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Aktenzeichen / Case Number / N° du recours : T 219/89 - 3.2.3

Anmeldenummer / Filing No / N° de la demande : 86 300 948.6

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 191 634

Bezeichnung der Erfindung: High reliability fuel oil nozzle for a gas turbine

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : F23D 11/38, F02C 7/22

ENTSCHEIDUNG / DECISION

vom / of / du 7 August 1990

Anmelder / Applicant / Demandeur : Westinghouse Canada Inc.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence : Fuel oil nozzle/WESTINGHOUSE

EPO / EPC / CBE Art. 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire



Case Number : T 219/89 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 7 August 1990

Appellant : Westinghouse Canada Inc.
120 King Street West
Hamilton, Ontario L8P 4V2 (CA)

Representative : van Berlyn, Ronald Gilbert
23, Centre Heights
London, NW3 6JG (GB)

Decision under appeal : Decision of Examining Division 072
of the European Patent Office dated
3 November 1988 refusing European
patent application No. 86 300 948.6
pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : C.T. Wilson
Members : H. Andrā
J.-C. Saisset

Summary of Facts and Submissions

- I. European patent application No. 86 300 948.6, filed on 12 February 1986 and published on 20 August 1986 (publication No. 0 191 634) was refused by a decision of Examining Division 072 of the European Patent Office dated 3 November 1988. The decision was based on Claims 1 to 5 filed with letter of 20 June 1988.

The reason given for the refusal was that the subject-matter of Claim 1 did not involve an inventive step having regard to the prior art known from GB-A-2 004 050.

- II. On 4 January 1989 the Appellant lodged an appeal against the decision. The appeal fee was duly paid and the statement of grounds was received on 7 March 1989.

The Appellant argued that the fuel nozzle assembly according to the invention was different, in principle, from the arrangement disclosed in the citation since the air tube of the fuel nozzle is resiliently forced into engagement with the fuel nozzle tip with a given force independent of the temperature difference between the outer air tube and the inner fuel tube.

- III. As a result of objections raised by the Board of Appeal in a communication dated 25 May 1990, the Appellant, with a response dated 22 June 1990, submitted a new Claim 1 in accordance with the Board's suggestion together with proposals for corresponding amendments to the description including a new page 2.

The Appellant requested that the impugned decision be set aside and a European patent be granted on the basis of the presently effective documents.

The effective Claim 1 reads as follows:

"A fuel nozzle, for a gas turbine, comprising a nozzle body (1) with an inner tube (3) bearing at its end a nozzle tip (4) having a central orifice (6) adapted for fuel to be ejected under pressure, an outer tube (9) surrounding said inner tube bearing at its end a swirl cap (11) including a plurality of passages (13) through which air is to be ejected under pressure into the stream of fuel from said central orifice and a central aperture in said swirl cap into which said nozzle tip fits and means to maintain said nozzle tip and said swirl cap in contact, said nozzle body having a cavity around said inner tube and the outer tube extending with its inner end opposite said swirl cap into said cavity and carrying a ring (15; 9,18) adapted to fit into said cavity so as to center said outer tube at its inner end, characterized in that spring means (16,19) are provided engaging said outer tube at its inner end and projecting axially so as to be compressed upon mounting of said nozzle body onto a gas turbine combustor for maintaining a resilient contact between said swirl cap and said nozzle tip."

IV. For the original claims and description, reference should be made to publication No. 0 191 634.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is admissible.
2. **Amendments**
 - 2.1 As compared to the originally filed version present Claim 1 is restricted to the following additional features:

- (a) the fuel nozzle comprises a nozzle body which has a cavity around the inner tube,
- (b) the outer tube extends with its inner end opposite the swirl cap into the cavity and carries a ring adapted to fit into the cavity so as to centre said outer tube at its inner end,
- (c) spring means are provided engaging said outer tube at its inner end and projecting axially so as to be compressed upon mounting of said nozzle body onto a gas turbine combustor for providing said resilient contact between said swirl cap and said nozzle tip.

These features are disclosed in the original detailed description on page 3, line 20, to page 4, line 5; page 4, line 30, to page 5, line 15, in connection with Figs. 1 and 2 of the original drawings.

Claims 2 to 5 are identical with original Claims 2 to 5.

All claims clearly define the matter for which protection is sought. They meet, therefore, the requirements of Articles 123(2) and 84 EPC.

2.2 Having regard to the description the amendments filed with letter of 22 June 1990 concern the adaptation and clarification of the description in an admissible extent. The amendments are not, therefore, objectionable.

3. Novelty

3.1 The closest prior art with regard to the subject-matter of Claim 1 is disclosed in GB-A-2 004 050 (D1) which discloses the features according to the precharacterising portion of Claim 1.

The fuel nozzle according to Claim 1 differs from what is disclosed in D1 by the features of the characterising portion of Claim 1. The subject-matter of Claim 1 is, therefore, novel having regard to this prior art (Article 54 EPC).

3.2 The remaining documents cited in the European search report, namely GB-A-1 378 190 (D2) and US-A-3 668 869 (D3), have not been introduced into the proceedings by the Examining Division.

D2 discloses a fuel nozzle, for a gas turbine, in which the nozzle tip does not, however, fit into a central aperture of the swirl cap. Besides, nozzle tip and swirl cap are not in contact, but are separated by helical grooves forming a gas injecting and whirling means with the nozzle cap.

D3 discloses a gas turbine fuel nozzle which does not comprise an outer tube surrounding an inner tube and extending into a cavity of the nozzle body. The element bearing the swirl cap is formed by a flat face plate having an airtight seat on the nozzle body.

Furthermore, neither D2 nor D3 disclose the features of the characterising portion of Claim 1.

Therefore, the subject-matter as set forth in Claim 1 is also novel as regards the prior art disclosed in D2 and D3.

4. Problem and solution

4.1 The features of the characterising portion in combination with the features of the precharacterising portion of Claim 1 have the effect that the fuel and air supply

components of the fuel nozzle remain in proper sealing engagement despite these components being subjected to different temperatures which build up in particular during start-up of the turbine. The exposure of separated surfaces of the fuel and air supply components to the environment inside the combustor which would produce pitting of these surfaces is thus avoided.

In view of these technical effects, the problem underlying the invention is to provide a fuel nozzle in which pitting of the fuel and air supply components is avoided.

4.2 The problem resulting from different temperatures in the fuel and air supply components causing differential axial expansion of the fuel and air ducts and therefore leading to a gap at the normally sealing interface of the swirl cap and the nozzle tip is known from D1 (page 1, lines 9 to 31). If, according to the invention, it has been found further that the formation of such a gap leads to the disadvantage that the exposure of the separated surfaces to the environment inside the combustor causes pitting of these surfaces, this aspect of the problem is based upon observations of detrimental effects arising from practice. Since it is the permanent endeavour of the person skilled in the art to eliminate detrimental effects observed, the posing of the underlying problem results from normal operation of the fuel nozzle known from the relevant prior art.

5. Inventive step

5.1 The question now to be considered is whether the claimed solution is obvious to the skilled person in view of the prior art.

5.2 The "prior art" embodiment according to Fig. 1 of D1 was considered by the Examining Division to reflect the relevant prior art. The fuel nozzle disclosed by this embodiment provides an end cap tightened onto the air tube, the nozzle tip projecting into a control opening of the end cap and being tightened to provide a sealed engagement between the end cap and the nozzle tip. Due to the higher temperature of the air delivery tube as compared to the temperature of the fuel delivery tube during operation, the air delivery tube expands axially greater than the fuel delivery tube which results in a gap between the nozzle tip and the end cap of the air tube. Thus, the interface of nozzle tip and end cap is exposed to air flow and reverse flow of combustion products which, according to the inherent problem of the invention, is to be avoided.

This "prior art" embodiment concerns, therefore, the relevant prior art from which the problem to be solved arises.

As the outer tube of this prior art fuel nozzle is integral with the nozzle support flange there is no suggestion of spring means engaging the outer tube at its inner end and projecting axially so as to be compressed upon mounting of said nozzle body onto a gas turbine combustor for maintaining a resilient contact between the end cap and the nozzle tip.

5.3 The embodiment according to Figs. 2 and 3 of D1 which has not been cited by the Examining Division provides a breech-lock interengagement between the outer tube and the inner tube adjacent the nozzle tip to limit the axial expansion that would produce a gap between the nozzle tip and the outer tube, to the small axial portion between the breech-lock and the front wall of the air tube. To

~~accommodate all other relative expansion between the outer~~
tube and the inner tube, an annular diaphragm member is
provided at the inner end of the outer tube which
diaphragm is deformed upon relative axial movement between
the two tubes.

Again, there is no suggestion whatsoever of spring means
engaging the outer tube at its inner end and projecting
axially so as to be compressed upon mounting of the nozzle
body onto the combustor for maintaining a resilient
contact between the end cap and the nozzle tip. Even if
the deformable diaphragm were regarded as constituting
spring means to which function there is no hint in the
citation, a deformation thereof would not have any effect
on the distance or contact force between the end cap and
the nozzle tip, since the breech-lock interengagement
between the outer tube and the inner tube near the nozzle
tip in combination with the forced sealing engagement
between the nozzle tip and the outer tube would prevent
any displacement of the outer tube being transferred from
the diaphragm to the interface of nozzle tip and end cap.

- 5.4 The Examining Division has argued in its decision that it
is generally known to use a spring for maintaining a
relatively constant force between the components and that
the features for solving the problem of avoiding pitting
of the fuel and air supply components of the fuel nozzle
do not involve a new surprising effect or technical
difficulties not resolvable by routine techniques.

The Board considers that this argumentation is not
convincing in proving obviousness of the claimed solution.
The prior art as outlined above discloses an arrangement
of the fuel nozzle elements in which the inner and the
outer tubes are firmly mounted together in the range of
the inner ends of the tubes ("prior art" embodiment of D1)

or in which the inner tube and the outer tube are firmly mounted together in the range of the nozzle tip, provisions being made at the inner end of the outer tube to accommodate the differential thermal expansion of the tubes (embodiment of Figs. 2 and 3 of D1). According to the invention, however, the concept of mounting the outer and inner tube firmly together is abandoned, there being no lead in the prior art to suggest such abandonment. Furthermore, the solution according to the invention is based on the idea different, in principle, from the prior art disclosed, of maintaining a resilient contact between the swirl cap and the nozzle tip by providing spring means arranged in accordance with the features of the characterising portion of Claim 1.

- 5.5 The documents D2 and D3 (see item 3.2 above) cited in the search report neither address the problem of overcoming the disadvantages indicated above nor do they give a lead to the features of the characterising portion of Claim 1.
- 5.6 For the foregoing reasons, the Board has come to the conclusion that the subject-matter of Claim 1 involves an inventive step.
- 5.7 The patentability of the dependent Claims 2 to 5 is supported by the patentability of the independent Claim 1.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant the patent on the basis of the following documents:

Claims: 1 to 3 filed with letter of 22 June 1990,
4 and 5 filed with letter of 20 June 1988;

Description: pages 1 and 3 to 5 as originally filed and amended as requested in the letter of 22 June 1990,
page 2 filed with letter of 22 June 1990,
page 2a filed with letter of 4 October 1988;

Drawings: sheets 1/2 and 2/2 as originally filed.

The Registrar:



S. Fabiani

The Chairman:



C.T. Wilson

11.9.90

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12.9.90

