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D E C I S I O N
of 13 June 2003

Case Number: T 0004/01 - 3.2.6

Application Number: 96200424.8

Publication Number: 0714725

IPC: B23K 26/04

Language of the proceedings: EN

Title of invention:

Multiple material systems and assisted powder handling for selective beam sintering

Patentee:

BOARD OF REGENTS THE UNIVERSITY OF TEXAS SYSTEM

Opponent:

EOS GmbH Electro Optical Systems

Headword:

-

Relevant legal provisions:

EPC Art. 24(2), 76, 123, 54, 56

Keyword:

"Novelty (main request): no"

"Inventive step (auxiliary request): no"

Decisions cited:

T 0320/00

Catchword:

-



Case Number: T 0004/01 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 13 June 2003

Appellant: EOS GmbH Electro Optical Systems
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
6 November 2000 concerning maintenance of
European patent No. 0714725 in amended form.

Composition of the Board:

Chairman: H. Meinders
Members: R. Ries
R. T. Menapace

Summary of Facts and Submissions

I. The appeal is from the interlocutory decision of the Opposition Division of 6 November 2000 maintaining European Patent 0 714 725 in amended form.

In its decision the Opposition Division rejected the main and first auxiliary request of the patentee for lack of novelty of independent claim 7 and considered allowable the claims 1 to 8 of the second auxiliary request. It considered the amendments of the claims as to the feature "softening temperature" to be in agreement with the requirements of Article 76 EPC, in respect of the parent application from which the patent in suit had been filed as a divisional application.

Of the documents relied upon in the decision under appeal, the following are relevant for the present decision:

D1: US-A-4 818 562

D4: WO-A-88/02677.

II. Against this decision the opponent filed an appeal on 29 December 2000, paying the appeal fee on that same date. The patentee filed an appeal by fax on 15 January 2001 paying the appeal fee the same day.

The appellant-opponent filed its statement of grounds of appeal on 12 March 2001, the appellant-patentee did so on 5 March 2001.

III. The Board invited the parties to oral proceedings, setting out its preliminary opinion on the question of inadmissible amendment (Article 76 EPC) and on novelty of the subject-matter of the independent claims then on file.

The appellant-patentee reacted to this communication, pointing out, *inter alia*, that the issue of inadmissible amendment raised in it had already been decided by the same Board in case T 320/00 for the parent patent and that therefore the Board was bound by the reasons of that decision (see point VII below). Thereupon the chairman and the legally qualified member, both having participated in that case, considered pursuant to Article 24(2) EPC that they should not take part in the appeal. This was accepted by the Board in its alternate composition, which then became the composition of the present Board.

IV. Oral proceedings were held on 13 June 2003, in which the appellant-opponent relied *inter alia* upon:

D22: Materials Handbook, 22nd edition, Mc Graw-Hill Book Co. 1986, pages 172-173,

filed in reply to the communication of the Board.

The appellant-opponent requested setting aside of the decision under appeal and revocation of the patent.

The appellant-patentee requested setting aside of the decision under appeal and maintenance of the patent with a set of 9 claims filed during the oral

proceedings according to its main request or its auxiliary request.

V. Claim 1 of the main request reads as follows:

"A method of producing a part (52), comprising the steps of:

depositing onto a target surface (26, 102), a layer (54, 164) of a powder (1100),

irradiating a selected portion of said powder (1100) corresponding to a cross-section of the part (52) with a laser beam (64), to sinter the powder so that particles of the powder are bonded in said selected portion,

depositing onto the bonded and unbonded portions of the one layer another layer of powder,

irradiating a selected portion of the powder of said other layer with said laser beam so that particles of the powder are bonded in the selected portion,

repeating said depositing and irradiating steps for a plurality of layers (54, 55), so that bonded portions of adjacent layers fuse to form a mass (52), and after the depositing and irradiating step,

removing unbonded portions of the powder (1100) to yield the mass, characterised in that

said powder (1100) comprises a first material (1002, 1102) and a second material (1001, 1101), said second

material has a lower softening temperature than said first material,

during said irradiation steps said second material bonds to particles of said first material in said selected portion, and

during said irradiating step said powder (1100) is exposed to a gas phase to promote infiltration of the second material (1001, 1101) within particles of the first material (1002, 1102)."

Claim 1 of the auxiliary request is identical to claim 1 of the main request, with the addition that **at least one of the first or second materials is a metal.**

VI. The arguments of the appellant-opponent can be summarised as follows:

Amendments

The feature in claim 1 of the second material having a softening temperature lower than the first material was not originally disclosed in the parent application 90 309 633.7 as filed. The only available disclosure in that application was for a "bonding temperature" or a "dissociation temperature", which, however, could not provide the basis for the term "softening temperature", contrary to what the Opposition Division had considered, as for the skilled person each of these terms had a specific, but different meaning. In fact the patentee itself used the term in one of its applications, D4, indicating that the softening temperature of the powder was well below the temperature at which sintering, i.e.

bonding, occurred.

Main request

The method of claim 1 was not novel when compared with the method as described in D1. As an example, a mixture of metal and ceramic particles was used to form a cermet structure, of which it was generally known (see also D22) that the metal functioned as second material, having a lower temperature at which viscous flow started than the ceramic particles. The reference to the fluidised bed being used to supply the next layer of particles to be irradiated did not mean that the unbonded particles were removed, as it was stated that for overhanging layers the fluidisation was stopped (column 4, lines 33 to 35). The patent in suit did not mention, neither in the claim nor in the description, what the mechanism was by which the gas promoted infiltration of the second material into the first material, other than by being "inert or active, preferably to either displace an undesired gas or introduce a desired gas." That was exactly what the gas referred to in column 6, line 65 to column 7, line 5 of D1 was doing.

The method of claim 1 also lacked novelty in respect of D4, which disclosed also a method of producing a part as in claim 1, in which the second material was a plastic material, e.g. ABS, and the first material was carbon black. It was common general knowledge that carbon black had a much higher temperature of viscous flow when compared with a plastic such as ABS. In this method also a gas, namely air, was used to even out temperature differences resulting in undesirable

shrinkage. For the same reasons as above, for D1, this gas was to be considered as promoting infiltration, as it was a desired gas, otherwise it would not be used.

Auxiliary request

The above reasoning applied also to claim 1 of the auxiliary request, which only differed from claim 1 of the main request in that at least one of the materials was a metal. In D1, as already said, cermets were produced by sintering a mixture of particle materials of which, by definition, one was a metal. In D4 the method was considered not limited to a particular type of material but rather adaptable to plastic, metal, polymer, ceramic or composite materials. As soon as a mixture of two different materials was chosen, one would have a lower softening temperature than the other; metal was suggested as one of these materials.

Inventive step of the subject-matter of claim 1 was put into question by D4 on its own, which suggested composite materials. For instance with composite materials like cermets as suggested in D1, the metal was there to function as the material with the lower softening temperature, binding the ceramic particles.

Document D22

This document was filed in response to the communication of the Board and was only provided for showing what was in any case common general knowledge, as regards the composition of the powders to make cermet structures. It should therefore be admitted.

VII. The appellant-patentee argued essentially as follows:

Amendments

As concerns the term "softening temperature" it had to be borne in mind that in the context of the invention the present process, as opposed to classical sintering, was a fast process in which particles of the second material bonded to the particles of the first material by viscous flow of the second material, thus there was a "softening" of that second material. The basis for this amendment could also be found in claims 40 and 45 of the parent application, which mentioned that the first material in said selected portion adhered particles of the second material and that the first material was sintered in the selected portion of the powder. There was not one single term available for all materials, which described this process, therefore the term "softening" was taken; it should not be seen as limited to amorphous materials.

In any case the present Board was prevented from deciding on this issue as it had already been decided in case T 320/00 for the parent patent, by the same Board, albeit in a different composition, where the same issue had been raised by the opponent. In that case the Board had decided that the parent application as filed provided sufficient basis for the term "softening temperature".

Main request

The subject-matter of claim 1 was novel over the method disclosed in D1, because the fluidised bed removed the

unbonded particles each time a new layer was deposited upon the previously irradiated layer, thus not after a plurality of layers had first been bonded, as now claimed. Further, the use of the gas was not mentioned for the purpose of promoting infiltration, thus could not be identical to the gas mentioned in the claim. The mention of "cermets" did not necessarily mean that only one of the two materials melted, it was only with knowledge of the invention that this was alleged to be the case; in fact D1, column 6, lines 21 to 23 indicated that all the powder should fuse, i.e. melt, thus not only one of the powders.

Novelty over D4 was also achieved by the fact that the ABS was not disclosed as a binder for the carbon black, but rather that the carbon black was only present to improve the energy absorption of the plastic. If anything, D4 was an accidental disclosure of the invention. Further, the air was only introduced for evening out temperature differences, it was not mentioned for the purpose of improving infiltration, nor did D4 otherwise mention that one of the materials is infiltrating the other. Finally there was no mention of one of the materials "softening".

Auxiliary request

The above also applied to claim 1 of the auxiliary request. As regards inventive step, the method disclosed in D1 did not allow for a change in the direction of the method as now claimed in claim 1, as it depended completely on using a fluidised bed. Further, it did not disclose how to actually make the cermet structures. D4 did not give any specific

indication that a metal should be used, nor that one of the materials should in that case be chosen for its softening temperature being lower than that of the other.

Late filed document D22

This document should not be admitted as it was late filed.

Reasons for the Decision

1. The appeals are admissible.
2. *Amendments (Article 76 EPC)*

The question of whether the present Board is bound by decision T 320/00 in the appeal concerning the parent patent, and of the allowability of the amendments carried out in the patent in suit during the examination proceedings need not to be decided upon in view of the outcome of these appeal proceedings on the question of novelty and inventive step of the subject-matter of claim 1, as discussed below.

3. *Late filed documents*

Document D22, filed in reply to the communication of the Board, contains an explanation of the composition of "cermets", in reply to the argument of the appellant-patentee that the composition of such materials was not known, or that it was not clear whether only one of the components melted. As this

document is only produced for the purpose of demonstrating, in printing, what in any case is general standard knowledge, the Board sees no objection to its introduction.

4. *Main request - Novelty*

4.1 D4, which is a patent application of the appellant-patentee, discloses a method of producing a part (52), comprising the steps of depositing on a target surface (26, 102) a layer (54) of a powder (22, 106), irradiating a selected portion of said powder (26, 102) corresponding to a cross-section of the part (52) with a laser beam (64), to sinter the powder so that particles of the powder are bonded in said selected portion, depositing onto the bonded and unbonded portions of the (first) layer another layer (55-57) of powder (see page 21, bottom paragraph), irradiating a selected portion (26, 102) of the powder of said other layer (55-57) with said laser beam so that particles of the powder are bonded in the selected portion, repeating said depositing and irradiating steps for a plurality of layers (54-57) so that bonded portions of adjacent layers fuse to form a mass (52), and after the depositing and irradiating step, removing unbonded portions of the powder (22) to yield the mass (see figure 5), wherein said powder comprises a first material (carbon black, page 16, line 16) and a second material (plastic, e.g. ABS, page 15, line 29), of which it is common general knowledge that it has a lower softening temperature than said carbon black. During said irradiation steps said plastic bonds to particles of carbon black in said selected portion, and

during said irradiating step said powder is exposed to a gas phase (air).

- 4.2 The appellant-patentee argued that D4 did not explicitly mention the air as promoting the infiltration of the lower softening material into the other material.

The Board observes that the patent in suit does not mention how said gas achieves this effect other than by referring to it as being "either inert or active, preferably to either displace an undesired gas or introduce a desired gas". If according to D4 air is introduced into the compartment in which the laser sintering is carried out, see figure 11, so as to prevent undesirable shrinkage due to temperature differences, the Board can only conclude that a "desired gas" is in fact introduced. Air is also generally considered to be an "active gas" as opposed to an "inert gas".

Thus all features of claim 1 of the main request are known from D4 and therefore its subject-matter is not novel (Article 54 EPC).

5. *Auxiliary request - Novelty*

- 5.1 The subject-matter of claim 1 according to the auxiliary request is novel in respect of D1, as this document does not unambiguously disclose the method step in which the unbonded particles are removed only after a plurality of layers has been deposited and each layer has been irradiated before the next layer is deposited on it. It is mentioned that the bed is not

fluidised during irradiation (column 4, lines 33 to 38), but this is the case only for overhanging layers. It does not directly mean that the fluidisation is stopped when applying the next layer. In fact, the method of D1 appears to depend on the fluidisation of the bed to throw a new layer on top of the part to be produced, see column 4, lines 29 to 33.

- 5.2 The method as specifically described in D4 only concerns the first material being carbon black, the second material being plastic (e.g. ABS). No metal powders are directly involved.

However, there is a general mention in D4 of materials with which the method can be performed, namely plastic, metal, polymer, ceramic powders or composite materials. The appellant-opponent argued that the mention of "metal" in this list was sufficient disclosure of a mixture of two materials in the powder, one being metal, at least one of these materials having a lower softening temperature than the other, thus rendering the subject-matter of claim 1 of the auxiliary request not novel

- 5.3 The Board considers there is no need to decide the issue of novelty of the subject-matter of claim 1 in comparison with the method disclosed in D4, as that subject-matter in any case does not involve inventive step for the reasons set out below.

6. *Auxiliary request - Inventive step*

- 6.1 Having regard to the various materials listed in D4, page 4, first full paragraph, the skilled person

working in the field of selective sintering as discussed in D4 will be charged with finding further fields of application for the method disclosed.

The production of cermet products, which are composite materials made up of ceramic particles dispersed in a metal matrix, is a well known field of application of sintering processes. Such products are widely used in industry as evidenced by D22, page 173.

In such cermet products the metal is provided as a powder and mixed with the ceramic particles, the mixture then being sintered so that the metal bonds the ceramic particles to form a solid body. Precisely for that reason the metals used have a lower melting temperature, thus also a lower softening temperature than the ceramic particles they are to bind.

- 6.2 Particularly in view of the suggestion in D4, page 4, lines 14 to 16, that the method is not limited to a particular type of powder, but rather is adaptable to plastic, metal, polymer, ceramic powders and composite materials, the Board finds that the skilled person not only **could**, but also **would** apply that method to the production of cermet products. In doing so he would be selectively sintering a mixture of powder materials in which one of the materials is a metal, having a lower softening temperature than the ceramic particles it is to bind. In any case, there is no indication given in D4 that the selective sintering method described in this document should not be applied to cermets or other particle mixtures, which would keep the skilled person from using this method. As D4 further discloses all the method steps of claim 1, see point 4 above, he would

thus be performing all the steps with the materials as claimed in claim 1 of the auxiliary request.

Thus claim 1 of the auxiliary request lacks inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside
2. The patent is revoked.

The Registrar

The Chairman

M. Patin

H. Meinders