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D E C I S I O N
of 29 March 1996

Case Number: T 0531/92 - 3.2.2

Application Number: 83300455.9

Publication Number: 0085553

IPC: C22F 1/18

Language of the proceedings: EN

Title of invention:
Zirconium alloy fabrication processes

Patentee:
WESTINGHOUSE ELECTRIC CORPORATION

Opponent:
Siemens AG

Headword:
Zirconium alloy/WESTINGHOUSE

Relevant legal provisions:
EPC Art. 56, 114(2)

Keyword:
"Inventive step - yes"

Decisions cited:
G 0009/91

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0531/92 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 29 March 1996

Appellant: (Opponent)
Siemens AG
Postfach 22 16 34
D-80506 München (DE)

Representative:
-

Respondent: (Proprietor of the patent)
WESTINGHOUSE ELECTRIC CORPORATION
Westinghouse Building
Gateway Center
Pittsburgh
Pennsylvania 15222 (US)

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

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 9 April 1992 rejecting the opposition filed against European patent No. 0 085 553 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: J. Seidenschwarz
Members: R. Lunzer
J. De Preter

Summary of Facts and Submissions

I. European patent No. 85 553 was granted on 23 November 1988 on the basis of application No. 83 300 455.9 filed on 28 January 1983, claiming a priority date of 29 January 1982 based on US Application No. 343 787. The single Claim of the patent as granted took the following form:

"1. A process for fabricating Zircaloy alloy shapes comprising the steps of heating a Zircaloy intermediate product to an elevated temperature above the alpha+beta to beta transus temperature and quenching said Zircaloy intermediate product from said elevated temperature to a temperature below the alpha+beta to alpha transus temperature to form precipitates having an average diameter below about 1100 Angstroms, then extruding said alloy at a temperature between about 500 and 600°C, then cold working said alloy in series of cold pilgering steps each of which is preceded by a thermal treatment step consisting essentially of only a low temperature anneal, said low temperature anneal limited to about 500 to 600°C, and after the final cold pilgering step subjecting the resulting material to a final anneal at about 466 to 600°C."

II. An opposition was filed by the Appellant on the ground of Article 100(a) EPC, alleging lack of any inventive step (Article 56 EPC). The opponent relied in particular on the following documents:

(1) DE-A-2 607 141
(2) US-A-2 894 866
(3) DE-A-3 003 610.

III. By its decision given orally on 20 February 1992, and issued in writing on 9 April 1992, the Opposition Division rejected the opposition. It regarded document (3) as the closest prior art. That document disclosed extrusion of zirconium alloys such as Zircaloy-2 at 600°C (page 9, 1st paragraph, and page 12, 2nd paragraph). At page 13 second paragraph there was a reference to annealing at 540 to 700°C, the exemplified temperatures of annealing being 675°C at step 2, 620°C at steps 5 and 8, and 480°C at step 12 (all these temperatures being given in Figure 3). There was no disclosure of annealing at a temperature high enough for the material to transform to the beta phase followed by quenching to alpha phase. However, even if such a step had been employed, as the alloy there disclosed was held for one hour at about 700°C and for a further hour at 675°C after extrusion (step 2 of Figure 3) the desired results of the patent in suit could not have been attained. Document (1) did not disclose any annealing in the beta temperature range followed by quenching, which was an essential feature of the Claim of the patent in suit. Therefore it did not support the objection of lack of inventiveness.

IV. An appeal against that decision was filed on 5 June 1992, the appeal fee was paid on the same day, and the statement of grounds of appeal was filed on 10 August 1992. In that statement the Appellant argued that document (1), rather than document (3), was the closest prior art. The Opposition Division had overlooked the fact that the patent in suit exemplified heating for 1.5 hours at 1,052°C, which was shown by document (1) to be a temperature within the normal range for the conversion of these alloys into the beta phase prior to quenching. Seen against that background, the sole new proposal contained in the patent in suit was to keep the temperature of extrusion, and the temperature of

annealing between cold-working steps, below those which had conventionally been adopted in the past. However, the skilled worker would have known that the retention of the finely divided precipitate attained by quenching could be achieved by keeping these temperatures on the low side, and therefore no inventive step was required to arrive at the subject-matter of the Claim of the patent in suit. Furthermore the subject-matter of the Claim of the patent in suit has been extended contrary to Article 123(2) EPC because there had been no disclosure in the application as filed of the range of 466 to 600°C, which was included as an essential feature of the Claim of the patent as granted.

V. The Respondent argued in its counterstatement that the Opposition Division had appreciated the importance of the small size of the precipitated particles, and their conservation by keeping the temperatures of extrusion and of annealing lower than had hitherto been normal. A minor seemingly unimportant change had brought about a change of major importance in the quality, and especially the corrosion resistance, of the end product. The objection to the alleged broadening of the Claim was without substance, since the figures included in the Claim of the patent as granted had been disclosed in the application as filed.

VI. The Appellant requested that the decision under appeal be set aside, and that the patent be revoked. The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Objection under Article 123(2) EPC*

As was indicated by the Respondent, the limits to which the Appellant objected had been disclosed in the application as filed. Specifically, the lower limit of 446°C is to be found at page 8 line 11 of the application as filed, corresponding to page 4 line 23 of the patent as published, while the upper limit of 600°C is to be found at page 6 line 6, and page 11 line 36, of the application as filed, corresponding to page 3 line 45, and page 6 line 2, of the patent as published. Although these values are not disclosed as defining a range of temperatures as such, they are in fact the upper and lower limits of temperatures mentioned in connection with the performance of the final annealing step, and the Board sees no valid objection to their inclusion in the range defined by the Claim of the patent as granted, despite the fact that that range was not mentioned as such in the claims of the application as filed.

As this objection was raised for the first time in the appeal proceedings, the Board could have excluded it altogether pursuant to the guidance given in the decision G 0009/91, OJ EPO 1993, 408 (Reasons point 17). However, as the issue was dealt with by the Respondent and could readily disposed in a clear and final manner, the Board preferred to give its view on this issue.

3. *The alleged inventions*

Document (2) is a patent applied for in 1958 which reflects the fact that tubes of zirconium base alloys have long been used as protective sheathing for the radio active materials used in atomic reactors, while document (1) refers at page 2 second paragraph to the long standing problem of the corrosion of these alloys, and the intensive research directed to finding a solution to that problem. Given that background, it is surprising that so simple a step as that proposed by the patent in suit, of keeping the precipitated particle size below 1100 Angstroms (and preferably below 800 Angstroms in accordance with the patent in suit at page 4 line 49) together with keeping the temperatures of extrusion and annealing below 600°C after the alloys had been quenched from the beta phase region, had escaped the attention of workers in this art. Table II of the patent in suit shows the performance of tubes made in accordance with the alleged invention comparing their corrosion resistance with that of conventional materials, and reflects a significant improvement. Figure 3 of the patent in suit also shows a substantial improvement in the stress rupture properties of alloys treated in accordance with the alleged invention. The validity of these results was not questioned by the Respondent.

4. *Novelty*

Having reviewed the cited documents, the Board is satisfied that none of them discloses a process having all the features defined in the Claim. Novelty was not contested by the Appellant, and the subject-matter of the Claim can be considered to be novel within the meaning of Article 54 EPC.

5. *Inventiveness*

5.1 The Appellant has challenged inventiveness, basing its objection principally on documents (1) and (2). Document (1) is relied on as showing that a heating step, such as for 1.5 hours at 1052°C mentioned in the example of the patent in suit at page 3 lines 59 to 60, is known from document (1) which discloses and claims heating into the broadly identified temperature range of 825 to 1100°C. However, there is no suggestion in that document that finely divided precipitated particles having an average diameter below 1100 Angstroms could be obtained. The limitation on the particle size of the precipitate after quenching has the effect of imposing a lower limit on the rate of cooling. That minimum rate of cooling is unlikely to have been achieved when using the apparatus disclosed in document (1), because, in contrast to the water quenching specified in the patent in suit at page 3 line 59, the spray cooling system disclosed in document (1) cools the tubes to 700°C in the course of 1 to 2 seconds, and to 500°C after a further 6 seconds (page 8 second paragraph).

5.2 In addition, the spray cooling described in document (1) is carried out after rapid induction heating to only 920°C for a very short period in a continuous zone heating apparatus. It is therefore unlikely that the physical structure specified in the Claim of the patent in suit for the zirconium alloy when quenched could be attained when carrying out the process described in document (1).

5.3 The further essential features of the Claim of the patent in suit, of extruding at a temperature of between 500 and 600°C, cold working in a series of pilgering steps with intermediate anneals limited to 500 to 600°C, and a final anneal in the range of 466 to 600°C are all

lacking from the disclosure of document (1). Document (1) concerns the use of an unusual process and apparatus, whereas the patent in suit relates to the conventional processes for the production of zirconium alloy tubes, involving the sequential steps of solution treating above the beta transus temperature, quenching, extrusion, pilgering, and annealing, modified only in that a drastic quench is specified, followed by extrusion and annealing at temperatures which are lower than usual. It follows that document (1) cannot be a pointer in the direction of the invention.

5.4 Document (3) is concerned with a zirconium alloy tube lined with pure zirconium. In connection with the manufacture of such lined tubes it discloses extrusion at the relatively low temperature of about 600°C (page 12 line 5). However, in the next paragraph on the same page there is reference to an hour long heating at 700°C. The rest of the production process is described in connection with Figure 3, which shows the first annealing step as having been carried out for one hour at 675°C, instead of the 700°C just mentioned, and two further annealing steps carried out for one hour at 620°C. (As indicated in paragraph III above, the Opposition Division interpreted this disclosure as meaning that there was an hour long anneal at each of the temperatures of 700 and 675°C. It is more likely that there was a single annealing step, with some vagueness as to whether one temperature or the other was used in the course of that step.) Although it is arguable that the 620°C of the latter annealing steps need not be markedly different from the "about 600°C" which is the specified upper limit of the Claim in suit, nonetheless the annealing at 675 or 700°C immediately after extrusion is inconsistent with the teaching of the patent in suit, to avoid reheating above 600°C. Similarly, it is insignificant that the final anneal in

accordance with document (3) is carried out for 4 hours at 480°C, and thus falls within the range specified for the final anneal in accordance with the Claim of the patent in suit. Despite these minor points of coincidence in the temperatures used in some steps, the annealing at 675 or 700°C in document (3) points in the opposite direction to the avoidance of temperatures above 600°C after extrusion, which is a distinguishing feature of the Claim of the patent in suit, and there is no indication in document (3) of any need to quench with sufficient severity to achieve the fine particle size of the precipitate which is a further essential feature of the Claim of the patent in suit. Accordingly, document (3) does not support the Appellant's objection of obviousness.

5.5 Document (2) was published in 1959, and relates to what was then the conventional practice of hot working and annealing at temperatures in the range of 810°C to 970°C, i.e. at temperatures well above those now proposed by the patent in suit. Thus it cannot be a pointer in the direction of the lower temperatures which are the subject-matter of the Claim of the patent in suit.

6. *Conclusion*

The Board is therefore satisfied that the invention is not obvious in the light of the prior art cited by the Appellant, and that the subject matter of the Claim satisfies the essential requirement of inventiveness specified in Article 56 EPC. The appeal is therefore dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

S. Fabiani

The Chairman:

H. Seidenschwarz