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**Datasheet for the decision
of 14 July 2011**

Case Number: T 2455/10 - 3.2.04

Application Number: 08100373.3

Publication Number: 1947346

IPC: F04D 29/02

Language of the proceedings: EN

Title of invention:
Composite inlet guide vane

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (no: main request) - (yes: auxiliary request)"

Decisions cited:
-

Catchword:
-



Case Number: T 2455/10 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 14 July 2011

Appellant:

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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 15 July 2010
refusing European patent application
No. 08100373.3 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: A. de Vries
Members: M. Poock
C. Heath

Summary of Facts and Submissions

I. The Appellant lodged an appeal, received 15 September 2010, against the decision of the Examining Division posted 15 July 2010, refusing the European patent application No. 08 100 373.3 and simultaneously paid the required fee. The grounds of appeal were received 25 November 2010.

In its decision the Examining Division held that the application did not meet the requirements of Articles 52(1) and 56 EPC for lack of inventive step having regard to the following documents:

D1: US-A-5 951 254

D2: US-A-5 791 879

D3: US-A-4 006 999

II. The Board also considers the following document cited in the European search report:

D4: GB-A-2 391 270

III. The Appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of the claims on file i.e. those filed with letter of 10 September 2009 (main request), or in the alternative, as an auxiliary request, on the basis of claims filed with the grounds of appeal.

IV. The wording of claim 1 of the requests is as follows:

Main Request

"A composite vane 110 comprising an airfoil portion 114 having an inner core 118 composed primarily of fiberglass epoxy and an outer metal sheath 124 surrounding said inner core."

Auxiliary Request

"A composite vane 110 comprising an airfoil portion 114 having an inner core 118 composed primarily of fiberglass epoxy and an outer metal sheath 124 surrounding said inner core, wherein said airfoil portion is further comprised of between 15-30% by volume of carbon/epoxy fabric 120 located in selected areas of said airfoil portion between said inner core 118 and said outer metal sheath 124 and additional fiberglass epoxy material 122 is interposed between said carbon/epoxy fabric 120 and said metal sheath 124."

Reasons for the Decision

1. The appeal is admissible.
2. *Background*

The application concerns a composite vane in which the airfoil portion has a fibre glass epoxy core surrounded by an outer metal sheath. The main idea is to strategically place different materials so as to

combine their different advantages in an effective manner, cf. paragraph [0003] of the published application.

3. *Main Request*

3.1 The decision under appeal argues lack of inventive step starting from D1 among others. D1 discloses, see figures 1 and 2 and column 5, a composite vane blade 1 with inner core 6 made of "fiber reinforced synthetic material", column 5, line 5, within two surrounding outer layers 7,7' and 8,8'. The first of these 7,7' is a "metallic cover layer" of fleece of felt of nickel fibres, column 5, line 17 to 19, or metal fabric, column 5, lines 38 to 40. The other is an additional outer protective layer 8 which may contain "metallic compound particles" 8A, column 5, lines 4 to 13. Both constitute outer metal sheaths surrounding the core in the sense of claim 1.

3.2 As acknowledged in the grounds of appeal, the claimed vane differs from this prior art only in the mention of fibreglass epoxy as specific fibre reinforced synthetics material for the core. D1 mentions fibre reinforced synthetics in general for the core but gives only one example, namely carbon fibre in a preferably epoxy matrix, column 5, lines 20 to 24. The published application, paragraph [0012], identifies fibreglass epoxy as economical with high tensile strength and fatigue life. All fibre reinforced materials in fact have high tensile strength (combined with low density), so that the associated technical problem can be formulated as *how to realize a vane as in D1, but with*

a fibre reinforced synthetic core that is comparatively cheap and robust.

3.3 D1 is not limited to the sole specific example of carbon fibre epoxy mentioned for the core, but rather considers all fibre reinforced synthetics materials as is immediately apparent from claim 1, or, for example, the first two paragraphs of the section "summary of the invention". There are many such materials, of which carbon fibre epoxy is but one example. In carrying out D1's teaching the skilled person, an engineer designing compressor vanes with extensive materials knowledge, will therefore consider any suitable fibre reinforced synthetics material and choose that one that best fits his needs and requirements. Fibreglass epoxy is best known from common general knowledge for its low cost and robustness, where, say carbon fibre epoxy is better known for its very high tensile strength. It is therefore obvious for the skilled person to choose the former if cost and robustness weighs heavier than tensile strength. The Board concludes that the vane of claim 1 lacks inventive step, contrary to Article 56 EPC.

3.4 The Board adds that it arrives at the same conclusion starting from D2 or D3 as prior art. These documents also teach composite vanes with fibre reinforced synthetics cores - though they do not specifically mention fibreglass epoxy - within a protective outer layer which is only metal at the vulnerable leading edge. Extending the metal layer to form a sheath surrounding the core - a further measure unrelated to the otherwise obvious choice of fibreglass epoxy for the core - is an obvious way of extending the

protection offered by the metal layer to the whole of the airfoil surface.

- 3.5 The Board thus confirms the decision's finding of lack of inventive step of claim 1 of the main request. Nor has the Appellant submitted arguments specific to this request that might speak against this finding. The penultimate paragraph of the grounds of appeal is a simple reflection on novelty, while any advantages asserted (e.g. in the first paragraph of page 2 of the grounds) refer to features that appear only in claim 1 of the auxiliary request.

4. *Auxiliary Request*

- 4.1 The auxiliary request adds to claim 1 of the main request the features of a carbon/epoxy fabric (in a given volume percentage) and fibreglass epoxy material interposed (in that order) between the core and outer metal sheath. They correspond to the features of dependent claims 2 and 5 as filed. Original claim 5 depends also on claim 2, while the further dependent claims correspond to the remaining dependent claims as filed, but renumbered. The Board is satisfied that the claims meet the requirements of Article 123(2) EPC.
- 4.2 Novelty is not at issue. Turning to inventive step, which the Board shall assess starting from D1, the added features represent further differences over this prior art. As stated in the published application at paragraph [0003] the carbon epoxy fabric gives the airfoil bidirectional stiffness, while the fibreglass epoxy core provides high static and fatigue strength at low cost. Strategic placement of these different

materials thus allows their different properties to be advantageously combined. The objective technical problem addressed by these features can be formulated as how to realize a vane as in D1 at low cost with high fatigue strength and improved (bidirectional) stiffness.

- 4.3 None of the prior art expressly suggests the differentiated use of different types of fibre reinforced materials for their different properties, let alone the use of a carbon epoxy *fabric* to give the airfoil bidirectional stiffness. The most pertinent prior in this respect is disclosed in D2 and D4.

D2, see figure 2, shows multiple functional layers of fibre reinforced material, with a composite core including fibre reinforced panel elements 38 of e.g. carbon epoxy, column 3, lines 40 to 60, surrounded by an intermediate skin 54, which may also be fibre reinforced, for example made of carbon, fibreglass, aramid in epoxy, column 6, lines 12 to 30. Both panel and skin ultimately serve the same general purpose of increased rigidity or stiffness (at reduced density) and there is no differentiation of their material properties: they could in fact be made of the same material. Nor is there any mention of a fibre reinforced *fabric* to provide stiffness in two directions.

The vane of further D4, see figure 6, and description page 11, also has internal multi-layering with two damping layers 62, 70 between core 64 and outer metal sheath 50,52. However, where the core 64 may be made of epoxy based syntactic material, possibly fibreglass reinforced (page 7, line 29, to page 8, line 5), layers

62 and 70 are of visco-elastic material such as structural epoxy resin (page 7, lines 7 to 21; page 11, lines 5 to 7). Neither is reinforced, let alone in fabric form.

4.4 In the Board's view, the above features also do not appear obvious per se in the light of the skilled person's common general knowledge. It therefore concludes that the vane of claim 1 of the auxiliary request is both novel and inventive, and thus meet the requirements of Article 52(1) in conjunction with Articles 54 and 56 EPC.

4.5 But for amendments to the description which are necessary to bring it into line with the claims of the auxiliary request - see for example the summary of the invention and the numbered claim-like clauses appearing at the end - the application would be ready for grant.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent with the following claims and a description to be adapted:

Claims: No. 1 to 8 filed as auxiliary request with the grounds of appeal

The Registrar

The Chairman

G. Magouliotis

A. de Vries