley
Members:	B. Miller
	E. Kossonakou

Summary of Facts and Submissions

I. European patent No. 2 287 355 (hereinafter: the disputed patent) relates to fine grained WC-Co cemented carbides containing grain refining elements.

II. Two oppositions based on Article 100(b) and (c) EPC and Article 100(a) together with Articles 54 and 56 EPC were filed against the disputed patent.
The opposition division rejected both oppositions.

III. Opponent 1 (the appellant) filed an appeal against this decision.

The appellant requested that the decision under appeal be set aside and the patent be revoked.

IV. The patent proprietor (the respondent) requested that the appeal be dismissed (main request) or that the patent be maintained according to the auxiliary request filed with the letter of 26 March 2019.

V. Opponent 2 (party as of right) did not actively take part in the appeal proceedings.

VI. Wording of the claims

Claim 1 according to the main request (claims as granted) including the feature numbering as proposed by the appellant reads:

1.1 "WC-Co cemented carbide
characterised in
1.2 a composition of 3-15 wt-% Co and Cr
1.3 such that the Cr/Co-ratio by weight is 0.05-0.15

1.4 and balance WC,
1.5 with a grain size of 0.1-2.0 µm
1.6 and in addition to that ppm levels of:
1.7a - one of the following additional elements V, Nb, Zr, Ta, or
1.7b - mixtures of at least two of Ti, V, Nb, Zr, Ta,
1.8 excluding a mixture consisting of the elements Ti+Ta,
1.9 then the grain size of the WC is >0.3 µm,
1.10 such that the ratio of Me/Co=(at-%Ti+at-%V+at-%Nb+at-%Zr+at-%Ta)/at-%Co
1.11 is lower than or equal to 0.014-(CW_Cr)*0.008
1.12 and higher than 0.0005,
1.13 with a CW_Cr ratio of 0.79-0.95,
1.14 with CW_Cr= (magnetic-% Co +1.13*wt%Cr)/wt%Co,
1.15 where magnetic-% Co is the weight percentage of magnetic Co
1.16 and wt-% Co is the weight percentage of Co in the cemented carbide."

Claims 2 to 6 relate to preferred embodiments of the process according to claim 1.

Claim 7 :

"Method of making a WC-Co cemented carbide according to claim 1 comprising mixing and wetmilling of powders of WC and Co, pressing and sintering characterised in that ppm levels of Ti, V, Nb, Zr or Ta or mixtures thereof as pure metals or as a carbides, nitrides and/or carbonitrides or mixtures thereof are added to the powder mixture."

VII. Cited documents

The appellant cited the following documents:

D4: JP 2004 315 904 A;
D4a: English translation of D4;
D5: EP 0 773 080 A1;
D10: EP 1 500 713 A1;
D15: Roebuck, B. et al., "Measurement Good Practice Guide - Mechanical Tests for Hardmetals", No. 20, NPL - National Physical Laboratory, UK, 1999.

The respondent additionally referred to the following documents:

D6: Roebuck B., "Magnetic Moment (Saturation) Measurements on Hardmetals", Int. J. of refractory and Hard Materials 14 (1996), pages 419 to 424;
D13: International Standard I EC 60404-14 (2002);
D14: Manual Koerzimat CS 1.096, (2001) Foerster;
D16: ASTM Standard B 886-98.

VIII. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) indicating to the parties its preliminary opinion of the case.

IX. Oral proceedings took place on 14 May 2019 in the absence of opponent 2 pursuant to Rule 115(2) EPC and Article 15(3) RPBA.
At the end of the oral proceedings the Board pronounced its decision.

X. The appellant's arguments can be summarised as follows.

Adding the disclaimer "excluding a mixture consisting of the elements Ti+Ta" (feature 1.8) into the wording of claim 1 was contrary to the requirements of Article 76(1) EPC and the principles of decision G2/10 of the Enlarged Board of Appeal.

The parameters "CW_Cr" and "magnetic-% Co" were neither defined in the disputed patent nor could their meaning clearly and unambiguously be derived by a skilled person.

The production of WC-Co cemented carbides having a mean grain size smaller than 0.5 µm posed many problems. The disputed patent did not teach how to achieve a grain size smaller than 0.5 µm by adding the grain growth inhibitors in very low amounts as defined in claim 1.

The disputed patent did not provide enough information to determine the grain size and to enable the skilled person to identify whether or not it worked within the boundaries of the scope of protection.

The subject-matter of claim 1 lacked an inventive step when starting from D4 or D10 as the closest prior art. The cemented carbides known from D4 and D10 had the same grain size as defined in claim 1. The parametric limitations of claim 1 were arbitrarily selected. In particular, D4 described the same combination of grain growth inhibitors as defined in the disputed patent and further suggested that the grain growth inhibitors could be used in very low amounts of 0.01 wt.-%.

XI. The respective arguments of the respondent can be summarised as follows.

The addition of the expression "excluding a mixture consisting of the elements Ti+Ta" corresponded to a deletion of one embodiment from a list of alternatives. The technical teaching was therefore not changed compared to the parent application.

The parameters "CW_Cr" and "magnetic-% Co" were well defined in the disputed patent and could clearly be understood by the skilled person.

The skilled person was aware of how to produce WC-Co cemented carbides having a mean grain size smaller than 0.5 µm. The appellant did not provide any evidence supporting the allegation that WC-Co cemented carbides having a mean grain size smaller than 0.5 µm could not be produced.

None of the cited documents suggested that low ppm levels of the grain growth inhibiting elements were sufficient to achieve a cemented carbide having a refined grain size.

Reasons for the Decision

1. Article 100(c) in conjunction with Article 76 EPC

1.1 The disputed patent originates from a divisional application of the parent application EP08104014 published as EP 2 011 890 A1.

Claim 1 of the parent application requires that the WC-Co cemented carbide comprises ppm levels of either
- one of the following additional elements V, Nb, Zr, Ta, or
- mixtures of at least two of Ti, V, Nb, Zr, Ta.

Claim 1 of the disputed patent is based on this claim and further includes the disclaimer "excluding a mixture consisting of the elements Ti+Ta".

1.2 The expression "mixtures of at least two of Ti, V, Nb, Zr, Ta" according to claim 1 of the parent application and the disputed patent defines in a concise way a group of 26 different embodiments. They could alternatively be defined as "mixtures of at least two elements, the mixtures being selected from the group consisting of
Ti+V, Ti+V+Nb, Ti+V+Nb+Zr, Ti+V+Nb+Zr+Ta, Ti+Nb, Ti+V+Zr, Ti+V+Nb+Ta, Ti+Zr, Ti+V+Ta, Ti+V+Zr+Ta, Ti+Ta, Ti+Nb+Zr, Ti+Nb+Zr+Ta, V+Nb, Ti+Nb+Ta, V+Nb+Zr+Ta, V+Zr, Ti+Zr+Ta, V+Ta, V+Nb+Zr, Nb+Zr, V+ Nb+Ta, Nb+Ta, V+Zr+Ta, Zr+Ta and Nb+Zr+Ta".

By "excluding a mixture consisting of the elements Ti+Ta" the subject-matter of claim 1 of the disputed patent has been limited compared to claim 1 of the parent application be deleting a single embodiment. This corresponds to the purpose of a divisional application, which in principle should be directed to a part of the parent application.

The deletion of one out of several embodiments does not create a new technical teaching regardless of the wording used a) to define the limited list of alternative embodiments and b) to express the deletion of the single embodiment.

In the present special circumstances, the introduction of the disclaimer is equivalent to a deletion of a single member from a list of alternatives and therefore does not create subject-matter going beyond the teaching of the parent application.

1.3 Even when applying the principles developed in G2/10 concerning undisclosed disclaimers, the subject-matter remaining in claim 1 of the disputed patent, i.e. the remaining 25 possible combinations of metals being present at ppm levels, is disclosed in the parent application as illustrated above by the alternative phrasing of claim 1.

The subject-matter of claim 1 therefore complies with the principles defined in G2/10.

1.4 In summary the Board reaches the final conclusion that the ground of opposition pursuant to Article 100(c) EPC in conjunction with Article 76 EPC does not prejudice the maintenance of the patent as granted.

2. Article 100(b) EPC

2.5 The appellant argues that the term "magnetic-% Co" and the parameter "CW_Cr" are not clearly and sufficiently defined in the disputed patent.

2.5.1 Concerning the term "magnetic-% Co"

According to the definition in claim 1 and in paragraph [0016] of the disputed patent the term "magnetic-% Co" refers to the weight percentage of magnetic cobalt (Co) whereas "wt-% Co" is the weight percentage of Co in the cemented carbide.

The skilled person is aware of the fact that the measured magnetic moment of the Co binder phase in cemented carbide is reduced compared to the theoretical magnetic moment of a binder phase of pure Co due to the diffusion of elements such as tungsten (W) into the binder phase. This is also indirectly confirmed in paragraph [0016] of the disputed patent by describing that the parameter "CW_Cr is a function of the W content in the Co binder phase".

Accordingly, measuring magnetic properties of cemented carbides is a well known and frequently used method in the characterization of cemented carbides, particularly of their binder phase, as is evident from documents D14 to D16:

D14 is a manual of the Koerzimat CS 1.096 by Foerster, an automated device for measuring the magnetic properties of cemented carbides.

D15 is a "good practice guide" for measuring the magnetic saturation of cobalt in the binder. It confirms on page 16, bottom to page 21 that the magnetic saturation can be used to measure the amount of tungsten and/or chromium dissolved in the cobalt binder phase since the magnetic saturation of the hard metal decreases linearly with the addition of tungsten and is not affected by the amount of carbon in solution.

D16 describes a ASTM-Standard for the measurement of magnetic saturation of a binder phase.

Therefore the term "magnetic-% Co" in regard to a WC-Co based cemented carbide is understood by the skilled person to refer to the amount of cobalt which still has

ferromagnetic properties which can be determined by saturation magnetisation of the Co binder phase.

2.5.2 Concerning the parameter "CW_Cr"

The parameter "CW_Cr" is defined by the formula given in claim 1:

CW_Cr = (magnetic-% Co + 1.13*wt-% Cr) /wt-% Co

Once the "magnetic-% Co" has been determined, the parameter "CW_Cr" can be easily calculated, since the amounts of chromium "wt-% Cr" and cobalt "wt-% Co" are known from the powder composition of the cemented carbide.

Claim 1 further defines that the parameter "CW_Cr" is within the range from 0.79 to 0.95, meaning that the ratio Me/Co may vary from 0.0005 to 0.00768.

The skilled person therefore obtains clear and precise instructions on how to calculate the parameter "CW_Cr", and further what it should be used for.

The appellant stresses that it was not clear whether the parameter "CW_Cr" or the term "magnetic -% Co" referred to the measurable saturation magnetisation.

However, the formula defined in claim 1 leaves no doubt that the parameter "CW_Cr" is to be determined by calculation and cannot be directly measured. Correspondingly the phrase "After sintering the CW_Cr and Hc were measured." in paragraphs [0027] and [0031] of the disputed patent may be unprecise, but leaves no room for doubts for the skilled person that the parameter can be calculated by using the formula as

presented in claim 1 and does not directly correspond to the measured saturation magnetisation as such.

2.6 The appellant further argues that the disputed patent does not provide sufficient information to enable the skilled person to produce a WC-Co cemented carbide having WC grains with a mean grain size smaller than 0.5 µm and to determine the grain size.

2.6.1 "With a grain size of 0.1 - 2.0 µm"

The examples of the disputed patent, in particular example 1I in table 1c, demonstrate that starting from WC having a particle size of 0.8 µm a cemented carbide having a grain size of about 0.6 µm can be obtained.

Although the examples do not achieve a grain size below 0.5 µm, a skilled person is aware that the final grain size depends for example on the sintering conditions (time and temperature) and the grain size of the starting material. The smaller the grain size of the starting material, the shorter the sintering time and the lower the sintering temperature, the smaller the grain size in the sintered material. The skilled person can therefore be expected to manufacture a cemented carbide having the required grain size by using a starting powder having an appropriately low grain size and by choosing the appropriate sintering conditions.

Using a starting material of smaller grain size may be experimentally more demanding as argued by the appellant.
However, it has not been demonstrated that the skilled person could not be able to obtain cemented carbide having a small grain size, even when confronted with higher experimental effort. Thereby the use of an inert

atmosphere to avoid known problems with handling very fine powders such as self-ignition, the formation of explosive mixtures and oxidation cannot be regarded as an undue burden which is caused by a lack of information.

2.6.2 Grain size determination

Example 1 of the disputed patent describes that the grain size is determined by coercivity measurements. According to example 2 the grain size is determined by the planimetric method by Jefferies.

Both methods are known in the art.

In this regard D15 confirms on page 12 that the measurement by coercivity is the "most widely used non-destructive method". Accordingly an ISO standard exists for this method of measurement, ISO 3326, which is described in more detail on pages 21 to 24 in chapter 3.4.2 of D15.

Moreover, determining the grain size e.g. by microscopy does not pose any problem for the skilled person and is routinely performed.

Therefore the skilled person knows methods to determine the particle size and is aware of the fact that differences in the accuracy of these methods exist. However, this does not mean that the methods lead to different results which cannot be compared. The skilled person is well aware of critical parameters in the conventional methods and will take them into consideration in order to achieve the required accuracy of the measurement results without undue burden.

Should the skilled person have doubts about clearly identifying whether he was operating within or outside the boundaries of claim 1, then this would relate to the clarity of the claim and not to sufficiency.

2.7 In summary the Board reaches the conclusion that the skilled person gets sufficient information from the patent to produce a cemented carbide as defined by claim 1. The ground of opposition pursuant to Article 100(b) EPC therefore does not prejudice the maintenance of the patent as granted.

3. Article 100(a) EPC in conjunction with Article 56 EPC

The disputed patent aims at providing fine or submicron grained cemented carbide cutting tools with improved binder phase distribution and reduced amounts of abnormal WC grains, which result in cemented carbide tools with improved mechanical and cutting properties (paragraph [0012]).

3.1 D4 as the closest prior art

Document D4, similarly to the patent, aims at cemented carbides having a fine-grained alloy structure, an improved suppression of hard phase grain growth and an excellent strength and toughness (paragraph [0006]). It therefore represents a suitable starting point for the assessment of inventive step.

3.1.1 It discloses in claim 1 and paragraph [0008] respectively a fine grained cemented carbide consisting of a WC hard phase, a binder phase of 2 to 15% by weight of Co and additives of a first metal and a second metal. The first metal consists of one or more

metals (Me) selected from Ti, Zr, Hf, Nb and Al, and may be present in the cemented carbide body in an amount from 0.01 to 5% by weight. The second metal consists of one or more metals selected from Cr, Ta and V, and may be present in an amount to fulfill a weight ratio of the total amount of said second metal to the binder phase within the range of 0.02-0.5 % by weight.

Exemplified cemented carbide compositions comprising grain refining elements are summarised in table 4. Examples 11, 18 and 19 describe chromium containing cemented carbides comprising in addition refining elements selected from Ti, Zr and Nb. The cemented carbides of all examples of D4 have a Me/Co ratio above 0.13.

3.1.2 The subject-matter of claim 1 differs from the carbides of examples 11, 18 and 19 of D4 in that the Me/Co ratio is within the range of 0.0005 to a maximum of between 0.0064 and 0.00768 depending on the CW_Cr value. The low Me/Co ratio indicates that the further grain refining elements are used at low ppm levels (features 1.10 to 1.12 of claim 1).

3.1.3 According to paragraphs [0001] and [0011] of the disputed patent low ppm levels of grain refiners Ti, V, Nb, Zr and/or Ta are used to achieve low grain growth without obtaining an embrittling secondary phase, thereby improving the mechanical properties.

Table 1c of the disputed patent shows grain sizes similar to those reported in table 4 of D4. This demonstrates that the larger amounts of grain refiner used according to D4 (Me/Co ratio above 0.13) are in fact not needed for chromium containing cemented carbides as defined in claim 1 of the patent.

3.1.4 The objective technical problem can therefore be regarded as providing a cemented carbide having a fine grain size with better mechanical properties.

3.1.5 D4 discloses in claim 1 that the first metal (i.e. the grain refining element) can be used in an amount from 0.01 to 5 wt.-%.

However, D4 does not teach or give any hint to the skilled person that the same grain size can be obtained irrespective of the amount of grain refining elements. In particular, D4 does not suggest that the same fine grain size as reported in the examples can also be obtained when using the grain refining elements at much lower levels, notably at 0.01 wt.-% or even below.

On the contrary, comparing examples 1 to 10 with examples 21 to 30 of D4 indicates the opposite. Examples 1 to 10 and 21 to 30 only differ by the amount of grain refining agent, which is lower in the latter set of examples. The grain size obtained by examples 21 to 30 on average is much higher than the grain size obtained by examples 1 to 10.

Hence, starting from D4 the skilled person would not have expected that the same fine grain size can be obtained when repeating examples 11, 18 and 19 of D4 whilst dramatically reducing the amount of the grain refining element being present in addition to chromium.

3.1.6 The skilled person does also not get an incentive to reduce the amount of the grain refining element when considering D5 or D6.

D5 discloses in claim 1 compacts comprising cubic boron nitride or diamond particles and is not relevant for cemented carbide bodies comprising tungsten carbide as hard particles.

D6 concerns magnetic moment measurements on hard metals and does not comment on additions of Ti, Nb, Zr, V and Ta in very small amounts, see abstract.

3.1.7 The cemented carbide of claim 1 is therefore not obvious when starting from D4 even when considering D5 and D6.

3.2 D10 as the closest prior art

3.2.1 The appellant argued for the first time in appeal proceedings that D10 represents a suitable starting point for the assessment of inventive step.

Since document D10 had already been used for the assessment of novelty in the opposition proceedings (see point 4 of the reasons of the contested decision), the Board will take this line of argument into consideration.

3.2.2 D10 discloses a method of making a fine-grained WC-Co cemented carbide (claim 1). Example 5 discloses a cemented carbide comprising 5.2 wt-% Co, 0.6 wt-% Cr_3C_2 and WC. The content of 0.6 wt-% Cr_3C_2 corresponds to 0.52 wt-% Cr, and the Cr/Co ratio by weight is 0.1.

D10 does not disclose that the fine-grained WC-Co cemented carbide can comprise a further grain growth inhibiting element.

The subject-matter of claim 1 differs from the cemented carbide described in example 5 of D10 in that it comprises ppm levels of: a) one of V, Nb, Zr, Ta, or b) mixtures of at least two of Ti, V, Nb, Zr, Ta with the exception of Ti+Ta and in that the ratio Me/Co is within the range as defined in claim 1.

According to paragraph [0012] of the disputed patent the presence of low levels of elements as defined in claim 1 leads to a pronounced grain refining effect in chromium containing cemented carbide. This statement is confirmed by the experimental evidence in the examples of the disputed patent (tables 1c) and 3c)).

The objective technical problem can therefore be regarded as the provision of a cemented carbide comprising chromium having a refined grain size.

D10 discloses in paragraph [0029] that Cr, V and/or Ta can be added as conventional grain growth inhibitors. The exemplified cemented carbides disclosed in D10 comprise either Cr, V or Ta.

The teaching of D10 is therefore more remote from the claimed subject-matter of the patent than D4, since it does not disclose the use of chromium in combination with further grain refining elements.

Even if the skilled person would consider further refining elements on the basis of its general knowledge, no teaching can be found in D10 which could motivate the skilled person to use further refining agents in very low amounts with the expectation of a further refinement of the particle size.

Therefore starting from D10 the subject-matter of claim 1 of the patent is not obvious.

3.3 In summary the Board therefore reaches the final conclusion that the ground of opposition pursuant to Article 100(a) in conjunction with Article 56 EPC does not prejudice the maintenance of the patent as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated