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Datasheet for the decision of 11 June 2018

Case Number: T 0118/15 - 3.2.08

Application Number: 03756486.1

Publication Number: 1540026

IPC: C22F1/10, B23P6/04

Language of the proceedings: EN

Title of invention:
PROPERTY RECOVERING METHOD FOR NICKEL SUPERALLOY

Patent Proprietor:
Ansaldo Energia IP UK Limited

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 100(a), 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
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Office européen des brevets

Beschwerdekammern

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Case Number: T 0118/15 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 11 June 2018

Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Siemens AG Postfach 22 16 34 80506 München (DE)
Respondent: (Patent Proprietor)	Ansaldo Energia IP UK Limited 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)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 8 January 2015 rejecting the opposition filed against European patent No. 1540026 pursuant to Article 101(2) EPC**

Composition of the Board:

Chairman M. Alvazzi Delfrate
Members: A. Björklund
C. Schmidt

Summary of Facts and Submissions

I. With its decision posted on 8 January 2015 the opposition division rejected the opposition against European patent No. 1 540 026.

II. The appellant (opponent) filed an appeal against this decision, in due form and within the prescribed time limits.

III. The appellant requested that the decision under appeal be set aside and the patent revoked.

The respondent (patent proprietor) requested that the appeal be dismissed and the patent maintained as granted. Oral proceedings were requested as a precautionary measure.

IV. The sole independent claim reads as follows:

"A property recovering method for single crystal and directionally solidified material bodies made from a Nickel based superalloy after the use in a high temperature environment comprising the steps of
(a) a stress relief treatment at 850°C - 1100°C,
(b) a γ' rejuvenation treatment at a temperature between 20°C and 80°C below γ'-solvus temperature ($T_{solvus,\ \gamma'}$) of the Nickel based superalloy,
(c) a precipitation treatment at 1050°C - 1150°C and
(d) an aging heat treatment at 800° - 980°C."

V. The following documents are mentioned in this decision:

D4: US 5,882,446 A
D5: Okazi M. et al. "Effect of local cellular transformation on fatigue small crack growth in CMSX-4

and CMSX-2 at high temperature"; Superalloys 2000, 2000, pages 505-514
D8: DE 196 17 093 A1 (German priority document of D4)

VI. The appellant argued essentially as follows:

The subject-matter of claim 1 did not involve an inventive step having regard to D5 as the closest prior art.

D5 (page 506, second paragraph of left column, Table I CMSX-4, Table II Conditions B and C, page 507, paragraph bridging left and right columns, and second paragraph of right column) disclosed a property-recovering method for single-crystal bodies of the nickel-based superalloy CMSX-4 comprising steps (b), (c) and (d) of claim 1.

The subject-matter of claim 1 differed only in that a stress-relief treatment according to step (a) was carried out before the rejuvenation treatment in step (b).

The objective technical problem to be solved was to avoid recrystallisation during a rejuvenation heat treatment and subsequent precipitation and ageing heat treatment.

The person skilled in the art was already taught in D5, page 507, second paragraph of right column, that avoidance of recrystallisation was associated with strain energy release, in other words stress relief in the material. He was also taught that higher treatment temperatures, which were advantageous because they would shorten the length of the heat treatment, led to

recrystallisation at least in the surface area of the samples.

The person skilled in the art seeking to solve the problem posed would have consulted D4, column 2, lines 19-36, or the corresponding document D8, which both concerned heat treatment of the same material, CMSX-4, including stress-relief annealing corresponding exactly to step (a) of claim 1. Having found the solution to the problem posed in D4, it would be obvious for him to carry out such stress relief before the heat treatment according to condition C of table II in D5.

The subject-matter of claim 1 therefore did not involve an inventive step.

VII. The respondent argued essentially as follows:

D4, or the corresponding D8, concerned a heat treatment method for unused, as-cast bodies of nickel-based superalloys for turbine blades. By contrast, the patent related to a method for heat-treating material bodies after they had been used in a high-temperature environment, and these had a different structure and behaviour than as-cast, unused bodies. For example, they were much more prone to recrystallisation.

While the multi-step heat treatment suggested in D8 included stress-relief annealing according to step (a) of claim 1, it was followed by further heat treatment steps of slowly increasing temperature even above the γ' solvus temperature, which were necessary to avoid recrystallisation. Therefore, a fully re-precipitated γ' structure was achieved, whereas in the patent heat treatment at 20-80°C below the γ' solvus temperature

was carried out after the annealing, resulting in a partially re-precipitated γ' structure.

D5 disclosed a heat treatment of samples which had been plastically deformed at room temperature by test probes, and which therefore had a completely different structure of deformation than ex-service parts after several tens of thousands of high-temperature cycles in a gas turbine. It did not disclose at least steps (a) and (b) of claim 1. It also did not disclose the temperature limit boundaries for a heat treatment free of recrystallisation. Indirectly, it proved that neither heat treatment step (a) nor step (b) on their own achieved the desired recrystallisation-free rejuvenation of ex-service alloys.

The person skilled in the art would not combine the teachings of D4 (or the corresponding D8), which concerned new as-cast parts, with the teachings of D5, which concerned simulated used parts. He had no incentive to pick out the single step of stress-relief annealing from the multi-step method for new as-cast parts disclosed in document D8 and to perform this before the heat treatment steps of the method disclosed in D5. Even if he did so, he would not arrive at the subject-matter of claim 1, since none of the documents disclosed a γ' rejuvenation at a temperature between 20-80°C below the γ' solvus temperature. This heat treatment step together with the preceding stress-relief treatment step led to a partial solution of the γ' and a microstructure free of recrystallisation.

Consequently, the subject-matter of claim 1 involved an inventive step.

Reasons for the Decision

1. Inventive step - Article 100(a) EPC in combination with Article 56 EPC

1.1 In order to establish a refurbishment technology for gas turbine components, document D5 investigates a method for reheat treatment of bodies made of nickel-based superalloys carried out on samples which have been plastically deformed at room temperature to simulate damage during service.

The methods investigated for alloys CMSX-4 and CMSX-2 are disclosed on pages 506-507, in particular Tables I and II, the paragraph bridging pages 506 and 507, page 507, the paragraph bridging the left and right columns, and the second paragraph of the right column. They comprise a reheat treatment followed by two ageing steps, see Table II. D5 does not expressly disclose that the reheat treatment is a γ' rejuvenation treatment at a temperature between 20°C and 80°C below γ' solvus temperature. However, the chemical composition of CMSX-4 as well as the reheat treatment temperatures in conditions B and C of Table II fall within the ranges defined in claim 3 of the patent. Hence, the reheat treatments of conditions B and C are in accordance with step (b) of claim 1.

Moreover, the temperatures of the ageing steps of Table II are in accordance with those of steps (c) and (d) of claim 1. Therefore D5 also discloses these steps.

1.2 It is undisputed that document D5 does not disclose a stress-relief treatment at 850°C-1100°C according to step (a) of claim 1.

1.3 The appellant argued that D4, or the corresponding document D8, rendered it obvious to perform this stress-relief treatment to avoid recrystallisation during the rejuvenation treatment.

1.4 It is true that D4 teaches to avoid recrystallisation of nickel-based superalloys by means of a multi-step heat treatment which begins with a stress-relief annealing step according to step (a) of claim 1, see column 2, line 19, to column 3, line 1. However, D4 is related to heat treatment of unused, as-cast articles, in particular gas turbine blades. Articles in an as-cast and unused state have a different microstructure and behaviour in respect of recrystallisation than articles after use in a high-temperature environment or, as in the case of D5, submitted to plastic deformation which simulates said use. Thus, the person skilled in the art would not consult D4 when seeking to avoid recrystallisation in the method of D5. Moreover, the method disclosed in D4 comprises further steps, including temperatures **above** the γ' solidus curve, which are equally essential to avoid recrystallisation, see column 2, lines 36-47. In contrast, D5, page 507, paragraph bridging the left and right columns, teaches that recrystallisation may begin at treatment temperatures already **below** the normal solution heat treatment temperature. Thus, the teachings of D5 and D4 in respect of the heat treatment temperatures are at odds.

Since documents D5 and D4 concern materials in different states with different recrystallisation behaviour and provide conflicting teachings on the temperature requirements of a heat treatment which avoids recrystallisation, the person skilled in the art

would, contrary to the appellant's view, not combine their teachings.

The same considerations apply in view of D8, which is the priority of D4.

1.5 Consequently, the subject-matter of claim 1 involves an inventive step (Article 56 EPC).

2. Since oral proceedings have been requested as a precautionary measure only by the respondent and the appeal is to be dismissed, the present decision is taken in writing.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Moser M. Alvazzi Delfrate

Decision electronically authenticated