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D E C I S I O N
of 16 July 1996

Case Number: T 0410/93 - 3.3.3

Application Number: 89105024.7

Publication Number: 0338271

IPC: C08G 65/48

Language of the proceedings: EN

Title of invention:
Method of preparing carboxy derivatives of polyphenylene ethers.

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:

"Problem and solution approach (effect-centred)"

Decisions cited:
T 0002/83; T 0031/84; T 0248/85; T 0246/91; T 0495/91; T 0686/91; T 0881/92; T 0939/92.

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0410/93 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 16 July 1996

Appellant: GENERAL ELECTRIC COMPANY
1 River Road
Schenectady
New York 12305 (US)

Representative: Catherine, Alain
General Electric France
Service de Propriété Industrielle
18 Rue Horace Vernet
F-92136 Issy-les-Moulineaux
Cedex (FR)

Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 17 February 1993 refusing European patent application No. 89 105 024.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
J. A. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 89 105 024.7, filed on 21 March 1989, claiming a US priority of 21 April 1988 (US 184328) and published under No. 0 338 271 was refused by a decision of the Examining Division dated 17 February 1993.

The decision was based on the set of Claims 1 to 19 as originally filed and published, Claim 1 of which reads as follows:

"A method for preparing a carboxy derivative of a polyphenylene ether which comprises contacting said polyphenylene ether at a temperature in the range of about 225-350°C with at least one ester of the formula

(I) 

wherein R^1 is an alkyl or fluoroalkyl radical containing about 1-6 carbon atoms or an unsubstituted or substituted aryl radical containing about 6-10 carbon atoms and R^2 is an organic radical containing at least one additional carboxylic acid ester or anhydride group, in the presence of a catalytic amount of at least one triaryl phosphite."

Claims 2 to 19 relate to elaborations of the method of Claim 1.

II. The only ground of refusal was non-compliance with the provisions of Article 56 EPC having regard to the teaching of the document:

D1: DE-A-2 505 329.

According to the decision, Example I of D1, which was regarded as the closest state of the art, disclosed a process for endcapping polyphenylene ethers (PPE) wherein the PPE was treated in solution with a base and an anhydride.

The subject-matter of Claim 1 was distinguished from this teaching by two features, namely:

(a) the process had been carried out at a temperature of 225 to 350°C and further

(b) the capping agent contained, additionally to an anhydride group, an ester group.

Considering these differences in turn, the objective technical problem to be solved by feature (a) was held to be to provide a further process for endcapping PPE. Since, however, the variation/optimisation of reaction parameters, such as the temperature, was a step routinely considered and undertaken by the skilled person when seeking to modify known processes, and since there was no evidence that the specific temperature range selected was associated with an unexpected technical effect, the claimed feature was merely the result of routine experiments, and no inventive step could be recognised.

As regards feature (b), the objective technical problem was again to provide a further process for endcapping PPE. On the basis of analagous arguments, it was a matter of routine for the skilled person to investigate modifications in the reagents used, including different substituent groups. There was no evidence discouraging the skilled person from taking an anydride modified by an ester group, nor that this was associated with any technical effect and hence not merely arbitrary. Such an arbitrary modification could not provide the basis for an inventive step.

Since there was no evidence that either of the differences (a) or (b) contributed in a non-obvious way to the solution of a technical problem over the process known from D1, no inventive step could be recognised for this claim.

III. On 14 April 1993, a Notice and Statement of Grounds of Appeal was filed, together with payment of the prescribed fee. In the Statement of Grounds of Appeal, the Appellant disputed the interpretation of D1 in the decision under appeal. Whilst on the one hand novelty had been recognised, on the other hand three important differences had been omitted, to wit:

(i) the primary purpose of the process was to carboxylate, and not merely endcap, PPE;

(ii) the process was carried out in the melt, not in solution; and

(iii) the endcapping agents used in D1 would not endcap PPE.

These differences were greater than those, for example, with respect to US-A-4 642 358, already acknowledged in the application in suit, so that D1 could not be regarded as the closest state of the art for the purpose of evaluating inventive step.

Compared with the acknowledged state of the art, the process of the application in suit avoided certain shortcomings of the solution method of carboxylation, in particular the use of organic solvent, and the presence in the product of a large quantity of fines and a substantial chloride content.

Finally, D1 did not mention the carboxylation, but only the endcapping of PPE, by reacting hydroxy-terminated PPE with a monofunctional material, e.g. a monoacyl halide or a monocarboxylic acid anhydride. This was not a carboxylating reaction, and in no way suggested employing the esters of formula (I) and a triaryl phosphite in the melt to carboxylate PPE.

IV. The Appellant requested:

1. that the decision under appeal be set aside, and that a patent be granted on the basis of the "present claims", i.e. Claims 1 to 19 as filed;

2. that the application be remitted to the Examining Division for examination to be resumed;

3. oral proceedings in the event that requests 1 and 2 were not allowed.

Reasons for the Decision

1. The appeal is admissible.

2. The only issue to be decided in this appeal is whether the refusal of the application for lack of inventive step in the light of the disclosure of D1 was correct.

3. The Board is unable to concur with the finding in the decision under appeal that the subject-matter of Claim 1 of the application in suit is distinguished from the disclosure of D1 only by the features (a) and (b).

3.1 Document D1 is concerned with reducing the oxidative and/or thermal degradation of PPEs, and achieves this by contacting the latter with (1) a capping agent in the presence of a water soluble base, (2) a catalytic phase transfer agent, e.g. an "onium" compound, and, optionally, (3) an effective reducing agent for the organic phase, e.g. a strong inorganic base (page 1; page 4, paragraph 6 to page 6, paragraph 1). The capping agent is selected from (i) monoacyl halides of the formula R-C(O)-X, (ii) hydrocarbon monosulphonyl halides of the formula R-SO_2-X, (iii) anhydrides of monocarboxylic acids of the formula R-C(O)-O-C(O)-R, (iv) alkyl halides of the formula R-X and (v) dialkylsuphates of the formula R-O-SO_2-O-R, in which R represents alkyl, cycloalkyl, aryl or mixtures thereof and X represents chlorine, bromine, fluorine or iodine (Claim 1; passage bridging pages 1 and 2). The preferred capping agent is, according to the description on page 4, lines 9/10 from the foot of the page, and the relevant Example I, acetyl chloride.

3.2 There is no mention in D1 of the use of a triaryl phosphite, let alone a triaryl phosphite in a catalytic quantity, as required by Claim 1 of the application in suit (section I, above).

Consequently, it is necessary to recognise at least a third distinguishing feature (c): that the reaction of PPE with the compound of formula I takes place in the presence of a catalytic quantity of a triaryl phosphite.

3.3 Furthermore, the application in suit is concerned with preparing a carboxy derivative of a PPE, as is clear from the wording of Claim 1, the title, the opening paragraph of the description and the statement of invention on page 3. The carboxy functional groups can then undergo reaction, for compatibilisation of the PPE with polyesters, polyamides etc., with the polyester or polyamide to form a copolymer. Such copolymers serve as compatibilisers for blends of unfunctionalised PPE with polyamide or polyester, thus improving such properties as impact strength and tensile strength (page 1, lines 1 to 21 and 28 to 30; page 2, lines 1 to 8).

3.4 In contrast to this, there is no intention in D1 to provide a functionally reactive derivative of PPE, let alone a carboxy reactive such derivative. On the contrary, the purpose of the capping agents is to de-activate any residual reactive groups, and thus to improve the oxidative and/or thermal stability of the PPE (page 4, last paragraph; page 8, paragraph 2).

This is furthermore reflected in the capping agents employed according to D1, which, as correctly pointed out in the decision under appeal, do not contain both an

anhydride group and an ester group. Indeed, closer examination of the definition of the capping group R in D1 shows that it excludes products with a residual carboxy functionality. The capping agents of D1 are thus intrinsically incapable of solving the problem addressed by the application in suit.

3.5 Consequently, one further distinction in the subject-matter of Claim 1 of the application in suit over the disclosure of D1, is that the former process has a different aim and a different result, namely (d): the preparation of a carboxy functional PPE.

3.6 The statement of problem adopted in the decision under appeal ("a further method of endcapping"), which was evidently derived by reference only to the features (a) and (b) which it found distinguished the subject-matter of Claim 1 from that of D1 (Section II, above) fails, however, to take account of the above differences (c) and (d).

3.6.1 Difference (d) in particular corresponds to a technical result (effect) obtained according to the method of the application in suit, which is not obtained according to the method of D1.

3.6.2 According to decision T 0248/85, OJ EPO 1986, 261, it is necessary to define the problem underlying the alleged invention by comparison of the technical results achieved by the claimed invention with those achieved by the designated closest state of the art (Reasons for the decision, point 11). Similarly, according to the decision T 0031/84, OJ EPO 1986, 369 it is necessary to "define the object of the invention on the basis of an objective analysis considering the difference or surplus of the results of the invention (effect) beyond such most relevant art" (Reasons for the decision, point 6).

3.6.3 If the surplus effect represented by difference (d) is taken into account in the light of the above, however, it becomes clear that the two methods are not realistically comparable with each other, since they are directed to the solution of different problems. Indeed, the problem addressed by the application is not derivable from D1, since (i) it is not mentioned in D1, (ii) the purpose of the method according to D1 has the opposite tendency (providing stability rather than reactivity), and (iii) the capping agents provided according to D1 are intrinsically incapable of providing a carboxy functional PPE (section 3.4, above).

3.6.4 Such a situation has been recognised by another Board in the decision T 0686/91 of 3 June 1994, not published in OJ EPO. In that decision the Board observed that, in the determination of the closest state of the art, ex post facto considerations should be avoided. Therefore a document not mentioning a technical problem that is at least related to that derivable from the patent specification, did not normally qualify as a description of the closest state of the art on the basis of which the inventive step was to be assessed, regardless of the number of technical features it might have in common with the subject-matter of the patent concerned. Although that decision concerned a granted patent, its legal principles are equally applicable to pre-grant proceedings.

3.6.5 In the light of the above, it is evident that D1 does not form an appropriate starting point for the derivation of a typical technical problem. In particular, it is not permissible to formulate a technical problem with respect to D1 in terms of "a

further method...." or even "an improved method" of endcapping PPE, since such a formulation presupposes that the two methods have the same, or at least a comparable object.

Hence, the Board cannot concur with the statement of problem in the decision under appeal.

3.6.6 In practical terms, the finding that the two methods are not comparable and furthermore that the relevant object of the application in suit is not derivable from D1 means that the skilled person, facing the need to compatibilise PPE (section 3.3, above) would not regard the disclosure of D1 as relevant to his purpose. He would not, therefore, seriously contemplate its teaching in his investigations, let alone take it as the "closest state of the art" serving as his starting point.

3.6.7 In the present case, furthermore, the two methods differ also in a number of the measures (features (a) and (b) at least) which they provide for the solution of their respective problems.

3.6.8 Clearly, such a state of the art, taken on its own, in which neither the problem nor the solution is closely oriented to the claimed subject-matter, can neither point in the relevant direction (problem), nor, a fortiori, provide an obvious route to the differing solution.

3.7 Even if this situation were ignored, however, and the statement of problem adopted in the decision under appeal ("a further process for end capping") accepted, for the sake of argument, it would still remain to be established whether it was obvious, in the light of that problem, to modify the process of D1 in respect of the admittedly distinguishing features (a) and (b).

3.7.1 As regards feature (a), the different temperature range, it is evident that the maximum temperatures taught in D1 are far lower than the bottom of the range mentioned in Claim 1 of the application in suit. Indeed, the maximum temperature mentioned in connection with the capping step in D1, which reflects the need to avoid any thermal or hydrolytic decomposition of the capping agent, is 100°C (passage bridging pages 6 and 7), and in Example I thereof, cited in the decision under appeal as forming the closest state of the art, the relevant step of reacting PPE with acetyl chloride is evidently carried out at room temperature.

Thus, the range specified in feature (a) cannot be regarded as a selection from the disclosure of D1.

3.7.2 The finding, in the decision under appeal, that there was no evidence that the specific temperature range "selected" was associated with an unexpected effect (Reasons for the decision, point 3.1) is irrelevant, since, as established above, the temperature range in question is not a selection from the teaching of D1.

3.7.3 The further finding, that the feature was merely the result of routine experiments, is itself inconsistent with the proper application of the problem and solution approach, since it addresses the question of what the person skilled in the art might or could have done.

On the contrary, according to the established case law of the Boards of Appeal, the decisive question is not whether a skilled person **could** have performed the contested subject-matter but rather whether he **would**

contested subject-matter but rather whether he **would** have done so in the expectation of solving the underlying technical problem (T 0002/83 OJ EPO 1984, 265; Reasons for the decision, point 7, and T 0939/92, OJ EPO, 1996, 309; Reasons for the decision, point 2.4.2, last two sentences).

In this connection, the teaching according to D1 emphasises the necessity of avoiding high temperatures because of the risk of decomposition of the capping agent, with the maximum temperature mentioned in this respect lying significantly (more than 100°C) below the minimum specified in Claim 1 of the application in suit (section 3.7.1, above).

Consequently, the skilled person could have had no expectation of success in raising the reaction temperature into the claimed range.

3.7.4 Thus, it would not be obvious to make a modification to D1 corresponding to feature (a).

3.7.5 As regards feature (b), there is not only no suggestion to use capping agents having an additional functional group, but the definition of the capping groups according to D1 excludes such species, as would be expected, given the general purpose of D1, which is to confer general stability, and not reactivity, on the polymer substrate (section 3.4, above).

3.7.6 The finding in the decision under appeal, according to which the person skilled in the art would take into consideration "all possible, known modifications, including different substituent groups" is inappropriate, for the same reasons as those given in connection with the temperature feature (section 3.7.3, above).

3.7.7 The further finding, that there was no teaching in the prior art which would discourage the skilled person from taking, as such a modification, an anhydride modified by an ester group cannot be supported by the Board, since the residual reactivity implied by the presence of two such groups is incompatible with the aim of D1, which, as stated above, is to provide stability and not reactivity.

Thus the teaching of D1 itself would discourage the skilled person from making modification (b).

3.7.8 Finally, the finding in the decision under appeal, according to which "there is no evidence that this feature is associated with any technical effect, or in other words that the modification of the anhydride group is purposive and not merely arbitrary" is unconvincing since the feature is quite clearly associated with a technical effect, namely that of providing a carboxy functional PPE. Thus the feature has not been shown to be arbitrary.

Consequently, it is not obvious to effect a modification in D1 corresponding to feature (b).

3.7.9 In other words, even accepting the statement of problem as formulated in the decision under appeal, neither modification (a) nor modification (b), let alone both in combination, arises in an obvious way from the disclosure of D1.

3.7.10 Thus, the decision under appeal has failed to show that the subject-matter of Claim 1 lacks an inventive step having regard to the state of the art represented by D1.

Hence, the appeal must succeed and the decision under appeal be set aside for this reason alone.

3.8 It is, however, conspicuous to the Board, that the decision under appeal, in relying on D1 as the closest state of the art, settled upon a document which is different from that acknowledged in the application itself and which, for the reasons given in the decision T 0686/91 (supra), would not normally qualify as a description of the closest state of the art (section 3.6.6, above).

3.8.1 In this connection, the Boards of Appeal have held on more than one occasion that an objective definition of the technical problem to be solved should normally start from the technical problem actually described by the Applicant. Only if it turns out (i) that an incorrect state of the art was used to define the technical problem or (ii) that the technical problem disclosed has in fact not been solved, can an inquiry be made as to which other technical problem objectively existed (see T 0246/91 of 14 September 1993, point 4.4 of the Reasons for the decision; T 0495/91 of 20 July 1993, point 4.2 of the Reasons for the decision; neither published in OJ EPO). Once again, whilst both these decisions concern granted patents, their legal principles are equally applicable to, and indeed have been applied in pre-grant proceedings (T 0881/92, of 22 April 1996; point 4.1 of the Reasons for the decision; not published in OJ EPO).

3.8.2 In the present case, document D2: US-A-4 642 358, which is acknowledged in the description of the application in suit (page 2), is concerned with the reaction of PPE with such polycarboxylic reactants as trimellitic anhydride acid chloride.

The teaching according to D2 is concerned with a process in which the object or purpose is substantially the same as that of the application in suit, and the means for achieving this aim, namely the capping agents, do not differ in the number of functional groups, but only in the nature of one of them, being a carboxylic acyl chloride instead of a carboxylic ester.

On the face of the documents, therefore, and in line with the submission of the Appellant in the Statement of Grounds of Appeal (section III., above), but contrary to the finding of the decision under appeal in this respect (Reasons for the decision, point 3.2.1), it is evident that D2 represents a closer state of the art than D1.

3.8.3 Apart from the dismissal, in the decision under appeal, of the argument of the Applicant regarding the advantages of the claimed method over that of D2 as being of no relevance, since it related to "a more distant state of the art" (Decision under appeal, reasons, point 3.2.1), there is no evidence that D2 has been fully considered in the light of the points (i) and (ii) above, in the examination proceedings so far.

Consequently, it will be necessary for the examination to be completed in this respect at least.

3.8.4 To enable this to be done, the Board intends to make use of its powers under Article 111(1) EPC to refer the case back to the first instance for further examination.

4. Since oral proceedings were only requested in the event that requests 1 **and** 2 were not allowed, these two requests being in themselves mutually exclusive (section IV., above), and the relief specifically requested by the Appellant in one of these requests (request No. 2) has been granted, it is not necessary for the Board to appoint oral proceedings.

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 for the examination to be resumed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin