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D E C I S I O N
of 16 March 1998

Case Number: T 0546/94 - 3.3.3

Application Number: 88115967.7

Publication Number: 0310924

IPC: C08L 71/04

Language of the proceedings: EN

Title of invention:
Stabilized polyphenylene ehterpolyamide compositions

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) - prior art documents not concerned with the specific technical problem"

Decisions cited:
-

Catchword:

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0546/94 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 16 March 1998

Appellant: GENERAL ELECTRIC COMPANY
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 14 February 1994 refusing European patent application No. 88 115 967.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. European patent application No. 88 115 967.7, filed on 28 September 1988, claiming a US priority of 9 October 1987 (US 107621) and published under No. 0 310 924 was refused by a decision of the Examining Division dated 14 February 1994.

The decision was based on an amended set of Claims 1 to 8 filed on 21 May 1993, with a letter dated 13 May 1993. Claim 1 of this set of claims reads as follows:

"A thermoplastic composition having improved retention of physical properties upon thermal aging comprising:

a. a compatible polyphenylene ether-polyamide resin blend comprised of, approximately 5 to 95 parts by weight polyphenylene ether resin, and 95 to 5 parts by weight polyamide resin;
and

b. approximately 0.001 to 0.5 parts by weight per 100 parts of resin composition a. of a metal salt of the formula

$$M_n^{y+} \qquad X_{\frac{n.y}{z}}^{z-}$$

where M represents a metal ion selected from the group consisting of copper, nickel, tin and cerium, n is an integer of from 1 to 6, X is an ion radical selected from the group consisting of halide ion and carboxylate ion, y is an integer representing the positive ionic charge of M and z is an integer representing the negative ionic charge of X."

Claims 2 to 8 are dependent claims directed to elaborations of the composition according to Claim 1.

II. The sole ground of refusal was lack of compliance with Article 56 EPC, having regard to the following documents:

(2): EP-A-0 236 596;
(3): Kunststoff-Handbuch, vol. VI, Polyamide, 1966, Carl Hanser Verlag München, pages 238, 240;
(4): US-A-3 067 168;
(5): US-A-3 658 705; and
(6): GB-A-1 536 488.

According to the decision, the composition according to Claim 1 of the application in suit was distinguished from that of document (2), which disclosed stabilisers in general, by the use of specified heat stabilisers (b.), so that the objective problem was to provide thermal stabilisers for compatibilised polyphenylene ether-polyamide resin blends, i.e. stabilisers which resulted in a better retention of impact strength and ductility after thermal aging. Document (2) led directly to the solution of this problem, however, because it taught that stabilisers known generally for polyamides might be used for compatibilised polyphenylene ether-polyamide resin blends. Thus, it was obvious to a person skilled in the art to try well-known thermal stabilisers for polyamides, relevant such compounds being described in (3) and (4). Although a direct comparison of impact performance with the stabilisers of (4) was not possible, such compounds were known from (5) to protect polyamides against embrittlement, and hence a drop in impact strength and ductility. Similarly, relevant such compounds were described in document (6) for the stabilisation of a methyl substituted polyphenylene ether against thermal degradation. Any improvement in impact performance

would thus only be the inevitable result of the teaching of (2) in combination with that of (3) to (6). Consequently, the claimed subject-matter, although novel, did not involve an inventive step.

III. On 11 April 1994, 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 17 June 1994, the Appellant argued, in essence, as follows:

(a) Document (4) was concerned with a different problem from that of the application in suit, since its object was to provide heat and light stabilised polyamide yarns which showed improved retention of tenacity when bleached.

(b) The refusal to permit a performance comparison with (4) was itself an indication that the latter had no relevance to protection against loss of impact strength and ductility.

(c) Similarly, none of the stabilisers disclosed in either (3) or (5) was mentioned as providing improved retention of impact strength or ductility after heat aging of the polyamides.

(d) Hence, none of the documents (3) to (5) was relevant to the technical problem.

(e) Even if it were obvious to the skilled person to try the stabilisers known from (3) to (5) in order to preserve impact strength and ductility, the compositions claimed in the application in suit exhibited unexpectedly superior characteristics as compared to the compositions of the prior art.

(f) As to document (6), it was clear that the disclosure was concerned with the stabilisation of polymers containing arylene methylene groups, rather than diarylether linkages. Whilst methyl substituted polyphenylene oxides were admittedly mentioned in Claim 4, they were not examples of such polymers and there appeared to be no basis for them in the description. Consequently, (6) was not relevant to the claimed subject-matter either.

IV. The Appellant requested:

1. that the decision under appeal be set aside, and a patent be granted on the basis of the "present" claims, i.e. Claims 1 to 8 underlying the decision under appeal;

2. that the application be remitted to the Examining Division for examination to be resumed;

3. oral proceedings, in the event that requests 1 and 2 are not allowed.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of amendments*

Claim 1 underlying the present decision differs from the version as originally filed only by the insertion of a definition of the value "n". This has a basis in the original description on page 5 at lines 11 to 12 (published application, page 3, lines 33 to 34).

Claims 2 and 3 are unchanged compared with the version as originally filed, and Claims 4 to 8 correspond to Claims 6 to 10 respectively as originally filed, Claims 4 and 5 as originally filed having been deleted.

Thus there is no objection to Claims 1 to 8 under Article 123(2) EPC.

3. *The closest state of the art; the technical problem*

The application in suit concerns stabilised polyphenylene ether-polyamide compositions based on compatibilised blends of polyphenylene ether (PPO) and polyamide (PA).

3.1 Such blends are described in (2) which the Board, like the Appellant and the Examining Division, regards as the closest state of the art. These blends are suitably prepared by melt extrusion (page 6, lines 36 to 44 in conjunction with Claim 1), then injection moulded to form test bars (page 7, lines 6 to 29). Table 1 shows that such blends have excellent mechanical properties, which would make them suitable for the production of large automotive panels. In practice, however, when these body panels are painted on-line in automotive paint ovens and thereby subjected to high oven aging temperatures, their thermal stability cannot be regarded as satisfactory.

3.2 In line with the approach mentioned in the application in suit (page 2, lines 17 to 31), the technical problem may be seen in the provision of such compatibilised blends having a higher stability to thermal aging.

3.3 According to the application in suit this problem is solved by adding metal salts of the formula specified in Claim 1.

3.4 In the light of the experimental results in the application in suit which show that the addition of copper salts significantly improves the retention of impact properties in samples aged in air at 350 and 375°F (Table 1) as well as the uniformity of impact resistance of moulded articles (Table 3), the Board is satisfied that the claimed measure provides an effective solution of the stated problem.

4. *Inventive step*

It remains to be decided whether the claimed solution involves an inventive step.

4.1 The only additional information in (2) is the possibility of incorporating "stabilizers", which defined as being the agents known generally for PA (page 6, lines 34, 35). Such a vague statement would not, however, lead the skilled person to the claimed subject-matter. Firstly, it fails to identify the kind of stability to be increased; this is an important deficiency of the disclosure of (2), because the problem to be solved involves the stabilisation of blends subjected to high temperatures for several hours, which sets very severe criteria. Secondly, as will be seen from the discussion of the other documents (section 4.7, below), there are many conventional compounds to be considered which are stabilisers for PA, so that in practice the skilled person is left without instruction for the solution of the above-defined technical problem.

4.2 Under such circumstances, it is plausible that the skilled person would turn to more fundamental teachings. Document (3) is such a teaching, since it is a general text on polyamides. Although the decision under appeal cites section 3.4.2.1 a)

"Stabilisierungsmittel" (stabilisers) as disclosing well-known thermal stabilisers for polyamides (Reasons for the decision, point 3.4), closer examination of this passage shows that the substance of the text of the cited section has been omitted.

4.2.1 According to the general sense of section 3.4.2.1 a), the **resistance** of shaped articles of polyamide against light and heat are often **under**estimated (emphasis by the Board), because the to some extent unfavourable experience with thin textile fibres, monofilaments or films is carried over to thick-walled articles. Even with unstabilised articles at elevated temperatures (above 100°C) and under intense UV illumination, only a very slow attack on the surface takes place, which thus acquires a brownish coloration. The attack comes to a standstill in general at a depth of about 0.7 to 1.0 mm. In the core of the article the molecular weight increases as a result of further condensation during storage. Similar results were observed with UV-illumination; here a still shallower depth of penetration is measured. Strongly crystallised polyamides of high amide group concentration are most stable (section 3.4.2.1 a), introductory paragraph).

4.2.2 Thus, on a more complete reading, the essential message of (3) is that thermal aging is an exclusively surface effect of PA, and does not take place in the interior. Consequently, it would not be expected in large sized objects, such as automobile panels. Consequently, this document can offer no hint to stabilisers which might be capable of solving the stated problem.

4.3 Similar considerations apply to the disclosure of document (4), which would be read in the light of the general knowledge supplied by (3), since the context of this document is also that of fibre-forming polyamides (column 1, lines 8 to 10). Hence, there is no hint to

the solution of the stated problem in document (4), either.

4.4 Furthermore, the disclosure of (5), although referring to "brittleness and discoloration" does so only in relation to "certain applications, such as electric insulation, transparent films, fibers, bristles, cloth, coated fabric and the like" (column 1, lines 42 to 48). It is thus equally restricted in its context to thin polyamides, in which the bulk characteristics approximate to the surface characteristics. Thus there is no hint to a solution of the objective problem in (5), either.

4.5 Document (6) is concerned with a stabilised high temperature resistant polymeric composition comprising: (a) a major proportion by weight of a high temperature resistant polymer having arylene methylene groups; (b) 0.0005 to 2.0 wt.% based on the total weight of the composition of a specified stabiliser (Claim 1).

4.5.1 Whilst it is true that there is an isolated reference to the "polymer" being a methyl substituted polyphenylene oxide (Claim 4), it is nevertheless clear that such a species is not an example of a polymer having arylene methylene groups. Nor is there any counterpart to this claim in the description.

4.5.2 Whilst it is possible to speculate why the claim was written in this way, it is clear from the general teaching of (6) that the diaryl ether linkage "is not nearly as unstable as the arylenemethylene group, but the polymer precursors in which it appears are considerably more expensive than the precursors in which the arylenemethylene group appears" (page 1, lines 39 to 43). The purpose of the disclosure of (6) is thus to enable the use of the relatively inexpensive arylenemethylene-containing polymer (page 1,

lines 44, 45). In other words, there is no suggestion that a polyphenylene ether would need thermal stabilisation.

4.5.3 It is thus evident that, on a fair reading, (6) does not disclose a problem of loss of impact strength of a polyphenylene ether due to thermal aging. Consequently, the stabilisers it discloses would not suggest themselves to the skilled person as likely to be capable of solving the stated problem.

4.6 In summary, these prior art documents are not concerned with the specific technical problem addressed by the application in suit. Consequently, they cannot, *a fortiori*, offer a hint to its solution.

4.7 Quite apart from this, a wide variety of thermal stabilisers are taught in documents (3) to (6).

4.7.1 For instance, Table 6 on page 240 of (3) lists no less than eight different classes of stabiliser (metal oxides; carbon; metal salts; halogen salts; phosphorus salts; salt combinations; inorganic sulphur compounds; elementary iodine; and aromatic compounds). Furthermore, of the eight compounds listed in the only one of these classes relevant to the application in suit (metal salts), only three correspond to the compounds specified in section b. of Claim 1.

4.7.2 Consequently, there is no "one way street" by which the skilled person, following the reference to "stabilizers" in (2) would in any case add a relevant stabiliser.

4.8 In summary, the subject-matter of Claim 1 of the application in suit does not arise in an obvious way from the state of the art. Hence, the subject-matter of

Claim 1 involves an inventive step. By the same token, the subject-matter of dependent Claims 2 to 8 also involves an inventive step.

4.9 In view of the above finding, the appeal must succeed.

4.10 Whilst the Board is aware that amended pages of description were filed together with the set of Claims 1 to 8 underlying the present decision, these pages have not been referred to, either in the decision under appeal or the Statement of Grounds of Appeal. It will therefore be necessary to refer the case back to the first instance for examination of the latter.

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 grant a patent on the basis of Claims 1 to 8 filed on 21 May 1993, with letter dated 13 May 1993, after any necessary consequential amendment of the description.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin