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(54) Electrically conductive, elastically stretchable hybrid yarn, method for the manufacture thereof and textile product with a hybrid yarn of this kind

Elektrisch leitfähiges, elastisches Verbundgarn, Herstellungsverfahren dafür und Textilprodukt das diese Garne enthalten

Fil composite elastique electriquement conducteur, procede de fabrication de ce fil, et produit textile contenant ce fil

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(73) Proprietor: **Kufner Textilwerke GmbH**
81379 München (DE)

(72) Inventor: **Voigt, Andreas**
81929 München (DE)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

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Description

Field of the Invention

[0001] The present invention relates to the field of textile yarns and the products in which yarns of this kind are used, in particular in the case of yarns that are electrically conductive and elastically stretchable. Products of this kind are, for example, sheet-type heating elements such as those used for seat heating in the automotive field. Yarns of this type are also used with floor coverings, blankets, heatable clothing or portions thereof and similar, and also shielding textiles to divert electric fields.

[0002] Textile electrical surfaces are used to adjust the temperature of environments that are in contact with the human body. In this regard, they are generally joined to other textile layers by stitching or gluing. In other cases, suitable heating conductors form surfaces comprising heating conductors and their supply lines. In this regard, the shape and size are adapted to match the applicable conditions of use.

Prior art

[0003] Although metallic wires are very suitable for conducting current, they themselves possess few textile properties and this is a drawback when processing, such as weaving, knitting, etc. These wires are in this regard completely inelastic and do not have a textile handle. To improve this situation, a metallic wire is combined with a textile yarn or filament, generally by winding or twisting. The combination comprising wire and elastic thread achieves a certain flexibility due to the elasticity of the textile filament. The two elements already exist as individual filaments before the winding process and have to be manufactured in individual separate preliminary processes and are brought together by the winding process. However, in this regard the metallic handle and the rigidity can only be influenced to a limited extent.

[0004] Known from WO 2004/097089 A1 is an electrically conductive, elastic composite yarn comprising an elastic element. This elastic element comprises one or more elastic filaments and is covered by at least one, but preferably a plurality of conductive filaments (longitudinal filaments). Each conductive thread surrounding the elastic element has a length that is greater than the drafted length of the elastic element so that all of the elongating stress imposed on the composite yarn is carried by the elastic element. This publication cites US-BS 6,341,504. This mentions an elastic textile product which has a conductive wire for use in garments. This is intended for indicating physiological body functions. This publication describes an elongated band of elastic material which is stretchable in the longitudinal direction and comprises at least one conductive wire either lying on or provided inside the elastic band.

[0005] DE 103 42 787 A1 discloses an electrically conductive yarn comprising at least one elastic core filament, at least one electrically conductive filament wound around the core filament and at least one non-conductive filament wound around the core filament which limits the stretch of the whole electrically conductive yarn. A similar composite yarn is disclosed in DE 102 42 785 A1.

Presentation of the invention

[0006] A technical problem (object) of the invention is to provide an electrically conductive, elastically stretchable hybrid yarn which is simple to manufacture and more effective with respect to electric conductivity and elastic stretch than the composite yarns known to date.

[0007] This object is achieved according to the invention by an electrically conductive, elastically stretchable hybrid yarn with an elastically stretchable core and an electrically conductive element assigned to the core on the circumferential side which permits the elastic stretch of the core, whereby the electrically conductive element comprises a fibre sheath surrounding the core at least partially and at least partially comprising electrically conductive fibres which are bonded with each other.

[0008] This produces a homogeneous yarn with a high degree of elasticity with the total elasticity extensively corresponding to the elasticity of the elastic core filament.

[0009] Preferably, the core comprises at least one filament which is surrounded by the fibre sheath. In this regard, the at least one filament may comprise textured polyester or Lycra® or a similar material. There can also be at least one inelastic core filament which is laid in such a way as to permit a desired stretch of the elastic core filament but in addition also limits the stretching.

[0010] Particularly good conductivity with the use of fibres is obtained in particular if the electrically conductive fibres are selected from the group:

conductive polyester fibres; high-grade steel fibres; carbon fibres; metal-coated

polymers, silver-plated, copper-plated; nickel-plated carbon fibres and similar.

[0011] A possible yarn number range is 2000-40 tex (Nm 0.5-25), whereby the fibres can have a fineness of 1.0-3.3 dtex and the fibres can have a cut length of 35-60 mm.

[0012] Conductive fibres such as carbon fibres, nickel-coated carbon fibres, metal fibres and fibres made of metal-coated polymers have no rigidity as individual fibres and, due to the fine titre, have extensively textile handle features.

[0013] To improve the bond between the elastic core filament and conductive sheath fibres, during the mixing process, fusible fibres can be mixed into slubbings or drawing slivers produced in a conventional preliminary spinning stage, preferably in an amount of 5-10%. Thermal after-treatment of the elastic, conductive yarn, which can, for example, be combined with a rewinding process

or even take place at the same time as the subsequent textile finishing of the finished fabric, causes the fusible fibres to adopt a plastic state and after cooling bond the core filament and sheath fibres which can considerably improve the antislip properties of the hybrid yarn without noticeably reducing the electrical conductivity.

[0014] The hybrid filament is preferably produced using the so-called friction spinning method with which the fibres can be bonded with the core. This friction spinning method was developed by the company Dr Fehrer Linz AG, the Dref2/Dref2000 System, which is familiar to a person skilled in the art.

[0015] The object is also achieved by a method for manufacturing a hybrid yarn by:

- the introduction of a core filament, which can also comprise single filaments
- the breaking down of slubbings or a drawing sliver into electrically conductive individual fibres and optionally fusible fibres in a spinning process
- laying the fibres substantially at right angles around the continuous core filament, and
- friction-bonding the fibres with the core filament using the so-called friction spinning method.

[0016] If fusible fibres are present, the heating can take place as thermal after-treatment of the elastic, conductive hybrid yarn, which can, for example, be combined with a rewinding process, or even during the subsequent textile finishing of the finished fabric. During this, the fusible fibres adopt a plastic state and after cooling bond the core filament and sheath fibres, which considerably improves the antislip properties of the hybrid yarn without noticeably reducing the electrical conductivity.

[0017] The object is also achieved by a textile product containing the aforementioned hybrid yarn.

Brief description of the drawings

[0018]

Fig. 1 is a perspective, schematic view of an electrically conductive, elastically stretchable hybrid yarn.

Fig. 2 is a perspective view of a device for the friction spinning method.

Description of an embodiment of the invention

[0019] Fig. 1 is a perspective view of a part of a hybrid yarn 3 in which a portion of the hybrid yarn in perspective view only shows the core filament 1, which here comprises a plurality of single filaments 4 which are bundled into a total core filament. This is not absolutely necessary, the core filament can also be embodied as a single filament. This core filament is surrounded by a fibre sheath 2 comprising a plurality of short individual fibres 5.

[0020] The core filament 1 is an elastically stretchable filament which can, for example, comprise textured polyester or Lycra® which is spun with conductive fibres. The total yarn has, for example, a yarn count range of 2000-40 tex (Nm 0.5-25). The fibre sheath is, for example, made of fibres with a fineness of 1.0-3.3 dtex and a cut length of 35-60 mm. To form the sheath, the fibres form a bond but this does not impair the elastic stretch of the core filament. This is even more applicable if, in a mixing process, fusible fibres are mixed into the sheath fibres, which are electrically conductive, for example in an amount of 5-10%. This serves to improve the bond between the elastic core filament and the conductive sheath fibres. These fusible fibres are, for example, mixed into the slubbings or drawing slivers produced in a normal preliminary spinning stage.

[0021] The sheath fibres can be conductive polyester fibres, high-grade steel fibres or metal and preferably silver or copper-coated polymers plus carbon fibres or nickel-plated carbon fibres.

[0022] The invention is based on the idea of spinning an elastic, textile filament such as, for example, textured polyester or Lycra® with conductive fibres. In this regard, the elastic filament forms the heart or the core of the yarn and the conductive fibres, not as yet a finished filament, are themselves bonded with the core filament by means of a special spinning process. This is performed with a device such as that shown in Fig. 2. In this device, the reference number 6 indicates the slubbings introduced, which are broken down into individual fibres by means of an opening cylinder 7. Reference number 8 designates a guide roll for introducing the core filament and reference number 9 a drawing-off disc for removing the finished yarn in the region of a rinsing unit 10 with a dirt extractor 11 provided on its side.

[0023] The hybrid yarn 3 shown in Fig. 1 is manufactured with a device of this kind. It is possible to use the so-called friction spinning method developed by the company Dr Fehrer Linz AG, the Dref2/Dref2000 System, which is known to every person skilled in the art.

[0024] During the spinning process, the slubbings are broken down into individual fibres and laid at right angles around the continuous core filament and friction-bonded therewith. This produces a homogeneous yarn with a high degree of elasticity, which in overall elasticity extensively corresponds to the elasticity of the elastic core filament.

[0025] The conductive fibres, such as carbon fibres, nickel-coated carbon fibres, metal fibres or fibres made of metal with coated polymers have no rigidity as individual fibres and, due to their fine titre, have extensively textile handle features. To improve the bond between the elastic core filament and conductive sheath fibres, during the mixing process, fusible fibres may be mixed into the slubbings or drawing slivers, which are produced in a conventional preliminary stage, in an amount of 5-10%. Thermal after-treatment of the elastic, conductive yarn, which can, for example, be combined with a rewinding

process or even takes place at the same time as the subsequent textile finishing of the finished fabric, causes the fusible fibres to adopt a plastic state and, after cooling, bond the core filament and sheath fibres, which improves the antislip properties of the hybrid yarn without noticeably reducing the electrical conductivity.

Claims

1. Electrically conductive, elastically stretchable hybrid yarn with an elastically stretchable core (1) and an electrically conductive element assigned to the core (1) on the circumferential side which permits the elastic stretch of the core, **characterised in that** the electrically conductive element comprises a fibre sheath (2) surrounding the core (1) at least partially and at least partially comprising electrically conductive fibres (5) which are bonded with each other.

2. Hybrid yarn according to claim 1, **characterised in that** the core is formed from at least one filament (4) surrounded by the fibre sheath (2).

3. Hybrid yarn according to claim 2, **characterised in that** the at least one filament (4) comprises textured polyester or Lycra® or a similar material.

4. Hybrid yarn according to claim 1, **characterised in that** the electrically conductive fibres (5) are selected from the group:

   conductive polyester fibres; high-grade steel fibres; carbon fibres; metal-coated polymers, silver-plated, copper-plated; nickel-plated carbon fibres and similar.

5. Hybrid yarn according to any one of claims 1 to 4, **characterised in that** the fibres (5) have a fineness of 1.0-3.3 dtex.

6. Hybrid yam, according to any one of claims 1 to 5, **characterised in that** the fibres (5) have a cut length of 35-60 mm.

7. Hybrid yarn according to claim 1, **characterised in that** fusible fibres are mixed into the electrically conductive fibres (5).

8. Hybrid yarn according to claim 7, **characterised in that** 5-10% fusible fibres are mixed in.

9. Hybrid yarn according to any one of claims 1 to 8, **characterised in that** the fibres are bonded with the core by means of the so-called friction spinning method.

10. Method for manufacturing a hybrid yarn according to any one of claims 1 to 9, **characterised by**

    - the introduction of a core filament, which can also comprise single filaments
    - the breaking down of slubbings or a drawing sliver into electrically conductive individual fibres and optionally fusible fibres in a spinning process
    - laying the fibres substantially at right angles around the continuous core filament, and
    - friction-bonding the fibres with the core filament using the so-called friction spinning method.

11. Method according to claim 10, **characterised in that** if fusible fibres are present, they are heated.

12. Textile product containing a hybrid yarn according to any one of claims 1 to 9.

Patentansprüche

1. Elektrisch leitfähiges, elastisch dehnbares Hybridgarn mit einem elastisch dehnbaren Kern (1) und einem elektrisch leitfähigen Element, das dem Kern (1) auf der Umfangsseite zugeordnet ist, welches die elastische Dehnung des Kerns zulässt, **dadurch gekennzeichnet, dass** das elektrisch leitfähige Element einen Fasermantel (2) umfasst, der den Kern (1) zumindest teilweise umgibt und zumindest teilweise elektrisch leitfähige Fasern (5) umfasst, die miteinander verbunden sind.

2. Hybridgarn nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kern aus zumindest einem Filament (4) ausgebildet ist, das durch den Fasermantel (2) umgeben ist.

3. Hybridgarn nach Anspruch 2, **dadurch gekennzeichnet, dass** das zumindest eine Filament (4) texturiertes Polyester oder Lycra® oder ein ähnliches Material umfasst.

4. Hybridgarn nach Anspruch 1, **dadurch gekennzeichnet, dass** die elektrisch leitfähigen Fasern (5) aus der Gruppe ausgewählt sind:

   leitfähige Polyesterfasern; Edelstahlfasern; Carbonfasern; metallbeschichtete Polymere, Silber-plattiert, Kupferplattiert; Nickel-plattierte Carbonfasern und ähnliche.

5. Hybridgarn nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Fasern (5) eine Feinheit von 1,0-3,3 dtex aufweisen.

6. Hybridgarn nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die Fasern (5) eine

Schnittlänge von 35-60 mm aufweisen.

7. Hybridgarn nach Anspruch 1, **dadurch gekennzeichnet, dass** schmelzbare Fasern in die elektrisch leitfähigen Fasern (5) gemischt sind.

8. Hybridgarn nach Anspruch 7, **dadurch gekennzeichnet, dass** 5-10% schmelzbare Fasern eingemischt sind.

9. Hybridgarn nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Fasern mit dem Kern mittels des so genannten Friktionsspinnverfahrens verbunden sind.

10. Verfahren zur Herstellung eines Hybridgarns nach einem der Ansprüche 1 bis 9, **gekennzeichnet durch**

    - das Einführen von einem Kernfilament, das auch einzelne Filamente umfassen kann,
    - das Zerlegen von Lunten oder eines Ziehfaserbands in elektrisch leitfähige individuelle Fasern und optional schmelzbare Fasern in einem Spinnprozess,
    - Legen der Fasern im Wesentlichen im rechten Winkel um das kontinuierlich Kernfilament, und
    - Friktionsbonden der Fasern mit dem Kernfilament unter Verwendung des so genannten Friktionsspinnverfahrens.

11. Verfahren nach Anspruch 10, **dadurch gekennzeichnet, dass**, wenn schmelzbare Fasern vorhanden sind, sie erwärmt werden.

12. Textilprodukt, enthaltend ein Hybridgarn nach einem der Ansprüche 1 bis 9.

Revendications

1. Fil hybride, électriquement conducteur, élastiquement extensible, avec un noyau élastiquement extensible (1) et un élément électriquement conducteur affecté au noyau (1) sur le côté circonférentiel qui permet l'extension élastique du noyau, **caractérisé en ce que** l'élément électriquement conducteur comprend une gaine en fibre (2) entourant au moins partiellement le noyau (1) et comprenant au moins partiellement des fibres électriquement conductrices (5) qui sont liées les unes aux autres.

2. Fil hybride selon la revendication 1, **caractérisé en ce que** le noyau est formé à partir d'au moins un filament (4) entouré par la gaine en fibre (2).

3. Fil hybride selon la revendication 2, **caractérisé en ce que** le au moins un filament (4) comprend du Lycra® ou polyester texturé ou un matériau similaire.

4. Fil hybride selon la revendication 1, **caractérisé en ce que** les fibres électriquement conductrices (5) sont sélectionnées parmi le groupe:

    de fibres de polyester conductrices; de fibres en acier noble; de fibres de carbone; des fibres de carbone plaquées au nickel, plaquées au cuivre, plaquées à l'argent, des polymères à revêtement métallique et autres similaires.

5. Fil hybride selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** les fibres (5) ont une finesse de 1,0-3,3 dtex.

6. Fil hybride, selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** les fibres (5) ont une longueur de pièce de 35-60 mm.

7. Fil hybride selon la revendication 1, **caractérisé en ce que** des fibres fusibles sont mélangées dans les fibres électriquement conductrices (5).

8. Fil hybride selon la revendication 7, **caractérisé en ce que** 5-10 % de fibres fusibles sont introduits dans le mélange.

9. Fil hybride selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** les fibres sont liées au noyau au moyen du procédé dit de filage par friction.

10. Procédé pour fabriquer un fil hybride selon l'une quelconque des revendications 1 à 9, **caractérisé par**

    - l'introduction d'un filament central, qui peut également comprendre des filaments simples
    - la transformation de loquettes ou d'un ruban d'étirage en fibres individuelles électriquement conductrices et optionnellement en fibres fusibles dans un processus de filage
    - mettre sous forme de couches les fibres essentiellement à angles droits autour du filament central continu, et
    - lier par friction les fibres avec le filament central en utilisant le procédé dit de filage par friction.

11. Procédé selon la revendication 10, **caractérisé en ce que** si des fibres fusibles sont présentes, elles sont chauffées.

12. Produit textile contenant un fil hybride selon l'une quelconque des revendications 1 à 9.

Fig. 1

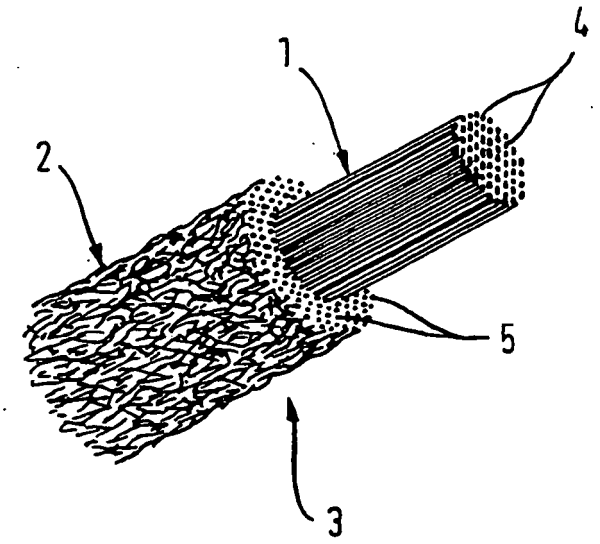
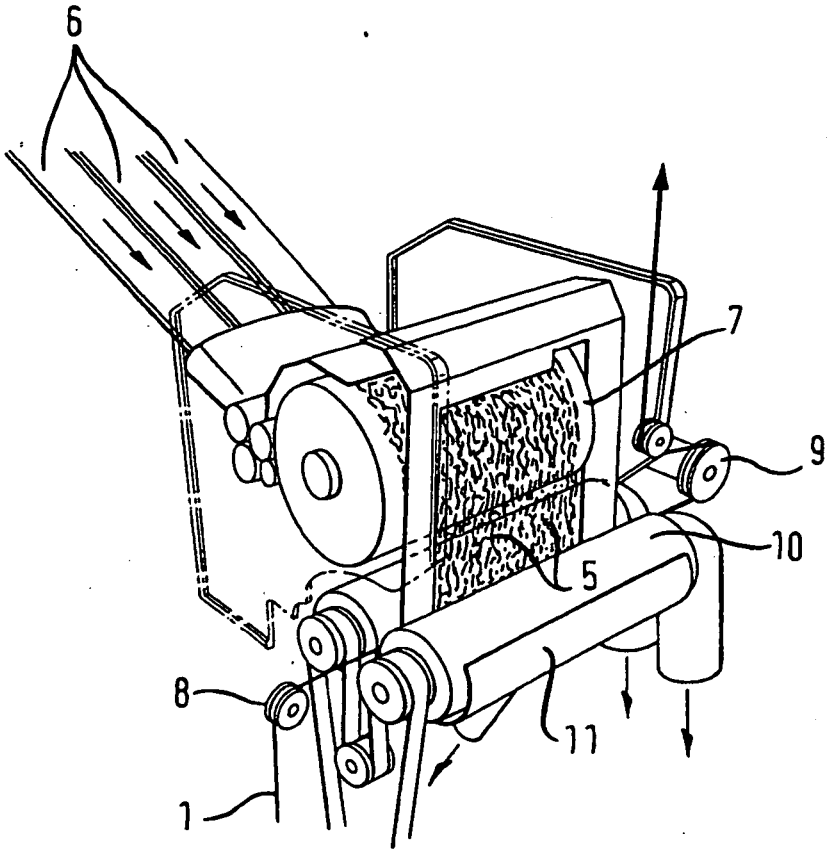


Fig. 2



REFERENCES CITED IN THE DESCRIPTION

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