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**Datasheet for the decision
of 30 January 2007**

Case Number: T 0349/04 - 3.2.07

Application Number: 95929705.2

Publication Number: 0805879

IPC: C22F 1/05

Language of the proceedings: EN

Title of invention:

Heat treatment process for aluminum alloy sheet

Patentee:

Novelis, Inc.

Opponent:

Alcoa Inc.

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 123(2)(3)

Keyword:

"Admissibility of amendments (yes)"

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0349/04 - 3.2.07

DECISION
of the Technical Board of Appeal 3.2.07
of 30 January 2007

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Decision under appeal:
Interlocutory decision of the Opposition
Division of the European Patent Office posted
28 January 2004 concerning maintenance of
European patent No. 0805879 in amended form.

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
C. Holtz

Summary of Facts and Submissions

I. The Patent Proprietor (appellant I) and the Opponent (appellant II) lodged appeals against the interlocutory decision of the Opposition Division to reject the main request of appellant I and to maintain European patent No. 0 805 879 in amended form on the basis of the auxiliary request, with claim 1 as filed with letter of 10 June 2002 and claims 2-16 as filed during the oral proceedings on 25 September 2003 before the opposition division.

II. An opposition had been filed against the patent as a whole and was based on Article 100(a) EPC (i.e. lack of novelty and lack of inventive step).

The Opposition Division held that claim 1 as granted according to the main request lacked novelty in view of E3 and E4 on its own while claim 1 of the auxiliary request was considered to meet all the requirements of the EPC.

III. The wording of claim 1 as granted reads as follows:

"1. A process of producing solution heat treated aluminum alloy sheet material suitable for use in the fabrication of automotive panels by the steps of forming and paint baking, which comprises subjecting hot- or cold-rolled Al-Mg-Si or Al-Mg-Si-Cu alloy sheet to solution heat treatment followed by quenching and natural age hardening, characterized in that, before substantial age hardening has taken place after said quenching and prior to forming and a paint baking thermal treatment, the alloy sheet material is

subjected to at least one subsequent heat treatment involving heating the material to a peak temperature in the range of 100 to 300°C, holding the material at the peak temperature for a period of time less than 1 minute, and cooling the alloy from the peak temperature to a temperature of 85°C or less."

- IV. With a communication dated 27 October 2006 and annexed to the summons to oral proceedings the Board presented its preliminary opinion based on the claims according to the main request (version as granted) and to the first to eighth auxiliary request, all auxiliary requests as filed by appellant I with letter of 22 December 2005.

The amendments made to the eight auxiliary requests appeared to meet the requirements of Article 123(2) and (3) EPC. Furthermore, it seemed that claim 1 of all auxiliary requests did not contain all features essential for carrying out the claimed processes since it did not define a final step of "and naturally age hardening the alloy sheet material" so that it seemed that the requirements of Article 84 EPC were not met.

The Board further stated that it would be necessary to interpret the definition "before **substantial** natural age hardening has taken place" of claim 1 of all requests in order to discuss and decide the issue of novelty with respect to documents E1 to E4 and E6.

Furthermore, provided that the requirements of Article 54 EPC were considered to be met for any of the requests then the issue of inventive step would have to be discussed for those requests by taking into

consideration the problem-solution approach. For this purpose it would first be discussed which document represented the closest prior art. In that respect appellant II seemed to consider E1 as the closest prior art while appellant I seemed to consider E4 to represent the closest prior art, whereas in the Board's view E6 could be considered as the closest prior art, although it did not mention that the final heat treatment should be immediately carried out after the quenching step. Taking account of the technical problem to be solved whether or not the available prior art rendered the subject-matter claimed obvious would be discussed.

V. With letter of 29 December 2006 appellant I submitted four additional auxiliary requests numbered 4.1 to 4.4 and further arguments with respect to novelty and the objection under Article 84 EPC as raised by the Board, together with a statement of a technical expert, Dr. D.J. Lloyd, which contained test results in the form of figures 1 to 3 relating to the natural aging of further aluminium alloys.

VI. Oral proceedings before the Board were held on 30 January 2007, with as final requests:

- (a) Appellant I requested that the decision under appeal be set aside and the patent be maintained on the basis of claims 1 to 11, pages 2 to 11 and figures 1 and 2, all as submitted during the oral proceedings.
- (b) Appellant II requested that the decision under appeal be set aside and the patent be revoked.

(c) The following documents and pieces of evidence were discussed or cited:

E1 = JP-A-05 070 908 (and English translation)

E4 = JP-A-02 209 457 (and English translation)

E6 = US-A-4 808 247

E7 = EP-A-0 874 917

VII. Claim 1 according to the request of appellant I reads as follows:

"1. A process of producing solution heat treated aluminium alloy sheet material suitable for use in the fabrication of automotive panels by the steps of forming and paint baking, which comprises subjecting hot- or cold-rolled Al-Mg-Si or Al-Mg-Si-Cu alloy sheet to solution heat treatment followed by quenching and natural age hardening, wherein within 12 hours of said quenching step, before substantial age hardening has taken place after said quenching and prior to forming and a paint baking thermal treatment, the alloy sheet material starts to be subjected to at least one subsequent heat treatment involving heating the material from a temperature of 60°C or less at a rate of 10°C/minute or more to a peak temperature in the range of 100 to 300°C, holding the material at the peak temperature for a period of time of 5 seconds or less, and cooling the alloy from the peak temperature to a temperature in the range of 55 to 85°C at a rate of 4°C/second or more, whereupon the sheet material is

coiled at that temperature and then further cooled to ambient temperature at a rate of less than 2°C/hour."

VIII. Appellant I argued essentially as follows:

Claim 1 is based on claims 1, 3, 7, 8 and 10 as granted in combination with page 3, lines 17 to 19 of the published patent (i.e. paragraph [0017]) corresponding to claims 1, 3, 7, 10 and 13 in combination with page 4, lines 19 to 24 and page 11, lines 8 to 14 of the application as originally filed (corresponding to the published application WO-A-96 07768). Only the dependent claims 4 and 11 were modified in order to specify a temperature range of 55 to 85°C, to be consistent with the range mentioned in claim 1, while the remaining dependent claims 2, 3 and 5 to 10 are identical with claims 2, 4, 9 and 12 to 16, respectively. Hence claims 1 to 11 meet the requirements of Article 123(2) and (3) EPC. The description has been adapted accordingly and in order to retain the examples in the specification for illustrating the invention they were designated to only illustrate steps of the process of claim 1. Thus also the description meets the requirements of Article 123(2) EPC. By defining the time period between the quenching step and the start of the heat treatment the objection under Article 84 EPC as raised by the Board has been overcome.

The subject-matter of claim 1 is novel with respect to the process disclosed in the available prior art due to the limitation of the time period between quenching and the subsequent heat treatment to "within 12 hours", the specified temperature ranges in combination with the

specific heating/cooling rates and the holding time of 5 seconds or less of the said subsequent heat treatment.

According to the claimed process of the patent in suit the temperature of the spike heat treated aluminium sheet is lowered to the coiling temperature and thereafter lowered to ambient temperature, both at specific cooling rates. The technical problem according to appellant II is simply to sell aluminium sheet to automakers. According to appellant I the aluminium alloy sheet material should be soft for the subsequent forming operation and hard after the paint baking, it should have a clean surface for good painting, and the product should be consistent in its properties. Such consistent properties in the sheet material were not obtained by the prior art processes.

The sequence of operations after the quenching step results in a synergistic effect. According to the patent in suit the spike heat treatment has nothing to do with a recovery treatment. The spike heat treatment destroys or influences the concentration gradients of the alloying elements which develop at lower temperatures after the quenching step. Not all diffusion taking place represents "ageing"; only that diffusion which changes the properties of the material.

There is a fundamental difference of diffusion phenomena between the claimed "pre-ageing" treatments and the prior art "recovery" heat treatments. Once substantial ageing has occurred a reversal of the microstructure coarsening can be accomplished only by a resolutionising procedure, getting the atomic species into solution by taking the material up to a

sufficiently high temperature for solutionising, then cooling rapidly to preserve that solution. Pre-ageing is not resolutionising but, rather, something that happens as material slowly cools to ambient temperature from a temperature of 55-85°C.

Claimed is no "recovery" treatment but a "stabilization" step performed at the end of the solution heat treatment line. The term "recovery treatment" is consistently used by the prior art but the treatment of the patent in suit does not represent such a recovery process. From the post-published E7 it can be derived that the spike heat treatment of E6 is applied as a pre-age step which results in accelerated natural ageing (see column 3, paragraph [0010]).

Furthermore, according to appellant I's expert normally no recovery treatment is carried out after the levelling step. This is also supported by E6 where such treatment is made only occasionally and thus is not compulsory (see column 7, line 64). E6 is an attempt to improve on E2 but from appellant I's view it does not.

Finally, according to E6 natural ageing has taken place due to "a lapse of 2 weeks" (see column 6, line 35) and the holding time applied in comparative example D of 50 seconds is stated to have been too short (see Table 10; column 17, lines 44 to 48) but is too long compared to the holding time of the spike heat treatment as defined in claim 1.

Consequently, taking account of the could-would approach the skilled person even could not have proceeded as claimed when considering the teaching of E6.

The burden of proof is on appellant II to show that the problem is not solved by the subject-matter of claim 1. However, it failed to do so.

The skilled person does not get any hint from the prior art E4, to cool down the alloy from the peak temperature to a temperature of 55-85°C to achieve the objects of the invention, i.e. to provide a process for heat treating an aluminium alloy sheet material having an improved paint bake response when subjected to conventional paint and bake cycles, to provide a heat treatment procedure without detrimental effect on the desired T4 and T8X tempers of the material and to produce a material having consistent yield properties irrespective of the time elapsed subsequent to coiling the material (see patent, paragraphs [0012] to [0015]). The skilled person has no incentive to combine the teachings of E4 and E1.

Therefore the process of claim 1 involves an inventive step.

IX. Appellant II argued essentially as follows:

The amendments made in claims 1 to 11 and the specification are no longer objected to with respect to their admissibility. Novelty is no longer disputed.

The subject-matter of claim 1, however, lacks an inventive step over a combination of the teachings of either E1 and E4 or of E6 and E1 for the following reasons.

E1 discloses a process for making a solution heat treated Al-Si-Mg-Cu alloy sheet material which after the quenching step, according to the example, sample C, is set 72 hours at room temperature and then pre heat treated at 300°C for 1 minute, set at 20°C for 10 minutes and then final heat treated at 100°C for 60 minutes (see its English translation, claims 1 and 2; page 2, first and second paragraphs; page 6, fourth paragraph; page 7, second paragraph; Tables 1 and 2).

The process of claim 1 thus differs from that of E1 in that the time period between the quenching and the heat treatment is started within 12 hours instead of 72 hours, in that specific heating and cooling rates are specified, in that the holding time is 5 seconds or less instead of 1 minute and in that a different temperature in the cooling step after the peak of the heat treatment is reached.

However, E1 discloses that the operation from pre-treatment to final heat treatment can be carried out continuously without the step of cooling to room temperature (see page 6, fifth paragraph). Thus E1 teaches an inline manufacturing method.

E4 concerns the same type of production of alloys and mentions that a time delay of 72 hours decreases an effect with respect the paint bake response (see English translation, page 2, fifth paragraph; page 3,

first, second and fourth paragraph). E4 teaches that it is disadvantageous to coil the sheet and leave it at room temperature. E4 teaches two alternative solutions, one involving that the rolled sheet is cooled to about 50-100°C and then reheated to 50-150°C and then coiled (see page 5, fourth paragraph). According to E4 the sheet is kept at a pre-aging temperature and a holding time as it is necessary (see page 6, first paragraph; and figure 4). Therefore E4 teaches the skilled person to use an inline process up to the coiling of the final product to overcome the problem with the time delay of 72 hours (see page 3, fourth paragraph). Thus applying the teaching of E4 in the method discussed in E1 results in a distinction from the method of claim 1 only in the heating/cooling rates and the duration of the spike heat treatment. The skilled person, however, knows how to apply such a heat treatment. It is also not known which problem is solved by these heating/cooling rates and/or the holding time. There are no data on file which show a specific effect thus obtained.

From the patent in suit it is known that the heat treatment is a stabilizing treatment but a stabilizing effect is only apparent if the pre-aging treatment has been carried out (compare Tables 2, 3 and 5, comparison of samples having undergone no natural ageing and having undergone one week natural ageing).

From E6, which deals with the same subject-matter as the patent in suit (see column 1, lines 5 to 14; column 3, lines 8 to 15; column 9 to column 10, Table 1), it is known that a spike heat treatment recovers the material properties from a former state. According

to E6 the sheet is flattened and thereafter a spike heat treatment is carried out to recover the material properties before ageing at room temperature takes place (see column 5, line 52 to column 6, line 5; column 7, lines 49 to 58 and lines 63 to 66). E6 discloses heating and cooling rates which at the upper limit reach 4000°C/sec (see figure 1) and the holding time at the spike heat treatment temperature of 200°C can be zero seconds (see column 6, line 45). According to E6 an inline process is preferred (see column 5, lines 12 to 17). The stabilization of the sheet material is obtained by pre-ageing the product such as disclosed in E1. Consequently, proceeding along the teaching of E6 using the teaching of E1 (page 6, last paragraph), one would arrive at the process of claim 1.

Reasons for the Decision

1. Admissibility of amendments (Article 123(2) and (3) EPC)

- 1.1 Claim 1 of the single request of appellant I is based on claims 1, 3, 7, 8 and 10 as granted in combination with page 3, lines 17 to 19 of the published patent (i.e. paragraph [0017]) corresponding to claims 1, 3, 7, 10 and 13 in combination with page 4, lines 19 to 24 and page 11, lines 8 to 14 of the application as originally filed (corresponding to the published application WO-A-96 07768).

Only the dependent claims 4 and 11 were modified by deleting the term "at least" from the wording of claims 5 and 18 as granted for clarity reasons in order

to be consistent with the identical temperature range as mentioned in claim 1, of 55 to 85°C.

The dependent claims 2, 3 and 5 to 10 of the request correspond to claims 2, 4, 9 and 12 to 16 as granted, respectively.

Hence claims 1 to 11 meet the requirements of Article 123(2) and (3) EPC.

- 1.2 Pages 3 and 4 of the description have only been amended in order to incorporate a short description of the relevant prior art documents E1, E2, E3, E4 and E6 and to provide a clear counterpart to claim 1, necessary for compliance with Rule 27(1)b) and Article 84 EPC, without being at odds with the requirements of Article 123(2) EPC.

Furthermore, by stating in the paragraphs [0034] and [0037] of page 5 that the examples only illustrate steps of the process of the invention and that some samples were given the additional pre-aging treatment of the invention, respectively, all the examples could remain in the patent specification without any inconsistency with the subject-matter claimed.

Pages 6 to 11 and the drawings, figures 1 and 2, of the patent as granted remained unchanged but were re-filed to submit a complete specification.

Therefore, the newly filed description pages 2 to 11 and drawing figures 1 and 2 are also considered to meet the requirements of Article 123(2) EPC.

1.3 The Board finally remarks that by incorporating the features "wherein within 12 hours of said quenching step" the alloy sheet "starts to be" subjected to at least one subsequent heat treatment, according to claim 1 under consideration, the unclarity inherent to the definition "before **substantial** natural age hardening has taken place" of claim 1 as granted has been removed.

2. *Novelty (Article 54 EPC)*

Novelty of the subject-matter of process claim 1 of the single request was not disputed by appellant II. The Board is satisfied that none of the submitted documents, particularly E1, E4 and E6, discloses a process of producing solution heat treated aluminium alloy sheet material having all the features of claim 1.

The Board therefore concludes that the subject-matter of claim 1 is novel with respect to the processes disclosed in these documents.

3. *Inventive step (Article 56 EPC)*

3.1 Document E1 discloses a manufacturing method for making an Al-Mg-Si-Cu alloy having excellent forming and bake hardening property for use in the manufacture of aluminium alloy material for such as the sheet material of automobile parts (see English translation, page 2, "abstract"). The cast Al-alloy ingot is rolled using the conventional method, followed by solution heat treatment, quenching, and setting at room temperature; thereafter the obtained material is preheat treated at 250-350°C for 5 minutes or less, the material is set at

room temperature for 60 minutes or less, and then a final heat treatment is performed at 50-150°C for 10-500 minutes (see claims 1 and 2). E1 aims to suppress the room temperature age hardening to improve the forming properties and the paint baking hardening properties in order to have a low yield strength in the pressing operation so as to improve the shape retentivity (see pages 4 and 5, paragraph [0008]).

Said preheat treatment at 250-350°C is stated to be a recovery treatment to recover the state similar to that immediately after quenching (see page 6, paragraph [0016]). The time for setting at room temperature from preheat-treatment to final heat treatment is preferred to be as short as possible so that age hardening does not take place; if the time is longer than 60 minutes then the room temperature ageing advances, and the effect of the final heat treatment becomes less significant; it is also possible to perform this operation continuously without the step of cooling to room temperature (see page 6, paragraph [0017]).

According to the examples the alloy sheet is solution heat treated in a continuous annealing oven at 540°C for 20 seconds at a heating rate of 500°C/min, quenched to 100°C at a rate of 500°C/min, the sheet was then set at room temperature for 72 hours and then subjected to a preheat treatment at 250 to 350°C for a period of 30 seconds to 5 minutes (according to examples C, F, G and H at 300°C for 1 minute), set to room temperature for 10 to 50 minutes and final heat treated at a temperature of from 60-150°C for a time period of 300 to 10 minutes (see page 7, paragraph [0019]; and Japanese original, Table 2).

3.2 Taking account of the above analysis, document E1 can be considered to represent the closest prior art for process claim 1, as it is additionally considered to meet all criteria for determining the closest prior art as set out in the existing case law of the Boards of Appeal (see Case Law of the Boards of Appeal of the European Patent Office, 4th edition 2001, sections I.D.3.1 to I.D.3.5). Furthermore, E1 aims to solve the same problem as the invention at issue, i.e. providing an improved aluminium alloy material having excellent forming property and paint bake hardening property.

3.3 *Problem to be solved*

The process of claim 1 thus differs from the process according to E1 in that

(a) the time period between the quenching and the start of the subsequent heat treatment is reduced from 72 hours to 12 hours,

(b) specific heating and cooling rates are used for the peak treatment,

(c) the holding time of the peak treatment is 5 seconds or less instead of 30 seconds to 5 minutes as disclosed in E1, and

(d) the material is cooled from the peak temperature to a temperature in the range of 55 to 85°C whereupon the sheet material is coiled and then further cooled to ambient at a cooling rate of less than 2°C/hour.

3.4 The objective technical problem to be solved with respect to the process of E1 is thus the provision of steps which provide an aluminium alloy sheet stabilizing heat treatment which reduces the detrimental effects of the post solution heat treating natural age hardening on the paint bake response and which material has a low yield strength in T4 temper and a high yield strength in T8X temper (compare patent in suit, paragraphs [0012] to [0015]).

3.5 *Solution to the problem*

The problem as defined above is solved by the process of producing solution heat treated aluminium alloy sheet material as defined in claim 1 of the single request.

It is firstly credible that the claimed measures provide a solution to the technical problem as defined above. Furthermore, appellant II admitted that a stabilizing effect is visible when the pre-aging treatment as claimed has been carried out. Further arguments of appellant II to the contrary cannot be accepted as no evidence has been filed with which it could have proven its allegations.

3.6 The Board considers that the subject-matter of claim 1 of the single request is not obvious to the person skilled in the art for the following reasons:

3.6.1 From the description of the examples of E1 it has to be concluded that the aluminium alloy sheet has been coiled after the solution heat treatment and quenching steps. Thus the alloy sheet has been set to room

temperature in coil form. Taking also into account that the final heat treatment at 50-150°C is carried out for a time period of 10 to 500 minutes it is clear to the skilled person that said coil of the alloy sheet material has been heat treated in a batch oven. It is evident that such a treatment with a holding period of 10 to 500 minutes is not feasible as an additional step in a continuous annealing line (CAL) after the quenching step.

3.6.2 Thus even if E1 suggests to perform the operation from pre-treatment to final heat treatment continuously without the step of cooling to room temperature the skilled person would not use the CAL for carrying out such heat treatments. Consequently, the arguments of appellant II to the contrary cannot be accepted.

3.6.3 Furthermore, if the skilled person would use a different, much slower running, heat treatment line for continuously carrying out such a combined heat treatment wherein the coil has to be unwound before the preheater section and will be wound up again after the final heater section he would not arrive at a process wherein the sheet is coiled after the peak heat treatment as claimed because there is no hint in E1 to do so.

Additionally, also with such an embodiment the skilled person is still left with the selection of the cooling rate from the pre-treatment temperature to the final heat treatment temperature since E1 is silent in this respect. Likewise, even if the skilled person were to select a temperature in the range of 55-85°C from the range of 50-150°C according to E1 - there is no

incentive to do so - he would not arrive at a process in accordance with claim 1 since E1 requires holding the temperature for a time of 10-500 minutes and not to cool the sheet to ambient at a specific cooling rate.

- 3.7 E4 discloses a heat treatment apparatus for bake hardenable aluminium alloys, such as the 6009 and 6010 type. Example 1 discloses that the rolled sheet enters a continuous annealing furnace for a solution heat treatment at 400-600°C for 3 seconds and that it is rapidly cooled to 100°C at a cooling rate of over 300°C/minute and normally the temperature becomes less than 50°C (see page 2, fourth paragraph; page 5, fourth full paragraph). E4 states that it reaches the temperature range of 50-100°C and that the sheet material is then further cooled until it reaches a temperature in the range of 20-50°C (see page 5, fourth full paragraph). Thereafter the sheet is almost immediately reheated to 50-150°C and wound into a coil and is then maintained above ambient temperature for a required time measured in hours; figure 4 indicates a time of over 5 hours. The highest temperature in the reheater 13 is reached only momentarily as can be derived from figure 4. This interpretation takes account of the fact that the heating to 400-600°C takes place in about 3 seconds and that the cooling takes place with a rate of 300°C/second so that the sheet will be cooled to less than 100°C within less than 2 seconds thereby reaching a temperature of 20-50°C after about further 3 seconds.

Thus the first numbers 5, 10, 15 and 40 on the x-axis of figure 4 correspond to seconds on this time axis while the next number - 5 hr - of the reheat treatment

corresponds to hours. This interpretation also takes account of the schematic configuration of the annealing line shown in figure 2 which shows a much shorter section of the reheater 13 than that of heater 5 or that of cooler 6. Hence said maximum reheat temperature of 50 to 150°C is held for a holding time which is actually zero seconds since the temperature after the winding then immediately but very slowly decreases since said reheater 13 is placed before the coil winder 10 so that cooling before winding is minimal (see page 4, first to fourth paragraph; and figure 4). The resulting coil is then maintained for a required time of several hours above the limiting temperature T_y which according to the temperature profile of figure 4 is about 100°C so that the winding temperature was above 100°C (compare figure 4 and page 6, first paragraph).

E4 does not disclose any explicit heating or cooling rates for the said reheat treatment.

3.7.1 The reheat treatment according to E4 thus does not comprise any spike peak at all, let alone one in the temperature range of from 100 to 300°C as required by claim 1. Furthermore, E4 nowhere suggests that the sheet material should be cooled from said spike peak to a temperature of 55 to 85°C at a rate of 4°C/second or more and that the sheet material should then be coiled at that temperature and then further cooled to ambient temperature at a rate of 2°C/hour.

3.7.2 Taking account of paragraphs 3.6.1 to 3.7.1 above it is evident that the mere combination of the teachings of E1 and E4 does not allow to arrive at the process of claim 1. This is due to the fact that the holding

period at 250-350°C according to E1 is suggested to be 30 seconds to 5 minutes and furthermore in E1 and E4 no heating/cooling rates for the subsequent heat treatments are disclosed or suggested. Finally, the final heat treatments according to E1 and E4 differ from each other considerably. E1 requires holding the temperature for a predetermined time whereas E4 requires maintaining the temperature above a value T_y and inherently teaches to slowly cool the coil as it is no longer heated. Hence these two alternatives are considered not to be compatible with each other.

3.7.3 Appellant II argued that the skilled person would know which heating/cooling rates he should use for such a spike heat treatment. This argument cannot be accepted because no evidence, such as a text book, has been submitted to prove this allegation. To the contrary, the prior art E6 discloses generally a broad range of heating/cooling rates of from $4 \times 10^{-3} \text{°C/sec}$ to $4 \times 10^3 \text{°C/sec}$ (see figure 1). The skilled person hence could have chosen any of these rates since he had no incentive to choose a specific one thereof. But even if he would have chosen a rate of 10°C/sec or more he would not have arrived at the process of claim 1 since the minimum holding time according to E1 of 30 seconds is too long.

3.8 According to the second line of arguments of appellant II the combination of the teachings of E6 and E1 would allow to arrive at the process of claim 1. These arguments, however, cannot be accepted for the following reasons.

3.8.1 E6 discloses a process for producing an Al-Mg-Si-Cu aluminium-alloy sheet particularly suitable for use for an automotive body (see column 2, lines 36 to 68 and Table 1). The production method preferably includes a continuous solution heat treatment furnace for the solution-heat treatment at a temperature of from 500°C to 580°C for a period of at least 5 seconds with a preferred heating rate of 5°C/sec, followed by quenching at a preferred cooling rate of 300°C/min or higher, and ageing at room temperature (see column 3, lines 1 to 15; and column 4, line 23 to column 5, line 22). Said solution heat treated sheet is preferably straightened to remove distortions and then subjected to a heat treatment for recovering the formability which conditions should be selected so as to avoid age hardening (see column 5, line 52 to column 6, line 5), i.e. at a temperature of from 60°C to 360°C.

The sheet is heated at a rate and held at this temperature for a time within the hatched regions of figures 1 and 2, respectively, and then cooled with a cooling speed also within the hatched region of figure 1. According to example 5 the quenched sheet underwent a straightening step followed by a final heat treatment step. Sample A was made at 200°C with a holding time of 50 seconds with a heating speed of 2°C/sec (corresponding to 120°C/minute) and a cooling speed of 1000°C/sec (corresponding to 60000°C/minute), while sample B was made at 100°C with a heating rate of 8×10^{-3} °C/sec (corresponding to 4.8×10^{-1} °C/minute) with a holding time of 7200 seconds and a cooling rate of 1.5×10^{-2} °C/sec (corresponding to 9×10^{-1} °C/minute) which appear to have been carried out without a natural

- ageing step before said treatments (compare column 15, line 3 to column 17, line 41; and Tables 10 and 11).
- 3.8.2 The minimum holding times for this heat treatment vary in the temperature range between 100°C and 300°C between more than 600 and 0 seconds, at 300°C it varies between 0 and about 8 seconds, at 350°C it varies between 0 and 1 second (compare figure 2). Comparative example D performed with a holding time of 50 seconds at 100°C with heating and cooling rates within the range required by claim 1 of the patent in suit is stated to have been treated too short (see column 17, lines 44 to 46).
- 3.8.3 Considering paragraph 3.8.2 above, the holding times of the heat treatment of E6 are not compatible with those generally suggested by E1; more particularly with those according to the examples of E1 (compare paragraph 3.1 above). Therefore the skilled person would not combine the teachings of E6 and E1.
- 3.8.4 In the theoretical case that the skilled person, despite of paragraph 3.8.3, above were to combine E6 and E1 he would have to make three selections from the hatched regions of figures 1 and 2, namely to select a peak temperature falling in the range of 100-300°C, to select a heating rate of 10°C/minute or more, and to select a cooling rate of 4°C/minute or more. Additionally, the skilled person would have to choose the option of E1 to continuously perform the pre-treatment and the final heat treatment and would have to select a temperature out of the range of E1 between 50 and 150°C. However, taking account of the teachings

of E6 and E1 the skilled person has no incentive or reason to make any of these selections.

3.9 The Board therefore concludes that the subject-matter of claim 1 of the single request involves an inventive step (Article 56 EPC).

The patent as amended is thus considered to meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The appeal of the opponent is dismissed.
3. The case is remitted to the department of first instance with the order to maintain the patent on the basis of the following documents:

claims: 1 to 11,

description: pages 2 to 11, and

drawings: figures 1 and 2,

all as submitted in the oral proceedings of 30 January 2007.

The Registrar:

The Chairman:

G. Nachtigall

H. Meinders