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(54) **Title**: WALL AND/OR CEILING PANEL AND METHOD FOR ITS PRODUCTION

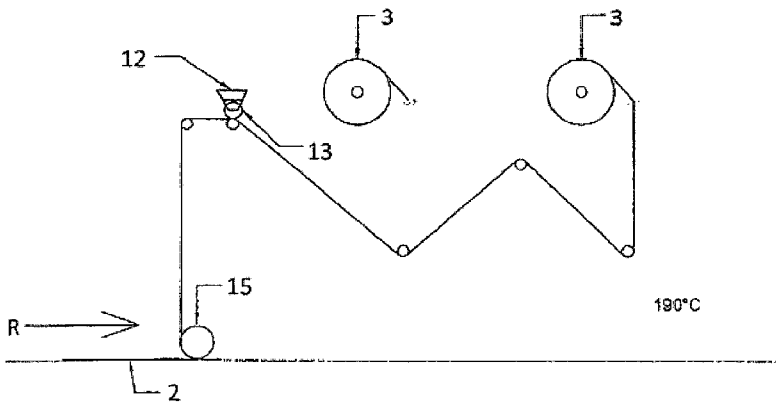

Fig. 2

(57) **Abstract**: The present invention is directed to wall and/or ceiling panels (1) comprising a substrate panel (2) and a non-woven material (3) disposed on the substrate panel (2), wherein the non- woven material (3) is adhered to the substrate panel (2) by means of an adhesive, wherein the adhesive is a starch-containing adhesive (4). The present invention further includes a method for producing a wall and/or ceiling panel (1) and use of the wall and/or ceiling panel.

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WALL AND/OR CEILING PANEL AND METHOD FOR ITS PRODUCTION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a PCT International Application of German Patent Application 10 2016 009 147.9 filed on March 17, 2016. The disclosure of the above application is incorporated herein by reference.

BACKGROUND

[0002] Ceiling intermediate panels are known which have a substrate panel made of mineral fibres, in particular of glass wool or rock mineral wool. In order to improve the optical impression, the substrate panel is provided with a non-woven material. This non-woven material is adhered to the substrate panel by adhesives which are matched to the respective application regions and must, for example, satisfy fire protection requirements.

[0003] A typical mineral fibre product is known, for example, in DE 199 21 284 A1, DE 2 810 091 A1 and DE 3 007 185 A1.

[0004] Starting from this prior art, it is now the object of the present invention to provide a wall and/or ceiling panel on which a firm adhesion of the non-woven material to the substrate panel takes place.

BRIEF SUMMARY

[0005] The present invention is directed to a wall and/or ceiling panel (1) comprising a substrate panel (2) and a non-woven material (3) disposed on the substrate panel (2), wherein the non-woven material (3) with the 5 is adhered to substrate panels (2) by means of an adhesive, characterised in that the adhesive is a starch-containing adhesive (4).

[0006] Other embodiments of the present invention include a method for the production of a wall and/or ceiling panel (1) comprising: a) transporting a strip of non-woven material (3) from a roll (10) along a machine direction R to an adhesive applicator (12) containing an adhesive; b) applying the adhesive to a surface of the strip of the non-woven material (3); c) transporting the strip of non-woven material (3) downstream from the adhesive applicator (12) along the machine direction R and where the surface of the non-woven material having the adhesive applied is placed in contact with a strip of a substrate material (2); and d) passing the strip of non-woven

material (3) and the strip of substrate material (2) under a calendaring roll (15), wherein the glue comprises a starch-containing component.

[0007] Other embodiments of the present application include a method for the production of a wall and/or ceiling panel (1) comprising: a) applying an adhesive from an adhesive applicator to a surface of strip of substrate material; b) transporting a strip of non-woven material (3) from a roll (10) along a machine direction R downstream from the adhesive applicator (12), where the surface of the substrate material having the adhesive applied is placed in contact with a strip of a non-woven material (3); and c) passing the strip of non-woven material (3) and the strip of substrate material (2) under a calendaring roll (15), wherein the glue comprises a starch-containing component.

[0008] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] Fig. 1 shows a schematic sectional view of the layer structure of the wall and/or ceiling panel; and

[0011] Fig. 2 shows a schematic view of a process sequence for producing the wall and/or ceiling panel.

DETAILED DESCRIPTION

[0012] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0013] As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by referenced in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

[0014] In the description of embodiments disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical,", "above," "below," "up," "down," "top" and "bottom" as well as derivative thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be constructed or operated in a particular orientation. Terms such as "attached," "coupled," "affixed," "connected," "interconnected," and the like refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

[0015] Unless otherwise specified, all percentages and amounts expressed herein and elsewhere in the specification should be understood to refer to percentages by weight. The amounts given are based on the active weight of the material.

[0016] A wall and/or ceiling panel according to the invention comprises a substrate panel and a non-woven material disposed on the substrate panel, wherein the non-woven material is adhered to the substrate panel by means of an adhesive and wherein the adhesive is a starch-containing adhesive.

[0017] The use of a starch-containing adhesive is known per se for its use as a wallpaper glue, but it has also been found that non-woven materials can also be adhered to a panel-like material by means of an adhesive of this type and thus such an adhesive is a cost-effective alternative to the adhesives hitherto used in this field of application.

[0018] Usually, the panels should meet certain fire protection criteria in order to be able to be used in the interior of residential and commercial premises. Corresponding wall or ceiling panels can be found, for example, in supermarkets, discotheques or other halls, where particularly high demands are placed on fire protection. Therefore, the selection of adhesives is additionally limited.

[0019] The use of the starch-containing adhesive in the present application enables a sufficient and reliable adhesion of the non-woven material, in particular of the mineral fibre non-woven material, to the substrate panel and fulfils the fire protection criteria for the fire protection

classification A2, in particular A2-S1d0, as described in DIN EN 13501-1 (in the current version at the time of the present application).

[0020] Further advantageous embodiments of the invention are the subject matter of the subclaims.

[0021] It is advantageous if the substrate panel is a fibre panel, in particular a mineral fibre panel. Such substrate panels are difficult to ignite and are nevertheless very stable. In an embodiment variant as an intermediate ceiling panel, for example, they enable the suspension of lights or the like, without an enlargement of the hole in the panel under the weight of the light. At the same time, the fibre panel is also sound-insulating. A disadvantage of the fibre panel is the uneven structure. An adhesive with corresponding gelling properties and a good flow behaviour is therefore required. It has been found in experiments that a starch-containing adhesive can be adjusted accordingly by dosing the concentration of starch in the solution, e.g. in water, in order to achieve an optimised flow behaviour and a preferred gelation. Thus, the starch-containing adhesive used according to the invention can optimally compensate for the disadvantages of a fibre panel.

[0022] The non-woven material can advantageously be designed as a glass fibre non-woven material. Glass fibre non-woven materials are also difficult to ignite. However, compared to other non-woven materials, glass fibre non-woven materials have very short fibre lengths and low average fibre diameters. This requires an adhesive with a high adhesive force with good wetting of the non-woven material fibres in order to achieve an adhesion of the glass fibres to the substrate panel. The use of a starch-containing adhesive allows an optimum connection of glass fibres to the substrate panel.

[0023] In experiments, it has been found to be advantageous if the adhesive has potato starch as the starch-containing component.

[0024] The non-woven material advantageously has a layer thickness between 0.2 and 1.2 mm.

[0025] Optimally, the adhesive application can be carried out in such a way that the mass application of adhesive to the substrate panel is between 6.5 and 11.5 g per 1000 cm^2 of substrate area. The adhesive is preferably evenly distributed.

[0026] In a particularly preferred embodiment of the invention, the ceiling panel can be designed as a ceiling intermediate panel for acoustic and thermal insulation.

[0027] A method according to the invention for producing a wall and/or ceiling panel according to the invention is characterised by the following steps:

A) provision of a substrate panel and a non-woven material;

B) application of the starch-containing adhesive to the substrate panel and/or the non-woven material; and

C) curing of the adhesive, wherein the starch-containing adhesive is heated after application to a temperature of more than 60°C and/or wherein the temperature of the starch-containing adhesive upon application is more than 60°C.

[0028] The method enables the aforementioned wall and/or ceiling panel to be produced using a starch-containing adhesive. The adhesion of the non-woven material to the substrate panel is an interesting alternative to the hitherto unknown and used adhesives in this field of application.

[0029] Advantageous embodiments of the method according to the invention are the subject matter of the subclaims.

[0030] The temperature during the application of the adhesive can advantageously be more than 70°C, preferably between 75°C and 95°C. This temperature range is particularly preferred in order to activate the adhesive properties of the starch-containing adhesive.

[0031] It is also advantageous if, immediately prior to application, a starch cold solution is provided, which is gelled and applied by the addition of hot liquid. The adhesive force of the adhesive is thereby freshly activated and the starch solution can be handled without an undesirable adhesion in a wrong place.

[0032] It is also advantageous if, after the application of the starch-containing adhesive, calendering with a hot calender is carried out at temperatures of more than 120°C, in particular between 150°C and 190°C.

[0033] Alternatively or in addition to the use of the hot calender, the adhesive can be dried in a drying oven at temperatures of more than 130°C.

[0034] In step B, the applied adhesive can have a starch content between 5 and 12 weight percent, preferably between 6.5 and 9.5 weight percent. A number of tests have shown that this starch content has an optimum adhesive effect for the field of application.

[0035] Furthermore, according to the invention, the use of the wall and/or ceiling panel as a fire protection panel is according to the classification A2-S1d0, as described in DIN EN 13501-1 (in the current version at the time of the application date of the present invention).

[0036] The subject matter of the invention is explained below in more detail with reference to an exemplary embodiment and with the aid of the figures having the following reference numerals

[0037] 1 Wall or ceiling panel

[0038] 2 Substrate panel

[0039] 3 Non-woven material layer 5

[0040] 4 Starch-containing adhesive layer

[0041] 10 Roller

[0042] 11 Non-woven material strip

[0043] 12 Deflection rollers 10

[0044] 13 Glue application roller

[0045] 14 Transport strip

[0046] 15 Calendering roller

[0047] R Feed direction

[0048] Fig. 1 shows schematically a structure of a wall or ceiling panel 1 according to the invention. This consists of a substrate panel 2 and a non-woven material 3, which are connected to each other by a starch-containing adhesive layer 4. The layer thickness of the non-woven material layer 3 is preferably less than 20% in relation to the layer thickness of the substrate panel 2.

[0049] The substrate panel 2 is preferably a mineral fibre panel and the non-woven material layer 3 is made of glass fibre non-woven material.

[0050] In its design as mineral fibre panels, the substrate panel 2 consists of various substances selected from the following substance classes: clay, starch, rock mineral wool, paper and/or perlite.

[0051] The starch grade of the adhesive was tested by experiments. It has been found that potato starch, other than corn starch, for example, has the optimum properties for the present application.

[0052] The wall and/or ceiling panel 1 can preferably have a sound absorption value (NRC value) of between 0.4 and 0.8.

[0053] Fig. 2 shows schematically a production method of a wall or ceiling panel 1 according to the invention. Starting from a roll 10 of non-woven material, the transport of a non-woven material strip 11 takes place in a feed direction R along a plurality of deflection rollers 12. The

feed direction R need not be rectilinear, but can be assembled from a plurality of partial sections, for example, as can also be seen in Fig. 2. A glue container 12 with the starch-containing adhesive is disposed above the non-woven material strip 11. Upon application, this has a starch content of 5 to 12 weight percent, preferably 6.5 to 9.5 weight percent, and is applied to the surface of the non-woven material strip by means of a glue application roller 13.

[0054] As an alternative to the glue application roller 13, the starch-containing adhesive can also be coated on by means of a brush, sprayed by means of a nozzle bar or applied to the non-woven material strip by means of a squeegee.

[0055] The starch-containing adhesive may already be applied to the non-woven material strip warm, e.g. at temperatures of more than 60°C. In the latter case, the adhesive already has adhesive properties after the application.

[0056] A transport strip 14 is disposed downstream in the feed direction R with the corresponding substrate panels 2 and a calendaring roller 15. The non-woven material strip 11 is then placed on the surface of the substrate panel 2 with the side coated in adhesive and is passed under the calendering roller 15. These can have temperatures of more than 120°C, preferably between 150°C and 190°C, whereby the adhesive properties of the starch-containing adhesive are additionally reinforced.

[0057] Alternatively or in addition to the calendering roller 15, a drying oven can also be used in which a curing of the adhesive can be achieved. This drying oven can be operated particularly preferably at temperatures of more than 130°C, in particular at temperatures of more than 150°C.

[0058] By providing a calendering roller or a drying oven, long periods of time for drying and curing the adhesive can, in particular, be avoided. Preferably, a direct further processing can be carried out in a continuous production process.

[0059] Finally, not shown in detail in Fig. 2, the non-woven material strip 11 is cut to length.

[0060] Fig. 2 illustrates only one possible embodiment. It is understood that within the context of the present invention numerous further embodiments are possible, which, however, are not all listed in detail.

CLAIMS

WHAT IS CLAIMED IS:

1. A method for the production of a wall and/or ceiling panel (1) comprising:

a) transporting a strip of non-woven material (3) from a roll (10) along a machine direction R to an adhesive applicator (12) containing an adhesive;

b) applying the adhesive to a surface of the strip of the non-woven material (3);

c) transporting the strip of non-woven material (3) downstream from the adhesive applicator (12) along the machine direction R and where the surface of the non-woven material having the adhesive applied is placed in contact with a strip of a substrate material (2); and

d) passing the strip of non-woven material (3) and the strip of substrate material (2) under a calendaring roll (15) ,

wherein the glue comprises a starch-containing component.

2. The method according to claim 1, wherein the starch-containing component is present in an amount between 5 wt. % to 12 wt. % based on the weight of the glue.

3. The method according to claim 2, wherein the starch-containing component is present in an amount between 6.5 wt. % and 9.5 wt. %.

4. The method according to any one of claims 1 to 2, wherein the glue further comprises water.

5. The method according to any one of claims 1 to 4, wherein the adhesive in step b) is applied in an amount ranging from 6.5 to 11.5 g per 1000 cm^2.

6. The method according to any one of claims 1 to 5, wherein the calendaring roll (15) is heated to a temperature of more than 120 °C.

7. The method according to claim 6, wherein the calendaring roll (15) is heated to a temperature between 150 °C and 190 °C.

8. The method according to any one of claims 1 to 7, wherein subsequent to step d), heating the adhesive present between the strip of non-woven material (3) and the strip of substrate material (2) to a temperature of more than 60°C.

9. The method according to claim 8, wherein the temperature is more than 70°C.

10. The method according to claim 9, wherein the temperature is between 75°C and 95°C.

11. The method according to any one of claims 1 to 10, wherein subsequent to step d), the strip of non-woven material (3) and the strip of substrate material (2) cut to length resulting in the wall and/or ceiling panel.

12. The method according to any one of claims 1 to 11, wherein substrate material comprises mineral fibre.

13. The method according to any one of claims 1 to 12, wherein the non-woven material (3) is a glass fibre non-woven material.

14. The method according to any one of claims 1 to 13, wherein the adhesive has potato starch as the starch-containing component.

15. The method according to any one of claims 1 to 14, wherein prior to step b) the adhesive is formed by gelling a cold solution comprising the starch-containing component and subsequently adding a hot liquid to the cold solution.

16. A method for the production of a wall and/or ceiling panel (1) comprising:

a) applying an adhesive from an adhesive applicator to a surface of strip of substrate material;

b) transporting a strip of non-woven material (3) from a roll (10) along a machine direction R downstream from the adhesive applicator (12), where the surface of the substrate

material having the adhesive applied is placed in contact with a strip of a non-woven material (3); and

c) passing the strip of non-woven material (3) and the strip of substrate material (2) under a calendaring roll (15),

wherein the glue comprises a starch-containing component.

17. The method according to claim 16, wherein the starch-containing component is present in an amount between 5 wt. % to 12 wt. % based on the weight of the glue.

18. The method according to claim 17, wherein the starch-containing component is present in an amount between 6.5 wt. % and 9.5 wt. %.

19. The method according to any one of claims 16 to 18, wherein the glue further comprises water.

20. The method according to any one of claims 16 to 19, wherein the adhesive in step b) is applied in an amount ranging from 6.5 to 11.5 g per 1000 cm^2.

21. The method according to any one of claims 16 to 20, wherein the calendaring roll (15) is heated to a temperature of more than 120 °C.

22. The method according to claim 21, wherein the calendaring roll (15) is heated to a temperature between 150 °C and 190 °C.

23. The method according to any one of claims 16 to 22, wherein subsequent to step d), heating the adhesive present between the strip of non-woven material (3) and the strip of substrate material (2) to a temperature of more than 60°C.

24. The method according to claim 23, wherein the temperature is more than 70°C.

25. The method according to claim 24, wherein the temperature is between 75°C and 95°C.

26. The method according to any one of claims 16 to 25, wherein subsequent to step d), the strip of non-woven material (3) and the strip of substrate material (2) cut to length resulting in the wall and/or ceiling panel.

27. The method according to any one of claims 16 to 26, wherein substrate material comprises mineral fibre.

28. The method according to any one of claims 16 to 27, wherein the non-woven material (3) is a glass fibre non-woven material.

29. The method according to any one of claims 16 to 28, wherein the adhesive has potato starch as the starch-containing component.

30. The method according to any one of claims 16 to 29, wherein prior to step b) the adhesive is formed by gelling a cold solution comprising the starch-containing component and subsequently adding a hot liquid to the cold solution.

31. A wall and/or ceiling panel (1) comprising a substrate panel (2) and a non-woven material (3) disposed on the substrate panel (2), wherein the non-woven material (3) with the 5 is adhered to substrate panels (2) by means of an adhesive, characterised in that the adhesive is a starch-containing adhesive (4).

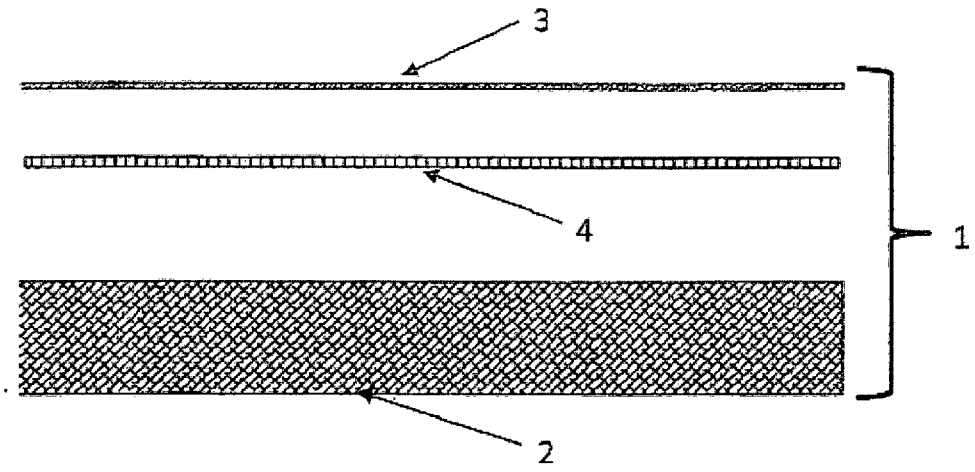

Fig. 1

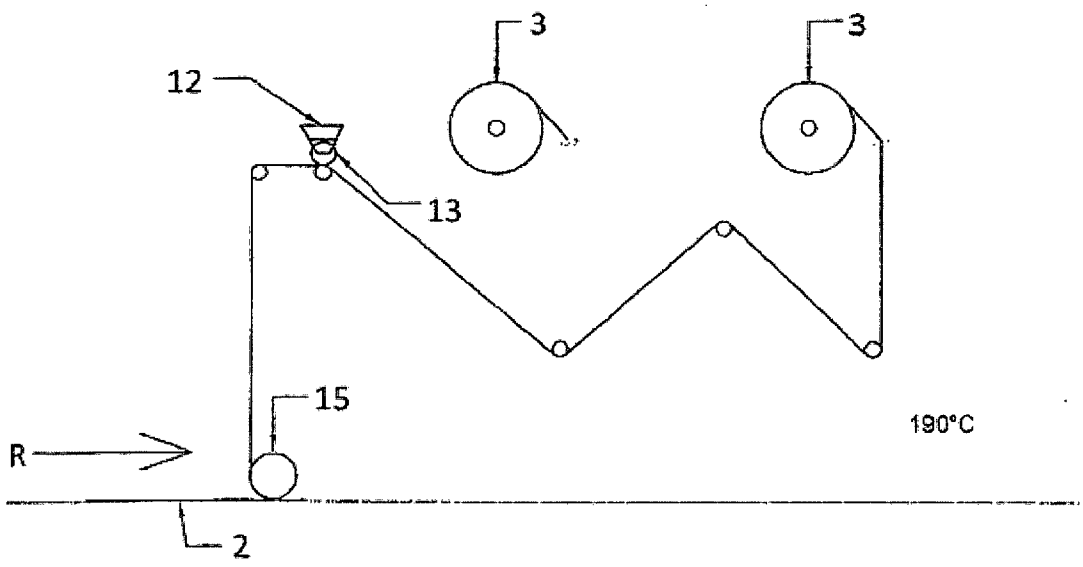

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B29C43/24 B32B37/12 B32B37/20
ADD. B29L31/10 B29L31/00 B29L7/00 B29K105/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C B29L B29K B32B B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/082396 A1 (KOSLOW EVAN E [US]) 1 May 2003 (2003-05-01)	1,5,11, 13,16, 26,28
Y	paragraphs [0006] - [0009], [0015], [0016], [0024], [0026], [0029], [0030]; figures 1,2	1-3,6-30

X	US 4 277 527 A (DUHL DANIEL) 7 July 1981 (1981-07-07)	31
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 May 2017	23/05/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moeller Bichler, M

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/000348

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2012/168054 A1 (CHEN LIANG [US] ET AL) 5 July 2012 (2012-07-05) paragraphs [0002], [0003], [0005], [0040], [0046], [0047], [0054], [0057]; figures 1,2c	31 12,13, 27,28
Y	EP 0 951 987 A1 (ITW LITEC FRANCE [FR]) 27 October 1999 (1999-10-27) paragraphs [0001], [0002], [0009], [0014], [0020], [0026] - [0031], [0035], [0036], [0045] - [0046]; figure 1	1-3, 6-10, 15-18, 20-22,30
Y	US 6 083 586 A (ANDERSEN PER JUST [US] ET AL) 4 July 2000 (2000-07-04) column 16, lines 9-63 column 40, line 56 - column 41, line 42	4,8-11, 14,15, 19, 23-26, 29,30
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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