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Datasheet for the decision of 1 December 2006

Case Number: T 0973/04 - 3.2.02

Application Number: 95936781.4

Publication Number: 0754775

IPC: C22C 38/32

Language of the proceedings: EN

Title of invention:
Perlite rail of high abrasion resistance and method of manufacturing the same

Patentee:
NIPPON STEEL CORPORATION

Opponents:
Corus UK Limited
Voest-Alpine Schienen GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Inventive step (no)"
"Amendments to the claims not admissible"

Decisions cited:
T 0201/83

Catchword:
-

Case Number: T 0973/04 - 3.2.02

D E C I S I O N
of the Technical Board of Appeal 3.2.02
of 1 December 2006

Appellants:	
(Opponent I)	Corus UK Limited 15 Great Marlborough Street London W1F 7AS (GB)
Representative:	Kruit, Jan Corus Technology BV Corus Intellectual Property Department PO Box 10000 NL-1970 CA IJmuiden (NL)
(Opponent II)	Voest-Alpine Schienen GmbH Leoben A-8700 Donawitz (AT)
Representative:	Wildhack, Helmut Patentanwälte Dipl.-Ing. Dr. Helmut Wildhack Dipl.-Ing. Dr. Gerhard Jellinek Landstrasser Hauptstrasse 50 A-1030 Wien (AT)
(Patent Proprietor)	NIPPON STEEL CORPORATION 6-3 Otemachi 2-chome Chiyoda-ku Tokyo 100-71 (JP)
Representative:	Vossius & Partner Siebertstrasse 4 D-81675 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted 18 June 2004 concerning maintenance of the European patent No. 0754775 in amended form.**

Composition of the Board:

Chairman: T. K. H. Kriner
Members: R. Ries
E. Dufrasne

Summary of Facts and Submissions

I. Following two oppositions filed against the grant of European patent no. 0 754 775, the opposition division decided by interlocutory decision posted 18 June 2004 to maintain the patent in an amended version according to the first auxiliary request then on file.

II. Appeals against this decision were lodged on
- 18 August 2004 by opponent OI (appellant I)
- 3 August 2004 by opponent OII (appellant II), and
- 20 August 2004 by the patent proprietor (appellant III).

The prescribed fees for appeal were paid by the appellants on the same day, respectively.

Statements setting out the grounds of appeal were received on
- 18 October 2004 from appellant I and II, and on
- 28 October 2004 from appellant III.

The appellants I and II argued that the patent as maintained by the opposition division did not meet the requirements of Articles 83, 84, 123(2), (3), 54 and 56 EPC. Revocation of the patent as a whole was requested.

Appellant III argued that the considerations of the opposition division with respect to the novelty and inventive step of the claimed subject matter were unjustified since none of the cited prior art documents disclosed a hypereutectoid steel rail having the claimed composition and microstructure or made it obvious for a skilled person to produce such a steel rail.

III. In the appeal stage, the discussion was based essentially on the following documents:

OID1: O. K. Nesterov et al.: "Properties of heat treated rails from continuously cast blooms of hypereutectoid steel", Steel in translation, 22, April 1992, pages 191, 192

OID6: A. J. Perez-Unzueta and J. H. Beynon: "Microstructure and wear resistance of pearlitic rail steels", Wear, 162 - 164, 1993, pages 173 to 182

OIID4: DE-A-2 148 722

OIID17: GB-A-1 457 061

For corroborating metallurgical standard knowledge, the following textbook reference was taken into account by the Board:

OID4: Constitution and Properties of Steel, Weinheim VCH 1992, pages 402 to 418.

IV. As requested by all parties, oral proceedings were held on 1 December 2006 at the end of which the following requests were made:

The appellants I and II (opponents OI and OII) requested that the decision under appeal be set aside and that the European patent 0 754 775 be revoked.

Appellant III (the patent proprietor) requested that the decision under appeal be set aside and the patent be maintained either as granted (main request) or, in the alternative, on the basis of:

- auxiliary requests 1 or 2 both filed with letter dated 28 October 2004;
- auxiliary request 2A filed during the oral proceedings;
- auxiliary requests 2B or 2C both filed with letter dated 31 October 2006;
- auxiliary requests 3, 4, 5, or 6 all filed with letter dated 28 October 2004;
- auxiliary request 7 filed during the oral proceedings.

V. Independent claims 1, 5 and 6 as granted (main request) read as follows:

"1. A steel rail having a pearlite structure with a good wear resistance, comprising, in terms of percent by weight:

C: more than 0.85 to 1.20%,
optionally Si: 0.10 to 1.00%, and
Mn: 0.40 to 1.50, and further

optionally at least one member selected from the group consisting of:

Cr: 0.05 to 0.50%,
Mo: 0.01 to 0.20%,
V: 0.02 to 0.30%,
Nb: 0.002 to 0.05%, Co: 0.10 to 2.00%,
B: 0.0005 to 0.005%, and

the balance consisting of iron and unavoidable impurities, wherein a pearlite lamella space in said pearlite is not more than 100 nm, and a ratio of a cementite thickness to a ferrite thickness in said pearlite structure is at least 0.15."

"5. A method of producing a pearlitic steel rail having a good wear resistance according to any of claims 1 to 4, said method comprising the steps of:

hot rolling a melted and cast steel;

cooling acceleratedly said steel rail retaining rolling heat immediately after hot rolling or a steel rail heated for the purpose of heat-treatment from an austenite temperature at a cooling rate of 1 to 10°C/sec;

stopping said accelerated cooling at the point when said steel rail temperature reaches 700 to 500°C; and

thereafter leaving said steel rail to cool;

wherein the hardness of said steel rail within the range of a depth of 20 mm from the surface of a head portion of said steel rail is at least Hv 320."

"6. A method of producing a pearlitic steel rail having a good wear resistance according to any of claims 1 to 4, said method comprising the steps of:

hot rolling a melted and cast steel;

cooling acceleratedly said steel rail retaining rolling heat immediately after hot rolling or a steel rail heated for the purpose of heat-treatment from an austenite temperature at a cooling rate of more than 10 to 30°C/sec;

stopping said accelerated cooling at the point when pearlite transformation of said steel rail has proceeded at least 70%; and

thereafter leaving said steel rail to cool;
wherein the hardness of said steel rail within the range of a depth of 20 mm from the surface of a head portion of said steel rail is at least Hv 320."

Independent claim 7 differs from claim 5 by the wording:

"7. Method ...
stopping said accelerated cooling at the point when the temperature of a gage corner portion of said steel rail reaches 700 to 500°C; and ...
wherein the hardness of said gage corner portion of said steel rail is at least Hv 360 and the hardness of the head top portion is Hv 250 to 320."

Independent claim 8 differs from claim 6 by the wording:

"Method...
stopping said accelerated cooling at the point when pearlite transformation of a gage corner portion said steel rail has proceeded at least 70%; and
thereafter leaving said steel rail to cool;
wherein the hardness of said gage corner portion of said steel rail is at least Hv 360 and the hardness of the head top portion is Hv 250 to 320."

Claim 1 of the auxiliary requests 1, 2, 2B, 2C, and 3 to 5 comprise the additional feature (highlighted by the Board) according to which
(i) the steel rail has **no martensitic structure at a segregation portion**, and
ii) the steel comprises, in terms of percent by weight, inter alia:

optionally Si: 0.10 to 1.00%, and
optionally Mn: 0.40 to 1.50.

Claim 1 of auxiliary request 6 refers to a method for producing a pearlitic steel rail i.a. comprising the step of cooling wherein the cooling rate is restricted to "1 to **5°C/sec"**.

Claim 1 of auxiliary request 7 refers to a steel rail wherein i.a. the carbon content is restricted to **1.02** to 1.20 wt%.

Method claim 1 of auxiliary request 2A reads as follows:

"1. A method of producing a pearlitic steel rail having a pearlitic structure with a good wear resistance, the method comprising the steps of;
hot rolling a melted and cast steel comprising in terms of percentage by weigh;
C: more than 0.85 to 1.20%,
optionally Si: 0.10 to 1.00%, and
Mn: 0.40 to 1.50%, further
optionally at least one member selected from the group consisting of:
Cr: 0.05 to 0.50%,
Mo: 0.01 to 0.20%,
V: 0.02 to 0.30%,
Nb: 0.002 to 0.05%,
Co: 0.10 to 2.00%,
B: 0.0005 to 0.005%, and
the balance consisting of iron and unavoidable impurities,
cooling acceleratedly said steel rail retaining rolling heat immediately after hot rolling or a steel rail

heated for the purpose of heat-treatment from an austenite temperature at a cooling rate of 1 to 10°C/sec;
stopping said accelerated cooling at the point when said steel rail temperature reaches 700 to 500°C **to cause sufficient recuperation from the inside of the rail**; and
thereafter leaving said steel rail to cool
the method being such that a pearlite lamellar spacing inside said structure is not more than 100nm a ratio of a cementite thickness to a ferrite thickness in said pearlite structure is at least 0.15, **and the structure within the range of a depth of 20 mm from the surface of a rail head portion of said steel rail with said head surface being the start point is said pearlite structure**, and the hardness of said steel rail within a depth of 20 mm from the surface of a head portion of said steel rail is at least Hv 320."

VI. The appellants I and II argued as follows:

Document OIID4 as the closest prior art disclosed a pearlitic hypereutectoid steel rail (0.95%C) which was cooled between 10 and 20°C/s down to a temperature of at most 550°C/s in order to avoid free cementite. Figure 6 of this document further included cooling rates of less than 10°C/s (left hand curve C' which corresponded to about 3.5°C/s) for which a 98% pearlite - 2% cementite structure was obtained. Such amounts of pro-eutectic cementite were likewise tolerated in the patent (see paragraph [0051]). Hence, no patentable distinction could be seen in the patent. Given that the starting material and process in OIID4 were the same as claimed in the patent, it should be revoked for the lack of novelty.

If novelty were nonetheless accepted, the patent lacked an inventive step since a clear pointer existed in OIID4 leading the skilled metallurgist to use cooling rates of 10°C/s or lower to produce pearlitic rails having minor amounts of cementite. Lower cooling rates in the range of 1.5 to 5.2°C were conventionally known also from OIID17 (cf. page 2, left hand column, lines 9 to 52) which resulted in a lamellar spacing of 90 to 110 nm for a steel rail having 0.69 to 0.82% C. Nothing else was done in the opposed patent.

As to the product claims, the ratio R_c was physically determined by the amount of carbon in the steel melt when the crystallisation of ferrite and cementite plates took place upon solidification. Thus, R_c did not represent an independent technical feature. Moreover, a low interlamellar spacing λ was always aimed at, as is shown in document OID6 or also in OIID17, page 1, line 85 to page 2, line 3. These parameters therefore did not represent distinguishing or inventive technical features.

The amendments to the claims of the auxiliary requests (optionally Mn; no martensite in the segregation portion; new limits for ranges) had no basis in the patent specification and therefore failed to satisfy the requirements of Article 123(2) EPC. In particular, it was inadmissible to create new upper or lower limits for a range on the basis of individual values of an example.

VII. The appellant III argued as follows:

The real disclosure of document OIID4 resided in the production of pearlitic eutectoid steel rails having a carbon content of 0.816% as set out in the examples 1 and 2. They fell within the typical range of 0.71 to 0.82% C for conventional eutectoid steel rails. Steel composition B referred to in this document on page 12 was therefore to be regarded as exceptional. A prejudice existed in the art with respect to increasing the carbon content to the hypereutectic range of >0.85 to 1.20%C since the ductility and toughness of such steel rails was adversely affected by the formation of a cementite network, as set out in document OID1, page 191, column 1, second and third paragraph. Hence, steel rails with more than 0.82% C were not recommended. Although OID1 specifically addressed the production of hypereutectoid steel rails comprising 0.92 and 0.95%C, these rails exhibited a globular pearlite structure after a first heat treatment which was then transformed into sorbite and troostite. This microstructure and the process for obtaining it was fundamentally different to the pearlitic steel rail claimed in the patent.

Moreover, the method disclosed in document OIID4 differed from that claimed in that the forced cooling was continued after the completion of the austenite-pearlite transformation down to 300°C (sample 1) or 400°C (sample 2). This continuous cooling promoted the formation of martensite or bainite structures within the pearlite structure, in particular in the micro-segregation portion of the rail. By contrast, the claimed method comprised a cooling stop within the "pearlite nose" at a temperature between 700 and 500°C to allow sufficient recuperation of the rail by its remaining interior heat (cf. Figure 2 of the patent). In doing so, the formation of deleterious martensite in the micro-segregation portion was successfully avoided.

Nor did document OIID4 disclose the interlamellar spacing λ and the ratio R_c. As already shown, the metallurgical behaviour of a hypoeutectoid steel was quite different from that of a hypereutectoid steel due to the formation the cementite network.
As to λ, one could not extrapolate simply the disclosure of other prior art, such as that given in document OID6 which dealt with eutectoid rather than hypereutectoid steel rails, to show that the hypereutectoid steel rail of OIID4 exhibited the claimed interlamellar spacing λ and the cementite/ferrite thickness ratio R_C.

As to the amendments to claim 1 of the auxiliary requests 1 to 6, 2B and 2C, manganese as an "optional" component was derived from paragraphs [0031] to [0033] and the absence a martensite at a segregation zone was based on the disclosure of paragraph [0061] of the patent specification.
The limitation of the cooling rate to 1 to 5°C/s (auxiliary request 6) and of the carbon range to "more than 1.02 to 1.20" (auxiliary request 7) were based on examples 21 to 23 and 41, respectively. The values of the cooling rate and of the carbon content were not so closely linked with the other features of these examples so that these amendments are permitted within the considerations given in decision T 201/83.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 The claimed subject matter

Claim 1 of the patent at issue relates to hypereutectoid steel rails comprising more than 0.85 to 1.20% carbon and a fully pearlite structure with a lamellar space λ of not more than 100 nm and a ratio R_c ($R_c = t_2/t_1$; t_2 = thickness of the cementite plates; t_1 = thickness of the ferrite plates) of at least 0.15. This particular microstructure is obtained by the process steps set out in either claims 5 to 8.

2.2 Novelty

Novelty has been amply discussed in the impugned decision and in the appeal proceeding. The opponents argued i.a. that the claimed steel rail and the process for producing it were, in particular, anticipated either by the disclosure of OID1 or OIID4.
Document OID1 relates to hardened steel rails of hypereutectoid steel with carbon contents of 0.92 and 0.95% (cf. OID1, page 191, right hand column, Table). As to improving ductility and toughness, the lamellar pearlite structure of the rail is - in a preliminary treatment - spheroidised into globular pearlite. In a further heat treatment, the rails are induction hardened, i.e. at least the rail head is austenized and subsequently cooled at a particular cooling speed to produce a considerable amount of fine pearlite changing

from troostite to sorbite (both phases are obsolete technical terms for fine-lamellar and ultra-fine pearlite, respectively); (cf. OID1, page 191, column 1, paragraphs 5 and 6; right hand column, last paragraph to page 192, first column, paragraph 1 and column 2, third full paragraph.) However, OID1 discloses neither the interlamellar spacing λ of not more than 100 nm and the ratio R_c nor the precise cooling speed and stop temperature set out in the process claimed in the patent.

Likewise, document OIID4 is concerned with the production of steel rails comprising 0.75 to 1.00% carbon. After hot rolling, the rails are cooled from a temperature higher than 750°C (i.e. >A_{c3}) at a cooling rate between 20 to 30°C/s down to a temperature of at most 550°C to transform the austenite structure into a fine pearlite structure (cf. OIID4, claim 1). Apart from conventional eutectoid steel rails (0.816%C; samples 1 and 2), this document also refers to a hypereutectoid steel rail (sample B: 0.95%C) having a very fine pearlite structure without the formation of free cementite. Sample B however fails to disclose the precise process steps (stop temperature for the accelerated cooling or stop when a specific degree of pearlite was formed) and remains silent about the interlamellar spacing λ and the ratio R_c of the pearlite structure.

Document OIID17 is essentially concerned with the production of hypoeutectoid steel rails with carbon in the range of 0.64 to 0.82% which is below the claimed carbon range of >0.85 to 1.20%.

The remaining documents are more remote in that they refer to the metallurgical background knowledge. None of them discloses all the technical features of the claimed hypereutectoid steel rails and the method for producing them.

The subject matter set out in claims 1 to 8 as granted (main request) is, therefore, novel.

2.3 Inventive step

It was common ground to all parties at the oral proceedings that document OIID4 qualifies as the closest prior art. As to the issue of inventive step, the Board cannot, however, agree with the patent proprietor's line of arguments brought forward in particular with respect to this document for the following reasons.

Like the opposed patent, OIID4 addresses the problem of increasing the hardness of the pearlite structure of a steel rail to obtain a higher wear resistance (cf. OIID4, page 2, second paragraph; page 3, last line to page 4, line 3; page 4, 3. full paragraph). Specifically, OIID4 relates to the production of wear resistant high carbon (0.075 to 1.00%C) steel rails obtained by accelerated cooling with forced air-water sprays from A_{c3} down to at most 550°C to promote a homogeneous fine pearlite structure in all parts of the rail and a hardness Hv in the range of 340 to 400 (cf. page 4). An overlap exists between the carbon content and hardness properties of the known steel rail with those claimed in the patent.

The patent proprietor's argument that the basic teaching of OIID4 resides in disclosing two eutectoid steel rails (0.816%C) which are quenched with different cooling rates and stop temperatures cannot be followed. The technical information in document OIID4 goes beyond this, teaching the skilled reader that even with carbon contents as high as 0.95%C (sample B) a homogeneous and fully pearlitic microstructure in a rail can be successfully achieved by adhering to a specific cooling regimen. Based on the Jominy test, a CCT (continuous cooling transformation) diagram (Figure 6) has been developed for steel composition B which is given in the Table on page 9. OIID4 further discloses on page 12 a (hot) rolled steel rail R which was produced from heat B and exhibited after quenching with a cooling rate between lines C_1 and C_2 (10-20°C/s; see OIID4, Figure 6) a fully fine pearlitic structure free from cementite and having a Vickers hardness Hv of 380 to 410, contrary to what could have been expected from the statements taught in document OID1.

The patent proprietor correctly pointed out that OIID4 does not disclose explicitly the ratio R_c and the interlamellar spacing λ.

Following the position of appellant II, the ratio R_c is physico-chemically determined by the carbon content of the steel melt when it crystallises to form alpha iron (ferrite) and Fe_3C (cementite). Contrary to the interlamellar spacing λ, the ratio R_c remains essentially unaffected by other parameters such as the cooling rate. This finding, not convincingly refuted by the patent proprietor at the oral proceedings, is corroborated by paragraph [0030] and by the examples 1 to 16 given in Tables 1 and 2 of the patent at issue, which reveal a strong linear correlation between the carbon content C and the ratio R_c. It is, therefore, justified to conclude that R_c is not an independent technical feature which actually effects a patentable distinction between the claimed steel rails and OIID4, since it can be assumed that the claimed ratio is likewise fulfilled in hypereutectic rail R made from the hypereutectic steel alloy B.

Turning to the lamellar spacing λ, document OID6 teaches that a very fine interlamellar spacing is indispensable for producing harder, more wear resistant pearlitic steel rails (cf. e.g. OID6, Abstract, first paragraph; 1. Introduction, first paragraph; 6. Conclusions, first sentence). This correlation of an improved hardness with a finer interlamellar spacing, well known to the metallurgical expert and reflected in many other documents, is evident for instance from OID6, Table 2. It shows that a hardness of about Hv 370 or more is obtained in a pearlitic steel rail if the mean true interlamellar spacing is less than 100 nm. The patent proprietor correctly argues that these results are obtained with four pearlitic steels with 0.76, 0.77, 0.79 and 0.81%C. It appears, however, from OID6, Figure 7 that the relationship $Hv/(\lambda^{-1/2})$ remains essentially unaffected by the carbon content of the steel. Despite the fact that the correlation between Hv and λ has been obtained with pearlitic hypoeutectoid or eutectoid steel rails, this finding can therefore be transferred also to hypereutectoid steel rails with carbon contents in the range of 0.85 to 1.20%. In so doing, rail B (0.95%C) in OIID4 having a hardness Hv between 380 and 410 is expected to exhibit an interlamellar spacing of about 100 nm or less, all the more so since the quenching rate of 10 to 20°C/s fully complies with the one used in the patent.

Apart from these specific considerations, the general teaching of OID6 is that a small interlamellar spacing λ achieves a better hardness and, in consequence thereof, an improved rail wear resistance. The same basic metallurgical teaching is given e.g. in the textbook reference OID4, page 418, third full paragraph or in document OIID17, page 1, line 85 to page 2, line 4: a fine interlamellar spacing of 90 to 110 nm of a fully pearlitic microstructure is obtained by the accelerated cooling of a steel rail having 0.64 to 0.82%C at a rate of 1.5 to 5.2°C/s and stopping the cooling between 538 and 371°C (cf. OIID17, page 2, left hand column, lines 9 to 52). It, therefore, does not involve an inventive step in view of the technical teaching of document OID6 or, in the alternative, of OID4 or OIID17 to adapt the process parameters for quenching so that the interlamellar spacing λ is reduced to a value as low as possible if the wear resistance of the rails is to be significantly improved.

With particular reference to document OID1, page 191, first column, paragraphs 2 and 3, the patent proprietor argues that the railway companies dissuade from producing hypereutectoid steel rails having more than 0.82% C due to the cementite network in the steel matrix and the embrittlement associated therewith.

The patent itself notes in paragraph [0051] that the claimed pearlitic steel rail may comprise in the pearlite matrix (traces or even considerable amounts of) pro-eutectic cementite which do not adversely affect strength and toughness of the rail. More importantly however is the technical teaching of document OIID4 that the formation of cementite can be minimised or even avoided in hypereutectic steel rails provided the cooling speed is controlled within specific limits.

The subject matter of claim 1 as granted, therefore, lacks an inventive step with respect to the combined technical teaching given in document OIID4 and OID6 or OIID17.

3. *Auxiliary requests 1, 2, 2B, 2C and 3 to 7*

3.1 Claim 1 of the auxiliary requests 1, 2, 2B, 2C, and 3 to 5 the terms

(i) "**and no martensite structure at a segregation portion"** as well as

(ii) **"optionally** Mn: 0.40 to 1.50%".

For support of the terms (i) and (ii), the patent proprietor referred to the patent specification (unamended in view of the application as filed) page 7, lines 23 to 28 to paragraphs [0031], [0032] and [0033], respectively.

As to amendment (i), the cited passage on page 7 of the specification discloses that sufficient recuperation from inside the rail cannot be expected after accelerated cooling down to a temperature of less than 500°C, and the martensite structure detrimental to the toughness and the wear resistance of the rail is formed at the segregation portion. It does, however, not disclose that no martensite structure at all is formed in the segregation portion when stopping the accelerated cooling at a temperature of 500°C or above. In the Board's view, however, the extraction of the reverse from what is stated in the cited passage of the patent is not allowed.

Turning to amendment (ii) it cannot be unambiguously derived from claim 1 as granted or from paragraphs [0031] to [0033] or from any other part of the original application whether or not Mn actually represents an optional component. The only option originally disclosed was Si and Mn (see original claim 3 and page 4, lines 9 to 17) and not Mn without Si which would be now covered. The introduction of the term "optionally" Mn thus cannot be allowed.

3.2 The upper limit for the cooling rate of 5°C/s featuring in claim 1 of auxiliary request 6 is derived from samples 21 to 23, which are all micro-alloyed with vanadium. Nothing is found anywhere in the original application to show that a cooling rate of 1 to 5°C/s is a preferred range.

Likewise, the lower limit of 1.02% of the carbon range featuring in claim 1 of auxiliary request 7 is derived from example 41.

It is, however, noted that examples 21 to 23 and 41 exhibit a specific steel composition and cooling rate which upon interaction bring about the final microstructure and mechanical properties of the steel rail. Contrary to the patent proprietor's position, the metallurgists know that C, Si, Mn and the microstructure as a consequence of the cooling rate contribute to the strength and toughness of the steel rail (cf. for instance paragraphs [0030] to [0034]). Moreover, the eutectoid composition itself (0.77%C for Fe-C alloys) varies when further alloying elements such as Mn, Si, Cr, etc are added. For corroboration only, reference is made to OID4, page 405/406, point 9,2,2 and page 417, first column, second paragraph. Hence, the individual amounts of elements and cooling rates making up an example cannot be regarded in strict isolation and, therefore, cannot not be used for the definition of a range. This may be done only in very exceptional cases. Reference is made in this context to decision T 201/83 (lead alloy) where the Board first established that, for a given Pb-alloy, only a loose or no connection existed between the components Ca and Mg with regard to their effect and that the actual amount of Ca was not tied to a specific magnesium content. From the detailed considerations given in T 201/83 the conclusion must be drawn that because of the effects of interaction of the constituents making up the claimed steel rails and their properties, it is not possible to make an arbitrary selection of individual features from the single examples for the definition of a (new) range. To disregard the specific context would result in a new selection from the original range which was neither explicitly nor implicitly disclosed. This means that in accordance with the above decision any arbitrary combination of values, isolated from the original text, is not allowed.

3.3 The amendments to claim 1 of the auxiliary requests 1, 2, 2B, 2C and 3 to 7, therefore, contravene the requirements of Article 123(2) EPC.

4. *Auxiliary request 2A:*

4.1 The process set out in claim 1 of auxiliary request 2A comprises an accelerated cooling at a rate of 1 to 10°C/s which is stopped when the rails reaches a temperature between 700 and 500°.

In the patent proprietor's view, the claimed method was different to that described in OIID4 in that a cooling rate between 10 and 20°C/s has to be adhered to for obtaining a pearlite structure and given that in the examples set out in OIID4 the accelerated cooling was stopped at a temperature far below the range of 700 to 500°C according the claims of the patent.

4.2 Although document OIID4 recommends a cooling rate between 10 and 20°C/s to promote a homogeneous pearlite structure in the rails, the lower limit of 10°C/s complies with that specified in claim 1. However, figure 6 of document OIID4 further shows that also for cooling rates somewhat lower than 10°C/s a fully pearlitic structure or at least a structure comprising 98% pearlite/2% Fe_3C can be successfully obtained for steel B (0.95% C). As noted in the patent, a certain amount of pro-eutectic Fe_3C can be tolerated in the pearlitic steel rails produced according to the claimed method (cf. [0051]). The technical findings in document OIID4 are therefore consistent with those given in the patent.

Document OIID4 further notes on page 12, penultimate paragraph that the austenite → pearlite transformation for steel B is finished at 550°C. This means to the metallurgical expert that there is no need to continue the accelerated cooling below this temperature or even down to ambient temperature given that no further phase transformation will occur.

4.3 The patent proprietor further argues that reducing or even interrupting the accelerated cooling of the steel rail during the austenite → pearlite transformation, i.e. within the so called "pearlite nose" was not disclosed in document OIID4.

However, the interrupted cooling represents a conventional practice well known to the metallurgist if the complete transformation of the austenite structure into pearlite is to be guaranteed. For corroboration purposes only, reference is in this context to the textbook OID4, page 418, 9.4.1.4. third paragraph and Figure 9.11.a. There an increased cooling rate is applied to conventional rails to cause refinement of the lamellar spacing. In this example, only the rail head is heated to about 900°C, rapidly cooled to a temperature of about 550 to 650°C using forced air cooling and held in this temperature range until the austenite is fully transformed to austenite.

4.4 The process features set out in claim 1 of the auxiliary request 2A therefore amount to nothing more than what is done in document OIID4 in combination with conventional practice that is applied by a person skilled in the art. Claim 1 of auxiliary request 2A therefore lacks an inventive step as required by Article 52(1) EPC in conjunction with Article 56 EPC.

5. Given that none of the requests relates to claims satisfying the requirements of the EPC, in particular

those of Articles 56 and 123(2) EPC, the patent is revoked.

Order

For these reasons it is decided that:

The patent is revoked.

The Registrar: The Chairman:

V. Commare T. K. H. Kriner