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(54) AIR TEXTURIZING OR AIR ENTANGLING MULTIFILAMENT-MONOFILAMENT HYBRID YARN

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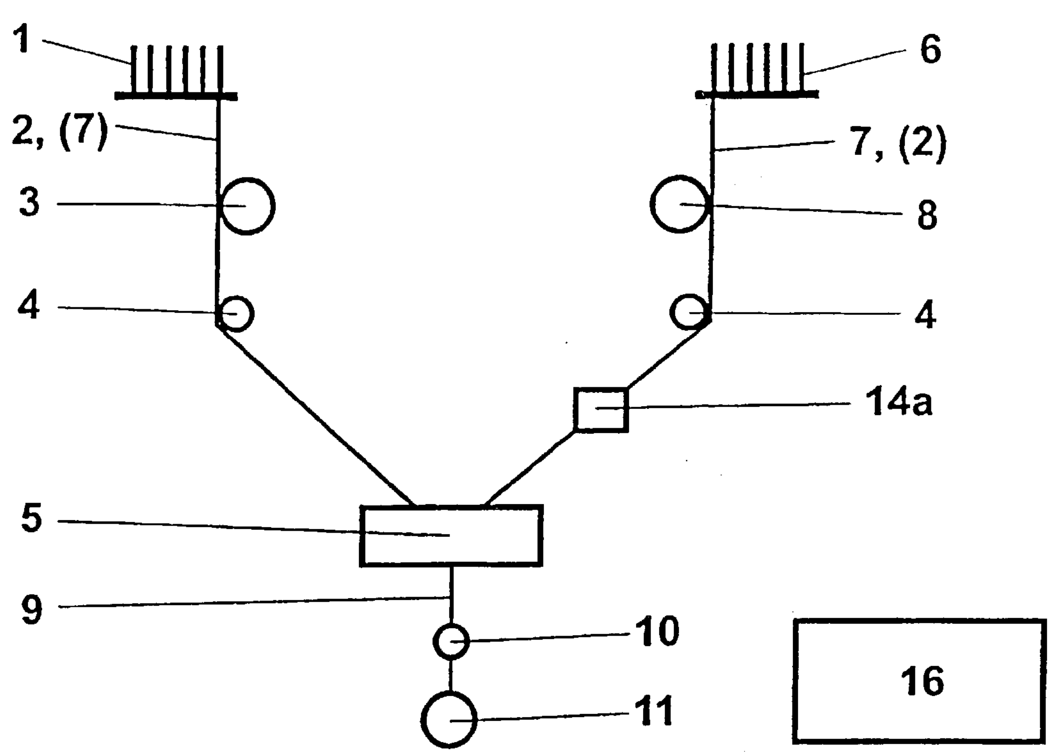
(57) **ABSTRACT**

The invention relates to a method for air texturizing or air entangling a metal or metal-containing monofilament yarn (**7**) with a multifilament yarn (**2**) to give a novel multifilament-metal monofilament hybrid yarn (**9**). The monofilament yarn (**7**) used may, for example, be a full-metal thread, a metal-coated chemical fiber or a metal wire strand. It is supplied to the air texturizing nozzle (**5**) as the stationary thread and/or the fancy yarn together with the multifilament yarn (**2**) and is texturized according to the invention. However, a plurality of differently textured monofilament yarns (**2**) can also be used. The multifilament yarn (**2**) or additional monofilament yarns (**7**) may consist of natural or synthetic continuous fibers. According to the invention, an adequately textile, twist-free, easily processible, very long-wearing and at the same time electroconductive hybrid yarn (**9**) is obtained. The main field of application is the further processing to electromagnetically shielding textile fabrics for electrostatic and/or electromagnetic shields for the protection of human beings and technical devices. Further embodiments relate to the production of abrasion-resistant textile fabrics for the automatic vehicle industry, of resistance heatable textile fabrics for the interior of homes or for passenger compartments of vehicles, and for shielding, anti-electrostatic, heatable and/or garments or textile products equipped with sensors.



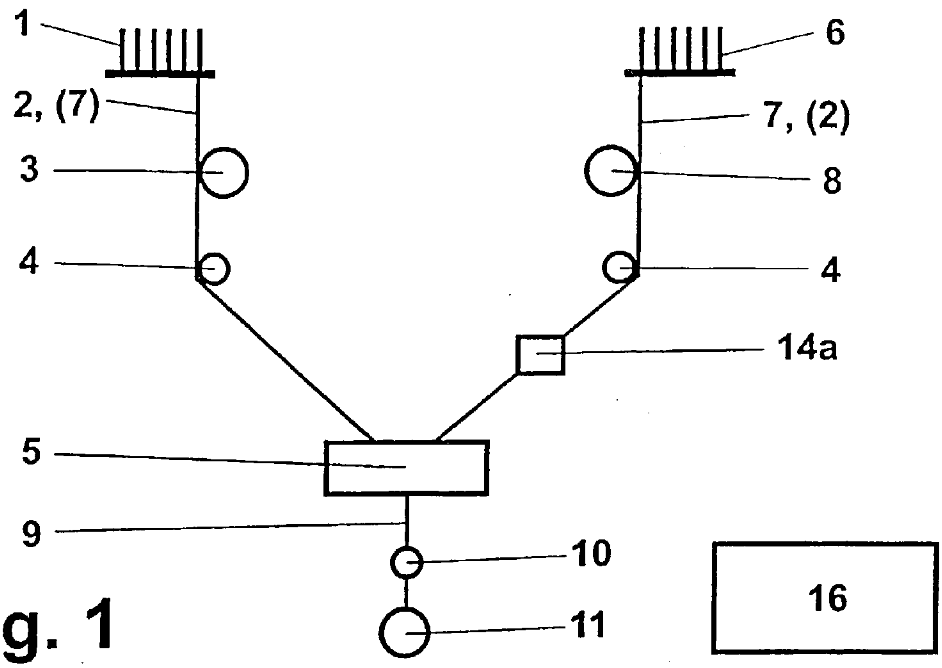
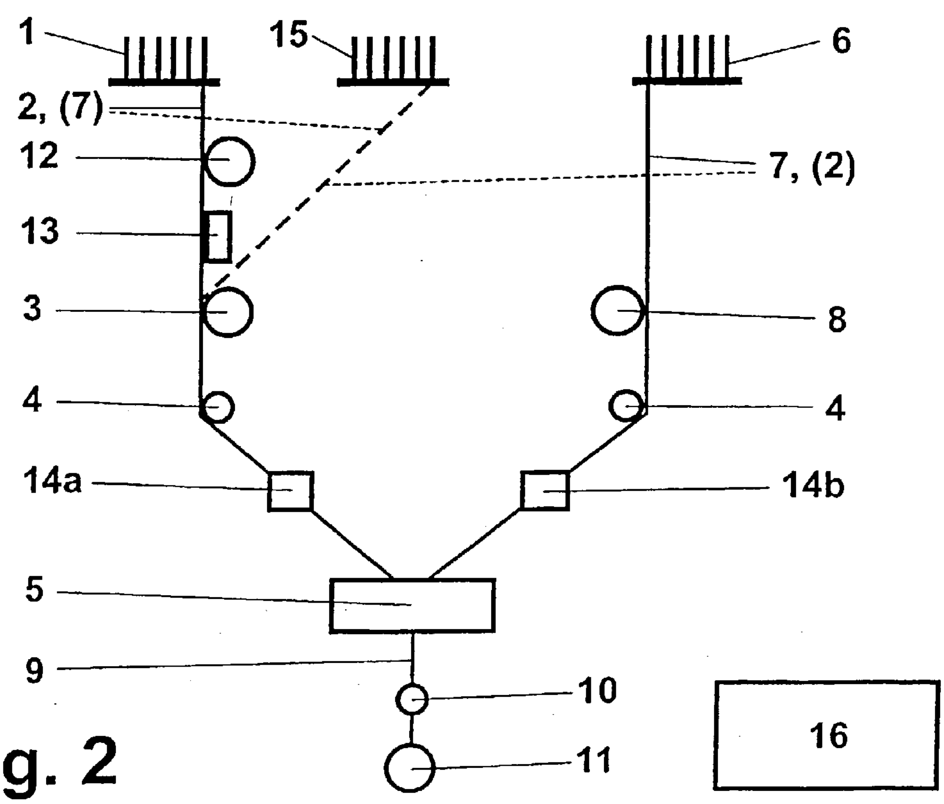

1
6
2, (7)
7, (2)
3
8
4
4
14a
5
9
10
11
16

Fig. 1


1
15
6
2, (7)
12
7, (2)
13
3
8
4
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14a
14b
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10
11
16

Fig. 2

AIR TEXTURIZING OR AIR ENTANGLING MULTIFILAMENT-MONOFILAMENT HYBRID YARN

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of the European patent application No. 99 124 961.6, which has been filed on Dec. 14, 1999 of which the entire disclosure is incorporated herewith by reference.

TECHNICAL FIELD

[0002] The invention relates to a method of air texturizing or air entangling of hybrid filament yarns, a product of the method and a application of the product in accordance with the introductory portion of the independent claims.

PRIOR ART

[0003] According to EP 0 696 331 B1 such air treatment techniques for the production of multicomponent yarns from endless-multifilament yarns or so-called multifilament yarns are known. In the air entangling technique a short fibre staple fibre yarn or a second multifilament yarn is entangled with a multifilament yarn. In the air jet texturizing, several multifilament yarns are combined with each other by a multicomponent loop yarn, or staple fibres are admixed to a multifilament yarn and a blended yarn is obtained. It is also possible to refine a single plain multifilament yarn to a loop yarn by a air jet texturizing. In all cases the air techniques are only applied to multifilament yarns of a synthetic or natural man-made fibre. Contrary to monofilament yarns, multifilament yarns consist of a plurality of single endless fibres or filaments. Thereby, air treated multicomponent yarns are built up exclusively from multifilament yarns, because it has been a general believe that a reliable combining of the components, i.e. of the multifilament yarns can be obtained only if each component is opened by the air flow and the individual filaments of all components interlace or entangle.

[0004] The invention makes reference to a prior art according to the U.S. Pat. No. 4,406,310. There, a monofilament yarn is processed together with at least one multifilament yarn by a air treatment of the kind mentioned above to a multicomponent yarn. To this end a monofilament yarn of a medium or high weight or denier value, possibly reinforced by a multifilament yarn, is air jet texturized as stationary thread together with a multifilament yarn with filaments of a low weight or denier value as fancy thread. Due to the relatively heavy mono-filament-stationary thread a multicomponent yarn of a high strength for a meaving into a carpet base fabric is obtained. For the air jet texturizing and specifically the forming of loops the multifilament-fancy thread must, however, include filaments which are as light as possible. A use of the monofilament yarn as fancy thread is not taken into consideration. Instead of that it was a general believe that a sufficient looping and a appealing yarn texturizing in the air flow is possible only by a supplying and opening of the at least one multifilament fancy thread by this method exclusively man-made fibres are air treated.

[0005] The EP 344 650 discloses a method in which a main fibre bundle with an accompanying fibre bundle are air entangled in such a manner that the main fibre bundle is opened only partly and is penetrated by fibres of the accompanying fibre bundle.

[0006] In the GB 2 214 937 a method of producing a glass fibre cable with metal cores for bullet-proof or flame-resistant textile fabrics is disclosed. The glass fibres of least one metal core and possibly synthetic man-made fibres are led together without any overfeed, subjected to a air flow treatment for an opening at low air pressures. By means of this a loose compound of filaments with a high total weight of 3000 dtex-96000 dtex is arrived at. The metal portion can vary between 20% and 80%. The metal cores remain to a large extent not influenced by the air flow treatment and serve predominantly for an increase of the tensile strength of the textile fabric cable. Contrary to the conventional air entangling or air blast texturizing process considerable coarser precursor materials with a much lower air volume per time without any positive overfeed and also without any thermal setting are processed. The final product displays practically no texturizing effect and no stretchability. The low pressure air treatment zone can be accomplished without a conventional texturizing apparatus and be integrated in the normal winding process between creel and reeling apparatus. The deflection panels used often in the conventional process for a multiple deflecting and improved texturizing of the thread are not present. Such deflection panels are considered rather to be a substantial obstacle for a incorporating metal filaments in air treatment processes.

[0007] The FR 2 730 507 discloses a similar method. In this, however, the effect yarn is delivered with an overfeed.

[0008] The final shaping proceeds after the texturizing by physical and chemical reaction.

SUMMARY OF THE INVENTION

[0009] The invention has as object to provide a simple production method for improved multicomonent yarns, a improved multicomponent yarn and a new application of the multicomponent yarn. This object is met in accordance with the invention by the features of the independent claims.

[0010] In accordance with the invention at least one multifilament yarn and at least one monofilament yarn are delivered in a air jet texturizing or air entangling process from at least on filament delivery apparatus to a pressurized air nozzle and are combined thereat by a air jet texturizing or air entangling to a multicomponent yarn, whereby at least a first monofilament yarn of the monofilament yarn is metalliferous and electrically conductive and is air jet texturized or air entangled with the at least one multifilament yarn. Accordingly, for the first time a metal or metalliferous monofilament yarn is processed into a multiple component yarn according to a method for a air jet texturizing or air entangling as disclosed for instance in the PE 0 696 331 B1. A reliable bond of the metalliferous monofilament yarn with the multifilament yarn is achieved in that the multifilament yarn is opened by the air flow and the individual filaments interlace with the depending from the overfeed more or less bent and loop forming metal containing monofilament yarn. Such a multifilament-metalmonofilament hybrid yarn has exceptionally large advantages and allows completely new applications. At the one side, the hybrid yarn possesses due to the intensive, specifically loop forming air treatment a high quality textile structure such as is expected from a texturized textile fibre, such as e.g. larger volume and voluminosity, increased mechanical strength and elasticity, improved moisture absorbing quality and much more. The hybrid yarn and textile fabric product from same can be washed, colored and printed and possess a extraordinary high resistance against rubbing. The main field of application of such textile fabrics is the production of electromagnetic shields with quite favorable attenuation properties and possibly large areas. A further advantage for all applications consists in the low specific weight of the hybrid yarn according to the invention and textile fabrics produced from same. Typical surface area weights are in the range of 150 g/m^2-450 g/m^2.

[**0011**] In an embodiment the first monofilament yarn is a metal thread and specifically a metal strand. The metal strand has hereby a monofilament character because it is not opened by the air treatment and is rather bent and looped as single filament. Because the metal monofilament yarn is not opened up by the air treatment it is possible to produce from the hybrid yarn lightweight electrically conductive textile fabrics for technical applications, coverings of rooms, garments and similar as a protection against a electrostatic charge and electromagnetic radiation. A further field of application for air flow texturized or air entangled metal monofilament-multifilament hybrid yarns is the production of electrically heatable coating materials, e.g. for motor vehicle seats, furniture or wall heaters. For specific applications the metal thread can be given prior to the air blast texturizing or air entangling a insulated coating preferably of a natural and/or synthetic polymeric and/or of inorganic material. By means of this it is possible to produce electromagnetically shielding textile fabrics with a chemically inert, specifically non oxidizing, electrically insulating or electrically only slightly conductive surface.

[**0012**] In another embodiment the first monofilament yarn is a metal thread in form of a metal coated monofilament yarn. The metal coated monofilament yarn may be e.g. a metal coated monofilament man-made fibre of a natural and/or synthetic polymeric and/or a metal coated monofilament yarn of an inorganic material, for instance a metal coated carbon thread. Regarding the processability in the air flow, a extremely low specific weight, a required electrical conductivity and/or a extent of a surface to be contacted, the materials and diameter of such a metal thread can be optimized for a desired application.

[**0013**] In a preferred embodiment the first monofilament yarn comprises at least one metal of the group iron, steel, aluminum, titanium, copper, silver, gold or an alloy of these or other metals. Specifically the first monofilament yarn is a metal thread and/or comprises a metal coating, which thread or coating consists of iron, steel, aluminum, titanium, copper, silvercoated copper, silver, gold or an alloy.

[**0014**] In another embodiment the at least first monofilament yarn is applied as a stationary thread and/or as fancy yarn. The selection between monofilament stationary thread and fancy thread can be influenced by the desired physical properties or by the desired appearance. The monofilament stationary thread has for instance a shorter length and can be selected thicker, wherewith the mechanical strength is increased and the electrical resistivity is decreased. At the monofilament fancy thread the obtainable textile or optical effect is besides the highly efficient electromagnetic screening effect also of advantage.

[**0015**] In a further embodiment two or more monofilament yarns, specifically at least two metal threads of differeing properties are air jet texturized or air entangled with at least one multifilament yarn. These properties may, thereby, pertain to the material or the cross-sectional shape, thickness, pre-treatment, etc. of the monofilament yarn. In this manner it is possible to combine by a easy procedure the properties of different monofilament yarns in a hybrid yarn. In an embodiment two metal threads, specifically two metal coatings, with different colors, e.g. of silver or gold are selected and fed from the feeding apparatus specifically with a overfeed of the same magnitude.

[**0016**] In a further embodiment exactly one metal containing monofilament yarn is air jet texturized or air entangled with one or possibly a few multifilament yarn(s). Also at such a mixture with a minimal or low number of components a excellent connection between the mono- and multifilament constituents is still obtained. Moreover, such a hybrid yarn displays a low weight, comparably high rupture strength and a hard-wearing property and a advantageous texture.

[**0017**] In another embodiment individual overfeeds are set for the at least one first monofilament yarn, specifically the metal thread and/or for the at least one multifilament yarn at a corresponding filament delivery apparatus. By means of this the textile, optical and electrical properties of the hybrid yarn can be changed and optimized in a planned manner. Furthermore, a monofilament man-made fibre at natural or synthetic polymerics or of inorganic materials can be admixed at the air jet texturizing or air entangling as second monofilament yarn.

[**0018**] In other embodiments a multifilament man-made fibre of natural and/or synthetic polymerics is used as multifilament yarn. Prior to the air jet texturizing or air entangling, the multifilament yarn can be stretched in a stretching apparatus and especially thermically set in a following heating apparatus, e.g. a autoclave or a on-line or in-line heating apparatus. By these additional processing steps the strength of the hybrid yarn is improved further. Moreover, the texture can he advantageously influenced by a wetting of the multifilament and/or monofilament yarn by water or other liquids.

[**0019**] In a second aspect the invention refers to a multicomponent yarn or hybrid yarn which is produced in accordance with the above disclosed method and features the above mentioned advantages.

[**0020**] In a third aspect the invention relates to an application of such a produced multicomponent yarn for the production of an electrically conductive textile fabric, specifically for the protection of human beings and technical devices and apparatuses against electromagnetic radiation and/or electrostatic charging. The textile fabrics produced from the hybrid yarn can display also an optically appealing metal luster or glitter character or be delevopped into preferably over the entire surface electrically resistance heatable textile fabrics. Due to the textile properties obtained by the air treatment, the hybrid yarn is specifically suitable for the production of any kind of textile fabrics for garments, for furniture, in the living area and similar. Anti-electrostatic clean room garments which in accordance with the invention are produced with metal-filament yarn instead with metal short staple fibers as has been done until now have the advantage that a production of dust by staple fibers is impossible. Flame retarding textile fabrics can be produced by air jet blowing or air entangling of the metal monofilament yarn together with a modified multifilament-base yarn, e.g. on a polyester or polyamide base.

[0021] In an embodiment a plane-like textile fabric is produced by a weaving process, a knitting process or a combination of these processes. Additionally, a conductive three-dimensional textile fabric of several layers of plane-like textile fabrics can be produced of which at least one layer is conductive.

[0022] In a different embodiment at least one multicomponent yarn in accordance with the invention is worked in one axis, specifically as weft, or in two axes, specifically as weft and warp, into the plane-like textile fabric. In both configurations a preferably plane-like shield of a high quality, low weight and possibly large surface area can be produced.

[0023] In further embodiments, adjacent threads of a multicomponent yarn are arranged at a non-contacting distance between each other and/or a metal containing monofilament yarn which includes a insulating coating is used for the production of a textile fabric which is electrically conductive exactly along one axis. Or, in order to produce a surface plane bound electric conductive textile fabric, threads of the multicomponent yarn are arranged at a distance between each other for a desired electromagnetic attenuation, and multicomponent yarn comprises specifically a monofilament yarn containing metal with a electrically conductive surface. Or, in order to produce a three-dimensional textile fabric which is electrically conductive in three axes, the threads of the multicomponent yarn are arranged for a desired electromagnetic attenuation sufficiently close inside of and between layers of the electrically conductive textile fabric, and the multicomponent yarn includes specifically metal containing monofilament yarn with a electrically conductive surface. A contacting between threads of the multicomponent yarn **9** can proceed for instance via the surface, at points of intersection, over ends of threads or through a grounding. The threads can, however, display a high shielding effect without any mutual contacting and/or grounding. By the density or possibly orientation of the shielding hybrid yarn threads a magnitude of the electromagnetic attenuation and specifically a set frequency range shielding can be set.

[0024] Further embodiments, advantages and applications of the invention follow from the dependent claims and the now following description with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] **FIG. 1** illustrates exemplarly a first air texturizing method to the production of a multifilament-monofilament hybrid yarn in the stationary thread-fancy yarn process in accordance with the invention;

[0026] **FIG. 2** illustrates a air texturizing method according to **FIG. 1** with additional process steps for the multifilament yarn.

[0027] Same parts in the Figures are provided with the same reference numerals.

PROCEDURES FOR EMBODIMENT OF THE INVENTION

[0028] In the context of this invention multifilament-monofilament hybrid yarn or in short hybrid yarn designates a multicomponent yarn which consists of one or several multifilament component(s) and one or several monofilament component(s).

[0029] According to **FIG. 1, a** method of a air jet texturizing or air entangling of filament yarns **2, 7** is disclosed in which at least one multifilament yarn **2** and at least one second filament yarn **7** are doffed from creels **1, 6** with normally six creel points each, which are delivered through at least one filament delivering device **3, 8** to a pressurized air nozzle **5** and are combined thereat by a air jet texturing or a air entangling to a multicomponent yarn **9**.

[0030] In order to realize the texturizing loop production in the multicomponent yarn **9**, the multifilament yarn **2** and/or the second filament yarn **7** are fed to the pressurized air nozzle **5** with an overfeed.

[0031] At the filament delivering device **3** and/or **8** a overfeed of typically a few % up to 300% relative to the reeling device **11** is set. Moreover, **4** designates exemplary guide rollers, **10** a stabilizing roller and **16** schematically a driving and control apparatus for the entire air treatment apparatus.

[0032] In accordance with the invention, now, a monofilament yarn **7** which contains metal and is electrically conductive along its axis, specifically a single filament metal thread **7** or a single filament like metal strand **7** is used as at least one of the at least one second filament yarn **7**. The metal strand **7** is a thin multiconductor metal wire **7** which remains unopened during the air treatment and, therefore, acts the same as a single filament metal thread. Accordingly, the monofilament yarn **7** can not be opened by the air treatment into individual filaments. It is, however, the more surprising that in spite of this, solely by the opening of the one multifilament yarn **2** or possibly the few multifilament yarns **2** in the air current, and by the flexibility and bendability of the metal thread **7** an excellent connection with the metal thread **7** to a hybrid yarn **9** is arrived at. The hybrid yarn **9** possesses the desired texture and combines in a advantageous way low weight with a high durability. The metal thread **7** adds advantageous electrical, optical and/or texture effects. The hybrid yarn **9** is specifically suitable for motor vehicle cover fabrics, furniture fabrics, furnishing fabrics and technical fabrics as set forth further below. The hybrid yarn **9** is specifically given new properties by the monofilament yarn **7**, called in short metal-monofilament yarn **7** or short metal thread **7**. The metal thread can also have a composite structure, e.g. a polymeric matrix with an embedded metal, specifically small metal spheres or metal needles. By the polymeric portion and specifically the polymeric matrix it is also possible to institute a desired frequency and/or temperature dependency of the electrical conductivity. The polymeric materials mentioned in the application can possibly also be doped in order to retain semi-conductive or weakly conductive properties in the polymeric portion. In the following, a few embodiments are disclosed.

[0033] The at least one metal-monofilament **7** can be air jet texturized or air entangled with the multifilament yarn **2** as stationary thread and/or effect thread. According to **FIG. 1** the at least one metal thread **7** is fed to the pressurized air nozzle **5** as stationary thread and the at least one multifilament yarn **2** as effect thread; the opposite association metal thread **7**—effect thread and multifilament yarn **2**—stationary thread is possible, as well, and e.g. in such a case preferred, in which the contact surface is to be increased or the optical effect be improved. Normally, the at least one stationary thread, here the metal thread **7**, is wetted by water from a wetting device **14***a*.

[**0034**] A advantageous combination of properties in the hybrid yarn **9** is arrived at in that at least two monofilament yarns **7**, specifically two metal threads **7**, of different materials and/or different cross-section and/or different pretreatment are air jet texturized or air entangled with the at least one multifilament yarn **2**. In **FIG. 1** for instance, two metal monofilament stationary threads **7** delivered in parallel from the delivering device **8** can be air jet texturized or air entangled with at least one multifilament effect threads **2** from the delivery device **3**. In the same way a metal-monofilament effect thread **7** from the delivering device **8** can be air jet texturized or air entangled with a stationary thread from the delivering device **3**, which in turn is a combination of a multifilament yarn **2** and possibly a metal-monofilament yarn **7**. For specific electrical, textile or optical effects it is also possible to deliver from the delivering device **8** parallel two monofilament effect threads **7** with differing colors, of silver or gold or other combinations. Moreover, also several multifilament yarns **2** with differing properties can be delivered from the delivering device **3** and possibly **8** and be air jet texturized or air entangled with the metal-monofilament yarn **7**.

[**0035**] Preferably, an individual overfeed is set at the corresponding filament delivering device **3**, **8** for the at least one metal thread **7** and/or for the at least one multifilament yarn **2**, specifically for each monofilament yarn **7** and/or for each multifilament yarn **7**, in order to optimize the air jet texturizing or air entangling in view of the desired properties of the hybride yarn **9**. Filament yarns **2**, **7** delivered parallel from the same delivering device **3**, **8** are given the same overfeed.

[**0036**] In another embodiment exactly one monofilament metal thread **7** and/or exactly one multifilament yarn **2** are together air jet texturized or air entangled. By a suitable selection of the metal thread **7** and by the air treatment the desired textile, mechanical and other properties can be given to the multifilament yarn **2**. By the use of one single multifilament yarn **2** and one single metal thread **7** the weight of the resulting hybrid yarn **9** can be minimized, too.

[**0037**] In experiments it has for the first time been proven that the air jet texturizing with metal monofilament yarns **7** can be accomplished. Suitable monofilament yarns **7** consist for instance of iron, steel, specifically stainless steel, aluminum, titanium, copper, silver cladded copper, silver gold or alloys of these and other metals. The metal thread diameter is preferably selected to be in a range of about 0.01 mm-0.15 mm, preferably 0.01 mm-0.1 mm, specifically preferably 0.03 mm-0.07 mm. At a diameter of 0.01 mm a weight is arrived, depending from the prevailing materials, of about 2 dtex-16 dtex, whereby dtex (=Dezitex or 1/10Tex) designates the weight of 10'000 m thread length in grams and equals about 1.1 denier. The experimentally determined limit for the application of the air entangling or air jet texturizing consists about in a weight of a single metal thread **7** of more than 600 dtex. In order to obtain a better electrical conductivity an as large as possible diameter of the metal thread **7** is selected. In case of aluminum the diameter corresponding to 600 dtex amounts to about 0.15 mm. Resulting yarn gauges of the hybrid yarn **7** amount typically to 50 dtex to 3000 dtex. The metal portion is selected typically in the range of 10%-30%, specifically about 20%.

[**0038**] The air treatment involves preferably an air jet treatment, whereby the pressurized air nozzle **5** is an air texturizing nozzle **5**. Particulars of the air treatment methods and specifically of the air jet texturizing technique are disclosed for instance in the EP 0 696 331 B1. In order to form loops a predeterminable overfeed is set. Pressurized air of 5-15 bar is fed to the jet nozzle. A supersonic speed is produced in the jet channel and the forming of loops is presumably caused in a shock wave zone. A baffle body for a deflecting and entangling of the filaments may be located below the air jet nozzle. Details of the apparatus and of the method and more precise model ideas are disclosed in the EP 0 696 331 B of which the contents shall be considered completely incorporated herein by reference.

[**0039**] As a second monofilament yarn **7** additionally a monofilament man-made fiber of natural or synthetic polymerics or inorganic materials can be used. As a multifilament yarn **2**, e.g. a multifilament man-made fiber of natural and/or synthetic polymerics shall be used of these as such known materials, until now only the yarns **2**, **7** of synthetic and natural man-made fibers have been subjected to air treatment techniques. By the employment of the above-mentioned materials a large diversity of multifilament-metalmonofilament hybrid yarns **9** can be produced and a wide spectrum of application for some be exploited.

[**0040**] It is also possible to use as second monofilament yarn **7** a monofilament synthesis fiber on a polyamide, polyester or polypropylene basis or a monofilament natural man-made fibre on a cellulose or celluloseacetate basis. The multifilament yarn **2** includes e.g. filaments on a polyamide, polyester and/or polypropylene basis or texturized, specifically false-twist texturized components.

[**0041**] **FIG. 2** illustrates an embodiment with additional textile processing steps. Thus, the multifilament yarn **2** from a first creel **1** is partly or completely stretched in a stretching apparatus ahead of the air jet texturizing or air entangling, and specifically thermically set in a following heating apparatus **13**. Additionally, a e.g. completely stretched multifilament yarn **2** can be delivered from a second creel **15** to the pressurized air nozzle **5** and air jet texturized or air entangled with the monofilament yarn **7**. Also illustrated is a wetting device **14***a*, **14***b* ahead of the air jet texturizing or air entangling for a wetting of the multifilament yarn **2** and/or the monofilament yarn **7** by a liquid, specifically water. The structure and the mechanical properties of a man-made-hybrid yarn **9** can be influenced in a as such known procedure by the stretching, setting and wetting. In addition, it is shown in the present invention that a conventional wetting device **14***a*, **14***b* can also be successfully applied for the wetting of metal monofilament yarns **7**.

[**0042**] In **FIG. 2** the functions of the multifilament yarn **2** and the metal monofilament yarn **7** as stationary and effect threads are interchangeable as before, i.e. from the creel **1** and/or **15** effect yarns and from the creel **6** stationary threads or vice versa can be delivered. Moreover, it is also possible to deliver from the creel **15** a possibly metal monofilament yarn **7** parallel to the multifilament yarn **2** from creel **1** via the delivering device **3** to the pressurized air nozzle **5**. In this case it is possible to additionally deliver from the delivering device **8** at least one multifilament yarn **2** and/or monofilament yarn **7** with individual overfeed. Further variants for parallel or individual, i.e. independent overfeeds of multifilament yarns **2** and/or monofilament yarns **7** and for additional processing steps such as stretching of multifilament yarn **2** can be realized directly by adding the corresponding processing steps and processing units, respectively.

[**0043**] A further subject of the invention is the above described multifilament-metal monofilament hybrid yarn **9** which is produced by one of the above described air entangling and/or air jet texturizing methods.

[**0044**] Subject of the invention is also the use of the multifilament-metal thread or multifilament-metal strand hybrid yarn **9** for the production of electrically conductive textile fabrics. Such textile fabrics are characterized as initially mentioned by advantageous electrical and moreover textile, optical and mechanical properties.

[**0045**] An embodiment refers to the production of a plane-like textile fabric by planar textile production methods known as such, e.g. weaving methods, knitting methods or combinations of these methods, by using of a multicomponent yarn **9** or several different multicomponent yarns. So-called three-dimensional textile fabrics can be produced from several layers of planar textile fabrics. According to one embodiment three-dimensional textile fabrics are equipped with at least one electrically conductive layer. The electrical properties of the textile fabrics according to the invention can be set inside of or at the surface or possibly in various directions. As example five variants shall be mentioned: (i) The multicomponent yarn **9** is worked into the planar textile fabric along one axis, specifically as weft. In order to produce a textile fabric which is electrically conductive precisely along one axis, adjacent threads of the multicomponent yarn **9** should be arranged at a sufficient non-contacting distance from each other and/or a metal containing monofilament yarn **7** with an insulating coating shall be used for the multicomponent yarn **9**. (ii) The multicomponent yarn **9** is worked into the planar textile fabric along two axes, specifically as weft and warp. In order to produce planarly electrically conductive textile fabric, threads of the multicomponent yarn **9** should be sufficiently close to each other for a desired electromagnetic attenuation. The multicomponent yarn shall include specifically metal containing monofilament yarns **7** with an electrically conductive surface for an improved contacting over the surface of the hybrid threads **9**. (iii) In order to produce a three-dimensional textile fabric which is electrically conductive in three axes, threads of the multicomponent yarn **9** should be arranged at a sufficiently close distance inside of and between electrically conductive layers. The multicomponent yarn **9** shall specifically include metal containing yarns **7** with an electrically conductive surface. (iv) The textile fabric can be produced with an electrically conductive surface in that a metal containing monofilament yarn **7** with an insulating coating is used for the multicomponendt yarn, and/or a layer of the textile fabric located at the outside is designed electrically insulating. (v) The textile fabric can be produced with an electrically conductive surface in that a metal containing monofilament yarn **7** with an electrically conductive surface is used for the multicomponent yarn.

[**0046**] Onedimensional conductive textile fabrics can be designed for specifically light weight and are e.g. suitable for polarisation dependent electromagnetic shielding. Two-dimensionally or planarly conductive textile fabrics give for arbitrary polarisation high shielding values. In comparison with metal foils they possess a quite advantageous mix of features of electrical attenuation effect, can be produced with large surface areas, can be easily cut to size and have specifically a mechanical rigidly. Electrically surface insulated conductive textile fabrics can be metal in a high voltage environment and similar. Electrically surface conductive textile fabrics can be used for electrostatic discharge or predetermined charging for instance in clean rooms.

[**0047**] Further embodiments refer to textile fabrics for the protection of persons and/or technical devices and apparatus against a electrostatic charging and/or electromagnetic radiation. An antistatic effect is arrived at by a use of silver or copper simply by discharging to the environmental air. The textile fabric can alternatively be grounded. In the same way such textile fabrics can be applied as Faraday screen against a higher frequency radiation, e.g. by grounding. It is possible to produce from the textile fabrics for instance shielding mats or shielding claddings for electronic apparatuses or persons, specifically in the field of computers, motor vehicles, air craft, space travel, communications medicine or security, e.g. for an improvement of security against interception of military or police installations or, however, for motor vehicle covering fabrics, furniture fabrics, carpets, office separation walls and similar, for front walls of buildings, wall constructions and/or roofs, specifically roof insulations, or for protective garments. The protective garments can be designed specifically for a shielding against mobile telephone apparatus radiation or also textile coverings for mobile telephone apparatuses. Of interest is especially the use for the production of floor covers, wall covers and/or ceiling covers for the shielding of rooms or passenger compartments of all kinds of vehicles, specifically in aircraft or in space travel. In the medical field a magnetic shielding of patients, staff and apparatuses in the environment magnetic resonance apparatuses or similar is of importance.

[**0048**] The electromagnetic shielding effect of such textile fabrics has been examined in experiments according to the MIL-STD 285 standards and the NSA 65-6 standards. Hereto, a textile fabric with a surface area of several m^2 is clamped onto a frame and an electrical and magnetic reduction between an emitter at the one side and a receiver at the other side of the textile fabric is measured. The hybrid yarns **9** used for the production of the textile fabric included about 10-30% by weight copper or stainless steel. Up to now electrical shielding values of up to about 100 dB and magnetic shielding values of up to about 50 dB have been measured in a frequency range between 100 MHz and 18 GHz. Depending from the constitution of the material, selection of the diameters and selection of the surface conductability of the metal-monofilament yarn **9** and also from the details of the textile production the conductivity and the dependency from frequency and temperature, as well, of the electromagnetic shielding can be selectively modified. Electrical resistance measurings at the textile fabrics display resistance values of the few Ohms per surface area.

[**0049**] According to a further embodiment the textile fabrics can be designed as electrical heating resistor in that electrical connections for a suitable source of current are provided and a hybrid yarn **9** with a suitable resistance is selected. Preferably, electrically heatable seat fabrics for motor vehicles or furniture, electrically heatable coatings for motor vehicles, dwellings and similar, e.g. textile floor heaters, textile wall heaters or textile ceiling heaters, or electrically heatable garments are produced from such textile fabrics. The extremely high abrasion value of the textile fabrics of significantly more than 100'000 cycles which are obtainable by the metal-monofilament yarn **7** is specifically advantageous for applications in motor vehicle constructions. The functions of the resistance heatability and shielding can be also combined with each other in a single electrically conductive textile fabric.

[**0050**] In another embodiment the electrically conductive textile fabric is designed as supporting material and/or as structural part of intelligent systems, specifically of a sensor, emitter, receiver and/or information processing module. At least one metal containing monofilament yarn **7** of the multicomponent yarn **9** is specifically used as electrical conduit for the supply of current, for the transmission of information, as antenna and/or as sensor, for instance as resistance-temperature sensor.

[**0051**] All together the air treatment in accordance with the invention allows the producing of a non-twisted hybrid yarn **9** also with a metal containing or completely metal monofilament yarn **7**, i.e. with a metal thread **7** or a metal strand **7**, whereby the hybrid yarn **7** can be processed and especially woven such as a normal textile yarn. The problems of the difficult twisting properties or weaving properties of metal threads in conventional spinning processes are solved by the air entangling or air jet texturizing in accordance with the invention. The experiments reveal that sufficiently thin metal threads are suitable for the texturizing in a conventional air entangling or air jet texturizing process.

1. Method of air jet texturizing or air entangling of filament yarns (**2**, **7**), whereby at least one monofilament yarn (**7**) and at least one multifilament yarn (**2**) are delivered from at least one filament delivering device (**3**, **8**) to a pressurized air nozzle (**5**) and combined thereat by air jet texturizing or air entangling to a multicomponent yarn (**9**), whereas in that at least one monofilament yarn (**7**) of the at least one monofilament yarn (**7**) contains metal and is electrically conductive and is air jet texturated or air entangled with the at least one multifilament yarn (**2**), and whereas the monofilament yarn (**7**) includes metal strand as far as it remains unopened during the air treatment and accordingly behaves the same on a singlefilament-metal thread, and whereas the monofilament yarn (**7**) is delivered to the pressurized air nozzle (**5**) with a set overfeed.

2. Method according to claim 1, characterized in that

a) the first monofilament yarn (**7**) is a metal thread (**7**),

b) specifically the metal thread (**7**) is a metal strand (**7**) and

c) specifically the metal thread (**7**) includes a insulating coating preferably of a natural and/or synthetic polymeric and/or an inorganic material.

3. Method according to one of the claims **1**-**2**, characterized in that

a) the first monofilament yarn (**7**) is a metal thread in form of a metal coated monofilament yarn (**7**),

b) specifically the metal coated monofilament yarn (**7**) is a metal coated monofilament manmade fibre of a natural and/or synthetic polymeric and/or a metal coated monofilament yarn (**7**) of an inorganic material.

4. Method according to one of the claims **1**-**3**, characterized in that

a) the first monofilament yarn (**7**) contains at least one metal of the group iron, steel, aluminum, titanium, copper, silver, gold or an alloy of these and other metals and

b) specifically the first monofilament yarn (**7**) is a metal thread (**7**) and/or comprises a metal coating, which consist(s) of iron, steel, aluminium, titanium, copper, silver-coated copper, silver, gold or an alloy.

5. Method according to one of the claims **1**-**4**, characterized in that

a) the first monofilament yarn (**7**) or the first monofilament yarns (**7**) are (is) as stationary thread and/or effect thread air jet texturized or air entangled with the multifilament yarn (**2**) and/or

b) at least two first monofilament yarns (**7**), specifically at least two metal threads (**7**) of differing materials and/or with differing cross-sections and/or with differing pretreatments are air jet texturized or air entangled together with the multifilament yarn (**2**).

6. Method according to one of the claims **1**-**5**, characterized in that

a) two metal threads (**7**), specifically two metal coatings with differing colours are selected,

b) specifically a metal thread (**7**) or a metal coating of silver and a metal thread (**7**) or a metal coating of gold are selected, and

c) specifically the two metal threads (**7**) or two metal coated monofilament yarns (**7**) are delivered from the delivering device with an equal overfeed.

7. Method according to one of the claims **1**-**6**, characterized in that

a) a diameter of the first monofilament yarn (**7**) is selected in a range of 0.01 mm-0.15 mm, preferably 0.01 mm-0.1 mm, specifically preferably 0.03 mm-0.07 mm and/or

b) a weight of the first monofilament yarn (**7**) of less than 600 dtex is selected.

8. Method according to one of the claims **1**-**7**, characterized in that

a) exactly one monofilament yarn (**7**) is air jet texturized or air entangled with the at least one multifilament yarn (**2**) and/or

c) the multicomponent yarn (**9**) is produced with a weight in the range of 50 tdex-3000 dtex.

9. Method according to one of the claims **1**-**8**, characterized in that

a) an individual overfeed is set for the at least one monofilament yarn (**7**) and/or for the at least one multifilament yarn (**2**) at a corresponding filament delivering device (**3**, **8**) and

b) specifically an individual overfeed is set for each first monofilament yarn **(7)** and/or for each multifilament yarn **(2)** at a corresponding filament delivering device **(3, 8)**.

10. Method according to one of the claims **1-9**, characterized in that

a) as a second monofilament yarn **(7)** a monofilament man-made fiber of natural and/or synthetic polymerics and/or of inorganic materials is air jet texturized or air entangled and/or

b) as the at least one multifilament yarn **(2)** a multifilament man-made fiber of natural and/or synthetic polymerics is air blast texturized or air entangled.

11. Method according to one of the claims **1-10**, characterized in that

a) a monofilament synthetic fibre on a polyamide, polyester or polypropylene basis is air jet texturized or air entangled as second monofilament yarn **(7)** and/or

b) a monofilament natural main-made fibre on a cellulose or cellulose acetate basis is air jet texturized or air entangled as second monofilament yarn **(7)**.

12. Method according to one of the claims **1-11**, characterized in that

a) multifilament yarn **(2)** on a polyamide, polyester and/or polypropylene base is air jet texturized or air entangled as the at least one multifilament yarn **(2)** and/or

b) a multifilament yarn **(2)** with texturized, specifically false-twist texturized components is air jet texturized or air entangled as the at least one multifilament yarn **(2)**.

13. Method according to one of the claims **1-12**, characterized in that at least one multifilament yarn **(2)** is partly stretched or completely stretched in a stretching apparatus **(12)** prior to the air jet texturizing or air entangling and specifically is thermically set in a following heating apparatus **(13)**.

14. Method according to one of the claims **1-13**, characterized in that the first monofilament yarn **(7)** and/or the multifilament yarn **(2)** is (are) method in a wetting device **(14*a*, 14*b*)** prior to the air jet texturizing or air entangling by a liquid, specifically water.

15. Multicomponent yarn **(9)**, characterized in that it is produced in accordance with one of the preceding claims.

16. Application of a multicomponent yarn **(9)**, characterized in that

a) at least one multicomponent yarn **(9)** is produced in accordance with one of the claims **1-14** and

b) an electrically conductive textile fabric is produced by a use of the at least one multicomponent yarn **(9)**.

17. Application of a multifilament yarn **(9)** according to claim 16, characterized in that

a) the textile fabric is a planar textile fabric which is produced by a textile planar production process, specifically a weaving process, a knitting process or a combination of these processes,

b) specifically the textile fabric is a three-dimensional textile fabric which is produced of several layers of planar textile fabrics, of which at least one textile fabric is electrically conductive, and

c) specifically that several differing multicomponent yarns **(9)** are used for the production of the textile fabric.

18. Application of a multicomponent yarn **(9)** according to claim 17, characterized in that

a) the multicomponent yarn **(9)** is worked into the planar textile fabric along one axis, specifically as weft, or

b) the multicomponent yarn **(9)** is worked into the planar textile fabric along two axes, specifically as warp and weft.

19. Application of a multicomponent yarn **(9)** according to one of the claims **17-18**, characterized in that

a) in order to produce a textile material which is electrically conductive exactly along one axis, adjacent threads of the multicomponent yarn **(9)** are arranged in a not contacting distance between each other and/or a metal containing monovilament yarn **(7)** with an insulating coating is used as the multicomponent yarn **(9)**, or

b) in order to produce a planar electrically conductive textile fabric threads of the multicomponent yarn **(9)** are arranged sufficiently close to each other for a desired electromagnetic attenuation, and specifically that the multicomponent yarn **(9)** comprises metal containing monofilament yarn **(7)** with an electrically conductive surface, or

c) in order to produce a three-dimensional textile fabric which is electrically conductive in three axes, threads of the multicomponent yarn **(9)** are located at a sufficiently close distance from each other inside and between electrically conductive layers of the textile fabric and specifically the multicomponent yarn **(9)** comprises metal containing monofilament yarn **(7)** with an electrically conductive surface.

20. Application of a multicomponent yarn **(9)** according to one of the claims **16-19**, characterized in that

a) the textile fabric is produced with an electrically insulating surface in that a metal containing monofilament yarn **(7)** with a insulating coating is used for the multicomponent yarn **(9)** and/or a layer of the textile fabric located at the outside is made electrically insulating, or

b) the textile fabric is produced with an electrically conductive surface in that a metal containing monofilament yarn **(7)** with an electrically conductive surface is used for the multicomponent yarn **(9)**.

21. Application of a multicomponent yarn **(9)** according to one of the claims **16-20**, characterized in that the electrically conductive textile fabric is designed for the protection of persons and/or technical devices and apparatuses against an electrostatic charging and/or electromagnetic radiation.

22. Application of a multicomponent yarn **(9)** according to one of the claims **16-21**, characterized in that following is produced from the textile material

a) shielding mats or shielding claddings, specifically in the computer, motor vehicle, aircract, space travel, communication, medicinal or security field an/or

b) motor vehicle cover fabrics or furniture fabrics and/or

c) floor coverings, wall coverings or ceiling coverings for rooms or passenger compartments and/or

d) shields for building front walls, wall structures and/or roofs, specifically roof insulations, and/or

c) protective garments.

23. Application of a multicomponent yarn (**9**) according to one of the claims **16**-**22**, characterized in that

a) the electrically conductive textile fabric is designed as an electrical resistance heater,

b) specifically electrically heatable seat fabrics for motor vehicles or furniture are produced from the textile fabric,

c) specifically electrically heatable floor coverings, wall coverings and/or ceiling coverings or electrically heatable garments are produced.

24. Application of a multicomponent yarn (**9**) according to one of the claims **16**-**22**, characterized in that

a) the electrically conductive textile fabric is designed as supporting material and/or structural portion of intelligent systems, specifically of a sensor, emitter, receiver and/or an information processing module,

b) specifically at least one metal containing monofilament yarn (**7**) of the multicomponent yarn (**9**) of the electrically conductive textile fabric is used as electrical conductor for the supply of electrical power, for the transmittal of information, as antenna and/or as sensor, for instance as resistance-temperature sensor.

25. Electrically conductive textile fabric, characterized in that is includes at least one multicomponent yarn (**9**) according to claim 15.

26. Electrically conductive textile fabric according to claim 25, characterized in that the textile fabric is selected from the textile fabrics described in claims **17**-**24**.

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