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D E C I S I O N
of 10 February 2000

Case Number: T 0137/97 - 3.3.3

Application Number: 85308603.1

Publication Number: 0192888

IPC: C08J 9/00

Language of the proceedings: EN

Title of invention:

Flexible, flame-retardant polyurethane foams

Patentee:

Dunlopillo Limited

Opponent:

- (I) BASF Aktiengesellschaft, Ludwigshafen
(II) Carpenter Plc
(III) Vauth & Sohn KG

Headword:

-

Relevant legal provisions:

EPC Art. 56, 114

Keyword:

"Inventive step - ex post facto analysis - selection involving unexpected improvement"

Decisions cited:

T 0111/90, T 0686/91, T 0644/97

Catchword:



Europäisches
Patentamt

European
Patent Office

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des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number: T 0137/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 10 February 2000

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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 23 October 1996, issued in writing on 11 November 1996 revoking European patent No. 0 192 888 pursuant to Article 102(1) 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. 0 192 888, entitled "Flexible, flame retardant polyurethane foams", in respect of European patent application No. 85 308 603.1, filed on 27 November 1985 and claiming a GB priority of 20 December 1984 (GB 8432153) was announced, following a successful appeal against the refusal, by the Examining Division of the latter application (No. T 111/90 - 3.3.3 of 11 April 1991, not published in OJ EPO), on 6 October 1993 (Bulletin 93/40). Claim 1 reads as follows:

"A method for the production of a flexible flame-retardant polyetherurethane foam, from a foam-forming reaction mixture including a polymeric polyol and an organic polyisocyanate, characterised in that the polymeric polyol is a polyether polyol and the foam-forming reaction mixture also contains, as flame-retardance conferring additive, "expandable graphite" which is graphite containing one or more exfoliating agents such that considerable expansion will occur at high temperatures."

Claims 2 to 4 are dependent claims directed to elaborations of the method according to Claim 1.

Claim 5, an independent claim, reads as follows:

"A flexible flame-retardant polyurethane foam which comprises the reaction product of a polyether polyol and an organic polyisocyanate characterized in that the foam contains, as flame-retardant ingredient, "expandable graphite" which is graphite containing one

or more exfoliating agents such that considerable expansion will occur at high temperatures."

Claims 6 to 10 are dependent claims directed to elaborations of the foam according to Claim 5. In particular, Claim 7 reads as follows:

"A foam according to Claim 5 or 6 characterized in that it passes the burning test of BS 4735 September 1974."

Furthermore, Claim 8 reads as follows:

"A foam according to Claim 5 or 6 characterized in that, when used with a textile cover, it passes the No. 7 crib test of BS 5852 Part 2 1982."

II. Notices of Opposition were filed:

- (i) by BASF (Opponent I) on 24 June 1994, on the grounds of lack of inventive step (Article 100(a) EPC);
- (ii) by Carpenter Plc (Opponent II) on 4 July 1994, on the grounds of Article 100(a) EPC (lack of novelty and inventive step) and 100(b) EPC (lack of sufficiency); and
- (iii) by Vauth & Sohn (Opponent III) on 2 July 1994, on the grounds of Article 100 (a) EPC (lack of novelty and inventive step).

The oppositions were supported *inter alia* by the following documents:

D2: US-A-4 139 501;

D3: JP-A-55-50035 (considered in the form of an English translation);

D4: US-A-3 333 941;

D5: US-A-3 574 644;

D8: EP-A-0 051 347; and

D19: GB-A-1 404 822 (equivalent to DE-A-2 428 307).

III. By a decision announced orally on 23 October 1996 and issued in writing on 11 November 1996, the Opposition Division revoked the patent.

According to the decision, the objection under Article 100(b) EPC, which had been raised against Claims 7 and 8, was more relevant to Article 84 EPC. This was not, however, an admissible ground of opposition, and even to the extent that the objection could be construed as arising under Article 83 EPC, it did not relate to the broadest form in which the subject-matter of the patent in suit was claimed. Furthermore, the two BS tests concerned would have been known to the skilled person.

As to novelty, none of the documents cited disclosed explicitly or implicitly all the essential features of (i) the foam being flexible; (ii) a polyetherpolyol component being used in the foam and (iii) an expandable graphite being used as flame retardant. The

claims were therefore novel.

On inventive step, there had been four attacks, only two of which related to the problem and solution approach.

- (i) D3, whilst not explicitly mentioning flexible foams, related to a method of preparing a polyurethane foam by incorporating 5 to 25% by weight of a swollen graphite as flame retardant, into the polymerisation reaction of a polyol having at least two active hydrogen groups per molecule with a multifunctional polyisocyanate. The argument of the Patentee, that a skilled person would read D3 as relating only to hard (i.e. rigid) polyurethane foams, could not be accepted. In particular, there was no justification for interpreting the general reference, on page 2 of D3, to the use in furniture as meaning only the use of hard foams as structural foams. On the contrary, the reference to furniture was a general one and there was no such limitation in Claim 1 or the corresponding description of D3, which related to polyurethanes in general. The skilled person would know how to try to obtain a result on flexible foams with an expectation of success.

- (ii) Claim 1 of the patent in suit could be seen as a selection from the disclosure of D3, in which the choice of polyether polyols for producing flexible foams was obvious and did not result in an unexpected effect. The fact that such a selection would work in for flexible foams was

not in itself an unexpected effect.

(iii) and (iv)

With respect to the problem and solution approach, the nearest prior art was D2 or D8, each of which related to improving the flame retardant properties of flexible polyurethane foams prepared from polyetherpolyols, and in particular to improving their resistance to the formation of dripping embers when ignited. This was achieved in D2 by the incorporation of melamine, and in D8 by the incorporation of alumina hydrate and optionally melamine, which did not burn, but charred, thus forming a coating on the polymer which reduced drips. In the light of these disclosures, the technical problem underlying the patent in suit could be seen in the definition of an alternative solution. Since, however, the formation, by swollen graphite, of a heat resistant, flame retardant protective layer atop the polyurethane foam was taught according to D3, and the general teaching of the latter was that the swollen graphite could be used in polyurethane foams in which the polyol component could be of the type used to prepare flexible foams, the skilled person would be able in an obvious way to use the swollen graphite according to D3 in either of D2 or D8. The argument of a prejudice against such a use of graphite, which was based on the relatively low decomposition temperature of the relevant foams compared with that of graphite was not convincing, because it was based on experimental evidence provided after the filing

date and not on prior published documentation. The evidence was in any case irrelevant, since the thermal decomposition temperature was not related to the burning characteristics. Hence the claimed subject-matter was rendered obvious by each of the combinations D2 + D3 and D8 + D3.

IV. On 20 January 1997, a Notice of Appeal against the above decision was filed, the prescribed fee being paid on the same day.

Together with the Statement of Grounds of Appeal, received on 21 March 1997, the Appellant (Patentee) filed the following further documents:

- A1: an extract from a new, independent, further translation of D3;
- A2: Ball, Haggis et al., "A New Heat Resistant Rigid Foam", Journal of Cellular Plastics, July 1968, page 248 (title page); and
- A3: "Flexible Polyurethane Foam - The Facts", published by The British Rubber Manufacturers' Association, 1982, pages 1, 5, 8 and 20 (numbered 1/4, 2/4, 3/4 and 4/4, respectively).

The Appellant argued in substance as follows:

- (a) The decision under appeal had relied heavily on an interpretation, in D3, of the word "furniture" in the passage referring to recent applications of the polyurethanes, as not being restricted to rigid structural components of furniture, but

rather as being quite general, and thus including flexible items. According to the newly filed translation, however, the relevant passage referred to such applications of "rigid" polyurethane foams. Consequently, the skilled reader of D3 would have understood that the disclosure related solely to rigid ("hard") foams. He would consequently not have expected analogous success with flexible polyurethane foams.

- (b) Neither D2 nor D8 made any reference to, or implied that, expandable graphite might usefully be incorporated in flexible polyurethane foams, even though such graphite had been available for many years. Since, furthermore, D3 related only to rigid polyurethane foams, there was no reason to find obviousness by combining the latter with D2 or D8.
- (c) In contrast to flexible polyurethane foams containing "char-former", the foams according to the patent in suit, when exposed to direct flame, usually developed a cellular char in association with the cellular structure of the foam. This was a new property not previously achieved.
- (d) There had been a "long felt want" for a flexible polyurethane foam having high flame retardance properties, as was evidenced by A3. The foams according to the patent in suit fulfilled this, and had in the meantime become highly commercially successful, currently satisfying 40% of the world market for aircraft applications. In this connection, D4 and D5, advocating the use of

expandable graphite for "various inorganic and organic materials", and "normally flammable materials", respectively, including rigid polyurethane foams, had been in existence for many years, but there had been no subsequent mention of expandable graphite being useful, let alone advantageous, in flexible such foams.

(e) The argument of a prejudice was maintained.

V. In response the Respondents (Opponents) each filed a counterstatement.

(i) Respondent I (Opponent I) argued, in a submission filed on 4 August 1997, in substance as follows:

(a) The newly filed translation of D3, even if assumed to be correct, only referred to the prior art and thus did not contain anything implying a limitation of the disclosure as a whole to rigid polyurethane foam materials. On the contrary, it was only in Claim 3 of D3 that there was a limitation to rigid foams, Claims 1 and 2 admittedly referring to polyurethane foams in general. Furthermore, the polyols having a functionality of 2 or more referred to in Claim 1 as starting materials for the preparation of the polyurethane foams according to D3 included polyols for flexible foams, which were known to have a functionality of 2 to 3.

- (b) The formation, by the flame retardant agent, of a protective blocking layer on flexible polyurethane foams, which hindered the melting and dripping of the burning polyurethane was described in D2 and D8. Since this known mechanism of flame retardance was also associated with the expandable graphite used as flame retardant in D3, which, contrary to the stance of the Appellant, was not limited to rigid polyurethane foams, the claimed subject-matter did not involve an inventive step.

 - (c) No prejudice that polyether-based flexible polyurethane foams behaved in a special way when subjected to flame retardant treatment had been credibly demonstrated. Neither could the alleged "long felt want" suffice to repair the deficiency of inventive step in the subject-matter of the patent in suit.
- (ii) Respondent II (Opponent II) filed, on 18 April 1997, a submission requesting rejection of the appeal and indicating that argument would be filed. In a submission filed on 7 January 2000, an argument along the lines of that of Respondent I was adduced in relation to the further translation of D3.

 - (iii) Respondent III (Opponent III) argued, in a submission filed on 23 July 1997, generally along the lines of Respondent I in relation to the disclosures of D3, D2 and D8. Furthermore,

Respondent III emphasised the relevance of D4 and D5, arguing in particular that their disclosures contained no limitation to rigid polyurethane foams but on the contrary extended to flammable materials in general. Consequently, the subject-matter of the patent in suit was rendered obvious by a combination of D3 with D4 or D5. Finally, it was recalled that D19 on the one hand exemplified the treatment of rigid polyurethane foams with expandable graphite but on the other made clear that its disclosure related to foamed polymers in general, the examples in this respect not being limiting on the disclosure. The finding that expandable graphite conferred a highly flame retardant effect would have been reason enough for the skilled person to prepare other foamed polymers as well and thus to arrive at a flame retardant flexible polyurethane foam.

- VI. By letter of 18 March 1998 the Appellant informed the EPO that the proprietor, originally Dunlop Limited, was now Dunlopillo Limited (cf. copy of the Register Extract of 11 March 1998).
- VII. With a submission received on 31 December 1999, the Appellant filed further information in relation to the new translation of the reference to "furniture" in D3.
- VIII. The Appellant requested that the decision under appeal be set aside, and the patent in suit maintained in the form as granted.

The Respondents I, II and III requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters; late-filed documents*
 - 2.1 The extract from a new, independent translation of D3, filed by the Appellant as document A1, was mentioned for the first time in the appeal, and thus does not automatically form part of the proceedings. Whilst its content may appear at first sight to be highly relevant, at least insofar as it relates to the construction of the reference to "furniture" on page 3 of the original English translation relied upon in the proceedings, it does not refute the essence of the case of the Respondents, which is that the disclosure of D3, whilst not specifying flexible polyurethane foams, nevertheless refers in a number of other places to polyurethane foams in general and thus embraces the use of such foams, or that other disclosures of similar scope (D4, D5) are also a subject of the case against the patent in suit. Even though no formal objection to the introduction into the proceedings of the new translation has been raised by the Respondents, the Board has come to the conclusion, after careful consideration, that it does not significantly alter the strength of the Appellant's case, and is thus not crucial to the outcome of the appeal. The same applies to the further information pertaining to the translation of the reference to "furniture", filed on

31 December 1999 (section VI., above). Consequently, the Board has decided, in the exercise of its discretion under Article 114(2) EPC, to exclude these documents from consideration in the appeal proceedings.

2.2 Similar considerations apply, in the Board's view, to the title page of the document referred to in D3, cited by the Appellant as A2, since the nature of the prior art acknowledged in a patent document is not, in the Board's view, normally crucial to determining the scope of the teaching of that document, and this case is no exception. The Board has therefore decided to exclude A2 from consideration in the appeal proceedings, pursuant to Article 114(2) EPC.

2.3 The pages from the article "Flexible Polyurethane Foam - The Facts", cited as A3 in the present proceedings (section IV., second paragraph, above) were originally cited as Appendix 9 of a submission filed on 16 November 1992 during the prosecution to grant of the European patent application forming the basis of the present patent in suit.

Whilst it might at first sight seem that this subject-matter does not at the present stage form part of the appeal proceedings, it is nevertheless clear from the submissions of the parties during the proceedings before the Opposition Division, that the file history of the proceedings leading to the grant of the present patent in suit was considered in detail during those proceedings.

In particular, it is stated in the minutes of the oral proceedings held before the Opposition Division on

23 October 1996, that "Opponent III repeated the file history of [the] present patent". Furthermore, according to the the part of the Facts and Submissions relating to Opponent II in the decision under appeal itself, that "This Opponent also referred to facts and arguments already existing in the previous Examination and Appeal procedures". Finally, reference is made in the reasoning specifically to an Appendix (Appendix 3) filed during the Examination of the application (Reasons for the decision, point 15). This Appendix was, however, one of a series of Appendices, of which A3 was the ninth and last, attached to the submission filed on 16 November 1992 during the Examination proceedings.

Consequently, the Board concludes that all the documents in the prosecution file of the application forming the basis of the patent in suit, including those relating to the ultimately successful appeal against refusal of that application (section I., above) have already *de facto* been introduced into the present proceedings. Under these circumstances, A3 clearly already forms part of the proceedings and the question of its formal introduction therefore does not arise.

2.4 Similar considerations apply to D19, referred to in the submission filed on 23 July 1997, of Respondent III (section V.(iii), above), since this was considered and adjudicated upon in the decision of Appeal T 111/90 (Facts and Submissions, section II; and Reasons for the Decision, section 5). Thus D19 also forms part of the present appeal proceedings.

3. *Sufficiency (Article 100(b) EPC)*

The issue of sufficiency, which was not stated in the decision under appeal to be a ground of revocation of the patent in suit, has not been further contested by the Respondents. The Board furthermore concurs with the views expressed in the decision concerning sufficiency, which were clearly of a positive tendency on that issue. Moreover, it is noted that the patent in suit contains several examples, in which various polyurethane foams within the terms of the patent in suit passed the burning tests described in British Standard Specification No. 4735 or the crib tests described in British Standard Specification No. 5852 part 2, 1982, as specified in the characterising part of Claims 7 and 8. The Respondents, which as the Opponents have the onus of proof, have not provided evidence that these specific examples, let alone the process according to the generality of Claim 1, could not be reproduced without undue burden. It follows that the Board has no reason to do other than find that the requirements of Article 100(b) EPC are met.

4. *Novelty*

The novelty of the subject-matter claimed in the patent in suit, which has explicitly been confirmed in the decision under appeal (Reasons for the decision, point 13), has not been disputed further by the Respondents. Consequently, the Board confirms the finding of the decision under appeal, that the claimed subject-matter is novel.

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

The patent in suit is concerned with the production of

flexible, flame-retardant polyurethane foams, in particular from a foam-forming reaction mixture including a polymeric polyol and an organic polyisocyanate, characterised in that the foam contains a specified flame-retardance conferring additive (Claim 1). Furthermore, it is concerned with the problem that flexible polyurethane foams are inherently flammable and this leads to melting and spread of burning debris. Although rigid such foams have similar thermal conductivity behaviour, the highly cross-linked nature of their chemical structure makes them less flammable as polymers and also inherently more inclined to form a protective char than to form the flaming molten polymer droplets which occur with flexible foams. Thus rigid cellular materials burn less easily than flexible foams and are easier to extinguish (page 2, lines 10 to 13 and 17 to 21).

- 5.1 Flexible, flame-retardant polyurethane foams are known from D2 or D8, both of which are concerned, like the patent in suit, with the problem of reducing the tendency of flexible such foams to melt and form burning debris or embers (D2, col. 1, lines 23 to 25; and D8, page 2, lines 1 to 4).

According to D2, a hydroxymethyl or lower alkoxyethyl derivative of melamine, such as tris-(hydroxymethyl) melamine or hexa-(methoxymethyl) melamine is incorporated, as the flame retardant additive, in the reaction mixture before foaming (col. 2, lines 27 to 31; Claims 1, 2 and 4). In a more limited embodiment, additionally a halogenated phosphorus ester is incorporated into the reaction mixture to be foamed (col. 1, lines 32 to 36). One suggested mechanism of

flame retardance is the resinification of the melamine derivative under the heat of combustion to form a thermoset material within the foam structure, resulting in a lesser tendency to drip (col. 2, lines 9 to 15).

Furthermore, according to D8, a flexible polyurethane foam having improved char-forming or intumescent properties compared to that according to D2, for instance when subjected to the direct flame of a gas blowtorch for times ranging from 10 seconds to 3 minutes, is prepared by incorporating, in the foam-forming reaction mixture, (i) at least one flame retardant, (ii) a hydrated alumina, and optionally (iii) a low viscosity polyester polyol, all at relatively high loadings (page 3, lines 25 to 34, in conjunction with page 5, line 32 to page 6, line 11). The flame retardant may be an optionally halogenated triester of phosphoric acid or a halogenated hydrocarbon (page 6, lines 25 to 29).

5.2 The technical problem arising in relation to the latter disclosure, which incorporates the features of D2 (page 2, line 35 to page 3, line 7; page 4, line 12 to page 5, line 20) and is considered to represent the closest state of the art, is to make a flexible polyurethane foam of improved flame retardancy, capable of behaving more like a rigid polyurethane foam when subjected to flame and thus to produce a protective char with little or no burning melt or drips (patent in suit, page 2, lines 26 to 28).

5.3 The solution proposed according to Claim 1 of the patent in suit is to incorporate, as the flame retardance conferring additive, "expandable graphite"

which is graphite containing one or more exfoliating agents such that considerable expansion will occur at high temperatures.

5.3.1 According to Example 1 of the patent in suit, it can be seen that a low resilience foam containing polybutene and a coarse or fine grade expandable graphite had a shorter burn length and burn time compared with a similar foam additionally containing a similar loading of hydrated alumina (Control Y), when subjected to the burning tests according to British Standards Specification No. 4735. Furthermore, the foam treated according to Example 1 charred, as opposed to the foam in Control Y, which melted and dripped. Thus the expandable graphite evidently provided improved flame retardance compared with hydrated alumina (cf. D8).

5.3.2 In addition to meeting the requirements of a number of crib tests according to British Standards Specification No. 5852, Part 2 (Examples 4 to 6, 7 and 8), a flexible polyurethane foam treated with an expandable graphite according to Example 9 was found, when tested in combination with a woollen fabric using a No. 6 wooden crib (weight 60g) to show a weight loss of only about 3% (page 9, lines 26 to 31). Thus it is evident that the cellular foam remains substantially unchanged.

5.3.3 The latter phenomenon is confirmed by the photographic evidence in Annex 1 accompanying the submission filed on 16 November 1992 during the prosecution of the application forming the basis of the present patent in suit, which already forms part of the proceedings (cf. section 2.3, above). In particular, photograph 2C of Annex 1 confirms that on application of a bunsen flame

to a rectangular block of flexible polyurethane foam treated with expandable graphite in accordance with the patent in suit, the foam does not collapse, or even allow penetration of the flame, but on the contrary retains the integrity of its cellular structure by formation of an associated, supporting cellular char. This corresponds, in the Board's view, to the phenomenon referred to by the Appellant in the Statement of Grounds of Appeal (section IV.(c), above). Its occurrence has in any case not been disputed by any of the Respondents.

5.3.4 Consequently, the Board finds it credible that the claimed measures provide an effective solution of the technical problem.

6. *Inventive step*

In order to assess the question of whether or not the claimed subject-matter involves an inventive step, it is necessary to consider whether the skilled person would have expected that the replacement, in a flexible polyurethane foam according to D8, of the flame retardant additives (hydrated alumina etc.), by expandable graphite would result in a still further improved flame retardancy, in particular by enabling the formation of a supporting cellular char corresponding to the structure of the foam, which therefore did not melt and create burning embers.

6.1 There is no incentive to make such a substitution in either D2 or D8, since the former refers only to melamine derivatives and phosphorus esters, and the latter only to hydrated alumina together with other

conventional halogenated flame retardants such as the esters mentioned in D2 and optionally a polyester polyol. There is no hint to use graphite, let alone expandable graphite.

6.2 The use of expandable graphite as a flame retardance conferring additive for polyurethane foams is, however, disclosed in D3. According to the English translation as originally filed by Respondent II (submission of 4 July 1994), a method of preparation of polyurethane foam involves incorporating, as the flame retardant, 5 to 25%, preferably 10 to 20%, by weight of swollen graphite having a bulk specific gravity of 0.2 or higher, when reacting polyol having at least two active hydrogen groups per molecule with multifunctional isocyanate in the presence of a flame retardant, catalyst and foaming agent (Claims 1, 2). The polyurethane foam may be a hard polyurethane foam (Claim 3). When initially heated, the swelling graphite swells 40 to 300-fold within the polyurethane foam. The swollen graphite thus forms an excellent heat resistant layer atop the polyurethane foam, and is very effective on the hard type of polyurethane foam which is the topic of this invention (page 5, lines 4 to 7). According to Examples 1 to 4, a propylene oxide was added to sucrose to prepare a polyetherpolyol which was used, together with a silicon glycol copolymeric silicone oil, a 33% solution of triethylene diamine in dipropylene glycol, trichloromonofluoromethane and varying amounts of swelling graphite to prepare the hard type of polyurethane foam by the one-shot method (page 5, lines 10 to 18).

6.2.1 The following facts emerge from the passages referred

to above, the translation of which has not been the subject of any dispute:

(a) whilst there are repeated references to hard (i.e. rigid) polyurethane foams, and also to polyurethane foams in general, there is no reference at all to flexible or resilient polyurethane foams.

(b) There is no mention of the problem of melting and the formation of burning embers.

6.2.2 The technical problem addressed by the patent in suit is, however, to reduce the formation of such embers. This is a problem specific to flexible polyurethane foams and indeed does not arise with hard or rigid polyurethane foams (section 3., second sentence, above). It follows that the disclosure of D3 does not have any *prima facie* relevance to the technical problem addressed by the patent in suit.

6.2.3 Even the passage objected to by the Appellant, which reads "Recently, the applications for polyurethane foam in structural foam, insulating materials, furniture, and in handicrafts have expanded dramatically, and flame retardancy is an especially important issue in the areas of structural foam and insulating materials" (page 2, lines 11 to 13) does not mention flexible polyurethane foams. It therefore does not supply the deficiency of any indication of the technical problem in D3.

6.2.4 Nor does the finding, in the decision under appeal, that the references to "polyurethane foam" in Claims 1

and 2 and the reference to "furniture" on page 3 were not restricted to hard foams itself provide a logical basis for assuming that the skilled person would necessarily consider flexible foams.

6.2.5 On the contrary, such an assumption would need, in the Board's view, have to have some deductive basis, such as a known parallelism of behaviour, under the relevant conditions, of hard foams on the one hand, and flexible foams on the other. Yet, for the reasons already given, precisely the opposite is the case, since the two types of foam behave quite differently under flaming conditions, to the extent that the relevant problem of burning embers, typical of flexible foams, does not arise in hard foams (section 6.2.2, above).

6.2.6 The effect of this finding of the decision under appeal is, however, to focus on a technical problem which is specific to flexible foams and which, although relevant to the patent in suit, is not otherwise apparent from the teaching of D3. This is, in the Board's view, rather indicative of an *ex post facto* approach.

6.2.7 In any case, it follows from the above, that the relevance of D3 to the skilled person starting from D2 or D8 and attempting to solve the relevant technical problem would not be apparent. Put another way, if the relevant technical problem is not apparent from D3, its teaching can hardly, without hindsight, point the way to the appropriate solution.

6.2.8 Even if the attention of the skilled person were, for some reason, nevertheless to focus on the disclosure of D3, and if, furthermore, the question of the

applicability of its teaching to flexible foams were to occur to his mind, there is nothing in D3 which would hint at the structurally supporting nature of the char which would be formed from the "swollen graphite" under flaming conditions, which characterises the solution of the technical problem. On the contrary, the only mechanism for conferring flame retardance disclosed in D3 is that the swollen graphite forms "an excellent heat resistant layer **atop** the polyurethane foam, and is very effective on the **hard type** of polyurethane foam..." (emphasis added). Thus it is evident that the hard foam provides the supporting structure which carries the char "atop" it.

This is the diametric opposite of the situation in the flexible foams according to the patent in suit, in which the expandable graphite evidently provides a cellular char in association with the cellular structure of the foam, by which the structural integrity of the latter is maintained under flaming conditions, thus preventing melting and the formation of burning embers. This cellular supporting function of the char is not hinted at in D3.

Consequently, the skilled person would not have any reason, from the disclosure of D3, to suspect that a flexible foam would be supported **by** the char formed from the swollen graphite. On the contrary, he would expect the char to collapse when the flexible foam collapsed.

In other words, the skilled person would have no expectation of success in applying the teaching of D3 to flexible polyurethane foams.

6.3 Similar considerations apply to D4 and D5, which also disclose the preparation and use of expandable graphite as flame retardant additive in various generally defined inorganic and organic materials, including polyurethane foams, since these documents are equally silent as to any applicability to flexible polyurethane foams or the prevention of the formation of burning embers, but merely exemplify hard polyurethane foams, rather similarly to D3.

6.4 In summary, the solution of the technical problem does not arise in an obvious way, starting from D8 as closest state of the art.

6.5 Nor would the outcome have been different if the starting point had been D3 (cf. decision under appeal, point 14(i)) since, for the reasons given above, the relevant technical problem is not derivable from its disclosure. This is not surprising if one considers that a technical problem arising from a "closest state of the art" disclosure, which is irrelevant to the claimed subject-matter in the sense that it does not mention a problem that is at least related to that derivable from the patent specification, has a form such that its solution can practically never be obvious, because any attempt by the skilled person to establish a chain of considerations leading in an obvious way to the claimed subject-matter gets stuck at the start (for instance T 644/97 of 22 April 1999, supplementing T 686/91 of 30 June 1994, neither

published in OJ EPO). It follows that the solution of the technical problem in the present case is not obvious starting from D3 as "closest state of the art".

6.6 Whilst the Board sees no reason to differ from the finding, in the decision under appeal, that the subject-matter claimed in the patent in suit could be regarded as a selection from D3, it does not concur with the conclusion, that there was no evidence on file for an unexpected effect (Reasons for the decision, point 14(ii)). On the contrary, the formation of a cellular char capable of causing a flexible polyurethane foam to behave like a rigid foam is, for the reasons already given, an unexpected result not shared by the generality of polyurethane foams disclosed in D3, but specific to flexible foams, which therefore confers on the latter the status of a true selection. From this point of view also, the claimed subject-matter does not arise in an obvious way starting from D3.

6.7 In summary, the subject-matter of independent Claims 1 and 5, both of which involve the combination of features forming the solution of the stated problem, involves an inventive step. It follows that the subject-matter of the respective dependent Claims 2 to 4 and 6 to 10 also involves an inventive step.

6.8 It is not, therefore, necessary for the Board further to consider whether or to what extent there was a "long felt want" in respect of the subject-matter of the patent in suit, or a prejudice against taking the measures represented by the claimed subject-matter (sections IV.(d) and IV.(e), respectively, above).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance, with the order to maintain the patent as granted.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin