Internal distribution code:

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

Datasheet for the decision of 13 October 2017

Case Number: T 0275/13 - 3.2.03

Application Number: 05021040.0

Publication Number: 1640477

IPC: C23C28/00, C23C4/06, F01D5/28

Language of the proceedings: EN

Title of invention:
High temperature component with thermal barrier coating and gas turbine using the same

Patent Proprietor:
Mitsubishi Hitachi Power Systems, Ltd.
Central Research Institute of Electric Power Industry

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 54, 56, 123(2)

Keyword:
Novelty - (yes)
Inventive step - (yes)
Amendments - allowable (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0275/13 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 13 October 2017

Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Siemens AG Postfach 22 16 34 80506 München (DE)
Respondent: (Patent Proprietor 1)	Mitsubishi Hitachi Power Systems, Ltd. 3-1, Minatomirai 3-chome, Nishi-ku, Yokohama 220-8401 (JP)
Respondent: (Patent Proprietor 2)	Central Research Institute of Electric Power Industry 6-1, Ohtemachi 1-chome Chiyoda-ku Tokyo (JP)
Representative:	Beetz & Partner mbB Patentanwälte Steinsdorfstraße 10 80538 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 10 January 2013 rejecting the opposition filed against European patent No. 1640477 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	G. Ashley
Members:	B. Miller
	E. Kossonakou

Summary of Facts and Submissions

I. European patent No. 1 640 477 relates to a high temperature component with a thermal barrier coating.

II. An opposition had been filed against the patent on the grounds of Article 100(a) EPC together with Articles 54 and 56 EPC and of Article 100(c) EPC.

III. The opposition division decided to reject the opposition.

IV. This decision was appealed by the opponent (appellant). The appellant requested that the impugned decision be set aside and the patent be revoked.

V. The respondent requested that the patent be maintained on the basis of the set of claims filed with the letter dated 13 September 2017.

VI. Independent claim 1 of this request reads:

"A high temperature component with a thermal barrier coating, comprising:
a heat resistant alloy substrate composed mainly of at least one element of nickel and cobalt;
a bond coat (2) formed by a low-pressure plasma spray on the surface of the substrate; and
a top coat (3) formed of a zirconia-based ceramic on a bond coat,
characterized in that
the bond coat is formed of an alloy which consists of:
at least one element of nickel and cobalt, a total amount of which is in the range of 50 to 75 wt%;
5 to 40 wt% of chromium;

1 to 30 wt% of aluminum; optionally at least one element selected from a group consisting of tantalum, tungsten, silicon, platinum, manganese and boron in a range of up to 20 wt%, and unavoidable impurities
and in that
the component has an interface oxide layer consisting of aluminum oxide between the bond coat and the top coat."

Dependent claims 2 to 9 concern preferred embodiments of the component of claim 1.

Independent claim 10 is directed to:

"A gas turbine provided with a high temperature component according to any of the preceding claims".

Dependent claim 11 concerns a preferred embodiment of the gas turbine of claim 10.

VII. State of the art

The following documents cited already during the opposition proceedings are of particular importance for the present decision:

D7: EP-A-1 365 044
D11: Materials at high temperatures, 20(4), (2003), pages 495 to 506

VIII. The appellant's arguments as far as relevant for this decision can be summarised as follows.

The request filed with the letter dated 13 September 2017 should not be admitted into the proceedings, since it was late-filed.

The technical teaching of claim 1 went beyond the teaching of the application as originally filed, since the features "by a low-pressure plasma spray" and "interface oxide layer consisting of aluminium oxide" were not disclosed in the application as originally filed. Moreover, the subject-matter of dependent claims 5 to 8 was not derivable from the application as filed.

D7 represented the closest prior art. D11 taught that top coats based on zirconia ceramics, nickel-based superalloys and the method of low-pressure plasma spray coating of bond coats were known to the skilled person working in the field of temperature-resistant components.
Therefore the subject-matter of claim 1 was obvious in view of D7 taking into account the teaching of D11.

IX. The respondent’s arguments as far as relevant for this decision can be summarised as follows.

Claim 1 was based on claim 1 as filed in combination with the features described in paragraphs [0015] to [0018] as originally filed.

D7 only disclosed a bond layer but did not disclose the remaining layers as defined by claim 1. Moreover, D7 taught the presence of further elements in the bond coat which were excluded by the wording of claim 1.

No hint could be found in D11 to modify the teaching of D7 in order to arrive at the subject-matter of claim 1.

Reasons for the Decision

1. Admissibility of the main request

With the summons to oral proceedings, the Board sent a communication pursuant to Articles 15(1) and 17(2) of the Rules of Procedure of the Boards of Appeal (RPBA) indicating its preliminary, non-binding opinion of the case.

In reaction thereto the respondent filed a new main request with the letter dated 13 September 2017, intended to address the issue of added subject-matter.

The Board considers that the further amendment of a claim by adding a feature, which the appellant argued had been omitted from the original amendment, cannot be considered as a surprise and cannot be regarded as an abuse of the procedure. Furthermore, both the Board and the appellant had sufficient time (in this case one month) to assess the thus amended request.

The Board therefore decided to admit the main request exercising its discretion under Article 13(3) RPBA.

2. Article 123(2) EPC

2.1 In the grounds of appeal the appellant argued that, in the definition of the composition of the bond coat in the then claim 1, the amounts of nickel and cobalt from the teaching of the application as originally filed had been omitted.

In claim 1 of the current main request the amounts for nickel and cobalt in the bond coat are defined in line

with the teaching in paragraphs [0016] and [0017] of the application as filed (reference is made to the A-publication) and claim 7 as originally filed.

2.2 During the oral proceedings the appellant argued for the first time that the definition of claim 1 went beyond the teaching as originally filed for further reasons. These objections were filed very late in the proceedings and are not particularly relevant.

The features concerned are:

a) "a bond coat (2) formed by a low-pressure plasma spray on the surface of the substrate;"

The application as originally filed states in paragraph [0018] that "The bond coat is most favorably formed by a low-pressure plasma spray technique."

Contrary to the appellant's submission, this feature is therefore unambiguously derivable from the application as originally filed.

b) "in that the component has an interface oxide layer consisting of aluminum oxide between the bond coat and the top coat"

The argument of the appellant that the amended feature is a generalisation of figure 3 is not persuasive, since paragraphs [0013] and [0015] of the application as filed teach that, in the absence of elements being more oxidisable than aluminium, the interface oxide layer is formed of pure aluminium oxide.
This teaching is also presented in a general manner by reference to figure 3, which is a schematic drawing

merely illustrating the invention without any limiting effect.

The Board therefore cannot determine any technical teaching concerning the interface oxide layer defined in claim 1 which goes beyond the teaching as originally filed.

2.3 The appellant further alleged for the first time during oral proceedings that claim 5 and claims 6 to 9, which are dependent on claim 5, were not derivable from the application as filed.

However, other than a deletion of redundant wording in claim 7 as filed (corresponding to claim 5 as granted) no further amendments could be identified by the Board.

3. The Board therefore concludes that the claims of the main request fulfil the requirements of Article 123(2) EPC.

4. Article 56 EPC

4.1 The Board agrees with both parties that D7 forms a suitable starting point for assessing inventive step, since it relates to the same aim as the contested patent and is directed to a MCrAl layer for use in components which are exposed to high thermal loads, in particular for a turbine blade or vane, especially for a gas turbine (paragraph [0001]).

4.2 The MCrAl layer according to D7 has the following composition (see claims 1 and 7 or paragraphs [0020] to [0021] respectively):
10 to 82% by weight of cobalt,
10 to 35% by weight of chromium,

8 to 14% by weight of aluminium, and
nickel as the balance with further optional alloying additions.

An aluminium oxide layer and a thermal barrier layer of a ceramic material are present on the MCrAl layer (see claims 1 and 12 or paragraphs [0026] to [0027] respectively).

4.3 D7 is based on the finding that the bonding of the thermally grown oxide (TGO) to the MCrAl layer is positively influenced by a microporosity of the TGO (paragraph [0020]).

4.4 To achieve the microporosity in the TGO, D7 teaches that the MCrAl layer preferably has to include additions of at least one element from each of three groups (I, II and III) defined in paragraph [0023]. This is also confirmed by the specific embodiments described in paragraphs [0024] to [0027] of D7.

Despite the fact that D7 uses in the first half-sentence of paragraph [0023] the word "preferentially", it becomes clear from the remaining text of this paragraph that the MCrAl layer must necessarily include ("muss ... zwingend ... aufweisen") elements from each of the three groups I, II and III defined therein. Indeed D7 discloses neither that further alternative elements could be present nor that the microporosity could be achieved in a sufficient manner in the absence of elements from each of three groups I, II and III.

Therefore when considering document D7 for further development, the skilled person would not consider the teaching of paragraphs [0020] to [0022] or claims 1, 7 and 12 in isolation but would consider the complete

teaching of D7, in particular the specific teaching of paragraph [0023].

4.5 Starting from the general technical teaching in paragraphs [0020] to [0023] of D7, the subject-matter of claim 1 differs in that the component comprises

a) a zirconia based ceramic top coat,

b) a substrate layer comprising nickel or cobalt,

c) a bond coat which is formed by a low-pressure plasma spray,

d) an interface oxide layer consisting of aluminium oxide and

e) a bond coat consisting of an alloy as defined in claim 1 which does not comprise any of the elements proposed in groups I, II and III of D7.

4.6 It is demonstrated in the examples of the contested patent that the absence of further elements such as yttrium (one of the elements of group I to be used according to D7) suppresses the growth of the interface oxide layer (example 1) leading to an improved durability (example 2).

4.7 Starting from D7 the objective technical problem can therefore be regarded to be the improvement of durability of the high temperature components.

4.8 The appellant argued that the use of zirconia-based ceramic top coats on nickel alloys is well known in the art, and that the use of a low-pressure plasma spray is

a conventional way of applying a coat layer as evidenced by D11 (abstract).

The Board however cannot identify any hint which motivates the skilled person when starting from D7, to ignore the explicit technical teaching of D7 (see e.g. paragraphs [0020] and [0023] to [0027]), and instead to use a bond coat as defined in present claim 1 in order to address the technical problems such as durability and spalling.

4.9 Even if the skilled person would not consider the presence of one of the elements of groups I to III as being essential according to D7 and would further disregard the experimental evidence shown in the contested patent, as was argued by the appellant, he does not get any hint or motivation to combine the teaching of D7 with the general teaching in the abstract of D11, and then to adapt the amounts of the nickel and cobalt in the bond coat and not to add further elements, such that the interface oxide consists solely of aluminium oxide.

5. Therefore the Board comes to the conclusion that the subject-matter of claim 1 of the main request is based on an inventive step and fulfils the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of the following documents:

   - claims 1 to 11 filed with letter dated 13 September 2017,
   - description pages 2, 3, 5 to 8 and 9, line 1, of the published specification and page 4 as filed in the oral proceedings before the Board and
   - drawings 1 to 8 as granted.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated