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D E C I S I O N
of 29 April 2004

Case Number: T 0526/02 - 3.2.3

Application Number: 95900015.9

Publication Number: 0679114

IPC: B22D 11/06

Language of the proceedings: EN

Title of invention:

Casting stainless steel strips on surface with specified roughness

Patentee:

Casting LLC

Opponent:

USINOR

Headword:

-

Relevant legal provisions:

EPC Art. 56, 100(a), 100(b)

Keyword:

"Fresh ground of opposition - extent of power to examine"
"Inventive step - yes (after amendment)"

Decisions cited:

G 0010/91

Catchword:

-



Case Number: T 0526/02 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 29 April 2004

Appellant: Casting LLC
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Respondent: USINOR
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 27 March 2002
revoking European patent No. 0679114 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. T. Wilson
Members: F. Brösamle
J. P. B. Seitz

Summary of Facts and Submissions

I. In the oral proceedings of 5 February 2002 the opposition division revoked European patent No. 0 679 114 in the light of

(D1) EP-A1-0 378 705 and

(D2) "Thin strip casting experiments at IRSID and Thyssen Stahl AG", Iron and Steelmaker, August 1993, pages 27 to 32.

The written decision was issued on 27 March 2002.

II. Against the above decision of the opposition division the proprietor - appellant in the following - lodged an appeal on 22 May 2002 paying the fee on the same day and filing the statement of grounds of appeal on 2 August 2002.

III. Following the board's communication pursuant to Article 11(2) RPBA in which the board expressed its provisional opinion of the case with respect to the objections under Articles 100(b) and 100(a) EPC oral proceedings were held on 29 April 2004 in which the appellant submitted new claims 1 to 11 and an amended description.

IV. The new independent claims 1 and 7 read as follows:

"1. A method of continuously casting metal strip of the kind in which a casting pool of molten metal is formed in contact with a moving casting surface such that metal solidifies from the pool onto the moving

casting surface, wherein the metal is an austenitic stainless steel containing chromium and nickel in a ratio (Cr/Ni) eq of less than 1.60, the casting surface is textured so as to have an Arithmetical Mean Roughness Value (R_a) in the range of 2.5 to 15 microns and heat is transferred from said austenitic stainless steel solidifying onto said textured surface at an initial heat transfer rate of more than 15 MW/m^2 during the initial 20ms to enable the solidification of said steel on the casting surface without deleterious segregation and surface cracking."

"7. A method of continuously casting metal strip of the kind in which molten metal is introduced into the nip between a pair of casting rolls via a metal delivery nozzle disposed above the nip to create a casting pool of molten metal supported on casting surfaces of the rolls immediately above the nip, wherein the metal is an austenitic stainless steel containing chromium and nickel in a ratio (Cr/Ni) eq of less than 1.60, the casting surfaces are textured so as to have an Arithmetical Mean Roughness Value (R_a) in the range 2.5 to 15 microns and heat is transferred from said austenitic stainless steel solidifying onto said textured casting surfaces of the rolls at an initial heat transfer of more than 15 MW/m^2 during the initial 20ms to enable the solidification of said steel on the casting surfaces without deleterious segregation and cracking."

V. In the oral proceedings before the board the appellant and the opponent - respondent in the following - essentially argued as follows:

(a) appellant:

- respondent's objection under Articles 84, 83 and 100(b) EPC being brought forward only in the appeal proceedings cannot be dealt with by the board since the appellant did not give his agreement to discuss this item;

- contrary to the first instance the nearest prior art is not seen in (D1) but rather in the prior art discussed in paragraph [0022] of the patent specification;

- the problem to be solved by the invention is therefore the same as originally filed in the specification, namely to exclude segregation and surface cracking;

- the solution as claimed is based on textured rolls leading to a high initial heat transfer rate during the initial 20 ms and is also based on the steel chemistry, namely restricting its ratio of Cr- and Ni- equivalents to 1.6 and below;

- the result of these features is a solidification of the cast steel in the gamma-phase instead of the delta-phase taught in (D1);

- following the teaching of claim 1 its last feature, namely "without deleterious...cracking" is automatically achieved so that the claim is not rendered unclear and obscure in its teaching;

- neither (D1) nor (D2) could render obvious the method of claim 1 being based on a combinatory effect of its parameters roughness, heat transfer rate and steel chemistry since (D1) deals with problems of roping/orange peel and gloss unevenness solved in post treatment steps and covers a broad range of the steel's chemistry not recognising, however, the limit of the equivalent of Cr and Ni "of less than 1.60" and clearly not making all necessary provisions for a gamma-phase solidification of the cast steel strip and secondly (D1) is completely silent about the parameter of roughness; the threefold cooling according to (D1) is not helpful to solve the invention's problems with respect to cracking and surface quality;
- (D2) being only a broad study on steel casting does not reveal to a skilled person an interrelationship between roughness and steel quality and heat flux, respectively;
- under these circumstances the subject-matter of claims 1 and 7 is novel and inventive.

(b) respondent:

- the claimed invention is not inventive since a skilled person only had to optimize the claimed parameters by carrying out routine tests;
- to investigate the influence of the roughness of the casting surface is already taught in (D2) setting out on page 31 and its Figure 13 that

there exists an interrelationship between roll roughness and heat extraction;

- even if (D2) relates to a broad study based on a laboratory installation a skilled person could derive therefrom that a broad range of surface roughnesses was already studied in the prior art and even in combination with stainless steel which steel quality has to meet a big demand on the market inviting a skilled man to study its behaviour in combination with its casting and its solidification;
- since (D1) deals with the same problem(s) as the invention it could be seen as the most relevant prior art since its Examples 7 and 30 are not based on hot rolling but rather rely on a product as cast;
- the patent specification taken as a whole and claim 1 are silent about the casting surface's roughness below 2.5 microns so that the exclusion of this range is nothing else than an artificial delimitation with respect to the prior art; the patent specification again taken as a whole being silent about the specific influence of the roughness - and heat transfer rate - parameter the final "feature" of claim 1 excluding deleterious segregation and surface cracking is not clear since not defined in the patent specification;
- summarising, the claimed invention is not based on an inventive step.

VI. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of his (main) request filed during the oral proceedings (claims 1 to 11).

VII. The respondent requested dismissal of the appeal.

Reasons for the Decision

1. The appeal is admissible.

Articles 83, 100(b) EPC

2. The objection under Article 84 EPC raised by the respondent in his reply to the statement of grounds of appeal was actually an objection under Articles 83 and 100(b) EPC as set out in remark 5 of the board's communication pursuant to Article 11(2) RPBA dated 18 August 2003.

The ground of opposition under Article 100(b) EPC - not brought forward by the respondent in his notice of opposition - could only be considered by the board with the approval of the patentee, see remark 18 of the "Opinion of the Enlarged Board of Appeal" G 0010/91, OJ EPO 1993, 420.

In the oral proceedings before the board the patentee (appellant) did not give his approval to deal with the objection under Article 100(b) EPC so that the board did not allow a discussion of this ground in substance.

Article 100(a) EPC

3. *Novelty*

Novelty not being disputed by the respondent, the opposition division nor the board, the crucial issue to be decided is inventive step in the light of (D1), (D2) and the prior art discussed in paragraph [0022] of EP-B1-0 679 114 - in the following (D0) - since even the respondent, see his letter of 19 February 2003, page 6, third paragraph, accepted that the claimed surface roughness **and** the initial heat transfer rate are not disclosed in (D1) seen by the respondent as the closest prior art document.

4. *Nearest prior art*

In agreement with the appellant, (D0) is considered to disclose the nearest prior art. (D1) cannot be accepted as the nearest prior art since it does not address the same problem as the claimed invention but rather deals with the problem of "roping" (orange peel effect) and of unevenness of gloss of the cast article, however, not in its **as cast** condition.

(D2) is **a study** dealing with all kinds of steel on the basis of laboratory equipment without specifically disclosing the combination of features set out in claims 1 and 7.

5. *Problem to be solved*

Starting from (D0) as the nearest prior art to be considered a Cr/Ni ratio within the range of 17 to 19

is taught to minimize cracks and segregation. However, it tends to cause crocodile skin and small initial heat transfer rates and coarser solidification structures in the case of a smooth casting surface.

The problem to be solved by the claimed invention is the same as set out in EP-B1-0 679 114 in page 2, lines 16 to 20, thereof, namely to obviate cracking and repetitive surface depressions appearing as a surface defect generally known as "crocodile skin" when casting austenitic stainless steel.

6. *Solution of the problem*

The above problem of the invention is solved with the features of claims 1 and 7, respectively, basically by restricting the steel's chemistry to (Cr/Ni) eq of less than 1.60, secondly by texturing the moving casting surfaces/ pair of casting rolls to an arithmetical mean roughness value in the range of 2.5 to 15 microns and by maintaining the heat transfer rate between the cast austenitic stainless steel solidifying on the above casting surfaces at more than 15MW/m^2 during the initial 20 ms - thereby avoiding "deleterious segregation and surface cracking".

7. *Advantageous effects of the claimed subject-matter*

As convincingly brought forward by the appellant the **combination** of features laid down in claims 1 and 7 - which are so narrowly related that they can be dealt with in the following simultaneously - are an initial heat transfer rate which safeguards the steel's solidification in the gamma-phase thereby excluding

"deleterious segregation and surface cracking" as set out in claims 1 and 7 **automatically**. This "feature" of claims 1 and 7 does not render their teachings unclear since it is nothing else than the description of what is **achieved automatically** when applying the prescribed parameters, namely steel chemistry, surface roughness and heat transfer rate in the initial 20 ms as claimed. The objection under Article 84 EPC raised by the respondent is therefore not justified.

8. *Inventive step*

The subject-matter of claims 1 and 7 being novel the assessment of inventive step with respect to (D0), (D1) and (D2) leads to the following findings:

- 8.1 The Board is convinced that claims 1 and 7 are based on a **combination** of features all suited and necessary to contribute to the problem to be solved according to above remark 5, namely to safeguard such a rapid solidification of the chosen steel quality that it happens in the **gamma**-phase instead of the **delta**-phase as derivable from (D1), see for instance its claim 1. As can be seen from Figures 7/9 of EP-B1-0 679 114 the steel chemistry - claimed range (Cr/Ni) eq being less than 1.60 - any "wrong" steel chemistry is less effective with respect to heat flux than the "right" steel chemistry, in Figure 7 being 1.559. As is readily derivable from Figure 9 of the patent specification the tendency of a crocodile skin is a function of steel chemistry again proving the importance of the claimed limit for the ratio of (Cr/Ni) eq less than 1.60.

8.2 The further parameter of the claimed combination of features is the roughness of the casting surface/pair of rolls which **in combination** with the claimed range of steel qualities achieves the above favourable effects with respect to segregation i.e. crocodile skin and surface cracking.

It has to be admitted that (D2) and its page 31, left column and right column, first paragraph, in combination with Figure 13 disclose that the interrelationship between "roll roughness" and "heat extraction" was **partly** known without, however, focussing this interrelationship to the claimed **low range** of roughness, namely only between 2.5 and 15 microns, and on the claimed **steel qualities** - as exemplified above having a severe influence on heat exchange rate and the formation of a crocodile skin.

8.3 Without knowing the claimed invention (D2) has to be seen as **a study** being very broad with respect to its steel qualities ranging from Fe-Si-alloys to carbon steel grades and to stainless steel grades, see column 2 of its page 30, again not focussing on the claimed steel qualities not to speak of the **interaction** of steel qualities and roughnesses and of heat exchange rates with respect to avoiding "deleterious segregation and surface cracking", as according to claims 1 and 7.

8.4 Contrary to the problems to be solved by the claimed invention (D1) relates to the aspects of how roping and gloss unevenness can be mastered without, however, restricting to the **as cast** phase of the solidified stainless steel since (D1) extensively deals with post treatment steps such as cooling, hot and cold rolling,

annealing... Under these circumstances (D1) is not pointing to the claimed solution of the problem to be solved by the invention since (D1) moreover is silent about the parameter of roughness being one of the crucial features of claim 1 with respect to achieving a gamma- instead of a delta-phase solidification of the steel. (D1) **not addressing roughness** its disclosure with respect to steel chemistry - being partly as claimed and partly outside thereof - **without knowing the claimed invention** cannot render obvious the subject-matter of claims 1 and 7 even if considered in combination with (D2).

8.5 Summarising the above considerations a skilled person confronted with the problem of how cracking and the formation of surface defects could be avoided when casting specific grades of stainless steel, the prior art (D1) and (D2) is not helpful to achieve the claimed invention according to claims 1 and 7, Articles 56 and 100(a) EPC, so that these claims are valid as is true for dependent claims 2 to 6 and 8 to 11 which relate to preferred embodiments of the invention.

8.6 Respondent's findings to the contrary are clearly the result of an *ex post facto* analysis, see the hint to routine tests for optimizing known parameters - not encouraged by (D1) and (D2). It is accepted by the board that (D2) is not irrelevant for assessing the inventive merit of claims 1 and 7 simply because it is based on laboratory equipment. (D2) was, however, not helpful for a skilled person to solve the above problems of the invention since the **combination** of steel chemistry, roughnesses and heat transfer rates as in claims 1 and 7 was not derivable from (D2) even if

(D1) was simultaneously considered. Also not convincing is respondent's further argument that there existed a big demand for stainless steel grades since the skilled person was thereby not pushed to consider the above **combination of parameters**.

8.7 Contrary to respondent's findings is it irrelevant that the patent specification is silent about the roughnesses below 2.5 microns since it is sufficient for a patentee to consider the interesting ranges of parameters. The appellant clearly has set out the advantageous effects of the claimed subject-matter so that it is inappropriate to demand from the patent specification (and the appellant) to assess the **individual influence** of any claimed parameter expressly.

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 on the basis of the following documents:
 - claims 1 to 11 as filed during the oral proceedings;

 - description page 2 as filed during the oral proceedings, pages 3 to 6 as granted;

 - Figures 1 to 9 as granted.

The Registrar:

The Chairman:

A. Counillon

C. T. Wilson