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(54) **Method to produce a composite yarn consisting of textile threads and metallic wire, and composite yarn thus produced**

Verfahren zur Herstellung von Verbundgarn aus Textilfäden und Metalldraht, und dadurch produziertes Verbundgarn

Procédé pour la production de fil composite de fils textiles et fil métallique, et fil composite ainsi produit

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- **PATENT ABSTRACTS OF JAPAN vol. 015, no. 512 (C-898) 26 December 1991 & JP-A-03 227 422 (OSAMU NAKAKIDO) 8 October 1991**

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## Description

This invention concerns a method to produce a composite yarn consisting of textile threads and metallic wire and concerns also the composite yarn thus produced, as set forth in the respective main claims.

The composite yarn thus produced is employed in the manufacture of knitted underwear and outer knitted garments,, shirts, jeans, furnishing fabrics, curtains, blankets, carpets and other textile products.

The state of the art covers various types of composite yarns consisting of a metallic wire associated with one or more textile threads. These composite yarns are employed in the manufacture of fabrics, knitted goods, carpets, etc. which possess the properties of providing screening against electromagnetic waves or antistatic properties and earth the body of the person who wears clothes made with such fabrics.

Moreover, these composite yarns are also employed in the production of fabrics that reduce physical pains associated with the breaking of bones inasmuch as they make normal the electrical charge of the body and reduce the differences of potential occurring in the body, for these differences of potential are the cause of pains due to the breaking of bones.

The philosophies which lead to the composite textile-metallic yarns are substantially two in number and affect the conformation of the metallic component.

A first philosophy provides for the use of segments of metallic wire which are assembled with the textile fibre component.

A second philosophy, from which this invention is derived, provides for the use of one or more continuous metallic wires.

The present invention is concerned with composite yarns employing continuous metallic wire.

The prior art document IT-BZ-92A000019 discloses a composite yarn in which at least two textile threads are wound on a taut metallic wire, which stays substantially straight substantially in the centre between the two textile threads.

This kind of yarn can be made only with a cording machine of the type used to produce cords or with a braiding machine.

The use of these machines entails a high production cost since these machines are very slow and therefore have a low output.

Other prior art exists which discloses the winding of one or more textile yarns together with metallic wire; one method of the prior art is to wind together long textile fibres or very fine textile threads with metallic wires so as to produce a composite yarn in which the metallic wire is positioned at random in the composite yarn.

This means that the metallic wire can come readily to the surface of the composite yarn, thus creating problems of use of the metal and problems of allergy and of suitability to be worn.

Another method of the state of the art is to wind together textile threads and metallic wire, the metallic wire being alone by itself or combined with a textile filament; the composite yarn thus produced does not ensure that the metallic wire becomes located in a protected and covered position within the composite yarn, and this fact too creates problems of use of the metal and problems of allergy and of suitability to be worn.

Neither of these methods ensures that the metallic wire does not come to the surface during the successive processing of the composite yarn and does not create problems and possible breakages of the metallic wire during such successive processings.

Both of these production methods involve also problems of production, output and cost.

EP-A-445872 describes a textile yarn composed of at least a metallic wire and at least a textile thread, where the purpose of the metallic wire is to increase the resistance of the composite yarn thus obtained, the composite yarn being used to produce articles of clothing which are particularly subject to stress, such as gloves and trousers.

In fact, the composite yarn produced according to EP'872 is intended for specific uses (the meat industry, the metal industry, the wood industry) where a particular resistance is required of the articles of clothing worn.

The metallic wire used in EP'872 serves to increase the resistance of the the composite yarn and not to obtain an electromagnetic screening effect on the body of the person wearing the article of clothing obtained with the composite yarn.

The composite yarn as disclosed by EP'872, moreover, is obtained by twisting together a metallic wire with one or more textile threads, using traditional twisting methods (column 3, lines 1 and 2).

Therefore, the metallic wire is not positioned straight and substantially central to the textile threads, thus remaining completely covered by them, it is wound in a spiral around them, creating problems of contact with the skin, possible allergic reactions, problems in dressing, injuries in the case of breakages, etc.

In the successive processing steps, the presence of the metallic wire protruding from the composite yarn can create problems and possible breakages, and consequently the whole composite yarn may have to be discarded.

The present applicants have studied, tested and obtained this invention so as to overcome the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterised in the main claims, while the dependent claims describe variants of the idea of the main solution.

The method according to the invention enables a composite yarn to be produced from a continuous metallic wire and at least two textile threads, the textile threads having a fineness of between 5 and 142 tex (a metric number (Nm) between 7,000 and 200,000 metres per kilogram).

The continuous metallic wire has a diameter which may vary between 0.010 mm. and 0.100 mm., depending on the final method of use of the composite yarn.

The metal of which the metallic wire consists will be suitable for the end use of the textile product and therefore may be stainless steel, copper coated with silver and/or gold, aluminium which has been surface-passivated, etc.

The metallic wire may possibly be coated with a resin, which advantageously is of a conductive type.

According to a variant the metallic wire is replaced by a metallic strap.

According to a further variant the metallic strap replacing the metallic wire has on one or both of its sides a protective adhering film of polyester, viscose or nylon.

According to another variant the metallic wire or metallic strap has a cross-section of a polygonal shape.

The method according to the invention arranges for the metallic wire and textile threads to undergo a first coupling operation in which the threads and wire are united according to a desired reciprocal positioning.

The coupled threads and wire which have their axes substantially parallel and linear then undergo a twisting step in which the metallic wire and textile threads are bonded together by a number of required twists about the lengthwise axis of the resulting composite yarn.

In the method according to the invention the metallic wire and the textile threads themselves undergo twisting.

The metallic wire coupled with two textile threads becomes located in a lateral position covered by the two coupled textile threads, so that the coupled metallic wire according to the invention is within the outer periphery of the finished yarn.

These coupling and twisting operations can be carried out with the normal coupling and twisting machines used at present in the processing of textile threads, thus enabling normal and very versatile machines to be employed with high speeds of output and high outputs of the composite yarn according to the invention to be ensured at a low cost.

Moreover, with such machines it is possible to use textile threads having a count of between 5 and 142 tex (metric number between 7,000 and 200,000 metres per kilogram) without thereby involving an appreciable drop of the output of the machines.

The properties of the metallic wire and textile threads employed and also the parameters of the twisting step vary according to the end use of the composite yarn according to the invention.

As an example we give below some data of some possible compositions of the composite yarn according to the invention as employed in particular to produce:

- knitted underwear:

  1 metallic wire having a diameter of 0.025 mm.;
  2 textile threads having a count of 14,2 tex (metric number of 70,000 metres/kg.);

  the number of twists imparted to the composite yarn is within the range of 500 to 800 twists per metre;
- shirts:

  1 metallic wire having a diameter of 0.010 to 0.015 mm.;
  2 textile threads having a count of between 5 and 7 tex (metric number within the range of 140,000 to 200,000 metres/kg.);

  the number of twists imparted to the composite yarn is within the range of 800 to 1000 twists per metre;
- woollen garments, inserts for blankets:

  1 metallic wire having a diameter of 0.025 to 0.040 mm.;
  2 textile threads having a count of 25 tex (metric number of 40,000 metres/kg.);

  the number of twists imparted to the composite yarn is within the range of 300 to 500 twists per metre;
- light carpets, furnishing fabrics:

  1 metallic wire having a diameter of 0.08 to 0.10 mm.;
  2 textile threads having a count of between 50 and 142 tex (metric number within the range of 7,000 to 20,000 metres/kg.);

  the number of twists imparted to the composite yarn is within the range of 150 to 350 twists per metre.

The attached figures are given as a non-restrictive example and show a preferred solution of the invention as follows:

Fig.1 is a block diagram of the method to produce a composite yarn according to the invention;

Fig.2 gives a view of a yarn consisting of a metallic wire and two textile threads and made with the method according to the invention;

Fig.3 shows in an enlarged scale a cross-section along the line A-A of the composite yarn of Fig.2.

The reference number 10 in the attached figures denotes generally a method to produce a composite yarn 11 consisting of a metallic wire 12 and at least two textile threads 13.

The method 10 to produce a composite yarn 11 according to the invention includes a first coupling step 14 in which the continuous metallic wire 12 is caused to cooperate with at least two textile threads 13 so as to produce a coupled thread 15 that comprises at least two

textile threads 13 and at least one metallic wire 12.

The coupling of the wire and threads takes place by first coupling the two textile threads and then by doubling the metallic wire with the coupled threads, taking care to place the metallic wire 12 between the two textile threads 13 in the first coupling step 14.

This coupling step 14 may be carried out with the common coupling machines employed in the traditional textile industry.

The coupling machines employed may be of the type with a thread-guide or of the type with a grooved roller.

The textile threads 13 or wire 12 are unwound by being drawn from a hank positioned on a stationary swift.

In fact, the unrolling of the textile threads 13 or metallic wire 12 from a hank positioned on a rotary swift leads in this case to lower unwinding speeds than is the case with unwinding from a stationary swift and therefore reduces the output of the machines.

Moreover, unrolling the metallic wire 12 from a rotary swift not only leads to the above problems of lower speeds but is also not employed owing to the fact that it induces in the metallic wire 12 tensions which tend to lengthen the metallic wire 12 and to reduce the percentage of plastic elongation which is required of the composite yarn 11 in the successive processes.

It should be noted that the invention arranges that in every successive step in the production of the composite yarn there is always unwinding from a hank positioned on a stationary swift.

In fact, to make possible the successive processings of the composite yarn 11 and to ensure that the finished fabric made with the composite yarn 11 behaves substantially like a fabric made of textile threads 13 alone, it is necessary to ensure a minimum percentage of elongation in the composite yarn 11.

The coupled thread 15 undergoes thereafter a twisting step 16, in which the metallic wire 12 and textile threads 13 forming the coupled thread 15 are bonded together by imparting a desired number of twists which wind the metallic wire 12 and threads 13 about the lengthwise axis of the composite yarn 11 thus produced.

This second twisting step 16 can be carried out with the common twisting machines employed in the traditional textile industry.

The metallic wire 12 has a diameter which may vary from 0.01 to 0.10 mm. depending on the end use of the composite yarn 11, while the textile threads 13 employed have a count of between 5 and 142 tex (metric number between 7.000 to 200.000 metres/kg.).

Furthermore, the number of twists imparted to the coupled thread 15 in the twisting step 16 will vary according to the end use of the composite yarn 11 and will generally range from 150 to 1000 twists per metre.

In the composite yarn 11 according to the invention the metallic wire 12 and the textile threads 13 undergo the twisting step 16 and are therefore spirally arranged about an ideal axis.

Where the composite yarn 11 according to the invention consists of a metallic wire 12 coupled to and twisted with two textile threads 13, the metallic wire 12 becomes positioned in a lateral position in the zone of mutual support of the two textile threads 13.

The metallic wire 12 becomes located in particular in an internal recess within a substantially V-shaped space 17 created at the point of mutual contact of the two twisted textile threads 13 (see Fig.3).

This positioning, owing to the method employed, entails protection of the metallic wire 12 by being covered by part of the two textile threads 13, which cover the metallic wire 12 at least partly. In any event the textile threads 13 create protective spines at the two sides of the metallic wire 12, so that the metallic wire 12 does not emerge from the spines of the textile threads 13.

This means that in the successive operations and in the finished product the metallic wire 12 practically never emerges from the composite yarn 11, thus preventing the metallic wire 12 causing problems in the successive processings of the composite yarn 11.

In fact, the metallic wire 12 is sunk in the textile yarn which thus acts as a protection, insulation and elastic absorption of the mechanical tensions which may occur in the metallic wire 12.

It should be noted that a fabric made with the yarn according to the invention behaves, when in contact with the skin, like a normal textile fabric since the textile threads are the threads which come in contact with the skin, and at the same time behaves like a Faraday cage owing to the screening effect of the metallic wire.

The method according to the invention makes it also possible to employ as metallic wire 12 a copper wire with a coating of gold and/or silver.

When the composite yarn 11 according to the invention has been knitted or woven, it may happen that the textile part of the fabric undergoes a required controlled shrinkage so that small segments of the metallic wire 12 may come to the surface; the shrinkage of the textile part may occur by washing the fabric for instance.

The metallic wire, emerging in segments from the composite yarn 11 forming the fabric, comes into contact with the wearer's skin. This contact is sought for and desired since it enables the composite yarn 11 to act not only as a Faraday cage but also as a conductor, thus making uniform the electrical charges in the body of the person wearing the garment made with the composite yarn 11 according to the invention.

In fact, it has been found that in this way the composite yarn 11 according to the invention makes possible the attenuation of the differences of electrical potential created within the body and deemed to be the cause of pains associated with the breaking of bones.

## Claims

1. Method to produce a composite yarn (11) consisting of at least one metallic wire (12) and at least two textile threads (13), the method being characterized in that it comprises a first step (14) of coupling the metallic wire (12) with at least two pre-doubled textile threads (13) so as to produce a coupled thread (15) in which the metallic wire (12) is positioned in a position covered by the two coupled textile threads (13), and a second twisting step (16) in which the desired twists are imparted to the coupled thread (15), at least the metallic wire (12) in the coupling step being unwound by being drawn from a hank positioned on a stationary swift, whereby the metallic wire (12) is within the outer periphery of the finished yarn.

2. Method as in Claim 1, in which the textile threads (13) are unwound by being drawn from a stationary swift in the coupling step.

3. Method as in Claim 1 or 2, in which the metallic wire (12) has a diameter between 0.01 and 0.10 mm.

4. Method as in any claim hereinbefore, in which the textile threads (13) have a count of between 5 and 142 tex (a metric number between 7,000 and 200,000 metres/kg.).

5. Method as in any claim hereinbefore, in which the composite yarn (11) to make knitted underwear comprises a metallic wire (12) having a diameter of 0.025 mm., and two textile threads (13) having a count of 14,2 tex (a metric number of 70,000 metres/kg.); while the number of twists imparted to the composite yarn (11) in the twisting step (16) is within a range of 500 to 800 twists per metre.

6. Method as in any of Claims 1 to 4 inclusive, in which the composite yarn (11) for production of shirts comprises a metallic wire (12) having a diameter of 0.010 to 0.015 mm. and two textile threads (13) having a count of between 5 and 7 tex (metric number within a range of 140,000 to 200,000 metres/kg.), while the number of twists imparted to the composite yarn (11) in the twisting step (16) is within a range of 800 to 1000 twists per metre.

7. Method as in any of Claims 1 to 4 inclusive, in which the composite yarn (11) for production of woollen garments and inserts for blankets comprises a metallic wire (12) having a diameter of 0.025 to 0.040 mm. and two textile threads (13) having a count of 25 tex (metric number of 40,000 metres/kg.), while the number of twists imparted to the composite yarn (11) in the twisting step (16) is within the range of 300 to 500 twists per metre.

8. Method as in any of Claims 1 to 4 inclusive, in which the composite yarn (11) for production of light carpets or furnishing fabrics comprises a metallic wire (12) having a diameter of 0.08 to 0.10 mm. and two textile threads (13) having a count of between 50 and 142 tex (metric number within the range of 7,000 to 20,000 metres/kg.), while the number of twists imparted to the composite yarn (11) in the twisting step (16) is within the range of 300 to 500 twists per metre.

9. Method as in any claim hereinbefore, with the further steps of forming the composite yarn (11) into a fabric and having the fabric undergo a controlled shrinkage of the textile portion thereof.

10. Composite yarn (11) produced with the method of any of the claims 1-8, characterized in that the metallic wire (12) is at least partly covered by at least two of the textile threads (13).

11. Composite yarn (11) as in Claim 10, in which the metallic wire (12) consists of silver-coated copper.

12. Composite yarn (11) as in Claim 10 or 11, in which the metallic wire (12) consists of gold-coated copper.

13. Composite yarn (11) as in Claim 10, in which the metallic wire (12) consists of stainless steel.

14. Composite yarn (11) as in Claim 10, in which the metallic wire (12) consists of aluminium which is advantageously passivated.

15. Composite yarn (11) as in Claim 10, in which the metallic wire (12) is coated with a resin which is advantageously conductive.

16. Composite yarn (11) as in Claim 10, in which the metallic wire (12) consists of a metallic strap.

17. Composite yarn (11) as in Claim 16, in which the metallic strap includes a coating film adhering to at least one side of the strap, the coating film consisting of polyester or viscose or nylon.

18. Composite yarn (11) as in any of Claims 10 to 17 inclusive, in which the metallic wire (12) has a circular cross-section.

19. Composite yarn (11) as in any of Claims 10 to 18 inclusive, in which the metallic wire (12) has a polygonal cross-section.

**Patentansprüche**

1. Verfahren zur Herstellung eines Verbundgarns (11), das aus wenigstens einem Metalldraht (12) und zwei Textilfäden (13) besteht, wobei das Verfahren **dadurch gekennzeichnet** ist, daß es einen ersten Schritt (14) zur Kopplung des Metalldrahts (12) mit wenigstens zwei vorgedoppelten Textilfäden (13) umfaßt, um einen gekoppelten Faden (15) zu erzeugen, in dem der Metalldraht (12) an einer Position angeordnet ist, die von den zwei gekoppelten Textilfäden (13) überdeckt ist, sowie einen zweiten Verzwirnungsschritt (16), in dem die erwünschten Verzwirnungen an dem gekoppelten Faden (15) ausgeführt werden, wobei wenigstens der Metalldraht (12) bei dem Kopplungsschritt abgewickelt wird, indem er von einem auf einer ortsfesten Schärtrommel angeordneten Strang abgezogen wird, wodurch der Metalldraht (12) innerhalb des Außenumfangs des fertiggestellten Garns ist.

2. Verfahren, wie in Anspruch 1, bei dem die Textilfäden (13) abgewickelt werden, indem sie von einer ortsfesten Schärtrommel bei dem Kopplungsschritt abgezogen werden.

3. Verfahren, wie in Anspruch 1 oder 2, bei dem der Metalldraht (12) einen Durchmesser zwischen 0,01 und 0,10 mm aufweist.

4. Verfahren, wie in irgendeinem vorhergehenden Anspruch, bei dem die Textilfäden (13) einen Wert von zwischen 5 und 142 tex aufweisen (eine metrische Zahl zwischen 7.000 und 200.000 Meter/kg).

5. Verfahren, wie in irgendeinem vorhergehenden Anspruch, bei dem das Verbundgarn (11), um gestrickte Unterwäsche herzustellen, einen Metalldraht (12) mit einem Durchmesser von 0,025 mm und zwei Textilfäden (13) mit einem Wert von 14,2 tex (eine metrische Zahl von 70.000 Meter/kg) umfaßt, während die Anzahl der Verzwimungen, die bei dem Verbundgam (11) bei dem Verzwirnungsschritt (16) ausgeführt werden, innerhalb eines Bereiches von 500 bis 800 Verzwirnungen pro Meter ist.

6. Verfahren, nach irgendeinem der Ansprüche 1 bis 4 einschließlich, bei dem das Verbundgam (11) zur Herstellung von Hemden einen Metalldraht (12) mit einem Durchmesser von 0,010 bis 0,015 mm und zwei Textilfäden (13) mit einem Wert von zwischen 5 und 7 tex (metrische Zahl innerhalb eines Bereiches von 140.000 bis 200.000 Meter/kg) umfaßt, während die Anzahl der Verzwirnungen, die bei dem Verbundgarn (11) bei dem Verzwirnungsschritt (16) ausgeführt werden, innerhalb eines Bereiches von 800 bis 1.000 Verzwirnungen pro Meter ist.

7. Verfahren, nach irgendeinem der Ansprüche 1 bis 4 einschließlich, bei dem das Verbundgarn (11) zur Herstellung wollener Kleidung und Einlagen für Decken einen Metalldraht (12) mit einem Durchmesser von 0,025 bis 0,040 mm und zwei Textilfäden (13) mit einem Wert von 25 tex (metrische Zahl innerhalb eines Bereiches von 40.000 Meter/kg) umfaßt, während die Anzahl der Verzwirnungen, die bei dem Verbundgarn (11) bei dem Verzwirnungsschritt (16) ausgeführt werden, innerhalb eines Bereiches von 300 bis 500 Verzwirnungen pro Meter ist.

8. Verfahren, nach irgendeinem der Ansprüche 1 bis 4 einschließlich, bei dem das Verbundgarn (11) zur Herstellung leichter Teppiche oder von Möbelstoffen einen Metalldraht (12) mit einem Durchmesser von 0,08 bis 0,10 mm und zwei Textilfäden (13) mit einem Wert von zwischen 50 und 142 tex (metrische Zahl innerhalb eines Bereiches von 7.000 bis 20.000 Meter/kg) umfaßt, während die Anzahl der Verzwirnungen, die bei dem Verbundgarn (11) bei dem Verzwimungsschritt (16) ausgeführt werden, innerhalb eines Bereiches von 300 bis 500 Verzwirnungen pro Meter ist.

9. Verfahren wie in irgendeinem vorstehenden Anspruch, mit den weiteren Schritten, das Verbundgarn (11) zu einem Kleidungsstück zu bilden, und wobei der Stoff einer gesteuerten Schrumpfung seines Textilanteils ausgesetzt wird.

10. Verbundgam (11), das mit dem Verfahren nach irgendeinem der Ansprüche 1-8 hergestellt ist, **dadurch gekennzeichnet,** daß der Metalldraht (12) zumindest teilweise von wenigstens zwei der Textilfäden (13) überdeckt ist.

11. Verbundgam (11) wie in Anspruch 10, bei dem der Metalldraht (12) aus silberbeschichtetem Kupfer besteht.

12. Verbundgarn (11) wie in Anspruch 10 oder 11, bei dem der Metalldraht (12) aus goldbeschichtetem Kupfer besteht.

13. Verbundgarn (11) wie in Anspruch 10, bei dem der Metalldraht (12) aus rostfreiem Stahl besteht.

14. Verbundgarn (11) wie in Anspruch 10, bei dem der Metalldraht (12) aus Aluminium besteht, das vorteilhafterweise passiviert wurde.

15. Verbundgarn (11) wie in Anspruch 10, bei dem der Metalldraht (12) mit einem Kunstharz beschichtet ist, das vorteilhafterweise leiffähig ist.

16. Verbundgarn (11) wie in Anspruch 10, bei dem der

Metalldraht (12) aus einem Metallband besteht.

**17.** Verbundgarn (11) wie in Anspruch 16, bei dem das Metallband einen Beschichtungsfilm einschließt, der an wenigstens einer Seite des Bandes anhaftet, wobei der Beschichtungsfilm aus Polyester oder Viskose oder Nylon besteht.

**18.** Verbundgam (11) nach irgendeinem der Ansprüche 10 bis 17 einschließlich, bei dem der Metalldraht (12) einen kreisförmigen Querschnitt aufweist.

**19.** Verbundgarn (11), wie in irgendeinem der Ansprüche 10 bis 18 einschließlich, bei dem der Metalldraht (12) einen polygonalen Querschnitt aufweist.

**Revendications**

**1.** Procédé pour la production d'un fil composite **(11)** constitué d'au moins un fil métallique **(12)** et d'au moins deux brins textiles **(13),** le procédé étant caractérisé en ce qu'il comprend une première étape **(14)** de couplage du fil métallique **(12)** avec au moins deux brins textiles doublés à l'avance **(13)** de façon à produire un brin couplé **(15)** dans lequel le fil métallique **(12)** est positionné dans une position recouverte par les deux brins textiles couplés **(13)** et une deuxième étape de torsadage **(16)** dans laquelle les torsades désirées sont communiquées au brin couplé **(15)**, au moins le fil métallique **(12)** étant déroulé lors de l'étape de couplage en étant extrait d'un écheveau positionné sur un tambour immobile ; de façon que le fil métallique **(12)** se trouve à l'intérieur de la périphérie externe du fil terminé.

**2.** Procédé selon la revendication 1, dans lequel les brins textiles **(13)** sont déroulés en étant extraits d'un tambour fixe lors de l'étape de couplage.

**3.** Procédé selon la revendication 1 ou 2, dans lequel le fil métallique **(12)** a un diamètre compris entre 0,01 et 0,10 mm.

**4.** Procédé selon l'une quelconque des revendications précédentes, dans lequel les brins textiles **(13)** ont un compte compris entre 5 et 142 tex (nombre métrique compris entre 7 000 et 200 000 mètres/kg).

**5.** Procédé selon l'une quelconque des revendications précédentes, dans lequel le fil composite **(11)**, destiné à réaliser un sous-vêtement de tricot, comprend un fil métallique **(12)** ayant un diamètre de 0,025 mm, et deux brins textiles **(13)** ayant un compte de 14,2 tex (nombre métrique de 70 000 mètres/kg) ; tandis que le nombre de torsades communiquées au fil composite **(11)** lors de l'étape de torsadage **(16)** se trouve à l'intérieur d'une plage allant de 500 à 800 torsades par mètre.

**6.** Procédé selon l'une quelconque des revendications 1 à 4 incluses, dans lequel le fil composite **(11)**, pour la production de chemises, comprend un fil métallique **(12)** ayant un diamètre de 0,010 à 0,015 mm et deux brins textiles **(13)** ayant un compte compris entre 5 et 7 tex (nombre métrique situé à l'intérieur d'une plage allant de 140 000 à 200 000 mètres par kg), tandis que le nombre de torsades communiquées au fil composite **(11)** lors de l'étape de torsadage **(16)** se trouve à l'intérieur d'une plage allant de 800 à 1000 torsades par mètre.

**7.** Procédé selon l'une quelconque des revendications 1 à 4 incluses, dans lequel le fil composite **(11)**, pour la production de vêtements en laine et d'insertions pour couvertures, comprend un fil métallique **(12)** ayant un diamètre de 0,025 à 0,040 mm et deux brins textiles **(13)** ayant un compte de 25 tex (nombre métrique de 40 000 mètres par kg), tandis que le nombre de torsades communiquées au fil composite **(11)** lors de l'étape de torsadage **(16)** se trouve à l'intérieur de la plage comprise entre 300 et 500 torsades par mètre.

**8.** Procédé selon l'une quelconque des revendications 1 à 4 incluses, dans lequel le fil composite **(11),** pour la production de tapis légers ou tissus d'ameublement, comprend un fil métallique **(12)** ayant un diamètre de 0,08 à 0,10 mm et deux brins textiles **(13)** ayant un compte compris entre 50 et 142 tex (nombre métrique situé à l'intérieur d'une plage comprise entre 7 000 et 20 000 mètres par kg), tandis que le nombre de torsades communiquées au fil composite (11) lors de l'étape de torsadage **(16)** se trouve à l'intérieur de la plage comprise entre 300 et 500 torsades par mètre.

**9.** Procédé selon l'une quelconque des revendications précédentes, avec les étapes supplémentaires de formation du fil composite **(11)** en un tissu, et le tissu subissant un rétrécissement contrôlé de sa portion textile.

**10.** Fil composite **(11)** produit avec le procédé de l'une quelconque des revendications 1 à 8, caractérisé en ce que le fil métallique **(12)** est au moins partiellement couvert par au moins deux des brins textiles **(13).**

**11.** Fil composite **(11)** selon la revendication 10, dans lequel le fil métallique **(12)** est constitué de cuivre revêtu d'argent.

**12.** Fil composite **(11)** selon la revendication 10 ou 11, dans lequel le fil métallique **(12)** est constitué de cui-

vre revêtu d'or.

**13.** Fil composite **(11)** selon la revendication 10, dans lequel le fil métallique **(12)** est constitué d'acier inoxydable.

**14.** Fil composite **(11)** selon la revendication 10, dans lequel le fil métallique **(12)** est constitué d'aluminium avantageusement passivé.

**15.** Fil composite **(11)** selon la revendication 10, dans lequel le fil métallique **(12)** est revêtu d'une résine avantageusement conductrice.

**16.** Fil composite **(11)** selon la revendication 10, dans lequel le fil métallique **(12)** est constitué d'une bande métallique.

**17.** Fil composite **(11)** selon la revendication 16, dans lequel la bande métallique comporte un film de revêtement adhérant sur un côté au moins de la bande, le film de revêtement étant constitué de polyester ou de viscose ou de Nylon.

**18.** Fil composite **(11)** selon l'une quelconque des revendications 10 à 17 incluses, dans lequel le fil métallique **(12)** a une section transversale circulaire.

**19.** Fil composite **(11)** selon l'une quelconque des revendications 10 à 18 incluses, dans lequel le fil métallique **(12)** a une section transversale polygonale.

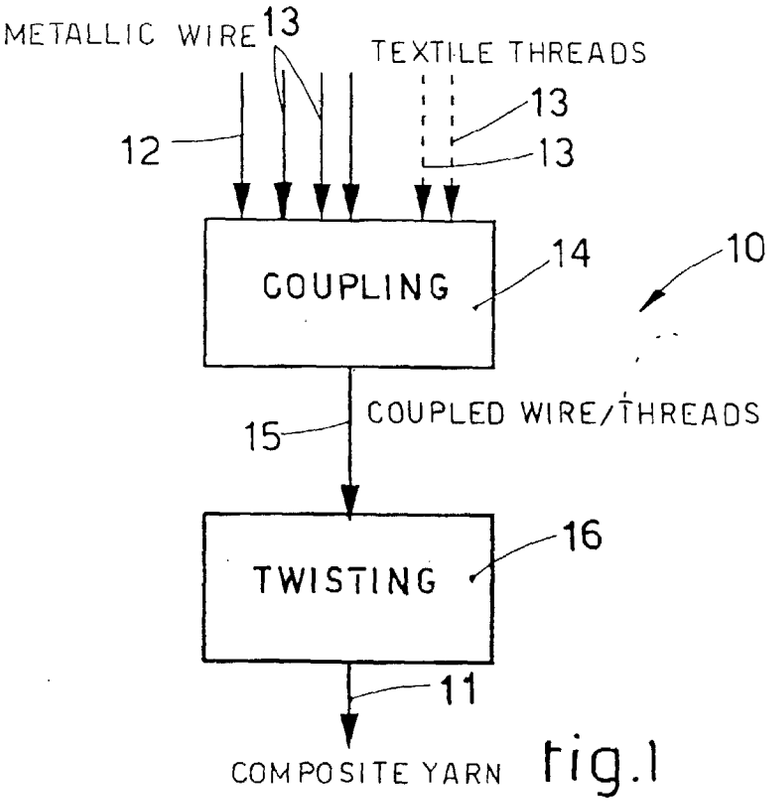



fig.1

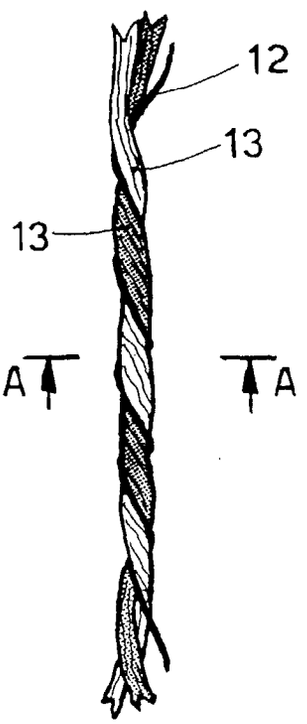



fig.2

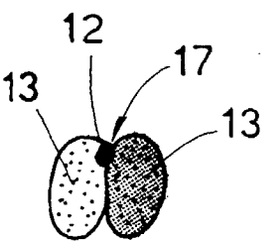



fig.3