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**D E C I S I O N**  
**of 29 October 1999**

**Case Number:** T 0190/97 - 3.3.3

**Application Number:** 88200744.6

**Publication Number:** 0289077

**IPC:** C08K 5/13

**Language of the proceedings:** EN

**Title of invention:**

Thermostabilized copolymer composition

**Patentee:**

Shell Internationale Research Maatschappij B.V.

**Opponent:**

BP International Limited Patents and Agreements Division

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56, 114(1)

**Keyword:**

"Late submitted material - not admitted"  
"Inventive step (yes) - non obvious selection"

**Decisions cited:**

T 326/87, T 0097/90

**Catchword:**

-



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Boards of Appeal

Chambres de recours

Case Number: T 0190/97 - 3.3.3

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

**Appellant:**  
(Opponent)

BP International Limited Patents and  
Agreements Division  
Chertsey Road  
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ROYAUME-UNI

**Respondent:**  
(Proprietor of the patent)

Shell Internationale Research  
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**Decision under appeal:**

**Decision of the Opposition Division of the  
European Patent Office posted 12 December 1996  
rejecting the opposition filed against European  
patent No. 0 289 077 pursuant to Article 102(2)  
EPC.**

**Composition of the Board:**

**Chairman:** C. Gérardin  
**Members:** P. Kitzmantel  
J. A. Stephens-Ofner

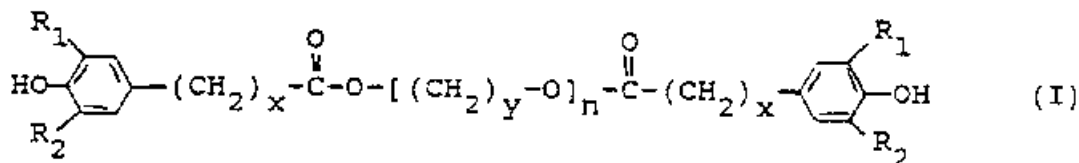
### Summary of Facts and Submissions

I. Mention of the grant of European patent No. 0 289 077 in respect of European patent application No. 88 200 744.6 in the name of Shell Internationale Research Maatschappij B.V., which had been filed on 19 April 1988, was announced on 30 June 1993 on the basis of two sets (A and B) of each 11 claims; set A relating to the Contracting States AT, BE, CH, DE, FR, GB, IT, LI, NL, SE and set B relating to the Contracting State ES).

Independent Claim 1 of set A reads as follows:

"1. A stabilized composition comprising an alternating copolymer of carbon monoxide and an olefinically unsaturated compound and, based on the weight of the copolymer, from 0.03 to 5.0 %w of an additive selected from

a) phenolic dicarboxylates having the general formula



in which

x is 0 to 4

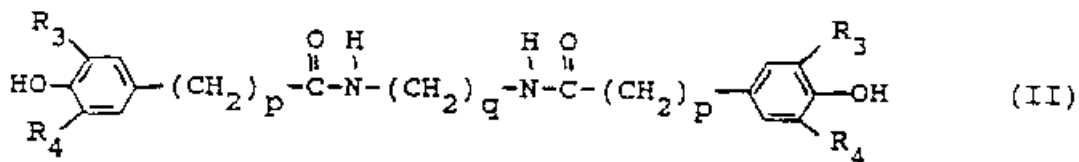
y is 2 to 6

n is 2 to 8

R<sub>1</sub> is hydrogen or alkyl with 1 to 6 carbon atoms

R<sub>2</sub> is alkyl with 1 to 6 carbon atoms.

b) phenolic dicarboxylates having the general formula



in which

p is 0 to 6

q is 0 to 12

R<sub>3</sub> is hydrogen or alkyl with from 1 to 6 carbon atoms

R<sub>4</sub> is alkyl with from 1 to 6 carbon atoms, optionally together with

c) phenolic dicarboxylates having the general formula



in which

R<sub>5</sub> is alkyl with from 1 to 6 carbon atoms and

R<sub>6</sub> is hydrogen or alkyl with from 1 to 6 carbon atoms."

Claim 1 of set B is directed to a method for the preparation of a stabilized composition according to Claim 1 of set A.

Claims 2 to 11 of both sets are dependent upon their respective Claim 1.

II. Notice of Opposition requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC was filed by BP Chemicals Ltd on 29 March 1994.

The opposition was based on documents

D1: "Kirk-Othmer Encyclopedia of Chemical Technology", 3rd Ed., Volume 3, pages 132 to 133,

D2: Ciba-Geigy preliminary product information on Irganox 245,

D3: Ciba-Geigy preliminary product information on Irganox MD-1024, and

D4: Ciba-Geigy product information on Irganox 1098.

After expiry of the opposition period the Opponent submitted the following further documents:

D5: "Encyclopedia of Polymer Science and Technology", Ed. John Wiley, pages 73 to 91,

D6: "Polymer Additives", Ed. R. Gächter, H. Müller, 2nd Ed. (1983), pages 55 to 66,

D7: "Research Disclosure" 25433 (1985), page 301,

D8: US-A-3 660 438, and

D9: US-A-3 584 047.

III. By its decision orally announced on 13 November 1996 and issued in writing on 12 December 1996, the Opposition Division rejected the opposition.

That decision held that D3 did not represent pre-published prior art within the meaning of Article 54(2) EPC and that the late filed documents D6 and D7 were to be disregarded according to Article 114(2) EPC. In the Opposition Division's judgment, the claimed subject-matter was novel and inventive over the cited prior art and especially over alternating copolymers of carbon monoxide and an olefinically unsaturated compound (hereinafter "et/CO-copolymers"), which do not contain any heat-stabilizer, because it was not obvious to achieve a higher heat stability by incorporation into these polymers of phenolic dicarboxylate thermostabilizers of formulae (I) or (II) (hereinafter "PDTS I" and "PDTS II"), as demonstrated by the Patentee, all the more as a host of other known heat stabilizers were considerably less effective.

IV. On 14 February 1997 the Opponent (Appellant) lodged an appeal against the decision of the Opposition Division and paid the appeal fee on the same day. The Statement of Grounds of Appeal was submitted on 21 April 1997.

The Appellant's arguments may be summarized as follows:

(i) In view of their relevance, documents D3, D6, D7 and the newly cited document

D10: EP-A-0 058 503

should be admitted into the appeal

proceedings, since they all address the points raised by the Patentee.

- (ii) The PDTS compounds used to exemplify the claimed invention were commercially available antioxidants known for their capability to impart improved oxidative and heat stability to a variety of polymers, particularly to polar polymers; their use in et/CO-copolymers was therefore prima facie obvious.
  
- (iii) The evidence produced by the Patentee (cf. patent in suit, Example, page 4, lines 6 to 48; "Additional Examples" filed with the Patentee's submission dated 15 September 1994) could not establish that the PDTS compounds according to the patent in suit exhibited an unexpected performance as compared to other known heat stabilizer compounds. This conclusion resulted from the following facts:
  - (iii-1) Since it was clear from D5 that, because of their lower sublimation rate, polynuclear phenols were generally preferred over monophenols, the inferior heat stabilizing performance of the compounds used according to the (comparative) examples 5, 7, 9, and 11 to 13 was to be expected.
  
  - (iii-2) D6, D7 and D10 established that the heat stabilizer compound used according to Patentee's example 6 (= Irganox<sup>(R)</sup> 1010) was inferior in its performance to the PDTS compounds to be used according to the patent

in suit.

(iii-3) It followed that only Patentee's examples 8, 10 and 14 could serve to rebut the argument of prima facie obviousness; this being, however, too small a basis to set aside this argument.

(iv) Moreover, in the Appellant's view, it was obvious to use the amide group containing PDTS II compound Irganox<sup>(R)</sup>1098, because, owing to its amide moieties, this compound was known to deactivate acid impurities present in et/CO-copolymers as the result of the use of acid containing catalysts in their preparation. The Respondent was therefore requested to declare whether the tested et/CO-copolymer samples contained acid impurities.

V. The arguments presented by the Respondent (Patentee) in their written submission dated 22 September 1997 may be summarized as follows:

(i) Since document D3 was not pre-published and since the late-filed documents D6, D7 and D10 were not prima-facie relevant, these documents should be disregarded.

(ii) The evidence adduced by the Respondent, i.e. the examples present in the patent in suit and those filed with letter of 15 September 1994, showed that the small group of narrowly defined PDTS compounds (I) and (II) covered by Claim 1 of the patent in suit performed significantly better than a wide range of



other antioxidant compounds.

For the following reasons, the Appellant's criticism of said evidence was unfounded:

- (ii-1) All heat stabilizers used for comparative purposes, except heat stabilizer No. 12, exhibited a low sublimation rate and were, therefore, comparable to PDTS I and II in that respect.
- (ii-2) On the other hand, heat stabilizer No. 12 also represented a reasonable comparative compound, because it was mentioned in Table 4 of D5 as the very first item and as suitable for use in a large range of polymers.
- (iii) Concerning the alleged obviousness of the use of the amide group containing heat stabilizer (PDTS II) Irganox<sup>(R)</sup> 1098, because of its purported ability to deactivate acid impurities which may be present in et/CO-copolymers, this was not an issue which needed to be considered, because the irrelevance of this objection clearly resulted from the fact that PDTS compounds of formula (I), which did not contain amide units, were equally effective; there was, thus, no need to provide information on the acid content of the et/CO-copolymers used, but, anyway, if acids had been used during preparation of the et/CO-copolymers they would be removed during purification.

(iv) The superior heat stabilization effect achieved by the PDTS compounds (I) and (II) was non-obvious over the state of the art, particularly over D5, which did not contain any incentive to consider a certain type of antioxydant for a certain type of polymer, be it "polar" or "apolar".

VI. By letter dated 10 August 1999 the Appellant withdrew its previous request to hold oral proceedings and requested that the Board reached its decision on the basis of the written record. Following this submission the Board informed the parties on 26 August 1999 of its intention (i) not to admit D3, D6, D7 and D10 into the proceedings, (ii) to rely on the surprising stabilizing effect of compounds (I) and (II) demonstrated by the Respondent, (iii) to follow the reasons given in the decision under appeal and, consequently, (IV) to reject the appeal without such oral proceedings.

VII. The Appellant requested that the decision under appeal be set aside and that the European patent No. 289 077 be revoked.

The Respondent requested that the appeal be dismissed.

### **Reasons for the Decision**

1. The appeal is admissible.

2. *Definitions of the heat stabilizers by trademarks:*

Irganox<sup>(R)</sup> 245:

- triethyleneglycol-bis(3-[3-tert.butyl-4-hydroxy-5-methylphenyl]propionate); (in D7 designated as "3,6-oxa-1,8-octane-diyl-bis-[3-(4-hydroxy-3-methyl-5-tert.butyl)-propionate]");
  
- this compound falls within the scope of PDTS I, but is structurally slightly different from the compound used in the patent in suit as heat stabilizer No. 1 (cf. page 4, lines 5 to 48, especially line 9), the difference being that the 4-hydroxyphenyl nucleus of said heat stabilizer No. 1 is substituted in both its positions 3- and 5- with a tert.butyl group, whereas in Irganox<sup>(R)</sup> 245 the position 5- is methyl-substituted.
  
- However, Irganox<sup>(R)</sup> 245 was used as heat stabilizer "additive 1a" in the "Additional Examples" submitted by the Respondent on 15 September 1994 in its rejoinder to the Notice of Opposition.

Irganox<sup>(R)</sup> 1098:

- 1,6-bis(3-[3,5-di-tert.butyl-4-hydroxyphenyl]propanamido)hexane;
  
- this compound falls within the scope of PDTS II and was used as heat stabilizer No. 3 in the Example of the patent in suit (cf. page 4, lines 5 to 48, especially line 11).

Irganox<sup>(R)</sup> MD-1024:

- N,N'-bis(3-[3,5-di-tert.butyl-4-hydroxyphenyl]propanoyl)hydrazine;

- this compound falls within the scope of PDTS II and was used as heat stabilizer No. 2 in the Example of the patent in suit (cf. page 4, lines 5 to 48, especially line 10).

Irganox<sup>(R)</sup> 1010:

- pentaerythtrityl tetra(3-[3,5-di-tert.butyl-4-hydroxyphenyl]propanoate;
- this compound is not a heat stabilizer to be used according to the patent in suit; it was used, however, for comparative purposes as heat stabilizer No. 6 in the Example of the patent in suit (cf. page 4, lines 5 to 48, especially line 14).

## 2. *Citations not to be considered*

### 2.1 Document D3:

The Appellant's request to consider document D3 cannot be allowed, because it failed to prove that this document belongs to the state of the art according to Article 54(2) EPC. D3 itself does not bear any date of publication and the reference therein to the prepublished US patents 3 660 438 and 3 773 722 is no proof for the pre-publication of D3 itself (cf. point 3.2 of the decision under appeal).

Although (i) the Respondent had raised the point in their counterstatement of 15 September 1994 (cf. page 1, paragraph 3), (ii) the Opposition Division had invited the Appellant to provide evidence for the

public availability of inter alia D3 (cf. communication of 9 February 1995) and (iii) the letter presented by the Appellant during the oral proceedings before the Opposition Division could not clarify the situation (cf. Reasons for the Decision, point 2.2), the Statement of Grounds of Appeal was completely silent about this critical issue. In fact, the substantive arguments in that statement did not refer at all to D3, so that even in the Appellant's view this citation could not have been particularly relevant. For these reasons the Board has decided not to admit D3 for consideration.

## 2.2 Documents D6 and D7:

These documents had been submitted after expiry of the opposition period and six weeks after the time limit according to Rule 71a EPC set by the Opposition Division in its communication of 19 March 1996. In view of their belated submission and insufficient relevance, amply substantiated in points 4.2 to 4.7 of the decision under appeal, they have not been considered by the Opposition Division.

On pages 2 and 3 (bridging paragraph) of the Statement of Grounds of Appeal the Appellant set out why it believed that these documents would be relevant to the issue of patentability. The Appellant did not, however, present any arguments countering the conclusions drawn by the Opposition Division.

- 2.2.1 Instead, with regard to D6, the Appellant asserted that Figures 26, 28, 29 and 31 would illustrate that Irganox<sup>(R)</sup> 1010, a compound used for comparative purposes

in Example 6 of the patent in suit, was known not to "perform as effectively as the compounds of the present invention".

However, Figures 26, 28 and 29 of D6 do not refer to Irganox<sup>(R)</sup> 1010 and Figure 30 of D6 does not distinguish between Irganox<sup>(R)</sup> 1010 and Irganox<sup>(R)</sup> 1098, a heat stabilizer coming under the scope of PDTS II of present Claim 1. These figures are, thus, unable to support the Appellant's assertion that it was known that Irganox<sup>(R)</sup> 1010 performed worse than Irganox<sup>(R)</sup> 1098.

2.2.2 With regard to document D7 the Appellant contented itself with the unsubstantiated statement that it "teaches the superior performance of compound 1 of claim 1 in processing stability and heat ageing when compared to other antioxidants including Irganox 1010". However, even disregarding that D7 deals with polyacetal polymers (not with et/CO-copolymers) and requires the presence of an acid acceptor, it could not show that the better performance of the "inventive" heat stabilizers was known, because it states that Irganox<sup>(R)</sup> 245 (= "inventive" PDTS I) performs equal to better than Irganox<sup>(R)</sup> 1010 (= "non-inventive" heat stabilizer) and Irganox<sup>(R)</sup> 1098 (= "inventive" PDTS II). So no common advantage of "inventive" heat stabilizers over Irganox<sup>(R)</sup> 1010 is apparent.

2.2.3 Consequently, the Appellant has not, on an objective basis, presented any arguments permitting the Board to reassess the Opposition Division's finding of non-relevance, but rather the Appellant's observations boil down to the unsubstantiated assertion that the Opposition Division's decision was wrong. In this

circumstance the Board decides not to re-open the question of whether or not documents D6 and D7 are to be considered, but to stick to the negative finding of the decision under appeal. Reference is made in this respect to T 97/90 (OJ EPO 1993, 719) where it was held that the wording of Article 114(1) EPC did not mean that the boards of appeal had to conduct rehearings of the first-instance proceedings.

### 2.3 Document D10:

This document was for the first time submitted with the Statement of Grounds of Appeal (there designated as document "D9"). Without giving any reason for the late submission, the Appellant set out that this document "also indicates that phenolic antioxidants possessing an amide group, for example Irganox 1098, is significantly more effective for polyester-polyether polymers than antioxidants containing no amide groups for example Irganox 1010 (see page 11 lines 25 to page 12 line 6)".

While it is true that a comparison of the heat stabilization results exhibited in Tables 1 and 2 of D10 demonstrates a superior performance of Irganox<sup>(R)</sup> 1098 over Irganox<sup>(R)</sup> 1010 (cf. page 10, line 8 to page 15), these data relate to the performance of these antioxidants in certain polyester-polyether copolymers (cf. Claim 1) and there is no reason to assume an analogous performance in et/CO-copolymers. Moreover, the teaching of D10 comprises the use of the amide-containing phenolic antioxidants, which encompass the PDTS II compounds used according to Claim 1 of the patent in suit, together with organotin compounds,

whose presence according to the patent in suit is not foreseen.

Since, therefore, (i) no reason was given by the Appellant for the belated submission of D10 and (ii) no arguments have been presented by the Appellant with respect to the relevance for the present et/CO-copolymers of the results obtained according to D10 with different polymers, the Board decides that *prima facie* the evidential weight of D10 is not more important than that of the prior art already in the proceedings (cf. T 326/87, OJ EPO 1992, 522). Document D10 is not, therefore, admitted for consideration.

### 3. Citations to be considered

#### 3.1 Document D1

On page 133 (last sentence of paragraph "Phenols") this document states that "In high-temperature applications, polynuclear phenols are generally preferred [as antioxidants] over monophenols because of their lower sublimation rate".

#### 3.2 Document D2

This "Preliminary Product Information" concerns the PDTS I type heat stabilizer Irganox<sup>(R)</sup> 245.



According to page 2 of D2 ("Application") Irganox<sup>(R)</sup> 245 was designed for stabilization of styrene and acetal homo- und copolymers, including polystyrenes, ABS, MBS, carboxylated SB and SBR latices. With regard to polyacetals it is set out that Irganox<sup>(R)</sup> 245 shows good protective effects during processing and service life at ambient and elevated temperatures.

### 3.3 Document D4

This document relates to the PDTs II type heat stabilizer and antioxidant Irganox<sup>(R)</sup> 1098.

On its front page D4 states that this compound prevents discolouration of polymers during thermal aging and is especially effective in polyamide polymers (see also page 1, right-hand column, chapter "Applications"). On page 3, left-hand column, chapter "Other Applications" it is stated that Irganox<sup>(R)</sup> 1098 "is also recommended for evaluation in polyacetals, linear saturated polyesters, styrenic polymers, polyvinyl chloride, polyolefins, and other polymers susceptible to thermal oxidative degradation." In the subsequent paragraph it is furthermore stated that the "amide groups present in Irganox<sup>(R)</sup> 1098 may deactivate acidic impurities found in some polymers, which would help to prolong the service life of the polymer."

### 3.4 Document D5

In Table 4 on pages 86 and 87 of this document the main classes of antioxidants sold in the U.S. and their applications are disclosed. The 6th, 9th and 12th compound on page 87 are, in this sequence, Irganox<sup>(R)</sup>

1098, Irganox<sup>(R)</sup> MD-1024 and Irganox<sup>(R)</sup> 245. The polymers which can be heat stabilized by these compounds are polyamides (PA), polyesters (PES), polyoxymethylenes (POM), rubbers (RU), cellulosics (CE), polyolefins (PO), polyvinyl chlorides (PVC) and polystyrenes (PS).

3.5 Document D8

This document relates to alkylhydroxyphenylalkanoylhydrazine compounds useful as antioxidants for organic materials. Examples IX-A and XI (columns 5 and 6) disclose the use of a compound structurally corresponding to Irganox<sup>(R)</sup> MD-1024 as antioxidant in polypropylene.

3.6 Document D9

This document relates to alkylhydroxyphenyl polyamides, including bis(dialkyl-4-hydroxyphenyl alkanoylamido)alkanes (Claims 1 and 11). Claim 2 relates to 1,6-bis(3-[3,5-di-tert.butyl-4-hydroxyphenyl]propionamido)hexane (= Irganox<sup>(R)</sup> 1098) (it must be concluded from the indicated 1,6-substitution, from the disclosure of the *hexane* compound in Example 1 and from the (correct) reference to the 1,2-substituted *ethane* radical in Claim 3 that the reference in Claim 2 to an *ethane* radical is false and correctly should read *hexane*).

According to Examples 8 to 16 these heat stabilizer compounds are used to stabilize polypropylene, mineral oil, lard, gasoline, paraffin wax, lubricating oil, high impact polystyrene resin containing elastomer, polyoxymethylene diacetate and nylon 6,6.

4. *Novelty*

The novelty of the subject-matter of the patent in suit was not called into question and also the Board is satisfied that this requirement of the EPC is met with respect to the cited prior art.

5. *Problem and solution*

5.1 Closest prior art

There is no document in the proceedings which discloses heat stabilized et/CO-copolymers. The closest prior art is, thus, represented by et/CO-copolymers which are not heat stabilized (cf. description page 2, lines 8 to 11; point 5.1 of the decision under appeal).

5.2 Problem to be solved

The problem underlying the claimed subject-matter is, therefore, the provision of et/CO-copolymer compositions having greatly enhanced heat stability.

5.3 Solution of the problem

The existing technical problem is solved by the incorporation into et/CO-copolymers of 0.03 to 5.0% by weight of a heat stabilizer selected from PDTS I and PDTS II.

5.4 The evidence contained in the patent in suit (Example page 4, lines 5 to 48) and the additional examples submitted by the Patentee on 15 September 1994 shows that Irganox<sup>(R)</sup> 245 (= PDTS I), Irganox<sup>(R)</sup> 1098 (= PDTS

II) and Irganox<sup>(R)</sup> MD-1024 (= PDTS II) provide good heat stability.

The Board is, thus, satisfied that the existing technical problem has effectively been solved by the claimed subject-matter.

6. *Obviousness*

This issue turns on the question whether it was obvious to one skilled in the art seeking to solve the existing technical problem to use the compounds PDTS I and II as heat stabilizers for et/CO-copolymers.

6.1 While, in the Board's judgment, it was *prima facie* obvious to improve the heat stability of et/CO-copolymers by incorporation of "a" heat stabilizer, it was not obvious, for the reasons to follow, to select as heat stabilizers PDTS I and II.

6.2 Firstly, the prior art is replete with heat stabilizers for polymers and it is, thus, not possible to arrive, with reasonable effort, by mere routine investigations and without any guidance by existing prior art at the solution of the existing technical problem.

This conclusion is supported by the Patentee's "Additional Examples" submitted on 15 September 1994, which show that Irganox<sup>(R)</sup> 245 (= PDTS I) and Irganox<sup>(R)</sup> 1098 (= PDTS II) are able to provide a heat stability to et/CO-copolymers which is substantially superior to that afforded by a variety of other heat stabilizers:

Table I: heat stabilizer		wt.-%	therm. aging*
1a	Irganox <sup>(R)</sup> 245 (PDTS I)	0.2	2.9
3	Irganox <sup>(R)</sup> 1098 (PDTS II)	0.2	3.1
5	octadecyl-3(3,5-di-t.butyl-4-hydroxyphenyl)propanoate	0.2	1.0
7	5-chloro-2(3,5-di-t.butyl-2-hydroxyphenyl)benzotriazole	0.3	0.8

\* relative performance in thermal ageing test with respect to the heat stabilizer of Example No. 5 = 1.0

Table II: heat stabilizer		wt.-%	therm. aging*
5	octadecyl-3(3,5-di-t.butyl-4-hydroxyphenyl)propanoate	0.25	1.0
6	Irganox <sup>(R)</sup> 1010	0.25	1.0
8	bis[3-(3,5-di-t.butyl-4-hydroxyphenyl)propanoate of 2,2-bis[4-(2-hydroxyethoxy)phenyl]propane	0.25	0.8
9	2,2-bis[(1,2,2,6,6-pentamethylpiperidyl-4)oxycarbonyl]-1-(3,5-di-t.butyl-2-hydroxyphenyl)hexane	0.25	0.8
10	bis(2,2,6,6-tetramethylpiperidyl-4)sebacate	0.25	0.7
11	2-(2-hydroxy-5-methylphenyl)benzotriazole	0.25	0.8

\* relative performance in thermal ageing test with respect to the heat stabilizer of Examples No. 5 and 6 = 1.0

Table III: heat stabilizer		wt.-%	therm. aging*
5	octadecyl-3(3,5-di-t.butyl-4-hydroxyphenyl)propanoate	1.0	1.0
6	pentaerythryl tetra[3-(3,5-di-t.butyl-4-hydroxyphenyl)propanoate]	1.0	1.0
12	2,6-di-t.butyl-4-methylphenol	1.0	0.7
13	2,4-bis(n-octylthio)-6-(4-hydroxy-3,5-di-t.butyl-phenyl)-1,3,5-triazine	1.0	0.5
14	4,4'-bis(á,á-dimethylbenzyl)diphenylamine	1.0	0.6

\* relative performance in thermal ageing test with respect to the heat stabilizer of Examples No. 5 and 6 = 1.0

It results from the above data in Tables I, II and III that the "inventive" heat stabilizers Irganox<sup>(R)</sup> 245 (PDS I) and Irganox<sup>(R)</sup> 1098 (PDS II) exhibit a heat stabilizing performance which is considerably superior to the performance of any of the other (comparative) heat stabilizers Nos. 5 to 14.

6.3 The Appellant argued that the skilled person had expected that the phenolic antioxidants according to examples 5, 7, 9, 11, 12 and 13 would not perform as well as the polynuclear phenolic antioxidants used according to the invention, because he was aware from D1 (falsely quoted by the Appellant as document D5) of the inferior sublimation resistance of the mononuclear phenol antioxidants; the Appellant continued by stating that the remaining comparative examples Nos. 8, 10 and 14 represented to small a basis for the acknowledgement of an inventive step.

However, as set out in the decision under appeal (point 6.1) and confirmed in the Respondent's submission of 22 September 1999, page 4, 4th paragraph, it is immediately evident to the skilled practitioner that the sublimation behaviour of organic compounds is to a large extent dependent on their molecular weight: the higher the molecular weight, the lower the tendency to sublimation at the same temperature.

Since all comparative heat stabilizers used by the Respondent, except for heat stabilizer No. 12, exhibit molecular weights which are at least similar to the molecular weights of Irganox<sup>(R)</sup> 245 and Irganox<sup>(R)</sup> 1098, irrespective of the number of phenolic nuclei they comprise, their heat stabilizing performance should not be impaired by a higher sublimation tendency.

The only comparative stabilizer of low molecular weight which was used by the Respondent, is compound No. 12, which, however, is the heat stabilizer first-named in Table 4 of document D5, where it is recommended for quite a number of polymers, including polyamides and polyolefins having different "polarity". The use of this compound for comparative purposes was, therefore, also a reasonable choice.

The respective evidence is therefore relevant as a whole (heat stabilizing additives Nos. 5 to 14) to prove that Irganox<sup>(R)</sup> 245 and Irganox<sup>(R)</sup> 1098 are indeed **surprisingly** superior in their effectiveness as heat stabilizers for et/CO-copolymers to a variety of other known heat stabilizers from different classes (monophenols, diphenols, polyphenols, arylamines and

hindered amine stabilizers).

The Appellant's comment (page 2, paragraph 4) that this document (D1) "must be taken at face value when it says that polynuclear phenols are preferred at higher temperatures to monophenols" does not take into account that D1 also indicates the reason for this preference by stating "... because of their lower sublimation rate". In the Board's judgment, the latter qualification is indeed crucial to the interpretation of the complete statement.

Thus, the Appellant's conclusion that the majority of these comparative compounds would have been expected to be less effective is not convincing.

- 6.4 The Appellant's further argument that it was known that Respondent's comparative heat stabilizer compound No. 6 Irganox<sup>(R)</sup> 1010 would be less effective than the "inventive" heat stabilizers PDTS I and II is not supported by any evidence which is to be considered here.

Even if evidence showing that this comparative heat stabilizer would perform worse than PDTS I and/or II in a certain polymer was to be considered, then, in order to prove the relevance to the claimed subject-matter of the afore-mentioned argument, it would have been necessary also to show that the same effect would occur in et/CO-copolymers (cf. subsequent point 6.5).

- 6.5 Documents D2, D4, D5, D8 and D9 disclose the suitability as heat stabilizers of Irganox<sup>(R)</sup> 245 (D2, D5), Irganox<sup>(R)</sup> 1098 (D4, D5, D9) and Irganox<sup>(R)</sup> MD-1024



(D5, D8) for a variety of polymers, including polyacetals, styrenic (co)polymers, polyamides, saturated polyesters, polyvinylchloride, rubbers, cellulosics, polyolefins, mineral oils, lard, gasoline, paraffin wax and lubricating oils.

From the fact that these heat stabilizers may be effective in polymers of such diverse chemical nature (including "polar" and "non-polar" polymers) as e.g. polyamides, cellulosics and paraffin wax, it is conspicuous that there is no "rule" enabling the skilled person to predict the efficiency of the "inventive" heat stabilizers on the mere basis of the chemical nature of a polymer.

The Appellant's argument that it was obvious that a heat stabilizer which is effective in "polar" polymers, like polyacetals and polyamides, must be similarly effective in the similarly "polar" et/CO-copolymers is, therefore, not convincing.

6.6 With respect to the Appellant's reasoning that the use as heat stabilizer in et/CO-copolymers of the amide group containing heat stabilizer (PDTs II) Irganox<sup>(R)</sup> 1098 was obvious, because of its ability to deactivate acid impurities which may be present in et/CO-copolymers, the Board concurs with the opinion of the Respondent (cf. point V (iii) supra), i.e. that the fact that non-amide group containing compounds PDTs I are equally effective proves the lacking criticality for the intended purpose of heat stabilizing of et/CO-copolymers of this alleged "neutralizing" effect.

6.7 From the above it can be concluded that the selection

of PDTS I and II as heat stabilizers for et/CO-copolymers from the host of possible heat stabilizing compounds amounts to a non-obvious selection.

6.8 The subject-matter of Claim 1 of the patent in suit, thus, complies with the requirement of inventive step according to Article 56 EPC.

6.9 Because of their appendancy to Claim 1, the same conclusion applies to the subject-matter of the dependent Claims 2 to 11.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin