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(54) **Cut-resistant knitted glove**

(57) Cut-resistant knitted glove made by double-sided knitting using several yarns in order to form an external technical side and an internal lining side, comprising:

- two yarns for the technical side, namely
- a first yarn consisting of a cut-resistant core yarn based on glass fibre, wrapped by a polyester yarn,
- a second, para-aramid yarn,
- a yarn for the lining side, which may comprise a polyamide-wrapped elastane core yarn,

characterized in that:

- the first yarn, having a linear density of 100 to 800 dtex, consists exclusively of a glass fibre core yarn double-wrapped with a polyester yarn,
- the second para-aramid yarn has a linear density of 100 to 500 dtex,
- the lining is formed by two 50 to 250 dtex elastane yarns wrapped or double-wrapped with polyamide.

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Description

[0001] The present invention relates to a professional cut-resistant knitted glove.

[0002] Cut-resistant gloves used today are generally seamless knitted gloves, with or without coating (polyurethane, latex, nitrile or the like).

[0003] The automotive industry makes considerable use of this type of glove, in particular for work stations like that called "paluchage" in French. There, the "palucheur", i.e. the operator in charge of that task transports sheet metal parts which are sometimes hot and have sharp cutting edges (which are not deburred at this stage of manufacture) and checks the appearance of the surface by running his hand on the surface of the part (micro-bump, etc.).

[0004] For this type of profession, it is necessary to use an uncoated glove, which is also cut-resistant, abrasion-resistant, heat (contact)-resistant, procuring very good dexterity and closely matching the shape of the hand, in order to preserve complete sensitivity of touch.

[0005] Document W02010/085415 teaches a cut-resistant knitted glove made by double-sided knitting with a plurality of yarns in order to form an external technical side and an internal lining side, which may comprise:

- two yarns for the technical side, namely
- a first yarn consisting of a cut-resistant core yarn based on glass fibre (56-680 dtex) and para-aramid (100-600 dtex), wrapped by a polyester yarn (110-680 dtex),
- a second para-aramid yarn (110-2000 dtex),
- a yarn (110-560 dtex) for the lining side, which may comprise a polyamide wrapped elastane core yarn (22-340 dtex).

[0006] According to this document, it is indispensable to provide the para-aramid yarn as the first yarn to prevent the glass fibre of the base yarn from ultimately becoming uncovered and injuring or irritating the hand.

[0007] It is the object of the invention to simplify the known construction while obtaining a glove that is perfectly suitable for its intended use. The object of the invention is therefore to develop a cut-resistant glove, knitted without seams, which may be uncoated, or covered with PVC pimples or coated with various polymers such as PU, latex, nitrile or PVC, and which has:

very good cut-resistance performance, according to standard EN 388 (level 5/5)

very good abrasion resistance according to standard EN 388 (level equal to or higher than level 2/4) for the uncoated version

good thermal performance with contact heat, according to standard EN 407 (level 1/4)

very good dexterity, suppleness and comfort in order to facilitate the work of the operator.

[0008] According to the invention, the glove is a cut-resistant knitted glove made by double-sided knitting using several yarns in order to form an external technical side and an internal lining side, comprising:

- two yarns for the technical side, namely
- a first yarn consisting of a cut-resistant core yarn based on glass fibre, wrapped by a polyester yarn,
- a second yarn selected from a para-aramid yarn (for preference) or a high-tenacity polyamide yarn,
- a yarn for the lining side, which may comprise a polyamide-wrapped elastane core yarn, characterized in that:

the first yarn, having a linear density of 100 to 800 dtex, consists exclusively of a glass fibre core yarn double-wrapped with a polyester yarn, the second para-aramid or polyamide yarn has a linear density of 100 to 500 dtex, the lining is formed by two 50 to 250 dtex elastane yarns wrapped or double-wrapped with polyamide.

[0009] The polyamide used is preferably a nylon-6 polyamide (polycaproamide $[\text{NH}-(\text{CH}_2)_5-\text{CO}]_n$) or a nylon-6,6 polyamide (polyhexamethylene adipamide: $[\text{NH}-\text{CH}_2)_6-\text{NH}-\text{CO}-(\text{CH}_2)_4-\text{CO}]_n$ for example Dupont de Nemours trade mark nylon®).

[0010] The polyester used is preferably a polyethylene terephthalate (PET).

[0011] For the range of sizes of the glass fibre, a smaller dimension is liable to make the yarn too fine and brittle, difficult to handle, and does not really provide cut-resistant performance. A larger dimension produces a yarn that is too thick and too stiff, with a negative impact on the dexterity and fineness of the glove, and also favours allergies.

[0012] For the range of sizes of the para-aramid fibre, a smaller dimension is liable to make the yarn too fine and brittle, and does not really provide cut-resistant performance. A larger dimension makes the para-aramid yarn occupy too much space in the glove and considerably deteriorates the abrasion-resistance properties. Furthermore, it is particularly advantageous to limit the size, and hence the quantity of para-aramid because of its relatively high cost, because the fibre is less comfortable than polyamide (to the touch), because the fibre retains the heat (thermal resistance) thereby procuring a feeling of heat to the user and increasing the perspiration, and finally because the abrasion performance of para-aramid is very poor.

[0013] For the range of sizes of the polyamide/elastane yarns, a smaller dimension is liable to make the yarn too fine and not elastic enough, while a larger dimension deteriorates the fineness of the glove and makes it less comfortable because it is more restraining.

[0014] Advantageously, each range may further be reduced independently of one another: the first yarn is of

300 to 400 dtex, the second para-aramid yarn is of 150 to 250 dtex and the lining yarns are of 130 to 160 dtex.

[0015] The glass fibre provides good cut-resistance. It is double-wrapped with polyester so that the glass fibres are not in direct contact with the user. The para-aramid yarn provides both good cut-resistance and good thermal resistance. It may comprise fibres or filaments. The elastane yarns double-wrapped with two polyamide yarns provide comfort, elasticity, and enable the glove to closely match the shape of the hand.

[0016] For example, a seamless glove was knitted in 13 gauge, using the plating technology that serves to manufacture a double-sided knit. This technique therefore serves to knit an A yarn and a B yarn in one step so that the A yarn is on the front and the B yarn on the back: in the present application, a glove is made with a cut-resistant yarn on the exterior side and a more comfortable yarn on the interior side (side in contact with the skin).

[0017] The glove therefore comprises three different yarns:

- one 330 dtex glass yarn double-wrapped with polyester,
- one 200 dtex para-aramid yarn, in this case a poly-para-phenylene terephthalamide (PPDT) of the Kevlar® trade mark,
- two 145 dtex polyamide/elastane yarns.

[0018] These three yarns are knitted so that:

- the double-wrapped glass yarn and the para-aramid yarn are located on the exterior surface of the knit, which is in contact with an object or a tool,
- the two polyamide/elastane yarns are located on the interior surface of the knit which is in contact with the user's skin.

[0019] It is known that para-aramid offers good cut and thermal resistance but, on the other hand, this fibre has very poor abrasion resistance.

[0020] According to the invention, a much finer para-aramid yarn is used than the one normally used in cut-resistant gloves in order to avoid excessively reducing the abrasion performance of the glove and to compensate for this fineness by using elastic fibres such as elastane to sharply increase the density of the material.

[0021] The knitted glove was subjected to standard tests with the following results.

- Cutting:

The glove has very good cut-resistance properties thanks to the combined action of the glass yarn and the para-aramid yarn and obtains level 5/5 according to standard EN 388 (for EN 388, this test consists in measuring the number of cycles needed for a circular blade, moving back and forth and rotating about itself, to cut a sam-

ple glove. There are 5 levels in this standard, and level 5 is the highest).

- Abrasion:

Since the para-aramid fibre has very low abrasion resistance, this glove could be expected to have a very low level in the abrasion test, but in fact, probably because the para-aramid yarn is very fine and the glove is very dense, very satisfactory abrasion resistance is obtained, that is, a level that is equal to or higher than level 2/4 for abrasion, and in fact very close to level 3.

- Dexterity and comfort:

The fact that the gauge used for knitting is fine and that the yarns used are also very fine and very supple, serves to obtain a level 5/5 in the dexterity test of standard EN 420. The glove is thus very comfortable, very supple and perfectly matches the shape of the hand, in order to facilitate the operator's work.

[0022] For comparison, a glove was prepared by a technique similar to that of document W02010/085415 by knitting a glass yarn double-wrapped with 597 dtex para-aramid and polyester (PET), a second 167 dtex textured PET yarn, and for the lining, a 340 dtex elastane yarn wrapped with PET. The glove was knitted in 10 gauge which is considered to offer at least equivalent or even better performance than 13 gauge. The tests showed that the abrasion performance is not only average (lower than 1, because less than 200 cycles) and that the cut-resistance performance is also average (level 2 with an index of 3.5).

[0023] The glove of the invention may be coated, on the palm and/or the fingers, with polymers such as polyurethane, nitrile, latex or PVC.

Claims

1. Cut-resistant knitted glove made by double-sided knitting using several yarns in order to form an external technical side and an internal lining side, comprising:

- two yarns for the technical side, namely

- i. a first yarn consisting of a cut-resistant core yarn based on glass fibre, wrapped by a polyester yarn,
- ii. a second yarn selected from a para-aramid yarn or a high-tenacity polyamide yarn,

- a yarn for the lining side, which may comprise a polyamide-wrapped elastane core yarn, **char-**

acterized in that:

the first yarn, having a linear density of 100 to 800 dtex, consists exclusively of a glass fibre core yarn double-wrapped with a polyester yarn, 5
 the second para-aramid or high-tenacity polyamide yarn has a linear density of 100 to 500 dtex, 10
 the lining is formed by two 50 to 250 dtex elastane yarns wrapped or double-wrapped with polyamide.

2. Glove according to Claim 1, **characterized in that** the first yarn has a linear density of 300 to 400 dtex. 15
3. Glove according to Claim 1, **characterized in that** the second para-aramid yarn is of 150 to 250 dtex.
4. Glove according to Claim 1, **characterized in that** the lining yarns have a linear density of 130 to 160 dtex. 20
5. Glove according to any one of Claims 1 to 4, **characterized in that** it is coated, on the palm and/or the fingers, with polymers such as polyurethane, nitrile, latex or PVC. 25

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		23 May 2011	D'Souza, Jennifer
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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23-05-2011

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

REFERENCES CITED IN THE DESCRIPTION

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