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(54) **A method of covering a substrate**

(57) A method of covering a substrate comprises the steps of supplying a substrate (1), a curable substance (5) and a substantially air-tight transparent film (6), applying a decorative pattern (3) on at least one of the substrate (1) and the film (6), forming a stack of the substrate (1), the substance (5) and the film (6), wherein the substance (5) is sandwiched between the substrate (1) and the film (6), bringing the film (6), the substance (5) and the substrate (1) in close contact to each other and curing the substance (5) by means of radiation through the transparent film (6) and fixing the substance (5) to the film (6) and the substrate (1).

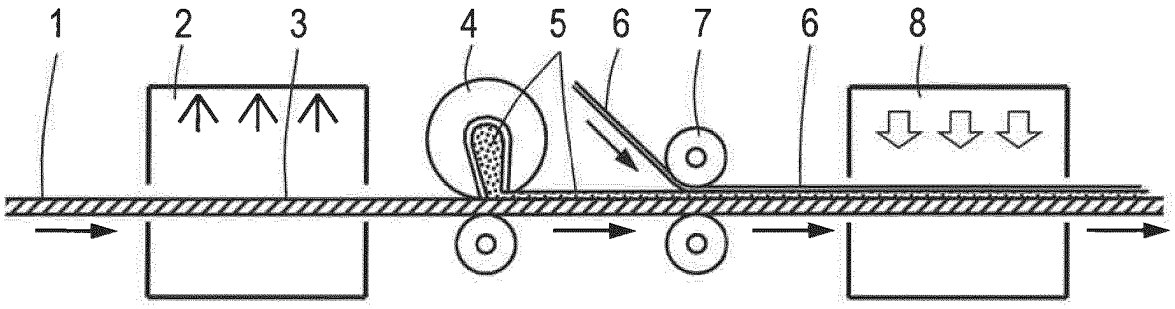

Fig.1

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Description

[0001] The present invention pertains to a method of covering a substrate.

[0002] A method of covering a substrate, in particular for manufacturing a floor panel, by means of a laminating process is known in the art. In a well-known laminating process one or more resin-impregnated paper sheets are placed on a substrate and the entire stack is pressed at elevated temperature. One of the paper sheets may be provided with a decorative pattern. Due to hot pressing the resin flows to the substrate and after cooling down the resulting product the one or more paper sheets are adhered to the substrate. A disadvantage of such a conventional laminating technique is that the method must be performed at relatively high pressure and temperature. Besides, conventional laminating techniques appear to provide inferior adherence quality between certain combinations of films and substrates due to less compatible materials, for example a PVC sheet on a substrate including an ink pattern on its surface. Furthermore, a relatively high temperature such as in case of a conventional laminating process may deteriorate a decorative pattern on the substrate, in particular in case of a decorative pattern of UV curable ink.

[0003] An object of the invention is to provide an improved method of covering a substrate.

[0004] This is achieved by the method according to the invention, which comprises the steps of supplying a substrate, a curable substance and a substantially air-tight transparent film, applying a decorative pattern on at least one of the substrate and the film, forming a stack of the substrate, the substance and the film, wherein the substance is sandwiched between the substrate and the film, bringing the film, the substance and the substrate in close contact to each other, curing the substance by means of radiation through the transparent film and fixing the substance to the film and the substrate. The transparency and composition of the film correspond to the type of radiation that is used. It is noted that the method is not finalized by removing the film, but the resulting product includes the film. Removing the film will be difficult or even impossible without damaging the surface of the cured substance.

[0005] An advantage of the method according to the invention is that the process can be performed at relatively low temperature. The method may be performed at room temperature, i.e. below 30 °C, or below 50 °C. This means that also substrates and films can be used which are sensitive to severe thermal conditions.

[0006] The curable substance forms a layer between the substrate and the film. Due to the air-tightness of the film it functions as a barrier against oxygen transfer through the transparent film. This means that local inert conditions at the curable substance are created. Therefore, an inert radiation chamber for creating inert conditions for the entire stack is not required.

[0007] The method can be performed at minimal pressure or without pressure; bringing the film, the substance and the substrate in close contact to each other is sufficient to minimize presence of air between the film and the substrate. This means that the pressure, if applied, is far below the level that is applied in conventional laminating techniques such as DPL and HPL, for example below 20 kg/m^2. Furthermore, the method according to the invention provides the opportunity to laminate materials which are less compatible in conventional laminating techniques such as a PVC sheet on HDF, or a PVC sheet on a substrate including an ink pattern; it is known, for example, that conventional laminating at elevated temperature of a PVC sheet on UV curable ink may lead to inferior adherence quality.

[0008] The curable substance may comprise a synthetic resin which is polymerized during the radiation treatment, more specifically via free radical polymerization. Radiation generates radicals in the substance. Since the chemical affinity between a radical and oxygen is higher than the affinity of the radicals with each other inert conditions are advantageous. The step of radiation may be performed by UV radiation, X-ray radiation, laser radiation, electron beam radiation, visible light, infrared, or the like. If curing is performed by means of UV light the curable substance may contain photoinitiators for initiating free radical polymerization. In particular, mercury-free UV LEDs appear to be appropriate because of their advantageous penetration characteristics into the curable substance. In case of using electron beam radiation photoinitiators are not required. As described above, the transparency and/or composition of the film correspond to the type of radiation that is used. For example, in case of applying electron beam radiation the film should be transparent for electron beam radiation, but may be opaque for visible light. Of course, if a decorative pattern below the film should be visible the film must be transparent for visible light, as well.

[0009] In case the decorative pattern is applied on the substrate the method has a further advantage compared to conventional laminating techniques in that a resin impregnated paper sheet or conventional glue can be omitted between the film and the substrate. Hence, any loss of transparency due to the manufacturing process, such as in case of applying a resin impregnated overlay paper, is minimized. Nevertheless, the method according to the invention may be applied for laminating a film, for example made of PVC, on a resin impregnated substrate when using a compatible curable substance between the film and the resin impregnated substrate.

[0010] The substance may contain additives for improving its properties during the step of applying it between the substrate and the film, for example plasticizers, fillers, or the like. The substance may also have further functional properties, for example for improving acoustic characteristics of the resulting product. It may also have anti-static properties or UV-filtering properties for protecting an underlying decorative pattern, or the like.

[0011] The resulting product may be a panel suitable

for a floor, wall or ceiling covering or alternative coverings. The product may also be a panel that is suitable for furniture, or the like.

[0012] The transparent film may be coloured or decorated but should be sufficiently transparent to pass the radiation. It is noted that transparency is related to the type of radiation; in case of applying electron beam radiation curing the film may be opaque for visible light radiation, but must be transparent for electron beam radiation. Furthermore, the film should not be degenerated under influence of the radiation, for example becoming brittle. Of course, if additional layers are applied these should be sufficient transparent, as well.

[0013] Additional layers may be applied on top of the film, but the film itself may also form the top layer of the final product. In the latter case, the film may have wear-resistant properties, for example containing anti-wear particles, but the composition of the film itself may provide sufficient wear resistance such as in case of a PVC sheet. Similarly, a balancing layer may be applied on the substrate at the side opposite to the side which is provided with the decorative pattern.

[0014] The stack may be formed by first applying the substance on the substrate, and then placing the film on the substance. It is also possible to apply the curable substance first onto the film, and then laying the substrate and the film including the curable substance onto each other. Alternatively, the curable substance is applied both onto the film and the substrate, after which the substrate and the film including the curable substance are laid onto each other.

[0015] It is efficient when the substance is fixed to at least one of the film and the substrate upon curing the substance, since separate fixing means can be omitted. In that case, the contact surfaces of the film and the curable substance and/or the contact surfaces of the curable substance and the substrate should be compatible to each other. For example, the contact surfaces of the film and the substrate may be slightly rough such that the curable substance partly enters into the contact surfaces and adheres thereto upon curing. It is also possible to apply a curable substance which reacts chemically with the film and/or the substrate such that adherence is promoted. Alternatively, one or more additional adhesive layers may be applied between the curable substance and the substrate and/or between the curable substance and the film for attaching the respective parts to each other. The additional layers may be cured by other treatments than radiation, for example by thermal treatment.

[0016] The method may be carried out as a continuous process wherein the step of bringing the film, the substance and the substrate in close contact to each other is performed by means of calandering or rollers. In general terms, the step of bringing the film, the substance and the substrate in close contact to each other may be performed by a low-pressure or no pressure laminating process, wherein the pressure is lower than 20 kg/m^2.

[0017] The decorative pattern may comprise an ink pattern. This may be printed on the substrate and/or the film by means of contact or non-contact printing, preferably by means of a digital printer. Alternative printing means are also possible. The decorative pattern may also be printed on a separate sheet that is attached to the substrate before, after or during printing. Numerous types of patterns are conceivable, for example a wood pattern, stone pattern, etc. It is noted that the substrate may be pretreated for improving the adherence of the decorative pattern to the substrate, for example a surface treatment such as plasma-treatment or applying a primer, or the like. The ink pattern may be dried before it contacts the substance, but not fully cured yet, for example, in case of a UV curable ink. Curing of the ink may occur at the same time as curing of the substance, but in practice the ink will be dried at least partially before contacting the substance and entirely curing the ink and the substance.

[0018] The transparent film may be provided with a surface texture. The surface texture may be applied during the step of bringing the film, the substance and the substrate in close contact to each other, but it is also conceivable that a film including a surface texture is supplied. In the latter case the surface texturing can be applied in a separate process and a relatively deep and sharp embossment is possible, whereas the embossment remains stable during the method of covering the substrate. Besides, an efficient process in terms of energy consumption is provided. In case of applying the step of bringing the film, the substance and the substrate in close contact to each other by means of a calander, the calander may be provided with a textured surface.

[0019] It is noted that the method according to the invention allows a relatively simple embossing-in-register process compared to a thermal lamination process. Embossing-in-register in this case can be performed more accurately than in conventional laminating processes in which a resin-impregnated paper sheet is provided with a decorative pattern, since the position of the pattern on the paper sheet varies due to the impregnation, in practice. The air-tight transparent film can be aligned with the substrate on which the decorative pattern is applied.

[0020] The transparent film may be made of PVC or an alternative wear-resistant material. This means that the resulting product may be a panel that is suitable as a floor panel. Additionally, the film may contain anti-wear particles such as corundum particles, glass beads, silica or the like.

[0021] The curable substance may be applied by means of screen printing, roller printing, spraying, curtain coating or the like. The thickness of the substance may be in a range from 20 to 500 μm, but a larger or smaller thickness is conceivable. The viscosity may be within a range from 150 centipoise to 500 poise at 20°C and more preferably within a range from 10 to 50 poise at 20°C. In practice, the substance may be a pasty liquid.

[0022] The thickness of the transparent film may be in a range from 5 to 1000 μm, but a larger or smaller thick-

ness is conceivable.

[0023] The substrate may be rigid or flexible such that the resulting product may comprise a panel which is rigid or flexible, respectively. It may be made of wood-based material like MDF, HDF, WPC, or vinyl, metal, glass, stone, ceramic, textile, non-woven fabric, polymeric composite or the like. Furthermore, the substrate may be a flexible thin sheet such that the resulting product itself can be an intermediate product that can be attached to a second substrate.

[0024] It is conceivable that the resulting product forms a so-called hybrid product, wherein the substrate is rigid and the film and/or the cured substance is/are elastic or reversed. Conventional laminating techniques including relatively high pressure and temperature are less suitable for manufacturing such hybrid products.

[0025] The method as described hereinbefore could also be combined with a sublimation process. For example, a sublimation agent can be applied on the side of the air-tight transparent film which is directed to the curable substance. Then, the film can be pressed at a low pressure level on the curable substance and heat can be supplied so as to transfer the sublimation agent towards the substrate. When limited pressing is performed by a calander it may comprise a heated roller or a heated engraved cylinder. The curable substance can be cured by means of radiation as described above. The film can be made of PVC on which the sublimation can be printed at a relatively low resolution. Upon the step of sublimation the agent slightly diverges during travelling towards the substrate. Consequently, the printed pattern is smoothened after sublimation.

[0026] The decorative pattern may be applied on a side of the film facing the substrate. Additionally, the opposite side of the film may be provided with a layer of thermoplastic polyurethane (TPU). The latter layer may be applied before or after the step of bringing the film, the substance and the substrate in close contact to each other. TPU belongs to a class of polyurethane plastics with many useful properties, including elasticity, transparency and resistance to oil, grease and abrasion. Technically, they are thermoplastic elastomers consisting of linear segmented block copolymers composed of hard and soft segments.

[0027] The substrate may comprise a decorative sheet, such as a paper sheet, on which the decorative pattern is applied, wherein the decorative sheet absorbs at least a part of the substance. The absorption properties of the decorative sheet and the material properties of the curable substance can be selected such that a desired level of penetration of the substance into the decorative sheet can be achieved before the step of curing the substance.

[0028] The number of layers of the stack may be extended. In a particular embodiment a second radiation-curable substance and a second substrate is supplied, wherein the stack is extended by the second substrate and a layer of the second substance which is sandwiched between the substrate and the second substrate, wherein the substances are cured by means of radiation through the transparent film and the substances are fixed to the film, the substrate and the second substrate. The second radiation-curable substance between the substrate and the second substrate may be the same as the curable substance between the transparent film and the decorative sheet. The second substrate may be rigid or flexible and/or thicker than the substrate, for example a board of HDF, but numerous other types of substrates are conceivable. If the substrate comprises the decorative sheet as mentioned above, the decorative sheet can absorb the curable substance at its side facing the transparent film, whereas the opposite side facing the second substrate can absorb the second curable substance before the step of curing and fixing. The material properties of the layers can be selected such that the radiation for curing reaches both substances. For example, electron beam radiation can penetrate relatively deeply such that both substances can be cured synchronously which appears to provide a surprisingly advantageous method of covering a substrate.

[0029] The invention will hereafter be elucidated with reference to the schematic drawings illustrating embodiments of the invention by way of example.

Fig. 1 is an illustrative view of an embodiment of the method according to the invention.

Fig. 2 is a cross-sectional view of a panel that is manufactured by an embodiment of the method according to the invention.

[0030] Fig. 1 illustrates an embodiment of the method according to the invention. In this case the method is performed as a continuous process. A substrate 1 in the form of a continuous sheet is supplied at the left side in Fig. 1 and transported from left to right. The substrate 1 passes a printing station 2 where a decorative pattern 3 is printed on the substrate 1. This may be performed by means of contact printing, non-contact printing, roller printing, inkjet printing, or the like.

[0031] Subsequently, at a coating station 4 a curable substance 5 in the form of a (pasty) liquid is applied onto the substrate 1 including the decorative pattern 3. Then, an air-tight transparent film 6 is supplied and placed on the layer of curable substance 5 and pressed at a low pressure level thereon by means of a calander 7. At this stage the curable substance 5 is still in a liquid and non-cured or partly-cured state. At a curing station 8 the curable substance 5 is cured by means of radiation which is transferred through the transparent film 6. It is also possible to apply the curable substance 5 onto both the substrate 1 and the film 6 or onto the film 6 only.

[0032] In an alternative embodiment an upper surface of the substrate 1 on which the decorative pattern 3 is printed may be pre-treated, for example by means of applying a primer.

[0033] The calander 7 may have a textured surface

such that the resulting product obtains an embossment. Such a texture may coincide with the decorative pattern 3 in order to achieve embossing-in-register. Alternatively, the film 6 has already a textured surface before it is supplied to the calander 7.

[0034] The resulting product at the end of the illustrated method in Fig. 1 is a large board which is cut in separate panels. Subsequently, the edges of the separate panels may be provided with locking means, for example tongues and grooves, in order to create a covering by locking similar panels to each other.

[0035] The curable substance may comprise acrylic acid esters or methacrylic acid esters which can be polymerized by a free radical mechanism by actinic radiation and which are present, on their own or together, in a polymerizable mixture. A component may be a mono- or polyfunctional prepolymer, i.e. a mono- or polyunsaturated prepolymer. In addition to this predominant component, the copolymerizable mixture contains, if appropriate, a further component having a diluting action, which is described as a diluent monomer or diluent oligomer. The proportion in the mixture of the polyfunctional prepolymer may be 20 to 100%, in particular 60 to 90%, by weight of the total weight of copolymerizable components. Prepolymers of a low viscosity, less than 100 poise at 20° C may be employed without the monomers or oligomers producing dilution.

[0036] Preferably, the components used have a strong tendency to polymerize by a free radical mechanism under the action of actinic radiation. Suitable actinic radiation is a light in the near UV region or high-energy radiation, for example electron, particle or x-ray radiation. A prepolymer which can be polymerized by free radical mechanism is a polyfunctional, unsaturated aliphatic or aromatic acrylate or methacrylate, preferably an unsaturated polyester acrylate oligomer and especially an aliphatic urethane acrylate oligomer or aromatic urethane acrylate oligomers.

[0037] In addition to the prepolymer, a mono-, di-, tri-, tetra-, penta- or hexaacrylate or -methacrylate, preferably a diacrylate or triacrylate, may be used as an additional suitable monomer or oligomer in the mixture which can be copolymerized by a free radical mechanism. These mono- to hexaacrylates or mono-to hexamethacrylates are esters of polyols having 1 to 6 OH groups with acrylic acid or methacrylic acid, respectively, and are therefore also known as polyol acrylates or polyol methacrylates, respectively. Suitable diacrylates are esters of acrylic acid with aliphatic, dihydric alcohols, in particular ethylene glycol, 1,2-propylene glycol, 1,3-propyleneglycol, butane diols, 1,6-hexane diol or neopentylglycol, with aliphatic ether-alcohols, in particular diethylene glycol, dipropylene glycol, dibutylene glycol, polyethylene glycols or polypropylene glycols, with oxyalkylated compounds of the above-mentioned aliphatic alcohols and ether-alcohols or with aromatic dihydroxy compounds, in particular bisphenol A, pyrocatechol, resorcinol, hydroquinone, p-xylyleneglycol or p-hydroxybenzyl alcohol. Preferred diacrylates are 1,6-hexanediol diacrylate, dipropyleneglycol diacrylate, acrylic acid 2-(2-vinyloxyethoxy)-ethyl ester, propoxylated neopentylglycol diacrylate, isobornyl acrylate, mono-2acrryloyloxyethyl phtalate, tricyclodecane dimethanol diacrylate, 2-carboxyethyl acrylate, Benzyl acrylate, tripropylene glycol diacrylate and 1,4-butanediol diacrylate. Preferred triacrylates are trimethylolpropane triacrylate and pentaerythritol triacrylate.

[0038] In addition to the urethane acrylate oligomers and unsaturated polyester acrylate oligomers already mentioned, suitable polyfunctional prepolymers are also epoxy-acrylate and silicone-acrylate oligomers, which are preferably used together with the diacrylates or triacrylates mentioned in the mixture which can be copolymerized by a free radical mechanism.

[0039] The prepolymers are compounds known per se and are prepared, for example, from hydroxylated copolymers in which the hydroxyl groups are distributed statistically along the copolymer chain. Statistically unsaturated acrylic copolymers are obtained from this copolymer by esterifying the hydroxyl groups with acrylic acid. Semi-terminal unsaturated acrylic copolymers are prepared by having the hydroxyl group at the end of the chain in the preparation of the hydroxylated copolymers. Urethane acrylate oligomers are prepared by reacting (meth)acrylic acid esters containing hydroxyl groups, for example, hydroxyethyl methacrylate, with polyfunctional isocyanates, preferably diisocyanates. The diisocyanates or polyisocyanates can preferably be reaction products of diols, polyether-diols or polyester-diols containing a stoichiometric excess of monomeric diisocyanate or polyisocyanate.

[0040] If the polyfunctional prepolymer preponderates in the polymerizable mixture, as the base resin, by virtue of its chemical nature, it determines the properties of the cured surface layer. The monoacrylate to hexaacrylate or monomethacrylate to hexamethacrylate added makes it possible as a diluent monomer or oligomer, to adjust the viscosity of the mixture to be cured, which is normally within a viscosity range from 20 to 100 poise at 20° C, and entirely takes part in the free radical polymerization. When irradiated, the coating is cured through free radical polymerization between the double bonds of the prepolymer and of the diluent monomer or oligomer which may be present.

[0041] Fig. 2 shows an embodiment of a part of a panel 9 that is manufactured by an alternative method according to the invention. The upper three layers are almost similar as shown in the embodiment according to Fig. 1: the transparent film 6 forms an upper layer, but the substrate is now formed by a paper sheet 1, whereas the cured substance 5 is sandwiched between the paper sheet 1 and the film 6. The paper sheet 1 is provided with a decorative pattern which remains visible through the transparent film 6. Furthermore, the panel 9 as shown in Fig. 2 also comprises a second substrate in the form of a board 10, for example a HDF board, whereas a layer

of the cured substance 5 is also sandwiched between the decorative paper sheet 1 and the board 10. Before the step of curing, the decorative paper sheet 1 has absorbed at least a part of both layers of substance 5, as indicated by reference sign 11 in Fig. 2. The layers of substance 5 are cured by means of radiation through the transparent film 6 such that all layers of the entire stack are fixed to each other in a single step of applying radiation. This is advantageous compared to conventional manufacturing techniques where the layers 1 and 6 would be attached to each other in a first step, for example by means of gluing, after which the resulting intermediate product would be adhered to the board 10 in a second step. During manufacturing the panel 9 the extended stack as shown in Fig. 2 can be stacked in a similar way as illustrated in Fig. 1. It is conceivable that the decorative sheet 1 does not absorb the substance 5, but allows to pass the radiation and adheres to the board 10 through the substance 5 upon curing.

[0042] The invention is not restricted to the above-described embodiments as shown in the drawing, which can be varied in several ways without departing from the scope of the invention.

Claims

1. A method of covering a substrate, comprising the steps of:

   supplying a substrate (1), a curable substance (5) and a substantially air-tight transparent film (6),
   applying a decorative pattern (3) on at least one of the substrate (1) and the film (6),
   forming a stack of the substrate (1), the substance (5) and the film (6), wherein the substance (5) is sandwiched between the substrate (1) and the film (6),
   bringing the film (6), the substance (5) and the substrate (1) in close contact to each other,
   curing the substance (5) by means of radiation through the transparent film (6) and fixing the substance (5) to the film (6) and the substrate (1).

2. A method according to claim 1, wherein the stack is formed by first applying the substance (5) on the substrate (1), and then placing the film (6) on the substance (5).

3. A method according to claim 1 or 2, wherein the substance (5) is fixed to at least one of the film (6) and the substrate (1) upon curing the substance (5).

4. A method according to one of the preceding claims, wherein the method is carried out as a continuous process wherein the step of bringing the film (6), the substance (5) and the substrate (1) in close contact to each other is performed by means of calandering.

5. A method according to one of the preceding claims, wherein the decorative pattern (3) comprises an ink pattern.

6. A method according to claim 5, wherein the ink pattern (3) is printed by means of contact or non-contact printing.

7. A method according to one of the preceding claims, wherein the surface of the substrate (1) on which the decorative pattern (3) is applied is provided with a primer for adherence of the decorative pattern (3) and/or the substance (5).

8. A method according to one of the preceding claims, wherein the curable substance (5) comprises a synthetic resin which is polymerized by radiation.

9. A method according to one of the preceding claims, wherein the transparent film (6) is provided with a surface texture.

10. A method according to claim 9, wherein the surface texture is applied during the step of bringing the film, the substance and the substrate in close contact to each other.

11. A method according to one of the preceding claims, wherein the curable substance (5) is applied by means of screen printing, roller printing, spraying, curtain coating or the like.

12. A method according to one of the preceding claims, wherein the thickness of the transparent film (6) is in a range from 20 to 1000 μm.

13. A method according to one of the preceding claims, wherein the thickness of the substance (5) is in a range from 5 to 200 μm.

14. A method according to one of the preceding claims, wherein the substrate (1) comprises a panel which is provided with locking means for coupling the resulting panel to locking means of an adjacent similar panel.

15. A method according to one of the preceding claims, wherein the decorative pattern (3) is applied on a side of the film (6) facing the substrate (1), wherein the opposite side of the film (6) is provided with a layer of thermoplastic polyurethane (TPU).

16. A method according to one of the preceding claims, wherein the substrate (1) comprises a decorative sheet, such as a paper sheet, on which the decora-

tive pattern is applied, which decorative sheet (1) absorbs at least a part of the substance.

17. A method according to one of the preceding claims, wherein a second radiation-curable substance (5) and a second substrate (10) is supplied, wherein the stack is extended by the second substrate (10) and a layer of the second substance (5) which is sandwiched between the substrate (1) and the second substrate (10), wherein the substances (5) are cured by means of radiation through the transparent film and the substances (5) are fixed to the film (6), the substrate (1) and the second substrate (10).

18. A method of manufacturing a panel, such as a floor panel, wall panel or a ceiling panel, which is manufactured by means of the method of covering a substrate according to one of the preceding claims, wherein the panel is provided with locking means for coupling the panel to locking means of an adjacent similar panel.

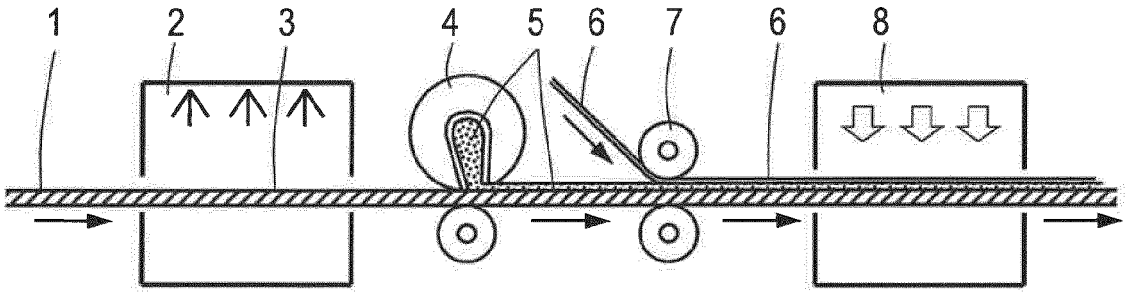

Fig.1

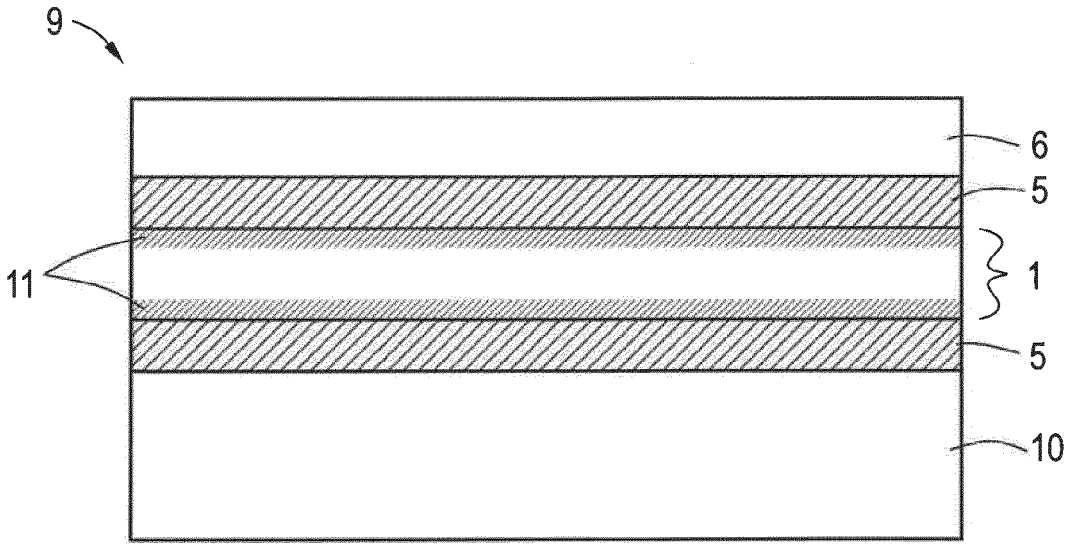

Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 3628

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	EP 1 203 657 A1 (IBIDEN CO LTD [JP]) 8 May 2002 (2002-05-08) * paragraph [0013] - paragraph [0028]; figures 1-9; examples 1(1)-1(7) *	1-18	INV. B44C5/04
X	DE 10 2004 034790 A1 (KUNZ HOLDING GMBH & CO KG [DE]) 3 February 2005 (2005-02-03) * paragraph [0020] - paragraph [0030]; figure 1 *	1-18	
X	EP 2 708 375 A1 (SPANOLUX N V DIV BALTERIO [BE]) 19 March 2014 (2014-03-19) * paragraph [0014] - paragraph [0019] * * paragraph [0069] *	1-18	
A	EP 0 872 338 A1 (DAINIPPON PRINTING CO LTD [JP]) 21 October 1998 (1998-10-21) * the whole document *	1-18	

TECHNICAL FIELDS SEARCHED (IPC)
B44C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 December 2014	Sartor, Michele

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 16 3628

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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17-12-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1203657 A1	08-05-2002	EP 1203657 A1	08-05-2002
		TW I299695 B	11-08-2008
		US 2003091758 A1	15-05-2003
		US 2005153611 A1	14-07-2005
		WO 0170496 A1	27-09-2001
DE 102004034790 A1	03-02-2005	AT 375214 T	15-10-2007
		DE 102004034790 A1	03-02-2005
		EP 1549511 A1	06-07-2005
		ES 2295905 T3	16-04-2008
		HK 1082712 A1	29-08-2008
		US 2006240247 A1	26-10-2006
		WO 2005009758 A1	03-02-2005
EP 2708375 A1	19-03-2014	EP 2708375 A1	19-03-2014
		WO 2014041085 A1	20-03-2014
EP 0872338 A1	21-10-1998	AU 730837 B2	15-03-2001
		AU 4031497 A	19-03-1998
		BR 9706666 A	20-07-1999
		CN 1206374 A	27-01-1999
		DE 69729177 D1	24-06-2004
		DE 69729177 T2	18-11-2004
		EP 0872338 A1	21-10-1998
		JP 3898256 B2	28-03-2007
		JP H1067085 A	10-03-1998
		NZ 330255 A	30-08-1999
		TW 460387 B	21-10-2001
		US 6103352 A	15-08-2000
		WO 9808682 A1	05-03-1998

EPO FORM P0459

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