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Bezeichnung der Erfindung: Laminating Process

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : G03F 7/16

ENTSCHEIDUNG / DECISION

vom / of / du 11 October 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

E.I. Du Pont de Nemours and Company

Einsprechender / Opponent / Opposant :

I BASF-Aktiengesellschaft
II Hoechst-Aktiengesellschaft

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé :

"Inventive step (No)";

"Combined analogous use of known properties of a substance and a per se known technique for its deposition without unforeseeable effects".

Leitsatz / Headnote / Sommaire

Europäisches
Patentamt

Beschwerdekammern

European Patent
Office

Boards of Appeal

Office européen
des brevets

Chambres de recours



Case Number : T 226 /88 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 11 October 1989

Appellant : Hoechst Aktiengesellschaft, Frankfurt (Main)
(Opponent II) c/o Kalle Niederlassung der Hoechst AG
Postfach 3540
D-6200 Wiesbaden 1

Further party : BASF Aktiengesellschaft, Ludwigshafen
(Opponent I) Patentabteilung C6
Carl-Bosch-Strasse 38
D-6700 Ludwigshafen

Respondent : E.I. Du Pont de Nemours and Company
(Proprietor of the patent) Legal Department
1007 Market Street
Wilmington, Delaware 19898
(USA)

Representative : Werner, Hans-Karsten, Dr. et al.
Deichmannhaus am Hauptbahnhof
D-5000 Köln 1

Decision under appeal : Interlocutory decision of the Opposition Division
of the European Patent Office dated 11 April 1988
concerning maintenance of European patent
No. 0 040 842 in amended form.

Composition of the Board :

Chairman : H. Reich

Members : C. Black

C. Payraudeau

Summary of Facts and Submissions

- I. European patent 0 040 842 was granted on the basis of European patent application No. 81 103 965.0.
- II. The Appellant "Hoechst AG" and the Opponent "BASF AG" separately filed notices of opposition against this patent on the ground that its subject-matter did not involve an inventive step in view of the prior art disclosed, inter alia, in documents:
- A: US-A-3 629 036, and
B: US-A-3 365 348.
- III. By an interlocutory decision within the meaning of Article 106(3) EPC the Opposition Division decided on the amended form in which the European patent could be maintained as requested by the proprietor of the patent (Respondent), and accordingly informed the parties in a communication pursuant to Rule 58(4) EPC, dated 23 October 1987.

The set of claims on which the decision was based comprises 11 claims, of which Claim 1, the sole independent claim, reads as follows:

"1. In a process for laminating a supported photosensitive layer to a substrate surface by means of pressure, the improvement comprising the sequential steps of:

- (a) forming a thin layer of an aqueous liquid on the substrate surface immediately prior to lamination by contacting the surface at a temperature below the condensation point of the liquid with a vapor derived from the liquid, which layer forms an interface

between the substrate surface and the photosensitive layer upon lamination; and

(b) displacing the thin layer of liquid from the substrate surface by absorption into the photosensitive layer during lamination."

IV. The Appellant "Hoechst AG" lodged an appeal against the interlocutory decision, citing the new document:

C: GB-A-898 871,

and complementing his arguments in a further letter. The Opponent "BASF AG" declared that he did not intend to comment.

V. In a communication accompanying a summons to oral proceedings, and at its beginning, the Board raised objections to Claim 1, referring, inter alia, to new documents:

D: US-A-4 075 051, and

E: R. Vieweg: "Kunststoff-Handbuch", Vol. I, Carl Hanser Verlag München, 1975, pages 305-307.

VI. Oral proceedings were held, at the end of which the Appellant "Hoechst AG" requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed and that the patent be maintained

as main request: on the basis of the documents mentioned in the communication pursuant to Rule 58(4) EPC dated 23 October 1987;

as auxiliary request: as in the main request with Claim 1 replaced by Claim 1 handed over during oral proceedings and the description to be amended accordingly.

The wording of Claim 1 of the auxiliary request corresponds to the text of Claim 1 of the main request, wherein the words:

"In a process for laminating a supported photosensitive layer" are replaced by the words: "In a process for laminating a supported photosensitive film resist layer".

The Opponent "BASF AG" being duly summoned did not appear at oral proceedings as announced beforehand.

VII. In support of his request the Appellant "Hoechst AG" argued essentially as follows:

- (a) It would be obvious for a skilled person to use the "aqueous liquid" known as resist softener from document D in the lamination process known from document A and to produce this aqueous liquid interface between resist and substrate by vapor condensation as known from document B.

- (b) Though document D describes resist softening for self-trimming, i.e. for a different technical purpose, a skilled person would be able to derive from this document D, column 3, lines 44-58, and column 4, lines 34-37 and 60-64, the fact that an aqueous liquid softens as well a resist material which is processed in an aqueous developer and therefore is water-soluble, as a resist material

which is processed in organic developer and thus is non-soluble in water. Although the various binders mentioned in the patent in suit, page 4, lines 23-43, permit the production of one or the other of these two types of resists, the description on page 4, lines 44 and 45, and example I would show that resists processible in aqueous developers are preferred. It would, moreover, belong to a skilled person's basic knowledge that resists which are processed in an aqueous developer swell when absorbing an aqueous liquid and get softened thereby.

- (c) Although Claim 1 is limited to "photosensitive layers", the patent under appeal concerns quite generally the lamination of thermoplastic polymers (page 2, lines 29-31, 61 and 62) as does also document B which discloses a structure having at least one thermoplastic coating 19,21 between the two cellulose films 11, 13 which are to be combined. In the method known from document B the vapor condensed in the interface admittedly serves to replace moisture losses in the cellulose films, but it also penetrates necessarily through the thermo-resist coating immediately prior to lamination (document B, column 1, lines 54-60 and column 2, lines 5-12) and thus produces the identical effects as in the patent under appeal. Moreover, document A stressing in column 3, line 23 and column 4, line 3, the necessity of a "uniform" layer of liquid in the interface, would incite a skilled person to make use of the known advantages of a surface layer formation by vapor condensation with regard to an accurate control and variation of the layer thickness (document B, column 1, line 64 to column 2, line 4).

VIII. The above opinion was contested by the Respondent (Patentee), who argued essentially as follows:

- (a) The contact period of the pressure rolls during the lamination step may well be identical in the patent and in the state of the art. However, the problem underlying the present invention is not only to accelerate the lamination speed as such but to shorten the waiting time for the subsequent process step, i.e. the "deswelling"-time necessary for a sufficiently stable adhesion of the laminate.

- (b) This problem is solved, according to the invention, by using a liquid interface which is "aqueous", an aqueous liquid being defined as a liquid containing a major proportion of water. The aqueous character of the liquid avoids swelling and thus softening of the resist, which softening is disclosed to have negative effects in the description, page 3, lines 1-4, and would unduly prolong said waiting time. The aqueous liquid in the interface only acts as a mechanical laminating aid in form of a lubricant only, providing a form-fit contact and avoiding an entrapment of air. After having played its role as mechanical lubrication the aqueous liquid is quickly removed from the interface. Document E would evidence that water can be absorbed into a high polymer resist without swelling effect, only reducing the "transformation temperature".

- (c) Document B would not incite a skilled person to form an aqueous liquid layer by vapor condensation in the lamination method known from document A, because in the method of document B the water layer is only used for remoistening the cellulose film. No positive

contribution of the water layer to the laminating procedure as such can be derived from document B.

- (d) In order to exclude the implication that the photosensitive gelatine layer described in document C is embraced by the term "photosensitive layer" in Claim 1 of the main request, Claim 1 of the auxiliary request is directed to a "photosensitive film resist layer," which is disclosed in the description, page 3, line 47.

IX. The Appellant "Hoechst AG" commented upon the Respondent's arguments stating the following:

- (a) The process claimed in Claim 1 of the patent under appeal comprising "displacing the thin layer of liquid from the substrate surface by absorption into the photosensitive layer", results automatically in a swelling and softening of at least the contacting surface regions of the thermoplastic resist layer. Contrary to the allegation of the Respondent, document E would evidence on page 305, paragraph 3, that the diffusion of a liquid into a high polymer material until equilibrium is regarded as having a "swelling" effect, and on page 306, last paragraph, that the swelling lowers the transformation temperature of the polymer material, which effect is called "softening".
- (b) The patent under appeal, page 3, paragraph 1, only mentions disadvantages of a solvent for the thermoplastic layer, but no negative effects of a non-solvent swelling agent.
- (c) It is furthermore doubtful, whether the choice of an "aqueous" liquid results in shorter waiting times for

all kinds of photosensitive layers, in particular hydrophobic polymer layers having no pores.

- X. ~~The Respondent contradicted the Appellant's view according to point IX-c above in that hydrophobic layers may be impermeable for water in liquid form but not for water in form of vapor. An instantaneous displacement of the aqueous liquid is moreover disclosed in the patent under appeal, page 2, line 51 and page 3, line 1.~~

Reasons for the Decision

1. The appeal is admissible.
2. Novelty - Main Request
- 2.1 Document A discloses in the wording of Claim 1 of the main request:

"In a process for laminating a supported (see document A, 14 and 16 in Figure 2) photosensitive layer (15) to a substrate surface (3) by means of pressure (11, 12; column 5, lines 9-13), the improvement comprising the sequential steps of: (a) forming a thin layer of liquid (7 in Figure 2) on the substrate immediately prior to lamination (see wick 9 in Figure 1), which layer forms an interface between the substrate surface and the photosensitive layer upon lamination (Figure 2); and (b) displacing the thin (column 3, lines 57-59) layer of liquid from the substrate surface by absorption into the photosensitive layer during lamination (column 5, lines 55-62)."

Thus, the subject-matter of Claim 1 differs from the process according to document A in that:

- (a) the thin layer of liquid on the substrate is "aqueous", and that
- (b) said thin layer of aqueous liquid is formed "by contacting the surface at a temperature below the condensation point of the liquid with a vapor derived from the liquid."

In the process according to document A exclusively resist-solvents are used in the interface, i.e. for resists with non-aqueous development not aqueous but organic liquids. Furthermore, the known thin liquid layer in the interface is formed by wicking means, roller coating, spraying, dipping or the like; see column 5, lines 3-8.

2.2 The laminating process known from document B concerns no photosensitive layers but two hydrophilic cellulosic sheet materials which are combined with each other by means of at least one thermoplastic coating between them (see column 1, paragraphs 1 and 2). In the laminating process according to document C, a gelatine layer is laminated onto a grained metal surface, wherein the aqueous liquid in the interface is not provided in form of a vapor condensed thin film but filled into the V-shaped space (20) between layer (12) and substrate (10) prior to lamination (see Figure 1) and the finished plate is sensitised only in a separate step (see page 2, lines 49-52). The lamination process known from document D uses no liquid layer at all in the interface for the lamination step. Only after lamination an aqueous liquid is applied onto the outer surface of the laminated photoresist film as a softening agent for the subsequent self-trimming of the resist along the edges of the substrate. Document E

generally describes the swelling mechanisms in polymer material without any reference to lamination techniques.

2.3 The remaining documents on file do not come closer to the subject-matter of Claim 1.

2.4 For the above reasons, the subject-matter of Claim 1 of the main request is considered to be novel within the meaning of Article 54 EPC.

3. Inventive step - Main Request

3.1 Starting from the nearest prior art as disclosed in document A, the objective problem underlying the present invention as claimed in Claim 1, is to provide a process which results in a more precise and uniform laminated layer with very good adhesion, so that it is in particular suited for printed circuits with very high line density; see the patent under appeal, page 2, lines 24-26 and 48.

The aim referred to by the Respondent in point VIII-a, i.e. a shortening of the waiting time for resolidification of the softened resist before a subsequent process step, cannot be used for the definition of the objective problem, because it does not have its origin in the feature distinguishing the independent claim under consideration from its nearest prior art (in analogy to decision T 197/86, OJ EPO 1989, 371). The Board is not able to follow the Respondent's argument in point VIII-b above, that the mentioned shortening of the waiting time does result from the use of an "aqueous" liquid, having the effect of avoiding a softening of the photosensitive layer during the lamination step, for the following reasons:

The subject-matter of Claim 1 includes quite generally all photosensitive layers, i.e. water-soluble layers, which are processed in an aqueous developer, as well as water-insoluble layers, which are processed in an organic developer. Thus, for the first type of photosensitive layers the claimed "aqueous" liquid in the interface is a solvent, which even in the patent under appeal, page 3, lines 1-4, is explicitly stated to produce a softening of the photosensitive layer during lamination.

Contrary to the Respondent's corresponding view in point VIII-b above, the fact that said text of the patent under appeal on page 3, lines 1-4, only refers to solvents as having a disadvantageous softening effect cannot be interpreted in the sense that swelling and consequently softening can be avoided by the use of a laminating agent, which is not a solvent. Having regard to water-insoluble photosensitive layers, the Board is convinced that document E correctly describes the physical effects arising from the absorption of liquids in polymer material. Thus, document E is held to evidence that any actual diffusion of an aqueous liquid into the micro-pores of also a water-insoluble photosensitive film automatically swells and therefore softens to a certain extent the absorbing material.

3.2 Due to the fact that a skilled person will find out in practice that the resulting precision and uniformity of the laminated photosensitive layer is insufficient for his particular needs and purposes - in particular for printed circuit with very high line density - no positive contribution to inventive step can be seen in formulating the technical problem.

This problem is solved by the distinguishing features (a) and (b) mentioned in point 2.1 above, i.e. by using a

liquid layer in the interface, which is "aqueous" and by forming this layer via vapor condensation.

- 3.3 Having regard to distinguishing feature (a), in the process known from document A, the "liquid" in the interface between the substrate and the photosensitive layer is well known to serve as a mechanical laminating aid which lubricates the substrate surface (column 5, lines 52-55) and avoids trapped air pockets (column 3, line 54), and also to produce a softening effect (column 5, line 56). An "aqueous" liquid is known to be a softening agent for a photosensitive layer from document D, column 4, lines 57-64. In this particular embodiment a solution of polyvinyl alcohol in water is applied to the surface of the laminated photosensitive layer after removal of a coversheet. The polyvinyl alcohol forms a non-tacky layer on top of the photosensitive layer and the water serves as a softening agent for the photo-sensitive layer in order to prepare it for a self-trimming step (column 4, lines 50-53).

The Board considers that a skilled person would be able, on the one hand, to ascribe the mechanical effects of a laminating aid to its liquid state and, on the other hand, to recognise that the softening effect is inherent to the aqueous character of the liquid itself and not dependent on the particular site of its application. Thus, a skilled person would know that an aqueous liquid does not only soften a photosensitive layer when applied on top of it for a subsequent self-trimming step, but also when applied as an interface layer during the lamination step itself. In particular, in view of the objective problem of the patent under appeal to produce a very good adhesion of the laminated layer, the Board holds that a skilled person will decide to retain the advantages of a softened surface portion as indicated in document A, column 5, lines 55-62.

For these reasons, the Board takes the view that the use in particular of the known softening properties of an "aqueous" liquid in a photosensitive layer - as disclosed in document D - in the method known from document A represents a mere analogous use of known properties of a known substance, which use is not regarded as being inventive.

- 3.4 Thus, it remains to be discussed, whether distinguishing feature (b) implies an inventive step. With a view to obtaining a precisely and homogeneously laminated layer, a skilled person will be aware of the necessity to keep the frictional resistance in the interface between substrate and layer as constant as possible all over the area to be laminated and also the compressibility of the softened surface region of the photosensitive layer with regard to the laminating pressure. It is regarded to belong to a skilled person's basic professional knowledge that the local value of said frictional resistance and the local value of said compressibility depend mainly on the quantity of liquid which is present at a particular point of the interface. Thus, it is obvious to a skilled person that in order to ameliorate the precision and homogeneity of the laminate on the substrate, the uniformity of the thickness of the liquid layer in the interface has to be improved; see also document A, column 3, line 23 and column 4, line 3. Looking for a formation method which results in a more reproducible liquid layer thickness than wicking, roller coating, spraying or dipping (such as mentioned in document A, column 5, paragraph 2), a skilled person will be taught by document B, column 1, line 65, to column 2, line 4, that a layer formation by vapor condensation allows to vary and accurately control the thickness of the condensed layer. For these reasons, it is regarded as obvious to make use of the known advantages of the vapor condensation according to document B also in the

lamination process known from document A. Thus, a skilled person arrives at distinguishing feature (b) by simply using a known technique in a closely analogous situation, which use is regarded as not implying an inventive step.

In the above analogous use exclusively the deposition process as such forms the applied technical means. The subsequent diverging technical purpose of the deposited layer in document B (replacing a loss of moisture in a cellulose film) does not influence the deposition process as such and does therefore - contrary to the Respondent's view in point VIII-c above - not impair the obviousness of the applied measure.

3.5 With regard to the Respondent's arguments in points VIII-b and X above, the Board, in addition, draws attention to the following facts: If having regard to the state of the art it would already have been obvious for a person skilled in the art to arrive at something falling within the terms of a claim, because an advantageous effect could be expected to result from the combination of the teachings of the prior art documents, such claim lacks inventive step, irrespective of the circumstance that an extra effect (possibly unforeseen) is obtained; see the decision T 21/81, OJ EPO 1983, 15, point 6.

Hence, an obvious way for arriving from the state of the art at the invention being shown in points 3.2 and 3.3 above, also a clearly demonstrated shortening of the resolidification time, would not have resulted in an inventive step of the subject-matter of Claim 1, even in the event that it was surprising.

Moreover, the advantage of being able to form an extremely thin liquid layer, which advantage may be regarded as implicit in the use of vapor condensation for forming a

liquid layer, results in being able to soften only the very surface portion of the laminate. This measure, however, is already known from document A, column 5, lines 55-62. It is also known from this text to solidify the softened surface region by diffusing the absorbed liquid out of the surface portion into the interior parts of the laminate.

The Respondent argues in point X above, that the use of an aqueous liquid accelerates the above-mentioned diffusion and thus shortens the waiting time also in the case where the photosensitive layer is hydrophobic. For the hydrophobic layers are permeable to water in the form of vapor. The Board regards this argument as not pertinent. Claim 1 comprises no means for an instantaneous transformation of the liquid into vapor right after the laminating contact to the substrate. (The Board saw no point in drawing the Respondent's attention to this fact before deciding on the case, because it is known from document A, column 5, line 66 to heat the laminate in order to speed said diffusion from the surface region into the interior parts of the laminate.)

- 3.6 For the reasons indicated in detail in points 3.1 to 3.5 above, the subject-matter of Claim 1 according to the main request is held to be a simultaneous analogous use of the known properties of a known substance on the one hand and of a known layer formation technique on the other hand, the combined use of which results only in foreseeable effects. Therefore, Claim 1 is considered to lack an inventive step within the meaning of Article 56 EPC. The same is valid for Claims 2 to 11 because of their dependency on Claim 1.

4. **Auxiliary Request**

The identical reasons set out in points 3.1 to 3.6 above also apply to a photosensitive layer which is limited to a "resist film". Thus, also the subject-matter of Claim 1 in its version according to the Respondent's auxiliary request does not involve an inventive step. Claims 2-11 of the auxiliary request which are identical with those of the main request, cannot be maintained because of their dependence on Claim 1.

5. Thus, the claims of the Respondent's main and auxiliary request do not meet the requirements of Article 52(1) EPC and for this reason cannot form the basis of a patent maintained in amended form according to Article 102(3) EPC.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

M. Beer

H. Reich