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D E C I S I O N
of 28 September 2000

Case Number: T 1179/97 - 3.3.3

Application Number: 86302825.4

Publication Number: 0202765

IPC: C08G 59/04

Language of the proceedings: EN

Title of invention:

Stable aqueous epoxy resin dispersions

Applicant:

SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - problem and solution"

Decisions cited:

T 0012/81; T 0181/82; T 0035/85; T 0197/86; T 0246/91;
T 0495/91

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 1179/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 28 September 2000

Appellant:

SHELL INTERNATIONALE RESEARCH
MAATSCHAPPIJ B.V
Carel van Bylandtlaan 30
NL-2596 HR Den Haag (NL)

Representative:

-

Decision under appeal:

Decision of the Examining Division of the
European Patent Office dated 28 January 1997,
issued in writing on 16 July 1997 refusing
European patent application No. 86 302 825.4
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
A. Lindqvist

Summary of Facts and Submissions

I. European patent application 86 302 825.4, filed on 16 April 1986, claiming a US priority of 18 April 1985 (US 724439) and published under No. 0 202 765, was refused by a decision of the Examining Division taken at oral proceedings held on 28 January 1997, which were not attended by the Applicant, and issued in writing on 16 July 1997. The decision was based on a set of Claims 1 to 11 forming a main request and a set of Claims 1 to 10 forming an auxiliary request, both filed with a submission dated 20 December 1996 (received on 23 December 1996). Claim 1 of the main request, which differed only editorially from Claim 1 of the application as originally filed, read as follows:

- "1. An epoxy resin dispersion composition comprising:
- (1) an aqueous medium; and
 - (2) from 50 to 70 weight percent of self-emulsifying epoxy resin, having a molecular weight of 1000 to 20,000, and which resin is the addition reaction product of:
 - (a) 40-90 parts by weight of a diglycidyl ether of a dihydric phenol,
 - (b) 5-35 parts by weight of a dihydric phenol,
 - (c) 2-15 parts by weight of a diglycidyl ether of a polyoxyalkylene glycol, and
 - (d) 2-15 parts by weight of an alkyl phenol-formaldehyde novolac resin wherein the alkyl group contains 4 to 12 carbon atoms."

Claims 2 to 10 were dependent claims directed to elaborations of the epoxy resin dispersion composition according to Claim 1.

Claim 11, an independent claim, read as follows:

"11. An aqueous coating composition comprising an epoxy resin dispersion in accordance with any of claims 1-10 and a polyamine curing agent such that the ratio of active amine hydrogens to epoxy groups is from 0.5:1 to 2:1."

Claim 1 of the auxiliary request contained the further requirements that components (a), (b), (c) and (d) had been addition reacted prior to curing, and that a specified epoxide equivalent weight range for (a) be fulfilled.

Claims 2 to 5 of the auxiliary request corresponded to Claims 2 to 5 of the main request, and Claims 6 to 10 corresponded to Claims 7 to 11, respectively, of the main request.

II. According to the decision, the subject-matter claimed in both the main request and auxiliary requests, whilst novel, did not involve an inventive step, in the light of the disclosures of:

D1: EP-A-0 051 483;

D3: FR-A-2 299 359; and

D5: H. Lee and K. Neville, "Handbook of Epoxy Resins", McGraw Hill Book Company, 1967, pages 11-13 to 11-15.

In particular, D1, which was the closest state of the art, disclosed a composition comprising components (a), (b) and (c) according to the application in suit, in

the same proportions and in combination, and also mentioned the use of novolac cross-linkers. Due to inconsistencies and the use of inappropriate test conditions in the experimental evidence on file, however, there were no comparative data showing the criticality of choice of the novolac cross-linker or comparing compositions differing only in the fact that part of the cross-linker had (according to the application) or had not (according to D1) reacted with the other components of the dispersed epoxy resin. Consequently, no technical effect had been shown to be caused by the feature distinguishing the claimed subject-matter from the prior art, and the objective technical problem underlying Claim 1 (both requests) in view of the closest embodiment of D1 could only be formulated as providing further aqueous dispersions comprising a self-emulsifying epoxy resin and a novolac cross-linker agent.

It was, however, known from D3 and D5 that the term "novolac" encompassed resins based on alkyl phenols, the alkyl group having, for instance, 4 to 12 carbon atoms. Hence, in the absence of evidence for the criticality of these groups, the particular novolac resins used according to Claim 1 had to be regarded as an arbitrary selection from the general teaching "novolac" in D1.

Furthermore, documents D1 and D5 showed that novolacs of various kinds had been well-known reactants for the preparation of epoxy resins, even in the context of aqueous epoxy resins dispersion yet to be cured. It was, therefore, an obvious solution to modify the self-emulsifying epoxy resins with part of the novolac cross-linking agent addressed in D1. The skilled person

would not have expected a substantial change in properties, because the cross-linker would in any case have been chemically incorporated in the epoxy resins upon curing, and the chemical structure of the cured product would thus be expected to remain essentially the same. Nor was there any disincentive to use a cross-linker such as a novolac, since the latter was known from D5 as well as from D1 to be a conventional cross-linking agent for epoxy resins.

Whilst not forming a ground for refusal, objection was also raised *inter alia* that there was a discrepancy between the lower limit of molecular weight of 1000 for the epoxy resins on the one hand and the molecular weights given for the various components (a) to (d) which implied that the total molecular weight in practice had to exceed this lower limit. Consequently, the claim was not clear in the sense of Article 84 EPC.

III. A Notice of Appeal against the above decision was filed on 14 August 1997, in Dutch, the prescribed fee being paid on the same day, and an English translation being filed on the following day.

In the Statement of Grounds of Appeal, filed on 21 November 1997, the Appellant (Applicant) argued, in substance, as follows:

- (a) The application in suit provided stable epoxy resin dispersions designed for use in two package, room temperature curable, aqueous coating compositions, to be used, in combination with an epoxy resin-interacting polyamine curing agent, as primers, automotive coatings, and industrial maintenance paint compositions. Such compositions,

which showed an improved combination of long term shelf stability and freeze thaw stability, and also physical coating properties, such as flexibility reflected by impact strength and Erichsen slow penetration of the cured film, represented a significant development for the industry.

- (b) Compared with the aqueous coating compositions according to D1, which could be cured with a variety of curing agents and *inter alia* with novolac curing agents but then only at high temperatures, the epoxy resin dispersions according to the application in suit differed in that a specific novolac curing agent (based on C₄-C₁₂ alkyl phenol) was prereacted with the three prior art resin constituents, and not used as a cross-linking or curing agent therefor. Thereafter, the thus obtained resin with the novolac chemically incorporated therein was dispersed in an aqueous medium, to be cured at room temperature with epoxy interacting polyamine curing agents. This resulted in a coating film showing improved properties, which could not have been expected by a person skilled in the art.
- (c) There was no disclosure or suggestion in D1 of the use of a specific alkyl phenol novolac curing agent as a prereacted constituent of an epoxy resins composition for providing an improved low temperature cure.
- (d) Whilst D3 disclosed a vulcanisable elastomeric composition containing the reaction product of an alkyl phenol novolac with an epoxy containing

compound, there was no disclosure or suggestion to incorporate an alkyl phenol novolac into a self-emulsifying epoxy resin.

- (e) There was no suggestion in D5 to react any phenol novolac with two different epoxy resins to be applied in room temperature curable coatings showing a good combination of properties.

The Statement of Grounds of Appeal was accompanied by a further set of comparative experiments to show an inventive step with respect to the disclosure of D1. Four sets of claims forming a main request and first, second and third auxiliary requests were also filed with the Statement.

- IV. Following the issue, by the Board, on 4 August 2000, of a communication referring to the necessity of complying with the requirement of Article 123(2) EPC and requesting further information concerning molecular weight limits in relation to components to (b) to (c) and (d) in Claim 1, the Appellant filed, on 29 August 2000, two further sets of Claims 1 to 9 forming a main request and first auxiliary request, respectively. Claim 1 of the main request reads as follows:

"A stable, aqueous epoxy resin dispersion composition comprising:

- (1) an aqueous medium; and
- (2) from 50 to 70 weight percent of self-emulsifying epoxy resin, having a molecular weight of 1000 to 20,000, and which resin is the addition reaction product of

- (a) 40-90 parts by weight of a diglycidyl ether of a dihydric phenol, and/or hydrogenated dihydric phenol,

(b) 5-35 parts by weight of a dihydric phenol,
(c) 2-15 parts by weight of a diglycidyl ether of a polyoxyalkylene glycol, and
(d) 2-15 parts by weight of an alkyl phenol-formaldehyde novolac resin wherein the alkyl group contains 4 to 12 carbon atoms,
wherein (a), (b), (c) and (d) have been prereacted by simultaneous heating and to which self emulsifying epoxy resin has been added,
(3) from 5 to 20 wt%, based on resins solid weight of a water miscible glycol or water miscible glycol ether, having from 2 to 8 carbon atoms,
(4) a water immiscible C₈-C₂₀ aliphatic monoepoxide reactive diluent in an amount of from 1 to 25 wt%, based on resin solid weight,
and wherein the aqueous resin dispersion has a maximum particle size of 3 microns."

Claims 2 to 7 are dependent claims directed to elaborations of the epoxy resins dispersion according to Claim 1.

Claim 8, an independent claim, is worded as follows:

"A room temperature curable aqueous composition comprising an epoxy resin dispersion in accordance with any of claims 1-7 and a polyamine curing agent such that the ratio of active amine hydrogens to epoxy groups is from 0.5:1 to 2:1."

Claim 9, a dependent claim, is directed an elaboration of the room temperature curable aqueous composition according to Claim 8.

The first auxiliary request differs from the main

request in that Claim 1 of the latter includes features relating to the epoxide equivalent weight of component (a) and the molecular weight ranges of components (c) and (d), as well as the melting point range of the latter.

Information concerning the corresponding parameters of the relevant components used in the additional experiments filed with the Statement of Grounds of Appeal was also included in the submission.

- V. The Appellant requested that the decision under appeal be set aside, and a patent granted on the claims of the main request or, in the alternative, those of the first auxiliary request, both filed on 29 August 2000.

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of amendments (main request)*

Claim 1 differs from Claim 1 underlying the decision under appeal, which itself differs from the version as originally filed only editorially by (a) the insertion of the word "and" between "20,000" and "which resin", and (b) the provision of an antecedent for "the alkyl group" by the insertion of the words "an alkyl phenol" before "novolac resin" in the definition of component 2(d) (cf. Section I., above), in the following four respects:

- (i) The definition of component (a) has been amplified to include, as an option, the replacement of at least part of the dihydric

phenol by hydrogenated phenol;

- (ii) A requirement that components (a), (b), (c) and (d) have been prereacted by heating has been inserted;
- (iii) A requirement for the presence of two further components (3) and (4) has been made; and
- (iv) A limitation to a specific maximum particle size of the resin dispersion has been introduced.

Feature (i) is supported by the description as originally filed on page 3 at lines 10 to 12 (printed specification, column 2, lines 27 to 30). Feature (ii) is supported by the description on page 6, lines 22 to 28 of application as originally filed (printed specification, column 4, lines 41 to 48). The components of feature (iii) are to be found in original Claims 8 and 7, respectively. Finally, feature (iv) is supported by the original description on page 7, line 7 (printed specification, column 5, lines 5 to 7).

Claims 2 to 5 correspond to Claims 2 to 5, respectively of the application as originally filed and Claims 6, 7 and 8 to Claims 7, 9 and 10 respectively of the application as originally filed. Claim 9 is supported by the description on page 7, lines 23 to 29 (printed specification, column 5, lines 25 to 34).

Thus, no objection under Article 123(2) EPC arises in respect of the amendments made, which are consequently admissible.

3. *Clarity (Main request)*

The alleged discrepancy between the lower limit of the molecular weight of component (2) in Claim 1 and the description of the application in suit (section III., last sentence, above) is based on statements, in the description, concerning the molecular weight of particular components, which are either stated to be "preferred" (page 3, line 4 from the foot of the page) or just "useful in this invention" (page 5, lines 1 to 4). It is, however, evident that these ranges are not explained as being essential in the description, and indeed in at least the first case are explicitly stated to be only preferable. Whilst some editorial amendment of the description may ultimately be necessary in this respect, the Board sees no irreparable contradiction with Claim 1 such as would justify the maintenance of an objection under Article 84 EPC. The latter was in any case not a ground for refusal of the application in suit according to the decision under appeal.

On the contrary, the present set of claims complies with the requirements of Article 84 EPC in that it provides a clear definition of the claimed subject-matter. In particular, it follows from the wording of Claim 1, that the self-emulsifying epoxy resin (2) is the addition reaction product of the four compounds (a) to (d), which generally reflects the method of preparation described on page 6, lines 22 to 28 (printed specification, column 4, lines 41 to 48), and that aliphatic monoepoxide reactive diluent (3) and glycol or glycol ether (4) are added to the aqueous dispersion of (1) and (2).

The requirement that the epoxy resin (2) be curable implies that the weight amounts of the diglycidyl ethers (a) and (c) on the one hand and of the modifiers

(b) and (d) on the other hand are such that in any case the epoxy groups are in excess to be subsequently reacted with the curing agent.

In summary, the claims meet the requirements of Article 84 EPC.

4. *Novelty (main request)*

Whilst novelty was recognised, according to the decision under appeal, because no objection to novelty had been raised up to then (Reasons for the decision, point 4), Claim 1 underlying the present decision is not identical with that underlying the decision under appeal. In particular, the claim has been broadened, by the re-definition of component (a) (feature (i); Section 2., above). The only document which, in the Board's view, is sufficiently close to the claimed subject-matter to enter into consideration as possibly being of relevance for the question of novelty is D1, the disclosure of which represents the closest state of the art. In the latter connection, it will be convenient to consider the disclosure in detail, since it also has relevance for the formulation of the technical problem and its solution.

4.1 According to D1, there is disclosed a stable epoxy dispersion composition for use as a coating composition in industrial maintenance coating systems (page 1, lines 1 to 2; page 3, lines 3 to 5).

The dispersion composition comprises:

- (1) an aqueous medium; and
- (2) from 50 to 70 weight percent of self-emulsifying epoxy resin, having a molecular weight of 500 to

20,000, and which resin is the addition reaction product of:

- (a) 40-90 parts by weight of a diglycidyl ether of a dihydric phenol and/or of a hydrogenated dihydric phenol,
- (b) 5-35 parts by weight of a dihydric phenol, and
- (c) 2-15 parts by weight of a diglycidyl ether of a polyoxyalkylene glycol (Claim 1).

A preferred embodiment of the composition may additionally contain, as further ingredients:

- (3) from 5 to 20 wt%, based on resin solids weight, of a water miscible solvent glycol or water miscible glycol ether, having from 2 to 8 carbon atoms, to render it freeze-thaw resistant (Claim 9; page 3, lines 35 to 37); and
- (4) a water immiscible C₈-C₂₀ aliphatic monoepoxide reactive diluent in an amount of from 1 to 25 wt%, based on resin solids weight, providing the composition with improved shear, shelf viscosity stability and paint gloss (Claim 7; page 3, lines 33 to 35; page 6, lines 19 to 26).

The aqueous resin dispersion may have a maximum particle size of 3 microns (page 10, lines 6 to 9).

A room temperature curable such composition may be prepared by admixing the stable epoxy dispersion composition with a polyamine curing agent, preferably at a ratio of active amino hydrogens to epoxy groups in the admixture of 0.5 to 2:1 (Claim 11; page 7, lines 13 to 19). Alternatively, a "one package" coating system may be prepared by blending a stable such epoxy dispersion composition with a crosslinking agent which is substantially unreactive with the epoxy groups at

room temperature. Suitable such curing systems include novolacs (page 8, line 26 to page 9, line 12).

According to general Example A and Examples I, II and III, such stable epoxy dispersions are prepared. According to Examples IV, V and VI stable such epoxy dispersions are formulated as water-borne paint compositions together with a solvent solution of a polyamido-amine curing agent.

- 4.2 Thus the additional option of "feature (i)" in Claim 1 of the application in suit is equally disclosed in the closest state of the art (Section 2., above). In other words, the presence of this feature does not alter the relationship of the claimed subject-matter to the disclosure of D1 as far as it is relevant to the question of novelty.
- 4.3 On the contrary, according to the decision under appeal, such a composition differed from that according to D1 in the requirement for the presence of a certain novolac (based on C₄-C₁₂ alkyl phenol) being used of which at least a certain proportion (2 to 15% by weight based on total resin) had been chemically incorporated in the dispersed epoxy resin (Reasons for the Decision, point 5.3, first paragraph).
- 4.4 Hence, it is evident that the claimed subject-matter did not rely for its distinction over D1 on the feature which was amended into feature (i). Consequently, the Board sees no reason to differ from the finding of the decision under appeal in relation to novelty even in respect of the amended claims forming the main request.
5. *The technical problem and its solution; Inventive step*

The finding, in the decision under appeal, of lack of inventive step rested on two principal findings.

- (i) There were no comparative data on file showing criticality of the choice of novolac or comparing compositions differing only in the fact that part of the novolac cross-linker had (according to the application) or had not (according to D1) reacted with the other components of the dispersed epoxy resin (Reasons for the Decision, point 5.3; second paragraph); and
- (ii) Neither Examples 4 and 5 according to the application in suit, nor the experimental data submitted with the letter dated 20 December 1996, even in the light of the further information provided by fax on 23 January 1997, was considered to represent a fair comparison of the claimed subject-matter to the prior art (Reasons for the Decision, point 5.6).

This led to the formulation of the technical problem arising from D1 in the more primitive form of merely providing further aqueous dispersions comprising a self-emulsifying epoxy resin and a novolac cross-linking agent (Reasons for the decision, point 5.3), to which the solution of prereacting the novolac was held to be obvious. The findings (i) and (ii) are intertwined with each other and will consequentially be dealt with together.

- 5.1 It is the long-established case law of the boards of appeal, that in the use of comparisons of compounds for the purpose of demonstrating a relevant technical

effect in relation to the prior art, special attention must be paid to the material disclosed in the sense of a complete, specific technical rule (T 181/82, OJ EPO 1984, 401; Reasons for the Decision, paragraph 7; supplementing T 12/81, OJ EPO 1982, 296). The former decision refers to the latter in its statement, "While the "C₁-C₄" definition specifically designates methyl bromide as an individual compound and the butyl bromides as a family (four possibilities), the "maximum C₄" definition does not **individualise** methyl bromide because the substance is not designated or otherwise more closely described." (T 181/82, Reasons, point 7, third paragraph). This is summed up in Headnote II of the Decision, according to which, "Only known substances - not notionally described ones - qualify for use in comparisons of compounds. Such substances include those which are the inevitable result of the starting materials and the process applied thereto, even if one of the two reactants manifests itself as a chemical entity (C₁ alkyl bromide) from a group of generically defined compounds (C₁-C₄ alkyl bromides) (see "diastereomers" T 12/81, OJ EPO 1982, 296)."

Applying these principles to the present case, the Board is unable to discern any such complete, specific technical rule defined by an embodiment in D1 containing not only components (2), (a), (b) and (c) but also an individualised novolac cross-linker. In this connection, D1 specifies neither a specific novolac nor its individualised combination with the remaining components of the epoxy resin composition, whether in prereacted form or not. In other words, the disclosure of D1 does not make available such a combination of chemical species as a known substance which would qualify for use in comparisons in the sense

of T 181/82 (*supra*).

5.2 On the contrary, the only relevant compositions described in D1 in sufficiently individualised form to qualify as the basis for a comparative test according to the criteria set out in the relevant case law, are those according to Examples IV, V and VI, in which the cross-linking agent is a polyamido-amine (Epi Cure CT60-8534) and no novolac at all is present. Hence, the criticism, in the decision under appeal, of the comparative data filed by the Appellant, on the basis that they did not compare compositions differing only in that part of the novolac cross-linker had (according to the application) or had not (according to D1) reacted with the other components of the dispersed epoxy resin, is not supported by the relevant disclosure of D1. This fails to make available, in the sense of Article 54(2) EPC, any such combination in individualised form (Section 5.1, above).

It follows from the above, that the combination of an individual stable epoxy dispersion composition according to D1 with "a novolac" is only notionally described. Hence, the issue of the "criticality" of the choice of novolac is irrelevant, since such a choice lies outside and not within the relevant combination of elements disclosed according to D1.

5.2.1 In this connection, to the extent that the decision under appeal made a requirement for a comparison with a composition otherwise according to D1 but further comprising a novolac, it amounted to a requirement for a comparison with a variant of D1 lying **closer** to the subject-matter of the application or patent in suit than what was actually made available in the state of

the art. It thus went beyond the provision of Article 56 EPC itself, according to which "an invention shall be considered as involving an inventive step if, having regard to **the state of the art**, it is not obvious to a person skilled in the art" (emphasis by the Board). Thus, the criticism that the experimental data on file did not constitute a fair comparison was not justified (Reasons for the decision, point 5.6, referring to the data filed on 20 December 1996 and 23 January 1997).

5.2.2 It is, of course, open to an Applicant or Patentee to discharge his onus of proof by voluntarily submitting comparative tests with newly prepared variants of the closest state of the art making identical the features in common with the invention in order to have a variant lying closer to the invention so that the advantageous effect attributable to the distinguishing features of the invention is thereby more clearly demonstrated (T 35/85 of 16 December 1986, not published in OJ EPO; Reasons for the Decision, paragraph 4, supplementing T 181/82 "Spiro-compounds", *supra*).

5.2.3 In this connection, the Board is aware of the decision T 197/86 (OJ EPO 1989, 371), according to the Headnote of which "In the case where comparative tests are chosen to demonstrate an improved effect over a claimed area, the nature of the comparison with the closest state of the art must be such that the effect is convincingly shown to have its origin in the distinguishing feature of the invention. For this purpose it may be necessary to modify the elements of

comparison so that they differ only by such a distinguishing feature (supplementing T 181/82, "Spiro compounds", OJ EPO 1984, 401) (cf. point 6.1.3 of the Reasons).".

It is evident from the Reasons of the latter, however, that a comparison embodying the modified elements called for had already been filed, voluntarily, in the sense of T 35/85 (*supra*) in that case. Thus the issue of non-compliance did not arise. In other words, the reference to the necessity of modifying the elements of the comparison amounted only to an *obiter dictum*.

5.3 In the present case, by contrast, the failure, by the Appellant, to provide a comparison with such a specified variant lying closer to the claimed subject-matter than the closest state of the art led to the formulation, in the decision under appeal, of a more primitive statement of technical problem and thence to a finding that the solution was obvious.

5.4 The Board can see no justification for the imposition of such a formulation of the technical problem, however, since the specific comparison called for in the decision under appeal represented a requirement going beyond the provisions of Article 56 EPC and was thus *ultra vires* (Section 5.2.1, above). It cannot be supported by the Board, and the decision under appeal must be set aside for this reason alone.

5.5 In view of the above, it will be necessary for the Board to consider the question of inventive step anew, and from first principles. 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 that an incorrect state of the art was used to define the technical problem or 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 246/91 of 14 September 1993, Reasons for the Decision, point 4.4; and T 495/91 of 20 July 1993, Reasons for the Decision, point 4.2; neither published in OJ EPO).

Whilst both of these decisions concerned granted patents, their legal principles are clearly not limited to post-grant proceedings.

- 5.6 According to the application in suit the technical problem was to provide stable aqueous dispersions of epoxy resin compositions, curable at room temperature, to provide cured coatings having improved flexibility, solvent resistance, salt spray resistance and humidity resistance compared with those according to D1 (page 1 "Summary of the Invention" first paragraph; page 5, lines 4 to 8; and page 6, lines 1 to 2 of the application as originally filed; printed specification, column 2, lines 25 to 27; column 3, lines 40 to 45; and column 4, lines 15 to 20).

The solution proposed according to Claim 1 of the application in suit is to supplement, in the preparation of the epoxy resin dispersion, components (a), (b) and (c) from which the self-emulsifying epoxy resin (2) is prepared, by a further component (d), an alkyl phenol-formaldehyde novolac resin in which the alkyl group contains 4 to 12 carbon atoms, and prereacting the components (a), (b), (c) and (d) to

form a modified self-emulsifying resin (2).

- 5.7 It can be seen from the examples of the application in suit, particularly Examples 4 and 5, that an epoxy resin dispersion composition in which the self-emulsifying epoxy dispersion has been modified by prereacting a nonylphenol-formaldehyde novolac with the remaining ingredients of component (2), has dramatically improved values of "Pencil Hardness", flexibility, solvent resistance, salt spray resistance and humidity resistance, compared with a somewhat similar composition differing in that the self-emulsifying epoxy resin component (2) had been made without an alkylphenol novolac (page 17; Table I).

Whilst certain criticisms of detail were raised in the decision under appeal to these comparative tests, in particular that the kinds and proportions of additives and solvents differed in too many respects, the principal criticism, namely that the comparison did not correspond to a relevant embodiment of D1 because Example 5 (comparison) did not itself contain an unreacted novolac, is not valid for the reasons given above.

Furthermore, the criticisms of detail have to be seen, in the Board's view, in the context of the results obtained. These show remarkably substantial increases, for compositions according to the illustrative Example 4, compared with that of Example 5 (comparative), in Pencil Hardness, coating flexibility and solvent resistance (see Table I). Furthermore, for the salt spray resistance and humidity tests, values of more than 1 000 hours resistance for the composition according to illustrative Example 4 are obtained,

compared with only 48 hours for comparative Example 5. The latter factor of improvement, of more than 15, can hardly be explained away simply by pointing to the presence of a further conventional component, such as a wax emulsion, particularly since the latter is present in the composition of the comparison Example 5 but not in the illustrative Example 4 (Reasons for the decision, point 5.6). On the contrary, these results merely confirm the general statement made in the description, that dramatic improvements in the relevant parameters were obtained according to the application in suit (page 5).

With regard to the additional data filed on 20 December 1996 and 23 January 1997, the criticism, in the decision under appeal, as to differences in molecular weights of the epoxy resin component in different experiments (Reasons for the Decision, point 5.6), is in any case not applicable to the new set of experimental data filed with the Statement of Grounds of Appeal. From the latter, in which Example A represents a composition as exemplified in D1, Example B represents a modification of the latter in which component (2) has been prereacted with a nonyl phenol novolac resin to provide a species of the same molecular weight, Example C has the same composition as B except that there is no novolac component, and Example D contains the modified component (2) of Example B together with the remaining additives according to Claim 1, it is evident that Example A represents the closest state of the art, and Examples B and C represent variants lying closer to the claimed subject-matter than Example A.

These further examples, in which the cross-linking

agent is formulated as a novolac derivative of a polyamine, comply even with the criteria demanded by the decision under appeal.

Furthermore it is evident from the table of results, that coatings derived from the resin dispersions obtained in Examples B and D, incorporating the prereacted novolac component by which the solution of the technical problem is characterised, showed an improvement in flexibility which is reflected in higher values for impact and Erichsen slow penetration. Furthermore, Example D showed an increase gloss compared to Example B.

Finally, these data show convincingly that the improved relevant coating qualities of flexibility and hardness are traceable unambiguously to the presence of a prereacted novolac in the self-emulsifying epoxy resin component (2), and thus to the relevant distinguishing feature.

In view of the above results, the Board finds it credible that the claimed measures provide an effective solution of the technical problem.

5.8 There is no suggestion in D1 to pre-react a novolac, let alone the relevant specified novolac with components (2), (a), (b) and (c) for any reason, let alone to improve the mechanical properties of a subsequently formed room-temperature cured coating. In other words, there is no hint to the solution of the technical problem in D1.

5.9 Nor is there any such hint in D3, which concerns a vulcanisable elastomeric composition curable with

sulphur, and thus has essentially nothing in common with the subject-matter of the application in suit.

- 5.10 The disclosure of D5, whilst admittedly referred to in D1 (page 9, lines 5 to 7) merely concerns the use of *inter alia* novolacs as elevated temperature curing agents and thus does not add anything significant to the disclosure of D1 itself.
- 5.11 In summary, the solution of the technical problem does not arise in an obvious way from the state of the art.
- 5.12 On the contrary, the improved performance of cured coatings resulting from compositions modified only by prereacting the specified novolac with the remaining components of the relevant epoxy resin must be regarded as a surprising result, especially in view of the expectation, according to the decision under appeal, that the chemical structure of the cured product would remain essentially the same, regardless of whether part of the cross-linking agent had been pre-reacted with the epoxy resin before complete curing or not (cf. Reasons for the Decision, point 5.5).

Consequently, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC. By the same token, the subject-matter of Claims 8 and 9 also involves an inventive step.

6. In view of the above, the main request is allowable. Consequently, it is not necessary for the Board further to consider the first and sole auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 9 of the main request filed on 29 August 2000, and after any necessary consequential amendment of the description.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin