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D E C I S I O N
of 24 May 2004

Case Number: T 1195/00 - 3.2.2

Application Number: 94924943.7

Publication Number: 0716716

IPC: C22C 21/02

Language of the proceedings: EN

Title of invention:
Extrudable Al-Mg-Si alloys

Patentee:
ALCAN INTERNATIONAL LIMITED

Opponent:
PECHINEY
Corus Aluminium Profiltechnik GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 52(1), 56

Keyword:
"Inventive step (yes, after amendment")

Decisions cited:
T 0595/90, T 0233/93

Catchword:
-

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Case Number: T 1195/00 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 24 May 2004

Appellant: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 30 October 2000 revoking European patent No. 0716716 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: S. S. Chowdhury
A. Pignatelli

Summary of Facts and Submissions

I. The decision of the opposition division revoking European patent No. 0 716 716 was dispatched on 30 October 2000. The patent had been opposed on the grounds that its subject-matter lacked novelty and inventive step and that claim 1 as granted was not based on the disclosure of the documents as originally filed. In its decision, the opposition division found that the claimed subject-matter lacked an inventive step.

II. On 27 December 2000 the appellant, Alcan International Ltd., filed an appeal against this decision and paid the appeal fee on the same day. The statements of grounds of appeal were received on 26 February 2001.

Respondent is Hoogovens (Now Corus Aluminium Profiltechnik GmbH)), and though it did not file any written submissions it was represented at the oral proceedings which took place on 24 May 2004.

The opponent Pechiney had also filed an appeal but withdrew its opposition by letter dated 19 January 2004.

III. The following documents were relied upon during the appeal proceedings:

PD1: JP-A-54-032111

PD3: JP-A-61-136650 (abstract in English and complete Japanese application)

HD2: I. Musulin and D. Dietz, "Selection of 6xxx alloys based on extrudability, properties and final usage", ET'92, p.25-33

HD5: J. Langerweger, "Influence of heat treatment practice on extrudability and properties of AIMgSi alloy sections", Aluminium Technology 1986, p.216-222

HD6: O. Reiso, "The effect of composition and homogenization treatment on extrudability of AlMgSi alloys", ET'84, p.31-40

HD7: A. Annenkoff and D. Marchive, "Properties of 6106 and 6005A extrusion alloys", ET'84, p.69-73

HD9: W.G. Barry, "Rationalization of structural aluminium magnesium-silicide extrusion alloys", ET'84, p.7-15

AL1: US-A-3 879 194

AL2: Zoeller et al., Metallurgical aspects of the development of AlMgSi alloys with low sensitivity to quenching, translated from Z. Metallkde 62(5), 1971, pp.354-358

AL3: US-A-4 814 022

AL4: WO-A-95/14113

AL5: US-A-5 690 758

AL6: Registration record of international alloy designations and chemical composition limits for wrought aluminum and wrought aluminum alloys, The Aluminum Association, Washington D. C., pages 1-15, April 1991.

IV. Requests

The appellant (patentee) requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the following documents: Claims 1 to 3 and description pages 2 to 6 as filed during the oral proceedings and the Figures as granted.

The respondent (opponent) requested that the appeal be dismissed.

V. Independent claims 1 and 3 read as follows:

"1. An extruded section of the following composition in weight %, in which Fe is present as -AlFeSi:

Mg	0.25 - 0.40
Si	0.60 - 0.90
Mn	0.10 - 0.35
Fe	up to 0.35
Others	up to 0.05 each, 0.15 total
Al	balance,

wherein the extruded section has after ageing an ultimate tensile strength of at least 240MPa.

3. An extruded section made by extruding an extrusion alloy of composition in weight %

Mg	0.25 - 0.40
Si	0.60 - 0.90
Mn	0.10 - 0.35
Fe	up to 0.35
Others	up to 0.05 each, 0.15 total
Balance	Al,

wherein the extruded section has after ageing an ultimate tensile strength of at least 240MPa.".

Claim 2 is dependent on claim 1.

VI. The parties submitted the following arguments:

(i) Appellant

The statement in the impugned decision, that the person skilled in the art wishing to ensure good corrosion resistance while maintaining adequate mechanical strength would consider lowering the Cu content in PD3, was wrong.

The prior art (in chronological order the documents AL2, HD9, PD3, and AL3) consistently taught that a certain level of Cu was necessary for attaining good mechanical properties, and that Cu posed a corrosion problem only at high Cu levels, not at levels of 0.10% and lower, and that the person skilled in the art would not reduce Cu below this level otherwise the tensile strength would suffer. The patent in suit provided a combination of good strength and extrudability properties (see Figure 5), as good as PD3 but surprisingly without the addition of Cu which the prior

art said was indispensable for obtaining good strength properties.

Contrary to the arguments of the opposition division PD3 and HD9 only taught that Cu was a problem as regards corrosion at the high end of the Cu range, ie at levels of 0.3% and above, but that Cu was still necessary in small amounts (>0.1%) for achieving good strength. There was no incentive to reduce the Cu level to trace amounts. The reference in HD2 to the limit of 0.10% was connected, not with corrosion resistance, but with the classification of the 6061 alloy by the Aluminum Association.

The patent in suit went against the prior art teaching in that it did not add Cu to an excess silicon Al-Mg-Si alloy and yet attained a tensile strength after ageing which was comparable with the tensile strength of prior art alloys, for example that of document PD3.

The high tensile strength of the claimed alloys was achieved by the special heating rate (10-100°C per hour) used to age the alloy, this being an essential feature of the invention. The heating rate for homogenisation was not the same as the heating rate used for ageing since the former concerned thick blocks and the latter thinner extruded sections.

(ii) Respondent

Starting from PD3 as the closest prior art document the general teaching such as in HD9 did teach to remove Cu from an extrusion alloy. According to HD9 an extrusion alloy must have corrosion resistance and, since Cu was

an issue as regards the corrosion resistance, there was an incentive for the person skilled in the art to remove Cu from the alloy. The statement of Zieger in AL2 and Greutert's incitement to find courage to add copper to the alloy confirmed the fact that Cu was an issue in this respect. AL3 to AL5 related to alloys in sheet form for automobiles, but these were subsequently painted so corrosion was not a serious problem here.

If Cu were removed from the alloy of PD3 this would have the required tensile strength if it were to be aged to peak strength by a T6 temper, as in the patent in suit, rather than by the T5 temper used in PD3. Figure 8 of the patent showed that the 6063A alloy had the same strength as the experimental alloy. Incentive for the removal of Cu was also provided by the cost of the metal, by its effect on corrosion resistance according to the general teaching of HD9, and its effect on extrusion pressure, as taught by AL2.

The alloy of Sample No. 1 of PD1 had the composition falling within the claimed range except for Mn, but this had little effect on the tensile strength. This alloy had no Cu and had a tensile strength of about 215 MPa after a T5 temper treatment, but if, with a view to increasing the tensile strength, an optimised T6 temper treatment were to be used instead, as taught by HD9, then a tensile strength of about 240 MPa could be achieved.

Starting from the alloy 6063 described in PD1, which had no Mn, the objective problem lay in improving the surface qualities of the alloy, since as stated in the patent in suit this was the purpose of Mn. The person

skilled in the art would, therefore, add Mn as taught in HD9 (Section (3) on page 8) to improve the surface qualities.

The heating rate used to age the alloy of the opposed patent was conventional, it was not mentioned in the prior art documents because it was too trivial. The heating rate for homogenisation in HD6 was the same as that in the patent in suit and would be same as the heating rate used for ageing, which was confirmed by Figure 2 of HD5.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Article 123(2), (3) EPC

The new claims are fairly supported by the application as originally filed and are restricted in scope as compared with the claims as granted. The description has been amended for consistency with the claimed invention so that the amended application is allowable. The respondent did not object to the amended patent on formal grounds.

3. *Clarity*

The last part of claims 1 and 3 contain a desideratum, namely that the extruded section should have, after ageing, an ultimate tensile strength of at least

240 MPa. This is allowable in the present case for the reasons given below in point 5.6.

4. Novelty has not been an issue during the opposition or appeal procedure. The Board agrees with the parties in this respect.

Inventive step

The broadest claim is claim 3, but the following considerations apply equally to claims 1 and 3 since these claims have substantially the same scope. The respondent has set out two lines of attack, one starting from PD3 as the closest prior art and the other from PD1, and each of these is considered in turn below.

5. Starting from PD3 as the closest prior art

The patent in suit concerns an extruded section of an excess silicon intermediate strength Al-Mg-Si alloy whose ultimate tensile strength after ageing is at least 240 MPa. Thus, the alloy is initially ductile enough to be extrudable, and is subsequently heat treated to deposit intermetallic compounds in the matrix in order to harden it. A high strength is imparted to the alloy by further heat treatment.

5.1 PD3 discloses an intermediate strength Al-Mg-Si alloy whose ultimate tensile strength after ageing is high. The document teaches (see page 3) the beneficial effect of Mn on refining the recrystallisation structure and improving the extrudability, and the effect of Cu on improving the mechanical properties on heating.

Sample 2 of Table 1, with 0.60% Si, 0.18% Fe, 0.15% Cu, 0.10% Mn, 0.42% Mg and the balance Al after extrusion and artificial ageing, presents a good surface quality and a tensile strength of 274 Mpa.

5.2 Claim 1 of the patent in suit defines a composition which differs from the alloy composition of PD3 in that the maximum impurity level for any one element, including Cu, is 0.05%, as against 0.10-0.30% in PD3. The claim also defines an important property, that the extruded section, after ageing, has an ultimate tensile strength of at least 240 Mpa.

It remains, therefore, to be determined whether it would be obvious to reduce the Cu content of the alloy of PD3 to below 0.05% and at the same time expect the ultimate tensile strength to be at least 240 Mpa after ageing.

5.3 It is not disputed that the prior art teaches a certain level of Cu to be indispensable for attaining a satisfactory tensile strength value. Thus, PD3 states (on page 3) that Cu is the constituent which acts to improve mechanical properties and that its effects are small if less than 0.10% is present. HD2 states (page 28, right column) that the strengthening mechanism of these alloys (ie Mg and Si) could be further enhanced by Cu additions such as the levels added to 6061 (which is 0.15%-0.40% according to AL6). HD9 says (page 7, right column) that tensile properties are the first requirement to be met and that Cu is extremely beneficial in increasing the T6 temper strength.

Similarly, AL2 teaches (page 3, last paragraph) the addition of 0.2% Cu as a strengthening element to the Al-Mg-Si alloy under discussion, and AL3 says (column 3) that below the minimum values given above for the main elements Si, Mg, and Cu (ie 0.10%-0.50% Cu) the desired mechanical characteristics in the treated state are not attained.

5.4 At the same time, however, Cu can have a deleterious effect on the corrosion resistance of Al-Mg-Si alloys having a high Si excess, and the prior art warns against adding too much Cu. PD3 says that adding more than 0.30% Cu is inappropriate because this can be linked to reduced corrosion resistance of the material, and HD2 states that additions of Cu to alloys with high Si excesses reduces corrosion resistance.
HD9 reports that an addition of Cu to the excess Si alloys adversely affects the corrosion resistance, especially under severe conditions, and AL2 discusses (page 4, last paragraph) corrosion aspects of Cu additions and says that this subject was open to dispute.

5.5 Therefore, there is consensus in the prior art that the Cu level must be maintained between certain levels in the interest of balancing the mechanical and corrosion properties of the alloys, the minimum being 0.1%. The question is whether the prior art additionally suggests reducing the Cu level to below 0.1%.

The cited paragraph on page 3 of PD3 indicates that corrosion becomes a problem only at Cu levels above 0.3%. HD9 does not state at which level of Cu corrosion becomes a problem, but on page 11, left column it is

stated that AA-6070 is preferred over AA-6066 because of its better corrosion resistance, and the former has Cu in the range 0.16%-0.40% according to AL6, which means that at these levels of Cu corrosion is not a problem. Although the corrosion problem was disputed in AL2, according to page 4 Mr Greutert recommends increasing the Cu content to values which have proved good in practice, which appears to be approximately 0.2%.

The statement in HD2, that additions of Cu to alloys with high Si excesses is reported to reduce corrosion resistance, but the limit for these alloys allows only up to 0.10% Cu, is not a recommendation to reduce the Cu level to below 0.10%, it is merely a statement to the effect that the Cu content of a 6351 or 6082 alloy must be limited to this level if the alloy is conform to the nomenclature of the registration record of international alloy designations and chemical composition limits for wrought aluminum and wrought aluminum alloys of the Aluminum Association (AL6). The impugned decision states that HD2 sets an upper limit of 0.10% for Cu because of the negative effect on the corrosion resistance, but this is not derivable from HD2.

Therefore, the prior art does not teach reducing the Cu level to below 0.10% and at the same time expect a high value of tensile strength to be maintained.

5.6 Despite the fact that the alloy of the patent is the same as that of PD3 except that it has Cu as a trace element only, the alloy, nevertheless, has an ultimate tensile strength of at least 240 Mpa. The difference

between the subject-matter of claim 1 of the patent in suit and PD3, therefore, corresponds to the desideratum that a high Si excess Al-Mg-Si alloy with only trace amounts of Cu be produced but without adversely affecting the high value of tensile strength attained in prior art alloys with Cu in significant amounts.

T 595/90 (OJ 1994, 695) concerns a product which could be envisaged as such with all characteristics determining its identity including its properties in use, but for which no known method of manufacture existed. Such an otherwise obvious entity might become non-obvious and claimable as such if there was no known way or applicable method in the art for making it and the method for its preparation was therefore the first to achieve this and do so in an inventive manner. The decision T 233/93 (unpublished) arrived at the same conclusion.

A high Si excess Al-Mg-Si extrusion alloy having no Cu but a high tensile strength could be envisaged as such, at least since Cu is expensive and it affects the extrusion pressure. This alloy would be an obvious entity, but for the fact that the prior art does not disclose a method of preparing such an entity. This is achieved for the first time in the patent in suit by the processing steps used, in particular the ageing process, which depends significantly on the rate of heating. A slow heating rate of 10 - 100°C is employed in the patent (page 3, lines 42 to 46). An effect equivalent to slow heating can be achieved by a two-stage heating schedule, with a hold temperature typically in the range of 80 - 140°C for a time sufficient to give an overall heating rate within the

above range. When aged to peak strength, extrusions are typically found to have an ultimate tensile strength of at least 240 MPa with acceptable toughness.

The respondent's argument that the slow heating rate of 10 - 100°C is conventional is not accepted in the absence of documentary or other evidence of this. The prior art discloses homogenisation heating rates of this order of magnitude, but the heating rate for homogenisation is not the same as the heating rate used for ageing, as the respondent argues, since the former concerns thick blocks and the latter thinner extruded sections. Moreover, heating is normally done as rapidly as possible for economic reasons, so that a relatively low heating rate for aging is unconventional.

5.7 The disclosed method of preparing a high Si excess Al-Mg-Si alloy extrusion alloy having no Cu but a reliably high tensile strength of a minimum of 240 MPa was not known in the prior art.

Starting from PD3 it is found that the extruded article involves an inventive step, accordingly. Therefore, the claimed extruded article is patentable.

6. Starting from PD1 as the closest prior art

The alloy of Sample 1 of document PD1 contains no Mn and the respondent argues that it would be obvious to add Mn for the sake of improving its surface qualities. The parties are agreed that Mn has little effect on the tensile strength.

The alloy, according to Table 2 of PD1, has a tensile strength of about 215 MPa after a T5 temper treatment. The document HD9 indicates that after peak ageing using a T6 temper treatment instead, a higher tensile strength would be achieved. However, the improvement in tensile strength between a T5 treatment and a T6 treatment would amount only to about 5% according to HD9, which is not sufficient to raise the tensile strength of the alloy of Sample 1 to 240 MPa.

As shown in point 5.6 above, the required tensile strength is achieved in the patent in suit by the special heating rate used in the ageing process, which is not suggested in the prior art. Moreover, a further advantage is that improved surface quality is obtained by the addition of Mn. Therefore, starting from PD1 also, it is found that the claimed extruded article involves an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form on the basis of the following documents:

   Claims 1 to 3 and description pages 2 to 6 as filed during the oral proceedings and the figures as granted.

The Registrar: The Chairman:

V. Commare W. D. Weiß