BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 13 February 1997

Case Number: T 0779/93 - 3.3.3

Application Number: 89301072.8

Publication Number: 0327384

IPC: H01B 1/24

Language of the proceedings: EN

Title of invention:
Conductive polyacetal composition exhibiting improved flexibility and toughness

Patentee:
HOECHST CELANESE CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - obvious combination of known features"

Decisions cited:
-

Headnote/Catchword:
-

Case Number: T 0779/93 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 13 February 1997

Appellant: HOECHST CELANESE CORPORATION
Route 202-206 North
Sommerville, N.J. 08876 (US)

Representative: De Minvielle-Devaux, Ian Benedict Peter
Carpmaels & Ransford
43, Bloomsbury Square
London WC1A 2RA (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 25 March 1993 refusing European patent application No. 89 301 072.8 pursuant to Article 97(1) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. European patent application No. 89 301 072.8, filed on 3 February 1989 and published under publication number 0 327 384 was refused by a decision of the Examining Division 2.1.02.052 of the European Patent Office dated 25 March 1993.

That decision was based on a set of 8 claims filed on 7 July 1992. The independent Claims 1, 5 and 7 of that set of claims read as follows:

"1. An electrically conductive polyacetal resin composition comprising 75 to 85% by weight of an oxymethylene polymer containing at least 50% $-OCH_2-$ units and having a melt index of 5.0 to 15.0 g/10min measured in accordance with ASTM D1238-82, 3 to 5% by weight of an electrically conductive carbon black characterised in that the carbon black has a surface area BET(N_2) greater than 1,200 square meters per gram and a pore volume DBP absorption greater than 500 cubic centimetres per 100 grams, and 5 to 20% by weight of an elastomeric polyurethane.

5. A method of improving the flexibility and toughness of an electrically conductive polyacetal resin molding composition comprising an oxymethylene polymer containing at least 50% -OCH_2- units and an electrically conductive carbon black characterised in that the composition contains 75 to 85% by weight of the polyacetal resin which has a melt index of 5.0 to 15.0 g/10min measured in accordance with ASTM D1238-82, there is used as carbon black 3 to 5% by weight of a carbon black having a surface area BET(N_2) greater than 1,200 square meters per gram and a pore volume DBP absorption greater than 500 cubic centimeters per 100 grams, and 5 to 20% by weight of an elastomeric polyurethane is incorporated in the composition.

7. A method of producing moulded articles in which an electrically conductive polyacetal resin moulding composition comprising an oxymethylene polymer containing at least 50% - OCH_2 - units and an electrically conductive carbon black is subjected in the thermoplastic state to a molding operation so as to form shaped articles, characterised in that the composition comprises 75 to 85% by weight of the polyacetal resin, the polyacetal resin has a melt index of 5.0 to 15.0 g/10min measured in accordance with ASTM D1238-82, the composition comprises 3 to 5% by weight of the carbon black, the carbon black has a surface area BET(N_2) greater than 1,200 square meters per gram and a pore volume DBP absorption greater than 500 cubic centimeters per 100 grams, and the composition comprises 5 to 20% by weight of an elastomeric polyurethane."

Subject-matter of dependent Claims 2 to 4, 6 and 8 are preferred embodiments of the composition according to Claim 1 and the methods according to Claims 5 and 7, respectively.

II. The reason for the decision was that the subject-matter as claimed met the provisions of Article 123(2) and 54 EPC, but lacked inventive step within the terms of Articles 52(1) and 56 EPC.

The following documents were cited in support of these objections:

D1 DE-A-3 303 760;
D2 Ketjenblack EC-600JD, Application Research Bulletin, Akzo-Chemie, September 1986; and

D3 US-A-4 391 741.

More specifically, it was stated that the subject-matter of Claims 1 to 4 differed from D1 in that the polyacetal composition contained a carbon black characterized by a relatively high specific surface area (> 1200 qm/g), but that in the absence of any conclusive evidence of a technical effect related to that feature, the objective technical problem could only be seen in the provision of a further, carbon black containing polyacetal composition. To test further well-known carbon black additives was considered to be obvious.

Even if one were to admit that the technical problem was to render the polyacetal composition of D1 electro

conductive (which had not been proved) without deteriorating its good mechanical properties, inventiveness would still remain objectionable with regard to the teaching given by D3 and the availability of carbon black with high conductivity (D2).

As to the method Claims 5 to 8 it was stated they could not involve any inventive step since the process features were well-known from D1 and the use of the starting materials was not inventive (see above).

III. On 12 May 1993 a Notice of Appeal was lodged against that decision together with payment of the prescribed fee. The Statement of Grounds of Appeal was submitted on 23 July 1993. The Appellant (Applicant) disputed in that statement as well as in a submission filed 10 January 1997 and during oral proceedings held on 13 February 1997 the findings of the Examining Division.

(i) Especially he stressed that

(1) reference D1, which was now considered in the form of its corresponding US patent, US-A-4 517 319 (D1'), was not concerned with electrical conductivity and that, therefore, references D2 and D3 would not be pertinent without the indication from the specification that the combination was worthwhile,

(2) the combination of all the components yielded a composition which had improved mechanical and electrical properties, and

(3) the combination of specific components was not suggested in the references themselves or in combination, unless one used the teachings of the present specification to pick and choose among the variables.

(ii) The Appellant further argued that D1' taught the use of carbon black with a particle size of less than 10 μm, preferably less than 5 μm, especially 0.035 μm (col. 1, ll.40-41 in conjunction with col. 9, l.14), which meant that fillers of that specific average particle size (col. 1, ll.34-35) were essential to produce POM compositions with the desired toughness. A skilled person would thus expect not to obtain the desired characteristics when using carbon black with the particle size disclosed in D2.

IV. Together with the written submissions and during oral proceedings the Appellant filed and withdrew numerous requests. The requests on which the present decision is based are as follows:

(i) The main request is, with the exception of the correction of a clerical error in Claim 8, identical with the set of claims refused by the Examining Division (see above under I).

(ii) The first auxiliary request differs from the main request in that the lower amount of "3 %" of carbon black in Claims 1, 5 and 7 is replaced by

"2 %".

(iii) The 2 claims of the second auxiliary request are directed to the same subject-matter as Claims 5 and 6 of the first auxiliary request, e.g. to a method of improving the flexibility and toughness of an electrically conductive polyacetal resin moulding composition.

(iv) The 2 claims of the third auxiliary request correspond to Claims 7 and 8 of the first auxiliary request, but are specifically directed to a method for producing a tabular shaped article from an electrically conductive polyacetal resin moulding composition.

(v) The fourth auxiliary request consists of one claim directed to the use of 2 to 5% by weight of carbon black, as specified in the claims of all requests, to confer improved flexibility and toughness in an electrically conductive polyacetal resin moulding composition.

V. The Appellants requested:

- that the decision under appeal be set aside and

- that a patent be granted on the basis of the claims submitted as the main request on 10 January 1997 (confirmed on 14 January 1997), or

- on the basis of the claim filed on the same date

as first auxiliary request, or

- on the basis of the claims submitted during oral proceedings as auxiliary requests 2 to 4.

Reasons for the Decision

1. The appeal is admissible.

2. No objection pursuant to Article 123(2) EPC arises having regard to the wording of the claims of the main request, since they are supported by respectively Claims (1+2), 3, 5, 6, (7+8), 9, (10+11) and 12 as originally filed. The specific MI and the method of its determination are disclosed on p. 8, ll.8-10 of the original files.

The replacement of "the elastomeric polyurethane" by "the carbon black" in Claim 8 is the correction of an obvious clerical error (see Claim 9 of the specification filed originally).

The provisions of Article 123(2) EPC are also met by the claims of the four auxiliary requests.

With the exception of the amount of carbon black, whose lower limit of 2% is supported by p. 16, l. 12 of the application as originally filed, Claims 1 to 8 of the first auxiliary request correspond to Claims 1 to 8 of the main request. The 2 claims of the second auxiliary request are identical with Claims 5 and 6 of the first auxiliary request.

The two claims of the third auxiliary request correspond to Claims 7 and 8 of the first auxiliary request, but restricted to the production of a tubular shaped article, which is disclosed on p. 18, l.2 of the original files.

The single claim of the fourth auxiliary request is directed to the use of the carbon black to confer electrical conductivity properties to polyacetal resin moulding compositions. This aspect is explained in detail in the "Summary of the Invention" bridging pages 2 and 3 of the description.

The claims of all requests thus fully comply with the provisions of Article 123(2) EPC.

3. Novelty was accepted in the decision under appeal and the Board sees no reason to conclude differently.

4. The present patent application is concerned with an electrically conductive polyacetal resin moulding composition exhibiting improved flexibility and toughness e.g. a polyacetal resin composition which must exhibit both electrical conductivity and good mechanical properties.

4.1 Whilst the Examining Division relied on D1 as the closest state of the art in the reasons, the Appellant regarded that approach as wholly artificial and argued in his statement of 10 January 1997 (page 4, paragraph 8) that it was more realistic to start from D3. In order to decide on that point, it is necessary to examine the properties and compare the ingredients of the respective compositions.

4.1.1 D'1 describes compositions having good toughness properties containing (a) a POM, (b) a thermoplastic polyurethane, and (c) a filler having an average particle size of less than 10 μm, such as carbon black (claim 1 in conjunction with column 1, lines 27 to 30 and column 6, lines 51/52). These compositions, which can be regarded as satisfactory as far as their mechanical properties are concerned, contain thus two ingredients within the terms of the application in suit, namely the POM and the polyurethane.

4.1.2 D3 relates to POM compositions having excellent antistatic properties comprising (a) 100 parts by weight of a POM, (b) 2 to 15 parts by weight of an electrically conductive carbon black having a surface area up to 1000 m^2/g and a pore volume up to 340 $cm^3/100$ g, and (c) 2 to 20 parts by weight of a low-density polyethylene (column 1, lines 52 to 58; column 2, lines 14 to 26). These compositions, whose electroconductive properties can be regarded as satisfactory, contain thus only one ingredient within the terms of the application in suit, namely the POM compound.

4.1.3 Whilst both citations can be regarded as equivalent from the point of view of the properties of the compositions, in that each mentions one of the two properties required in the application in suit, the compositions according to D'1 are closer to the compositions according to the application in suit than those known from D3 in that they require only one modification. This was ultimately accepted by the Appellant and the discussion of inventive step during oral proceedings took place on that basis. There will thus be no reference to D3 hereinafter.

4.2 As specified in D'1, the compositions containing a POM, a thermoplastic polyurethane and a filler are thermoplastic (column 8, lines 11 to 21). They can be comminuted mechanically, for example by chopping or grinding, to give granules, chips, flakes or powders, and are accessible to any modes of processing typical for thermoplastic compositions; they can, therefore, be processed by injection moulding or extrusion moulding to give shaped articles, such as tapes, rods, sheets, films, pipes and tubes (compare original application, page 17, lin 21 to page 18, line 2). In spite of their versatility, however, these compositions cannot always be used in sliding type parts, because they tend to generate static electricity resulting in electrical noise and adhesion of dust.

4.3 In the light of this shortcoming the technical problem underlying the application in suit may be seen in the provision of POM compositions having antistatic properties without impairing their mechanical

properties.

4.4 According to the application this problem is to be solved by the use of carbon black having a surface area greater than 1200 m^2/g and a pore volume greater than 500 $cm^3/100$ g, as specified in Claim 1.

4.5 The experimental data in the application in suit (Tables 2 and 3) provide evidence that a carbon black having such physical characteristics, while ensuring good mechanical properties, confers electroconductive properties to POM compositions.

5. It has to be decided whether this solution would have been obvious to a person skilled in the art having regard to the state of the art.

5.1 During oral proceedings the Appellant pointed out that, although the compositions disclosed in D'1 may contain carbon black as a filler, they could not properly be regarded as electroconductive compositions. This would appear from the introduction of this citation, where the detrimental influence of fillers on the mechanical properties of mixtures of POM and polyurethane was discussed (column 1, lines 5 to 30), as well as from the requirements in terms of particle size and particle size distribution, which these fillers had to meet (column 6, lines 14 to 21) in order to avoid that influence.

According to the introduction of D'1, PM's exhibit in particular high strength and hardness properties, but a relatively low toughness, in particular a low impact

strength, which restricts their capacity to be used for some purpose. Although toughness may be improved by incorporating a thermoplastic polyurethane, this beneficial effect is lost when fillers are added to these mixtures. The thrust of the teaching of D'1 is that, even in that case, satisfactory toughness properties can be achieved, provided these fillers have a specific average particle size.

The ternary compositions used in Examples 7, 9, 11 and 16, which contain a POM, a thermoplastic polyurethane and carbon black, are thus basically compositions having good toughness properties. The fact that they contain carbon black cannot be interpreted as pointing at electroconductive properties, which means that D'1 by itself cannot assist the skilled person in the search of a solution of the above defined problem.

5.2 D2 is precisely concerned with a type of carbon black filler which, while conferring extremely high antistatic and electroconductive performance to polymers, overcomes the problem of the deterioration of the mechanical properties.

5.2.1 This filler, named KETJEN BLACK EC-600 JD, has a surface area BET (N_2) of 1250 m^2/g and a pore volume (DBP-absorption) of 495 $cm^3/100$ g (page 1, Table 1) and corresponds to the carbon black particularly recommended in the application in suit (compare column 6, lines 5 to 8; column 10, Table 2). Its properties are said to diverge considerably from those of conventional electroconductive blacks; in particular, its performance as an electroconductive

filler is so high that only a fraction of the amount of carbon black is needed to reach a certain level of conductivity as compared to other carbon blacks. This offers considerable advantages in those areas where the physical properties of the base polymer, in particular the impact strength, should be affected as little as possible by the introduction of carbon black (page 1, paragraph "Introduction"; page 5, paragraph "Mechanical properties and flow behaviour"). These advantages may be observed with both highly crystalline and amorphous base polymers, e.g. with thermoplastis, rubbers and thermosetting resins (page 1, paragraph "Introduction"; page 2, paragraph "Electroconductive performance" last line).

5.2.2 The argument by the Appellant that the disclosure of D'1 concerning the upper limit of the size of the filler would be regarded by a skilled person as a disincentive to the use of carbon black having an average particle size higher than 10 μm in POM based compositions cannot be accepted, for the teachings of D'1 and D2 are not contradictory. On the contrary, the authors of D2 were well aware of the general detrimental effect on impact strength of carbon black, which is on line with the specific teaching of D'1, but found that the lower loadings of KETJEN BLACK EC-600 JD which are required to achieve the same level of electroconductivity allow a better preservation of the original mechanical properties of the base polymer. As stated above, this effect is described in general terms and would thus be expected to occur to the same extent with POM based compositions.

5.2.3 For this reason, the promising teaching of D2 would clearly outweigh the specific disclosure of D'1 and provide an incentive to use KETJEN BLACK EC-600 JD in POM compositions in order to ensure a desirable combination of electroconductive properties and impact strength properties.

5.3 It follows that the claimed subject-matter is obvious having regard to the teaching of D'1 and D2 and does not, therefore, involve any inventive step (Article 56 EPC).

6. Claim 1 of the main request not being allowable, the same applies to Claim 1 of the auxiliary requests drafted respectively as a composition claim (first auxiliary request), as a method claim (second and third auxiliary requests) or as a use claim (fourth auxiliary request), all directed to or involving the use of a POM based composition comprising an elastomeric polyurethane and a specific carbon black.

7. The same considerations also apply to the dependent and independent claims of the various requests which are all directed to preferred compositions or methods based on the same non-inventive concept.

8. It follows that all the requests have to be rejected for non-compliance with the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin