

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 7 March 2012**

Case Number: T 1287/11 - 3.2.06
Application Number: 06251560.6
Publication Number: 1710398
IPC: F01D25/00, C23C4/10, C23C18/12,
C23C30/00, C23C28/00
Language of the proceedings: EN

Title of invention:

Turbine component other than airfoil having ceramic corrosion resistant coating and methods for making same

Applicant:

GENERAL ELECTRIC COMPANY

Relevant legal provisions:

RPBA Art. 13(1)
EPC Art. 123(2)

Keyword:

Amended requests filed after the appellant's grounds of appeal
- not admitted

Decisions cited:



Case Number: T1287/11 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 7 March 2012

Appellant: GENERAL ELECTRIC COMPANY
(Applicant) 1 River Road
Schenectady, NY 12345 (ETATS-UNIS D'AMERIQUE)

Representative: Pedder, James Cuthbert
London Patent Operation,
General Electric International, Inc.,
15 John Adam Street
London WC2N 6LU (ROYAUME UNI)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted 16 November 2010
refusing European patent application No.
06251560.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: M. Harrison
Members: G. de Crignis
W. Sekretaruk

Summary of Facts and Submissions

- I. With its decision posted on 16 November 2010 the Examining Division refused the European patent application No. 06251560.6 *inter alia* due to lack of clarity and lack of inventive step with regard to claim 1.
- II. On 26 January 2011 the appellant (applicant) filed an appeal against this decision and paid the appeal fee on the same date. On 24 March 2011 a statement setting out the grounds of appeal was received at the EPO together with an amended set of claims.
- III. In a communication sent on 22 December 2011 as an annex to a summons to oral proceedings, the Board gave its provisional opinion on *inter alia* lack of clarity, an apparent contravention of Article 123(2) EPC and lack of inventive step (Article 56 EPC 1973).
- IV. With letter of 7 February 2012, the appellant replaced the previous claims by amended claims of a main request and a first auxiliary request. With facsimile letter of 29 February 2012, the appellant withdrew the request for oral proceedings and requested the decision be taken based upon the current state of the file. In a telephone call of 29 February 2012, he further informed the registrar of the Board that he would not attend the oral proceedings.
- V. Oral proceedings were held on 7 March 2012. The appellant's written request was that the decision under appeal should be set aside and that a patent be granted on the basis of the main request or the auxiliary request, both filed with the letter of 7 February 2012

Claim 1 of the main request has the following text:

"An article comprising a turbine component (30) other than a turbine airfoil having a superalloy substrate (60) based on nickel, cobalt and/or iron alloys and a ceramic corrosion resistant coating (64) overlaying and formed on a surface (62) of the substrate (60), wherein the ceramic corrosion resistant coating (64) has a thickness from 0.2 to 13 microns and comprises a ceramic metal oxide comprising a combination of 85 mole % or more zirconia and 15 mole% or less hafnia, wherein the ceramic corrosion resistant coating (64) comprises from 60 to 98 mole% ceramic metal oxide and from 2 to 40 mole% of a stabilizer metal oxide selected from the group consisting of yttria, calcia, scandia, magnesia, india, gadolinia, neodymia, samaria, dysprosia, erbia, ytterbia, europia, praseodymia, lanthana, tantala, and mixtures thereof."

Claim 1 of the auxiliary request differs from this claim 1 in that the turbine component (30) is specified as being "a compressor or turbine disk (32), or a compressor or turbine seal element (44, 46, 48), or a turbine shaft, or a turbine blade retainer."

The main request and the auxiliary request also include an independent method claim.

VI. The arguments of the appellant may be summarised as follows:

Concerning the main request, claim 1 had been amended in order to address the objections concerning clarity and Article 123(2) EPC. The feature "formed on a surface (62)" concerning the substrate (60), was based on Figure 2 in conjunction with page 9, lines 6 to 7 of

the application as filed. The further amendment concerning the ceramic metal oxide comprising a "combination of 85 mole% or more zirconia and 15 mole% or less hafnia" was based on claim 4 and page 5 of the application as filed. Such a combination implicitly precluded the presence of a concentration of 100 mole% zirconia and 0 mole% hafnia for the ceramic metal oxide.

Measurement of the parameters of the thickness of the ceramic corrosion resistant coating would be within the scope of the knowledge of the skilled person without the requirement to exercise any inventive effort, thereby falling under the exception granted under the Guidelines for Examination, CIII 4.18(ii).

The wording "an article comprising a turbine component other than a turbine airfoil" would clearly be understood as referring to turbine components that were not airfoils, encompassing the article being the turbine component itself or including the turbine component. Accordingly, the clarity objections underlying the appealed decision and raised by the Board had been remedied.

The sol-gel process described in the application as filed was capable of forming the turbine component as defined in claim 1, which included obtaining the defined range for the thickness of the coating. Therefore, incorporation of the defined thickness range for the coating into claim 1 did not represent a contravention of Article 123(2) EPC.

Claim 1 was distinguished from the closest prior art of D1 (US-B-6 869 703) in that the ceramic metal oxide of the ceramic corrosion resistant coating comprised a

combination of 85 mole% or more zirconia and 15 mole% or less hafnia and in that the ceramic corrosion resistant coating had a thickness of from 0.2 to 13 microns. The use of hafnia alongside zirconia had been found to enhance the corrosion resistance of the ceramic coating. This enabled the use of a relatively thin coating. Additionally, the embodiments described in D1 all relied upon the presence of a bond coat layer which further increased the thickness of the coatings applied to the metal substrate. The passage mentioning the use of small amounts of hafnia neither indicated what should constitute a "small amount" nor did it indicate any advantage arising therefrom. Accordingly, the skilled person was not taught to apply the claimed amount, let alone to apply such amount and reduce the thickness of the ceramic layer.

Reasons for the Decision

1. Non-admittance of late-filed requests

The current requests were filed after filing the grounds of appeal and also after the communication of the Board prior to oral proceedings. According to Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA), it lies within the discretion of the Board to admit any amendment to a party's case after it has filed its grounds of appeal. In accordance with established case law of the boards of appeal, in order to be admitted, such requests should clearly be allowable in the sense of overcoming the objections raised without giving rise to new objections, which is not the case at least for claim 1 of the main request and of the auxiliary request, as explained below.

2. *Main request - claim 1*

2.1 Whereas claim 1 as originally filed defined a ceramic corrosion resistant coating having "a thickness up to 127 microns", current claim 1 defines *inter alia* a ceramic corrosion resistant coating having a thickness of "from 0.2 to 13 microns".

2.2 Such feature is originally disclosed on page 10, lines 16 to 20 (corresponding to paragraph [0027] of the A-publication of the application). This paragraph concerns the embodiment of the method of the invention being a sol-gel process. Claim 1 does not define a sol-gel coated component, nor is any disclosure present to the effect that such thickness applies for any article for which the coating has been applied by another type of method than a sol-gel process. Accordingly, the thickness parameter of 0.2 to 13 microns is not clearly and unambiguously disclosed in the general manner in which it is now claimed. Hence, at least with regard to this feature, the requirement of Article 123(2) EPC is not met.

2.3 Further objections concerning clarity, sufficiency of disclosure and disclosure as originally filed which were set out in the annex to summons need not be further addressed in view of the above finding. The aforementioned objections notwithstanding, the subject-matter of claim 1 anyway lacks an inventive step.

2.4 Taking D1 (US-B-6 869 703) as the closest prior art this discloses an article comprising a turbine component other than a turbine airfoil (col. 1, l. 6 - 23) having a superalloy substrate based on nickel, cobalt and/or iron alloys (col. 1, l. 30 - 32) and a

thermal barrier coating overlaying and formed on a surface of the substrate (col. 1, l. 23 - 25), wherein the thermal barrier coating has a thickness from 76 to 1778 micrometer (col. 1, l. 42 - 46) and comprises a ceramic metal oxide (col. 1, l. 33 - 35) comprising an yttria stabilized zirconia (col. 1, l. 40 - 42) and small amounts of hafnia (col. 3, l. 36 - 38), wherein the thermal barrier coating comprises at least about 91 mole% zirconia and from 3 to 9 mole% of a stabilizer metal oxide selected from the group consisting of neodymia, ytterbia and mixtures thereof (col. 3, l. 15 - 35).

- 2.5 The subject-matter defined in claim 1 differs from the disclosure in D1 only in that the ceramic corrosion resistant coating has a thickness from 0.2 to 13 microns.
- 2.6 Although the appellant considered claim 1 to be additionally distinguished from D1 in the further feature that the ceramic metal oxide of the ceramic corrosion resistant coating comprises a combination of 85 mole% or more zirconia and 15 mole% or less hafnia, such distinction is not justified.
- 2.7 D1 specifies in col. 3, l. 17 - 38 the zirconia-containing ceramic composition as comprising at least about 91 mole% zirconia, typically from about 91 to about 97 mole% zirconia, more typically from about 95 to about 97 mole% zirconia. Accordingly, all these percentages fall within the claimed range for zirconia and such content of zirconia in the ceramic composition is anticipated in D1.
- 2.8 Concerning the question as to which amount of hafnia should be considered as a "small amount", D1 discloses

that "*the zirconia-containing ceramic compositions used herein can also optionally comprise small amounts of hafnia, titania, tantala, niobia and mixtures thereof*". Such "small amounts of hafnia, ..." referred to in D1 can only concern amounts around or below 6 mole% because the zirconia containing ceramic compositions disclosed in D1 contain typically from about 91 to 97 mole% zirconia and from 3 to about 9 mole% stabilizer metal oxide like ytterbia either alone or more typically in combination with yttria. Hence, the amount of hafnia concerns an amount less than 9 mole% at maximum and thus within the range claimed. Accordingly, the combination of zirconia of 85 mole% or more and 15 mole% or less hafnia is disclosed in D1.

- 2.9 Although the embodiments described in D1 all relied upon the presence of a bond coat layer, such layer is optional (see e.g. col. 2. 1. 20 to 23) and hence does not distinguish the claimed subject-matter from D1.
- 2.10 Accordingly, these features are not suitable to distinguish the claimed subject-matter from the disclosure of D1.
- 2.11 In regard to the fact that claim 1 defines a "corrosion resistant coating" while D1 discloses a thermal barrier coating, it is implicit that any coating and in particular the coating of D1 which has the same components, will provide a degree of corrosion resistance. The coating in D1 is thus also a corrosion resistant coating.
- 2.12 The appellant's argument that the use of hafnia alongside zirconia in such thin layers had been found to enhance the corrosion resistance of the ceramic coating was not supported by any evidence. Therefore,

no link between the composition containing hafnia alongside zirconia and an enhanced corrosion resistance for a relatively thin coating could have been taken into account when considering whether an inventive step is present.

- 2.13 Hence, in the absence of any disclosure in the application as to the degree or extent of corrosion resistance of the defined coating or how such a property could be established, the objective technical problem solved by the subject-matter of claim 1, when starting from D1, can only be understood to relate to the sole distinguishing feature, namely the claimed range for the thickness of the coating.
- 2.14 Such thickness is specified in the application in suit in relation to the sol-gel process and it is set out that "the sol-gel can be applied by spraying at least one thin layer, e.g., a single thin layer, or more typically a plurality of thin layers to build up a film to the desired thickness for coating 64." (see paragraph [0027] of the A-publication). In this paragraph concerning the application of the sol-gel process, reference is also made to US-A-2004/0081767 which document (published before the priority date of the present application) discloses applying a crack-free layer of ceramic material via the sol-gel process resulting in a dense matrix having a thickness most preferably of about 0.5 to 20 microns (see e.g. paragraph [0023] thereof). Hence, the objective problem to be solved when starting from D1 is merely to arrive at an article having a suitable thickness coating. The skilled person however knows how to apply such a sol-gel process in a way to obtain such thickness of the coating layer and knows that such a range for the thickness should preferably be obtained.

2.15 Hence, when starting from D1, which discloses that the thickness of the thermal barrier coating is typically in the range of from about 25 to about 2540 microns, and depends upon a variety of factors (see col. 8, l. 18 - 21) and could be applied in particular via physical vapour deposition (col. 8, l. 40 - 60), the skilled person who chooses the sol-gel process as an alternative appropriate application method (as suggested in e.g. D6 or US-A-2004/0081767 (as referred to in item 2.8 above)) would also choose a preferred thickness of the coating layer consistent therewith, dependent on the structure, the materials and the conditions for use. Such procedure is within the normal remit of the skilled person wishing to find suitable conditions for the particular structure and materials chosen. Hence, in the present case, when starting from D1, the application of common general knowledge of the skilled person is all that is required when considering the use of a sol-gel process in order to arrive at the subject-matter of claim 1. The subject-matter of claim 1 thus lacks an inventive step.

3. *Auxiliary request - claim 1*

3.1 Claim 1 of the auxiliary request differs from claim 1 of the main request in that it specifies the turbine component (30) as being "a compressor or turbine disk (32), or a compressor or turbine seal element (44, 46, 48), or a turbine shaft, or a turbine blade retainer".

3.2 Such disclosure is present in originally filed claim 2 as well as in the description on page 1, third paragraph, and on page 6, the paragraph bridging to page 7 (corresponding to paragraphs [0003] and [0020] of the A-publication). However, neither the disclosure

in these paragraphs nor the features of originally filed claim 2 was linked to the claimed selected range for the thickness of the ceramic corrosion resistant coating. Accordingly, the requirements of Article 123(2) EPC are already not met for such a claim.

- 3.3 Albeit not required in view of the foregoing conclusion, it may be added that even when considering such parts in combination with the claimed range for the thickness of the coating, no inventive step could be accorded to such subject-matter.
- 3.4 When starting from D1, the further objective problem to be solved is the selection of a suitable article to which such a coating can be applied. The first issue to be considered concerns whether the substrate is suitable. Since the substrate (nickel, cobalt and/or iron superalloy substrate) is identical in D1 to that in claim 1, the skilled person is aware that he could apply the coating on all such components or parts. No reason is disclosed for limiting the claimed coating to only the specified components. Moreover, D1 specifies such superalloys as being used for turbine engine parts like *"airfoils, blades, vanes, shrouds, nozzles, combustor components such as liners and deflectors, augmentor hardware of gas turbine engines and the like"* (col. 7, l. 4 - 8). Additionally, this paragraph indicates that *"it should also be understood that the thermal barrier coatings of this invention are useful with metal substrates of other articles that operate at, or are exposed to, high temperatures"* (col. 7, l. 18 - 21). Hence, the coatings disclosed in D1 are not limited to the specified turbine engine parts and others, such as those defined in claim 1, which are

also part of the turbine, would thus be suitable articles to which the coating would also be applied.

- 3.5 In regard to the objective technical problem to be solved it should be noted that the thickness of the coating is of no particular relevance in this regard, since D1 suggests applying it to any turbine engine part of appropriate metal substrate that operates at, or is exposed to high temperatures, whereby all parts of a turbine component are to be considered and the skilled person needs no further inventive step to do so. Hence, the subject-matter of claim 1 of the auxiliary request also does not involve an inventive step (Article 56 EPC 1973).

4. *Requests not admitted / no request in proceedings*

Consequently claim 1 of the main request as well as that of the auxiliary request both - at least - fail to fulfil the requirement of Article 123(2) EPC and the subject-matter of claim 1 of both anyway lack an inventive step (Article 56 EPC 1973). At least for these reasons, these claims were not prima facie allowable and the Board exercised its discretion in Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA) and did not admit the requests into the proceedings.

As no request is in proceedings, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



M. Patin

M. Harrison

Decision electronically authenticated