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Datasheet for the decision of 16 May 2007

Case Number: T 0007/05 - 3.2.02

Application Number: 95902988.5

Publication Number: 0685566

IPC: C22C 38/00

Language of the proceedings: EN

Title of invention:
Rail of high abrasion resistance and high tenacity having pearlite metallographic structure and method of manufacturing the same

Patentee:
NIPPON STEEL CORPORATION

Opponent:
SMS Demag AG
Voest-Alpine Schienen GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56, 83, 100(a), (b)
EPC R. 88

Keyword:
"Novelty, inventive step (yes) after amendment"

Decisions cited:
-

Catchword:
-

Case Number: T 0007/05 - 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 16 May 2007

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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 27 October 2004 concerning maintenance of the European patent No. 0685566 in amended form.

Composition of the Board:

Chairman: T. K. H. Kriner
Members: R. Ries
A. Pignatelli

Summary of Facts and Submissions

I. Two oppositions were filed against European patent No. 0 685 566 as a whole and were based on Article 100(a) EPC, (lack of novelty and inventive step) and on Article 100(b) EPC (insufficiency of disclosure of the invention).

In its interlocutory decision dispatched on 27 October 2004, the opposition division held that the subject matter of the claims according to the second auxiliary request then on file met the requirements of the EPC and maintained the patent in amended form.

II. On 31 December 2004 the patent proprietor (appellant I) lodged an appeal against this decision and the fee for appeal was paid on the same date. The statement setting out the grounds of appeal was received on 21 February 2005.

The opponent 02 (appellant II) also lodged an appeal which was received on 21 December 2004 and the fee for appeal fee was paid on the same date. The statement setting out the grounds of appeal was received on 28 February 2005.

III. At the end of the oral proceedings before the board, the following requests forming the basis of the decision were submitted:

The appellant I (patent proprietor) requested that

- the decision under appeal be set aside and
- the patent be maintained on the basis of claims 1 to 7 of the main request filed with the statement

setting out the grounds of appeal or, in the alternative,

- on the basis of claims 1 to 4 of the auxiliary request filed during the oral proceedings, and pages 2 to 8 of the description as filed during the oral proceedings and Figure 1 as granted.

The appellant II (opponent 02) requested that the decision under appeal be set aside and that the European patent No. 0 685 566 be revoked.

The respondent (opponent 01) informed the Board by its letter received 8 March 2007 that it will not attend the oral proceedings. No further comments on the case have been submitted.

IV. The independent claims 1, 4 and 5 of the main request reads a follows:

"1. A pearlitic steel rail of high wear resistance and toughness having a pearlitic structure consisting, by weight, of 0.60 to 1.20 % carbon, 0.10 to 1.20 % silicon, 0.40 to 1.50 % manganese, and optionally one or more elements selected from the group of 0.05 to 2.00 % chromium, 0.01 to 0.30 % molybdenum, 0.02 to 0.10 % vanadium, 0.002 to 0.01 % niobium and 0.1 to 2.0 % cobalt with the remainder consisting of iron and unavoidable impurities, characterised by the grain diameter of pearlite blocks averaging 20 to 50 μm in a part up to within at least 20 mm from the top surface of the rail head and in a part up to within at least 15 mm from the surface of the rail base and 35 to 100 μm in other parts, and by having an elongation of not less than 10 % and a U notch Charpy impact value (2UE+20°C)

of not less than 15 J/cm^2 in the part where the grain diameter of pearlite blocks averages 20 to 50 μm."

"4. A process for manufacturing a pearlitic steel rail of high wear resistance and toughness comprising the steps of roughing a billet of carbon or low-alloy steel containing, by weight, 0.60 to 1.20 % carbon, 0.10 to 1.20 % silicon, 0.40 to 1.50 % manganese, and optionally one or more elements selected from the group of 0.05 to 2.00 % chromium, 0.01 to 0.30 % molybdenum, 0.02 to 0.10 % vanadium, 0.002 to 0.01 % niobium and 0.1 to 2.0 % cobalt, into a semi-finished breakdown, continuously finish rolling the breakdown while the surface temperature thereof remains between 850° and 1000° C by giving three or more passes, with a reduction rate of 5 to 30 % per pass and a time interval of not longer than 10 seconds between the individual passes, and allowing the finished rail to cool naturally in the air, thereby adjusting the grain size of the pearlite blocks and the mechanical properties of the rail."

"5. A process for manufacturing a pearlitic steel rail of high wear resistance and toughness comprising the steps of roughing a billet of carbon or low-alloy steel containing, by weight, 0.60 to 1.20 % carbon, 0.10 to 1.20 % silicon, 0.40 to 1.50 % manganese, and optionally one or more elements selected from the group of 0.05 to 2.00 % chromium, 0.01 to 0.30 % molybdenum, 0.02 to 0.10 % vanadium, 0.002 to 0.01 % niobium and 0.1 to 2.0 % cobalt, into a semi-finished breakdown, continuously finish rolling the breakdown while the surface temperature thereof remains between 850° and 1000° C by giving three or more passes, with a

reduction rate of 5 to 30 % per pass and a time interval of not longer than 10 seconds between the individual passes, and cooling the finished rail from 700° C or above to between 700° and 500° C at a rate of 2° to 15° C per second, thereby adjusting the grain size of the pearlite blocks and the mechanical properties of the rail."

Independent claims 1 and 2 of the auxiliary request correspond to process claims 4 and 5 of the main request.

V. In the appeal proceedings, only the following documents have played a major role:

E1: Der Kalibreur - Le calibreur No. 9, September 1968, pages 25 to 48

E25: Wada, T., Fukuda K.: Effect of Rolling in Low Temperature Austenite Region on strength, Ductility and Toughness of Rail Steels", Tetsu to Hagané, 1987, pages 86 to 93

E25a: Translation of E25 into German language, 26 pages

Annex A: JIS Z 2202, (1980), Test Pieces for Impact Test for Metallic Materials, page 128, (in Japanese language), submitted by the patentee on 5 February 2004 and

Translation of Annex A into English language of JIS Z 2207, pages 38, 39(Beilage 1) and of JIS Z 2242, pages 53 to 59, submitted by the opponent 02 during the oral proceedings

VI. The appellant II (opponent O2) argued as follows:

The designation "2UE+20°C" of the toughness test specimen referred to in the patent at issue was unclear in its form and meaning. Annex A (and the translation thereof) did not include the term "2UE+20°C" and neither explained the patent specification what the "2UE+20°C" test pieces were supposed to be. The situation was even aggravated by the dimension "J/cm^2" used in the patent for measuring the toughness that was unknown in the art and did not comply with "J" (Joule) conventionally used (see Annex A and JIS 2242). Given this situation, the patent specification did not provide an enabling disclosure to the skilled person as to how the pearlitic steel rail set out in claim 1 and having a "2UE+20°C Charpy impact value of not less than 15 J/cm^2" should be successfully obtained. Objection therefore arose under Article 100(b) and 83 EPC.

Moreover, the application as originally filed was amended by replacing "V notch" by "U notch" Charpy impact values now featuring in the patent at issue. This amendment, however, constituted a violation of Article 123(2) EPC.

Turning to the claims of the auxiliary request, document E25a qualified as the closest prior art which, however, disclosed neither continuous hot rolling nor the time interval between the rolling passes. Continuous hot rolling of steel rails was, however, disclosed in detail in document E1. In so doing, the skilled metallurgist always aimed at restricting the time interval between the single rolling passes to a

minimum in order to minimize recrystallisation and grain growth between the passes. The time interval of not more than 10 seconds thus amounted to nothing more than conventional practice. The subject matter of process claims 1 and 2 thus lacked an inventive step.

VII. The appellant I (patent proprietor) argued as follows:

The expression "2UE+20°C" was generally used in the technical field the patent belonged to. As explained in the patent specification, the Charpy impact value was measured by using U notch Charpy test specimen No. 3 of JIS, page 2, lines 25 and 26 (see also Annex A, page 128). Moreover, it was clearly evident from the international PCT application that nothing else than the U notch Charpy impact test was intended and performed. The patent and the invention to which it related was therefore disclosed sufficiently clear and complete to be carried by a skilled person.

In the closest prior art E25a, hot rolling is performed on a lab scale on a reversing mill where the time interval between the passes generally was 20 to 25 seconds as the patent specification explained on page 4 lines 56, 57. document E25a neither disclosed continuous hot rolling at all nor was the claimed time interval of not more than 10 seconds between the continuous rolling passes mentioned. Contrary to the patent, E25a preferred controlled rolling in a low temperature austenite region in combination with the addition of either Nb, Cr or Si to reduce the size of the pearlite colonies. However, no clear pointer could be found anywhere in this document to limit the time interval between the passes as requested in the process

claimed in the patent while performing high temperature rolling with a finishing temperature in the range of 850 to 1000°C.

E1, on the other hand, disclosed continuous hot rolling and the reduction of the grain size in the rails by universal rolling, but without specifying any process parameters for the hot rolling such as the surface temperature during finishing hot rolling, the reduction rate per pass and the time interval between the individual passes. Hence, the technical teaching of documents E1 and E25a could not lead in an obvious way to the claimed process. Novelty and inventive step of the claims of the main and auxiliary request were therefore given.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 It is consistent case law of the boards of appeal that sufficiency of disclosure within the meaning of Article 83 EPC must be assessed on the application as a whole including the description and the claims, and that substantially any embodiment of a patent, as defined in the broadest claim, must be capable of being realized on the basis of the disclosure.

The opponent's essential objection under Article 83 EPC concerned the "U notch Charpy impact value (2UE+20°C) of not less than 15 J/cm^2" characterizing the pearlitic

steel rail according to claim 1 of the main request. The dimension "(2UE+20°C) J/cm^2 " of the toughness has also been used for the test results given in Table 4 of the patent which comply with the data displayed in Table 4-1 and 4-2 of the international application WO 95/17532 in Japanese language.

2.2 In its "**Description of the Prior Art**", the patent specification refers in paragraph [0004] to toughness tests made on U notch Charpy test specimens No. 3 according to JIS at normal temperatures exhibiting a toughness of approximately 10 to 20 J/cm^2 for rails of eutectoid carbon steels with a pearlite structure.

Contrary the patentee's conception, however, the patent specification itself does not comprise a clear teaching or indication proving that the toughness tests featuring in Table 4 have been actually performed on "U notch Charpy test specimens No. 3 according to JIS", all the more so since the JIS Z 2202 (Annex A and translation) neither mentions the designation "(2UE+20°C)" in general nor for Test Piece No. 3 in particular. It therefore remains unclear which test specimen has been actually used in the patent at issue. The term "2UE+20°C" may imply that the tests have been performed on a 2 mm U-notch impact test piece at ambient temperature, as pointed out by the patent proprietor. However, JIS Z 2242 (Method for impact test for metallic materials) specifies that the absorbed energy E required for breaking the test pieces is generally measured in Joule (J), contrary to the patent at issue, wherein the absorbed energy is determined in J/cm^2 (cf. translation of Annex A, page 55, paragraph 6 (1): Determination of absorbed energy,

percent fracture, transition temperature and lateral expansion; see also Figure 3 on page 59).

Given this confusing situation, the skilled person, putting into practice the claimed pearlitic steel rail, would be left very well short of (i) the precise type of impact test piece he has to choose and (ii) of the method as to how the fracture toughness, which is one of the essential mechanical properties of the steel rail stipulated by claim 1 of the main request, should be correctly determined (J or J/cm^2). As previously shown, the lacking information required to produce the claimed steel rail cannot be obtained from the cross reference Annex A and the Translation thereof.

Under these circumstances and in the absence of any concrete evidence or verifiable facts as to how the toughness should be exactly determined, it is concluded that claim 1 and the patent specification fail to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. Since the requirements of Article 83 and 100(b) EPC, respectively, are not satisfied, the claims according to the main request are therefore not allowable.

3. *Auxiliary request*

3.1 Amendments, Article 123(2), 84 EPC

3.1.1 Claims 1 to 4 of the auxiliary request correspond to claims 4 to 7 as granted (claims 5 to 8 as originally filed) and meet the requirements of Article 123(2) EPC.

The description has been suitably adapted to these claims. In amended Table 4, only samples (Reference No.) 15 and 16 have been correctly identified as "conventional process". This printing error after granting the European patent is immediately evident from Table 4-1 and 4-2 of the international application PCT/JP94/02137 read in combination with the corrected Table the patent proprietor enclosed with its letter of 8 July 1999.

3.1.2 Correction of a translation error

The present European patent was originally filed on 19 December 1994 at the Japanese Patent Office as International Patent Application PCT/JP94/02137 in Japanese language and published under WO 95/17532. Japanese is a prescribed language for an international application filed with the Japanese Patent Office as the receiving office within the meaning of Article 11(1)(ii) and Rule 12.1(a) PCT. Therefore, the documents as originally filed are represented by the original Japanese application documents. Errors in the translation can be corrected during the national phase, before all designated offices. This praxis is confirmed by the PCT Applicant's Guide, see General Part of Volume II - National Phase, 1 January 2004, Chapter VI, page 13, paragraph 57, under "Correction of Translation".

In the present case, the correction of the translation error (from Japanese into English language) of "V notch" into "U notch" requested by the patent proprietor in its letter of 8 July 1999 corresponds to a correct translation of what is indicated in the

original international Japanese application on page 1, last line, page 4, first line, page 6, lines 4, 6 and 10, page 8, last but one line, Table 4—1 and 4—2, claims 1, 2 and 4 and the Abstract in English language given on the front page.

In the board's view, the skilled reader understands from the patent application as a whole and, in particular, from the toughness test results featuring in the Tables that nothing else than U notch Charpy toughness values could have been meant. The conditions of Rule 88 EPC are therefore met. Moreover, the European patent specification as amended according to the auxiliary request does, in the board's assessment, not extend beyond the application as originally filed. For these reasons, the correction into "U notch" does not contravene the requirements of Article 123(2) EPC, contrary to the opponent's position.

3.1.3 In view of these considerations, there are no formal objections under Article 123(2) EPC to the amended documents according to the auxiliary request.

3.2 Enabling disclosure Articles 83, 100(b) EPC

3.2.1 Independent process claims 1 and 2 of the auxiliary request no longer comprise the mechanical property of the "U notch Charpy impact value". Rather more, these claims are concerned exclusively with process features for manufacturing the pearlitic steel rail. In paragraphs [0028] to [0035] and Tables 2 to 4, the patent specification provides sufficient experimental data that helps to put into practice the claimed process including operable composition ranges and

process parameters such as temperature, time, reduction rate etc. as well as comparative data that compares the claimed process with related performance of the prior art. The issue under Article 100(b) and Article 83 EPC therefore no longer arises.

3.3 Novelty

None of the cited documents discloses all the process features set out in independent claims 1 and 2 of the auxiliary request. Specifically, the step of restricting the time interval to not longer than 10 seconds between the individual rolling passes is nowhere disclosed or suggested in any of the cited documents. Novelty has not been disputed at the oral proceedings and hence there is no need to deal with this issue in more detail.

3.4 Inventive step

3.4.1 In the appellant's II (opponent's 02) assessment, the process features in claims 1 and 2 of the auxiliary request are obvious from the technical teaching of document E25A read in combination with the disclosure of document E1, or simply in combination with a skilled person's basic knowledge. The board cannot, however, agree on this position for the following reasons.

3.4.2 At the oral proceedings, it has been common ground to the parties and to the board that document E25 or the translation into German E25a, respectively, qualifies as the closest prior art. E25a is concerned with tests of pearlitic rail steels on a laboratory scale for studying the effect of compositional changes and of the

controlled hot rolling on the microstructure and the mechanical properties of eutectoid steels (cf. E25a, page 1, Abstract). As to the chemical analysis of the steels referred to in E25a, Table 1, sample "Si" and "Si+Nb" satisfy the compositional requirements of the claimed alloy and so do the temperature levels and reduction rates of the "controlled rolling" conditions for samples S1 to S3 set out in E25a, Table 2. E25a further mentions on page 6, point 3.2, second paragraph that recrystallisation of the polygonal austenite (γ) grains takes place after finishing the rolling. It can be further noted from pages 7 and 9 that the grain size of the "pearlite colonies" within the polygonal austenite (γ) grains (i.e. the pearlite blocks) can be reduced by decreasing the finishing rolling temperature and by adding Nb and Cr or Si to the steel alloy. However, E25a fails to disclose explicitly the steps of continuous rolling, controlling the time interval between the rolling passes and air cooling the steel rails.

Starting from the technical disclosure of document E25a, the problem underlying the patent at issue resides in providing a process for producing pearlite steel rails having an improved ductility, toughness, wear resistance and microstructure (cf. also paragraph [0007] of the patent specification).

The solution to this problem essentially consists in restricting the time interval between the continuous rolling passes to not more than 10 seconds thereby controlling the size of the pearlite blocks in the rail head, web and base (preferably to fall within a range of 35 to 50 μm; cf. paragraph [0034] of the patent

specification). The mechanical properties and wear resistance, the claimed process imparts to the steel rails and which are given in Tables 2 to 4, show that the problem has been successfully solved.

3.4.3 Although the correlation between a reduced pearlite block size and increasing mechanical properties of eutectoid steel seems to be generally known in the art, e.g. from E25a, page 17, point 4.3, nothing in this document discloses or suggests the limitation of the time interval between the rolling passes to reduce the pearlite block size. Rather more, E25a favours the addition of niobium or silicon to the steel composition and/or the lowering the finishing rolling temperature to promote "fine pearlite colonies" and to accomplish an improvement of the mechanical properties of the steel rails (cf. E25a, page 9, second paragraph, page 21, final remarks, point 5). Hence, document E25a represents a different approach to influence the size of the pearlite colonies and of the rail's mechanical properties and wear resistance.

Contrary to the opponent's assessment, the technical disclosure of document E1 is neither helpful in this respect. This document relates to hot rolling steel rails on reversing (duo or trio) rolling mills followed by continuous finishing rolling (cf. e.g. E1, page 42, column 1, third paragraph). Moreover, E1 discloses on page 48, column 1, point 1 that the (austenite) grain size of the rails can be decreased by the universal rolling process, but the document remains silent on the specific rolling conditions, i.e. the finishing rolling temperature, the reduction rate achieved by the individual passes and on the time interval to adhere to

between the rolling passes. Hence, the person skilled in the art is not led in an obvious manner by the disclosure of documents E25a and E1, taken either individually or in combination, to the process set out in claims 1 and 2 of the auxiliary request.

3.4.4 This assessment of the prior art has been refuted by the opponent's submission that a skilled person would always restrict the time period between the continuous rolling passes to a minimum in order to prevent recrystallization and grain growth, and that the time interval between the single passes is generally less than 10 seconds.
However, the opponent did not provide any convincing evidence in support of this allegation.

3.5 In view of the considerations made above, novelty and inventive step of the process set out in claims 1 and 2 of the auxiliary request therefore cannot be disputed on the basis of the submissions provided by the opponent.

Claims 3 and 4 relate to preferred embodiments of the process set out in independent claims 1 and 2 and are, therefore, also allowable.

4. In conclusion, the patent according to the auxiliary request satisfies the requirements of the EPC.

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 maintain the patent on the basis of the following documents:

   - Claims 1 to 4 according to the auxiliary request filed during the oral proceedings.

   - Description pages 2 to 8 according to the auxiliary request filed during the oral proceedings;

   - Figure 1 as granted.

The Registrar: The Chairman:

V. Commare T. K. H. Kriner