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**D E C I S I O N**  
of 18 April 2002

**Case Number:** T 0614/99 - 3.3.3

**Application Number:** 92900072.7

**Publication Number:** 0554392

**IPC:** C08L 61/00

**Language of the proceedings:** EN

**Title of invention:**

Polyoxymethylene compositions containing linear low density polyethylene

**Patentee:**

E.I. DU PONT DE NEMOURS AND COMPANY

**Opponent:**

HOECHST AKTIENGESELLSCHAFT Patent- und Lizenzabteilung  
Asahi Chemical Industry Co., Ltd.

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 54, 56

**Keyword:**

"Novelty - prior disclosure -implicit features (no)"  
"Inventive step - problem and solution (not suggested)"

**Decisions cited:**

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**Catchword:**

-



Case Number: T 0614/99 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 18 April 2002

**Appellant:**  
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**Representative:** -

**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 21 April 1999  
rejecting the opposition filed against European  
patent No. 0 554 392 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** A. Däweritz  
J. De Preter

## Summary of Facts and Submissions

- I. The grant of European patent No. 0 554 392 in respect of European patent application No. 92 900 072.7, which was based on International patent application PCT/US91/07352 filed on 15 October 1991 and claiming priority of 22 October 1990 of an earlier application in the United States of America (606080), was announced on 13 March 1996 (Bulletin 1996/11) on the basis of 11 claims.

Claim 1 as granted read as follows:

"A composition consisting essentially of

(a) 97-99.8 weight percent of a polyoxymethylene polymer and

(b) 0.2-3.0 weight percent of a linear low density polyethylene

wherein the weight percents are based upon the weight of component (a) and (b) only."

Claims 2 to 9 were dependent claims relating to particular elaborations of the composition of Claim 1. Claims 10 and 11 concerned shaped articles made from such compositions.

- II. On 13 December 1996, Notices of Opposition were filed by two Opponents (Opponents 01 and 02), in which revocation of the patent in its entirety was requested on the grounds of lack of novelty within the meaning of Articles 54(1) and (2) EPC and inventive step within the meaning of Article 56 EPC. Opponent 02 additionally raised an objection of insufficiency of disclosure under Article 100(b) EPC.

In the course of the opposition procedure, reference was made to 15 documents, of which the following played a role in these appeal proceedings:

D1: US-A-3 795 715,

D3: JP-A-48-015 954 (partial English translation),

D4: "Plastics", vol. 32, pages 61 to 66, 1981 (partial English translation)

D5: "Plastics", vol. 33, pages 61 to 67, 1982 (partial English translation)

D8: US-A-3 704 275,

D9: "Plastics Age", May 1981, pages 63 to 74 (partial English Translation)

D10: "Plastic World", December 1979, "Something new in polyethylene: Linear low-density PE", page 86,

D14: L. Bohn, in "Kolloid-Zeitschrift", vol. 194, 1964, pages 10 to 15, and

D15: G. Natta et al., in "Revue Générale du Caoutchouc", July-August 1960, pages 1003 to 1007.

III. By a decision issued in writing on 21 April 1999, the Opposition Division rejected the oppositions, because the subject-matter of the patent in suit as granted met the requirements of novelty and inventive step, and the patent specification complied with Articles 83 and 100(b) EPC.

- (i) Novelty was acknowledged, because these citations did not refer to linear low density polyethylene (LLDPE) or contained amounts of polyolefin above the upper range limit of Claim 1 of 3% by weight.
- (ii) For the assessment of inventive step, the Opposition Division defined the technical problem underlying the patent in suit as to provide polyoxymethylene compositions having an increased elongation at break, as set out on page 2, lines 7 and 8 and page 3, lines 4 to 7 of the patent in suit. It did not accept the statement of Opponent 02 that the invention aimed simply at a modification of polyoxymethylenes (POM).

According to the decision, none of the citations dealt with or mentioned the above problem or contained any suggestion as to its solution by admixing a certain amount of LLDPE to the POM.

The Opposition Division accepted that the examples of the patent in suit demonstrated that the addition of LLDPE to POM led to considerable improvements in elongation at break over the result obtained by addition of the same amount of low density polyethylene (LDPE).

IV. On 9 June 1999, a Notice of Appeal was lodged by Opponent 02 (Appellant) against this decision with simultaneous payment of the prescribed fee. It requested that the decision be set aside and the patent be revoked or, alternatively, oral proceedings be held.

In the Statement of Grounds of Appeal filed on 1 September 1999 as well as in a later submission dated 8 September 2000, the Appellant maintained its previous objections.

In substance, it argued essentially as follows:

- (i) The opposed patent lacked a clear definition of the subject-matter claimed, because the exact meaning of LLDPE was not given.

Pre-published documents dealing with LLDPE and the fact that LLDPE had already been marketed in 1959 (as shown eg in D5, page 64, right column, line 11 *et seq.*) could not substitute the lack of definition in the claims of the patent in suit.

- (ii) There was lack of novelty, because Example 6 of D1 described a composition comprising a polyacetal and 0.5% by weight of a "Copolymer of ethylene and propylene (56/44)". Although LLDPE was not mentioned *expressis verbis*, the skilled person was aware of the fact that the copolymer did not relate only to rubbery polymers, but encompassed LLDPE as well. Thus, the skilled person was provided with the disclosure of two alternatives. A selection of one of the two disclosed alternatives did, however, not amount to a novel invention (Statement of Grounds of Appeal: last paragraph starting on page 3 and extending to page 4).

In view of the fact that LLDPE had been known prior to the relevant filing date of the patent in suit, the skilled person had no reason to assume that the ethylene-propylene copolymer used in Example 6 of D1 was a rubber rather than LLDPE, as argued by the Patentee (Respondent). This argument was further supported by D14 which clearly indicated that the copolymer used in the said example of D1 was a straight-chain polymer

and had a density of about 0.86 (i.e. a low density). It followed that the patent in suit was not unequivocally delimited from the closest prior art document.

Consequently, neither Claim 1 of the patent in suit nor D1 comprised data which would distinguish the respective copolymers from each other.

- (iii) Although it was correct that the technical problem underlying the patent in suit was to provide POM having increased elongation at break, it was known in the art that this property, similar to impact strength, was one essential mechanical feature of a moulding composition.

D8 provided mouldable compositions suitable for shaped articles having improved mechanical properties. Table 7 of D8 demonstrated that 3% by weight or 1% by weight of a polyethylene added to a polyacetal provided a polyacetal composition having improved mechanical properties.

D3 went much further and clearly showed to increase elongation at break by adding 0.1 to 30 parts by weight of a copolymer of ethylene and an  $\alpha$ -olefin to a polyacetal resin composition (Table 1).

Although not expressly stated in these documents, the use of LLDPE was an obvious choice for the skilled person in the polymer field either from a combination of D8 with D10 or D3 with D10.

D10 clearly indicated that LLDPE was particularly useful for the improvement of the elastic properties, in particular of elongation. Hence, D10 provided a strong suggestion to use LLDPE in the composition of D8 or D3 in order to obtain improved elastic-mechanical properties, including high elongation at break.

V. In its counterstatement dated 17 March 2000, the Respondent (Proprietor) supported the findings of the decision under appeal and disputed all the arguments of the Appellant essentially as follows:

(i) LLDPE and its difference from HDPE and LDPE were well-known in the art already at the priority date and the term "LLDPE" had a well established meaning in the art.

(ii) Example 6 of D1 referred only to copolymers of ethylene and propylene. This term was generic and covered - at least in principle - any polymer made from ethylene and propylene by any process known at that time. Hence, LLDPE was not derivable directly and unambiguously from that example or any other passage of D1.

Moreover, the copolymer in said Example 6 was composed of the two monomers in a weight ratio of 56:44, which made it almost certain that the copolymer was an ethylene-propylene rubber.

(iii) Without exception, the addition of LLDPE in varying amounts within the claimed range afforded a substantial improvement of the elongation at break in comparison to POM polymer without said addition. This proved that the technical problem underlying the patent in suit had been effectively solved.



- (iv) None of the documents cited in the course of the opposition proceedings addressed the same technical problem, let alone suggested to solve it by adding small amounts of LLDPE to the POM.

The mechanical properties of the polyacetal mentioned in D8, on which the Appellant relied, were the ball indentation hardness and the stiffness in torsion, but not the elongation at break.

Elongation at break was only referred to in D3 for a combination of a polyacetal and a polyepichlorohydrin rubber. D3 was strictly limited to the addition of saturated rubber polymers. LLDPE did not correspond to this definition.

D10 did not mention elongation at break either. Moreover, it would be unreasonable to expect that the properties of LLDPE manifested themselves to any significant extent in compositions where LLDPE accounted for at the most less than 1/30 of the whole composition.

- VI. A request for transfer of the opposition from the Party as of right (Opponent 01) to another company dated 20 February 2002 was withdrawn by letter of 12 April 2002. Apart from this procedural matter, the Party as of right did not make any written submissions to the factual questions disputed in the appeal proceedings.
- VII. Oral proceedings were held on 18 April 2002 in the presence of the Appellant and the Respondent. Since the Party as of right who did not attend these proceedings had also been duly summoned, the oral proceedings were continued in the absence of this Party, in accordance with Rule 71(2) EPC.

- (i) The Appellant further pursued its novelty objection to Claim 1 on the basis of Example 6 as presented in Table 1 of D1 and argued that this example disclosed a composition of a polyacetal containing 0.5% of a copolymer composed of ethylene and propylene in a weight ratio of 56:44 and having a second order transition temperature ( $T_g$ ) of  $-40^{\circ}\text{C}$ , which value was taken from D14, as could be seen from Footnote 1 of the said table. Based on the presence of this footnote, it was further argued that the content of D14 was - in accordance with current case law of the Boards of Appeal of the EPO - to be considered as part of the disclosure of D1.

Admittedly, D14 was silent about the preparation and structure of the ethylene-propylene copolymers, but it referred to D15 (D14: page 11, right column, line 4 above its Figure 3, "Natta (2)") which gave these details (D15, page 1003, left column, the abstract, and page 1004, right column, the paragraph following Figure 2: their preparation by means of Ziegler-Natta type catalysts, linear elastomers having a low density), and it would show that the softening temperature of the copolymers was lower than the melting point of the polyacetal. Whether called rubber or not, LLDPE showed in any case good elastomeric properties.

Hence, it would be evident that the ethylene-propylene copolymer used in the said example of D1 was linear and was prepared by means of an anionic coordination catalyst, and it followed that it

complied with the definition of component (b) on page 4, lines 1 to 9 of the patent in suit which did not contain any limitation as to the ratio of the ethylene and the  $\alpha$ -olefin in this component.

The Appellant concluded that Example 6 of D1 anticipated the subject-matter of claim 1 of the patent in suit.

As regards inventive step, the Appellant brought forward that, although polyacetals *per se* exhibited good mechanical properties including impact strength and elongation at break, there was still a need for further improvement. D1 aimed at such improvements. According to this document, the impact strength of polyacetals was improved by addition of a mixing component, such as a copolymer of ethylene and  $\alpha$ -olefins, in amounts as low as 0.1 to 10% by weight, especially by the addition of 0.5% of a copolymer of ethylene and propylene, as demonstrated in its Example 6. Accordingly, D1, read in conjunction with D14 and D15 for the same reasons as presented above with respect to novelty, was considered to represent the closest state of the art.

Admittedly, D1 was silent with respect to elongation at break, on which the patentee focused, but as generally known in the art, mechanical properties could not be regarded separately, because any modification of one such property affected the others as well.

This was evident from D3, wherein an impact resistant polyacetal composition was obtained by adding 0.1 to 30 parts by weight of a copolymer of ethylene and an  $\alpha$ -olefin to from 99.9 to 70 parts by weight of a polyacetal resin. Although

Example 1 of this document referred to a composition of the polyacetal and another polymer (polyepichlorohydrin rubber), its Table 1 clearly demonstrated that the improvement of the impact strength was accompanied by a significant increase of the tensile elongation at break. Hence, a skilled person was aware of this information when reading Example 3 of this document, wherein the addition of a copolymer of ethylene and propylene to a polyacetal resulted in a significant improvement of the impact strength. This fact that mechanical properties of polyacetals could be improved by the addition of polyethylenes was also confirmed by further documents cited in the opposition proceedings.

If, however, it was known from D3 to improve the elongation at break and the impact strength of a polyacetal by addition of a product, nowadays called LLDPE, in small amounts of eg 5 or 10%, it would have been obvious in view of D1 in conjunction with D14 and D15 [sic] to increase the elongation at break of a polyacetal composition by means of small amounts of as little as 0.1% of such a polyethylene.

Although known *per se* at least since 1959 (D5, point 4-1: "Sclair" and "Neo-ZEX") and although its properties were already known from Natta (D15), this particular type of polyethylene (LLDPE) had not been used on an industrial scale till the 1970's or 1980's for economical reasons only, in particular due to the high prices of the comonomers. For this reason only, LLDPE was referred to in D4 as "LDPE of the new generation".

(ii) The Respondent disputed these arguments in their entirety and submitted that LLDPE was a particular type of polyethylene which was prepared by copolymerisation of ethylene with certain comonomers under specific conditions, including a certain pressure and involving the use of a particular catalyst system. The skilled person knew the differences between the different types of polyethylene. D1 did not specify the process by which the copolymer used in Example 6 was prepared. Moreover, the  $T_g$  value was not very meaningful and could not serve as an argument to prove identity between the polymers in question.

In D1, the reference to D14 concerned only the explanation for the  $T_g$  values in the table.

According to the abstract on page 15 of D14, the influence of branching in the amorphous part of polyethylene and copolymers of ethylene was discussed on the basis of the extrapolation of  $T_g$  values for linear, fictitious completely uncrystallized polyethylene. Therefore, these data did not provide any information about the nature of the product used in D1.

D15 referred to linear essentially saturated and amorphous elastomers which were different from LLDPE (page 1004, right column).

It followed that the arguments produced by the Appellant with respect to the alleged lack of novelty were based on pure assumptions.

According to the discussion of the state of the art on page 2 of the description of the patent in suit, the starting point for the claimed subject-matter was the knowledge that polyacetal

compositions showed good properties for a variety of different uses. Nevertheless, there still was a desire for further improvements in respect of the elongation at break. As shown in that discussion, the addition of an inappropriate additive or an additive in too high an amount could even impair the property in question.

Since no mention was made of LLDPE in any one of the documents of the state of the art, it was not foreseeable that one specific property, ie the elongation at break, could be increased by adding a limited amount of LLDPE to the polyacetal. Two selections had to be made: the choice of the appropriate polyethylene and its amount. Based on all the information available to him, the skilled person certainly might have made the right choices, but it was doubtful that he would have done so without undue burden.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed.

### Reasons for the Decision

1. The appeal is admissible.
2. *Procedural matter*
  - 2.1 The Appellant objected to the patent in suit, because it lacked a clear definition of its subject-matter, ie its component (b). This objection is not considered by the Board under Article 84 EPC, because it is not a ground of opposition under Article 100 EPC.

2.2 The objection under Article 100(b) EPC initially raised by Opponent 02 has not been further pursued in these appeal proceedings. The Board does not see any reason to deviate from the findings of the Opposition Division as regards sufficiency of disclosure in the decision under appeal.

2.3 Consequently, the patent in suit meets the requirements of Article 83 EPC and the ground of opposition under Article 100(b) EPC does not succeed.

### 3. Novelty

To support its novelty case, the Appellant relied essentially on D1. In view of references in this document to D14 and in D14 to D15, the Appellant argued that the contents of the latter two documents were to be considered as part of the disclosure of D1.

Due to the alleged lack in Claim 1 of a clear definition of "linear low density polyethylene" (LLDPE) used as component (b), the Appellant was, furthermore, of the opinion that the subject-matter of the patent in suit was not delimited from the disclosure of D1.

3.1 D1 concerns a thermoplastic moulding composition having increased impact strength without any reduction of the hardness and stiffness (column 2, lines 14 to 18).

3.1.1 The known composition consists essentially of a mixture of (a) 99.9 to 90% by weight of a polyacetal and (b) 0.1 to 10 % by weight of another polymer having an average molecular weight of from  $10^3$  to  $10^6$  and a softening temperature below the crystallite melting point of (a).

More particularly, component (b) has a  $T_g$  value within a range of from  $-120$  to  $+30^\circ\text{C}$  and is present in the mixture in the form of particles having diameters in the range of from  $0.1$  to  $5 \mu\text{m}$ . Preferably, it is selected from homo- and copolymers of olefinically unsaturated compounds of the formula  $\text{H}_2\text{C}=\text{CR}_8\text{R}_9$  (formula VIII; wherein  $\text{R}_8$  is H or a methyl group,  $\text{R}_9$  is a H or a carboxyl, an alkyl carboxyl, an acyloxy or a vinyl group). In a list relating to a variety of different types of suitable polymers, "homo- and copolymers of  $\alpha$ -olefins, for example polyethylene, copolymers of ethylene and propylene, ... as well as copolymers of ethylene and vinyl acetate" are mentioned (Claim 1; column 1, lines 51 to 66; column 4, line 22 to column 5, line 8; in particular column 4, lines 42 to 49).

3.1.2 Thus, Example 6 relates to an impact-resistant (expressed in terms of a drop height of 100 cm) composition made up of (a) a copolymer of trioxane and ethylene oxide (in a weight ratio of 98:2) having a melt viscosity  $i_2$  ( $190^\circ\text{C}$ ) of 9.0 (ie POM), and (b) a copolymer of ethylene and propylene (in a weight ratio of 56:44; which is equivalent to a mol ratio of approximately 65.6:34.4) having a molecular weight of 140 000. Furthermore, Table 1 of D1 provides the following particulars of component (b):

"Amount (percent)	$T_g$ ( $^\circ\text{C}$ )	Diameter of particle ( $\mu$ )
0.5	<sup>1</sup> -40	0.5-5.0"

In the same way, these particulars (including Footnote 1 referring to D14) are also disclosed for compositions containing different components (b) such as polyethylenes and copolymers of ethylene and vinyl acetate, in Examples 4, 5 and 7 to 11 in the same table.



3.1.3 In the course of the opposition and appeal proceedings, the parties did not dispute that "LLDPE was well-known in the respective fields of the technique" (Opponent 02's letter of 13 December 1996, page 4, lines 1 to 3; cf. Patentee's letter of 2 October 1997, page 3, paragraph 1, and section V.i), above). It was not disputed either that LLDPE is prepared by "utilizing a[n] reformatinal technique of ion polymerization" (partial translation of D4, page 2, line 4).

This is in line with the argument of the Respondent during the oral proceedings that LLDPE is produced under very special reaction conditions (e.g. pressure, catalyst and comonomers) and that, consequently, the description of a copolymer of ethylene and propylene in the absence of the above particulars in a prior art document is not an inherent disclosure for LLDPE (section VII.ii, above).

3.1.4 D1 does not provide any details as to the method by which the above ethylene polymers used in Table 1 of D1 are manufactured nor any details as to their structures. In fact, it has not been in dispute between the parties that D1 neither explicitly characterises the "Copolymer of ethylene and propylene (56/44)" used in Example 6 of D1 as being a "linear low density polyethylene" (LLDPE) nor anywhere mentions LLDPE.

Furthermore, during the oral proceedings, the question of whether ethylene and propylene can only be copolymerised by means of one specific polymerisation method was not answered by the Appellant in the affirmative. From these facts, it follows that D1, by itself, does not exclude other known polymerisation methods which can be used to prepare copolymers from these two olefins.

3.1.5 In view of these facts and arguments, the Board comes to the conclusion that, in the absence of the said details concerning the ethylene-propylene copolymer used in Example 6 of D1, this example, by itself, is too vague and too unspecific with respect to the nature of the ethylene-propylene copolymer to amount to a clear and unmistakable disclosure of the subject-matter of Claim 1 of the patent in suit, which is a condition precedent to a finding that the claim lacks novelty (cf. T 465/92; OJ EPO 1996, 32, point 8.4 of the Reasons). The onus to prove that component (b) in that example is LLDPE was on the Appellant, which it has not discharged.

3.2 Since the Appellant referred to D14, the disclosure of which - due to the said Footnote 1 in Table 1 of D1 (section 3.1.2, above) - allegedly formed part of the content of D1, the Board has further examined whether the disclosure of D1 includes intrinsic features (disclosed or further specified in D14) which would establish the identity of component (b) of Claim 1 under consideration and the copolymer in Example 6 of D1, as suggested by the Appellant. This suggestion was based on the argument that, "according to current case law of the Boards of Appeal of the EPO" and due to the clear reference in D1 to this document, the disclosure of D14 was to be incorporated in D1 (letter dated 8 September 2000, page 2, point 2). The Appellant has, however, not identified any decision which would include such a general statement. Chapter I.C.3.1 of the Case Law of the Boards of Appeal, 4<sup>th</sup> edition, 2001, refers to a number of decisions dealing with this question, but it refers also to the specific marginal conditions which have to be met in each such case to allow the disclosure or part of the disclosure of a secondary document to be read into the disclosure of a primary document.

- 3.2.1 Thus, in Decision T 153/85 (OJ EPO 1988, 1), the Board was faced with such a question. However, the present situation clearly differs therefrom in a number of aspects: First, the footnote is not unambiguously related to the definition of the specific copolymer *per se* (the passage in Table 1 of D1 does not read: "Copolymer of ethylene and propylene (56/44)<sup>1</sup>"), but it rather refers to the  $T_g$  value ("<sup>1</sup>-40") only. Secondly, this footnote is not only found in Example 6 of D1 comprising the use of an ethylene-propylene copolymer but also in seven further examples of the table which include the presence of different polymers, ie two different polyethylenes and three different copolymers of ethylene and vinyl acetate. Thirdly, D14 does not mention the specific copolymer used in Example 6 of D1.
- 3.2.2 Document D14 which relates to the "Einfriertemperatur des Polyäthylens" (second order transition temperature of polyethylene) neither refers to LLDPE nor discloses any method for the preparation of the polymers used as the basis material in this survey of transition temperatures. On the contrary, the data published in D14 are said to be based in part on measurements made by the author or taken from literature on polymers of the "ethylene-propylene system" and in part on ethylene-vinyl acetate copolymers. Moreover, the data taken from literature were approximated on the basis of practical experience by recalculation to 100 Hz with the assumption of activation energies of 12 or 20 kcal per mol, respectively. From these data, curves of the transition temperatures against the composition of the polymers, ranging from 0 to 100 mol % of comonomer (ie, in the case of the ethylene-propylene system, ranging from ethylene homopolymer to propylene homopolymer) were constructed (Figure 3), the shape of which was confirmed by measurements of the rebound elasticity of

a long series of copolymers by Natta in D15 (page 10, last sentence ranging to page 11, left column, line 4 and the paragraph directly following Figure 2; as well as page 11, right column, line 10 et seq.).

3.2.3 The plotted points in Figure 3 (and the same applies to those in Figure 2) do not allow to identify the exact composition and structure of individual ethylene-propylene copolymers, let alone the copolymer used in Example 6 of D1. In the first paragraph of the right column on page 11, there is a general remark stating that the content of 6 to 7 mol % of branched comonomers would correspond to a degree of branching of "3 to 3.5 CH<sub>3</sub>/100 C". However, information which would elucidate further any details of the specific ethylene-propylene copolymer missing in D1 cannot be derived therefrom.

3.2.4 The Appellant argued repeatedly that the T<sub>g</sub> values of the copolymer in Example 6 of D1 would correspond to those values in Figure 3 of D14 and that this would prove the linearity of that copolymer. This argument which has been strongly disputed by the Respondent (see section VII.ii, above) is not convincing, because the diagram does not refer to linearity and the remark about the branching, mentioned in the previous paragraph, would allow such a conclusion at most for a very limited range of comonomer content, which is, furthermore, clearly different from that in the copolymer used in Example 6 of D1.

3.2.5 Even if it were assumed that the diagram of Figure 3 in D14 encompassed *inter alia* also LLDPE - the correctness of this assumption has, however (in the absence of further information about the preparation and structure of the polymers used in the survey; see section 3.2.2, above), not been proven by the Appellant - it would, nevertheless, not be admissible to deduce from the diagram that a particular compositional point

corresponding to a relevant  $T_g$  value in this diagram would amount to the disclosure of a linear low density polyethylene.

- 3.2.6 Such a conclusion would be an improper converse conclusion (which could be named in German "Umkehrschluß") from the possibly conceivable scope of a range of matter to the disclosure itself. This is particularly true for a copolymer which cannot be identified as such in D14, ie the copolymer used in Example 6 of D1.
- 3.2.7 Consequently, D14 does not add any particulars to the disclosure of D1 which would remove the above deficiencies from the Appellant's arguments concerning its novelty objection.
- 3.3 No reference to D15 can be found in D1. Hence, its disclosure cannot form part of the disclosure of D1. It does not even contribute to the content of D14. It is referred to therein for a single purpose, ie to confirm the findings and conclusions drawn by the author of D14 with respect to his measured or calculated  $T_g$  data.
- 3.4 Nevertheless, the Board has considered this additional document under the aspect of whether it would demonstrate the common general knowledge in this art with respect to the olefin copolymer used in Example 6 of D1.
- 3.4.1 D15 contains a general statement that linear, essentially saturated and amorphous copolymers are obtained by copolymerisation of ethylene with  $\alpha$ -olefins. These copolymers have good rubbery properties and are of special interest amongst all the new

synthetic elastomers developed in the previous years on the basis of processes of anionic coordination polymerisation (abstract in the frame on page 1003; page 1004, right column, first paragraph).

3.4.2 These very general statements do, however, not allow the conclusion that this characterisation would be true for each copolymer of ethylene and  $\alpha$ -olefins (cf. sections 3.1.3 to 3.1.5 and 3.2.2 to 3.2.6, above).

3.4.3 Furthermore, no mention is made in D15 of a copolymer having the particular composition of the one used in Example 6 of D1.

3.4.4 The only experimental particulars in this document refer to the apparatus ("appareil de micro-rebondissement Pirelli (4)") used for its measurements (page 1007, right column, paragraph "Appareillage employé").

3.4.5 It follows that D15 does not contribute either, to establish the identity of component (b) in Claim 1 of the patent in suit and the particular copolymer added to the polyacetal in Example 6 of D1. Consequently, the considerations in the above section 3.2.6 are also valid for this document.

3.5 Since the previous novelty objections based on other documents, which were raised during the opposition procedure, have not been maintained by the Appellant, the Board does not see any reason to deviate from the findings of the Opposition Division in this respect.

3.6 Consequently, the Board concludes that the novelty requirement of Articles 52(1) and 54 EPC is met by Claim 1 under consideration.

4. *Problem and Solution*

4.1 The patent in suit concerns polyoxymethylene compositions containing linear low density polyethylene and shaped articles made therefrom.

4.2 According to the introductory part of the patent in suit and as admitted by the Appellant, the technical problem underlying the patent in suit is to provide POM compositions having increased elongation at break (patent in suit: page 2, lines 7 to 24; Statement of Grounds of Appeal, dated 1 September 1999, page 4, item 4).

4.3 According to the patent in suit, the above technical problem is solved by admixing 0.2 to 3.0% by weight of LLDPE to 97 to 99.8% by weight POM. In the examples and comparative examples, compositions of POM and varying amounts of a number of different LLDPE polymers are compared with POM as such and a mixture of POM and LDPE, respectively. In each case, a significant improvement in elongation at break relative to the POM as such or to the POM-LDPE mixture is demonstrated. Therefore, the Board is satisfied that the technical problem has actually been solved by compositions in accordance with Claim 1.

4.4 Whilst, in the Statement of Grounds of Appeal, the Appellant based its arguments of lack of inventive step on combinations of D3 and D10 or D8 and D10, it did not maintain these arguments in the oral proceedings before the Board, but, instead, it relied on D1 in conjunction with D14 and D15 as the closest state of the art and was of the opinion that the claimed subject-matter was obvious in view of this closest state of the art in combination with D3. Documents D4, D5 and D9 were additionally referred to in order to demonstrate the common general knowledge in the art.



4.5 The disclosure of D1 by itself or in view of D14 and D15 has already been considered in detail with respect to novelty (sections 3 to 3.4.5). It is evident from these considerations that D1 (or any combination of D1 with D14 and/or D15) does not relate to an improvement of elongation at break of POM compositions, but to improvements of impact strength. Indeed, these facts were accepted by the Appellant.

5. *Obviousness*

It remains to be decided whether the solution disclosed in the patent in suit was obvious to a person skilled in the art having regard to the state of the art relied upon by the Appellant.

5.1 Based on the above considerations, the Board is convinced that D1, by itself or in any combination with D14 and/or D15, does not suggest compositions of 97 to 99.8% by weight of POM and 0.2 to 3.0% by weight of LLDPE in order to solve the above technical problem.

5.2 D3 relates to an impact resistant polyacetal resin composition obtained by adding 0.1 to 30 parts by weight of at least one saturated rubber to from 99.9 to 70 parts by weight of a polyacetal resin having 85 mol % or more of oxymethylene units in the main chain. The rubber is either a polyether rubber or a copolymer of 40 to 98 mol % of ethylene units and 2 to 60 mol % of a compound according to the general formula  $CH_2=CR_1R_2$ , wherein the two R groups stand for halogen, hydrocarbon, halogenated hydrocarbon;  $R_1$  may additionally stand for H (the Claim).

5.2.1 Example 1 provides experimental data of some mechanical properties, including Charpy impact strength and tensile elongation at break, for compositions



consisting of a commercially available polyacetal and 5 or 10% of a commercially available polyepichlorohydrin rubber.

In Example 3, "DuPont impact values" are given for binary blends of 95 parts of the same polyacetal and 5 parts of a number of saturated rubber polymers, *inter alia* an ethylene-propylene (50 mol % each) copolymer.

- 5.2.2 The only passage in the prior art cited during the opposition and appeal proceeding which refers to elongation at break is found in Example 1 of D3.
- 5.2.3 In view of these facts, the Appellant based its objection of lack of inventive step on the argument that whilst it had been known that POM compositions had advantageous mechanical properties there was still a need for further improvements. Table 1 in Example 1 of D3 would demonstrate that the addition of a modifier to POM improved both impact strength and elongation at break. Even though the modifier in that example was a different polymer used in amounts of 5 or 10%, it would have been obvious to use the modifying polymers in Example 3 for the same purpose, the first of which was a copolymer of ethylene and propylene, and D1 additionally taught an amount of only 0.5% by weight (which was in line with the amount defined in the claim of D3).
- 5.2.4 This argument is not convincing for the following reasons:

Firstly, D3 requires the addition of saturated rubbers to POM (the claim, page 6, line 5 of the partial translation).

As far as the ethylene-propylene copolymers are concerned, the Appellant has conceded that, being alternatives, LLDPE and ethylene-propylene rubbers relate to different types of polymers (see section IV.ii), above, first paragraph). Moreover, D3 does not provide any further details as to the preparation of these rubbers or their structures, and reference can thus also be made to the considerations in sections 3.1.3 to 3.1.5, above, which apply here as well.

Secondly, D3 does not provide any hint that elongation at break of a POM composition could be further improved by addition of LLDPE in comparison with the same amount of LDPE having the same density (see Table I in the patent in suit).

Thirdly, measurements of elongation at break and Charpy impact strength besides those of tensile stress (at yield or at break), Vicat softening point, Rockwell hardness and flexural strength are described in D3 only with respect to the addition of 5 or 10% of polyepi-chlorohydrin rubber to POM (Table 1). This does not allow any conclusions about the situation with compositions comprising 0.2 to 3.0% by weight of LLDPE, with respect to the above properties mentioned in Table 1, let alone with respect to elongation at break, in particular.

5.3 Hence, the Board is convinced that the skilled person does not derive from either D1 or D3 or both that the elongation at break of POM can be improved by addition of 0.2 to 3.0% by weight of LLDPE. None of these documents provides an incentive to prepare a composition according to Claim 1 under consideration in order to solve the above technical problem.

6. Although not maintained in the oral proceedings, the previous arguments to inventive step submitted by the Appellant in writing have also been considered by the Board.
- 6.1 On the basis of D3, as considered in the above sections 5.2 to 5.2.3, the Appellant held this document in combination with D10 to be of particular relevance. The same would be true for D8 and D10. Although neither D8 nor D3 expressly stated that the mixing component added to the polyacetal was to be LLDPE, this would have been an obvious choice either from a combination of D8 and D10 or D3 and D10 (see section IV.iii).
- 6.2 The Board cannot accept these arguments for the following reasons:
  - 6.2.1 Similarly to D3 already considered in detail, above, neither D8 nor D10 provides an incentive to solve the above technical problem in such a way so as to arrive at something within the scope of the claims in the patent in suit.
  - 6.2.2 D8 discloses thermoplastic moulding compositions on the basis of POM, suitable modifying components and a specific amount of a nucleating agent. The compositions are suitable for the manufacture of shaped articles having improved mechanical properties by keeping the diameter of the POM spherulites formed in the isothermal crystallisation of the moulding composition within a certain range (column 1, line 60 to column 2, line 11). According to D8, the formation of large spherulites, which generally occurs when cooling down molten POM, results in opacity, microscopically small fissures and internal tensions, which detrimentally affect the physical properties of eg injection moulded

articles. These flaws are the more pronounced, the larger the individual spherulites are (column 1, lines 32 to 45).

The solution found in D8 resides in the addition to POM of 0.0005 to 1.0% by weight of a nucleating agent and of 0.1 to 10% by weight of modifying components which are, with only minor modifications in the wording, defined in the same way as the second component of the composition in D1 (D1: column 4, line 22 to column 5, line 8; D8: column 3, line 61 to column 4, line 49).

In the examples, a number of different polymers were used as modifiers, and the compositions or shaped articles made therefrom were tested with respect to the size of their spherulites, their impact strength (hammer drop test), their melt index, their ball indentation hardness and their stiffness in torsion. The modifiers used ranged from polyethylene and copolymers of ethylene and vinyl acetate or ethylene and ethyl acrylate to poly(tetrahydrofuran), poly(ethylene oxide), copolymer of ethylene oxide and propylene oxide, copolymer of butadiene and acrylonitrile and poly(2-ethylhexyl methacrylate). Elongation at break was not contemplated.

Thus, the disclosure of D8 is no more relevant to the subject-matter of the patent in suit than D1. For similar reasons, it cannot assist the skilled person to find the solution of the above technical problem.

- 6.3 The three copies which were submitted as one document, D10, are of poor legibility (namely in respect of their publication dates) and do not appear to belong to one publication. In any case, they describe in general terms the differences between HDPE, LDPE and LLDPE, see e.g. Figure 1 (on the sheet titled "New Polyethylenes") relating to the different structures of these different

polymers. The properties of the polymers can be modified by controlling their degree of linearity and branching as well as the amount of comonomer used. Thus, polymers can be prepared for film applications having enhanced tear and tensile strengths and toughness. For injection and rotational moulding, properties can be optimised for minimum warpage, excellent environmental stress crack resistance, low temperature impact or heat resistance. Films made of LLDPE are reported to have improved tear strength, higher tensile strength, elongation and toughness in comparison to standard LDPE (sheet titled "Something new in polyethylene ...", left column).

On all three pages, LLDPE is only discussed with respect to uses of the polymer as such. Blending or its use as a modifier for other polymers is not considered at all. The effects of 0.2 to 3.0% by weight of LLDPE in admixture with 97 to 99.8% by weight of POM on the elongation at break cannot be inferred from this disclosure, as already argued by the Respondent (section V.iv), above).

Thus, D10 has no contextual relationship to the disclosures of D8 or D3 and in particular does not add anything thereto which would be relevant to the solution of the above technical problem.

7. It follows that the subject-matter of Claim 1 is not obvious to a person skilled in this art in view of these documents previously relied upon by the Appellant, whether considered in isolation or in combination. Consequently, the subject-matter of Claim 1 involves an inventive step.

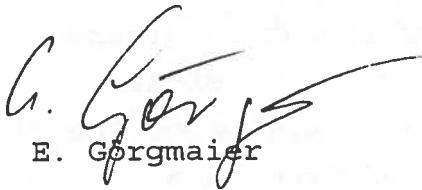
8. These arguments apply also to the subject-matter of Claims 2 to 11, which are based on the composition of Claim 1 and include the same components. Therefore their subject-matter involves an inventive step also.

**Order**

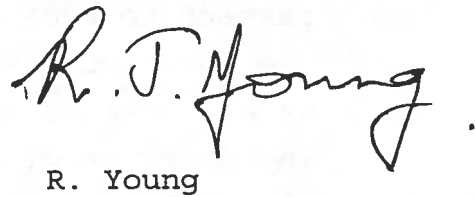
**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

  
E. Gorgmaier

The Chairman:

  
R. Young