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File Number: T 450/89 - 333

Application No.: 84 903 142.2

Publication No.: 0 153 369

Title of invention: Electroless nickel plating of aluminium

Classification: C23C 3/02

D E C I S I O N  
of 15 October 1991

Applicant: Enthone, Incorporated

EPC Articles 54, 56

Keyword: "Novelty (affirmed) - no clear and unmistakable directions in prior art document" - "Inventive Step (affirmed after amendment)".

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 450/89 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 15 October 1991

**Appellant :** Enthone, Incorporated  
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**Representative :** Cropp, John Anthony David  
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**Decision under appeal :** Decision of Examining Division of the European  
Patent Office dated 09.02.1989 refusing European  
patent application No. 84 903 142.2 pursuant to  
Article 97(1) EPC.

**Composition of the Board :**

**Chairman :** F. Antony  
**Members :** R.A. Lunzer  
M.K.S. Aúz Castro

Summary of Facts and Submissions

I. European patent application No. 84 903 142.2, publication No. 0 153 369, was based on the international application PCT/US 84/01253 with an international filing date of 8 August 1984, a priority date of 22 August 1983, and an international publication number WO 85/01070 dated 14 March 1985.

II. By its decision given on 9 February 1989 the Examining Division refused the application, holding that it lacked novelty and inventiveness having regard in particular to:

(1) US-A-4 346 128

(3) US-A-3 666 529

(5) Handbuch der Galvanotechnik, Band II, 1966 (Carl Hansen Verlag), pages 740-741.

Independent Claim 1 was in the following form:

"A process for plating zinc or tin coated aluminium substrates with an adherent, non-blistered electroless metal coating by metal plating from a primary electroless plating bath to the desired thickness, the bath being replenished as needed to maintain the desired metal concentration, and with the bath being used until the electroless metal coatings produced on the substrates are non-adherent and blistered after which the bath is discarded, characterised in that the life of the bath is increased by plating a thin coating comprising the same metal on the substrates from another electroless metal plating bath prior to plating to the desired thickness with the primary bath, said thin coating being thinner than said subsequent plating and wherein both electroless

metal plating baths contain a source of ions of said metal and a reducing agent to reduce the metal ions."

- III. An appeal against that decision was lodged on 3 April 1989, the appeal fee was paid on the same day, and the Grounds of Appeal were filed on 12 June 1989. In the Statement of Grounds of Appeal, the Appellant contended that document (1), which had been relied on by the Examining Division as being destructive of novelty, could not bear the interpretation placed upon it, because it did not include any clear disclosure of the performance of process steps which were essential to the present invention. In particular, although it mentioned the possibility of using nickel plating at col. 7 line 49, the reference in that context was not clear, and appeared to refer to an undercoating of nickel, which was then to be followed by a final coating of tin, or possibly to a single nickel coating.
- IV. In support of its arguments, the Appellant introduced a short Affidavit by an expert, who was one of the co-inventors, and who stated that in his view the passage relied on by the Examining Division was capable of bearing four possible meanings, not one of which was that ascribed to it by the Examining Division.
- V. Together with its Statement of Grounds of Appeal, the Appellant filed as a main request a new Claim 1. Following a communication from the Board on 10 July 1991, indicating that this new claim did not meet the requirements of Article 123(2) EPC because of the introduction of additional matter, the Appellant agreed to delete the matter objected to, and introduced into the proceedings the further document:

- (6) "Wear resistant surfaces in engineering", 1986  
published by the Department of Trade and Industry.

The single independent Claim 1 now in issue is in the following terms:

"1. A process for plating a zinc or tin coated aluminium substrate by applying a metal plating to the desired thickness on to said zinc or tin coating from an electroless plating bath, the bath being replenished as needed to maintain the desired metal concentration, characterised in that the life of the bath is increased by plating a thin coating comprising the same metal on the zinc or tin coated substrate from another electroless metal plating bath prior to plating to the desired thickness with the primary bath, said thin coating being thinner than said subsequent plating and wherein both electroless metal plating baths contain a source of ions of said metal and a reducing agent to produce the metal ions."

VI. The Appellant requested that the patent should be granted with Claim 1 as indicated above, Claim 6 as filed on 12 June 1989, Claims 2 to 5 and 7 to 11 as filed on 17 December 1987, and a description yet to be adapted; alternatively, that Claim 1 be replaced Claim 1 according to auxiliary request I or II filed on 4 September 1991.

#### Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is admissible.

2. Admissibility of Amendments

2.1 The claims were amended in the course of the examination procedure, and Claim 1 as now put forward contains a number of features which were not to be found in the claim as originally filed. The following six features have been added to Claim 1, words added being shown in quotation marks:

- (i) the plating is performed on a - "zinc or tin coated aluminium substrate"
- (ii) - from "an electroless plating bath"
- (iii) "the bath being replenished as needed to maintain the desired metal concentration"
- (iv) "the life of the bath is increased by"
- v) "plating a thin coating comprising the same metal on the zinc or tin coated substrate from another electroless plating bath prior to plating to the desired thickness with the primary bath, said thin coating being thinner than said subsequent plating"
- (vi) "wherein both electroless metal plating baths contain a source of ions of said metal and a reducing agent to produce the metal ions."

2.2 All of the above identified features are to be found clearly disclosed in the application as originally filed, in some instances in more than one place. Relevant passages which provide a basis for the above identified features (i) to (vi) inclusive, in the application as originally filed, are to be found in the following passages:

- (i) Claims 2 and 3, and page 4 lines 2 to 5;
- (ii) Claim 5 and page 4 line 2;
- (iii) page 8 lines 1 to 5, read in conjunction with page 2 lines 4 to 6;
- (iv) page 3 lines 20 to 24;
- (v) page 6 lines 4 to 23; and  
machine suitable for the layered placing of dam cores and
- (vi) page 4 lines 25 to 26.

Accordingly, these amendments are admissible, since they meet the requirements of Article 123(2) EPC.

3. Novelty in relation to document (1)

3.1 At page 4 of its decision, the Examining Division found that the alleged invention was lacking in novelty having regard to the disclosure of document (1). Document (1) relates almost entirely to plating aluminium substrates with tin, although its claims refer to sequential deposition of two layers from, "a (metal plating solution", and to the use of, "a metal plating bath".

3.2 The Board is in agreement with the Examining Division that document (1) discloses clearly the following from amongst the essential features of Claim 1:

- an aluminium substrate (col. 1 line 22)
- pretreated with zinc, (col. 15 line 31)
- the deposition of a thin metal barrier layer which may be an electroless deposit of nickel; (col. 7 line 28)

- deposition of a second main coating layer  
(col. 19 lines 35 to 54).

Also, it is implicit that the second of those two layers, being the main coating layer, must be thicker than the thin first layer.

- 3.3 Furthermore, the Board agrees in principle with the Examining Division that, if document (1) had disclosed the performance of the process steps which define the alleged invention, even if directed to a different purpose, it would follow inevitably that the advantage specified in Claim 1, viz. that the life of the bath is increased, would also be attained, since, in accordance with the application in suit, this desirable result is no more than the consequence of the adoption of the process steps defined. Consequently, the Board would have agreed with the finding of lack of novelty, if document (1) had indeed disclosed that the two last deposited layers were of the same metal, deposited from two different baths.
- 3.4 As indicated above, document (1), although directed almost entirely to outer coatings of tin, has claims which refer to the deposition of metals, without limitation. As for deposition of metals other than tin, there is a clear disclosure of an undercoating with nickel (col. 7 lines 28 to 30), but such mention as there is of a nickel outer coating is both cryptic and obscure. (The relevant passages are quoted verbatim in 3.7 below). A comparable situation is to be found in the application in suit. Although it is directed almost entirely to nickel deposition, the claims refer to "a metal". Consequently, in resolving the issue of novelty, the Board would have been bound to find the application in suit lacking novelty



if document (1) had disclosed the sequential deposition either of two coatings of tin, or of two coatings of nickel, plated successively from two separate baths.

- 3.5 So far as concerns the use of an outer layer of tin, the consistent teaching of document (1) is that it is to be deposited on a layer of copper, or preferably nickel. An electroless nickel barrier layer is stated to be preferable to copper at col. 7 lines 28 to 30. Consequently, there is no disclosure at all of two coatings of tin.
- 3.6 Turning to the question of any possible disclosure of two successive layers of nickel, the deposition of nickel is first mentioned in the context of alkali attack on the aluminium substrate when depositing tin from a hot alkaline tin depositing solution (col. 7 lines 6 to 30), indicatin at line 28 the preference for nickel.
- 3.7 Then, as an alternative to depositing tin from an alkaline solution, the possibility of using an acid tin depositing bath is suggested at col. 7 lines 31 to 47. It states:

"Recognizing that high pH, high temperature solutions attacked aluminum and aluminum alloy substrates, especially when surface porosities are present, a low pH, low temperature acid tin bath was tested. It was found that only a very thin barrier layer of electroless nickel was required when using: (i)...., (ii)...., (iii)...., (iv) an outermost layer of plating, if other than electroless nickel (tin etc.), applied in a (acid), low temperature plating bath."

There then follows at lines 48 to 51 the following statement:

It has been found that the processes of the present invention economically produce electroless nickel, tin or other plated coatings on porous aluminum or aluminum alloys...."

- 3.8 Apart from those two references, which may or may not be intended to refer to nickel as the outer coating, document (1) contains 21 columns of detailed description, devoted entirely to the deposition of outer coatings of tin on aluminium substrates. These two stray mentions of the word "nickel", (other than in the context of a nickel underplate as a basis for tin plating, e.g. as at col. 18 line 3, and col. 22 line 3,) are obscure in the extreme. At col. 7 line 45, there is not even any clear proposal to provide an outer coating of nickel, but instead to provide an outermost layer of plating of, "other than electroless nickel". These words convey an implication that an outer coating of nickel had been previously suggested elsewhere in this document, which is not the case.
- 3.9 The Board is unable to find in document (1) any recommendation of using two sequential steps of depositing nickel. Still less is there any disclosure that the first layer should be thin and the second thicker, nor is there any disclosure that the two deposits should be made from two different nickel plating baths.
- 3.10 Accordingly the Board is satisfied that there is no disclosure in document (1) of the steps of depositing two layers of the same metal, from two different baths, as is required by Claim 1 in suit, with the consequence that prior disclosure of the alleged invention by document (1) is not established.

3.11 In the Board's view, it is of fundamental importance to the determination of the issue of novelty that a conclusion of lack of novelty ought not to be reached unless the prior document contains a clear and unmistakable disclosure of the subject matter of the later invention. Here, document (1) contains no more than a stray reference, in an obscure and self-contradictory passage, to the possibility of having an outer coating of nickel, which reference is inconsistent with the thrust of the teaching of the rest of the document, and it contains no disclosure at all of the use of two coatings of nickel. Such a prior document cannot deprive the present alleged invention of novelty.

4. Novelty in relation to document (5)

4.1 Document (5) is a German textbook on plating. A short part of its text, at page 740 is translated below. Under the heading:

"21.24 Nickel plating by the reduction method on various metals and non-metals (Nichtleitern)"

it includes a short passage which is relevant for present purposes. It says

"Nickel plating on aluminium and magnesium is of particular interest" (page 740, first line of last paragraph).

It then mentions the advantages of so doing, and continues at page 740, last line, to page 741, line 8:

"Aluminium pistons were plated by D. L. Garland in an ammoniacal reduction bath. S. A. Vischenkow also advocated an ammoniacal solution.... He treated

the aluminium in a zincate pickling solution, before treating it in the alkaline solution. In order to achieve thicker deposits, he suggests continuing deposition in an acid solution..... The acid solution attacks the aluminium, and does not yield any satisfactory plating."

- 4.2 That document contains another clear disclosure of the majority of the features of Claim 1 in suit. However, its disclosure is very brief, and there is no suggestion that the second coating should be thicker than the first.
- 4.3 In its communication attached to the summons sent on 10 July 1991, the Board suggested to the Appellant that such difference of thickness could be implicit in this disclosure, if one were to make the simple and reasonable assumption that the reason for using two plating baths, instead of one, is that the speed of plating from an acid bath is faster than from an alkaline bath. If that were so, the skilled worker would naturally apply the thicker coating from the second, faster plating bath.
- 4.4 However, the Appellant demonstrated, by reference to document (6), that there was no basis for the Board's assumption, and that in fact the rate of plating from an acid or an alkaline bath are much the same. As the essential feature of Claim 1, of making the outer layer thicker than the inner, is not disclosed in document (5), the Board is satisfied that this document does not deprive the invention of novelty.
- 4.6 As none of the other cited documents are any more pertinent than documents (1) and (5) considered in detail above, the Board is satisfied that the invention is novel for the purposes of Article 54 EPC.

5. Closest prior art

5.1 Although, as already indicated above, both documents (1) and (5) each contain disclosures of a large proportion of the features of the alleged invention, the Board does not regard either of them as being the closest prior art for the purposes of evaluating the issue of inventiveness. The teaching of document (1) is to use a succession of deposits of zinc, nickel, and tin, which is not a pointer in the direction of the alleged invention, while the disclosure of document (5) is so brief that it does not permit any valid comparison to be made between the prior art and the alleged invention.

5.2 The Board regards the statement which is to be found in lines 1 to 18 of example I of the application in suit, as being a valid indication of prior art practice. There it is indicated that aluminium panels were subjected to cleaning, zincated at room temperature, and plated with nickel in an electroless nickel plating bath sold by the Appellant under the name ENPLATE NI-431. The example reports that after about 5 turnovers, the nickel plating started to blister.

5.3 Although there is no evidence to this effect, the Board regards it as implicit from this example that plating baths of that character were available commercially before the priority date, and thus that this example contains a valid comparison between the alleged invention and the prior art.

6. Problem and its solution

6.1 The objective problem to which the application in suit is directed is to extend the life of a plating bath used for plating nickel onto zinc coated aluminium substrates.

Example I goes on to indicate (lines 19 to 30) that upon taking a fresh aluminium panel, which had been cleaned, zincated, and given a preliminary nickel coating, and then depositing a further coating with the above-mentioned plating bath, a blister free nickel deposit was obtained, notwithstanding the fact that the same bath resulted in blistered coatings when used as a single nickel plating bath.

- 6.2 The validity of this result was tested by immersing a fresh zincated panel in the bath (without any first nickel plating), and this time the nickel coating was blistered again. This demonstrates to the satisfaction of the Board that the process here disclosed has a considerable effect in extending the useful life of a plating bath, used to plate nickel onto zincated aluminium substrates.

7. Inventiveness

- 7.1 The issue of inventiveness turns on whether a skilled person, having as his starting point a single plating bath of the kind discussed above, and seeking to attain a significant increase in bath life in terms of the number of turnovers, would have appreciated that that problem was capable of being solved by the simple expedient of using two baths instead of one, and applying the nickel coating mainly from the second of the two nickel plating baths.

- 7.2 In the view of the Board, the prior art practice illustrated in example 1 does not suggest the use of two baths instead of one. Furthermore, the prior art documents (1) and (5), already considered above, do not point in that direction. The most pertinent of these is document (5), which, in the passage cited in 4.1 above, mentions the Russian language publication by Vischenkow,

teaching the successive use of two nickel plating baths, but there is no hint in that very brief disclosure of any possible advantage of applying the bulk of the nickel plating from the second bath. Nevertheless, having regard to its obligation to investigate the matter of its own motion as is required by Article 114(1) EPC, the Board attempted to secure a copy of the Russian text through inter-library co-operation, but that attempt was unsuccessful. The possibilities of obtaining a copy directly from Russia were not exhausted, but in the interest of procedural economy the Board did not want further to delay this decision.

7.3 The Examining Division expressed the view at page 7 paragraph 6 of its decision that the invention was obviously derivable from the combination of the teaching of document (5) with that of document (1) or document (3). As for document (1), as the Board has already found in connection with the issue of novelty that it contains no clear disclosure of two coatings of any one metal, whether that metal be nickel or tin, it can be ignored for present purposes.

7.4 Document (3) is more relevant in this connection. Its teaching is to avoid the use of a base coat of zinc, which had been commonly applied in the past, and to use instead a thin strike coating of nickel, followed by a second thicker nickel coating (col. 2 lines 15 to 17). The Board does not consider that a skilled worker, starting from the closest prior art as identified above, or even starting from the explicit disclosure of two nickel coatings contained in document (5), would find any pointer in document (3) towards making the first nickel coating thinner than the second.

7.5 That is because document (3) discloses this sequence of nickel coatings solely in the context of using the thin first nickel coating as a substitute for the usual zinc coating. In contrast, what is regarded by the Board as the closest prior art, and equally document (5), both relate to the more usual situation in which a zinc coating is present, so that the incentive for using a first thin coating of nickel, followed by a second thicker coating, as described in (3), does not exist. Consequently the Board is satisfied that there is no combination of the prior art here under consideration which would render the invention obvious.

8. Conclusion

The subject matter of Claim 1 of the patent in issue is novel, and involves an inventive step as required by Article 56 EPC. The claim is therefore patentable. The same applies to the dependent Claims 2 to 11, which relate to modifications of the process in accordance with Claim 1, and derive their inventiveness from Claim 1. Having allowed the Appellant's main request, the Board does not need to consider the auxiliary requests.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.



2. The case is remitted to the Examining Division with the order that a patent be granted on the basis of Claim 1 as indicated in V. above, Claim 6 as filed on 12 June 1989, Claims 2 to 5 and 7 to 11 as filed on 17 December 1987, and a description yet to be adapted.

The Registrar:

The Chairman:

  
E. Görgmaier

  
F. Antony