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D E C I S I O N
of 10 October 2000

Case Number: T 0275/98 - 3.2.3
Application Number: 91902761.5
Publication Number: 0463182
IPC: B22D 11/06, C21D 8/02, B21B 3/02,
C21D 9/46

Language of the proceedings: EN

Title of invention:

Method of manufacturing Cr-Ni stainless steel sheet excellent
in surface quality and material thereof

Patentee:

NIPPON STEEL CORPORATION

Opponents:

I: MEFOS Stiftelsen för metallurgisk forskning
II: DAVY DISTINGTON Limited
III: USINOR SACILOR S.A.

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - (yes) after amendment"

Decisions cited:

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Catchword:

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Case Number: T 0275/98 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 10 October 2000

Appellant:
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 26 November 1997,
posted on 19 January 1998, revoking European
patent No. 0 463 182 pursuant to Article 102(1)
EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I. European patent No. 0 463 182 was granted on 12 July 1995 with five claims.

II. The independent claims as granted read as follows:

"1. A process for manufacturing a thin strip or sheet of a Cr-Ni-base stainless steel having an excellent surface quality and material quality, which comprises casting a cast strip having a thickness of 6 mm or less from a Cr-Ni-base stainless steel represented by 18%Cr-8%Ni steel by a continuous casting wherein a casting mold is moved synchronously with the cast strip, and subjecting the cast strip to cold rolling to form a thin sheet product, characterized in that the cast strip immediately after the casting is coiled at a temperature of 800 to 1200°C and subjected to cold rolling and final annealing to form a thin sheet product."

"4. A process for manufacturing a thin strip or sheet of a Cr-Ni-base stainless steel, which comprises casting a cast strip having a thickness of 6 mm or less from a Cr-Ni-base stainless steel represented by 18%Cr-8%Ni steel and subjecting the cast strip to cold rolling to form a thin sheet product, characterized in that a molten steel comprising said Cr-Ni-base stainless steel is regulated to have a δ -Fe cal(%) of 0 to 10%, said δ -Fe cal(%) being defined by the equation δ -Fe cal(%) = $3(\text{Cr} + 1.5\text{Si} + \text{Mo} + \text{Nb} + \text{Ti}) - 2.8(\text{Ni} + 0.5\text{Mn} + 0.5\text{Cu}) - 84(\text{C} + \text{N}) - 19.8(\%)$, and is cast in an atmosphere mainly composed of nitrogen or helium

to form a thin cast strip, held at a temperature in the range of 800 to 1250°C for 80 min or less, and subjected to cold rolling and final annealing."

III. With the decision of 19 January 1998 the opposition division revoked European patent No. 0 463 182 for reasons of Articles 56 and 100(a) EPC since it came to the conclusion that granted claims 1 and 4 and amended claim 4 - "mainly" of granted claim 4 being deleted and "80 min or less" being changed into "3 to 80 min" - did not define inventive subject-matter in the light of

(D3) Transaction ISIJ, vol. 28, (1988), pp. 23 to 27 and

(D5) R. S. Carbonara: "Process Control in Direct Casting, (5 pages)" Proc. Int. Symp. on Casting of Net Shape Products, Nov. 13-17, 1988, Honolulu, The Metallurgical Soc., Inc.

IV. Against the above decision to revoke European patent No. 0 463 182 the proprietor - appellant in the following - lodged an appeal on 25 February 1998 paying the appeal fee on the same day and filing the statement of grounds of appeal on 6 April 1998. He argued that the subject-matter of granted claims 1 and 4 and of amended claim 4 is novel and inventive.

V. From opponents I to III only opponents I and III - respondents I and III in the following - have been active in the appeal proceedings; respondents I and III came to the result that the claimed subject-matter is not inventive in the light of (D3), (D5) and of

- (D1) 4th International Conference Continuous Casting Preprints 2, Brussels 1988, Yoshida Ch., et al, "Development of Twin-Roll Strip Caster and Metallurgical Aspects of Stainless Steel", pp. 716-727;
- (D2) Transactions ISIJ, vol. 27, (1987), pp. 919-927;
- (D20) The Effect of Cooling Rate and Heat Treatment on the Delta-Ferrite contents of Cast Austenitic Stainless Steels, British Foundryman, 1980-11, vol. 73, No. 11, pp. 324-329;
- (D21) Rapport IRSID, RE 88313, April 1988, Mise au point de nouvelles procédures de bobinage au train à bandes, édité à l'attention de la Commission des Communautés Européennes, Rapport final, contents (FR-EN-GE); pp. 1-3, 24-30, 88-98, 149-150; and
- (D24) EP-A-0124684.

VI. Following the board's communication pursuant to Article 11(2) RPBA oral proceedings were held on 10 October 2000 in which respondents I and II were not present so that the proceedings were carried out without them according to Rule 71(2) EPC. The arguments brought forward by the appellant and respondent III essentially can be summarized as follows:

(a) appellant

- nearest prior art with respect to granted claims 1 and 4 is (D3); its annealing step does not serve the same purpose as claimed, namely to enhance the metal's elongation and to avoid surface defects in the form of "roping";

- it is observed that annealing according to (D3) has to be seen as heating up of a product, holding a temperature and finally cooling the product; in contrast to this teaching the claimed invention is based on immediately coiling a hot sheet after the casting step;
- in (D1) a solution treatment is disclosed without, however, mentioning the heating temperature, holding time and the effect to be achieved; it is moreover not derivable from (D1) that the coiling is carried out "immediately" after the casting step;
- from (D2) it is not clear when coiling is carried out and at which temperature; again the aspects of elongation and roping are not dealt with;
- (D21) mentions coiling of a cast strip; what should be of specific interest in (D21) for a skilled person was not set out by respondent III;
- summarizing, the aspects of elongation and roping are not dealt with in any of the documents (D3), (D1), (D2) and (D21) so that no incentive can be seen by the Board that would lead the skilled person - not only could lead - to combine the teachings of (D3), (D1), (D2) and (D21) to arrive at the subject-matter of granted claim 1;
- granted claim 1 is silent about the contents of MnS, delta and gamma ferrite since these parameters are useful for the background theory of the subject-matter of granted claim 1 but are not necessary for the definition of its teaching since the crucial features for achieving the target of the invention are clearly set out in this claim;

- with respect to claim 4 as granted or as amended it is observed that its crucial features are the control of delta-ferrite, casting in an atmosphere of nitrogen or helium and coiling in a specific temperature and time range;
- the surprising effects of this problem solution can be seen from Figures 4 and 5 of the patent specification, namely the ranges in which elongation and roping can be achieved as wished;
- the claimed atmosphere is not to be seen as a simple protecting atmosphere rather has an influence on the metallurgical result;
- neither (D3), (D5), (D20) nor (D24) address the problems of elongation and roping as in EP-B1-0 463 182 so that a skilled person would not be led to the teaching of granted or amended claim 4 even if these documents were seen in combination;
- the protective gasses mentioned in (D5) or in (D24) such as argon, neon, xenon, krypton and mixtures thereof do not achieve the wished for result with respect to elongation and roping but rather are used to avoid contamination of the melt i.e. address another problem to be solved.

(b) respondent III

- from (D3) annealing is known, see page 26 right column, second paragraph; it is moreover known therefrom that the delta ferrite can be decreased *inter alia* by annealing;

- from (D21) and from (D2) it is known to coil a cast sheet so that all features of granted claim 1 were known to a skilled person;
- the content of MnS and the reduction of delta ferrite do not form part of granted claim 1; it is observed that the results of the heat treatment could be foreseen and are not surprising;
- with respect to granted or amended claim 4 it is observed that it is not clear whether or not the sheet is directly coiled after the casting step or whether the sheet has to be coiled after a cooling step;
- with respect to amended claim 4 it is observed, see Figures 4 and 5 of the patent specification, that its parameters can lead to results which are defective in view of elongation and roping; it follows therefrom that the problem is not solved with all parameters comprised by amended claim 4;
- nitrogen for instance known from (D21) does not cause problems in combination with stainless steel due to lack of carbon; which atmosphere is chosen is therefore a normal consideration for the skilled person and not to be seen as an inventive endeavour of a skilled person;
- summarizing, claims 1 and 4 as granted or amended do not define inventive subject-matter.

VII. The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (main request), or auxiliarily on the basis of claims 1 to 3 and 5 as granted with claim 4 as filed in the oral proceedings of 26 November 1997 or further

auxiliarily on the basis of claims 1 to 3 as granted with a description to be adapted, (such, claims 1 to 3, description pages 3 to 8 and page 12, and Figures 1 and 2, being submitted during the oral proceedings).

VIII. The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

Novelty

2. Novelty of the subject-matter of granted claim 1 and of claim 4 as granted or amended not being disputed by the respondents or the board it is not necessary to deal with this issue in detail.

Inventive step

Main request

3. The crucial claim of the main request is (granted) claim 4 and the issue whether or not its subject-matter is based on an inventive step.

3.1 Starting point of the invention according to claim 4 is (D3) from which document it is known to cast a thin strip or sheet of a Cr-Ni-base stainless steel which strip or sheet is thereafter annealed at 1100°C/60s, cold rolled and final annealed at 1050°C, see Table 3 at page 27. Using the formula of claim 4, Table 2 of (D3) leads to a delta-Fe cal(%) of 9,35 i.e. within the range laid down in claim 4 as granted.

- 3.2 What is different from (D3) is the protective atmosphere of claim 4 but not the temperature and time of heat treatment, namely "800 to 1250°C" and "80 min or less", since the above parameters of (D3) fall within the claimed ranges of temperature and time.
- 3.3 Using an atmosphere "mainly composed of ..." according to the characterizing clause of claim 4 does not even exclude air. The prior art e.g. (D5), see paragraph headed "Melting and Molten Metal Flow" first paragraph, deals with **nitrogen** as cover gas or see (D24), claim 7, where **nitrogen** and **helium** or a mixture thereof are dealt with - makes it clear that use of a cover gas is mandatory so that it must be followed that, if these known cover gasses were used, the same reactions would take place in (D3) as in granted claim 4, namely that the microstructure of the stainless steel is converted into fine gamma ferrite grains being a synonym for good elongation values and for avoiding roping as required by the problem laid down in EP-B1-0 463 182, see page 4, lines 14/15.
- 3.5 It is true that granted claim 4 does not exclude cooling after casting even if the term "held at a temperature in the range of ..." is considered since the wording of claim 4 as granted does not exclude cooling down the cast strip to room temperature, reheating it and then "holding at a temperature in the range of ...".
- 3.6 Summarizing the above considerations the board comes to the conclusion that the subject-matter of granted claim 4 is rendered obvious by a combination of (D3) with (D5) or (D24). Granted claim 4 is therefore not valid for reasons of Articles 56 and 100(a) EPC.

- 3.7 Since one not valid claim makes the whole request to maintain a patent unallowable, the main request has to be rejected.

First auxiliary request

4. This request differs from the main request in that claim 4 was slightly amended by prescribing an atmosphere being composed (completely) of nitrogen or helium and a temperature range of 800 to 1250°C and a time range of 3 to 80 min.
5. Since this claim 4 was convincingly dealt with in the impugned decision and the board fully shares these considerations it should be emphasized that the steps (a) and (b) of claim 4 not disclosed in (D3), namely the "casting atmosphere being nitrogen or helium" and by maintaining the cast steel strip at a temperature of 800 to 1250°C for 3 to 80 min to improve elongation and surface quality, are rendered obvious by the combination of (D3) and (D5), see impugned decision, remark 4 on pages 7 to 10 and remark 5 on page 11 thereof.
6. With respect to the arguments of the parties brought forward in the oral proceedings before the board it is agreed that from claim 4 it is not clear whether the cast strip is directly coiled or not. This feature has a direct influence on the heat treatment; it is again observed that "annealing" is different from "holding a specific temperature", see above remark 3.5, where it is set out that holding is not contradictory to a three-step annealing. Respondent III pointed to Figures 4 and 5 of EP-B1-0 463 182 and derived that combined with the parameters of claim 4 ranges are claimed in which the wished elongation and roping values are not achieved. These findings are correct with respect to claim 4 itself and its interpretation

in the light of above Figures 4 and 5; however, by simultaneously relying on the patent specification's description a skilled person could be in a position to combine holding time/holding temperature such that good results with respect to elongation and roping are achieved. An objection under Article 100(b) EPC appears therefore not justified (and was not expressly set out by respondent III).

7. In full agreement with the impugned decision with respect to amended claim 4 the board also comes to the conclusion that its subject-matter is obvious, Articles 56 and 100(a) EPC, so that the first auxiliary request is also to be rejected.

Second auxiliary request

8. The only independent claim of this request is claim 1 as granted. As can be seen from the impugned decision this claim has not been dealt with by the opposition division. Rather, it stated in the minutes of the oral proceedings of 26 November 1997, see page 2, third paragraph, that claim 1 as granted comprises an inventive step. The board shares these findings for the following reasons:
 - 8.1 Applying the problem-solution-approach leads to the result that (D3) is the starting point of the invention and that the problem to be solved is as outlined in EP-B1-0 463 182, page 4, lines 14/15.
 - 8.2 Its solution according to granted claim 1 is achieved by coiling the cast sheet **immediately** after the casting at a temperature of 800 to 1200°C.

8.3 (D3) does not solve the problem of the invention since the crucial feature of claim 1 is not realized in (D3), namely coiling immediately after casting the sheet. In this context it is justified to consider a substantial difference between the claimed and known heat treatment since "annealing" as in (D3), see Table 3, is based on heating up a product from room temperature and holding at that temperature whereas according to granted claim 1 **no heating up** is necessary.

8.4 This substantial difference in the heat treatment step is the reason why the advantageous effects achieved by the teaching of claim 1, namely good elongation values and reduction of roping, cannot be achieved in (D3). Consequently (D3) does not address the problem to be solved by the invention and cannot lead a skilled person confronted with it to the features laid down in claim 1.

8.5 The further prior art documents (D1), (D2) and (D21) even seen in combination with (D3) also do not lead a skilled person to the teaching of claim 1.

(D1) and (D2) do not address the problem set out in the patent specification, namely considering the aspects of elongation and roping when producing a sheet of stainless steel. Any incentive for combining (D1/D2) with (D3) can therefore not be seen since the crucial question to be answered in this respect is not what a skilled person could have done; rather it has to be decided what he would have done when starting from (D3).

8.6 In detail, (D1) deals with casting and coiling a sheet of stainless steel, see Figure 1 and pages 719, last paragraph and page 720, first paragraph, without, however, mentioning the coiling temperature, holding

time and the effects to be achieved. (D2) does not specify when coiling is carried out and at which temperature so that the crucial features of claim 1 are missing.

8.7 According to the "Zusammenfassung" first paragraph of (D21) coiling temperatures of about 700 to 550°C are mentioned, see also pages 1 "le bobinage à haute température" and 28, remark 4 ("à 730°C") and Figures 24 to 31; these temperatures being, however, outside the claimed range. Again a skilled person not knowing the teaching of claim 1 is not directly led to the combination of features according to granted claim 1 and an incentive to consider (D21) in combination with (D3) cannot be seen. Without an inadmissible *ex post facto* analysis therefore the prior art cannot render obvious the claimed invention according to granted claim 1.

8.8 It has moreover to be accepted that claim 1 has not to be restricted to specific contents of MnS, delta and gamma ferrite since its teaching is clear and completely solves the problem indicated in the patent specification. The appellant can moreover not be bound by a background theory which is based on the above contents. Rather, it is sufficient to set out in an independent claim the indispensable features for achieving the wished results with respect to elongation and roping of the produced sheet of stainless steel.

8.9 Summarizing the above considerations, the board comes to the conclusion that granted claim 1 defines novel and inventive subject-matter so that this claim is valid.

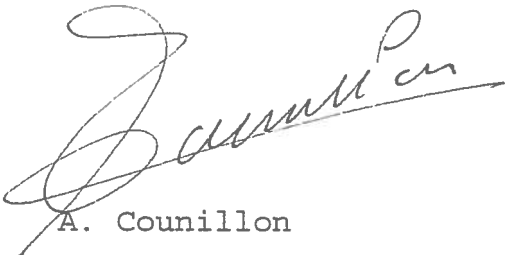
8.10 Granted claims 2 and 3 as dependent claims concerning further embodiments of the invention are likewise valid. Since the appellant submitted revised documents during the oral proceedings which comply with the requirements of the EPC there is a basis for maintaining the patent in amended form according to the second auxiliary request.

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 with the documents submitted during the oral proceedings.

The Registrar:



A. Counillon

The Chairman:



C. T. Wilson

JPS.