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D E C I S I O N
of 8 July 1997

Case Number: T 0086/94 - 3.3.3

Application Number: 82304129.8

Publication Number: 0072203

IPC: C08L 23/02

Language of the proceedings: EN

Title of invention:

Method of producing partially cross-linked rubber-resin composition

Patentee:

MITSUI PETROCHEMICAL INDUSTRIES, LTD.

Opponents:

Hüls Aktiengesellschaft
Stamicarbon B.V.

Headword:

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Relevant legal provisions:

EPC Art. 54(2), 56, 114(1), (2)

Keyword:

"Postponement of oral proceedings (no)"
"Previously uncontested issue raised during appeal (allowed)"
"Novelty (yes)"
"Inventive step - could vs. would (yes)"

Decisions cited:

G 0009/91, G 0010/91, T 0181/92, T 0002/83, T 0035/85,
T 0007/86, T 1002/92

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0086/94 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 8 July 1997

Appellant:
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 19 October 1993
issued in writing 25 November 1993 revoking
European patent No. 0 072 203 pursuant to
Article 102(1) EPC.

Composition of the Board:

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

Summary of Facts and Submissions

- I. The mention of the grant of European patent No. 0 072 203, in respect of European patent application No. 82 304 129.8, filed on 4 August 1982 and claiming a Japanese priority of 7 August 1981 (JP 123643/81) was announced on 11 November 1987 (Bulletin 87/46).
- II. Notices of Opposition were filed on 3 August 1988 (Opponent I) on the ground of lack of inventive step, and on 5 August 1988 (Opponent II), on the grounds of lack of novelty and inventive step. The oppositions were supported by the documents:
- D1: DE-A-2 642 090, and its English Language equivalent
- D1a: US-A-4 140 732;
- D2: W.A. Mack, "Plastics in Packaging", Nat. Tech. Conf., Soc. Plast. Eng., 1969, 63 to 65;
- D3: Brochure "Technologies pour matières plastiques", VIII. 1979 by Messrs. Werner & Pfleiderer
- D4: US-A-3 806 558;
- D5: US-A-4 130 535;
- D6: US-A- 4 271 049;
- D7: Werner & Pfleiderer brochures:

D7a: Chr. Millauer "Aufbereitung und Verarbeitung von pulver- und krümförmigen Elastomeren", lecture dated 5 October 1979 at "International Rubber Conference";

D7b: Werner & Pfleiderer proc. Techn. Continua;

D7c: Alloying of PP with EPDM;

D7d: KCVt Kurzinformation;

D8: Leaflets VF 05 020 a and VF 05 020 B, IV. 1984 of Messrs. Werner & Pfleiderer;

and the later filed, but admitted:

D9: Chr. Millauer: "Compoundieren und Weiterverarbeiten von thermoplastischen Elastomeren", Lecture at Scandinavian Rubber Conference held on 8-9 May 1980.

III. By a decision which was given at the end of oral proceedings held on 19 October 1993 and issued in writing on 25 November 1993, the Opposition Division revoked the patent. The decision was based on a set of Claims 1 to 9, filed on 25 June 1990 and forming a main request, and a set of Claims 1 to 8, filed on 20 September 1993 and forming a subsidiary request. Claim 1 of the main request reads as follows:

"A method of producing a partially cross-linked rubber-resin composition by melting and mixing a peroxide-curable olefin copolymer rubber and a peroxide-decomposing polyolefin resin with an organic peroxide compound in which method the rubber and the resin are mixed in a weight ratio in the range 10:90 to 95:5 and are subjected to dynamic heat treatment in the presence of the peroxide characterised in that the rubber is an

essentially amorphous copolymer of olefins or of olefins and non-conjugated diene and the resin is a resin selected from crystalline polypropylene-based resins, crystalline poly(1-butene)-based resins and poly(4-methyl-1-pentene)-based resins and in that the rubber in particulate form and the resin and peroxide are fed to a twin screw extruder in which the dynamic heat treatment is carried out, under the condition:

$$x \leq 200$$
$$y \geq 0.003x + 0.12$$

wherein "x" stands for weight of the copolymer rubber (g/100 particle), and "y" stands for specific energy at the extrusion (kWhr/kg)."

Claims 2 to 9 related to elaborations of the method according to Claim 1.

Claim 1 of the subsidiary request differed from the main request only in the formula, which read as follows:

$$1 \leq x \leq 200$$
$$0.003x + 0.12 \leq y \leq 1.0$$

Claims 2 to 8 of the subsidiary request related to elaborations of the method according to Claim 1.

The decision held that neither of the documents D7b and D7c nor the two leaflets numbered D8 formed state of the art in the sense of Article 54(2) EPC. It furthermore held that, although the subject-matter claimed was novel over the state of the art, it did not involve an inventive step. In particular, whilst D4, which formed the closest state of the art, referred to the use of different devices without specifying the types used, D3 stated that twin screw extruders allowed

single step processing, D7a stated that the "Continua", which used such a twin screw system, had been constructed to process elastomers and was recommended for rubber-polypropylene processing, and D7d identified the specific energy consumed in such processing. Finally, it had been demonstrated that the particle sizes of the rubber as defined by the parameter "x" corresponded to those disclosed in D7a, and that the minimum energy value, calculated on the basis of such particle sizes, was consistent with the values given in D7d.

Hence, the "y" value in the patent in suit represented an input energy within the general range found when using twin-screw extruders as demonstrated in D7d, and the examples of the patent in suit only demonstrated that larger particles required more energy to obtain a homogenised mixture. Such a finding was, however, foreseeable. Consequently, the main request of the patent in suit, and also the subsidiary request, the further features of which did not have any significance for the solution of the technical problem, did not involve an inventive step.

- IV. On 27 January 1994, a Notice of Appeal against the above decision was filed by the Patentee, together with payment of the prescribed fee. The Statement of Grounds of Appeal was filed on 22 March 1994.
- V. A communication was issued by the Board on 12 February 1997, appointing oral proceedings for 8 July 1997.
- VI. The Appellant notified a change of representative to the EPO by an authorisation filed on 10 March 1997. The new representative filed, on 5 June 1997, a comprehensive submission. The arguments contained in this and the previous submissions of the Appellant in appeal may be summarised as follows:

- (i) In addition to the documents already excluded, the documents numbered D3, D7a, D7d and D9 in the decision under appeal should also not be considered to constitute part of the state of the art, since they had not been shown to have been made available to the public at the priority date of the patent in suit.
- (ii) The teaching of the patent in suit was advantageous over D4, since it enabled products of particular homogeneity and excellent surface properties to be obtained continuously in a single step, which could be easily optimised with regard to energy consumption, the products having improved surface and mechanical properties.
- (iii) The teaching of D4, which was silent on energy requirements and the influence of a continuous mode of operation, was also indifferent to the type of mixing apparatus. It taught rather that the properties of the product were dependent on nature of the starting materials; furthermore, whilst mentioning an extruder amongst other suitable known mixing devices, it did not specify the type of extruder or even the number of screws if a screw extruder had been contemplated. Nor did any of D1, D2, D5 and D6 in combination with D4 teach that using such an extruder could be beneficial.
- (iv) As regards the quantification of the minimum energy required for optimal product properties, the explicit teaching of D2, that the energy required was, in continuous operations, largely independent of the specific design of the compounding equipment, was wrong for the dynamic curing processes claimed. Furthermore, D2 failed

to notice the significance of a lower limit for the specific energy, which represented a true threshold value. D1, D5 and D6 did not address the energy input at all. Consequently, neither D2, nor any of D1, D5 and D6 could render obvious the specific energy value "y" in Claim 1.

- (v) It was incorrect to regard the parameter "x" in Claim 1 as simply a measure of particle size, since it also incorporated the specific weight of the rubber starting material.

- (vi) As to the product properties themselves, the novel features compared with D4 (extruder and "y") led to surprising merits, as could be seen from the comparative examples in the patent in suit, which corresponded to the teaching of D4 using a single screw extruder.

Two experimental reports were filed by the Appellant, a first report (A) being annexed to the Statement of Grounds of Appeal, and a second report (B) being annexed to the submission filed on 5 June 1997. Furthermore, the latter submission also referred, for the first time to two documents:

D10: Römpps Chemie-Lexikon, eighth edition, Franck'sche Verlagshandlung, Stuttgart, Germany, 1981, 1230; and

D11: G. Schenkel, "Plastics Extrusion Technology and Theory", Iliffe Books Ltd., London, 1963, 5, 53, 55 and 63 to 67.

- VII. The Respondent protested, in a letter filed on 23 June 1997, that the submission filed on 5 June 1997 was too extensive to be considered in the time remaining before the oral proceedings. In particular, it not only repeated and elucidated arguments submitted during the proceedings to date, but also brought new facts, arguments and evidence. In particular, the challenge to the status of documents previously accepted as state of the art amounted to a "new ground of appeal" which should have been brought in the Statement of Grounds of Appeal. A postponement of the oral proceedings, scheduled for 8 July 1997, was requested by the Respondent.
- VIII. On 25 June 1997, the Board issued to the parties, by fax, a communication indicating that no postponement would be granted.
- IX. The Respondent then filed an additional submission, received on 2 July 1997, citing for the first time two further documents, as follows:
- D12: *L.P.B.M. Janssen*, "Twin screw extrusion", Elsevier, 1978, 24-25; and
- D13: VDI Taschenbuch; Kunststoff II, 1973, 97-101.
- X. Oral proceedings took place on 8 July 1997.
- XI. The written and oral submissions of the Respondent in the appeal may be summarised as follows:
- (i) The questioning, at such a late stage in the proceedings, of the status of documents D3, D7a, D7d and D9, which had hitherto been acknowledged without question as belonging to the state of the art, was an unacceptable extension of the scope of the proceedings, which amounted to the

introduction of a new ground of appeal. This should have been done in the Statement of Grounds of Appeal. Consequently, the Board should exclude the issue from the proceedings.

- (ii) The experimental results filed with the Appellant's submission of 5 June 1997 were belated.

- (iii) The novelty of the claimed subject-matter was no longer acknowledged. The claimed process lacked novelty over the disclosure of D1a, when read in the light of common general knowledge, since the composition of the rubber component processed according to D1a and that presented in the examples of the patent in suit were identical.

- (iv) As regards the issue of inventive step:
 - (a) The two parameters "x" and "y" in Claim 1 of the patent in suit did no more than teach "for a good dispersion you need a minimum amount of energy; the greater the particle size of the feedstock, the higher the energy to prepare a good dispersion".

 - (b) Such a result was trivial, since it was known from D5 and D6 that in a thermoplastic elastomer the particle size of the dispersed rubber had to be below 50 microns, which was in effect much smaller than the particle size of the feed rubber, so the rubber fed to the extruder has to be broken down into a dispersed form which required energy.

(c) Whether using a Banbury mixer, as in D4, or a twin screw extruder, as in D1a, a certain minimum energy input was always necessary simply to melt the ingredients; this energy was well known to correspond to at least the minimum constant specified in Claim 1, as was evidenced by the screw speed disclosed in Example 9 of D1a in combination with a typical feedstock particle size.

(d) As regards the quality of the products obtained, it could be seen from the results in D4, the use of a Banbury mixer provided products having mechanical properties as good as those exemplified in the patent in suit; furthermore, it could be seen from the results in D1a that the products obtained using a twin screw extruder were somewhat better than using a different kind of mixer.

(e) The Appellant had in any case used an artificial parameter, namely the "surface homogeneity" to determine the goal of good mechanical properties. This was not, however, an appropriate test, since it was evident that improvements in properties still occurred above the critical "specific energy" value, but that these reached a plateau.

(f) The same parameter was also inappropriate to show differences between "unvulcanised" and "partially vulcanised" products, because, when pressing thin sheets of unvulcanised blends, the presence of non-well mixed rubber would not be seen in a

surface texture because rubber would be deformed and spread out over the sheet; in contrast, vulcanised particles were rigid and could not be deformed. It was for this reason that all the experiments filed with the Grounds of Appeal qualified in the "surface-homogeneity test" as A, although it was evident that the physical properties had not reached their final value at the point of the minimum specific energy.

(g) Thus, the products according to the patent in suit were not different from those of the state of the art, and the parameters in the claims of the patent in suit taught only the well known principles of good dispersion.

(h) Hence, the decision under appeal had full validity, since the requirements of Claim 1 would always be fulfilled when working according to the prior art.

XII. The Appellant requested that the decision under appeal be set aside and the patent maintained on the basis of the main request filed on 25 June 1990 with letter dated 22 June 1990, or, as auxiliary request, on the basis of the subsidiary request filed on 20 September 1993.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Procedural points:*
 - 2.1 The Respondent's request for a postponement of oral proceedings
 - 2.1.1 The Respondent's request arose from the Appellant's submission filed on 5 June 1997, and stated that the submission was a comprehensive document requiring careful consideration not only by the representative himself, but also by a number of other people in the business group. The basis of the request centred on the allegation, which was made for the first time in this submission, that certain of the documents cited in the appeal did not belong to the state of the art in the sense of Article 54(2) EPC (sections VI and IX, above).
 - 2.1.2 The question of whether a cited document belongs to the state of the art in the sense of Article 54(2) EPC is a matter to be decided on the basis of evidence, the party making the allegation normally carrying the onus of providing such evidence. In the present case, this onus lay with the Respondent, as the party relying on the cited documents as state of the art.
 - 2.1.3 The Respondent could not have been taken by surprise by the new allegation, since the submission in question was received, by the Respondent's own admission, three weeks before the oral proceedings (Respondent's letter dated 23 June 1997, stating that the submissions of the Appellant had been received "last week").

- 2.1.4 The request for a postponement of the oral proceedings could therefore only have arisen out of a need of the Respondent to gather evidence regarding the availability to the public of the documents in question. This implies that the Respondent was not, at the point in time when the submission was received, in a position to discharge this onus.
- 2.1.5 The onus to provide such evidence did not, however, arise only when the citations were challenged in the submission of 5 June 1997, but, on the contrary, at the latest on the date on which they were first relied upon by the Respondent. Such reliance is evident from the explicit reference, in the submission of the Respondent filed on 26 September 1994, to item 7.4 of the decision under appeal, which itself refers to all four of the documents under discussion.
- 2.1.6 Had the Respondent been in a position to provide such evidence in substantiation, even as late as 26 September 1994, it would clearly have had no difficulty in providing the same evidence, given three weeks notice, in time for the oral proceedings before the Board in 1997.
- 2.1.7 That it was not in a position to do so implies that this party had not been in a position to discharge its onus of proof at any stage in the proceedings. The latter had, at this point, however, already been pending for nearly ten years.
- 2.1.8 It would not have been equitable, in the Board's view, to delay the proceedings still further, simply to allow yet more time for the Respondent to set about gathering evidence which it should already have had at its disposal at least three years earlier.

2.1.9 Consequently, there was no justification for a postponement of the oral proceedings.

2.2 The objection of the Respondent to the allegation, made in the submission of 5 June 1997, regarding the state of the art.

The essence of the Respondent's objection was that the allegation raised for the first time in the above submission (section 2.1.1, above) constituted "a new ground of appeal", which should have been raised in the Statement of Grounds of Appeal.

Thus, the Respondent was disputing the right of the Appellant to raise this issue at a later stage of the proceedings than the filing of the Statement of Grounds of Appeal.

2.2.1 Although the existence of a document may be described as a fact, the question of whether a party has discharged its onus of proof in relation to such a document is not a fact. Nor is it evidence. On the contrary, it is an argument. Hence, the reference by the Respondent to "a new ground of appeal" is a misnomer.

2.2.2 Whilst the Board is mindful of jurisprudence which prohibits any addition to the extent to which a patent is opposed, and severely restricts the raising of a new ground of opposition (G 0009/91, G 0010/91; OJ EPO 1993, 408 and 420, respectively) or the introduction of a new fact or of new evidence (T 1002/92, OJ EPO 1995, 605), it is not aware of any ruling which would apply to the admission of a new argument. Indeed, the very purpose of appeal proceedings, and in particular of oral proceedings, is to provide an opportunity to a losing party to throw new light on relevant aspects of matters which have been decided to the detriment of

that party and/or to draw attention to facts in the reasoning of the first instance Department that resulted in a decision adverse to him. This can, in practice, best be achieved by reliance on new arguments: a mere rehearsal of what went before would be ineffectual.

- 2.2.3 It is true that the Appellant apparently raised no objection to the documents in question when they were first cited, nor, indeed, up to the date of filing of the contested submission. Although this might be assumed to amount to an acknowledgment of the status of the documents as state of the art in the sense of Article 54(2) EPC, the Board is unaware that this would constitute an "admission against interest", thereby estopping that party from contesting that status on appeal.
- 2.2.4 In the latter connection, whilst Article 108 EPC specifies that a written statement setting out the "grounds of appeal" must be filed within four months of the notification of the decision under appeal, the issue is not, as alleged by the Respondent, "a new ground of appeal", since it is merely a new argument (section 2.2.1, above).
- 2.2.5 Whilst it is, of course, desirable that all relevant arguments be brought at the earliest possible stage of the proceedings, there is no requirement in Article 108 EPC that the Statement of Grounds of Appeal be exhaustive as to the arguments to be brought.
- 2.2.6 Finally, the Board sees mitigation for the Appellant in the fact that a new Representative was appointed only in March 1997, and this Representative submitted the new argument in question within three months of taking responsibility for the case.

- 2.2.7 Consequently, the fact that the issue of the cited documents was not raised in the Statement of Grounds of Appeal is not itself a reason for excluding it from consideration.
- 2.2.8 Nor can the Board see any other reason for excluding the issue.
- 2.2.9 Consequently, the issue was fully considered by the Board.
- 2.3 The material cited for the first time in the submission of 5 June 1997.

The submission of 5 June 1997 contained an experimental report B (Section IV, above) and references for the first time to documents D10 and D11.

- 2.3.1 The experimental report involves new comparative data, which, in view of the shortness of time before the date appointed for oral proceedings, the Respondent would have been unable to repeat or even check, and which was furthermore objected to as belated (submission of the Respondent filed on 23 June 1997, page 2, first paragraph).
- 2.3.2 Consequently, the Board, in the exercise of its discretion, has decided to exclude the contents of experimental report (B) from consideration in accordance with Article 114(2) EPC.
- 2.3.3 Regarding the citation, for the first time, of documents D10 and D11, no objection was raised by the Respondent, to the introduction of these documents, which are, in any case, only short extracts from standard works. Consequently, these documents are introduced into the proceedings pursuant to Article 114(1) EPC.

2.3.4 The remainder of the submission is merely a recasting and amplification of matters already raised in the proceedings. This alone could not have given rise to a need to consult other people in the business group (section 2.1.1, above). Consequently, no unfair disadvantage to the Respondent arises.

2.4 The content of the Respondent's submission of 2 July 1997.

The above submission itself referred to two new documents D12 and D13 for the first time. These documents are, however also short extracts from standard works, and no objection was raised by the Appellant to their introduction.

Consequently, D12 and D13 are introduced into the proceedings pursuant to Article 114(1) EPC.

2.5 The re-opening of the question of novelty.

The previous acknowledgment, by the Respondent, of the novelty of the claimed subject-matter (decision under appeal, reasons for the decision, point 6, and minutes of the oral proceedings) was withdrawn by the same party, at the oral proceedings before the Board.

There is no doubt, however, that novelty was one of the issues considered and decided upon in the decision under appeal. For reasons analogous to those given in relation to the challenging of the status of documents previously accepted as state of the art (section 2.2, etc., above), the Board can see no objection to the principle of challenging, in appeal, the previously acknowledged novelty of the claimed subject-matter. Consequently, the issue of novelty was fully considered by the Board.

3. *Documents forming state of the art (Article 54(2) EPC)*

- 3.1 According to the decision under appeal, documents D7b and D7c were not taken into account because it was not evident, and had not been convincingly demonstrated, that they had been made available to the public in due time. Furthermore, both leaflets numbered D8 were not considered because they had been made available to the public after the application date and therefore did not meet the requirements of Article 54(2) EPC (Reasons for the decision, point 5).

This finding was not challenged in appeal, and the Board sees no reason to take a different view. Consequently, documents D7b, D7c and both leaflets numbered D8 are held not to belong to the state of the art in the sense of Article 54(2) EPC.

- 3.2 Document D7a, alleged by the Respondent to belong to the state of the art, does not carry an explicit publication date. It is evidently the text of a lecture, since it carries, in its heading, a reference to a lecture of 5.10.79 "Internationale Rubber Conference", held in Venice. Whilst the date in the heading is clearly earlier than the priority date of the patent in suit, no evidence was brought as to whether the lecture was actually held on this date at the conference, nor whether, if held, its content corresponded to the text of D7a, nor even as to whether the audience included members of the public.

The verbal statement of the Respondent at the oral proceedings before the Board, that the text of D7a had been obtained by colleagues who had attended the

lecture in Venice, cannot itself be regarded as more than hearsay evidence, since no statement by one of the colleagues concerned was presented, nor was the Respondent in the position even to name a single one such colleague.

The onus of proof that D7a in this case lies, however, with the Respondent, since this is the party making the assertion.

In view of the above, this onus cannot be regarded as having been adequately discharged by the Respondent. Consequently, D7a cannot be accepted by the Board as state of the art in the sense of Article 54(2) EPC.

3.3 Document D9 is evidently the text of a lecture at the "Scandinavian Rubber Conference" 8-9 May 1980. The same considerations apply as in the case of D7a. Consequently, the onus of proof the Respondent to show that this document belongs to the state of the art has also not been adequately discharged. Hence, D9 cannot be accepted by the Board as state of the art in the sense of Article 54(2) EPC.

3.4 Document D7d is an information leaflet of the firm Werner & Pfleiderer and is dated 21.9.79. Whilst it carries an indication that it has been approved for external distribution, it does not, however, carry an explicit publication date. The approval for external distribution does not amount, in the Board's view, to evidence that it was indeed distributed externally, nor, if such distribution took place, on what date.

Consequently, the Respondent has not adequately discharged its onus of proof. Hence, D7d cannot be accepted as belonging to the state of the art in the sense of Article 54(2) EPC.

- 3.5 Document D3 is apparently a brochure from the firm Werner & Pfleiderer, since it describes certain twin screw extruder devices of this firm. It does not, however, carry an explicit publication date. The footnote, "VF 05 020-VIII.79 GSP Wö" appearing on the last page of D3, although possibly representing a printing date, as speculated by the Appellant, (submission of 5 June 1997, page 2, second paragraph), might equally well have some other significance. No evidence or even an explanation of the footnote was provided by the Respondent. Yet the onus of proving a relevant publication date lay with the Respondent.

Consequently, the Respondent has not discharged his onus of proof in this respect. Hence, D3 cannot be accepted as belonging to the state of the art in the sense of Article 54(2) EPC.

- 3.6 Consequently, the state of the art taken into consideration in this decision consists of D1, D2, D4, D5, D6 and D10 to D13.

4. *The patent in suit (main request); the closest state of the art*

The patent in suit is concerned with a method of producing a partially cross-linked rubber-resin composition by melting and mixing a peroxide-curable olefin copolymer rubber and a peroxide-decomposing polyolefin resin with an organic peroxide compound, in which the rubber and the resin are mixed in a weight ratio in the range 10:90 to 95:5 and are subjected to dynamic heat treatment in the presence of a peroxide and in that the rubber is an essentially amorphous

copolymer of olefins or of olefins and non-conjugated diene and the resin is a resin selected from crystalline polypropylene-based resins, poly(1-butene)-based resins and poly(4-methyl-1-pentene)-based resins (Claim 1).

- 4.1 Whilst such a process is known from D4, which was considered, in particular in the decision under appeal, to represent the closest state of the art, the Respondent took the position, at the oral proceedings before the Board, that D1 (considered in the form of its English language equivalent D1a), could preferentially be regarded as the closest state of the art. It is necessary, therefore, for the Board to consider which of the documents D4 and D1a represents the closer state of the art.
- 4.2 According to D1a, there is provided a thermoplastic rubber composition consisting of a mixture of a polyolefin resin and an ethylene-propylene rubber (EPM) or an ethylene-propylene terpolymer (EPDM), wherein sequential polymers are used as the EPM copolymer or EPDM terpolymer respectively (column 1, lines 6 to 11).
- 4.2.1 As a result of the partial crystallinity, the sequential polymers are characterised, in contrast to statistical, and hence amorphous polymers, by very high crude strengths. The degree of crystallinity, detected by both X-ray and Raman spectroscopy, correlates both with the ethylene content and the crude strength (column 1, lines 34 to 50).
- 4.2.2 In one embodiment, the EP-component is initially mixed with the polyolefin, for example in a kneader, on mixing rolls or in self-cleaning multiple shaft screws. The two components may also be mixed in the form of powders or granulates in high-speed mixers or other stirring units. This mixture is then partially

vulcanised in a kneader with the addition of cross-linking agent. Internal mixers, mixing rolls and multiple-shaft screws may be used. These steps may be carried out continuously or in batches. The two components may be simultaneously mixed with the cross-linking agent (column 3, lines 15 to 31).

The resulting thermoplastic rubber composition may be processed into a shaped article, by moulding or extrusion (column 3, lines 40 to 44).

4.2.3 According to Example 9, a composition comprising 40 pbw of an EPDM-sequential polymer component (67 pbw ethylene/27 pbw propylene/ethylidene norbornene), 60 pbw isotactic polypropylene, 0.3 pbw of a peroxide and 1.0 pbw of a stabiliser is processed in a mixing extruder having a double-shaft screw, at a screw speed of 300 r.p.m., and a mixing temperature of 160°C (column 6, lines 1 to 19).

4.2.4 The products have improved properties in terms of tensile strength, elongation at break, 100% and 300% modulus, Shore A hardness, shock elasticity and structural strength (column 6, lines 27 to 34 in connection with column 1, lines 12 to 63).

4.3 Thus D1a is directed to the processing of a composition in which the rubber component is at least partially crystalline. This is in contrast to the patent in suit, which is concerned with compositions in which the relevant rubber component is required to be essentially amorphous.

4.4 The argument of the Respondent at the oral proceedings, that the ethylene content of the rubber according to D1a widely overlapped that of the rubbers exemplified

in the patent in suit, so that the degree of crystallinity in each case had to be the same, with the consequence that the term "amorphous" in the patent in suit was not clear, is not convincing, for the following reasons:

- 4.4.1 Firstly, D1a itself draws a clear distinction between amorphous and at least partially crystalline polymers, which, in the Board's view would be understood by the person skilled in the art.
- 4.4.2 Secondly, although the percentage ethylene content in a rubbery copolymer is admittedly a factor affecting its crystalline character, it is not the sole factor. In this connection, D1a itself emphasises the sequential structure, rather than the ethylene content, as the primary feature associated with crystallinity (section 4.2.1, above).
- 4.4.3 Thirdly, although the examples of the patent in suit do not explicitly recite the microscopic structure of the relevant compositions, they are entitled to be read in the light of the remainder of the document, in particular Claim 1, which requires that the rubber component be amorphous.
- 4.4.4 Consequently, there is no ground, on the one hand, for supposing that D1a, relates, in contradiction to its explicit teaching, to amorphous polymers, or, on the other, that the patent in suit relates to crystalline polymers. On the contrary, the distinction between the classes of materials processed according to D1a and the patent in suit, respectively, is clear. In particular, the reference to amorphous polymers in the patent in suit must be regarded as a definition of the structure.

4.5 In the application of the problem and solution approach, it is axiomatic that the effect of such a process is manifested in the result, i.e. the product (T 0119/82, OJ EPO, 1984, 217; T 0150/82, OJ EPO, 1984, 309).

4.5.1 It is clear from the above, however, that the materials processed according to D1a differ from those according to the patent in suit, in a structural aspect which is significant for the relevant technical properties of the product (sections 4.2.1, 4.2.4, above).

4.5.2 Such a structural difference is not to be found, however, in the class of materials processed according to D4, in which it is stated that the monoolefin copolymer rubber employed in the blend is an essentially amorphous, random, elastomeric copolymer (column 2, lines 25 to 28).

4.5.3 In other words, the effect of the process disclosed in D4 is evidently comparable with that according to the patent in suit, whereas that of the process disclosed in D1a is not. A comparison of the residual or surplus effect over that of the closest state of the art is, however, crucial for the derivation of the technical problem underlying the patent in suit.

4.5.4 Hence, D4 must be regarded as the closest state of the art.

5. *The technical problem*

According to D4, it is important that mastication or shearing takes place whilst semi-curing the blend of the monoolefin copolymer rubber with the polyolefin resin (column 3, lines 22 to 25). To effect the dynamic semi-cure, the mix may be worked on an open roll mill, or in an internal mixer, such as a Banbury mixer, an

extruder mixer, or a transfer mixer, in a basically one-step process (column 5, lines 26 to 29; column 8, lines 40 to 50). In the examples, a series of such blends is mixed using a Banbury mixer. According to the patent in suit, however, a disadvantage of such a process is that it is not very economical, being a batch process, and it is difficult to obtain a product of constant quality because of insufficient mixing of the partially cross-linked rubber and the polyolefin resin (patent in suit, page 2, lines 10 to 15).

5.1 Compared with this state of the art, the technical problem may be seen in the search for a simplified and more economical process of producing a homogeneous partially cross-linked rubber-resin composition of excellent properties.

5.2 The solution proposed according to Claim 1 of the patent in suit is for the rubber, in particulate form, and the resin and peroxide to be fed to a twin screw extruder in which the dynamic heat treatment is carried out, under the condition:

$$x \leq 200$$

$$y \geq 0.003x + 0.12$$

wherein "x" stands for weight of the copolymer rubber (g/100 particle), and "y" stands for specific energy at the extrusion (kWhr/kg)."

5.3 It can be seen from the large number of examples and comparative examples in the patent in suit, that the quality of the product is dependent on whether the mixing device used is a single screw or a twin screw extruder, as well as upon the granulometry of the rubber added, in terms of the weight per 100 g of rubber particles (factor "x" in the formula) and also the energy input to the extruder (factor "y" in the

formula). In particular, a sharp improvement in product quality, in terms of stress at 100% elongation, stress at breaking, elongation at breaking, permanent strain and surface quality of the moulded article is obtained, when using a twin screw extruder at or above the energy input threshold defined by the formula in the solution of the stated problem, as compared with using a single screw extruder under the same conditions and with the same starting materials (Examples 5, 6 vs. Examples 18 and 20 respectively, as reproduced in the submission of 5 June 1997, Table 1 on page 10; and Examples 2, 5 vs. Examples 17, 18 respectively, as reproduced in the submission of 5 June 1997, Table 4 on page 18). Indeed, it is evident that, with the same ingredients and a single screw extruder, satisfactory properties in the products are almost impossible to obtain even with a sufficient specific energy input (patent in suit, page 2, lines 44 to 48; Tables I and II, pages 8 and 9, respectively).

- 5.4 Whilst it is true that the comparison instituted according to the patent in suit is with a single screw extruder rather than a Banbury mixer as in the examples of the closest state of the art document D4, nevertheless the use of a single screw extruder provides a single step continuous process as required by the solution of the stated problem, rather than a batch process as exemplified in D4 and therefore lies, if anything, closer to the claimed subject-matter than the examples of D4. In this connection, it is open to an Applicant or Patentee to discharge his onus of proof by voluntarily submitting comparative tests with 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 0035/85 of 16 December 1986, not published in OJ EPO, Reasons for the decision, point 4; supplementing T 0181/82 "Spiro-compounds", OJ EPO 1984, 401).

Consequently, the experimental results provided in the examples of the patent in suit are considered a fair comparison.

- 5.5 The argument of the Respondent, that the quality of the products according to the patent in suit was not improved compared with those disclosed in D4 is not convincing, because the ingredients processed according to the latter are not sufficiently similar to those in the patent in suit to enable such a precise comparison validly to be made. Consequently, no conclusion can be drawn from the results reported for the products in D4.
- 5.6 The argument of the same party, alleging artificiality in the "surface homogeneity" parameter, in terms of its behaviour at a specific energy level (section IX.iv.(c), above) is unconvincing, because such behaviour has no bearing on the objectivity of the parameter itself. On the contrary, the Respondent's observation, in this context, that improvements in the relevant properties still occur above the critical value of the specific energy merely tends to confirm that there is a threshold for the properties of the materials processed according to the proposed solution of the stated problem.
- 5.7 The argument that the "surface homogeneity" parameter is also unsuitable to show differences between "(partially) vulcanised" and "unvulcanised" products (section IX.iv(g), above) is irrelevant to the comparisons in the examples of the patent in suit (section 5.3, above), since these all use partially

vulcanised materials. To the extent that the argument refers to the comparison test (A) filed with the Statement of Grounds of Appeal, it is also irrelevant, because, according to the results of this test in Table A, all the other relevant technical properties, in addition to the surface homogeneity, of the products are reported, and these also show the relevant improvements.

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

6. *Novelty*

6.1 The disclosure of D1a relates to the processing of crystalline, and not amorphous rubbers (sections 4.3, 4.4.4, above). For this reason alone, it fails to disclose all the features of the claimed solution. Consequently, the subject-matter of Claim 1 is novel in the light of the disclosure of D1a.

6.2 The disclosure of D4, although referring to extruder mixers in general, fails to disclose a twin screw extruder. Furthermore, there is no reference to the ingredients being fed to the mixing device with the rubber in particulate form. Nor is there any reference to the amount of energy fed to the mixer. Consequently, D4 fails to disclose all the features of the claimed solution. The subject-matter of Claim 1 is thus novel over the disclosure of D4.

6.3 Lack of novelty was not alleged in relation to any of the other documents. Nor does the Board see any reason to raise an objection of its own under this heading.

6.4 Consequently, the subject-matter of Claim 1, and, by the same token, also of dependent Claims 2 to 9, is held to be novel.

7. *Inventive Step*

To assess the question of inventive step, it is necessary to determine whether the skilled person, starting from D4, would have considered making the combined modifications corresponding to the solution of the stated problem (section 5.2 above), in the expectation of (i) obtaining a homogeneous product of excellent qualities (ii) in a single step, continuous process (iii) at an energy input threshold which could be determined solely on the basis of an averaged particle weight of the rubber component.

7.1 There is no such teaching in D4, since this does not attach any importance to the type of mixing device used, nor even mention, amongst the several options presented, a twin screw extruder. On the contrary, the device used in all the examples is a Banbury mixer, which is a batch device requiring more than one step to the final product. Nor is there any discussion of the energy input at all.

Consequently, there is no hint to the solution of the stated problem in D4.

7.2 Although D1a exemplifies the use of a twin screw extruder and even mentions the shaft speed (section 4.2.3, above), it is not concerned with processing amorphous rubber containing materials of the kind disclosed in D4. On the contrary, it specifically teaches that such materials have inferior technical properties (column 1, lines 12 to 24).

Consequently, there would be a specific disincentive for the person skilled in the art, wishing to maintain excellent properties in the end product, to process the materials of D4 in D1a.

- 7.2.1 The argument of the Respondent at the oral proceedings, that the technical qualities of the products according to Example 9 of D1a, which uses a twin screw extruder, were better than those of Example 7, which uses a laboratory rolling mill, is not convincing, since the composition of the relevant starting materials according to Example 9 is different from that according to Example 7 (60/40 vs. 40/60 EPDM- sequential polymer/isotactic polypropylene).

Consequently, there is no teaching in D1a which would cause the skilled person to associate the qualities of the products independently with the type of mixing device used.

- 7.2.2 As regards the level of the energy input, the Respondent's argument at the oral proceedings before the Board, that the shaft speed disclosed in Example 9 (300 r.p.m.) would necessarily involve an energy input above the lower limit specified in the formula defining the energy input "y" in the solution of the technical problem, was not supported by any concrete evidence.

- 7.2.3 Even if this assertion were accepted at face value, however, Example 9 does not specify the form in which the material, and in particular the rubber component (required in the solution of the stated problem to be particulate), is fed to the extruder. The reference in D1a to mixing "in the form of powders or granulates", referred to by the Respondent in this connection, does not refer to the extruder process of Example 9, but on the contrary to "high-speed mixers or other stirring units" (section 4.2.2, above).

Consequently, there is no teaching in D1a which would lead the skilled person to associate the technical qualities of the final products generally to the energy input, let alone specifically in terms of a threshold dependent on the granulometry of the rubber component (factor "x" in the solution of the technical problem).

7.2.4 In other words, even if the skilled person were to attempt, in spite of the disincentive mentioned, to process amorphous rubber materials according to Example 9 of D1a, he would not do so in any expectation of solving the technical problem, nor have any guidance to the relevant parameters of its solution.

7.3 According to D2, specific energy requirements data can be applied in the design of compounding plants, e.g. twin screw compounders (title). The energy to achieve a given quality of compound can be measured and expressed in terms of "kWh per pound of product". A formula for calculating the energy input in a compounding operation is given (page 63, right column, first complete para.).

In continuous compounding operations, this unit is largely independent of the specific design of equipment and has shown a good degree of reproducibility in many compounding processes and formulations (page 63, left column, fourth para.).

Specific energy data for selected compounding operations are given. For instance, the specific energy consumption of a twin screw extruder for mixing low density polyethylene with high density polyethylene and homogenising is from 0.114 to 0.159 kWh/lb. For de-watering synthetic rubber from 50% to 10%, it is 0.027 kWh/lb (page 65, Table 1).

The validity of these results depends on the uniformity of the feed materials, notably granulometry of fillers and pigments. For example, as the degree of coarseness of pigment particles increases, so will the energy requirements to achieve a given level of dispersion in the final compound (page 64, left column, last para.).

7.3.1 Whilst D2 mentions a relationship between granulometry and energy input, this is in connection with specific types of additive having nothing to do with the dynamic curing process forming the basis of the technical problem. Indeed, there is no mention in D2 of such a dynamic curing process. Consequently, the skilled person would not regard D2 as being relevant to the technical problem he was trying to solve.

7.3.2 Even if, in spite of its apparent lack of relevance, the attention of the skilled person were for some reason to fall upon the disclosure of D2, there is no hint that a specific mixing device might have an influence on product quality. On the contrary, the specific teaching of D2 is that the energy input factor is independent of machine design.

Consequently, the skilled person would not be led to replace the Banbury mixer, used in all the examples of D4, by a twin screw compounder.

7.3.3 In any case, there is no hint in D2 of a sharp improvement in the relevant properties at a specific energy input threshold.

Consequently, there is no teaching in D2 which would help the skilled person towards a solution of the technical problem.

7.4 According to D5, a thermoplastic elastomeric composition is a fully cured vulcanisate of a composition comprising a blend of (a) 25 to 85 % weight of crystalline thermoplastic polyolefin resin, (b) 75 to 15 % weight of vulcanised monoolefin copolymer rubber and (c) an extender oil, wherein the rubber is present in the form of small dispersed particles essentially of a size of 50 microns or below (Claim 1).

The composition may be prepared by blending the components with curatives and then masticating the blend at vulcanising temperature using conventional masticating equipment, for example, Banbury mixer, Brabender or mixing extruders (column 2, line 64 to column 3, line 5).

The particular results obtained are a function of the rubber curing system. Some curatives, particularly certain peroxides may degrade polyolefin resins during dynamic curing (column 3, lines 27 to 36).

According to the examples, a Brabender mixer is used.

7.4.1 The disclosure of D5 suggests that the use of peroxides, mandatory in the process according to the patent in suit, may be harmful, and consequently would not be regarded by the skilled reader as a useful supplement to D4. Even if this negative teaching were ignored and an attempt made to utilise the teaching in relation to the stated problem, it does not bring the skilled person closer to the solution, because it is devoid, like D4, of any reference to a twin screw extruder and furthermore silent as to energy input.

7.4.2 The argument of the Respondent regarding necessity of the particles having a size of 50 microns or less (section XI.iv (b), above) is irrelevant, because this passage refers to the product after mixing and not the material prior to processing. Consequently, it carries no implication of a relationship between energy input and feed material granulometry.

7.4.3 Consequently, there is no further hint to the solution of the technical problem in D5.

7.5 The disclosure of D6 is rather similar to that of D5, except that it requires a rubber-curative system which is selected from the group consisting of phenolic, urethane and sulphur donor curatives; there is no mention of a peroxide (column 1, line 52 to column 2, line 2; column 3, lines 34 to 37). It therefore leads away from the subject-matter claimed in the patent in suit.

7.6 In view of the above, the Respondent's case amounts, at its strongest, to no more than an assertion that the skilled person could have taken steps which would have amounted to a solution of the technical problem.

This is not, however, sufficient to justify a finding of obviousness, because the relevant question is not whether the person skilled in the art could have taken this or that course of action, but whether he would have done so in the expectation of solving the technical problem (following T 0002/83, OJ EPO 1984, 265, and T 0007/86, OJ EPO 1988, 381).

7.7 Hence, the solution of the technical problem does not arise in an obvious way from the state of the art.

- 7.8 On the contrary, the finding that using a twin screw extruder and applying a particular threshold energy, related to a measure of the averaged particle weight of the amorphous rubber feed material, results in a palette of sharply improved mechanical and surface properties in the product, is regarded as an unexpected and useful technical effect enabling energy consumption to be minimised and product quality to be maximised.
- 7.9 Consequently, the subject-matter of Claim 1 and, by the same token, of dependent Claims 2 to 9 involves an inventive step within the meaning of Article 56 EPC.
8. In view of the above finding, it is not necessary to consider the auxiliary request of the Appellant further.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent with the claims submitted in the main request, i.e. Claims 1 to 9 filed on 25 June 1990 with letter dated 22 June 1990, and after any consequential amendment of the description.

The Registrar:


E. Gorgmaier

The Chairman:


C. Gérardin