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D E C I S I O N
of 25 May 2000

Case Number: T 0373/96 - 3.2.2

Application Number: 89113096.5

Publication Number: 0351762

IPC: C21C 7/06

Language of the proceedings: EN

Title of invention:

Process for producing high cleanness extra low carbon steel

Patentee:

KAWASAKI STEEL CORPORATION

Opponent:

Corus Staal B.V.
Nippon Steel Corporation

Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 56

Keyword:

"Inadmissible amendments (main request and first and third auxiliary requests)"

"Inventive step (second auxiliary request - no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0373/96 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 25 May 2000

Appellant: KAWASAKI STEEL CORPORATION
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 26 February 1996
revoking European patent No. 0 351 762 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: W. D. Weiß

Members: S. S. Chowdhury
J. C. M. De Preter

Summary of Facts and Submissions

I. The Appellant (patent proprietor) lodged an appeal against the decision of the Opposition Division to revoke the patent No. 0 351 762 on 25 April 1996 and paid the appeal fee on the same day. The decision was dispatched on 26 February 1996.

The statement setting out the grounds of appeal was received on 8 July 1996.

The Opposition Division had decided that amended claims submitted during the opposition procedure did not meet the inventive step requirement of Article 52(1) EPC.

The following prior art documents among those regarded as relevant by the Opposition Division have been taken into account as relevant documents during the appeal proceedings:

D1: Kuwabara, T. et al, 70th Steelmaking Conference Proceedings, AIME, March 29-April 1, 1987, 381-387

D3: JP-A-60152 611 and English translation of same

D4: JP-A-59 70 710 and English translation of same

D8: Van Es, M.A.H., et al, Fachberichte Hüttenpraxis Metallverarbeitung, 24(1986)10, 958-964

II. Oral proceedings before the Board took place on 25 May 2000.

At the end of the oral proceedings the Appellant (Kawasaki Steel Corporation) requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of claims of a main request or any one of the three auxiliary requests filed on 25 April 2000.

The Respondents (Corus Staal BV (Respondent I) and Nippon Steel Corporation (Respondent II)) requested that the appeal be dismissed.

Respondent I additionally requested that should the Board consider the broader claims now on file, then the case be remitted to the first instance, and costs incurred during any further oral proceedings or taking of evidence should be fully borne by the Appellant.

III. Claim 1 of the main and auxiliary requests read as follows:

Main request

"A process for producing high cleanness ultra low carbon (ULC) steel suitable for continuous casting without blocking of a continuous casting nozzle, the process comprising the steps of:

preparing low carbon, non-deoxidized molten steel in a refining furnace; tapping the molten steel into a ladle; performing vacuum degassing processing by means of a vacuum degassing apparatus for decarburization of the ladle molten steel; and blowing oxygen during the decarburization, characterized in that

the ladle slag is deoxidized by adding deoxidizing agent prior to the decarburization to a T.Fe level below or equal to 5%, thereby to suppress oxygen supply from the ladle slag to cause shortage of oxygen during the decarburization, and in that the oxygen blowing is required during the decarburization to ensure decarburization to a carbon (C) level below or equal to 0.006%."

First auxiliary request

"A process for producing high cleanness extra low carbon steel comprising the steps of: preparing low carbon, non-deoxidized molten steel in a refining furnace adding deoxidizing agent to the slag of the molten steel tapped from said furnace to a ladle for adjusting T.Fe in the slag at less than or equal to 5% performing vacuum degassing process by means of a vacuum degassing apparatus with blowing oxygen to the molten steel bath for decarbonizing to lower carbon contain less than or equal to 0.006%."

Second auxiliary request

"A process for producing high cleanness extra low carbon steel comprising the steps of: preparing low carbon, non-deoxidized molten steel in a refining furnace adding deoxidizing agent to the molten steel tapped from said furnace to a ladle for adjusting T.Fe in the slag at less than or equal to 5% performing vacuum degassing process by means of a vacuum degassing apparatus with blowing oxygen to the molten steel bath for decarbonizing to lower carbon contain less than or equal to 0.006%."

Third auxiliary request

"A process for producing high cleanness ultra low carbon (ULC) steel suitable for continuous casting without blocking of a continuous casting nozzle, the process comprising the steps of:

preparing low carbon, non-deoxidized molten steel in a refining furnace; tapping the molten steel into a ladle; performing vacuum degassing processing by means of a vacuum degassing apparatus for decarburization of the ladle molten steel; and blowing oxygen during the decarburization, characterized in that

the ladle slag is deoxidized by adding deoxidizing agent prior to the decarburization to a T.Fe level below or equal to 5%, thereby to suppress oxygen supply from the ladle slag to cause shortage of oxygen during the decarburization, and in that the oxygen blowing is required during the decarburization to ensure decarburization to a carbon (C) level below or equal to 0.006%, and in that said molten ladle steel that has been tapped has a carbon (C) level higher than or equal to 0.035%, and said deoxidizing agent is selected from a group consisting of aluminum (Al), aluminum ash and silicon (Si)."

IV. The Appellant essentially argued as follows:

Admissibility of the requests

Claim 1 of the main request included new features that indicated the problem to be solved and clearly distinguished the claimed process from the prior art

processes, so as to overcome all objections raised against the claims refused by the Opposition Division. New dependent claims were added to support these features.

The figure of 0.035% for the carbon content in claim 1 of the third auxiliary request was supported by the table on page 5 of the patent.

Inventive step

No prior art document discussed the nozzle blocking problem, and moreover, the teachings of Documents D1 and D8 were incompatible with each other, and the person skilled in the art would not combine them. Document D1 described the production of ultra low carbon (ULC) grade steel already starting from a very low carbon steel, and the RH process used in D1 produced clean steel without oxygen blowing. The person skilled in the art would not have contemplated adding an aluminium slag treatment step if oxygen blowing was to be performed subsequently since any excess aluminium would be oxidised in the RH-OB process, which would be counter-productive since aluminium oxide, which was responsible for the nozzle blocking, would be formed. It is for this reason that Documents D1, D3 and D4 describe a combination of ladle treatment and the RH process without oxygen blowing.

- V. The Respondent I has submitted no arguments and Respondent II essentially argued as follows:

Admissibility of the requests

According to the decision T 528/93 it was not

permissible for the Appellant to revert to claims of a broader scope than the claims considered by the Opposition Division as he had unconditionally filed new claims at the opposition stage and had clearly stated that he was not interested in claims having a different scope. In any case it was an abuse of the procedure to file the claims one month before the oral proceedings before the Board and four years after the decision of the Opposition Division.

Furthermore, the claims of all requests contained cosmetic changes, which was not permitted in opposition proceedings. The figure of 0.035% for the carbon content claim 1 of the auxiliary request was not supported by the application as originally filed.

Inventive step

The two measures of slag deoxidation treatment for obtaining high cleanliness and vacuum degassing while blowing oxygen for obtaining extra low carbon content did not represent a combination of steps that complemented each other for achieving a common goal, rather they represented the stringing together of two separate measures for achieving independent and different purposes. Each of these measures, in itself, was known, respectively from Documents D1 and D8, and the person skilled in the art wanting to obtain steel of high cleanliness as well as extra low carbon content would have applied the teachings of Documents D1 and D8 successively. There was no real combination, only the independent and obvious application of two known teachings to obtain two known properties of steel.

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of the requests*

Respondent II's arguments, that the filing of new claims at this late stage was an abuse of procedure and was also prohibited for reasons given in the decision T 528/93, are not accepted. The new claims were filed one month before the oral proceedings before the Board, and met the time limit set out in the communication dated 25 November 1999 from the Board. Moreover, the present case is different to the case of the decision T 528/93, since in the latter case the patent had been maintained in amended form, whereas in the present case the patent had been revoked by the Opposition Division. In this case, the patentee is entitled to revert to a more broadly worded version of claims, in particular to the granted version, even if he had filed a restricted version at the commencement of the appeal proceedings, as explained in the decision T 89/85.

However, the main request and the first and third auxiliary requests are not admissible and the second auxiliary request is admissible for the reasons set out below:

Main request

Claim 1 contains changes of terminology ("extra low" to "ultra low" and "decarbonizing" to "decarburization"), a step that was already implicit in the granted claim but is recited explicitly in the new claim (tapping the molten steel into a ladle), and statements of purpose

("suitable for continuous casting without blocking of a continuous casting nozzle", "for decarburization of the ladle molten steel", "thereby to suppress oxygen supply from the ladle slag to cause shortage of oxygen during the decarburization", and "in that the oxygen blowing is required during the decarburization to ensure decarburization"), and is now cast in the two-part form. The statements of purpose do not alter the scope of the claim and are not inserted in order to meet a ground of opposition. The same applies to the changes of terminology and the use of the two-part form of claim.

The new dependent claims 2 to 5, 7, and 11 to 13 do not have any bearing on the grounds of opposition and are not admissible for this reason. All in all the changes are of a cosmetic nature and not allowable according to well established case law, see for example, the Board of Appeal decision T 0406/86, OJ 1989, 302.

First auxiliary request

The Appellant admitted, at the oral proceedings before the Board, that the addition of the words "the slag of" was only for clarification, and this request is, therefore, not admissible for the same reason as the main request.

Third auxiliary request

Claim 1 of the third auxiliary request is open to same objections as claim 1 of the main request, and is additionally objectionable under Article 123(2) EPC since the figure of 0.035% for the carbon content has been taken out of its context from the table on page 5,

and there is no teaching in the description that this figure is significant or that the invention would not work outside the claimed range.

Second auxiliary request

The claims of the second auxiliary request correspond to the claims as granted but for an insignificant difference, the addition of a definite article.

However, the Appellant stated at the oral proceedings before the Board that the intention was to revert to the granted version, so these claims will be treated as though they were the granted claims.

In view of the foregoing, only the second auxiliary request is admissible and only this request is to be examined as to its substantive merits.

3. *Novelty*

Lack of novelty has not been disputed during the appeal procedure and the Board is satisfied that none of the documents cited by the Respondents discloses a process for producing high cleanliness extra low carbon steel comprising the combination of all the steps defined in claim 1.

4. *Inventive step*

4.1 Closest prior art

The opposed patent is concerned with a process for producing an extra low carbon steel. The described process starts from molten steel tapped to a ladle and having relatively high carbon contents of 0.035 to

0.050% (see Table on page 5), and the steel is decarburized using the RH process, to attain ultra low carbon (ULC) levels (of the order of 10 ppm) necessary for use in the automobile industry in which deep drawability is an essential property.

The Document D8 also describes a process for obtaining a steel of ULC grade, starting from steels with relatively high carbon contents of around 0.04 % and applying the RH process to the molten steel tapped to a ladle. The Board considers this document as representing the closest prior art, in agreement with all the parties and the opposition division.

In the section "Ultra-low carbon treatment", on page 962 it is stated that "the OB-option is also applied in case of shortage of oxygen during the final decarburization of ULC steel". This means that oxygen may be blown into the steel if not enough is present to convert the carbon to attain ULC grade steel. The RH plants depicted in Figures 3 and 6 are equipped with oxygen tuyeres, accordingly.

Thus, this document describes the generally known apparatus and method of refining steel. That is, depending on the carbon content of the molten steel in the ladle, which in turn depends on the conditions prevailing in the converter, the steel is further reduced to ULC grade in the RH plant, whereby the remnant oxygen in the steel is combined with the carbon in the steel and the resulting carbon monoxide gas escapes from the steel, whose carbon and oxygen contents are thereby reduced. The steel is finally killed by the addition of aluminium to passivate any remaining oxygen.

The process according to claim 1 differs from this known process in that deoxidising agent is added to the ladle slag before the vacuum treatment in order to reduce the T.Fe to a level below or equal to 5%.

4.2 Technical problem

It is well known in the art that, when producing ULC grade steel, problems may arise with its cleanliness (see, for example, Document D1, page 385, "Technique for Making Clean Steel", Document D3, page 1, "Detailed Description of the invention", and Document D4, page 2, lines 3 to 8). This lack of cleanliness may lead to intolerable surface defects when the steel is used to produce outer panels for automobiles, for example.

Therefore, when performing the state of the art process according to Document D8, the person skilled in the art will always strive to carry out the process in a manner which results in the utmost cleanliness of the steel. This is also the problem underlying the patent in suit.

4.3 The Document D1 not only mentions this well known problem, but it also discusses the cause of surface defects and also provides the solution for avoiding the problem.

4.4 Inventive step

The person skilled in the art seeking to produce ULC grade steel of high cleanliness would be aware of the Document D1 since this discusses both the cause of surface defects as well as the solution to this problem.

According to Document D1, the high oxygen potential of slag is the cause of surface defects since FeO in the slag acts as an oxygen carrier and transfers oxygen from the atmosphere to the steel (see page 385, right column, penultimate paragraph). On page 385, right column under "Technique for Making Clean Steel" there are reviewed older methods of counteracting the problem and improving steel cleanliness, and it is stated that "slag stopping with refractory ball is not sufficient to prevent metal reoxidation by the highly oxidizing slag from the BOF." Therefore, the steel from a BOF furnace was tapped to a ladle where the slag was deoxidized by the addition of Al powder to lower the T.Fe % to "6% or less". Figure 14 depicts the relationship between the incidence of surface defects, which is connected with the steel's cleanliness, and the T.Fe content, and shows a clear correlation between the two, with several values of T.Fe below 6% and as low as about 1%. This slag treatment prevents metal re-oxidation.

In view of the explanation given in this document of the mechanisms involved in the production of surface defects and also of the fact that a solution to this problem, i.e. slag treatment is given, the person skilled in the art would find ample incentive to use the same solution in the process described in Document D8, and thereby produce a steel that is both clean and is of ULC grade. Indeed, the opposed patent describes the same mechanism (page 2, lines 25 and 26) that degrades the cleanliness of the steel, and employs the same solution, that of reacting the slag with a deoxidizing agent to reduce the T.Fe to less than or equal to 5%. Therefore, the person skilled in the art would arrive at the claimed process as an obvious

combination of known measures.

This step would be inserted before the RH process as in Document D1. Given that the oxygen content of the slag had been adjusted to effect the decarburization, the person skilled in the art would be aware that the reduced oxygen content of the slag would no longer suffice to achieve a carbon level corresponding to the ULC grade. This oxygen deficiency, however, would not deter the person skilled in the art from using the RH process, since the RH plant of Document D8 anticipates this problem and is equipped with means for supplying additional oxygen to make up this deficiency, (see page 962 of D8, left column), and no further modification of the plant is required.

As regards the nozzle blocking problem, this is also related to the presence of insoluble oxides and the solution of the problem of cleanliness automatically brings with it a solution of the nozzle blocking problem.

The Appellant's arguments that no prior art document discussed the nozzle blocking problem and that the teachings of Documents D1 and D8 were incompatible and therefore the person skilled in the art would not have combined them, are not accepted for the following reasons.

No evidence of any prejudice against the use of slag treatment in combination with the RH process has been presented by the Appellant. The fact that Documents D1 to D4 do not use a combination of slag treatment and oxygen blowing is not sufficient evidence that a prejudice existed in this respect or that the teachings

of Documents D1 and D8 are incompatible with each other.

In the absence of any strong evidence that it is not worth while attempting to perform the slag treatment of Document D1 in addition to blowing oxygen during the RH process as in Document D8, the person skilled in the art would indeed consider trying a combination of these processes in view of the very satisfactory results each of these processes individually promises, particularly when no further modification of the RH plant is necessary. The plant of Document D8 is already equipped with this facility so no extra effort is involved in the attempt.

The skilled person wanting to provide ULC grade steel that is very clean is incited to carry out the slag deoxidising step as described in D1, followed by the decarbonising step as described in D8, while using the option D8 of blowing oxygen in the RH process. Thus the process of claim 1 does not involve an inventive step. The fact that it also ensures that the nozzle of a continuous casting apparatus does not get blocked, is a bonus effect which occurs automatically as a by-product of the main effect and cannot impart inventivity to the claimed process.

Therefore, the second auxiliary request is not allowable since the process of claim 1 thereof lacks an inventive step.

5. *Other matters*

Since the Opposition Division had, in its decision, refused claims narrower in scope than the present

claims for lack of inventive step, it had in effect already given its opinion on the present set of claims and remittal to first instance, as requested by the Respondent I, is not necessary, accordingly.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

V. Commare

W. D. Weiß