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(54) FIBRILS TRANSPLANTATION PROCESS

(71) We, JIN AN INDUSTRIAL CO., LTD., duly organized according to the law of Taiwan, located at 175 Min-Tsu West Road, Taipei, Taiwan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for transplanting fibrils onto an object in a desired pattern.

In the prior art, it is well known to plant fibrils on the surface of goods, such as a trademark, badge or sewing ornament to enhance its appearance. In the conventional method, adhesive is applied on the surface onto which fibrils are to be planted in conformity with a given pattern, the fibrils are then spread on the adhesive and fixed thereon by means of blast or electrostatic techniques. The main disadvantage of this method is that it may not produce a neat and sharp contour of the desired pattern, thus giving the finished goods a vague and unpleasant appearance.

The object of the present invention and its embodiments is to mitigate the aforementioned drawback and provide a process for transplanting fibrils from a substrate to an object by means of a heat-activateable adhesive under a suitable pressure and temperature to readily obtain the desired delicate exact pattern.

In one aspect the present invention provides a fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on the substrate and planting erect fibrils over all said transient adhesive layer, then applying a heat-activateable adhesive layer on said fibrils in conformity with a predetermined pattern, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activateable adhesive, and finally peeling off the substrate; whereby the fibrils adhered to said heat-activateable adhesive are transplanted from said substrate to said object and those fibrils without heat

activateable adhesive remain on said substrate.

By the term "transient adhesive" we mean the adhesive bonding is of a temporary rather than a permanent nature such that when the substrate is peeled off those fibrils adhered to the heat activateable adhesive become detached from the substrate. It is to be understood, however, that the transient adhesive remains adhered to the substrate when the substrate is peeled off.

In a second aspect the invention provides a fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on a substrate and planting erect fibrils selectively on said transient adhesive layer in conformity with a predetermined pattern, then applying a heat-activateable adhesive layer over all said fibrils, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activatable adhesive, and finally peeling off the substrate; whereby substantially all the fibrils are transplanted to said object, substantially nothing remaining on said substrate except said transient adhesive layer. In this manner, fibrils unnecessary for the object may be saved.

A further aspect of the invention provides a heat sensitive transfer which comprises a substrate having a transient adhesive (as herein defined) layer, fibrils being planted erect in the transient adhesive layer and having a colour printed design thereon, a layer of heat-sensitive adhesive being applied on the fibrils in conformity with a predetermined pattern.

Embodiments of the process will now be described with reference to the accompanying drawings, which are all in elevational cross-section view schematically depicting the steps of the fibrils transplantation process wherein:

Figs. 1 to 5 illustrate one embodiment of the process according to the present invention; and

Figs. 6 to 10 illustrate another embodi-

ment.

In the drawings, Fig 1 shows that the substrate 1 is spread with a transient adhesive layer 2 all over the surface thereof, for example by means of a conventional coating method. Next, fibrils 3 are spread over the transient adhesive layer 2, for example by a conventional blowing or electrostatic method, and layer 2 dried and solidified so that the fibrils 3 stand erect on said layer 2, as shown in Fig. 2. Then, a layer 4 of a heat-activateable adhesive is selectively applied on the fibrils 3 (see Fig 3) by printing, for example by a conventional screen printing or block printing method, in conformity with a desired pattern design. Thus the heat-activateable adhesive layer 4 is not applied over the whole area of the fibrils. The printing of said layer 4 can be alternatively carried out by brushing, spraying, rolling, stripping, powdering and the like. Subsequently, the object 5 onto which the fibrils are to be transplanted is overlaid on said heat-activateable adhesive layer 4, and turned up-side-down as shown in Fig 4, to form a laminate. An appropriate pressure and suitable temperature is then applied to both the top and bottom surfaces of the laminate. Finally, as shown in Fig 5, the substrate 1 together with the transient adhesive layer 2 is peeled off, when the fibrils 3 coated with the heat-activateable adhesive layer 4 remain on the object 5, while those fibrils without heat-activateable adhesive still remain on the substrate 1. Thus, fibrils are transplanted to the object 5 in conformity with the predetermined pattern.

The substrate 1 serves as the support for the transient adhesive layer 2. It should have such an affinity to said transient adhesive layer 2 as to effect the planting of the fibrils 3. On the other hand, it should not interfere with the transplantation of said fibrils to the object 5 under the action of pressure and heat. Therefore, various processed papers are suitable for this substrate 1, of which resin impregnated paper or various types of foil-backed paper can be particularly mentioned.

The said transient adhesive layer 2 is firmly adhered to substrate 1 and has a relatively weak bonding ability to the fibrils 3 compared to the later applied heat-sensitive adhesive layer 4. Further, the transient adhesive layer 2 should adhere to the substrate when the substrate is peeled off after the fibril transplantation has been carried out under pressure and heat, and at the same time be capable of freely releasing fibrils 3 transplanted in said heat-sensitive adhesive layer 4.

For this transient adhesive, resins such as polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyurethane polyesters and polyamides, as well as cellulose, rubbers, proteins, starches, dextrans and rosins are preferred. This transient adhesive may be

applied in a liquid state, such as a solution or emulsion, by mixing about 10% by weight based on resulting liquid of one or more of these aforementioned adhesives, about 40% by weight of suitable solvent and about 50% by weight of water by means of a high speed agitator. The adhesive solution or emulsion is preferably used in an amount of 200 g/m² on a wet basis, may be varied widely as desired.

The fibrils employed may be selected from those readily available on the market, such as an artificial fibre e.g. nylon or cotton, preferably in a length of 0.5 to 3.0 mm, either dyed or not.

As regards the heat-activateable adhesive layer 4 on said fibrils 3, it may preferably be formed by printing an adhesive solution or emulsion containing 12 to 20% by weight of one or more of polyvinyl chloride, thermoplastic acrylic resin, polyvinyl acetate, polyamide, polyesters, paraffins and rubber, and made by dissolving in a mixture of a suitable solvent and water while agitating with a high speed agitator.

The heat-activateable adhesive layer may alternatively be applied by the so-called powder coating method, i.e. after the aforementioned heat-activateable adhesive solution or emulsion has been treated on said fibrils, further spreading thereon the same adhesive in powder form to create a unitary layer 4.

The object onto which the fibrils are to be transplanted may be any material or article desired, such as a woven or non-woven fabric, a knitted article, paper, plastics sheet, metal plates, or wooden wares.

During the fibril transplantation step, the heat and pressure may be applied by means of, for example, a hot press, roller or simply an iron. The heat is applied to the extent of causing the heat-activateable adhesive layer to become molten when a thermoplastic adhesive is used, preferably at a temperature ranging from 130°C to 160°C, while the pressure is preferably in the range of 50 g/cm² to 20 Kg/cm². The treatment time is usually from several seconds to about 30 seconds, but can be varied as necessary.

In a modified embodiment, as shown in Figs 6 to 10, the substrate 1 is coated with the transient adhesive 2 in the same way as in the first embodiment, but the fibrils 3 are planted according to the given pattern rather than over the overall area, see Fig 7. In this manner, a pattern mold or masking can be used to prevent the fibrils from being planted at unnecessary places. Then the heat-activateable adhesive layer 4 is applied over all the fibrils 3, as shown in Fig 8. The object 5 is overlaid thereon, after transplantation the substrate 1 is peeled off and all the fibrils 3 are transplanted to the object 5 with nothing remained on substrate 1 except the transient adhesive layer 2.

Further, the fibrils 3 after being planted on said transient adhesive layer 2 may be dyed with a colour ink, such as by a screen printing method. The colour ink may be formulated from an inorganic or organic pigment in about 5 to 7% by weight, penetrating agent in about 1% by weight, and a solvent, such as water, to make up the balance. The penetrating agent is selected from those having a penetrating action to the fibrils so that the ink penetrates the full depth of the fibrils layer, as is well known by the person skilled in the art, so that here details are omitted.

The invention is further illustrated by the following Examples.

Example 1

The surface of a fine-quality paper substrate weighing 150 g/m² is coated with approximately 200 g/m² of a polyvinyl acetate adhesive emulsion having 30 weight % solid content by means of a conventional doctor knife coating method to form a transient adhesive layer. Then artificial fibre fibrils of length about 0.8 mm are planted and fixed on said transient adhesive layer by means of a conventional electrostatic technique. Next, an emulsion formulated by dissolving acrylic resin in a mixture of water and solvent is printed on said fibrils by a screen printing method in conformity with a desired pattern, to form a heat-activateable adhesive base, then polyvinyl acetate powder spread thereon to form the heat-activateable adhesive layer.

During the transplantation step, a cotton fabric is overlaid on said heat-activateable adhesive layer to form a laminate, and both outside surfaces thereof are heated to a temperature about 160°C at a pressure of about 20 Kg/cm² for 20 seconds. Finally, the substrate is peeled off so that the fibrils in the desired pattern are transplanted from said paper substrate to the cotton fabric with a neat appearance.

Example 2

The surface of a fine-quality paper substrate weighing 100 g/m² is coated with approximately 200 g/m² of a polyvinyl acetate adhesive emulsion having 30 weight % solid content by means of a conventional doctor knife coating method to form a transient adhesive layer. Then, artificial fibre fibrils of length about 0.5 mm are planted thereon. A colour ink is screen printed on said fibrils in a desired pattern, then on said coloured fibrils is further printed an emulsion acrylic resin to form a heat-activateable adhesive base, then polyamide powder spread thereon to form the heat-activateable adhesive layer.

During the transplantation step, a cotton fabric is overlaid on said heat-activateable

adhesive layer to form a laminate, and both outside surfaces thereof are heated by a high frequency press operating at 40 to 46 million cycles to about 130°C at a pressure about 1 Kg/cm² for about 3 seconds. Finally, on peeling off the paper substrate, the given pattern of coloured fibrils in the given pattern are completely transplanted to the cotton fabric in a colourful and delicate exact pattern.

WHAT WE CLAIM IS:—

1. A fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on the substrate and planting erect fibrils over all said transient adhesive layer, then applying a heat-activateable adhesive layer on said fibrils in conformity with a predetermined pattern, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activateable adhesive, and finally peeling off the substrate; whereby the fibrils adhered to said heat-activateable adhesive are transplanted from said substrate to said object and those fibrils without heat-activateable adhesive remain on said substrate.

2. A fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on a substrate and planting erect fibrils selectively on said transient adhesive layer in conformity with a predetermined pattern, then applying a heat-activateable adhesive layer over all said fibrils, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activateable adhesive, and finally peeling off the substrate; whereby substantially all the fibrils are transplanted to said object, substantially nothing remaining on said substrate except said transient adhesive layer.

3. A process as claimed in claim 1 or 2, further comprising the step of printing the fibrils with an ink after said fibrils have been planted on said transient adhesive layer and before heat-activateable adhesive is applied to the fibrils.

4. A process as claimed in any one of claims 1, 2 and 3, wherein said transient adhesive is polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyurethane, a polyester, a polyamide, a cellulosic, rubber, protein, starch, dextrin, rosin or a mixture thereof.

5. A process as claimed in claim 4, wherein the transient adhesive is a liquid composition containing one or more of said transient adhesives in an amount of substantially 10% by weight based on the total

Further, the fibrils 3 after being planted on said transient adhesive layer 2 may be dyed with a colour ink, such as by a screen printing method. The colour ink may be formulated from an inorganic or organic pigment in about 5 to 7% by weight, penetrating agent in about 1% by weight, and a solvent, such as water, to make up the balance. The penetrating agent is selected from those having a penetrating action to the fibrils so that the ink penetrates the full depth of the fibrils layer, as is well known by the person skilled in the art, so that here details are omitted.

The invention is further illustrated by the following Examples.

Example 1

The surface of a fine-quality paper substrate weighing 150 g/m² is coated with approximately 200 g/m² of a polyvinyl acetate adhesive emulsion having 30 weight % solid content by means of a conventional doctor knife coating method to form a transient adhesive layer. Then artificial fibre fibrils of length about 0.8 mm are planted and fixed on said transient adhesive layer by means of a conventional electrostatic technique. Next, an emulsion formulated by dissolving acrylic resin in a mixture of water and solvent is printed on said fibrils by a screen printing method in conformity with a desired pattern, to form a heat-activateable adhesive base, then polyvinyl acetate powder spread thereon to form the heat-activateable adhesive layer.

During the transplantation step, a cotton fabric is overlaid on said heat-activateable adhesive layer to form a laminate, and both outside surfaces thereof are heated to a temperature about 160°C at a pressure of about 20 Kg/cm² for 20 seconds. Finally, the substrate is peeled off so that the fibrils in the desired pattern are transplanted from said paper substrate to the cotton fabric with a neat appearance.

Example 2

The surface of a fine-quality paper substrate weighing 100 g/m² is coated with approximately 200 g/m² of a polyvinyl acetate adhesive emulsion having 30 weight % solid content by means of a conventional doctor knife coating method to form a transient adhesive layer. Then, artificial fibre fibrils of length about 0.5 mm are planted thereon. A colour ink is screen printed on said fibrils in a desired pattern, then on said coloured fibrils is further printed an emulsion acrylic resin to form a heat-activateable adhesive base, then polyamide powder spread thereon to form the heat-activateable adhesive layer.

During the transplantation step, a cotton fabric is overlaid on said heat-activateable

adhesive layer to form a laminate, and both outside surfaces thereof are heated by a high frequency press operating at 40 to 46 million cycles to about 130°C at a pressure about 1 Kg/cm² for about 3 seconds. Finally, on peeling off the paper substrate, the given pattern of coloured fibrils in the given pattern are completely transplanted to the cotton fabric in a colourful and delicate exact pattern.

WHAT WE CLAIM IS:—

1. A fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on the substrate and planting erect fibrils over all said transient adhesive layer, then applying a heat-activateable adhesive layer on said fibrils in conformity with a predetermined pattern, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activateable adhesive, and finally peeling off the substrate; whereby the fibrils adhered to said heat-activateable adhesive are transplanted from said substrate to said object and those fibrils without heat-activateable adhesive remain on said substrate.

2. A fibrils transplantation process which comprises the steps of first applying a transient adhesive (as herein defined) layer on a substrate and planting erect fibrils selectively on said transient adhesive layer in conformity with a predetermined pattern, then applying a heat-activateable adhesive layer over all said fibrils, overlaying the fibrils with an object onto which the fibrils are to be transplanted to form a laminate, applying pressure and temperature to the laminate to adhere the object to the heat-activateable adhesive, and finally peeling off the substrate; whereby substantially all the fibrils are transplanted to said object, substantially nothing remaining on said substrate except said transient adhesive layer.

3. A process as claimed in claim 1 or 2, further comprising the step of printing the fibrils with an ink after said fibrils have been planted on said transient adhesive layer and before heat-activateable adhesive is applied to the fibrils.

4. A process as claimed in any one of claims 1, 2 and 3, wherein said transient adhesive is polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyurethane, a polyester, a polyamide, a cellulosic, rubber, protein, starch, dextrin, rosin or a mixture thereof.

5. A process as claimed in claim 4, wherein the transient adhesive is a liquid composition containing one or more of said transient adhesives in an amount of substantially 10% by weight based on the total



weight of the resulting liquid.

6. A process as claimed in any preceding claim, wherein said substrate is a paper.

5 7. A process as claimed in any preceding claim wherein said heat-activateable adhesive is polyvinyl chloride, a thermoplastic acrylic resin, polyvinyl acetate, a polyamide, a polyester, a paraffin, a rubber or a mixture thereof.

10 8. A process as claimed in claim 7, wherein said adhesive is a liquid composition containing one or more of said adhesives in an amount of substantially 12 to 20% by weight based on the total weight of the
15 resulting liquid.

9. A process as claimed in claim 8, further comprising the step of spreading further heat-activateable adhesive in powder form all over the liquid adhesive layer on
20 said fibrils to form a unitary heat-activateable adhesive layer.

10. A process as claimed in any preceding claim, wherein the transplantation step is carried out under a pressure of from 50
25 g/cm² to 20 Kg/cm² at a temperature in the range of 130° to 160°C for a time of from several seconds to 30 seconds.

11. A process as claimed in any preceding claim, wherein after being planted in the transient adhesive and before application of the heat-activateable adhesive, the fibrils are colour printed.

12. A process according to claim 11, wherein the fibrils are printed by a screen
35 printing process.

13. A process according to claim 12, wherein the fibrils are substantially 0.5 mm in length.

14. A process as claimed in any of claims 1 to 13, wherein pressure and temperature are applied to both outer surfaces of said laminate to adhere said object to said heat-activateable adhesive.

15. A fibrils transplantation process substantially as herein described with reference to Figs. 1 to 4 or 6 to 10 of the accompanying drawings.

16. A heat sensitive transfer which comprises a substrate having a transient adhesive (as herein defined) layer, fibrils being planted erect in the transient adhesive layer and having a colour printed design thereon, a layer of heat-sensitive adhesive being applied on the fibrils in conformity with a predetermined pattern.
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17. A heat sensitive transfer substantially as described with reference to and as shown in Figures 3 or 8 of the accompanying drawings.

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