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D E C I S I O N
of 7 December 2000

Case Number: T 0550/98 - 3.3.3

Application Number: 90119934.9

Publication Number: 0425900

IPC: C08J 7/06

Language of the proceedings: EN

Title of invention:

Molded synthetic resin articles having thin metal film and
production process thereof

Patentee:

YKK CORPORATION

Opponent:

Opti Patent,- Forschungs - und Fabrikations- AG

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - *ex post facto* analysis"

Decisions cited:

G 0010/01, G 0007/95

Catchword:

-



Case Number: T 0550/98 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 7 December 2000

Appellant: Opti Patent,- Forschungs- und Fabrikations- AG
(Opponent) CH-8750 Riedern-Allmeind (CH)

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Respondent: YKK CORPORATION
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 30 April 1998
rejecting the opposition filed against European
patent No. 0 425 900 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: A. Däweritz
V. Di Cerbo

Summary of Facts and Submissions

- I. The grant of European patent No. 0 425 900 in respect of European patent application No. 90 119 934.9 filed on 17 October 1990 and claiming priority of 17 October 1989 of an earlier application in Japan (268204/89), was announced on 24 January 1996 (Bulletin 1996/04) on the basis of 9 claims.

Independent Claims 1 and 7 as granted read as follows:

"1. A molded synthetic resin body (1) having a thin coating on a surface thereof, said thin coating comprising an undercoat layer (3), an outer vapor-deposited metal layer (4) formed by vapor-phase deposition and a transparent or translucent topcoat layer (5), all said layers being successively provided on said surface of said body (1) in the order set out above; *characterized by* an inner vapor-deposited metal layer (2) formed by vapor-phase deposition between said body (1) and said undercoat (3)."

"7. A process for the production of a molded synthetic resin body (1) having a thin coating on a surface thereof which comprises:

forming an inner vapor-deposited metal layer (2) of a desired metallic material on said surface of said body by vapor-phase deposition;

applying on a surface of said inner vapor-deposited metal layer (2) an undercoating formulation having an adhesive force to said inner vapor-deposited metal layer (2), whereby an

undercoat layer (3) is formed;

forming an outer vapor-deposited metal layer (4) of a deposited metallic material on a surface of said undercoat layer (3) by vapor-phase deposition; and

applying on a surface of said outer vapor-deposited metal layer (4) a transparent or translucent topcoating formulation having an adhesive force to said second vapor-deposited metal layer (4), whereby a topcoat layer (5) is formed."

Claims 2 to 6 related to preferred embodiments of the synthetic resin body according to Claim 1. Preferred embodiments of the process according to Claim 7 were defined in Claims 8 and 9.

II. On 15 October 1996, a Notice of Opposition was filed in which revocation of the patent in its entirety was requested on the grounds of Article 100(a) EPC.

The opposition was substantiated exclusively with respect to an objection of lack of inventive step within the meaning of Article 56 EPC on the basis of the following documents:

D1: US-A-4 268 570 and

D2: GB-A-2 210 899.

After the expiry of the opposition period, another document was cited which was, however, admitted into the proceedings:

D3: GB-1 190 480.

III. By decision issued in writing on 30 April 1998, the Opposition Division rejected the opposition.

- (i) In substance, the Opposition Division took the view that the subject-matter of the patent in suit aimed at a moulded synthetic resin article having a thin metal film formed on its surface, which has a good adhesion and at the same time provides surface gloss inherent to metal. This aim was achieved by a coating having four successive layers formed on a surface of the substrate: a first vapour-deposited metal layer, an undercoat layer, a second vapour-deposited metal layer and a topcoat layer. The Opposition Division held that the experimental data in the patent in suit demonstrated in Table 1 that good adhesion and surface gloss were achieved when all these layers were present in comparison to structures wherein the inner metal layer alone or the inner metal and the undercoat layers had been omitted.

- (ii) The Opposition Division pointed out that D1 disclosed four different embodiments of metal coating, ranging from a single metal layer to a sequence of three, i.e. adhesive, metal and topcoat, layers. This latter embodiment formed the basis of the preamble of Claim 1 of the patent in suit. The Opposition Division did not accept the Opponent's argument that D1 dealing with the same problem as the patent in suit gave an incentive to apply a metal layer between the body and the adhesive layer.

Whilst D1 taught that a good adhesion of the metal layer strongly depended on the specific polymer to which it was bonded, the invention taught that the adhesion problem was overcome by a specific sequence of different layers. Hence it was not obvious to apply an additional metal layer between the substrate and the adhesive layer in the fourth embodiment of D1.

- (iii) D2 referred to an entirely different problem, i.e. to the reduction of gas permeability. It did not relate to the improvement of adhesion in combination with surface gloss.
- (iv) D3 concerned metallised films having varying iridescent appearance due to a more or less irregular reflection of light. This effect was due to the presence of two metal layers and an intermediate transparent varnish layer, the thickness of which served to empirically control the iridescent shades.
- (v) Consequently, the Opposition Division concluded that none of these documents alone nor any combination thereof rendered the claimed subject-matter obvious, and an inventive step was acknowledged.

IV. On 30 May 1998, a Notice of Appeal was lodged by the Appellant (Opponent) against this decision with simultaneous payment of the prescribed fee.

In the Statement of Grounds of Appeal, received on 26 June 1998, as well as in later submissions which were received on 3 February 1999, 7 August 1999 and

22 January 2000, respectively, the Appellant maintained its previous arguments and raised new objections. In substance, it argued essentially as follows:

- (i) The materials of the undercoat and topcoat layers in product Claim 1 were not defined. Hence, the teaching of Claim 1 was incomplete, because it was unlikely that any materials could be used for these layers.
- (ii) The claimed subject-matter did not involve an inventive step because it was self-evident to the skilled person that delamination and poor metal gloss were to be reduced as far as possible, as otherwise the products would not be useful. Although dealing with specific problems, both D2 and D3 disclosed a metal layer between substrate and undercoat layer. In view of these facts the skilled person would contemplate "entsprechende Übertragungen" (corresponding transfers).
- (iii) Additionally, a novelty objection was raised by the Appellant in the Statement of Grounds of Appeal for the first time. It was based on

D4: US-A-3 170 833, in particular, Figure III.

V. In its counterstatements, received on 13 January 1999, 8 July 1999, 13 December 1999 and 29 May 2000, the Respondent (Proprietor) supported the findings of the decision under appeal and rebutted the statements of the Appellant substantially as follows:

- (i) The problem underlying the patent in suit was the provision of a moulded synthetic resin article

with a thin metal film formed on the surface thereof and having at the same time a good adhesion thereto, an excellent metallic gloss surface free of irregular reflections of light and excellent abrasion resistance. These advantages were to be achieved even if the moulded resin base had a roughness of 0.1 μm or more.

- (ii) The necessity of all four layers in the structure was clear from the test results of the comparative examples as considered already during the opposition procedure. The first metal layer was necessary for a good adhesion of the thin coating to the body, the undercoat layer was required to absorb the surface roughness of the base body and to provide a flat surface on which the second metal layer could provide the desired metallic gloss and high durability against abrasion which was achieved by the protective topcoat layer.
- (iii) D1 did not teach a surface coating composed of the said four layers, but it required a specific polymer substrate which was coated with a single metal layer bonded thereto. Although this layer could be bonded directly to the substrate, an intermediate adhesive layer for adequate adhesion was recommended. A further top coating was only optional as well.
- (iv) Amended claims which had been submitted on 13 January 1999 were replaced by a new main request and an auxiliary request on 8 July 1999.

In the main request, the first line of each of Claims 1 and 7 has been amended after "molded synthetic resin body (1) having" by inserting "a roughness of 0.1 μm or greater and being covered by ...".

In the auxiliary request, Claims 1 and 7 were amended in the same way. Additionally, the first part of Claim 4 was incorporated in Claim 1, which resulted in a rewording of Claim 4 as well.

VI. Oral proceedings, which were requested by both parties as auxiliary motions, were held on 7 December 2000.

(i) The oral submissions of the Appellant with respect to the main request were essentially as follows:

1. The objection of lack of novelty based on D4 would not be pursued any further. No further arguments would be based on that document either.
2. With respect to lack of inventive step, the Appellant disputed the reasons in the decision under appeal.
 - a. D1, which it considered to be the closest prior art, dealt with the metal-coating of moulded plastic shaped articles. As Claim 1 of the patent in suit was silent with respect to the chemical composition of the polymer, the reasons in the decision under appeal, which were based on the specific polymer

composition recommended in D1, were fallacious. The findings in D1 that different polymers had different adhesion properties to a given metal were also valid for the patent in suit.

Moreover, D1 described the use of a substrate prepared by e.g. injection moulding (column 5, lines 5 to 9) which therefore met the roughness requirement in Claim 1, in agreement with page 2, lines 19 to 21 of the patent in suit.

- b. As regards the facts that the adhesive layer between the substrate and the metal layer was only optional in D1 (column 5, lines 33 to 34) and that the substrate was coated with a metal layer by conventional methods in D1 (D1: sputtering or vacuum metallising, column 5, lines 24 to 25) and in the patent in suit (vapour-deposition), only the chemical composition of the polymer and the metal could be involved in and decisive for the adhesion of the metal to the substrate.
- c. Consequently, it was evident that the first aspect of the technical problem underlying the patent in suit to provide a good adhesion between substrate and metal layer, which were not necessarily different from the corresponding components in D1, had already been solved. Moreover, an increased

resistance against abrasion of the metal layer by a top coating layer (column 2, lines 18 to 19) had also been reached in D1.

- d. It followed that the only problem still to be solved vis-à-vis D1 was to obtain good metal gloss.
- e. This problem was addressed in D3. It was solved by applying a metal layer directly to a polymer body (page 2, lines 43 to 44) by gas phase deposition (page 1, lines 63 *et seq.*), coating this layer subsequently by a varnish layer and a further metal layer. This process resulted in a metallised appearance which was neither masked nor reduced (page 1, lines 77 to 79).
- f. Therefore, reading D1 and D3 together automatically led to the solution claimed in the patent in suit.

- (ii) The Respondent referred to its arguments already presented in writing and stressed that neither the problem underlying the invention nor the solution found should be considered piecemeal. The invention related to a combination of features requiring a sequence of four definite layers on a polymer substrate which was neither disclosed nor foreshadowed in the cited prior art. The Appellant's arguments showed only what could have been done by a skilled

person, but not that it would have done so.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed and the patent be maintained on the basis of the main request as filed on 8 July 1999.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Amendment*

The Board is satisfied that the new feature in both independent claims, meets the requirements of Article 123(2) and (3) EPC. The basis for the amendment can be found on page 2, lines 19 to 24 in connection with page 2, line 45 of the patent specification (*page 2, lines 11 to 23 and page 3, lines 15 to 17 of the original filed application*), and it further limits the scope of the claims.

This amendment is not objectionable under Article 84 EPC either, since it ensures a better correspondence between the claims and the description, which stresses the criticality of surface roughness for the general properties of such structures.

3. *Procedural matter*

- 3.1 The allegation of incompleteness of Claim 1, in the sense that other features alleged essential for a proper definition of the moulded bodies would be missing, raises the issue of support (Article 84 EPC) which is not a ground for opposition according to Article 100 EPC. Therefore the Board does not have the competence under Articles 101, 110 and 111 EPC to consider this question.
- 3.2 The novelty objection raised in the Statement of Grounds of Appeal for the first time was not further pursued in the oral proceedings. In view of Decisions G 10/91 and G 7/95 of the Enlarged Board (OJ EPO 1993, 420 and 1996, 626, respectively) and due to the fact that the Respondent has not given its consent, the Board has no discretion to consider this fresh ground for opposition.
- 3.3 D4 cited to support this novelty objection was not relied upon further by the Appellant in presenting its case during the oral proceedings and, in fact, it is not relevant to this decision, as will become apparent herein after. Since the Respondent has not objected to its late submission and has submitted arguments dealing with the citation in substance, it was not necessary for the Board to decide on the admissibility of D4.

4. *Problem and solution*

- 4.1 The patent in suit concerns moulded synthetic resin articles having a thin metal film and the process for preparing such an article.
- 4.2 Such a product and the process for its preparation are known from D1 which the Board, like the parties and the

Opposition Division, regards as representing the closest state of the art.

- 4.2.1 The citation describes plastic moulded articles coated with a metal layer which can keep their beautiful appearance for a long period of time without peeling off of the metallic coating layer and hence are excellent as a substitute of a metallic product. In addition to their appearance like a metallic product they have other properties similar or greater than conventional metallic products (column 1, lines 4 to 11, 15, 45 to 50, 54 to 57).
- 4.2.2 These properties are achieved by coating a substrate which comprises a mixture of 95 to 20% by weight of a specific polyester block copolymer and 5 to 80% by weight of a specific acrylic monomer/butadiene/styrene copolymer with either
- (a) a metallic layer (Claims 1 to 8; column 8, lines 53/54; Example 2, one embodiment of Sheet E) or
 - (b) a metallic layer bonded to the substrate via an adhesive layer (Claims 9 to 11; column 5, lines 34/35; Example 4) or
 - (c) a metallic layer and a topcoat layer (Claim 12 and 13; column 5, lines 31 to 34; column 6, lines 10 to 15; column 8, lines 42 to 52; Example 2, the other embodiment of sheet E) or
 - (d) an adhesive layer followed by a metal layer and a topcoat layer (column 5, lines 31 to 35; column 6, lines 10 to 14; Examples 1 and 3). This

embodiment forms the basis for the wording of preamble of Claim 1 under consideration.

- 4.2.3 In the examples, samples were subjected to flexural ("flexal"), scratch, tensile strength, elongation and Vicat softening tests.
- 4.2.4 In the patent in suit, Comparative Examples 1 and 2 were carried out, the results of which are shown in Table 1 (page 5). They differ from the above embodiments (c) and (d) of D1 only by the chemical composition of the substrate, so that they provide a meaningful comparison to the claimed body.
- 4.3 In the light of the results of these comparative tests and in line with the introductory statements in the patent specification, the technical problem underlying the patent in suit may thus be seen in the provision of a product which shows at the same time good adhesion, high abrasion resistance and gloss properties under forced and service conditions, e.g. as a buckle assembly or as a slide fastener.
- 4.4 According to the patent in suit, this problem is solved by a moulded synthetic resin body which is coated by the following sequence of four mandatory layers: vapour-deposited metal, undercoat, vapour-deposited metal and topcoat layers.

As demonstrated by the results in Table 1, the sample according to Claim 1 (Example) does not show any deficiencies in the separation and surface gloss properties in service tests, in contrast to those of the Comparative Examples which are unsatisfactory in one of these properties (page 5, lines 6 to 8, 13 to 18

and 37 to 39).

There is no evidence that the problem would not be solved within the whole range of Claim 1.

4.5 Consequently, there can be no doubts that all the aspects of the above defined technical problem are effectively solved by the moulded synthetic resin body as defined in Claim 1.

5. *Obviousness*

It remains to be decided whether this solution was obvious to a person skilled in the art having regard to the state of the art relied upon by the Appellant.

5.1 D1 by itself does not provide any incentive to solve the above technical problem by a moulded synthetic resin body covered by four layers in a specific sequence for the following reasons:

5.1.1 D1 does not mention any differences in surface quality (gloss) of the final products according to the four embodiments mentioned under point 4.2.2, regardless of the conventional moulding processes that can be used (column 5, lines 5 to 9). The surface deficiencies occurring under specific circumstances in this type of metallised shaped articles are addressed in the patent in suit for the first time.

5.1.2 In order to obtain the desired final products, D1 teaches to coat any substrate having the specific chemical composition mentioned above with a *single* metal layer of 0.01 to 5 μm . Optionally, an adhesive layer of 5 to 50 μm (between the substrate and the

metal layer) and/or, preferably, a topcoat layer of 5 to 50 μm may be applied as well (column 5, line 24 and column 6, lines 3/4 and 42/43). The dangers of inferior bending properties and breakage, if the metal layer is too thick, are mentioned and a thickness of the metal layer of 0.01 to 2 μm is therefore preferred.

- 5.1.3 In the examples of D1, the properties of the above embodiments (c) and (d) (see point 4.2.2) are shown. In the scratch test (side length of each of the 100 squares = 2 mm, compared to the stricter conditions in the "forced test" of only 1 mm in the patent in suit; D1: column 8, lines 1 to 8; patent in suit: page 5, lines 5 to 8), the samples according to embodiment (d) (Examples 1, 3 and 4) show better adhesion values than those in Example 2 which correspond to embodiment (c) (without an adhesive layer).

These results clearly support the statement in D1 (column 5, lines 33/34) that "it is preferable to apply an adhesive coating before the metallic coating".

It is worth noting that in D4 (Example 1) it is also recommended to bond a metal layer to a substrate by means of an adhesive layer rather than metallising the substrate directly by vapour deposition (D4: column 10, lines 15 to 22 and 33 to 38).

Irrespective of the presence of an adhesive layer, the results in the examples are unsatisfactory to insufficient when a given block copolymer according to Claim 1 of D1 is used alone or in admixture with a copolymer outside the definitions in that claim (see Tables 1, 2 and 3, samples C, F, J, L and M). No measurements relating to gloss are given in any one of

the examples.

- 5.1.4 It follows that the skilled person reading D1 does neither become aware of different degrees of gloss in dependency on the surface quality of the substrate nor derives any incentive to use two metal layers instead of one, to bond one of these layers directly to the substrate, and to apply an undercoat layer between these two metal layers to ensure that the outer metal layer is coated onto a flat underground to avoid irregular light reflection (patent in suit: page 3, lines 28 to 32). Instead, D1 clearly teaches away from directly coating its single metal layer onto the substrate without an intermediate adhesive layer.
- 5.2 D2 does not contemplate the above technical problem at all, but is related solely to the question of reducing gas permeability of plastic packaging films for materials sensitive to oxygen and/or water vapour (e.g. in food and pharmaceutical industry). It is therefore irrelevant to the issue under consideration.
- 5.3 D3 relates to a process for making iridescent metallised films and filaments.
- 5.3.1 Whilst it had been known to metallise films or strips of various plastics materials and then to varnish the metallised face, the value of such a process was limited by the fact that the films and filaments thus obtained showed a uniform metallised effect, devoid of variation (page 1, lines 10 to 20). For that purpose, it had been known to apply coloured prints producing various effect on the varnished face of the metallised film. These prints were however based on either opaque or only partially transparent inks, so that the

metallised face was masked and the greater part of the aesthetic effect produced by the metallisation was removed.

- 5.3.2 In order to achieve the desired effect of varying iridescent appearance, a first thin metallic layer is deposited on a flexible support, then a layer of a transparent varnish is applied thereto. Finally a second metal layer is deposited on this varnish layer. This outer metal layer is as thin as possible and in each case thinner than the first metal layer and is practically transparent to normally incident light rays, while reflecting light inclined at a large angle to the normal (page 1, lines 33 to 44; Claim 1). As a further variation, it is possible to have a locally interrupted metallised surface layer (page 1, lines 59 to 61) or to vary the average thickness of the varnish layer (page 2, lines 3 to 17).

Such a coating makes it possible to avoid the above mentioned disadvantages due to opaque or only partially transparent inks previously used, so that the metallised appearance is no longer masked or reduced.

- 5.3.3 In the examples, biaxially stretched films were used. Such a treatment yields films having reduced surface roughness (see patent in suit: page 2, lines 15/16).
- 5.3.4 In this document, none of the aspects of the technical problem, neither the high adhesion of the coating to the substrate nor its abrasion resistance nor the high metallic gloss despite a surface roughness of the substrate equal to or exceeding 0.1 μm , is considered. Hence, this document does not give any incentive to modify the teaching of D1 either in order to solve

these aspects of the technical problem underlying the patent in suit.

5.4 D4 relates to an adhesive composition which is to reduce the metal losses and delamination in the further chemical processing of laminates of polyester films with a metal layer sandwiched adhesively between the said films (column 1, lines 10 to 64). It does not deal with all the aspects of the technical problem underlying the patent in suit but - as mentioned under point 5.1.3 - it rather deters the skilled person from using polyester films one surface of which is directly metallised instead of bonding the metal layer by means of the claimed adhesive to the polyester films.

5.5 The Board concurs with the Respondent's argument that the required properties and the features necessary to achieve them cannot be considered separately. Any modification of the system may have an unpredictable positive or negative influence on each of the different aspects of the technical problem.

Therefore, the Board comes to the conclusion that the suggestion of the Appellant to combine the teachings of D1 and D3 could only be based on the knowledge of the patent in suit. Apart from this fundamental deficiency of the inventive step objection, there was no incentive to consider only specific features and teachings from each document and to disregard all the others in order to solve the present technical problem and, thereby, to arrive at something within the definitions of Claim 1.

- 5.6 It follows that the moulded synthetic resin bodies according to Claim 1 would not be obvious to a person skilled in the art having regard to the documents relied upon by the Appellant, whether considered in isolation or in combination and, therefore, involve an inventive step.
6. The above arguments also apply to the process according to Claim 7 which is based on the same combination of features and, hence, also involves an inventive step.
7. Claims 2 to 6 as well as Claims 8 and 9, which relate to preferred embodiments of the articles according to Claim 1 and the process according to Claim 7, respectively, are supported by the patentability of the independent claims and thus also allowable.

Auxiliary request

8. Since the main request of the Respondent was successful it is not necessary to consider the auxiliary request in further detail.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the main request filed on 8 July 1999 and the description yet to be adapted.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin