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Datasheet for the decision of 24 June 2021

Case Number: T 2036/17 - 3.2.03

Application Number: 12162058.7

Publication Number: 2644299

IPC: B22F7/06, B23B27/00

Language of the proceedings: EN

Title of invention:
Cemented carbide body and method for manufacturing the cemented carbide body

Patent Proprietor:
SECO TOOLS AB

Opponent:
Ceratizit Austria GmbH

Headword:

Relevant legal provisions:
EPC Art. 83, 56

Keyword:
Sufficiency of disclosure - (yes)
Inventive step - main request (no) - auxiliary request (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2036/17 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 24 June 2021

Appellant: (Opponent)	Ceratizit Austria GmbH Metallwerk-Plansee-Strasse 71 6600 Reutte (AT)
Representative:	Nordmeyer, Philipp Werner df-mp Dörries Frank-Molnia & Pohlman Patentanwälte Rechtsanwälte PartG mbB Theatinerstraße 16 80333 München (DE)
Respondent: (Patent Proprietor)	SECO TOOLS AB 737 82 Fagersta (SE)
Representative:	WSL Patentanwälte Partnerschaft mbB Postfach 6145 65051 Wiesbaden (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 10 July 2017 concerning maintenance of the European Patent No. 2644299 in amended form.**

Composition of the Board:

Chairman	C. Herberhold
Members:	B. Miller
	E. Kossonakou

Summary of Facts and Submissions

I. European patent No. 2 644 299 (the "patent") relates to a method for manufacturing a cemented carbide body.

II. The opposition division decided that the patent met the requirements of the EPC on the basis of the claims of auxiliary request III submitted during the oral proceedings on 21 June 2017.

III. This interlocutory decision was appealed by the opponent (the "appellant"). They requested that the decision under appeal be set aside and the patent be revoked.

IV. The proprietor (the "respondent") requested that the appeal be dismissed or that the patent be maintained on the basis of one of auxiliary requests I to III filed with the reply to the grounds of appeal. The set of claims according to auxiliary request III discussed in the contested decision of the opposition division therefore constitutes the main request of these appeal proceedings.

V. Wording of the independent claims

Claim 1 according to the main request reads as follows:

"A method for manufacturing a cemented carbide body (1), comprising the following steps:
- forming a first part (2, 9, 14, 17) of a first powder composition comprising a first carbide and a first binder phase by injection moulding or extrusion,
- sintering the first part (2) to full density in a

first sintering operation,
- forming a second part (3) of a second powder composition comprising a second carbide and a second binder phase by uniaxial or multiaxial pressing,
- sintering the second part (3) to full density in a second sintering operation,
- bringing a first surface (4) of the first sintered part (2) and a second surface (5) of the second sintered part (3) in contact,
- joining the first and second surface in a heat treatment operation, and
- performing the heat treatment operation for joining the at least first and second part at a temperature where the first binder phase and the second binder phase are in liquid state for at least one minute."

Claim 1 of auxiliary requests I and II corresponds to claim 1 of the main request whereby the following feature according to claim 5 as granted has been added at the end of claim 1:

"and
- arranging at least one metal foil or metal film (6) between the first surface (4) and the second surface (5), before performing the heat treatment operation".

Claim 2 of auxiliary request I corresponds to claim 1 of the main request whereby the following feature according to claim 8 as granted has been incorporated:

"and
- grinding the first and second surfaces to plane and parallel surfaces".

VI. State of the art

The following documents, cited already during the opposition proceedings, are referred to in this decision:

D1: DE 32 08 282 A1;
D2: US 6 908 688 B1;
D3: "Hartmetall für den Praktiker", Schedler, Wolfgang, 1988, VDI-Verlag GmbH, pages 92 to 109;
D4: "Cemented tungsten carbides", Upadhyaya, Gopal. S, 1998, Noyes Publications, pages 100 to 103 and 130 to 133;
D7: "Modern Ceramic Engineering", David. W. Richerson, 1992, Marcel Dekker Inc., pages 128 to 129;
D8: "Liquid Phase Sintering", Randall M. German, 1985, Plenum Press, pages 5 to 10.

VII. Oral proceedings were held on 24 June 2021 by videoconference with the consent of both parties.

VIII. The appellant's arguments, as far as they are relevant for this decision, can be summarised as follows.

(a) Article 100(b) EPC

The patent did not provide a clear definition for the expression "sintered to full density" in claim 1. Paragraph [0012] of the patent provided three different definitions for the expression:

i) a density of 99.5% of theoretical density,
ii) a density of 99.9% of theoretical density and
iii) a density that will not change during the subsequent heat treatment operation.

Moreover, the patent did not even define what was meant by the expression "theoretical density" referred to in paragraph [0012] of the patent.

The skilled person was therefore unable to determine whether or not he/she was working within the scope of protection.

(b) Article 56 EPC - Main request

D1 disclosed a method of manufacturing a cutting tool by joining different fully sintered parts.

Using different methods for forming the parts to be joined resulted in an increased process flexibility.

The objective technical problem could therefore be regarded to be to provide a more flexible manufacturing method for cemented bodies.

The skilled person was aware of various different production methods for green bodies such as extrusion, injection moulding, uniaxial and multiaxial pressing and their advantages as evidenced by D2 to D4.

It was obvious to choose the most suitable manufacturing method dependent on the shape and the desired properties of the parts to be joined to form a cemented body.

(c) Article 56 EPC - Auxiliary requests I and II

It was common practice for the skilled person to arrange at least one metal foil or metal film on the contact surface of the bodies to be joined. Moreover, a

film of cobalt was inherently formed during sintering of a cemented body. Said inherently formed cobalt film was then arranged between the first and second surfaces upon bringing these surfaces in contact.

Therefore the subject-matter of claim 1 of auxiliary requests I and II was obvious when starting from D1 for the same reasons as for claim 1 of the main request.

Grinding was a conventional process step before joining parts in order to increase the contact surface.

Therefore the subject-matter of claim 2 of auxiliary request I was likewise obvious when starting from D1 for the same reasons as claim 1 of the main request.

IX. The respondent's respective arguments can be summarised as follows.

(a) Article 100(b) EPC

Paragraph [0012] of the patent clearly defined that the expression "sintered to full density" referred to a density of 99.5% of the theoretical density. Disclosing in addition a preferred, more limited definition and the technical consequence thereof rendered the expression not unclear and placed no undue burden on the skilled person. The expression "theoretical density" had a clear technical meaning for the skilled person as evidenced by D7 and D8.

(b) Article 56 EPC - Main Request

In view of the prior art discussed in D1 on page 11 it had to be concluded that D1 related to a manufacturing

process according to which the green bodies of different material and shape were formed by pressing.

The subject-matter of claim 1 differed from the disclosure in D1 in that fully sintered parts are joined, which were formed by different manufacturing methods as defined in claim 1.

Forming a cemented body by using an extruded or injection moulded part together with an uniaxially or multiaxially pressed part, both of which had been fully sintered, enabled the skilled person to manufacture a cemented body without cracks - which were usually formed due to the different sintering properties of green bodies manufactured by different methods - comprising a first part having a thin wall thickness and a complex geometry and a second part having a thick wall thickness and a simple geometry.

This was not obvious in view of the cited prior art. In particular, neither D1 nor one of the further cited documents D2 to D4 provided an incentive to join fully sintered parts having a complex geometry and a thin wall thickness which have been formed by injection moulding or extrusion with further fully sintered parts having a thick wall thickness which have been formed by uniaxial or multiaxial pressing.

(c) Article 56 EPC - Auxiliary Requests I and II

Compared to claim 1 of the main request the subject-matter of claim 1 differed further from the disclosure in D1 in that a metal foil or film was applied between the surfaces to be joined.

D1 aimed at a process which did not require metal as a bonding aid (soldering agent) as evident from claim 1 or page 12, second paragraph of D1.

Hence D1 taught away from the method according to claim 1 of auxiliary requests I and II.

None of the cited documents disclosed that it was beneficial to apply a further grinding step before joining the sintered parts. Hence, starting from D1 the subject-matter of claim 2 of auxiliary request II was also not obvious.

Reasons for the Decision

1. Article 100 (b) EPC

1.1 The objection of lack of sufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts. Otherwise it is unlikely to succeed.

In order to establish insufficiency, the burden of proof is upon an opponent to establish on the balance of probabilities that a skilled reader of the patent, using his common general knowledge, would be unable to carry out the invention (Case Law of the Boards of Appeal, 9th edition, 2019, Chapter II.C.9).

1.2 The appellant questions the reproducibility of the claimed invention with regard to the expression "sintered to full density" used in claim 1.

In this respect, it is to be noted that according to established case law the patent specification as a whole, and not claim 1 as such, must convey a workable teaching for the skilled person (Case Law of the Boards of Appeal, 9th edition, 2019, Chapter II.C.3.1).

Paragraph [0012] of the contested patent teaches in regard to the expression "sintered to full density":

"In this description and in the claims with full density is meant a density of at least 99.5 percent of theoretical density, preferably a density of at least 99.9 percent of theoretical density. By this the density of the first and second part will not change during the heat treatment operation."

Paragraph [0012] therefore does not provide three different definitions for the expression "sintered to full density" as argued by the appellant, but clearly states that it refers to a density of at least 99.5% of the theoretical density. The paragraph then "discloses merely a preferred option by stating that sintered to full density" can refer to a density of at least 99.9% of the theoretical density. Finally, the last sentence in paragraph [0012] explains what the consequence of a sintering to full density is, namely that the first and second part of the cemented carbide body will not change during the heat treatment operation according to claim 1.

Consequently, paragraph [0012] of the patent leaves no doubt for the skilled person that "sintered to full density" requires a sintering step at a temperature and for a time so that the density obtained is at least 99.5 % of the theoretical density.

1.3 This explicit definition in paragraph [0012] is also not in contradiction to the following statement in paragraph [0030] of the patent:

"As the parts that are to be joined together by heat treatment in the heat treatment operation have already been sintered to their final density, i.e. a density that is close to the theoretical density, it is possible to use different compositions of the material in different parts of the cemented carbide body."

On the contrary, this sentence simply paraphrases the definition in paragraph [0012], since a density of at least 99.5% of the theoretical density is nothing else than a density that is close to the theoretical density.

Therefore, the statement in paragraph [0030] casts no doubt on the definition presented in paragraph [0012] and in particular does not provide any further definition for the expression "sintered to full density" used in claim 1.

1.4 Furthermore, the expression "theoretical density" mentioned in paragraph [0012] is a technical term readily understood by a person skilled in the art. This is evidenced by the textbook D7. It presents a general definition of the theoretical density on page 128, first paragraph:

"For many applications, it is desirable to produce a ceramic material that contains minimum open and closed porosity. If this ceramic could be densified completely to contain no open or closed porosity, it would consist only of a mixture of solid phases. This pore-free condition would represent the maximum bulk density

achievable for the specific composition and is referred to as the theoretical density. Theoretical density is often used as a standard against which to compare the actual bulk density achieved for a material. For example, if a material contained 10% porosity, it would be defined as 90% of theoretical density."

This definition in document D7 corresponds to the definition given on page 8, in the second paragraph of chapter E "Nomenclature" of D8 which states that "Theoretical density corresponds to a pore-free solid density".

1.5 Hence, the Board agrees with the reasons in point I.2.2 of the contested decision and concludes that the invention as defined in the patent fulfils the requirements of Article 83 EPC. The ground of opposition pursuant to Article 100(b) EPC therefore does not prejudice the maintenance of the patent on the basis of the present main request.

2. Article 100 (a) in combination with Article 56 EPC - Main Request

2.1 The patent relates to a method for manufacturing a metal cutting member of cemented carbide being composed of at least two parts formed in two separate forming operations without the risk for the formation of cracks in the cutting member.

D1 aims at the same purpose as the patent and concerns a method for the production of a cemented carbide cutting tool by means of joining two separate bodies.

The Board therefore agrees with the assessment in point I.2.6.1 of the contested decision that D1 is a suitable starting point for the assessment of inventive step.

2.2 D1 discloses in claim 1 a method of securely bonding a first body of cemented carbide to at least one second body made of cemented carbide of a different composition than said first body, which comprises sintering said first and second bodies while in contact with each other.

D1 discloses on page 18, second paragraph (reference is made to the handwritten page numbering) that the two cemented bodies can be used both in a pre-sintered and in a finished, fully sintered state:

"Die miteinander und/oder mit einer Metallunterlage nach dieser Erfindung zu verbindenden Sinter-Hartmetall-Körper können entweder in dem endgültigen, fertig gesinterten Zustand oder in einem vorgesinterten Zustand sein. Die Temperaturen, bei denen die Verbindung nach dieser Erfindung durch Sintern hergestellt wird, muss nach den besonderen Umständen jedes einzelnen Falles festgelegt werden."

D1 therefore discloses that the cemented carbide bodies can be joined by sintering in two different states:

a pre-sintered state and
a finished, fully sintered state.

In the sentence bridging pages 19 and 20 D1 discloses the embodiment in more detail according to which two or more finished, fully sintered cemented carbide bodies of different compositions are bonded to each other by sintering.

This general disclosure in D1 is further supported by the embodiment disclosed in the paragraph bridging pages 24 and 25 in relation to the embodiment shown in figure 2.

2.3 D1 does not explicitly define what is meant by the expression "endgültigen, fertig gesinterten Zustand" (finished, fully sintered state). However, the terms "endgültig" and "fertig" clearly imply to the skilled person that the sintering has been completely finished. The sintering of a cemented body for a hard metal tool is only considered to be finished and completed, when there are practically no pores left in the body, since only then the desired mechanical properties of the cemented body are obtained.

Therefore the skilled person would interpret the finished, completely sintered state in D1 as corresponding to a condition where the body has been sintered to full density.

D1 therefore clearly makes a distinction between a method using only finished, fully sintered parts and a method using also pre-sintered parts.

With both parts fully sintered, no further shrinking of the parts to be joined occurs, such that in this case there is no crack formation due to possibly different sintering properties of the green bodies, independent of their method of manufacture.

2.4 D1 does not explicitly define by which process the parts to be joined are manufactured.

However, on page 11, lines 1 to 4, D1 refers to a process according to the prior art for forming cemented bodies which makes use of pressed parts ("Pressling geformt und anschließend in der üblichen Weise gesintered wird"). Based on the disadvantages observed with regard to this process, D1 proposes a manufacturing method which does not require the use of a metal soldering agent ("Lötmittel"), see claim 1 of D1 or page 12, first complete paragraph.

The respondent concludes from the discussion of the prior art in D1, that all green bodies to be joined according to the method of D1 are formed by pressing.

2.5 Following this argument of the respondent, the method of claim 1 differs from the embodiment described in the sentence bridging pages 19 and 20 in that one cemented part is produced by either injection moulding or extrusion and that only the second part is produced by pressing, either uni- or multiaxial.

2.6 The patent does not disclose a specific technical effect which is achieved due to the choice of the specific manufacturing methods for the green bodies to be joined. In particular, it does not describe any advantage or effect with respect to crack formation by joining parts which have been formed with different manufacturing methods as defined in claim 1.

Furthermore, claim 1 does not specify the shape or function of the first and the second part of the cemented carbide body to be manufactured. Hence it is not required by claim 1 that a first part having a thin wall thickness and a complex geometry is to be joined with a second part having a thick wall thickness and a simple geometry. Consequently, the shape and the wall

thickness of the parts to be joined cannot be taken into account for formulating the objective technical problem, contrary to the argument of the respondent.

It can however be accepted that in general terms the use of different techniques for forming the individual parts to be joined increases the process flexibility.

2.7 The objective technical problem can therefore be regarded as to be the provision of a more flexible manufacturing method for complex cemented bodies.

2.8 The skilled person is aware of the different commonly used manufacturing methods such as extrusion, injection moulding, uni- and multiaxial pressing and he/she is further used to selecting an appropriate method dependent on the required geometry and properties of the part to be formed. This general knowledge of the skilled person is reflected in the disclosure in paragraph [0005] of the patent and is further confirmed by D2 to D4.

2.8.1 D2 teaches in column 9, lines 58 to 63 that uniaxial pressing, dry or wet bag cold isostatic pressing, as well as extrusion and injection molding are commonly known production paths for forming hard metal bodies and that the appropriate manufacturing process is typically chosen according to the desired shape of the body to be produced:

"Each mixture is then formed, either serially or in parallel, into a green body by a convenient method such as those known in the art, examples being, uniaxial pressing in hard steel tooling, dry or wet bag cold isostatic pressing in rubber tooling, extrusion and

injection molding. The particular method is selected primarily by the shape that is desired."

2.8.2 D3 confirms that the skilled person is aware of various manufacturing processes and their advantages, see chapter 3.4.1 concerning direct pressing, chapter 3.4.2 concerning axial pressing or extrusion, chapter 3.4.4 concerning cold isostatic pressing.

2.8.3 D4 further demonstrates that the skilled person is aware of the possibility to form parts from powder compositions by using a screw extruder, a piston extruder (figure 7, on page 102) or powder injection moulding (chapter 7.3 on page 130).

2.9 Selecting an alternative manufacturing method for producing one of the parts of a cemented body produced according to the process described in the sentence bridging pages 19 and 20 of D1 does not require inventive skills. Dependent on the intended shape of a specific part, this is rather done by the skilled person within usual practice while taking into account the known advantages and limitations of the conventional manufacturing methods.

The subject-matter of claim 1 of the main request is therefore regarded to be obvious when starting from D1 and does not fulfil the requirements of Article 56 EPC.

3. Article 56 EPC - Auxiliary Request I

It is undisputed that D1 also represents the closest prior art for the subject-matter of claim 2 of auxiliary request I.

It is further uncontested that the subject-matter of claim 2 differs from the manufacturing method of D1 by the same features as claim 1 of the main request and in addition in that the method comprises the step of grinding the first and second surfaces to plane and parallel surfaces.

Although the appellant has not provided any evidence in relation to grinding, the Board accepts that grinding is a conventional process step before joining body parts. In fact the principle to smooth contact surfaces in order to increase the area of contact between the contact surfaces and to achieve a better bonding is well known to a skilled person.

Thus, with respect to claim 2, the same argument as with respect to claim 1 of the main request applies, since a further grinding step is a commonly applied process for improving the adherence of body surfaces and is considered by the skilled person within usual practice.

The subject-matter of claim 2 of auxiliary request I is therefore regarded as obvious when starting from D1 and does not fulfil the requirements of Article 56 EPC.

4. Article 56 EPC - Auxiliary Request II

It is undisputed that D1 also represents the closest prior art for the subject-matter of claim 1 of auxiliary request II.

According to claim 1 at least one metal foil or metal film has to be arranged between the first surface and the second surface.

Inherently forming a metal film on the surface of the body during sintering due to diffusion of the metal binder ("Ausschwitzen") does not fulfil the requirement of claim 1 according to which a metal film or foil has to be arranged between the first and second surface in a separate method step, i.e. in addition to the step of bringing a first surface of the first sintered part and a second surface of the second sintered part in contact.

The subject-matter of claim 1 therefore differs from the manufacturing method of D1 by the same features as claim 1 of the main request and in addition in that the method comprises the step of arranging at least one metal foil or metal film between the first surface and the second surface before performing the heat treatment operation.

D1 on the contrary aims at a process which does not require metal as a bonding aid (soldering agent), see claim 1 or page 12, second paragraph.

Starting from D1 the subject-matter of claim 1 of auxiliary request II is therefore not obvious, since D1 teaches away from applying a metal film or metal foil between the surfaces to be joined by a heat treatment.

Paragraph [0019] of the patent teaches that improved wetting can be achieved by using a metal film or foil during the joining step by sintering.

This effect is also not derivable from the further documents cited by the appellant, which do not teach that the bonding of fully sintered parts can be improved by applying a metal film or foil before the heat treatment resulting in the binding of the parts.

It follows that the subject-matter of claim 1 of auxiliary request II is not obvious in view of the cited prior art. Article 56 EPC therefore does not prejudice the maintenance of the patent in amended form on the basis of auxiliary request II.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of the following documents:
   - claims 1 to 7 of auxiliary request II
   - description pages 2 to 6 filed at the oral proceedings before the Board and
   - figures 1 to 8 of the patent specification.

The Registrar: The Chairman:

C. Spira C. Herberhold

Decision electronically authenticated