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D E C I S I O N
of 19 January 2000

Case Number: T 1183/97 - 3.5.2

Application Number: 92311246.0

Publication Number: 0550974

IPC: H01F 41/04

Language of the proceedings: EN

Title of invention:
Method for making multilayer magnetic components

Applicant:
AT&T Corp.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 52(1), 54(3), (4), 56

Keyword:
"Inventive step - yes, after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 1183/97 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 19 January 2000

Appellant: AT&T Corp.
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NY 10013-2412 (US)

Representative: Johnston, Kenneth Graham
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 July 1997 refusing European patent application No. 92 311 246.0 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: A. G. Hagenbucher
C. Rennie-Smith

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division to refuse European patent application No. 92 311 246.0. The reason given for the refusal was that the subject-matter of claim 1 filed with the letter dated 6 May 1997 lacked an inventive step having regard to document

D1: DE-A-3 628 021

and general knowledge.

II. In response to a communication from the Board the appellant filed with a letter dated 2 November 1999 new claims 1 to 7 and a new page 1 of the description.

Claim 1 now reads as follows:

"1. Method of making a magnetic device comprising the steps of:

a) providing a plurality of sheet-like green ceramic members, at least one of the green members (e.g. 61, 62, 63 of Fig. 6) comprising a thermally removable material (63);

b) assembling said plurality of green members into a stack and sintering said stack such that said thermally removable material is substantially removed and a composite ceramic structure results;

CHARACTERIZED IN THAT

c) at least one green member (e.g. 61, 62, 63 of Fig 6) comprises a first region of green high magnetic permeability material (62) and a second region of green insulating low magnetic permeability material (61) with

thermally removable material (63) disposed between said first and second regions, whereby upon sintering said first and second regions are separated by free space for alleviating fabrication stresses due to different thermal characteristics of the high magnetic permeability and low magnetic permeability materials, thereby reducing cracking or degradation due to magnetostriction."

Claims 2 to 7 are dependent on claim 1.

III. The appellant argued that the prior art document D1 disclosed a method for manufacturing a different device from that manufactured by the method according to the present claim 1. According to the invention thermally removable material was placed between a first region of high magnetic permeability material and a second region of insulating low magnetic permeability material so that upon sintering a free space was left separating the two regions in order to reduce cracking and degradation otherwise caused by differing thermal expansion and contraction accompanying sintering. The thermally removable material used in the solution of document D1 did not serve the same function, as the voids created upon sintering were subsequently infiltrated by a liquid metal to form coil windings. Hence, the claimed solution was completely different from the prior art and therefore inventive.

IV. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of

Claims: 1 to 7 filed with the letter dated

2 November 1999,

Description: page 1 filed with the letter dated 2 November 1999;
pages la, 2 and 3 filed with the letter dated 7 March 1996;
pages 4 to 8 as originally filed,

Drawings: 6 sheets as originally filed.

Reasons for the Decision

1. The appeal is admissible.

2. The amendments made to the application documents (claims and description) comply with the requirement of Article 123(2) EPC. All the features in the present claims can be found in the original claim 1 and description, pages 3 to 5 in combination with Figures 2, 3D and 6. In particular, the term "insulating", which was recited in claim 1 as originally filed, then deleted in response to an objection raised by the examining division, has been reinstated.

3. *Novelty*

The introduction of the present description refers to document EP-A-512 718 which has a priority date of 2 May 1991 and was published on 11 November 1992. This document has to be considered under Article 54(3) and (4) EPC. It describes a method of making a magnetic

device comprising the steps (a) and (b) according to the preamble of the present claim 1. Furthermore, one green member comprises a first region of green high magnetic permeability material and a second region of green insulating low magnetic permeability material. Thermal compatibility of the two materials is achieved by doping the insulating material with metals in order to avoid cracking during the sintering process, but there is no thermally removable material disposed between said first and second regions.

Novelty with respect to document D1 of claim 1 then on file had not been disputed by the department of first instance. The scope of the present claim 1 is narrower.

Hence, the subject-matter of claim 1 is novel over the above-cited prior art.

4. *Inventive step*

4.1 Document D1 discloses a method having the features indicated in the preamble of the present claim 1. A stack of a multiplicity of sheet-like green non-magnetic ceramic members is sintered such that a monolithic body results. One or more of the green sheets comprises a structure of thermally removable material selected such that the removable material is volatilized during sintering of the stack, resulting in the presence of a void of predetermined geometry in the sintered monolithic body. The void is then filled with liquid metal, resulting in the formation of a conductor of predetermined shape within the monolithic body. None of the green members comprises two regions comparable with those of the claimed subject-matter, namely a

first region of green high magnetic permeability material and a second region of green insulating low magnetic permeability material which both survive the sintering process.

4.2 The present invention solves the problem of how to make a magnetic device with at least one green member comprising a first region of green high magnetic permeability material and a second region of green insulating low magnetic permeability material, which two different materials are not thermally compatible with each other, by a method which is more tolerant of differences in the sintering and thermal expansion properties of the constituent ceramic materials.

4.3 This problem is solved by the features in claim 1.

The solution essentially consists in disposing a thermally removable material between the first and second regions of different materials, whereby upon sintering said first and second regions are separated by free space for alleviating fabrication stresses due to different thermal characteristics of the two different materials.

4.4 Since document D1 does not concern a method of making a magnetic device where at least one green member comprises two material regions with different thermal expansion properties, which two material regions should survive the sintering process, the problem underlying the present invention does not arise in the method known from document D1. The void created according to document D1 is not determined for separating two regions of materials with differences in sintering and

thermal expansion properties but for being filled with liquid metal to form a conductor of predetermined shape within the monolithic body. The preconditions and the purpose of the void created according to document D1 are therefore so different that the known solution cannot be analogised with that of the claimed subject-matter. Thus, the subject-matter of claim 1 is not obviously derivable from document D1 even considering general knowledge. Hence, the subject-matter of claim 1 involves an inventive step.

5. In the opinion of the Board, independent claim 1, together with dependent claims 2 to 7 are allowable. The amended application documents meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent as requested (see paragraph IV above).

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler