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**Datasheet for the decision
of 18 October 2022**

Case Number: T 2290/18 - 3.2.06

Application Number: 12182870.1

Publication Number: 2568115

IPC: F01D5/08, F01D25/12, F02C3/08,
F02C7/18, F02C3/04

Language of the proceedings: EN

Title of invention:

Cooling system for gas turbine blades comprising a compressor positioned aft of the turbine stage in flow direction

Patent Proprietor:

Ansaldo Energia IP UK Limited

Opponent:

Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:

EPC Art. 56, 111(1)
RPBA Art. 12(4)

Keyword:

Inventive step - (yes)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2290/18 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 18 October 2022

Appellant: Ansaldo Energia IP UK Limited
(Patent Proprietor) 5th Floor, North Side
7/10 Chandos Street
Cavendish Square
London W1G 9DQ (GB)

Representative: Bernotti, Andrea
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

Respondent: Siemens Aktiengesellschaft
(Opponent) Werner-von-Siemens-Straße 1
80333 München (DE)

Representative: Siemens AG
Postfach 22 16 34
80506 München (DE)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
2 July 2018 concerning maintenance of the
European Patent No. 2568115 in amended form.**

Composition of the Board:

Chairman M. Harrison
Members: M. Hannam
E. Kossonakou

Summary of Facts and Submissions

- I. An appeal was filed by the appellant (patent proprietor) against the interlocutory decision of the opposition division in which it found that European patent No. 2 568 115 in an amended form met the requirements of the EPC. The appellant requested that the decision under appeal be set aside and the patent be maintained according to the main request filed with letter of 9 March 2018 during the opposition proceedings.
- II. The respondent (opponent) requested that the appeal be dismissed.
- III. The following documents are relevant to the present decision:
- | | |
|-----|----------------|
| D7 | US-B-7 677 048 |
| D8 | EP-A-2 309 109 |
| D9 | EP-A-2 330 274 |
| D20 | EP-A-2 187 019 |
- IV. The Board issued a summons to oral proceedings and a subsequent communication containing its provisional opinion, in which it indicated *inter alia* that D7 appeared to disclose all features of claim 1 save for 'the at least one compressor stage inducts a cooling air mass flow from a rotor-bearing plenum' and that the outcome of the appeal may depend upon the formulation of the objective technical problem to be solved.
- V. With letter of 3 June 2022 the respondent indicated that it did not intend to attend the scheduled oral

proceedings.

- VI. The appellant replied with letter of 20 July 2022 commenting on the preliminary opinion.

- VII. Oral proceedings were held before the Board on 18 October 2022 in the absence of the respondent. In the course of the oral proceedings, the appellant filed a replacement set of claims of the main request, claim 1 of which was drafted in the two-part form in the light of D7.

At the end of the oral proceedings, the appellant requested that the decision under appeal be set aside and the patent be maintained in accordance with the main request filed during the oral proceedings before the Board.

The respondent requested, in writing, that the appeal be dismissed.

- VIII. Claim 1 of the main request, upon which the decision is based, reads as follows:

"A gas turbine (20, 30), comprising a compressor (12), which, via an air intake (11), inducts and compresses air, a combustion chamber (13), in which a fuel (14) is combusted, using the compressed air, and a hot gas is produced, and also a turbine (15), equipped with rotor or a shaft (16, 24) with turbine blades (32), in which the hot gas is expanded, performing work, wherein first means are provided in order to cool turbine blades (32) with compressed cooling air, wherein the first means comprise at least one separate compressor stage (22, 25) which produces compressed cooling air independently of the compressor (12), and wherein the at least one

compressor stage (22, 25) is integrated into the rotor or into the shaft (16, 24) and wherein the at least one compressor stage (22, 25) is designed as a radial compressor (25), and the at least one compressor stage (22, 25) delivers a main mass flow (31) of compressed cooling air to the last turbine rotor blades (32) for cooling purposes, and the at least one compressor stage (22, 25) is arranged directly aft of the last turbine rotor blades (32) in the flow direction, characterised in that the at least one compressor stage (22, 25) inducts a cooling air mass flow (28) from a rotor-bearing plenum (27)."

IX. The appellant's arguments relevant to the present decision may be summarised as follows:

The subject-matter of claim 1 of the main request involved an inventive step. When starting from D7, this failed to disclose solely that 'the at least one compressor stage inducts a cooling air mass flow from a rotor-bearing plenum'. The technical problem to be solved could be seen as being 'to provide an alternative source of air for cooling the last turbine stage'. D20 was not a suitable document for combining with D7 since it addressed cooling of completely different parts of the turbine; the cooling air disclosed in D7 was directed into the last turbine stage blades whereas that in D20 was directed to cool the bearing part 12 and the struts 14. Even after having cooled these components, the cooling air flow was not directed to the last turbine stage but rather into the gas path part 7 downstream of the last turbine stage (see arrow in Fig. 2 indicating airflow through cooling flow channel 17; paragraph [0036]). The skilled

person would consequently not consider D20 for guidance as to a suitable source of cooling air for the last turbine stage.

Considering D7 alone, the skilled person would still not reach the claimed subject-matter without becoming inventively active since many possible ways of supplying air to the rotor blades were known, the claimed way not being disclosed in any cited document and the claimed subject-matter thus not being obvious to the skilled person.

- X. The respondent's arguments relevant to the present decision may be summarised as follows:

The subject-matter of claim 1 lacked novelty or at least lacked an inventive step based on D7 alone. D7 implicitly disclosed the cooling air being induced from a rotor-bearing plenum since only two options were available: either through the rotor shaft, as disclosed in D8, or from the rotor-bearing plenum. The skilled person would thus take the cooling air from the rotor-bearing plenum and reach the claimed subject-matter without exercising an inventive step.

When starting from D7 and combining the technical teaching of D20 with this, the skilled person would be led to the claimed solution. The cooling air being fed to the rotor blades in D20 was taken from the rotor bearing plenum as indicated by arrows 17 and 25 in Fig. 2 of D20.

Reasons for the Decision

Main request

1. *Inventive step - Article 56 EPC*

1.1 D7 in combination with the technical teaching of D20

1.1.1 D7 discloses the following features of claim 1 (the reference signs in parentheses referring to D7):

A gas turbine, comprising a compressor, which, via an air intake, inducts and compresses air, a combustion chamber, in which a fuel is combusted, using the compressed air, and a hot gas is produced, and also a turbine, equipped with rotor or a shaft with turbine blades, in which the hot gas is expanded, performing work (all implicit from e.g. col. 1, lines 17 to 19), wherein first means (30, 31; see Fig. 2; col. 2, lines 51 to 61) are provided in order to cool turbine blades (12) with compressed cooling air, wherein the first means comprise at least one separate compressor stage (cover plate 30 and impellers 31) which produces compressed cooling air independently of the (process air) compressor, and wherein the at least one compressor stage (30, 31) is integrated into the rotor (col. 2, lines 54 to 59), wherein the at least one compressor stage is designed as a radial compressor, and the at least one compressor stage is arranged directly aft of the last turbine rotor blades (12; see Fig. 2) in the flow direction, the at least one compressor stage inducts a cooling air mass flow (see arrows in Fig. 2 from "press. ambient" through the chamber containing the impellers 31 and into the blade 12), and the at least one compressor stage delivers a main mass flow of compressed cooling air to the last

turbine rotor blades (12) for cooling purposes (col. 2, lines 55 to 59).

- 1.1.2 D7 therefore solely fails to disclose that the at least one compressor stage inducts a cooling air mass flow from a rotor-bearing plenum. This was not contested by the appellant.
- 1.1.3 The respondent argued that D7 implicitly disclosed the cooling air being induced from a rotor-bearing plenum since only two options for the source of the cooling air were available: either through the rotor shaft or from the rotor-bearing plenum. This argument is, however, not accepted.
- 1.1.4 D7 is silent as to the location from which the ambient pressure air for cooling is taken. No rotor bearing is depicted or discussed in the entire disclosure. The fact that a rotor bearing is present is clear, but that does not result in an unambiguous disclosure, even on an implicit basis, of the cooling air fed to the last stage of the turbine being induced from a rotor-bearing plenum in D7.
- 1.1.5 Regarding from where the cooling air mass flow is taken in D7, this is entirely unspecified, it solely being indicated that it is an ambient pressure source of air (see col. 3, lines 3 to 13 and Fig. 2). The objective technical problem to be solved based on the sole differentiating feature may thus be seen as being 'to provide a suitable source of air for cooling the last turbine stage'.
- 1.1.6 Contrary to the appellant's argument, an 'alternative' source of air cannot be part of the objective problem since no specific source of cooling air at all is

disclosed in D7. The opposition division's proposed problem relating to avoiding a decrease in turbine efficiency is also not objective since D7 uses ambient air, rather than let-down pressurised process air, for cooling.

- 1.1.7 When wishing to solve the objective technical problem formulated in point 1.1.5 above, the skilled person would not consider D20 since, as also argued by the appellant in its letter of 20 July 2022, D20 firstly does not refer to cooling the last stage of the turbine (see last paragraph on page 2). Further, after having cooled the bearing part 12 (col. 6, line 56 to col. 7, line 1) and the strut 14 (col. 6, lines 44 to 47) of D20, the combined cooling air flow 17, 25 passes through the flow openings 21 and then into the gas path part 7 (col. 6, lines 48 to 50). This gas path part 7 contains the process air downstream of the last turbine stage. Consequently, D20 does not disclose cooling air being supplied to the last turbine stage and the air available at that point has already been heated up due to it already having been used to cool the bearing and struts.
- 1.1.8 Therefore, starting from D7 and wishing to solve the objective technical problem, the skilled person would not consider D20 as an appropriate basis of teaching for the problem to be solved, not least since it fails to disclose a suitable source of air for cooling the last turbine stage.
- 1.1.9 This specific argument was raised before the opposition division which noted this in the penultimate paragraph of point 17.2.1 of its decision. In the appeal proceedings it was explicitly raised in the last paragraph on page 2 of the appellant's letter of

20 July 2022, noting that the Board had specifically indicated in its communication under Article 15(1) RPBA 2020 (see items 2, 3 and 4) that the objective problem to be solved had to be established. The respondent was thus given adequate opportunity to comment on this issue, even if it was not addressed in the Board's preliminary opinion, not least through the possibility of participation in the scheduled oral proceedings before the Board but, in electing not to attend these, had not taken advantage of this.

1.1.10 The subject-matter of claim 1 thus involves an inventive step when starting from D7 and combining the technical teaching of D20 with this. The issue, contested by the appellant, whether D20 even disclosed a rotor bearing plenum at all in the area/volume as indicated by the respondent e.g. in its reply of 3 June 2022 (see Figures 1 and 2 thereof), therefore did not need to be answered.

1.2 D7 alone

1.2.1 In as far as the respondent might have been making an inventive step attack based on D7 alone (see its reply to the grounds of appeal, third to last paragraph on page 5, where it states that the subject-matter of claim 1 lacked an inventive step based on D7), this inventive step objection is unsubstantiated, since no indication is given of how the skilled person would actually reach the claimed subject-matter. Instead, the arguments possibly leading to this statement only take issue with certain statements made by the appellant. If the respondent's contention were even regarded to implicitly be considering the problem posed by the opposition division, this is, as found in point 1.1.6 above, not objective such that a valid inventive step

objection cannot be recognised.

1.2.2 In its further letter of 3 June 2022, the respondent expanded slightly on its inventive step objection based on D7 alone, arguing that an 'alternative source of cooling air' could not be the problem to be solved since there was no alternative to inducing cooling air from the rotor-bearing plenum, other than taking this through the rotor itself. This argument is not accepted. Firstly it is noted that these are not the sole two options available to the skilled person. In addition to inducing cooling air from the rotor bearing plenum or through the rotor (as in D8, see Fig. 4; AF01 to AF04), it could alternatively be guided to the rotor blades via a path external to the rotor shaft (such as in D9, see particularly paragraph [0056], Fig. 2) or even via pipes feeding the cooling air from outside the turbine. However, irrespective of this, the respondent has failed to cite a single document in which the cooling air used for cooling the last turbine stage is induced from a rotor bearing plenum, such air being particularly suited for cooling since the air in a bearing plenum is typically slow moving and at low/atmospheric pressure. It thus follows that, while the skilled person indeed could have modified D7 by taking the cooling air from the rotor bearing plenum, the respondent has failed to provide a persuasive argument as to why the skilled person would do so. Consequently, the modification of D7 to provide cooling air from the rotor bearing plenum to the last turbine stage is not obvious to the skilled person when considering D7 alone or even when considering D7 in the light of common general knowledge.

1.2.3 Summarising, the Board finds the inventive step attack based on D7 alone to be unsubstantiated. Even if the

attack were considered in substance, it is found not to be persuasive.

1.3 In conclusion the Board finds the subject-matter of claim 1 to involve an inventive step (Article 56 EPC).

2. *Remittal according to Article 111(1) EPC*

2.1 According to Article 111(1) EPC 1973, when deciding on an appeal, the Board may either exercise any power within the competence of the department which was responsible for the decision appealed or remit the case to that department for further prosecution.

2.2 In view of the now much narrower subject-matter in claim 1 relative to that granted, the Board exercised its discretion to remit the case to the opposition division to adapt the description to the amended claims with requisite care. A particular thing to consider relates to claim 1 having been delimited in a two-part form with respect to D7 such that, in this particular case, and in view of the large number of features of claim 1 disclosed by D7, the opposition division should consider the appropriateness of citing this document in the description.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of claims 1 to 4 as filed in the oral proceedings before the Board and a description to be adapted accordingly.

The Registrar:

The Chairman:



D. Grundner

M. Harrison

Decision electronically authenticated