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Datasheet for the decision of 22 February 2021

Case Number: T 1118/18 - 3.3.05

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Language of the proceedings: EN

Title of invention:
HIGH-STRENGTH METAL SHEET FOR USE IN CANS, AND MANUFACTURING METHOD THEREFOR

Patent Proprietor:
JFE Steel Corporation

Opponents:
ThyssenKrupp Rasselstein GmbH
Tata Steel Nederland Technology BV

Headword:
Metal sheet for cans/JFE

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - Main request and first auxiliary request (no) - second auxiliary request (yes)

Decisions cited:

Catchword:

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Beschwerdekammern

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Case Number: T 1118/18 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 22 February 2021

Appellant: (Opponent 1)	ThyssenKrupp Rasselstein GmbH Koblenzer Strasse 141 56626 Andernach (DE)
Representative:	Gehrsitz, Stefan Charrier Rapp & Liebau Patentanwälte PartG mbB Fuggerstrasse 20 86150 Augsburg (DE)
Appellant: (Opponent 2)	Tata Steel Nederland Technology BV Wenckebachstraat 1 1951 JZ Velsen-Noord (NL)
Representative:	Group Intellectual Property Services c/o Tata Steel Nederland Technology B.V. P.O. Box 10000 - 3G.37 1970 CA IJmuiden (NL)
Respondent: (Patent Proprietor)	JFE Steel Corporation 2-3, Uchisaiwai-cho 2-chome Chiyoda-ku Tokyo, 100-0011 (JP)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 29 March 2018 rejecting the opposition filed against European patent No. 2253729 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	E. Bendl
Members:	J. Roider
	O. Loizou

Summary of Facts and Submissions

I. The appeals of opponent 1 (appellant 1) and opponent 2 (appellant 2) lie from the opposition division's decision to reject the oppositions.

II. The following documents already cited in the decision under appeal are of relevance here:

D2 EP 1 741 800 A1
D3 EP 1 006 203 A1
D5 EP 2 050 834 A1

III. In the communication dated 17 December 2020, the board expressed the preliminary opinion that the main request and the first auxiliary request did not meet the requirement of Article 56 EPC, whereas the then-second auxiliary request appeared to meet the requirements of the EPC.

IV. The main request corresponds to the patent as granted. Claim 1 of the main request reads as follows:

Claim 1:

"A high-strength steel sheet for a can comprising, on a mass percent basis, 0.03%-0.10% C, 0.01%-0.5% Si, 0.001%-0.100% P, 0.001%-0.005% S, 0.01%-0.10% Al, 0.005%-0.012% N, the balance being Fe and incidental impurities, and microstructures that do not contain a pearlite microstructure, wherein when Mnf = Mn [% by mass] - 1.71 x S [% by mass], Mnf is in the range of 0.3 to 0.6."

V. With respect to the presence of an inventive step starting from D3, the arguments of appellant 1 can be summarised as follows:

Document D3, in particular table 1, example 12, was considered to form the most relevant state of the art. The subject-matter of claim 1 differed therefrom by a lower sulfur content. The problem the patent was intended to solve by the lower sulfur content was to prevent edge cracks. A comparison of examples 2 and 14 of the patent in suit, showed that the subject-matter of claim 1 did not solve the problem, since both examples fell within the definition of the subject-matter of claim 1, but, unlike example 2, example 14 showed slab cracking.
D3, para. [0089] disclosed that sulfur causes edge cracks because of the precipitation of (Fe,Mn)S in the γ grain boundaries (para. [0092]). The extent of the reduction in sulfur content was limited only by economic considerations. This limit, according to D3, para. [0093], was 0.001 wt% sulfur, thus coinciding with the lower limit of the range given in the patent in suit.

VI. With respect to the presence of an inventive step starting from D3, the arguments of the patent proprietor (respondent) can be summarised as follows:

D3, para. [0092] suggested that an excessive sulfur content caused supersaturation of the dissolved sulfur. Only then could edge cracks occur. However, by limiting the sulfur content to 0.02%, the upper limit indicated in D3, edge cracks could be further reduced. Thus, even if the problem underlying the appealed patent was not considered solved, D3 did not suggest reducing the sulfur content to the claimed range.

Moreover, D3 related to (Fe,Mn)S precipitates and not to MnS precipitates, which were fundamentally different.
Moreover, example 14 of the patent in suit represented merely correlation and not causation. The occurrence of edge cracks could be further reduced by avoiding the temperature range between 800°C and 900°C, although this did not mean that the effect observed due to the reduction in sulfur content was absent. It followed that the problem should not be considered merely as providing an alternative alloy, but rather as providing an alloy having fewer defects.
Moreover, in view of D3, para. [0089], the skilled person would not add any Mn since Mn was only needed to bind S to prevent edge cracks. If edge cracks were already avoided due to the low sulfur content, there was no reason to add manganese at all.

VII. Auxiliary request I was filed with the reply to the grounds of appeal. Claim 1 of auxiliary request I reads as follows (markup with respect to claim 1 of the patent in suit):

Claim 1:
"A high-strength steel sheet for a can ~~comprising~~ consisting of, on a mass percent basis, 0.03%-0.10% C, 0.01%-0.5% Si, 0.001%-0.100% P, 0.001%-0.005% S, 0.01%-0.01% Al, 0.005%-0.012% N, Mn such that Mnf is in the range of 0.3 to 0.6 ~~the balance being Fe and incidental impurities, and microstructures that do not contain a pearlite microstructure~~, wherein ~~when~~ Mnf = Mn [% by mass] - 1.71 x S [% by mass], and the balance being Fe and incidental impurities, and microstructures that do not contain a pearlite microstructure ~~Mnf is in the range of 0.3 to 0.6.~~"

VIII. The submissions relating to Article 56 EPC in relation to D3 were the same as for the main request.

IX. Auxiliary request II was filed during the oral proceedings of the appeal procedure. The claims of auxiliary request II are as follows (markup with respect to auxiliary request I):

Claim 1:

"A high-strength steel sheet for a can consisting of, on a mass percent basis, 0.03%-0.10% C, 0.01%-0.5% Si, 0.001%-0.100% P, 0.001%-0.005% S, 0.01%-0.04~~0.10~~% Al, 0.005%-0.012% N, Mn such that Mnf is in the range of 0.3 to 0.6, wherein Mnf = Mn [% by mass] - 1.71 x S [% by mass], and the balance being Fe and incidental impurities, and microstructures that do not contain a pearlite microstructure."

Claim 2 is dependent on claim 1. The subject-matter of claim 3 is directed to a method for manufacturing the high-strength steel sheet according to either of claims 1 or 2.

X. Lack of inventive step was the only objection raised by appellant 1 with regard to auxiliary request II. Its arguments can be summarised as follows:

According to para. [0011] of the patent in suit, the problem to be solved was to provide a steel with a yield strength of 450 MPa or more which was free from cracking at a slab corner in a continuous casting process and had low production costs.
The subject-matter of claim 1 differed from the closest prior art (D3, table 1, ex. 12) in the content of sulfur and aluminium.

With respect to the sulfur content, reference was made to the arguments relating to the main request.
With respect to the aluminium content, D3, para. [0095] disclosed that aluminium was required for deoxidation, but excessive addition was economically undesirable. Moreover, aluminium fixed nitrogen such that soft steel qualities were obtained. To produce hard steel qualities according to the patent in suit, the skilled person would have limited the addition of aluminium to avoid fixing nitrogen, and would instead have used other deoxidation agents such as those mentioned in para. [0096]. Of the elements mentioned in that list, the skilled person would have preferred silicon, as it was already contained in example 12 of D3.

XI. Appellant 2, which did not attend the oral proceedings before the board, commented in writing on the patentability of the patent as granted but not of auxiliary request II.

However, it raised objections as to lack of novelty and presence of an inventive step with respect to the combination of claims 1 and 2 as granted, which corresponds to claim 1 of auxiliary request II. Moreover, it raised objections as to sufficiency of disclosure with respect to claims 4 and 5 as granted, which correspond to claims 2 and 3 of auxiliary request II.

As to sufficiency of disclosure, appellant 2 took the view that there were many interpretations of yield strength but the patent did not disclose the conditions under which the tensile tests had been performed. It was therefore impossible reliably to determine the value of the yield strength as disclosed in the patent. Since the yield strength was a critical parameter in

granted claims 4 and 5, and hence claims 2 and 3 of auxiliary request II, the requirements of Article 83 were not met.

Appellant 2 moreover took the view that the granted claim 2 furthermore lacked novelty over comparative example 2 of D2. It argued that the content of sulfur of 0.01% disclosed in this example should, following the EPC Guidelines G-IV 8.1, be seen as ranging from 0.005% to 0.014%, thus covering the upper range of the sulfur content of 0.005%. Since an analogous objection applied to the aluminium content, the granted claim 2 lacked novelty.

It additionally concluded that the granted claim 2 also lacked novelty over D5. Example 10 of D5 disclosed the claimed range of silicon and manganese when the above-mentioned rounding rules were again applied. Since moreover the lower limit of the aluminium content of 0.02% was disclosed in the general description and the aluminium content in examples 1 to 16 ranged from 0.024% to 0.095%, this anticipated the ranges of claim 2 as granted.

Based on document D5, appellant 2 in its grounds of appeal also challenged the presence of an inventive step of claim 2 as granted.

It argued that the general disclosure of D5 showed a significant overlap with the claimed range of the manganese content. Since sulfur caused red brittleness and because it was known that two parts of Mn could bind around one part of sulfur, the technical effect of free manganese was known from D5.

The examples in D5 showed that the skilled person would seriously have contemplated working in the overlapping range.

Moreover, D5 disclosed limiting the amount of aluminium to avoid AlN formation. Again, in view of the examples, the skilled person would have worked in the overlapping range.

XII. The arguments of the patent proprietor (respondent) can be summarised as follows:

The requirements of Articles 83 and 54 EPC were met. Concerning inventive step with respect to the sulfur content, reference was made to the arguments relating to the main request.

With respect to the aluminium content, D3 did not mention AlN anywhere in the description. Moreover, the effects disclosed in D3 with respect to Al were unrelated to edge cracks. However, the patent in suit disclosed that AlN was also responsible for edge cracks and it also showed this finding in the example. Therefore the problem stated in the patent did not need to be reformulated.

XIII. Appellants 1 and 2 (opponents 1 and 2) requested that the decision under appeal be set aside and the patent be revoked in its entirety.

XIV. The respondent (patent proprietor) requested that the appeals be dismissed (main request), or in the alternative that the patent be maintained in amended form on the basis of the set of claims of one of auxiliary requests I to III, auxiliary requests I and

III having been filed with its reply to the appeal and auxiliary request II during the oral proceedings.

Reasons for the Decision

1. Main Request, Novelty, Article 54 EPC, Claim 1

In the written proceedings, appellant 1 had raised an objection as to lack of novelty in view of D3, example 12. However, in the course of discussion during the oral proceedings appellant 1 had conceded that the difference between example 12 of D3 and claim 1 at issue was to be seen in the sulfur content.

Appellant 2 had not raised any novelty attack on the basis of D3 in the written proceedings.

The board too shares the view that novelty of the subject-matter of claim 1 vis-à-vis D3 exists.

2. Main Request, Inventive Step, Article 56 EPC, Claim 1

2.1 The patent relates to a steel sheet for a can with reduced thickness and to a method for manufacturing the steel sheet.

2.2 Document D3 relates to a steel sheet for a can which is extremely thin and to a method for manufacturing the steel sheet (para. [0001]), and thus is a reasonable starting point for assessing the presence of an inventive step of the patent in suit.

2.3 According to document D3, the carbon content for the alloy used in example 12 is 0.035 wt%. According to

table 5, the annealing temperature is 660-690°C, which is well below Ar1. The pearlite-free microstructure is hence implicit. The subject-matter of claim 1 thus differs from document D3, example 12 by its sulfur content.

2.4 The problem to be solved according to the patent is to prevent cracking of the steel slabs during deformation in a continuous casting machine (patent, para. [0009]).

2.5 Cracking occurs along the Fe grain boundaries due to the presence of MnS precipitates (patent, para. [0013]). The solution proposed in claim 1 of the patent is to reduce the sulfur content to a range of 0.001% to 0.005% (patent, claim 1 and paras. [0014] and [0022]). The effect of this difference is to prevent precipitation of MnS at the grain boundaries.

2.6 By comparing examples 2 and 14 of the patent in suit, it can be concluded that the subject-matter of claim 1 does not solve the problem over the entire scope claimed. Indeed, both examples fall within the definition of the subject-matter of claim 1 but, unlike example 2, example 14 shows slab cracking.

2.7 Thus the problem must be reformulated less ambitiously, as providing an alternative steel sheet.

2.8 During oral proceedings, the proprietor's representative argued that normally only some samples would show edge cracks, and it was merely a coincidence that a non-working sample was documented.

This assertion has not been proved. Additionally, by casting doubt on the validity of it being marked as a comparative example, the marking of all other examples,

including those which were marked as an example of the invention, would have to be questioned too.

2.9 The question to assess is thus whether the skilled person would have an incentive from D3 to work within the claimed range.

2.10 Document D3 discloses in para. [0092] that sulfur causes precipitation of (Fe,Mn)S at the grain boundaries, which causes edge cracks. It is thus proposed (para. [0092]) to limit the sulfur to 0.05 wt%, preferably to 0.02 wt% or less, but not to below 0.001 wt% (para. [0093]) because of cost considerations.

D3 thus discloses that sulfur causes edge cracks of the steel strips, and proposes limiting the sulfur content. The skilled person consequently receives the teaching of avoiding edge cracks by reducing the sulfur content. Whether or not there is agreement between D3 and the patent in suit that edge cracks are caused by MnS or by (Fe,Mn)S precipitates is not relevant.

2.11 According to D3, paras. [0092]-[0093], both the susceptibility to edge cracks and the cost remain within acceptable limits for a steel with a sulfur content within the range of 0.001 wt% to 0.02 wt%.

2.12 Starting from D3, in view of the less-ambitious problem, the skilled person would hence consider reducing the sulfur content to the claimed range, in particular to 0.001 wt%.

2.13 No teaching requiring further changes to the alloy when reducing the sulfur content, as alleged by the respondent, could be found. Nor is it plausible that

the skilled person would reduce the manganese content to zero when reducing the sulfur content. In these types of steels, manganese is an essential alloying component, as it provides solution strengthening. It is noted that D3, example 12 contains 24 times as much manganese as sulfur. In view of this proportion, it is not convincing that the skilled person would consider changing the manganese content at all.

2.14 Therefore the subject-matter of claim 1 of the main request does not involve an inventive step (Article 56 EPC).

3. Auxiliary Request I, Inventive Step, Article 56 EPC

The subject-matter of claim 1 of auxiliary request I contains only amendments in reaction to the objections under Article 83 EPC. However, no further restriction relevant to the assessment of inventive step was made to the subject-matter of claim 1.

Therefore the subject-matter of claim 1 does not involve an inventive step, for the same reasons as the subject-matter of claim 1 of the main request.

4. Auxiliary Request II, Admissibility, Article 13(2) RPBA

4.1 Auxiliary request II, filed during oral proceedings in an attempt to overcome a discrepancy in the claims, is almost identical to auxiliary request II, submitted with the reply to the grounds of appeal. The only difference is the deletion of former claim 3 and the resultant amendment of the back-reference.

4.2 The amendments were the result of an issue which only became apparent during the oral proceedings. Appellant 1 did not raise any objection with regard to submitting an amended auxiliary request II, and the amendment solved the outstanding issue immediately without creating any new issues whatsoever.

Thus the board finds that exceptional circumstances within the meaning of Article 13(2) RPBA 2020 were credibly demonstrated by the respondent.

5. Auxiliary Request II, Sufficiency of disclosure, Article 83 EPC

Claims 4 and 5 as granted correspond to claims 2 and 3 of auxiliary request II.

Appellant 2 did not raise any objections with regard to auxiliary request II, but argued that the yield strength of the steel according to claim 4 as granted and therefore also the method according to granted claim 5 for producing that steel was crucial, but unclear to such an extent that the invention could not be reproduced.

Measuring the yield strength of steel is a routine task for the skilled person. Even if different measurement protocols yield different results, there is no indication that such differences go beyond a mere lack of clarity of the scope of the invention.

Thus no proof has been submitted to convincingly show that the steels according to claim 4 and the method according to claim 5 as granted cannot be reproduced by the skilled person.

6. Auxiliary Request II, Novelty, Article 54 EPC

Again, appellant 2 did not raise any objections with regard to auxiliary request II, but raised a novelty objection based on the combination of claims 1 and 2 as granted, which corresponds to claim 1 of auxiliary request II.

6.1 Appellant 2's interpretation that the S content of comparative example 2 of D2 of 0.01% should be read, due to the rounding rules, as a range of from 0.005 to 0.014%, with the consequence that the value mentioned in claim 1 of 0.005% would be anticipated, is purely speculative. Even if the board accepted this reasoning, which it does not, there would not be any clear teaching as to whether the upper or the lower limit was anticipated in example 2. Therefore no clear and unambiguous novelty-destroying disclosure is contained in D2.

6.2 Applying the same logic, Appellant 2 considered that also the examples of D5 would take away novelty of the claimed subject-matter. However, the same reasoning as above applies, *mutatis mutandis*.

6.3 Thus the subject-matter of claim 1 is novel vis-à-vis the disclosures of D2 and D5.

7. Auxiliary Request II, Inventive Step, Article 56 EPC

The subject-matter of claim 1 of auxiliary request II is based on auxiliary request I, additionally including the subject-matter of claim 2 as granted, thus restricting the content of aluminium to a range of 0.01 wt% - 0.04 wt% (as opposed to 0.01 wt% - 0.10 wt%

in claim 1 as granted). It follows that example 14 of the patent in suit is no longer covered by the subject-matter of claim 1.

7.1 Document D3 is still considered to form the closest prior art for the same reasons as for the main request.

7.1.1 The subject-matter of claim 1 differs from D3, example 12 in its sulfur and aluminium contents.

7.1.2 For both the sulfur and aluminium contents, the problem to be solved according to the patent is to prevent steel slab cracking during deformation in a continuous casting machine (patent, para. [0009]) while at the same time providing a high-strength steel sheet (patent, para. [0014]).

7.1.3 It was shown that cracking occurs along the Fe grain boundaries due to the presence of AlN and MnS precipitates (patent, para. [0013]). Since no disclosure to the contrary could be found, the effect provided by a reduction of sulfur and aluminium is considered additive.

7.1.4 The solution proposed in the patent is to reduce the aluminium content to a range of 0.01% to 0.04% (patent, paras. [0014] and [0023]) while maintaining the level of silicon and manganese within the defined ranges. The board has no doubt that the proposed solution solves the problem as stated in the patent.

7.1.5 Therefore reformulation of the problem of preventing edge cracking to the different, more generic, problem as suggested by appellant 1 is not indicated.

7.1.6 It remains to be assessed whether or not selection of this range involves an inventive step.

7.1.7 D3 does not mention AlN and its detrimental effect on slab edge cracking, nor does any other cited document. The skilled person would thus, in view of the above-mentioned problem, have no motivation to reduce the aluminium content of the alloy in D3, example 12.

7.1.8 Even if the problem were the provision of an alternative, the subject-matter of claim 1 would not be apparent to the skilled person.

As acknowledged by appellant 1, aluminium provides the steel with deoxidation, which is essential for producing high quality steels. The skilled person would hence have to compensate for the significant reduction in aluminium, e.g. by adding another element which provides the same effect. D3 discloses at least Ti, Ca and Si for that purpose (para. [0096]). Therefore the skilled person would have to make multiple choices, which are to reduce the amount of aluminium and sulfur to the claimed ranges while maintaining the claimed Mn/S ratio and to select silicon from among the above-mentioned elements. It is moreover not apparent that the use of silicon in the claimed range as a deoxidation agent would be preferred over the use of aluminium, titanium or calcium.

7.1.9 For these reasons, the subject-matter of claim 1 of auxiliary request II involves an inventive step within the meaning of Article 56 EPC.

7.2 In the written procedure, appellant 2 also challenged the presence of an inventive step starting from D5. This document relates to a steel sheet for a can (para.

[0001]) of thin and hard material (para. [0009]) and a method for manufacturing the steel sheet (para. [0001]).

7.2.1 Appellant 2 is of the opinion that the content of free manganese and silicon is disclosed in D5. The board could however not find any disclosure of the content of these elements which might anticipate the claimed range.

The alleged interpretation of ranges by broadening upon application of rounding rules cannot be accepted for the reasons set out above.

7.2.2 The subject-matter of claim 1 of auxiliary request II thus differs from D5, example 10 in
(1) the claimed aluminium content, which is within the range of 0.01 wt% - 0.04 wt%, whereas D5, example 10 discloses 0.095 wt%,
(2) the claimed free manganese content Mnf, which is within the range of 0.3 wt% - 0.6 wt%, whereas D5, example 10 discloses 0.27 wt%, and
(3) the claimed silicon content, which is within the range of 0.01 wt% - 0.5 wt%, whereas D5, example 10 discloses 0.008 wt%.

7.2.3 As a consequence, even when considering that D3 and D5 deal with the same problems, D5 distinguishes from the claimed subject-matter in more features than D3. Consequently, D3 is the closest prior art and the reasoning as set out above applies.

7.3 Dependent claim 2 and method claim 3 make reference to the subject-matter of claim 1 and thus include all the features thereof. Therefore claims 2 and 3 are novel

(Article 54(1) and (2) EPC) and involve an inventive step (Article 56 EPC) too.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of the claims of auxiliary request II as filed during oral proceedings and a description to be adapted thereto.

The Registrar: The Chairman:

C. Vodz E. Bendl

Decision electronically authenticated