EXHIBIT I

United States Patent [19]

Masaki

[11] **4,314,813**

[45] **Feb. 9, 1982**

[54] **FLOCK TRANSFER SHEET AND FLOCK TRANSFER PRINTING PROCESS**

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[21] Appl. No.: **191,726**

[22] Filed: **Sep. 29, 1980**

[30] **Foreign Application Priority Data**

Nov. 16, 1979 [JP] Japan 54-148477

[51] **Int. Cl.**[3] **D06P 5/00; B44C 3/02**

[52] **U.S. Cl.** **8/468;** 8/471; 8/488; 156/230; 156/234; 156/235; 156/240; 427/148

[58] **Field of Search** 8/468, 471, 488; 427/148; 156/234, 235

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,918,895	11/1975	Mizuno	8/468
4,201,810	5/1980	Hisashisuchi	156/234
4,233,027	11/1980	Albero	8/488

FOREIGN PATENT DOCUMENTS

50/52361	5/1975	Japan .
78/35619	9/1978	Japan .
78/36058	9/1978	Japan .

Primary Examiner—A. Lionel Clingman
Attorney, Agent, or Firm—Paul J. Sutton

[57] **ABSTRACT**

The present invention provides a flock transfer sheet comprising a base sheet, a pattern layer overlaid on said base sheet and containing a heat-sublimable or heat-vaporizable dye as a main ingredient, a thickener layer overlaid on said pattern layer, a pile layer of short fibers electrostatically overlaid on said thickener layer, and a hot melt adhesive layer formed on said pile layer. Said thickener layer has a multiplicity of gas permeable micropores for allowing the sublimated or vaporized dye to penetrate and pass therethrough while leaving the thickener layer per se undyed. The present invention also provides a flock transfer printing process wherein the aforementioned flock transfer sheet is used to heat transfer the pattern formed by said pile layer to a blank stuff, such as woven or knitted fablics.

28 Claims, 15 Drawing Figures

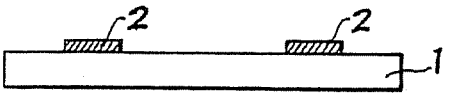


Fig. 1

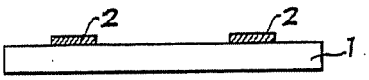


Fig. 2a

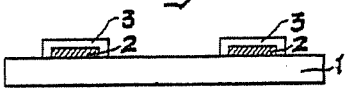


Fig. 3a

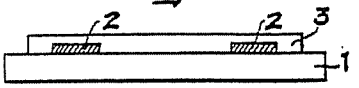


Fig. 2b

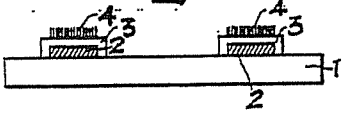


Fig. 3b

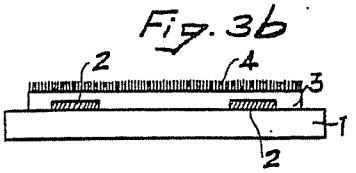


Fig. 2c

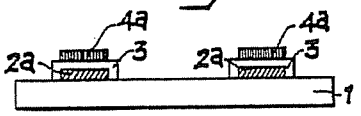


Fig. 3c

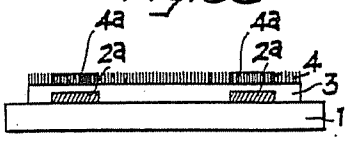


Fig. 2d

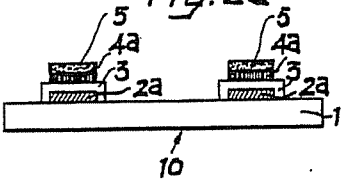


Fig. 3d

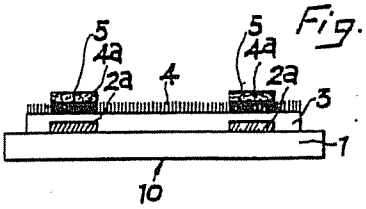


Fig. 4a

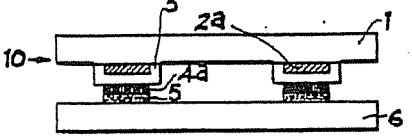


Fig. 5a

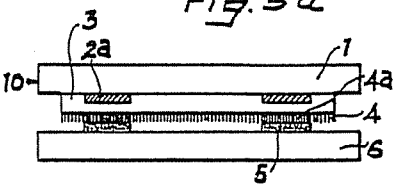


Fig. 4b

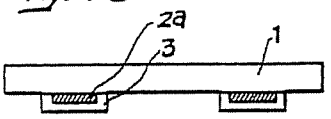
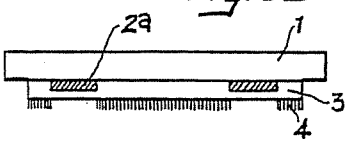
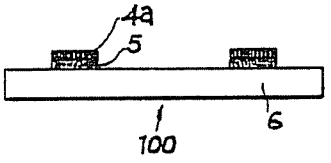
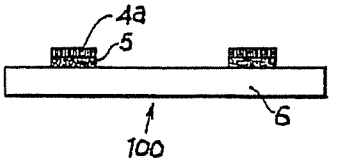


Fig. 5b







FLOCK TRANSFER SHEET AND FLOCK TRANSFER PRINTING PROCESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a flock transfer sheet and a flock transfer printing process using the aforementioned flock transfer sheet, and more particularly to a flock transfer sheet adapted for transferring a pile layer made of short fibers dyed to form a pattern of single color or multicolor to a blank stuff, such as a textile fabric or other substrate, to be transferred with the pattern and a flock transfer printing process using such a flock transfer sheet.

2. Prior Art

A flock transfer printing process has been known in the art, in which a pile layer is preliminarily formed on a textile fabric by flocking short fibers and then a pattern is directly printed on the thus flocked pile layer by the use of a printing ink containing a pigment or a resin-bonded pigment color for textile printing followed by fixing the pigment to the short fibers of the pile layer by means of a binder to effect coloring. However, the flock printed matter manufactured by this known process and colored with pigments has disadvantages that it is inferior in color fastnesses to rubbing and crocking that the feeling of the printed portions becomes stiffish and that the printed color lacks brightness and deepness.

In order to improve the feeling of the printed portions and to improve the brightness and deepness of the printed color, it has been proposed to dye the pile layer of short fibers preliminarily flocked on a blank textile fabric with the use of dye. However, whatever dyes are used in practical operation of this known process, it is necessary to after-treat the printed matter through additional steaming and rinsing steps which require a complete waste water treating plant to avoid the pollution problems, thus resulting in considerable increase in investment for such facilities.

Japanese Patent Publication No. 35619/1978 discloses another process which comprises the steps of flocking a release paper sheet with short fibers to form a flocked sheet having a pile layer of short fibers, printing a pattern on the thus flocked sheet using a printing ink containing a pigment to form a flock transfer sheet colored with the pigment, applying the thus formed flock transfer sheet closely on a textile fabric to transfer the pile layer on the textile fabric, and then peeling off the release paper sheet from the pile layer to form a flock printed matter. However, according to this known process, the face of the pile layer of short fibers which has contacted with the release paper sheet forms the upside face of the final printed product. Accordingly, it is required that the printing ink containing the pigment penetrates through the pile layer into the surface area of the release paper sheet in order to form a uniform colored pattern. However, if the printing ink is allowed to penetrate into the surface area of the release paper sheet, the printed images forming the pattern become inevitably thickened and obscure to make it impossible to precisely reproduce a fine or halftone pattern with attendant disadvantage that the feeling of the transfer-printed fabric becomes stiffish.

A further sublimation transfer printing process has been known to the art by French Pat. No. 1,223,330, in which the common sublimation printing method is disclosed. As a method utilizing this known process, a flocked sheet is formed by flocking short fibers on a textile fabric in a desired pattern to form a pile layer, and a separate transfer sheet printed with the same desired pattern is prepared using a printing ink containing a heat-sublimable or heat-vaporizable dye. Then, the transfer sheet is overlaid on the flocked sheet while precisely registering the printed pattern of the former with the contour of the flocked portion on the flocked textile fabric and heated under pressure, whereupon the dye contained in the printed ink is sublimated or vaporized to dye the pile layer so that the printed pattern is transferred to the flocked textile fabric to form a flock printed matter. Although the flock printed matter produced by this known process is improved in bright color and comfortable touch or feeling over the products produced by the preceding known processes in which pigments are used, it has a disadvantage in that halo and ghosting phenomena tend to occur at the heat transferring step due to the difference in heat-shrinckage percentage between the transfer sheet and the flocked textile fabric to which the printed pattern is transferred.

I have already proposed a flock transfer printing process for producing a flock printed matter which is excellent in feeling and printed with a multi-colored pattern or image of bright color. (See Japanese Patent Publication No. 36058/1978.) In this process previously proposed by me, short fibers are flocked on a release paper sheet to prepare a flocked sheet forming a pile layer of short fibers. Separately, a transfer pattern is printed on another sheet of paper using a printing ink containing a heat-sublimable or heat-vaporizable dye followed by applying a hot melt adhesive on the exposed face of the transfer pattern formed of the printing ink. Then, the pile layer of the flocked sheet is peeled off from the release paper and overlaid on the transfer sheet to apply one face of the pile layer to the printed pattern born on the transfer sheet through the hot melt adhesive. An adhesive is coated on the other face of the pile layer, to which a textile fabric is applied through the adhesive. Then, the entire laminate structure is heated under pressure to transfer the printed pattern to the pile layer and concurrently to adhere the pile layer to the textile fabric by means of the adhesive. Finally, the sheet of paper used for the base sheet of the transfer sheet is peeled off to produce a finished product of a flock printed matter. However, this process is disadvantageous in that the heating time is essentially prolonged since the dye shall penetrate or permeate through the hot melt adhesive onto the short fibers during the heating step. A further and more serious disadvantage of this process resides in that the resinous material used as the hot melt adhesive tends to adhere to the surfaces of the short fibers resulting in loss of comfortable touch which is the desired characteristic feature of the flocked textile and the resultant product has the appearance and feeling resembling to a non-woven fabric. Moreover, in case where a plurality of pile layers is transferred and adhered to a textile fabric, a delicate and time-consuming operation is required for the precise layout and arrangement of the patterns formed by said plurality of pile layers, otherwise a considerable amount of defective products is resulted.

OBJECTS AND SUMMARY OF THE INVENTION

An object of the present invention is, therefore, to provide a flock transfer sheet and a flock transfer printing process for producing a flock printed matter having a dyed pile layer of short fibers which is improved in feeling or touch and bright and deep in color.

Another object of the present invention is to provide a flock transfer sheet and a flock transfer printing process for producing a flock printed matter which is improved in fastness to light, fastnesses to rubbing and crocking, fastness to washing and fastness to dry cleaning and excellent in durability.

A further object of the present invention is to provide a flock transfer sheet and a flock transfer printing process for forming and fixing a pattern composed of a pile layer of short fibers very easily at a desired position on a blank stuff on which the pattern will be transferred.

A still further object of the present invention is to provide a flock transfer printing process in which a dyestuff is used but any troublesome after-treatments including the steaming and rinsing steps may be dispensed with and any pollution problems are not caused.

Yet a further object of the present invention is to provide a flock transfer sheet and a flock transfer printing process for printing and transferring a desired pattern without the need of complicated layout or registering operation.

Another object of the present invention is to provide a flock transfer sheet and a flock transfer printing process in which no disadvantageous halo and ghosting penomena occur at the heat-transferring step.

A further object of the present invention is to provide a flock transfer sheet and a flock transfer printing process for forming a multicolored pattern through simple and efficient operation steps.

A further object of the present invention is to provide a flock transfer sheet and a flock transfer printing process for reproducing a fine pattern precisely with ease.

The above and other objects of the present invention will become apparent from the following detailed description of the invention.

According to one aspect of the present invention, there is provided a flock transfer sheet comprising a heat-resistant base sheet, a pattern layer overlaid on said base sheet to form a pattern and containing a heat-sublimable or heat-vaporizable dye and a binder as main ingredients, a thickener layer overlaid on said pattern layer to cover at least said pattern and containing a water-soluble high polymer selected from the group consisting of cellulose derivatives, processed natural rubbers, processed starches, synthetic high polymers and sodium alignate as a main ingredient, a pile layer of short fibers electrostatically overlaid on said thickener layer and having dyeability to be dyed with said dye, and a hot melt adhesive layer overlaid on said pile layer for adhering to a matter to which the pattern is transferred, said base sheet being not substantially dyeable with said dye, said thickener layer being not substantially dyeable with said dye but having multiplicity of gas permeable micro-pores for allowing the dye to penetrate and pass therethrough when the dye is sublimated or vaporized by heating, said thickener layer being reduced in bonding strength to said pile layer to readily release said pile layer when heated, and said dye passing through said thickener layer and dyeing the short fibers of said pile layer to form a dyed pattern to be transferred onto said matter.

According to another aspect of the present invention there is provided a flock transfer printing process comprising the steps of:

(a) overlaying a pattern layer containing a heat-sublimable or heat-vaporizable dye and a binder as main ingredients on a heat-resistant base sheet which is not substantially dyeable with said dye to form a pattern to be transferred;

(b) forming at least on said pattern a thickener layer which allows a sublimated or vaporized dye to pass therethrough;

(c) electrostatically overlaying short fibers which are dyeable with said dye over said thickener layer to form a pile layer;

(d) heating to sublimate or vaporize the dye contained in said pattern layer for allowing the same to penetrate and pass through gas permeable micropores of said thickener layer without dyeing said thickener layer per se so that said short fibers of said pile layer are dyed with the dye passing through said thickener layer by vapor phase dyeing to form a dyed pattern to be transferred, and concurrently lowering the bonding strength of said thickener layer to said pile layer by heating;

(e) forming a hot melt adhesive layer over said pile layer thus dyed by vapor phase dyeing;

(f) applying said hot melt adhesive layer on a matter to be transferred with said pattern followed by heating to adhere said dyed pile layer to said matter through said adhesive layer; and

(g) peeling said base sheet off from said pile layer at the interface between said pile layer and the thickener layer having been lowered in its bonding strength at the preceding heating step (d) to transfer the dyed flock print pattern to said matter to be transferred.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic section showing the first step of the process for preparing a flock transfer sheet embodying the invention;

FIGS. 2*a* to 2*d* are schematic sections diagrammatically showing the steps for preparing the flock transfer sheet according to the invention;

FIGS. 3*a* to 3*d* are schematic sections similar to those shown in FIGS. 2*a* to 2*d* but showing another embodiment of the flock transfer sheet according to the invention;

FIGS. 4*a* and 4*b* are schematic sectons diagrammatically showing the process for transferring the pattern or image from the flock transfer sheet prepared by the steps shown in FIGS. 2*a* to 2*d* to the stuff on which the pattern is transferred;

FIGS. 5*a* and 5*b* are schematic sections diagrammatically showing the process for transferring the pattern or image from the flock transfer sheet prepared by the steps shown in FIGS. 3*a* to 3*d* to the stuff on which the pattern is transferred.

DESCRIPTION OF THE INVENTION

The present invention will now be described in detail with reference to the appended drawings.

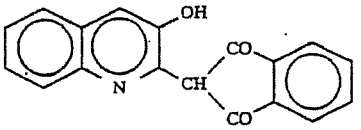
Firstly referring to FIG. 1, a desired pattern is drawn or printed on a base sheet 1 using one or more heat-sublimable or heat-voporizable dyes to form a pattern layer 2.

The mateials which may be used as the base sheet shall be heat-resistant and shall have a lesser affinity with the heat-sublimable or heat-vaporizable dye contained in the pattern layer 2 as the main ingredient. If the base sheet is made of a material which is inferior in heat resistant property and cannot withstand heat at the heating steps, satisfactory flock transfer sheet is not prepared. On the other hand, if the base sheet is made of a material which has an appreciable affinity with the used dye, the base sheet 1 tends to be dyed by the dye of itself to incur disadvantageous results in that the short fibers are unevenly dyed, leading to blurred appearance or in that color strength is lowered. It is desirous that the base sheet has smooth surfaces, uniform thickness and good printability. It is also preferred that the base sheet 1 has sufficient strength and thickness enough for holding the layers overlaid one after another thereon. Accordingly, it is desired that the basis weight of the base sheet 1 be 50 to 200 g/m^2, preferably 100 to 150 g/m^2. If the basis weight is less than 50 g/m^2, the strength is reduced too low to withstand the total weight of the laminated sheet. On the contrary, if the basis weight exceeds 200 g/m^2, transmission of heat at the heating step is hindered to make it difficult to sublimate or vaporaize the dye to effect dyeing. The material for the base sheet 1 is not particularly limited as far as it satisfies the aforementioned conditions, and wood-free paper and laminated paper composed of a paper layer and an aluminum foil or cellophane layer may be preferably used.

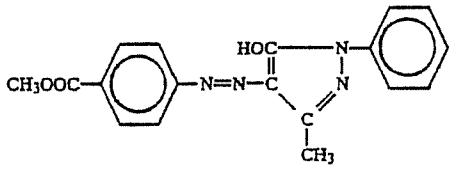
The heat-sublimable or heat-vaporizable dyes contained in the pattern layer 2 as the main ingredient may be selected from the disperse dyes which have been generally used for the heat transfer printing purpose. (In this connection, reference should be made to "American Dyestuff Reporter", 64, No. 2, 46 (1975).)

For example, the following dyes are suited for the production of the flock transfer sheet according to the invention:

Yellow Dye:

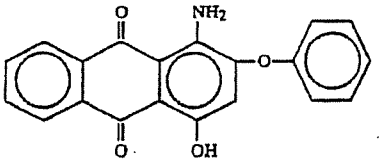


C.I. Disperse Yellow 54

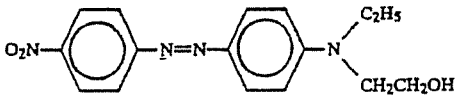


C.I. Disperse Yellow 60

Red Dye:



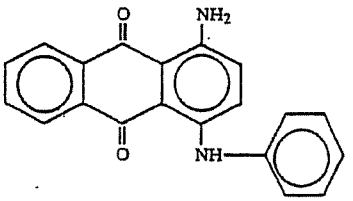
C.I. Disperse Red 60



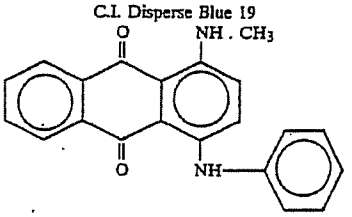
-continued

C.I. Disperse Red 1

Blue Dye:



C.I. Disperse Blue 19



C.I. Disperse Blue 24

The pattern layer 2 contains a binder as the main ingredient other than the heat-sublimable or heat-vaporaizable dye. Ethyl cellulose, linseed oil varnishes, rosin modified phenolic resin varnishes, water-soluble acrylic resins and hydroxyethyl cellulose may be used as the binder. The thickness of the pattern layer 2 may range from 1 to 50 microns, preferably from 3 to 30 microns. If the thickness of the layer 2 is less than 1 micron, color strength of the flock transferred image may tend to be too feeble, whereas if the thickness exceeds 50 microns, there is a fear that a week fine line is thickened and the pattern becomes rather obscure due to the presence of excess dye.

The pattern layer 2 may be applied or printed on the base sheet 1, using, for example a printing ink prepared by dispersing a dye uniformly and finely in an ink vehicle, by means of almost all of practically employed printing processes including the screen printing process, the flexographic printing process, the gravure printing process, the offsetlithographic printing process and the letterpress printing process. The screen printing process is suited for the production of printed matters of high color strength or for the production of a small scale lot. The gravure printing process is suited for the production of fine gradation pattern and for the production of a large scale lot. The offset-tithographic printing process is advantageous over the gravure printing process in that it can produce a fine gradation pattern at a lower cost. In the present invention, the latterpress printing process can be applied to produce a printing matter of single color or multicolor by the use of a zinc line block, a copper halftone block, a photopolymer block or a rubber plate.

After overlaying the pattern layer 2 on the base sheet 1, a thickener layer 3 is coated on the pattern layer 2 so that the layer 2 is covered by the layer 3 as shown in FIG. 2*a*. The thickener layer 3 may be coated on the overall face of the base sheet 1 including the pattern layer 2, as shown in FIG. 3*a*.

It is important that the thickener layer 3 contains a water-soluble high polymer as the main ingredient. This water-soluble high polymer forms a film having a multiplicity of micro-pores to become gas-permeable, when dried, and allows the aforementioned bye to penetrate and pass therethrough while the dried film per se being left undyed. In order to further increase the number of