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D E C I S I O N
of 31 March 1998

Case Number: T 0956/94 - 3.3.3

Application Number: 88907373.0

Publication Number: 0371131

IPC: H04R 7/00

Language of the proceedings: EN

Title of invention:
Acoustic Material

Applicant:
Sony Corporation, et al

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56, 84

Keyword:
"Claims - clarity (yes) - product-by-process formulation"
"Inventive step - remote technical field"

Decisions cited:
-

Catchword:
-

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Case Number: T 0956/94 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 31 March 1998

Appellant: Sony Corporation
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 10 June 1994 refusing European patent application No. 88 907 373.0 pursuant to Article 97(1) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. European patent application No. 88 907 373.0, published with the international publication number WO 89/02207 and the filing date of 22 August 1988 relating to an "acoustic material" was refused on 10 June 1994 by a decision of the Examining Division 2.2.11.059.

II. The decision was based on a set of 6 claims filed on 21 March 1994, of which the only independent Claim 1 read as follows:

"Drawn high elastic modulus polyethylene containing paraffin wax characterised in that the drawn high elastic modulus polyethylene containing paraffin wax is used as an acoustic material and the surface thereof has been processed with plasma to immobilise 1 to 5 wt.% of the paraffin wax in the drawn high elastic modulus polyethylene and to cause it to remain in the drawn high elastic modulus polyethylene after extraction of paraffin wax with boiling n-hexane."

Dependent Claims 2 to 6 related to specific embodiments of the subject-matter of Claim 1.

The first reason for the refusal was that Claim 1 attempted to define the subject-matter in terms of the result to be achieved. Since it seemed to be possible to define the subject-matter in more concrete terms the Examining Division considered Claim 1 to be objectionable under Article 84 EPC.

The second reason for that decision was lack of inventive step of Claim 1. The most relevant prior art was said to be represented by

D1: EP-A-0 115 192 and

D2: PATENT ABSTRACTS OF JAPAN, volume 9, no. 178 (E-330) 1901 corresponding to JP-A-60-48696.

The distinguishing features of the claimed subject-matter versus D1 were that the polyethylene wax base product was used as an acoustic material and that the surface of the drawn high elastic material was processed with plasma.

D1 disclosed that stretched articles, such as stretched filaments, strands, fibres, sheets, tapes and the like, were produced from ultrahigh-molecular-weight polyethylene. Hence, the skilled person would also consider this polymer for the manufacture of acoustic material.

Plasma processing was generally known to improve surface properties, such as e.g. adhesiveness (cf. D2). The disclosure of D1 and common general knowledge would thus enable a skilled person to arrive at the subject-matter of Claim 1.

III. On 9 August 1994 the Appellant (Applicant) filed a Notice of Appeal together with payment of the prescribed fee.

(i) With the Statement of Grounds of Appeal filed on 13 October 1994 a new set of 5 claims was filed as main request. New Claim 1 was said to meet one of the objections based on Art.84 EPC, the others were disputed and arguments were provided to support inventive step.

(ii) That set of claims was replaced by a new main request filed on 19 December 1994.

(iii) In an annex to the summons for oral proceedings the Rapporteur raised various objections against the wording of these last claims and suggested that new Claim 1 be drafted as a product-by-process claim. Together with the reply of 27 February 1998 four new sets of claims were filed as main request and auxiliary requests.

(iv) During oral proceedings held on 31 March 1998 the Appellant withdrew its former requests and filed a new set of claims as his sole request. This set of claims consists of two independent claims of which Claim 1, after correction in feature (i) of "wherein the melt draw orientation process including the steps of" into "wherein the melt draw orientation process includes the steps of", reads as follows:

"An acoustic material suitable for use as a diaphragm for a loudspeaker;
wherein the acoustic material consists essentially of a drawn high elastic modulus polyethylene containing from 1 to 5 wt.% paraffin wax,
wherein the drawn high elastic modulus polyethylene has an initial tensile elastic modulus of not less than 30 GPa, and a fracture elongation of not higher than 6%; and
wherein the drawn high elastic modulus polyethylene containing paraffin wax is obtained by a process comprising

(i) subjecting a mixture of paraffin wax and a high molecular weight polyethylene to melt draw orientation, wherein the high molecular weight polyethylene has

- an intrinsic viscosity in a decalin solution at 135°C of not less than 5 dl/g,
wherein the melt draw orientation process includes the steps of
- melting and kneading a mixture of the high molecular weight polyethylene and paraffin wax by a screw extruder at a temperature of 190° to 280°C,
- extruding the undrawn material from a die maintained at 210° to 300°C,
- drafting the material at a draft ratio at least above unity, cooling and
- solidifying the material and drawing the cooled and solidified material at a temperature of 60° to 140° at a draw ratio not less than three;

(ii) processing the surface of the drawn polyethylene with plasma;
whereby not all of the paraffin wax remaining in the drawn polyethylene is modified;
whereby modification of the wax occurs only in the region of 10 to 30 A from the surface of the drawn polyethylene; and
whereby the wax deep within the drawn polyethylene remains intact without undergoing any reaction;
and

(iii) extraction with boiling n-hexane of paraffin from the drawn polyethylene."

Claim 2 is drafted as a use claim:

"Use of a paraffin wax as a dumping agent to increase the internal losses in an acoustic material for use as a diaphragm for a loudspeaker ....", followed by the same product and process features as in Claim 1.

IV. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request submitted during oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. *Article 123(2) EPC*

2.1 Claim 1 relates to an acoustic material suitable for use as a diaphragm for a loudspeaker consisting essentially of drawn high elastic modulus polyethylene. That subject-matter was disclosed in Claim 1 in conjunction with the first full paragraph of page 1 of the original files.

2.2 That the drawn high elastic modulus polyethylene contains from 1 to 5 wt % of paraffin wax and has an initial tensile elastic modulus of not less than 30 GPa as well as a fracture elongation of not higher than 6% was disclosed in original Claim 2 in conjunction with Claim 6.

2.3 That the polyethylene subjected to melt draw orientation has an intrinsic viscosity in a decalin solution at 135°C of not less than 5 dl/g was disclosed in Claim 7.

2.4 That the polyethylene to be used as acoustic material is obtained by melt draw orientation processing including the steps specified in the claims was disclosed in original Claim 8 in conjunction with the first full paragraph on page 4 of the original files .

2.5 Plasma processing of the surface of the drawn polyethylene to modify only the wax in a region of 10 to 30 A from the surface with the wax deep within the drawn polyethylene remaining intact i.e. not all of the wax being modified was supported by Claim 1 in conjunction with the passage bridging pages 6/7 of the original files.

2.6 The extraction with boiling n-hexane in the final step was disclosed in Claim 3 in conjunction with the passage bridging pages 8/9 of the original files.

2.7 The use of a paraffin wax as a dumping agent to increase the internal losses in an acoustic material according to Claim 2 was disclosed on page 3, lines 2 to 8 of the original files.

2.8 For these reasons the Board is satisfied that the claims meet the requirements of Article 123(2) EPC.

3. *Article 84 EPC*

The new claims are devoid of features which could be regarded as defining the claimed subject-matter solely by the result to be achieved, without sufficiently indicating the means to obtain the desired result.

The only features which may be regarded as expressing a result concern the effects occurring by processing the surface of the drawn polyethylene with plasma in step (ii). As argued by the Appellant during oral proceedings, the triple effect specified in that step is in fact an automatic result of the plasma treatment;

in other words, it has no limiting impact on the scope of the claim, but should merely be regarded as explanatory or descriptive. As such, it is not objectionable under Article 84 EPC.

4. *Novelty*

Novelty was not disputed and since the Board is also of the opinion that neither D1 nor D2 disclose the combination of features specified in the present claims, there is no need to discuss that matter any further.

5. *Inventive step*

The application in suit concerns an acoustic material suitable for use as a diaphragm for a loudspeaker. As explained in the introduction, such a diaphragm is required to have low density, high modulus of elasticity and hence a high rate of propagation of longitudinal waves and large internal losses, for enhancing the reproduction frequency range (see page 1, lines 11 to 14).

5.1 D1 relates to a process for producing stretched articles of ultrahigh-molecular weight polyethylene. According to Claim 1 this process comprises (1) melt-kneading a mixture composed of an ultrahigh-molecular-weight polyethylene and a paraffinic wax in a screw extruder, (2) melt-extruding that molten mixture through a die, (3) cooling the resulting unstretched extrudate to solidify it, and (4) subjecting the unstretched solidified extrudate to a stretching treatment. The resulting articles are said to be stretched filaments, strands, fibres, films, sheets and tapes, particularly stretched shaped articles having high tensile strength and modulus of elasticity and a

high quality of excellent uniformity and reproducibility as well as being substantially free from stretching unevenness (cf. page 1, lines 1 to 10). These articles are said to be suitable as various functional materials, such as selective membranes and electrets (page 20, lines 10 to 12).

5.2 Assuming that a skilled person would also regard these shaped articles to be appropriate for use as acoustic material, the problem underlying the present application may be seen in the provision of a material having improved properties.

5.3 This problem is said to be solved with an acoustic material consisting essentially of a drawn high elastic modulus polyethylene containing 1 to 5 wt.% of a wax not extractable with boiling n-hexane after plasma treatment, as specified in Claim 1.

5.4 In view of the experimental data in the application, which show the beneficial influence of plasma processing combined with limited amounts of paraffin wax on the dumping properties, the Board is satisfied that the above defined technical problem is effectively solved by the given means.

6. It remains to be decided whether the combination of features, i.e. a wax content of 1 to 5 wt.% after plasma treatment and extraction with boiling n-hexane, is obvious having regard to the documents relied upon by the Examining Division.

6.1 In order to achieve the suitability as selective membranes and electrets, the stretched articles according to D1 should exhibit a high degree of crystal orientation as well as micropores, the former resulting from stretching at very high ratios and the latter from the extraction of the paraffin wax (B) (page 20,

lines 6 to 12). Although at first sight this might be regarded as an incentive to operate with lower amounts of paraffin wax, this feature alone cannot render obvious the claimed subject-matter for the following reasons.

The first is that there is no teaching in D1 regarding the amount of wax following extraction. In particular, the vague statement that the excess of paraffin wax should be extracted cannot be equated with the requirement of 1 to 5 % by weight. In fact, D1 teaches away from such low amounts of paraffin wax, since a blend of 95 p.b.w. of ultrahigh molecular weight polyethylene and 5 p.b.w. of paraffin wax cannot be extruded from the orifice of a screw extruder (page 26, Comparative Example 2).

The second reason is that there is no disclosure in D1 of processing the surface of the drawn polyethylene with plasma, let alone of a modification limited to the surface of the material. It follows that the technical context of paraffin extraction in D1 is entirely different from that in the application in suit; whereas that step is combined in D1 with stretching at very high ratios in order to ensure both high crystallinity and microporosity, it is performed in the application in order to complete the superficial modification of the drawn polyethylene.

Thus, even if the functional materials referred to in D1 were interpreted as acoustic materials within the terms of the application in suit, the person skilled in the art would have no reason to consider an extraction step of paraffin wax for the solution of the above defined technical problem.

6.2 D2 relates to the manufacture of diaphragm for speakers. The method consists in activating by means of plasma processing the surface of a diaphragm shaped from a polyolefin resin, whereby the adhesive properties of that surface are increased (see "Purpose" and "Constitution"). In addition to the fact that the polyolefin does not contain any paraffin wax and is not subjected to any melt draw orientation process, that plasma treatment does not aim at improving the dumping characteristics, but merely at enhancing the wettability of the adhesives. In view of these differences it is evident that D2 alone cannot lead a skilled person to the combination of features now required in Claim 1.

6.3 The last issue to be decided is whether this combination of features would be rendered obvious by combination of the teaching of D1 and D2.

To begin with, in the Board's view, taking into account the differing objectives of these disclosures, there would be no incentive for a skilled person to consider specific product and/or process features thereof in order to combine them. But even a hindsight combination would not result in the claimed subject-matter. As pointed out by the Appellant, the features according to D1 combined with the plasma treatment according to D2 would at most lead to a material containing large amounts of paraffin wax, which would not be an acoustic material having the desired properties.

6.4 These considerations show that the documents relied upon in the decision under appeal, whether taken in isolation or in combination, do not render obvious the claimed subject-matter which, therefore, involves an inventive step.

6.5 The same applies to Claim 2, which is directed to the

use of a paraffin wax as dumping agent to increase the internal losses in an acoustic material for use as a diaphragm for a loudspeaker, wherein the acoustic material is defined by the same combination of product and process features as in Claim 1, and consequently for the same reasons involves an inventive step.

7. Although the present wording of the claims meets the requirements of Articles 84 as well as 56 EPC and, thereby, overcomes the grounds of refusal, a patent cannot be granted according to the Appellant's request in view of the substantial amendments required in the description. To that end, the case has to be remitted to the Examining Division.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside;

2. The case is remitted to the Examining Division with the order to grant the patent with the claims submitted during oral proceedings and after any consequential amendments of the description.

The Registrar: The Chairman:

P. Martorana C. Gérardin