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D E C I S I O N
of 29 September 1999

Case Number: T 0980/97 - 3.3.3

Application Number: 88202344.3

Publication Number: 0313170

IPC: C08K 3/26

Language of the proceedings: EN

Title of invention:

Flame retardant polymer composition

Patentee:

Shell Internationale Research Maatschappij B.V.

Opponent:

BP International Limited Patents and Agreements Division

Headword:

-

Relevant legal provisions:

EPC Art. 114(1), 114(2), 56, 84

Keyword:

"Inventive step (yes) - effect attained regarded as surprising"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0980/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 29 September 1999

Appellant: BP International Limited Patents and
(Opponent) Agreements Division
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN (GB)

Representative: -

Respondent: Shell Internationale Research
(Proprietor of the patent) Maatschappij B.V.
Carel van Bylandtlaan 30
2596 HR Den Haag (NL)

Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 17 April 1997,
issued in writing on 16 July 1997 rejecting the
opposition filed against European patent
No. 0 313 170 pursuant to Article 102(2) EPC.

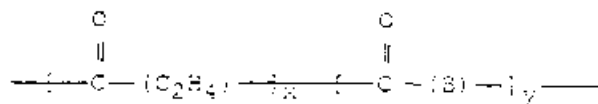
Composition of the Board:

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

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 313 170, entitled "Flame retardant polymer composition", in respect of European patent application No. 88 202 344.3, filed on 19 October 1988 and claiming a US priority of 22 October 1987 (US 111466) was published on 22 March 1995 (Bulletin 95/12). Claim 1 read as follows:

"Flame retardant polymer composition comprising a linear alternating polymer of the formula



wherein B is the moiety of an alpha-olefin of at least 3 carbon atoms polymerized through the olefinic unsaturation, x and y being integers, the ratio of y:x being no more than 0.5, and a quantity of 2% to 30% by weight, based on total composition, of magnesium or calcium carbonate as flame-retarding additive."

Claims 2 and 3 were dependent claims directed to elaborations of the composition according to Claim 1.

II. Notice of Opposition was filed on 21 December 1995 on the ground of lack of inventive step. The opposition was supported by the documents:

D1: Katz and Milewski, "Handbook of Fillers and Reinforcements for Plastics" (1978), pages 260/261;

D2: GB-A-2 085 899;

D3: GB-A-1 398 207; and

D4: JP-A-60 248 755, considered in the form of a later filed English translation.

The Patentee additionally introduced, with a submission filed on 6 June 1996, the document:

D5: J. Troitzsch, "International Plastics Flammability Handbook" (1983), pages 45 to 46.

The Opponent cited, in a submission filed on 21 February 1997, three further documents:

D6: Morrison and Boyd, "Organic Chemistry" (1977), pages 675 to 677 and 630 to 634;

D7: Grassie and Scott, "Polymer Degradation and Stabilisation" (1985), pages 43 to 48; and

D8: Cullis and Hirschler, "The Combustion of Organic Polymers" (1981), pages 117, 122, 149, 150.

III. By a decision which was given at the end of oral proceedings held on 17 April 1997, and issued in writing on 16 July 1997, the Opposition Division rejected the opposition.

According to the decision, none of D6 to D8 referred either to polyketones, i.e. polymers having the keto group in the polymer chain, or to flame-retardancy. Furthermore, D6 was a general text book of organic

chemistry without any link to polymers, D7 was a general text book dealing with thermal degradation and stabilisation, but not with the burning process, and D8 referred to thermal decomposition, but not to flaming. Consequently, these documents, which were *prima facie* not relevant to the decision, had been excluded from the proceedings pursuant to Article 114(2) EPC.

Novelty had not been contested and was conceded.

As to inventive step, it had not been disputed that the technical problem objectively arising, which was to increase the flame retardancy of the linear alternating polymers acknowledged to be known in the patent in suit, had been successfully solved by the distinguishing feature of adding 2 to 30% by weight of magnesium or calcium carbonate. This solution did not arise in an obvious way from the state of the art, however, because D1 taught to use calcium carbonate in a quantity typical for its use as a filler, which would exceed the upper limit defined in Claim 1, and D2, D3 and D4 referred to polymers which were quite different from the polyketones according to the patent in suit, and the teachings of these documents could not be transferred to the polyketones claimed.

- IV. On 19 September 1997, a Notice of Appeal against the above decision was filed, together with payment of the prescribed fee.

In the Statement of Grounds of Appeal, filed on 13 November 1997, the Appellant (Opponent) argued in substance as follows:

- (a) The Opposition Division had been wrong to exclude D6, D7 and D8 from the proceedings, since they were representative of the common general knowledge of the person skilled in the art of polymer flame retardancy.
- (b) The use of calcium carbonate as a flame retardant was common general knowledge as evidenced by D1, a reference text book, so that a person skilled in the art of flame retardancy would try using such a well known flame retardant in polyketones in the expectation of success, especially since carbonates were known to be suitable for use as flame retardants for polymers which thermally degraded in a similar manner to polyketones, such as polyvinyl acetate.
- (c) The sub-problem of the amount in which the known flame retardant should be added was a matter of trial and error, the skilled person wishing in any case to minimise the amount added, since it was known from D1 that calcium carbonate had a deleterious effect on mechanical properties.
- (d) The scale of flame retardancy achieved according to the patent in suit was a bonus effect following inevitably from the use of an obvious measure.

The Statement of Grounds of Appeal also cited the following further documents:

D9: N. Grassie et al., Makromol. Chem., vol. 64, page 82 (1963); and

D10: US-A-3 979 373,

as well as referring to further pages (81, 98, 106 and 111) of D1.

- V. The Respondent (Patentee) objected, in a submission filed on 28 May 1998, to the introduction of new documents D9 and D10, as being irrelevant, and also to the introduction of further individual pages of D1, which he referred to as D11. The Respondent referred for the first time to the document:

D12: Troitzsch, "International Plastics Flammability Handbook", Hanser 1983, page 53;

and argued substantially as follows:

- (a) The submissions of the Appellant did not support the admissibility of D6, D7 and D8, and their introduction was still objected to.
- (b) The reasoning in the decision under appeal, on the basis of D1 to D5 was correct.
- (c) The reference by the Appellant to a "sub-problem" was inappropriate, since this was the actual problem confronted by the patent in suit, and the solution, which was to add low amounts of calcium or magnesium carbonate; moreover it was not obvious, since the skilled person knew from D1 that calcium or magnesium carbonate had to be added in large quantities to get the benefit of the diluent effect. This teaching of D1 was confirmed by D12.

VI. The Appellant informed the EPO, in a letter filed on 11 August 1999, that it would not be attending the oral proceedings scheduled for 29 September 1999, and withdrew its request for oral proceedings. Instead, it requested a decision on the written record.

VII. With a further submission filed on 27 August 1999, the Respondent filed additional experimental evidence that magnesium carbonate in an amount of 20% showed a significant flame retardant performance, and also referred, for the first time, to the publication:

D13: Hornsby et al., in the Proceedings of the "Flame Retardants '94" Conference, pages 93 to 109.

VIII Finally, in a submission filed on 23 September 1999, the Respondent filed further pages of the document D8, "The Combustion of Organic Polymers", cited by the Appellant.

IX. Oral proceedings were held on 29 September 1999. During the oral proceedings, the Board confirmed the exclusion of documents D6 to D8 from the proceedings and furthermore decided to exclude D9 to D11, as well as the further pages of D8, from the proceedings under Article 114(2) EPC, but introduced D12 and D13 under Article 114(1) EPC.

The Respondent filed a new set of Claims 1 to 3 and amended pages of description in response to an objection raised by the Board, that the claim was indeterminate as to the ratio of polyketone to carbonate, because the composition according to Claim 1 needed only to "comprise" the linear alternating

polymer (polyketone) and the magnesium or calcium carbonate, whereas the quantity of the latter was nevertheless calculated on the "total composition".

Claim 1 of the new set differs from Claim 1 as granted in that the word "comprising" in the first line has been replaced by "consisting of", and in that the phrase "based on total composition" has been replaced by "based on the composition".

Claim 2 corresponds to Claim 2 as granted.

Claim 3 differs from Claim 3 as granted only in that the phrase "based on total composition." has been replaced by "based on the composition."

- X. The Appellant requested that the decision under appeal be set aside, and the patent in suit revoked in its entirety.

The Respondent requested that the decision under appeal be set aside, and that the patent be maintained on the basis of Claims 1 to 3 and the description both filed during oral proceedings.

Reasons for the Decision

1. The appeal is admissible.
2. *Text underlying the decision*

The amended text underlying the present decision consists of:

Amended Claims 1 to 3 as filed at the oral proceedings;
and an amended description consisting of:

Amended pages 2 and 3 as filed at the oral proceedings;
and page 4 of the description as granted.

3. *Admissibility of amendments*

3.1 The replacement, in Claim 1, of "comprising" by "consisting of" is supported by the examples, in which only the polyketone and Ca or Mg carbonate are present, and the general description on page 3 at lines 28 to 30, according to which, "The polymer composition, in addition to polymer and Ca or Mg carbonate, may incorporate other conventional additives...". Thus, it is evident that the preferred composition consists only of the polymer and Ca or Mg carbonate. The amendment of "total composition" to "the composition" in Claims 1 and 3 is consequent upon the above amendment.

Hence, the amended claims meet the requirements of Article 123(2) EPC.

Furthermore, the fact that Claim 1 has been limited to a composition consisting of only two components instead of any number of components including two, means that Claim 1 as amended is narrower in scope than Claim 1 as granted.

Consequently, the amended claims also meet the requirements of Article 123(3) EPC.

3.2 The amendments to page 2 of the description correspond to those in Claim 1. The amendments on page 3 are

consequential on the amendment of Claim 1 and involve the deletion of references to additional flame retarding materials (lines 10 to 14), since they no longer fall within the definition of the composition as defined in Claim 1. The amendment of the references to further additives (lines 28 to 31) is to avoid the suggestion that they form part of the composition as defined in Claim 1. These amendments do not involve added subject-matter or result in a broadening of the scope of Claim 1.

Consequently, the amended description also meets the requirements of Article 123(2) and 123(3) EPC.

- 3.3 The amendment of "comprising" to "consisting of" on both the claims and the description also meets the requirements of Article 84 EPC in that it reflects the Respondent's actual contribution to the art and contributes to a clear definition of the claimed subject-matter.

As it emerges from the arguments put forward by the Respondent, the effect relied upon during the proceedings is to be found in the effectiveness of small amounts of calcium/magnesium carbonate as a fire retardant in specific carbonyl/alkene terpolymers. The present wording of the claims, which now explicitly requires such a low ratio, makes it possible to accept as relevant the Respondent's arguments in relation to fire retardancy, and hence to inventive step.

- 3.4 In summary, the amended text underlying the present decision meets both the relevant objection of the Board (Section IX, second paragraph, above) and the

requirements of Articles 123 and 84 EPC.

4. *Late-filed documents and evidence*

4.1 Documents D6 to D8

The Board sees no reason to differ from the finding, in the decision under appeal, that documents D6 to D8 should be excluded from the proceedings for lack of relevance. The argument of the Appellant, that they were representative of the common general knowledge of the person skilled in the art of polymer flame retardancy (Section IV(a), above) is not sufficient to establish that the documents are relevant to the case in point. On the contrary, the absence of any direct connection with the specific problem addressed by the patent in suit (flame retardancy) would have led the Board also under these circumstances to exclude these documents under Article 114(2) EPC. Consequently, the Board had no reason to consider that the Opposition Division had exercised their discretion in an unreasonable manner in excluding the documents under Article 114(2) EPC. It therefore confirmed the exclusion of these documents from the proceedings.

4.2 Similar considerations apply to the contents of documents D9 and D10, which relate to thermal degradation rather than flame retardancy. Nor does D11, which consists of further pages of D1, add anything of significance to the documents already in the proceedings. Consequently, the Board decided to exclude D9, D10 and D11 from the proceedings under Article 114(2) EPC also.

- 4.3 It follows from the exclusion of D8, for lack of relevance (Section 4.1, above), that the further pages of this document, filed with the submission of the Respondent on 23 September 1999, which merely provide background to matter already excluded as irrelevant, should, by the same token, also be excluded for lack of relevancy. Consequently, this disclosure was also excluded from consideration under Article 114(2) EPC.
- 4.4 Document D12 contains further detail as to the context in which calcium carbonate was regarded as capable of functioning as a flame retardant. It thus supplements and further enhances the relevance of D1. It is thus considered sufficiently relevant to merit its admission to the proceedings. It was therefore introduced by the Board in the exercise of its discretion under Article 114(1) EPC.
- 4.5 Document D13, although itself not prior published, was argued by the Respondent at the oral proceedings to contain relevant information already available prior to the relevant filing date of the patent in suit, and furthermore to provide additional information regarding the behaviour of calcium carbonate as a fire retardant in specific systems. To the extent that such behaviour is relevant to understanding the arguments of the Respondent concerning the nature of the technical problem, the document is highly relevant, and was introduced by the Board in the exercise of its discretion under Article 114(1) EPC.
- 4.6 The experimental evidence filed with the submission of 27 August 1999 merely provides further detail of the procedure followed and results obtained in Example 2

according to the patent in suit, the accuracy of which has in any case not been contested. The Board had no objection to its introduction into the proceedings. It was therefore introduced pursuant to Article 114(1) EPC.

5. *The patent in suit; the technical problem*

The patent in suit relates to a polymer composition based on a linear alternating polymer of carbon monoxide and olefinically unsaturated compounds of specific formula, hereinafter termed a "polyketone" (Section I, above). Such compounds are acknowledged in the patent in suit to belong to the state of the art (page 2, lines 7 to 9). It has, furthermore, not been disputed that a disadvantage of such polyketones is that they are relatively easily flammable. This is confirmed by the "Control" example in the patent in suit, in which such a polyketone has a limiting oxygen index (LOI) of 18.5 to 19, which corresponds to an ability to burn in an atmosphere deficient in oxygen compared with natural air.

5.1 The technical problem addressed by the patent in suit is thus to provide flame retardant compositions of such polyketone polymers (page 2, lines 16 to 17). The solution proposed according to Claim 1 of the patent in suit is to add 2 to 30% by weight of Ca or Mg carbonate, based on the composition, to the polyketone.

5.2 It can be seen from the results of Example 1 of the patent in suit, that the addition of different percents of Ca carbonate to a polyketone terpolymer prepared from carbon monoxide, ethylene and propylene and having

a limiting viscosity number (LVN) of 1.60, measured at 60°C in m-cresol (melting point 219°C), is associated with an increase in LOI, from 23 to 23.5 at 5% loading of Ca carbonate, through 25.5 to 26 at 10% loading, to 27 to 27.5 at 25% loading, compared with 18.5 to 19 for a "Control" terpolymer containing no added Ca carbonate. Furthermore, a similar result is stated, according to Example 2, to be obtained using magnesium carbonate under similar conditions. This is confirmed by the experimental data filed by the Respondent (Section 4.6, above).

- 5.3 The fact that the "Control" polyketone terpolymer in Example 1 is different from the terpolymer to which Ca carbonate had been added, in that it has a LVN of 1.83 (melting point 221°C) and has been prepared using a different catalyst, was accepted, by the Board, as being of no significance for the validity of the results, for the following reasons. The Respondent argued, at the oral proceedings, that LVN had no major influence on LOI and that the closeness of the limiting viscosity number - which was within experimental error the same in both cases - was indicative of the same generic polymer structure in each polymer. Consequently, the "Control" terpolymer was, for the purposes of the LOI test, effectively identical with the terpolymer to which Ca carbonate had been added. The Board saw no reason to doubt the veracity of the submissions thus made, and consequently concluded that the LOI values given in Table 1 of the patent in suit represented a fair comparison of the flamed retardant properties with and without the addition of Ca carbonate as flame retardant.

5.4 Furthermore, the fact that the quantities of each monomer are not stated explicitly in either the first or the second terpolymer exemplified in the patent in suit was accepted as not giving rise to doubt as to whether such polymers fell within the scope of Claim 1, for the following reason. The Respondent argued, at the oral proceedings, that the LVN value was indicative of the percentage of the third monomer (propylene) and corresponded, in the case of each of the terpolymers exemplified, to a level of propylene in the polyketone of around 6 mole%. This corresponded to a value of y in Claim 1 of about 0.06, so that the exemplified terpolymers both fell within the scope of Claim 1. The Board sees no reason to doubt the accuracy of these statements. Consequently, it is held that the examples illustrate the subject-matter of Claim 1.

5.5 In view of the above, the addition of the exemplified amounts of Ca carbonate evidently confers appreciable flame retardancy to the polyketones.

5.6 In summary, the Board finds it credible that the technical problem is effectively solved by the claimed measure.

6. *Novelty*

The novelty of the subject-matter claimed in the patent in suit has not been contested. Consequently, this subject-matter is held to be novel.

7. *Inventive step*

In order to assess the question of inventive step, it is necessary to consider whether the person skilled in the art, starting from the specified polyketone terpolymers, would have expected an appreciable increase in their flame retardancy to result from adding the specified amounts of Ca or Mg carbonate (Section 5.5, above).

7.1 According to D1, it is stated, "Calcium carbonate... is used as a cheap, inert filler in many polymer applications. CaCO_3 shows significant flame retardancy predominantly through its diluent effect." (page 261, left column, first sentence). The emphasis is thus on the inert nature of Ca carbonate as a filler, which therefore functions as a flame retardant principally in the sense that it does not itself burn.

7.2 This impression is reinforced by the disclosure of D12, according to which "Chalk, a filler which some also consider as a flame retardant, acts purely by the diluting effect of highly filled plastics materials reducing the amount of combustible material available per unit volume and thus reducing combustibility. Since chalk does not break down below 900°C , flame-retardant action, i.e. reaction in the temperature range of plastics pyrolysis (150°C to 400°C), does not take place." (page 53). Here, the additive is stated to act as a flame retardant "purely", rather than merely "predominantly" by its diluent effect.

7.3 The question thus arises as to what level of addition of Ca carbonate (or Mg carbonate) would correspond to

providing a "diluent" effect. Generally speaking, such an effect would require that the carbonate had been added in sufficiently large quantities that the composition as a whole had begun to take on the character of Ca or Mg carbonate, rather than that of a polyketone.

7.4 The argument of the Appellant, that the amount of flame retardant which should be added was a matter of trial and error, the skilled person wishing in any case to minimise the amount (Section IV(c), above), whilst unexceptionable to the extent that it merely rehearses the disinclination of the skilled person to add amounts of carbonate significantly in excess of any threshold at which the diluent effect would be expected to take effect, is irrelevant to the question of where the skilled person would expect this threshold to be.

7.5 The implication of the Appellant's argument, that the expectation would be within the range claimed in the patent in suit is not supported by either of D1 or D12, since neither of these documents give quantitative details in this respect.

7.6 Nor is it derivable from the remaining documents D2, D3 and D4 considered by the decision under appeal, which are less pertinent, for the reasons given in the decision under appeal, which reasons have not, in the Board's view, been refuted by the Appellant. In particular, no convincing evidence was brought that the mechanism of combustion of polymers in general was so well understood at the relevant filing date of the patent in suit, that the skilled person would have been able to predict the quantitative effectiveness of a

particular flame retardant additive, let alone that such a parallel could be drawn from the vinyl acetate polymer referred to, for instance in D4. Even if this had been the case, however, the flame resistant additive referred to in D4, which is a basic magnesium carbonate, does not degrade to magnesium carbonate, and consequently does not fall within the terms of Claim 1 or correspond to the solution of the stated problem.

7.7 On the contrary, from the general considerations above, the expected threshold for a "diluent" effect would imply, in the Board's considered view, an amount of carbonate at least equal to that of the polyketone, i.e. at least 50% by weight based on the composition. This is furthermore corroborated by the state of the art acknowledged in the patent in suit, according to which 150 to 600 parts by weight of Ca carbonate are incorporated in 60 to 100 parts by weight of ethylene/CO/VA (vinyl acetate) copolymer, i.e. an amount well in excess of 50% by weight of the resulting composition.

7.8 In summary, there is nothing on the file which would refute the position which has been consistently adopted by the Respondent, namely that the level the skilled person would have regarded as a threshold for Ca carbonate to act as a flame retardant by virtue of its "diluent" effect, would be substantially above the maximum of 30% by weight of the composition according to Claim 1, and forming the solution of the technical problem according to the patent in suit.

7.9 Hence, the fact that appreciable flame retardancy is obtained by adding amounts of the carbonate well below

this level must, under the circumstances, be regarded as a surprising result. Consequently, the solution of the technical problem does not arise in an obvious way having regard to the state of the art. In other words, the subject-matter of Claim 1 of the patent in suit involves an inventive step within the meaning of Article 56 EPC.

7.10 It follows from the above, that the subject-matter of dependent Claims 2 and 3 also involves an inventive step within the meaning of Article 56 EPC.

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 on the basis of Claims 1 to 3 and the description both filed during oral proceedings (see Section 2, above).

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin