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(54) **Method for the manufacture of digitally printed substrates**

(57) The present invention concerns a method for the manufacture of wood fiber or mineral fiber based decorative substrates (1), comprising the steps of:

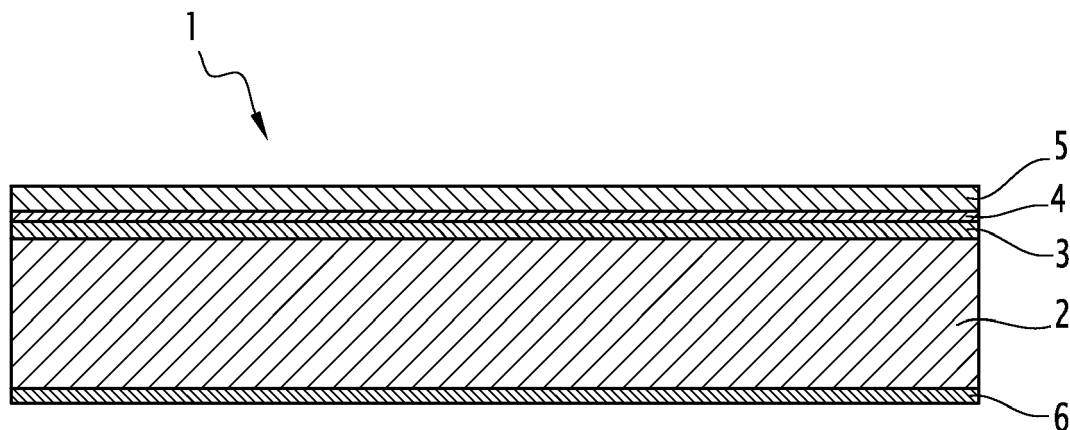
(a) coating a substrate (2) with a liquid reactive composition which can be digitally printed on after drying;
(b) drying the reactive composition coated onto the substrate so as to form a basic layer (3) having a permeability such that it may adsorb and release any condensation products formed during step (d) and (e);

(c) digitally printing a decor (4) onto the basic layer using a liquid ink ;

(d) drying or curing the liquid ink forming the digitally printed decor; and

(e) coating the digitally printed decor with an overlay (5) at conditions which ensure curing of both the basic layer and the overlay.

The invention further concerns a floor panel or board (1) obtainable by a method according to the invention.



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Description

[Technical field of the invention]

[0001] The present invention concerns a method for manufacturing decorative substrates, notably panels and boards, in particular based on wood fibers or mineral fibers such as wood particles boards, MDF (Medium Density Fiberboard) or HDF (High Density Fiberboard) substrates on which a decor is formed by digital printing.

[0002] The invention further relates to substrates such as panels and boards, notably useful as flooring, that are obtainable by such methods.

[Background of the invention]

[0003] It is known to use digital printing in order to apply a décor to wood-based panels and boards such as wood particles boards, MDF or HDF panels.

[0004] Digital printing refers to methods of printing from a digital based image directly to the substrate. It usually refers to professional printing where small run jobs from desktop publishing and other digital sources are printed using large format and/or high volume laser or inkjet printers. Digital printing has a higher cost per printed object than traditional offset printing methods but this price is usually offset by the cost saving achieved by avoiding all the technical steps in between needed to make printing plates. It also allows for on demand printing, short turn around, and even a modification of the image with each printed copy. The savings in labour and the increased capability of digital presses means digital printing is reaching a point where it could match or supersede offset printing technology's ability to produce larger print runs of several thousand copies at a low price.

[0005] However, when using digital printing on substrates such as high density fiberboard, the décor is generally still printed on a separate support of paper or fleece which is applied onto the substrate. Indeed, while a basic layer may be applied in order to ensure sufficient adherence of the applied inks, such basic layers may affect the printing quality. Indeed, a porous layer may absorb the ink leading to insufficient covering while a non porous basic layer may lead to their coalescence and affect color quality. The use of a separate support for printing however makes the process more costly and complex.

[0006] The international patent application WO 2010/084386 thus proposes to use several printing devices and to expose the print portion deposited by one printing unit to forced drying before activating the following printing unit. Such process is expensive as it requires special equipment. Further, the quality of the décor depends on the precision of the printing unit alignment.

[0007] Another problem encountered with producing laminates is that multilayer laminates have a tendency to delaminate under stress due to insufficient cohesion between the different layers.

[0008] The technical problem underlying the present

invention is thus to provide a method for the manufacture of substrates comprising a decor formed directly on the substrate by digital printing which overcomes one or more of the above indicated drawbacks.

[0009] In particular, the invention aims to provide a method for the manufacture of such substrates which allows for a good image quality.

[0010] Also, the invention aims to provide such a method which does not require the procurement of special equipment.

[0011] Further, the invention aims to provide such a method which yields substrates which show an improved resistance to delamination under stress.

[0012] The invention resides in particular in the finding that a basic layer coating made using a liquid reactive composition as specified below forms, after evaporation of volatile components such as solvents, a coating with a porosity such that any condensation products such as water formed later on, upon curing of the ink or the subsequent layers may be adsorbed without forming bubbles which could impair the print quality and/or the cohesion between the different layers, thus acting as an appropriate primer for this application. Finally, after curing, the composition reinforces cohesion between the décor and the substrate, thus acting as an adhesive and preventing delamination under stress.

[Summary of the invention]

[0013] According to a first aspect, the invention thus concerns a method for the manufacture of wood fiber or mineral fiber based decorative substrates, comprising the steps of:

a) coating a substrate with a liquid reactive composition which can be digitally printed on after drying;

b) drying the reactive composition coated onto the substrate so as to form a basic layer having a permeability such that it may adsorb and release any condensation products formed during step (d) and (e);

c) digitally printing a decor onto the basic layer using a liquid ink ;

d) drying or curing the liquid ink forming the digitally printed decor; and

e) coating the digitally printed decor with an overlay at conditions which ensure curing of both the basic layer and the overlay.

[0014] The substrates may be in particular panels or boards and more specifically wood particles boards such as MDF or HDF panels or mineral fiber boards such as calcium silicate boards or fiber cement boards.

[0015] The liquid reactive composition may be formu-

lated as a one-component composition or a two-component composition. The liquid reactive composition may be water-based or may contain organic solvents.

[0016] In some embodiments it may be preferred if the liquid reactive composition is a two-component composition.

[0017] The first component of such a two-component composition may comprise amine-, hydroxy- or carboxy-functionalized acrylates, polyester, polyether polyols or vinylic polymers.

[0018] The second component of such a two-component composition may comprise isocyanate or aziridine hardeners.

[0019] According to a preferred embodiment, the liquid reactive composition is water based.

[0020] The reactive composition preferably has a viscosity in the range from 1 to 3 Pa s.

[0021] Advantageously, the reactive composition is applied in step (a) using a roller, a jetting device or a spraying device.

[0022] Step (b) may be carried out notably by heating the coated substrate to a temperature of 50 to 80 °C.

[0023] Preferably, step (c) is carried out using water-based ink. Advantageously, the digital printing in step (c) is carried out using a Drop-on-Demand (DOD) inkjet system.

[0024] Step (d) may be carried out by heating the substrate having the digitally printed decor printed thereon to a temperature of 70 to 250°C, preferably for a period of 2 to 30 seconds.

[0025] According to a preferred embodiment of the invention, the overlay applied in step (e) is transparent. Preferably, it is in the form of a melamine resin or a melamine sheet or paper.

[0026] Preferably, step (e) is carried out by pressing at a temperature in the range of 100 to 300°C, with a pressure comprised between 20 to 60 kg/cm² and/or for a period of 2 to 30 seconds.

[0027] The method of the invention may also comprise further the step of providing the back side of the panel with a balance paper or a layer of lacquer.

[0028] According to a second aspect, the invention also concerns a decorative floor panel obtainable and obtained by a method as indicated above.

[0029] The method according to the invention will be described more in details below.

[Detailed description of the invention]

[0030] The method of the invention aims to manufacture wood fiber based decorative substrates, notably for use as flooring.

[0031] The substrates used within this process can notably be high density fiberboards (HDF). However, the substrates used in this process may alternatively be based on massive, veneer, plywood, particle or MDF boards.

[0032] In case of floor panels, the printed fiberboards

obtained in the process are cut to form a final floor panel that preferably has a surface of less than 0.5 m², or of even less than 0.3 m². The thickness of such floor panels may vary between 4 and 25 mm, or still better between 6 and 15 mm. Prior to applying the method according to the invention, the surface of the substrates may be filled with a material layer comprising a filler in order to obtain an even surface.

[0033] In step (a) of the method according to the invention, the substrate is coated with a liquid reactive composition so as to form a basic layer.

[0034] The liquid reactive composition preferably used within the method of the invention is a two-component system, in particular a water-based two-component system.

[0035] The first component of the two-component composition may include OH functionalized acrylates, polyester, polyether polyols or vinylic polymers.

[0036] The second component of the two-component composition may include isocyanate or aziridine hardeners.

[0037] The reactive composition, with the two components described above combined, typically has a content in active ingredient comprised between 50 and 70 % by weight.

[0038] The pH of the reactive composition, with the two components mixed, is typically in the range of 6 to 10.5. In some embodiments, the pH is in the range of 7.0 to 9.9. A pH adjuster (e.g., acids or bases) may be added to the composition to obtain the desired pH; typically, the composition is inherently acidic, so the pH is raised. The pH can be adjusted using various bases or buffering agents. Suitable bases or buffering agents include, for example, borax, sodium hydroxide, alkali phosphates, alkali silicates, alkali carbonates, ammonia, and amines such as diethanolamine or triethanolamine.

[0039] In addition to the active ingredients, the individual components can also contain other ingredients such as polyvalent metal compounds, alkali-soluble resins, solvents, waxes, reactive or non-reactive acrylic compositions, reactive or non-reactive polyester compositions (such as polyester polyols), surfactants, permanent and fugitive plasticizers, defoamers, wetting agents, and biocides. Additionally or alternatively, any optional ingredients may be added after the reactive composition has been formed by the mixing of the two individual components. The polyvalent metal compound provides crosslinking of the polymers in the film and increases the detergent resistance of the finish. Plasticizers or coalescing agents can be added to lower the temperature of film formation. Surfactants can be added to aid leveling and wetting. Solvents can be added to aid the coatability of the reactive composition. Biocides help minimize the formation of molds or mildew in the coating. Antifoamers and defoamers minimize the formation of bubbles in the coating.

[0040] Water-based two component reactive compositions useful in the method according to the invention

are available on the market, for example from Friedrich Klumpp GmbH, Germany, under the trade name Hydroplast® Printing Sealer.

[0041] The two components may be mixed using conventional means such as pneumatic hand-held agitator.

[0042] After mixing of the two components, the resulting reactive composition can be applied to the substrate. The reactive composition is formulated as a liquid. It may be applied using conventional means such as one or more rollers, and/or jetting or spraying devices.

[0043] The reactive liquid composition typically has a viscosity of 1 - 3 Pa·s, and usually 1,5-2,5 Pa·s. The composition is usually easy to apply, and readily flows to even out low spots. The reactive composition typically provides a thin, easily managed coating.

[0044] After coating, the reactive composition coated onto the substrate is dried in step (b) so as to evaporate any volatile components. Such volatile components may be in particular any solvents such as water or organic solvents. The drying in step (b) is merely a physical process and any chemical curing of the reactive composition should be avoided as much as possible.

[0045] The drying can be effected under ambient conditions or optionally be accelerated using conventional means such as a heater or a fan. The time required for the basic layer to dry depends on a number of factors such as the specific individual components used in the composition, its water content, the coating thickness, and of course, temperature of the surface, temperature and humidity of the surrounding air, and the amount of air circulation in the immediate area of the applied reactive composition.

[0046] However, it is preferred that any heat applied during the drying step be moderate, that is lower than 80°C, and better lower than 50°C, so as to prevent or reduce any curing of the basic layer at this stage.

[0047] The thickness of the coated reactive composition after drying is usually comprised between 25 and 150 µm, preferably between 50 to 100 µm.

[0048] After drying, the basic layer formed can be digitally printed on. Before curing, the basic layer preferably has a permeability which allows the adsorption and the release of products such as water that may be formed subsequently, notably upon curing of the overlay.

[0049] The dried basic layer has a good affinity towards most inks, notably water-based inks, and therefore ensures good adhesion of the ink. Further, it has a porosity which ensures that the ink is not absorbed in notable quantities while still preventing the drops from coalescing.

[0050] In step (c), the substrate coated with a basic layer is submitted to digital printing to form the decor.

[0051] Generally, the printed decor represents a wood pattern. Other patterns such as stone patterns or fantasy patterns are however also possible. As digital printing is very versatile, any pattern may be printed, even for small quantities and within short time and without requiring an exterior provider such as a printing company.

[0052] The dried reactive composition provides a particularly good adherence for water-based inks. Water-based inks are also less expensive than solvent-based inks. Water-based inks are thus preferred for said digital printing. However, solvent-based inks are not excluded.

[0053] Preferably, said digital printing techniques are of the type which can deposit ink droplets in a point-wise manner, such as this is the case, for example, with Drop-on-Demand (DOD) inkjet systems.

[0054] In a preferred embodiment, the substrate has during printing a speed of more than 30 m/min and better of more than 80 m/min or in particular up to 150 m/min.

[0055] In another preferred embodiment, the substrate is standing still and the printhead of the inkjet system are passing over the substrate.

[0056] In step (d), the ink forming the printed decor is dried or cured. Drying of the ink may be effected under ambient conditions or optionally be accelerated using conventional means such as a heater or a fan. The time required for the ink to dry depends on a number of factors such as the composition of the ink, its water content, the drop size, and of course, temperature of the surface, temperature and humidity of the surrounding air, and the amount of air circulation in the immediate area of the printed decor.

[0057] The suitable temperature range for drying or curing the ink may vary with the ink used. However, generally, a temperature in the range of 70 to 250°C is generally appropriate. A heating for a period comprised between 2 to 30 seconds is generally sufficient to induce the drying and the degree of cross-linking required.

[0058] While applying heat is possible to accelerate drying and induce ink curing at this stage, the ink may also be dried at ambient conditions and ink curing may be effected during step (e) where the overlay is applied at a temperature suitable for the curing of the basic layer and of the overlay.

[0059] In step (e), the printed substrate is covered with an overlay or finishing layer at a temperature which ensures curing of the overlay, as well as possibly of the ink. The heat also cures the basic layer, essentially by way of cross-linking reactions of the remaining reactive groups in the basic layer.

[0060] The conditions required to ensure curing of the basic layer and of the overlay include in particular the temperature range, duration and pressure. Suitable temperature range, duration and pressure for curing the reactive composition and the overlay may vary as they are function notably of the specific polymer and hardener used. However, generally, a temperature in the range of 100 to 300°C, preferably 120°C to 250°C is appropriate. A heating for a period comprised between 2 seconds to 10 minutes, preferably 2 to 30 seconds is generally sufficient to induce the degree of cross-linking required. Further, a pressure of 20 to 60 kg/cm² is preferred.

[0061] The curing confers to the basic layer novel properties. In particular, it provides the layer with durable elastic and adhesive properties. Therefore, the basic layer

may contribute to ensure the mechanical stability of the substrate. In particular, the adhesive properties of the cured basic layer enforce the cohesion between the different layers of the panel and thereby reduce the risk of delamination of the substrate when submitted to exterior forces. Advantageously, the basic layer has a permeability with regard to liquids, notably water, which allows the diffusion of products such as water formed during curing. Thereby, the accumulation of such products in form of bubbles may be prevented, and the cohesion between the overlay and the printed substrate is improved.

[0062] Preferably, the overlay is based on an amino resin, such as a melamine provided in the form of a resin or sheet. As an alternative, translucent or transparent lacquers may also be used.

[0063] Preferably, the overlay is coated onto the board in liquid form, for example, by means of one or more rollers. Alternatively, the overlay is coated onto the board by using melamine sheets. After this material possibly has dried, then, for example, in the case of an amino resin, also a press operation may be applied. By means of such press operation, a structure can be obtained at the surface of the respective board. Preferably, the pressed design is combined with the printing operation in order to obtain an Embossed in Register (EIR) design.

[0064] Said overlay further may also comprise hard particles, such as aluminum oxide, by which an improved wear resistance is obtained at the surface of the final substrate. This overlay shows an improved abrasion resistance than a lacquer. Preferably, such particles are provided on the still wet overlay.

[0065] The final thickness of the overlay is generally comprised between 2 and 100, preferably between 5 and 50 μm .

[0066] The back of the substrate may be protected by a balance paper or by a layer of lacquer.

[0067] The invention preferably is directed to the manufacture of substrates such as floor panels or boards and/or panels or boards of which said substrate material comprises or substantially consists of wood particles boards, MDF or HDF material. In the case of manufacturing floor substrates such as panels or boards, the method according to the invention may also comprise the step of forming profiled edge regions at the panels; such profiled edge regions preferably comprise coupling means allowing the interconnection of two or more of such floor panels at their edges.

[0068] The invention further relates to a substrate, notably a floor panel or board, which is obtained by means of the method according to the invention described above.

[Brief description of the Drawings]

[0069] Figure 1 schematically represents a substrate manufactured using a preferred embodiment of the meth-

od according to the invention.

[0070] According to a preferred embodiment of the method of the invention shown in Fig. 1, a panel 1 is manufactured as follows.

[0071] A substrate 2 made of a high-density fiberboard (HDF) is coated on the top side with a reactive composition such as Hydroplast® Printing Sealer (manufactured and sold by Friedrich Klumpp GmbH, Germany) which forms a basic layer 3. More specifically, the two components are mixed in a ratio of 95:5 and then applied in three application steps onto the substrate 2 by a suitable means, for instance by way of a roller. After drying each applied layer for 1 minute at 70°C, the basic layer 3 has a preferred thickness of 20 to 40 μm .

[0072] The substrate 2 thus coated with a basic layer 3 is then provided with a decor 4 using digital printing and water-based ink, using for instance a Drop-on-Demand (DOD) inkjet system. The specific properties of the basic layer 3 improve adherence of the ink on the substrate 2 while preventing excessive absorbing or on the contrary coalescence of the ink drops forming the decor 4.

[0073] After printing the decor 4, the panel 1 is introduced into an oven and heated to a temperature of 70 to 250°C, for a period of 2 to 30 seconds in view of drying and/or curing the ink drops forming the decor 4.

[0074] Subsequently, the decor applied onto the panel 1 is protected by application of an overlay 5, notably based on an amino resin, in particular a melamine resin. Such resin may be coated onto the panel 1 in liquid form, notably by means of one or more rollers. Alternatively the overlay is provided onto the panel 1 in solid form, notably by means of one or more sheets. The dimensions of the overlay sheet are chosen according to the dimensions of the panel. As an example, the overlay sheet has a length of 2620 mm, a width of 2070 mm and a gram-mage of 150 gr/m^2 .

[0075] After drying, if a resin is used, the overlay is submitted to a press operation under a pressure of about 60 kg/cm^2 at a temperature of between 100 and 300 °C for a period of 10 seconds. This step induces a curing of the basic layer 3 and the overlay 5 by cross-linking of the polymers. If required, the water based ink may also be cured during this step. After curing, the basic layer 3 has notable adhesive properties while however maintaining its elasticity and flexibility. Thereby, cohesion between the different layers of the panel 1 is reinforced and the risk of delamination, notably under stress, is reduced.

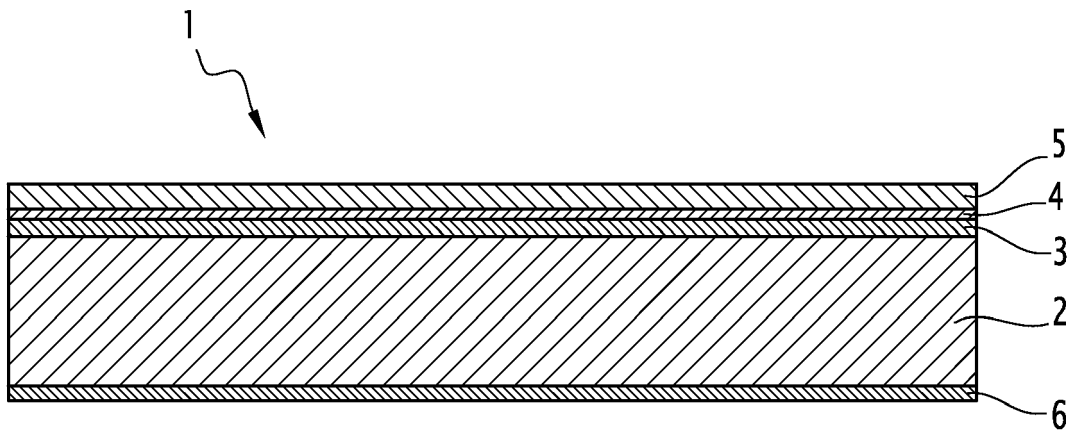
[0076] The final thickness of the overlay 5 is generally comprised between 2 and 100, preferably between 5 and 50 μm . In the case of manufacturing floor panels, profiled edge regions may be formed at the panels, either before or after applying the process of the invention.

[0077] The back of the panel may further be protected by application of a suitable protection layer 6 such as a balance paper or of a suitable lacquer.

Claims

Drop-on-Demand (DOD) inkjet system.

1. Method for the manufacture of wood fiber or mineral fiber based decorative substrates, comprising the steps of:
 - (a) coating a substrate with a liquid reactive composition which can be digitally printed on after drying;
 - (b) drying the reactive composition coated onto the substrate so as to form a basic layer having a permeability such that it may adsorb and release any condensation products formed during step (d) and (e);
 - (c) digitally printing a decor onto the basic layer using a liquid ink;
 - (d) drying or curing the liquid ink forming the digitally printed decor; and
 - (e) coating the digitally printed decor with a overlay at conditions which ensure curing of both the basic layer and the overlay.
2. Method according to claim 1, wherein the substrates are panels or boards.
3. Method according to claim 1, wherein the substrates are HDF based.
4. Method according to any of claims 1 to 3, wherein the liquid reactive composition is formulated as a two-component composition.
5. Method according to any of claims 1 to 4, wherein the liquid reactive composition is water based.
6. Method according to claim 4 or 5, wherein the first component comprises hydroxy functional polymers.
7. Method according to any of claims 4 to 6, wherein the second component of the two-component composition comprises isocyanate and aziridine hardeners.
8. Method according to any of claims 1 to 7, wherein the reactive composition has a viscosity comprised between 1 and 3 Pas at 20°C.
9. Method according to any of claims 1 to 8, wherein step (d) is carried out by heating the substrate having the digitally printed decor printed thereon to a temperature of 70 to 250 °C, preferably for a period of 2 to 30 seconds.
10. Method according to any of claims 1 to 9, wherein step (c) is carried out using water-based ink.
11. Method according to any of claims 1 to 10, wherein the digital printing in step (c) is carried out using a
12. Method according to any of claims 1 to 11, wherein the overlay applied in step (e) comprises a melamine resin.
13. Method according to any of claims 1 to 12, wherein step (e) is carried out by pressing at a temperature in the range of 100 to 300°C, with a pressure of 20 to 60 kg/cm² and/or for a period of 2 to 30 seconds.
14. Method according to any of claims 1 to 13, comprising further the step of providing the back side of the panel with a balance paper or a layer of lacquer.
15. Floor panel or board obtainable by a method according to any of claims 1 to 14.





EUROPEAN SEARCH REPORT

 Application Number
 EP 13 30 5458

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2004/086678 A1 (CHEN HAO A [US] ET AL) 6 May 2004 (2004-05-06)	15	INV. B44C5/04 B41M5/00
A	* paragraph [0020] - paragraph [0047] * -----	1-14	
X	EP 1 837 449 A2 (FICHTNER RENATE [DE]) 26 September 2007 (2007-09-26)	15	
A	* the whole document * -----	1-14	
A	EP 1 902 849 A1 (FUJIFILM CORP [JP]) 26 March 2008 (2008-03-26)	1-14	
A	* paragraph [0017] - paragraph [0085] * -----	1-14	
A	WO 02/085638 A1 (3M INNOVATIVE PROPERTIES CO [US]) 31 October 2002 (2002-10-31) * page 7, line 9 - page 23, line 25 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) B44C B41M
A	US 6 034 166 A (JACKSON MICHAEL L [US] ET AL) 7 March 2000 (2000-03-07) * column 2, line 30 - column 5, line 47 * -----	1-14	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 September 2013	Examiner Björklund, Sofie
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 30 5458

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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20

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30

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45

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004086678 A1	06-05-2004	AU 2003285120 A1	07-06-2004
		CA 2503553 A1	21-05-2004
		EP 1556561 A1	27-07-2005
		MX PA05004686 A	08-06-2005
		US 2004086678 A1	06-05-2004
		US 2008176039 A1	24-07-2008
		WO 2004042168 A1	21-05-2004
EP 1837449 A2	26-09-2007	DE 202006004493 U1	08-06-2006
		EP 1837449 A2	26-09-2007
EP 1902849 A1	26-03-2008	EP 1902849 A1	26-03-2008
		JP 4903618 B2	28-03-2012
		JP 2008105377 A	08-05-2008
		US 2008074482 A1	27-03-2008
WO 02085638 A1	31-10-2002	AT 281312 T	15-11-2004
		AU 2002247025 B2	24-08-2006
		BR 0208909 A	20-04-2004
		CA 2444572 A1	31-10-2002
		CN 1518504 A	04-08-2004
		DE 60201823 D1	09-12-2004
		DE 60201823 T2	24-11-2005
		EP 1381519 A1	21-01-2004
		JP 2004532144 A	21-10-2004
		JP 2007237733 A	20-09-2007
		JP 2009034995 A	19-02-2009
		MX PA03009492 A	24-05-2004
		US 2003021961 A1	30-01-2003
		WO 02085638 A1	31-10-2002
US 6034166 A	07-03-2000	AU 700849 B1	14-01-1999
		BR 9802539 A	08-09-1999
		CA 2238797 A1	25-01-1999
		CN 1212270 A	31-03-1999
		DE 69812787 D1	08-05-2003
		DE 69812787 T2	25-03-2004
		EP 0893483 A2	27-01-1999
		ES 2196495 T3	16-12-2003
		JP H11106680 A	20-04-1999
		US 5962574 A	05-10-1999
		US 6034166 A	07-03-2000

EPO FORM P0458

55

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2010084386 A [0006]