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D E C I S I O N
of 7 November 1995

Case Number: T 0134/92 - 3.3.4

Application Number: 85300757.3

Publication Number: 0153081

IPC: B32B 15/08

Language of the proceedings: EN

Title of invention:

Metal-deposited laminated film and method for making capacitor elements using same

Patentee:

TORAY INDUSTRIES, INC.

Opponent:

Hoechst Aktiengesellschaft Werk KALLE-ALBERT

Headword:

Metal-deposited laminated film/TORAY

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - (yes)"

Decisions cited:

-

Catchword:

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Summary of Facts and Submissions

I. European patent No. 0 153 081 relating to a metal-deposited laminated film and method for making capacitor elements using same was granted on the basis of twelve claims contained in European patent application No. 85 300 757.3.

II. An opposition was filed against the granted patent raising objection under Article 100(a) EPC on the grounds that its subject-matter was not inventive as required by Article 56 EPC.

III. The patent was maintained in unamended form by the Opposition Division after oral proceedings. Claim 1 reads as follows:

"1. A metal-deposited laminated film for a capacitor, characterized by comprising an at least uniaxially oriented polyethylene terephthalate film having a thickness of 0.2 to 2.0 μ m, on one surface of which a metal is vacuum-deposited, and a propylene copolymer film bonded closely to the surface, opposite to the metal-deposited surface, of the polyethylene terephthalate film with an adhesive force of 0.1 to 2.0g/cm."

Claims 2 to 10 relate to laminates having preferred features and claims 11 and 12 refer to methods of making a capacitor element using the laminates of claims 1 to 10.

The reasons for the decision of the Opposition Division were essentially the following:

(a) In the light of documents

E1: DE-B-1 704 764

E2: DE-A-2 710 132

E3: US-A-3 915 779

novelty was accepted.

(b) In view of the general disclosure in the closest prior art document E2 it was accepted that a laminate of a topology like the one of claim 1 was known. In the light of this the problem to be solved was to effectively realise a metal-deposited laminate film for a capacitor, which laminated film was capable of being separated very easily into its two components without drawbacks. Three features distinguished the laminates of the invention from the prior art. These were (a) the 0.2-2.0 μ m thickness of the polyethyleneterephthalate film (PET), (b) the choice of a polypropylene copolymer (PPC) and (c) the adhesive force of 0.1 to 2.0 g/cm between the two polymer film layers.

Accepting that feature (b) would be obvious as a result of combining the teaching of document E2 with the general knowledge of a skilled engineer, a combination of all three features was not obvious from the prior art document E2 together with E1 and/or E3 as there was no incentive from document E2 to use films of thickness 2.0 μ m or less and therefore the problem associated with such very thin films had not been addressed by the prior art. Also feature (c) was not obvious from document E1 as this did not disclose a PET/PPC film layer combination and did not relate to metallised laminates. Further even if it were possible to obviously derive the combination of features (a)-(c) from the prior art it

would have been clearly impossible to predict whether specific values or ranges for (a) and (c) would work in combination to solve the problem. Accordingly the subject-matter of the claims was inventive.

IV. The Appellant (Opponent) filed an appeal against the decision of the Opposition Division, paid the appeal fee and submitted a statement of grounds.

V. In a communication pursuant to Article 11(2) of the rules of procedure of the Boards of Appeal the Respondent's attention was drawn to decision T 32/82 (OJ EPO 1984, 354) in which it is held that if essential features are necessary to obtain the desired effect or to solve the problem with which the application is concerned they have to be in the claim. In this connection and in order to determine the subject-matter for which protection was sought, the Board referred to the necessity of the presence of a lubricant in either or both of the polymer films as stated in the description.

In reply to this communication the Respondent (Proprietor of the patent) filed a new main and subsidiary request.

VI. Oral proceedings took place on 7 November 1995.

At the beginning of oral proceedings, the Board indicated to the Respondent that since he had filed an amended claim it was open to objections under Article 84 EPC in particular with reference to the means by which the specific adhesive force between the two polymer layers was achieved.

In response to these objections by the Board, the Respondent converted the main request into a first auxiliary request (see section IX infra) and continued with a main request on the basis of the claims as granted.

- VII. The Appellant did not object to the requests on file in respect of Articles 54 and 123 EPC. As far as the requirements of Article 84 EPC were concerned, he argued that only a request which complied with this Article could be discussed. He doubted the value of the comparison examples performed by the Respondent as the first was merely a repetition of the prior art in which the layer thicknesses had been reduced and the second was not a proper comparison as it was not according to the invention and gave a wrinkled product. Having regard to the two examples of the invention, there were doubts that all the essential features of the invention were evident in the main claim of the main request and was of the opinion that the range of adhesive values was very broad and covered all those values which were usual for known laminates.

With regard to inventive step it was argued that document E2 represented the nearest prior art and that the three features (a), (b) and (c) detailed by the opposition division were obvious. Feature (c) was not a real feature as it related to a range of adhesive forces the values of which were conventional for polymer laminates and therefore did not distinguish the invention from the prior art. In the present case the problem was to find values of adhesive forces which were not so great that the layers could not be separated. Such values were obvious in the light of the tensions applied to film laminates as they passed through the metallisation apparatus used in the examples of document E2. Feature (a) did not represent an inventive

characteristic as films of thickness 1,5µm were already known and document E2 referred to 10 to 5µm or less, and the trend in the art was to reduce thickness of films for the production of smaller capacitors.

The choice of PET as a film layer for the capacitor was obvious as all experts were agreed that this was by far the most advantageous layer which in combination with a non-polar PPC layer (b) would not exhibit adhesive forces such that it would not be possible to separate said layers. It was also obvious to employ PPC rather than polypropylene (PP) because of the superior stretching qualities of the PPC. Accordingly there was only one choice for the skilled person, namely the obvious combination of PET with PPC.

The disclosure of document E3 related to the problem of producing thin metallised polymer films without wrinkles being formed in the product of the metallisation process, and the solution to this problem was that a carrier film was laminated with the film to be metallised after which metallisation was carried out and the carrier film optionally separated from the laminate. Admittedly document E3 did not disclose a PPC carrier layer as polyvinylidene fluoride had been used for both layers of the laminate in each example. There was only a general reference to polyester as metallised film capacitor component, however for reasons given above it was obvious to combine this with PPC.

VIII. The Respondent argued essentially that the "adhesive" forces (those which hold the layers together) existing between the layers of the claimed laminate were consequent upon the choice of the PET/PPC layers and that the "tension" forces (those which exist along the length of a laminate as it is pulled through the processing machinery) employed in the metallisation

process of document E2 at a speed of e.g. 250m/min did not relate to the same thing. Examples 1 to 4 of document E2 were of a comparative nature using single polymer layers giving unsatisfactory results and were not appropriate as an indication of how to achieve non-wrinkled laminates. Further, document E2 described only examples of films 8µm thick which were not relevant to the problem of handling very thin films of maximum 2µm thickness.

With regard to document E3 the disclosure was concerned with avoiding wrinkles in a laminate of two polymer layers formed before metallisation took place and not with the avoidance of flaws after metallisation and during separation of the carrier layer. The process of document E3 advocated the use of two films which were of the same basic material and therefore of compatible behaviour. Consequently, it could not be obvious from this prior art to select the PET/PPC combination.

IX. The Appellant requested that the decision under appeal be set aside and that European patent No. 0 153 081 be revoked.

The Respondent requested that the appeal be dismissed or that the patent be maintained based on the following auxiliary requests:

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|------------------------------|---|
| (a) First auxiliary request: | Claims 1 to 11 filed on 5 December 1994 as main request. |
| (b) Auxiliary request 2: | Claims 1 to 11 filed on 26 October 1995 as first auxiliary request. |

(c) Auxiliary requests 3 to 8: Claims filed on 5 December 1994 as auxiliary requests 2 to 7.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

The main request relates to the patent as granted. Consequently Article 84 EPC is not an issue.

3. *Novelty (Article 54 EPC)*

The Appellant did not object on the ground of lack of novelty and having considered the cited prior art the Board is also of the opinion that the claimed subject-matter is novel.

4. *Inventive step (Article 56 EPC)*

4.1 The closest prior art.

Document E2, which was considered as closest prior art by the Opposition Division in its decision because it contained in its general disclosure a laminate of a topology like that of claim 1, concerns a process in which two polymer films are laminated together and passed through a vacuum-metallisation process with the result that one side of each of the polymer layers is metallised thus producing a four layered laminate which may optionally be separated into two laminates comprising one metal and one polymer layer. This enabled

avoidance of defects in the films which were presented for metallisation. The examples relate to four layer laminates in which the two polymer films are each 8µm thick and are of the same polymer material, there being no details of how a choice of materials would affect a separation process. The description recommends using for the laminates polymer layers which are of the same strength and same polymer in order to avoid difficulties. There is no suggestion that a three layered laminate be prepared of which one layer is metal coated onto PET laminated with PPC, which laminate is suitable for separation by removal of the PPC layer.

Document E3 discloses a process effecting vacuum-metallisation on both sides of a film involving the steps of laminating two polymer layers together followed by metallisation of one side of one polymer layer, thus producing a three layered laminate of structure Metal/Polymer 1/Polymer 2 which topology corresponds to the three layers of the laminate claimed in the patent in suit, but the materials are different. The outer polymer layer 2 is then removed and relaid on the side bearing the metal coating, thus a structure Polymer2/Metal/Polymer 1 is arrived at, which is then metallised on the second side of Polymer 1 at which time a structure Polymer 2/Metal/Polymer 1/Metal is achieved from which Polymer 2 may be separated, its function as support film having been completed. This process enables a wrinkle-free metallised laminate of structure Metal/Polymer 1/Metal to be prepared. As a possible layer to be metallised polyester is specified and separately "extremely thin films", i.e. "below 6 microns in thickness" (column 1, line 43) are referred to. At column 2 line 18 of this citation only sheet polymers of the same polymer are recommended for laminate use, and there is no reference to PPC as carrier sheet at all in this document.

The Board considers document E3 to be the nearest prior art as it describes a Metal/Polymer/Polymer laminate and refers to the problem of wrinkling.

4.2 The technical problem.

Having regard to the disclosure of document E3 the objective problem to be solved was to avoid wrinkles being formed during the manufacture of a metallised laminate having a polymer layer with a thickness of 0.2 to 2.0 μ m.

4.3 The solution to the problem.

The above problem was solved by the choice of the Metal/PET/PPC laminate according to claim 1.

4.4 Assessment of inventive step.

The question is whether this laminate could have been derived in an obvious manner from document E3 or any other prior art document on file.

The preparation of the laminate according to the main claim and separation of layers is facilitated by the presence of the support layer and by the choice of the materials of which the polymer layers are made as this determines the adhesive forces which exist between said layers and directly influences their wrinkle-free separability.

The laminates prepared according to document E3 include three-layered Metal/polymer/polymer laminates which are preparable without defects and there is a reference to polyester films of below 6 μ m thickness in general and of 4 μ m in particular in the second embodiment (see

column 5, lines 14 to 24). However, there is no example thereof nor reference to PPC as a support layer and this was acknowledged by the Appellant during oral proceedings.

One difference between the patent in suit and document E3 is that having obtained a metallised laminate of topology Metal/PET/PPC in which the PPC layer acted as a support layer for the PET layer this metallised laminate is used to prepare wound up capacitor material by separating the PPC layer from the laminate and directly winding up the Metal/PET layers without there being any wrinkles formed. This is facilitated by the ease with which the PET/PPC layers may be separated and is dependent upon the adhesive forces to be overcome during separation and which are specified in the main claim as a technical feature of the laminate. The range of adhesive forces given in the main claim plausibly can be considered as forces existing between the PET/PPC layers. It does not seem likely or probable that this range would include all possible values which would result from the combination of any two polymer layers of known laminates. Since there is no hint in document E3 that the choice of particular layers may result in adhesive forces suitable to avoid wrinkles when the thickness of the film is 0.2 to 2.0 μ m, the Board concludes that inventive skill was to be applied to arrive at the claimed subject-matter in the light of the teachings of document E3 alone. The question is whether any other document alone or in combination makes the claimed subject-matter obvious.

Document E2 describes in example 7 the preparation of a laminate having two layers of 8 μ m thick PET and metallised on both sides. However, there is no suggestion to replace one of these layers by a PPC layer with a view to providing the desired adhesive forces and

thereby influence the separability of the polymer layers, nor is there any reference to particular problems associated with handling extremely thin films of 2µm thickness or less. The figures given in the examples of document E2 concerning the tension under which the metallised laminates were pulled through the metallising apparatus are not at all comparable with the adhesive forces holding the PET/PPC layers together or of forces which might be applied to separate said layers. This is because forces of tension are applied along the laminate as it is pulled through a processing machine, whereas adhesive and separation forces are those which exist between two surfaces, or are applied at a right-angle to the surfaces of two layers which are laminated to each other. Neither this document alone nor a combination of it with document E3 does therefore lead to the solution of the alone problem in an obvious manner.

Document E1 is concerned with stretching a laminate of two polymer films one of said films being chosen for its good stretching characteristics whilst the other does not exhibit this feature. The problem of stretching the poorly stretchable polymer film is alleviated by combining it with the other film during stretching after which the films are separated. Film thicknesses of 20 to 500µm are recommended and no reference to films of 2µm is made. A combination of PET with polyethylene was disclosed but reference to PPC was absent. This document has no apparent relevance to the metallised laminates of the patent in suit or to the problem solved thereby and therefore could not lead the skilled person in an obvious manner to the claimed subject matter.

The essential combination of the PET/PPC layers to avoid wrinkles or breaks when ultra thin films of a thickness of 0.2 to 2.0µm are manufactured is not obviously derivable from any of the citations as PPC is not referred to as a laminate layer nor is it indicated as a carrier layer which is easily separable from the very thin PET layer. Further, there is nothing in the prior art which indicates that such a function for PPC is part of the common general knowledge.

Accordingly the Board does not consider that the claimed metallised laminates being the subject-matter of the main claim of the main request have been rendered obvious by any combination of the documents E1, E2 or E3.

The method of independent claim 11, which relates to the manufacture of capacitor elements, makes use of the laminates according to claim 1 and is inventive for the same reasons.

In view of the above finding the further requests need not be considered.

Order

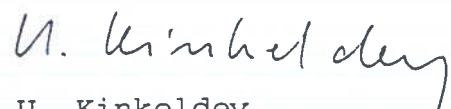
For these reasons it is decided that:

The appeal is dismissed.

The Registrar:


L. P. McGarry

The Chairwoman:


U. Kinkeldey