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DECISION
of 20 August 2003

Case Number: T 0518/01 - 3.2.2

Application Number: 95307276.6

Publication Number: 0709469

IPC: C21C 7/10

Language of the proceedings: EN

Title of invention:

Method of producing molten aluminium-killed steel for thin steel sheet

Patentee:

Kawasaki Steel Corporation

Opponents:

Thyssen Krupp Stahl AG
Mannesmann Aktiengesellschaft

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Novelty - (yes)"

"Inventive step - (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0518/01 - 3.2.2

DECISION
of the Technical Board of Appeal 3.2.2
of 20 August 2003

Appellant: Thyssen Krupp Stahl AG
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 16 March 2001
rejecting the opposition filed against European
patent No. 0709469 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: R. Ries
E. J. Dufrasne

Summary of Facts and Submissions

I. European patent No. 0 709 469 was granted on 20 January 1999 on the basis of European patent application No. 95307276.6.

II. The granted patent was opposed by the present appellant (opponent OI) and by opponent OII on the grounds that its subject matter lacked novelty and did not involve an inventive step with respect to the state of the art (Articles 100(a), 54 and 56 EPC).

Of the pre-published documents relied upon in the opposition proceedings, only the following have played any significant role on appeal:

D1: EP-A-0 512 118

D4: Proceedings of the "First Int. Calcium Treatment Symposium", Glasgow, Scotland, 30 June 1988, The Institute of Metals, 1988, pages 103 to 108.

III. With its decision posted on 16 March 2001, the opposition division held that the patent could be maintained as granted and rejected the oppositions.

IV. An appeal against this decision was filed by opponent OI (the appellant) on 4 May 2001 and the fee for the appeal was paid on the same day. In the statement of grounds of appeal the following new document was referred to:

D13: "HSLA Steels: Metallurgy and Applications",
Proceedings of an International Conference on HSLA
Steels, '85, 4 to 8 November 1985, Beijing, China,
ASM-International, 1986, pages 397 to 406.

V. Oral proceedings before the Board were held on
20 August 2003. In a letter dated 18 March 2003
opponent OII, being a party to the proceedings in the
meaning of Article 107 EPC second sentence, informed
the Board that it would not attend the oral proceedings.

The appellant (opponent OI) requested that the decision
under appeal be set aside and the patent be revoked in
its entirety.

The party as of right (opponent OII) did not file any
substantial submissions or requests.

The respondent (patentee) requested that the appeal be
dismissed and that the patent be maintained according
to the main request or in amended form according to
claims 1 to 4 of the auxiliary request submitted with
letter of 2 July 2003.

VI. Claim 1 as granted reads as follows:

"1. A method of producing a molten steel capable of
forming a steel sheet, comprising the steps of:
producing molten steel in a converter;
tapping the molten steel from the converter to a vacuum
degasser;
decarburising the molten steel to a predetermined
carbon concentration in the vacuum degasser to produce
a decarburized molten steel;

adding Al to the decarburized molten steel in the vacuum degasser to produce a deoxidised molten steel; characterized in that the steel is an aluminium-killed steel, in that material containing metallic Ca is added to the deoxidised molten steel so that the Ca-content is from 0.0005 to 0.005 wt% and $[\%Ca] \times [\%S] \leq 2 \times 10^{-5}$ in the deoxidised molten steel, and in that thereafter a degassing treatment is performed on the deoxidised molten steel to produce molten aluminium-killed steel."

VII. The appellant argued as follows:

The novelty of the claimed subject matter is not disputed. Moreover, document D4 is no longer considered as being relevant since it relates to a resulphurized steel, i.e. to a different kind of steel. However, the claimed process does not involve an inventive step vis-à-vis the technical teaching given in documents D1 and D13.

Like the disputed patent, document D1 aims at providing a process which allows the stable continuous casting of an ultra low carbon (ULC) aluminium killed steel without nozzle clogging during casting the liquid steel and without swelling or rusting of the cold rolled sheet. These objects are achieved by a ULC steel composition which comprises a final amount of calcium in the range of 6 to 20 ppm calcium and less than 0.01% sulphur so that the condition $[Ca] \times [S] \leq 2.0 \times 10^{-5}$ is met. Apart from adding Ca or Ca-alloy to the steel in the ladle or tundish, document D1 does not disclose any specific details regarding how the final calcium in the molten steel is obtained. For further technical

information, a person skilled in the art would, therefore, turn to document D13. This document relates to the production of high-strength low-alloy (HSLA) steel and discloses a secondary metallurgical treatment of this steel which comprises the combination of a vacuum treatment of the melt and an injection treatment with calcium or calcium alloys for modifying the non-metallic inclusions and controlling the sulphide shape in the liquid steel. In particular Figure 19 of document D13 discloses a method which comprises (after deoxidizing the melt) the injection of calcium into the liquid steel and thereafter a degassing (vacuum) treatment to decrease the calcium in the melt to a final level of about 15 ppm which complies with the range stipulated in document D1 (6 to 20 ppm). The steps of (i) adding calcium to the liquid steel to promote the modification of the non-metallic inclusions and (ii) thereafter removing surplus calcium from the melt by a vacuum treatment to the level known from document D1, therefore, represent obvious secondary metallurgical operations which are generally used by the skilled metallurgist when the need therefor arises. Consequently, the process steps set out in claim 1 of the disputed patent do not involve an inventive step.

VIII. The respondent (patentee) argued as follows:

Document D1 which represents the closest prior art discloses a process for casting a ULC aluminium-killed steel to which controlled amounts of calcium have been added in the range of 6 to 20 ppm to prevent nozzle clogging during the continuous casting and to suppress rusting of the cold rolled steel. However, there is no specific disclosure in document D1 of any vacuum

treatment at all and, consequently, the teaching of this document does not lead a skilled person to continue such a vacuum treatment in order to remove excess calcium, as does the patent at issue. It may be assumed that also in the process given in D1 a vacuum treatment would have been carried out when decarburizing and deoxidising the steels to achieve the desired ultra-low carbon contents and the low oxygen contents. However, document D1 merely mentions that the Ca may be added either in the ladle or in the tundish.

As regards document D13, the problem underlying the disputed patent, i.e. the provision of a process which prevents clogging of the immersion nozzle and rusting of the cold rolled steel sheet, is not at all addressed in this document. Hence, there is no inducement whatsoever for a skilled person to turn to this document, are even less motivation to combine the technical teaching of document D13 with that given in document D1, as argued by the appellant. Document D13 teaches adding limited amounts of calcium in the range of 30 to 60 ppm to the liquid steel in order to achieve an effective modification of the inclusions and to control the shape of the sulphides. Despite the fact that document D13 envisages (on page 401) the combination of injecting calcium with a subsequent vacuum treatment, it nevertheless strongly recommends applying the Ca-treatment after the vacuum treatment and adhering to a specific Ca-content to guarantee adequate modification of the non-metallic inclusions. Thus, document D13 teaches away from the process claimed in the disputed patent. The subject matter of claim 1 is, therefore, novel and involves an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. *Novelty*

At the oral proceedings, the novelty of the claimed subject matter was no longer challenged by the appellant-opponent. Likewise, the Board is satisfied that none of the documents under consideration actually discloses all the technical features of the process set out in claim 1 of the patent at issue. Hence, there is no need to deal with the issue of novelty any further.

3. *Inventive step*

- 3.1 It was common ground to all parties that document D1 represents the closest prior art. Like the patent at issue, document D1 discloses a process for continuously casting a ULC (ultra low carbon content in the range of 15 to 30 ppm) aluminium killed steel. This process aims at reliably preventing (i) the clogging of the immersion nozzle during casting and (ii) the cold rolled steel from swelling and rusting (cf. D1, page 3, lines 46 to 50). The problem underlying the process given in document D1 and the claimed process is, therefore, the same. To solve this problem, document D1 proposes, in combination with further process parameters, the addition of calcium in the form of metallic Ca or Ca-Si alloy to the ULC aluminium killed steel so that the final steel composition comprises 6 to 20 ppm of Ca and less than 100 ppm of S, and to carry out the continuous casting without blowing argon

gas into the immersion nozzle (cf. D1, page 1, line 47 to page 2, line 1; claims 1 and 2). It follows from the numerical specifications given in document D1 that the product of $[20 \cdot 10^{-4} \% \text{ Ca}] \times [100 \cdot 10^{-4} \% \text{ S}]$ is at most $2.0 \cdot 10^{-5}$ at the time of casting (cf. D1, page 6, lines 50 to 54; Figure 8). However, document D1 only mentions on page 7, lines 6 to 8 that the addition of Ca may be carried out while the molten steel is in the ladle or in the tundish.

3.2 The process set out in claim 1 of the disputed patent differs from that given in document D1 in that

- (a) during the calcium adding period the Ca-content in the liquid steel is to be maintained from 0.0005 to 0.005% and
- (b) after the Ca-treatment, a degassing treatment is performed.

This interpretation of the claimed sequence of process steps is supported by the patent specification on page 4, lines 26 to 30, 43, 44, page 7, lines 7 to 10 and by the examples. By performing the (second part of the) vacuum treatment on the deoxidised molten steel after the addition of calcium for Al_2O_3 form control, the surplus of dissolved calcium is removed by evaporation so that the Ca-content in the steel decreases gradually and the formation of CaS is limited or avoided (cf. the patent specification page 4, lines 19 to 23).

3.3 The appellant-opponent has produced arguments based on document D13, page 401, left hand column which deals with the combination of a vacuum and a calcium treatment of HSLA steels. Two different process combinations, (a) vacuum treatment followed by the injection of calcium and (b) calcium injection followed by a vacuum treatment, are considered, and the contents of [Ca] and [S] in the melt obtained during and after processes (a) and (b) are given in Figures 19 and 20 of D13. In the opponent's view, at least the process depicted in Figure 19 renders the claimed process obvious.

According to document D13, page 401, left hand column, second complete paragraph, a calcium amount of 30 to 60 ppm is required when teeming the liquid steels to adequately modify the non-metallic inclusions (see also Figure 14 of D13). Document D13 goes on to say in the same sentence of this paragraph that the calcium treatment shall be applied after the vacuum treatment to achieve adequate inclusion modification rather than before the vacuum treatment as claimed in the disputed patent (cf. also Figure 20 of D13). In this respect, document D13 leads away from the sequence of process steps stipulated in claim 1 of the patent at issue. Moreover, document D13 does not address the problem of rusting or swelling of the cold rolled steel sheet.

Turning to Figure 19 of document D13, a degassing treatment of the melt is actually performed after the injection of 1.3 kg Ca/t. However, the calcium level rises up to 100 ppm during the injection of calcium, which means that the Ca-content during this period is twice as high as allowed by the claimed process (5 to

50 ppm Ca). It is further apparent from Figure 18 of D13 that even smaller injection rates of calcium, raise the calcium levels in the melt up to 80 ppm or higher. Moreover, the accompanying comment on Figures 19 and 20 given in document D13 on page 401, column 1, the last three lines and column 2, line 2 and comparing both processes draws the reader's attention to the difference in the final calcium content of the heats obtained in either process (Figure 19 about 15 ppm when casting the melt compared to about 42 ppm in the process depicted in Figure 20). This comment, however, has to be read in the light of the technical teaching summarized under the heading "Combination of Vacuum and Injection Treatment" given on the same page, column 1, last sentence of the second complete paragraph, according to which a calcium content in the heats between 30 to 60 ppm is considered as being indispensable to achieve the desired adequate inclusion modification. To the skilled reader's perception, this means that document D13 actually dissuades the reader from performing a vacuum degassing after the calcium injection treatment, i.e. from performing the process claimed in the disputed patent. Given this situation, it could not have been obvious to carry out the process defined in claim 1 of the patent at issue by combining the technical teaching given in documents D1 and D13, as alleged by the appellant.

4. The claims as granted according to the main request being allowable, there is no need to deal with claims according to the auxiliary request.

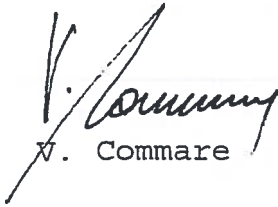
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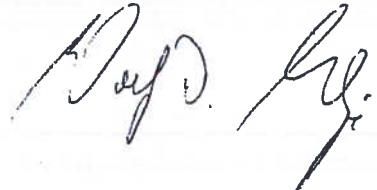
For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:


V. Commare


W. D. Weiß

