BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File No.: T 0168/91 - 3.3.3

Application No.: 81 110 422.3

Publication No.: 0 054 290

Classification: C08F 283/00

Title of invention: Method of preparing carboxyl group-modified polyhydroxyethers, preparing an aqueous colloidal ionomer dispersion therefrom, and the use of the dispersion as protecting coating composition

D E C I S I O N
of 28 May 1993

Applicant: UNION CARBIDE CORPORATION

Proprietor of the patent:

Opponent: BASF Lacke + Farben Aktiengesellschaft, Münster

Headword:

EPC: Art. 56

Keyword: "Inventive step (no)"

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0168/91 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 28 May 1993

Appellant: (Proprietor of the patent)
UNION CARBIDE CORPORATION
39 Old Ridgebury Road
Danbury
Connecticut 06817 (US)

Representative:
Wuesthoff, Franz, Dr.-Ing.
Wuesthoff & Wuesthoff
Patent- und Rechtsanwälte
Schweigerstraße 2
D - 81541 München (DE)

Respondent: (Opponent)
BASF Lacke + Farben Aktiengesellschaft,
Münster
-Patentabteilung-
Max-Winkelmann-Straße 80
Postfach 61 23
D - 48165 Münster (DE)

Representative:

Decision under appeal: **Decision of the Opposition Division of the European Patent Office of 6 November 1990, issued in writing on 20 December 1990 revoking European patent No. 0 054 290 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: R. Lunzer
M. Aúz Castro

Summary of Facts and Submissions

I. European patent No. 0 054 290 was granted on 6 May 1987 on the basis of application No. 81 110 422.3 filed on 14 December 1981, having a priority date of 15 December 1980 derived from US Application No. 216 639.

II. On 15 January 1988 an opposition was lodged by the Respondent on the ground of Article 100(a) EPC, alleging lack of novelty (Article 54 EPC), and lack of any inventive step (Article 56 EPC). Although a considerable number of documents were referred to in the course of the proceedings before the Opposition Division, only a single document was relied on as depriving the alleged invention of both novelty and inventiveness, that being

(1) DE-A-2 721 823 and
(2) Wagner/Sarx, Lackkungsharze, Carl Hanser Verlag München 1971, pages 174-194,

the other cited documents having been used essentially as background material relevant to the proper interpretation of document (1).

III. In the course of the oral proceedings before the Opposition Division, held on 6 November 1990, a new Claim 1 was filed which reads as follows, the words added to the claim as granted being shown in bold type:

"Method of preparing a carboxyl group-modified polyhydroxy ether composition dispersible in water, characterized by grafting onto normally solid **linear** thermoplastic polyhydroxy ethers **having weight average molecular weights of at least 30,000** consisting of n units -(D-O-E-O)- wherein D is the residuum of a dihydric phenol, E is a hydroxyl containing residuum of

an epoxide, the degree of polymerization n being at least 30, one or more ethylenically unsaturated hydrocarbon monomers having 3 to 8 carbons, at least one of the monomers containing sufficient carboxyl groups to provide from 1 to 10 carboxyl groups per 10 monomeric units of thermoplastic polyhydroxy ether."

There are in all seven dependent claims, Claims 2 to 7 being directed to the preparation of aqueous colloidal ionomer dispersions in accordance with Claim 1, and Claim 8 to the use of such a dispersion to protect metallic substrates.

By its decision given on the same day, and issued in writing on 20 December 1990, the Opposition Division revoked the patent. It held that although the disclosure of document (1) came quite close to the subject-matter of the amended Claim 1, nevertheless document (1) did not actually disclose the complete modification of all the epoxy groups, which modification had to take place before grafting, nor did it disclose a polymer having a solely linear structure, nor the requisite level of molecular weight.

It found, however, that there was no inventive step involved, because the problem of making poly-hydroxyethers water dispersible for use in coatings without employing large amounts of solvents was solved by the method disclosed in document (1), *viz.* by grafting onto them carboxyl group containing monomers. As the modified epoxy resins of document (1) had a high molecular weight of up to 20,000, they were closely related to the polyhydroxyethers of the opposed patent, and it would therefore have been obvious to the skilled worker to apply the method known from document (1) to the known and very similar polyhydroxyethers.

IV. An appeal against that decision was lodged on 20 February 1991, the appeal fee was paid on the same day, and the Grounds of Appeal were as filed on 22 April 1991. The argument of the Appellant can be summarised as follows: the polyhydroxyethers of high molecular weight of the alleged invention formed a different class, having qualitatively different properties from the lower molecular weight epoxide resins disclosed in document (1). As was shown by a Test Report filed with the Grounds of Appeal, it had proved impossible to prepare a waterborne dispersion of high molecular weight polyhydroxyether by merely blending with a polycarboxylic acid (polymethacrylic acid). The invention was based on the discovery that high molecular weight polyhydroxyethers could be rendered water dispersible by grafting instead of blending, which was not disclosed or suggested by document (1). The Respondent's argument concerning the interpretation of the molecular weights given in document (1) was contested.

The Respondent had mis-stated the problem solved by the alleged invention. It was not confined merely to rendering polyhydroxyethers water dispersible, but entailed in addition finding a way of producing a coating which had excellent film forming protective properties.

V. In its counterstatement, the Respondent argued that the disclosure of document (1) deprived the alleged invention of novelty, or alternatively any inventive step. At the stage when in accordance with document (1) at page 18 the epoxide groups had been completely removed, the residual polymer which was then grafted could better be described as being a polyhydroxyether, rather than as an epoxide resin.

For the purpose of securing ease of dispersion in water, document (1) disclosed (pages 36 to 37) that the COOH groups should amount to at least 2% of the weight of the graft polymer, although in general a higher proportion such as at least 5% was preferred.

As for the alleged distinction based on molecular weights, document (1) did not specify when referring to molecular weights whether weight average molecular weight (M_w), or number average molecular weight (M_n), was intended. However, that doubt was resolved by the fact that at page 42 there was reference to the calculated average molecular weight of the Shell (Trade Mark) product EPON 1009 (Trade Mark) as being 6,500. The same commercial product was identified at page 4 of the Affidavit of Robert N. Johnson (filed by the Appellant on 7 November 1989) as having an M_w of 23,000. Thus it was clear that the average molecular weights referred to in document (1) were M_ns, from which it followed that the maximum M_n there disclosed of 20,000, could be regarded as equivalent to an M_w of the order of 60,000, and thus easily embraced the minimum M_w of at least 30,000 specified in Claim 1 in suit.

Furthermore, no valid distinction could be based on the fact that the claimed polyhydroxyethers were linear, because the epoxy resins which formed the starting point in accordance with document (1) also were predominantly linear. Thus there was a lack of novelty.

As for inventiveness, the problem with which the patent in suit was concerned was making the polyhydroxyethers water dispersible. Document (1) in fact disclosed exactly the same process for making substantially the same compounds water dispersible. Therefore there could be no inventive step in applying the teaching of document (1) to very similar, if not identical, polymers.

VI. The Appellant requested that the decision under appeal should be set aside, and that the patent should be maintained with Claim 1 as amended. The Respondent requested that the appeal should be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of amendments*

The Board regards the amendments to Claim 1 as admissible for the purposes of Articles 123(2) and 123(3) EPC. The introduction of the word "linear" defines the polyhydroxyethers more precisely, and is supported by the disclosure at page 2, line 54 of the patent as granted, corresponding to page 4, line 8 of the application as originally filed. Regarding the limitation to polyhydroxyethers having a weight average molecular weight of at least 30,000, the resin which is used in each of the seven examples is identified at page 5, line 64 as having about that weight average molecular weight. The same limitation was disclosed in the application as filed (page 16, line 8). As the Board does not consider that that figure is closely tied to other features of the Examples, it is admissible as a lower limit for the molecular weight. Apart from being dependent on the amended Claim 1, the dependent claims were unaltered.

3. *Novelty*

3.1 Novelty is strongly contested by the Respondent on the basis of the disclosure of document (1). According to its general teaching (Claim 1), the terminal epoxy

groups of an epoxy resin are first reacted with a modifying agent, and an ethylenically unsaturated monomer is subsequently grafted on that modified resin in the presence of a free radical initiator. Alternatively, these two steps may be performed in the reverse order, or even simultaneously. The modification is either a reaction of the epoxy groups with a monofunctional compound, or a chain extension reaction with a difunctional compound (page 18, paragraph 2; page 20, paragraph 1; page 23, paragraph 3).

There is thus a fundamental difference between the known process and the method claimed in the patent in suit. Whereas the prior art process can be regarded as a two-step process starting from an epoxy resin, the method defined in the main claim of the patent in suit is a one-step process using a linear polyhydroxyether as a starting compound. Novelty can thus be acknowledged on the sole basis of the different starting compound. There is thus no need to consider the question of the molecular weight of the epoxy resin at this stage.

4. *The closest prior art*

4.1 Document (1) is agreed to be the closest state of the art. When, according to a preferred embodiment, the graft monomer is acrylic acid, the resulting products are particularly suitable for coating applications, in particular in aqueous dispersions to coat metal cans used for drinks (page 20, paragraph 2 to page 21, paragraph 2; page 32, paragraph 3). In this case, the epoxy resin, which is a diglycidyl ether of bisphenol A with a molecular weight of 4,000 to 10,000 is first reacted with a diphenol (page 38, paragraph 2 to page 42, paragraph 2). In view of the proportions indicated in Table II on page 41, the resulting product must be regarded as a linear polyhydroxyether or phenoxy

resin. The carboxyl groups, which represent at least 2 weight percent of the graft polymer, ensure dispersibility in water in the presence of a suitable neutralizing or ionizing agent (page 28, paragraphs 1 and 2; page 36, paragraph 3 to page 37, paragraph 1; page 62, paragraph 2; page 63, paragraph 2). As demonstrated during the opposition procedure, such a carboxyl group content corresponds to a large extent to the range specified in Claim 1 of the patent in suit.

4.2 This raises the question of the molecular weight of the polyhydroxyether, since it is not specified in document (1) whether the above upper limit of 10,000 for the molecular weight relates to a weight average molecular weight (M_w) or to a number average molecular weight (M_n). In the Board's view, there can be no doubt that the polyhydroxyether, i.e. the epoxy resin after chain extension, has a weight average molecular weight higher than 30,000 for three reasons. The first results from the correspondence between the calculated average molecular weight of 6,500 and the weight average molecular weight of 23,000 in the case of epoxy resin EPON 1009 (document (1), page 42, paragraph 2 in conjunction with the Affidavit of Mr Johnson filed on 7 November 1989, page 4). On the basis of a similar polydispersity, it can reasonably be assumed that an epoxy resin having a number average molecular weight of 10,000 will give rise to a polyhydroxyether having a weight average molecular weight higher than 30,000. The second is that the polyhydroxyether is obtained by chain extension of the epoxy resin with bisphenol A, whereby the initial molecular weight of the epoxy resin is increased. The third is that the polyhydroxyethers according to the patent in suit and those according to document (1) are described in the same terms, in that they are obtained by chain extension of diepoxide compounds with diphenols which are in both cases similar

to each other (compare in particular page 40, paragraph 1 of document (1) with page 3, line 11 to page 4, line 3 of the patent in suit). For these reasons, the Board concludes that the molecular weight of the polyhydroxyether according to the preferred embodiment fulfils the condition expressed in Claim 1 of the patent in suit. For the same reasons, the Board regards the requirement in the patent in suit that the polyhydroxyether should be normally solid as a requirement implicitly met in the prior art.

4.3 It follows that the preferred embodiment of the process according to document (1) and the method claimed in the patent in suit aim at the preparation of coating compositions which are identical and, therefore, must have the same properties. The conclusion reached by the Appellant in the Experimental Report accompanying the Affidavit of Mr Johnson referred to in IV above, that starting with an epoxide resin, and carboxylating it (Experiments 1 to 3), is not an exact equivalent in terms of the quality of the coating obtainable, to the coating obtainable when starting from a polyhydroxyether (Experiments 4 to 7), is not disputed, but it is not appropriate for the purpose of demonstrating any superiority of the coatings obtainable with the claimed method. As specified above, the closest state of the art is not a non-modified epoxy resin which would be subjected to graft polymerisation with an unsaturated carboxylic acid, but an epoxy resin which is first reacted with a molar excess of bisphenol A, whereby all the epoxy groups are consumed, before being subjected to that reaction; in other words, the closest state of the art corresponds to a sequence of operations in which the intermediate product is identical with the starting product of the patent in suit.

5. *Problem*

In view of this finding, the problem underlying the patent in suit may be seen in finding a further simplified process of preparing the same carboxyl group-modified polyhydroxyether compositions in the form of dispersions.

6. *Solution and its effectiveness*

The solution proposed in accordance with the alleged invention is to start from a polyhydroxyether already prepared, and to subject it to the same grafting reaction with ethylenically unsaturated monomers containing carboxylic groups.

In the light of the experimental results reported in Example 11 of the patent in suit, and in the Experimental Report of Mr Johnson, the Board is satisfied that the above-defined technical problem has been effectively solved.

7. *Inventive step*

The issue of inventive step comes down to the question of whether the prior art provides an incentive for the skilled person to start from polyhydroxyethers already prepared when looking for a simplified process.

In addition to the fact that the suitability of polyhydroxyethers for use in coating applications is acknowledged in the patent in suit, document (2) mentions their use, in particular for metal can lining, either as single film-forming components, or in combination with hydroxyl reactive components (page 194). It is thus known to make use of the reactivity of the hydroxy groups of polyhydroxyethers to

prepare the final polymer ingredient in one single step. The Board therefore finds that it was obvious for the skilled person to apply this teaching to the solution of the above-defined technical problem.

From that it follows that the existence of an inventive step cannot be recognised.

8. Claim 1 not being allowable, the same applies to the dependent Claims 2 to 8, which are directed to preferred embodiments of the method according to the main claim, and thus they fall with it.

9. *Conclusion*

The subject-matter of Claim 1 of the patent in issue thus did not involve any inventive step as required by Article 56 EPC, with the consequence that the decision of the Opposition Division revoking the patent must be upheld.

Order

For these reasons, it is decided that:

1. The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin