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Aktenzeichen / Case Number / N^o du recours : T 19/89 - 3.3.1

Anmeldenummer / Filing No / N^o de la demande : 80 108 124.1

Veröffentlichungs-Nr. / Publication No / N^o de la publication : 0 033 780

Bezeichnung der Erfindung: Method for preventing slopping during subsurface
Title of invention: pneumatic refining of steel
Titre de l'invention :

Klassifikation / Classification / Classement : C21C 5/34

ENTSCHEIDUNG / DECISION

vom / of / du 22 March 1990

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Union Carbide Corporation

Einsprechender / Opponent / Opposant :

Klöckner CRA Technologie GmbH

Stichwort / Headword / Référence : Steel refining/UNION CARBIDE

EPÜ / EPC / CBE Articles 56 and 114(2)

Schlagwort / Keyword / Mot clé : "Inventive step (confirmed)"

Leitsatz / Headnote / Sommaire



Case Number : T 19/89 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 22 March 1990

Appellant : Klöckner CRA Technologie GmbH
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Respondent : Union Carbide Corporation
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Decision under appeal : Interlocutory decision of the Opposition Division of
the European Patent Office dated 25 October 1988
concerning maintenance of European patent
No. 0 033 780 in amended form.

Composition of the Board :

Chairman : K.J.A. Jahn
Members : R.W. Andrews
J.A. Stephens-Ofner

Summary of Facts and Submissions

- I. The mention of the grant of European patent No. 0 033 780 in respect of European patent application No. 80 108 124.1, filed on 23 December 1980 and claiming priority of 27 December 1979 from a prior application in the United States of America, was announced on 9 October 1985 (cf. Bulletin 85/41).
- II. A Notice of Opposition was filed on 8 July 1986 in which the revocation of the patent was requested on the ground that its subject-matter was not patentable within the terms of Articles 52, 54 and 56 EPC. The opposition was supported by the following documents
- (1) US-A-4 187 102
 - (2) DE-C-914 380 and
 - (3) DE-A-2 552 392.
- III. By an interlocutory decision dated 25 October 1988, the Opposition Division maintained the patent in amended form on the basis of Claims 1 to 3 filed on 19 April 1988.

The Opposition Division held that document (1) could not be considered under Articles 54 and 56 EPC since the claimed subject-matter of the disputed patent was entitled to the claimed priority date of 27 December 1979. The Opposition Division also decided that the claimed subject-matter was novel and involved an inventive step. In view of the different purpose of the process disclosed in document (3), it was not obvious to replace the carbon-containing fuels of this document by aluminium, silicon or zirconium which, in contrast to the gaseous compounds resulting from the additives of document (3), have to be separated from the melt into the slag.

The Opposition Division also considered that it was not obvious to transfer the teaching of document (2) which is concerned with a bottom blown air steelmaking process to the particular refining processes of the disputed patent in view of the different kinetic conditions involved in the two types of processes.

IV. An appeal was lodged against this decision on 29 December 1988 together with payment of the prescribed fee. A Statement of Grounds of Appeal was filed on 3 March 1989 by a duly confirmed telecopy. In their statement, the Appellants contended that the process of document (2) is not so different from the present process and that, since the purpose of this prior art process is not only to produce low nitrogen steels, but also low phosphorus and low oxygen steels, it follows that it is suitable for any refining process using nitrogen-free oxygen containing refining gases.

The Appellants also alleged that a reduction in the danger of slopping is an inevitable consequence of low refining temperatures and even if many parameters are involved in increasing the tendency of a heat of steel to slop, the danger of it occurring must be decreased by the removal of one of them, i.e. high melt temperature.

In their statement of grounds and in their letter filed on 28 November 1989, the Appellants also based arguments on the disclosure of DE-C-1 916 945 (document (4)) and US-A-3 323 907 (document (5)).

In a telecopy received on 9 March 1990, the Appellants withdrew their request for oral proceedings.

- V. In their reply to the statement of grounds and during the oral proceedings held on 22 March 1990 in the absence of the Appellants, the Respondents contended that it was not possible to draw parallels between the present process and the one disclosed in document (2)), since the purpose of the latter process was to produce low nitrogen steels whereas that of the claimed process was to prepare steels which required the addition to the melt of oxidisable fuel material beyond that contained in the charge for raising the temperature of the heat.

The problem underlying document (3) was to increase the amount of scrap, ore or iron pellets that may be added to an OBM converter. The proposed solution leads to the evolution of additional amounts of gases and would, if anything, increase the danger of slopping.

In the Respondent's view, none of the cited documents disclose the present problem and none of them disclose any step which would be a suitable solution to the problem.

- VI. The Appellants requested that the decision under appeal be set aside and the patent revoked. The Respondents requested that the decision under appeal be set aside and the patent maintained on the basis of the specification as amended in the course of oral proceedings. The only independent claim of the amended patent reads as follows:

"A method for preventing slopping during subsurface pneumatic refining, with an oxygen-rich gas, of a steel melt which requires fuel additions, while simultaneously controlling the temperature of the melt, in AOD, CLU, OBM, Q-BOP and LWS processes, characterized by adding aluminum, silicon or zirconium to the melt in an amount sufficient to obtain the desired tap temperature at the end of the refining period, at a time after the melt has been

decarburiized to substantially the specification carbon content or after the carbon content has fallen below about 0.50% and oxidizing said aluminum, silicon or zirconium with said said oxygen-rich gas".

VII. At the conclusion of the oral proceedings, the Board announced its decision.

Reasons for the Decision

1. The appeal is admissible.
2. There are no formal objections in the present claims under Article 123 EPC, since they are supported by the original disclosure and do not extend the protection conferred.
3. The patent in suit relates to an AOD, CLU, OBM, Q-BOP or LWS process for refining a steel melt which requires the addition of oxidisable fuel material beyond that contained in the charge. The above-mentioned bottom-blown oxygen steel-making processes suffer from the difficulty of achieving complete refining of certain steel melts while maintaining a sufficiently high temperature to permit tapping of the heat at the end of the refining period. In order to obtain the desired tap temperature it has been proposed to generate heat by the exothermic oxidation of added fuels. Such a procedure obviates the need for reblowing the heat without the melt reaching temperatures during refining that cause excessive refractory deterioration.

However, according to the disputed patent, a disadvantage of such a process is the occurrence of slopping. Slopping is a term used in the art to denote the sudden ejection of

considerable amounts of slag-metal emulsion out of the open mouth of the refining vessel.

Although there is no evidence on file to support this statement with respect to the occurrence of slopping, the Board is prepared to accept it, since it has not been contested by the Appellants and the Respondents' representative, who when questioned on this point during the oral proceedings, confirmed that it correctly represented the state of the art.

- 3.1 In the light of this prior art, the technical problem underlying the patent in suit may be seen in providing a bottom-blown oxygen steelmaking process of the specified type for refining steels which require fuel additions to obtain the desired tap temperature in which slopping is prevented.

According to the disputed patent, this technical problem is essentially solved by oxidising with an oxygen-rich gas aluminium, silicon or zirconium, which has been added in an amount sufficient to obtain the desired tap temperature at the end of the refining period at a time when the melt has been decarburised to substantially the specification carbon or after the carbon content has fallen below about 0.5%.

In view of the Examples in the disputed patent, the Board is satisfied that this technical problem is credibly solved.

4. After examination of the cited prior art, the Board is satisfied that the claimed subject-matter is novel. In their letter filed on 28 September 1989, the Appellants alleged that Claim 1 of the disputed patent, insofar as it relates to a process in which the aluminium, silicon or zirconium is added at a time after the melt had been

decarburised to substantially the specification carbon content, lacked novelty having regard to the disclosure of document (5). This allegation is clearly unfounded since this document is concerned with a top-blown oxygen steelmaking process. Similarly, in the Board's judgement, it is not relevant for the assessment of inventive step. Therefore, in accordance with Article 114(2) EPC, document (5), which was filed after the expiry of the time allowed for filing opposition, will be disregarded by the Board (cf. T 156/84, OJ 1988, 372, point 3.8).

5. It still remains to be examined whether the requirement of inventive step is met by the claimed subject-matter.
- 5.1 Document (1), which was published on 5 February 1980, did not form part of the state of the art within the meaning of Article 54(2) EPC before the validly claimed priority date (27 December 1979) of the patent in suit. Nevertheless, the Appellants contended that the process disclosed therein must have been made available to the public in another publication, since it is referred to in the disputed patent as a prior art method (cf. column 5, lines 24 to 28). However, it is clear to the Board that this process forms part of the Respondents' own internal prior art. Therefore, since the Appellants have not filed any evidence to support their contention, their argumentation based on the teaching of document (1) must be left out of consideration by the Board.
- 5.2 Document (2) discloses a process for the preparation of low nitrogen, low oxygen, low phosphorus steel by a bottom-blown air process wherein oxidic or other additions are added at the beginning of the melting operation or near the end of the decarburisation at such a rate that the nitrogen content of the melt is less than 0.010% and wherein subsequently oxidisable fuel material which does not cause

an increase in the nitrogen or phosphorus content, particularly calcium and/or magnesium or alloys thereof with silicon and/or aluminium, is added in quantities which allow the melt to be poured without difficulty (cf. Claim 1).

In order to prepare low nitrogen steel by a bottom-blown air process, it was considered necessary to undertake the refining at relatively low temperatures. However, this leads to difficulties during the pouring of the heat. Although this problem may be overcome by adding oxidisable fuels, such as aluminium and silicon, to the melt, this resulted in an undesirable increase in the nitrogen content of the steel (cf. page 2, lines 15 to 28, 43 to 44 and 94 to 103). To avoid any increase in the nitrogen content, document (2) proposes the addition of particular fuel material. Therefore, the teaching of this document is solely directed to maintaining a low nitrogen content while, at the same time, obtaining the desired tap temperature. However, the document is wholly silent with respect to the phenomenon of slopping and it may be assumed that, due to the use of air as the refining gas, slopping did not occur during this prior art process.

Therefore, the teaching of this document would not lead the skilled person to the realisation that slopping during the bottom-blow oxygen refining of a steel melt which requires the addition of oxidisable fuel material beyond that contained in the charge for raising the temperature of the charge may be prevented by ensuring that the combination of high carbon level of the heat and high temperature do not occur in conjunction with the presence of a slag-metal emulsion during decarburisation, or that this could be attained by adding aluminium, silicon or zirconium at a time after the melt has been substantially decarburised.

- 5.3 Document (3) discloses a process for adding heat to a iron melt by bringing a gaseous mixture comprising at least partially of carbon dioxide and steam obtained by burning a fuel, preferably carbon or a hydrocarbon with oxygen, into intimate contact with the steel melt, the maximum carbon content of which is about 0.10% (cf. Claim 1). According to Figure 2 and the corresponding description on pages 7 and 8 (typewritten numbers at the bottom of the pages) the fuel and the oxygen are injected beneath the surface of the melt through tuyeres mounted in the converter bottom, which is removable from the rest of the converter. It is intended that this additional heat be used to increase the amount of scrap which may be added to the melt and to melt other coolants, such as ores or iron pellets (cf. first complete paragraph on page 7). Thus, document (3) is not concerned with the problem of preventing slopping and would not be of any assistance to the skilled person seeking to solve the problem underlying the disputed patent. Furthermore, since the requirement that the carbon content of the steel melt should be below about 0.10% is to ensure that the combustion of the carbon or hydrocarbon is sufficiently exothermic, this would not lead the skilled person to the conclusion that in order to avoid slopping the additional fuel in the form of aluminium, silicon or zirconium should be added at a specified time.
6. Therefore, in the Board's judgement, the proposed solution to the problem of preventing slopping in a bottom-blow oxygen steelmaking process of the specified type for refining steel which require fuel additions to obtain the desired tap temperature is inventive. Thus, the subject-matter of Claim 1 involves an inventive step.
- 6.1 Claims 2 and 3, which relate to preferred embodiments of the process according to Claim 1, are also allowable in view of the acceptability of Claim 1.

7. The Board cannot accept the Appellant's argument that the danger of slopping would be decreased by lowering the refining temperature, since due to the nature of the charge, the refining of steel melts which require the addition of oxidisable fuel material beyond that contained in the charge for raising the temperature of the heat takes place at relatively low temperatures and it remains undisputed that slopping still occurs.
8. Document (4), a German patent, which was cited for the first time in the grounds of appeal, was published on 17 April 1980, viz after the validly claimed priority date of the patent in suit. In agreement with the decision of this Board T 185/88 of 22 June 1989 (to be published), the Board could have replaced this document by the corresponding prepublished Offenlegungsschrift. However, in view of the lack of relevance of this document and its late filing, the Board decided not to introduce the prepublished document into the proceedings.

Order

For these reasons, it is decided that:

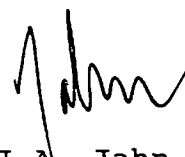
1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as amended in the course of oral proceedings.

The Registrar:



M. Beer

The Chairman:



K.J.A. Jahn