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**Datasheet for the decision
of 22 June 2020**

Case Number: T 0633/18 - 3.3.05

Application Number: 11752999.0

Publication Number: 2546375

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C22C38/04, C22C38/06

Language of the proceedings: EN

Title of invention:
HIGH-STRENGTH PRESSED MEMBER AND METHOD FOR PRODUCING SAME

Patent Proprietor:
JFE Steel Corporation

Opponent:
ArcelorMittal

Headword:
High-strength pressed member/JFE

Relevant legal provisions:
EPC Art. 100(a), 100(b), 100(c)

Keyword:

Added subject-matter (no)
Insufficiency of disclosure (no)
Novelty (yes)
Inventive step (yes)

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0633/18 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 22 June 2020

Appellant: ArcelorMittal
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 16 January 2018
rejecting the opposition filed against European
patent No. 2546375 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman E. Bendl
Members: G. Glod
S. Fernández de Córdoba

Summary of Facts and Submissions

- I. The opponent's (appellant's) appeal lies from the opposition division's decision to reject the opposition against the European Patent No. B-2 546 375.

The claims of the patent read as follows:

"1. A high strength press-formed member obtainable by hot press-forming, wherein a steel sheet constituting the member consists of, by mass %,
C: 0.12% to 0.69% (inclusive of 0.12% and 0.69%),
Si: 3.0% or less,
Mn: 0.5% to 3.0% (inclusive of 0.5% and 3.0%),
P: 0.1 % or less,
S: 0.07% or less,
Al: 3.0% or less,
N: 0.010% or less,
Si + Al: at least 0.7%,
optionally at least one type of elements selected from
Cr: 0.05% to 5.0% (inclusive of 0.05% and 5.0%),
V: 0.005% to 1.0% (inclusive of 0.005% and 1.0%),
Mo: 0.005% to 0.5% (inclusive of 0.005% and 0.5%),
Ti: 0.01% to 0.1 % (inclusive of 0.01% and 0.1 %),
Nb: 0.01% to 0.1% (inclusive of 0.01% and 0.1 %),
B: 0.0003% to 0.0050% (inclusive of 0.0003% and 0.0050%),
Ni: 0.05% to 2.0% (inclusive of 0.05% and 2.0%),
Cu: 0.05% to 2.0% (inclusive of 0.05% and 2.0%),
Ca: 0.001% to 0.005% (inclusive of 0.001% and 0.005%),
REM: 0.001% to 0.005% (inclusive of 0.001% and 0.005%),
and as remainder Fe and incidental impurities;
wherein the microstructure of the steel sheet constituting the member includes martensite, retained austenite, and bainite containing bainitic ferrite;

wherein the area ratio of said martensite with respect to the entire microstructure of the steel sheet is in the range of 10% to 85% (inclusive of 10% and 85%), wherein at least 25% of said martensite is tempered martensite; wherein the content of said retained austenite is in the range of 10% to 40% (inclusive of 10% and 40%); wherein the area ratio of said bainitic ferrite in said bainite with respect to the entire microstructure of the steel sheet is at least 5%; wherein the total of area ratios of said martensite, said retained austenite, and said bainitic ferrite in said bainite with respect to the entire microstructure of the steel sheet is at least 65%; and wherein the average carbon concentration in the retained austenite is at least 0.65 mass %."

"2. A method for manufacturing a high strength press-formed member, comprising the steps of:
preparing a steel sheet consisting of, by mass %,
C: 0.12% to 0.69% (inclusive of 0.12% and 0.69%),
Si: 3.0% or less,
Mn: 0.5% to 3.0% (inclusive of 0.5% and 3.0%),
P: 0.1 % or less,
S: 0.07% or less,
Al: 3.0% or less,
N: 0.010% or less,
Si + Al: at least 0.7%,
optionally at least one type of elements selected from
Cr: 0.05% to 5.0% (inclusive of 0.05% and 5.0%),
V: 0.005% to 1.0% (inclusive of 0.005% and 1.0%),
Mo: 0.005% to 0.5% (inclusive of 0.005% and 0.5%),
Ti: 0.01% to 0.1% (inclusive of 0.01% and 0.1%),
Nb: 0.01% to 0.1% (inclusive of 0.01% and 0.1%),
B: 0.0003% to 0.0050% (inclusive of 0.0003% and 0.0050%),
Ni: 0.05% to 2.0% (inclusive of 0.05% and 2.0%),

*Cu: 0.05% to 2.0% (inclusive of 0.05% and 2.0%),
Ca: 0.001% to 0.005% (inclusive of 0.001% and 0.005%),
REM: 0.001% to 0.005% (inclusive of 0.001% and 0.005%),
and as remainder Fe and incidental impurities;
heating the steel sheet to a temperature in the range
of 750°C to 1000°C (inclusive of 750°C and 1000°C) and
retaining the steel sheet in that state for 5 seconds
to 1000 seconds (inclusive of 5 seconds and 1000
seconds); subjecting the steel sheet to hot press-
forming at a temperature in the range of 350°C to 900°C
(inclusive of 350°C and 900°C); cooling the steel sheet
to a temperature in the range of 50°C to 350°C
(inclusive of 50°C and 350°C); heating the steel sheet
to a temperature in a temperature region ranging from
350°C to 490°C (inclusive of 350°C and 490°C); and
retaining the steel sheet at a temperature in the
temperature region for a period ranging from 5 seconds
to 1000 seconds (inclusive of 5 seconds and 1000
seconds)."*

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

A1: WO 2009/099079 A1

A1': EP 2 267 176 A1 (English family member of A1; used
when referring to A1 hereinafter)

A2: WO 2007/034063 A1

A3: T. Altan; Stamping Journal; December 2006,
pages 40 and 41; www.Stampingjournal.com

A5: EP 2 325 346 A1

III. In its communication pursuant to Article 15(1) RPBA,
the board was of the preliminary opinion that the
appeal would likely be dismissed.

IV. Since the appellant subsequently withdrew its request for oral proceedings, the already scheduled oral proceedings were cancelled.

V. The appellant's arguments relevant to the decision can be summarised as follows.

The invention was not sufficiently disclosed since the heating and cooling rates were not mentioned in the patent. Figure 1 did not allow deducing the cooling rate. It was also not indicated that the heating rate had to be restricted to a given range to suppress coarsening of the crystal grains. The use of a cooling rate during hot forming, which was unusual and lower than the cooling rate generally used in hot forming and used to achieve martensitic transformation, was not taught in the patent.

The subject-matter of claim 1 extended beyond the content of the application as filed. The range of 10%-40% for the retained austenite was at the most disclosed in paragraph [0026] with respect to a steel sheet in the application as filed but not with respect to a press-formed member constituted by a steel sheet. Paragraphs [0020] to [0032] of the application as filed did not teach that the microstructure was the microstructure of the press-formed member.

A1 anticipated the novelty of the subject-matter of claim 1. The average carbon concentration in the retained austenite of Examples 5 and 8 of A1 was inevitably at least 0.65%. A5, which provided evidence of the state of the art, proved that the hot press deformation did not have any influence on the carbon content in austenite.

Should claim 1 be novel in view of A1, claim 1 would in any case not provide any technical effect as compared to A1. The subject-matter of claim 2 lacked an inventive step in view of A1 or A1 in combination with A2 or A3. A1 disclosed all the features of claim 2, except for the feature that the steel sheet is subjected to hot press-forming at a temperature in the range of 350°C to 900°C. The tensile strength and elongation were comparable to those of the patent. There was no technical effect linked to this difference, so the subject-matter was an obvious alternative. If claim 2 were considered to provide a technical effect compared to A1, this technical effect would only exist if the hot press-forming step were performed to produce a press-formed member not constituted by a sheet but by a part shaped to the final geometry for the part. The technical problem was to provide a method for reliably manufacturing a formed member of the desired shape. A2 and A3 both addressed this problem and taught the claimed solution.

- VI. The respondent's (patent proprietor's) relevant arguments are reflected in the reasoning provided below.

- VII. The appellant requests that the impugned decision be set aside and that the patent be revoked.

The respondent requests that the appeal be dismissed, alternatively, that the patent be maintained in amended form on the basis of one of auxiliary requests 1 to 3 submitted with the reply to the statement of grounds of appeal.

Reasons for the Decision

Main request (patent as granted)

1. Article 100(c) EPC
 - 1.1 The appellant is of the opinion that the range of 10% to 40% for the retained austenite is not directly and unambiguously derivable from the application as filed. The board does not concur with this position for the following reasons.
 - 1.2 Claim 1 of the application as filed discloses that the content of retained austenite that is part of the steel sheet constituting the member is in the range of 5% to 40%. This range is reflected in paragraph [0023] of the application as filed and discussed in the context of a TRIP effect. The range is further explained in paragraph [0026]. In this paragraph, the lower end point of 10% is also indicated in the context of a more preferred range of 10% to 35%. It is directly and unambiguously derivable that this end point of 10% relates to the content of retained austenite mentioned in claim 1 of the application as filed. Regarding whether the requirement of Article 123(2) EPC is met, it is irrelevant whether the retained austenite is understood as part of the final high-strength press-formed member or as part of the steel sheet that is subsequently press-formed as the skilled person would have immediately recognised that the range given in claim 1 of the application as filed corresponded to the range described in paragraph [0026].
 - 1.3 The ground under Article 100(c) EPC does not prejudice the maintenance of the patent.

2. Article 100(b) EPC

2.1 The appellant is of the opinion that the disclosure is insufficient since the heating and cooling rates are not disclosed.

2.2 The board is not convinced by the appellant's arguments for the following reasons.

It is accepted that the patent does not provide any values for the heating and cooling rates. Paragraphs [0046] and [0047] of the patent in suit provide some information on the temperature range and the retaining time. Thus, the skilled person would have understood that normal heating rates could be applied to arrive at the desired temperature. After hot press-forming, the steel sheet is cooled. Paragraphs [0048] and [0049] provide some information concerning the temperatures and the desired microstructure of the steel after cooling. This means that the skilled person would have adapted the cooling temperature such that a portion of martensite proceeded to martensitic transformation. When reworking the multiple examples in the patent, the skilled person would have started with conventional heating and cooling temperatures and adapted the temperatures as needed to get the required microstructure. There is no evidence on file that the appellant was not able to rework the examples by following this procedure and that the possible adaptation of the heating and/or cooling temperature was excessive.

The reference to A1' on this point is not very helpful since A1' does not disclose a hot press-forming step in the range of 350°C to 900°C.

Therefore, the ground under Article 100(b) EPC does not prejudice the maintenance of the patent either.

3. Article 100(a) EPC in combination with Article 54 EPC
 - 3.1 The appellant is of the opinion that claim 1 lacks novelty with respect to A1'.
 - 3.2 The board understands claim 1 of the main request such that the composition and the microstructure relate to the press-formed member since the steel sheet constitutes the member and the member is press-formed.
 - 3.3 A1' does not disclose press-forming or average carbon concentration in the retained austenite of at least 0.65 mass %.
 - 3.4 The fact that A5 discloses in example 27 a steel sheet that has not been formed by hot pressing and has a similar microstructure as example 20 of the patent in suit does not mean that hot press-forming generally has no influence on the microstructure. At least there is no evidence that this would also apply to the examples of A1'.
 - 3.5 There is also no evidence that the carbon content of the retained austenite is at least 0.65 mass % in examples 5 and 8 of A1'. The appellant's observations filed on this point are based on assumptions in view of similarities between the process of A1' and the patent and on the premise that hot press-forming is irrelevant. Without proof, this does not lead to the conclusion that the steel sheets of these examples inevitably have the required carbon content.

The requirements of Article 54 EPC are fulfilled.

4. Article 100(a) in combination with Article 56 EPC
- 4.1 Claim 1
- 4.1.1 The invention relates to a high-strength press-formed member (paragraph [0001]).
- 4.1.2 A1' is the closest prior art since it relates to high-strength galvanised steel sheets and specifically discloses in examples 5 and 8 plated steel sheets having similar microstructure and tensile properties as the claimed members.
- 4.1.3 The problem to be solved by the invention is to develop a member having high strength and excellent ductility (paragraph [0008]).
- 4.1.4 The problem is solved by a member according to claim 1 characterised in that the member is press-formed and has an average carbon concentration in the retained austenite of at least 0.65 mass%.
- 4.1.5 In view of the examples, it is accepted that the problem is solved, but this problem is also already solved in A1' (see Table 4, examples 5 and 8 of A1').
- 4.1.6 Therefore, the problem is redefined to the appellant's benefit as the provision of an alternative high-strength member.
- 4.1.7 The solution is not obvious for the following reasons.

Even if it were accepted that the carbon concentration in the retained austenite of at least 0.65 mass % was within the teaching of A1', A1' lacks any information that the same high-strength steel would be obtained

when a press-forming step was performed. The combination with A2 or A3 is based on the premise that the press-forming step would not have any effect on the final structure. As indicated above (point 3.4), in view of the lack of evidence, the board is not convinced by this approach.

4.2 Claim 2

A similar argumentation as the one presented for claim 1 applies since the subject-matter of claim 2 includes hot press-forming at a temperature in the range of 350°C to 900°C.

4.3 The requirements of Article 56 EPC are fulfilled.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



A. Voyé

E. Bendl

Decision electronically authenticated