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Datasheet for the decision of 24 February 2009

Case Number: T 0558/06 - 3.2.07

Application Number: 98108034.4

Publication Number: 0879900

IPC: C23C 30/00

Language of the proceedings: EN

Title of invention:
Composition for providing a coating on an airfoil and a process for forming the coating

Patent Proprietor:
United Technologies Corporation

Opponent:
SIEMENS AKTIENGESELLSCHAFT

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 84, 123(2) and (3)
RPBA Art. 12, 13

Relevant legal provisions (EPC 1973):
-

Keyword:
"Admissibility of requests (main request and auxiliary requests 2, 4-7 and 10-11 - no)"
"Admissibility of amendments (auxiliary requests 1, 3, 8, 9 - yes)"
"Novelty (yes)"
"Inventive step (auxiliary requests 1, 3, 8, 9 - no)"

Decisions cited:
G 0009/92, G 0004/93, T 0130/89

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0558/06 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 24 February 2009

Appellant: (Opponent)
SIEMENS AKTIENGESELLSCHAFT
Postfach 22 16 34
D-80506 München (DE)

Representative:
-

Respondent: (Patent Proprietor)
United Technologies Corporation
United Technologies Building
Hartford
Connecticut 06101 (US)

Representative:
Hiebsch, Gerhard F.
Hiebsch Behrmann Wagner
Patentanwälte
Heinrich-Weber-Platz 1
D-78224 Singen (DE)

Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 24 February 2006 concerning maintenance of European patent No. 0879900 in amended form.

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
I. Beckedorf

Summary of Facts and Submissions

I. The opponent (appellant) lodged an appeal against the interlocutory decision of the Opposition Division to maintain European patent No. 0 879 900 in amended form and requested that the decision be set aside and the patent be revoked.

II. For this decision the following document of the opposition proceedings is of relevance:

D14 = US-A-5 366 765

III. An opposition had been filed against the patent in its entirety under Article 100(a) EPC, for lack of novelty and inventive step, under Article 100(b) EPC, that the patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art, and under Article 100(c) EPC for extending beyond the content of the application as originally filed.

IV. The Opposition Division held that the patent fulfilled the requirements of Article 83 EPC. The main request and auxiliary request I as filed at the oral proceedings dated 12 January 2006 were considered to meet the requirements of Articles 123(2) and (3) EPC and of Articles 83 and 84 EPC. The Opposition Division considered that the subject-matter of claim 1 of the main request was novel, particularly with respect to D6 (EP-A-0 837 153), but it lacked an inventive step with respect to a combination of D5 (EP-A-0 525 545) with D8 ("Gas phase deposition of aluminium on nickel alloys", R. S. Parzuchowski, Thin solid Films, 45 (1977),

pages 349-355) but not with respect to D5 and D14. The subject-matters of independent claims 1 and 6 of auxiliary request I were considered to be novel over D14 and to involve an inventive step since D14 could not be combined with any other document, particularly D1 (US-A-4 241 113) and D23 (US-A-4 347 267).

V. Claims 1 and 6 as maintained read as follows:

"1. A composition for providing an oxidation and corrosion resistant coating on internal surfaces of an airfoil, said composition including a dry composition consisting essentially of from 2.5 wt% to 7.0 wt% aluminum fluoride, from 5.0 wt% to 20 wt% of a chromium-aluminum powder, and from 75 wt% to 92.5 wt% Al_2O_3, further comprising a cellulose compound and water added to said dry composition so as to form a slurry composition to be injected into said airfoil."

"6. A process for forming an oxidation and corrosion resistant coating on selected surfaces of an airfoil comprising: forming a dry composition consisting essentially of from 2.5 wt% to 7.0 wt% aluminum fluoride, from 5.0 wt% to 20 wt% of a chromium-aluminum powder, and from 75 wt% to 92.5 wt% Al_2O_3, mixing said dry chemical composition with a cellulose compound and water so as to form a slurry composition; placing said slurry composition into contact with internal surfaces of said airfoil; and baking the slurry."

VI. With a communication annexed to the summons dated 20 November 2008 the Board arranged for oral proceedings and presented its preliminary opinion based on claims 1-13 of auxiliary request I as filed during

the oral proceedings before the Opposition Division on 12 January 2006 (i.e. claims 1-13 as maintained with the impugned decision).

It stated amongst others that the dependent claims 4, 11 and 12 of auxiliary request I (corresponding to claims 5, 12 and 13 as granted) had been amended but that these amendments were obviously not related to a ground of opposition so that they were considered to contravene Rule 80 EPC. Therefore it appeared that it could not accede to the request of the respondent (patent proprietor) to confirm the impugned decision.

With respect to the issue of sufficiency of disclosure the Board stated that it would have to be discussed as to whether or not the person skilled in the art was enabled to produce such coatings, particularly of a certain thickness, without undue burden by simply carrying out routine tests. It seemed that D14 should be considered in this context for stating that the skilled artisan can readily determine, without undue experimentation, the balance between the aluminium source and the halide activator to produce a desired thickness of coating at a particular temperature within a particular time.

With respect to the discussion of inventive step it remarked that this issue would be dealt with taking into consideration the problem-solution approach. Starting from the closest prior art and taking account of the problem to be solved - which would be based on the effect of the distinguishing features - it would be discussed whether or not the available prior art, particularly D14, rendered the subject-matter claimed

obvious when either combined with another teaching in the prior art or the common general knowledge of the person skilled in the art.

In this context the Board noted the following points:

The patent in suit disclosed comparative examples with a product PWA 273 (i.e. slurry 7 of Tables 1 and 2 which contained 5 wt% AlF_3, 30 wt% Cr-45Al and 65 wt% Al_2O_3) which represented a commercial product (of Pratt-Whitney) considered available before the application underlying the patent in suit had been filed. It seemed that the applicant considered this aluminiding composition to represent the closest prior art. The question was whether or not this composition PWA 273 corresponded to that of D14, which in the patent in suit was stated to (1) result in a too brittle coating which (2) as a composition was too thick to apply to the internal cooling passages of a high pressure turbine airfoil, and (3) was not compatible with the processes for coating the external surfaces of airfoils (see patent, page 2, paragraph [0004]).

With respect to the slurries 1-6 of the other examples the Board remarked that there seemed to be no proof that the resulting coatings were less brittle than those of the prior art.

Another question might be whether or not the person skilled in the art had any incentive to simply select a dry composition for pack cementation and then to apply it as a slurry in order to coat internal surfaces of an airfoil.

With respect to decision T 130/89 referred to by the parties it appeared not to be apparent that there would be obtained a surprising effect by the combination of the use of a slurry and the three-component aluminiding composition. The slurry forming components, i.e. the cellulose compound and water served to disperse the "dry composition" and to place it at the internal surfaces; thereafter they were degraded and at least partially decomposed during the baking step. In the aluminiding step at about 1000°C the cellulose should be totally decomposed and should not influence the aluminiding reaction at all. Each group of features therefore seemed to serve a different purpose.

Finally it remarked that any further written submission should be filed as soon as possible and at least one month before the date of the oral proceedings and that the admittance of facts and evidence was still subject to the provisions of Article 114(2) EPC and Articles 12 and 13 of the Rules of Procedure of the Boards of Appeal (RPBA).

VII. With letter dated 23 January 2009 received by fax of 26 January 2009 the respondent submitted sets of claims as an amended main request together with auxiliary requests 1 to 9 in combination with arguments concerning the allowability of the amendments made therein and the patentability of their claims, taking account of the Board's communication.

VIII. Oral proceedings before the Board were held on 24 February 2009. The Board remarked at the start that the independent claims of the main request and of auxiliary requests 2, 4 and 6 appeared formally not

allowable since they extended beyond the scope of the claims 1 and 6 as maintained by the Opposition Division. The patent proprietor not having appealed it was limited to defending its patent within the limits of the claims maintained with the impugned decision. The respondent did not wish to argue further on these requests. Thus the subject-matters of the composition claims 1 of auxiliary requests 1 and 3 were first discussed in substance with respect to inventive step, but considered by the Board to be obvious. Thereafter the use claims 1 of auxiliary requests 5 and 7 were discussed and considered not to *prima facie* comply with Article 84 EPC. The discussion of inventive step was then continued with respect to the process claims 1 of auxiliary requests 8 and 9 which due to typing errors contravened Articles 84 and 123 EPC and therefore were subsequently replaced by modified versions. As a result of this inventive step discussion the respondent submitted the additional auxiliary requests 10 and 11.

IX. The appellant requested that the decision under appeal be set aside and that the patent be revoked. Additionally, it requested an apportionment of costs in view of auxiliary requests 10 and 11 filed by the respondent during the oral proceedings if the Board admitted these requests.

The respondent requested that in setting aside the decision under appeal the patent be maintained in amended form with the set of claims according to the main request filed with letter of 23 January 2009 or, alternatively, according to one of the sets of claims filed as auxiliary request 1 to 7 with letter of 23 January 2009, or according to one of the sets of

claims filed as auxiliary requests 8 to 11 during the oral proceedings.

At the end of the oral proceedings the Board announced its decision.

X. The subject-matter of composition claim 1 of the main request differs from claim 1 as maintained (see point V above) in that the features "**, further comprising a cellulose compound and water added to said dry composition so as to form a slurry composition to be injected into said airfoil**" (emphasis added by the Board) have been omitted.

Independent claim 7 of the main request is identical with claim 6 as maintained.

XI. The independent claims 1 and 6 of auxiliary request 1 are identical with the independent claims 1 and 6 as maintained.

XII. The subject-matter of composition claim 1 of auxiliary request 2 differs from claim 1 as maintained in that the concentration ranges have been restricted to "75 wt% to **80** wt% of Al_2O_3, from 2.5 wt% to **5.0** wt% aluminum fluoride, and from **15** wt% to 20 wt% chromium-aluminium powder" and that the features "**, further comprising a cellulose compound and water added to said dry composition so as to form a slurry composition to be injected into said airfoil**" (emphasis added by the Board) have been omitted.

Independent process claim 7 of auxiliary request 2 is identical with claim 6 of auxiliary request 1.

XIII. The subject-matter of claim 1 of auxiliary request 3 differs from claim 1 as maintained in that the concentration ranges have been restricted to "75 wt% to **80** wt% of Al_2O_3, from 2.5 wt% to **5.0** wt% aluminum fluoride, and from **15** wt% to 20 wt% chromium-aluminium powder" (emphasis added by the Board).

Independent process claim 6 of this request is identical with claim 6 of auxiliary request 1.

XIV. Claim 1 of auxiliary request 4 differs from composition claim 1 of the main request in that the subject-matter has been reworded as a use claim by adding the term "**Use of**" (emphasis added by the Board).

Independent process claim 7 of this request is identical with claim 6 of auxiliary request 1.

XV. Claim 1 of auxiliary request 5 differs from composition claim 1 as maintained in that the subject-matter has been reworded as a use claim by adding the term "**Use of**".

Independent process claim 6 of this request is identical with claim 6 of auxiliary request 1.

XVI. Claim 1 of auxiliary request 6 differs from composition claim 1 of auxiliary request 4 in that the subject-matter has been reworded as a use claim by adding the term "**Use of**" (emphasis added by the Board).

Independent process claim 7 of this request is identical with claim 6 of auxiliary request 1.

XVII. Use claim 1 of auxiliary request 7 differs from the use claim 1 of auxiliary request 5 in that the subject-matter has been restricted to "75 wt% to **80** wt% of Al_2O_3, from 2.5 wt% to **5.0** wt% aluminum fluoride, and from **15** wt% to 20 wt% chromium-aluminium powder" (emphasis added by the Board).

Independent process claim 6 of this request is identical with claim 6 of auxiliary request 1.

XVIII. Process claim 1 of auxiliary request 8 differs from that of process claim 6 of auxiliary request 1 in that the additional features "**, the process further comprising: placing said airfoil with said baked slurry composition in a coating fixture; placing a chemical composition in said fixture for coating exterior surfaces of said airfoil**" have been incorporated.

XIX. Process claim 1 of auxiliary request 9 differs from that of auxiliary request 8 in that the additional features "**; and applying heat for a time sufficient to form a protective coating on the exterior surfaces of the airfoil and simultaneously form a protective coating on the internal surfaces**" have been incorporated.

XX. Process claim 1 of auxiliary request 10 differs from that of auxiliary request 9 in that the additional feature "**, and wherein said exterior surface chemical coating composition comprises a composition containing aluminium fluoride and a chromium-aluminium powder**" has been incorporated.

XXI. Process claim 1 of auxiliary request 11 differs from that of auxiliary request 10 in that the additional feature "**, and consisting essentially of 15.4 wt% aluminium fluoride and 84.6 wt% of chromium-45 aluminium**" has been incorporated.

XXII. The appellant argued essentially as follows:

Novelty of the subject-matter claimed is not disputed.

Claim 1 of auxiliary request 1 defines a first group of features relating to the dry composition, i.e. AlF_3, the chromium-aluminium powder and Al_2O_3, and a second group of features relating to the slurry, i.e. water and the cellulose compound. Compared to claim 1 the subject-matter of process claim 6 of this request requires only an additional baking step of the slurry. The patent in suit nowhere discloses that the slurry has an influence onto the aluminiding reaction related to the first group of features. Since the slurry is dried during the baking step and the water and the cellulose compound added for making it a slurry disappears at the high temperature of 550°C (see patent, paragraph [0018]) it is clear that these two have no influence on the amount of aluminium which is diffused into the part at the coating temperatures of above 1000°C. The slurry only serves to deliver the desired amount of the dry composition to the desired place before the heating step. At 550°C and likewise at 1000°C there is neither cellulose nor water present at the internal surfaces of the airfoil, only the dry composition is present. Therefore claim 1 relates to an invention having two separate objects: the first one is to define a dry composition for coating the part with a desired

thickness, the second one is to place said dry composition into contact with internal surfaces of parts to produce an internal coating. The dry composition defines the amount of Al which is to be diffused into that part, i.e. the coating thickness. Such a composition is e.g. known from D8 which discloses a dry composition containing 10 wt% aluminium, 5 wt% transport agent (AlF_3) and 85 wt% Al_2O_3 (see page 350). From D5 it is known that chromium can be added to such a composition in order to reduce the vapour pressure of the aluminium halide (see page 4, lines 30 to 33; examples 1 to 6). The dry composition of D8 thus modified can be used for coating the external surfaces and the internal surfaces of a turbine part.

It is stated in the patent (see paragraph [0017]) that the dry composition has to be transformed into a slurry in order to be suitable for coating internal surfaces of such parts. Starting from D8 the problem to be solved is how to apply the dry composition on internal surfaces of the part which are difficult to access. Since a pure CVD process is not necessary for simple airfoil parts the person skilled in the art would apply a pack cementation process for the other surfaces. The problem of coating internal surfaces of such airfoils is already known from D14 (see column 2) which teaches to make a slurry using water and a cellulose compound and which is not restricted to a specific dry composition. D14 additionally mentions the drying step of the slurry which is subsequently baked before the aluminiding step is carried out (see column 6, lines 10 to 13). Therefore the solution to said second problem involves no inventive step and the subject-matter of

claim 1 of auxiliary request 1 thus lacks an inventive step.

It is also possible to consider D14 as the closest state of the art. It discloses that the person skilled in the art can easily determine the required specific aluminiding composition in order to produce a desired thickness of the coating (see column 3, lines 16 to 20). Consequently, the person skilled in the art would also arrive at the claimed composition by applying its common general knowledge.

With respect to the three alleged disadvantages of the resulting coating according to D14 mentioned in the patent in suit (see paragraph [0004]) it is remarked that the examples are silent with respect to brittleness while claims 1 and 6 neither define the size of the internal holes nor the thickness of the coating to be produced, nor do they define the process for coating the external surfaces of the airfoil. Consequently, all these disadvantages cannot be considered. Claims 1 and 6 do also not exclude the use of argon. Whether or not the dry composition PWA 273 of the comparative example 7 of the patent in suit belongs to the state of the art and results in a brittle coating is not relevant since this example was only executed to prove that certain thicknesses cannot be produced. If the composition according to D8 is identical with that of claim 1 of auxiliary request 1 then the thickness and the properties of the resulting coating should be the same.

Although D5 concerns a process for refurbishing of corroded turbine parts such process is not excluded by

the subject-matter of claim 1 or claim 6. The coating composition per se according to D5 is not restricted to the refurbishing process.

The above arguments are also valid for the subject-matter of claims 1 and 6 of auxiliary request 3.

Claim 1 of auxiliary request 8 does not define the chemical composition which can be a different one (compare the patent in suit, page 2, lines 47 and 48) and does also not define the heating step. D14 mentions that pack cementation compositions are used for coating the exterior surfaces of the airfoil (see column 4, lines 22 to 33 and column 6, lines 13 to 16). Claim 1 of auxiliary request 9 specifies said heating step but its subject-matter is – likewise as that of auxiliary requests 1 and 3 – suggested by D5, D8 and D14. It is clear that the coating compositions have to be similar to be suitable. It has also to be considered that the use of argon or reducing gas for the aluminiding step makes technically sense since aluminium readily reacts with oxygen by forming aluminium oxide. Therefore claims 1 of auxiliary requests 8 and 9 lack an inventive step, too.

Auxiliary request 10 was late filed and should therefore not be admitted into the proceedings. In case that it is admitted then an apportionment of the costs is requested.

The process of D14 also uses a "coating fixture", i.e. a chamber, wherein the described pack cementation powder is placed, then dried and baked. The subject-matter of process claim 1 of auxiliary request 10 does

not exclude any pack cementation process for coating the exterior surfaces since the feature "fixture" only implies a reaction chamber which, however, is not restricted to the one described in the description of the patent in suit. Claim 1 of auxiliary request 10 thus likewise lacks an inventive step.

Claim 1 of auxiliary request 11 is also late filed and should therefore not be admitted since the right to be heard is not respected. Otherwise an apportionment of costs is requested. The additional feature has been taken from the description and thus the appellant was not capable carrying out a further search for this feature. The respondent’s case should have been complete before the oral proceedings so that this amendment goes against the Rules of Procedure of the Boards of Appeal. The person skilled in the art would select a chemical composition suitable for the intended CVD process. Furthermore, the definition "consisting essentially of" in combination with the two specified components summing up to 100% renders claim 1 unclear.

XXIII. The respondent argued essentially as follows:

The requests (main, second, fourth and sixth auxiliary request) extending beyond the scope of the independent claims 1 and 6 as maintained by the Opposition Division were maintained without further arguments.

D14 represents the closest prior art as correctly outlined in the impugned decision (see point 5 of the reasons. The person skilled in the art is represented by an engineer having an academic background in turbine technology as well as oxidation and corrosion

protection of turbines, this person having concrete experience in applying protective coatings. There exists no evidence that the problems mentioned in the context of D14 do not exist (see patent in suit, paragraph [0004]). Although it is known that CVD can be used for coating internal holes it has disadvantages (see patent, paragraph [0005]). There exists no evidence that the process of D14 actually works.

The brittleness of the aluminide coating is possibly due to the high aluminium content of the powder pack. The thickness of the coating is the result of a certain composition of the slurry and not of the aluminium content. It is known to be difficult to remove the rest of the powder after a coating step of small internal passageways (see D3, column 2, lines 18 to 52) and it is therefore essential to provide a thin uniform layer of slurry on the surface to be cured (see D14, column 3, lines 27 to 33). Indeed the object may be formulated as to how to provide a composition suitable for forming thinner not so brittle coatings and suitable to be deposited on internal surfaces of airfoils as compared to those in D14. Definitely this object is solved by all features in combination as defined in claim 1 of auxiliary request 1. There is a combinative synergy of all components as proven also by D14 (column 3, lines 62 to 64) in that the cellulose compound should be selected such that the slurry is less likely to undergo a reaction between the free aluminium and water. It is clear from the description that the coating is formed from the slurry rather than from the dry composition. There is clear evidence in the description that also the cellulose is part of the coating process upon elevated temperatures (compare in this context D14

(column 3, line 38 to column 4, line 16) which is incorporated by reference at page 3, line 45 of the patent in suit). D14 does not suggest any CVD process for coating the external surfaces (see column 6, lines 13 to 16). The above proves that the appellant's assumption of two distinct groups of features is not justified in the present case and that the two objects formulated by it are not independent in a technical sense. According to T 130/89 for the case of a not-combinatory invention a first object must be solved exclusively by a first group of features and a second object must exclusively be solved by a second group of features and the features of the second group should not be contributing to the functionality of the features of the first group *vice versa*, which is not the case here. The claimed process does not require any argon as disclosed by D14.

D5 concerns a refurbishing process so that the practitioner would not apply its teaching. Furthermore, although the powder composition is somehow close it results in fairly thick coatings of about 200 µm thickness which is too thick for small internal passageways (see D5, examples).

Since D14 is the closest state of the art but does not work the skilled person would not apply its teaching, but go for the CVD process.

The comparative example 7 was made with PWA 273. PWA 273 is not a specific composition but a set of process instructions which are not limited to any product. Unfortunately no copies of these instructions were obtained from the patent proprietor. There exists

no evidence that this composition was public and belonged to the prior art. It is not known why comparative example 7 was made with PWA 273 and not made with a composition in accordance with D14.

The same conclusions apply to the more restricted concentration ranges of claims 1 and 6 of auxiliary request 3.

Therefore the subject-matters of claims 1 and claim 6 of auxiliary requests 1 and 3 involve an inventive step.

In respect of the clarity objection of the Board raised against auxiliary requests 5 and 7 no arguments were submitted.

Claims 1 of auxiliary requests 8 and 9 have been amended to define the simultaneous coating of internal and external surfaces which was the original synergy envisaged, which results in advantages (see patent, paragraph [0012]). The "coating fixture" has to be interpreted according to the patent in suit as a coating device having specific functional restrictions (see patent, paragraphs [0005], [0015] and [0019]; Figure 1) and thus excludes pack cementation. D14 concerns only powder pack coating and does not suggest combining CVD coating with slurry coating of the internal passages of an airfoil.

Claim 1 of auxiliary request 10 is based on claims 7, 12 and 14 as granted while claim 1 of auxiliary request 11 comprises a further feature having a basis at page 9, lines 5 to 7 of the application as originally filed. These requests are the result of the inventive step

discussion and are intended to make clear that CVD chemical compositions are meant. Since the practicability of the process has been under dispute the appellant cannot be surprised by these new requests, particularly because the first one is based on a combination of dependent claims. Claims 1 of both requests now define what is actually used as chemical composition in the process. The wording "consisting essentially of …" of auxiliary request 11 is taken from the description. It is clear and concerns only the typical impurities comprised in said composition. The Board should not be too strict with the admissibility of these two requests.

Reasons for the Decision

1. *Admissibility of requests*

1.1 According to the established jurisprudence of the Boards of Appeal if the opponent is the sole appellant against an interlocutory decision by an Opposition Division maintaining the patent in amended form the patent proprietor/respondent is primarily restricted in the appeal proceedings to defending the patent as maintained. Amendments proposed by it could be rejected by the Board as inadmissible if they were neither appropriate nor necessary (see Case Law of the Boards of Appeal, 5th edition 2006, Chapter VII.D.6.1; G 9/92 and G 4/93, both OJ EPO 1994, 875).

1.1.1 Exactly the aforementioned situation is given in the present case. As a consequence, since the subject-matter of claims 1 of the main request and auxiliary

requests 2, 4 and 6 is broader in scope than that of claim 1 as maintained by the Opposition Division due to the omission of the features concerning the cellulose compound and water (compare points V, X, XII, XIV and XVI above) it is evident that these requests cannot be admitted.

1.1.2 The subject-matters of claims 1 of auxiliary requests 5 and 7 are directed to the "**use** of a composition **for providing an oxidation and corrosion resistant coating on internal surfaces**" (emphasis added by the Board), i.e. to a physical activity. The technical features of a claim to an activity are the physical steps which define such an activity.

However, claims 1 of auxiliary requests 5 and 7 do not specify the process steps which are necessary for obtaining the indicated result. Consequently, claims 1 of auxiliary requests 5 and 7 *prima facie* do not comply with Article 84 EPC. Furthermore, if these essential features were to be incorporated into the subject-matter of claim 1 of these requests then they would in any case correspond to that of the independent process claims already present among the requests.

Therefore the Board decided not to admit auxiliary requests 5 and 7 into the proceedings.

1.2 During the discussion of inventive step of the subject-matter of process claims 1 of auxiliary requests 8 and 9, i.e. at a time when the Board had presented its opinion that the remaining higher ranking requests were not allowable for lack of inventive step, the respondent submitted the new auxiliary requests 10 and

11. By these two new requests it attempted to exclude a pack cementation process for coating the exterior surfaces of the airfoil as was suggested by D14 (see point 4.9.1 below). It argued that the suggested amendments could be expected by the appellant since the incorporation of the subject-matter of a dependent claim into the subject-matter of the independent claim is common practice, while the feature taken from the description corresponds to the preferred embodiment of said dependent claim.

1.2.1 The appellant objected to the filing of these new requests at the oral proceedings and argued that they could have been filed earlier and thus were clearly late filed. Furthermore, since the additional feature of claim 1 of auxiliary request 11 was taken from the description of the patent in suit the appellant had not had the possibility to carry out a further search for this specific feature. Therefore these two new requests should not be admitted into the proceedings taking account of the Rules of Procedure of the Boards of Appeal.

1.2.2 In its communication annexed to the summons to oral proceedings the Board had remarked that D14 appeared to be particularly relevant. Furthermore, the parties were requested to make any submissions at least one month before the oral proceedings and were advised to take note that the admittance of facts and evidence was still subject to the provisions of Article 114(2) EPC and Articles 12 and 13 RPBA (see point VI above). With its letter of 23 January 2009 received by fax dated 26 January 2009 the respondent has submitted an amended main request and auxiliary requests 1 to 9 as a

response to the Board's communication (see point VII above). Although these ten requests were not filed before at least one month before the date of the oral proceedings expired, i.e. 24 February 2009, as stated in its communication, the Board considered and examined all these requests during the oral proceedings. The discussions concerning the formal admissibility thereof resulted in the filing of modified versions of claims 1 of auxiliary requests 8 and 9 (see point VIII above), which were also admitted.

1.2.3 From Article 13 RPBA it is clear that amendments to a party's case after the issue of the summons to oral proceedings need not be admitted if they raise issues which the Board or the other party cannot reasonably be expected to deal with without adjournment of the oral proceedings.

1.2.4 The fact that the respondent submitted with letter of 23 January 2009, sent by fax of 26 January 2009, a new main request and auxiliary requests 1 to 9 in reaction to the Board's communication shows that it was aware of the risk that the patent could be revoked. Therefore it could have filed auxiliary requests 10 and 11 earlier than during the oral proceedings, which are thus considered as filed very late. The Board thus examined the amendments and their consequences for the appeal proceedings.

1.2.5 Claim 1 of auxiliary request 10 represents a combination of claims 1 and 7 of auxiliary request 9.

The additional feature of claim 1 of auxiliary request 10 specifies that "said exterior surface chemical

coating composition **comprises** a composition **containing** aluminium fluoride and a chromium-aluminum powder" (emphasis added by the Board). Due to the combined use of the terms "comprising" and "containing" this composition is openly defined and thus allows the presence of further unspecified components, such as Al_2O_3. The latter component, however, will be present in the pack cementation aluminiding composition according to D14.

Consequently, the proposed amendment of claim 1 of auxiliary request 10 does **not** exclude any pack cementation process for coating the exterior surfaces and is thus *prima facie* not suitable for overcoming an inventive step objection based on D14.

1.2.6 The additional feature of claim 1 of auxiliary request 11 is taken from the description (see patent, page 3, lines 47 and 48).

The Board holds that the appellant could not expect such a request on the basis of claim 1 of auxiliary request 10 - which was filed for the first time during the oral proceedings - and another feature taken from the description of the patent in suit. Such a combination had never been proposed before by the respondent, nor was it the subject of any of the earlier discussions. It would have been unfair to the appellant to confront it with this new auxiliary request without allowing it to carry out an additional search for the feature taken from the description. This, however, would at least have necessitated adjournment of the oral proceedings and arrangement of a further date for them, a situation which is addressed in

Article 13(3) RPBA as an express reason for not admitting an amendment to a party's case.

1.2.7 The Board therefore decided not to admit auxiliary requests 10 and 11 into the proceedings. As a consequence thereof the appellant's request for an apportionment of costs need not be further considered.

Thus only the auxiliary requests 1, 3, 8 and 9 were admitted into the proceedings and discussed as to their substance.

2. *Admissibility of amendments (Articles 123(2) and (3) EPC)*

The Board is satisfied that claims 1 and 6 of auxiliary requests 1 and 3, and claims 1 of auxiliary requests 8 and 9 comply with Articles 123(2) and (3) EPC.

3. *Novelty (Article 54 EPC)*

3.1 Novelty has not been disputed during the appeal proceedings and the Board is satisfied that none of the cited documents discloses a composition or a process having all the features of claims 1 and 6 of auxiliary request 1, respectively.

The subject-matters of claims 1 and 6 of auxiliary request 1 are thus novel (Article 54 EPC).

3.2 The above conclusion applies *mutatis mutandis* to claims 1 and 6 of auxiliary request 3 and claims 1 of auxiliary requests 8 and 9 (see points XIII, XVIII and XIX above) for being more restricted than claims 1 and

6 of auxiliary request 1. Consequently, the subject-matters of the independent claims of auxiliary requests 3, 8 and 9 are considered to be novel.

4. *Inventive step (Article 56 EPC)*

Auxiliary request 3

4.1 The Board comes to the conclusion that claim 1 of the more restricted auxiliary request 3 lacks inventive step over the disclosure of D14 and the common general knowledge available to the skilled person for the reasons that follow:

4.2 D14 relates to the art of forming an oxidation and corrosion resistant coating on internal surfaces of superalloy turbine blades, i.e. airfoils. The described pack cementation process according to D14 uses an aqueous slurry coating system for this purpose. Generally the slurry comprises a source of aluminium in particulate form, an inert ceramic particulate, a halide activator compound in particulate form and a viscous aqueous base dispersant. Said slurry is injected into the internal passage or otherwise coated on the internal surface to be protected. Thereafter the coated article is heated to dry the slurry and remove the aqueous solvent base and then the dried article is diffusion heat treated between about 1350°F and 2250°F (= 732.2-1232.2°C) for a period of time between approx. 4 hours and 24 hours to form the aluminide coating (see abstract and figures 1 to 2b; column 1, lines 6 to 13).

As aluminium source pure Al powder, Al-alloys, Al-compounds can be used, e.g. Co_2Al_5, CrAl, and Fe_2Al_5 work

well (see column 2, lines 47 to 66). The halide activator can be any of a large number of halide compounds including e.g. AlF_3, NaF, etc. (see column 2, line 67 to column 3, line 8). The inert ceramic particulate material may be selected from a large group of possible materials, preferably in the form of very fine particles (see column 3, lines 21 to 37).

The previously mentioned particulate materials along with an organic thickener are dry mixed and the mixture is formed into a slurry by adding water and stirring it. The thickener may be methyl cellulose but many other cellulose-base compounds may be used, e.g. Kelzan™; the key requirements for the thickener are to provide the desired degree of viscosity increase, that it degrade or decompose at moderate temperatures, i.e. below 1000°F (=537.8°C) and preferably below 600°F (=315.6°C), that it leave no residue on the surface to contaminate the surfaces after degradation and breakdown, that it not produce excessive by-products during decomposition, that it leave a network of interconnected voids to facilitate easy removal of the powder pack material, and that it contain no chemical species which are harmful to superalloys (see column 3, lines 38 to 66).

The desired viscosity of the slurry is within 100-1000 cP (see column 4, lines 3 to 16). Finally, the filled blade could also be placed in a conventional diffusion aluminide power pack so that the outside of the blade is coated at the same time as the inside of the blade (see column 6, lines 13 to 16).

4.3 The subject-matter of composition claim 1 of auxiliary request 3 differs from the composition used in the

process according to D14 in that the dry composition consists essentially of from 75 to 80 wt% of Al_2O_3, and from 2.5 to 5 wt% aluminium fluoride, and from 15 to 20 wt% chromium-aluminium powder.

4.3.1 According to the patent in suit said feature provides a coating that is not too brittle and not too thick to apply to the internal cooling passages of high pressure turbine airfoils (see patent, paragraph [0004]). It also allows that the slurry is compatible with processes used for simultaneously coating the external surfaces of airfoils (see patent, paragraph [0012]).

4.3.2 However, from the examples 1 to 7 of the patent in suit it cannot be derived that the coatings obtained with the composition of claim 1 are actually less brittle than those of D14. This is due to the fact that the patent in suit does not comprise any comparative example which is stated to have been made in accordance with D14 - which was already identified in the application to the patent in suit as originally filed (see page 2, second paragraph) - and because no relevant data of the examples with respect to this property have been disclosed. The patent in suit, however, refers to a comparative example, i.e. slurry composition 7, "**using the PWA 273 dry composition**" (see patent, page 4, lines 2 and 3; Tables 1 and 2).

4.3.3 According to said examples 1 to 7 a comparison was made with PWA 273 which from the Board's view represents a commercial product of Pratt-Whitney that was apparently available at the time before the application underlying the patent in suit had been filed. The Board had expressed this view in its communication and asked the

respondent for clarification in this context (see point VI above).

With its letter of 23 January 2009, faxed on 26 January 2009, the respondent stated "it has not been possible to confirm that slurry composition 7 (**the PWA 273 composition** identified in tables 1 and 2) formally corresponds to US 5,366,765 (document D14), however, and in view of a common origin of these technologies, confirmation was given that **the PWA 273 composition** was the one that failed to be applicable to the problem as outlined in the present patent, and that gave rise to the problems as identified at [0004] of the patent specification" (see fax, page 3, fifth paragraph).

Furthermore, "concerning the brittleness problem in this regard, the inventors have commented that the coating being too brittle **in the case of PWA 273** appears to be a threshold issue, **namely the known composition** being too brittle to be useful, and all examples prepared according to the present invention satisfying the usefulness criteria" (see page 3, sixth paragraph; all emphasis added by the Board).

4.3.4 Thus according to the statements made by the respondent in this letter the Board concludes that it is admitted that said composition of PWA 273 belongs to the prior art.

Contrary to these statements the respondent surprisingly argued during the oral proceedings that PWA 273 represents no composition but a set of process instructions which are not confined to any product and that there exists no evidence that this composition was

public and belonged to the prior art. The respondent, however, could not submit any evidence, such as copies of these instructions, to support this allegation. The Board remarks in this context that said designation "PWA" in combination with a 3-digit or 4-digit code is used by the company Pratt-Whitney to refer to specific commercial compositions, e.g. PWA 1484, which refers to a single crystal nickel base superalloy (see D6, column 7, lines 43 to 45). Therefore the Board sees no reason to deviate from its original view that PWA 273 represents a known composition.

The Board further remarks in this context that it would not be useful to make a comparison of the claimed composition with respect to a commercial product of a third party, particularly if certain disadvantages of this product are put forward in the context of a different prior art, i.e. document D14 (which had already been identified in the application in suit as originally filed), if said product would not have been comprised in the prior art.

The Board therefore concludes that the respondent, when filing the application for the patent in suit, considered this aluminiding composition PWA 273 to represent the proper comparison product, i.e. a closer prior art with respect to the claimed composition than D14.

PWA 273 is a composition including 5 wt% AlF_3, 30 wt% Cr-45Al and 65 wt% Al_2O_3.

The composition of claim 1 of auxiliary request 3 differs therefrom by allowing 2.5 wt% to 5 wt% AlF_3,

15 wt% to 20 wt% chromium-aluminium powder, and 75 wt% to 80 wt% Al_2O_3 in the dry aluminiding composition to which is added water and a cellulose compound so as to form a slurry composition.

This has the effect that the slurry composition can be applied as a thin coating to the internal passageways of airfoils and that it is not too brittle (see patent, paragraphs [0004], [0006] and [0020] to [0022]).

4.3.5 The objective problem is therefore the provision of a slurry composition suitable for forming thinner (but still at reasonable uniform thickness) not so brittle coatings to be deposited on internal surfaces of airfoils as compared to those of PWA 273.

4.4 This problem is solved by the composition as defined in claim 1 of auxiliary request 3. It is credible that the claimed measures provide a solution to said technical problem.

4.5 The person skilled in the art knows that various sources of aluminium will provide different amounts of aluminium at a given temperature and that various halide compounds will be more or less effective in transporting the aluminium to the surface to be coated. He also knows how to balance between the aluminium source and the halide activator to produce a desired thickness of coating at a particular temperature within a particular time (see D14, column 3, lines 9 to 20 referring explicitly to this available knowledge).

4.5.1 Starting from D14 the person skilled in the art would have to adapt the entire composition of the aluminiding

dry composition in order to obtain a coating which has the desired thickness so that it is suitable for the passageways of the airfoils and which is less brittle.

4.5.2 Instead, taking account of the fact that PWA 273 represents a closer state of the art with respect to the dry composition of claim 1 of auxiliary request 3 for consisting of 5 wt% AlF_3, 30 wt% Cr-45Al and 65 wt% Al_2O_3 (see patent, Tables 1 and 2) the person skilled in the art would start from said PWA 273 dry aluminiding composition.

When performing experiments with said PWA 273 composition in the form of a slurry (see patent in suit, page 4, line 2) the person skilled in the art would realize that this composition results in an unnecessarily thick and too brittle coating. Thus it is clear to him that he would have to change the amount of the aluminium source in the dry mixture relative to the amount of AlF_3 in order to reduce the coating thickness since the ratio of these two constituents is responsible for the mass transfer of the aluminiding reaction (see D14, column 3, lines 9 to 21 presenting this as the skilled person's general knowledge).

As PWA 273 is a simple three-component mixture the person skilled in the art knows that the effect of a reduction of the thickness of the produced aluminide coating can be achieved by increasing the amount of Al_2O_3 while reducing the amount of the aluminium source Cr-45Al in the composition. Thereby the person skilled in the art would at the same time obtain an aluminide coating which is less brittle than that according to the composition PWA 273.

However, by carrying out such an optimisation of the coating thickness by variation of the relative amounts of two components of the composition, which is considered to belong to the ordinary skills of the person skilled in the art, he would arrive at the subject-matter of claim 1 of auxiliary request 3 without any inventive skill.

4.5.3 The respondent argued that a combinative synergy of all components of the claimed composition would be present.

This argument cannot hold since the patent in suit nowhere discloses that the slurry has an influence on the aluminiding reaction according to the first group of features defining the components of the dry composition. Since the slurry is dried during the baking step and the binder is removed at the high temperature of 550°C (see patent, paragraph [0018]) it is clear that the water and cellulose compound cannot influence the amount of aluminium which is diffused into the part at the coating temperatures of above 1000°C. The additional slurry components, i.e. a cellulose compound and water, only serve to deliver the desired amount of the dry composition to the desired location before the heating step. At 550°C and likewise at 1000°C there is neither cellulose nor water present at the internal surfaces of the airfoil, only the dry composition is present. Therefore claim 1 relates to a an invention having two distinct objects: the first one is to define a dry composition for coating the part with a desired thickness, the second one is to place said dry composition into contact with internal surfaces of parts to produce an internal coating.

4.6 The said optimised (modified) three component dry composition is applied as aqueous slurry which comprises a cellulose compound onto the internal surfaces of an airfoil and is first heated to dry the slurry and remove the aqueous solvent base.

Following the instructions produced by D14 the skilled person will heat the slurry coated articles at a temperature below 212°F to remove the aqueous solvent from the dispersant, leaving the aluminium source, the halide activator compound, and the inert ceramic particles dispersed in a hardened organic matrix on the internal surfaces of the passageways (see column 2, lines 22 to 38). Thus this dried article is considered to be "baked". Thereafter this dried article is diffusion heat treated to provide an oxidation and corrosion resistant aluminide coating on the internal surfaces (see column 2, lines 38 to 46). Consequently, the person skilled in the art would also arrive at the subject-matter of process claim 6 of auxiliary request 3 in an obvious manner.

The respondent's argument that the subject-matter of claim 6 would exclude the use of argon (and thus the process steps suggested by D14) cannot hold since claim 6 does not contain any corresponding limitation. Furthermore, the description of the patent in suit only mentions that the need for an argon purge and the need for specialized plumbing with respect to the coating of the internal surfaces are eliminated (see patent, paragraphs [0009], [0011] and [0021]). It has also to be considered that the aluminiding reaction as such implies the use of an inert gas.

4.7 Claims 1 and 6 of auxiliary request 3 therefore do not comply with the requirements of Article 56 EPC. Consequently, auxiliary request 3 is not allowable.

Auxiliary request 1

4.8 Since claim 1 of auxiliary request 3 is narrower in scope than claim 1 of auxiliary request 1 (compare points XI and XIII above) the above conclusion with respect to claim 1 of auxiliary request 3 applies *mutatis mutandis* to claim 1 of auxiliary request 1.

The Board therefore concludes that claim 1 of auxiliary request 1 does not comply with the requirements of Article 56 either. Auxiliary request 1 is thus not allowable either.

Auxiliary request 9

4.9 Process claim 1 of auxiliary request 9 differs from independent process claim 6 of auxiliary request 3 in that the airfoil with the baked slurry composition is placed in a coating fixture, that a chemical composition is placed therein for coating the exterior surfaces of said airfoil, and that sufficient heat is applied to simultaneously form a protective coating on the exterior and internal surfaces of said airfoil (see points XIII and XIX above).

4.9.1 D14 discloses that the exterior surfaces of the airfoil can be coated at the same time as the inside surfaces by placing the airfoil with the baked slurry composition in its internal passages in a conventional

diffusion aluminide powder pack (see column 4, lines 22 to 33 and column 6, lines 13 to 16) which is a chemical composition.

It is implicit to the person skilled in the art that said chemical composition for coating the exterior surfaces of the airfoil is placed together with said airfoil in a chamber for carrying out the reaction in a reducing or inert gas atmosphere (see column 6, lines 16 and 17).

4.9.2 The respondent argued that the subject-matter of claim 1 of auxiliary request 9 would define CVD coating of the exterior surfaces of the airfoil.

This argument cannot hold since the features of claim 1 "the process further **comprising**: **placing** said airfoil with said baked slurry composition **in a coating fixture**" and "**placing a chemical composition in said fixture for coating** exterior surfaces of said airfoil" (emphasis added by the Board) do not exclude that the exterior surfaces of the airfoil are coated by a pack cementation process.

First of all, the feature "**coating fixture**" of claim 1 is not restricted to the interpretation given in the description of the patent in suit as described at page 3, lines 42 to 50 in the context of Figure 1 with respect to the preferred CVD coating. This is due to the fact that the description of the patent in suit also generally, i.e. without mentioning any CVD process, discloses that the airfoils for simultaneous coating of their internal and exterior surfaces are placed with their baked slurry composition in a coating fixture

wherein also a chemical composition is placed (see patent, paragraph [00012]).

Similarly the features "**comprising**" and "**placing a chemical composition** in said fixture **for coating** …" of claim 1 of this request also allow that the airfoil is not CVD coated but placed in said chemical composition, i.e. it can be a conventional diffusion aluminide powder pack for coating the exterior surfaces of the airfoil.

4.9.3 Therefore the Board considers that the person skilled in the art executing the process as disclosed in point 4.5.2 above would arrive at the subject-matter of claim 1 of auxiliary request 9 in an obvious manner when applying the aforementioned further teaching of D14 to obtain an inner as well as an outer coating of the airfoil. Therefore the process of claim 1 of auxiliary request 9 lacks an inventive step (Article 56 EPC). Auxiliary request 9 is thus not allowable.

Auxiliary request 8

4.10 Since claim 1 of auxiliary request 9 is narrower in scope than claim 1 of auxiliary request 8 (compare points XVIII and XIX above) the above conclusion with respect to claim 1 of auxiliary request 9 applies *mutatis mutandis* to claim 1 of auxiliary request 8.

The Board therefore concludes that claim 1 of auxiliary request 8 does not comply with the requirements of Article 56 either. Auxiliary request 8 is thus also not allowable.

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:

G. Nachtigall H. Meinders