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(11) **EP 1 416 079 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
06.05.2004 Bulletin 2004/19

(51) Int Cl.7: **D04H 1/45**, D04H 1/42,
D04H 1/46

(21) Application number: **01274292.0**

(86) International application number:
PCT/JP2001/011543

(22) Date of filing: **27.12.2001**

(87) International publication number:
WO 2002/099175 (12.12.2002 Gazette 2002/50)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**

(30) Priority: **30.05.2001 JP 2001161917**

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(54) **MATERIAL FOR FLAME RETARDANT SHEET**

(57) The flame retardant sheet material of the present invention simultaneously affords good flame retardancy and melting resistance in a sheet material in which a nonwoven is used, and also simultaneously provides good abrasion resistance and an excellent design, making it suitable for use in automotive trim surface materials. A flame retardant sheet material is obtained by first needle-punching and then stitch-bonding a web

containing 70 to 95 wt% base fiber and 5 to 30 wt% flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber. It is preferable for propox-phosphazene or another such phosphoric ester-based flame retardant to be kneaded into the flame retardant fiber. It is also preferable to add a binder fiber to the web in order to improve abrasion resistance.

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DescriptionTECHNICAL FIELD

5 **[0001]** This invention relates to a flame retardant sheet material that makes use of a nonwoven, which is suited to use as an automotive trim surface material.

BACKGROUND ART

10 **[0002]** Automotive trim surface materials are one of the most common applications of flame retardant sheet materials in which nonwoven is used. For instance, Japanese Patent Application Laid-Open No. H3-189250 discusses a sheet material produced by integrally laminating a needle-punched entangled nonwoven and a spunbond nonwoven; Japanese Utility Model Application Laid-Open No. H4-127291 discusses a sheet material produced by needle-punching a web including low melting point fibers, and heating this product to fuse the fibers together; and Japanese Utility Model Publication No. H5-46522 discusses a sheet material produced by laminating a foamed latex on one side of a nonwoven.

15 **[0003]** Automotive trim surface materials need to be flame retardant, and the above-mentioned sheet materials are therefore subjected to a flame retardancy treatment. For instance, aramid fiber, polychloral fiber, or the like in which the fiber itself is flame retardant can be used as one of the synthetic fibers that make up a nonwoven, or a phosphoric acid-based flame retardant, boric acid-based flame retardant, or metal oxide-based flame retardant can be blended into a synthetic fiber during spinning, or the sheet material can be coated or impregnated with a binder coating liquid in which a flame retardant has been dispersed.

20 **[0004]** However, while flame retardancy was indeed improved when a sheet material was rendered flame retardant as above, if a flame retardant fiber other than aramid fiber was used, there were problems with melting, i.e., the heat resulting from burning melted the fibers that made up the nonwoven, resulting in the dripping of molten liquid, or produced holes in the nonwoven. On the other hand, if aramid fiber was used, the cost of manufacturing the sheet material was higher because of the high cost of aramid fiber itself, and since a property of aramid fiber is that it resists being dyed, there were limitations on the appearance and design of the sheet material.

25 **[0005]** Also, the above-mentioned sheet materials did not lend themselves to use as automotive trim surface materials such as car seats and door trim ornaments, which need to have particularly high abrasion resistance as well as an attractive design. The reason for this is that if the abrasion resistance of the nonwoven used in the sheet material is to be increased, the interlacing of the fibers, the amount of resin applied, the mixing ratio of binder fiber, and so forth must also be increased, and taking these measures not only deteriorates the soft surface feel originally had by the nonwoven, but also results in a loss of moldability.

30 **[0006]** It is an object of the present invention to provide a sheet material that makes use of a nonwoven, which has both good flame retardancy and good melting resistance, and which also have good abrasion resistance and an attractive design so as to be suited to automotive trim surface materials.

DISCLOSURE OF THE INVENTION

40 **[0007]** The inventors arrived at the present invention upon discovering that flame retardancy and melting resistance can be imparted to a sheet material by using a specific flame retardant fiber in a specific proportion in addition to a base fiber in the production of a web of nonwoven and that abrasion resistance and design can be improved and moldability enhanced without deteriorating the surface fabric feel had by a needle-punched nonwoven by following needle-punching with stitch-bonding in the course of producing a sheet from a web containing this specific flame retardant fiber.

45 **[0008]** Specifically, the present invention provides a flame retardant sheet material, comprising a web containing 70 to 95 wt% base fiber and 5 to 30 wt% flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber, the web being subjected to needle-punching and then stitch-bonding.

BEST MODE FOR CARRYING OUT THE INVENTION

50 **[0009]** The flame retardant sheet material of the present invention is obtained by needle-punching a web containing a base fiber and a flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber, and then stitch-bonding this product. The modacrylic fiber referred to here is fiber produced from a copolymer of a vinyl chloride monomer and an acrylic acid monomer, and is available, for example, in the Protex series, which is a trade name of Kanegafuchi Chemical Industry.

55 **[0010]** The web in the present invention contains a base fiber and a flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber. The flame retardant rayon fiber referred to here is produced by using viscose

rayon, cuprammonium rayon, polynosic rayon, or the like manufactured from a raw material pulp, and imparting flame retardancy to this rayon either before or after spinning. Basically, this is a cellulose-based fiber that readily carbonizes without dripping when burned, and that has a slower burn rate. This fiber imparts good flame retardancy and melting resistance to the flame retardant sheet material. The modacrylic fiber, like the flame retardant sheet material rayon fiber, also is a fiber that readily carbonizes without dripping when burned, and as such it also imparts good flame retardancy and melting resistance to the flame retardant sheet material.

[0011] Examples of specific ways to impart flame retardancy to a rayon fiber or modacrylic fiber include mixing a known flame retardant into a spinning raw material. Such flame retardants include phosphoric ester-based flame retardants such as propoxyphosphazene; halogen-based flame retardants such as decabromodiphenylene oxide; and metal hydrate compounds such as aluminum hydroxide, magnesium hydroxide and antimony trioxide. In this case, the flame retardant is contained inside the fibers. Another possible method is to coat the surface of spun fibers with a flame retardant paint containing a flame retardant in a binder resin. When uniform coating of the flame retardant, workability of the fiber, and dropout of the flame retardant component are taken into account, it is preferable for the flame retardant to be contained inside the fibers. Flame retardancy will be inadequate if the amount contained is too small, but fiber strength will drop if the amount is too large, so the preferred amount is 5 to 25 wt%, with 10 to 15 wt% being even better.

[0012] The diameter of the flame retardant fiber used in the present invention can be suitably determined according to the intended application of the flame retardant sheet material and the compatibility with the base fiber, which is discussed below.

[0013] The flame retardancy and melting resistance of the flame retardant sheet material will be inadequate if the flame retardant fiber used in the present invention is contained in the web in too small an amount, but the strength of the nonwoven will decrease and the cost will be higher if the amount is too large, so the preferred amount is 5 to 30 wt%, with 7 to 15 wt% being even better.

[0014] The base fiber in the present invention is the main constituent fiber of the web, and is used for the nonwoven in conventional sheet materials that make use of a nonwoven. Examples of this base fiber include fibers made up of one or more types of synthetic fiber such as polyester fiber, polyamide fiber, polyvinyl chloride fiber, acrylic fiber, polypropylene fiber, and polyethylene fiber. Of these, polyester fiber can be used to advantage in terms of its durability, recyclability, and cost.

[0015] The diameter of the base fiber can be suitably determined according to the intended application of the flame retardant sheet material and the compatibility with the flame retardant rayon fiber.

[0016] If the base fiber is contained in the web in too small an amount, there will be a decrease in weather proof and abrasion resistance, and the cost will also be higher, but if the amount is too large, there will be a relative decrease in the content of flame retardant sheet material rayon fiber, so the flame retardancy and melting resistance of the flame retardant sheet material will be inadequate, so the preferred amount is 60 to 95 wt%.

[0017] It is preferable in the present invention for the web to further contain a binder fiber in order to further increase the abrasion resistance of the flame retardant sheet material. Examples of this binder fiber include fibers with a lower melting point than the above-mentioned base fiber or flame retardant fiber, such as polyester-based binder fiber, polypropylene-based binder fiber, polyethylene-based binder fiber, polyamide-based binder fiber, and ethylene/vinyl acetate copolymer-based binder fiber, which may be used singly or as conjugate fibers.

[0018] The diameter of the binder fiber can be suitably determined according to the intended application of the flame retardant sheet material and to the compatibility with the base fiber.

[0019] When a binder fiber is contained in the web, no intended effect will be obtained if the amount is too small, but the texture (soft feel) and design of the flame retardant sheet material will deteriorate if the amount is too large, so the preferred amount is 3 to 15 wt%, with 5 to 10 wt% being even better.

[0020] The basis weight of the web containing the above-mentioned base fiber and flame retardant fiber (and binder fiber if needed) can be suitably determined according to the intended application of the flame retardant sheet material and other such considerations, but is usually about 100 to 300 g/m².

[0021] Other than the use of the flame retardant rayon fiber or modacrylic fiber as one of the constituent fibers, the web in the present invention can be produced by a conventional web formation method and using a conventional web formation apparatus.

[0022] The flame retardant sheet material of the present invention is produced by first needling and then stitch-bonding the web described above.

[0023] The reason needling is performed here is to entangle the web fibers and increase the abrasion resistance of the nonwoven may be performed on one or both sides. The abrasion resistance of the nonwoven will be inadequate if the needling density is too low, but the texture of the nonwoven will be deteriorated if this density is too high, so the preferred density is 100 to 500 punches/cm², with 200 to 400 punches/cm² being even better.

[0024] This needling in the present invention can be performed by a conventional needling method and using a conventional needling apparatus.

[0025] The reason stitch-bonding is performed after the needling is to strengthen the abrasion resistance obtained

by needling without deteriorating the texture of the nonwoven. Also, it is easy to form a pattern or change the textured yarn in the stitch-bonding, so this stitch-bonding allows the design of the flame retardant sheet material to be enhanced.

[0026] The yarn used in the stitch-bonding may be any ordinary filament yarn or textured yarn, as long as the flame retardant sheet material is to be used in applications that do not demand special shape conformability, such as car seats, but the use of a low melting point yarn is particularly favorable when elongation needs to be minimized. If the flame retardant sheet material is to be used in applications involving deep drawing, such as molded door trim coverings, it is preferable to use a stretch yarn such as Spandex or a twisted crimped yarn. This will improve the abrasion resistance of the flame retardant sheet material, make it more attractive, and also improve its shape conformability.

[0027] The stitch-bonding in the present invention can be accomplished by a conventional stitch-bonding method and using a conventional stitch-bonding apparatus.

[0028] The following is an example of typical stitch-bonding conditions.

Yarn: polyester multifilament yarn (248 dtex/72f)

Stitch pattern: 2 Bar (Trikot/Franse)

Processing machinery: Karl Mayer Type Maliwatt Model 14022C.N2800

Yarn shot density: 100 g/m²

[0029] In order to further improve the abrasion resistance, the flame retardant sheet material of the present invention may after stitch-bonding be coated or impregnated with an emulsion- or solution-type resin composition containing a thermoplastic resin, such as an acrylic resin emulsion. The above-mentioned flame retardant may also be added to this resin composition in order to further increase the flame retardancy and melting resistance of the flame retardant sheet material.

[0030] This resin composition will not provide its full effect if the coating or impregnation amount of the resin composition is too small, but the flame retardant sheet material will not have a good texture if the amount is too large, so the preferred amount is 2 to 30 weight parts, and especially 5 to 10 weight parts, per 100 weight parts of the web.

[0031] The flame retardant sheet material can be used in a variety of applications. For instance, it can be used to advantage for automotive and interior trim.

EXAMPLES

Example 1

[0032] Polyester fiber (3.3 dtex × 51 mm; made by Oyama Chemical) and flame retardant rayon fiber (1.7 dtex × 51 mm; Junron made by Fujibo Ehime) were blended by a standard method in a weight ratio of 80/20 to produce a web with a basis weight of 170 g/m².

[0033] This web was needled by a standard method at a needle density of approximately 280/cm² and a needle depth of 10 mm, and was then stitch-bonded using a 248 dtex/72f polyester multifilament yarn to obtain a nonwoven sheet material. The stitch-bonding conditions were as follows.

Stitch pattern: 2 Bar (Trikot/Franse)

Seam gauge: 14 gauge/inch

Shot density: 19.5 courses/inch

Example 2

[0034] Other than blending the polyester fiber and flame retardant rayon fiber in a weight ratio of 95/5, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Example 3

[0035] Polyester fiber (3.3 dtex × 51 mm; made by Oyama Chemical), flame retardant rayon fiber (1.7 dtex × 51 mm; Junron made by Fujibo Ehime), and a polyester-based core/sheath binder fiber (4 dtex × 50 mm; 3380 made by Unitika) were blended in a weight ratio of 70/20/10 to produce a web with a basis weight of 170 g/m².

[0036] This web was needled and stitch-bonded under the same conditions as in Example 1. A heat treatment was then performed with 180°C hot air for 3 minutes to fuse the fibers together with the binder fiber and obtain a nonwoven sheet material.

Example 4

[0037] Other than blending the polyester fiber, flame retardant rayon fiber, and polyester-based core/sheath binder fiber in a weight ratio of 75/20/5, a nonwoven sheet material was obtained by repeating the procedure of Example 3.

Example 5

[0038] Other than substituting modacrylic fiber (Protex-M made by Kanegafuchi Chemical Industry) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Example 6

[0039] Other than substituting modacrylic fiber (Protex-M made by Kanegafuchi Chemical Industry) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 2.

Comparative Example 1

[0040] Other than producing the web from just polyester fiber, and not using the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 2

[0041] Other than not performing the stitch-bonding, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 3

[0042] Other than substituting a flame retardant acrylic fiber (Lufnen V08 made by Kanebo) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 4

[0043] Other than substituting an aramid fiber (Cornex made by Teijin) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 5

[0044] Other than substituting a flame retardant polyester fiber (Nannex N-200S made by Kuraray) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 6

[0045] Other than substituting a polychloral fiber (Cordelan FBCH made by Kohjin) for the flame retardant rayon fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1.

Comparative Example 7

[0046] Other than producing the web from just polyester fiber, a nonwoven sheet material was obtained by repeating the procedure of Example 1. The back of the nonwoven sheet material thus obtained was coated with a resin composition comprising a mixture of 100 weight parts an emulsion of an acrylic ester resin with a glass transition point of 15°C (made by Dainippon Ink & Chemicals) and 2 weight parts phosphoric ester-based flame retardant (Nonnen made by Marubishi Oil), such that the weight ratio of the resin solids to the fiber weight (web weight) would be 90/10, and this coating was dried at 130°C to obtain a sheet material.

Comparative Example 8

[0047] Other than substituting an emulsion of an acrylic ester resin with a glass transition point of -10°C (made by Dainippon Ink & Chemicals) for the emulsion of an acrylic ester resin with a glass transition point of 15°C, a nonwoven

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sheet material was obtained by repeating the procedure of Comparative Example 7.

Evaluation

[0048] The nonwoven sheet materials obtained in the above examples and comparative examples were tested and evaluated as described below for flame retardancy, melting resistance, 20% modulus, elongation, abrasion resistance, moldability, and design. The obtained results are given in Table 1.

Flammability

[0049] Eight test pieces (10 cm wide, 35 cm long) cut from a nonwoven sheet material were subjected to a burn test using an MVSS flammability tester (made by Suga Shikenki) conforming to the FMVSS302. More specifically, the end of the test piece was brought into contact with a flame for 15 seconds and lit, and the time it took for the ignited flame to go from a benchmark (0) provided 1.5 inches (3.81 cm) from the end of the test piece to a point 10 inches (25.4 cm) from this benchmark (0) was timed with a stopwatch.

[0050] If the flame went out prior to reaching the point 10 inches (25.4 cm) from the benchmark (0), the time until it went out was recorded.

[0051] The time data obtained from this test was plugged into the following formula to calculate the burn rate (mm/min) per minute. In the formula, the burn distance indicates the distance burned from the benchmark (0).

Burn rate (mm/min) =

$$\{\text{burn distance (mm)}/\text{burn time (sec)}\} \times 60 \text{ (sec/min)}$$

Rating procedure

[0052]

- (1) Find the burn rate from the above formula for those test pieces on which the flame burned all the way to the 10-inch mark.
- (2) Label with "n" those test pieces on which the flame went out within 5 cm of the benchmark and went out within 60 seconds.
- (3) Label with "N" those test pieces on which the flame went out before reaching the benchmark.
- (4) If (1) to (3) do not apply, measure the time and distance from the benchmark to the place where the flame went out, and calculate the burn rate from the above formula.

[0053] From the results of (1) to (4) above:

- (1) If all eight of the test pieces are labeled n or N, a "pass" rating is given, and n or N is entered in Table 1.
- (2) If at least four of the eight test pieces are labeled n or N, a "pass" rating is given, and the maximum burn rate is entered in Table 1.
- (3) If less than four of the eight test pieces are labeled n or N, then the burn rate is determined according to the above formula for those test pieces not labeled n or N, and the average thereof is entered in Table 1. The standard deviation σ is also found. A pass rating is given if the sum of adding 3σ to the average is 100 or less, and a fail rating is given if this number is over 100.

Melting resistance

[0054] A test piece cut from a nonwoven sheet material (10 cm wide, 10 cm long) was placed face-up on a flat plate. A mosquito coil was cut to a length of 5 cm, lit at one end, and placed over the test piece. After the mosquito coil had burned up, the ash was removed and a rating was given according to the following criteria.

Rating	Criteria
5	No scorching, no trace
4	Trace of scorching left, but fiber shape not

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(continued)

Rating	Criteria
	lost
3	Scorched, but no holes burned through
2	Holes burned through in places
1	Holes burned through nearly everywhere

20% modulus

[0055] Five test pieces 5 cm wide and 20 cm long were taken from a nonwoven sheet material, these test pieces were pulled at a rate of 20 cm/min according to JIS L 1068, the stress (in kg units) was measured at the point the elongation reached 20%, and the average value was termed the 20% modulus.

Elongation

[0056] Five test pieces 5 cm wide and 20 cm long were taken from a nonwoven sheet material, these test pieces were pulled at a rate of 20 cm/min according to JIS L 1068, the elongation at break was measured, and the average value was termed the elongation.

Abrasion resistance

[0057] A test piece was cut from a nonwoven sheet material, an abrasion wheel CS-10 under a load of 250 g was brought into contact with this test piece by a Taber rotary abraser (made by TABER), the wheel was rotated 500 times at a speed of 60 rpm in this state, the surface condition of the test piece was visually observed, and the abrasion resistance was evaluated according to the following rating criteria.

Rating	Criteria
5	No change noted
4	Slight change noted
3	Clear change noted
2	Fairly pronounced change
1	Pronounced change

Moldability

[0058] A nonwoven sheet material was laminated over a wooden resin board used as a base for automotive door materials with a polyamide film interposed therebetween. This was heated and integrally molded in a mold to produce a trim piece. The product was checked for any separation between the base and the nonwoven. Those products with no separation were rated good, and those with separation were rated poor.

Design

[0059] A good rating was given when there was aesthetic and design freedom regarding color, pattern, etc., and a poor rating was given when there were limitations imposed on color and pattern, restricting the appearance and design freedom.

Table 1

	Flame retardancy	Melting resistance	20% modulus	Elongation	Abrasion resistance	Moldability	Design
Examp.			warp/weft	warp/weft			
1	N	4	23.7/1.8	33.6/122.0	4	good	good
2	54	3	22.8/1.8	28.8/118.2	4	good	good
3	N	4	24.0/1.7	29.3/120.2	4-5	good	good

Table 1 (continued)

	Flame retardancy	Melting resistance	20% modulus	Elongation	Abrasion resistance	Moldability	Design
Examp.			warp/weft	warp/weft			
4	60	3	23.5/1.8	27.6/121.0	4	good	good
5	N	3	22.5/1.7	28.0/121.8	4	good	good
6	82	3	21.3/1.5	28.0/120.0	4	good	good
Comp. Ex.							
1	156	1	24.2/1.7	30.2/116.3	4	good	good
2	N	3	6.8/5.1	89/102	2	good	poor
3	96	2	22.1/1.6	26.9/119.8	4	good	good
4	69	3	20.7/1.5	36.1/136.5	4	good	poor
5	134	1	21.6/1.6	30.5/121.6	4	good	good
6	88	2	24.2/1.8	35.2/130.3	4	good	poor
7	85	1	33.8/2.6	40.2/142.1	4	poor	good
8	93	1	26.2/1.9	34.8/121.8	4	good	good

[0060] As is clear from Table 1, good results were obtained for all evaluated categories with the flame retardant sheet materials of Examples 1 to 6, obtained by first needling and then stitch-bonding a web containing 70 to 95 wt% base fiber and 5 to 30 wt% flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber.

[0061] On the other hand, the flame retardancy was unsatisfactory with Comparative Example 1, in which only a polyester web was used, and no flame retardant fiber. The flame retardant sheet material of Comparative Example 2, which did not undergo stitch-bonding, was lacking in abrasion resistance and design. Melting resistance was a problem with the flame retardant sheet material of Comparative Example 3, in which a flame retardant acrylic fiber was used instead of the flame retardant rayon fiber. The design was particularly unsatisfactory with the flame retardant sheet material of Comparative Example 4, in which aramid fiber was used instead of the flame retardant rayon fiber. Flame retardancy and melting resistance were both a problem with the flame retardant sheet material of Comparative Example 5, in which a flame retardant polyester fiber was used instead of the flame retardant rayon fiber. The flame retardant sheet material of Comparative Example 6, in which a polychloral fiber was used instead of the flame retardant rayon fiber, was lacking in both melting resistance and design. And the melting resistance was particularly poor with the flame retardant sheet materials of Comparative Examples 7 and 8, in which the resin compositions were applied without any flame retardant fiber being used.

INDUSTRIAL APPLICABILITY

[0062] The flame retardant sheet material of the present invention simultaneously exhibits good flame retardancy and melting resistance, despite the fact that a nonwoven is used, and also has good abrasion resistance and moldability, as well as an excellent design, making it suitable for use in automotive trim surface materials.

Claims

1. A flame retardant sheet material, comprising a web containing 70 to 95 wt% base fiber and 5 to 30 wt% flame retardant fiber selected from among flame retardant rayon fiber and modacrylic fiber, the web being subjected to needle-punching and then stitch-bonding.
2. The flame retardant sheet material according to Claim 1, wherein the flame retardant fiber contains a phosphoric acid-based flame retardant or a halogen-based flame retardant.
3. The flame retardant sheet material according to Claim 1 or 2, wherein the yarn used in the stitch-bonding is Spandex yarn or a twisted and crimped yarn.
4. The flame retardant sheet material according to Claim 1 or 2, wherein the yarn used in the stitch-bonding is a low

melting point yarn.

5. The flame retardant sheet material according to any of Claims 1 to 4, wherein the base fiber is polyester.

5 6. The flame retardant sheet material according to any of Claims 1 to 5, wherein the web further contains 3 to 15 wt% binder fiber.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/11543

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ D04H1/45, D04H1/42, D04H1/46 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) Int.Cl. ⁷ D04H1/00-18/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2002 Kokai Jitsuyo Shinan Koho 1971-2002 Jitsuyo Shinan Toroku Koho 1996-2002 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPIL D04H1/45, D04H1/46		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 10-183451 A (Dynic Corporation), 14 July, 1998 (14.07.1998), Full text (Family: none)	1, 5, 6
Y	JP 10-88448 A (Kanegafuchi Chem. Ind. Co., Ltd.), 07 April, 1998 (07.04.1998), Full text (Family: none)	2-4
Y	JP 7-97732 A (Kanebo, LTD.), 11 April, 1995 (11.04.1995), Full text (Family: none)	2
Y	JP 5-148728 A (Kanegafuchi Chem. Ind. Co., Ltd.), 15 June, 1993 (15.06.1993), Full text (Family: none)	2
Y	JP 1-256545 A (Shin Kojin Kasei K.K.), 13 October, 1989 (13.10.1989), Full text (Family: none)	2
Y	JP 49-35613 A (Kanebo, LTD.), 02 April, 1974 (02.04.1974),	2
☒ 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 document 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 22 January, 2002 (22.01.02)		Date of mailing of the international search report 29 January, 2002 (29.01.02)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/11543

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Full text (Family: none)	
Y	JP 8-13305 A (Dynic Corporation), 16 January, 1996 (16.01.1996), Claims; Claims 6, 7; Par. Nos. [0008], [0009] (Family: none)	3, 4
A	JP 61-201064 A (Kyoshi OTSUKA), 05 September, 1986 (05.09.1986), Full text (Family: none)	1-6
A	JP 3-180555 A (Toray Industries, Inc.), 06 August, 1991 (06.08.1991), Full text (Family: none)	1-6

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