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Datasheet for the decision of 12 January 2009

Case Number: T 0715/06 - 3.2.06

Application Number: 00302114.4

Publication Number: 1039096

IPC: F01D 9/04

Language of the proceedings: EN

Title of invention:
Turbine nozzle

Applicant:
GENERAL ELECTRIC COMPANY

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0715/06 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 12 January 2009

Appellant: GENERAL ELECTRIC COMPANY
1 River Road
Schenectady, NY 12345 (US)

Representative: Goode, Ian Roy
London Patent Operation
General Electric International, Inc.
14 John Adam Street
London WC2N 6LU (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 2 December 2005 refusing European application No. 00302114.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Alting Van Geusau
Members: G. Pricolo
K. Garnett

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division, posted on 2 December 2005, refusing the European patent application 00302114.4 on the grounds of lack of inventive step in the light of the disclosure of documents

D1: US-A-4 897 021, and

D2: US-A-5 423 659.

II. The appellant (applicant) filed a notice of appeal on 6 February 2006 and paid the appeal fee on the same day. The statement setting out the grounds of appeal was received at the European Patent Office on 11 April 2006.

III. Various telephone conversations subsequently took place between the rapporteur of the Board and the appellant. The rapporteur questioned, inter alia, whether claim 1 met the requirements of Article 84 EPC and addressed the question of the closest prior art.

IV. Following these telephone conversations the appellant filed amended patent application documents and eventually requested that a patent be granted on the basis of claims 1 to 5 (part) filed with letter dated 25 November 2008, claims 5 (part) to 14 filed with letter dated 16 November 2007, and description page 2a filed with letter dated 2 December 2008 and pages 3, 7-9 and 11 filed with letter dated 13 November 2008 in combination with the remaining documents as originally filed.

V. Claim 1 has the following wording:

"A turbine nozzle (26) for a gas turbine engine (10), comprising:
a plurality of vanes (28) integrally joined at opposite ends to outer and inner bands (30,32); and
said inner band (32) having a forward hook (36) and an aft flange (38) which extend radially inwardly for supporting a honeycomb rotor seal (40), said forward hook being inboard of a leading edge of said inner band (32), said hook (36) including an inner lip (36a) spaced radially from an outer lip (36b) to define a retention slot (42) therein, wherein
the inner lip (36a) is circumferentially continuous between its opposite ends and characterised in that the outer lip (36b) is segmented to define a plurality of circumferentially spaced apart outer lips."

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

The amendments made to the claims were based on the application as originally filed and the description was amended to bring it into conformity with the amended claims and to acknowledge the prior art known from D1 and D2.

D1 did not disclose a plurality of circumferentially spaced-apart outer lips spaced radially from an inner lip to define a retention slot.

D2 pertained to a shroud segment and not a nozzle inner band. The examining division considered that the lip 104 and the undercut 106 of the shroud segment

constituted inner and outer lips. However the undercut 106 was part of the same lip 104. It also provided a different function than the segmented outer lip recited in claim 1.

Therefore, the combination of D1 and D2 would not lead the skilled person to the subject-matter of claim 1.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The contested decision is based on the claims as originally filed.

2.2 Claim 1 has been amended in these appeal proceedings by the addition of the following features:

(a) an aft flange which extends radially inwardly for supporting a honeycomb rotor seal;

(b) the inner lip is circumferentially continuous between its opposite ends;

(c) the outer lip is segmented to define a plurality of circumferentially spaced apart outer lips.

These features, which are taken from the description (see the passages indicated by the appellant on page 5, lines 17 to 20 and 27 to 28 and page 6, lines 10 to 20), specify in a more clear manner the arrangement of the inner band for supporting the honeycomb rotor seal (feature (a)) and the configuration of the inner and outer lips.

Dependent claims 2 to 14 correspond to original claims 2 to 14.

2.3 The description has been amended to bring it into conformity with the amended claim 1 and to acknowledge the prior art disclosed by D1 and D2.

2.4 Accordingly, the amendments made do not give rise to objections under Article 123(2) and 84 EPC.

3. *Novelty*

Novelty of the claimed turbine nozzle was not objected to by the Examining Division. The Board on its own sees no reason to take a different view for the more restricted subject-matter of present claim 1.

4. *Inventive step*

4.1 In the Board's view, the closest prior art is represented by a conventional turbine nozzle according to the preamble of claim 1, namely a turbine nozzle for a gas turbine engine, comprising: a plurality of vanes integrally joined at opposite ends to outer and inner bands; said inner band having a forward hook and an aft flange which extend radially inwardly for supporting a honeycomb rotor seal, said forward hook being inboard of a leading edge of said inner band, said hook including an inner lip spaced radially from an outer lip to define a retention slot therein, wherein the inner lip is circumferentially continuous between its opposite ends.

4.2 The subject-matter of claim 1 differs therefrom in that the outer lip is segmented to define a plurality of circumferentially spaced apart outer lips.

4.3 This feature has the technical effect of reducing the thermal mass of the turbine nozzle's forward hook without compromising the performance of the forward hook for supporting the rotor seal in a sealed fit. By reducing the thermal mass, thermal mismatch between the forward hook and the inner band during transient operation is reduced, leading to increased durability and life of the turbine nozzle (see the description of the application page 2, last paragraph and page 6, third paragraph).

4.4 The objective technical problem can therefore be seen in increasing the durability and life of the turbine nozzle.

4.5 In the decision under appeal, the examining division held that D1 represented the closest prior art. The Board does not follow this view because D1 neither specifically relates to the turbine nozzle of a gas turbine engine nor constitutes an appropriate starting point for arriving at the subject-matter of claim 1.

In fact, D1 relates in general to gas turbine engines (see col. 1, lines 13, 14), and in particular to the compressor section thereof (see col. 3, lines 59, 60) but fails to mention details of the turbine section.

Furthermore D1 discloses (see Figs. 1, 3 and 4) a stator assembly comprising a plurality of vanes (55a) integrally joined at opposite ends to outer and inner

bands (inner platform 60 and inner case 28). The inner band (60, see Figs. 3 and 4) has rear and forward hooks (flanges 72, 78 can be regarded as the inner lips of said hooks, see Figs. 3 and 4) that support a honeycomb rotor seal (48). The rotor seal (48) has a circumferentially extending plate (84) which extends into the grooves (74, 80) of the hooks (see col. 5, line 61 to col. 6, line 4). A circumferentially extending spring member (70) exerts a radial force on the plate (84) of the rotor seal (48) urging it radially inward into abutting contact with the inner lip (i.e. against surfaces 76, 86 and 82, 88) of the hook (see col. 6, lines 15 to 19). The spring member provides both damping to each stator vane and the rotor seal and provides sealing between each pair of vanes despite normal tolerance variations of these parts (see col. 8, lines 48 to 51).

When starting from D1, the skilled person would not consider the provision of a second, outer lip because in the arrangement of D1 the rotor seal exclusively contacts the inner lip due to the force exerted by the spring member (70).

When starting form the closest prior art according to the preamble of claim 1, as discussed above, the skilled person would not find any indication in D1 suggesting the provision of a segmented outer lip.

4.6 The examining division considered that the feature in the characterising portion concerning the provision of a segmented outer lip was obvious in view of D2. D2 relates to a shroud segment for a gas turbine engine (see claim 1). According to the teaching of D2, a

turbine shroud segment (68, see Fig. 2 to 4) has a plurality of circumferentially spaced apart hooks (78, 82) for radially retaining the shroud segment (68, see col. 4, lines 29 to 35). This is achieved by means of axially extending hook portions (96) that are sized to engage with slots (98) in the stator assembly (32). Each hook portion (96) has an inner support surface (104) that engages a contact surface of the slot of the stator assembly, and an undercut surface (106) axially spaced apart from the support surface (104) which, in an installed condition, does not touch the contact surface of the slot. The undercut surface does not provide radial support for the shroud segment (68) and, as a result, the moment arm for the bending stress within the hook (88) is defined by the maximum length of the support surface (104; see col. 5, lines 10 to 20).

The examining division considered that the support surfaces (104) corresponded to the segmented outer lip and the undercut surfaces (106) to the inner lip recited in claim 1 of the present patent application. The Board cannot follow this view because the support surface (104) and the undercut surface (106) are both provided on the same side of the above-mentioned axially extending hook portion (96) of the hook (see Fig. 6). Accordingly, the support surface (104) and the undercut surface (106) cannot be regarded as inner and outer lips that define a retaining slot. In fact, the whole axially extending hook portion (96) can be regarded as a lip of the hook.

D2 does not disclose that by providing this lip as a plurality of hooks, i.e. that that by providing this

lip as a segmented lip, the durability and life of a turbine nozzle is increased. The skilled person would therefore have no reason to consider that the provision of a lip formed by a plurality of hooks as taught by D2 would solve the above-mentioned objective technical problem. In any case, even if the skilled person would consider applying the teaching of D2 to a turbine nozzle according to the preamble of claim 1 of the present application or to D1, he would not arrive at the subject-matter of claim 1. Since according to D2 the lip (96) is at a distance from the main body of the shroud (68), it corresponds to the inner lip of the turbine nozzle according to the preamble of claim 1, and to the flanges (72, 78) of the hooks of D1 that constitute inner lips (see Figs. 3 and 4). Accordingly, applying the teaching of D2 to the turbine nozzle according to the preamble of claim 1 or to D1 would result in segmenting the inner, rather than the outer lip as required by claim 1.

4.7 The remaining available prior art also does not contain any indication which would suggest to the skilled person the modification of the outer lip such that it is segmented to define a plurality of circumferentially spaced apart outer lips.

4.8 In the decision under appeal the examining division also argued that that the skilled person starting from D1 would arrive in an obvious manner at the subject-matter of claim 1 having regard to common general knowledge. The skilled person would know that a long continuous mating surface submitted to thermal stress would suffer deformation resulting in an uneven contact surface and would consider the straightforward

modification consisting in providing several smaller contact surfaces.

Although in principle, and in absence of design constraints, this statement may be regarded as correct, there is however no indication in the prior art that would lead the skilled person to consider the modification of a specific part of the turbine nozzle such as the forward hook outer lip, as defined in the characterising portion of claim 1. Nor is there any indication suggesting that that by segmenting the forward hook outer lip only, advantages in terms of increased durability and life of the turbine nozzle without compromising the performance of the forward hook would be obtained.

4.9 It follows that the subject-matter of claim 1 would not be obvious to the skilled person in view of the available prior art.

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 to 5 (part), filed with letter dated 25 November 2008; and 5 (part) to 14, filed with letter dated 16 November 2007,

description pages 1, 2, 4 to 6, 10, 12 as originally filed; page 2a filed with letter dated 2 December 2008; pages 3, 7-9 and 11, filed with letter dated 13 November 2008;

drawings Figures 1 to 8 as originally filed.

The Registry The Chairman

M. Patin P. Alting van Geusau