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Datasheet for the decision of 15 January 2019

Case Number: T 0100/15 - 3.2.03

Application Number: 07013153.7

Publication Number: 1878522

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Language of the proceedings: EN

Title of invention:
Mass production of tridimensional articles made of intermetallic compounds

Patent Proprietor:
Ge Avio S.r.l.

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 123(2), 83

Keyword:
Amendments - intermediate generalisation
Sufficiency of disclosure - completeness of disclosure

Decisions cited:

Catchword:

Europäisches Patentamt
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Beschwerdekammern

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Case Number: T 0100/15 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 15 January 2019

Appellant: (Patent Proprietor)	Ge Avio S.r.l. Via I Maggio, 99 10040 Rivalta di Torino (TO) (IT)
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Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Kaiser, Axel CT IP S DE Corporate Intellectual Property and Functions Postfach 22 16 34 80506 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 20 November 2014 concerning maintenance of the European Patent No. 1878522 in amended form.**

Composition of the Board:

Chairman	G. Ashley
Members:	B. Miller
	G. Weiss

Summary of Facts and Submissions

I. European patent No. 1 878 522 relates to a process for the mass production of tridimensional articles made of intermetallic compounds.

II. An opposition was filed against the patent and based on Article 100(a) EPC together with Articles 54 and 56 EPC, Article 100(b) EPC and Article 100(c) EPC.

III. The interlocutory decision of the opposition division was appealed by both parties, the patent proprietor (appellant I) and the opponent (appellant II).

Since both parties are appellants and respondents, they are referred to as the proprietor and the opponent in in this decision.

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

V. The proprietor requested that the decision under appeal be set aside and the patent be maintained as granted, alternatively on the basis of one of auxiliary requests 1 to 4 submitted with the grounds of appeal or of auxiliary requests 5 to 6 filed with the letter dated 4 December 2018 or of auxiliary request 7 submitted during the oral proceedings before the Board.

VI. Documents referred to in this decision

a) documents already cited in the contested decision:

NPL3: B. Haller - Development of a new high AN^2 last LP stage turbine & Exhaust Systems - A cost

effective solution for the 21st century, Proc. of Turbo Expo 2005, pages 1 to 8;

NPL4: Ti-Al phase diagram.

b) documents submitted by the proprietor with the statement setting out the grounds of appeal:

NPL6: Thesis from Carell Elizabeth Weeks with the title "Evaluation of a gamma titanium aluminide for hypersonic structural applications", 2015, pages 1 to 127;

NPL7: S.F.Frazén and J. Karlsson, Diploma work No.37/2010 with the title "γ-Titanium Aluminide Manufactured by Electron Beam Melting", 2010, pages 1 to 89.

VII. The sole independent claim 1 according to the main request (claims as granted) reads as follows:

"A process for the mass production of three-dimensional articles made of an intermetallic compound based on titanium and aluminium by electron beam melting, comprising the steps of:

a) generating a three-dimensional mathematical model of said articles and storing it in a control unit;

b) preparing the powders of the intermetallic compound with the same chemical composition as the final intermetallic compound with which said articles are produced, wherein the grain size of said powders ranges from 20 to 150 µm;

c) depositing a quantity of said powders in a melting chamber to form a layer of powders with a regular and substantially uniform thickness;

d) preheating said layer of powders deposited in said melting chamber to a temperature not lower than 700°C but below the melting point of said powders;

e) performing melting in high vacuum conditions by scanning with a focused electron beam in the area corresponding to a cross section of said articles according to the three-dimensional model stored in said control unit;
f) bringing the upper surface of the last cross section of said articles thus formed to the level of the powders located in said melting chamber and which are arranged around the portions already formed of said articles; and
g) repeating said steps from c) to f) until the last cross section of said articles is reached according to the three-dimensional model stored in said control unit,and
h) providing a final cooling step of said articles at the end of their formation in a inert gas atmosphere once the temperature of the articles has dropped below about 1200 °C".

Claim 1 of auxiliary request 1 is based on claim 1 of the main request wherein the first four lines read as follows (difference over granted claim 1 is indicated in bold):

"A process for the mass production of three-dimensional articles made of an intermetallic compound based on titanium and aluminium **having properties of low density and high resistance to high temperatures** by electron beam melting, comprising the steps of:"

Claim 1 of auxiliary request 2 is based on claim 1 of the main request wherein the first four lines read as follows:

"A process for the mass production of three-dimensional articles made of an intermetallic compound based on

titanium and aluminium, **including γTiAl and α_2Ti_3Al intermetallic compounds**, by electron beam melting, comprising the steps of:"

Claim 1 of auxiliary request 3 is based on claim 1 of the main request wherein the first four lines read as follows:

"A process for the mass production of three-dimensional articles made of an intermetallic compound based on titanium and aluminium, **said articles being produced using γTiAl intermetallic compounds** by electron beam melting, comprising the steps of:".

Claim 1 of auxiliary request 4 is based on claim 1 of the main request wherein the first four lines read as follows:

"A process for the mass production of three-dimensional articles made **of a γTiAl** intermetallic compound based on titanium and aluminium by electron beam melting, comprising the steps of:".

The process steps a) to h) according to claim 1 of each of auxiliary requests 1 to 4 correspond to steps a) to h) of the main request.

Claim 1 of auxiliary request 5 is based on claim 1 of auxiliary request 3 wherein process step h) reads:

"h) providing a final **controlled** cooling step of said articles at the end of their formation in a inert gas atmosphere once the temperature of the articles has dropped below about 1200 °C".

Claim 1 of auxiliary request 6 is based on claim 1 of auxiliary request 3 wherein process step h) reads:

"h) providing a final **controlled** cooling step of said articles at the end of their formation in a inert gas atmosphere **by feeding a flow of inert gas into the melting chamber at a pre-established pressure** once the temperature of the articles has dropped below about 1200 °C".

Claim 1 of auxiliary request 7 is based on claim 1 of auxiliary request 3 wherein process step h) reads:

"h) providing a final cooling step of said articles at the end of their formation in a inert gas atmosphere **by feeding a flow of inert gas into the melting chamber at a pre-established pressure** once the temperature of the articles has dropped below about 1200 °C".

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 were held on 15 January 2019.

X. The proprietor's arguments, as far as relevant for this decision, can be summarised as follows.

The amendments to claim 1 as filed did not generate a technical teaching which went beyond the teaching of the application as filed.
Page 6, lines 24 to 30 of the application as filed (paragraph [0032] of the application as published)

disclosed that cooling did not influence the microstructure of the articles produced using γTiAl.

The temperature triggering the cooling in an inert gas atmosphere was not linked to a specific intermetallic material, i.e. γTiAl.

In this context the term "γTiAl" did not refer strictly to the γ-phase of titanium aluminide but to all possible intermetallic compounds based on titanium (Ti) and aluminium (Al) as evident from the teaching on page 2, lines 4 to 13 of the application (paragraph [0008] of the application as published).

Even if the term "γTiAl" on page 6, line 30 was considered literally, it was evident, when reading the application as a whole, that γTiAl was only a preferred material. Omitting an optional feature from the wording of a claim did not change the teaching of the application as filed.

Taking into account the description of the application as a whole and in particular the embodiment described on page 12, lines 19 to 23 it was clear to the skilled person that the expression "controlled cooling" on page 6, line 28 did not imply that a specific cooling rate or temperature gradient had to be obtained. It merely referred to a step of cooling under an inert atmosphere and did not add any further technical teaching, since any cooling step was controlled to a certain extent.

Claim 1 of the main request defined that the cooling could start in an inert atmosphere, once the temperature of the article reached 1200 °C. Thus, the cooling was inherently controlled by paying attention

to the threshold temperature indicated in the claim and by controlling the atmosphere. Furthermore, allowing the cooling to take place in an inert atmosphere achieved a faster and thus controlled cooling when compared to the processes known from the prior art which performed the cooling under vacuum.

The application as filed did not describe any further special cooling step which could qualify as a controlled cooling. In particular, it did not disclose that a flow of gas was passed through the melting chamber for achieving a controlled cooling or even cooling at all.

The omission of the term "controlled" from the wording of claim 1 did not extend the teaching of the application as originally filed, since it was only a label without any further technical meaning.

Claim 1 of auxiliary requests 1 to 4 further defined the intermetallic compounds in line with the teaching on page 2, lines 4 to 7 of the application as filed.

Claim 1 of auxiliary request 5 defined that step h) is a controlled cooling step as disclosed literally on page 6 as originally filed.

The skilled person had no difficulty in repeating the process according to claim 1 of auxiliary request 5, since the "3D metal printing process" was known in the art. A controlled cooling was achieved by providing an inert gas atmosphere in the melting chamber, once the temperature of the article has reached 1200 °C. Hence, the skilled person had no difficulty to repeat the claimed process.

Claim 1 of each of auxiliary requests 6 and 7 was based on the teaching on page 6, lines 24 to 30 of the application as filed.

XI. The opponent's respective arguments can be summarised as follows.

The subject-matter of claim 1 of the main request and of each of the auxiliary requests 1 to 4 generated a generalisation of the teaching on page 6, lines 24 to 30 of the application as filed, which taught the specific conditions for starting the cooling ("once the temperature of the articles has dropped below approximately 1200 °C") only in combination with a specific intermetallic compound ("γTiAl") under specific conditions ("controlled cooling").

The contested patent did not describe how the controlled cooling had to be performed, i.e. which cooling rate and which temperature gradient could be tolerated. Therefore the process according to claim 1 of auxiliary request 5 could not be repeated without undue burden by the skilled person.

The application as filed did not disclose that a controlled cooling step can be performed "in an inert gas atmosphere by feeding a flow of inert gas into the melting chamber at a pre-established pressure" as defined by claim 1 of auxiliary request 6.

Claim 1 of auxiliary request 7 did not define a "controlled" cooling step and therefore constituted an intermediate generalisation for the same reasons as claim 1 of the main request.

Reasons for the Decision

1. Main Request - Article 100(c) EPC

1.1 Claim 1 of the main request is based on claim 1 as filed, which has been amended inter alia by adding process step h):

h) providing a final cooling step of said articles at the end of their formation in a inert gas atmosphere once the temperature of the articles has dropped below about 1200 °C.

1.2 The only teaching in the application as filed which could form the basis for step h) according to claim 1 can be found on page 6, lines 27 to 30 of the application as filed (paragraph [0032] of the application as published, lines 41 to 45), which reads:

"In fact, it has been found that controlled cooling, once the temperature of the articles has dropped below approximately 1200°C does not influence the microstructure of the articles produced using γTiAl intermetallic compounds."

Therefore the specific starting temperature for the controlled cooling (once the temperature of the articles has dropped below approximately 1200 °C), the specific intermetallic material (γTiAl) and the cooling method (controlled cooling) are described together and are linked to each other.

This teaching in the application as filed reflects the technical understanding of the skilled person.

It is generally known that the microstructure depends on the cooling rate, which initiates phase transitions at certain temperatures, and which varies from material to material dependent on the various phases which can be produced in each individual material.

It follows that the selected starting temperature for the cooling cannot be generalised independently

a) to any possible intermetallic material based on titanium and aluminium and
b) to any cooling method.

1.3 Concerning the generalisation a)

1.3.1 The application as filed does not disclose that the specific cooling method described on page 6, lines 27 to 30 for γTiAl intermetallic compounds can be used for any intermetallic compounds based on aluminium and titanium to create a stable microstructure irrespective of the content of aluminium, titanium and any further possible elements.

1.3.2 Page 2, lines 4 to 7 (paragraph [0008] of the application as published, lines 52 to 58) discloses in this regard:

"Titanium and aluminium intermetallic compounds, and in particular the compounds defined with the abbreviation γTiAl (γ Titanium Aluminides), represent the group of intermetallics ..."

The application as filed therefore makes it clear that γTiAl refers to a particularly preferred group of intermetallics and does not refer in general to all intermetallic compounds based on titanium and

aluminium. Furthermore, the application consistently refers to γTiAl compounds as a preferred group of intermetallics for the invention, see page 6, lines 22 to 23 and page 9, lines 17 to 19.

1.3.3 The proprietor refers to documents NPL3, NPL4, NPL6 and NPL7 (published after the priority date of the contested patent) to support the argument that γTiAl encompasses all possible intermetallic compounds based on Al and Ti.

Generally the disclosure of further documents does not form part of the teaching of the application as originally filed, and is therefore of no relevance for the assessment whether the requirements of Article 123(2) EPC are met.

Even if the teaching of these further documents is considered for interpreting the wording of the application as filed, e.g. by considering phase diagrams of specific intermetallic compounds based on Al and Ti, the documents are still not relevant for the present case, since they do not disclose that the term γTiAl can be used to mean all possible intermetallic compounds based on Al and Ti.

1.3.4 Since claim 1 does not require that the articles are made by using γTiAl compounds, but includes the possibility that they can be made by using any intermetallic compound based on Ti and Al, e.g. Ti_3Al, Al_3Ti, Al_2Ti with undisclosed and thus unknown behaviour on cooling, the definition of the invention in claim 1 of the main request constitutes an undisclosed generalisation of the specific teaching of the application as filed.

1.4 Concerning the generalisation b)

1.4.1 As already indicated above, page 6, lines 27 to 30 of the application as filed refers to a "controlled cooling".

1.4.2 The proprietor explains that the term "controlled cooling" in the context of the contested patent refers to a step whereby inert gas is fed into the melting chamber under vacuum at the end of the production in order to provide an inert gas atmosphere.

However, the embodiment described on page 12, lines 19 to 23 as filed (paragraph [0070] of the application as published) does not support the argument of the proprietor.

It is not disclosed in the embodiment on page 12 that the cooling is controlled. The paragraph describes that the "inert gas used is preferably helium fed into the chamber at a pressure of approximately 2 bar **for a time sufficient to ensure that the temperature** which allows removal of the articles from the melting chamber **has been reached**" (emphasis added).

The embodiment on page 12 therefore does not describe the mere provision of an inert gas atmosphere in which the articles are left on their own to cool, but describes a cooling whereby a gas flow is fed through the melting chamber at a pressure of approximately 2 bar for a time sufficient to ensure that the desired temperature has been reached.

1.4.3 If it is intended to use an expression which is known in the art, such as "controlled cooling", to define a special meaning, the description may give the

expression this meaning by explicit definition (Case Law of the Boards of Appeal, 2018, 8th edition, Chapter II.A.6.3.3). However, in the present case no such explicit definition is given in the application as filed.

1.4.4 Furthermore, the interpretation of the expression adopted by the proprietor does not reflect the usual meaning given by the skilled person, but rather corresponds to a creation of the atmosphere in which the cooling takes place.

"Controlled cooling" is understood to refer to a cooling step whereby, for example, the cooling rate, the temperature gradient within the article or the temperature during the cooling is controlled, i.e. monitored and adjusted to a specific value. This common meaning of the expression is not the same as merely providing an atmosphere in which any kind of temperature reduction takes place.

1.4.5 It follows that the wording of claim 1 of the main request does not inherently define a controlled cooling as required by the expression on page 6 of the application as filed, irrespective of the question whether the expression "controlled cooling" means a cooling step as disclosed in the embodiment of the application or it has the usual meaning given by the skilled person.

1.5 In conclusion, the subject-matter of claim 1 of the main request extends the technical teaching of the application as filed, contrary to the requirements of Article 123(2) EPC.

The ground of opposition pursuant to Article 100(c) EPC therefore prejudices the maintenance of the patent as granted.

2. Auxiliary requests 1 to 4 - Article 123(2) EPC

Claim 1 of each of auxiliary requests 1 to 4 defines the intermetallic material in more detail than claim 1 of the main request.

Nevertheless, process step h) according to claim 1 of each of these requests does not define that the final cooling step is a "controlled" cooling as described on page 6, lines 27 to 30.

Hence, the same reasoning as for claim 1 of the main request applies to all of these requests with respect to the intermediate generalisation resulting from the omission of the term "controlled", see point 1.4 above.

The subject-matter of claim 1 of each of auxiliary requests 1 to 4 therefore does not fulfil the requirements of Article 123(2) EPC.

3. Auxiliary request 5 - Article 83 EPC

3.1 Claim 1 of auxiliary request 5 is directed to a process wherein the articles are produced using γTiAl intermetallic compounds and wherein the method step h) refers to a controlled cooling.

According to paragraph [0036] of the contested patent (corresponding to page 6, lines 26 to 30 of the application as filed) the controlled cooling below 1200°C does not influence the microstructure of the articles produced using γTiAl intermetallic compounds.

Hence, it is essential for the skilled person to know how to achieve the controlled cooling in order to obtain articles with the desired microstructure and thus with the required mechanical properties.

3.2 In this context the proprietor argues that the opponent has not demonstrated that the skilled person is unable to repeat the standard "metal 3D printing" process disclosed in the contested patent.

The Board agrees with the argument of the proprietor in that the burden for establishing insufficiency of disclosure lies with the opponent in inter-parte proceedings.

However, when a patent does not give any information on how a feature of the invention can be put into practice, and the opponent has plausibly argued that common general knowledge would not enable the skilled person to put this feature into practice, it is for the patent proprietor to show otherwise, see Case Law of the Boards of Appeal, 8th edition, 2016, Chapter III.G. 5.2.2.

3.3 In the present case, an undue burden for the skilled person seeking to put the invention into practice arises from the the addition of the term "controlled". into the wording of claim 1 as granted.

It is undisputed that the contested patent does not provide a definition for the controlled cooling. The argument of the proprietor, that the term should be interpreted as a control of the atmosphere and not of the temperature reduction, is not persuasive (see points 1.4.2 and 1.4.3 above).

In this context it can be accepted that cooling in an inert gas atmosphere is faster than cooling under vacuum due to the heat conduction provided by the gas atmosphere. However, reducing the total cooling time is not the same as controlling the cooling, since the article can still cool in an uncontrolled manner.

Furthermore, monitoring the threshold temperature from which the controlled cooling can start does not inherently define a controlled cooling step, but only defines the point in time when to start the controlled cooling.

Therefore it has been rendered plausible by the opponent during the appeal proceedings, that the skilled person does not get the required information from the contested patent as to how to perform the controlled cooling.

3.4 The contested patent describes in the second sentence of paragraph [0036] that cooling can take place by feeding a flow of inert gas into the melting chamber at a pre-established pressure. This teaching is consistent with the embodiment in paragraph [0074] of the patent (corresponding to paragraph [0070] of the application as published and page 12, lines 19 to 23 of the application) where it is disclosed that inert gas is fed into the chamber at a pressure of approximately 2 bar for a time sufficient to ensure that the temperature which allows removal of the articles from the melting chamber has been reached.

However, it is not disclosed that these steps of cooling described in the contested patent should be considered as providing a controlled cooling.

3.5 Moreover, considering a mere flow of inert gas as a measure for providing a controlled cooling in a process as defined in claim 1 does not make sense technically, as explained on page 4 of the proprietor's letter of 4 August 2015, at the end of the manufacturing process the articles are embedded within a metal powder bed (see also Figures 2A to 2D of the contested patent). Therefore a flow of inert gas cannot reach the articles and cannot provide a controlled cooling thereof.

3.6 It follows that the skilled person is not taught by the contested patent how the controlled cooling defined in amended claim 1 can be performed, in particular the patent does not disclose which parameter has to be monitored and how it is to be adjusted during the controlled cooling. The skilled person has to guess what is meant by this term and whether, for example, the cooling rate or the temperature gradient within the article should be controlled.

Even if the skilled person could be expected to arbitrary select a suitable parameter, the contested patent does not give any information to which extent and how it should be controlled, for example which cooling rate could be tolerated in order to achieve articles with the required stability of the microstructure.

3.7 Also in the example of the contested patent no indication concerning the controlled cooling is presented. Paragraphs [0084] and [0085] disclose that approximately 30 hours are required to produce 30 turbine blades under vacuum and cool them in helium.

The example does not disclose that a controlled cooling has to be performed and does not indicate a time frame for the cooling step itself. Moreover, the example does not correspond to the embodiment described in paragraph [0074] of the patent, according to which a flow of inert gas is fed until the desired temperature is achieved.

3.8 In the absence of any teaching of how to control the cooling, the skilled person has to set up its own research program to find appropriate conditions which do not have an influence on the microstructure according to paragraph [0036] of the contested patent.

This amounts to an undue burden for the skilled person.

3.9 In summary, the Board reaches the conclusion that the subject-matter of claim 1 of auxiliary request 5 does not fulfil the requirements of Article 83 EPC.

4. Auxiliary request 6 - Article 123(2) EPC

Claim 1 of auxiliary request 6 is based on the wording of claim 1 of auxiliary request 5.

The wording of claim 1 has been further amended by defining in method step h) that the final controlled cooling step is achieved by feeding a flow of inert gas into the melting chamber at a pre-established pressure.

However, the application as filed does not teach that a step of cooling by feeding a flow of inert gas into the melting chamber at a pre-established pressure is a controlled cooling step, see arguments above in points 1.4 and 3.4.

The Board therefore concludes that claim 1 of auxiliary request 6 does not meet the requirements of Article 123(2) EPC.

5. Auxiliary request 7 - Article 123(2) EPC

Claim 1 of auxiliary request 7 defines in method step h) that the final cooling step is achieved by feeding a flow of inert gas into the melting chamber at a pre-established pressure.

Step h) of claim 1 therefore does not require that the cooling step is a controlled cooling.

However, as argued above in point 1.4, the embodiment described on page 6, lines 27 to 30 is limited to a controlled cooling step.

Claim 1 according to auxiliary request 7 therefore does not meet the requirements of Article 123(2) EPC for the reasons indicated above in point 1.4 in regard to the main request.

Order

For these reasons it is decided that:

1. The appeal of the patent proprietor is dismissed.

2. The contested decision is set aside.

3. The patent is revoked.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated