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**Datasheet for the decision  
of 11 March 2009**

**Case Number:** T 1448/06 - 3.4.02

**Application Number:** 01274217.7

**Publication Number:** 1298429

**IPC:** G01N 29/08

**Language of the proceedings:** EN

**Title of invention:**

Method of producing continuously cast pieces of steel

**Patentee:**

JFE Steel Corporation

**Opponent:**

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**Headword:**

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**Relevant legal provisions:**

EPC Art. 56

**Relevant legal provisions (EPC 1973):**

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**Keyword:**

"Claim I, inventive step - yes (after amendment)"

**Decisions cited:**

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**Catchword:**

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Case Number: T 1448/06 - 3.4.02

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.02  
of 11 March 2009

Appellant: JFE Steel Corporation  
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Tokyo, 100-0011 (JP)

Representative: HOFFMANN EITLE  
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Decision under appeal: Decision of the Examining Division of the  
European Patent Office posted 24 March 2006  
refusing European patent application  
No. 01274217.7 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** A. Klein  
**Members:** M. Rayner  
C. Rennie-Smith

## Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division refusing European patent application number 01 274 217.7. The patent application is concerned with producing continuously cast pieces of steel.

II. In the decision under appeal, the examining division made reference to, amongst others, the following documents:

- D3 Patent Abstracts of Japan vol. 011, no 378  
(P-645), 10 December 1987 (1987-12-10)  
& JP 62 148850 A
- D5 JP 57 073 670 A
- D6 JP-A-53 106 085.

According to the examining division, the features of claim 1 before it were disclosed by document D3, excepting cooling a surface layer portion such that it is  $\alpha$  transformed. This feature is rendered obvious in the light of document D5 or D6, both of which disclose improved results by performing measurements below the Curie temperature. Any magnetostriction present in an  $\alpha$  transformed ring around the casing, about which claim 1 is silent, would appear to be inherently related to surface temperature.

III. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of documents as filed on 11.03.2009 (i.e. description pages 1-31, claims 1-3, drawings sheets 1/7-7/7). Oral proceedings were requested on an auxiliary basis. The

appellant argued that any interference with the thermal environment of the casting strand of document D3 has consequences for the rate of casting and location of crater end, which was not a scenario faced by the authors of document D5 or D6, because they were looking at ultrasonic quality control measures, where the object of attention is not moved out of the field of view.

- IV. The board had doubts about the case of the appellant and therefore appointed oral proceedings. During the oral proceedings, the appellant filed amended application papers including an independent claim amended with respect to that before the examining division and argued as follows in support of its case.

In order to achieve an adequate signal to noise ratio, a separation of less than two millimetres of the detector from the steel strand had been thought necessary. In view of irregular surface configuration, maintaining such a small lift off separation requires a contact method using a touch roll. Document D5 concerns an eddy current rather than an ultrasonic method and thus its teaching would not have been combined by the skilled person with that of the teaching of document D3. While admitting that, say, document D6 might reveal that a temperature less than that of the Curie point could yield better results, this is only a weak effect and the effect of magnetostriction on signal to noise ratio is not appreciated in this context in any of the prior art documents. Moreover, as the steel manufacturing process is already optimised, the skilled person would not have introduced extra cooling unnecessarily. The invention as claimed enables a lift

off separation of four millimetres, i.e. sufficient for non-contact, yet nevertheless attaining an adequate signal to noise ratio. The subject matter claimed can therefore be considered to involve an inventive step having regard to any of the prior art documents.

V. The independent claim is worded as follows.

"1. A manufacturing method for a continuously cast product of steel comprising the steps of:

detecting a position of crater end of product by using a method for measuring a solidification state of continuously cast product by a sensor arranged without use of a touch roll in non-contact with said product; and

controlling at least one condition selected from the conditions of the casting speed and the quantity of secondary cooling water based on said detected position of crater end, said method for measuring a solidification state of continuously cast product comprising the steps of:

cooling said product until a surface layer portion thereof is at a temperature lower than its Curie point, and  $\alpha$  transformed;

transmitting transverse waves of electromagnetic ultrasonic waves to said cooled product as a transmitting signal, said transverse waves causing a magnetostrictive effect in the surface layer portion;

receiving a signal after said transmitting signal propagates in said product as a receiving signal, said signal exhibiting a S/N that is improved by 10dB as compared with the case where said cooling step is omitted; and

judging the solidification state of said product based on said receiving signal."

VI. At the end of the oral proceedings, the board gave its decision.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Support for the amendments made to independent claim 1 during the appeal proceedings can be found in the documents as originally filed, for example, on page 4, lines 18-19 (without use of touch roll) page 10, line 22 (Curie point), page 24, line 15 (magnetostrictive effect) and page 24, lines 22 to 23 (S/N).
3. The magnetostriction effect referred to by the examining division is explicitly recited in the amended claim, which also recites "detecting... without use of a touch roll". Moreover, both the magnetostrictive effect and S/N are claimed in the context of the cooled product. These aspects are not known from any of the available prior art documents, nor were they dealt with in the decision under appeal. The problem solved by the novel features is to improve the manufacturing method for a continuously cast product of steel comprising detecting a position of crater end. In view of, for example, the improved lift off separation made possible by the claimed features, the board finds persuasive the case presented by the appellant during the oral proceedings in support of inventive step of the subject

matter of the independent claim. The remaining claims depend therefrom.

4. The amendments to the description are for consistency with the invention as now claimed and therefore do not give rise to objection.
5. In view of the foregoing, the application papers as amended can be considered to meet the requirements of the Convention.

## **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 grant a patent on the basis of claims, description and drawings as filed during the oral proceedings of 11.03.2009.

The Registrar

The Chairman

M Kiehl

A G Klein