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Datasheet for the decision of 10 August 2023

Case Number: T 1692/18 - 3.2.06

Application Number: 07253778.0

Publication Number: 1908921

IPC: F01D5/18, F01D9/04

Language of the proceedings: EN

Title of invention:
Method of impingement cooling a turbine airfoil and corresponding turbine airfoil

Patent Proprietor:
Raytheon Technologies Corporation

Opponent:
Safran Aircraft Engines

Headword:

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
Amendments - added subject-matter (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 1692/18 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 10 August 2023

Appellant: (Patent Proprietor)	Raytheon Technologies Corporation 10 Farm Springs Road Farmington, CT 06032 (US)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Appellant: (Opponent)	Safran Aircraft Engines 2 boulevard du Général Martial Valin 75015 Paris (FR)
Representative:	Regimbeau 20, rue de Chazelles 75847 Paris Cedex 17 (FR)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 20 April 2018 concerning maintenance of the European Patent No. 1908921 in amended form.**

Composition of the Board:

Chairman	M. Harrison
Members:	M. Dorfstätter
	D. Prietzel-Funk

Summary of Facts and Submissions

I. In its interlocutory decision, the opposition division found that, account being taken of the amendments made by the patent proprietor during the opposition proceedings, the European patent No. 1 908 921 met the requirements of the EPC.

II. Appeals were filed by the patent proprietor and the opponent respectively. As both parties are appellants, they will be referred to as the 'patent proprietor' and the 'opponent' respectively in the following.

III. The patent proprietor requested that the decision under appeal be set aside and the patent be maintained as granted, or that the opponent's appeal with regard to the first auxiliary request found allowable by the opposition division be dismissed, or that the patent be maintained in amended form according to one of the second to seventh auxiliary requests all filed with the letter dated 15 January 2019, or to one of the eighth or ninth auxiliary requests filed with the letter dated 21 July 2023.

IV. The opponent requested that the decision under appeal be set aside and the European patent be revoked.

V. The Board issued a summons to oral proceedings and a subsequent communication, in which it indicated *inter alia* that it considered that Article 123(2) EPC was contravened by claim 1 as found allowable by the opposition division.

VI. Oral proceedings were held before the Board, at the end of which the patent proprietor withdrew its appeal and also the second to ninth auxiliary requests.

VII. The patent proprietor's final and sole request was thus that the opponent’s appeal be dismissed.

The opponent confirmed its initial requests as stated above.

VIII. Claim 1 of the first auxiliary request found allowable by the opposition division, being the subject of the patent proprietor's sole request, reads as follows:

"A method of impingement cooling a turbine airfoil (60) with a platform (66) to airfoil fillet (64) radius which comprises:
providing an airfoil (60) having an airfoil fillet (64) having a defined contour and a minimum fillet wall thickness
with said airfoil (60) having a plurality of cooling holes (68) through the fillet wall (62);
and characterised by
positioning an impingement tube (72) inside said airfoil so as to follow the fillet contour;
applying impingement air through said tube (72) onto the airfoil and fillet walls, with said impinged air thereafter flowing out through said fillet cooling holes (68) to thereby provide film cooling to the airfoil fillet (64),
wherein the fillet (64) has been cored such that a ceramic core (70) used to create the fillet (64) follows the exterior shape of the airfoil as it transitions from the airfoil to the fillet (64) to the platform (66)

and wherein the airfoil wall (62) increases in thickness as the fillet (64) transitions from the airfoil (60) to the platform (66)."

IX. The arguments of the patent proprietor may be summarised as follows:

Claim 1 did not contravene Article 123(2) EPC.

Claim 6 as filed did not define a large fillet radius. It was thus a basis for claim 1 without a large fillet radius.

Further, the presence of a large fillet radius was anyway implicit from a technical point of view for the subject-matter of claim 1.

There was a basis in the application as filed for cooling of airfoils that had cooling holes in the fillet but none in the airfoil wall.

Furthermore, from a technical point of view, as the patent dealt with internally cooled airfoils, it was implicit that it contained cooling holes all over its surface and across its span. Therefore, claim 1 included not only cooling holes in the fillet but implicitly also in the airfoil walls.

X. The arguments of the opponent may be summarised as follows:

Claim 1 of the main request contravened Article 123(2) EPC.

Due to the deletion of the term "large", claim 1 covered cooling of an airfoil with a small platform to

fillet radius. There was no basis in the application as filed than for cooling fillets with a large radius.

Due to the replacement of the term "airfoil" by the term "fillet", claim 1 covered the cooling of airfoils that had cooling holes in the fillet but none in the airfoil wall, for which there was no basis in the application as filed.

Reasons for the Decision

1. Contrary to the requirement of Article 123(2) EPC, claim 1 contains subject-matter which extends beyond the content of the application as filed.

Claim 1 of the sole request is based on claim 5 as filed, but contains several amendments. At least two of them contravene Article 123(2) EPC, as explained below.

2. *Deletion of the term "large"*

Claim 1 relates to

> "[a] method of impingement cooling a turbine airfoil with a platform to airfoil fillet radius",

whilst claim 5 as filed relates to

> "[a] method of impingement cooling a turbine airfoil with a large platform to airfoil fillet radius".

By removing the term "large", the claim is not limited to the fillet radius being of any particular size. The claim thus covers cooling a turbine airfoil that does not have a large fillet radius, for which there is however no basis in the application as filed.

It is noted, that the terms "small" and "large" in this case are not just vague expressions, but are given a

particular meaning in the description at the end of paragraph [0002] and beginning of paragraph [0003]. Omitting the term "large" thus alters the claimed subject-matter.

2.1 In a first line of argument, the patent proprietor argued that independent product claim 6 as filed did not include the term "large" and was thus not limited to a large fillet radius. Claim 6 as filed, albeit directed to a product, was thus a basis for method claim 1 as amended.

This is, however, not accepted. Claim 6 as filed is of a different category and relates to an airfoil. The patent proprietor did not present a clear and convincing argument by which, despite the change of category, the method of claim 1 could be seen as derivable from claim 6 as filed. For such a deduction, it would be necessary to derive the feature of a "minimum wall thickness" (which is a feature of claim 1) from the feature relating to the "fillet wall maintained at a thickness similar to that of the airfoil sidewalls". The Board finds that these features do not relate to essentially the same characteristics, contrary to the argument of the patent proprietor. The minimum wall thickness relates to a limit, under which values must not fall, while there is no upper limit. A wall thickness maintained at values similar to that of the airfoil side walls excludes fillet walls that are substantially thicker than the wall of the airfoil (such as in Fig. 4 of the patent, relating to the prior art). It thus defines an upper limit.

Moreover, claim 6 as filed does not include a definition of a fillet radius at all. As also argued by the opponent, the application as filed is however

replete with references to a large fillet radius. The term is ubiquitous (or "omniprésent" as the opponent formulated it), including the title of the invention, the statement of the field of the invention and also the discussion of the related background in column 1, paragraphs [0002] and [0003]. At this juncture in the description it is explained that in the prior art, fillets with small radii could be left uncooled, but "as the size of the airfoil fillet increases from .150 (3.81 mm) to upwards of an inch (25.4 mm) or greater, it becomes difficult to continue to ignore cooling of the filleted region of the airfoil." The description then continues by explaining the problems arising from such large fillets. With the application referring to a large fillet radius as the basic underlying concept to the invention, claim 6 as filed is considered a solution to the problems associated with large fillets as mentioned in paragraph 3. Although not specifically defining any fillet radius and thus not being limited to large fillet radii, no information can be directly and unambiguously derived therefrom for fillets not having a large radius. Thus, claim 6 cannot provide a basis for the removal of the term "large" from claim 5 as filed, nor generally for a method claim without the term "large".

2.2 In a second line of argument, the patent proprietor argued that, in order to be able to arrange cooling holes in the fillet, it had to have a certain size and thus a large radius. It further argued that, in order for the impingement tube to follow the fillet contour as claimed, a large radius was implicit in claim 1.

This is also not accepted. Interpreted with its literal meaning and with the same standard being applied as above for claim 6 as filed, claim 1 is not limited to

fillets with a large radius but it covers fillets with a large radius, just as it covers fillets with a small radius in the sense given to these terms in paragraphs [0002] and [0003] of the description. Considering the claimed subject-matter from a technical point of view, the Board also sees no constraints which would exclude the provision of cooling holes in fillets having a small radius. Nor did the patent proprietor provide any evidence for its allegation that it was technically infeasible to provide cooling holes in fillets with a small radius.

Claim 1 is thus not, also not implicitly, limited to fillets with a large radius.

2.3 The omission of the term "large" thus introduces subject-matter extending beyond the content of the application as filed contrary to Article 123(2) EPC.

3. *Replacement of the term "airfoil" by the term "fillet"*

Claim 1 defines

> the "airfoil (60) having a plurality of cooling holes (68) through the fillet wall (62)",

whilst claim 5 as filed defines

> the "airfoil (60) having a plurality of cooling holes (68) through the airfoil wall (62)". Similar language is used in claim 6 as filed.

Due to the replacement of the term "airfoil" by the term "fillet" in the definition of the position of the cooling holes, the claim covers the cooling of airfoils that have cooling holes in the fillet but nowhere else in the airfoil wall, for which there is however no basis in the application as filed.

3.1 In a first line of argument (referred to by the patent proprietor as "the linguistic basis"), reference was made to column 2, lines 14-16 of the A2-publication. It argued that the statement that "the air ... exits the airfoil or fillet through multiple cooling holes", due to the word "or", contained the information that there could be cooling holes in the airfoil only or in the fillet only or in both the airfoil and the fillet.

This is not accepted. The word "or" is not considered as providing information about alternative arrangements of the cooling holes at this juncture. As even accepted by the patent proprietor, the word "or" can be understood to mean "and" in the context presented. The Board understands it indeed to refer to the two possibilities for the air to exit the inner space of the airfoil through cooling holes where they are provided, without however giving any information about an individual location of the cooling holes.

As also argued by the opponent, any given stream of air cannot exit the inner space via all cooling holes, it thus exits the inner space via the airfoil or the fillet (i.e. in part via the airfoil and in part via the fillet). To have these two exit possibilities, this means that cooling holes must be provided in both the fillet and the airfoil.

The Board thus concludes that there is no information about the location of the cooling holes being only in the fillet which is unambiguously derivable from the sentence referred to by the patent proprietor.

3.2 In a second line of argument (referred to by the patent proprietor as "the technical basis"), the patent proprietor argued that the whole patent dealt with an

internally cooled airfoil, which commonly if not exclusively would have cooling holes all over its surface. Furthermore, claim 1 included a reference to film cooling, such that the airfoil implicitly had to have cooling holes across its span and not only in the fillet.

This is also not accepted. The reference to film cooling in claim 1 defines film cooling of the fillet. It may be technically useful and also common to use film cooling for the whole airfoil, but this is not implicit. The need for cooling the different locations of the airfoil also depends on other factors (such as its location in the turbine and the temperatures at which it is used), none of which are claimed. Claim 1 is thus not limited in this respect, as it leaves open whether the parts of the airfoil other than the fillet comprise cooling holes.

3.3 The proprietor further argued that claim 6 as filed defined an airfoil having "cooling holes through the airfoil wall", thus without specifying where the holes were in the wall, such that it was left open whether the holes were in the airfoil sidewall or not. This allegedly provided a further basis for defining only that cooling holes were in the fillet.

This argument is, however, not persuasive. As explained above in regard to the omitted feature "large", claim 6 as filed is a product claim which contains different features to those in the method claim 5 as filed, such that the presence of a feature in the product claim is not by itself an unambiguous basis for amending features in the method claim. Further, the generality (i.e. not specifying a particular location of the holes in the airfoil) in the product claim is not suitable as

a basis for a method claim which has a method claim as its basis and which has been amended to cover an airfoil with cooling holes specifically through the fillet wall (only).

3.4 The replacement of the term "airfoil" by the term "fillet" thus introduces subject-matter extending beyond the content of the application as filed contrary to Article 123(2) EPC.

4. The patent proprietor's sole request is thus not allowable whereby the opponent's appeal is 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:

D. Grundner M. Harrison

Decision electronically authenticated