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Datasheet for the decision of 2 February 2022

Case Number: T 0205/20 - 3.3.05

Application Number: 12731180.1

Publication Number: 2714947

IPC: C21D1/20, C21D8/02, C21D9/52

Language of the proceedings: EN

Title of invention:
BAINITIC STEEL OF HIGH STRENGTH AND HIGH ELONGATION AND METHOD TO MANUFACTURE SAID BAINITIC STEEL

Patent Proprietor:
Tata Steel Limited

Opponent:
ArcelorMittal

Headword:
Bainite steel/Tata Steel Ltd

Relevant legal provisions:
EPC Art. 54, 56
RPBA 2020 Art. 13(2)

Keyword:
Novelty - (yes)
Inventive step - (yes)
Amendment after summons - taken into account (no)

Decisions cited:
T 0013/84, T 0039/93, T 1422/12

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 0205/20 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 2 February 2022

Appellant: (Patent Proprietor)	Tata Steel Limited Research and Development and Scientific Division Jamshedpur 831 001 (IN)
Representative:	J A Kemp LLP 80 Turnmill Street London EC1M 5QU (GB)
Appellant: (Opponent)	ArcelorMittal 24-26, Boulevard d'Avranches 1160 Luxembourg (LU)
Representative:	Lavoix 2, place d'Estienne d'Orves 75441 Paris Cedex 09 (FR)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 3 December 2019 concerning maintenance of the European Patent No. 2714947 in amended form.**

Composition of the Board:

Chairman	P. Guntz
Members:	S. Besselmann
	G. Glod

Summary of Facts and Submissions

I. The appeals in this case, by the patent proprietor (appellant) and the opponent (appellant), lie from the opposition division's interlocutory decision that European patent No. 2 714 947 B1 in the form of auxiliary request 5 of 10 September 2019 met the requirements of the EPC.

The patent in suit concerns a bainitic steel of high strength and high elongation and a method for manufacturing it.

II. The decision under appeal referred to the following documents, *inter alia*:

D3 EP 2 559 783 B1 (6 July 2016), international publication date 8 December 2011

D4 EP 2 310 545 B1 (23 October 2013), international publication date 4 February 2010

D8 S. Das, S. Kundu and A. Haldar "Development of continuously cooled high strength bainitic steel through microstructural engineering at Tata steel", Materials Science Forum Vols. pp. 702-703 (2012) 939, online since 6 December 2011

III. With its statement of grounds of appeal, the patent proprietor maintained as its main request that the opposition be rejected. It filed nine auxiliary requests, which were the same as filed before the opposition division. In its opinion, the opposition division's decision to admit, *inter alia*, D8 should be overturned. When replying to the opponent's appeal, the patent proprietor replaced auxiliary request 9 with auxiliary requests 9 to 11, auxiliary request 11 being

the same as auxiliary request 9 filed with the statement of grounds of appeal. In reply to the board's preliminary opinion, it made further submissions on 23 December 2021, including a declaration by one of the inventors:

D14 Declaration of Dr Sourav Das, 23 December 2021

During the oral proceedings before the board, the patent proprietor withdrew its main request and auxiliary requests 1 to 7 and made auxiliary request 8 its main request.

IV. The appellant (opponent) maintained its objections of lack of novelty and lack of inventive step against the final main request. With its statement of grounds of appeal, it submitted Figure D8a, which is an overlay of Figure 5 of D8 and Figure 9 of the patent in suit.

V. The independent claims of the final main request, filed as auxiliary request 8 with the statement of grounds of appeal, relate to a bainite steel (claim 1) and a method for manufacturing a bainite steel (claim 6) and read as follows:

"*1. Bainite steel consisting of the following elements in weight%:*

C: 0.30-0.40
Si: 1.2-1.7
Mn: 1.6-2.1
Cr: 0.9-1.2
Ti: 0.0-0.07
Cu: 0.0-1.2
V: 0.0-0.5
Nb: 0.0-0.06
Al: 0.0-0.2

N: <0.004
P: <0.025
S: <0.025

the balance being iron and unavoidable impurities, wherein the bainite is carbide-free and with a microstructure with bainite plates with a thickness of less than 100 nm, and the steel has a microstructure with 15-30% of retained austenite."

"*6. Method for manufacturing a bainite steel consisting of the following elements in weight%:*

C: 0.30-0.40
Si: 1.2-1.7
Mn: 1.6-2.1
Cr: 0.9-1.2
Ti: 0.0-0.07
Cu: 0.0-1.2
V: 0.0-0.5
Nb: 0.0-0.06
Al: 0.0-0.2
N: <0.004
P: <0.025
S: <0.025

the balance being iron and unavoidable impurities, by heat treating the steel to form bainite steel comprising the steps of:

- *hot rolling a cast slab into strip wherein the final hot rolling temperature is at least 850° C,*
- *rapidly cooling the strip to a temperature above the bainite start temperature, in the range of 400 - 550° C,*
- *coiling the strip at a temperature above the bainite start temperature, in the range of 350 - 500° C,*

- *cooling the coiled strip by natural cooling to ambient temperature,*

wherein the bainite is carbide-free and with a microstructure with bainite plates with a thickness of less than 100 nm, and the steel has a microstructure with 15-30% of retained austenite."

Dependent claims 2 to 5 and 7 to 8 relate to particular embodiments.

VI. The patent proprietor's arguments, where relevant to the present decision, can be summarised as follows.

The opposition division should not have admitted D8 into the proceedings. The conclusion that D8 was *prima facie* relevant to the then main request was incorrect. The opposition division should have assessed the reasons for the late filing and whether it could have been filed earlier. It was incorrect to assume that the contents of D8 would not be surprising to the patent proprietor given that in fact the document was not known to its representative.

Moreover, D8 did not take away novelty and inventive step; it did not specify any individual steel, and the examples of D8 could not be reworked. The steel according to the current claims had an improved (lower) YS/UTS ratio compared to D8. The YS/UTS ratio was a measure of a material's ability to undergo plastic deformation before rupture. As held by the opposition division, there was nothing in the prior art that would motivate the skilled person to provide a steel having a composition according to claim 1 in the expectation of providing an improved YS/UTS ratio.

The method steps of claim 6 were deliberately chosen to steer the method towards a particular microstructure and were not an obvious modification of D8.

VII. The opponent's arguments, where relevant to the present decision, can be summarised as follows.

D8 was correctly admitted by the opposition division and formed part of the proceedings.

D8 was relevant to novelty. The skilled person carrying out the teaching of D8 would naturally work in the area around the midpoints of the ranges of Table 1, and thus within the scope of the claim at issue. Moreover, the steels prepared in the examples of D8 were the same as two of the examples of the patent in suit, the corresponding figures (Figures 3b, 4 and 5 of D8) being identical to those in the patent (Figures 7 left part, 8 and 9). This could also be taken from D8a. These examples were within the scope of the claim, so that the skilled person reproducing them would inevitably have been working within the scope of the claim. D8 furthermore referred to a modelling program which allowed calculating the TTT diagram of a steel composition. The TTT diagram and the Bs and Ms temperatures were known from D8, so this information allowed identifying the corresponding composition of the steel by means of computer simulation.

D8 alternatively rendered obvious the claimed steel. No technical effect was obtained. The examples in the patent in suit and D8 were unsuitable to support a technical effect because no individual results were available. The application as originally filed did not deal with lowering the YS/UTS ratio meaning that this could not be regarded as the objective technical

problem. The YS/UTS ratio was not a relevant parameter and reflected neither the ductility nor the work hardening. The calculated difference of this ratio compared to D8 was insignificant. D14, the admissibility of which was no longer contested, showed that this ratio was not lowered across the whole scope of the claim.

It would have been obvious for the skilled person to decrease the yield strength by decreasing the content of Si, Mn and Cr, if this were desired. This was well known and described in D3 (paragraphs [0021], [0022] and [0033]).

The patent proprietor's new arguments with respect to claim 6 should not be considered in view of Article 13(2) RPBA 2020. If they were taken into consideration, objections under Articles 84, 123(2) and 123(3) EPC against claim 6 would have to be addressed.

VIII. The patent proprietor (appellant) requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request, filed as auxiliary request 8 with its statement of grounds of appeal or, alternatively, based on auxiliary requests 9 to 11 filed with the reply to the opponent's appeal, auxiliary request 11 being the same as auxiliary request 9 filed with the statement of grounds of appeal.

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

Reasons for the Decision

1. Consideration of D8

1.1 The impugned decision relies on D8 for assessing novelty and inventive step, so D8 forms part of the appeal proceedings under Article 12(2) RPBA 2020.

1.2 Document D8 had been filed on the final date for making written submissions in preparation for the oral proceedings before the opposition division, set in accordance with Rule 116 EPC. Admitting D8 was therefore within the discretion of the opposition division.

1.3 It is settled case law that a board of appeal should only overrule the way in which the opposition division exercised its discretion if the board concludes that the opposition division did so according to the wrong principles, or without taking into account the right principles, or in an unreasonable way (see Case Law of the Boards of Appeal of the EPO, 9th ed. 2019, IV.C. 4.5.2).

1.4 The opposition division must first examine the relevance of the newly filed documents. Late-filed facts and evidence and supporting arguments should only exceptionally be admitted into the proceedings if, *prima facie*, there are reasons to suspect that such late-filed documents prejudice the maintenance of the European patent in suit (see Case Law of the Boards of Appeal of the EPO, 9th edition 2019, IV.C.4.5.1).

This was the case here. The opposition division admitted D8 because it was *prima facie* relevant to the novelty of claim 1 of the granted patent. Whether the *prima facie* assessment is ultimately confirmed in the final decision is irrelevant.

1.5 The opposition division also took into consideration that D8 was authored by the inventors of the patent in suit, concluding that the patent proprietor must have been fully familiar with D8 and that the document's contents could not come as a surprise.

The opposition division thus assessed whether the patent proprietor could be expected to deal with the newly filed document. This is a valid consideration. It is also relevant that D8 was written by the inventors. Even if the document was not known to the patent proprietor's representative, the document and all related information were within the sphere of the patent proprietor, facilitating dealing with the document within the available time (D8 was filed two months before the date of the oral proceedings).

1.6 Moreover, the opposition division had no reason to explore whether there might have been tactical reasons for the late filing since there were no indications nor concrete objections to this effect.

1.7 In conclusion, there is no reason to overturn the opposition division's discretionary decision, and D8 forms part of the proceedings.

2. Novelty

2.1 It was not under debate that the effective date of the application underlying the patent in suit is the filing date. Thus, D8 is prior art under Article 54(2) EPC.

2.2 It needs to be determined what is directly and unambiguously derivable from D8 without the knowledge of the patent.

2.3 D8 relates to the development of continuously cooled high strength bainitic steel. The document does not explicitly mention the specific chemical composition of any individual steel but describes ranges of the content of various components (Table 1). Comparing only these ranges with those specified in the claim shows that the ranges overlap but that multiple selections within Table 1 are necessary to arrive at a composition within the scope of the claim, namely by selecting at least the content of carbon, manganese and chromium.

There is no teaching in D8 instructing the skilled person to work near the midpoints of the ranges in Table 1. The midpoints are not specifically mentioned, and the ranges are not explained as describing a variation around a targeted midpoint. There is no defined area around the midpoints either. Furthermore, the midpoints of the ranges for Mn (2.25 wt%) and Cr (1.5 wt%) do not fall within claim 1 at issue.

The chemical composition specified in claim 1 thus differs from the one defined in Table 1 of D8.

2.4 It had to be assessed whether the teaching of D8 as a whole pointed to a specific or at least a narrower steel composition within Table 1 to determine whether

there was an implicit disclosure of a steel composition within the overlapping area of Table 1 with claim 1 at issue.

2.4.1 D8 describes results relating to the properties and microstructure of specific samples (TEM micrographs, tensile test stress-strain curve, XRD, etc.). However, there is no evidence that these results would have allowed a precise reproduction of the samples to which they relate, along with their chemical compositions, by reverse engineering.

2.4.2 It was argued that some figures (Figures 3b, 4 and 5 of D8) were the same as those in the patent (Figures 7 left part, 8 and 9), meaning that the samples also had to be the same. D8a was filed to prove that the two curves in Figure 5 of D8 were identical to two of the three curves in Figure 9 of the patent in suit.

The patent proprietor contested that the samples or figures in D8 were the same.

The board finds that there is insufficient proof that the samples described in D8 are the same as those in the patent in suit. The figures look the same, but their resolution is low. The actual value of the yield strength specified in D8 (950 MPa; page 942, line 3 below the figures) is outside the range indicated in the patent in suit (864±28 MPa; Table 4). The bainite plate thicknesses also differ (100 to 150 nm according to D8, see page 941, "Results and discussion", line 4 versus less than 100 nm according to the patent in suit, see paragraph [0049]). In this case, directly comparing these values is justified because the authors of D8 and the patent in suit are the same, so these values should have been the same if the samples were

identical. The question whether the parameter is clear as such is irrelevant in that respect.

D8 and the patent in suit do not describe the same experiments, as is clear from a comparison of the casting steps (25 kg heat in an air induction furnace in D8 (page 940, fourth line from the bottom) versus 40 kg heats in a vacuum induction furnace in the patent in suit (paragraph [0046])).

It is therefore concluded that D8 and the patent in suit do not describe identical samples.

2.4.3 D8 additionally shows a calculated TTT diagram for a particular steel grade and discloses the Bs and Ms temperatures. The opponent argued that the skilled person could identify the specific chemical composition of this steel grade using modelling software, namely the "MUCG83 program" (reference 6 of D8). In its opinion, this was facilitated by the fact that this approach could be limited to the compositional ranges of Table 1. The opponent stressed that this exercise could easily be carried out by the skilled person because it was merely a computer simulation that did not require preparing the samples. The opponent furthermore argued that it was generally known how a change in the content of one component influenced the TTT diagram, as could be taken from Figures 2 to 4 in D4 (for instance, the carbon content having a high influence).

However, the opponent did not carry out such a simulation. It is therefore not known what its result would be. Nor is it known which specific (range of) steel composition(s) correspond to the indicated TTT diagram and in particular the indicated values of the

Ms and Bs temperatures. According to D8, "*... a particular chemistry (Table 1) was chosen for final tests. The calculated TTT diagram for this particular grade is shown in Fig. 1.* " (page 940, penultimate paragraph, lines 1 and 2). D8 thus links the TTT diagram to the general ranges in Table 1.

Thus, it has neither been proven that the calculated TTT diagram and the Bs and Ms temperatures provided in D8 make available a chemical composition within the overlapping area as an implicit disclosure of D8.

2.5 In conclusion, there is no evidence that D8 discloses a steel composition falling within claim 1 at issue. The subject-matter of claim 1 is novel (Article 54(1) EPC).

2.6 Claim 6, relating to a method for manufacturing a bainite steel, defines the same chemical composition of the steel and is thus novel for the same reasons.

3. Inventive step

3.1 The patent in suit addresses the technical problem of providing a bainitic steel with an excellent combination of strength (UTS) and ductility (elongation) while avoiding the need to add costly alloying elements (paragraphs [0011] to [0014]).

3.2 D8 relates to developing ultra high strength bainitic steel with outstanding ductility (title, conclusion) and thus addresses the same technical problem. D8 constitutes a suitable starting point for assessing inventive step.

3.3 The problem of providing high strength and good ductility is already solved in D8.

3.4 It is established case law that only the effect actually achieved vis-à-vis the closest prior art should be taken into account for determining the objective technical problem (T 13/84, Headnote, OJ 1986, 253 and T 39/93, OJ 1997, 134, and more recently T 1422/12, Reasons 2.3.2).

3.5 In this case, the examples of the patent in suit demonstrate that the claimed steels have similar strength and ductility but a lower YS/UTS ratio (Table 4) compared to D8.

3.6 The opponent objected that no valid comparison could be made because the results for the individual examples were not known and because no comparative example having a composition outside the scope of the claim was available.

3.7 However, the patent in suit provides average values of the mechanical properties (Table 4, paragraph [0052]). All the samples have very similar mechanical properties as reflected by the low variation of these values, so that additionally specifying the individual results is dispensable here. According to the patent proprietor, the variation indicated for each average value constitutes the span between the lowest and the highest value obtained. On this basis, the YS/UTS ratio (for which no variation is indicated) is at most 0.65.

At the same time, the examples provided in the patent in suit reasonably cover the whole scope of the claim in terms of the contents of the mandatory elements. The content of the optional element phosphorus in two of

the examples lies slightly above the claimed range (0.03 wt% in the examples versus < 0.025 wt% in the claim), but no argument was provided why this would be significant. In addition, the claim is limited to the relevant microstructure.

D8, on the other hand, does not disclose the composition of any individual steel, and it is not known to which specific chemical composition the experimental results relate, if at all they can be linked to a specific (range of) chemical composition(s) (see point 2.4). From the indicated mechanical properties, the YS/UTS ratio can be calculated to be 0.69.

It is therefore concluded that the subject-matter of claim 1 constitutes a purposive selection within the disclosure of D8, this selection being associated with a lower YS/UTS ratio.

Document D14 does not cast doubt on this conclusion because the microstructures of the samples shown in D14 (figure on page 3) are not known, as admitted by both parties, and no precise numerical values of YS and UTS can be taken from it.

3.8 Improving (lowering) the YS/UTS was also the objective technical problem formulated by the opposition division in its decision.

3.9 In this case, relying on the YS/UTS ratio when formulating the objective technical problem is permissible. It is clear from the application as originally filed that this ratio is one of the mechanical properties of interest because it is explicitly mentioned in Table 4. Moreover, the desired

high tensile strength and elongation are additionally obtained, so that the objective technical problem is not reformulated in a way that would contradict the initial purpose of the invention.

The board has no reason to doubt the patent proprietor's explanation that a low value of the YS/UTS ratio was beneficial because it signified the material's ability to undergo plastic deformation prior to rupture. It is not decisive how this ratio is labelled. The opponent's objection that referring to the YS/UTS ratio as "ductility" or "work hardening" was incorrect is therefore irrelevant. There is no evidence either that the difference in comparison to D8 would be technically insignificant.

3.10 As follows from the above, the objective technical problem may be seen in the provision of steels characterised by a low YS/UTS ratio while maintaining high strength and ductility.

This problem is solved by the claimed bainite steel, having the specified chemical composition.

3.11 There is no teaching in the prior art that would have guided the skilled person towards the claimed chemical composition of the steel.

The opponent argued that it was obvious in view of D3 that lowering the content of Si, Mn and Cr decreased the strength and thus the YS/UTS ratio. However, irrespective of what teaching can be taken from D3 and whether this teaching can at all be combined with D8, even working near the lower end of the ranges for Si, Mn and Cr known from D8 would not result in a steel within the scope of claim 1 (the lowest content of Mn

and Cr being below the corresponding range in claim 1 at issue). The relevant ranges disclosed in D3 (Si content of 0.2 to 1.2%, Mn content of 1.0 to 2.0% and Cr content of 0.05 to 0.50%) do not anticipate the ranges in the claim at issue and thus do not lead the skilled person towards the claimed ranges either.

3.12 In conclusion, the subject-matter of claim 1 involves an inventive step (Article 56 EPC).

3.13 Claim 6 relates to a method for manufacturing a bainite steel and contains the identical definition of the steel as claim 1 (same composition, same microstructure). The method thus involves an inventive step for the same reasons as claim 1. It is therefore irrelevant whether the method steps also contribute to novelty and inventive step, and there is no need to consider additional documents cited in relation to these method steps.

3.14 Claims 2 to 5 and 7 to 8 depend on claims 1 and 6, respectively, so the same conclusion applies.

4. Article 13(2) RPBA

4.1 During the oral proceedings before the board, both parties made new submissions.

The patent proprietor aimed to establish further distinguishing features of method claim 6 and their effects.

In reaction to this, the opponent raised objections under Articles 84, 123(2) and 123(3) EPC against claim 6.

4.2 It was undisputed that the indicated submissions were made for the first time. However, the request to which they relate was filed with the statement of grounds of appeal and was the same as filed during opposition proceedings. Neither the patent proprietor nor the opponent indicated exceptional circumstances justifying the late filing of their respective submissions, which were based on new facts.

4.3 These submissions were therefore not taken into account.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of claims 1 to 8 of the main request, submitted as auxiliary request 8 with the statement of grounds of appeal and a description to be adapted.

The Registrar: The Chairman:

C. Vodz P. Guntz

Decision electronically authenticated