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Datasheet for the decision of 1 March 2012

Case Number: T 0111/11 - 3.2.05

Application Number: 03254501.4

Publication Number: 1384856

IPC: F16J15/44

Language of the proceedings: EN

Title of invention:
Endface gap sealing of steam turbine packing seal segments and retrofitting thereof

Applicant:
GENERAL ELECTRIC COMPANY

Headword:

Relevant legal provisions:
EPC Art. 54, 84, 111(1), 123(2)

Keyword:
Added subject-matter (no)
Clarity of claims (yes)
Novelty (yes)
Remittal to the department of first instance for further prosecution (yes)

Decisions cited:

Catchword:

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T0111/11 - 3.2.05

D E C I S I O N
of the Technical Board of Appeal 3.2.05
of 1 March 2012

Appellant: (Applicant)
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Representative:
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 29 June 2010 refusing European patent application No. 03254501.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: H. Schram
Members: S. Bridge
M. J. Vogel

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision, posted on 29 June 2010, by which the European patent application No. 03 254 501.4 was refused. The Examination Division held that the subject-matter of claim 1 of the sole request of the appellant was not new (Article 54 EPC).

II. The appellant requested that the decision under appeal be set aside and that the amended application filed 22 February 2012 (sole request) be remitted to the Examining Division for further prosecution.

III. Independent claim 1 according to the sole request reads as follows:

"1. A steam turbine (10) comprising:
a rotor (16) having a steam turbine section (12, 14);
a stationary casing (18, 28) surrounding the rotor including the steam turbine section;
said casing carrying a plurality of circumferentially extending packing seal segments (26) about said casing at a seal location (23) axially spaced from said turbine section for sealing between the casing and the rotor;
each of said seal segments (26) having endfaces (56) respectively in circumferential registry with opposed endfaces of circumferentially adjacent seal segments (26), said endfaces including slots (54, 62) opening circumferentially and in general circumferential registration with one another; and
a first spline seal (58) extending between each of said opposed endfaces of circumferentially adjacent seal segments (26) and in said slots for minimizing or

precluding steam leakage past said registering endfaces, wherein said first spline seal (58) extends generally in axial and tangential directions for sealing against leakage flows in generally radial directions

characterised in that said spline seal (58) is a flat metal plate of generally rectilinear shape that extends along the majority of an arcuate flange (42) that extends from a neck portion (38) disposed between hooks (36) of said casing in opposite axial directions; and:

a second spline seal (60) disposed between the endfaces of adjacent seal segments (26), wherein the second spline seal (60) is disposed in circumferential registering, generally radially outwardly extending grooves (62) formed in the endfaces (56) adjacent the downsteam [sic] end of respective seal segments (26) such that the second spline seal (60) extends generally radially to minimize leakage flow in an axial direction through a gap (50) between circumferentially adjacent seal segments (26), said first spline seal (58) also spanning the gap (50) between the circumferentially adjacent seal segments (26), wherein

said first spline seal (58) has a thickness of said flat metal plate that is less than the depth of the respective slots in which it is disposed so as to accommodate relative radial movement of the seal segments (26), said spline seals (58, 60) further having respective central portions bridging the respective gaps (50) between the seal segments (26) spaced from respective sides of the grooves (62) so as to enable relative movement of the seal segments (26) in a direction normal to the spline seals (58, 60)without binding or severing the spline seals (58, 60)."

IV. The following document is referred to in the present decision:

D1: EP-A-0 979 962

V. In the written procedure, the appellant argued essentially as follows:

Claim 1 has been amended to recite that the spline seals have thicknesses less than the depth of respective slots in which they are disposed and that they further have respective central portions bridging respective gaps between segments that are spaced from the sides of the grooves so as to enable relative movement of the segments in directions normal to the spline seals. The basis for such amendments can be found in the description on page 2, lines 24 to 28 and page 7, lines 4 to 7 of the application documents as filed. The amendments thus satisfy the requirements of Article 123(2) and Article 84 EPC.

A steam turbine with free floating spline seals which provide good sealing capability whilst simultaneously giving greater freedom of play between adjacent packing seal segments is not known from document D1.

The subject-matter of amended claim 1 is novel with respect to the teaching of document D1.

In particular, document D1 teaches the use of compression type sealing elements fully packing the slots between respective packing elements. Thus document D1 teaches away from the provision of free floating seals of the type as now defined in amended claim 1.

Reasons for the Decision

1. Amendments

The preamble of claim 1, apart from minor editorial amendments (e.g. the "*segments*" are systematically referred to as "*seal segments (26)*" and the "*spline seal (58)*" has been renamed "*first spline seal (58)*"), substantially corresponds to the combination of claims 1 and 2 as originally filed.

The features of the characterising part of claim 1 are based on the description of the application as filed (published version) column 1, lines 54 to 55; column 2, lines 4 to 9; column 4, lines 33 to 37; column 5, lines 10 to 21 and 25 to 34.

Dependent claim 2 is based on claim 4 as filed.

The amendments thus satisfy the requirements of Article 123(2) EPC. Since the claims are also clear and supported by the description, the requirements of Article 84 EPC are also complied with.

2. Novelty

Document D1 discloses a seal assembly for a steam turbine (column 1, lines 3 to 9) including a rotor, a casing, seal segments and a resilient imperforate member (column 2, lines 11 to 13). The casing comprises circumferentially arrayed seal segments 22, 24, 26, 28, 30 and 32 wherein circumferentially-adjacent seal segments have circumferentially-opposing and generally matching grooves which are preferably radially aligned (paragraph [0010]). Additional longitudinally aligned

grooves may also be provided (paragraph [0011], figure 9). Resilient and imperforate members 40 preferably made of spring steel (column 4, lines 27 to 28) are positioned in the grooves (column 3, lines 4 to 7) preferably have a general 'C' or 'W' shape when viewed end on (column 4, lines 28 to 34, figures 5 to 8). These resilient and imperforate members 40 span the gap between circumferentially adjacent seal segments (figure 2) and act as seals which minimise leakage (column 4, lines 16 to 27).

The subject-matter of claim 1 thus differs from the steam turbine disclosed in document D1 in that:

- the first spline seal is a flat metal plate of generally rectilinear shape that extends along the majority of the arcuate flange of the seal segment and the thickness of the flat metal plate is less than the depth of the respective slots in which it is disposed so as to accommodate relative radial movement of the seal segments,
- the generally radially outwardly extending grooves for a spline seal are adjacent the downstream end of respective seal segments (The Board notes that in figure 9 of document D1 the high pressure side on the right hand side (column 5, lines 17 to 18) whereas in figure 2 of the present application the high pressure side is on the left hand side (application as filed, published version, column 4, lines 39 to 44)), and
- the spline seals have respective central portions spaced from respective sides of the grooves so as to enable relative movement of the seal segments in a direction normal to the spline seals without binding or severing the spline seals.

The subject-matter of claim 1 is thus new with respect to document D1 (Article 54 EPC).

3. Further remarks

The requirements of Rule 43(1) EPC do not appear to have been complied with.

The Board notes that free floating seals seem to be known from document US-A-5,154,577 (column 4, lines 30 to 34, figure 3).

4. Remittal

Since the issue of inventive step has not yet been examined by the Examining Division the Board exercises the discretion given to it under Article 111(1) EPC and remits the case to the department of first instance for further prosecution.

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 for further prosecution.

The Registrar: The Chairman:

D. Meyfarth H. Schram

Decision electronically authenticated