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D E C I S I O N
of 15 December 1998

Case Number: T 1066/93 - 3.3.3

Application Number: 87112416.0

Publication Number: 0261430

IPC: C08K 3/36

Language of the proceedings: EN

Title of invention:
Biaxially oriented polyester film

Applicant:
Teijin Limited

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56, 84

Keyword:
"Claims - clarity (yes)"
"Inventive step (yes)"

Decisions cited:
T 0035/85, T 0181/82

Catchword:
-

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Case Number: T 1066/93 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 15 December 1998

Appellant: Teijin Limited
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Decision under appeal: Decision of the Examining Division of the European Patent Office dated 22 March 1993 and issued in writing on 22 July 1993 refusing European patent application No. 87 112 416.0 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. 87 112 416.0, relating to "Biaxially oriented polyester film", filed on 26 August 1987 and published under No. 0 261 430, was refused by a decision of the Examining Division dated 22 March 1993 and issued in writing on 22 July 1993, for lack of inventive step having regard to the disclosures of the documents:

D1: WPIL, FILE SUPPLIER, no. 84-278981, Derwent Publications Ltd., London, GB; & JP-A-59171623;

D2: EP-A-0 124 291;

D6: Journal of the Japanese Chemical Society, 1981, No. 9, page 1503ff; and

D7: DE-A-3 401 625.

The decision was based on a set of Claims 1 to 11 filed on 3 March 1993 and forming a main request, as well as on a set of Claims 1 to 9 forming an auxiliary request filed at oral proceedings held before the Examining Division on 22 March 1993.

Claim 1 of the main request read as follows:

"A biaxially oriented polyester film formed from an intimate mixture consisting of
(1) an aromatic polyester, and
(2) 0.01 to 4 % by weight, based on the aromatic polyester, of spherical fine particles of silica having
(a) an average particle diameter of 0.05 to 4 µm,
(b) an average particle diameter ratio, defined by the ratio of maximum diameter to minimum diameter, of from 1.0 to 1.2, and

(c) a relative standard deviation (σ) of particle size, defined by the following equation

$$\sigma = \frac{\sqrt{\sum_{i=1}^{n} (D_i - \bar{D})^2 / n}}{\bar{D}}$$

wherein D_i is the diameter (μm) of the equivalent circular area of each of the particles, D is an average value (μm) of the diameter of the equivalent circular area defined by the following equation

$$\bar{D} = \sum_{i=1}^{n} D_i / n$$

and n is the number of the particles, with the proviso that the diameter of the equivalent circular area denotes the diameter of each particle calculated when it is assumed that each particle is of a true spherical shape, of up to 0.3."

Claims 2 to 7 were dependent claims directed to elaborations of the film according to Claim 1.

Claim 8, an independent claim, was worded as follows:

"A biaxially oriented polyester film formed from an intimate mixture consisting of
(1) an aromatic polyester, and
(2) 0.005 to 3 % by weight, based on the aromatic polyester, of spherical fine particles of silica having
(a) an average particle diameter of 0.05 to 4 μm,
(b) an average particle diameter ratio, defined by the ratio of maximum diameter to minimum diameter, of from 1.0 to 1.2, and
(c) a relative standard deviation (σ) of particle size, defined by the following equation

$$\sigma = \frac{\sqrt{\sum_{i=1}^{n} (D_i - \bar{D})^2 / n}}{\bar{D}}$$

wherein D_i is the diameter (µm) of the equivalent circular area of each of the particles, D is an average value (µm) of the diameter of the equivalent circular area defined by the following equation

$$\overline{D} = \sum_{i=1}^{n} D_i/n$$

and n is the number of the particles, with the proviso that the diameter of the equivalent circular area denotes the diameter of each particle calculated when it is assumed that each particle is of a true spherical shape, of up to 0.3, and

(3) 0.005 to 3 % by weight, based on the aromatic polyester, of inert fine particles except silica and porous silica having an average particle diameter of 0.01 to 3 µm and not exceeding the average particle diameter of the spherical fine particles of silica."

Claims 9 and 10 were dependent claims directed to elaborations of the film according to Claim 8.

Claim 11, an independent claim, was directed to a magnetic recording medium comprising the film according to Claim 1 or Claim 8 and a magnetic layer on one or both surfaces.

The auxiliary request was a set of Claims 1 to 9, differing from the main request in that the lower limit of the amount of spherical fine particles of silica added to the aromatic polyester (2) in Claim 1 and Claim 6 of the auxiliary request, which corresponded to Claim 8 of the main request, was 0.1 wt% based on the aromatic polyester and in that Claims 6 and 7 of the main request had been deleted.

II. According to the decision, the distinguishing feature over D1, which was the closest state of the art, was the width of the relative standard deviation of the size of the silica particles. The technical problem arising was that of providing polyester films for magnetic tapes having an improved abrasion resistance and a decreased coefficient of friction. It was, however, taught in D7 that such biaxially oriented polyester films comprising conventional filler particles with uniform particle size and with a particle size distribution with a small steep maximum achieved excellent slipperiness and surface roughness, as well as very good mechanical and electromagnetic properties. Furthermore, it was known from D2 that a biaxially oriented aromatic polyester film containing inert fine particles having a controlled (i.e. narrow) particle size distribution had excellent surface properties. Consequently, it would have been obvious to select a silica filler having a narrow particle size distribution according to D7 or D2 for the polyester film according to D1. The skilled person would have known from D6 how to provide a silica filler having such a narrow particle size distribution. Thus the claimed subject-matter was obvious.

III. On 15 September 1993, a Notice of Appeal was filed against the above decision, the prescribed fee being paid on the same day. In the Statement of Grounds of Appeal, filed on 23 November 1993, the Appellant argued in substance as follows:

(a) The disclosure of monodispersed spherical silica according to D6 had been publicly available before any of the documents D1, D2 and D7 were published, the authors of the latter all being specialists in

the relevant field. Nevertheless, none of the inventors of D1, D2 and D7 used such silica. Consequently, the relevant combination had not in fact been obvious.

(b) The reasoning in the decision under appeal had been based on the assumption that any particle that was spherical and had a sharp particle size distribution would be expected to exhibit the relevant effects in biaxially oriented polyester films, as found according to the application in suit. Such an assumption was not, however, grounded in reality, since particles of other materials, even if spherical and of more uniform size than the relevant silica, produced quite poor properties when incorporated in such a film. Consequently, the finding of the decision under appeal was ill-founded.

(c) The small particles of "controlled particle size or particle distribution" according to D2 were not monodisperse particles as defined in the application in suit, as was evidenced by the statement, in D2, that the desired particles, although not available commercially, could be obtained by crushing or disintegrating commercially available products, since such monodisperse particles could not be obtained by crushing and filtration.

(d) The inorganic particles of uniform size according to D7 were merely a batch of particles from which larger particles had been removed. Thus, they also could not be spherical fine particles of silica as defined in the application in suit.

(e) In view of the above, the subject-matter of the application in suit was new and involved an inventive step.

The Statement of Grounds of Appeal was accompanied by a table of comparative data (Table 1) to show that a base film for tape provided with particles meeting the particle size distribution requirement according to the application in suit but not others, did not exhibit the relevant advantageous mechanical properties associated with the polyester film according to the application in suit.

IV. On 3 November 1997 the Appellant filed, at the request of the Rapporteur, an English language translation of the previously cited Japanese document D1. Further objections to the claims were raised by the Board in communications issued on 29 October 1997 and 8 June 1998, respectively, to which the Appellant responded with submissions containing further sets of claims, on 9 February 1998 and 11 August 1998, the former submission further containing technical data in explanation of the subject-matter of the application in suit. After an interview with the Rapporteur, held on 21 October 1998, the Appellant filed, on 27 November 1998, a revised set of Claims 1 to 7 and adapted pages of description. Claim 1 reads as follows:

"A biaxially oriented polyester film formed from an intimate mixture consisting of
(1) an aromatic polyester, and
(2) 0.01 to 4 % by weight, based on the aromatic polyester, of spherical fine particles of silica having
(a) an average particle diameter of 0.05 to 4 µm,
(b) a particle diameter ratio, defined by the ratio of maximum diameter to minimum diameter, of from 1.0 to 1.2, and

(c) a relative standard deviation (σ) of particle size, defined by the following equation

$$\sigma = \frac{\sqrt{\sum_{i=1}^{n} (D_i - \overline{D})^2 / n}}{\overline{D}}$$

wherein D_i is the diameter (μm) of the equivalent circular area of each of the particles, D is an average value (μm) of the diameter of the equivalent circular area defined by the following equation

$$\overline{D} = \sum_{i=1}^{n} D_i / n$$

and n is the number of the particles, with the proviso that the diameter of the equivalent circular area denotes the diameter of each particle calculated when it is assumed that each particle is of a true spherical shape, of up to 0.3,
wherein when the surface of the film is observed under an electron microscope, protrusions attributed to the spherical fine particles of silica are seen; when the surface of the film is ion-etched and then observed under an electron microscope, the spherical silica particles are directly seen, and in this observation, it is seen that the adjoining spherical silica particles in one protrusion have either a relation of being in direct contact with each other, or a relation of being interrupted by void space, and that only up to 10 protrusions among 100 arbitrarily selected protrusions on the film surface before ion etching have a group of spherical fine silica particles having the aforesaid relations."

Claims 2 to 6 are dependent claims directed to elaborations of the film according to Claim 1. Claim 7 is an independent claim, directed to "A magnetic recording medium comprising the biaxially oriented film of claim 1 and a magnetic layer on one or both surfaces of the film.".

V. A further amended page 12 was filed by fax on 11 December 1998 and replaced by a corrected version, filed by fax on 15 December 1998.

VI. The Appellant requests that the decision under appeal be set aside and a patent granted on the basis of the set of Claims 1 to 7 filed on 27 December 1998, and adapted pages of description, namely pages 1 to 11 and 13 to 40 filed on 27 November 1998, and page 12, filed on 15 December 1998.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of amendments*

Claim 1 is supported by Claims 1, 5 and 8 of the application as originally filed. The passage at the end of the claim, defining a film the surface of which, when observed under an electron microscope, is found to have only up to 10 protrusions among 100 arbitrarily selected protrusions which fulfil the relationship mentioned in Claim 1, differs from the original wording, by the insertion of the words "in one protrusion" after "the adjoining spherical particles". This amendment, which clarifies the status of the particles referred to as "adjoining", amounts only to a

repetition of the relevant part of the original antecedent "protrusions attributed to the spherical fine particles of silica", and thus does not comprise added subject-matter.

Claims 2 to 4 are identical with the corresponding claims as originally filed. Claims 5 and 6 correspond to Claims 6 and 7 respectively as originally filed. Claim 7 corresponds to Claim 12 as originally filed.

The description has been extensively amended to render it consistent with the scope of Claim 1, in particular by deleting examples which fell outside the latter, and consequent renumbering of the remaining examples and comparative examples. None of the amendments involve added subject-matter.

Consequently, the text underlying the present decision meets the requirements of Article 123(2) EPC.

3. *Article 84; clarity*

The amendment of the passage at the end of the Claim 1 to specify that the adjoining particles are located in one protrusion (section 2., above) clarifies the requirement for only up to 10 out of 100 protrusions to contain such adjoining particles as meaning that not more than 10% of the surface protrusions contain particles which are in a state of agglomeration. This predicates that at least 90% of the particles in the surface protrusions are non-agglomerated. There is thus no contradiction with the term "consisting of" in Claim 1 (cf. decision under appeal; Reasons for the decision, point 4.1, in relation to the then Claim 7). Nor is there any other lack of clarity of which the Board is aware.

Consequently, Claims 1 to 7 are held to be clear as required by Article 84 EPC.

4. *The application in suit; the technical problem*

The application in suit is concerned with the provision of a biaxially oriented polyester film for use, for instance, as a base film for magnetic recording tape, containing substantially spherical fine particles of silica (opening paragraph). Such a film is, however, known from D1, which was regarded, quite rightly in the Board's view, in the decision under appeal as the closest state of the art, and is here considered in the form of the English language translation provided by the Appellant (D1*).

4.1 According to D1*, such a film having good surface properties, especially windability and abrasion resistance, is formed containing 0.01 to 5, preferably 0.1 to 1 wt% of substantially spherical particles having an average diameter of about 0.1 to 1 micron (primary particle), derived from colloidal silica (Claim 1). Such films have been found to have disadvantages, especially in terms of poor abrasion resistance.

4.2 Compared with this state of the art, and in accordance with the approach adopted in the application in suit itself, the technical problem is to be seen in the search for an improved oriented polyester film having excellent slipperiness and abrasion resistance (page 4, lines 20 to 35).

4.3 The solution proposed according to Claim 1 of the application in suit is to replace the colloidal silica particles by similar spherical silica fine particles having a very narrow range of sizes, as defined in

terms of relative standard deviation, of 0.3, so that only up to 10% of the protrusions attributed to the spherical fine particles of silica contain agglomerated particles.

4.4 According to the acknowledgment of prior art in the application in suit as originally filed, it had been found that the colloidal silica particles used in D1 contained a considerable amount of secondary agglomerates of primary spherical particles (page 4, lines 6 to 19). Furthermore, according to the technical explanations accompanying the submission of the Appellant, filed on 9 February 1998, it is evident that the presence of such agglomerated particles leads to a less sharp shaped protrusion, with a larger void space, which is associated with an inferior combination of low friction coefficient and low surface roughness, compared with an individual, i.e. non-agglomerated particle, which leads to a sharper protrusion having a smaller void space, which in turn leads to more favourable surface properties ("Explanations on the present invention by the Inventor", page 1). Hence, the slipperiness and abrasion resistance properties of the claimed films should be improved.

4.5 Whilst there is a large number of examples in the application in suit showing that polyester films having the relevant parameters exhibit excellent properties of slipperiness and abrasion resistance, there is no direct comparison of a pair of films differing only in the relative standard deviation of the size of the spherical silica particles, a point which was raised during the examination proceedings (communication of the Examining Division issued on 11 October 1991, point 4.2).

4.5.1 The Appellant, however, filed, with his response to this communication, comparative data relating to a film differing from that according to Example 1 of the application in suit only in that the spherical fine particles of silica had a relative standard deviation of 0.55 instead of 0.2 (submission filed on 21 April 1992 "Further comparative example to Table 1"). Comparison with the data relating to Example 1 (Table 1) shows that the abrasion resistance of the latter was superior to that of the comparative example and the coefficient of friction lower.

4.5.2 It is the established case law of the Boards of Appeal of the EPO that an applicant or patentee may discharge his onus of proof by voluntarily submitting comparative tests with newly prepared variants of the closest state of the art making identical the features common with the invention in order to have a variant lying closer to the invention so that the advantageous effect attributable to the distinguishing features of the invention is thereby more clearly demonstrated (T 0035/85 of 16 December 1986, supplementing T 0181/82 "Spiro compounds", OJ EPO 1984, 401).

4.6 In the light of the above, it is credible to the Board that the claimed measures provide an effective solution of the stated problem.

5. *Novelty*

Lack of novelty was not a ground of refusal in the decision under appeal. Nor has the Board any reason to doubt the novelty of the claimed subject-matter. Consequently, the subject-matter of Claims 1 to 7 is held to be novel.

6. *Inventive step*

In order to determine the issue of inventive step, it is necessary to consider whether the skilled person, starting from D1*, would have expected an improvement in surface mechanical properties of the polyester film, in particular its slipperiness and abrasion resistance, to be obtained by the measure of replacing the colloidal silica by spherical fine particles of silica limited to a narrow size range corresponding to a value of the relative standard deviation (σ) up to 0.3.

6.1 There is no suggestion to do this in D1, since there is no mention of spherical silica particles having any particular value of relative standard deviation, let alone that specified in the solution of the stated problem.

6.2 According to D2, there is disclosed a biaxially oriented polyester film having a certain relationship between its surface flatness and coefficient of travelling friction (Claim 1). Preferably, the film has many minute protrusions on its surface which are attributed to fine particles of titanium dioxide or both titanium dioxide and calcium carbonate (page 4, line 33 to page 5, line 4). Preferably the fine particles have a controlled particle size distribution (γ), represented by the equation $\gamma = D_{25}/D_{75}$, of 1.2 to 2.3, where D_{25} is the particle diameter of the fine particles when their cumulative weight is 25% based on their total weight, and D_{75} is the particle diameter of the fine particles when their cumulative weight is 75% based on their total weight (page 10, lines 3 to 14).

6.2.1 Not only is the particle size distribution parameter, (γ), a bulk parameter which does not correspond to the relative standard deviation (σ) in any discernable way, but the particles used are titanium oxide, there being no suggestion of using spherical fine particles of silica. On the contrary, the only silica referred to is a silica sol and this is used in comparative examples showing inferior surface properties (page 35, Comparative Example 3). Thus, there is no suggestion to select particle size on the basis of relative standard deviation (σ), or indeed to use spherical fine particles of silica at all.

6.2.2 The argument in the decision under appeal, that it would have been obvious to replace the titanium oxide by another kind of particle having a controlled size is thus not convincing, since neither the relevant size distribution, nor the use of spherical fine particles of silica is made available by D2, any more than it is by D1.

6.2.3 Consequently, there is no guidance to the solution of the stated problem in the disclosure of D2.

6.3 According to D7, a polyester film for magnetic recording purposes has minute protrusions on its surface, having a specified relationship between the surface roughness and the number (H_2) of secondary interference bands as measured by a multi-interference method (Claim 1). It is taken that the value of H_2 is closely related to the electromagnetic properties of the tape, and the surface roughness to the coefficient of friction (page 8, lines 26 to 28). Whereas H_2 should not be too large, the surface roughness should not be too small (page 8, line 26 to page 9, line 18). The film may contain additives such as titanium dioxide, fine particles of silica or kaolin; or a slip agent (page 8, lines 5 to 7). In order to obtain a favourable

balance of these two values, it is possible to add to the film material particles of uniform particle size, from which the larger particles have been removed, in order to obtain a particle size distribution curve with a narrow, steep maximum (page 9, line 20 to page 10, line 16).

6.3.1 The reference in D7 to a "narrow steep maximum" in the particle size distribution curve is purely qualitative and cannot be taken as implying a particular level of relative standard deviation.

6.3.2 Furthermore, just as in the case of D2, there is no mention of spherical particles of silica.

6.3.3 Nor is there any suggestion that the particles should be non-agglomerated.

Consequently, there is no hint to the solution of the stated problem in the teaching of D7.

6.4 D6 is more remote, since it merely discloses the formation of spherical silica, which may be aggregated, and makes no reference to a possible use.

6.5 In summary, the solution to the stated problem does not arise in an obvious way from the cited state of the art. Consequently, the subject-matter of Claim 1, and, by the same token, that of dependent Claims 2 to 6 involves an inventive step. The subject-matter of independent Claim 7, which is nevertheless limited to the film according to Claim 1, consequently also involves an inventive step.

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 a patent on the basis of the following text:

Claims: Claims 1 to 7 filed on 27 November 1998;

Description: pages 1 to 11 and 13 to 40, filed on 27 November 1998;
page 12 filed on 15 December 1998.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin