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Datasheet for the decision of 20 August 2009

Case Number: T 1379/08 - 3.2.06

Application Number: 03257566.4

Publication Number: 1426136

IPC: B23P 6/00

Language of the proceedings: EN

Title of invention:
Methods for replacing combuster liners

Applicant:
GENERAL ELECTRIC COMPANY

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1379/08 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 20 August 2009

Appellant: GENERAL ELECTRIC COMPANY
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Representative: Pedder, James Cuthbert
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 29 February 2008 refusing European application No. 03257566.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: K. Garnett
Members: M. Harrison
G. Pricolo

Summary of Facts and Submissions

I. The appellant (applicant) filed an appeal against the decision of the Examining Division refusing European patent application No. 03257566.4 and requested grant of a patent in the form of the application upon which the decision of the Examining Division was based.

In its decision, the Examining Division found that the subject matter of claim 1 lacked an inventive step when starting from

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as the closest prior art. In particular, the Examining Division found that the subject matter of claim 1 related to an alternative to the two solutions disclosed in D3, which was merely a logical and obvious extension of those methods, such that the claimed solution merely filled the gap between those solutions.

II. The Board issued a summons to oral proceedings together with an annex containing comments relating to the claims in respect of Article 123(2) EPC and Article 84 EPC 1973 as well as to the issue of inventive step.

III. With its letter of 26 June 2009, the appellant filed a replacement set of claims upon which grant of a patent was requested.

IV. Oral proceedings were held before the Board on 20 August 2009, during which the appellant cancelled all its previous requests and requested grant of a patent based on claims 1 and 2 and description pages 1,

1a, 2 to 7 as filed during the proceedings, together with the Figures as filed.

V. Claim 1 reads as follows:

"A method for replacing a portion of a gas turbine engine combustor liner (40) the downstream end of which is coupled to a turbine nozzle arrangement, the combustor (30) having a combustion zone (36) formed by an inner and outer liner (42 and 44), the inner and outer liners each including a plurality of cooling features (88) formed by overhanging portions (84) of the inner and outer liners, said method comprising:
cutting circumferentially through at least one of the combustor inner and outer liners aft of one of said overhanging portions, such that a portion (124) of the combustor liner upstream from the cut (122) remains coupled within the combustor;
removing the portion of the combustor liner that is aft of the cut;
installing a replacement liner portion within the combustor by welding the replacement liner portion to the remaining portion of the liner that is secured within the combustor (16) such that the replacement liner portion extends aftward from the portion of the combustor liner that is upstream from the cut; and
coupling a support flange (100 or 102) on the replacement liner portion downstream end (50 or 52) to the turbine nozzle assembly."

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

Claim 1 overcame all objections under Article 123(2) EPC and Article 84 EPC 1973 that had been made by the Board. The subject matter of claim 1 also involved an inventive step. In particular, the type of liner in claim 1 had a complex form compared to that in D3 since each liner of the present invention included at least two cooling features formed by overhanging portions, whereby it was important to note that such cooling features were aligned appropriately when manufactured.

D3 disclosed a liner whereby only a relatively even, annular section had to be replaced, whereby the use of a new liner portion did not involve any alignment problems. The methods disclosed in D3 gave no hint towards repair of a liner of the type defined in claim 1 and it would be using hindsight to suggest that cutting, removing and replacing the entire section behind a single cut line was an obvious alternative, since no indication for doing this existed. Whilst the claim also covered the possibility that the entire section downstream only of the last overhanging portion of the liner was the section replaced, the downstream section of combustor liners around and including the flanges was essentially not an area prone to damage. In the rare case that some damage were present at this location, this would be indicative of a far greater problem with the entire combustor structure such that entire liner replacement would be the only reasonable option, not least due to safety concerns. Thus, whilst in some technical fields it might indeed be known to cut off and replace end sections of metal panels where an outer end was damaged, as opposed to merely cutting out and replacing a damaged mid-section, this gave no hint towards a repair in the field of gas turbine

liners with circumferential connection flanges where, in the prior art, any repair to downstream ends involved complete liner replacement, not least due to accessibility problems for performing cutting and welding operations.

Reasons for the Decision

1. *Amendments*

1.1 Claim 1 is based on claims 1, 3 and 5 of the application as filed, with minor rewording for grammatical reasons and with further amendments introduced as follows:

(a) the wording "a portion of" introduced into the first line of claim 1 clarifies that the entire liner is not being replaced in the method, which is evident from the entire explanation of the method given in the description as well as the opening wording in claim 7 of the application as originally filed. For the same reason, the terminology "replacement liner portion" replaces the terminology "replacement liner" throughout claim 1;

(b) the wording "the downstream end of which is coupled to a turbine nozzle arrangement" clarifies where the turbine nozzle arrangement is positioned with respect to the combustor liner. This is disclosed for example on page 4, lines 8 to 12 of the application as originally filed;

(c) the introduced term "circumferentially" clarifies that the cut made through the liners extends all the way round and thus excludes the possibility that merely a segment of the liner might be cut and removed. This is disclosed for example on page 6, lines 1 to 3 of the application as originally filed;

(d) the wording "coupling a support flange on the replacement liner portion downstream end to the turbine nozzle assembly" clarifies what is being coupled and where it is being coupled, it being noted that the claim already states that the replacement liner portion is welded to the remaining portion of the liner. This is disclosed on e.g. page 6, lines 8 and 9 of the last paragraph of the application as originally filed.

1.2 Claim 2 corresponds to claim 6 as filed, merely being renumbered.

1.3 The amendments to the description merely provide consistency with the claims and include a brief disclosure of the content of D3 which is useful for understanding the invention.

1.4 Since the amendments do not result in subject matter which extends beyond the content of the application as originally filed, the amendments meet the requirement of Article 123(2) EPC. The Board also finds that the requirements of Article 84 EPC 1973 are met since the claims are clear (as explained already in item 1.1), as well as being concise and supported by the description.

2. *Novelty*

D3 does not disclose the combination of features in present claim 1. For example, it does not disclose inner and outer liners each including a plurality of cooling features formed by overhanging portions of the inner and outer liners. Instead D3 discloses (see e.g. the Figures) a single overhanging portion (in respect of which holes for cooling are located) at the upstream end of the outer liner. Although a further overhanging portion is located at the liner downstream end, there is no indication that this could act as a cooling feature.

At least for this reason, the subject matter of claim 1 is novel with respect to D3.

Prior art liners which do have such a plurality of cooling features are however known (see e.g. third paragraph on page 1 of the application as originally filed). However, no prior art is available to the Board indicating the way in which such liners are repaired, other than by using repair patches or by complete liner replacement (see fourth paragraph on page 1 of the application as originally filed). Thus the method steps defined in claim 1 which involve removal and replacement of the portion of such a liner aft of the circumferential cut in the liner are not known.

Likewise, none of the further prior art cited in the search report is contains the combination of features defined in claim 1.

The requirements of Article 54 EPC 1973 are therefore met in respect of the cited prior art.

3. *Inventive step*

3.1 As opposed to the claim considered by the examining division when considering inventive step, claim 1 now defines a particular type of liner (which includes a plurality of cooling features formed by overhanging portions on the liner), whereby in such liners due to the accuracy requirements imposed by flow characteristics the cooling features must be accurately aligned, and whereby repair of the liner requires a similar alignment to be obtained. D3 on the other hand concerns repair methods on a different type of liner, namely of the type which includes upstream cooling features formed by a single overhanging portion. The repair method disclosed in D3 also notably involves removal and replacement of an annular portion in the form of a substantially smooth right cylinder. D3 thus teaches the performing of a repair on an area which is not only simple in structure, but which is also located away from the more complex upstream and downstream end configurations and thus where it is also easily accessible. The method of D3 is therefore disclosed in the context of a liner repair having damage in a relatively large and relatively even annular section whereby the repair method only involves replacing, aligning and joining of even surfaces, all of approximately the same diameter, albeit these surfaces may contain features such as boltholes and the like (see D3, column 3, lines 2 to 7).

3.2 The method defined in claim 1 however involves repair of a more complex type of liner as regards its cooling feature structure, as regards which the Board finds that the closest prior art is not that in D3, but instead a method of repairing a liner such as that defined in claim 1, which has hitherto been performed by removal of the entire liner and which method is known *per se* (see e.g. the application as filed, page 1, third and fourth paragraphs).

3.3 Starting from the aforementioned method of repairing the known liner, the method in claim 1 differs therefrom in that "a portion of" the liner is replaced rather than the entire liner, whereby that portion is the (entire) portion of the liner located aft of a circumferential cut (including thus the support flange), and whereby that portion is removed and replaced according to the method steps defined in the claim.

The problem to be solved by these features is to create an alternative and cost-effective method of performing a repair on such a liner.

By adopting the method defined in claim 1, the skilled person only needs to perform one circumferential cut and to weld the replacement liner portion at a single location during replacement.

3.4 The skilled person is taught by D3 that as an alternative to the known method of discarding and replacing the entire liner, an annular section which includes a damaged region may be removed and replaced between upstream and downstream ends of the liner (see e.g. D3 column 1, lines 17 to 45), whereby however (as

explained above) the area where the repair section is re-attached is itself an even-surfaced cylindrical portion within a larger cylindrical portion of the same diameter. This prior art method involves the use of two circumferential cuts and two circumferential welds. Nothing in D3 however teaches or indicates that the repair should for any reason be extended outside of such a region to include, as in claim 1, the downstream flanged end which is itself normally free of damage. As explained by the appellant, any damage at the downstream end would be indicative of a major defect in the liner structure as a whole and would thus involve entire liner replacement.

It is admittedly well known, e.g. in the art of automotive body panel repair, that instead of cutting out and replacing a defective section using a repair patch, an entire panel end section may be cut off and replaced when the end section is also damaged. However, the repair of such panels is somewhat remote to the field of gas turbine engine liners which themselves involve essentially flanged tubular structures, having regard in particular to the fact that the end sections of such gas turbine liners are unlikely to be damaged. Thus, the Board finds that a skilled person would not be taught to apply a known technique, e.g. from the area of body panel repair, to a gas turbine liner repair.

Even in the case that an end section of the liner had in some way become damaged, and in the absence of any evidence to the contrary, the Board accepts the appellant's explanation that a skilled person in the art of gas turbines would immediately consider that

entire liner replacement would have to be performed due to the underlying structural deficiency of the liner which is indicated by such a defect.

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cited in the search report, concerns a method where damage in one or more of the annular sections of a flame tube liner of a gas turbine combustion chamber is repaired by making a circumferential cut in each annular section and removing the respective end portion of each annular section (see e.g. Figure 3 and the description in column 3, line 65 to column 4, line 11). Here however, the end portions themselves are also damaged and although the most downstream damaged annular section includes an attachment flange on an outer surface, this flange is notably not removed with the end portion when making the repair.

3.5 Even if D3 were to be considered the closest prior art for consideration of inventive step, as opposed to the Board's finding explained *supra*, the skilled person would first have to recognise that the repair being made in D3 would be suitable for the different type of liner defined in claim 1 where, previously, such liners have been repaired with patches or have been replaced in their entirety. The skilled person would then have to take the further step of modifying the method of D3 so that only one cut was made, followed by removing the entire end section and whereby only one weld location would then be necessary during replacement. However none of the cited prior art provides a hint towards such a solution. The Board thus finds that, in view of the cited prior art, a skilled person would not arrive

at the solution defined by the subject matter of claim 1 unless an inventive step were involved.

3.6 Thus, with respect to the cited prior art, the Board concludes that the subject matter of claim 1 involves an inventive step and that the requirement of Article 56 EPC 1973 is met.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the basis of claims 1 and 2 filed during oral proceedings, description pages 1, 1a, 2a to 7 as filed during the oral proceedings and Figures 1 to 4 as originally filed.

The Registrar The Chairman

G. Magouliotis K. Garnett

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Datasheet for the decision of 28 October 2009

Case Number: T 1379/08 - 3.2.06

Application Number: 03257566.4

Publication Number: 1426136

IPC: B23P 6/00

Language of the proceedings: EN

Title of invention:
Methods for replacing combustor liners

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
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Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC R. 89

Keyword:
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Decisions cited:
-

Catchword:
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Case Number: T 1379/08 - 3.2.06

D E C I S I O N
of 28 October 2009 correcting the decision of the Technical Board of Appeal 3.2.06 of 20 August 2009

Appellant: GENERAL ELECTRIC COMPANY
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Representative: Pedder, James Cuthbert
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 29 February 2008 refusing European application No. 03257566.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: K. Garnett
Members: M. Harrison
G. Pricolo

Summary of Facts and Submissions

The present decision concerns the correction under Rule 89 EPC 1973 of the decision dated 20 August 2009, taken in the case T 1379/08 concerning European patent application number 03257566.4, due to the presence of an error, whereby on page 11 of the decision, in the "Order", item 2, the wording "description pages 1, 1a, 2a to 7" is not in accordance with the description as filed during the oral proceedings, namely pages 1, 1a and 2 to 7, as is recorded in the minutes of said proceedings.

Reasons for the Decision

The error is one of transcription, since the minutes of the oral proceedings of 20 August 2009 correctly state which description pages were filed during the oral proceedings, namely "description pages 1, 1a, 2 to 7".

The requirement for correction under Rule 89 EPC 1973 is thus met.

Order

For these reasons it is decided that:

On page 11 of the decision, in the "Order", item 2, the wording "description pages 1, 1a, 2a to 7" is hereby corrected to read "description pages 1, 1a, 2 to 7".

The Registrar: The Chairman:

M. Patin K. Garnett