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D E C I S I O N
of 21 September 2005

Case Number: T 0862/03 - 3.3.03

Application Number: 94200008.4

Publication Number: 606931

IPC: C08L 71/12

Language of the proceedings: EN

Title of invention:
Polyphenylene ether based moulding composition

Patentee:
Enichem S.p.A.

Opponent:
General Electric Company

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (no)"
"Substantial procedural violation: no - no request for oral proceedings pending on date of decision of opposition division"

Decisions cited:
-

Catchword:
-



Case Number: T 0862/03 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 21 September 2005

Appellant: ENICHEM S.p.A.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 28 March 2003
revoking European patent No. 606931 pursuant to
Article 102(1) EPC.

Composition of the Board:

Chairman: R. Young
Members: M. Gordon
E. Dufrasne

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 0 606 931 in respect of European patent application No. 94200008.4 in the name of Enichem S.p.A. was announced on 21 July 1999 (Bulletin 1999/29) on the basis of 20 claims.

Claims 1, 7 and 9 read as follows:

"1. Moulding composition having an extremely good combination of physical- mechanical, tensile and thermal properties which consists of:

(C1) a polyphenylene ether, and

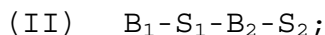
(C2) a high impact vinyl aromatic polymer consisting of a blend of

(i) a vinyl aromatic monomer-conjugated diene block polymer, containing at least two blocks with different molecular weights prevailingly consisting of a vinyl aromatic monomer, and at least one block prevailingly consisting of a conjugated diene, said polymer having a content of vinyl aromatic monomer comprised within the range of from 55 to 85% by weight, and

(ii) a high-impact vinyl-aromatic polymer, containing from 5 to 15% by weight, based on said polymer, of a dispersed dienic rubber in the form of particles having a cellular structure and an average chord of at least 1.2 micrometers.

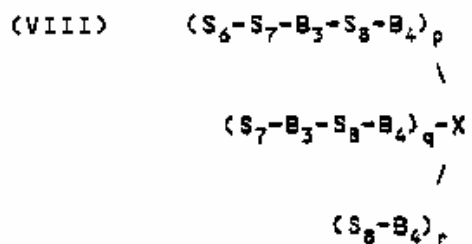
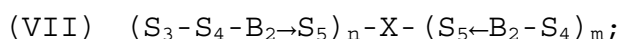
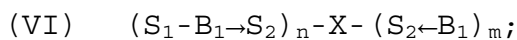
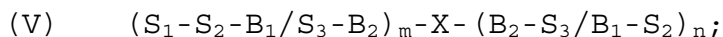
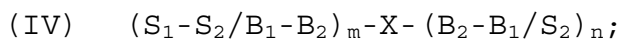
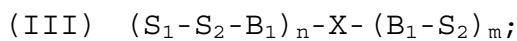
7. Moulding composition according to any of the preceding claims, in which the block polymer (i) is of linear type, having the general formula (I) or (II):

(I) S_1-B-S_2 ;



in which: S_1 and S_2 are non-elastomeric polymeric blocks of a vinyl aromatic monomer having different molecular weights; and B , B_1 and B_2 are elastomeric polymeric blocks based on a conjugated diene, having the same, or different molecular weights; said non-elastomeric polymeric blocks having a molecular weight comprised within the range of from 5,000 to 250,000 and said elastomeric blocks having a molecular weight comprised within the range of from 2,000 to 250,000.

9. Moulding composition according to any of the preceding claims 1 to 6, in which the block polymer (i) is of radial type, having one of following general formulae from (III) to (VIII):



wherein:

S_1 , S_2 , S_3 , S_4 , S_5 , S_6 , S_7 , and S_8 are non-elastomeric polymeric blocks, of a vinylaromatic monomer, each having different molecular weights, thus yielding bimodal, trimodal, or, in general, polymodal blocks;

B_1 , B_2 , B_3 and B_4

are elastomeric polymeric blocks based on a conjugated diene, having the same molecular weight or different molecular weights from one another;

X

is the radical of a polyfunctional coupling agent, by means of which the block copolymers forming the arms are chemically coupled with one another;

m and n

are integers, with m being larger than n, and the sum of which is equal to or larger than 3, generally comprised within the range of from 3 to 10 and preferably is either 3 or 4, and corresponds to the functionality of radical X; and

p, q and r

are integers the sum of which is equal to or larger than 3, generally comprised within the range of from 3 to 10 and preferably is either 3 or 4, and corresponds to the functionality of radical X; and

S_2/B_1 , B_1/S_2 , B_1/S_3 and S_3/B_1

are blocks of copolymers of either "random" and/or "tapered" type of vinyl aromatic monomer and conjugated diene."

II. A notice of opposition was filed on 21 April 2000 by the General Electric Company.

The Opponent requested revocation of the patent on the grounds of Article 100(a) EPC, specifically because the subject matter claimed did not meet the requirements of Articles 54 and 56 EPC. An auxiliary request was made for oral proceedings.

III. The following documents were cited in support of the opposition:

D1: US-A-3 835 200

D2: US-A-3 939 112

D3: ACS Organic Coatings and Plastic Preprint, 167th, Los Angeles, April 1974, pages 37-48

D4: US-A-3 639 517.

IV. In the course of the opposition proceedings, the Opposition Division issued a written communication dated 30 November 2001.

(a) By its decision issued in written procedure (without an oral proceedings) on 28 March 2003, the Opposition Division revoked the patent. The decision was based on a main and a first auxiliary request consisting of 18 and 20 claims respectively, both filed on 11 April 2002 with a letter of 10 April 2002.

(b) Claim 1 of the main request corresponded to a combination of the subject matter of claims 1, 7 and 9 as granted, formula III, however, being deleted. Claim 1 of the auxiliary request corresponded to claim 1 as granted amended by introduction of the following proviso after the phrase "...at least 1.2 micrometers", i.e. at the end of the claim:

"with the proviso that the component C2(i) is different from the Phillips Petroleum K-Resins".

(c) The decision stated that:

- the Opponent had made an auxiliary request for oral proceedings (paragraphs I.3 and II.1);
- the Patentee had not requested Oral Proceedings (paragraph II.1);
- it was not considered necessary, in the light of the discussion in the written procedure, to convene an Oral Proceedings (paragraph II.1).

(d) With regard to the requirements of Article 123(2) EPC, in addition to noting a typographical error in claim 1, it was observed that the molecular weight requirement of blocks S₁, S₂, B, B₁, B₂ as specified in granted claim 7 had been omitted, contrary to Article 123(2) EPC. This was the sole objection pursuant to Article 123(2) EPC, and was considered minor, since the Patentee would have been able to address it if necessary. Hence it did not form a ground for the decision. It was held that the claims of both the main and auxiliary requests met the requirements of Article 123(3) EPC.

(e) Novelty of the subject matter of claim 1 of both requests over D1 was acknowledged as the resin KRO-3 (corresponding to formula III of claim 9 as granted) disclosed in D1 no longer fell within the terms of the claims. The claimed subject matter

accordingly differed from the disclosure of D1 in that polymer C2(i) was one according to formulae I, II, IV, V, VI, VII or VIII.

(f) With regard to inventive step for both the main and auxiliary requests:

(i) It was held that D1 represented the closest prior art.

(ii) It was further held that the resin Styrolux® 2686, corresponding to formula III of the claims as granted, employed in example 4 of the patent in suit was similar to the KRO-3 Resin of D1 and hence fairly represented the prior art.

(iii) From a comparison, with regard to compositions showing a good balance of properties, of examples 4 and 6 of the patent in suit, example 4 corresponding to the prior art "radial" block copolymer resin of formula III and example 6 employing a "linear" block copolymer of formula I of the patent in suit, it was concluded that there was no essential difference between the compositions containing "radial" or "linear" block copolymers. By analogy it was concluded that the differences between compositions containing the "radial" copolymer of D1 and those "radial" copolymers represented by formula IV-VIII would be at least as small.

- (iv) The problem underlying the patent in suit was thus defined as to provide further compositions of polyphenylene ether, styrene-butadiene block copolymers and high impact polystyrene showing a good balance of mechanical properties.
- (v) This problem was solved by replacing the "radial" block copolymers of formula III known from D1 by similar "linear" or "radial" block copolymers (those of formulae I, II or IV-VIII).
- (vi) D1 expressed a preference for "radial" block copolymers, which implied that the use of "linear" block copolymers was also contemplated. The "linear" block copolymers were known, commercially available compounds as witnessed by the statement at page 4, line 7 of the patent in suit. It was considered that the skilled person would try compositions comprising "linear" block copolymers in the expectation of obtaining similar, or slightly worse, properties to those reported in D1.
- (vii) The examples of the patent confirmed that this result was in fact obtained, the Izod values being slightly worsened, and tensile strength and elongation being slightly improved.
- (viii) The argument of the patentee that D1 would suggest to the skilled person to disregard

block copolymers other than KRO-3 was not found convincing since D1 disclosed the use of any block copolymer of type A-B-A, block B having lower molecular weight than block A, and expressed a preference for "radial teleblock" copolymers, which were covered by the formulae IV-VIII of the amended claim 1. Thus, it was considered that claim 1 worked within the broad teaching of D1 and proposed further alternative compositions containing polymers C2(i) of the same type and structure to those disclosed in D1. The further argument of the patentee that D1 would teach against the use of "linear" block copolymers was not found convincing since D1 taught the use of all copolymers of type A-B-A, including the "linear" copolymers. Hence it was obvious on the basis of D1, in order to solve the defined technical problem to employ different block copolymers.

- (ix) Arguments of the Patentee based on the comparative examples of D1 and the patent in suit were deemed irrelevant as the comparative examples in question did not represent the closest prior art.

- (x) Accordingly inventive step for the subject matter of both the main and auxiliary requests was denied.

- V. A notice of Appeal was filed against this decision on 21 May 2003, the requisite fee being paid on the same day.
- (a) Together with the Statement of Grounds of Appeal, filed on 1 July 2003, the Appellant filed a revised set of 18 claims as the sole request, amended as compared to the main request on which the decision of the Opposition Division was based by restriction of claim 1 to the block co-polymers of formulae (I), (II) and (VII).
- (b) The Appellant submitted that the technical problem to be solved by the patent in suit with respect to D1 was "as indicated also by the Opposition Division", to individuate a moulding composition based on polyphenylene ether ("PPE") having a good balance of physical-mechanical properties, such as (IZOD) resilience as well as, tensile and thermal characteristics, e.g. VICAT softening point, or the technical problem could also be formulated as being to provide further compositions of PPE, styrene-butadiene block copolymers and high impact polystyrene ("HIPS") displaying a good balance of mechanical properties.
- (c) D1 suggested to increase the IZOD of such compositions by selecting a particular block copolymer, implicitly suggesting to disregard other types of block copolymer. As indicated by the Opposition Division, D1 preferred the "radial" block copolymers. The patent in suit demonstrated on the contrary that other - linear - block

copolymers could be used and resulted in improved IZOD properties.

- (d) Also in seeking to solve the technical problem of providing further compositions having a good balance of properties, the skilled person would in the light of D1 not have considered polymodal "linear" block copolymers since D1 taught in the opposite direction. Even if such polymers had been employed, they would have yielded compositions with a slight improvement in properties, and thus represented an alternative solution presenting a good balance of properties.
- (e) It was further argued that the improvement in IZOD properties between the comparative examples and examples according to the claims in the patent in suit was greater than the corresponding improvement in the examples of D1, and that obtaining such an increase in IZOD without worsening of other mechanical properties was surprising in view of D1.

VI. In a letter dated 18 December 2003, the Respondent raised objections pursuant to Article 84 EPC against the clarity of claims 1 and 18. The definition of component C2 in claim 1 as a "polymer" when it was in fact a blend of two different polymers and the possibility, defined in claim 18, of the presence of up to 50 wt% of additional components whereas claim 1 employed the wording "consists of" were objected to. Regarding novelty, it was objected that the subject matter of claim 1 was not novel in view of the whole content of D1.

With regard to inventive step, the distinguishing feature was seen to be definition of a narrow class of block copolymers not disclosed in the examples of D1. The Respondent concurred with the finding of the Opposition Division that the block copolymer employed in example 4 of the patent in suit was similar to the KRO-3 product employed in D1. It was argued that the examples of the patent showed that the results obtained with "linear" and "radial" block copolymers were overall the same and that no unexpectedly superior results compared to the block copolymers known from D1 (KRO-1, KRO-3) had been demonstrated. It was further noted that there were no data for polymers of formula II.

VII. The Board issued on 6 May 2005 a Summons to Oral Proceedings, to take place on 21 September 2005. In the accompanying communication, preliminary objections to certain features in the amended claims were raised in respect of Articles 84 and 123(2). It was also noted that a number of unexplained amendments had been made as compared to the corresponding claims of the granted patent.

It was further preliminarily observed that the objections raised by the Respondent pursuant to Article 84 EPC were not admissible, since the features objected to had been present in the claims as granted.

VIII. With a letter dated 8 August 2005, the Appellant submitted in response to the communication of the Board an amended claim 1 and a copy of page 12 of the patent as granted, bearing claims 8-14 and 15 in part.

IX. In a letter dated 29 August 2005, the Appellant requested that the decision under appeal be set aside, the case remitted to the Opposition Division, the planned Oral Proceedings before the Board be cancelled and the appeal fee be reimbursed, since a substantial procedural violation had, in the Appellant's view, occurred in the decision under appeal.

The Appellant had discovered, upon checking the file after receipt of the summons to oral proceedings issued by the Board, that, contrary to the statement in the decision under appeal, oral proceedings had indeed been requested during the opposition procedure in a letter of 5 February 2001. A copy of said letter, the DHL Courier receipt and the acknowledgement of receipt bearing the EPO stamp dated 7 February 2001 was submitted. The application number (94200008.4) and the opposition division number (2102) were correctly indicated on the letter. However due to a typing error, the patent number had been indicated as EP 0 609 931 instead of EP 0 606 931. Proceedings with respect to EP 0 609 931 had already terminated when the February 2001 letter was sent. The EPO should have informed the then Patentee of an incongruence in the letter, and it was considered that in view of the principle of good faith it had been incumbent on the European Patent Office to ask for clarification of this matter, especially if the incongruence had led to the communication of the patentee being disregarded.

X. With a letter dated 30 August 2005, the Respondent objected to the request of the Appellant of 29 August 2005. It was considered that such a request could not

be admitted at the stage the procedure had reached, and to do so would itself constitute a procedural violation. It was noted that the Appellant had failed to raise this issue previously, specifically with the statement of grounds of appeal.

XI. The Appellant contacted the Board by telephone on 13 September 2005 to enquire about the status of the request of 29 August 2005 and was informed by the Registrar of the Board that the oral proceedings before the Board were to take place as scheduled. The record of the telephone consultation was sent to the parties by telefax on 14 September 2005.

XII. Oral proceedings took place on 21 September 2005. In its preliminary, provisional remarks, the Board drew attention:

(i) In relation to the alleged procedural violation to the precise wording of the letter dated 5 February 2001, which had contained the request for oral proceedings and which stated:

"Following the letter of November 13, 2000, the undersigned Representative wishes to request an Oral Proceeding according to Article 116 EPC in case the request of maintaining the patent at bar in the amended form as filed on November 13, 2000, should not be satisfied";

(ii) In relation to the set of claims filed with the submission of 8 August 2005 to certain apparent inconsistencies between a sub claim and claim 1.

Thereupon the Appellant provided a revised, complete set of claims.

- (a) With regard to the request of the Appellant for remittal of the case to the first instance for oral proceedings before the Opposition Division:
 - (i) The Appellant submitted that the February 2001 request for oral proceedings should not be construed as limited to the claims filed with the letter of 13 November 2000, but as a general request for oral proceedings for the case that the patent were not to be maintained.
 - (ii) Concerning the point in the appeal procedure at which this issue had been raised, the Appellant submitted that their normal practice in opposition proceedings was to request oral proceedings as a matter of course. In the present case this had - exceptionally - only been done with the later letter, which letter had not been found in the files of the Appellant when preparing the appeal. The fact that the letter failed to reach the file at the EPO indicated that some error had occurred. This late request was neither an abuse of procedure, nor an attempt to delay the appeal proceedings.
 - (iii) The Respondent considered that it was an abuse of procedure to raise this issue at such a late stage of the procedure, and

requested that the request of Appellant for remittal be dismissed.

- (b) With regard to the requirements of Article 84 EPC, the Respondent maintained the objections raised in the written proceedings but made no further submissions.
- (c) The Respondent did not maintain the objection raised with respect to novelty.
- (d) Regarding inventive step:
 - (i) The Appellant submitted that D1 clearly favoured "radial" block copolymers, and contained also a vague teaching to "linear" block copolymers. The disclosure of D1 in respect of the block copolymers was not clear. The formulae reported ("ABA") appeared to relate to monomodal "linear" block copolymers, whereas the patent in suit required polymodal copolymers.
 - (ii) The claims were now restricted to two "linear" block copolymers and one "radial" block copolymer. Comparing examples 3 and 6 of the patent in suit showed that the "linear" material of example 6 gave rise to an improvement over the "radial" material of example 3. Such an improvement would not be expected from the teaching of D1.

(iii) The Appellant contested the assumption in paragraph 5.3 of the decision under appeal that the resin of example 4 was sufficiently similar to the prior art resin KRO-3 to serve as a basis for comparison. There was no statement in the patent in suit to this effect. In particular, it was denied that KRO-3 corresponded in any way to formula III in the patent in suit. The correct comparison was with example 6 of D1. With regard to the material of formula VII, it was submitted that example 3 of the patent in suit and example 6 of D1 concerned similar compositions. Comparing the IZOD values, (after applying the appropriate conversion factor), the composition containing the block copolymer of formula VII showed an unexpected improvement in properties.

(iv) The Respondent objected to the change in the basis of comparison. The relationship between the block copolymer employed in example 4 of the patent in suit and KRO-3 had never previously been challenged.

It was considered that there were too many differences in the nature and proportions of components employed in example 6 of D1 and the examples of the patent in suit to render a comparison possible.

- (v) The Appellant submitted that KRO-3 was defined in D1 as being of the formula A-B-A. D1 failed to explain what was meant by the terms "linear" and "radial". It was considered that the term "linear" meant a polymer with two extremities, whereas "radial" referred to a polymer with at least 3 branches, but this distinction did not emerge clearly from D1. While D1 taught "linear" block copolymers, there was a clear preference for "radial" block copolymers. Due to the ambiguities in D1 with respect to the structures of the block copolymers, it could not render obvious the structures defined in the claims of the patent in suit.
- (vi) The Respondent submitted that D1 did not teach a clear preference for "radial" block copolymers. The claims of the patent in suit were now restricted to three types of block copolymers, but the patent in suit contained evidence only for two of these (formulae I and VII). The evidence did not show that the block copolymers according to formulae I and VII gave rise to a surprising improvement compared to those generally disclosed in D1. There was no evidence at all in respect of the block copolymers of formula II. Hence the technical problem was to provide alternative compositions. This was solved by employing commercially available block copolymers.

XIII. The final requests of the Parties were:

Appellant (patentee): that the decision under appeal be set aside and that the case be remitted to the opposition division because of a substantial procedural violation or, in the alternative, that the patent be maintained according to the request (claims 1 to 18) filed during oral proceedings.

Respondent (opponent): that the appeal be dismissed.

Reasons for the Decision

1. The Appeal is admissible.
2. *The alleged procedural violation*
 - 2.1 The Letter of 5 February 2001

Whilst it is true that there is no indication of the letter having reached the office, it has been acknowledged by the Appellant that this letter contained an incorrect file reference. Whether and to what extent this error on the part of the Appellant contributed to the letter failing to reach the opposition file is a matter for speculation and cannot be resolved by the Board.

The question to be resolved by the Board is whether the fact that oral proceedings were not held by the Opposition Division amounted, as alleged by the Appellant, to a substantial procedural violation, requiring remittal of the case to the first instance.

2.2 The wording of the request

The Request in the letter of February 2001 was unambiguous in that the request for appointment of oral proceedings was conditional on the patent not being maintained on the basis of the set of claims filed on 13 November 2000. Claim 1 of that version was formulated with a disclaimer to KRO-3 resin.

2.3 Following the written communication of the Opposition Division dated 30 November 2001 in which, on the basis of examination of the claims submitted with the letter of 13 November 2000, the Opposition Division took the provisional position that revocation of the patent in suit would be the likely outcome of the opposition procedure, two further requests - a main and an auxiliary request - were filed on 11 April 2002 with the letter of 10 April 2002. These replaced the claims of 13 November 2000 and formed the basis of the decision of the Opposition Division (Section IV above), none of which has been contested by the Appellant.

2.4 The requests pending at the date of the decision

Since the provisional request for oral proceedings was unambiguously restricted to the case that the patent not be maintained on the basis of the (sole) set of claims of 13 November 2000 and since the requests pending at the date of the decision consisted of other, later filed sets of claims which replaced the earlier filed set of claims and in respect of which the Patentee (Appellant) had not made any request for oral proceedings, there was clearly no valid request for

oral proceedings by the Appellant in being at the time the Opposition Division announced its decision to revoke the patent in suit. Hence, even if the letter dated 5 February 2001 had reached the file in time for it to be considered before the issuance of the decision under appeal, the opposition division would have been entitled to take a decision, as it did, in written procedure without holding oral proceedings.

2.5 Accordingly, the fact that oral proceedings were not held had no influence on the outcome of the opposition procedure.

2.6 It is therefore concluded that no substantial procedural violation took place. Accordingly, there were no grounds for acceding to the Appellant's request and cancelling the oral proceedings before the Board, let alone for remitting the case to the opposition division.

3. *Article 84 EPC*

The wording objected to by the Respondent (see section VI above) was present in the claims of the patent as granted and was not introduced as an amendment during the course of the opposition procedure.

Accordingly the objection raised is not admissible.

No further objections were raised by the Respondent under Article 84 EPC concerning the claims under consideration. Nor has the Board any such objections of its own.

4. *The patent in suit*

The patent in suit relates to PPE based moulding compositions containing in addition to a PPE a high impact vinyl aromatic polymer component which is a blend of a block copolymer having blocks derived from a vinyl aromatic monomer and a conjugated diene and a copolymer of a vinyl-aromatic monomer and a conjugated diene containing from 5-15 wt% of dispersed dienic rubber in the form of particles, having an average chord of at least 1.2 micrometres (in the examples a copolymer of styrene and butadiene). As becomes apparent from the description of the patent in suit, namely paragraphs [0027] and [0033] and the examples, in which trade names are employed to identify the products used, the block copolymers falling within the terms of the claims are known, commercially available products.

The patent explains in paragraphs [0004] to [0006] that PPE resins suffer from problems such as poor processability, as a result of a relatively high viscosity in the molten state and a narrow processability range which can cause difficulties during extrusion and injection moulding operations. The high temperatures which must be employed to soften the resins and associated problems such as instability and discoloration render the industrial use of the said techniques unattractive. PPE resins further display poor solvent resistance and low IZOD resilience.

According to paragraph [0002] of the patent, the problem which is addressed is the provision of PPE based moulding compositions which exhibit a good

balance of physical-mechanical properties, such as IZOD resilience as well as tensile and thermal characteristics, e.g. VICAT softening point.

5. *The prior art*

Such compositions are known from D1 which, by common consent, represents the closest state of the art.

5.1 According to D1 there is disclosed a normally rigid thermoplastic composition comprising:

- (a) A matrix comprising a polyphenylene ether resin and a grafted interpolymerization product of a styrene monomer and a diene rubber and
- (b) a normally rigid block copolymer of a vinyl aromatic compound (A) and a conjugated diene (B), of the A-B-A type, blocks B being of lower average molecular weight than those of blocks A. The polymer forming blocks A is selected *inter alia* from styrene, that forming blocks B *inter alia* from butadiene. Regarding the grafted component, the preferred embodiment thereof (D1, column 7, lines 7-13) comprises a styrene homopolymer grafted onto from about 3 to 30, preferably from 4 to 12 percent by weight of polybutadiene or a rubbery diene copolymer backbone.

5.1.1 The examples of D1 employ a grafted interpolymer having 8 wt% of polybutadiene, the particle size of the rubber being about 5 microns (micrometres).

5.1.2 According to the examples of D1 two materials are employed as the normally rigid block copolymers. That employed in examples 4-15 is identified as "KRO-3", while examples 1-3 employ "KRO-1". D1 itself does not provide any detailed information about the structure of these materials.

5.2 In order to elucidate the structure of KRO-3, reference was made by the Respondent to three further documents in this connection, viz. D2, D3 and D4. According to D2 there is provided a composition consisting essentially of a polymodal radial branched block copolymer of the general formula $(A-B)_xY$ wherein A is essentially a block of polymerized monovinyl-substituted aromatic monomers of 8 to about 16 carbon atoms; B is essentially a polymerized conjugated alkadiene block, the alkadiene having 4 to about 12 carbon atoms; Y is an atom or group of atoms derived from a polyfunctional coupling agent; and x represents the number of functional groups of said polyfunctional coupling agent, and an amount of a naphthenic extender oil. Thus D2 clearly relates to polymodal radial branched block copolymers. Furthermore, according to example I of D2, the polymodal block copolymer resin is identified as KRO-3, consequently it must be concluded that KRO-3 is a radial polymodal branched block copolymer.

This conclusion is reinforced by the reference in D2 at column 2, lines 33-35 to D4, entitled "Resinous, branched block copolymers" which is stated in D2 to disclose the polymodal polymers useful in D2 as well as methods for the preparation thereof. According to the discussion at column 2 from line 42 of D4, the polymers are prepared by sequential polymerisation of monovinyl-

substituted aromatic hydrocarbons and conjugated dienes. The non-elastomeric segments are formed first by multiple addition of the vinyl substituted aromatic hydrocarbons and organolithium initiator. Subsequently, the conjugated diene is added to form an elastomeric block. This is followed by addition of a polyfunctional treating agent. The examples show such a multi-stage preparation process. Particularly instructive is example 4, employing styrene and butadiene as monomers, in which after each stage of the process the product obtained was analysed by gel permeation chromatography (GPC). These analyses show that after the first polymerisation of styrene, a single molecular weight peak is obtained (Figure 1a in D4). Following polymerization of the second charge of styrene a second, smaller, lower molecular weight peak is apparent (figure 1b). A similar plot is obtained after the third step of polymerisation in which the butadiene is incorporated (figure 1c). In a final step, the polymer chains are reacted with a pentavalent epoxide derivative (variously referred to in D4 as "Epoxol 9-5" or "Epoxy 9-5"). The final plot (figure 1d) is of the final branched product and shows a bimodal molecular weight distribution. Finally D3, a document referring explicitly to the K-Resin polymers discusses KRO-3 in qualitative terms. A GPC plot of the resins is presented of KRO-3 that clearly corresponds to figure 1d of D4 referred to above.

Thus KRO-3 is confirmed as being a polymodal block copolymer as prepared in example IV of D4.

In view of the manner of preparation of KRO-3, it is apparent that there will be two types of chain present:

- a chain containing two blocks of styrene, of differing molecular weight, and a block of butadiene, which can be schematically represented as "S-S'-B";

- since it is plausible that at least a part of the second charge of styrene will polymerise with itself and not interact with the pre-existing polystyrene chain, there will be a second type of chain derived from the second charge of styrene, which can be schematically represented as "S'-B". Since a pentafunctional branching agent is employed, the final polymer will have a structure:

$(S-S'-B)_a-X-(S'-B)_b$ wherein the sum of a and b is 5, corresponding to the valency of the Epoxol 9-5 branching agent.

This has not been disputed by the Appellant.

- 5.2.1 This structure corresponds to formula III of claim 9 of the patent as granted (see section I above).

- 5.2.2 By an analogous analysis of the documents D2-D4 it is possible to conclude that the resin KRO-1 corresponds to KRO-3 with the difference that only a single charge of styrene is employed, yielding a structure $(S-B)_5-X$, which formula finds no correspondence in the claims of the patent in suit.

- 5.2.3 As is evident from the analysis of the teachings of D2 and D4 KRO-3, employed in examples 4-15 of D1 corresponds to the formula III as disclosed in the

patent in suit, with the consequence that compositions of PPE and HIPS containing a branched polymodal block copolymer of formula III must be regarded as reflecting the state of the art.

5.3 Furthermore, according to the decision under appeal, the resin Styrolux[®] 2686 employed in example 4 of the patent corresponded to formula III. It may be derived from the Statement of Grounds of Appeal (see section V.b above), that the formulation of the technical problem employed in the decision under appeal was implicitly accepted by the Appellant. This implicit acceptance of the formulation of the technical problem amounts, in the Board's view, to an admission that the analysis and interpretation of the teaching of the prior art cited and relationship thereof to the subject matter and data of the patent in suit given in the decision (see sections IV.f.ii and iii above) were correct.

5.3.1 This formulation of the technical problem employed in the decision under appeal was however challenged as being incorrect by the Appellant at the oral proceedings before the Board. Specifically, in support of this challenge, it was disputed (see section XII.d.iii above) that resin KRO-3 corresponded to formula III of the patent in suit and hence that the block copolymer employed in the composition of example 4 (Styrolux[®] 2686) was sufficiently similar to prior art resin KRO-3 to serve as a basis of comparison.

With regard to the disputed facts, the Board notes the following:

- Concerning the nature of resin KRO-3, it is apparent from the analysis given in section 5.2 that KRO-3 does correspond to the formula III of the claims. Hence the arguments of the Appellant in this respect are not supported by the facts.

5.3.2 Thus the Board can identify no objective reasons to diverge from the findings of the decision under appeal concerning the nature and relevance of the teachings of example 4 of the patent in suit as being representative of the prior art known from D1.

5.3.3 Accordingly, it is concluded the structure of both the resin KRO-3, employed in D1 and Styrolux® 2686, employed in example 4 of the patent in suit, corresponds to formula III and hence that example 4 of the patent in suit, employing Styrolux® 2686 does represent a fair comparison with the prior art.

5.4 Compared with the state of the art, the technical problem arising was as set out in the decision under appeal, namely to provide (further) compositions of PPE, block copolymer and HIPS showing a good balance of mechanical properties. This corresponds to the problem set out in the patent in suit itself.

5.5 The solution to this problem was to use as a block copolymer instead of the compound of formula III, a compound of formulae I, II or VII (see section IV above).

5.5.1 The examples of the patent show compositions containing block copolymers according to formula VII (example 3) and formula I (examples 5-9). Example 4 employs a resin identified as "Styrolux[®] 2686", which according to the decision under appeal is similar to resin "KRO-3", and thus corresponds to formula III of claim 9 of the patent as granted (See section (I) above).

Examples 3, 4 and 6 of the patent in suit employ compositions based on 42 parts PPE, 43.5 parts of HIPS, the same PPE and HIPS being employed in all three examples, and 14.5 parts of block copolymers according to formulae VII, III and I respectively.

The properties of these compositions are summarised in the following table:

Example	3	4	6
Type of Block copolymer	VII	III*	I
Izod 3.2mm (J/mm)	300	360	350
Izod 12.7mm (J/mm)	230	290	270
Yielding Strength (N/mm ²)	43	44	46
Tensile Strength (N/mm ²)	39	42	45
Elongation at break (%)	70	74	78
Elastic modulus (N/mm ²)	2100	2150	1950
VICAT 1kg (°C)	138	137.5	138
VICAT 5Kg (°C)	122	123	121

*Not according to the claims of the patent in suit.

It is apparent from this table that all compositions exemplified exhibit a broadly similar profile of properties.

5.5.2 This evidence renders it plausible that the technical problem set out above has in fact been solved, at least as far as the block copolymers of formulae I and VII are concerned, and thus correctly represents the

objective technical problem to be solved by the subject matter of the patent in suit in relation to prior art D1. For the materials of formula II there is no evidence. However, in the light of the close correspondence between this structure and that of block copolymer I, it is plausible that the materials of formula II will exhibit comparable results. The Opponent (Respondent) has not discharged the burden of proof of demonstrating that such results are not obtained with the block copolymers of formula II.

6. *Novelty*

According to the claims of the sole request, the block copolymer to be employed in the compositions of the patent in suit has the formula I, II or VII.

As may be derived from the foregoing discussion of the prior art, neither of the block copolymer resins employed in the examples of D1 corresponds to these formulae. Accordingly, novelty of the subject matter claimed is acknowledged.

7. *Inventive Step*

- 7.1 As noted under paragraph 5.5.2, the technical problem of providing further compositions of PPE, block copolymers and HIPS showing a good balance of mechanical properties was solved according to claim 1 of the patent in suit by replacing the preferred polymodal A-B-A block copolymers of D1 by other, commercially available polymodal block copolymers of the same type. The replacement of a component of a composition by known alternatives of the same type

- represents an obvious route to solve the technical problem of providing further compositions of PPE, block copolymers and HIPS showing a good balance of mechanical properties, and hence cannot provide support for an inventive step.
- 7.2 As regards the argument, advanced by the Appellant in the written submissions (sections V.c and V.d above) and the oral proceedings (sections XII.d.i and XII.d.v), that D1 expressed a preference for "radial" block copolymers whereas the patent in suit demonstrated that also "linear" block copolymers may be employed, it is apparent from the following considerations that this is not supported by the facts.
- 7.2.1 D1 distinguishes between "linear" and "radial" block copolymers. According to column 2, line 37 of D1 "linear" copolymers have the structure "A-A-A-A-B-B-B-B" while polymers of the structure "A-B-A" are termed "radial teleblock copolymers" (D1 column 5, lines 35-57, wherein "A" and "B" denote blocks derived from vinyl aromatic compounds and conjugated diene compounds respectively). D1 also teaches that the polymers designated as "radial" are preferred (column 5, lines 50 and 51).
- 7.2.2 The patent in suit also distinguishes between two classes of block copolymers and employs the terms "linear" and "radial". Those block copolymers of formulae I and II are designated "polymodal linear block copolymers" (paragraph [0022]) while the block copolymer of formula VII is designated as belonging to the class "radial polymodal block copolymers" (paragraph [0028]). All the block copolymers defined

according to the claims of the patent in suit however have the structure "A-B-A" and so fall within the class of block copolymers denoted as "radial" in the terminology of D1.

7.2.3 Thus, contrary to the arguments of the Appellant, the claimed block copolymers correspond to that class explicitly identified as preferred in D1. Thus the argument of the Appellant, based on the nomenclature employed for the block copolymers, that the claims of the patent in suit are directed to a class of block copolymers identified as non-preferred in D1 is not supported by the facts.

7.3 Accordingly the solution to the technical problem provided according to the claim 1 of the patent in suit is obvious and hence does not meet the requirements for inventive step pursuant to Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young