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**D E C I S I O N**  
of 19 February 1997

**Case Number:** T 0281/96 - 3.2.2

**Application Number:** 90105153.2

**Publication Number:** 0389913

**IPC:** B23P 6/00

**Language of the proceedings:** EN

**Title of invention:**  
Turbine blade repair

**Applicant:**  
REFURBISHED TURBINE COMPONENTS LIMITED

**Opponent:**  
-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56, 122(1)

**Keyword:**  
"Restitutio - all due care - isolated mistake"  
"Inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
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Case Number: T 0281/96 - 3.2.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.2  
of 19 February 1997

**Appellant:** REFURBISHED TURBINE COMPONENTS LIMITED  
George Bayliss Road  
Droitwich  
Hereford and Worcester WR9 9AB (GB)

**Representative:** Symes, Christopher A.  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 11 December 1995  
refusing European patent application  
No. 90 105 153.2 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** H. Seidenschwarz  
**Members:** M. Bidet  
C. Holtz

## Summary of Facts and Submissions

- I. European patent application No. 90 105 153.2 filed on 19 March 1990, claiming GB priorities of 28 March and 21 July 1989 and published under No. 0 389 913 was refused by a decision of the examining division issued 11 December 1995.
- II. The reason given for the decision was that the subject-matter of Claim 1 as modified at the oral proceedings before the examining division did not meet the requirements of Article 52(1) and 56 EPC having regard to the disclosures of the prior art documents EP-A-0 303 433 (D2) and EP-A-0 087 279 (D1).
- III. On 8 February 1996 the appellant (applicant) lodged an appeal against the decision of the examining division. The statement of grounds was filed on 22 April 1996. In response to a communication of 12 April 1996 from the Board of Appeal, the appellant requested re-establishment of rights in respect of the payment of the appeal fee and paid this fee and the fee for re-establishment with letter of 16 April 1996. The statement of grounds in support of the application for re-establishment of rights (three sworn affidavits, by the representative, his secretary, and his assistant) was filed with letter of 12 June 1996.
- IV. Oral proceedings were held on 19 February 1997 in which the appellant explained the circumstances of the case justifying its request for re-establishment of rights and presented a new Claim 1 with the following wording:

"A method of repairing or modifying a turbine blade (10) comprising the steps of:

- (a) removing an end part of the blade;
- (b) forming a new piece of material (35) to replace the part removed, in which the new piece only proximates to, and is larger than, the final form required, so as to allow for any misalignment of the new piece;
- (c) welding the new piece (35) to the end of the blade (10) without forcefully restraining the one relative to the other;
- (d) heating said blade (10) in the area of said weld (28,39);
- (e) machining or otherwise working the new piece of material (35) as necessary to the required shape."

V. In its statement of grounds and in the oral proceedings, the appellant argued as follows :

- (i) as regards the request for re-establishment:

The representative's partnership has several offices. In England there is one in Birmingham and one in London, and in Germany there is among others one in Munich. For European patent applications two identical files exist, one in the office where the representative is normally based and the other in Munich. The Birmingham office was responsible for the present application.

The offices in England used a computerised system, COMUS, which had been introduced some 14 years ago. There had never before been any delays in paying the

appeal fee. All fee payments were monitored and reminder prompts were sent out for the fees. Due to the present non-payment an omission in the computer system was however discovered, namely that no reminder prompt was issued by the Birmingham computer system with regard to appeal fees. This was in contrast to the London office, where such reminders were sent out. It can only be assumed that this omission was due to an installation error at the time the system was introduced. This omission was then compounded by the fact that the representative, who had originally planned to file the notice of appeal from the Birmingham office where he was normally based, decided to have the Munich office do so, as he planned to be in residence there at the time the appeal was filed. The representative had at the time an assistant in Birmingham who prepared the notice of appeal, which the representative duly signed, as well as a cover note to the Munich office, asking them to file the notice. In the cover note the Munich office was asked to confirm by return that "the above documents" had been filed at the EPO. The only documents that needed filing were the notice of appeal, the fee sheet and cheque. This would have meant that there would have been included in the secure bag to be sent to Munich, the notice of appeal of 6 February 1996, the fee voucher and a cheque. Although it is usual for the attorney in charge to sign the fee sheet and the cheque, this is not infrequently done by one of the partners, for example if the attorney in question is in a meeting. As the secretary who prepared the documents was a very experienced and reliable person, the representative firmly believed that the correct documents were sent to Munich.

In her affidavit, the secretary could only offer the explanation as to why she had not prepared any fee voucher that she was under the impression that the fee would be paid from Munich.

The assistant explained in his affidavit that he certainly had not been asked to pay the appeal fee from the Birmingham office since this would have been inconsistent with the representative's intention to file the appeal from Munich. The reason the wording "the above documents" was used in the cover note was probably that the assistant was aware that a fee voucher had to be included and that he never believed anything other than that the notice of appeal would be filed with the fee and fee voucher.

(ii) as regards the inventiveness of the invention disclosed in its present application:

Document D2 discloses the most relevant prior art since it relates to a method of repairing the end part of a turbine blade.

Document D1 also concerns a repairing method for turbine blades but specifically for repairing cracks around holes receiving a lacing wire interconnecting these blades in a rotor. According to the methods disclosed in documents D1 and D2, the piece of material or the insert must be accurately aligned with the remainder of the blade during the welding step. In the method of document D2, the piece of material is additionally maintained in position by force.

Therefore, none of these documents could suggest the features of providing a new piece of material larger than the final form required so as to allow for any misalignment of the new piece and of welding the new piece to the blade without forcefully restraining it to the end of the blade according to the method Claim 1.

- VI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 7 and an amended description filed during the oral proceedings.

### Reasons for the Decision

1. *Admissibility of the appeal*

But for the late payment of the appeal fee, the appeal conforms to Article 106 and 108 EPC.

From the affidavits and the further information given by the representative in the oral proceedings, the Board is able to conclude the following:

The omission to provide reminders for the appeal fee apparently was due, not to a failure in designing the computerised monitoring system, but rather to some human error at the time the system was installed physically in the Birmingham office. This conclusion is supported by the fact that the identical system in the London office did include reminders for this fee.

The explanations given by the representative that the original omission was compounded by the fact that he decided not to have the appeal filed from the office responsible for the appeal, but from the Munich office, is corroborated by the affidavits by the secretary and

the assistant, both claiming that the reason that no fee voucher or cheque was prepared must have been that the representative had decided to have the Munich office do the filing. In this context the Board observes that a system, however meticulously planned, may fail exactly because established routines are not followed. This should have warned the representative to take extra precautions in ensuring that all needed actions would be taken. However, as everyone involved believed that the monitoring system would have issued a proper reminder on time, the Board finds it convincingly shown that the appellant took all due care under the circumstances and that the error was due to a single mistake in an otherwise satisfactory system.

The request for re-establishment is therefore allowable and hence the appeal must be declared admissible.

2. *Amendments*

- 2.1 Present claim 1 is mainly claim 1 of the originally filed set of claims, with the addition of the features of Claims 5 and 6, relating to the sequence of steps, and the provision of the new piece of material larger than that being removed and the acceptance of misalignment of this piece relative to the remaining rotor blade. It is further supported by the description of the application as filed (see page 3, lines 6 to 29; page 4, fourth full paragraph; page 5, last three lines to page 6, line 9; page 6, lines 24 to 28; page 7, lines 3 to 14).



The welding step according to Claim 1 (feature b) as originally filed has been completed by the feature "without forcefully restraining the new piece relative to the end of the rotor blade" which finds its support page 11, lines 20 to 24; page 12, line 33 to page 13, line 3.

The word "polishing" in the final feature of Claim 1 (feature (d)) as originally filed has been deleted to make clear the difference between the machining step necessary to obtain the desired shape and any further polishing operation. It is clear that the new piece being oversized would not reasonably and significantly be reduced to its final shape only by a polishing step. This corresponds to the disclosure page 6, lines 24 to 28, page 11, lines 25 to 31, page 12, line 3 to 6.

The one-part form of Claim 1 is appropriate since it avoids any distorted or misleading picture of the invention (see also Guidelines CIII,2.3).

- 2.2 Dependent claims 2 to 7 correspond to claims 2, 3, 4, 7, 8 and 9 respectively of the application as originally filed, from which claims 3 and 4 have been rendered appendant to at least Claim 1, as obvious from the clear intention of the writer of the application making reference to features necessarily mentioned in proceedings claims.
- 2.3 The description has been brought in line with the content of the new Claim 1 and cites the features of claim 1 known from the method according to document D2.
- 2.4 The requirement of Article 123(2) EPC is therefore met by the amended document.

3. *State of the art*

- 3.1 Document D2 discloses a method of repairing a turbine blade, in which a damaged end part of the blade has been removed. A new piece of material, including an integral blade end part, formed to replace the part removed, is welded to the end of the blade. Thereafter, a heat treatment of the blade is carried out (see column 7, lines 40 to 58; column 9, lines 9 to 13; column 10 lines 21 to 27).

It is an object of the known method of building up worn tenons by welding an end part of the blade (tenon with a root part), as set out in the description of document D2, to reduce the time needed to very accurately machine the slot receiving the new tenon and to avoid the need for the services of specialised persons (see column 1, line 60 to column 2, line 17).

The method of repairing or modifying a turbine blade according to Claim 1 of the patent application in suit differs from the method according to document D2 in that:

- (i) the new piece only proximates to, and is larger than, the final form required, so as to allow for misalignment of the new piece,
- (ii) the new piece is welded to the end of the blade without forcefully restraining one relative to the other,
- (iii) the new piece is machined or otherwise worked as necessary to the required shape.

3.2 Document D1 relates to a method of repairing turbine blades in which damaged material from the blade is removed, a new piece of material is secured in place by welding. The stresses induced by this operation are released by a heat treatment (see page 2, lines 11 to 24, page 5, line 17 to page 6, line 6). According to the embodiment of Figure 6, an insert is first positioned in an enlarged hole of the removed part and secured by welding into place (see page 6, lines 1 and 2).

It is an object of the teaching of document D1 to provide for an improved method of repairing turbine blades having lacing wire holes as well as to provide means to ensure that the lacing wire holes are reformed in the correct position (see page 1, lines 1 to 9; page 2, lines 9 and 10).

However, the repairing method does not relate to the end part of the turbine blade being removed and replaced by a new end part but to the damaged material around the lacing holes being removed and replaced by an insert in form of a plug. This plug does not approximate the required final form and is not allowed to be misaligned with the remaining part of the turbine blade.

#### 4. *Novelty*

It results from the above that none of the documents D1 and D2 discloses in combination all the features in Claim 1 of the application in suit.

Since also the other documents cited in the search report do not show a method coming closer to the claimed method than those disclosed by the above mentioned documents, the subject-matter of Claim 1 is therefore considered to be new within the meaning of Article 54(2) EPC.

5. *Inventive step*

Since document D2 is the only cited document disclosing repairing the outer end of a turbine blade, the Board agrees with the appellant that this document discloses the state of the art nearest to the invention.

5.1 In the repairing method according to document D2, the new piece is accurately machined and is accurately aligned and maintained in position just before welding it to the remaining part of the turbine blade. During welding stresses occur which have to be annealed by heat treatment. Although care is taken to avoid any misalignment of the new piece and any remaining stresses in welding area, deformation may occur. Due to this deformation, the required shape of the new piece may not be achieved, and stresses induced during welding of the two pieces forcefully maintained in position may not all be annealed with the consequence of increasing the risk of damages during use of the rotor blade.

Therefore, the problem to be solved by the subject-matter of Claim 1 with respect to the repairing method according to document D2 is to develop a method which is cheaper and gives a satisfactory replacement of an end part of a turbine blade.

The Board is of the opinion that this is achieved by the features (i) to (iii) mentioned in point 3.1 above.

Since the new piece according to Claim 1 is not fixed to the remaining part of the rotor blade, the new piece is able to deform during the welding step, thereby reducing the resulting stresses when compared to the forceful restraint involved in the method according to document D2. Furthermore, the excess of material of the new piece allows for it to be additionally misaligned with respect to the remaining part of the rotor blade. The final shape is then achieved by machining the excess material.

- 5.2 In the method according to document D2, the end part and the remaining part is accurately located and maintained in position during welding by locating means such as disclosed in Figure 11. Consequently, the new end part is not able to deform freely so that stresses remain after welding. Therefore, the teaching of document D2 does not give any hint to a solution in which the alignment and the maintenance of the alignment are abandoned to reduce the stresses.
- 5.3 The examining division was of the opinion that the plug (the new piece) to be inserted in a turbine blade according to the method of document D1 had excess material which was to be removed by machining after the welding and heat treating steps.

The board does not accept this argumentation for the following reasons:

The main concern of the method according to document D1, is to repair the damaged area of the turbine blade around the vicinity of a lacing wire hole. It goes without saying that the repaired turbine blade should fulfil the quality conditions for safe use.

To this end, the plug is disposed in the hole and welded so as to fill the hole. The reason for this step is to avoid or eliminate any area of discontinuity of the turbine blade and thus to reduce or eliminate an area of high residual stress (see page 2, lines 30 to 34; page 3, lines 6 to 13, page 4, lines 1 to 7 and page 6, lines 12 to 21). According to a first embodiment, the end surfaces of the plug which are exposed, may be provided with indentations and in a second embodiment, the plug protrudes from the surface of the rotor blade (see page 3, lines 20 to 25). After heat treatment, the excess of material - namely the excess of weld material according to the first embodiment or any excess of material of the plug such as the protrusions - is removed by machining.

The function of the protrusions and indentations is throughout the description for additionally providing location means for a boring or a drilling machine which may easily be positioned to reform the lacing wire hole in the correct position (see page 3, lines 14 to 22; page 4, lines 13 to 15 and page 5, lines 31 to 36). The excess material in both embodiments does **not** have the function of allowing any misalignment of the two pieces.

This document D1 therefore does not suggest

- (i) either roughly locating the plug relative to the turbine blade with the intention of tolerating misalignment of the two pieces and not restraining the plug relative to the turbine blade,

- (ii) or providing excess material for a purpose other than to provide location means for correct alignment of the new piece as well as subsequent guiding means for a machining tool.

Consequently, the teaching of document D1 considered in its entirety does not give any hint that may lead the skilled person to the invention.

5.4 Therefore none of the documents D1 and D2 or the other documents alone or in combination with another, gives any hint to the skilled person of providing a method of repairing turbine blade in which the new piece does not need to be aligned or to be forcefully restrained in alignment with the remaining part of the blade during the welding operation as specified in Claim 1 of the patent application in suit.

5.5 It follows from the above that it was not obvious to arrive at the claimed method of repairing turbine blade in view of the cited prior art. Therefore, the subject-matter of Claim 1 is considered to involve an inventive step in accordance with Articles 52(1) and 56 EPC.

5.6 Claim 1 being allowable, the same applies to the dependent claims 2 and 7 whose patentability is supported by that of Claim 1.

Order

For these reasons it is decided that:

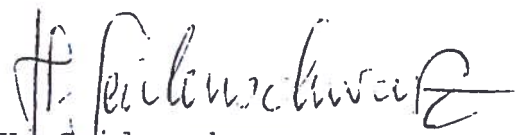
1. The decision under appeal is set aside
2. The case is remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 7 and an amended description as filed during the oral proceedings.

The Registrar:



S. Fabiani

The Chairman:



H. Seidenschwarz