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D E C I S I O N
of 25 January 1994

Case Number: T 0091/91 - 3.3.2

Application Number: 82305351.7

Publication Number: 0076709

IPC: B32B 17/10

Language of the proceedings: EN

Title of invention:
Sandwich glass

Patentee:
Bridgestone Tire Company Limited

Opponent:
Hüls Troisdorf Aktiengesellschaft

Headword:
Sandwich Glass/BRIDGESTONE

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (yes)"
"Non-obvious modifications"

Decisions cited:
-

Catchword:
-

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Case Number: T 0091/91 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 25 January 1994

Appellant: (Proprietor of the patent)
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Respondent: (Opponent)
Hüls Troisdorf Aktiengesellschaft
Abt.: Patente/Lizenzen
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Representative:
-

Decision under appeal:
Decision of the Opposition Division of the European Patent Office dated 25 October 1990 and posted on 26 November 1990 revoking European patent No. 0 076 709 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P.A.M. Lançon
Members: I.A. Holliday
S.C. Perryman

Summary of Facts and Submissions

I. European patent No. 0 076 709 concerning sandwich glass was granted on the basis of ten claims contained in European patent application No. 82 305 351.7.

II. Opposition was filed against the granted patent by the Respondent citing, *inter alia*, the following documents:

(1) DE-A-2 650 118,
(7) Bartl and Peter, Kautschuk und Gummi (1961), 2, pp. WT 23 to 32,
(8) Annual Report Springborn Labs. Inc. for Jet Propulsion Laboratory, June 1979, "Investigation methods, material properties and processes for solar cell encapsulants".

III. The Opposition Division revoked the patent on the grounds of lack of inventive step. In the opinion of the Opposition Division the closest prior art was document (1) which discloses a sandwich glass which differs from that of the patent in suit insofar as the EVA intermediate layer does not comprise a curing assistant. It was known from the prior art, e.g. document (7) that ethylene/vinyl acetate copolymer (EVA) having a VA content of 35-40% was transparent and clear but lacked adequate tensile strength. Document (8) reported that cross-linked EVA had high transparency. In the light of the above, the Opposition Division took the view that it would have been obvious to add a curing assistant to EVA compositions used in the sandwich layer according to (1).

The Opposition Division was also not convinced that the haze values quoted in the declaration of Mr. Tanuma, filed in response to the opposition, were evidence of improved transparency over the prior art.

IV. The Appellant lodged an appeal against the decision of the Opposition Division. Oral proceedings took place on 25 January 1994.

The arguments of the Appellant, both in the written procedure and at the oral proceedings, may be summarised as follows.

The sandwich glass known from document (1) would be different from that of the patent in suit. In the process disclosed in (1), the EVA sheet was dipped into a lacquer or varnish containing silicon compound and peroxide which would lead to the curing agents being present only on the surface of the sheet. On the other hand, the sheets according to the patent in suit, in addition to containing the curing assistant, are thoroughly kneaded in order to obtain an even distribution of the curing agents.

It was also demonstrated in the Tanuma declaration, filed in the opposition proceedings, that, even when the sheets were kneaded, a better cure (as indicated by torque values) was obtained when a curing assistant was present.

A further declaration by Mr. Tanuma was filed with the statement of appeal and at a later stage by another of the inventors, Dr. Naito. Both sought to demonstrate that the haze values obtained for the sandwich glass of the patent in suit were indeed superior to those of the prior art. At the oral proceedings, the inventors gave a

visual display to show that the haze values of products of the patent in suit were superior to products prepared according to document (1).

The Appellant originally requested maintenance of the patent in suit on the basis of the claims revoked by the Opposition Division. At the oral proceedings, however, the request was restricted to claims designated "Amended Auxiliary Claims C" filed with the letter dated 20 December 1993.

V. Both during the written procedure and at the oral proceedings, the Respondent argued essentially as follows.

It was argued that the final addition to the claim relating to kneading and uniform distribution of the peroxide was not supported by the original disclosure and accordingly offended Article 123(2) EPC. The Respondent also argued that the reference "to be used in windscreens for automobiles or in windows for buildings" was no effective limitation.

The Respondent questioned whether document (1) was in fact restricted to dipping when introducing the peroxide. Document (1) is a patent of addition to DE-A-2 549 474 (1a) and the Respondent argued that the subject-matter of the parent patent is also incorporated into that of the patent of addition. Document (1a) which relates to a sandwich glass containing a layer of polyvinyl chloride (PVC) mentions in Claim 10 that a silane is uniformly distributed in the layer. It was accordingly the Respondent's contention that the disclosure of (1) also included sandwich glass in which peroxide and silane were uniformly distributed in the

EVA layer. Although the Respondent had originally argued a lack of novelty *vis-à-vis* (1), at the oral proceedings the arguments were confined to lack of inventive step.

The Respondent argued that document (8) indicated clearly that improved transparency was obtainable with cross-linking of EVA. Furthermore, it was apparent from document (7) that curing assistants of the type used in the patent in suit, e.g. triallyl cyanurate, had long been known in curing EVA. Thus, although the Respondent did not contest the results obtained in the patent in suit and in the Tanuma and Naito declarations, it was argued that the steps taken to improve the optical and mechanical properties of the products known from document (1) were obvious in the light of the teachings of (7) and (8) and the results obtained would have been expected.

The Respondent also objected that the amended claim failed to mention a minimum value of peroxide to be used; compositions were thus included which contained very small amounts of peroxide which would exhibit negligible cross-linking.

It was finally argued that Claim 3 of the patent in suit which relates to a light cross-linking in the presence of a photosensitiser was an obvious alternative to the peroxide induced cross-linking specified by Claim 1 and also lacked inventive step.

VI. Claim 1 on which this decision is based reads as follows:

"1. A sandwich glass **to be used in windscreens for automobiles or in windows for buildings**, consisting of glass plates and an intermediate layer interposed therebetween, characterized in that the said

intermediate layer is formed by crosslinking a resin composition comprising a non-hydrolysed ethylene-vinyl acetate copolymer having a vinyl acetate content of **19-40%** by weight and an organic peroxide and an acryloyloxy or methacryloyloxy group-containing compound or an allyl or vinyl-group containing compound as a curing assistant under heating of the said resin composition above the melting point of the copolymer; in that the said organic peroxide is utilized in an amount of not more than 5 parts by weight based on 100 parts by weight of the ethylene-vinyl acetate copolymer; and in that the said resin composition contains not more than 50% by weight of the said curing assistant; **wherein the said resin composition is thoroughly kneaded to uniformly disperse the organic peroxide into the ethylene-vinyl acetate copolymer, and then shaped into a sheet."**

The last additions in comparison with the earlier claim are emphasised by the Board.

Independent Claim 3 has very similar wording but refers to "photocrosslinking" in line 5 and to "a photosensitiser" instead of "an organic peroxide" in line 8.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the set of claims headed "Amended Auxiliary Claims C" filed with the letter dated 20 December 1993.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. The amended Claim 1 is in effect a combination of Claims 1, 3 and 9 as granted together with further restrictions derived from the description.

2.1 In the judgment of the Board, the passage at the end of the claim relating to uniformly dispersing the peroxide, which was objected to by the Respondent, is adequately supported by the original disclosure. When the passage from line 63 on page 3 to line 1 on page 4 of the printed patent (page 9, lines 1 to 8 as originally filed) is read in conjunction with page 3, lines 31 to 34 (page 6, line 24 to page 7 as originally filed), a basis exists for the amendment.

2.2 The reference to the uses of the sandwich glass mentioned under V above has support in the description on page 2, lines 3 to 4 (originally page 1, lines 1 to 3). The Board agrees that this has only a limited effect but it would exclude from the scope of the patent any sandwich glass not having the properties necessary for the specified purposes.

2.3 The reference to a vinyl acetate content of 19-40% by weight is to be found in the description as granted on page 2, lines 54 to 57 (originally page 4, lines 1 to 4). The reference to the curing assistant, its quantity and chemical nature has basis on page 3, lines 35 to 37 of the granted patent (originally page 7, lines 4 to 9). The reference to the maximum amount of peroxide occurs on page 3, lines 8 to 10 (originally page 5, lines 8 to 12).

2.4 Support for the amendments to Claim 3 is also to be found in the passages noted in 2.1 and 2.2 above together with page 2, lines 50 to 54 (originally, page 3, lines 20 to 28) relating to photocrosslinking.

2.5 Since the amendments all find basis in the originally filed documents and the subject-matter now claimed is more restricted in relation to that granted, the requirements of Articles 123(2) and (3) EPC are satisfied.

3. None of the documents cited during the proceedings disclose sandwich glass having all the features set out in Claims 1 and 3 of the patent in suit. Since novelty is no longer in dispute, it is not necessary further to investigate the matter.

4. The patent in suit relates to a sandwich glass consisting of glass plates with an intermediate layer interposed between them which comprises a non-hydrolysed EVA. In the opinion of the Board, the closest prior art is document (1), which also relates to a sandwich glass having an intermediate layer of EVA.

4.1 Examples of EVA employed according to (1) contain 8%, 26% and 45% by weight of VA. The EVA compositions used to form the intermediate layer contain a silane which may have an ethylenically unsaturated group, e.g. vinyltriethoxy-, vinyltrimethoxy-, or γ-methacryloxy-propyltrimethoxy- silane. According to the description on page 6, a free radical generator, such as a peroxide, may also be employed in conjunction with such unsaturated silanes. The preferred method to apply the silane (and the peroxide) to the EVA film is by dipping into a solution, e.g. in toluene (page 9 and Examples 1 to 22). The dipped film is placed between glass plates, air removed by passing between rubber rollers and finally treated in an autoclave, e.g. at 12 bar and 170°C.

4.2 In relation to (1), the problem can be seen as developing a sandwich glass having improved mechanical and optical properties.

4.3 The problem is solved by the sandwich glass in accordance with Claim 1 or Claim 3 of the patent in suit in which the EVA contains, in addition to the peroxide or photosensitiser and silane, a curing assistant and in which the additives are uniformly distributed by kneading. Having regard to the comparative results filed, especially the declarations of Mr. Tanuma and Dr. Naito, the Board is satisfied that the problem has indeed been solved. Having regard to the uncontested remarks of Dr. Naito at the oral proceedings, that longer dipping times would lead to a swelling of the EVA film, the Board is satisfied that the comparisons are fair.

5. It remains to consider whether or not Claims 1 and 3 satisfy the requirements of Article 56 EPC in respect of inventive step.

5.1 The sandwich glass in accordance with the patent in suit differs from that known from (1) in two respects. Firstly the EVA composition contains, in addition to an ethylenically unsaturated silane and a peroxide, a curing assistant containing an acryloyloxy, methacryloyloxy, allyl or vinyl group. Secondly, the resin composition is thoroughly kneaded in order to uniformly distribute the organic peroxide (or photosensitiser) into the EVA copolymer prior to shaping into a sheet.

5.2 Document (1) is wholly silent concerning the presence of curing assistants of the type specified in the patent in suit. It is clear from the comparative experiments on file, especially the Tanuma and Naito declarations, that

ethylenically unsaturated silanes such as γ-methacryloxypropyltrimethoxysilane used according to (1) do not function in the same way as the di- and tri-functional materials, e.g. ethylene glycol dimethacrylate or triallyl isocyanurate, used as curing assistants according to the patent in suit. There is accordingly no hint in (1) that the use of such curing assistants might improve the optical and mechanical properties of the resultant sandwich glass.

5.2.1 The Respondent has argued that having regard to the status of document (1) as a patent of addition to document (1a), there is an incentive in (1) towards kneading the product in order to obtain a uniform distribution of curing agent. The Board cannot accept this argument. Document (1a) is essentially concerned with different subject-matter, i.e. a process for manufacturing sandwich glass using an intermediate layer of a different material, namely plasticised PVC. The object of the process according to (1a) is to improve the adhesion of the plasticised PVC to glass (page 8, lines 6-7, typewritten pagination). Such enhanced adhesion is obtained by inclusion of a silane, including unsaturated silanes of the type used in (1) (e.g. Table III on page 25). Claim 10 of (1a) refers to a process in which the silane is uniformly distributed in the plastics (PVC) layer. Although this claim finds support in the description on page 11, it is to be noted that in the actual worked examples of (1a), the silane is introduced by dipping PVC film into a solution of the silane in analogous manner to (1). Another important difference concerns the fact that there is no suggestion of crosslinking the PVC, e.g. by using a peroxide or photosensitiser as is recommended in document (1) (e.g. at the foot of page 6). Accordingly, document (1) (even when read in conjunction with document (1a)) provides no indication that improved optical and mechanical

properties might be obtained when a curing agent is uniformly distributed by kneading.

5.3 Document (7) is a general review of the properties of EVA. In the summary on page WT 23 and more specifically in the left hand column of page WT 26, reference is made to curing of EVA by means of peroxide vulcanisation in the presence of compounds having a plurality of ethylenically unsaturated groups. A preferred example of such a compound is triallyl cyanurate (TAC). Figures illustrate the improved cure (as determined by shear modulus) when using TAC together with a peroxide, compared with a peroxide cure in the absence of TAC. Admittedly TAC is not one of the preferred materials according to the patent in suit but as the Appellant admitted at the oral proceedings, this compound does fall within the definition of a "curing assistant" in terms of Claim 1 of the patent in suit. At the priority date of the patent in suit, the skilled person would thus have been aware that an improved cure of EVA could have been obtained by using a peroxide in the presence of such a curing assistant. Such a cure could well lead to improved mechanical properties of a sandwich glass employing EVA as the intermediate layer.

5.3.1 What is not clear from the disclosure of (7) is the effect of cross-linking on the optical properties of an EVA film. Accordingly, the skilled man could not have derived from document (7) that the optical as well as the mechanical properties of EVA would have been improved by curing.

5.4 The Respondent has argued that document (8) gives an indication that the optical properties or transparency of EVA are improved by cross-linking and has pointed to various passages therein. Certain passages were also noted in the contested decision of the Opposition

Division. The passages noted on pages 1-1, 2-3, 3-1, 3-2 and 3-14 variously refer to "transparent" or "highly transparent" when describing cross-linked EVA. There is, however, no indication that **improved** transparency is obtained as a result of cross-linking.

5.4.1 Document (8) also appears to teach against the use of curing assistants of the type used in the patent in suit. The passage at the top of page 3-5 indicates that better cures are obtainable by curing with peroxide in the absence of such materials as trimethylolpropane trimethacrylate or triallyl cyanurate.

5.4.2 Accordingly there is nothing in the teachings of document (8) which might have lead one skilled in the art to employ the features set out in Claims 1 and 3 of the patent in suit in the expectation of obtaining a sandwich glass with improved mechanical and optical properties.

5.5 In the contested decision, the Opposition Division expressed doubt concerning the haze values which appeared in the Tanuma declaration received on 20 November 1989 referring in particular to Table 1 which appears on page 2 thereof. When the haze values of Table 1 are read in conjunction with the later declaration of Mr. Tanuma and that of Dr. Naito, it is then clear that, when considered in comparative terms, the values of 0.56 to 0.75 quoted for the compositions d to g according to the invention are indeed a significant improvement on the values 0.94 recorded for samples a and b according to the prior art (no curing assistant). It is also clear that the prior art values are quite poor in comparison with the value 0.4 for conventional transparent glass. The significance of the improvement can be more readily appreciated with the explanations given in the second declaration of Mr. Tanuma and that

of Dr. Naito, especially when considered with the more precise haze values therein given obtained by the use of a colour computer.

5.6 The amounts of peroxide (Claim 1) and photosensitiser (Claim 3) are defined only in terms of an upper limit of 5% by weight based on the EVA copolymer without any minimum being specified. The Respondent has argued that this would include compositions with very low amounts of curing agent which would demonstrate a negligible degree of cross-linking. Such compositions would have properties indistinguishable from those of the prior art and thus show no evidence in favour of inventive step.

5.6.1 It must be borne in mind that Claims 1 and 3 refer to "crosslinking a resin composition". It is accordingly the Board's opinion that the claims must be construed to relate notionally to the minimum amount of peroxide (or photosensitiser) necessary to achieve a degree of cross-linking which improves the optical and mechanical properties of the EVA layer.

5.7 The Respondent himself acknowledges that Claim 3 relates to an alternative method for initiating a free radical polymerisation. The same reasoning as that set out for Claim 1 must therefore apply.

5.8 In the light of the preceding paragraphs, it is apparent that the improved optical as well as physical properties of the sandwich glass according to the patent in suit are not foreshadowed by the cited prior art. An inventive step can thus be recognised.

6. The Board has noted that certain examples are no longer in accordance with the subject-matter currently claimed and that the general description also requires adaption to the new claims. The Board accordingly uses its powers

under Article 111 EPC to remit the case to the first instance with an order to maintain the patent in accordance with the new claims and a description to be adapted.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is referred to the first instance with the order that the patent be maintained on the basis of the set of claims headed Amended Auxiliary Claims C filed with the letter of 20 December 1993 and a description to be adapted.

The Registrar: The Chairman:

P. Martorana P.A.M. Lançon