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D E C I S I O N
of 10 April 2003

Case Number: T 0596/01 - 3.2.7

Application Number: 92902653.2

Publication Number: 0568557

IPC: B27N 3/00

Language of the proceedings: EN

Title of invention:

Producing parts by compound formation of precursor powders

Patentee:

BOARD OF REGENTS, THE UNIVERSITY OF TEXAS SYSTEM

Opponent:

EOS GmbH Electro Optical Systems

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 100(c), 123(2)

Keyword:

"Novelty - main request (yes)"

"Inventive step - main and first auxiliary requests (no)"

"Non-admittance of second auxiliary request filed during the oral proceedings"

Decisions cited:

-

Catchword:

-



Case Number: T 0596/01 - 3.2.7

D E C I S I O N
of the Technical Board of Appeal 3.2.7
of 10 April 2003

Appellant:
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 5 April 2001
revoking European patent No. 0 568 557 pursuant
to Article 102(1) EPC.

Composition of the Board:

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

Summary of Facts and Submissions

- I. The appellant (proprietor) filed an appeal against the decision of the Opposition Division to revoke the European Patent No. 0 568 557.
- II. Opposition was filed against the patent as a whole and based on Article 100(a) EPC (lack of novelty and lack of inventive step) and Article 100(c) (added subject-matter).

The Opposition Division held that the subject-matter of the main request was not novel and the subject-matter of the single auxiliary request did not involve an inventive step.

The most relevant prior art documents and pieces of evidence for the present decision are:

D1: US-A-4 944 817

D2: WO-A-90/03893

D9: EP-A-0 221 276

P3: Metallic Materials Specification Handbook,
R. B. Boss, page 151

- III. The appellant requested that the decision under appeal be set aside and the patent be maintained unamended (main request). Alternatively, the patent should be maintained in amended form on the basis of the set of claims according to the first auxiliary request filed on 15 August 2001, or on the basis of the set of claims according to the second auxiliary request filed during oral proceedings on 10 April 2003.

The respondent requested that the appeal be dismissed. The respondent further requested that if the second auxiliary request filed in the oral proceedings were to be admitted into the proceedings then further oral proceedings should be appointed.

IV. Claim 1 of the patent as granted reads as follows:

"1. A method of producing a part, comprising:
depositing a first layer of powder onto a target surface, said powder comprising first and second materials (901, 902),
directing a laser beam at a selected portion of said first layer of powder to selectively sinter the powder in a first cross-sectional region of the part;
depositing a second layer of said powder onto said first layer of powder; and
directing a laser beam at a selected portion of said second layer of powder to selectively sinter the powder in a second cross-sectional region of the part; characterised by
reacting said first and second materials (901, 902) in said first and second cross-sectional regions of the part to form a chemical compound of said first and second materials."

Claim 1 of the first auxiliary request adds, as a first feature of the characterising portion the following feature:

"the relative proportions of said first and second materials are selected to permit the formation of a chemical compound of said first and second materials,"

Claim 1 of the second auxiliary request adds the features of dependent claims 2 to 4 as granted to claim 1 of the first request. The extra wording of the claim reads as follows:

"wherein said directing steps heat said powder to a temperature between the melting point of said first material and the melting point of said second material, the melting point of said chemical compound is higher than the melting point of said first material, and the melting point of said chemical compound is higher than the temperature to which the selected portions of the powder are heated in said directing step."

IV. The appellant argued in written and oral submissions essentially as follows:

(i) The ground under Article 100(c) is not justified as there was no extension of the subject-matter over the content of the application as filed. Claim 1 as filed included a heating step. In claim 1 as granted there is a step of sintering by a laser. The skilled person understands sintering as meaning heating and in this case heating by laser power. There is thus no deletion of a feature but a narrower definition of a feature.

(ii) As regards the novelty of claim 1 of the main request the claim is distinguished from the disclosure of document D1 by the characterising feature of the claim. Document D1 mentions dissolving tin into copper. The skilled person would understand that the α -phase of bronze is thereby produced. The α -phase is an alloy and not a chemical compound. Although bronze is mentioned in the patent description it is not a chemical compound. This is shown by the fact that after a reference to bronze in column 9, lines 43 to 52 of the patent reference is made in column 10,

line 41 to an alternative embodiment which involves a chemical reaction. This shows that the production of bronze was not considered to involve a chemical reaction.

It is true that document D2 mentions a composition which may comprise more than one material. However, there is no mention of a chemical reaction and in particular no mention of a chemical reaction between two materials as required by claim 1.

- (iii) The subject-matter of claim 1 of the main request involves an inventive step. Document D1 is the closest prior art document. The problem to be solved by the invention is to produce materials which cannot be sintered. Document D1 does not teach the forming of chemical compounds but rather teaches forming solutions such as α -phase bronze and hence teaches away from the invention. Although document D2 mentions composite materials this is only a vague reference. Also in document D2 although mixtures are mentioned it is then stated that the adhesive component is eliminated by evaporation which is not a chemical reaction. There is no mention of chemical reactions in document D2. Document D9 does not disclose a process suitable for sintering. According to the patent in suit the laser should have a power of one hundred watt whereas the power of the laser mentioned in document D9 is two thousand watt.
- (iv) Claim 1 of the first auxiliary request does not offend against Article 123(2) EPC. There is no requirement for definite proportions of the constituents. On pages 22 and 24 of the application as filed a number of different proportions are disclosed.

(v) The subject-matter of claim 1 of the first auxiliary request involves an inventive step. The extra feature of the claim requires that the materials be positively selected to form the intended chemical compound. Accidental formation of chemical compounds is thus avoided. Intermetallic compounds are generally not desirable as shown in document P3 so that the skilled person would not select the powder materials so as to form these.

(vi) The second auxiliary request should be admitted into the proceedings. The appellant could not know whether the Board rejected the main request because of a problem of definition or because the invention as a whole was obvious. Since the appellant did not know before the oral proceedings why the main request would not be allowed it was not possible to formulate corresponding auxiliary requests.

V. The respondent argued in written and oral submissions essentially as follows:

(i) Claim 1 as filed contained a step of heating. Claim 1 as granted does not contain this step. Sintering, as now specified in the claim, does not necessarily mean heating. Sintering mainly means densifying. It is known that cross-linking of polymers, and hence densifying thereof, can be achieved by the application of UV light without the production of heat. Therefore, the sintering step of claim 1 as granted does not necessarily mean that heating occurs. There is nothing in the application as filed to suggest that heating is not an essential feature of the invention. The omission of this feature therefore offends against Article 123(2) EPC.

- (ii) The claims of a patent must be interpreted in the light of the description. In the description bronze and other alloys are given as examples of the invention. These are also disclosed in document D1. Also, bronze includes intermetallic compounds, such as ϵ -bronze, which would always be produced whenever bronze is formed. Document D2 also takes away the novelty of claim 1. Document D2 refers to composite powders and mixtures of powders. Also, reference is made to chemical change which implies chemical reactions.
- (iii) The subject-matter of claim 1 of the main request does not involve an inventive step. Starting from document D1 as nearest prior art the problem to be solved is not that given in the patent, i.e. to produce a material having different properties from the precursors as that problem is already solved in document D1 by the disclosure of the formation of bronze. The objective problem is to produce other materials. The skilled person has two choices for producing other changes either physically or chemically. Document D2 already discloses these two possibilities. Since document D1 already discloses the first alternative the skilled person would choose the second alternative to produce other materials. The subject-matter of claim 1 is also obvious in view of document D2 alone or a combination of documents D1 and D9.
- (iv) The extra feature of claim 1 the first auxiliary request was not disclosed in the application as filed so that the amendment offends against Article 123(2) EPC. The amendment leaves open the relative proportions of the powder materials and this is not disclosed in the application as filed which everywhere mentions the stoichiometric

quantities. On page 20, lines 10 to 35 a number of criteria are given for selecting the compound to be formed which are not reflected in the amendment to claim 1.

- (v) The subject-matter of claim 1 of the first auxiliary request does not involve an inventive step. According to the description of the patent there needs only to be enough of each powder material to form at least one molecule of the chemical compound since the stoichiometric quantities are not required. Whenever tin and copper are mixed, as disclosed in document D1, there would be some formation of a chemical compound. Accidental formation of the chemical compound is not excluded by the claim. In any case every chemistry student knows that particular proportions of starting materials are necessary to form a chemical compound.

- (vi) The newly filed second auxiliary request should not be admitted into the proceedings. The respondent has no time to prepare a response to the request which could require contacting technical experts. If the request were admitted then further oral proceedings would be necessary to allow an appropriate preparation.

Reasons for the Decision

Main Request

1. Article 100(c) EPC

Compared to the application as filed, claim 1 of the patent as granted contains the feature "directing a laser beam...to selectively sinter...in a first cross-sectional region of the part" whereas in claim 1 of the application as filed the corresponding feature was "heating...a cross-sectional region of the part". In the application as filed on page 4, line 14 reference is made to "sintering or melting temperatures". On page 4, lines 27 to 28 reference is made to "the temperature to which the directed beam subjects the powder". On page 6, lines 26 to 29 reference is made to "The control mechanism operates the laser to selectively sinter...layers sintered together". On page 9, line 31 to page 10, line 11 it is explained that thermal energy may enable chemical reaction. The reaction may occur during the application of directed energy. Alternatively, the directed energy may melt or sinter the materials and a subsequent heat treatment cause the reaction. According to page 17, lines 34 to 35 the sintering may be effected on a polymer to cause the polymer to flow. According to claim 8 as filed the heating step comprises directing an energy beam and according to claim 9 the directing step of claim 8 comprises directing a laser.

From the above mentioned parts of the application as filed the Board concludes that the step set out in claim 1 regarding directing a laser to produce sintering is disclosed in the application as filed. Claim 1 as filed however contained a reference to heating in this respect. According to the normal

technical understanding of sintering this process implies causing a material to coalesce under the influence of heat. Each of the above-mentioned references to sintering in the application as filed is consistent with this definition.

The respondent has argued sintering implies densification and that cross-linking a polymer causes densification. Further, a polymer may be cross-linked by a laser without the production of heat so that sintering may be affected without heating. The Board considers that this line of argumentation is not consistent with the normal technical meaning of the term sintering which requires some heating. Moreover, the description of the patent is consistent with the normal technical meaning. Therefore, the Board considers that claim 1 as granted does not offend Article 123(2) EPC in this respect.

2. *Novelty*

In the opinion of the Board the subject-matter of claim 1 is novel because neither of documents D1 or D2 disclose the characterising feature of the claim. The Opposition Division in their decision considered that an alloy was a chemical compound. The Board cannot agree with the Opposition Division on this point. It is well established that an alloy may comprise a mixture, a solid solution or an intermetallic compound. In the opinion of the Board only an intermetallic compound may be considered a chemical compound in the sense of claim 1 since mixtures and solutions in principle form a physical association but not a chemical association. The description of the patent is consistent with this view as it describes intermetallic compounds as chemical compounds, but does not indicate mixtures or solid solutions as chemical compounds.

In document D1 there is a disclosure of forming bronze together with the other features of claim 1. Bronze is well-known to have phases which are intermetallic compounds, but also forms solid solutions depending upon the composition and the heat treatment. The only indication in the document of the form of bronze is an indication that the tin is dissolved into the copper in the solid state. Thus, in document D1 there is no indication that an intermetallic phase of bronze is formed, so that there is no disclosure of the characterising feature of claim 1.

In document D2 the features of the preamble of claim 1 are disclosed and the appellant has not disputed this view. The document further mentions the presence of first and second materials in that there is a reference to the powder materials being used may be "composite". This means that the powder comprises more than one material. The document at several instances also makes reference to a "chemical change", to a difference in "chemical property", and to "chemical bonding". The Board is thus satisfied that the document discloses a chemical reaction in the layer of powder material. However, the Board is not satisfied that this chemical reaction necessarily results from a chemical reaction between two materials. Chemical reactions may also occur when heating a single substance. Even in the case of heating a composite powder chemical change can result from a chemical change in one constituent alone without any interaction between the constituents. There is thus no unambiguous disclosure in document D2 of a chemical reaction between two constituents.

Therefore, the subject-matter of claim 1 is novel in the sense of Article 54 EPC.

Inventive step

3.1 Closest prior art

The closest prior art is represented by document D1 which discloses a method comprising the features of the preamble of claim 1.

3.2 Problem to be solved

The appellant considered that the problem to be solved is to form a compound which cannot be sintered. The Board cannot agree with this problem since the characterising feature of claim 1 does not necessarily solve this problem. The characterising feature of claim 1 merely requires the formation of a chemical compound. The chemical compound may be any chemical compound. There is no feature in the claim which ensures that the compound formed cannot be sintered. Therefore, the claim does not contain the features necessary to ensure that this problem is solved.

The appellant argued that it is sufficient that the features of the claim can solve the problem and it is irrelevant that the problem is not solved throughout the whole breadth of the claim. The Board cannot agree with this view. If an inventive step is to be based on the solution to a particular problem then it is essential that the problem is solved throughout the breadth of the claim. Otherwise, a patentee would obtain protection for subject-matter which does not solve the problem and does not involve an inventive step.

According to column 3, lines 10 to 12 of the patent the problem to be solved is to produce a part by applying energy to a powder wherein the material of the part has properties which differ from those of the material in

the powder. This problem however is already solved in document D1 since bronze, which is produced from tin and copper, has properties which differ from those of each of tin and copper. The Board therefore concludes that the objective problem to be solved by the features of claim 1 is to provide an alternative solution to the problem stated in the patent.

3.3 Solution to the problem

The solution to the problem is that the first and second powder materials are reacted to form a chemical compound of said materials.

3.4 The solution to the problem is obvious for the following reasons:

It is well established that heating can change physical and/or chemical properties. This is mentioned in document D2 where on page 11, lines 8 to 9 explicit reference is made to a laser beam changing the physical or chemical properties of a powder. Thus, the skilled person is aware that properties can be changed either physically or chemically. The skilled person is also aware that when alloys, such as bronze, are formed then either solutions, i.e. physical change, or compounds, i.e. chemical change, can be formed depending upon the percentages of the constituents and/or the treatment process. Thus, the skilled person knows that when bronze or another alloy is being formed he has a choice of effecting change either physically or chemically to arrive at a material which has differing properties to the starting material. Alloys are indeed formed for the purpose of producing materials which have useful properties which are not obtained in the pure constituent materials. Document D1 discloses such production, i.e. producing bronze, at least physically since dissolving is mentioned. Since the alternative

method of achieving the goal, i.e. via a chemical reaction, is well-known and specifically mentioned in document D2 there is no inventive step involved in choosing this alternative method.

The appellant has argued that the skilled person reading document D1 would want to make α -bronze which is useful and this would lead him away from forming a chemical compound. The Board cannot agree with this view. Although document D1 mentions dissolving there is no indication that this should be to form α -bronze. There are other forms of bronze which are well-known which have useful properties. These other forms include intermetallic compounds. The skilled person would consider solving the problem by providing the alternative solution of forming bronze in a phase involving an intermetallic compound. Intermetallic compounds are within the scope of claim 1 and indeed the main embodiments of the patent are intermetallic compounds. In any case claim 1 of the patent has no features which ensure any particular properties of the chemical compound being produced. Therefore arguments based on the usefulness of chemical compounds or on prejudices against forming chemical compounds are baseless given the wording of the claim. The characterising feature of claim 1 is therefore obvious to the skilled person.

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

First Auxiliary Request

4. *Article 123(2)*

In the application as filed there is a disclosure on page 21, lines 5 to 9 of a compound formed from the stoichiometrical quantities of the constituents. It is then stated that an excess amount of one of the constituents may be supplied, i.e. non-stoichiometrical quantities. The extra feature of claim 1 corresponds to these two disclosed possibilities. There is therefore no addition of subject-matter.

5. *Inventive step*

The extra feature of claim 1 of this request indicates relative proportions of the powder materials which form the chemical compound. It does not require the stoichiometrically exact proportions for the compound, but merely that the proportions permit the formation of the compound. Indeed, in the description it is explicitly allowed that one of the constituents may be in a quantity greater than the stoichiometrically correct quantity, so that after formation of the compound some of the one constituent will remain in excess. In the opinion of the Board this feature was already inherently included in claim 1 of the main request. Since claim 1 of the main request requires the formation of a chemical compound from two powder materials it is clear that there must be provided some of each material. Claim 1 of the first auxiliary request specifies no more than this. The appellant argued that the selection step avoided any chance anticipation. However, the question with respect to inventive step is not that of a chance anticipation but of an obvious measure. This argument does not therefore support an inventive step.

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

Second Auxiliary Request

6. *Non-admittance of the request*

During the oral proceedings before the Board the appellant withdrew his then existing second auxiliary request which had been filed with his appeal grounds. In its place he submitted a new second auxiliary request which added the features of the dependent claims 2 to 4 as granted to claim 1 of the first auxiliary request. The Board therefore has to decide whether to admit this request at this stage of the proceedings.

With the invitation to the oral proceedings the Board provided the parties with its provisional opinion. In that opinion the Board provisionally considered that none of the requests on file of the appellant was likely to succeed. The appellant was thus aware well before the oral proceedings that further requests might be helpful to him. The appellant however did not file any further requests.

The Board cannot therefore identify any extenuating circumstances which might justify exceptionally admitting the late filed request. The appellant has argued that he did not know if the Board saw the problem with his other requests in the definition of the terms of the claims or in a more general problem. The Board cannot agree with this line of argumentation. In its provisional opinion the Board not only indicated

its negative view of the requests but gave clear reasons to justify the view. The argument of the representative that he did not know the problem with the requests is therefore not justified.

The respondent has pointed out that the new request differs substantially from the existing requests and reasonably requested further oral proceedings in the case that the request is admitted into the proceedings. It is indeed clear that the new request would require the respondent to develop new lines of argumentation and to review the disclosures of all the documents in the proceedings. In order that the respondent could reasonably respond to the new request a further oral proceedings would be necessary.

In these circumstances the Board exercises its discretion not to admit the second auxiliary request of the appellant (see "Guidance for parties to appeal proceedings and their representatives", OJ 1996, 342 point 3.3).

Order

For these reasons it is decided that:

1. The appeal is dismissed.

The Registrar:

The Chairman:

D. Spigarelli

A. Burkhart