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(54) **An appliqué and method for applying an appliqué**

(57) The present invention relates to an appliqué for application to a substrate, the appliqué comprising: a layer of intermediate lacquer; a layer of adhesive; and a third layer comprising one or more of an ink layer, an embossable layer, a design layer, a white back layer, a silver back layer and a migration resistant layer, wherein, in use, the layer of intermediate lacquer aids bonding of the layer of adhesive to the third layer and a method for adhering the appliqué to a substrate, the method comprising the step of adhering the appliqué in a single-step by applying a temperature of 135°C or lower.

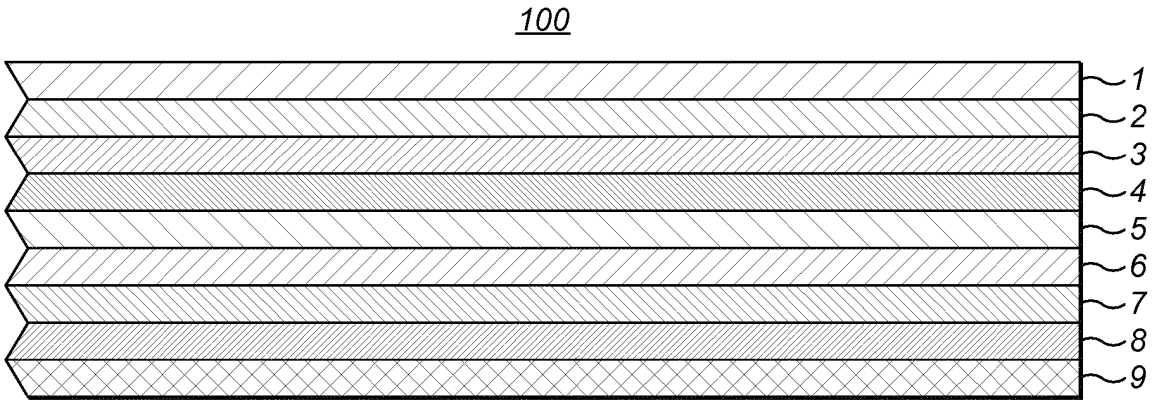

FIG. 1a

EP 2 924 165 A1

Description

Field of the Invention

[0001] The present invention relates generally to an appliqué and a method for applying said appliqué to a substrate. More particularly, but not exclusively, the present invention relates to an appliqué comprising a specially selected hot-melt layer and lacquer layer which provide for improved wash fastness and durability compared to existing appliqués and which provide for a single-step method for applying the appliqué to a substrate.

Background to the Invention

[0002] In this specification, the term "appliqué" includes, but is not limited to including, a decorative patch, label, badge or other such application, which may be applied to a substrate (for example, a fabric or a garment made of fabric) to impart a decorative design such as a logo on the substrate. The term may encompass, but is not limited to only encompassing, appliqués which are applied to a substrate via heat transfer techniques and appliqués which are sewn or glued to a substrate.

[0003] It will be understood that wherever the term substrate is used throughout this specification, it also covers fabric(s) or a garment made of fabric(s).

[0004] Wash fastness and durability are key concerns in the field of appliqués.

[0005] It is often a customer/brand requirement that appliqués and embellishments meet the certain specified standards for laundering and graphic durability. An example of once such brand standard is the 2010 Nike™ Approved Test Methods & Technical Details for Graphic and Print Durability.

[0006] The purpose of graphic and print durability testing is to determine the durability and appearance of graphic and print appliqués when subjected to laundering conditions. Test specimens are laundered at elevated temperatures to assess the integrity of application processes and the wash and wear durability of the appliqué. Graphic and print appliqués include, but are not limited to, screen prints, sublimated prints, puff prints, heat transfers and flocking and dimensional welds.

[0007] A customer/brand will often specify American Association of Textile Chemists and Colorists (AATCC), International Organization for Standardization (ISO) or brand specific test methods. The customer/brand will also often specify apparatus, reagents and materials to use during the test along with procedures. One such test is AATCC Colour Evaluation Procedure 1 - Assessment of Colour Change.

[0008] The durability of an appliqué is assessed by measuring the bond to the garment, colour loss and surface changes resulting from detergent solution and abrasive action of a specified number of standard home launderings, with or without chlorine.

[0009] Wash fastness describes the resistance of an appliqué to accelerated laundering tests. Accelerated laundering tests are known in the apparel industry and used to evaluate the resistance to laundering of textiles, appliqués and embellishments, which are expected to withstand frequent laundering.

[0010] There is a constant desire for appliqués with improved wash fastness and durability.

[0011] Furthermore, currently available appliqués require a multi-step application process. Current processes involve placing the appliqué adhesive side down on the substrate, applying heat (for example, a heat of between 130°C - 140°C) from the top down using, for example, a heat plate as is well known in the art, often for between 5 to 8 seconds, to keep the appliqué in place, essentially tacking the appliqué onto the garment at the desired location. The garment, with appliqué tacked onto it, is then turned over and heat (for example, a heat of between 130°C - 140°C) is applied again, often for a further 15 to 20 seconds, in order to fully adhere the appliqué to the garment. Such a two-step application process is required to ensure that the appliqué is permanently applied to the garment without any embossing detail being lost during the application process, as would be the case were heat to be applied top down until the appliqué were fully adhered to a garment. Embossing detail is lost when heat is applied top down until the appliqué is fully adhered to a garment because the embossable materials which are currently used in appliqués have a relatively low Shore hardness as there is also a desire for flexibility, especially where the applique is to be applied to garments.

[0012] Such two-step application processes are often cumbersome and inefficient. As such, there is a desire for a more simplified application process.

Summary of the Invention

[0013] The present invention relates, in part, to an appliqué for application to a substrate, the appliqué comprising: a layer of intermediate lacquer; a layer of adhesive; and a third layer comprising one or more of an ink layer, an embossable layer, a design layer, a white back layer, a silver back layer and a migration resistant layer, wherein, in use, the layer of intermediate lacquer aids bonding of the layer of adhesive to the third layer.

[0014] Advantageously, a stronger bond between the layer of adhesive and third layer is achieved by including the layer of intermediate lacquer.

[0015] The layer of intermediate lacquer may further comprise a solution of polyester type thermoplastic polyurethane.

[0016] The solution of polyester type thermoplastic polyurethane may be Estane 5701 dissolved in cyclohexanone.

[0017] The solution of Polyester Type Thermoplastic Polyurethane may further comprise a hot-melt powder dispersed in it.

[0018] The hot-melt powder may comprise a Griltex 1A P1 powder.

[0019] Advantageously, a stronger bond between the layer of adhesive and third layer via the layer of intermediate lacquer can be achieved at lower temperatures by adding Griltex 1A P1 to the layer of intermediate lacquer. Therefore, less heat need be applied during the application process. As such the single-step application process (to be described in detail below) can be used as there is less risk of losing embossing detail.

[0020] The solution of polyester type thermoplastic polyurethane may further comprise Desmophen C1200.

[0021] N75 may be added to the appliqué on press.

[0022] The solution of polyester type thermoplastic polyurethane may further comprise a solution of Modaflow 2100.

[0023] The solution of polyester type thermoplastic polyurethane may further comprise Foamex N.

[0024] The solution of polyester type thermoplastic polyurethane may further comprise L142.

[0025] The layer of adhesive may be a layer of hot-melt adhesive.

[0026] The layer of hot-melt adhesive may further comprise one or more of a thermoplastic film made from aromatic and an aliphatic thermoplastic.

[0027] The layer of hot-melt adhesive may include one or more of polyamide, polyester, polyolefin, polyurethane, and polyurethane ester.

[0028] The present invention relates, in part, to a method for adhering the appliqué of any preceding claim to a substrate, the method comprising the step of adhering the appliqué in a single-step by applying a temperature of 135°C or lower.

[0029] Advantages of this single-step application process include, but are not limited to, one or more of reduced handling time, reduced application time and other improved efficiencies during application.

[0030] The temperature may be applied top down for 20 seconds or less at a medium pressure.

Brief Description of Drawings

[0031] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 a shows an exemplary first appliqué;

Figure 1b shows the exemplary first appliqué with the top carrier removed;

Figure 2a shows an exemplary second appliqué;

Figure 2b shows the exemplary second appliqué with the top carrier removed;

Figure 3a shows an exemplary third appliqué;

Figure 3b shows the exemplary third appliqué with the top carrier removed;

Figure 4a shows an exemplary fourth appliqué;

Figure 4b shows the exemplary fourth appliqué with the top carrier removed;

Figure 5a shows an exemplary fifth appliqué;

Figure 5b shows the exemplary fifth appliqué with the top carrier removed;

Figure 6a shows an exemplary sixth appliqué;

Figure 6b shows the exemplary sixth appliqué with the top carrier removed;

Figure 7 shows a multiple piece design appliqué; and

Figure 8 shows a simplified version of a roll to roll embossing and cutting process concept.

Detailed Description

[0032] The present invention provides an appliqué with improved wash fastness and durability compared to existing appliqués and which can be applied to a substrate in a single-step.

[0033] Figures 1a to 6b show all show variations of exemplary appliqués which will each be discussed below.

[0034] Figures 1 a and 1 b show an exemplary first appliqué 100. The first appliqué 100 comprises an optional removable top carrier 1 (shown in Figure 1 a) which holds the first appliqué 100 rigid. The rigidity of the first appliqué 100 is important during a printing of 'design' layers of the first appliqué 100 (to be described below) and where, for example, the first appliqué 100 further comprises large thermoplastic polyurethane (TPU) film sheets (for example, sheets of around 720mm x 520mm of larger) meaning that there may be a risk of dimensional instability. Figures 1b shows the exemplary first appliqué 100 of Figure 1 with the removable top carrier 1 removed.

[0035] The removable top carrier 1 may be between 70μm and 120μm in thickness.

[0036] The removable top carrier 1 may be made of polyester. The carrier may be made of a plastic or of a paper film as is well known in prior art.

[0037] A polyester film is preferred because, at least as compared to some other plastic materials such as polyethylene or non-orientated polypropylene, polyester possesses more favourable mechanical properties. Polyester has greater dimensional stability, thermal stability and a higher tensile strength. Dimensional stability refers to the ability of the polyester material to maintain its essential or original dimensions while being used as a carrier. Thermal stability refers to the fact that the polyester does not undergo any chemical changes during standard processing of this product.

[0038] In addition unlike polyethylene, polyester does not tend to soften and become tacky at the types of temperatures encountered during processing.

[0039] The removable top carrier 1 may be single coated with a release layer on one side. For example, a release layer of release material may be provided on an inner surface of the removable top carrier 1 to facilitate a clean separation of the carrier 1 from the appliqué 100.

[0040] Both Figures 1a and 1b show the first appliqué 100 comprising an optional specially selected embossable material layer 2 supplied on the removable top carrier 1. Preferred materials may be any suitable embossable material that those well versed in the art will know about which include, but are not limited to, glycol modified polyethylene terephthalate (PETG), polyethylene terephtahalate (PET), polypropylene (PP), (polyvinyl chloride) (PVC).

[0041] For applications where the first appliqué 100 is to be applied to textiles, it is preferable to select a softer, more flexible embossable material 2 such as PETG, PP, or TPU. It is preferable to use a material with a Shore hardness of 80-98A and more preferable to use a material 2 with a Shore hardness of 88-94A. Most preferably, a material with a Shore hardness of between 90A and 92A is used.

[0042] A specially selected embossable material 2 with a low Shore hardness would lose emboss detail during heat application (to be described below), materials with a Shore hardness of 85A and below have been proven to have this characteristic of losing emboss detail.

[0043] Materials with a Shore hardness of 95A and above, while keeping the emboss detail, are too hard and rigid on the garment and are not suitable for such textile applications. Materials with a Shore hardness between 86A and 94A are deemed most suitable because they both hold the emboss detail well and also have the required flexibility for application to textiles.

[0044] For applications where the first appliqué 100 is to be applied to a rigid substrate using a pressure sensitive adhesive (PSA), it is preferable to select a PET or a rigid PVC as the embossable material 2.

[0045] For all applications, the specially selected embossable material 2 may be, but is not limited to being, one or more of transparent, opaque, tinted, coloured, incorporate effect pigments or metallised particles.

[0046] The specially selected embossable material 2 may be up to 1 mm in thickness and may also be a film or sheet of material with or without said thickness.

[0047] Both Figures 1a and 1b show the first appliqué 100 comprising optional design layers 3 (to be described below) which may be printed in specific sequence and also may be printed in register to each other.

[0048] Inks that may be used to print the design layers 3 include, but are not limited to, one or more of solvent based polyurethane (PU), water based PU, UV curable, Acrylic and Plastisol.

[0049] Typically, and where the appliqué 100 is a heat transfer type appliqué, the optional design layers 3 may comprise thermoplastic colour layers which are capable of being adhered to substrates upon the application of heat and pressure using, for example, a heat plate as is well known in the art.

[0050] Suitable thermoplastic inks for said thermoplastic colour layers include, but are not limited to including, epoxies, polyurethanes, polymethacrylates, polyethylene, vinyl acetates, polyvinyl chlorides, vinyl chloride/vinyl acetate co-polymers, functionalised vinyl chloride/vinyl acetate co-polymers, chlorinated halogenated polyolefins such as chlorinated and fluorinated polyolefins and polystyrene.

[0051] Alternatively, the colour layers may be cross linked to form a thermoset polymer with increased durability including improved abrasion resistance and chemical resistance, such as would be required for an apparel label being subjected to multiple wash and wear cycles. In this case a thermoplastic adhesive would be required to facilitate the bond between the label and the fabric.

[0052] Both Figures 1a and 1b show the first appliqué 100 comprising optional single or multiple white back-up layers 4. These may be added to the first appliqué 100, usually after any coloured ink layers have been printed, to give print opacity and brightness.

[0053] Both Figures 1a and 1b show the first appliqué 100 comprising optional single or multiple silver back-up layers 5. These may be added to the first appliqué 100, usually after any coloured ink layers have been printed, to provide opacity and dye blocking properties.

[0054] The "silver" inks used to produce the silver back-up layers 5 may be made with aluminium pigment particles. Using vacuum metallized aluminium pigments, such as the Metasheen series from BASF and the Metalure series from Eckhart, allows the best deposition of aluminium particles so as to form a physical barrier to the sublimation dyes responsible for dye migration observed in the decoration of some coloured fabrics

[0055] Both Figures 1a and 1b show the first appliqué 100 comprising optional single or multiple migration resistant layers 6 which may be added to the first appliqué 100 if required.

[0056] Activated carbon particles are widely used in both pharmaceutical and the food and beverage industries to purify products by absorbing contaminants referred to as "colour bodies". Activated carbon based inks may be used in the migration resistant layers 6 of the first appliqué 100 to prevent dye migration through the absorption of the sublimation dyes which can transfer from the fabric into labels causing discolouration.

[0057] All of layers 2 to 6 are optional. They may equally be replaced by a single or composite layer comprising one or more of an ink layer, an embossable layer, a design layer, a white back layer, a silver back layer and a migration resistant layer.

[0058] Both Figures 1a and 1b show the first appliqué 100 comprising a specifically selected lacquer 7 which aids bonding of hot-melt 8 (described below) to the other layers.

Table 1: Exemplary Lacquer Composition

Ingredient	Wt%	Estane 5701	Cyclo/Bio-based alternative	C1200	EEP	Modaflow	Griltex 1AP1	Foamex N	L142
Resin Solution	82.30	14.81%	67.49%						
Desmophen C1200	12.50			12.50					
Modaflow solution	2.00		0.15%		0.85%	1.00%			
Foamex N	0.10							0.10%	
Griltex 1AP1	3.00						3.00%		
L142	0.10								0.10%
Total wt%		14.81%	67.64%	12.50%	0.85%	1.00%	3.00%	0.10%	0.10%

[0059] Table 1 shows the composition of an exemplary lacquer which may be used as specifically selected lacquer 7.

[0060] Specifically selected lacquer 7 may be a solution of Polyester Type Thermoplastic Polyurethane such as Estane 5701 which may be dissolved in cyclohexanone and may be dissolved along with a hot-melt powder such as Griltex 1 A P1 powder dispersed in it. Such a material (Estane 5701) displays low temperature flexibility and abrasion resistance.

[0061] A cyclohexanone replacement such as Elsol CXR, Estasol or similar may be used as a 'green chemistry' alternative.

[0062] A benefit of adding Griltex 1A P1 is that the powder gives the lacquer a rough surface. The lacquer acts as a tie layer between the silver and the hot-melt adhesive because the Estane 5701 provides adhesion to the Estane based silver backup ink and the Griltex provides adhesion to the hot-melt adhesive.

[0063] The Tg (glass transition temperature) for Estane 5701 is below room temperature, so this type of raw material is a softer more flexible material than Estane 5715 for example, which is why this type of material was selected. This is also supported by the known Shore hardness data for each material. The Estane 5701 has a Shore hardness of 85A that is similar to the desired Shore hardness of the previously discussed specially selected embossable material 2 (which may be a TPU film).

[0064] 5% N 75 may be added on press. N 75 is an aliphatic polyisocyanate resin based on hexamethylene diisocyanate (HDI) and dissolved in n-butyl acetate and xylene at a ratio of 1:1. N 75 is added and mixed to the ink prior to the ink being printed (i.e. on press). N 75 is an accelerator for the isocyanate - hydroxyl reaction. The source of the hydroxyls is the Desmophen C1200, which is a linear diol, which reacts with the N75 to provide a cross-linked network for improved wash resistance and/or colour fastness.

[0065] A 50% solution of Modaflow 2100 from Cytec and may be used as a levelling agent.

[0066] Foamex N is antifoam from Tego and L142 is an optical brightener, both of which may be used in the composition of the lacquer 7.

[0067] Accelerated laundering tests are known in the apparel industry and used to evaluate the colourfastness to laundering of textiles, appliqués and embellishments, which are expected to withstand frequent laundering. Colour loss and surface changes resulting from detergent solution and abrasive action of a specified number of standard home launderings, with or without chlorine, are used to evaluate wash resistance. Specimens are tested under appropriate conditions of temperature, detergent solution, bleaching and abrasive action such that the resulting colour change is similar to that which would occur in a specified number of home launderings.

[0068] It was established that the weakest point in the construction of existing appliqués was between the final ink layer (e.g. the equivalent of layers 2 to 6 of the first appliqué 100) and the hot-melt film (e.g. the equivalent of the below described adhesive layer 8). On initial trials these layers delaminated during laundering at temperatures of 60 °C.

[0069] Accordingly, copolyamide hot-melt powder Griltex 1 AP 1 was added to the lacquer 7 formulation. This provides a rough surface that increases the surface area of the lacquer 7 to allow a greater surface area for the adhesive (hot-melt) layer 8 to bond to. The selection of the powder is such that it will melt in the same temperature range as the specially selected adhesive 8 (described below) forming a strong three dimensional tie layer between the final ink layer (which ever of layers 2 to 6 are present) and the specially selected hot-melt 8. The additional tie layer significantly improves the wash fastness of the appliqué.

[0070] Advantageously, a stronger bond between the adhesive layer 8 and the final ink layer (via the lacquer 7) can be achieved at lower temperatures, therefore, less heat need be applied during the application process. As such the single-step application process (to be described in detail below) can be used as there is less risk of losing embossing detail.

[0071] The hot-melt powder was specially selected, as it is washfast at 60 °C, thus overcoming the above outlined problems associated with existing appliqués.

[0072] Both Figures 1a and 1b show the first appliqué 100 comprising a specially selected adhesive layer 8 that allows the first appliqué 100 to be applied in one application (to be described below) at temperatures of between 125°C and 135°C and pass appliqué durability testing at 60°C. Hotmelts used in existing appliqués would not adhere if heat in this temperature range were used in the single-step top down application process described herein.

[0073] While this temperature range overlaps with that of the two step application, it is important to note that with the two-step application process for existing appliqués it is necessary during the second step to turn the garment (or substrate) upon which the appliqué is tacked around so the adhesive side of the appliqué is facing towards the heat source (which, for example, may be a heat plate) and heat the adhesive side of the appliqué. This is because the embossable layer of existing appliqués, as well as that of the appliqués described herein, acts as a heat sink and the actual temperature reaching the adhesive during top down heating is lower than 130°C. As such, applying heat to the adhesive side during the second step not only reduces the risk of the embossable layer losing embossing detail, it also means that a higher temperature reaches the adhesive layer causing it adhere fully to the garment.

[0074] The adhesive used in the appliqués described herein can be fully adhered to a substrate at significantly lower temperatures than are used in adhering existing appliqués as a result of the composition and characteristics of their component layers, as described herein. As such, a single-step top down heating process can be performed with a lower temperature reaching the adhesive layer of the appliqués (for example, a temperature of between 100°C - 120°C) whilst

still achieving sufficient adhesion.

[0075] In applications where, for example, the first appliqué 100 is to be applied onto hard substrates, the adhesive may be a double sided PSA.

[0076] The adhesive 8 of the first appliqué 100 may also be a hot-melt adhesive, specially selected so that it allows the first appliqué 100 be applied top down at temperatures of 130°C or lower.

[0077] The hot-melt adhesive may comprise a thermoplastic film made from aromatic or aliphatic thermoplastic. The hot-melt film may include, but is not limited to including, one or more of polyamide; polyester; polyolefin; polyurethane; and polyurethane ester.

[0078] The melting point of the hot-melt film may be in the range of 100°C to 120°C.

[0079] This range is commonly known as the Glue Line temperature range. Glue Line Temperature is the actual temperature range to which the adhesive should be exposed. The optimum glue line temperature depends on the applied pressure and the substrate's permeability.

[0080] The hot-melt film is washfast at 60°C.

[0081] As its composition is PU, it is compatible with a PU ink system.

[0082] Its hand feel is soft and flexible which is also a desirable quality for an appliqué.

[0083] The selected hot-melt adheres to fabrics including, but not limited to including, the following compositions: Acetate, acrylic, cotton, nylon, lycra, polyester, cotton, wool.

[0084] It is necessary to apply the first appliqué 100 at temperatures of around 135 °C or lower. 135°C is an upper limit as, above this, there is a risk that any embossed detail will be lost. Lower temperature application conditions also save energy, avoid the activation of sublimation dyes and reduce fabric marking.

[0085] Additionally, where the specially selected embossable material 2 is a thermoplastic, if too high a temperature is used, the embossed detail will be lost at the application stage.

[0086] 130°C is the preferable application temperature.

[0087] The present application process would not work if embossable material with the same Shore hardness as existing appliqués were used.

[0088] During material evaluation it has been found on application of an appliqué comprising embossable material with a Shore hardness of 85A or below that embossing detail would be lost, the edges of the print would melt and the appliqué may pick up surface pattern from fabric substrate.

[0089] The specially selected adhesive 8 also has wash fastness at 60°C.

[0090] Using a polyurethane (PU) hot-melt adhesive in the first appliqué 100 gives a soft feel and improved flexibility once applied and, as such, the adhesive 8 may be a PU hot-melt adhesive.

[0091] Both Figures 1 a and 1 b show the first appliqué 100 comprising a further bottom carrier 9, upon which the hot-melt adhesive 8 or any alternative adhesive is supplied. This carrier may be removed when the first appliqué 100 is to be applied to a substrate.

[0092] Figures 1b shows a specifically designed embossing die 10. This may be used to emboss the specially selected embossable material 2 of the first appliqué 100.

[0093] It will be understood that the order of the layers and materials which comprise the first appliqué 100 shown in the Figures, and indeed any appliqué herein described, is the preferable order. However, this order need not necessarily be the order of the layers and materials other possible orders of materials are envisaged.

[0094] A process for manufacturing, packing and then applying the first appliqué 100, shown in Figure 9 shall now be described. Steps which relate to optional material layers are also optional.

[0095] Steps 901 to 905 relate to the manufacture of the first appliqué 100, step 906 relates to the packing of the first appliqué 100 and step 907 relates to the application of the first appliqué 100.

[0096] At step 901, the optional specially selected embossable material 2, which may be made of TPU and may be in the form of a film or sheet, is cut to size. Preferably a sheet size of 720mm x 520mm is cut.

[0097] The optional design layers 3 may be printed in a specific sequence and/or in register to each other. For some applications, multiple passes of different colour inks and designs may be printed to produce a multi-coloured graphic. For example, a first ink colour may be screen printed onto specially selected embossable material, a second ink colour may be screen printed in register to first ink colour, and third ink colour may be printed in register to the first two colours. This process may be repeated until the design colours are all printed.

[0098] The optional single or multiple white back-up layers 4 may be printed to give appliqué opacity if required.

[0099] The optional single or multiple silver back-up layers 5 may be printed to give print die blocking properties if required.

[0100] The optional single or multiple migration resistant layers 6 may be printed if required.

[0101] The specially selected lacquer 7 may be printed to aid bonding of the specially selected adhesive 8 layer to layers 2 to 6.

[0102] It is recognised that the specially selected embossable material 2 may not be dimensionally stable, for example, where the specially selected embossable material 2 is a TPU sheet of 720mm x 520mm in size, it would not be dimen-

sionally stable and would therefore be extremely difficult to print in register. This issue has been overcome by the selection of the specially selected embossable material 2 (as described above) and the incorporation of a rigid carrier.

[0103] Known appliqués do not conform to industry standards for wash fastness at 60°C. Known appliqués of the type of appliqué described herein tend to delaminate. The addition of a specially selected lacquer 7 eliminates this issue.

[0104] Currently, TPU sheets of no larger than 420mm x 300mm (16.5" x 12") are printed on hand benches or semi-automatic printing machines. The sheet size is limited due to the dimensional stability issues outlined above.

[0105] At step 902, the specially selected adhesive 8 may be laminated in sheet form for a pre-set time at a pre-set temperature. The specially selected adhesive 8 may be supplied on a bottom carrier 9 and this may be left on to prevent the appliqué 100 from inadvertently sticking to another surface, for example, to prevent the specially selected adhesive 8 from sticking to the top of the specially selected embossable material 2 in instrances where multiple sheets are stacked on top of each other.

[0106] At step 903, the top carrier 1 is removed. The top carrier 1 needs to be removed for material to emboss properly.

[0107] At step 904, a specifically designed and manufactured die 10 is used to emboss single or multiple appliqués in register to the ink printed design.

[0108] This embossing step can be carried out using HF, RF or sonic welding machines. The embossing process may involve using HF/RF welding in conjunction with an embossing die to form different surface effects on the surface of the embossing material. The process of HF/RF involves pressing the embossing die down on top of the embossing material 2 and passing high frequency waves through the material. The high frequency waves cause the molecules within the material to move and therefore, the material increases in temperature. The increase in temperature, in combination with a pressure being applied, causes the embossing material 2 to take the form of the die 10.

[0109] The die 10 may be made by machining a pattern, texture or design out on the surface of a specially selected conductive metal. The die will have peaks and troughs at different heights to form the textured effect on the surface of the embossing material.

[0110] The die 10 may include many different effects including, but not limited to, one or more of press down, chevron, carbon fibre and lenticular.

[0111] Embossing may also be done in wallpaper design where there is a pattern embossed all over the TPU film. This can be done using either an embossing cylinder or an embossing die. This is relevant where it is desired to create an appliqué with an 'all over' pattern, for example, an appliqué with a carbon fibre effect.

[0112] A wallpaper pattern or group (or plane symmetry group or plane crystallographic group) is a mathematical classification of a two-dimensional repetitive pattern, based on the symmetries in the pattern. Such patterns occur frequently in architecture and decorative art. There are 17 possible distinct groups.

[0113] Wallpaper groups are two-dimensional symmetry groups, intermediate in complexity between the simpler frieze groups and the three-dimensional crystallographic groups. A symmetry of a pattern is, loosely speaking, a way of transforming the pattern so that the pattern looks exactly the same after the transformation. For example, translational symmetry is present when the pattern can be translated (shifted) some finite distance and appear unchanged. An example is shifting a set of vertical stripes horizontally by one stripe. The pattern is unchanged.

[0114] At step 905, the appliqué may be cut out in sheet form or in register to the printed image using a single or multiple design die or using optical registration, laser cut in register to the printed image.

[0115] For a multiple piece design, a PSA carrier may be used to keep free standing components in the correct positions. Cut out areas appliqués may also be cut at this stage.

[0116] At step 906, the appliqué is packed for storage and/or transport. The bottom carrier 9 which the adhesive layer 8 is supplied on can be left for ease of handling of the appliqué during packing.

[0117] At step 907, the appliqué is applied to a substrate. Appliqués may be applied at temperatures of between 125°C and 135°C and in a single-step top down application, for between 10 and 20 seconds at a medium pressure of, for example, 200 kPa pneumatic line pressure.

[0118] This is enabled by the above outlined selection of the adhesive 8, lacquer 7 and/or embossable material layer 2.

[0119] The three application parameters for the bonding of a heat transfer or appliqué to a substrate/garment are time, temperature, and pressure.

[0120] Time temperature and pressure are equally important to achieve the proper bond between the appliqué's adhesive and the substrate.

[0121] Application time is defined as: the time the platen is applying pressure and heat to the application area.

[0122] Proper pressure during applications is important to allow the applique's adhesive to form a proper bond with the fabric. Pressure that is too high can damage the appliqué or the fabric. This may result is a loss of embossing detail for example. Pressure set too low will not allow the appliqué to properly bond with the fabric.

[0123] Pressure is sometimes communicated as line pressure, which is simply the pressure in the air line supplying the heat press. Line pressure ignores the size and shape of the platen and size of the cylinder and for this reason it is not the preferred way to quote pressure for heat transfer application. Line pressure in this instance may be 200 kPa.

[0124] Applied pressure, or plate pressure, is the measure of the force the platen exerts during application. This

calculation takes into account the size of the cylinder in the press and the size and shape of platen used. For these reasons, plate pressure is a more reliable unit of measure for heat activated applications. Applied pressure may be 33.34 kPa.

[0125] Correct application temperature is crucial for proper heat transfer application. Heat that is too low does not activate the adhesive and thus does not allow a permanent bond to be established between the adhesive and the fabric. This can lead to the adhesive partly or fully delaminating from the fabric. Application heat that is too high can damage the appliqué and result in a loss of embossing detail. Heat that is too high during application can also cause the fabric to have shinny marks in the shape of the platen or sustain other damage such as colour change.

[0126] The adhesive layer is the area of the appliqué that bonds with the fabric.

[0127] Medium pressure may be applied at a rate of 200 kPa line pressure or 33.34 kPa applied pressure for 20 seconds at 135°C or below.

[0128] During this time the bonding layer softens and typically penetrates into the substrate.

[0129] The appliqué may then be left to cool so that the bonding layer exhibits a strong adhesion to bond the appliqué to the substrate.

[0130] Appliqués may be applied with the above conditions using an Insta MS728T Heat Seal machine.

[0131] Currently available appliqués require a multi-step application process. Current processes involve placing the appliqué adhesive side down on the substrate, applying heat from the top down (for example, a heat of between 130°C - 140°C), often for between 5 to 8 seconds, to keep the appliqué in place, essentially tacking the appliqué onto the garment. The garment, with appliqué tacked onto it is then turned over and heat is applied again (for example, a heat of between 130°C - 140°C), often for a further 15 to 20 seconds, in order to fully adhere the appliqué to the garment. Such a two-step application process is required to ensure that any embossing detail is not lost during the application process as a result of the applied heat (as prolonged top down heat would be required in a single step application process which would cause the thermoplastic embossable material layer to lose its embossing detail) and that the appliqué is permanently adhered to the garment (by ensuring that sufficient heat has reached the adhesive).

[0132] Advantages of the present single-step application process include, but are not limited to, one or more of reduced handling time, reduced application time and other improved efficiencies during application.

[0133] The embossable material layer 2 is stable during this process and the embossing detail is not deteriorated. The low application temperature in combination with the selection of an embossable material layer 2 with a Shore hardness between 86A and 94A can be critical as the embossable material layer 2 is hard enough to hold emboss detail during a top down application and also feel quite soft and flexible on the garment once applied.

[0134] Different papers may be used to cover prints during application to give different effects.

[0135] Appropriate selection of the embossable material layer 2 can also allow for appliqués to be sewn down if desired.

[0136] Advantages of the present single-step application process include, but are not limited to, one or more of reduced handling time, reduced application time and other improved efficiencies during application.

[0137] The embossable material layer 2 is stable during this process and the embossing detail is not deteriorated.

[0138] The low application temperature in combination with the specific embossable material layer 2 with a Shore hardness between 86A and 94A can be critical as the embossable material layer 2 is hard enough to hold emboss detail during a top down application and also feel quite soft and flexible on the garment once applied.

[0139] Step 907 can be performed using the appliqué 100, regardless of whether the appliqué 100 has been produced and/or packed following the steps 901 to 906 outlined above.

[0140] The above described process may be a sheet printing process or a roll printing process.

[0141] The appliqués shown in Figures 2a to 6b shall now be described in detail. It will be understood that steps 901 to 907 also apply to these appliqués, with necessary modifications being made to account for differences in the material makeup of these appliques, as would be understood by a person skilled in the art. Specifically, all the appliqués shown in Figures 2a to 6b can be applied using the method of step 907.

[0142] Figures 2a and 2b show a second exemplary appliqué 200 which comprises the same materials 1 to 9 as described in relation to the first exemplary first appliqué 100.

[0143] However, the second exemplary appliqué 200 further comprises a 'Smart/Security' feature 11 incorporated prior to printing, the Smart/Security' feature 11 comprising, but not limited to comprising, one or more of RFID, overt, holographic, data capturing and active/passive.

[0144] Figures 3a and 3b show a third exemplary appliqué 300 which comprises the same materials 1 to 9 as described in relation to the first exemplary first appliqué 100.

[0145] However, the third exemplary appliqué 300 also further comprises the 'Smart/Security' feature 11 incorporated post printing, the Smart/Security' feature 11 comprising, but not limited to comprising, one or more of RFID, overt, holographic, data capturing and active/passive.

[0146] Figures 4a and 4b show a fourth exemplary appliqué 400 which comprises the same materials 1 to 9 as described in relation to the first exemplary first appliqué 100.

[0147] However, the fourth exemplary appliqué 300 also further comprises an Insert 12 incorporated in cut out area

of appliqué 300. The insert 12 may be, but is not limited to being, one or more of natural or synthetic fabric, dyed fabric, sublimation, inkjet, screen printed fabric, fabric with or without hot-melt, fabric with or without blockout coating, foil, film and/or security device.

[0148] Figures 5a and 5b show a fifth exemplary appliqué 500 which comprises the same materials 1 to 9 as described in relation to the first exemplary first appliqué 100.

[0149] However, the fifth exemplary appliqué 500 also further comprises a covert feature 13 incorporated post printing.

[0150] Covert security features, such as covert feature 13, may often be referred to as second-level features. Covert security features, such as covert feature 13, may not be obvious to the naked eye and require simple tools and/or some training for authentication. The covert feature 13 may be, but is not limited to being, one or more of UV-fluorescent inks, microprinting, taggent and DNA inks. For authentication, these covert features require access to an ultraviolet lamp, a magnifier and a reader respectively. In terms of balancing security and ease of authentication, covert security features lie between overt and forensic security features. The covert feature 13 may also be a hidden security feature, for example an RFID chip.

[0151] Figures 6a and 6b show a sixth exemplary appliqué 600 which only comprises the materials 2, 3, 4, 5, 8 and 9 as described in relation to the first exemplary first appliqué 100.

[0152] Figure 7 shows a multiple piece design appliqué with a free standing component 14, a PSA 15 to hold free standing components in the correct position and a printed TPU badge 16.

[0153] Figure 8 shows a simplified version of a roll to roll embossing and cutting process concept with the following features: a printed TPU film 20, laminated with specially selected hot-melt adhesive, a carrier film take up 21, an embossing station 22, specifically designed embossing die embosses the surface of the TPU film, a cutting station 23, where prints are cut out using either a specifically designed cutting die or using a laser cutter with optical registration and a scrap re-wind, where excess film is rewound on a core.

Numbered clause 1. An appliqué for application to a substrate, the appliqué comprising:

an embossable material with a Shore hardness between and inclusive of 80A and 98A; and
one or more coloured and/or patterned layers.

Numbered clause 2. The appliqué of numbered clause 1, further comprising an adhesive layer;

Numbered clause 3. The appliqué of numbered clause 2, wherein the appliqué is a hot-melt film.

Numbered clause 4. The appliqué of any of numbered clauses 2 and 3, further comprising a lacquer to aid bonding of the adhesive layer to the ink layers.

Numbered clause 5. The appliqué of any preceding numbered clause, further comprising a removable carrier film with a thickness between and inclusive of 70μm and 120 μm which acts to provide dimensional stability to the embossable material.

Numbered clause 6. The appliqué of numbered clause 1, wherein the removable carrier film is polyester and is single coated with release on one side

Numbered clause 7. The appliqué of any preceding numbered clause, wherein the embossable material is one of a thermoplastic polyurethane (TPU), glycol modified polyethylene terephthalate (PETG), polyethylene terephthalate (PET), polypropylene (PP), polyvinyl chloride (PVC) film.

Numbered clause 8. The appliqué of any preceding numbered clause, wherein the embossable material has a Shore hardness between 86A and 94A.

Numbered clause 9. The appliqué of either of any preceding numbered clause, wherein the embossable material has a Shore hardness between 88A and 94A.

Numbered clause 10. The appliqué of either of any preceding numbered clause, wherein the embossable material has a Shore hardness between 90A and 92A.

Numbered clause 11. The appliqué of any preceding numbered clause, wherein the embossable material has a thickness of up to 1 mm.

Numbered clause 12. The appliqué of any preceding numbered clause, wherein the removable carrier film has a thickness of 85μm.

Numbered clause 13. The appliqué of any preceding numbered clause, further comprising an embedded smart device.

Numbered clause 14. An appliqué for application to a substrate, the appliqué comprising:

an embossable material layer;
one or more coloured and/or patterned layers;
an adhesive layer; and
a removable carrier film in contact with the adhesive layer, the carrier film having a thickness between and inclusive of 70μm and 120 μm which acts to provide dimensional stability to the embossable material.

[0154] The features of the appliqué set out in the above numbered clauses can be combined with the features of the appliqué as set out in the claims below in any conceivable combination as would be understood by the skilled person. For example, the appliqué of numbered clause 1 may include also include the features of claim 1 or any of its dependent claims.

Claims

1. An appliqué for application to a substrate, the appliqué comprising:

a layer of intermediate lacquer;
a layer of adhesive; and
a third layer comprising one or more of an ink layer, an embossable layer, a design layer, a white back layer, a silver back layer and a migration resistant layer, wherein, in use, the a layer of intermediate lacquer aids bonding of the layer of adhesive to the third layer.

2. The appliqué of claim 1, wherein the layer of intermediate lacquer further comprises a solution of polyester type thermoplastic polyurethane.

3. The appliqué of claim 2, wherein the solution of polyester type thermoplastic polyurethane is Estane 5701 dissolved in cyclohexanone.

4. The appliqué of either of claims 2 and 3, wherein the solution of polyester type thermoplastic polyurethane further comprises a hot-melt powder dispersed in it.

5. The appliqué of claim 4, wherein the hot-melt powder comprises a Griltex 1A P1 powder.

6. The appliqué of any claims 2 to 5, wherein the solution of polyester type thermoplastic polyurethane further comprises Desmophen C1200.

7. The appliqué of any preceding claim, wherein N75 is added on press.

8. The appliqué of claims 2 and 7, wherein the solution of polyester type thermoplastic polyurethane further comprises a solution of Modaflow 2100.

9. The appliqué of any claims 2 and 8, wherein the solution of polyester type thermoplastic polyurethane further comprises Foamex N.

10. The appliqué of claims 2 and 9, wherein the solution of polyester type thermoplastic polyurethane further comprises L142.

11. The appliqué of any preceding claim, wherein the layer of adhesive is a layer of hot-melt adhesive.

12. The appliqué claim 11, wherein the layer of hot-melt adhesive further comprises one or more of a thermoplastic film

made from aromatic and an aliphatic thermoplastic.

13. The appliqué of either of claims 11 and 12, wherein the layer of hot-melt adhesive includes one or more of polyamide, polyester, polyolefin, polyurethane, and polyurethane ester.

14. A method for adhering the appliqué of any preceding claim to a substrate, the method comprising the step of adhering the appliqué in a single-step by applying a temperature of 135°C or lower.

15. The method of claim 14, wherein the temperature is applied top down for 20 seconds or less at a medium pressure.

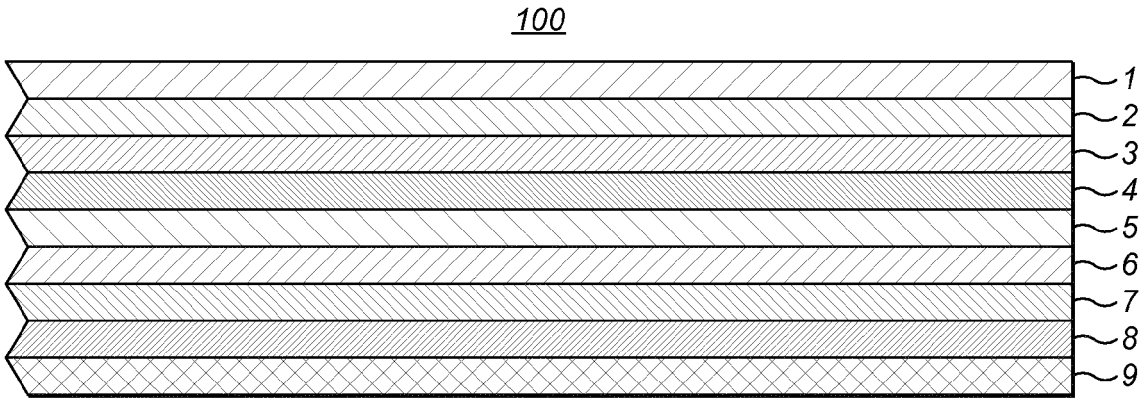

FIG. 1a

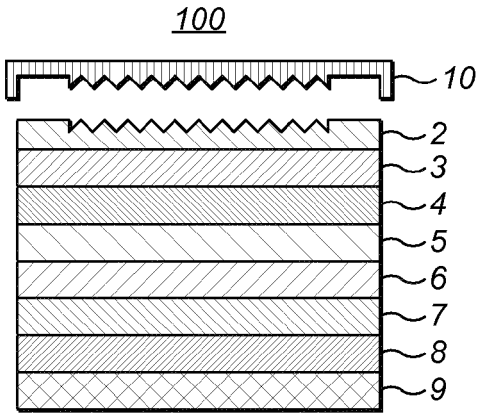

FIG. 1b

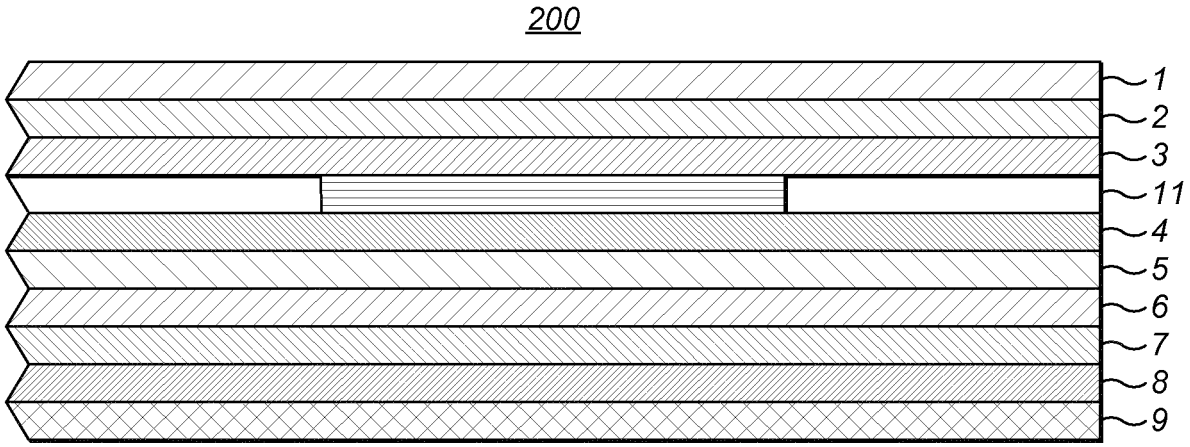

FIG. 2a

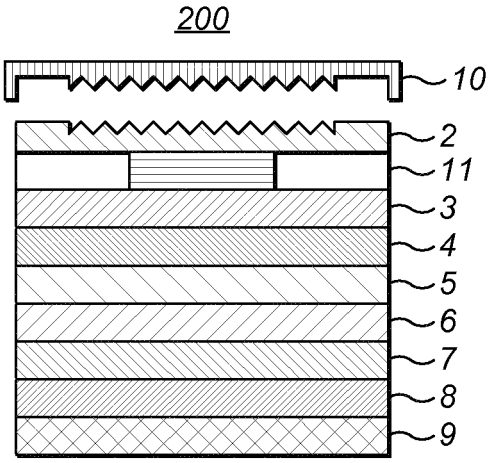

FIG. 2b

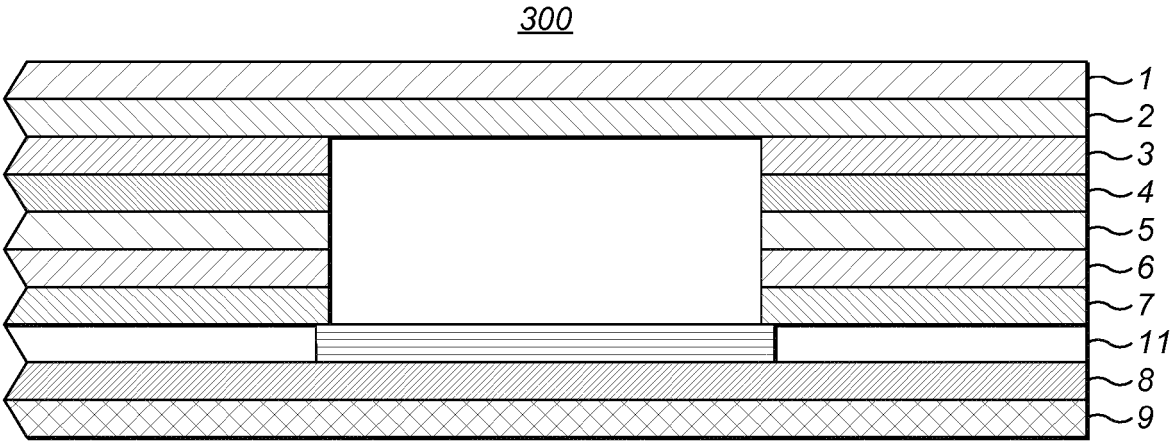

FIG. 3a

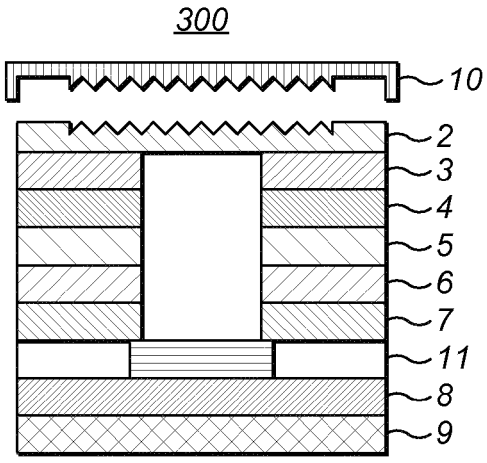

FIG. 3b

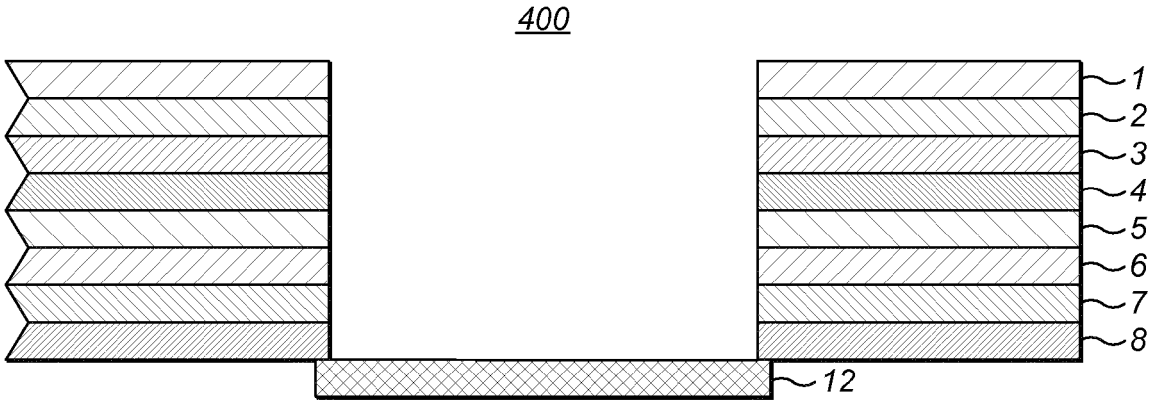

FIG. 4a

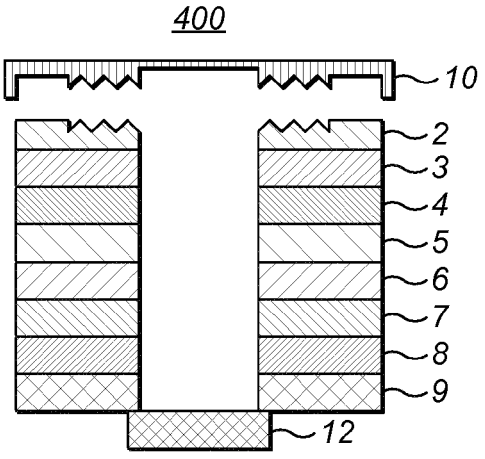

FIG. 4b

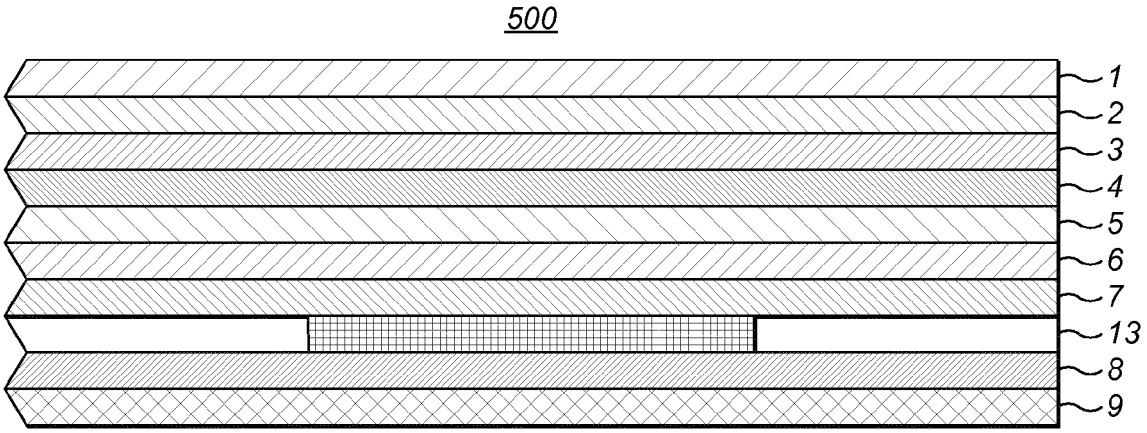

FIG. 5a

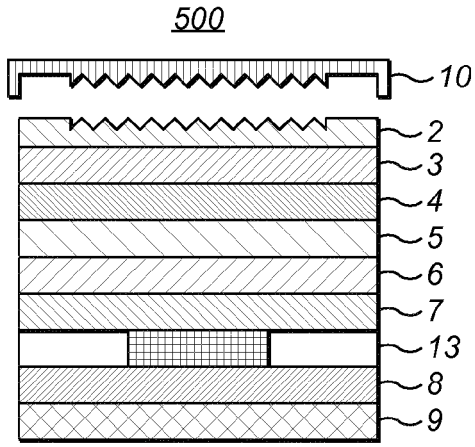

FIG. 5b

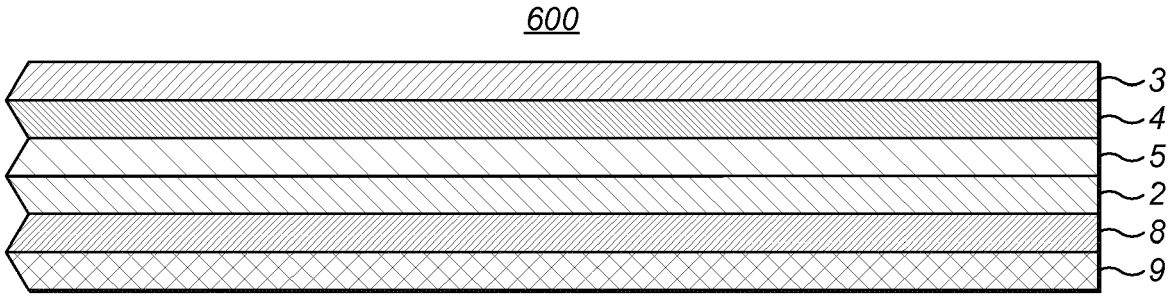

FIG. 6a

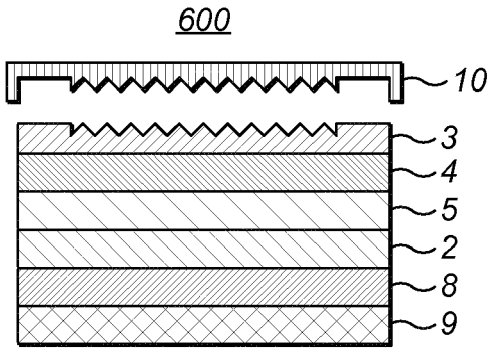

FIG. 6b

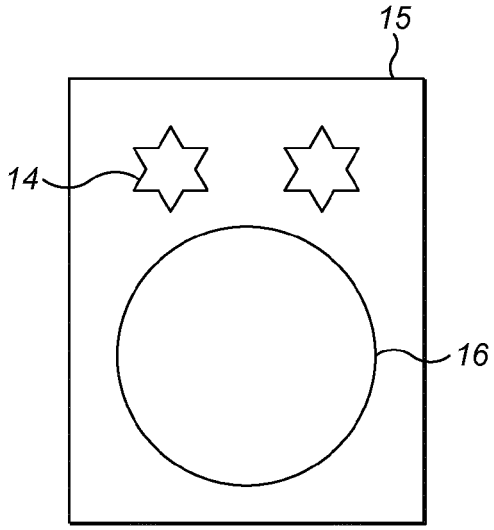

FIG. 7

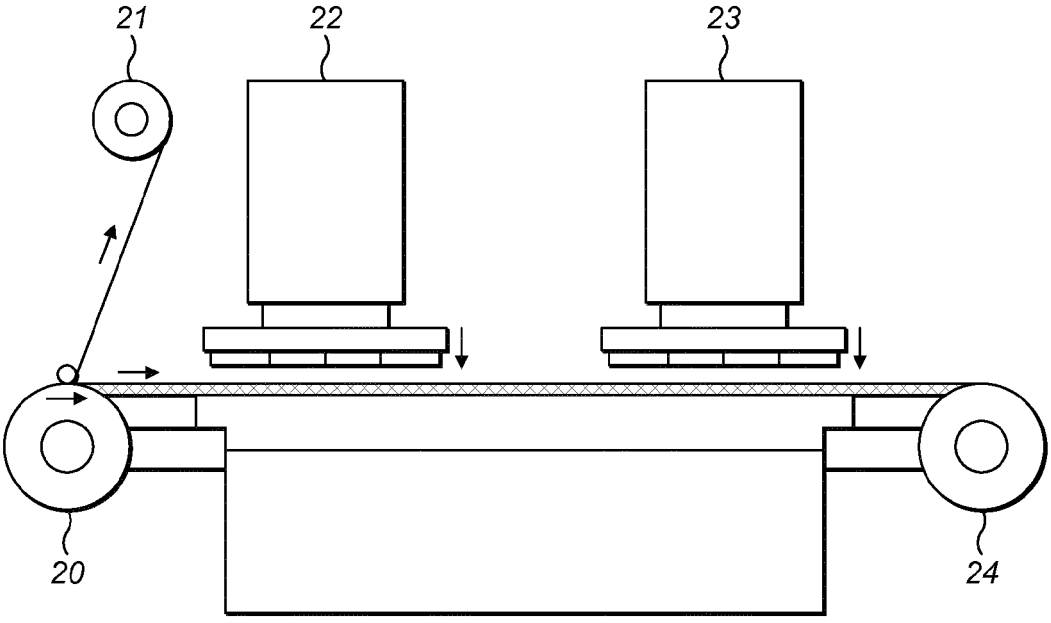

FIG. 8

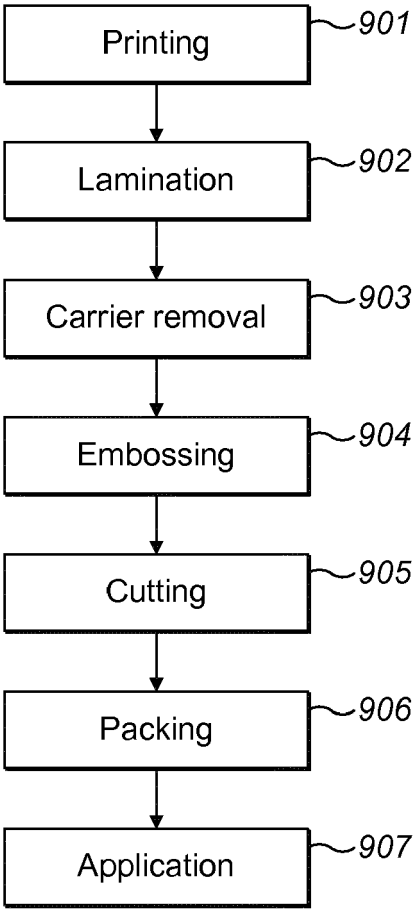
Printing
901
Lamination
902
Carrier removal
903
Embossing
904
Cutting
905
Packing
906
Application
907

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 2498

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X	US 2003/091799 A1 (FRANKE KELL ERIK [DK]) 15 May 2003 (2003-05-15) * paragraphs [0008] - [0017], [0026], [0029]; claims 1-3 * -----	1,2, 11-13	
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D06Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 October 2014	Blas, Valérie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 16 2498

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