



(11) **EP 2 093 317 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
26.08.2009 Bulletin 2009/35

(51) Int Cl.:
D04B 21/02 (2006.01) **D03D 27/00** (2006.01)
D04B 1/02 (2006.01)

(21) Application number: **07850052.7**

(86) International application number:
PCT/JP2007/073404

(22) Date of filing: **04.12.2007**

(87) International publication number:
WO 2008/069206 (12.06.2008 Gazette 2008/24)

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE
SI SK TR**

(72) Inventor: **MAKIDA, Manabu**
Fukui 918-8560 (JP)

(30) Priority: **04.12.2006 JP 2006327251**

(74) Representative: **Krauns, Christian et al**
Syrinstrasse 35
89073 Ulm (DE)

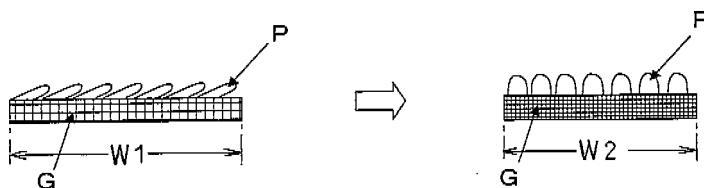
(71) Applicant: **Seiren Co., Ltd**
Fukui-shi, Fukui 918-8560 (JP)

(54) **PILE FABRIC**

(57) It is aimed to provide a pile fabric that is favorable in anticurling and pile-raising performance and in curbing of coming off of the piles. To this end, yarns forming the ground part are core-in-sheath yarns having sheaths of low-melting resin; knitting or weaving pattern is such that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; and the

piles are fixed in an erect state, on the ground part, as a result of heat setting at a time the fabric is strained in the warp or weft direction. The fabric has been subjected to the heat setting at a temperature not lower than a melting temperature of the low melting resin; and a change in average pile-raising extent of the fabric is not less than 2%, before and after the heat setting.

FIG. 4



Description

Technical Field

5 **[0001]** The invention relates to a pile fabric, which is comprised of piles and a ground part; and, more specifically, to a pile fabric, in which piles are fixed in an erect state on the ground part and which is excellent in pile-raising performance. The invention also relates to manufacturing method of such pile fabric.

Background Art

10 **[0002]** The pile fabric is obtained by weaving or knitting and forming the piles simultaneously with the weaving or knitting. There have been achieved no pile fabric that is fully satisfactory in anticurling performance, in curbing of coming off of the piles and in the pile-raising performance.

15 **[0003]** In a way aiming to solve this problem, JP1989(H01)-292139A (Japan's patent application publication No. H01-292139) discloses a pile woven fabric, in which yarns for forming the ground part are commingled yarns formed of fusible fibers and non-fusible fibers. Due to use of such commingled yarns, heat setting at high temperature is remained to be troublesome and hence, coming off of the piles may not be sufficiently curbed.

[0004] JP1988(S63)-256748A discloses a raised pile fabric, in which false-twist textured yarns of polyester fibers are used for forming the piles; so that the ground part is not diaphanous and touch of the fabric becomes soft.

20 **[0005]** When a load has been applied to a surface of any of the pile fabrics mentioned hereto, the piles are remained to be collapsed toward one direction or in random directions and do not restore even after the load is ceased to be applied. Moreover, there is also a problem that touch of the fabric is deteriorated.

[0006] In a way aiming to solve this problem, JP1993(H05)-117975A discloses a technique of adding aqueous dispersion of polyurethane resin onto at least the piles of the fabric, so as to curb collapsing of the piles. However, such resin finish has such risk that the resin exudes to pile-side surface of the fabric; thus, controlling of touch of the fabric becomes difficult. Moreover, when the fabric is low in stiffness, curling might occur on course of using the fabric as clothing.

25 **[0007]** Meanwhile, JP1993(H05) -115312A discloses a pile fabric, in which yarns for forming at least the ground part are formed of core-in-sheath composite fibers having sheaths formed of low melting polymer so that the composite fibers are bonded with other ones via thermal fusion of the low melting polymer; and touch of the fabric is excellent and deformation would not occur even after repeated use of the fabric. Nevertheless, the pile-raising performance is not considered in designing of the fabric and thus is not satisfactory.

Disclosure of Invention

35 Problems to be Solved by the Invention

[0008] In view of the above, it is aimed to provide a pile fabric favorable in the pile-raising performance and to provide manufacturing method of such pile fabric; in which the ground part is formed by yarns of the core-in-sheath composite yarns that have sheaths of heat fusible resin. It is further aimed to provide such pile fabric excellent in the pile-raising performance and in anti-curling performance and to provide manufacturing method of such pile fabric; by which change in average pile-raising extent of the fabric is not less than 2% when the fabric is subjected to a heat setting at a temperature not less than a melting point of the low-melting resin.

Means for Solving the Problems

45 **[0009]** The invention is directed to (1) a pile fabric, which is comprised of piles and a ground part; wherein yarns forming the ground part are formed of core-in-sheath composite yarns having sheaths comprised of low-melting resin; knitting or weaving pattern is such that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; and the piles are fixed in an erect state, on the ground part, as a result of heat setting at a time the fabric is strained to stretch in said either of warp and weft directions.

[0010] The invention is further directed to (2) the pile fabric according to the above (1), wherein the fabric has been subjected to the heat setting at a temperature not lower than a melting temperature of the low melting resin; and a change in average pile-raising extent of the fabric is not less than 2%, before and after the heat setting.

[0011] The invention is further directed to (3) the pile fabric according to the above (1) or (2), wherein yarns of the ground part are bonded with other ones by fusing.

55 **[0012]** The invention is further directed to (4) the pile fabric according to the above anyone of (1) to (3), wherein the fabric is a tricot fabric.

[0013] The invention is further directed to (5) the pile fabric according to the above anyone of (1) to (4), wherein the

pile fabric is raised.

[0014] The invention is further directed to (6) a manufacturing method of a pile fabric, which is comprised of piles and a ground part, comprising: adopting yarns forming the ground part, which are formed of core-in-sheath composite yarns having sheaths comprised of low-melting resin; knitting or weaving of the pile fabric in such a pattern that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; and heat-setting of thus knitted or woven fabric at a time the knitted or woven fabric is strained to stretch in said either of warp and weft directions, at a temperature not less than a melting point of the low-melting resin.

Advantages of the Invention

[0015] The present invention facilitates manufacturing and providing of a pile fabric that is excellent in the pile-raising performance and in anti-curling performance; with no damage on strengths and on the touch, of the pile fabric. The pile fabric of the invention is sufficiently practicable when to be used as clothing or industrial materials.

Best Modes for Carrying Out the Invention

[0016] The invention will be described in detail as below.

[0017] A pile fabric of the invention is comprised of piles and a ground part, in which yarns forming the ground part are formed of core-in-sheath composite yarns having sheaths comprised of low-melting point resin; and knitting or weaving pattern of the pile fabric is such that the piles are raised when the fabric is strained to stretch in either of warp and weft directions. Resultantly, when the fabric is subjected to heat setting in after-mentioned predetermined state, there is obtained a pile fabric that is excellent in pile-raising performance and in anti-curling performance. As materials for forming the piles, synthetic fibers such as polyester or nylon are preferably used.

[0018] The core-in-sheath composite yarns used in the fabric of the invention each have a so-called core-in-sheath structure, and in which melting point of a resin forming the core is different from that for the sheath. In particular, the melting point of the resin for the sheath is lower than that for the core.

[0019] The melting point of the resin comprising the sheath in the core-in-sheath composite yarns is preferably from 150 to 220°C and, more preferably, from 170 to 210°C. The melting point, or fusion bonding temperature, of the sheath lower than 150°C would lead to that; fusion bonding in the ground part by heat treatment becomes incomplete; and curling of the fabric and coming off of the piles would easily occur. Meanwhile, the melting point of the sheath exceeding 220°C would lead to that; yarns of the piles become brittle by heat at a time of the heat treatment and are thus deteriorated in strengths. As the resin for forming the sheath, exemplified are; polyester resins such as polyethylene terephthalate, and polypropylene. As the resin for forming the core as to be combined with the low melting resin of the sheath, adopted are resins having a higher melting point than that of the sheath; for example, polyethylene terephthalate, 6-nylon, 66-nylon, and the like may be named. While the resins are adopted in a manner that there is a difference in melting points between the core and the sheath; the difference is preferably 30°C or more in detail because such extent of difference facilitates the fusion bonding within the ground part.

[0020] Adopted in the invention as the fabric having the piles is a woven or knitted fabric; and knitting or weaving pattern of the fabric is such that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; for example, in length direction (warp direction) of the fabric. Adoptable in the invention are; weft pile woven fabrics such as velveteen and corduroy; warp pile woven fabrics such as velvet, moquette, brush and carpet; pile knitted fabrics of circular knitting; and pile knitted fabrics of warp knitting such as tricot or double raschel. Whereas the fabrics adoptable in the invention are not limited to certain ones, it is preferable to adopt a pile knitted fabric that exhibit more remarkable effect of raising the piles, than other fabrics, at a time the fabric is strained in either of warp and weft directions.

[0021] As for an occasion the warp knitted fabric is adopted for example, followings are examples of knitting patterns, which are of satin-stitch tricot. Fig.1 shows a knitting pattern, in which; front guide bar F shogs as 1-0/4-5 (chain numbers of 1, 2, 3 ... are allocated. Same goes hereinafter) ; a middle guide bar M shogs as 0-1/1-0; and a back guide bar B shogs as 1-0/1-2. Fig.2 shows a knitting pattern, in which; front guide bar F shogs as 1-0/4-5; a middle guide bar M shogs as 0-1/1-0; and a back guide bar B shogs as 1-0/2-3. And, Fig.3 shows a knitting pattern, in which; front guide bar F shogs as 1-0/4-5; a middle guide bar M shogs as 1-0/1-2; and a back guide bar B shogs as 2-3/1-0. The piles are formed by lateral extending portions of yarns on the front guide bar F, which appear on backside of the fabric. Warp knitted pile fabrics other than the above may be adopted. As a matter of course, the invention is not limited to the warp knitted pile fabrics, and any fabric may be used as long as it has such a knitting or weaving pattern that the piles are raised at a time the fabric is strained to stretch in either of warp and weft directions.

[0022] Raising or erecting of the piles by straining is described hereafter. As for the tricot knitted fabrics as shown in Figs. 1-3 for example, straining of fabrics to stretch in warp or longitudinal direction would lead to decreasing of width in weft direction, of the fabric; that is, the width is decreased from a dimension W1 on left-hand illustration to a dimension

W2 on right-hand illustration, in cross-sectional view of the Fig.4. In this way, intervals of wales are decreased. Therefore, density of the yarns forming the ground part G, which have been led through the middle and back guide bars M and B, is increased in kitting-width direction. Resultantly, raised or erected are the piles P, which are lateral extending portions of yarns led through the front guide bar F, as to assume an erect state.

[0023] Same as above goes for warp knitted pile fabrics of the other knitting patterns and for circular knitted pile fabrics. Straining of such fabrics in warp or weft direction would lead to raising or erecting of the piles in same manner as the above; by decreasing of dimension of the fabrics in a direction perpendicular to that of straining and by resultant increasing of density of the yarns.

[0024] In view of the above, the pile fabric having above-mentioned knitting or weaving pattern is strained in either of warp and weft directions, or in a warp or longitudinal direction when the tricot knitted fabric is adopted for example. In such strained state, the fabric is subjected to heat setting at a temperature not lower than melting point of the sheath formed of the low melting resin, in the core-in-sheath composite yarns that forms the ground part. Resultantly, the piles of the fabric are raised to assume an erect state; and bonding with thermal fusion of the sheaths is made among the core-in-sheath composite yarns that form the ground part and have been led through the middle guide bar M and the back guide bar B. When the fabric is cooled, fused sheaths are solidified; and hence, the piles are stably fixed in above-mentioned erect state on the ground part. In particular, change in average pile-raising angle of the fabric is not less than 2%, before and after such final heat setting that is a final processing step. Tensile force applied to the fabric at time of the heat setting is, being varied depending on the materials, preferably 10 to 200 N in practical use.

[0025] Therefore, collapsing of the piles on course of processing of the fabric is curbed and the fabric is excellent in the pile-raising performance and in anti-curling performance; when the fabric has been subjected to the final heat setting at a temperature not lower than melting point of the low melting resin while being strained in either of warp and weft directions.

[0026] The fibers for forming the fabric of the invention may be colored as needed. Also adoptable are; spun-dyed yarns that are colored by adding pigment or the like in spinning liquid before spinning the fibers; and dyeing of the knitted or woven fabric with dye stuff or the like after knitting or weaving. Here, coloring method is not specifically limited.

[0027] Height of the piles, basis weight of the fabric or the like may be set arbitrarily, depending on need. The pile may be either of a loop pile or a cut pile; and shape of the piles is not limited specifically.

[0028] The pile fabric of the invention may be subjected to any techniques such as raising, dyeing and heat setting which per se are known. Such processing techniques are not specifically limited. In order to prevent the curling and coming off of the piles, and to fix the pile in the erected state, by applying a final heat setting on the pile fabric in a state of causing the piles to erect by straining the fabric in the lengthwise direction at the temperature not lower than the melting point of the low melting resin used for the sheath portions of the core-in-sheath composite yarns and using the fabric having the structure in which the piles of the fabric erect when the fabric is strained in the lengthwise direction of the fabric specifically at the final heat setting, which is the final step of the processing steps, the ground portion is melt bound in the state where the pile is erected, and therefore the curling or coming off of the piles are hardly occurred and, in addition, the piles are fixed in the state of being erected. By taking such process steps, change in average pile-raising extent of the fabric before and after the final heat setting becomes not less than 2%. Resultantly, the pile fabric excellent in pile-raising performance is obtained.

[0029] The pile fabric of the invention may be raised as needed. The raising is preferably made with a normal brush or the like and is not specifically limited.

Examples

[0030] The invention will be described further in detail by way of Examples; while the invention is not limited to these examples. The characteristic values in the examples were measured in a following method.

(1) Pile-raising performance

[0031] Pile-raising performances of the pile fabrics obtained in examples and comparative examples were evaluated. Angles of the piles with respect to the ground part were measured, at five points, by observing a cross section or end surface of the fabric, with a microscope (manufactured by KEYENCE CORPORATION, Digital Microscope VHX-500), and obtaining an average value. Such observation and measuring was made before and after the final heat setting, which is a dry heating at 185°C, or is a dry heating at 170°C only for the fabric formed of 100% of nylon fibers. Thus obtained average values were plugged in following calculation formula, as to obtain a change in average pile-raising extent (%).

$$\begin{aligned} &<\text{Change in average pile-raising extent}> = \\ &\frac{\{<\text{Average pile angle after final heat setting}> - <\text{Average pile angle before final heat setting}>\}}{<\text{Average pile angle before final heat setting}>} \\ &\quad \times 100 \end{aligned}$$

(2) Appearance

[0032] The pile fabrics obtained in the examples and the comparative examples were visually evaluated about extent of curling of the ground part and about extent of coming off of the piles.

[Example 1]

[0033] The knitting pattern of Fig.1 was adopted. Yarns adopted for forming the ground part, which have been led through the middle and back guide bars M and B, are core-in-sheath polyester filament yarns, which are; core-in-sheath composite yarns having core of regular polyester and sheath of a polyester having a melting point of 160°C; manufactured by KB SEIREN LTD.; of 56 dtex/24f; and of a contraction coefficient in boiling water at 10%. Yarns adopted for forming the piles, which have been led through the front guide bar F, are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A tricot knitted fabric of the satin stitch was obtained by following manner of knitting; 1-0/4-5 for the front guide bar F, 0-1/1-0 for the middle guide bar M, and 1-0/1-2 for the back guide bar B. Thus obtained knitted fabric was subjected to; a raising; a pre-heat setting by dry heating at 150°C; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 185 °C while being strained in warp or knitting direction (length direction). The ground part of thus obtained pile fabric had a basis weight of 170g/m². Results of the evaluation are shown in Table 1.

[Example 2]

[0034] Yarns adopted for forming the ground part are core-in-sheath polyester filament yarns, which are; core-in-sheath composite yarns having core of regular polyester and sheath of a polyester having a melting point of 160°C; manufactured by KB SEIREN LTD.; of 56 dtex/24f; and of a contraction coefficient in boiling water at 10%. Yarns adopted for forming the piles, which have been led through the front guide bar F, are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A tricot knitted fabric of the carpet stitch was obtained. Thus obtained knitted fabric was subjected to; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 185°C while being strained in length direction. The ground part of thus obtained pile fabric had a basis weight of 190g/m². Results of the evaluation are shown in Table 1.

[Example 3]

[0035] The knitting pattern of Fig.2 was adopted. Yarns adopted for forming the ground part, which have been led through the middle and back guide bars M and B, are core-in-sheath polyester filament yarns, which are; core-in-sheath composite yarns having core of regular polyester and sheath of a polyester having a melting point of 160°C; manufactured by KB SEIREN LTD.; of 84 dtex/24f; and of a contraction coefficient in boiling water at 10%. Yarns adopted for forming the piles, which have been led through the front guide bar F, are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A tricot knitted fabric of the satin stitch was obtained by following manner of knitting; 1-0/4-5 for the front guide bar F, 1-0/0-1 for the middle guide bar M, and 1-0/2-3 for the back guide bar B. Thus obtained knitted fabric was subjected to; a raising; a pre-heat setting by dry heating at 150°C; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 185°C for one minute while being strained in warp or knitting direction (length direction). The ground part of thus obtained pile fabric had a basis weight of 160g/m². Results of the evaluation are shown in Table 1.

[Example 4]

[0036] The knitting pattern of Fig.3 was adopted. Yarns adopted for forming the ground part, which have been led through the middle and back guide bars M and B, are core-in-sheath polyester filament yarns, which are; core-in-sheath composite yarns, as spun-dyed with black pigments, having core of regular polyester and sheath of a polyester having a melting point of 160°C; manufactured by KB SEIREN LTD.; of 84 dtex/24f; and of a contraction coefficient in boiling

water at 10%. Yarns adopted for forming the piles, which have been led through the front guide bar F, are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A tricot knitted fabric of the satin stitch was obtained by following manner of knitting; 1-0/4-5 for the front guide bar, 1-0/1-2 for the middle guide bar, and 2-3/1-0 for the back guide bar. Thus obtained knitted fabric was subjected to; a raising; a pre-heat setting by dry heating at 150°C; scouring at 100°C; and then, the final heat setting by dry heating at 185°C while being strained in warp or knitting direction (length direction). The ground part of thus obtained pile fabric had a basis weight of 90g/m². Results of the evaluation are shown in Table 1.

[Comparative Example 1]

[0037] The tricot knitted fabric used in Example 1 was subjected to; a raising; a pre-heat setting by dry heating at 140°C; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 140°C while being strained in the length direction. The ground part of thus obtained pile fabric had a basis weight of 170g/m². Results of the evaluation are shown in Table 1.

[Comparative Example 2]

[0038] A knitting pattern of Fig.5 was adopted. Yarns adopted for forming the ground part, which have been led through the middle and back guide bars M and B, are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 56 dtex/12f, a contraction coefficient in boiling water is 6%). Yarns adopted for forming the piles, which have been led through the front guide bar F, are also nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A tricot knitted fabric of the satin stitch was obtained by following manner of knitting; 1-0/4-5 for the front guide bar F, 0-1/2-1 for the middle guide bar M, and 2-1/0-1 for the back guide bar B. Thus obtained knitted fabric was subjected to; a raising; a pre-heat setting by dry heating at 150°C; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 170°C while being strained in warp or knitting direction (length direction). The ground part of thus obtained pile fabric had a basis weight of 140g/m². Results of the evaluation are shown in Table 1.

[Comparative Example 3]

[0039] Yarns adopted for forming the ground part are nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 56 dtex/24f, a contraction coefficient in boiling water is 6%). Yarns adopted for forming the piles are also nylon filament yarns (nylon 6, manufactured by KB SEIREN LTD., 117 dtex/12f, a contraction coefficient in boiling water is 6%). A moquette knitted fabric of the carpet stitch is obtained. Thus obtained knitted fabric was subjected to; "one-side dyeing", by which only the nylon yarns forming the piles were dyed; and then, the final heat setting by dry heating at 170°C while being strained in warp or knitting direction (length direction). The ground part of thus obtained pile fabric had a basis weight of 190g/m². Results of the evaluation are shown in Table 1.

Table 1

	Final heat setting Temperature (°C)	Basis weight of ground part (g/m ²)	Change in average pile-raising extent (%)	Occurrence of Curling	Coming off of Piles
Example 1	185	170	47	no	no
Example 2	185	190	8	no	no
Example 3	185	160	40	no	no
Example 4	185	90	35	no	no
Comparative Example 1	140	170	1	yes	yes
Comparative Example 2	170	140	-5	yes	no
Comparative Example 3	170	190	0	yes	yes

[0040] As seen from Table 1, the pile fabrics obtainable by Examples 1 to 4 are excellent in the pile-raising performance and exhibit no change in appearance.

[0041] In contrast, the pile fabrics obtainable by Comparative Examples 1 to 3 are poor in the pile-raising performance and exhibit change in appearance as curling and coming off of the piles are observed.

Industrial Applicability

[0042] The invention is preferably applicable to various types of pile fabrics used in various clothing or industrial applications.

Brief Description of the Drawings

[0043]

Fig. 1 is an example of a knitting pattern, for a pile fabric adopted in the Examples of the invention;
 Fig. 2 is another example of a knitting pattern, for a pile fabric adopted in the Examples of the invention;
 Fig. 3 is a still other example of a knitting pattern, for a pile fabric adopted in the Examples of the invention;
 Fig. 4 is an explanatory schematic cross-sectional view showing how the piles are raised or erected when the fabric is strained; and
 Fig. 5 is an example of a knitting pattern, for a pile fabric adopted in the Comparative Example.

Claims

1. A pile fabric which is comprised of piles and a ground part; wherein yarns forming the ground part are formed of core-in-sheath yarns having sheaths comprised of low-melting resin; knitting or weaving pattern is such that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; and the piles are fixed in an erect state, on the ground part, as a result of heat setting at a time the fabric is strained to stretch in either of warp and weft directions.
2. The pile fabric according to claim 1, wherein the fabric has been subjected to the heat setting at a temperature not lower than a melting temperature of the low melting resin; and a change in average pile-raising extent of the fabric is not less than 2%, before and after the heat setting.
3. The pile fabric according to claim 1 or 2, wherein yarns of the ground part are bonded with other ones by fusing.
4. The pile fabric according to anyone of claims 1-3, wherein the fabric is a tricot knitted fabric.
5. The pile fabric according to anyone of claims 1-4, wherein the fabric is raised.
6. A manufacturing method of a pile fabric, which is comprised of piles and a ground part, comprising: adopting yarns forming the ground part, which are formed of core-in-sheath yarns having sheaths comprised of low-melting point resin; knitting or weaving of the pile fabric in such a pattern that the piles are raised or erected when the fabric is strained to stretch in either of warp and weft directions; and heat-setting of thus knitted or woven fabric at a time the knitted or woven fabric is strained to stretch in said either of warp and weft directions, at a temperature not less than a melting point of the low-melting resin.

FIG. 1

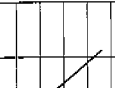


F	M	B
		
5 4 3 2 1 0	2 1 0	3 2 1 0
1-0/4-5	0-1/1-0	1-0/1-2

FIG. 2

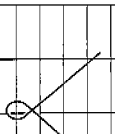
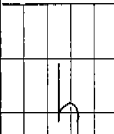
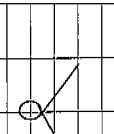
F	M	B
		
5 4 3 2 1 0	2 1 0	3 2 1 0
1-0/4-5	1-0/0-1	1-0/2-3

FIG. 3

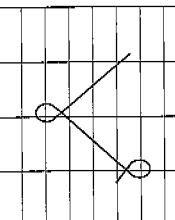
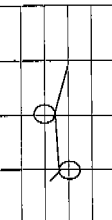
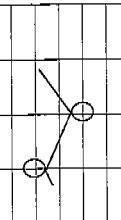
F						M			B			
												
5	4	3	2	1	0	2	1	0	3	2	1	0
1-0/4-5						1-0/1-2			2-3/1-0			

FIG. 4

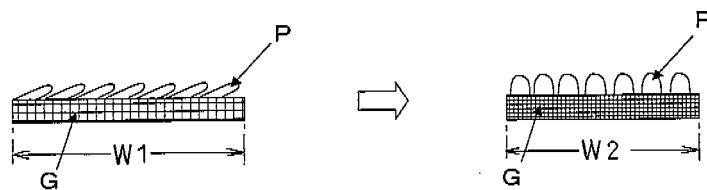
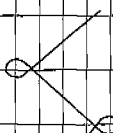
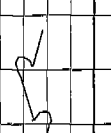
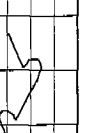


FIG. 5

F	M	B
		
5 4 3 2 1 0	2 1 0	3 2 1 0
1-0/4-5	0-1/2-1	2-1/0-1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/073404

A. CLASSIFICATION OF SUBJECT MATTER

D04B21/02(2006.01) i, D03D27/00(2006.01) i, D04B1/02(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D04B1/00-1/28, D04B21/00-21/20, D03D1/00-27/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2008

Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 5-115312 A (Kanebo, Ltd.), 14 May, 1993 (14.05.93), Claims 1 to 2; Par. No. [0013] (Family: none)	1-6
Y	JP 2002-020967 A (Mitsubishi Rayon Co., Ltd.), 23 January, 2002 (23.01.02), Claims 2 to 3; Par. No. [0023] (Family: none)	1-6
A	JP 2005-200811 A (Sanwa Techno Corp.), 28 July, 2005 (28.07.05), Full text (Family: none)	1-6

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
29 February, 2008 (29.02.08)Date of mailing of the international search report
11 March, 2008 (11.03.08)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 1989H01292139 A [0003]
- JP H01292139 B [0003]
- JP 1988S63256748 A [0004]
- JP 1993H05117975 A [0006]
- JP 1993H05115312 A [0007]