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(54) **LADDERPROOF STRETCH FABRIC AND ITEM OF CLOTHING FOR SPORTS ACTIVITIES MADE THEREIN**

LAUFMASCHENFESTER ELASTISCHER STOFF UND DARAUS HERGESTELLTER
KLEIDUNGSARTIKEL FÜR SPORTAKTIVITÄTEN

TISSU EXTENSIBLE INDÉMAILLABLE ET VÊTEMENT POUR L'ACTIVITÉ SPORTIVE FABRIQUÉ
À PARTIR DE CE TISSU

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Description

[0001] The present invention relates to a ladderproof stretch fabric, particularly for producing garments intended for sports activities and/or for producing garments for leisure time.

[0002] Ladderproof fabrics are warp stitch fabrics which, being "non-knitted" are generally more resistant to the strain that develop during the use of the garment produced with such fabric.

[0003] However, ladderproof fabrics of the known type and in particular ladderproof stretch fabrics, when used for garments intended for dynamic sports, i.e. that require intense physical activity, but also when used for garments for leisure time, have undesired drawbacks.

[0004] For example, the level of comfort perceived by the user of garments made of ladderproof stretch fabrics of the known type is poor, with respect for example to garments made with other types of fabrics that are more comfortable to wear.

[0005] Document US2004/0237597 describes a stretchable warp-knitted fabric comprising an elastic yarn and a non-elastic yarn.

[0006] Document US 6,446,471 describes run-free, wholly elastic warp-knitted fabrics.

[0007] The main task of the present invention consists of realising a ladderproof stretch fabric that obviates the drawbacks and overcomes the limits of the prior art, allowing garments to be realised that can provide excellent and comfortable wearability and at the same time high resistance and durability.

[0008] Within the scope of this task, an object of the present invention is that of realising a ladderproof stretch fabric that has excellent resistance to mechanical strain and is therefore resistant to tearing, abrasion and deformation.

[0009] Another object of the invention consists of the fact that a ladderproof fabric that is soft to wear is realised.

[0010] A further object of the invention consists of realising a ladderproof stretch fabric that is capable of providing the broadest guarantees of reliability and safety when used.

[0011] Another object of the invention consists of realising a ladderproof stretch fabric that is easy to make and is economically competitive when compared with the known technique.

[0012] The task disclosed above, and also the objects mentioned and others which are more apparent below, are achieved by a ladderproof stretch fabric as illustrated in claim 1.

[0013] Other characteristics are envisaged in the dependent claims.

[0014] Further features and advantages shall be more apparent from the description of a preferred, but not exclusive, embodiment of a ladderproof stretch fabric, illustrated by mere way of non-limiting example with the aid of the accompanying drawings, in which:

figure 1 schematically illustrates some examples of weaves on single combs, with a closed stitch (figures A, B, C and D) and in a weft weave (figures E, F, G and H);

figure 2 illustrates an example of combined weaves on four combs, for realising a ladderproof stretch fabric, according to the invention;

figure 3 illustrates an embodiment of a ladderproof stretch fabric, according to the invention, realised on the basis of the example of figure 2.

[0015] With reference to the mentioned figures, the ladderproof stretch fabric, indicated overall with reference number 1 comprises, according to the invention, at least three sets of threads 3, 5, 7 each knitted-in on at least one comb of a plurality of combs, wherein at least two of said three sets of threads 3, 5, 7 are knitted-in according to a closed or open stitch pattern, and where said at least three sets of threads 3, 5, 7 comprise:

- at least one set of artificial or synthetic rigid thread 3,
- at least one set of synthetic elastic thread 5, and
- at least one set of natural rigid thread 7.

[0016] The set of natural rigid thread 7 is knitted-in according to a weft stitch pattern. In this way the two sets of threads knitted-in according to a closed or open stitch pattern, realise a warp stitch that allows the third set of thread knitted-in according to a weft stitch pattern also to be held in place.

[0017] In the examples shown in figures 2 and 3, the artificial or synthetic rigid threads 3 are represented with a thick continuous line, the synthetic elastic threads 5 are represented with a thick broken line, whereas the natural rigid threads 7 are represented with a continuous thin line.

[0018] The term synthetic indicates the threads obtained from polymerization or polycondensation processes of simple substances of a non-natural nature, such as petroliferous fractions, whereas the term artificial means threads obtained from the transformation of natural polymeric products such as cellulose.

[0019] Advantageously, the set of artificial or synthetic rigid thread 3 may be selected from the group consisting of:

- polyamide thread and
- polyester thread; further, in examples not forming part of the invention, the set of artificial or synthetic rigid thread 3 may be selected from: - acrylic thread; and
- cupro thread.

[0020] According to the invention, the set of artificial or synthetic rigid thread 3 is of polyamide or polyester synthetic rigid thread.

[0021] Advantageously the set of synthetic rigid thread may be made of standard, or recycled, or biodegradable, polyester or polyamide.

[0022] Advantageously the polyamide thread may be of the "Nylon 6" or "Nylon 6, 6" type.

[0023] Advantageously the polyamide thread may be a multi-fibre thread or a micro-fibre thread.

[0024] Advantageously the polyamide thread may have a titre comprised between 20 dtex and 78 dtex.

[0025] Advantageously the polyester thread may be of the standard or cationic type.

[0026] Advantageously the polyester thread may be a multi-fibre thread or a micro-fibre thread.

[0027] Advantageously the polyester thread may have a titre comprised between 20 dtex and 110 dtex.

[0028] Advantageously the set of synthetic elastic thread 5 may be of polyurethane based thread, or polyester based thread, or elastolefin-based thread.

[0029] Advantageously the set of synthetic elastic thread 5 is made of an elastomeric polymer.

[0030] Advantageously the synthetic elastic thread 5 may be made of a standard, or recycled, or biodegradable elastomeric material.

[0031] Advantageously the set of synthetic elastic thread 5 can comprise elastic synthetic fibres of the spandex or elastan type.

[0032] The set of elastic thread 5 can be advantageously selected from the group comprising the following yarns commercially known as Lycra, Creora, Roica, XLA, Elasthan, SHN or HNM.

[0033] Advantageously the set of synthetic elastic thread 5 can have a titre comprised between 10 and 100 dtex.

[0034] Advantageously, the set of natural rigid thread 7 is selected from the group consisting of:

- pure wool thread and
- blended wool thread;

further, in examples not forming part of the invention, the set of natural rigid thread 7 may be selected from:

- pure silk thread;
- blended silk thread;
- pure cotton thread;
- blended cotton thread; and
- linen thread.

[0035] According to the invention, the set of natural rigid thread 7 is of pure wool thread or blended wool thread.

[0036] Advantageously the blended wool thread is obtained in a blend with textile fibre having a titre comprised between 20 dtex and 250 dtex.

[0037] In an example not according to the invention, the blended silk thread is obtained in a blend with textile fibre having a titre comprised between 20 dtex and 250 dtex.

[0038] In an example not according to the invention, the blended cotton thread is obtained in a blend with textile fibre having a titre comprised between 20 dtex and

250 dtex.

[0039] Advantageously the textile fibre used in the aforesaid blends can be selected from the group consisting of:

- Polyamide 6;
- Polyamide 66,
- Acrylic;
- Cotton;
- Wool;
- Silk;
- Polyester;
- Cationic polyester;
- Linen; and
- Cupro.

[0040] Preferably the textile fibre used in the aforesaid blends can be selected from the group consisting of Polyamide 6, Polyamide 66, Polyester and Cationic polyester.

[0041] Advantageously the synthetic component of the aforesaid blended threads may be of the standard, recycled or biodegradable type.

[0042] Advantageously the closed stitch pattern is selected in the group consisting of patterns of the 1-0/1-2, 1-0/2-3, 1-0/3-4 (not forming part of the invention) and, possibly, 1-0/4-5 (not forming part of the invention) type, such as the patterns illustrated respectively in figures 1A, 1B, 1C and 1D. In the closed stitch patterns the loop of the thread is fastened onto the tooth of the comb.

[0043] Advantageously the open stitch pattern is selected in the group consisting of weaves of the 0-1/2-1, 0-1/3-2, 0-1/4-3 (not forming part of the invention) and, possibly, 0-1/5-4 (not forming part of the invention) type. In the open stitch pattern the loop of the thread is not fastened onto the tooth of the comb but is only wrapped around it.

[0044] Advantageously the weft stitch pattern is selected in the group consisting of patterns of the 0-0/2-2 (not forming part of the invention) 0-0/3-3 (not forming part of the invention) 0-0/4-4 and 0-0/5-5 type, such as the patterns illustrated respectively in figures 1E, 1F, 1G and 1H.

[0045] Advantageously all of the aforesaid patterns can be combined on the loom in phase or in counter-phase.

[0046] Advantageously the ladderproof stretch fabric 1 can be produced on warp knitting machines with fineness comprised between 7 and 14 (meaning the number of needles per centimetre - corresponding to 18 and 36 needles per inch).

[0047] Advantageously the ladderproof stretch fabric 1 can be produced on single bed machines, of the simple tricot type, of the rasher type, of the tricot type with texture or of the double knit type.

[0048] Advantageously the machines for producing ladderproof stretch fabric 1 can comprise from 2 to 6 combs.

[0049] Advantageously the ladderproof stretch fabric

1 will have natural rigid threads in one or more combs, synthetic or artificial rigid threads in one or more combs and synthetic elastic threads in one or more combs.

[0050] Each of the aforesaid combs can have full threading or any ratio of full to empty spaces.

[0051] According to the invention, the at least one set of natural rigid thread 7 is mainly visible from a first face of the ladderproof stretch fabric 1, while the at least one set of artificial or synthetic rigid thread 3 is mainly visible from a second face of the ladderproof stretch fabric 1 opposite said first face.

[0052] In this way the ladderproof stretch fabric 1 has, on a first face, the typical resistance of synthetic fibres and on the opposite face has the typical comfort to wear of natural fibres, assisted by the wearability comfort provided by the elastomeric yarn.

[0053] Advantageously the correct selection of patterns and textile constructions and the correct selection of the preparation, dyeing and finishing methods of the yarns allows this triple result to be obtained.

[0054] Advantageously the ladderproof stretch fabric 1 may be subject to one or more processes selected from the group consisting of: purging, dyeing, heat setting, raising, sanding and brushing.

[0055] Figures 2 and 3 represent, respectively, an example of combined weave on 4 combs and the related textile construction.

[0056] In this example the ladderproof stretch fabric 1 comprises a set of artificial or synthetic rigid thread 3 knitted-in according to a closed stitch pattern of the 1-0/2-3 type, a set of elastic synthetic thread 5 knitted-in according to a closed stitch pattern of the 1-0/1-2 type and two sets of natural rigid threads 7 knitted-in according to a weft pattern of the 0-0/3-3 and 0-0/4-4 type, respectively.

[0057] The present invention further relates to a garment for sports activities, a garment for outdoor use or a swimming costume, made with a ladderproof stretch fabric 1 as described above.

[0058] In the specific example of figures 2 and 3 the weaves and positionings of the yarns were designed so as to be able to perform a raising process for the purpose of mainly fraying the natural yarns, to obtain a ladderproof stretch fabric 1 finished with a face mainly composed of synthetic yarn and with a smooth surface effect, and with the opposite face, the so-called skin-side, mainly composed of natural yarns with a furry surface effect.

[0059] Therefore, the set of natural rigid thread 7 is raised, i.e. it has been subjected to a raising process. In this way the set of natural rigid thread 7 is also able to confer an insulating effect to the ladderproof stretch fabric 1.

[0060] The present invention therefore also relates to a garment for sports activities made of a ladderproof stretch fabric 1 with a set of raised natural rigid thread 7, wherein the face mainly comprising natural yarn is the inner face of the garment, i.e. the one in contact with the body of the wearer, the so called skin-side.

[0061] A preferred embodiment of the invention, being particularly highly performing in terms of resistance, elasticity, comfort and heat-regulating capacity, is comprised of the following combination of technical characteristics:

- the set of synthetic rigid thread 3 is knitted-in according to a closed stitch pattern of the 1-0/2-3 type or an open stitch of the 0-1/3-2 type and is made of polyester or polyamide, possibly recycled and/or biodegradable;
- the set of synthetic elastic thread 5 is knitted-in according to a closed stitch pattern of the 1-0/1-2 type or an open stitch of the 0-1/2-1 type and is made of an elastomeric material, possibly recycled and/or biodegradable;
- the set of natural rigid thread 7 is knitted-in according to a weft stitch pattern of the 0-0/4-4 or 0-0/5-5 type and is made of raised wool yarn, or raised blended wool yarn. It has in practice been noted how the ladderproof stretch fabric, according to the present invention, fulfils the task and the predefined objects as it is comfortable to wear and is particularly resistant to mechanical strain and chemical agents.

[0062] Another advantage of the ladderproof stretch fabric, according to the invention, consists of the fact that it is particularly adapted to the realisation of garments intended for practising sports, but not only, as the presence of synthetic elastic threads confers excellent characteristics to the sports garment in terms of elastic modulus, such as to allow the fabric to be deformed without being ruined also when used for particularly intense sports activities.

[0063] Thanks to the presence of synthetic threads, both rigid and elastic, the garments obtained with the fabric according to the invention also display excellent resistance to tearing and abrasion, and therefore are further particularly adapted to be used in dynamic sports. They also display excellent resistance to chemical agents, and therefore are resistant to contact with sweat or washing detergents.

[0064] The ladderproof stretch fabric according to the invention, dyed in the piece, also has excellent colour solidity to washing, in contact with sweat and exposure to light.

[0065] A further advantage of the ladderproof stretch fabric, according to the invention, consists of the fact that the use of natural threads confers softness to the fabric, such as to make it absolutely comfortable to wear. Furthermore the natural threads also confer high hygroscopic, natural heat regulation and antistatic characteristics.

[0066] In practice, the ladderproof stretch fabric according to the invention allows the elasticity and resistance characteristics of ladderproof fabrics produced with synthetic yarns to be combined with the classic comfort characteristics of fabrics made with natural fibres.

[0067] The ladderproof stretch fabric as conceived herein is susceptible to many modifications and varia-

tions. In practice, the materials used, as well as their dimensions, can be of any type according to the technical requirements.

[0068] In practice, the dimensions and the contingent shapes can be any according to the requirements.

Claims

1. Ladderproof stretch fabric (1) comprising at least three knitted-in sets of threads (3, 5, 7), at least two of said three sets of threads (3, 5, 7) being knitted-in according to a closed or open stitch pattern, said at least three sets of threads (3, 5, 7) comprising at least one set of synthetic or artificial rigid thread (3) in polyamide or polyester, at least one set of synthetic elastic thread (5) and at least one set of natural rigid thread (7) in pure wool or blended wool, said at least one set of natural rigid thread (7) being mainly visible from a first face of said ladderproof stretch fabric (1), said at least one set of synthetic or artificial rigid thread (3) being mainly visible from a second face of said ladderproof stretch fabric (1) opposite to said first face, said ladderproof stretch fabric (1) being **characterised in that:**
 - said set of natural rigid thread (7) is raised;
 - said set of synthetic or artificial rigid thread (3) is knitted-in according to a closed stitch pattern of the 1-0/2-3 type or according to an open stitch pattern of the 0-1/3-2 type;
 - said set of synthetic elastic thread (5) is knitted-in according to a closed stitch pattern of the 1-0/1-2 type or according to an open stitch pattern of the 0-1/2-1 type;
 - said set of natural rigid thread (7) is knitted-in according to a weft stitch pattern of the 0-0/4-4 or 0-0/5-5 type.
2. Ladderproof stretch fabric (1) according to one or more of the preceding claims, **characterised in that** said at least one set of synthetic elastic thread (5) is of polyurethane-based or polyester-based, or elastofin-based thread.
3. Ladderproof stretch fabric (1) according to one or more of the preceding claims, **characterised in that** said at least one set of synthetic elastic thread (5) is selected within the group consisting of the following threads commercially known as Lycra, Creora, Roica, XLA, Elaspam, SHN or HNM.
4. Ladderproof stretch fabric (1) according to one or more of the preceding claims, **characterised in that** said at least one set of synthetic elastic thread (5) comprises elastic synthetic fibres of the spandex or elastane type.

5. Item of clothing for sport activities made in a ladderproof stretch fabric (1) according to one or more of the preceding claims.

6. Item of clothing for sport activities made in a ladderproof stretch fabric (1) according to claim 5, **characterized in that** said first face of said ladderproof stretch fabric (1) is the internal face of said item, so called "skin-side".

Patentansprüche

1. Laufmaschenfester elastischer Stoff (1) mit mindestens drei eingestrickten Fadensätzen (3, 5, 7), wobei mindestens zwei der drei Fadensätze (3, 5, 7) nach einem geschlossenen oder offenen Maschenmuster eingestrickt sind, wobei die mindestens drei Fadensätze (3, 5, 7) mindestens einen Satz synthetischer oder künstlicher starrer Fäden (3) aus Polyamid oder Polyester, mindestens einen Satz synthetischer elastischer Fäden (5) und mindestens einen Satz natürlicher starrer Fäden (7) aus reiner Wolle oder Wollgemisch umfassen, wobei der mindestens eine Satz natürlicher starrer Fäden (7) hauptsächlich von einer ersten Seite des laufmaschenfesten elastischen Stoffes (1) aus sichtbar ist, wobei der mindestens eine Satz künstlicher starrer Fäden (3) hauptsächlich von einer zweiten Seite des laufmaschenfesten elastischen Stoffes (1) aus sichtbar ist, die der ersten Seite gegenüberliegt, wobei der laufmaschenfeste elastische Stoff (1) **dadurch gekennzeichnet ist, dass:**
 - der Satz natürlicher starrer Fäden (7) angehoben wird;
 - der Satz synthetischer oder künstlicher starrer Fäden (3) nach einem geschlossenen Maschenmuster des Typs 1-0/2-3 oder nach einem offenen Maschenmuster des Typs 0-1/3-2 eingestrickt wird;
 - der Satz synthetischer elastischer Fäden (5) nach einem geschlossenen Maschenmuster des Typs 1-0/1-2 oder nach einem offenen Maschenmuster des Typs 0-1/2-1 eingestrickt wird;
 - der Satz natürlicher starrer Fäden (7) nach einem Kulliermaschenmuster des Typs 0-0/4-4 oder 0-0/5-5 eingestrickt wird.
2. Laufmaschenfester elastischer Stoff (1) nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der mindestens eine Satz synthetischer elastischer Fäden (5) aus Fäden auf Polyurethan- oder Polyesterbasis oder auf Elastofinbasis besteht.
3. Laufmaschenfester elastischer Stoff (1) nach einem oder mehreren der vorstehenden Ansprüche, **da-**

durch gekennzeichnet, dass der mindestens eine Satz synthetischer elastischer Fäden (5) ausgewählt ist aus der Gruppe bestehend aus den folgenden Fäden, die im Handel als Lycra, Creora, Roica, XLA, Elaspam, SHN oder HNM bekannt sind.

4. Laufmaschenfester elastischer Stoff (1) nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der mindestens eine Satz synthetischer elastischer Fäden (5) elastische synthetische Fasern des Typs Spandex oder Elastan umfasst. 10
5. Kleidungsartikel für Sportaktivitäten, hergestellt aus einem laufmaschenfesten elastischen Stoff (1) nach einem oder mehreren der vorstehenden Ansprüche. 15
6. Kleidungsartikel für Sportaktivitäten aus einem laufmaschenfesten elastischen Stoff (1) nach Anspruch 5, **dadurch gekennzeichnet, dass** die erste Seite des laufmaschenfesten elastischen Stoffes (1) die Innenseite des Artikels, die sogenannte "Hautseite", ist. 20

Revendications

1. Tissu extensible indémaillable (1) comprenant au moins trois ensembles de fils (3, 5, 7) tricotés, au moins deux desdits trois ensembles de fils (3, 5, 7) étant tricotés selon un motif de point fermé ou ouvert, lesdits au moins trois ensembles de fils (3, 5, 7) comprenant au moins un ensemble de fil rigide synthétique ou artificiel (3) en polyamide ou polyester, au moins un ensemble de fil élastique synthétique (5) et au moins un ensemble de fil rigide naturel (7) en laine pure ou en laine mélangée, ledit au moins un ensemble de fil rigide naturel (7) étant principalement visible à partir d'une première face dudit tissu extensible indémaillable (1), ledit au moins un ensemble de fil rigide synthétique ou artificiel (3) étant principalement visible à partir d'une seconde face dudit tissu extensible indémaillable (1) opposée à ladite première face, ledit tissu extensible indémaillable (1) étant **caractérisé en ce que**: 30 35 40 45
 - ledit ensemble de fil rigide naturel (7) est en relief;
 - ledit ensemble de fil rigide synthétique ou artificiel (3) est tricoté selon un motif de point fermé du type 1-0/2-3 ou selon un motif de point ouvert du type 0-1/3-2; 50
 - ledit ensemble de fil élastique synthétique (5) est tricoté selon un motif de point fermé du type 1-0/1-2 ou selon un motif de point ouvert du type 0-1/2-1; 55
 - ledit ensemble de fil rigide naturel (7) est tricoté selon un motif de point de trame du type 0-0/4-4

ou 0-0/5-5.

2. Tissu extensible indémaillable (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit au moins un ensemble de fil élastique synthétique (5) est un fil à base de polyuréthane ou à base de polyester, ou à base d'élastoléfine. 5
3. Tissu extensible indémaillable (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit au moins un ensemble de fil élastique synthétique (5) est sélectionné au sein du groupe constitué des fils suivants commercialement connus sous le nom de Lycra, Creora, Roica, XLA, Elaspam, SHN ou HNM. 10
4. Tissu extensible indémaillable (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit au moins un ensemble de fil élastique synthétique (5) comprend des fibres synthétiques élastiques du type spandex ou élasthane. 15
5. Article d'habillement pour activités sportives réalisé dans un tissu extensible indémaillable (1) selon l'une ou plusieurs des revendications précédentes. 20 25
6. Article d'habillement pour activités sportives réalisé dans un tissu extensible indémaillable (1) selon la revendication 5, **caractérisé en ce que** ladite première face dudit tissu extensible indémaillable (1) est la face interne dudit article, dénommée « côté peau ». 30

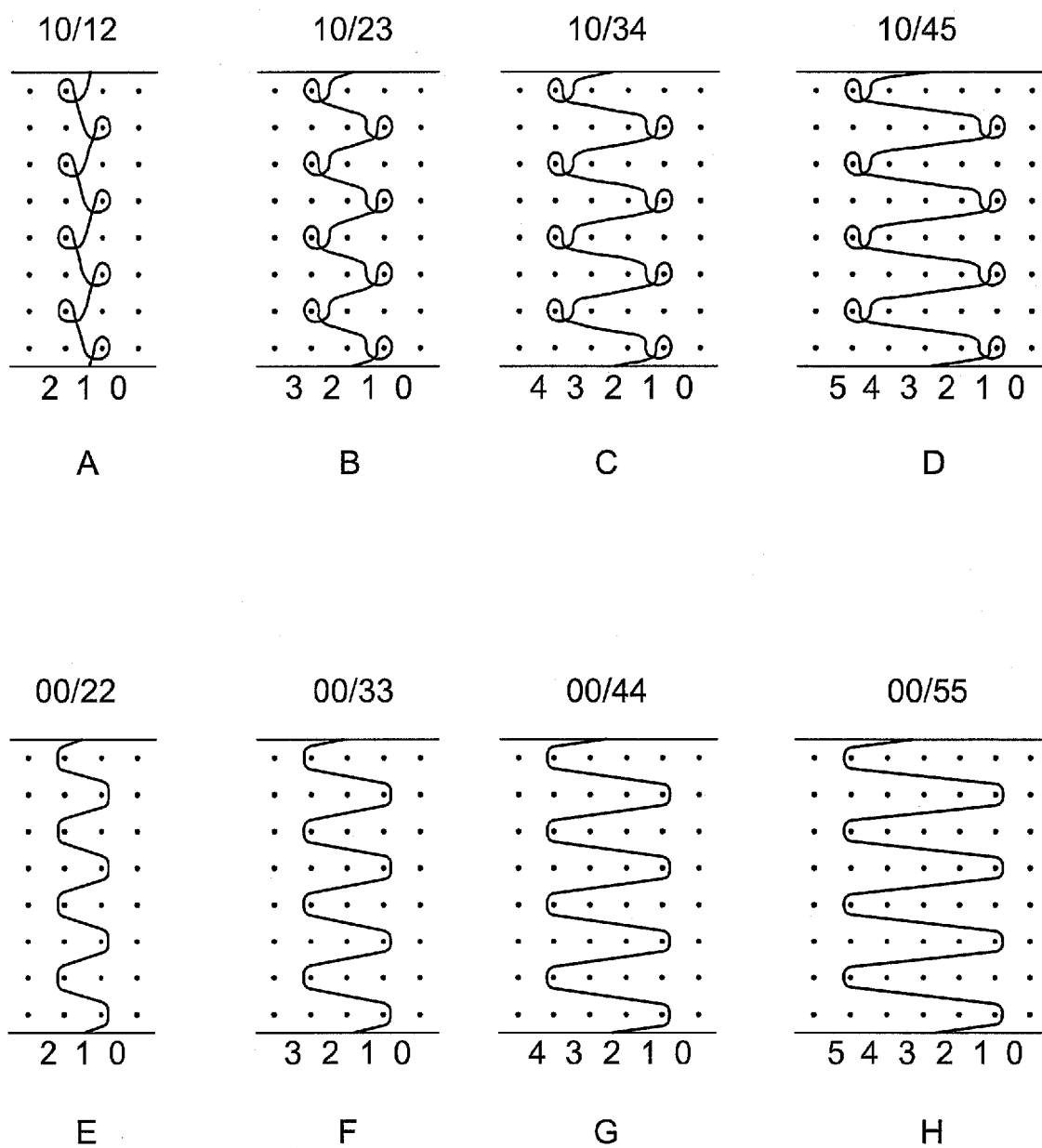


Fig. 1

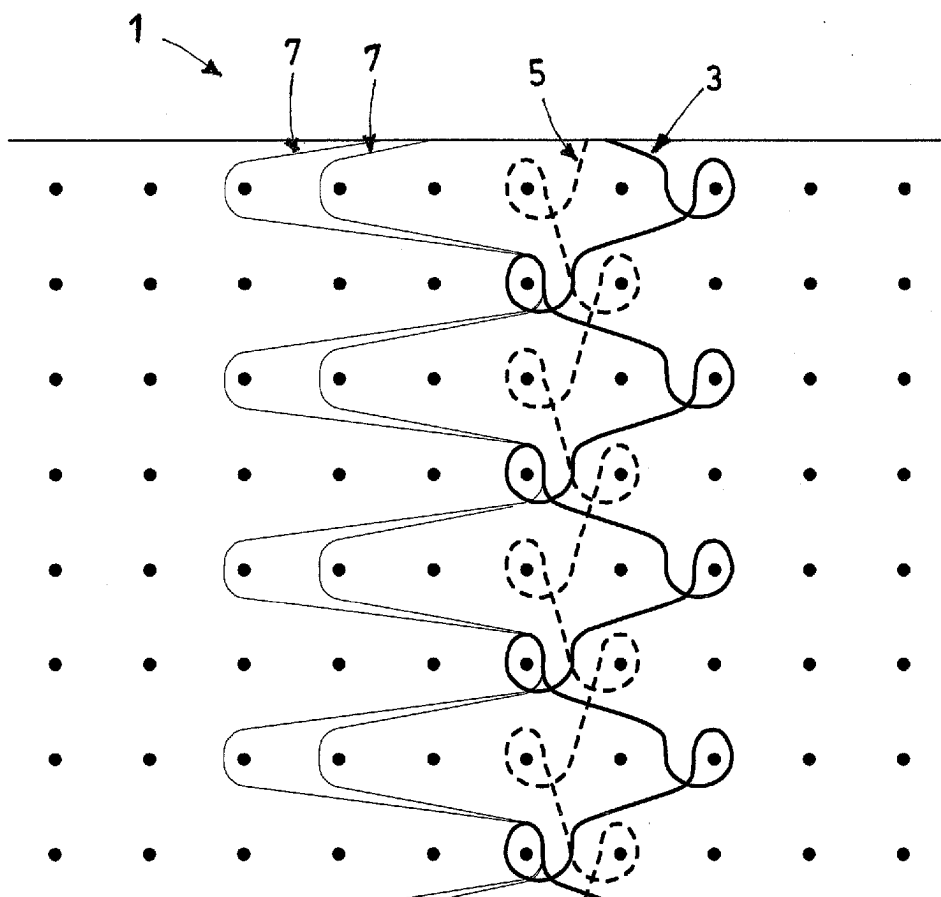


Fig. 2

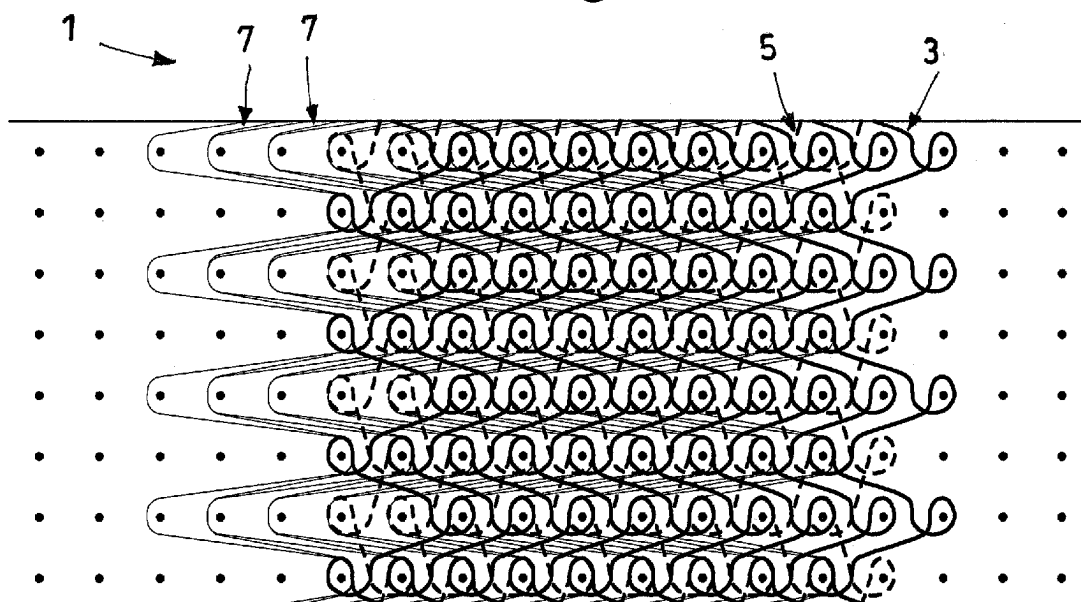


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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