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Datasheet for the decision of 5 August 2014

Case Number: T 0100/12 - 3.2.08

Application Number: 99973310.8

Publication Number: 1052302

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Language of the proceedings: EN

Title of invention:
HIGH STRENGTH COLD ROLLED STEEL PLATE AND METHOD FOR PRODUCING THE SAME

Patent Proprietor:
JFE Steel Corporation

Opponent:
ThyssenKrupp Steel Europe AG

Headword:

Relevant legal provisions:
EPC Art. 100(a), 54, 56
RPBA Art. 12(4)

Keyword:
Novelty - selection invention (yes)
Inventive step - (yes)
Late submitted material - document admitted (yes)

Decisions cited:

Catchword:

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Case Number: T 0100/12 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 5 August 2014

Appellant: (Opponent)	ThyssenKrupp Steel Europe AG Kaiser-Wilhelm-Strasse 100 47166 Duisburg (DE)
Representative:	Simons, Johannes COHAUSZ & FLORACK Patent- und Rechtsanwälte Partnerschaftsgesellschaft Bleichstrasse 14 40211 Düsseldorf (DE)
Respondent: (Patent Proprietor)	JFE Steel Corporation 2-3, Uchisaiwai-cho 2-chome Chiyoda-ku Tokyo, 100-0011 (JP)
Representative:	HOFFMANN EITLE Patent- und Rechtsanwälte Arabellastrasse 4 81925 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 8 November 2011 concerning maintenance of the European Patent No. 1052302 in amended form.**

Composition of the Board:

Chairman	T. Kriner
Members:	C. Herberhold
	I. Beckedorf

Summary of Facts and Submissions

I. By its decision posted on 8 November 2011 the opposition division decided that European patent No. EP-B-1 052 302 in amended form according to the main request then on file and the invention to which it related met the requirements of the EPC.

II. The appellant (opponent) lodged an appeal against that decision in the prescribed form and within the prescribed time limit.

III. Oral proceedings before the board of appeal were held on 5 August 2014.

At the end of the oral proceedings the requests of the parties were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed.

IV. The independent claims as maintained by the opposition division read as follows:

Claim 1:
"A high strength cold rolled steel sheet consisting of 0.0040 to 0.010% C, 0.05% or less Si, 0.10 to 1.20% Mn, 0.01 to 0.05% P, 0.02% or less S, 0.01 to 0.1% sol.Al, 0.004% or less N, 0.003% or less O, 0.01 to 0.20% Nb, 0.005 to 0.02% Ti, optionally further containing 0.002% or less B, by weight, balance Fe and unavoidable impurities; and satisfying the formulae (2), (3), (4), and (5);

$10.8 \geq 5.49 \times \log[YP] - r$ (2)

$11.0 \leq r + 50.0 \times n$ (3)

$2.9 \leq r + 5.00 \times n$ (4)

$-0.46 - 0.83 \times \log[C] \leq (Nb \times 12)/(C \times 93) + (Ti^* \times 12)/(C \times 48) \leq -0.88 - 1.66 \times \log[C]$ (5)

where YP denotes the yield strength (MPa), r denotes the r value, and n denotes the n value (1 to 5% strain), Ti* = Ti-(48/14) x N-(48/32) x S, Ti* = 0 when Ti* is not more than 0, and C, S, N, Nb, and Ti denote the content (% by weight) of C, S, N, Nb, and Ti, respectively."

Claim 2:
"A method for manufacturing a high strength cold rolled steel sheet, comprising the steps of: preparing a continuous casting slab of a steel which consists of 0.0040 to 0.010% C, 0.05% or less Si, 0.10 to 1.20% Mn, 0.01 to 0.05% P, 0.02% or less S, 0.01 to 0.1% sol.Al, 0.004% or less N, 0.003% or less O, 0.01 to 0.20% Nb, 0.005 to 0.02% Ti, by weight, balance Fe and unavoidable impurities, and which satisfies the formula (5); preparing a hot rolled steel sheet by finish rolling the slab at temperatures of Ar3 transformation temperature or more; coiling the hot rolled steel sheet at temperatures not less than 540°C; and cold rolling the coiled hot rolled steel sheet at reduction ratios of from 50 to 85%, followed by continuously annealing thereof at temperatures from 680 to 880°C;

$-0.46 - 0.83 \times \log[C] \leq (Nb \times 12)/(C \times 93) + (Ti^* \times 12)/(C \times 48) \leq -0.88 - 1.66 \times \log[C]$ (5)

where Ti* = Ti - (48/14) x N - (48/32) x S, Ti* = 0 when Ti* is not more than 0, and C, S, N, Nb, and Ti denote the content (% by weight) of C, S, N, Nb, and Ti, respectively."

V. The following documents played a role for the present decision:

D2: Boucek, A. J. et al., "Processing and Properties of ULC Stabilized Steels", Mechanical Working and Steel Processing Proceedings, 1989, pages 533-546;

D4: Krauss et al., "PROCESSING AND PROPERTIES OF INTERSTITIAL-FREE STEELS" in Interstitial free steel sheet: Fabrication and properties, 1991, pages 1-14.

VI. The essential arguments of the appellant can be summarised as follows:

Document D4

During the opposition proceedings the relevance of D2 had been put into doubt because it did not relate to surface strain resistance and its influence on the waving effect. In order to counter said objection, the appellant had now provided D4, which discussed the effect of residual carbon reduction on surface quality, in particular in the field of vehicle construction. The filing of document D4 was thus in reaction to the course of the proceedings before the opposition division, and the document should be taken into account by the board.

Novelty

Document D2 disclosed several ultra-low carbon stabilised steel varieties which had been produced by the company LTV. In particular, variety Cb/Ti-MS - defined in Table II of the document - showed a composition overlapping with the one claimed in claim 1 of the amended patent. Furthermore, Table IX gave a summary of the average tensile property data for the steels produced by LTV within the last year, which included Cb/Ti marginally stabilised steels such as the Cb/Ti-MS steel of Table II. The parameters disclosed in Table IX for yield strength, r – and n-value of marginally stabilised Cb/Ti steels fulfilled the criteria defined in equations (2), (3) and (4) of claim 1.

Although claim 1 admittedly defined a narrow sub-selection having a particular technical effect, the selection could not qualify as novel because the person skilled in the art would seriously contemplate working in the range of overlap: D2, Table I C) and the corresponding passage on page 534, left column, taught the skilled person the stoichiometric proportions in which the elements Ti and Nb had to be provided - depending on the N and S content - in order to fully bind the carbon. Nothing more was expressed in the middle portion of formula (5), with an upper limit being imposed by cost considerations and a lower limit being necessary in view of variations during alloy production. Thus, the teaching of D2 directly led the skilled person to an alloy composition for Cb/Ti-MS steel fulfilling the criteria of formula (5). In this context, corrected Tables 2-5, submitted on 7 July 2014, showed that several examples of the Cb/Ti-MS steel variety existed which had the composition defined in claim 1 and fulfilled the criteria defined in formula (5).

Consequently, the subject-matter of claim 1 as amended was not new over prior art D2.

Inventive step

As shown above, the person skilled in the art would seriously contemplate working in the range of overlap. Naturally, the same considerations also made it obvious to provide an ultra-low carbon steel sheet having the claimed composition and fulfilling formulas (2), (3), (4) and (5). In this context D4 provided evidence that reduction of residual carbon by addition of Nb and Ti was known to the skilled person to improve surface strain resistance in the vehicle construction field.

Therefore, claim 1 as maintained by the opposition division did not qualify as inventive.

VII. The essential arguments of the respondent can be summarised as follows:

Document D4

Document D4 had been filed only with the grounds of appeal. As the facts of the case had not changed, the document should have been filed in the first-instance proceedings, and its admissibility was therefore at the discretion of the board. Although convincing evidence had been provided with respect to the publication date, the document was less relevant than D2, it did not refer to surface stress reduction, and the only example in the grounds of appeal taking elemental concentration values from the ranges disclosed in D4 was wrongly calculated and did not fulfil the criteria of formula (5). Furthermore, the appellant had not given any reasons justifying the late filing of the document. The

document should thus not be admitted in accordance with Article 12(4) RPBA.

Novelty

As already conceded by the appellant, the selection in claim 1 as maintained by the opposition division was narrow as well as purposive. There was also no example disclosed which fell within the claimed ranges. In particular, with respect to corrected Tables 2 to 5 provided by the appellant with submission dated 7 July 2014, there was either a titanium content above the claimed range, or the requirement of formula (5) was not fulfilled. Moreover, contrary to the appellant's assertion, it was impossible to derive even the middle part of formula (5) from the D2 disclosure. In fact, calculation of Ti* according to claim 1 as maintained required knowledge of the sulphur content, on which D2 was entirely silent. Consequently, the teaching of D2 could not give the skilled person any hint to work within the range of overlap.
With all three criteria for a novel sub-range being fulfilled, and with the person skilled in the art not seriously contemplating working in the range of overlap, the subject-matter of claim 1 as maintained by the opposition division was novel.

Inventive step

It had been shown above that the criteria of formula (5) could not be derived from prior art D2. This evaluation was not changed by the disclosure of document D4. Contrary to the appellant's assertion, D4 had nothing to do with resistance to surface strain - i.e. with the problem the patent intends to solve - but addressed strain ageing. Furthermore, the favourable

low waving properties of the inventive sheet were not only caused by free carbon being bound by titanium and niobium, but resulted from balancing all constituents. Thus, even if the titanium and niobium contents could be derived from the prior art so as to reduce residual carbon, there was no teaching about the further constituents.

Consequently, the subject-matter of claim 1 as maintained by the opposition division was inventive.

Reasons for the Decision

1. The appeal is admissible.

2. Document D4

Document D4 was submitted for the first time with the statement of grounds of appeal. Because the subject-matter of independent claim 1 as maintained by the opposition division is - apart from a reduction in the range of the Ti content - identical to independent claim 2 as granted, the document could have been presented in the first-instance proceedings. Consequently, in accordance with Article 12(4) RPBA it is within the power of the board to admit the document into the proceedings or not.

The document discloses a cold-rolled steel sheet having a composition at least partially overlapping with the one claimed. Its disclosure is thus of *prima facie* relevance. The appellant has convincingly explained that D4 had been filed in response to objections raised in the first-instance proceedings. Indeed, the impugned decision states on page 7, last paragraph, that D2 did

not discuss the surface strain and its influence on the waving effect. The board thus considers the filing of D4 an adequate reaction and sees no reason to hold the document inadmissible.

3. Claim 1, novelty

3.1 D2:

3.1.1 In the following table the ultra-low carbon stabilised steel Cb/Ti-MS disclosed in Table II of D2 is compared with the composition of the steel sheet according to claim 1 as maintained by the opposition division (all values - also in the following - are in wt%):

wt%	Claim 1	D2:Cb/Ti-MS	Overlap
C	0.004-0.01	0-0.005	0.004-0.005
Si	0-0.05		
Mn	0.1-1.2	0.08-0.3	0.1-0.3
P	0.01-0.05	0-0.015	0.01-0.015
S	0-0.02		
Sol. Al	0.01-0.1		
N	0-0.004	0-0.006	0-0.004
O	0-0.003		
Nb	0.01-0.2	0.015-0.025	0.015-0.025
Ti	0.005-0.02	0.01-0.03	0.01-0.02
B	0-0.002		
Fe	Bal.	Bal.	

In addition to the restriction in elemental concentrations of C, Nb, Ti, N and S imposed by the claim, the criteria of formula (5) apply:

$$-0.46 - 0.83 \times \log[C] \leq (Nb \times 12)/(C \times 93)+(Ti^* \times 12)/(C \times 48) \leq -0.88 - 1.66 \times \log[C] \quad (5)$$

with
Ti* = Ti-(48/14) x N-(48/32) x S, Ti* = 0 when Ti* is not more than 0.

As can be seen from the above table, the claimed composition partly overlaps with the disclosure for steel Cb/Ti-MS. It therefore has to be examined whether the claimed method satisfies the three criteria for a "novel selection", i.e. (i) the overlap must be small; (ii) the examples disclosed in the prior art must be sufficiently far removed from the claimed range; (iii) the selection is not arbitrary, as e.g. inferable from a technical effect obtained by the selected range. Also, it has to be examined whether the skilled person taking into account the technical disclosure of document D2 would seriously contemplate working in the range of overlap.

3.1.2 The fulfilment of criteria (i) and (iii) has not been contested by the appellant, nor does the board see any reason to do so for the following reasons:
Ad (i): A rough scan through concentrations of C, Nb, Ti and N (for S=0) within the range of overlap (see the row "Overlap") reveals that formula (5) is fulfilled in less than 10% of cases. This restriction applies in addition to the restriction imposed by the claimed ranges, including e.g. a restriction of 20% for C. The board is thus satisfied that claim 1 defines a narrow selection.

Ad (iii): In view of the effect of the criteria defined in formula (5) on the waving height difference as demonstrated in Figure 2 of the patent, the board is also satisfied that the selection is not arbitrary.

The board notes that steel variety CB/Ti/P-MS (see Table II of D2) also partially overlaps with the claimed ranges. However, with respect to P there is only a one-point overlap, the selection being thus clearly narrow. All further arguments discussed with respect to steel variety Cb/Ti-MS apply *mutatis mutandis*.

With respect to criterion (ii) it is emphasised that said criterion concerns specific examples disclosed in the prior-art document and not "examples" of values freely chosen by the appellant from the ranges disclosed in the prior art.

None of the further varieties/specific examples disclosed in D2 falls within the definition of claim 1. The steels in Table III have a titanium content above the claimed range, those disclosed in Table VII have either insufficient phosphorus (rows 1 and 3), insufficient carbon (rows 2 and 3) or insufficient Ti (row 4). Last but not least, the further steel varieties disclosed in Table II either have too much Ti (first two rows) or not enough Ti (last row).

Consequently, the three criteria for novelty of a selection invention are fulfilled.

The board points out that even if the "examples" provided by the appellant in corrected Tables 2 to 5 were to be taken into account, none would fulfil all requirements of claim 1. In Tables 2a (Ti content: 0.025%), 2b (Ti content: 0.029%), 4 (Ti content: 0.028%), and 5 (Ti content: 0.023%), the Ti content was chosen above the upper limit claimed (0.02%). The same is true of the last two rows of Table 3 (Ti content: 0.025 and 0.03% respectively). For the first three rows

of Table 3, the Ti content is within the claimed range, but the criteria of formula (5) are not fulfilled (indicated as "falsch" in the Tables).

3.1.3 The board also cannot follow the argument that the formula in Table I, C) of D2 would directly lead the skilled person to alloy compositions fulfilling the requirements of claim 1 as maintained. Firstly, as correctly pointed out by the respondents, there is no information about the S content. Even the appellant appears to be in doubt which S content to use, applying a content of 0.008-0.020% in the opposition proceedings (see the decision, page 5, third paragraph) versus a sulphur content of 0 in the calculations in corrected Tables 2-5 submitted in the appeal proceedings.

Secondly, even if one accepted that the middle part of formula (5) could be derived from D2, Table I C), there is no information as to which upper and lower limits to apply. As shown in Figure 2 of the patent in suit, these limits have been deduced from experimental results and show a logarithmic dependency with respect to the C content. The appellant has not shown how application of the formula in Table I C) of D2 would lead to a sub-range falling within the narrow limits of formula (5). Indeed - even by freely choosing values within the parameter ranges disclosed in D2 - the appellant was not able to provide a single example fulfilling all criteria of claim 1.

Thus, the appellant's argument that the person skilled in the art would seriously contemplate working in the range of overlap cannot be followed.

3.2 D4:

During the oral proceedings before the board, the appellant did not rely on D4 as novelty-destroying.

For the sake of completeness, the board notes that the novelty attack based on D4 in the written procedure is not convincing for the following reasons:

3.2.1 Firstly, the Ti content claimed is already reduced to 10% of the range disclosed in D4, the criteria of formula (5) applying in addition. The selection thus qualifies as narrow. Secondly, D4 does not disclose any specific example. Thirdly, the data shown in Figure 2 of the patent in suit indicate that the selection is not arbitrary. Consequently, the three criteria for a novel selection are fulfilled.

3.2.2 There is also no hint in D4 which would prompt the skilled person to work in the range of overlap. The single "example" given in the grounds of appeal which allegedly falls within the scope of claim 1 cannot prove that the skilled person would have worked within the range of overlap. This is all the more so as the particular example given does not fulfil the left inequation of formula (5). As correctly pointed out by the respondent, the lower limit ("links") is 1,45 contrary to the 1,429 given on page 6 of the grounds of appeal, formula (5) thus not being fulfilled.

4. Claim 1, inventive step

Document D2 represents the most relevant prior art. It discloses a high-strength cold-rolled steel sheet having a composition overlapping with the one claimed (see the Table provided in point 3.1.1 above). The subject-matter of claim 1 differs from that prior art teaching mainly in the criteria of formula (5) being

fulfilled. The technical effect of the requirements defined in formula (5) is a reduced waving height difference as evidenced by the data shown in Figure 2 of the patent in suit, solving the problem of improving resistance to surface strain (see paragraph [0005] of the patent in suit). Even if D4 were accepted as teaching the skilled person to reduce the residual carbon in order to improve resistance to surface strain - although reduction of strain ageing is in fact not equivalent to strain reduction - this information could give no indication towards working within the specific logarithmically C dependent narrow limits defined in formula (5). In fact, the teaching would point rather towards fully stabilised steel grades (Cb/Ti-FS, see Table II of D2).

As discussed in point 3.1.3, the teaching in D2 - which does not even address surface strain - also cannot teach the skilled person to work within the narrow range of overlap.

Consequently, the subject-matter defined in claim 1 as maintained by the opposition division is inventive.

5. Claim 2:

Independent claim 2 defines a method of manufacturing a high-strength cold-rolled steel sheet having all the properties of the sheet defined in claim 1. With the steel sheet *per se* being novel and inventive, so is the method for its manufacture.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare T. Kriner

Decision electronically authenticated