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D E C I S I O N
of 5 December 1995

Case Number: T 0551/93 - 3.2.5

Application Number: 86306502.5

Publication Number: 0214797

IPC: B22D 11/18

Language of the proceedings: EN

Title of invention:
Method for controlling early casting stage in continuous casting process

Patentee:
NIPPON STEEL CORPORATION

Opponent:
Stopinc AG

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0551/93 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 5 December 1995

Appellant: (Opponent)
Stopinc AG
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CH-6341 Baar (CH)

Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 21 April 1993 rejecting the opposition filed against European patent No. 0 214 797 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: G. Gall
Members: A. Burkhart
W. D. Weiß

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against the patent No. 0 214 797.

Opposition was filed against the patent as a whole and based on Articles 100(a) (lack of inventive step) and 100(b) EPC.

The Opposition Division held that the grounds for opposition mentioned in Articles 100(a) and (b) EPC did not prejudice the maintenance of the patent unamended having regard to the following documents

E1: DE-A-3 205 480,

E2: Abstract of JP-A-58/84652, and

E3: GB-A-2 172 532,

the latter document not representing a state of the art in the meaning of Article 54(2) EPC.

II. Claims 1 and 2 of the patent in suit read as follows:

"1. A method for controlling an early casting stage in a continuous casting process comprising the steps of commencing to pour molten steel into a mold (4) provided with a dummy bar head (5) through an immersion nozzle (3) provided with a flow rate control device, detecting that a steel level (a) in said mold has reached a predetermined drawing commencement level and commencing drawing of said dummy bar head, characterized by predetermining a holding time for the molten steel in said mold,

from a commencement of pouring molten steel into said mold to a commencement of drawing said dummy bar head (5), through a solidified shell formation velocity under prevailing operating conditions, selectively carrying out anyone of the following operations (a) and (b)

(a) setting a standard steel bath level rising pattern wherein, when said holding time for the molten steel in the mold has passed, and at substantially the same time said steel level reaches said drawing commencement level, commencing pouring the molten steel, calculating a deviation by comparing a time required for the steel level to reach a predetermined intermediate confirmation level with a required time obtained through said standard steel bath level rising pattern and controlling a flow rate of the molten steel by changing the steel bath level rising pattern so that deviation can be corrected before said commencement of drawing,

or

(b) detecting when said predetermined level is reached, the time required for said steel level to reach said drawing commencement level from the commencing of pouring, when the required time does not equal the molten steel holding time for said molten steel in the mold, reducing the opening degree of the flow rate control device to an emergency treatment opening degree determined by the control properties and the operating conditions using the reaching of the steel level to said drawing commencement level as a trigger, and commencing drawing after ensuring the holding time for the molten steel in a mold.

2. A method according to claim 1, characterized by, when the steel level after commencing pouring of the molten steel does not reach the predetermined drawing level in said required time, widening the opening degree of the flow rate control device to a predetermined opening degree for an emergency treatment to follow said basic steel bath level rising pattern, using the passage of said required time as a trigger."

III. In his Statement of Grounds of Appeal the Appellant argued that the subject-matter of the patent in suit was not novel with respect to the state of the art according to document E1 and that the teachings of documents E1 and E2 rendered obvious the subject-matter of the patent in suit.

The Appellant requested that the decision of the Opposition Division be set aside and the patent be revoked.

IV. The Board issued a communication, wherein it expressed its provisional opinion that the subject-matter of Claim 1 of the contested patent was both new and involved an inventive step having regard to the prior art disclosed in documents E1 and E2.

V. In a letter of reply to this communication, the Appellant submitted that the subject-matter of the patent in suit was not novel with respect to the disclosure of document E1.

The Appellant contended that all the features of Claims 1 and 2 of the patent in suit were present in the method of document E1 and that, in particular, the

features (a) and (b) of Claim 1 of the patent in suit were disclosed in Figure 7 and Claim 6 and pages 19 and 20 of document E1.

VI. Oral proceedings were held before the Board of Appeal.

(i) The duly summoned Appellant had informed the Board in advance that he would not attend the oral proceedings.

(ii) The Respondent (patent Proprietor) argued essentially as follows:

The method of Claim 1 of the patent in suit was both new and involved an inventive step having regard to the state of the art according to documents E1 and E2 for essentially the reasons set out in the decision of the Opposition Division and in the communication of the Board.

In particular, the method of document E1 differed form the method of Claim 1 of the patent in suit in that it did not relate to casting of steel, that it used neither a mould nor a dummy bar head, and that it did not comprise the measure of predetermining a holding time for the molten steel in the mould through a solidified shell formation velocity under prevailing operating conditions.

Moreover, since in the method of document E1 an electromagnetic inductor was used instead of a mould, no shell formation took place within the inductor and therefore the problem underlying the invention, i.e. avoidance of break-through of the molten steel through the outer shell and adhesion of the dummy bar head to a solidified shell during the commencement of casting, did not arise in the

method of document E1. Consequently, there could be found no suggestion in document E1 that the casting process should be commenced only after a predetermined holding time for the molten steel in the mould, sufficient to ensure a certain solidified shell thickness within the mould, had passed.

(iii) The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. *Novelty*

Document E1 discloses a method of casting metal, e.g. aluminium, into a plurality of ingots, wherein the casting units comprise electromagnetic inductors each of which holding a liquid metal bath on a plate, and wherein, in a filling stage, all of the bath levels are brought at a common predetermined level before the plates are lowered for the commencement of ingot casting. During this filling stage all bath levels are continuously controlled for following a given filling pattern.

The method of Claim 1 of the patent in suit differs from this known method in

that it is concerned with the casting of steel,

that the molten steel is poured into a mould the bottom of which is closed by a dummy bar head and a solidified shell is formed within the mould before commencement of drawing of the dummy bar head,

that a holding time for the molten steel in the mould is predetermined from a commencement of pouring molten steel into the mould to a commencement of drawing the dummy bar head through a solidified shell formation velocity under prevailing operating conditions,

that a deviation is calculated by comparing a time required for this steel level to reach a predetermined intermediate confirmation level with a required time obtained through a standard steel bath level rising pattern and controlling a flow rate of the molten steel by changing the standard steel bath level rising pattern so that deviation can be corrected before the commencement of drawing (see alternative (a) of Claim 1) or

that the filling rate is adjusted according to the measures of feature (b) of Claim 1.

Document E2 discloses a method for controlling an early casting stage in a continuous casting process comprising the features of the preamble of Claim 1 of the patent in suit. In this known method the amount molten steel poured into the mould is controlled by a flow rate control device controlling the opening degree of a charging nozzle, and when the molten matter bath in the mould reaches a preset level, drawing commences and is accelerated up to a steady drawing speed.

Document E2 does not disclose the step of predetermining a holding time in the mould, nor does it disclose either of the alternatives (a) or (b) set out in Claim 1 in the patent in suit.

Therefore, the method of Claim 1 of the patent in suit is novel with respect to the methods disclosed in documents E1 or E2.

2. *Inventive step*

2.1 The problem underlying the invention of the contested patent consists in providing a method for controlling continuous casting of steel into a mould in an early stage in such a way that the molten steel from the interior of the casting does not break through the outer shell when casting commences nor does the casting become welded to the dummy bar head (see page 2, line 52; page 7, lines 49 to 51; page 8, lines 37 to 39 of the patent in suit).

This problem is solved by the method as defined in Claim 1 of the patent in suit. The features of the characterizing part of Claim 1 assure that drawing of the dummy bar head is commenced only after a predetermined holding time for the molten steel in the mould has elapsed, during which holding time an optimum thickness of a solidified shell is formed, which, on the one hand, is sufficiently thick to prevent break through of the molten steel, and which, on the other hand has not yet reached such a thickness to create a welding or blockage of the dummy bar head in the mould, when casting commences.

2.2 The method of Claim 1 is not rendered obvious by the documents E1 or E2, for the following reasons.

Document E1 relates to a specific casting process for aluminium, wherein an electromagnetic inductor device is used instead of a tubular mould for holding the liquid metal bath (see page 7, second paragraph). In this process, the liquid metal is not in contact with surrounding mould walls and the solidification of the metal primarily results from axial heat conduction from the liquid metal bath to the portion of the solidifying

metal which is cooled by the cooling medium (see page 7, second paragraph and page 8, first paragraph, last sentence).

Consequently, in the process of document E1 no solidified shell formation takes place in an early stage before commencing of the casting process and therefore, the problem relating to the solidified shell formation underlying the invention of the patent in suit does not arise in the process of document E1.

Hence, the person skilled in the art looking for a solution of the problem underlying the patent in suit would not consider document E1.

However, even if the person skilled in the art considered document E1, he would not find in this document any suggestion for the gist of the invention of the patent in suit which is characterized by the feature "predetermining a holding time for the molten steel in the mould through a solidified shell formation velocity under prevailing operating conditions" and which, by means of the adjusting measures according to features (a) or (b) of Claim 1, assures that the drawing of the dummy bar head is only commenced after both the predetermined holding time for the molten metal has elapsed and a predetermined drawing commencement level has been reached, in order to form an optimum initial thickness of the solidified shell within the mould.

In particular, Figure 7 and the corresponding part of the description of document E1, which were referred to by the Appellant, merely teach that the filling rate of the various casting units should follow a certain common filling pattern up to an end level (Endsollspiegel C) and that casting should commence at a predetermined bath level or time point **before** arriving at that end level

(see last sentence of page 20). There is no suggestion that the factor which needed to be controlled was the overall time (predetermined holding time) elapsing from the start of filling of the mould to the commencement of drawing, and that the filling rate pattern should be adjusted to meet this predetermined holding time.

Document E2 discloses a method comprising the features of the preamble of Claim 1 of the patent in suit. However, this document does not address the problem underlying the method of the patent in suit, nor discloses any of the features of the characterizing portion of Claim 1.

2.3 Therefore, having regard to the state of the art according to the documents E1 and E2, the method of Claim 1 of the patent in suit is not obvious to a person skilled in the art, and consequently, has to be considered as involving an inventive step in the meaning of Article 56 EPC.

The same applies to the method defined in the dependent Claim 2 which represents a further advantageous development of the method of Claim 1.

3. Hence, the method claimed in the patent in suit constitutes a patentable invention in the meaning of Article 52(1) EPC, and the patent can be maintained as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Townend G. Gall