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(54) **Air permeable and waterproof stretchable woven fabric**

(57) The present invention is an air permeable and waterproof stretchable woven fabric. It is a multifunctional woven fabric comprising the following processes: warping and weaving the warps and the wefts to obtain a gray fabric; adding stretchable yarns into the warps and the

wefts; and, dyeing and finishing the gray fabric. Accordingly, without coating with or laminating rubbers or films, the fabric can obtain elasticity and better stretchability in the directions of the longitude or the latitude or both and is also waterproof and highly air permeable.

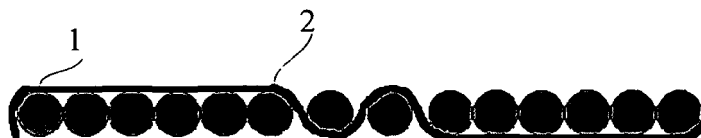


FIG.1 (a)

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FIG.1 (b)

Description

Field of the invention

[0001] The present invention relates to an air permeable and waterproof stretchable woven fabric. More particularly, the present invention relates to an air permeable and waterproof stretchable woven fabric without coating with or laminating rubbers or films, the woven fabric can still obtain elasticity and better stretchability in the directions of the longitude and the latitude and can be waterproof and highly air permeable.

Description of the related art

[0002] The technology of air woven fabric has progressed a lot during the past years, so the role of air permeable and waterproof woven fabric is becoming increasingly important. Traditionally, the prior art of fabric usually utilizes the technique of coating or laminating to obtain waterproofing and air permeability, as disclosed in EP 1 316 634 A1, which is achieved by that the interval mesh size of the rubber or the film is smaller than that of the water and bigger than that of the air. Because the fabric is processed with a regular single layer cloth, the working time and the cost is increased; so is the thickness and the weight; and a hardness of hand feel shows.

[0003] Moreover, the water pressure resistance of the high density fabric without coating or laminating improves a lot now to a value of 600~1300mm/H₂O. Since it is not stretchable, clothes made of it provide no stretchability and less comfort on wearing it.

[0004] Beside the above shortages of the two prior arts, their C.F. (cover factor) value, stretchability, C.F.S. (cover factor stretch) value, water vapor permeability, water pressure resistance, water repellence, and air permeability is not desirable. Thus, the related arts do not fulfil users' requests on actual usage.

Summary of the invention

[0005] Therefore, the main purpose of the present invention is that, without coating with or laminating rubbers or films, the woven fabric can obtain elasticity and better stretchability in the directions of the longitude and the latitude and can be also waterproof and highly air permeable.

[0006] To achieve the above purposes, the present invention is an air permeable and waterproof stretchable woven fabric comprising the following processes: warping and weaving the warps and the wefts to obtain a gray fabric; adding stretchable yarns into the warps and the wefts of the gray fabric to obtain elasticity in the directions of the longitude and the latitude and to obtain better stretchability; and, dyeing and finishing the gray fabric to obtain a gray fabric with waterproofing and high air-permeability. Without coating with or laminating rubbers or films, the fabric can obtain elasticity and better stretcha-

bility in the directions of the longitude and the latitude and can be waterproof and highly air permeable.

Brief description of the drawings

[0007] The present invention will be better understood from the following detailed description of preferred embodiments of the invention, taken in conjunction with the accompanying drawings, in which:

- FIG.1 is a cross-sectional view of the structure on the longitude direction according to the present invention;
- FIG.2 is a cross-sectional view of the structure on the latitude direction according to the present invention;
- FIG.3 is a view of the dyeing heat-up curve according to the present invention;
- FIG.4 is a flow chart of the preparatory fixing according to the present invention;
- FIG.5 is a flow chart of the post fixing according to the present invention; and
- Fig. 6 is a comparison table showing result data of the experiments on (1) the present invention; (2) regular density with stretchability; (3) high density without stretchability.

Detailed description of the preferred embodiments

[0008] The following descriptions of the preferred embodiments are provided to understand the features and the structures of the present invention.

[0009] FIG.1 through FIG.5 show a cross-sectional view of the structure on the longitude direction, a cross-sectional view of the structure on the latitude direction, a view of the dyeing heat-up curve, a flow chart of the preparatory fixing and a flow chart of the post fixing, according to the present invention. As shown in the figures, the present invention is an air permeable and waterproof stretchable woven fabric whose warps 1 and wefts 2 are warped and woven to obtain a gray fabric. The warping process comprises steps of winding, warping, lapping, warp beaming, starching, lapping, doubling, and cloth warp beaming. The weaving process comprises steps of cloth warp beaming, harnessing, weaving, installing drop wire, setting up the weaving parameters, and obtaining high-density fabric (gray fabric). The gray fabric with high coverage is obtained through controlling the density by the weaving process. Stretchable yarns are added into the warps 1 and the wefts 2 of the gray fabric to obtain elasticity in the directions of the longitude and the latitude and to obtain better stretchability, wherein FIG.1 shows the cross-sectional view on the longitude direction and FIG.2 shows the cross-sectional view on the latitude direction. Then the gray fabric is processed with dyeing and finishing. The dyeing-and-finishing process comprises steps of desizing, refining, preparatory fixing, dyeing, drying, and post fixing and finishing. Or, it

may comprise steps of fixing, desizing, refining, dyeing, drying, and post fixing and finishing. Or, it may comprise steps of obtaining gray fabric, desizing, refining, preparatory fixing, dyeing, drying, intermediate inspecting, fixing, post inspecting, and packing. Therein, the temperature for the desizing is between 80°C (Celsius degree) and 100°C where its speed is between 30m/min and 50m/min (°C: degrees Celsius; m: meter; min: minute). The temperature for the preparatory fixing is between 170°C and 200°C where its speed is between 30m/min and 55m/min. The dyeing can be done by using liquid-overfeed dyeing machine or air-flow dyeing machine. When processing the dyeing with a heat-up around 120°C to 135°C for 30min to 60min, it starts by adding medicaments at 25°C; then the temperature is heated up till around 120°C to 130°C at a speed of 1.5°C per minute; then the temperature is kept on for around 30min to 60min; then the temperature is cooled down to 80°C at a speed of 1.5°C per minute; then reductant and sodium dithionite are added for deterging; and then a drainage is processed when the temperature reaches down at 60°C (As shown in FIG.3). The temperature for the drying is between 110°C and 130°C where its speed is between 40m/min and 55m/min. The temperature for the post fixing is between 160°C and 190°C where its speed is between 30m/min and 50m/min. When processing the preparatory fixing, the fabric is wetted through a water tank 3 and is passed through a plurality of ovens 4 and then is plaited (As shown in FIG.4). When processing the post fixing, the fabric is passed through a pressure absorber 5 which comprises water repellent to make the fabric capable of water repellence; then the fabric is passed through a plurality of ovens 6; and then the fabric is plaited (As shown in FIG.5). So forth, the gray fabric becomes a fabric with waterproofing and high air-permeability. The fabric is a synthetic fiber comprised of textured yarns, wherein its C.F. (cover factor) value is between 2500 and 4200 and its C.F.S. (cover factor stretch) value is between 15000 and 35000. Through experiments, its stretch-and-recovery ratio is between 75% and 95% (ASTM D4964 under a stretch ratio of 30%); the ratio for its stretchability is between 10% and 35% (ASTM D3107); and its water vapor permeability is between 6000g/m²/24hrs and 9000g/m²/24hrs (JIS L1099 A1) or between 15000g/m²/24hrs and 35000g/m²/24hrs (JIS L1099 B1) (g: gram; hrs: hours). The fabric is water repellent with a value above 90 (AATCC 22) even after thirty times of washing (AATCC 135). It can pass the RAIN-TEST (AATCC 35). Its water pressure resistance remains the same even after washing (AATCC 135). Its air-permeability is between 1.5cm³/cm²/s and 11 cm³/cm²/s (cm: centimeter; s: second). Accordingly, a novel air permeable and waterproof stretchable woven fabric is obtained.

[0010] Fig. 6 shows in a table 1 the result data of the experiments according to (1) the present invention, (2) a regular density with stretchability, and (3) a high density without stretchability. According to the data shown in the

table I, the fabric made according to the present invention is better than the stretchable fabric with regular density and the non-stretchable fabric with high density on C.F. value, stretchability, C.F.S. value, water vapor permeability, water pressure resistance, water repellence, and air permeability. Hence, by referring to the table 1, the present invention can obtain elasticity and better stretchability in the directions of the longitude or the latitude or both and can be waterproof and highly air permeable without coating or laminating rubbers or films.

[0011] The preferred embodiments herein disclosed are not intended to unnecessarily limit the scope of the invention. Therefore, simple modifications or variations belonging to the equivalent of the scope of the claims and the instructions disclosed herein for a patent are all within the scope of the present invention.

Claims

1. Air permeable and waterproof stretchable woven fabric comprising processes of:
 - a) warping and weaving warps and the wefts (1, 2) to obtain a gray fabric;
 - b) adding stretchable yarns into the warps and the wefts (1, 2) of said gray fabric to obtain elasticity in the directions of the longitude and the latitude and to obtain better stretchability; and
 - c) dyeing and finishing said gray fabric, wherein said dyeing and finishing comprises: desizing, refining, preparatory fixing, dyeing, drying, and post fixing and finishing.
2. Fabric according to claim 1, wherein said warping comprises: winding, warping, lapping, warp beaming, starching, lapping, doubling, and cloth warp beaming.
3. Fabric according to claim 1 or 2, wherein said weaving comprises: cloth warp beaming, harnessing, weaving, installing drop wire, setting up the weaving parameters, and obtaining high-density fabric (gray fabric).
4. Fabric according to one of claims 1 to 3, wherein said gray fabric is obtained having high coverage through controlling density by said weaving.
5. Fabric according to one of claims 1 to 4, wherein, when processing said preparatory fixing, said gray fabric is wetted through a water tank and is passed through a plurality of ovens and then is plaited.
6. Fabric according to one of claims 1 to 5, wherein, when processing said post fixing, said gray fabric is passed through a pressure absorber which comprises water repellent to make said gray fabric capable

of water repellence; said gray fabric is passed through a plurality of ovens; and then said gray fabric is plaited.

7. Fabric according to one of claims 1 to 6, wherein the temperature for said desizing is between 80°C (Celsius degree) and 100°C and the speed for said desizing is between 30m/min (meter per minute) and 50m/min.
8. Fabric according to one of claims 1 to 7, wherein the temperature for said preparatory fixing is between 170°C and 200°C and the speed for said preparatory fixing is between 30m/min and 55m/min.
9. Fabric according to one of claims 1 to 8, wherein said dyeing process is done by using a liquid-over-feed dyeing machine.
10. Fabric according to one of claims 1 to 9, wherein said dyeing process is done by using an air-flow dyeing machine.
11. Fabric according to one of claims 1 to 10, wherein when processing said dyeing with a heat-up around 120°C to 135°C for 30min to 60min, said dyeing starts by adding medicaments at 25°C; then the temperature is heated up till around 120°C to 130°C at a speed of 1.5°C per minute and the temperature is held for about 30min to 60min; then the temperature is cooled down to 80°C at a speed of 1.5°C per minute; then reductant and sodium dithionite are added for deterging; and then a drainage is processed when the temperature reaches down at 60°C.
12. Fabric according to one of claims 1 to 11, wherein the temperature for said drying is between 110°C and 130°C and the speed for said drying is between 40m/min and 55m/min.
13. Fabric according to one of claims 1 to 12, wherein the temperature for said post fixing is between 160°C and 190°C and the speed for said post fixing is between 30m/min and 50m/min.
14. Fabric according to one of claims 1 to 13, wherein the C.F. (cover factor) value of said gray fabric is between 2500 and 4200 and the C.F.S. (cover factor stretch) value of said gray fabric is between 15000 and 35000.
15. Fabric according to one of claims 1 to 14, wherein said dyeing and finishing comprises:
fixing, desizing, refining, dyeing, drying, and post fixing and finishing.

16. Fabric according to one of claims 1 to 15, wherein

said dyeing and finishing comprises:

obtaining gray fabric, desizing, refining, preparatory fixing, dyeing, drying, intermediate inspecting, fixing, post inspecting, and packing.

17. Fabric according to one of claims 1 to 14, wherein the stretch-and-recovery ratio of said gray fabric is between 75% and 95%; the stretchability ratio of said gray fabric is between 10% and 35%; and the water vapor permeability of said gray fabric is between 6000g/m²/24hrs (gram per square meter per 24 hours) and 9000g/m²/24hrs.
18. Fabric according to claim one of claims 1 to 17, wherein the water vapor permeability of said gray fabric is between 15000g/m²/24hrs and 35000g/m²/24hrs.
19. Fabric according to one of claims 1 to 18, wherein the water repellence of said gray fabric has a value above 90 even after thirty times of washing.
20. Fabric according to one of claims 1 to 19, wherein said gray fabric is able to pass RAIN-TEST and the water pressure resistance of said gray fabric remains the same even after washing.
21. Fabric according to one of claims 1 to 20, wherein the air-permeability of said gray fabric is between 1.5cm³/cm²/s (cubic centimeter per square centimeter per second) and 11cm³/cm²/s.
22. Fabric according to one of claims 1 to 21, wherein said gray fabric is a synthetic fiber comprised of textured yarns.

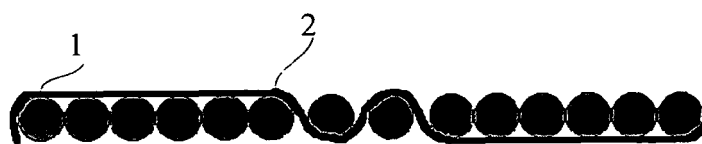


FIG.1 (a)

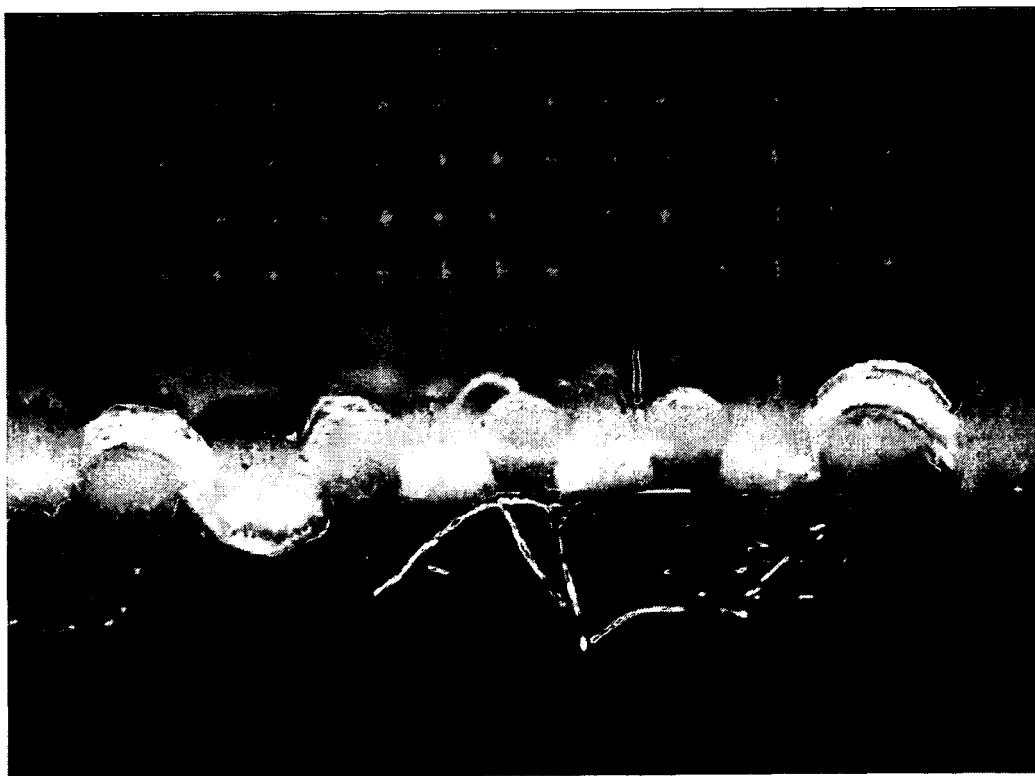


FIG.1 (b)

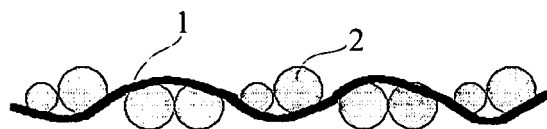


FIG.2 (a)

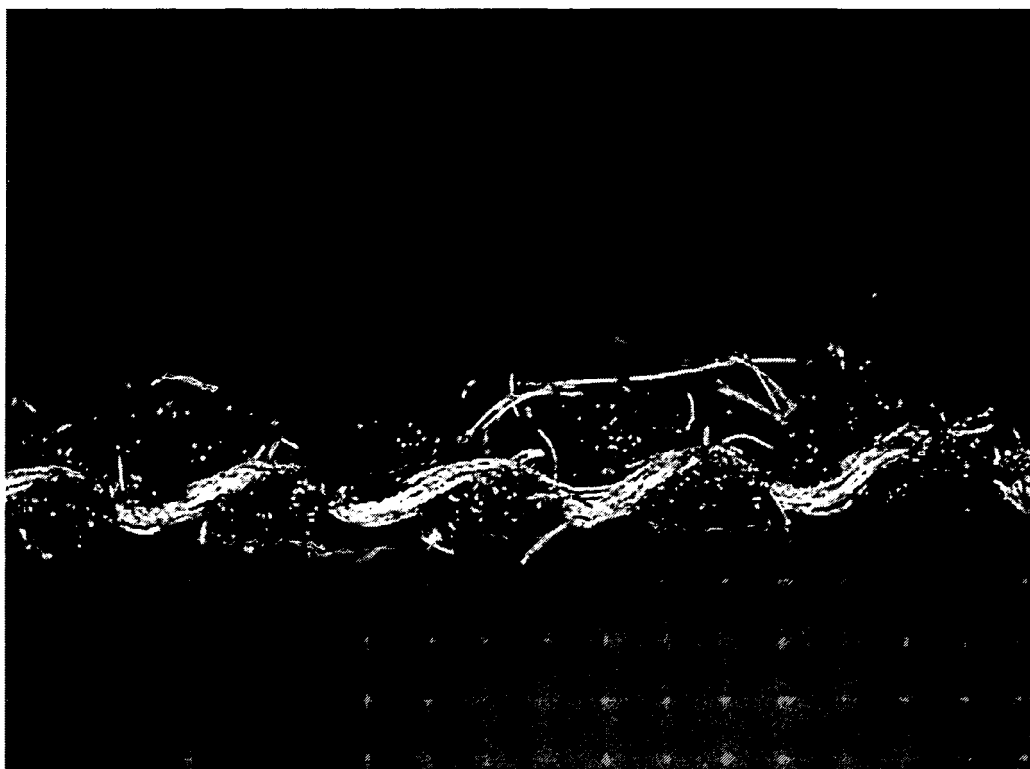


FIG.2 (b)

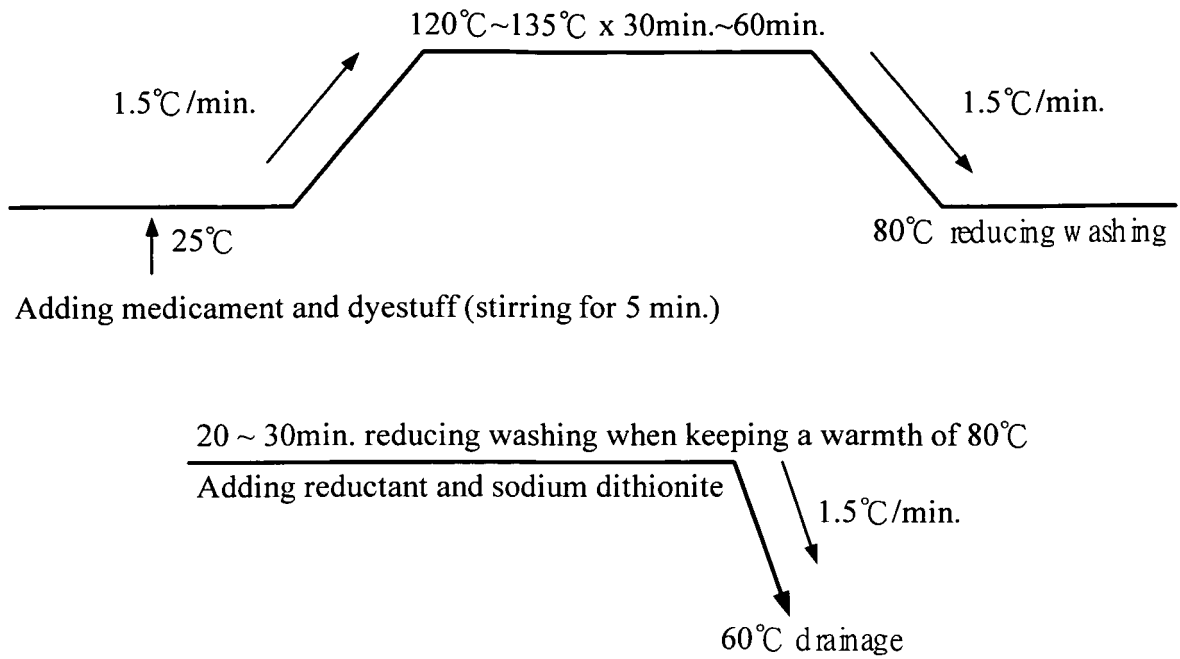


FIG.3

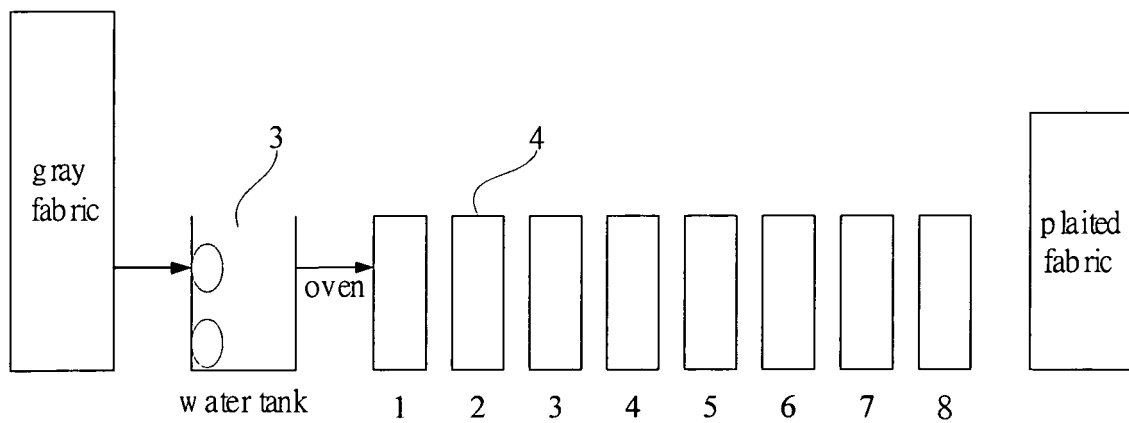


FIG.4

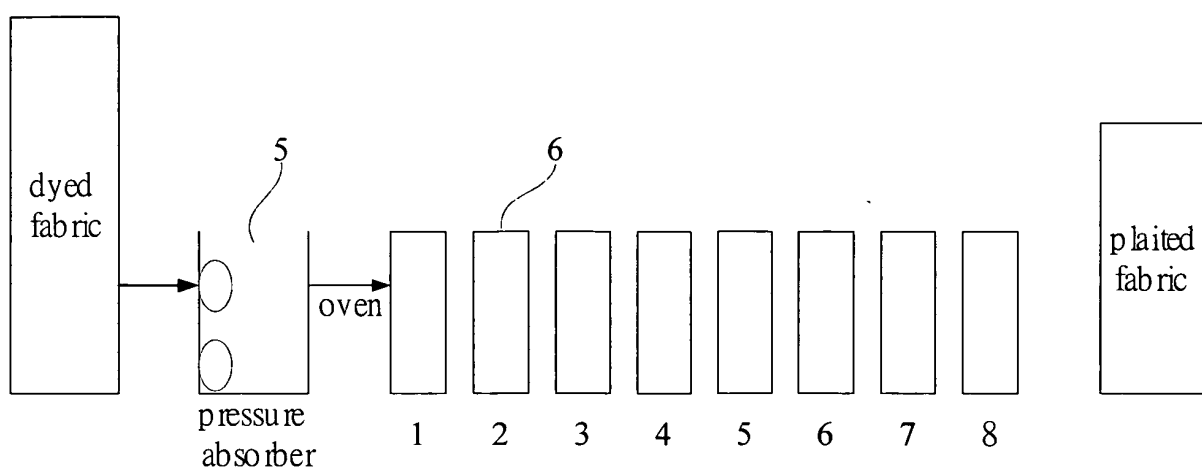


FIG.5

Table 1

Test method/No.	(1)8147	(1)8161	(1)8170	(2)8072	(2)8064	(3)8011
C,F	3874	3662	4092	2285	1844	1882
Stretchability (ASTM D3107)	20.00%	12.80%	12.90%	18.10%	25.30%	0
C,F,S	19370	28609	31720	12554	7288	0
WVP*1 (JIS L1099A1)	7300	6400	8000	8500	10500	8200
WVP (JIS L1099B1)	20500	16799	20580	33286	36112	36774
WPR*2 (ISO 811)	420	250	400	130	100	350
Water repellence (AATCC 22)	100	100	100	100	100	100
Air permeability (ASTM D737)	2.04	5.89	1.56	7.07	11.6	3.71
RAIN TEST (AATCC 35)	PASS	PASS	PASS	X	X	X

*1: Water vapor permeability; *2: Water pressure resistance

FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 7101

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,X	EP 1 316 634 A (ASAHI KASEI KABUSHIKI KAISHA) 4 June 2003 (2003-06-04) * page 4, line 6 - line 11 * * page 4, line 42 - line 46 * * page 7, line 19 - line 25 * * page 10, line 1 - line 12 * -----	1,22	D03D15/08 D06B21/00
A	EP 1 298 236 A (ASAHI KASEI KABUSHIKI KAISHA) 2 April 2003 (2003-04-02) * claims 1,2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D03D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 1 March 2005	Examiner Goodall, C
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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01-03-2005

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82