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# DECISION
## of 17 June 1997

**Case Number:** T 0276/96 - 3.4.2

**Application Number:** 87901876.0

**Publication Number:** 0296167

**IPC:** C25D 13/22

**Language of the proceedings:** EN

**Title of invention:**
Method of cationic electrodeposition using dissolution resistant anodes

**Patentee:**
PPG INDUSTRIES, INC.

**Opponent:**
BASF Lacke + Farben AG
Heraeus Elektrochemie GmbH

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 54, 56, 84, 123

**Keyword:**
"Novelty - implicit disclosure (no)"
"Inventive step - no"
"Amendments - method claim changed into use claim"

**Decisions cited:**
G 0005/83

**Catchword:**
-

Europäisches Patentamt
Beschwerdekammern

European Patent Office
Boards of Appeal

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Chambres de recours

**Case Number:** T 0276/96 - 3.4.2

# DECISION
## of the Technical Board of Appeal 3.4.2
## of 17 June 1997

| | |
|---|---|
| **Appellant:**<br>(Proprietor of the patent) | PPG INDUSTRIES, INC.<br>One PPG Place<br>Pittsburgh<br>Pennsylvania 15272 (US) |
| **Representative:** | Sternagel, Hans-Günther, Dr.<br>Patentanwälte Dr. Michael Hann<br>Dr. H.-G. Sternagel<br>Sander Aue 30<br>51465 Bergisch Gladbach (DE) |
| **Respondent:**<br>(Opponent) | BASF Lacke + Farben AG<br>Patente/Lizenzen/Dokumentation<br>Postfach 61 23<br>D-48136 Münster (DE) |
| **Representative:** | Fitzner, Uwe, Dr.<br>Dres. Fitzner & Christophersen<br>Rechts- und Patentanwälte<br>Kaiserswerther Str. 74<br>40878 Ratingen (DE) |
| **Respondent:**<br>(Opponent) | Heraeus Elektrochemie GmbH<br>Heraeusstr. 12-14<br>D-63405 Hanau (DE) |
| **Representative:** | Kühn, Hans-Christian<br>Heraeus Holding GmbH<br>Stabsstelle Schtzrechte<br>Heraeusstrasse 12-14<br>63450 Hanau (DE) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted 15 January 1996 revoking European patent No. 0 296 167 pursuant to Article 102(1) EPC.** |

**Composition of the Board:**

**Chairman:** E. Turrini
**Members:** S. V. Steinbrener
L. C. Mancini

## Summary of Facts and Submissions

I. The appellant (proprietor of the patent) lodged an appeal against the decision of the Opposition Division to revoke European patent No. 0 296 167.

Two oppositions had been filed against the patent as a whole and based on Article 100(a) EPC since the subject matter of the patent in suit allegedly lacked novelty and inventive step, respectively.

The Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC prejudiced the maintenance of the patent, inter alia having regard to the following documents:

D1: DE-A-34 23 605
D2: DE-C-15 71 721.

During appeal proceedings the Board considered the following further documents:

D7: R. Brdička: "Grundlagen der physikalischen Chemie", 8th edition, VEB Deutscher Verlag der Wissenschaften, Berlin 1969, pages 771 to 773

D8: Thyssen Edelst. Techn. Ber., 5th volume, number 1, 1979, pages 49 to 51

which were cited for the first time in the appeal proceedings by respondent I (BASF Lacke + Farben AG, Münster).

Moreover, in the oral proceedings the Board of its own motion referred to the prior art acknowledged at page 3, lines 27 to 42 of the patent in suit, in particular to US-A-4 031 050. Finally, the appellant cited US-A-3 682 814 in the oral proceedings, this document being also acknowledged in the patent specification.

II. In the communication of 17 February 1997 pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal the Board pointed out that although the claimed subject matter appeared to be novel with respect to the available prior art, it was doubtful whether the substitution of the well-known "dimensionally stable anodes" for the more recent design of document D1 could still be considered inventive, and that the additional features of the dependent claims were not likely to contribute to patentability.

III. Oral proceedings took place on 17 June 1997.

IV. The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of claims 1 and 2 as filed with the letter of 14 May 1997 as "Main request" or, auxiliarily, on the basis of claims 1 and 2 also filed with said letter as "Auxiliary request".

V. The respondents requested that the appeal be dismissed.

VI. The wording of claim 1 according to the main request on file at the time of the present decision reads as follows:

"1. A method of electrocoating an electrically conductive surface serving as a cathode in an electrical circuit comprising said cathode and an anode which does not dissolve nor deteriorate during the electrocoating process and having a coating of a material selected from the group consisting of ruthenium oxide, iridium oxide and mixtures thereof with a thickness of from 0.254 µm to 254 µm (0.01 to 10 mils) adhered to a self-supporting titanium including alloys of titanium substrate, immersed in an aqueous dispersion of a cationic resinous composition containing 10 to 200 parts by weight of chloride ions per million parts of the aqueous dispersion which will dissolve stainless steel anodes by passing electric current between said cathode and anode at a constant voltage of from 50 to 500 volts and a current density of from 0.5 to 10 amperes per 929.034 cm$^2$ (square foot) to cause a coating to deposit on the cathode."

Claim 2 is appended to claim 1.

Claim 1 according to the auxiliary request is worded as follows:

"1. Use of an anode comprising a self-supporting titanium including alloys of titanium substrate having thereon a conductive coating of a material selected from the group consisting of ruthenium oxide, iridium oxide and mixtures thereof with a thickness of from 0.254 µm to 254 µm (0.01 to 10 mils) in a method of electrocoating an electrically conductive surface serving as a cathode in an electrical circuit comprising said cathode and the anode, immersed in an aqueous dispersion of a cationic resinous composition containing 10 to 200 parts by weight of chloride ions per million parts of the aqueous dispersion which will dissolve stainless steel anodes by passing electric current at a current density of from 0.5 to 10 amperes per 929,034 cm$^2$ (square foot) between said cathode and anode at a constant voltage of from 50 to 500 volts to cause a coating to deposit on the cathode, to avoid dissolution or deterioration of the anode during the electrocoating process."

There is also a dependent claim 2 in accordance with the auxiliary request.

VII. The appellant's argumentation in support of its requests may be summarised as follows:

The respondents were overstraining the implicit disclosure of document D1 in that a mere reference to electrodeposition in general in said document has been used as a basis for deriving ranges of process parameters only claimed in the patent in suit, in particular the chloride content and the thickness range of the anode coating. Moreover, subject matter disclosed for the first time in the patent in suit has surprisingly been cited as state of the art against the appellant. Respondent I failed to prove by reference to a document that the corrosion problem was known. If the claimed chloride content was conventional as respondent I asserts, then corrosion of stainless steel should have been noticed everywhere in the past since stainless steel has been used in the field of cationic electrodeposition for about twenty years as standard material for anodes and tank walls. However, no such phenomenon has been reported in literature. Even if there was a sufficient amount of hydrolysable chloride in conventional resinous compositions, this would not mean that the chloride is actually hydrolysed under specific process conditions. The occurrence of hydrolysis has also not been proved by respondent I.

Nor is the claimed coating thickness derivable from document D1 since a spongy material as provided in D1 cannot be described by spherical particles used in the model calculations of respondent I. Furthermore, the arguments of respondent II (Heraeus Elektrochemie GmbH, Hanau) having regard to high catalyst consumption due to the spongy titanium material provided in D1 were clearly not supported by said document expressly emphasising a low catalyst content.

Having regard to the issue of inventive step, a person skilled in the art would not return from document D1 to classic "dimensionally stable anodes (= DSAs)" known from document D2. In this case, all advantages of D1 were lost, and such a modification would be contrary to the teaching of D1. It is true that document D1 mentions the DSA solution in the prior art discussion, however when defining the underlying problem, D1 does not make any reference to DSA type anodes. Since D1 claims low catalyst content, increased active surface and durability for its specific anode configuration, a skilled person would be barred from reconsidering the DSA concept.

In the appellant's view, document D1 is not the closest prior art but US-A-3 682 814 disclosing steel anodes which may be coated with oxidation catalyst sites. However, this document as well is silent with respect to the chloride corrosion problem. Corrosion resistant anodes of DSA type have been invented in the middle of the sixties, so the question arises why after such a long period these anodes have been proposed by the present inventor for the first time, in particular if the corrosion problem must have been detected earlier in accordance with the respondents' allegations. The respondents' economic considerations in this respect were not convincing since the cost of a more expensive anode material like titanium must be balanced against the considerable cost of shutting down an electrodeposition bath because of corrosion problems due to cheaper steel anodes.

Having regard to example 1 of document D2 cited by respondent II, this anode has a different structure since it is coated with palladium oxide. Moreover, D2 does not contain any reference to electrodeposition but relates to the electrolysis of brine which is subject to different process requirements.

Thus, a skilled person had no reason to use an anode of DSA type and the claimed invention cannot be considered obvious if a hindsight approach is to be avoided. At least the use for a new purpose set out in claim 1 according to the auxiliary request should be allowable.

VIII. The counterargumentation of respondent I may be summarised as follows:

The appellant's statements having regard to corrosion of stainless steel anodes in the presence of chloride ions and to chloride content of electrodeposition paints are in contradiction to the state of the art as also acknowledged in the specification of the patent in suit (see page 2, lines 11 to 24; page 3, 43 to 51 and page 4, examples in combination with Table I). The corrosion problems due to the presence of chloride ions form part of the common general knowledge of a skilled person as can be seen from the rather old textbook D7 mentioning an inhibition of anode passivation, and from the article D8 taken as an example from a flood of publications on typical localised corrosion effects observed with chemically resistant steels. An electrochemist would also know that chloride corrosion phenomena may be more or less pronounced in similar tank/bath combinations as has been described in the patent in suit.

A solution to the well-known chloride corrosion problem would be governed by economic considerations. As also admitted by the appellant in the patent specification, electrodeposition paints, in particular those made from epichlorohydrin, are normally always contaminated by chloride ions, apart from extremely pure ones which, however, are too expensive to be commercialised. The chloride content of conventional paints has been confirmed by the respondent's approximative calculations in the letter dated 19 November 1996, which were based on a Shell data sheet from 1992 used as an expert opinion.

Therefore, if a too rapid anode dissolution was observed in a conventional electrodeposition paint, it would be obvious to an electrochemist either to regularly replace the stainless steel anode by a new one or to select a more stable anode. In this context, one could already argue that it would then also be obvious to directly turn to dimensionally stable anodes as described in D2. However in the respondent's view, document D1 comes closest to the claimed subject matter since it already refers to an application of the anode in baths containing electrodeposition paints. All the claimed parameter ranges were typical for such baths. D1 is based on anodes of the DSA type and indicates a long lifetime for its specific DSA-like anode configuration. Since the specific anode configuration according to D1 has never been put to market and an increased effective anode surface as provided by D1 was not necessary for electrodeposition paints, a skilled person would readily fall back upon the well-known, proven DSA design which - at the time of D1 - had not been taken into account for reasons of cost.

IX. The respondent II argued as follows:

Despite their well-known drawbacks (see page 2 of the patent in suit), steel anodes have been used for such a long time because of economic reasons: anodes having a titanium core in accordance with D2 were rather expensive in the past since the metal was artificially withheld from the market.

The fact that stainless steel tanks are not affected by chloride corrosion would not be surprising for a skilled person since the tank walls are not electrically connected to anode potential.

Having regard to the claimed coating thickness, similar thicknesses have also been disclosed in example 1 of document D2.

With the spongy titanium material of D1, a lot of precious metal oxide may be absorbed and therefore be lost as an active oxidation catalyst for the electrodeposition process. In this respect, the catalyst forming a thin film on the surface of a titanium core was used more effectively in D2. When comparing the anodes according to D1 and D2, respectively, a skilled person would therefore base the decision on which anode to select on the relation between the respective prices of titanium and platinum metals.

Finally, in document D1, there are several references to document D2, all of these references being of positive nature. A skilled person would clearly realise that anodes of the DSA type in particular meet the requirement of low oxygen overvoltage. Document D2 discloses an anode which is resistant to chloride ions and, in the context of examples 1 and 3, explicitly refers to electrolysis of chlorine containing solutions in combination with organic compounds and general applications in galvanic industry.

## Reasons for the Decision

### 1. *Articles 84 and 123 EPC*

Apart from a formal rearrangement due to the change from two-part form to one-part form, claim 1 according to the main request differs from the granted claim in that the additional features of claim 4 as granted have been included in claim 1. Moreover, the claimed subject matter has been further restricted by features derived from the patent specification, these features concerning the thickness range of the coating and the fact that the substrate is "self-supporting" (see page 4, lines 13 to 14 and page 3, lines 52 to 54 of the patent in suit).

Claim 1 according to the auxiliary request relates to the use of an anode as defined in claim 1 according to the main request in a method of electrocoating an electrically conductive surface as defined in claim 1 according to the main request in order to avoid dissolution or deterioration of the anode during the electrocoating process.

In the Board's view, this change of a claim of the type "Method of fabricating item A using item B providing effect C" to a claim of the type "Use of item B in a method of fabricating item A to provide effect C" does not extend the protection conferred since with both formulations in fact the same activity would be forbidden for competitors whether they may not use the specific anode structure in an electrodeposition process for a specific purpose or may not carry out the electrocoating process using said anode structure serving said purpose (see G 5/83, reasons 11 to 13).

Therefore, the amended claim 1 according to both requests meets the requirements of Articles 84 and 123 EPC.

2. *Articles 54 and 56 EPC*

The grounds for opposition raised by the respondents concern lack of novelty and inventive step pursuant to Article 100(a) EPC.

2.1 *Main request*

2.1.1 In the Board's opinion, document D1 comes closest to the subject matter of claim 1 since it already relates to the use of a corrosion resistant oxygen producing anode in a method of electro-dipvarnishing (see D1, claim 23; page 3, last paragraph and page 8, second paragraph). In particular, the Board agrees with the parties that these passages implicitly disclose a method of electrocoating an electrically conductive surface serving as a cathode in an electrical circuit comprising said cathode and an anode which does not dissolve nor deteriorate during the electrocoating process, to cause a coating to deposit on the cathode.

Furthermore, the prior art anode comprises a coating of a material selected from the group consisting of ruthenium oxide, iridium oxide and mixtures thereof adhered to titanium particles which are partly embedded in the surface of electrically conductive synthetic material (see D1, claim 1; Figure 1 and associated text; examples 8 and 10). From the known use of the prior art anode for electro-dipvarnishing, a skilled person would also directly and unambiguously derive the fact that the anode will be immersed in an aqueous dispersion of a cationic resinous composition.

2.1.2 The allegation of respondent I that the known coating should also have a thickness falling in the range from 0.254 µm to 254 µm (0.01 to 10 mils) has been contested by the appellant in the oral proceedings, mainly because a "spongy material" as provided in example 10 of D1 could not be approximated by spherical particles. However, in example 10 of D1 the material is also described as "whet powder" (see D1, page 28, second paragraph) having a particle size from 0.4 to 0.85 mm (see D1, page 27, fourth paragraph) so that the results of respondent I's calculations based on the parameter values of example 10 (see the letter dated 19 November 1996) still appear to be plausible as a first approximation. Taking account of these results, the coating thickness in D1 should indeed fall within the claimed range. Nevertheless, this issue does not appear to be of crucial importance since the claimed thickness range proves to be conventional anyway as will be pointed out below in the context of the remaining prior art. Therefore, even if doubtful novelty of said feature with respect to document D1 may be conceded without further consideration.

Moreover, in view of the fact that there is no explicit disclosure of any parameter values of an electrocoating process in document D1, respondent I argued that features (iii) and (iv) containing "typical" parameter ranges would also be implicit to a skilled person from that document. In the Board's view, however, these ranges - even if typical - cannot be derived directly and unambiguously from the prior art and therefore are not considered anticipated by document D1 in accordance with the established interpretation of novelty before the EPO.

2.1.3 In consequence, the subject matter of claim 1 according to the main request differs from the closest prior art in that

(i) the coating is adhered to a self-supporting titanium including alloys of titanium substrate;

(ii) the coating has a thickness of from 0.254 µm to 254 µm (0.01 to 10 mils);

(iii) the aqueous dispersion contains 10 to 200 parts by weight of chloride ions per million parts of the aqueous dispersion which will dissolve stainless steel anodes; and

(iv) electric current is passed between said cathode and anode at a constant voltage of from 50 to 500 volts and a current density of from 0.5 to 10 amperes per 929.034 $cm^2$ (square foot).

2.1.4 The remaining documents being more remote from the claimed subject matter, claim 1 of the main request meets the requirements of Article 54 EPC.

2.1.5 Although D1 is silent on the parameter ranges set out in features (iii) and (iv) above, the Board is convinced that these ranges are familiar to an expert for electro-dipvarnishing processes.

This opinion has not been disputed by the appellant having regard to feature (iv). In fact, there is ample disclosure of similar voltage and current values in the prior art documents cited at page 3, fourth paragraph of the patent specification (see e.g. US-A-4 031 050, column 6, lines 20 to 28).

Having regard to feature (iii) the appellant initially contested the presence of the claimed chloride ion portion in conventional aqueous dispersions but finally restricted its argument to disputing the assumption of respondent I (see the letter dated 19 November 1996) that all of the hydrolysable chlorine contents of conventional cationic resinous compositions can actually be hydrolysed.

In the Board's view, the fact that conventional aqueous dispersions of cationic resinous compositions contain 10 to 200 parts by weight of chloride ions per million parts of the aqueous dispersion must be assumed on the basis of the appellant's own statements in the patent specification. At page 3, lines 43 to 51 of the patent in suit, it is stated that "the cationic electrodeposition paints preferably contain capped isocyanate curing agents... However, cationic electrodeposition paints based on epoxy resins and capped polyisocyanates are often contaminated with chloride ion which is a by-product of the method of preparation of the epoxy resins and capped polyisocyanates. Many epoxy resins are made from epichlorohydrin...". This is, e.g., the case for US-A-4 031 050 cited in the patent specification (see US-A-4 031 050, column 3, lines 36 to 39). The passage goes on saying "Such paints typically have a chloride ion concentration of at least 10, usually 10 to 200 parts per million (ppm) based on total weight of the aqueous dispersion" (emphasis added by the Board).

Moreover, in the examples at page 4 of the patent in suit, reference is made to the corrosive effects of typical cationic electrodeposition paints which were commercially available from PPG Industries, Inc. before the filing date of the application for the patent in suit and contained 24 ppm and 21 ppm chloride ions, respectively, according to Table I of the patent specification.

Therefore, it must be assumed that features (iii) and (iv) relate to normal process conditions a skilled person would expect in electro-dipvarnishing and thus cannot make any contribution to the establishment of an inventive step.

2.1.6 When starting from document D1, the technical problem as formulated in the patent in suit (see page 2, lines 38 to 39 of the patent specification) seems to be already solved by the closest prior art which discloses a method of electro-dipvarnishing using a corrosion resistant anode in an environment typically containing the claimed chloride ion content. Since the remaining differences (i) and (ii) relating to the anode configuration do not appear to provide an additional technical effect with respect to the anode of D1, the problem solved by the claimed subject matter with respect to the closest prior art may be seen in providing an alternative method of cationic electrodeposition in that an alternative anode design is employed under otherwise typical conditions of electrocoating processes.

2.1.7 The quest for alternative solutions as such must be considered to fall within an average practitioner's daily routine activities. In the present case, the Board believes that a clear hint of where to look out for an alternative anode design is already given in document D1: dimensionally stable anodes known from document D2 are described in D1 as being particularly advantageous, inter alia for chlorine production (see D1, page 1, last paragraph - page 2, first paragraph).

The classic DSA design relies on features (i) and (ii) (see D2, claim 1 and examples 1, 3, 4, 11 and 12) and leads to corrosion resistant anodes having low oxygen overvoltage values (see D2, column 4, lines 15 to 43) and being suitable for various electrolytic processes and applications in the galvanic industry, in particular for electrolysis of chlorine containing solutions in combination with organic compounds (see D2, column 5, lines 9 to 15 and column 6, line 68 to column 7, line 18). In this context, the appellant is right in saying that example 1 specifically relates to a different coating material (palladium oxide). However, the coating thicknesses and recommendations for use given in this example (see D2, column 5, lines 9 to 15 and 28 to 30) seem to refer to platinum metal oxides in general so that a skilled person would not assume the validity of these findings to be restricted to palladium oxide exclusively.

Therefore, the Board cannot see any barrier preventing the notorious skilled person from considering well-known DSA type anodes as a possible alternative design. In fact, the anode configuration according to D1 makes use of the basic DSA features, i.e. a valve metal, e.g. titanium, coated with a platinum metal oxide, e.g. ruthenium oxide. The features of D1 differing from the classic DSA type, i.e. the dispersed particle form of the valve metal and the plastic matrix for embedding said particles, apparently serve the purposes of achieving a low weight base structure in combination with an increased active surface (see D1, page 4, third paragraph). The Board agrees with the appellant that those additional effects would be lost when "returning" to anodes of classic DSA type. However, if light weight and active surface considerations are of secondary importance - which may be the case in electrocoating applications as the respondents allege - then a skilled person would undoubtedly be prepared to accept these "losses". Having regard to corrosion resistance and possible applications, the Board is convinced that an electrochemist would in any case expect a similar behaviour of the different anode structures.

2.1.8 Starting from a process employing stainless steel anodes as proposed by the appellant and disclosed in US-A-3 682 814 would not lead to a different result. An electrochemist using conventional electrodeposition paints would - due to the chloride content of the commercially available paints - necessarily observe anode corrosion. It must also be assumed that a skilled person would be inclined to trace any observed steel corrosion back to the presence of chloride ions since chloride corrosion appears to be a well-known fact revealing itself by typical corrosion patterns (see documents D7 and D8 in this context). Since a skilled person would become aware of the corrosion problem and its possible cause when carrying out the conventional electrodeposition process, an inventive step could only be seen in the selection of the DSA type anode as a solution to the corrosion problem. However, these anodes are the classic stable anodes reliably working in a chloride ion environment and suitable for a broad range of electrolytic applications including the electrolysis of chlorine containing solutions in combination with organic compounds as can be seen from document D2 (see the passages cited above). Therefore, in the Board's view it would also be obvious to try the claimed anodes of DSA type in said electrocoating process without considering document D1.

2.1.9 Finally, the appellant's argument that the use of a DSA type anode should be inventive since in accordance with the respondents' allegations the corrosion problem of stainless steel must have existed for a long time in parallel to the classic DSA concept until the patent in suit for the first time linked the concept to the problem is not considered to be convincing either. When observing corrosion problems of stainless steel anodes in an electrodeposition process, the skilled person, in fact, has only two options: either to replace the steel anodes as often as necessary or to look for a more stable anode which might be more expensive. Of course, the first option will include the onus of a more frequent process shut down. The Board considers it reasonable to assume that an electrochemist being well aware of the pros and cons of the existing alternatives would make a decision in accordance with circumstances including economic aspects which may favour continuing use of traditional arrangements. The issue of an anode modification may become more urgent if anode corrosion turned out to be responsible for further undesirable effects as e.g. discolouration of specific paints mentioned by the appellant during the oral proceedings. Although such a further more recent incentive may explain why a long existing technology is eventually adopted, it would not make its application less obvious under the present circumstances. In any case, the patent in suit does not relate to specific electrodeposition paints and associated effects.

2.1.10 In consequence, the Board cannot see an inventive step in selecting a DSA type anode for an alternative method of electrocoating an electrically conductive surface.

2.2 Auxiliary request

2.2.1 As has been pointed out in item 1 above, the Board considers the reformulation of claim 1 according to the main request as the use of said anode in said electrocoating process as a formal rearrangement of substantially identical subject matter. Therefore, the above arguments with respect to claim 1 according to the main request apply with equal force to claim 1 according to the auxiliary request. In particular, starting from document D1 already disclosing the use of a corrosion resistant anode in a conventional electro-dipvarnishing process it would be obvious to alternatively use a basically related anode of the classic DSA type with a reasonable expectation of success.

2.3 In consequence, the Board comes to the conclusion that the subject matter of claim 1 according to both requests lacks the inventive step required by Articles 52(1) and 56, EPC.

## Order

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana E. Turrini