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D E C I S I O N
of 6 August 2003

Case Number: T 0069/98 - 3.3.7

Application Number: 90302222.6

Publication Number: 0385791

IPC: B32B 17/10

Language of the proceedings: EN

Title of invention:
Production of heated windows

Patentee:
PILKINGTON PLC

Opponent:
SEKURIT SAINT-GOBAIN Deutschland GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (yes) after amendment"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0069/98 **-** 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 6 August 2003

Appellant: (Opponent)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 1 December 1997 concerning maintenance of European patent No. 0385791 in amended form.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: B. L. ter Laan
B. J. M. Struif

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 0 385 791 in respect of European patent application No. 90 302 222.6, filed on 1 March 1990, claiming priority from an earlier application in Great Britain (8904902 of 3 March 1989), was published on 28 December 1994. The patent was granted on the basis of seven claims, claim 1 reading:

"A process for the production of a wire-heated laminated window comprising an array of fine, closely spaced heating wires embedded in a ply of interlayer sandwiched between outer panes, said array extending between and in contact with opposed bus bars, in which process the laminate is subjected to an autoclaving step to adhere the interlayer to the adjacent panes, characterised in that a face of at least one of the bus bars in contact with the heating wires is provided with a surface layer comprising a solder which has a melting point such that on autoclaving of the laminate the solder melts to provide good electrical contact between that bus bar and the heating wires."

Claims 2 to 6 were directed to preferred embodiments of the process of Claim 1. Claim 3 read:

"A process according to claim 1 or claim 2 in which each bus bar comprises a pair of opposed metal strips, one on each side of the wire array, and at least one of the metal strips of each pair is provided with a surface layer of the solder on its face in contact with the heating wires."

Claim 7 read:

"A wire heated laminated window comprising an array of fine, closely spaced heating wires embedded in a ply of polyvinylbutyral interlayer sandwiched between and adhered to outer panes, the array extending between and in contact with opposed bus bars, characterised in that a face of at least one of the bus bars in contact with the heating wires is provided with a surface layer comprising a solder having a melting point up to about 150°C."

II. On 20 September 1995, a Notice of Opposition against the granted patent was filed, in which the revocation of the patent in its entirety was requested on the grounds of lack of novelty and inventive step as set out in Article 100(a) EPC.

The opposition was, *inter alia*, supported by the following documents:

D1 US-A-4 323 726,

D2 US-A-4 102 722

D3 DE-B-1 540 940

D5 EP-B-0 186 787

D6 GB-A-1 392 736

D7 US-A-4 395 622

D8 DE-C-870 475

D9 DE-B-1 515 208

III. In a decision issued in writing on 1 December 1997, the Opposition Division held that the grounds for opposition did not prejudice the maintenance of the patent in amended form, the amendment consisting in the incorporation into the independent process and product claims of the subject-matter of Claim 3 as granted, which concerned the combination of two opposed metal strips as bus bars. In particular, it was held that

(a) the claimed subject-matter was novel since none of the cited documents, in particular D1, disclosed the combination of two opposed metal strips as bus bars.

(b) the problem to be solved vis-à-vis D1, which was considered to be the closest prior art document, was, in a process for the production of a wire-heated laminated window comprising two opposed metal strips for each bus bar, to avoid the problem of corrosion due to voids located between the strips. None of the cited documents identified this problem, nor was there any motivation for the skilled person to construct a bus bar assembly according to the main request. Therefore, the claimed subject-matter was inventive.

IV. On 16 January 1998, the Opponent (Appellant) lodged an appeal against the above decision and paid the prescribed fee simultaneously. The Statement setting out the Grounds of Appeal was filed on 30 March 1998.

With a letter dated 4 July 2003, the Proprietor (Respondent) filed a new main request and one auxiliary request.

V. Oral proceedings before the Board were held on 6 August 2003. During the oral proceedings, after discussion of the requests then on file, the Respondent filed a new request of five claims as the sole request, which replaced the previous requests, the independent claims reading:

"1. A process for the production of a wire-heated laminated window comprising an array of fine, closely spaced heating wires **(7)** embedded in a ply of interlayer **(3)** sandwiched between outer panes **(1)**, said array extending between and in contact with opposed bus bars **(4,8;5,8) with a face of each of the bus bars (4,8;5,8) in contact with the heating wires (7) being provided with a surface layer (10) of a solder**, in which process the laminate is subjected to an autoclaving step to adhere the interlayer to the adjacent panes, **the solder having** a melting point such that on autoclaving of the laminate the solder melts to provide good electrical contact between that bus bar **(4,8;5,8)** and the heating wires **(7), characterised in that each bus bar (4,8;5,8) comprises a pair of opposed metal strips (4,8;5,8), one on each side of the wire array (7), and at least one of the metal strips (4,8;5,8) of said pair is provided with a surface layer (10) of the solder on its face in contact with the heating wires (7) whereby following autoclaving the solidified solder (10) fills the space between the metal strips (4,8;5,8).**"

"5. A wire heated laminated window comprising an array of fine, closely spaced heating wires **(7)** embedded in a ply of polyvinylbutyral interlayer **(3)** sandwiched between and adhered to outer panes **(1)**, the array **(7)** extending between and in contact with opposed bus bars **(4,8;5,8)**, **each** of the bus bars **(4,8;5,8)** in contact with the heating wires **(7) being** provided with a surface layer **(10) of** a solder having a melting point up to about 150°C, **characterised in that each bus bar (4,8;5,8) comprises a pair of opposed metal strips (4,8;5,8), one on each side of the wire array (7), the solder (10) filling the space between the metal strips (4,8;5,8) and gripping the heating wires (7) in position.**"
(The amendments vis-à-vis the claims as granted are indicated in bold).

VI. The Appellant's arguments can be summarised as follows:

Starting from D1 as the closest prior art, that document disclosed all features of the process of claim 1 except for the use of two metal strips as bus bars. In particular, the use of a low melting solder material was mentioned, as well as the filling of the space between the metal strip and the heating layer by an electroconductive layer. The use of two metal strips was however known from other documents, such as D3 and D9. It was not apparent which problem was solved by the use of two metal strips instead of only one; a possible improved electrical conductivity was obvious. The skilled person would find additional information in the other documents on file, which all referred to the same problem: to provide good, reliable contacts between the bus bars and the heating wires.

Taking D9 as the starting point, the claimed subject-matter differed from that document in the kind of solder used, which was known from D1. The Respondent's argument that the solder should have a low melting point was not part of the claimed subject-matter.

Therefore, the claimed subject-matter was not inventive.

VII. The Respondent argued that D1 was the proper starting point since it referred to the same problem as the patent in suit, i.e. to control the heating temperature. D1 also referred to avoiding burn-outs. This problem was solved by the claimed process steps, which were suitable to obtain free flow of the solder upon melting, whereas the process described in D1 was not suitable to obtain a freely flowing solder, so that the desired technical effect was not achieved. In that respect, D1 did not mention the use of two metal strips as bus bars, nor the application of the solder on at least one of the metal strips. Also, the process described in D1 implied the use of a higher temperature than applied in autoclaving.

The other documents, some of which the skilled person would not even combine with D1, did not disclose the claimed features lacking in D1. In particular D9 did not mention two metal strips as bus bars, nor the importance of having the solder fill the space between them.

Therefore, the claimed subject-matter was inventive.

VIII. 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 that the patent be maintained on the basis of the set of claims 1 to 5 submitted during the oral proceedings.

Reasons for the Decision

Admissibility of the appeal

1. The appeal is admissible.

Amendments

2. The Appellant did not raise any objections to the amendments and the Board sees no reason to deviate from that view.

In essence, Claim 1 differs from Claim 1 as granted in the following aspects:

– the move of the passage referring to the face of each of the bus bars being provided with a surface layer of a solder from the characterizing part to the preamble,

– the move of the passage referring to the requirements of the melting point of the solder from the characterizing part to the preamble,

– the change of "each pair" of metal strips into "said pair" in line 11,

– the addition of reference signs,

– the incorporation of the contents of Claim 3 as granted,

– the replacement of the word "comprising" by the word "of" in the passage "a surface layer (10) comprising a solder" and

– the addition of the passage referring to the solder filling the space between the metal strips upon autoclaving.

The first four of the above-indicated amendments do not change the contents of the claimed subject-matter. The fifth and sixth amendment are based on the application as filed. The last amendment is based on page 7, last paragraph, of the application as originally filed as well as on Figure 4a, which also serves as a basis for the combination of the amendments. The amendments result in a limitation of the claims.

Product Claim 5 has been amended in a similar way, supported by the same passages as indicated above for process Claim 1.

Therefore, the requirements of Article 123(2) and 123(3) EPC are met.

Inventive step

3. The patent in suit aims at providing, in a process for the production of a wire-heated laminated window, simple means of securing a reliable and durable electrical contact between the bus bars and the heating wires (column 1, lines 36 to 39). Any reference to the prevention of corrosion due to the presence of voids is not based upon information that could be derived from the original application so that corrosion prevention cannot be taken into consideration as (part of) the problem to be solved. In order to solve the above-defined problem, the patent in suit proposes to use two metal strips as the bus bars between which the wires should be placed and to fill the space between the metal strips with solder, as defined in Claim 1. As demonstrated by the photographs filed on 22 October 1997, the claimed process leads to a construction that shows a better contact between the bus bars and the heating wires than a commercial wire-heated window. Therefore, the Board is satisfied that the above-mentioned problem has been effectively solved.

3.1 D1, which was considered to be the closest document, discloses a bus bar assembly for electrically connecting a source of electrical potential to an electroconductive pattern on a nonelectroconductive substrate at a plurality of points, comprising: at least one elongated metallic current carrying member positioned adjacent said pattern at said plurality of points; and an electroconductive layer between and in contact with adjacent surfaces of said current carrying member and said electroconductive pattern to maintain same in spaced relation, said layer conforming to the

surface configurations of both the contacted adjacent surfaces of said member and said pattern to minimize localized high current densities therebetween and having a volume resistivity of less than about 10^{-2} ohm-cm., wherein said layer comprises a mixture of finely divided metallic electroconductive particles bound together by fused metal alloy particles substantially free of non-metallic components (Claim 1).

The current carrying member comprises preferably a flexible strip or mesh (Claims 7 to 9). The electroconductive layer is preferably a metallic layer substantially free of non-metallic compounds, and may be a fusible material having a fusion temperature below the deformation temperature of the substrate and the decomposition temperature of the electroconductive pattern, e.g. a mixture of finely divided metallic electroconductive particles and finely divided metal alloy particles (Claims 2 to 6; column 2, lines 48 to 55). The electroconductive pattern may be a matrix of thin wire or thin strips of electroconductive material as well as, preferably, a metal or metal oxide coating on the surface of the substrate (Claim 11; column 3, line 64 to column 4, line 2).

According to D1, such electroconductive coatings on the substrate are generally thin and sensitive to high current densities, which may cause localized destruction of the coating conductivity, so-called burnouts, leading to variations in current density in the coating which are considered undesirable. Therefore, D1 aims at the uniform distribution of current to the coating at a level below which burnouts occur (column 1, lines 20 to 32). To that end, the

current carrying member and the electroconductive layer preferably remain in spaced relation and the electroconductive layer is conformable to the contacted surfaces of the current carrying member and the electroconductive pattern (column 4, lines 38 to 52).

The assembly of D1 may be constructed by forming a mixture of 90 parts by weight of finely divided silver particles and 10 parts by weight of finely divided metal alloy particles, e.g. comprising bismuth lead, cadmium and tin and having a liquidus temperature of about 94°C, adding a volatile carrier material, and silk-screening the mixture onto the desired portions of the electroconductive pattern to form the electroconductive layer. Then the current carrying member is placed over the exposed surfaces of the electroconductive layer, the volatile carrier is evaporated and the nonelectroconductive substrate layers are positioned about the sub-assembly. The assembly is then laminated, during which process the electroconductive layer is heated above its liquidus temperature and subsequently cooled to fuse it in position between the electroconductive pattern and the electroconductive member. During the lamination process the electroconductive layer becomes liquid. It should however remain in its predetermined position and should not freely flow onto the vision areas of the substrate. Therefore, the fusible material for the electroconductive layer is selected so as to have a liquidus temperature only slightly below the laminating temperature (column 5, line 38 to column 6, line 43).

Although D1 mentions the possibility of using wires as the electroconductive pattern, it concerns mainly the

problems occurring when a coating, applied to the substrate, is used as the electroconductive pattern and only one strip, which is preferably in the form of a flexible mesh, is placed onto the electroconductive layer, which had already been applied to the electroconductive pattern. The solution proposed by D1 involves a process in which some space is left between the current carrying member or bus bar and the electroconductive layer and in which free flowing of the solder should be prevented. The patent in suit, however, concerns the problem of the mechanical contact of the bus bars and the heating wires and its solution involves filling the space between the bus bars during autoclaving (column 1, lines 32 to 39 and column 4, lines 48 to 54). In particular, by requiring that the bus bars should be provided with a surface layer **of** a solder having a melting point such that it melts on autoclaving, the presence of any higher melting material in that surface layer, such as silver particles - which do not melt during the autoclaving process -, is excluded. In the process according to the patent in suit, the whole of the solder melts and fills the space between the bus bars. Therefore, the concept of using a mixture of finely divided metallic electroconductive particles bonded together by fused metal alloy particles as the electroconductive layer, as described in D1, teaches away from the present solution and does not render the claimed subject-matter obvious.

3.2 None of the other documents cited during the oral proceedings provides any information that, in combination with the disclosure of D1, would result in the claimed subject-matter. Only D9 aims at the same

problem as the patent in suit and only D3 and D7 mention a possible use of two metal strips as bus bars between which the heating wires are located. Even if those and the other cited documents each disclose one or more aspects of the claimed subject-matter, that does not mean that those aspects were known in combination, even less so if they are regarded within the context of their disclosures.

3.2.1 D9, which was also cited as a possible starting point for assessing the presence of an inventive step, aims at improving the reliability of the connection between heating wires and bus bars (column 2, lines 31 to 35). It proposes a process for the production of a laminated transparent panel comprising sheets of transparent material laminated together, the panel incorporating means whereby it can be heated, which means comprises a plurality of electrically conductive thin heating wires extending in parallel between common feed conductors, the wires lying between a pair of adjacent sheets of electrically non-conductive material, one sheet of said pair of sheets presenting an even face against which first the wires and then the feed conductor strips are applied and then applying pressure, so that each strip arches away from said face where it passes and contacts each wire, and the adjacent face of the other sheet of said pair being formed with recesses which receive the wires and the feed conductor strips (Claim 1).

Although the possibility to use two metal strips as feed conductors strips or bus bars is mentioned in the description of the prior art (column 1, lines 48 to 56), the construction of the panel according to D9 involves the placement of the heating wires on a glass

sheet and the application of only one metal strip across the wires. A soldering iron may be passed along the strips to solder the strips to the wires at least partly deforming the metal strips so that they lie against the surface of the glass sheet and arch away from the sheet over the wires. Then the sheet of interlayer material is placed over the assembly and on top of that a second glass sheet. The final bonding is performed in an autoclave (column 2, line 36 to column 5, line 42).

According to D9, the bus bars may comprise a tinned strip of soft, ductile copper (column 7, lines 18 to 21), but no further specific indication is given as regards the soldering material to be used, nor of the use of two metal strips as bus bars and filling the space between them with a solder having a melting point as now required in present Claim 1. Moreover, D9 describes treatment of the bus bars with a solvent and possibly a soldering iron after application to the wires and before autoclaving (column 7, lines 24 to 38).

Therefore, D9 taken either alone or in combination with D1 does not result in the claimed process, so that any such combination would not render the claimed subject-matter obvious.

3.2.2 D3 addresses the problem of extending the useful portion of the heated window (column 2, line 67 to column 3, line 3). Figure 5 shows a structure in which an extending portion of heating wires is bent back towards the opposite edge of the glass plate to which the wires are attached. The wires are soldered to a

first electrode means underneath the portion of the wires that had been bent back, after which a second electrode means formed of tin plated copper is soldered via the wires to the first electrode. However, it does not disclose autoclaving the window, nor to use any solder that would melt under autoclaving conditions. Since D3 does not concern the same problem as the patent in suit, the mere mention of tin being present on a copper electrode or bus bar is not sufficient to render the claimed subject-matter obvious. No mention is made either of filling the space between the two metal strips or electrodes, so that D3 does not provide the information necessary to arrive at the claimed subject-matter starting from D1.

3.2.3 D7 describes a laminated glass pane comprising a transparent thermoplastic layer interposed between two glass plates including a heating network of fine metallic wires inlaid in said thermoplastic layer between two collector strips, in which the metallic wires are so thin as to be substantially invisible to the naked eye, are undulated along directrices forming arcs of circles, are separated from each other and do not impair vision through the laminated glass pane (Claim 1).

After completion of the network, the extremities of the wires and the two strips initially put in place may be covered with two identical collector strips. The wires are then soldered to the collector strips (column 6, lines 50 to 53). The aim of D7 is to create an optimal heating area that coincides with the area to be swept by wipers (column 1, line 56 to column 2, line 8), so that there is no incentive for the skilled person to

combine this document with D1. Even if the two documents were read in combination, that would not lead to the claimed subject-matter since there is no hint at filling the space between the two metal strips in either of the documents.

3.2.4 The other documents mentioned during the oral proceedings are even less relevant:

3.2.5 D2 neither addresses the problem of improving the reliability of the connection between heating wires and bus bars nor does it mention the use of metal strips. Instead, a similar mixture of metal particles and metal alloy as described in D1 is applied to function as current carrying means. Therefore, D2 does not add the lacking elements to the disclosure of D1 so as to arrive at the claimed subject-matter.

3.2.6 D5 describes the preparation of glass laminates. It does however not refer to laminates containing heating wires, so that this document cannot be seen as relevant for the claimed subject-matter.

3.2.7 D6 discloses a process for incorporating parallel wires in a thermoplastic sheet by continuously applying a plurality of parallel spaced wires to the surface of a moving sheet, softening the surface by heating and pressing the wires into it by means of a pressing member rolling on the surface. This document does not mention connecting the wires to electrodes or bus bars. It is not relevant for the claimed subject-matter.

3.2.8 D8 discloses a process for the production of a laminated glass sheet having parallel wires in an intermediate sheet or parallel wires mounted on the glass sheet and connected with two sideward bus bars by soldering or welding, in which a special system of organizing and applying the wires in a parallel spacing to the sheet is used. D8 aims at the use of very thin wires and soldering is only mentioned as a possible means of connecting the wires to the bus bars. D8 does not disclose any details of the soldering material, nor does it say that the bus bars should comprise two metal strips.

3.3 For the above reasons, the Board concludes that the subject-matter of Claim 1 is not made obvious by the documents relied upon by the Appellant, whether taken alone or in combination, and, therefore, involves an inventive step.

3.4 As Claim 1 is allowable and Claims 2 to 4 relate to further embodiments, their patentability is supported by that of Claim 1.

3.5 Claim 5 is a product claim that contains the same essential features as process Claim 1, which relate to the structure of the obtained product. In particular each bus bar comprises a pair of opposed metal strips, one on each side of the wire array, and each of the bus bars is provided with a surface layer of a low-melting solder, which fills the space between the two metal strips. Accordingly, the same considerations apply as mentioned above having regard to process Claim 1 (see points 3 to 3.3 above). Therefore, the product defined in Claim 5 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 department of first instance with the order to maintain the patent with the claims 1 to 5 submitted during the oral proceedings and a description yet to be adapted.

The Registrar: The Chairman:

E. Eickhoff R. Teschemacher