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Datasheet for the decision of 19 October 2021

Case Number: T 2029/19 - 3.3.05

Application Number: 14197428.7

Publication Number: 3006579

IPC: C21D9/56, C22C21/10, C22F1/053

Language of the proceedings: EN

Title of invention:
Method of continuously heat-treating 7000-series aluminium alloy sheet material

Patent Proprietor:
Aleris Aluminum Duffel BVBA

Opponents:
C-TEC CONSTELLIUM TECHNOLOGY CENTER / CONSTELLIUM NEUF-BRISACH
Linde GmbH
Novelis Inc.
Arconic Corporation

Headword:
Heat-treating/Aleris

Relevant legal provisions:
EPC Art. 123(2), 84, 83, 56
EPC R. 80

Keyword:
Amendments - allowable (yes)
Claims - clarity (yes)
Sufficiency of disclosure - (yes)
Inventive step - (yes)
Amendment occasioned by ground for opposition - (yes)

Decisions cited:
T 0116/18, T 0608/07, T 1329/04

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 2029/19 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 19 October 2021

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Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 17 May 2019 concerning maintenance of the European Patent No. 3006579 in amended form.**

Composition of the Board:

Chairwoman	S. Fernández de Córdoba
Members:	G. Glod
	T. Burkhardt

Summary of Facts and Submissions

I. The appeals filed by opponents 1 to 4 lie from the opposition division's decision finding that the amended European patent EP-B1-3 006 579, based on the then auxiliary request 3, met the requirements of the EPC.

Claim 1 of that request reads as follows:

"*1. Method for continuously annealing aluminium alloy sheet, by continuously moving uncoiled heat-treatable 7000-series aluminium alloy sheet in the direction of its length through a continuous heat-treatment furnace arranged to heat the moving aluminium sheet to a set solution heat-treatment temperature (T_{SET}) in the temperature range of 370°C to 560°C, the continuous heat treatment furnace has an entry section and an exit section, the moving aluminium sheet moves substantially horizontally through the continuous heat-treatment furnace, the continuous heat-treatment furnace is heated by means of convective heating means, and wherein the moving aluminium sheet is rapidly cooled from T_{SET} to below about 100°C on leaving the exit section, and wherein before the entry section of the continuous heat-treatment furnace the moving aluminium sheet is pre-heated to a temperature of 5°C to 100°C below the T_{SET} using an average heat-up rate as function of the sheet thickness of at least $Y = -31.ln(X) + 50$, wherein "Y" is the heat-up rate in °C/sec and "X" is the sheet thickness in mm, and wherein sheet thickness is in the gauge range of 0.3 to 4.5 mm.*"

Claims 2 to 15 relate to preferred embodiments.

II. The following documents are cited in the present decision:

D1: WO 2014/046047 A1
D2: WO 2010/049445 A1
D3: WO 2014/053657 A1
D7: Heat treating of aluminium alloys, ASM Handbook, Vol 4: Heat treating, p.841-879, 1991
D10: US 2 887 422
D11: JP 10-298668
D18: Aluminum Properties and Physical Metallurgy, John E. Hatch, editor, p. 134-199, 1984
D32: Heat treatment of strip aluminium using TFX; Aluminium Industry, Vol. 7, No 1, Jan. 1988
D33: R. Waggott et al., Metals Technology, 9:1, 1982, p. 493-498, DOI:10.1179/030716982803285954
D38: Declaration by Gavin Wyatt-Mair of 4 February 2019

III. With its reply to the statements of grounds of appeal, the respondent (patent proprietor) filed document

D42: Experimental results with figures 1 to 4 already filed with letter of 26 July 2018.

IV. Opponents 1 and 2 withdrew their appeals on 12 July 2021 and 4 September 2019 respectively.

V. Oral proceedings took place on 19 October 2021.

VI. The arguments of appellants 1 and 2 (opponents 3 and 4), as far as relevant to the present decision, can be summarised as follows:

The opposition division exercised its discretion incorrectly to admit the then auxiliary request 3. The

amendment present in claim 1 was taken from the description and was filed in response to an objection that had already been raised at the beginning of the opposition proceedings.

The subject-matter of claim 1 did not fulfil the requirements of Article 123(2) EPC. The passage on page 15, line 22, to page 16, line 2, of the application as originally filed did not recite "sheet thickness in the gauge range". "Gauge" related to the off-the-shelf final product thickness, but the latter did not apply to "thickness". Figure 3 did not show any embodiment of the alleged invention and could not therefore provide the basis for the amendment. The lines given in figure 3 did not show the plot of the formula of claim 1.

The subject-matter of claim 1 did not fulfil the requirements of Article 84 EPC. If "gauge" and "thickness" were considered to be synonyms, it was unclear why two different terms were used immediately after each other. In addition, the omission of "the" before "sheet thickness" made it unclear which sheet thickness was meant. It was also unclear what "the gauge range" referred back to.

The requirements of Rule 80 EPC were not fulfilled. If the terms "gauge" and "thickness" were synonymous, then the change from "gauge" to "thickness" was unnecessary. It was not occasioned by any ground for opposition either.

The invention was insufficiently disclosed within the meaning of Article 83 EPC. The patent did not contain any specific worked example. D38 confirmed that the invention could not be repeated without undue experimentation. The skilled person had to adapt too

many parameters. The patent only mentioned transverse flux induction heating (TFIH), but claim 1 was not limited to TFIH and therefore included other methods of heating which did not achieve the claimed results. The heat-up rate was open-ended, but the skilled person was not able to achieve enormously high heat-up ranges. Since the heat-up rates were part of the claim, the teaching should be such that the skilled person could obtain them over the whole range claimed.

The requirements of Article 56 EPC were not met. D2 was a suitable starting point for the assessment of inventive step. The distinguishing features of claim 1 were (a) pre-heating *before* the furnace, (b) to a temperature 5 to 100°C below T_{SET}. Claim 1 did not specify how the final temperature T_{SET} was obtained; heating could just be continued in the same way. The problem to be solved was to provide an alternative method to D2. The data presented in D42 could not be taken into consideration in view of T 1329/04. In any event the distinguishing features were not linked to the more favourable microstructure, because alloy sheets having a very fine isotropic grain structure were already described in D2. Figures 2 and 4 of D42 did not show an effect linked to the pre-heating before the entry section of a continuous heat treatment compared to the set-up of D2, where the heating takes place inside the furnace. Pre-heating was an obvious alternative. Pre-heating to below T_{SET} was also obvious since the skilled person would apply a safety margin to avoid overheating, as explained in D38. Furthermore, D10 indicated the heating to below the solution heat treating temperature. The claimed solution was also obvious in view of a combination of D2 with D3, D32 or D33.

Starting from D3, the only difference was the alloy. It was obvious for the skilled person to try the method of D3 with a 7000-series alloy.

VII. The respondent's relevant arguments are reflected in the reasoning below.

VIII. Appellants 1 and 2 (opponents 3 and 4) request that the decision under appeal be set aside and that the patent be revoked.

The respondent requests that the appeals be dismissed or, alternatively, that the patent be maintained in amended form on the basis of one of the first to thirteenth auxiliary requests submitted with the reply to the grounds of appeal.

Reasons for the Decision

Main request (auxiliary request 3 underlying the impugned decision)

1. Admittance

The admittance of this request was at the opposition division's discretion. Compared to the then auxiliary request 2 it only contains a deletion of an embodiment from claim 1. The auxiliary request 2 was considered to be a fair reaction to the development of the proceedings and the parties were given time to study the amendment. The board cannot recognise that the opposition division exercised its discretion in an unreasonable way or based on the wrong criteria (Case Law of the Boards of Appeal of the EPO, 9th edition, 2019, IV.C.4.5.2).

The boards do not have the power to disregard, on appeal, submissions admitted by the opposition division in exercise of its discretion (Case Law of the Boards of Appeal of the EPO, 9th edition, 2019, V.A.3.5.4). The request was part of the impugned decision and is part of the appeal proceedings.

2. Article 123(2) EPC

The requirements of Article 123(2) EPC are fulfilled for the reasons set out below.

The wording under discussion is "wherein sheet thickness is in the gauge range of 0.3 to 4.5 mm" in claim 1. Figure 3 of the application as filed "is a schematic representation of the required minimum average heat-up rate as a function of the sheet thickness" for sheet gauges in the preferred gauge range of 0.3 to 4.5 mm, as indicated in the description on page 15, line 22. to page 16, line 2. Based on the expression "schematic representation" the skilled person understands undoubtedly that "line 1" in figure 3 is not supposed to be an exact mathematical representation of the formula, but an indication of how the heat-up rate changes with sheet thickness. It is mentioned that the preferred gauge range is from 0.3 to 4.5 mm, which is not completely in line with the range of approximately 0.5 to 4.5 mm given in figure 3. The skilled person would still understand that the preferred gauge range relates to the sheet thickness of the sheet to be heated up at a minimum rate according to line 1. The x-axis is defined as the "sheet thickness", and the "gauge range" in line 26 relates to the relationship shown. Therefore the skilled person understands that, in that context, gauge and thickness

are used as synonyms. The expression under discussion "sheet thickness is in the gauge range of 0.3 to 4.5 mm" is understood to be a sheet thickness in the thickness range of 0.3 to 4.5 mm.

The appellants' argument that "gauge" always relates to the off-the-shelf final product thickness cannot be accepted. Claim 4 as filed specifically indicates "final gauge". The word "final" would be superfluous if said argument were followed.

The fact that the formula of claim 1 results in negative heat-up rates for thickness values above the claimed range is of no relevance.

3. Article 84 EPC

The expression "and wherein sheet thickness" in claim 1 specifies the sheet thickness previously mentioned. Therefore, it relates to the sheet thickness of the aluminum sheet during pre-heating. A different understanding is rather theoretical and not in line with a skilled person trying to make technical sense of claim 1.

Claim 1 uses "gauge" and "thickness" as synonyms. Although this may not be the most elegant formulation, the skilled person understands that the thickness of the sheet to be pre-heated should be in the range of 0.3 to 4.5 mm.

The gauge range refers to the range of "0.3 to 4.5 mm". Although "the" has no antecedent, the skilled person trying to understand the claim has no difficulties in establishing what "the" is supposed to relate to.

The requirements of Article 84 EPC are met.

4. Rule 80 EPC

Claim 1 meets the requirements of Rule 80 EPC, the amendments being made to overcome the ground of opposition under Article 100(b) EPC.

The now claimed gauge range does indeed avoid negative - and thus impossible - heat-up rates that result when the formula of claim 1 is used with excessively high thickness values.

The fact that two different words are used as synonyms is also due to the wording in the application as filed.

5. Article 83 EPC

The requirements of Article 83 EPC are met for the following reasons:

According to claim 1 the pre-heating has to be carried out before the entry of the continuous heat-treatment furnace and must have a minimum heat-up rate according to the formula given. The skilled person understands that the sheet subsequently enters the heat-treatment furnace and is further heated to T_{SET}.

D38 indicated that the temperature rise of the aluminum sheet was a function of the electric current in the inductor, the frequency of alternation of the current, the stand-off distance of the inductor from the aluminum alloy sheet, the aluminum alloy composition of the sheet, the speed of motion of the aluminum alloy sheet and the thickness of the aluminum alloy sheet. As the patent did not contain any

information concerning how to adjust these parameters, there was an undue burden for the skilled person trying to reproduce the invention.

Paragraphs [0055] to [0056] of the contested patent contain information about how to put the method according to claim 1 into practice. The fact that details of the processing are missing, as set out in D38, does not prevent the skilled person from setting up the required conditions. Starting from the information given in the aforementioned paragraphs, the skilled person will adapt the pre-heating rate to different conditions. Every process requires a certain amount of fine-tuning before it works as desired. The skilled person knows the parameters that are important, as set out in D38, and will adapt them as required. Such work is within the skilled person's competence and cannot be considered an undue burden. At least there is no convincing evidence to show that the required heat-up rates cannot be obtained when using a TFIH.

The average heat-up rate given in claim 1 is open-ended, but the teaching of the whole patent has to be taken into consideration when evaluating sufficiency of disclosure. Although claim 1 is not limited to a certain type of pre-heating means, TFIH is the method of choice (paragraph [0016]) for high heating rates. The skilled person understands therefrom that heating rates achievable with such means are to be considered. Unreasonably high pre-heating rates are also excluded by the fact that T_{SET} is in the range of 370°C to 560°C, which means that the pre-heating stops at a maximum of 555°C. Therefore, the heating rate is considered to be implicitly limited by T_{SET}.

If two different values partially overlap when their error margin is considered, they can still be statistically different. In any event, the objection that the skilled person would not know how to obtain a temperature 5°C below T_{SET} in view of the error margin given in the patent is based on an ambiguity in the scope of the claim, which in accordance with T 608/07 (Reasons 2.5.2) does not permeate the whole claim and does not lead to a lack of sufficiency.

6. Article 56 EPC

6.1 The present invention relates to a method for continuous solution heat-treating aluminium AA7000-series alloy sheet (paragraph [0001]).

6.2 D2 is considered to be the closest prior art. It relates to the heat-treatment of AA7000-series aluminium alloy sheet (example 1). It discloses that the aluminium alloy sheet during the solution heat treatment is heated to the solution heat treatment temperature in a range of about 400°C to 500°C using an average heat-up rate of more than 30°C/sec, and preferably of more than 50°C/sec, which fulfils the inequality of claim 1. This leads to the formation of a recrystallised and very fine isotropic grain structure (page 5, lines 30 to 36). D2 does not disclose a pre-heating step before the entry section of the continuous heat-treatment furnace (page 5, line 36, to page 6, line 1). The pre-heating before the furnace of claim 1 is understood as a heating step that is separate from the furnace and does not include a continuous heating to T_{SET}.

D3 constitutes a less appropriate starting point since it does not relate to 7000-series aluminium alloy and the grain structure of such an alloy.

D1 and D11 had been cited as closest prior art by opponent 1, which withdrew its appeal. In any case, D1 and D11 do not have more features in common with claim 1 than D2. Furthermore, the goal of D1 is to have a fibrous fine processed microstructure in which the average grain size is 15 µm or lower (paragraph [0030]). D11 does not disclose the heat-treatment to a temperature of 5 to 100°C below T_{SET}. Furthermore, it has a continuous annealing furnace in vertical direction.

6.3 The problem to be solved is to provide a method leading to a 7000-series alloy sheet having fine equiaxed grains in combination with good mechanical properties (paragraph [0010]).

6.4 The problem is solved by a method according to claim 1 characterised by the *combination* of:
- a pre-heating of the moving aluminium sheet *before* the entry section of the continuous heat-treatment furnace
- to a temperature of 5°C to 100°C below T_{SET}
- using an average heat-up rate as a function of the sheet thickness of at least $Y = -31.\ln(X) + 50$, wherein "Y" is the heat-up rate in °C/sec and "X" is the sheet thickness in mm.

6.5 It is accepted that said problem, which had already been stated in the application as filed and in the granted patent, is successfully solved. There is no evidence to the contrary. Equally, there is no reason to doubt that the claimed process conditions have an

influence on the structure of the alloy. Indeed, D42, which had already been submitted during opposition proceedings, confirms that a process according to claim 1, which is illustrated in figure 4, leads to equiaxed grains. There is no data to show that a similar structure is obtained with a process according to D2. Although D2 mentions a very fine isotropic grain structure, there is no evidence that such a structure is equivalent to equiaxed grains.

D42 represents post-published evidence that was submitted to confirm the effect stated in the patent, which had not been called into question by evidence. T 1329/04 is not relevant to the present case, since it related to a product claim, which was limited to a specific polynucleotide, of which the structure did not make it plausible that the problem put forward was indeed solved. In the present case, the post-published evidence is not considered as the sole basis for establishing that the problem is solved.

The board is aware that meanwhile decision T 116/18 has been issued, thereby referring questions regarding the consideration of post-published evidence to the Enlarged Board of Appeal. The board considers that the present case differs from said referral. Indeed, the present case concerns a method claim for which the problem to be solved had already been stated as such in the patent as granted (see paragraph [0010]). The evidence does not relate to a different problem, but to the problem stated in the patent. In addition, the provided additional evidence only confirms an effect which has not been called into question. Therefore, the outcome of the referral does not influence the outcome of the present case.

6.6 The solution is not obvious for the following reasons:

D2 suggests the fast heating and its effect on the crystal structure. However, the very fine isotropic grain structure of D2 is not identical to the equiaxed grains of the contested patent. Indeed, such a structure does not necessarily mean that the grains are all directed in one direction. D2 does not teach a pre-heating step before the furnace either.

D10 does not relate to a 7000-series alloy and does not mention mechanical properties or an equiaxed grain structure. The skilled person trying to solve the problem posed has no reason to consider it.

Neither D3 nor D32 mentions a 7000-series alloy. Said documents do not explicitly disclose pre-heating at the claimed rate to a temperature of 5°C to 100°C below the T_{SET} before the furnace. It is only disclosed that direct flame impingement (DFI) allows very quick heating of the aluminum strip or coil (D3: page 8, lines 14 to 23) and that transverse flux induction heating, possibly as pre-heating, is very fast (D32: page 14, left-hand column, and page 15, right-hand column). Furthermore, there is no indication that the pre-heating would have an impact on the microstructure.

D33 discloses transverse flux induction heating (TFIH) of aluminium-alloy strip. Table 2 and figure 10 thereof show a comparison between batch-annealed and TFIH-annealed alloy strips. However, said comparison does not concern a 7000-series alloy, but instead 3103 or 3105 alloy strips. In addition, there is no indication of a pre-heating step. D33 does not lead the skilled person to the proposed solution.

Although D7 and D18 indicate that temperatures have to be limited to a safe level below the maximum in order to avoid overheating, there is no teaching of a rapid pre-heating and its impact on the microstructure.

Such pre-heating and its effect are not disclosed in D1 or D11 either.

6.7 The subject-matter of claim 1 involves an inventive step within the meaning of Article 56 EPC. The same applies to the subject-matter of claims 2 to 15, which directly or indirectly relate to claim 1.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar: The Chairwoman:

C. Vodz S. Fernández de Córdoba

Decision electronically authenticated