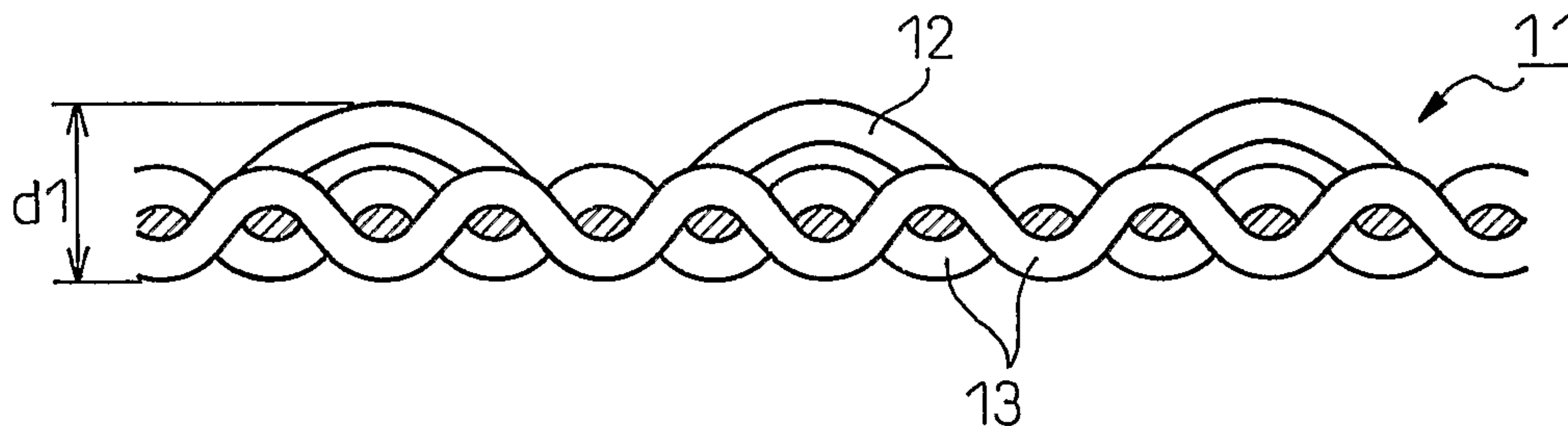




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(54) Titre : TISSU COMPOSITE ETIRABLE ET PRODUIT D'HABILLEMENT OBTENU A PARTIR DUDIT TISSU
(54) Title: STRETCHABLE COMPOSITE FABRIC AND CLOTHING PRODUCT THEREFROM



(57) **Abrégé/Abstract:**

A stretchable composite fabric which is a woven or knitted fabric comprising composite yarns (A) formed from stretchable yarns (1) having a self elongation upon water absorption of 5 % or more and an elongation at break of 200 % or more and non-stretchable yarns (2) having a self elongation upon water absorption less than 5 % and yarns (B) containing stretchable yarns (3) having a self elongation upon water absorption of less than 5 % and an elongation at break of 30 % or more, wherein a sample taken from the fabric exhibits a ratio of L1 to L2 (L1/L2) of 0.9 or less, wherein L1 and L2 represent average lengths of yarns (1) and yarns (2) in the sample, respectively, and yarns (1) undergo self-elongation when they absorb water and undergo shrinkage when they are dried. The stretchable composite fabric can be suitably used for sport and inner wear clothes.

ABSTRACT

A stretchable composite fabric appropriate to sports wear and under wear is a woven or knitted fabric including a composite yarns (A) formed from stretchable yarns (1) having a self-elongation of 5% or more upon absorbing water and an elongation at break of 200% or more and non-stretchable yarns (2) having a self-elongation less than 5% upon absorbing water, and yarns (B) including stretchable yarns (3) having a self-elongation less than 5% upon absorbing water and an elongation at break of 30% or more, wherein the yarns (1) and (2) in a sample taken from the composite fabric respectively have a length L1 and a length L2, the ratio L1/L2 is 0.9 or less, and the yarns (1) can self-elongate upon absorbing water and shrink upon drying.

DESCRIPTION

STRETCHABLE COMPOSITE FABRIC AND CLOTH PRODUCTS THEREOF

5 TECHNICAL FIELD

The present invention relates to a stretchable composite fabric and cloth products thereof. More particularly, the present invention relates to a stretchable composite fabric which is a woven or knitted
10 fabric comprising a stretchable and high water-absorbent and self-elongative yarn (1), a non-stretchable, low water-absorbent and low self-elongative yarn (2) and a stretchable, low water-absorbent and low self-elongative yarn (3), and capable of, when wetted with water,
15 generating a rough (or rugged or concave and convex) pattern due to difference in water-absorption and self-elongation among the yarns from which the fabric is constituted, and removing, when dried, the rugged pattern from the fabric, and cloth products thereof.

20

TECHNICAL BACKGROUND

It is known that various proposals have been made to utilize stretchable woven or knitted fabrics in uses of sports wear and under wear, as described in, for example,
25 Japanese Unexamined Patent Publication No. 3-174043 (Patent Reference 1).

When the stretchable woven or knitted fabrics comprising synthetic fibers and/or natural fibers are used in the use of clothes, for example, the sports wear
30 and under wear, however, a problem that when sweated, from the skin, the cloth adheres to the skin so as to create unpleasantness, occurred. To solve the problem, Japanese Unexamined Patent Publication No. 2003-147657 (Patent Reference 2) provided a woven fabric having a
35 double ply weave structure and a rough (or rugged or concave and convex) pattern formed on the back surface of the fabric. In this case, however, as the woven fabric

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has the rough (or rugged or concave and convex) pattern formed on the surface, a cloth prepared from the woven fabric is provided with unnecessary rugged pattern on the cloth surface in usual condition (non-wetted (non-sweated) condition), and thus has an undesired appearance.

Also, for example, Japanese Unexamined Patent Publication No. 3-213518 (Patent Reference 3) and No. 10-77544 (Patent Reference 4) provided woven fabrics capable of self-controlling the air permeability thereof. The cloth prepared from this woven fabric can always provide good comfort by such a mechanism that when sweated and the temperature of the inside of the cloth increases, the air permeability of the woven fabric from which the cloth is formed increases so that moisture stored in the cloth is discharged to the outside of the cloth, and when the sweat stops, the cloth is dried and the temperature of the inside of the cloth decreases, the air permeability of the woven fabric from which the cloth is formed decreases so that the warmth-keeping property of the cloth increases.

Further, Japanese Unexamined Patent Publication No. 2002-266249 (Patent Reference 5) provided a double ply-structured woven or knitted fabric containing a water-absorbing agent.

In the above-mentioned conventional woven or knitted fabrics for clothes, however, the problem that when sweated, the cloth creates an unpleasantness, has not yet fully solved.

[Patent Reference 1] JP-3-174043-A
[Patent Reference 2] JP-2003-147657-A
[Patent Reference 3] JP-3-213518-A
[Patent Reference 4] JP-10-77544-A
[Patent Reference 5] JP-2002-266249-A

SUMMARY OF THE INVENTION

An object of the present invention is to provide a

stretchable composite fabric comprising a yarn capable of self-elongating upon wetting with and absorbing water and shrinking upon drying and exhibiting, as a whole, a stretchability, and a cloth product thereof.

5 The above-mentioned object can be attained by the stretchable composite fabric of the present invention.

 The stretchable composite fabric of the present invention is a woven or knitted fabric comprising at least three types of yarns (1), (2), and (3) different
10 from each other,
 wherein

 the yarn (1) is a stretchable, high water-absorbent and high self-elongative yarn, comprising stretchable fibers having relatively high self-elongation
15 upon absorbing water, and an elongation at break of 200% or more;

 the yarn (2) is a non-stretchable, low water-absorbent and low self-elongative yarn comprising substantially non-stretchable fibers having relatively
20 low self-elongation upon absorbing water;

 the yarn (3) is a stretchable, low water-absorbent and low self-elongative yarn, comprising stretchable fibers having a relatively low self-elongation upon absorbing water, and an elongation at
25 break of 30% or more;

 the yarn (1) has a self-elongation of 5% or more upon absorbing water and the yarn (2) and (3) have an self-elongation less than 5% upon absorbing water, determined in such a manner that each type of yarn
30 selected from the yarns (1), (2) and (3) is wound around a hank frame having a frame girth of 1.125m under a load of 0.88 mN/d tex, to provide a hank with a winding number of 10, the hank yarn is removed from the hank frame and left to stand in the air atmosphere having a temperature
35 of 20°C and a relative humidity of 65% for 24 hours to condition the hank yarn, the resultant dried hank yarn is subjected to a measurement of the dry length (Ld, mm)

thereof under a load of 0.0080 mN/d tex, immersed in water at a water temperature of 20°C for 5 minutes, and then taken up from water, the resultant water-wetted hank yarn is subjected to a measurement of the wet length (LW, mm) thereof under a load of 0.0088 mN/d tex, and the self-elongation of the yarn is calculated in accordance with the following equation:

$$\begin{aligned} &\text{Self elongation (\%)} \text{ of yarn upon absorbing water} \\ &= [(Lw - Ld)/(Ld)] \times 100; \end{aligned}$$

from the yarn (1) and the yarn (2), a stretchable, water-absorbent, and self-elongative composite yarn (A) is formed, and the yarn (3) is contained in a stretchable, non-water-absorbent and non-self-elongative yarn (B) having substantially no self elongation; and

the woven or knitted fabric has a ratio L1/L2 of 0.9 or less, determined in such a manner that the woven or knitted fabric is subjected to a dimension stabilization in the air atmosphere having a temperature of 20°C and a relative humidity of 65%; then from the dimension-stabilized woven or knitted fabric, a specimen of the composite yarn (A) having a length of 30 cm is picked up; and average lengths L1 and L2 of the yarns (1) and (2) contained in the specimen of the composite yarn (A) are measured under a load of 0.0088 mN/d tex, then the ratio of L1 to L2 is calculated.

The composite fabric of the present invention preferably has a woven fabric structure, and in the warp yarn group and/or weft yarn group of the woven fabric structure, the stretchable, water-absorbent, and self-elongative composite yarn (A) and the stretchable, non-water absorbent and non-self-elongative yarn (B) are alternately arranged with every one yarn or every two or more yarns.

In the composite fabric of the present invention,

preferably the yarns of one group of the warp and weft yarn groups are formed from the composite yarn (A) and the yarn (B), and the yarns of the other group are formed from at least one type of yarns different from the composite yarn (A) and the yarn (B).

In the composite fabric of the present invention, the different yarn, from the composite yarn (A) and the yarn (B), is preferably selected from yarns formed from a plurality of individual fibers having a flat cross-sectional profile and yarns formed from a plurality of individual fine fibers having a thickness of 1.5 d tex or less.

The composite fabric of the present invention preferably has a multi-ply structure having two or more plies, in which the multi-ply structure at least one ply comprises the composite yarn (A) in a content of 20% by mass or more, based on the total mass of the ply and another at least one ply comprises the yarn (B) in a content of 20% by mass or more, based on the total mass of the another ply.

In the composite fabric of the present invention, preferably, the fibers from which the stretchable, high water-absorbent and self-elongative yarn (1) contained in the composite yarn (A) is constituted, are selected from polyetherester fibers formed from polyetherester elastomers comprising hard segments formed from polybutylene terephthalate blocks and soft segments formed from polyoxyethyleneglycol blocks.

In the composite fabric of the present invention, preferably, the fibers, from which the non-stretchable, low water-absorbent and low self-elongative yarn (2) contained in the composite yarn (A) is constituted, are selected from polyester fibers.

In the composite fabric of the present invention, preferably the fibers, from which the yarn (2) is constituted, have an individual fiber thickness of 1.5 d tex or less.

In the composite fabric of the present invention, preferably, the stretchable, non-water absorbent and non-self-elongative yarn (B) is a composite yarn comprising another yarn (4) in addition to the stretchable, low
5 water-absorbent and low self-elongative yarn (3), the yarn (3) has an elongation at break of 200% or more, the yarn (4) comprises fibers having substantially no self-elongation upon absorbing water and no stretchability, and the ratio $L3/L4$ of the average length $L3$ of the
10 yarn (3) to the average length $L4$ of the yarn (4) in the composite yarn (B), is 0.9 or less, determined by the same manner of measurement as that applied to the composite yarn (A).

In the composite fabric of the present invention, preferably, the fibers from which the yarn (3) having the
15 elongation at break of 200% or more is constituted, are selected from polyetherester fibers formed from polyetherester elastomers comprising hard segments formed from polybutylene terephthalate blocks and soft segments
20 formed from polytetramethyleneoxide glycol blocks.

In the composite fabric of the present invention, the fibers from which the yarn (4) is constituted are preferably selected from polyester fibers.

The composite fabric of the present invention preferably has a ruggedness change of 10% or more,
25 determined by a measurement such that a plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, and left to stand in air atmosphere at a temperature of 20°C at a relative humidity
30 of 65% for 24 hours to provide a plurality of dried specimens; separately a plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, immersed in water at a temperature of 20°C for 5 minutes, taken up from water, and subjected to a water
35 removal by interposing each specimen between a pair of filter paper sheets, and applying a pressure of 490 N/m²

to the interposed specimen for one minute to remove water remaining between fibers in the specimens and provide a plurality of wetted specimens; an average largest thickness Dw of the wetted specimens and an average largest thickness Dd of the dried specimens are measured, and the roughness change of the composite fabric is calculated in accordance with the following equation:

$$\text{Roughness change (\%)} = [(Dw - Dd)/(Dd)] \times 100$$

In the composite fabric of the present invention having a woven fabric structure, the woven fabric preferably has a cover factor of 2500 or more.

The composite fabric of the present invention preferably has at least one surface applied with a water-repellent treatment.

The composite fabric of the present invention preferably has an air permeability of 50 ml/cm²·s or less, determined in accordance with JIS L 1096 - 1998, 6.27, method A (Fragir type method), in the air atmosphere at a temperature of 20°C at a relative humidity of 65%.

The composite fabric of the present invention preferably has a hydraulic pressure resistance of 100 mmH₂O or more, determined in accordance with JIS L 1092 - 1998, 4(1.1) (low hydrostatic static pressure method) in the air atmosphere at a temperature of 20°C at a relative humidity of 65%.

The cloth material of the present invention comprises the above-mentioned stretchable composite fabric of the present invention and is capable of generating a rugged pattern on at least one surface of the cloth material when wetted with water.

The clothing of the present invention has at least one portion selected from armhole, side, breast, back and shoulder portions and formed from the above-mentioned cloth material of the present invention.

The clothing of the present invention is preferably selected from under wear.

The cloth of the present invention is preferably selected from sports wear.

BRIEF DESCRIPTION OF THE INVENTION

5 Fig. 1 is an explanatory bird's eye view of an embodiment of the stretchable composite fabric of the present invention upon drying,

10 Fig. 2 is an explanatory bird's eye view of the stretchable composite fabric shown in Fig. 1 upon wetting with and absorbing water,

 Fig. 3 shows an explanatory cross-sectional profile of another embodiment of the stretchable composite fabric of the present invention upon drying,

15 Fig. 4 shows an explanatory cross-sectional profile of the stretchable composite fabric shown in Fig. 3 upon wetting with, and absorbing, water,

 Fig. 5 is an explanatory front view of an embodiment of the cloth containing the stretchable composite fabric of the present invention,

20 Fig. 6 is an explanatory front view of another embodiment of the cloth containing the stretchable composite fabric of the present invention,

25 Fig. 7 is an explanatory front view of still another embodiment of the cloth containing the stretchable composite fabric of the present invention,

 Fig. 8 is an explanatory lack view of still another embodiment of the cloth containing the stretchable composite fabric of the present invention,

30 Fig. 9 is an explanatory front view of still another embodiment of the cloth containing the stretchable composite fabric of the present invention,

35 Fig. 10 shows a woven fabric structure of an embodiment of the stretchable composite fabric of the present invention having a weft backed weave structure, and

 Fig. 11 shows a woven fabric structure of another embodiment of the stretchable composite fabric of the

present invention having a weft backed weave structure.

BEST MODE OF CARRYING OUT THE INVENTION

5 The stretchable composite fabric of the present invention is a woven or knitted fabric comprising at least three types of yarns (1), (2) and (3) different in self elongation upon absorbing water and/or stretchability from each other.

10 The yarn (1) is a stretchable, high water-absorbent and high self-elongative yarn comprising stretchable fibers having a relatively high self elongation upon absorbing water, the yarn (1) exhibiting an elongation at break of 200% or more;

15 the yarn (2) is a non-stretchable, low water-absorbent and low self elongative yarn comprising substantially no stretchable fibers having a relatively low self elongation upon absorbing water; and

20 the yarn (3) is a stretchable, low water-absorbent and low self elongative yarn comprising stretchable fibers having relatively low self elongation upon absorbing water, the yarn (3) exhibiting an elongation at break of 30% or more.

The self elongations upon absorbing water of the yarns (1), (2) and (3) are determined as follows.

25 Each of the yarns (1), (2) and (3) is wound around a hank frame having a frame girth of 1.125m under a load of 0.88 mN/d tex, to provide a hank with a winding number of 10; the hank yarn is removed from the hank frame and left to stand in the air atmosphere having a temperature of
30 20°C and a relative humidity of 65% for 24 hours to condition the hank yarn; the resultant dried hank yarn is subjected to a measurement of the dry length (L_d , mm) thereof under a load of 0.008 mN/d tex, then is immersed in water at a water temperature of 20°C for 5 minutes, and
35 taken up from water; the resultant water-wetted hank yarn is subjected to a measurement of the wet length (L_w , mm) thereof under a load of 0.0088 mN/d tex; and the self

elongation of the yarn is calculated in accordance with the following equation:

Self elongation (%) of yarn upon absorbing water
5 = $[(L_w - L_d)/(L_d)] \times 100$. The yarn (1) has a self elongation upon absorbing water of 5% or more, and the yarns (2) and (3) each exhibit a self elongation upon absorbing water of less than 5%.

10 The stretchable composite fabric of the present invention comprises a stretchable, water-absorbent and self-elongative composite yarn (A) formed from the yarns (1) and (2) and a stretchable, non-water absorbent and non-self elongative yarn (B) containing the yarn (3) and exhibiting substantially no self elongation.

15 The woven or knitted fabric for the present invention must have a ratio L_1/L_2 of 0.9 or less determined in a manner such that the woven or knitted fabric is subjected to a dimensioned stabilization in the air atmosphere having a temperature of 20°C and a relative
20 humidity of 65%; from the dimension-stabilized woven or knitted fabric, a specimen of the composite yarn (A) having a length of 30 cm is picked up; and the average lengths L_1 and L_2 of the yarns (1) and (2) contained in the specimen of the composite yarn (A) are measured under
25 a load of 0.0088 mN/d tex and the ratio of L_1 to L_2 is calculated.

30 The composite fabric of the present invention having the above-mentioned constitution exhibits a stretchability in at least one directions of warp and weft directions or at least one direction of course and wale directions and further exhibits a performance such that when the fabric is wetted with water, at least the yarn (1) absorbs water and self elongates to cause the form and appearance of the composite fabric to be
35 changed, and when the water-wetted fabric is dried, at least the water-absorbed and self-elongated yarn (1) desorbs water and self-shrunk to cause the form and

appearance of the fabric to return to the original form and appearance.

5 The yarn (1) usable for the present invention is constituted from fibers having high self elongation upon absorbing water and a stretchability. The self elongation of the yarn (1) upon absorbing water is 5% or more, preferably 6% or more, still more preferably 8 to 30%. The fibers from which the yarn (1) is formed include, for example, polyetherester fibers formed from 10 polyetherester elastomers comprising hard segments formed from polybutylene terephthalate and soft segments formed from polyoxyethylene glycol; polyester-mixed resin fibers formed from mixtures of polyester resins with at least one resin selected from polyacrylate metal salt polymers, 15 polyacrylic acid polymers and copolymers thereof, polymethacrylic acid polymers and copolymers thereof, polyvinyl alcohol polymers and copolymers thereof, polyacrylamide polymers and copolymers thereof and polyoxyethylene polymers; and polyester fibers in which 20 5-sulfoisophthalic acid component is copolymerized. Among them, the polyetherester fibers formed from polyetherester elastomers comprising polybutylene phthalate, as hard segments, and polyoxyethylene glycol as soft segments, have not only a high self elongation 25 upon absorbing water but also a high stretchability, and thus are preferably utilized as a component for constituting a stretchable composite fibers in which the high elasticity of the polyetherester fibers is utilized.

30 The polybutylene terephthalate from which the hard segments of the polyetherester elastomers preferably contain butylene terephthalate units in a content of at least 70 molar %. The content of the butylene terephthalate units is more preferably 80 molar % or more, still more preferably 90 molar % or more. The 35 principal acid component of the butylene terephthalate structure is terephthalic acid. In this butylene terephthalate structure, a small amount of another

dicarboxylic acid may be copolymerized. Also, the glycol component comprises, as a principal ingredient, tetramethylene glycol and, as an optional copolymerization ingredient, another glycol compound.

5 The dicarboxylic acids other than terephthalic acid include aromatic and aliphatic dicarboxylic acids, for example, naphthalene dicarboxylic acids, isophthalic acid, diphenyl dicarboxylic acids, diphenyloxyethane dicarboxylic acids, β -hydroxyethoxybenzoic acid, p-
10 hydroxybenzoic acid, adipic acid sebacic acid, and 1,4-cyclohexane dicarboxylic acid. Also, polycarboxylic acids having tri- or more functionality, for example, trimellitic acid and pyromellitic acid are optionally employed as copolymerization ingredients, if they
15 substantially do not counteract attainment of the object of the present invention.

 Also, the diol compounds other than tetramethylene glycol include aliphatic, cycloaliphatic and aromatic diol compounds, for example, trimethylene glycol,
20 ethylene glycol, cyclohexane-1,4-dimethanol and neopentyl glycol. Further, polyol compounds having tri- or more functionality, for example, glycerol, trimethylolpropane and pentaerythritol, are optionally employed as copolymerization ingredient, if they substantially do not
25 counteract attainment of the object of the present invention.

 The above-mentioned polyoxyethylene glycol preferably has a number average molecular weight in the range of from 400 to 8,000, more preferably from 1,000 to
30 6,000.

 The above-mentioned polyetherester elastomer can be produced, for example, by subjecting a material comprising dimethyl terephthalate, tetramethylene glycol and polyoxyethylene glycol to a transesterification
35 reaction in the presence of a transesterification catalyst, to prepare (ω -hydroxybutyl)terephthalate and/or oligomers thereof, then subjecting the

transesterification product to a melt poly-condensation reaction in the presence of a polycondensation catalyst and a stabilizing agent at an increased temperature under a reduced pressure.

5 The ratio in mass of the hard segments to the soft segments are preferably in the range of from 30/70 to 70/30.

 Where the polyetherester elastomer comprises, as a copolymerization component, a metal salt of an organic sulfonic acid, for example, 5-sodium sulfoisophthalic acid, the resultant fibers exhibiting a further enhanced self elongative property upon absorbing water can be obtained.

 The polyetherester fibers can be produced by melt-extruding the polyetherester elastomer through a conventional melt-spinneret, taking up the extruded filaments at a taking-up speed of 300 to 1200 m/minute, preferably 400 to 980 m/minute, and winding-up the taken-up filaments at a winding draft rate of 1.0 to 1.2 times, preferably 1.0 to 1.1 times, the above-mentioned taking-up speed.

 There are no specific limitations to the total thickness, the individual fiber thickness and the number of filaments per yarn, of the water-absorbent and self-elongative yarn (1). In view of hand and producibility, the yarn (1) preferably has a total thickness of 30 to 300 d tex, an individual fiber thickness of 0.6 to 100 d tex and a number of filament per yarn of 1 to 10.

 The fibers from which the non-stretchable, low water-absorbent, low self-elongative yarn (2), the yarn (2) forming, together with the above-mentioned yarn (1), the composite yarn (A), include, for example, natural fibers, for example, cotton and hemp fibers; cellulose chemical fibers, for example, rayon and cellulose acetate fibers; and synthetic fibers, for example, polyester fibers, for example, polyethylene terephthalate and polytrimethylene terephthalate fibers,

polyamide fibers, polyacrylnitrile fibers and polypropylene fibers. Among these fibers, the conventional polyester fibers are preferably employed for the yarn (2). When the low water-absorbent, and low self-elongative yarn (2) has a individual fiber thickness of 1.5 d tex or less (more preferably 1.0 d tex or less, still more preferably 0.1 to 0.8 d tex, and the number of the fibers per yarn is 30 or more, more preferably 50 to 300, the resultant composite yarn (A) exhibits an increased water absorption and thus has an increased self elongation upon absorbing water, and therefore, the composite fabric of the present invention comprising the composite yarn (A) exhibits an enhanced ease in generation of change in appearance and form of the fabric due to water absorption and wetting.

In the composite yarn (A), the yarns (1) and (2) from which the composite yarn (A) is constituted, must have a specific difference in yarn length, as shown below.

A woven or knitted fabric containing the composite yarn (A) comprising the above-mentioned yarn (1) and (2) is dimension-stabilized in the air atmosphere having a temperature of 20°C and a relative humidity of 65%; a specimen of the composite yarn (A) having a length of 30 cm is picked up from the dimension-stabilized composite fabric; an average lengths L1 and L2 of yarns (1) and (2) contained in the specimen of the composite yarn (A) are measured under a load of 0.0088 mN/d tex; and the ratio of L1 to L2 is calculated. The ratio L1/L2 must be 0.9 or less.

Preferably, the ratio L1/L2 is 0.9 to 0.2, and more preferably 0.8 to 0.3. When the ratio L1/L2 is more than 0.9, the resultant composite yarn (A) exhibits an insufficient stretchability. Also, if the ratio L1/L2 is less than 0.3, the resultant composite yarn (A) may exhibit too low a change in form and appearance of the composite yarn (A) when water-absorbed and wetted.

There is no specific limitation to the method of producing the composite yarn (A). For example, a composite yarn having a core-in-sheath structure is formed by stretching (drafting) a yarn (1) at a desired elongation rate (for example, 1.1 to 5.0); combining a yarn (2) with the stretched yarn (1) so as to form a core-in-sheath structure in which the core is formed from the stretched yarn (1) and the sheath is formed from the yarn (2) surrounding the core yarn (1); optionally lightly twisting the resultant composite yarn, and then releasing the stretch of the yarn (1) in the composite yarn to allow the yarn (1) to elastically shrink. In the resultant composite yarn (A), the yarn (2) has a longer yarn length than that of the shrunk yarn (1), and thus the fibers from which the yarn (2) is constituted are folded and surround around the yarn (1) to form a sheath part of the composite yarn. Therefore, the resultant composite yarn appears as a bulky yarn. The yarn (1) is selected from multi-filament yarns and staple fiber-spun yarns, preferably the multi-filament yarns. The yarn (2) is selected from multi-filament yarns and staple fiber-spun yarns, preferably the multi-filament yarns. The multi-filament yarn (2) may be processed with a texturing treatment, for example, a false twist-texturing treatment.

In the composite yarn (A), there is no specific limitation to the numbers of the yarn (1) and the yarn (2), while the ratio of the number of the yarn (1) to that of the yarn (2) is preferably 1:1, and the ratio in mass of the yarn (1) to that of the yarn (2) is preferably 10:90 to 70:30, more preferably 15:85 to 50:50.

In the production procedure of the composite yarn (A), the stretch ratio of the yarn (1) is preferably controlled to 1.1 or more, more preferably 1.2 to 5.0.

The combination procedure of the stretched yarn (1) with the yarn (2) may be carried out in accordance with a

doubling (paralleling) method, air-jet type interlace yarn combining method, Taslan air jet type yarn combining method, covering type yarn combining method and composite false twist texturing type yarn combining method. The
5 covering type yarn combining method in which the yarn (2) are wound around the stretched yarn (1) is preferably employed. In this method, the resultant composite yarn exhibits a clear core-in-sheath structure.

The yarn (B) usable for the present invention
10 comprises, as an indispensable component, a yarn (3) having a stretchability and a low self elongation upon absorbing water. The yarn (3) is constituted from stretchable, low water-absorbent and low self-elongative fibers and exhibits an elongation at break of 30% or
15 more.

In the composite fabric of the present invention, the yarn (3) usable for the yarn (B) is formed from stretchable fibers having a relatively low self-elongation of 5% or less upon absorbing water and
20 exhibits an elongation at break of 30% or more. The fibers from which the above-mentioned stretchable, low water-absorbent and low self elongative yarn (3) is formed, may be selected from stretchable polyetherester fibers, stretchable polyurethane fibers, stretchable
25 side-by-side type-conjugated polyester fibers, stretchable polytrimethylene terephthalate fibers, and false twist-textured filaments.

The stretchable polyetherester fibers are preferably selected from polyetherester elastomer fibers which
30 comprise hard segments comprising polybutylene terephthalate and soft segments comprising polytetramethyleneoxide glycol, and are available under, for example, the trademark REXE by TEIJIN FIBERS CO. The elastomer fibers can be produced by the same method as
35 that of producing the polyetherester fibers usable for the yarn (1), except that the polyoxyethylene glycol used as a material for forming the soft segments is replaced

by polytetramethyleneoxide glycol. To impart a low air permeability and/or a high water repellency to a target composite fabric, the individual fiber thickness of yarn (3) is preferably controlled to 1.5 d tex or less, more preferably 1.0 d tex or less, still more preferably 0.1 to 0.8 d tex. Also the number of the fibers or filaments per yarn of the yarn (3) is preferably controlled to 30 or more, more preferably 50 to 300.

The yarn (B) may consist of the yarn (3) only or may be a composite yarn comprising the yarn (3) and a yarn (4) different from the yarn (3). When the yarn (B) is the composite yarn, the yarn (4) may be formed from non-stretchable, low water-absorbent and low self elongative fibers and has a self elongation of 5% or less upon absorbing water.

When the composite yarn (B) is subjected to a measurement of the average yarn lengths L3 and L4 of the yarn (3) and the yarn (4) in the same manner as that applied to the composite yarn (B), the ratio of L3 to L4 (L3/L4) is preferably 0.9 or less, more preferably 0.9 to 0.2, still more preferably 0.8 to 0.5. The non-stretchable, low water-absorbent and low self elongative yarns usable for the yarn (4) contained in the yarn (B) may comprise at least one type of fibers, for example, non-stretchable polyester fibers, polyamide fibers, polyacrylic fibers, polypropylene fibers, cellulose chemical fibers and natural fibers which are also usable for forming the yarn (2).

The combination of the yarn (3) with yarn (4) to provide the composite yarn (B) is carried out so as to allow the resultant composite yarn (B) to exhibit a sufficient stretchability. For example, the combination of the yarn (3) with the yarn (4) may be carried out in the same method as that of combining the yarn (1) with the yarn (2) to form the composite yarn (A). In this case, the yarn (3) is arranged in a stretched form in a core position and the yarn (4) is combined with the

stretched yarn (3) so as to form a sheath surrounding around the stretched yarn (3), the combination of the yarn (3) with the yarn (4) is subjected to a desired yarn-processing procedure, for example, an air jet
5 interlace treatment, or a covering type yarn-combining procedure or a composite false twist texturing procedure, and thereafter, the resultant composite yarn is released from the stretch of the yarn (3), to allow the stretched yarn (3) to elastically return to the original form. In
10 this yarn combination, the yarn (3) is arranged in a core position, and the fiber of the yarn (3) in the sheath part extend outward and are bent or curved to cause the resultant composite yarn (B) to exhibit a bulky composite yarn appearance.

15 There is no specific limitation to the total thickness of the composite yarn (B). The total thickness can be appropriately established in response to the desired structure of the target woven or knitted fabric, for example, 30 to 300 d tex. There are no specific
20 limitations to the individual fiber thickness and the number of fibers or filaments per yarn of the yarn (4). To impart a low permeability and/or a high water repellency to the target woven or knitted fabric, the yarn (4) preferably has an individual fiber thickness of
25 1.5 d tex or less, more preferably 1.0 d tex or less, still more preferably 0.1 to 0.8 d tex, and a number of fibers or filament per yarn of 30 or more, more preferably 50 to 300. There is no limitation to the cross-sectional profile of the fibers from which the
30 yarn (3) and yarn (4) are constituted. The cross-sectional profile may be circular or irregular.

The stretchable composite fabric of the present invention may have a woven fabric structure or a knitted fabric structure.

35 In the case where the stretchable composite fabric of the present invention has a woven fabric structure, in the warp yarn group and/or the weft yarn group of woven

5 fabric structure, the stretchable, water-absorbent and self-elongative composite yarn (A) and the stretchable, non-water-absorbent and non-self-elongative yarn (B) may be alternately arranged with every one yarn or every two or more yarns, preferably 2 to 800 yarns, more preferably 5 to 500 yarns, still more preferably 10 to 100 yarns.

10 In the case where the stretchable composite fabric of the present invention has a knitted fabric structure, in the course yarn group and/or the wale yarn group in the knitted fabric structure, the stretchable yarn (A) having a self-elongation upon absorbing water and the stretchable yarn (B) having non-self elongation upon absorbing water may be alternately arranged with every one yarn or every a plurality of yarns.

15 In the stretchable composite fabric of the present invention, the alternate arrangement of the composite yarn (A) and the yarn (B) may be regularly or irregularly made and preferably regularly.

20 In the stretchable composite fabric of the present invention having the woven fabric structure, optionally only one yarn group selected from the warp yarn group and the weft yarn group in the woven fabric structure is constituted from the composite yarn (A) and the yarn (B), and the other yarn group is constituted from at least one type of yarn different from the composite yarn (A) and the yarn (B).

25 In the stretchable composite fabric of the present invention having the knitted fabric structure, optionally only one yarn group selected from the course yarn group and the wale yarn group is constituted from the composite yarn (A) and the yarn (B), and the other yarn group is constituted from at least one type of yarn different from the composite yarn (A) and the yarn (B).

30 The yarn different from the composite yarn (A) and the yarn (B) preferably selected from yarns comprising a plurality of individual fibers having a flat cross-sectional profile and yarns comprising a plurality of

individual fibers having a fine thickness of 1.5 d tex or less. These different types of yarns are very flexible. The flexible fibers preferably have a flat cross-sectional profile having a ratio of major axis to minor axis of 1.2 or more, more preferably 2 to 5. The fine thickness fibers preferably have a thickness of 1.5 d tex or less, as mentioned above, more preferably 0.1 to 1.3 d tex. There is no further limitation to the different types of fibers as long as the above-mentioned requirements are satisfied. The different types of fibers may be selected from natural fibers, for example, cotton and hemp fibers, cellulose chemical fibers, for example, rayon and cellulose acetate fibers and synthetic fibers, for example, polyester fibers, typically polyethylene terephthalate and polytrimethylene terephthalate fibers, and polyamide, polyacrylonitrile and polypropylene fibers.

Fig. 1 is an explanatory bird's eye view of an embodiment of the stretchable composite fabric of the present invention in the dry state, and Fig. 2 is an explanatory bird's eye view of the fabric of Fig. 1 in the water-wetted state.

In the composite fabric 1 shown in Figs. 1 and 2, the warp yarn group comprises regions 2 constituted from a plurality of composite yarns (4) and regions 3 constituted from a plurality of yarn (B), and the regions 2 and the region 3 are alternately formed with each other. The warp yarns in the regions 2 and the regions 3, are the same as each other and constituted from stretchable, non-water absorbent and non-self-elongative yarns. In Fig. 1, the regions (2) the fabric 1 in dry state have a thickness of d1.

When the composite fabric 1 of Fig. 1 is wetted with water, the dimensions and form (appearance) of the regions 3 comprising, as weft yarns, yarns (B) substantially do not change, because all the warp and weft yarns in the regions 3 are non-water absorbent and

non-self-elongative, as shown in Fig. 2. In the regions 2 containing, as weft yarns, the composite yarns (A), however, when wetted with water, the yarns (1) contained in the composite yarns (A) absorb water and self elongate. Also, the yarns (2) combined with the yarn (1) in the composite yarns (A) are in a bending form or spirally wound around the yarns (1), and thus the yarns (2) are apparently elongate together with the water-absorbed and self-elongated yarns (1) in the longitudinal direction of the composite yarn (A), to cause the dimension of the regions (2) in the weft yarn direction to increase and the regions (2) to be corrugated in a rough (or rugged or concave and convex) pattern. In this case, a height difference d_2 between a highest point 4 and a lowest point 5 of the regions 2, namely a thickness of the regions 2 is larger than D_1 . The rough pattern of the regions 2 generated in the wetted state disappears after drying and the region 2 becomes flat.

In the stretchable composite fabric of the present invention, there are no specific limitations to the type and the number of plies of the woven fabric structure. The woven fabric structure includes plain, twill and satine weave structures but is not limited to the above-mentioned structures. The composite fabric include single ply fabrics and two or more ply fabrics.

In the stretchable composite fabric of the present invention when the yarn length of the composite yarn (A) contained in the composite fabric in the air atmosphere at a temperature of 20°C at a relative humidity (RH) of 65% is represented by LA , and the length of the yarn (B) in the composite fabric under the above-mentioned conditions is represented by LB , the difference between LA and LB is preferably as small as possible, and the ratio LA/LB is preferably in the range between 0.9 and 1.1. If the ratio LA/LB is less than 0.9, or more than 1.1, a rough pattern may be generated on the surface of

the composite fabric even when dried and thus the resultant composite fabric has an unsatisfactory appearance.

5 The lengths of the yarns are determined by the following measurement.

A sample of a composite woven fabric is left to stand in the air atmosphere at a temperature of 20°C at a relative humidity (RH) of 65% for 24 hours, then from the dimension-stabilized fabric, specimen pieces (n = 5)
10 having dimensions of 30 cm × 30 cm are provided by cutting, a piece of composite yarn (A) and a piece of yarn (B) are picked up from each specimen piece and the length LA in mm of the piece of the composite yarn (A) and the length LB in mm of the piece of the yarn (B) are
15 measured. During the measurement, each piece of the yarns are tensioned under a load of 0.0088 mN/d tex (1 mg/denier). The ratio LA/LB is represented by a ratio of an average of the measured lengths LA to the average of the measured lengths LB. The piece of the composite
20 yarn (A) and the piece of the yarn (B) picked up from each specimen piece of the fabric must be those extended in one the same direction of the composite fabric. For example, where the composite yarn (A) piece is picked up from the warp (or weft) yarns of the composite fabric,
25 the yarn (B) piece must be picked up from the warp (or weft) yarns of the woven fabric.

Where the yarn (B) is a composite yarn containing non-stretchable, non-water absorbent and non-self elongative yarns (4), the ratio LA/LB can be controlled
30 in the range of from 0.9 to 1.1 by the following method. Where the composite yarn (B) is prepared from the stretchable yarns (3) and the non-stretchable yarns (4), the draw ratio applied to the stretchable yarns (3) during the production of the yarns (3) influences upon
35 the shrinkage in boiling water of the resultant composite yarns (B). Therefore, the draw ratio in the production procedures of the stretchable yarns (3) is controlled so

that the ratio α/β of the shrinkage in boiling water of the composite yarns (A) to the shrinkage in boiling water of the composite yarns (B) containing the yarns (3) falls within the range of from 0.9 to 1.1. When the composite fabric is produced by the above-mentioned method, and the resultant composite fabric passes through a boiling water treatment, for example, a dyeing procedure, the composite yarns (A) and the composite yarns (B) are thermally shrunk to the same extent as each other, and thus the difference in yarn length between the composite yarns (A) and (B) is made small. In the case where the difference in yarn length between the composite yarns (A) and (B) contained in the composite fabric is made large by the dyeing procedure, etc., a heat set treatment in which the composite fabric is heat set while expanding the width of the composite fabric to 1.4 times or less the original width thereof, enables the average yarn length ratio L_A/L_B of the composite yarns (A) and (B) in the composite fabric to be controlled in the range of from 0.9 to 1.1.

The composite fabric of the present invention is preferably wet-treated at a temperature of 60°C or more (more preferably 65 to 98°C), then optionally subjected to a dyeing procedure, and then the wet-treated (or, if applied, dyeing-processed) composite fabric is preferably heat-set while expanding the width of the fabric at a width expansion ratio of 1.4 or less (more preferably 1.0 to 1.3). If the heat set is carried out at a width expansion ratio more than 1.4, the self elongation of the yarn (1) contained in the composite yarn (A) upon absorbing water may decrease and the sufficient change in the rough pattern of the fabric due to wetting and drying may not be obtained.

In the stretchable composite fabric of the present invention, when wetted with water, the composite yarns (A) self-elongate upon absorbing water and the yarn lengths of the yarns (A) increase, whereas the

stretchable, non-water absorbent and non-self elongative yarns (B) arrayed adjacent to the composite yarns (A) do not change the yarn lengths thereof. As a result, only the elongated composite yarns (A) are corrugated in the fabric to cause a rugged pattern to be generated on the surface of the fabric. When the composite fabric is dried, the yarn lengths of the composite yarns (A) reversibly decrease to the original and the rough pattern on the fabric surface disappears.

With respect to the yarn length difference between the composite yarns (A) and the yarns (B) when wetted with water, when the yarn length of the wetted composite yarn is represented by L_{Aw} , and the length of the wetted yarn (B) is represented by L_{Bw} , the ratio L_{Aw}/L_{Bw} is preferably controlled to 1.05 or more, more preferably 1.1 to 1.3. If the ratio L_{Aw}/L_{Bw} in the wetted state is less than 1.05, the generation of the rough pattern on the fabric surface when wetted with perspiration may become insufficient and thus an unpleasant sticky feel cannot be sufficiently prevented: the change in the roughness (or ruggedness) between the wet and dry conditions is preferably 10% or more, more preferably 100% or more, still more preferably 200% or more but not more than 1000%.

The roughness change of the fabric surface of the stretchable composite fabric of the present invention, generated by water-wetting and drying can be determined by the following measurement.

A plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, and left to stand in the air atmosphere at a temperature of 20°C at a relative humidity of 65% for 24 hours to provide a plurality of dried specimens; separately a plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, immersed in water at a temperature of 20°C for 5 minutes, taken up from water,

and subjected to a water removal by interposing each specimen between a pair of filter paper sheets, and applying a pressure of 490 N/m^2 to the interposed specimen for one minute to remove water remaining between fibers in the specimens to provide a plurality of wetted specimens; an average largest thickness D_w of the wetted specimens and an average largest thickness D_d of the dried specimens are measured, and the roughness change of the composite fabric is calculated in accordance with the following equation:

$$\text{Roughness change (\%)} = [(D_w - D_d) / (D_d)] \times 100.$$

The average largest thicknesses D_d and D_w of the dried specimens and the wetted specimens by subjecting the dried and wetted specimens to a largest thickness measurement using a super high precise laser displacement meter (Model: LC-2400, made by KEYENCE CO.). The measurement procedure is repeated for five specimens and the average largest thicknesses D_w and D_d are calculated from the resultant data.

When the stretchable composite fabric of the present invention is wetted with, for example, perspiration, a rugged pattern is generated in the fabric due to the self-elongation of the yarn (1) upon absorbing perspiration, to decrease the area of the fabric at which the fabric comes into contact with the skin, and to cause the unpleasant feel due to wetting to decrease of the fabric, and further the drying of the fabric to be enhanced.

The stretchable composite fabric preferably has an elastic elongation of 6% or more, more preferably 8 to 30% in the direction along which the composite yarns (A) and the yarns (B) are arranged.

Further, the stretchable composite fabric of the present invention is optionally treated with at least one function-imparting treatment, for example, water-repellent, raising and ultraviolet ray-shielding treatments, or with at least one-function-imparting agent

selected from, for example, anti-bacterial agents, mothproofing agents, light accumulating agents, regressive reflecting agents and negative ion-generating agents.

5 The stretchable composite fabric of the present invention may have a multi-ply fabric structure having two or more plies. In this case, preferably, at least one ply in the multi-ply fabric structure contain the composite yarns (A) in a content of 20% by mass or more,
10 based on the total mass of the ply and at least one another ply in the multi-ply fabric structure contain the yarn (B) in a content of 20% by mass or more, based on the total mass of the another ply.

 In the two ply-structured composite fabric of the
15 present invention, there is no specific limitation to the two-ply woven or knitted fabric structure. For example, in the case of woven fabrics, the two ply fabric structure includes warp two-ply weave structures, weft
20 two ply weave structures, double weave structures, superpose weave structures, and may be a plain weave/plain weave combination, a twill weave/plain weave combination, a satin weave/plain weave combination and a satin weave/twill weave combination. Also, in the case
25 of knitted fabrics, the two ply knitting structures include half structures, half base structures and satin structures using two reeds or three reeds. The two ply fabric structure further include a combination of two single woven or knitted fabrics heat-bonded to each other or oversewn together. Generally the two-ply woven or
30 knitted fabrics made by weaving or knitting in the two ply structure have a soft hand and thus are more preferable than the heat-bonded or oversewn two ply fabrics.

 In the two ply structured composite fabric of the
35 present invention, when the two ply composite fabric comprises the composite yarns (A) and the yarns (B), a ply principally comprises the composite yarns (A) and the

other ply principally comprises the yarns (B), and in the resultant cloth, the ply comprising the composite yarns (A) is arranged in an inner side of the cloth, facing the skin and the other ply comprising the yarn (B) is
5 arranged in an outer atmosphere side of the cloth, a rough (rugged) pattern is generated on the inner side of the cloth facing the skin when wetted with perspiration. Also, in the outer atmosphere side surface of the two-ply structured woven or knitted composite fabric, usually the
10 rough (rugged) pattern is not generated even when the cloth is wetted with rain, and thus no change in the appearance of the outer side surface of the composite fabric occurs, to produce a two ply woven fabric in which the composite yarns (A) are arranged, as a principal
15 component, in a ply and the yarns (B) are arranged, as a principal component, in the other ply, for example, in accordance with a weft two ply weave structure as shown in Fig. 10 which will be explained in detail hereinafter, in which structure, in the weft yarn group of the weave
20 structure, the composite yarns (A) and the yarns (B) are alternately arranged with every one yarn, and in the warp yarn group of the weave structure is filled with stretchable, non-water-absorbent and non-self-elongative yarns. In this case, the stretchable, non-water-
25 absorbent and non-self-elongative yarns usable for the weft yarns preferably have a individual fiber thickness of 1.5 d tex or less, more preferably 1.3 d tex or less, still more preferably 0.1 to 1.2 d tex and a number of the individual fibers per of yarn of 30 or more, more
30 preferably 50 to 300. When this type of weft yarn is employed, the resultant composite fabric may exhibit a high water-repellency.

When a water-repellent agent is applied to the ply comprising the stretchable, non-water absorbent and non-
35 self elongative yarns, as a principal component, the resultant composite fabric can exhibit an enhanced resistance to penetration of rain water thereinto. The

water-repellent agent may be selected from the conventional water repellent agents usable for the textile products. For example, the water-repellent agent include fluorine resin and silicone resin water-repellent agents. In this case, a single type of water-repellent agent may be used, or a mixture of two or more types of water repellent agents may be used. When the water-repellent agent is applied in a combination with a cross-linking agent, for example, a melamine cross-linking agent or an isocyanate cross-bonding agent, the water-repellent agent can be firmly fixed to the two ply-structured woven or knitted fabric.

There is no limitation to the method of applying a water-repellent agent to the surface formed principally from the stretchable, non-water absorbent and non-self elongative yarns (B), of the two ply-structured composite fabric. The application of the water-repellent agent may be effected by a flat screen-printing method, a rotary screen-printing method, a roller printing method, a gravuar roll method, a kiss roll method and foam-processing machine method.

Further, the ply in which the composite yarns (A) are mainly arranged, is optionally imparted with a water-absorbing agent.

The water-absorbing agent may be selected from those having an affinity to the composite yarns (A). Particularly, water-absorbing polymeric materials are preferably employed for polyester fibers. This type of water-absorbing polymeric materials include, for example, block copolymers obtainable by block copolymerizing a polyalkylene glycol (for example, polyethylene glycol, polypropylene glycol etc.) with terephthalic acid and/or isophthalic acid and a lower alkylene glycol (for example ethylene glycol, etc.). In this case, a single type of water-absorbing agent or a mixture of two or more types of water-absorbing agents may be used. There is no limitation to the application method of the water-

absorbing agent. For example, to apply the water-
absorbing agent, a flat screen printing method, a rotary
screen printing method, a roller printing method, a
gravure roll method, a kiss roll method and foam
5 processing machine method can be utilized.

In the case where the water-repellent agent and the
water-absorbing agent are applied to the two ply-
structured composite fabric of the present invention,
there is no limitation to the sequence of applications
10 thereof, and thus, first, the water-repellent agent may
be applied to a ply principally comprising the non-water-
absorbent and self elongative yarns (B), and then the
water-absorbing agent may be applied to the other ply
comprising the composite yarns (A), or first the water-
15 absorbing agent may applied to a ply comprising as a
principal component, the composite yarn (A) and then the
water-repellent agent may be applied to the other ply
comprising as a principal component to the non-water
absorbent and self elongative yarns (B). In general,
20 former sequence is preferable in practice, because the
penetration of the water-absorbing agent into the water-
repellent surface can be prevented with high efficiency.

In the two ply-structured composite fabric of the
present invention, the fabric preferably has a high
25 density to prevent a penetration of rain water into the
fabric. For example, when the two ply-structured
composite fabric has a woven fabric structure, the fabric
preferably has a cover factor CF of 2500 or more, more
preferably 3000 to 4500. Herein, the cover factor CF is
30 defined by the following equation.

$$CF = (DWp/1.1)^{1/2} \times MWp + (DWf/1.1)^{1/2} \times MWf$$

wherein DWp represents a warp yarn total thickness
(d tex) of; MWp represents a weave density of the warp
yarns (yarns/3.79 cm); DWf represents a weft yarn total
35 thickness (d tex); and MWf represents a weave density of
the weft yarns (yarns/3.79 cm).

A target of the weave density is that at which the

fabric exhibit an air permeability at dry of preferably 5 ml/cm²·s or less; more preferably 0.1 to 3.0 ml/cm²·s, and a hydraulic pressure resistance of preferably 100 mmHg or more, more preferably 120 to 600 mmHg.

5 The two ply-structured composite fabric of the present invention can be easily produced by, for example, the following method.

 A composite yarn (A) is prepared by dubling a yarn (1) with a yarn (2) while overfeeding the yarn (2) to the doubling step, or combining a yarn (2) with a yarn (1) comprising a polyetherester elastic yarn while applying a draft to the yarn (1), and then subjecting the doubled or combined yarn to an air jet interlace treatment, or covering processing, or composite false twist texturing treatment. In order to obtain a composite yarn (A) having a clear core-in-sheath structure, the covering processing is preferably applied. In the combining step, the draft ratio for the yarn (1) is preferably 1.1 or more, more preferably 1.2 to 5.0, namely 120 to 500%. Then a two ply-structured woven or knitted fabric is produced from the composite yarns (A) alone or the composite yarns (A) together with the non-self elongative yarns (B), in an appropriately established weave or knitting structure as mentioned above. In the case where the non-self elongative yarns (B) have no stretchability, while the composite yarns (A) are stretchable, the composite yarns (A) are stretched under a tension applied thereto during the weaving or knitting procedure and then are released from the tension after the weaving or knitting procedure is completed, and the length of the composite yarns (A) elastically returns to the original length so as to cause a crape-like rugged pattern to be generated on the woven or knitted fabric. Thus, in order to produce a relatively flat woven or knitted fabric, the non-self elongative yarns (B) is selected from single stretchable yarns (3) or elastic composite yarns. In an embodiment of the yarn

arrangements for the composite fabric, a weft two ply structured woven fabric is produced from a weft yarn group in which the composite yarns (A) and the non-self elongative yarns (B) are alternately arranged with every one yarn, or every one yarn (A) and a plurality of yarns (B), or every a plurality of yarns (A) and one yarn (B), or every a plurality of yarns (A) and a plurality of yarns (B), and a warp yarn group consisting of non-self elongative yarns; or a warp two ply structured woven fabric is produced from a warp yarn group in which the composite yarns (A) and the non-self elongative yarns (B) are alternately arranged with every one yarn or every one yarn (A) and a plurality of yarns (B), or every plurality of yarns (A) and one yarn (B) or every plurality of yarns (A) and a plurality of yarns (B), and a weft yarn group consisting of non-self elongative yarns; or a two ply structured knitted fabric is produced from the composite yarns (A) and the non-self elongative yarns (B) alternately arranged with every one yarn, or every one yarn (A) and a plurality of yarns (B), or every plurality of yarns (A) and one yarn (B) or every plurality of yarns (A) and a plurality of yarns (B).

The two ply structured composite fabric of the present invention is preferably processed with a water-repellent treatment of a water-absorption treatment. Also, before or after the water-repellent treatment or the water-absorption treatment, the composite fabric is optionally subjected to dyeing and finishing procedures. Optionally, the composite fabric is further subjected to a raising procedure or an ultraviolet ray-shielding procedure or treated with at least one function-imparting agent selected from antibacterial agents, deodorizing agents, mothproofing agents, light-accumulating agents, return-reflecting agents and negative ion-generating agents.

In the two ply structured composite fabric of the present invention, the composite yarns (A) constituted

from water-absorbent, self elongative yarns (1) and non-water absorbent, self elongative yarns (2) are contained at least one ply of the composite fabric, and therefore, when wetted with water, the composite yarns (A) self
5 elongate upon absorbing water to generate a rough pattern on the woven or knitted fabric surface. Also, when dried, the yarn length of the stretchable composite yarns (A) reversibly decreases into the original length, and the rough pattern disappears.

10 Fig. 3 shows an explanatory cross-sectional view of an embodiment of the two ply structured woven fabrics of the present invention in dry state. In Fig. 3, a composite fabric 11 comprises an upper ply formed from composite yarns (A) 12 comprising stretchable, water
15 absorbency and self elongative yarns (1) and non-stretchable, low water absorbent and low self elongative yarns (2), and a lower ply formed from yarns (B) 13 comprising stretchable, low water absorbent and low self elongative yarns (3). In this dry state, the woven
20 fabric has a thickness d_1 .

Fig. 4 shows an explanatory cross-sectional view of the two ply structured woven fabric as shown in Fig. 3 in water-wetted state. In Fig. 4, the yarns (1) in the composite yarns (A) 12 are wetted with water, absorb
25 water and self elongate to increase the length of the yarns (1) and thus the yarns (2), which are wound around the yarns (1) and are in a bent form or a spiral form, are elongated, to cause the length of the composite yarns (A) 12 to increase as shown in Fig. 4, and thus the
30 roughness of the surface of the two ply structured woven fabric to increase. Thus the thickness d_2 of the water-wetted woven fabric 11 becomes larger than d_1 . When the wetted fabric shown in Fig. 4 is dried, the form of the fabric returns to that shown in Fig. 3, and the
35 ruggedness of the fabric surface decreases.

The degree of change in the ruggedness of the composite fabric surface caused by drying, wetting and

drying can be represented by the ruggedness change as defined above.

5 The ruggedness change of the two ply structured composite fabric of the present invention is preferably 10% or more, more preferably 20 to 50%. If the ruggedness change is less than 10%, a cloth prepared from the resultant two ply structured composite fabric may adhere to the skin when wetted with perspiration with an increased unpleasantness, and may be difficult to dry.

10 The composite fabric of the present invention preferably exhibits an air permeability of 50 ml/cm²·s or less, more preferably 5 to 40 ml/cm²·s, determined by an air permeability measurement in accordance with JIS L 1096 - 1998, 6.27, method A (Fragir type method) in
15 the air atmosphere at a temperature of 20°C at a relative humidity of 65%.

Also, the composite fabric of the present invention preferably exhibits a hydraulic pressure resistance of 100 mmH₂O or more, more preferably 120 to 600 mmH₂O,
20 determined by a hydraulic pressure resistance measurement in accordance with JIS L 1092 - 1998, 4(1.1) (Law hydraulic pressure method), in the air atmosphere at a temperature of 20°C at a relative humidity of 65%.

In accordance with the present invention, various
25 textile products including cloth materials, for example, men's clothes, women's clothes, sports wear; interior materials, for example, bed materials and curtains, and automobile interior materials, for example, car sheets, can be provided from the above-mentioned two-ply
30 structured composite fabric. The textile materials may be entirely formed by sewing the composite woven or knitted fabric as mentioned above, or parts of the textile materials, for example, armholes and breast portions, may be formed by sewing the composite woven or
35 knitted fabric of the present invention. When the textile materials produced as mentioned above are employed, the penetration of rain water into the textile

materials can be prevented, and the area of a portion of the textile material coming into contact with the skin when wetted with perspiration can be made small, to cause the sticky feel due to the wetted textile material portion to decrease and the pleasantness to increase.

The cloth material of the present invention comprises the stretchable composite fabric of the present invention as mentioned above and is capable of generating a rugged pattern on at least one surface of the cloth material when wetted with water.

The cloth of the present invention is formed by using the cloth material of the present invention. The cloth may be entirely formed from the cloth material of the present invention, or may have at least one portion, for example, an armhole, a side, a breast, a back or a shoulder portion formed from the cloth material of the present invention. In the latter case, cloth portions corresponding to portions of the body in which a perspiration occurs at a relatively high extent are formed from the cloth material of the present invention, and the remaining portions of the cloth are formed from a material different from the cloth material of the present invention and, thus, are not capable of producing a rough pattern on the surface of the remaining portions when wetted with water. For example, right and left armhole portions 21 of a cloth shown in Fig. 5, right and left undersleeve portions and right and left body side end portions of a cloth shown in Fig. 6, breast center portion of a cloth shown in Fig. 7, back upper center portion of a cloth shown in Fig. 8 and right and left shoulder portions of a cloth shown in Fig. 9, are formed from the cloth material of the present invention. The total area of the portions formed from the cloth material of the present invention is preferably 500 to 10000 cm² per cloth, and the percentage of the total area of the portions on the basis of the entire area of the cloth is preferably in the range of from 5 to 70%, more preferably

from 10 to 60%. If the area percentage is less than 5%, and when the cloth portions are wetted with, for example, perspiration, the effect of the rugged pattern generated in the wetted portions on the whole cloth may be too low. Also, if the area percentage is more than 70%, and when wetted with water, the change in dimensions of the cloth may be too high.

EXAMPLE

The present invention will be further illustrated by the following Examples which are not intended to limit the scope of the present invention in any way.

In the examples, the following measurements were carried out.

(1) Lengths of a yarn contained in woven or knitted fabric in dry and in wet were determined in accordance with the measurement method as described hereinbefore.

(2) Self elongations of a yarn upon absorbing water were determined in accordance with the measurement method as described hereinbefore.

(3) Shrinkage of a yarn in boiling water

The shrinkage of a yarn in boiling water was determined in accordance with JIS L 1013 - 1998, 7.15. The number (n) of specimens subjected to the measurement was 3.

(4) Measurements of air permeabilities of a woven or knitted fabric in dry and in wet and change in air permeability

A sample of a woven or knitted fabric to be tested was left to stand in the air atmosphere at a temperature of 20°C at a relative humidity of 65% for 24 hours, and a plurality of dry specimens (n = 5) were provided from the dried sample. Separately, another sample of the woven or knitted fabric was immersed in water at a temperature of 20°C for 5 minutes; the wetted sample was taken up from water, interposed between a pair

of filter paper sheets and pressed under a pressure of 490 N/m² for one minute to remove water remaining between fibers in the sample; and a plurality of specimens (n = 5) were provided from the wetted sample. Then the dry specimens and wetted specimens were subjected to a measurements of air permeability in accordance with JIS L 1096 - 1998, 6.27.1, method A (Fragir type method), to determine average air permeabilities of the dry and wetted specimens.

Further, the change in air permeability of the woven or knitted fabric was calculated in accordance with the following equation.

$$\begin{aligned} &\text{Change in air permeability (\%)} \\ &= [(P_w - P_d)/P_d] \times 100 \end{aligned}$$

wherein P_w represents an average air permeability of the wetted specimens and P_d represents an average permeability of the dry specimens.

(5) Largest thicknesses of woven or knitted fabric in dry and in wet and change in ruggedness of the fabric were determined by the measurements as described hereinbefore.

(6) Elongation at break

Elongation at break of a yarn was determined in accordance with JIS L 1013 - 1998, Elongation measuring method.

(7) Cover factor (CF)

Cover factor of a woven fabric was calculated in accordance with the following equation.

$$CF = (DW_p/1.1)^{1/2} \times MW_p + (DW_f/1.1)^{1/2} \times MW_f$$

wherein DW_p represents a thickness (d tex) of warp yarns in the woven fabric, MW_p represents a weave density (yarns/3.79 cm) of the warp yarns in the woven fabric, DW_f represents a thickness (d tex) of weft yarns in the woven fabric and MW_f represents a weave density (yarns/3.79 cm) of the weft yarns in the woven fabric.

(8) Hydraulic pressure resistance

Hydraulic pressure resistance of a fabric was

determined in accordance with JIS L 1092, Method B (low hydraulic static pressure method).

(9) Water repellency

Water repellency of a fabric was evaluated in points in accordance with JIS L 1092, Spray method.

(10) Water absorption

Water absorption was measured in accordance with JIS L 1967, the dropping method, in which water was dropped onto a surface of a fabric sample and a time for which the water drop disappeared a specular reflection thereon was measured, and the water absorption of the fabric sample was represented by the measured time.

(11) Stick-preventing property of a fabric to the skin

Three testers respectively wore a type of cloth to be tested and quietly stayed on a chain under conditions of a temperature of 35°C and a relative humidity (RH) of 50% for 5 minutes, and thereafter walked at a constant walking speed of 5 km/hour. During walking, the comfortability of the cloth was organoleptically evaluated in the following three classes by the testes.

<u>Class</u>	<u>Comfort</u>
3	Good, no sticky feel
2	Practically usable, slightly sticky
1	Bad, Significantly sticky

Example 1

A polyetherester polymer produced from 49.8 parts by mass of polybutylene terephthalate for hard segments and 50.2 parts by mass of polyoxyethylene glycol having a number average molecular weight of 4,000 for soft segments was melted at a temperature of 230°C and extruded at an extrusion rate of 3.05 g/minute through a melt spinneret for a monofilament. The extruded polymer filament was taken up at a taking-up speed of 705 m/minute through two godet rollers and wound up at a

winding-up speed of 750 m/minute under a winding draft of 1.06, to provide a stretchable, high water absorbent and self elongative yarn (1) having a yarn count of 44 d tex/1 filament. The yarn (1) had a self elongation of 10% upon absorbing water in the longitudinal axis direction thereof, a shrinkage in boiling water of 8% and an elongation at break of 816%.

Also, as a non-stretchable, low water absorbent and low self-elongative yarn (2), a conventional polyethylene terephthalate multi-filament yarn (56 d tex/144 filaments) having a self elongation less than 1% upon wetting with water was employed.

A stretchable composite yarn (A) having a core-in-sheath structure was produced from the stretchable, high water absorbent and self elongative yarn (1) as a core yarn and the non-stretchable, low water absorbent and low self elongative yarn (2) as a sheath yarn, by combining the core yarn (1) with the sheath yarn (2) in accordance with a covering method at a draft (in %) of the core yarn (1) of 300% (3.0 times) with a yarn covering number of the sheath yarn (2) of 1000 turns/m in the S direction.

Separately, as a stretchable, low water absorbent and low self elongative yarn (3), a stretchable polyetherester yarn available under the trademark REXE, made by TEIJIN FIBERS, LTD, and having a yarn count of 44 d tex/1 filament, a shrinkage in boiling water of 24% and a self elongation upon absorbing water less than 1% in the longitudinal axis direction of the yarn was employed, and as a yarn (4), a conventional polyethylene terephthalate multi-filament yarn (56 d tex/144 filaments) was employed. A stretchable, low water absorbent and low self elongative composite yarn (B) was produced from the yarn (3) as a core yarn and the yarn (4) as a sheath yarn, by a yarn-combining procedure in accordance with a covering method at a draft (in %) of the core yarn of 30% (1.3 times) at a covering

number of the sheath yarn (4) of 1000 turns/m in the S direction.

The composite yarn (A) and the composite yarn (B) were subjected as weft yarns to a weaving procedure. As a warp yarn, a polyethylene terephthalate multifilament yarn (5) having a yarn count of 84 d tex/30 filaments was employed. The yarn (5) is formed from individual filaments having a flat cross-sectional profile with a flatness of 3.2, and having ridge (projecting) portions and groove (constricted) portions formed in two sides with respect to the major axis of the flat cross-sectional profile. In the profile, the number of the groove portions was 3 and the number of the ridge portions was 4 each per side of the profile.

A plain weave having a warp density of 117 yarns/25.4 mm and a weft density of 107 yarns/25.4 mm was produced from a warp yarn group consisting of the yarns (5) and a weft yarn group consisting of the composite yarns (A) and the composite yarns (B) which were alternately arranged with every 50 yarns.

The resultant plain weave was subjected to a wet heat treatment at 95°C for 3 minutes and was dyed with a disperse dye at 120°C for 45 minutes in a liquid stream type dyeing machine. The dyed woven fabric was dry heat-treated in a tenter at 160°C for one minute while expanding the fabric at a expansion ratio of 1.1 in the cross direction of the fabric.

The resultant plain weave exhibited a stretchability in the weft direction. The stretch percentage of the plain weave in the weft direction was 12%. Also, in the plain weave, the yarn length ratio LA/LB of the composite yarns (A) to the composite yarns (B) contained in the weft yarn group was 1.03 in dry condition and 1.15 in water-wetted condition. The change in the ruggedness of the plain weave between the dry and wetted conditions was 496%. Also, in the plain weave, the average yarn length

ratio $L1/L2$ of the yarn (1) to the yarn (2) contained in the composite yarns (A) in the weft yarn group, and the average yarn length ratio $L3/LB$ of the yarn (3) to the yarn (4) in the composite yarn (4) was 0.73.

5 A sport shirt was produced from the stretchable plain weave as mentioned above. It was confirmed that, when wetted with perspiration during wearing of the shirt, a rugged pattern was generated on the shirt, to decrease the sticking of the shirt to the skin and the
10 comfort of the shirt was good.

Example 2

 A stretchable plain weave was produced by the same weaving, dyeing and heat-setting procedures as in those
15 in Example 1, except that the as warp yarns, polyester multifilament yarn having a yarn count of 84 d tex/72 filaments and thus a fine individual filament thickness.

 In the resultant stretchable plain weave, the yarn
20 length ratio LA/LB of the composite yarns (A) to the composite yarns (B) used as weft yarns was 1.02 in dry condition and 1.14 in wetted condition, and the ruggedness change occurred when wetted with water was 487%.

25 Also, in the weft yarn group of the stretchable plain weave, the average yarn length ratio $L1/L2$ of the yarns (1) to the yarns (2) contained in the composite yarns (A) was 0.43, and the average yarn length ratio $L3/L4$ of the yarns (3) to the yarns 4 contained in the
30 composite yarns (B) was 0.80.

 The stretchable plain weave had a stretch percentage of 11% in the weft direction.

 A sport shirt was prepared from the stretchable plain weave as mentioned above. It was confirmed that
35 when wetted with perspiration, during wearing of the shirt, a rugged pattern was generated on the shirt to prevent the sticking of the shirt to the skin, and the

comfort of the shirt was good.

Comparative Example 1

5 A plain weave was produced by the same weaving, dyeing and heat-setting procedures as in Example 1, except that the weft yarn group consisted of only the composite yarns (A).

The resultant stretchable plain weave exhibited a stretch percentage of 10% in the weft direction.

10 When the stretchable plain weave was wetted with water, however, the plain weave evenly elongated in the warp direction and substantially no rough pattern was generated on the fabric. (Roughness change = 0.5%)

15 A sport shirt was prepared from the above-mentioned plain weave. It was found that when worn and wetted with perspiration, the shirt elongated in the weft direction of the fabric but no rough pattern was generated. Thus, the sticking of the shirt to the skin could not be controlled and the comfort of the shirt was
20 unsatisfactory.

Example 3

A polyetherester polymer produced from 49.8 parts by mass of polybutylene terephthalate for hard segments and
25 50.2 parts by mass of polyoxyethylene glycol having a number average molecular weight of 4,000 for soft segments melted at a temperature of 230°C and extruded at an extrusion rate of 3.05 g/minute through a melt spinneret. The extruded polymer filament was taken up at
30 a taking-up speed of 705 m/minute through two godet rollers and wound up at a winding-up speed of 750 m/minute under a winding draft of 1.06, to provide a stretchable, high water absorbent and self elongative yarn (1) having a yarn count of 44 d tex/1 filament. The
35 yarn (1) had a self elongation of 25% upon absorbing water in the longitudinal axis direction thereof, and an elongation at break of 816%.

Also, as a low water absorbent and low self elongative yarn, a false twist-textured yarn prepared by subjecting a conventional polyethylene terephthalate multifilament yarn to a conventional false twist-texturing procedure and having a yarn count of 56 d tex/144 filaments, a self elongation less than 1% upon wetting with water and an individual filament thickness of 0.39 d tex was employed.

The yarns (1) and the yarns (2) were fed into a covering type yarn-combining machine in which the yarns (1) were used as core yarns, the yarns (2) were used as sheath yarns, and the core yarns (1) were combined with the yarns (2) at a draft of the core yarns (1) of 120% (1.2 times) at a covering number of the sheath yarns (2) of 1000 turns/m in the S direction, to prepare a stretchable composite yarn (A).

Separately, as a stretchable, low water absorbent and low self elongative yarn (3), a stretchable polyetherester yarn available under a trademark REXE, made by TEIJIN FIBERS, LTD, and having a yarn count of 44 d tex/1 filament, a shrinkage in boiling water of 24%, a self elongation upon absorbing water less than 1% in the longitudinal axis direction of the yarn and an elongation at break of 650% was employed, and as a non-stretchable, low water absorbent and low self elongative yarn (4), a conventional polyethylene terephthalate multi-filament yarn (56 d tex/144 filaments) having an individual filament thickness of 0.39 d tex and a self elongation less than 1% upon absorbing water in the filament axis direction, was employed. A stretchable, low water absorbent and low self elongative composite yarn (B) was produced from the yarns (3) used as core yarns and the yarns (4) used as sheath yarns, by using a covering type yarn-combining machine at a draft (in %) of the core yarns of 300% (3.0 times) at a covering number of the sheath yarn (4) of 1000 turns/m in the S direction, separately, a polyethylene terephthalate

multi-filament yarn was subjected to a false twist-texturing treatment, to prepare a false twist-textured polyester yarn having a yarn count of 84 d tex/72 filaments, and an individual filament thickness of 1.17 d tex.

The resultant two yarns were combined with each other while twisting the resultant combined yarn at a twist number of 200 turns/m in the S direction, to provide a combined and twisted polyester yarn (5).

A woven fabric was produced from the combined and twisted polyester yarns (5) used as warp yarns and the above-mentioned composite yarns (A) and (B) used as weft yarns, in the woven fabric structure as shown in Fig. 10, in which the composite yarns (A) and the composite yarns (B) are alternately arranged with every one yarn. The resultant woven fabric had a warp density of 135 yarns/3.79 cm and a weft density of 215 yarns/3.79 cm. The resultant woven fabric was a weft two ply structured woven fabric having a surface formed mainly from the composite yarns (1) and an other surface formed mainly from the composite yarns (2).

The resultant woven fabric was subjected to a wet heat treatment at 95°C for 3 minutes and was dyed with a disperse dye at 120°C for 45 minutes in a liquid stream type dyeing machine.

The surface of the dyed woven fabric which surface was mainly formed from the composite yarns (B) was coated with an aqueous water repellent treating liquid containing 3.0% by mass of a fluorine-containing water repellent agent (trademark: ASAHIGUARD AG 7101, made by ASAHI Glass CO.) by a roller printing method, dried at 120°C, and dry heated in a tenter at 160°C for 45 seconds, while expanding in the cross-direction the fabric at a expansion rate of 1.1.

The resultant two ply structured woven fabric exhibited the following performance.

Air permeability : 1.40 ml/cm²·s
Hydraulic pressure resistance on a
surface formed mainly from the
composite yarns (B) : 175 mmH₂O
Water repellency of a surface
mainly formed from the composite
yarns (B) : Class 5
Water absorption of a surface
mainly formed from the composite
yarns (A) : 5.5 seconds
Roughness change : 25%
Comfort : Class 3

A cloth for sports wear was prepared from the two
ply structured woven fabric and worn. It was found that
the surface mainly formed from the composite yarns (B)
could prevent penetration of rain water and the other
5 surface mainly formed from the composite yarns (A) could
prevent or decrease sticky feel of the cloth to the skin
when perspired and stuffy feel of the cloth and the
comfort of the cloth was good.

10 Example 4

A two ply structured woven fabric was produced by
the same weaving, dyeing, water repellent-treating and
heat treating procedures as those in Example 3, except
that, as warp yarns, combined yarns produced by
15 subjecting polyethylene terephthalate multi-filament
yarns (having a self elongation less than 1% upon
absorbing water) to a false twist-texturing procedure,
paralleling two of the resultant polyester false twist-
textured yarns (having a yarn count of
20 84 d tex/36 filaments and an individual filament
thickness of 2.3 d tex to each other, and twisting the
resultant double yarns at a twist number of 200 turns/m
in the S direction, were employed.

The resultant two ply structured woven fabric
25 exhibited the following performance.

Water repellency of the surface
not treated with water repellent
agent : 6.4 seconds
Roughness change : 22%
Comfort : Class 3
Air permeability : 5.5 ml/cm²·s
Hydraulic pressure resistance on
the surface treated with the water
repellent agent : 80 mmH₂O

5 A cloth for sports wear was prepared from the above-
mentioned fabric and worn. The comfort of the cloth was
good, while the waterproofing property of the cloth was
slightly lower than that of Example 1, as the non-
stretchable, low water absorbent and low self elongative
yarns (2) to be contained in the composite yarns (A),
false twist-textured yarns (having a yarn count of
56 d tex/24 filaments and an individual filament
thickness of 2.3 d tex) produced by false twist texturing
10 polyethylene terephthalate multi-filament yarns (having a
self elongation less than 1% upon absorbing water), were
employed.

The resultant two ply structured woven fabric
exhibited the following performance.

Air permeability : 1.5 ml/cm²·s
Hydraulic pressure resistance of
the water repellent-treated
surface : 170 mmH₂O
Water repellency of the water
repellent-treated surface : Class 5
Comfort : Class 2
Roughness change : 8%

15 A cloth for sports wear was prepared from the above-
mentioned fabric and worn. The waterproofing property of
the cloth was satisfactory, while the comfort of the
cloth was slightly lower than that in Example 1.

20 Example 6

Composite yarns (A) were produced by the same procedures as in Example 3, except that in the yarn-combining procedure, the draft of the yarns (1) was changed to 300% (3 times).

5 Composite yarns (B) were produced by the same procedures as in Example 3.

10 Separately, twisted yarns were produced by twisting each of the same false twist textured polyethylene terephthalate multi-filament yarns having a yarn count of 84 d tex/72 filaments and an individual filament thickness of 1.17 d tex as those used in Example 1, at a twist number of 300 turns/m in the S direction, and were employed as warp yarns for weaving.

15 A two ply structured woven fabric having a warp density of 188 yarns/3.79 cm and a weft density of 157 yarns/3.79 cm was produced from the composite yarns (A) and the composite yarns (B) used as weft yarns and the above-mentioned warp yarns, in accordance with the two ply weaving structure as shown in Fig. 11. A surface
20 of the two ply structured woven fabric was mainly formed from the composite yarns (A) and the other surface of the fabric was mainly formed from the composite yarns (B).

25 The two ply structured woven fabric was dyed, water repellent-treated and heat threated in the same procedures as in Example 3.

The resultant two ply structured woven fabric exhibited the following performance.

Air permeability	: 4.50 ml/cm ² ·s
Hydraulic pressure resistance of water repellent-treated surface	: 120 mmH ₂ O
Water repellency of water repellent-treated surface	: Class 5
Water absorption of non-water repellent-treated surface	: 8.2 seconds
Roughness change	: 40%
Comfort	: Class 3

A cloth for sports wear was prepared from the above-

mentioned two ply structured woven fabric and worn. The waterproofing property and confortability (stick-preventing property of the cloth to the skin when wetted with perspiration, and stuffiness-preventing property) were good.

Example 7

A two ply structured woven fabric was produced by the same procedures as in Example 6, wet heat-treated at 95°C for 3 minutes; and dyed with a disperse dye at 120°C for 45 minutes in a liquid stream type dyeing machine. Then the dyed woven fabric was immersed in a treating liquid containing 5.0% by mass of a water absorbing agent (trademark: YM-81, made by TAKAMATSU YUSHI K.K.); squeezed to an extent allowing the water absorbing agent in an amount of 120% to be impregnated in the fabric; dried at a temperature of 120°C; and then heat-treated in a tenter at 160°C for 45 seconds while expanding the fabric at a expansion ratio of 1.2 in the cross direction of the fabric.

The resultant two ply structured woven fabric exhibited the following performance.

Air permeability	: 4.50 ml/cm ² ·s
Water absorption in the surface mainly formed from the composite yarns (A)	: 1.5 seconds
Roughness change	: 40%
Comfort	: Class 3

A cloth for sports wear was prepared from the above-mentioned two ply structured woven fabric and worn. During the wearing, a slick feeling of the cloth to the skin, when perspiring was small, the stuffy feeling was little, and the comfort was good.

CLAIMS

1. A stretchable composite fabric which is a woven or knitted fabric comprising at least three types of yarns (1), (2), and (3) different from each other,
5 wherein
the yarn (1) is a stretchable, high water-absorbent and high self-elongative yarn, comprising stretchable fibers having relatively high self-elongation upon absorbing water, and an elongation at break of 200%
10 or more;
the yarn (2) is a non-stretchable, low water-absorbent and low self-elongative yarn comprising substantially non-stretchable fibers having relatively low self-elongation upon absorbing water;
15 the yarn (3) is a stretchable, low water-absorbent and low self-elongative yarn, comprising stretchable fibers having a relatively low self-elongation upon absorbing water, and an elongation at break of 30% or more;
20 the yarn (1) has a self-elongation of 5% or more upon absorbing water and the yarn (2) and (3) have an self-elongation less than 5% upon absorbing water, determined in such a manner that each type of yarn selected from the yarns (1), (2) and (3) is wound around
25 a hank frame having a frame girth of 1.125m under a load of 0.88 mN/d tex, to provide a hank with a winding number of 10, the hank yarn is removed from the hank frame and left to stand in the air atmosphere having a temperature of 20°C and a relative humidity of 65% for 24 hours to
30 condition the hank yarn, the resultant dried hank yarn is subjected to a measurement of the dry length (Ld, mm) thereof under a load of 0.0080 mN/d tex, immersed in water at a water temperature of 20°C for 5 minutes, and then taken up from water, the resultant water-wetted hank
35 yarn is subjected to a measurement of the wet length (LW, mm) thereof under a load of 0.0088 mN/d tex, and the self-elongation of the yarn is calculated in accordance

with the following equation:

Self elongation (%) of yarn upon absorbing water

$$= [(L_w - L_d) / (L_d)] \times 100;$$

5 from the yarn (1) and the yarn (2), a stretchable, water-absorbent, and self-elongative composite yarn (A) is formed, and the yarn (3) is contained in a stretchable and non-water-absorbent and non-self-elongative yarn (B) having substantially no self elongation; and

10 the woven or knitted fabric has a ratio L_1/L_2 of 0.9 or less, determined in such a manner that the woven or knitted fabric is subjected to dimension stabilization in the air atmosphere having a temperature of 20°C and a relative humidity of 65%; then, from the
15 dimension-stabilized woven or knitted fabric, a specimen of the composite yarn (A) having a length of 30 cm is picked up; and average lengths L_1 and L_2 of the yarns (1) and (2) contained in the specimen of the composite yarn (A) are measured under a load of
20 0.0088 mN/d tex, then the ratio of L_1 to L_2 is calculated.

2. The composite fabric as claimed in claim 1, having a woven fabric structure, in the warp yarn group and/or weft yarn group of which woven fabric structure,
25 the stretchable, water-absorbent and self-elongative composite yarn (A) and the stretchable, non-water absorbent and non-self-elongative yarn (B) are alternately arranged with every one yarn or every two or more yarns.

30 3. The composite fabric as claimed in claim 2, wherein the yarn of only one group selected from the warp and weft yarn groups are formed from the composite yarn (A) and the yarn (B), and the yarn of the other group are formed from at least one type of yarn different from the
35 composite yarn (A) and the yarn (B).

4. The composite fabric as claimed in claim 3, wherein the yarn different from the composite yarn (A)

and the yarn (B) is selected from yarns formed from a plurality of individual fibers having a flat cross-sectional profile and yarns formed from a plurality of individual fine fibers having a thickness of 1.5 d tex or less.

5 5. The composite fabric as claimed in claim 1, having a multi-ply structure having two or more plies, in which multi-ply structure at least one ply in the multi-ply structure comprises the composite yarn (A) in a
10 content of 20% by mass or more, based on the total mass of the ply and another at least one yarn comprises the yarn (B) in a content of 20% by mass or more, based on the total mass of the another ply.

15 6. The composite fabric as claimed in any one of claims 1 to 5, wherein the fibers, from which the stretchable, high water-absorbent and self-elongative yarn (1) contained in the composite yarn (A) is constituted, are selected from polyetherester fibers formed from polyetherester elastomers comprising hard
20 segments formed from polybutylene terephthalate blocks and soft segments formed from polyoxyethyleneglycol blocks.

25 7. The composite fabric as claimed in any one of claims 1 to 6, wherein the fibers, from which the non-stretchable, low water-absorbent and low self-elongative yarn (2) contained in the composite yarn (A) is constituted, are selected from polyester fibers.

30 8. The composite fabric as claimed in any one of claims 1 to 7, wherein the fibers, from which the yarn (2) is constituted, have an individual fiber thickness of 1.5 d tex or less.

35 9. The composite fabric as claimed in any one of claims 1 to 8, wherein the stretchable, non-water absorbent and non-self-elongative yarn (B) is a composite yarn comprising another yarn (4) in addition to the stretchable, low water-absorbent and low self-elongative yarn (3), the yarn (3) has an elongation at break of 200%

or more, the yarn (4) comprises fibers having substantially no self-elongation upon absorbing water and no stretchability, and the ratio $L3/L4$ of the average length $L3$ of the yarn (3) to the average length $L4$ of the yarn (4) in the composite yarn (B), is 0.9 or less, determined by the same manner of measurement as that applied to the composite yarn (A).

10. The composite fabric as claimed in claim 9, wherein the fibers, from which the yarn (3) having the elongation at break of 200% or more is constituted, are selected from polyetherester fibers formed from polyetherester elastomers comprising hard segments formed from polybutylene terephthalate blocks and soft segments formed from polytetramethyleneoxide glycol blocks.

11. The composite fabric as claimed in claim 9, wherein the fibers, from which the yarn (4) is constituted, are selected from polyester fibers.

12. The composite fabric as claimed in any one of claims 1 to 11, having a roughness change of 10% or more, determined by a measurement such that a plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, and left to stand in air atmosphere at a temperature of 20°C at a relative humidity of 65% for 24 hours to provide a plurality of dried specimens; separately, a plurality of specimens having dimensions of 5 cm × 2 cm are prepared from the composite fabric, immersed in water at a temperature of 20°C for 5 minutes, taken up from water, and subjected to a water removal by interposing each specimen between a pair of filter paper sheets, and applying a pressure of 490 N/m² to the interposed specimen for one minute to remove water remaining between fibers in the specimens and provide a plurality of wetted specimens; an average largest thickness D_w of the wetted specimens and an average largest thickness D_d of the dried specimens are measured, and the roughness change of the composite fabric is

calculated in accordance with the following equation:

$$\text{Roughness change (\%)} = [(D_w - D_d) / (D_d)] \times 100$$

13. The composite fabric as claimed in any one of claims 1 to 12, having a woven fabric structure, wherein
5 the woven fabric has a cover factor of 2500 or more.

14. The composite fabric as claimed in any one of claims 1 to 13, having at least one surface applied with a water-repellent treatment.

15. The composite fabric as claimed in any one of
10 claims 1 to 14, having an air permeability of 50 ml/cm²·s or less, determined in accordance with JIS L 1096 - 1998, 6.27, method A (Fragir-type method), in the air atmosphere at a temperature of 20°C at a relative humidity of 65%.

15 16. The composite fabric as claimed in any one of claims 1 to 15, having a hydraulic pressure resistance of 100 mmH₂O or more, determined in accordance with JIS
L 1092 - 1998, 4(1.1) (low hydrostatic pressure method) in the air atmosphere at a temperature of 20°C at a
20 relative humidity of 65%.

17. A cloth material comprising the stretchable composite fabric as claimed in any one of claims 1 to 15 and being capable of generating a rough pattern on at least one surface of the cloth material when wetted with
25 water.

18. Clothing having at least one portion selected from armhole, side, breast, back and shoulder portions and formed from the cloth material as claimed in claim 16.

30 19. The clothing as claimed in claim 18, selected from under wear.

20. The clothing as claimed in claim 18, selected from sports wear.

Fig.1

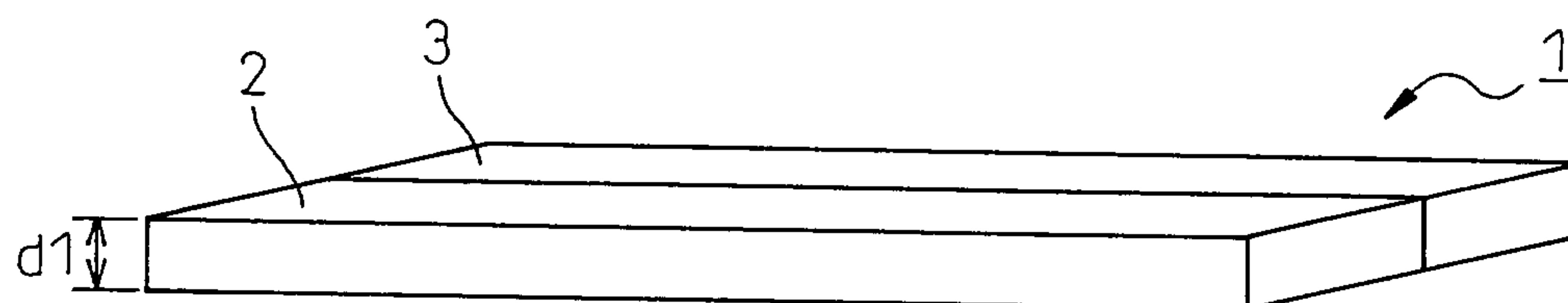


Fig.2

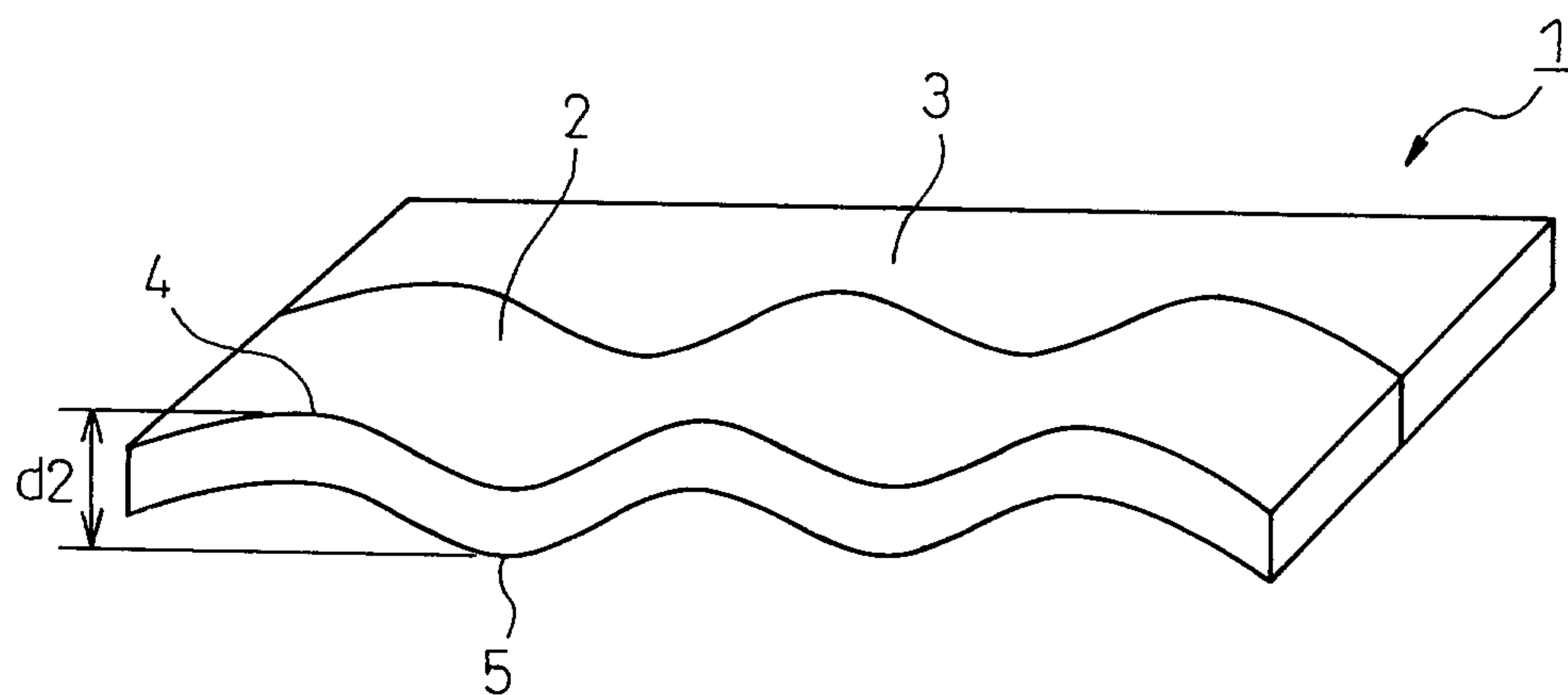


Fig.3

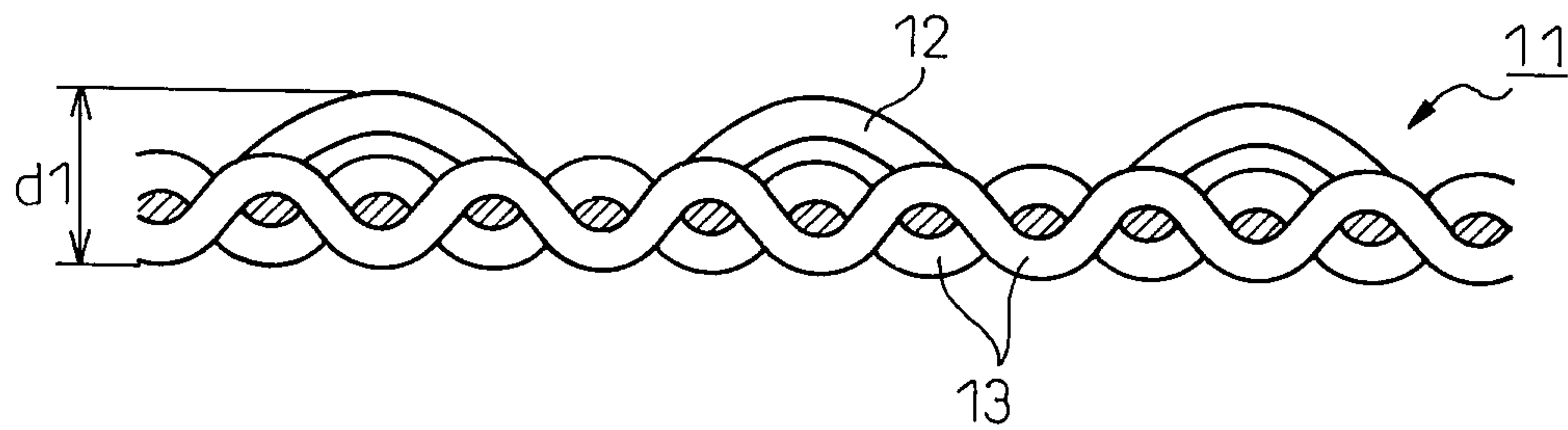


Fig.4

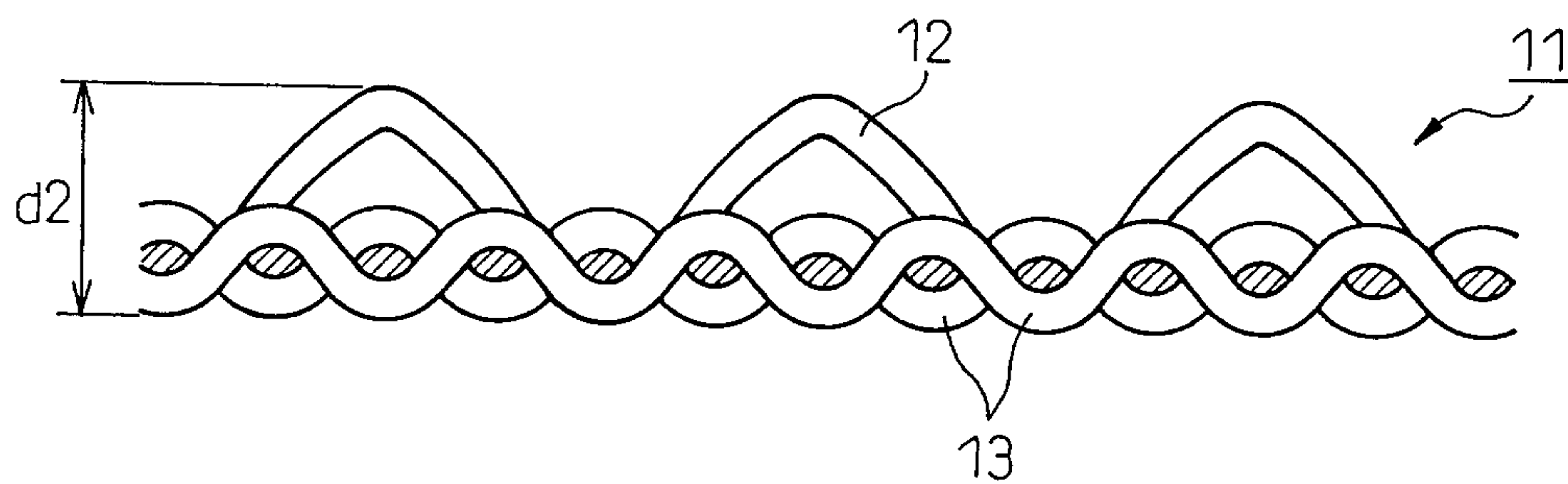


Fig. 5

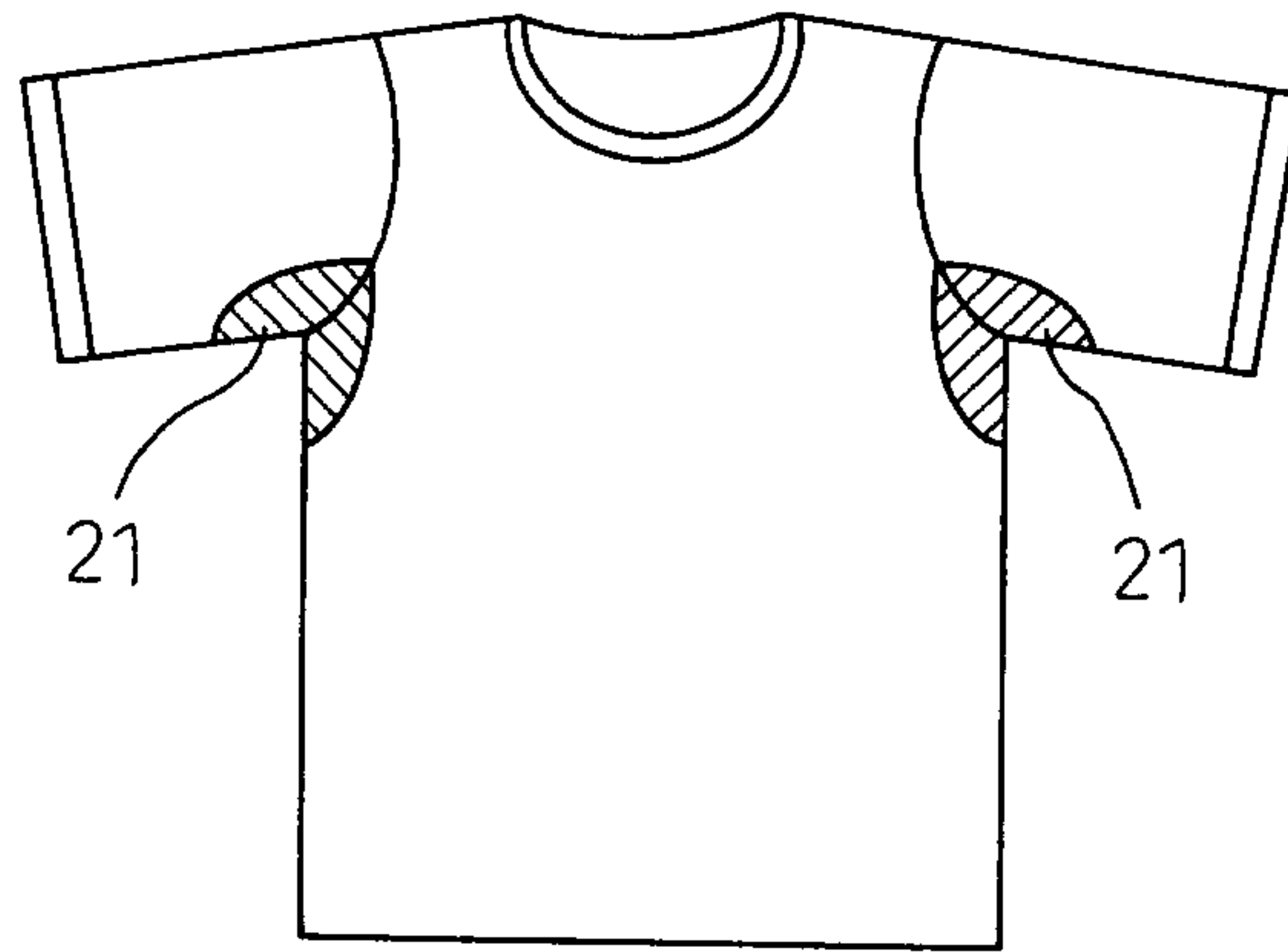


Fig. 6

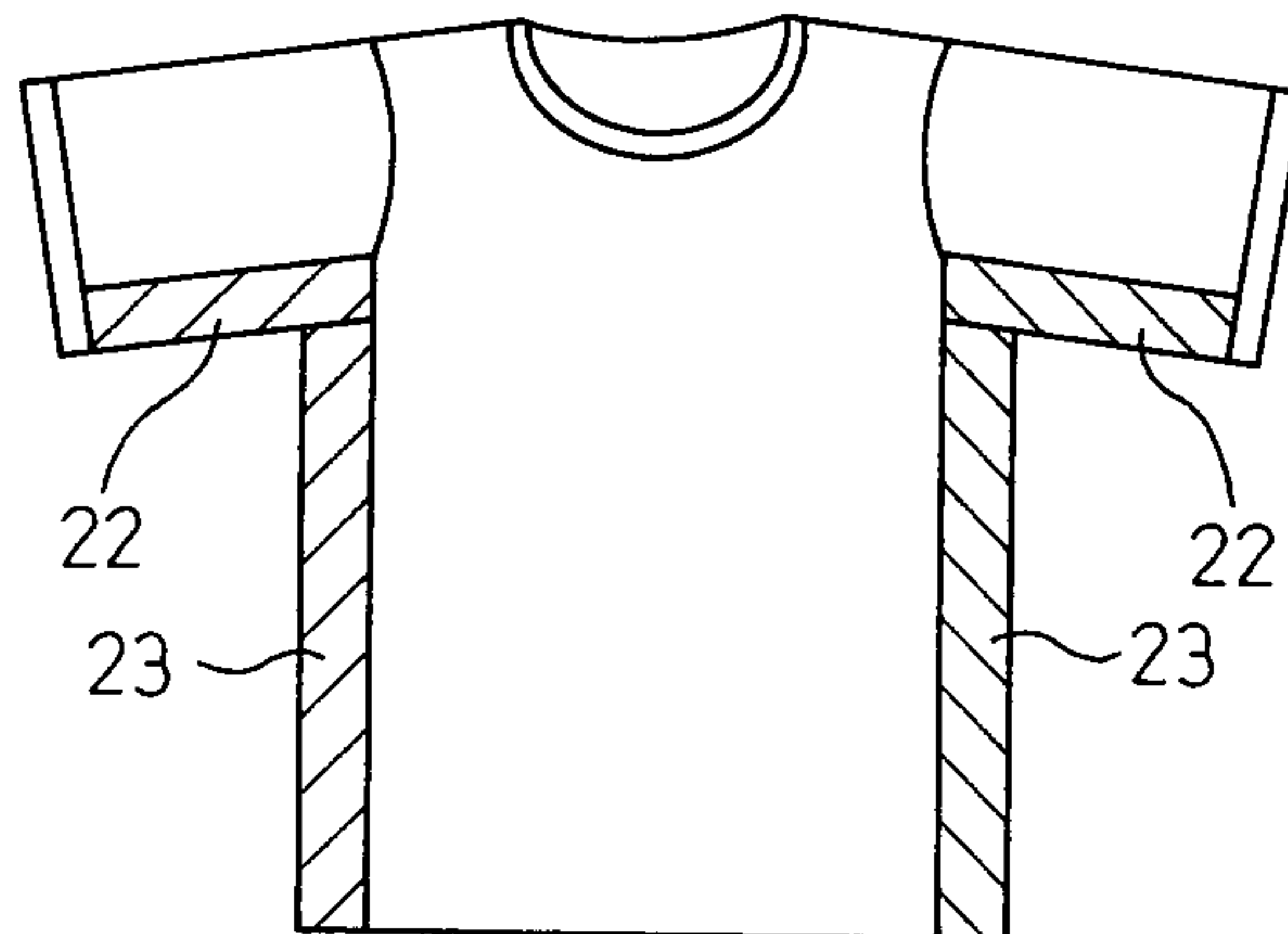


Fig. 7

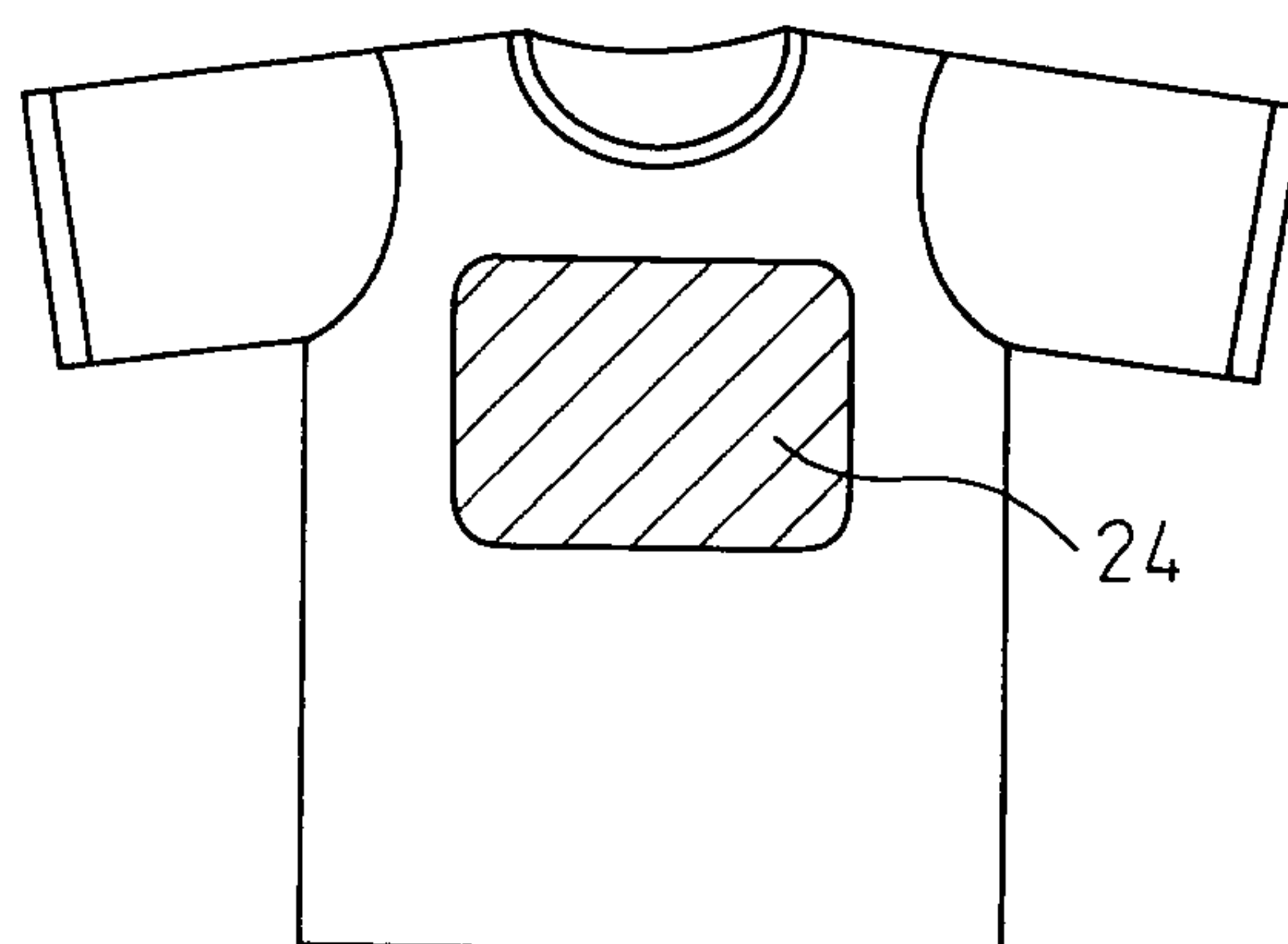


Fig. 8

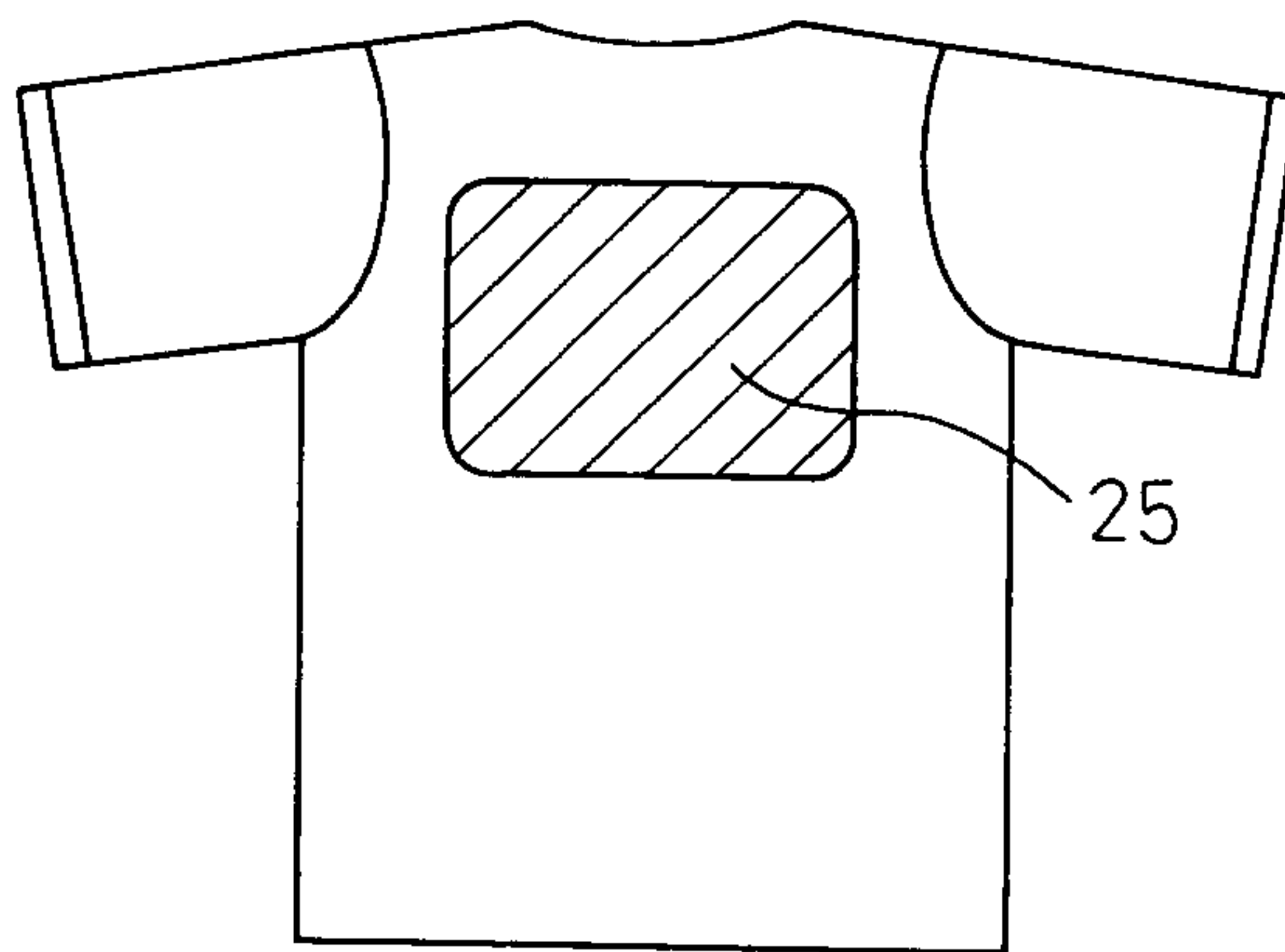


Fig. 9

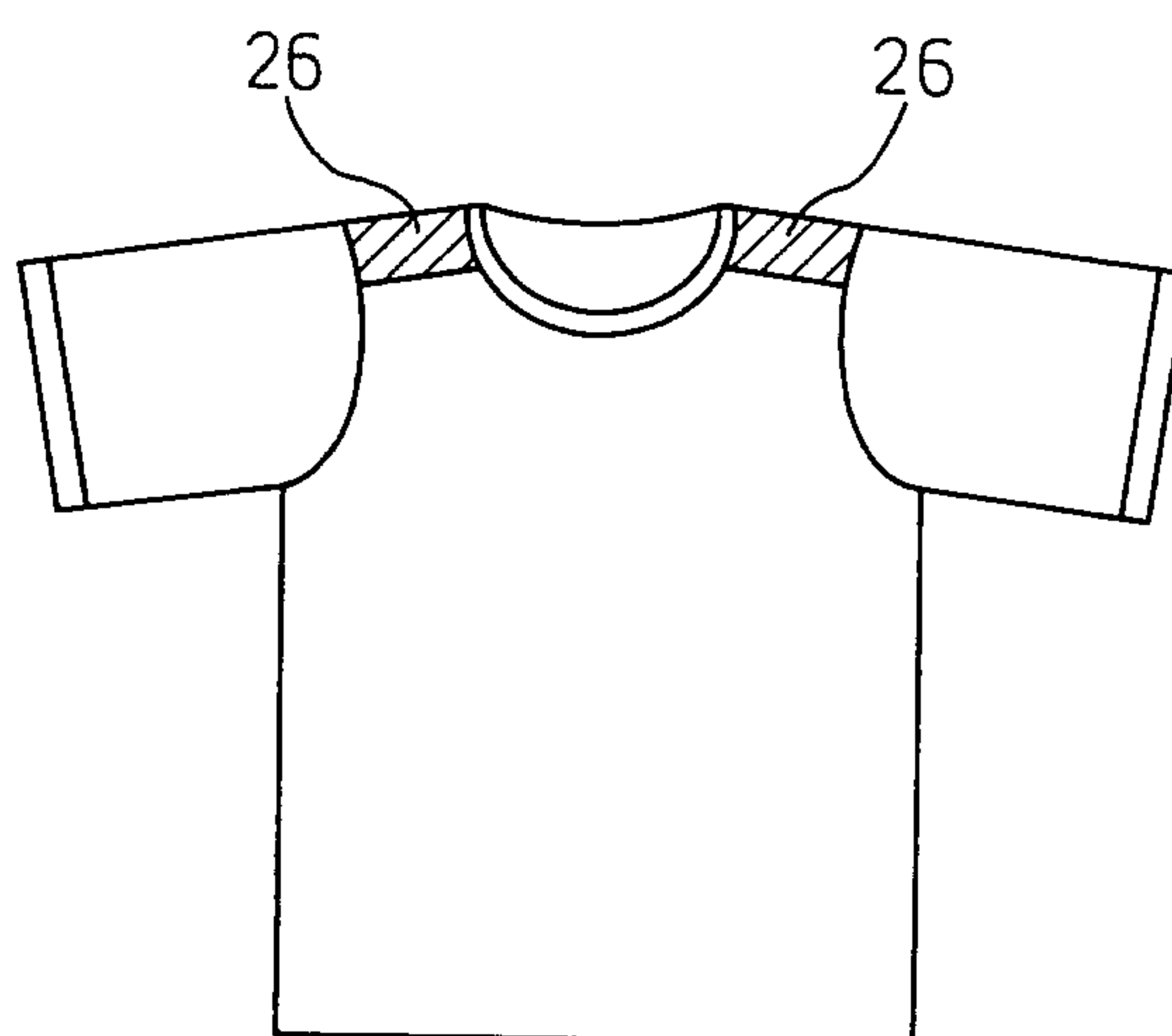
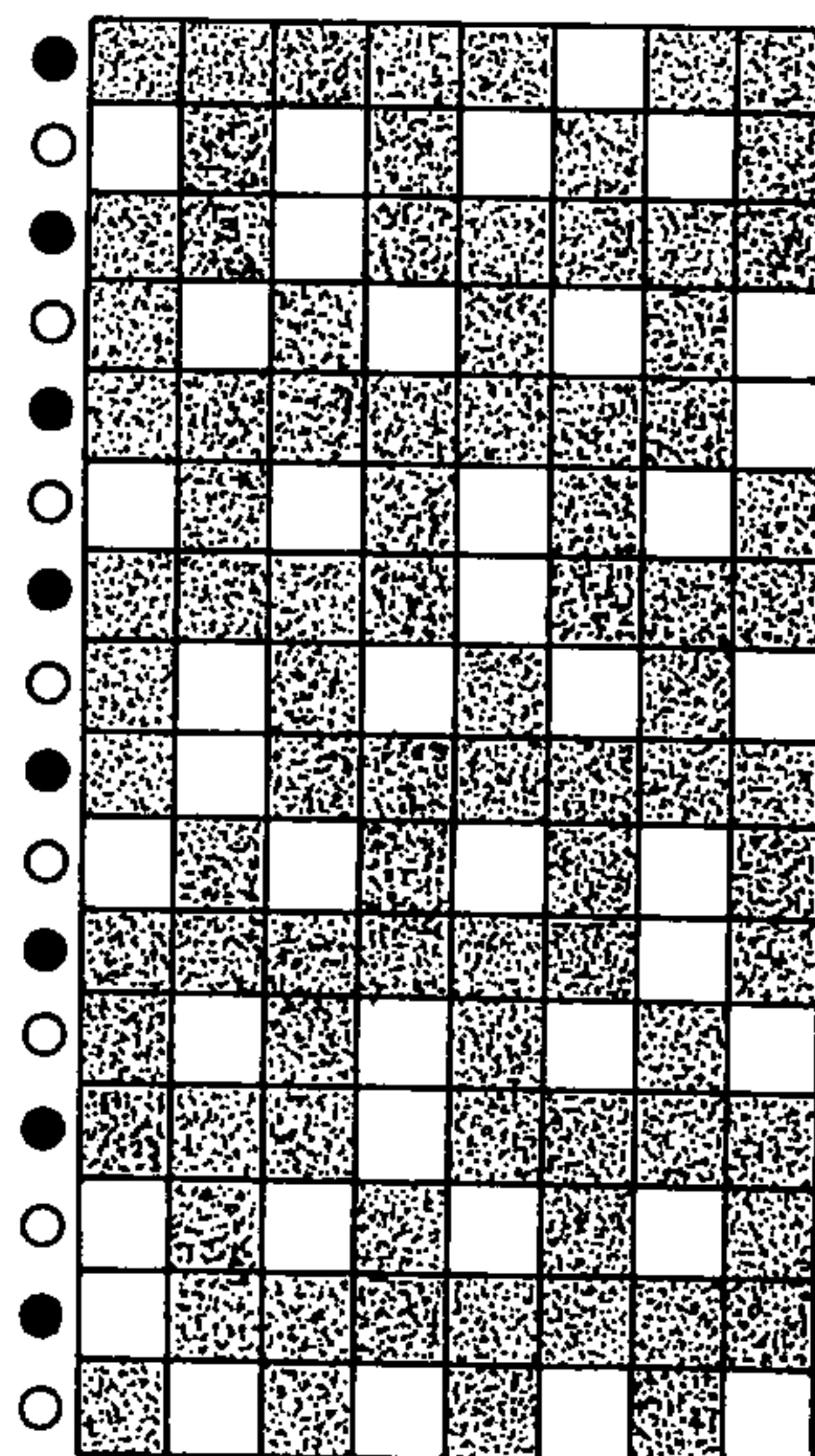


Fig.10



- : COMPOSITE YARN (A) COMPRISING HIGH WATER-ABSORBENT AND SELF-ELONGATIVE, STRETCHABLE YARN (1) AND LOW WATER-ABSORBENT AND SELF-ELONGATIVE, NONSTRETCHABLE YARN (2)
 ○ : YARN (B) COMPRISING LOW WATER-ABSORBENT AND SELF-ELONGATIVE, STRETCHABLE YARN (3)
 WEFT {
 WARP : LOW WATER-ABSORBENT AND SELF-ELONGATIVE FALSE-TWIST TEXTURED YARN

Fig.11

