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(54) **KNITTED COMPONENT WITH A SURFACE AREA FORMED WITH HIGH-TENACITY YARN**

(57) A knitted component may include a first surface and a second surface, the first surface facing opposite the second surface, the first surface including at least a first yarn and the second surface including at least a second yarn. The first and second yarns may be different. The first surface and the second surface may be secured via a knit structure of the knitted component, where the first surface includes an exposed first surface area, where at least 65% of the exposed first surface area is formed of the first yarn, and where the first yarn has a tenacity of at least 5 grams per denier (g/d).

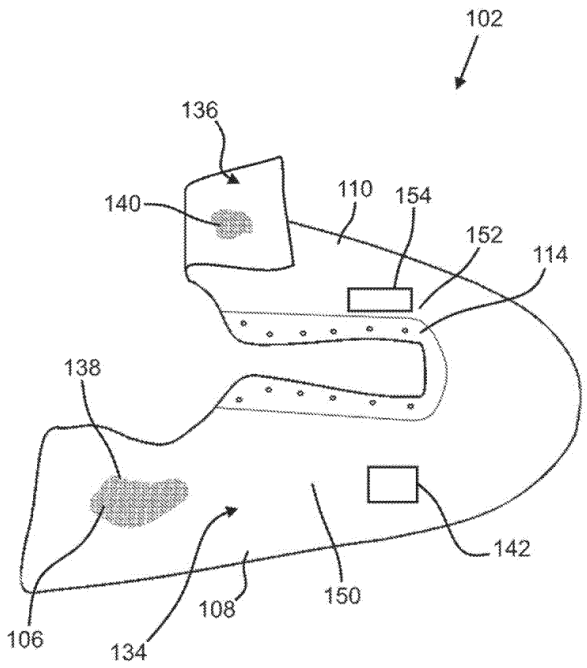

FIG. 2

EP 4 582 603 A2

Description

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 62/502,291, filed May 5, 2017, which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] A variety of articles are formed from textiles. As examples, articles of apparel (e.g., shirts, pants, socks, footwear, jackets and other outerwear, briefs and other undergarments, hats and other headwear), containers (e.g., backpacks, bags), and upholstery for furniture (e.g., chairs, couches, car seats) are often at least partially formed from textiles. These textiles are often formed by weaving or interlooping (e.g., knitting) a yarn or a plurality of yarns, usually through a mechanical process involving looms or knitting machines. One particular object that may be formed from a textile is an upper for an article of footwear.

[0003] Conventional articles of footwear generally include two primary elements: an upper and a sole structure. The upper is secured to the sole structure and forms a void within the article of footwear for comfortably and securely receiving a foot. The sole structure is secured to a lower surface of the upper so as to be positioned between the upper and the ground. In some articles of athletic footwear, for example, the sole structure may include a midsole and an outsole. The midsole may be formed from a polymer foam material that attenuates ground reaction forces to lessen stresses upon the foot and leg during walking, running, and other ambulatory activities. The outsole may be secured to a lower surface of the midsole and forms a ground-engaging portion of the sole structure that is formed from a durable and wear-resistant material.

[0004] The upper of the article of footwear generally extends over the instep and toe areas of the foot, along the medial and lateral sides of the foot, and around the heel area of the foot. Access to the void on the interior of the upper is generally provided by an ankle opening in a heel area of the footwear. A lacing system is often incorporated into the upper to adjust the fit of the upper, thereby facilitating entry and removal of the foot from the void within the upper. The upper may include a tongue that extends under the lacing system to enhance adjustability of the footwear, and the upper may incorporate a heel counter to limit movement of the heel.

BRIEF SUMMARY

[0005] One general aspect of the present disclosure includes a knitted component with a first surface and a second surface, the first surface facing opposite the second surface, the first surface including at least a first yarn and the second surface including at least a second yarn. The first and second yarns may be different. The first surface and the second surface may be secured via a knit structure of the knitted component, where the first surface includes an exposed first surface area, where at least 65% of the exposed first surface area is formed of the first yarn, and where the first yarn has a tenacity of at least 5 grams per denier (g/d).

[0006] Another general aspect of the present disclosure includes a method including the steps of knitting a first layer of a knitted component and knitting a second layer of the knitted component. The first layer may have a first surface and the second layer may have a second surface, the first surface facing opposite the second surface. The first layer may include at least a first yarn and the second layer may include at least a second yarn, the first and second yarns being different. The first layer and the second layer may be secured via a knit structure of the knitted component, where the first surface includes an exposed first surface area, where at least 65% of the exposed first surface area is formed of the first yarn, and where the first yarn has a tenacity of at least 5 grams per denier (g/d).

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is an illustration showing an article of footwear formed with an upper, the upper including a knitted component in accordance with an embodiment of the present disclosure.

FIG. 2 is an illustration showing the knitted component for the upper depicted in FIG. 1 as it may appear after formation on a knitting machine.

DETAILED DESCRIPTION

[0008] Various aspects are described below with reference to the drawings in which like elements generally are identified by like numerals. The relationship and functioning of the various elements of the aspects may better be understood by reference to the following detailed description. However, aspects are not limited to those illustrated in the drawings or explicitly described below. It also should be understood that the drawings are not necessarily to scale, and in certain instances details may have been omitted that are not necessary for an understanding of aspects disclosed herein, such as conventional fabrication and assembly.

[0009] Certain aspects of the present disclosure relate to articles at least partially formed from textiles. One example of an article is an article of apparel (e.g., shirts, pants, socks, footwear, jackets and other outerwear, briefs and other undergarments, hats and other headwear, or the like). The article may be an upper configured for use in an article of footwear. The upper may be used in connection with any type of footwear. Illustrative, non-

limiting examples of articles of footwear include a basketball shoe, a biking shoe, a cross-training shoe, a global football (soccer) shoe, an American football shoe, a bowling shoe, a golf shoe, a hiking shoe, a ski or snowboarding boot, a tennis shoe, a running shoe, and a walking shoe. The upper may also be incorporated into a non-athletic shoe, such as a dress shoe, a loafer, and a sandal.

[0010] FIG. 1 is an illustration showing an article of footwear 100 formed with an upper 102, where the upper 102 is substantially formed as a textile component, such as a knitted component 106. As shown, the upper 102 may be secured to at least one sole structure 104. The upper 102 may include a lateral side 108 and a medial side 110. The area where the sole structure 104 joins the upper 102 may be referred to as a biteline 112. The upper 102 may be joined to the sole structure 104 in a fixed manner using any suitable technique, such as through the use of an adhesive, by sewing, etc. The upper 102 may extend partially or completely around a foot of a wearer and/or may be integral with the sole structure 104, and a sockliner may or may not be used. In some embodiments, the sole structure 104 may include a midsole (not shown) and an outsole.

[0011] The upper 102 may additionally include a throat area 114 extending from and an ankle opening 116 leading to a void 118, and a collar 120 may at least partially surround the ankle opening 116. The void 118 of the article of footwear 100 may be configured (e.g., sized and shaped) to receive and accommodate a foot of a person. The throat area 114 may be generally disposed in a midfoot area 122 of the upper 102. The midfoot area 122 of the upper 102 may be located between a heel area 124 and a toe area 126. In some embodiments, an optional tongue, such as the depicted tongue 128 may be disposed in the throat area 114. The tongue 128 may be any type of tongue, such as a gusseted tongue or a burrito tongue. If a tongue is not included (or in combination with a tongue), the lateral and medial sides of the throat area 114 may be joined together.

[0012] The article of footwear 100 may include a fastening element, such as a shoelace 130. Any other suitable type of fastening element may be used, a strap, a cable-tensioning system, and/or any other suitable device. The upper 102 may be configured to secure to and communicate with the fastening element such that the fastening element may adjust and/or tighten the upper 102 around a foot of a wearer. For example, the upper 102 may include a set of apertures for receiving the fastening element, but other suitable element(s) may alternatively be used.

[0013] At least a portion of the upper 102, and potentially substantially the entirety of the upper 102, may be formed of the knitted component 106 (or another suitable textile component). Forming the upper 102 with the knitted component 106 may provide the upper 102 with advantageous characteristics including, but not limited to, a particular degree of elasticity (for example, as expressed in terms of Young's modulus), breathability, bendability, strength, moisture absorption, weight, abrasion resistance, and/or a combination thereof. These characteristics may be accomplished by selecting a particular single layer or multi-layer knit structure (e.g., a ribbed knit structure, a single jersey knit structure, or a double jersey knit structure), by varying the size and tension of the knit structure, by using one or more yarns formed of a particular material (e.g., a polyester material, a relatively inelastic material, or a relatively elastic material such as spandex), by selecting yarns of a particular size (e.g., denier), and/or a combination thereof.

[0014] The knitted component 106 may also provide desirable aesthetic characteristics by incorporating yarns having different colors, textures or other visual properties arranged in a particular pattern. The yarns themselves and/or the knit structure formed by one or more of the yarns of the knitted component 106 may be varied at different locations such that the knitted component 106 has two or more portions with different properties (e.g., a portion forming the throat area 114 of the upper 102 may be relatively elastic while another portion may be relatively inelastic). In some embodiments, the knitted component 106 may incorporate one or more materials with properties that change in response to a stimulus (e.g., temperature, moisture, electrical current, magnetic field, or light). For example, the knitted component 106 may include yarns formed of a thermoplastic polymer material (e.g., a polyurethane, polyamide, polyolefin, and/or nylon) that transitions from a solid state to a softened or liquid state when subjected to certain temperatures at or above its melting point and then transitions back to the solid state when cooled. The thermoplastic polymer material may provide the ability to heat and then cool a portion of the knitted component 106 to thereby form an area of bonded or continuous material (herein referred to as a "fused area") that exhibits certain advantageous properties including a relatively high degree of rigidity, strength, and water resistance, for example.

[0015] FIG. 2 is an illustration showing the knitted component for the upper 102 as it may appear after formation on a knitting machine. The knitted component 106 may be formed as a continuous and integral one-piece element during a knitting process, such as a weft knitting process (e.g., with a flat knitting machine or circular knitting machine), a warp knitting process, or any other suitable knitting process. That is, the knitting process on the knitting machine may substantially form the knit structure of the knitted component 106 without the need for significant post-knitting processes or steps. Alternatively, two or more portions of the knitted component 106 may be formed separately as distinct integral one-piece elements and then the respective elements attached. After the knitting process, the upper 102 may go through one or more post-processing steps. For example, in no particular order, the upper 102 may be attached to other elements of the article of footwear

(e.g., the sole structure 104 of FIG. 1), may be placed over a foot-shaped last, and /or may be steamed or otherwise treated to be formed into its wearable shape.

[0016] The knitted component 106 may be formed of one or more types of yarn. Herein, a "yarn" shall mean an elongated, continuous length of at least one fiber or strand suitable for use in the production of textiles by hand or by machine, including (but not limited to) textiles made using weaving, knitting, crocheting, braiding, sewing, embroidery, or ropemaking techniques. Thread is a type of yarn commonly used for sewing, for example. While yarns can be made using fibers formed of natural, regenerated, and synthetic materials, the manufacturing articles of footwear and performance athletic apparel may utilizes yarns formed from synthetic polymer fibers, as synthetic polymers fibers typically provide the durability and consistency required for these products and for producing them in high volume.

[0017] Synthetic polymer fibers are generally formed in continuous strands using techniques such as melt extrusion, reaction spinning, solution dry spinning, and solution wet spinning. The thickness and other cross-sectional characteristics of the synthetic polymer fibers can affect the properties of the fibers and yarns incorporating them. The properties of synthetic polymer fibers (and yarns incorporating them) can also be affected by processes such as drawing (i.e., stretching) the fibers, annealing (i.e., hardening) the fibers, and/or crimping the fibers. The color of the synthetic polymer fibers can be altered by adding pigments or dyes to the polymeric material, for example, before or during fiber formation, or by dyeing the fibers before or after forming them into a yarn. Three basic forms of synthetic polymer fibers are typically used to make yarn: relatively long and continuous filaments; tow, which are formed of many continuous filaments loosely joined side by side; and staple (cut) fibers. The length of synthetic polymer staple fibers typically used to form spun synthetic yarns ranges from about 0.5 inches to about 18 inches in length.

[0018] A wide variety of synthetic polymers can be used to form fibers. Commodity polymers commonly used to make fibers include polyesters, such as polyethylene terephthalate (PET); polyamides, such as nylon 6,6, nylon 6, and nylon 12; and polyolefins such as polyethylene and polypropylene. Polyacrylonitrile copolymers are used to make acrylic fibers. Other copolymer such as polyester copolymers and polyamide copolymers can also be used to form synthetic polymer fibers. Elastane, a polyester-polyurethane copolymer, is one such example. Polyurethane (PU), including thermoplastic polyurethane (TPU), can be used to make fibers for use in yarns, and can also be used to coat fibers or yarns formed of other polymeric materials. High performance synthetic polymer fibers can be made from polymeric materials including aramid and ultra-high molecular weight polyethylene (UHMWPE). In addition to one or more types of synthetic polymers, the material used to form the fibers can include pigments or dyes, fillers, processing aids, and the like.

[0019] Types of yarn which can be formed using synthetic polymer fibers include filament yarns (including monofilament yarns) and spun yarns. Synthetic polymer filament yarns are formed of continuous elongated filaments which can be twisted or grouped together. Monofilament yarns are formed of a single elongated, continuous filament of a synthetic polymer material. Spun yarns are made by twisting staple fibers together to make a cohesive strand. The process of forming a yarn from staple fibers typically includes carding and drawing the fibers to form sliver, drawing out and twisting the sliver to form roving, and spinning the roving to form a strand. Multiple strands can be plied (twisted together) to make the spun yarn thicker. The twist direction of the staple fibers and of the plies can affect the final properties of the yarn. Synthetic polymer spun yarns can be formed using a single type of fiber, such as a single type of synthetic polymer fiber, by using a blend of more than one type of synthetic polymer fiber, as well as by using blends of one or more type of synthetic polymer fibers with natural and/or regenerated fibers. Similarly, synthetic polymer continuous filament yarns can be formed from continuous filaments of a single type of synthetic polymer, can be formed from continuous filaments formed from more than one type of synthetic polymer, or can be formed from a combination of continuous fibers formed from a regenerated material with synthetic polymer continuous filaments formed of one or more types of synthetic polymers. Once formed, filament and spun yarns can undergo further treatments such as dyeing, texturizing, or coating with a material such as a synthetic polymer, in order to alter the properties of the yarn.

[0020] One way to characterize a yarn is based on its mass density or weight per unit length. The linear mass density or weight per unit length of a yarn can be expressed using various units, including denier (D) and tex. Denier is the mass in grams per 9000 meters. The linear mass density of a single filament of a fiber can also be expressed using denier per filament (DPF). Tex is the mass in grams per 1000 meters; decitex (dtex) is the mass in grams per 10,000 meters.

[0021] Another way to characterize a yarn is based on its tenacity. As used herein, "tenacity" is understood to refer to the amount of force (expressed in units of weight, for example: pounds, grams, centinewtons or other units) needed to rupture a yarn (i.e., the breaking force or breaking point of the yarn), divided by the linear mass density of the yarn expressed, for example, in (unstrained) denier, decitex, or some other measure of weight per unit length. The amount of force needed to break a yarn (the "breaking force" of the yarn) may be determined by subjecting a sample of the yarn to a known amount of force by stretching the sample until it breaks, for example, by inserting each end of a sample of the yarn into the grips on the measuring arms of an extensometer, subjecting the sample to a stretching force, and measuring the force required to break the sample using a strain

gauge load cell. Suitable testing systems can be obtained from Instron (Norwood, MA, USA). Yarn tenacity and yarn breaking force are distinct from burst strength or bursting strength of a textile, which is a measure of the maximum force that can be applied to the surface of a textile before the surface bursts.

[0022] Generally, in order for a yarn to withstand the forces applied in an industrial knitting machine, the minimum tenacity required is approximately 1.5 grams per denier (g/D). Most synthetic polymer continuous filament yarns formed from commodity polymeric materials generally have tenacities in the range of about 1.5 g/D to about 4 g/D. For example, polyester filament yarns that may be used in the manufacture of knit uppers for article of footwear have tenacities in the range of about 2.5 g/D to about 4 g/D. Filament yarns formed from commodity synthetic polymeric materials which are considered to have high tenacities generally have tenacities in the range of about 5 g/D to about 10 g/D. For example, commercially available package dyed polyethylene terephthalate filament yarn from National Spinning (Washington, NC, USA) has a tenacity of about 6 g/D, and commercially available solution dyed polyethylene terephthalate filament yarn from Far Eastern New Century (Taipei, Taiwan) has a tenacity of about 7 g/D. Filament yarns formed from high performance synthetic polymer materials generally have tenacities of about 11 g/D or greater. For example, filament yarns formed of aramid typically have tenacities of about 20 g/D, and filament yarns formed of ultra-high molecular weight polyethylene (UHMWPE) having tenacities greater than 30 g/D are available from Dyneema (Stanley, NC, USA) and Spectra (Honeywell-Spectra, Colonial Heights, VA, USA).

[0023] Further, yarns may include one or more elastomeric filaments to provide the yarn with a particular degree of elasticity. Elastic filaments may include, for example, latex, spandex, or elastane (which are often referred to as Lycra). A fiber of elastic material (e.g., a fiber of spandex) may be stretched to twice its unstretched length, 4 times its unstretched length, or even 8 times or more its unstretched length without rupturing. When incorporated into a yarn (which may additionally include other materials, such as polyester), the elastomeric filaments may provide the yarn with elasticity such that the yarn has the ability to elongate (i.e., increase in length) without rupturing when subjected to a tensile force and then recover to its original length when relieved from the tensile force.

[0024] Some yarns, such as monofilament yarns made of a single filament of an inelastic synthetic polymer material, may have substantially no, or very little, elasticity. For example, a monofilament yarn made of an inelastic synthetic polymer material may have maximum elongation of less than 5% (e.g., the maximum length of the yarn when subjected to a tensile force approaching its breaking force is less than 5% of its length when not subjected to a tensile force), and it is contemplated that a such a yarn could have a maximum elongation of 1 %, 0.5%, or even less. Other yarns, such as yarns formed of textured polyester, may have a maximum elongation of between about 20% and about 40%. A yarn incorporating spandex (with or without other materials), for example, may have a maximum elongation of 100%, 200%, 300%, or more.

[0025] The knitted component 106 may be a single layer knitted component or it may be a multi-layer knitted component. An example of a multi-layer knitted and associated method of forming the multi-layer knitted component is fully described in U.S. Patent Application No. 15/443,808, filed February 27, 2017, which is herein incorporated by reference in its entirety. In some embodiments, the knitted component 106 may be a two-layer knitted component with a first layer forming a first surface 134 (e.g., outer surface) and a second layer forming the second surface 136 (e.g., inner surface) as described in further detail below. While not required in all embodiments, the first and second layers may both be knitted layers, and they will be referred to herein as the "first layer" and the "second layer." While more than (or less than) two layers could be included, this description generally describes the knitted component 106 as having two layers for simplicity of description. Further, it is contemplated that different portions of the knitted component 106 could have a different number of layers (e.g., a portion corresponding to the throat area 114 may have one layers, while a portion corresponding to the medial side 110 and the lateral side 108 may have more than one layer).

[0026] The first and second layers of the knitted component 106 may be separately formed or integrally formed, and one or both layers may be formed during a knitting or other textile manufacturing process. In one example, the first layer defining the first (outer) surface 134 and the second layer forming the second (inner) surface 136 may be formed during a single knitting process (e.g., simultaneously on a knitting machine). For example, the first and second layers may be formed on a flat knitting machine with two needle beds. The first layer may be primarily formed on a front needle bed, and the second layer may be primarily formed on a back needle bed, or vice versa. In some embodiments, the first layer and the second layer may be integral and tightly bound together such that they are inseparable and/or are not readily distinguishable (visually or otherwise). In another example (or in another location of the knitted component 106), the knitted component 106 may have at least one location where the first layer and the second layer are separable and/or form a pocket therebetween, which may be filled with an insert or other filler material (e.g., a cushioning material). It is contemplated that the first layer and the second layer may be attached only at the edges of the knitted component 106 or the first and second layers may be attached at additional points by a tie stitch at any one or more points on the upper. Further, the knitted component 106 may have some areas where the layers are substantially bound or attached together

(in an indistinguishable manner, or not) and other areas where they are substantially separable and/or distinguishable. Separable first and second layers may be formed by a tubular knitting process where the yarns forming the first layer are knitted only on one bed of a knitting machine and the yarns of the second layer are knitted only on a second bed of the knitting machine. Alternatively, the knitted component 106 may be formed of two or more layers that are knitted or otherwise formed separately and then joined together by, for example, a sewing or stitching process, by using an adhesive, or by another suitable bonding/attachment technique.

[0027] The first layer defining the first surface 134 of the knitted component 106 may be primarily formed by a first yarn 138 such that the exposed surface area 142 of the first surface 134 is primarily formed by the material defining the first yarn 138. In some embodiments, the first layer of the knitted component 106 may be fully or substantially fully formed substantially of the first yarn 138, at least in certain areas or zones. Similarly, the second layer defining the second surface 136 of the knitted component 106 may be primarily formed by a second yarn 140 such that the exposed surface area of the second surface 136 is primarily formed by the material defining the second yarn 140. In some embodiments, the second layer of the knitted component 106 may be fully formed or substantially fully formed of the second yarn 140, at least in certain areas or zones. It is noted that, for simplicity, only two yarns (representing two yarn types) are described, but more than two yarn types may be included, and the features described herein may apply to more than two yarn types.

[0028] Particularly when the first layer and the second layer are formed together in an inseparable manner on a knitting machine (e.g., when the first layer is formed on a first needle bed and the second layer is formed on a second needle bed), the second yarn 140 may be incorporated into the first layer and the first yarn may be incorporated into the second layer at least at some locations, and the proportion (i.e., percentage of exposure on a surface area) of each yarn type exposed on each surface may vary. The exposure of each yarn may be specifically selected to provide the surfaces with certain surface characteristics. Thus, the amount of the first yarn 138 incorporated into the first layer relative to other yarn types may be optimized such that a desirable amount of material forming the first yarn 138 is exposed on the first surface. For example, with respect to a particular surface area, it may be desirable for at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, or even more of the material that is exposed on the first surface 134 at an exposed surface area 142 to be the material provided by the first yarn. Similarly, with respect to a particular surface area on the second surface 136, it may be desirable for at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, or even more of the material that is exposed on the second surface 136 to be the material provided by the second yarn.

[0029] It is contemplated that the two layers may optionally have an inverse composition of material types (but this is not required). For example, at least at one area, the exposed surface area of the first surface 134 may have a composition of about 70% of the material provided by the first yarn and about 30% of the material provided by the second yarn, while the exposed surface area of the second surface 136 may have an opposite composition (e.g., 70% of material provided by the second yarn and 30% of material provided by the second yarn).

[0030] While yarns having a high tenacity are traditionally used for providing an article with tensile strength, the inventors have unexpectedly found that forming a surface of a knitted component primarily with a high tenacity yarn gives the knitted component advantageous surface characteristics for certain functions. For example, it was found that when an exposed portion of a surface is about 70% (or more) formed by a high tenacity yarn (e.g., a polyethylene terephthalate filament yarn from National Spinning (Washington, NC, USA) with a tenacity of about 6 g/D, and/or a polyethylene terephthalate filament yarn from Far Eastern New Century (Taipei, Taiwan) with a tenacity of about 7 g/D), and 30% (or less) formed of another yarn (e.g., a synthetic polymer continuous filament yarn formed having a tenacity in the range of about 1.5 g/D to about 4 g/D), that exposed portion of the surface has a desirable grip (e.g., friction coefficient) for use in shoe configured for rope climbing in at least one direction (e.g., in a vertical direction with respect to the shoe) and also had desirable anti-abrasiveness and durability. Thus, in one embodiment, the first surface 134 of the knitted component 106 may be primarily formed by the first yarn 138 (at least at one area), and the first yarn 138 may be a high tenacity yarn. That is, the first yarn 138 may have a tenacity of at least 5 grams per denier (g/D), and in some embodiments the first yarn 138 may have a tenacity of about 6 grams per denier (g/D) or higher, about 7 grams per denier (g/D) or higher, about 10 grams per denier (g/D) or higher, or even about 20 grams per denier (g/D) or higher. The portion of the exposed surface area 142 of the first surface 134 may be at least 1 square centimeter in area, such as at least 4 square centimeters in area, at least 9 square centimeters in area, etc.

[0031] To facilitate comfort to the wearer, the second surface 136 may be formed of the above-described second yarn, which may have a tenacity less than 4 grams per denier (g/D). The second yarn 140 may be a polyester yarn having suitable softness, anti-abrasiveness, flexibility, compressibility, and/or other characteristics that are associated with comfortable contact with a foot and/or sock of a wearer.

[0032] In some embodiments, the knitted component 106 may include a first zone 150 and a second zone 152, where at least one surface has a different composition of exposed yarns in the first zone 150 with respect to the second zone 152. As shown, the exposed surface area 142 may be located in the first zone 150, and the second

zone may have an exposed second surface area 154. When it is desired for the exposed second surface area 154 to have different characteristics than those of the exposed first surface area 142 (e.g., when grip is not needed in that location), less than 65% of the exposed second surface area 154 may be formed of the first yarn. For example, at least 50% of the exposed first surface area may be formed of the second yarn 140. This non-limiting embodiment may provide the ability to use a different knit structure (e.g., a single-layer knit structure) that has suitable elasticity, comfort-related characteristics, and/or other characteristics that are desirable in certain areas of the upper (such as the throat area).

[0033] All of the structures and methods disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While this disclosure may be embodied in many different forms, there are described in detail herein specific aspects of the disclosure. The present disclosure is an exemplification of the principles of the disclosure and is not intended to limit the disclosure to the particular aspects illustrated. In addition, unless expressly stated to the contrary, use of the term "a" is intended to include "at least one" or "one or more." For example, "a yarn" is intended to include "at least one yarn" or "one or more yarns."

[0034] Any ranges given either in absolute terms or in approximate terms are intended to encompass both, and any definitions used herein are intended to be clarifying and not limiting. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the disclosure are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in their respective testing measurements. Moreover, all ranges disclosed herein are to be understood to encompass any and all subranges (including all fractional and whole values) subsumed therein.

[0035] Furthermore, the disclosure encompasses any and all possible combinations of some or all of the various aspects described herein. It should also be understood that various changes and modifications to the aspects described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the disclosure and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

Embodiments

[0036] Embodiment 1: A knitted component comprising:

a first surface and a second surface, the first surface facing opposite the second surface, the first surface including at least a first yarn and the second surface including at least a second yarn, the first and second yarns being different,

wherein the first surface and the second surface are secured via a knit structure of the knitted component,

wherein the first surface includes an exposed first surface area, wherein at least 65% of the exposed first surface area is formed of the first yarn, and

wherein the first yarn has a tenacity of at least 5 grams per denier (g/D).

[0037] Embodiment 2: The knitted component of embodiment 1, wherein the first yarn has a tenacity of at least 7 grams per denier (g/D).

[0038] Embodiment 3: The knitted component of embodiment 1, wherein the exposed first surface area has an area of at least 1 square centimeter.

[0039] Embodiment 4: The knitted component of embodiment 1, wherein the exposed first surface area has an area of at least 9 square centimeters.

[0040] Embodiment 5: The knitted component of embodiment 1, wherein at least 70% of the exposed first surface area is formed of the first yarn.

[0041] Embodiment 6: The knitted component of embodiment 1, wherein the second yarn includes a tenacity of less than 4 grams per denier (g/D).

[0042] Embodiment 7: The knitted component of embodiment 1, further comprising:

a first zone; and

a second zone,

wherein the exposed first surface area is located in the first zone,

wherein in the second zone, the first surface includes an exposed second surface area, and

wherein the percentage of the exposed second surface area formed by the first yarn is different than the percentage of the exposed first surface area formed by the first yarn.

[0043] Embodiment 8: The knitted component of embodiment 7, wherein less than 60% of the exposed second surface area is formed of the first yarn.

[0044] Embodiment 9: The knitted component of embodiment 1, wherein the second surface includes an exposed second surface area, wherein at least 50% of the exposed second surface area is formed of the second yarn.

[0045] Embodiment 10: The knitted component of embodiment 1, wherein the first yarn is a polyethylene terephthalate filament yarn.

[0046] Embodiment 11: A method comprising:

knitting a first layer of a knitted component; and

knitting a second layer of the knitted component,

wherein the first layer has a first surface and the second layer has a second surface, the first surface facing opposite the second surface, the first layer including at least a first yarn and the second layer including at least a second yarn, the first and second yarns being different,

wherein the first layer and the second layer are secured via a knit structure of the knitted component,

wherein the first surface includes an exposed first surface area, wherein at least 65% of the exposed first surface area is formed of the first yarn, and

wherein the first yarn has a tenacity of at least 5 grams per denier (g/D).

[0047] Embodiment 12: The method of embodiment 11, wherein the first yarn has a tenacity of at least 7 grams per denier (g/D).

[0048] Embodiment 13: The method of embodiment 11, wherein the exposed first surface area has an area of at least 1 square centimeter.

[0049] Embodiment 14: The method of embodiment 11, wherein the exposed first surface area has an area of at least 9 square centimeters.

[0050] Embodiment 15: The method of embodiment 11, wherein at least 70% of the exposed first surface area is formed of the first yarn.

[0051] Embodiment 16: The method of embodiment 11, wherein the second yarn includes a tenacity of less than 4 grams per denier (g/D).

[0052] Embodiment 17: The method of embodiment 11, further comprising:

knitting a first zone of the knitted component; and knitting a second zone of the knitted component, wherein the exposed first surface area is located in the first zone,

wherein in the second zone, the first layer includes an exposed second surface area, and

wherein the percentage of the exposed second surface area formed by the first yarn is different than the percentage of the exposed first surface area formed by the first yarn.

[0053] Embodiment 18: The method of embodiment 17, wherein less than 60% of the exposed second surface area is formed of the first yarn.

[0054] Embodiment 19: The method of embodiment 18, wherein the second surface includes an exposed second surface area, wherein at least 50% of the exposed second surface area is formed of the second yarn.

[0055] Embodiment 20: The method of embodiment 11, wherein the first yarn is a polyethylene terephthalate filament yarn.

Claims

1. A knitted component (106) comprising:

a first surface (134) and a second surface (136) including a first yarn (138) and a second yarn (140),
wherein the first surface (134) and the second surface (136) are secured via a knit structure of the knitted component (106),
wherein the first surface (134) includes an exposed first surface area (142),
wherein at least 70% of the exposed first surface area (142) being formed of the first yarn (138),
wherein the first yarn (138) has a tenacity of at least 6 grams per denier.

2. The knitted component (106) of claim 1, wherein the first surface (134) and the second surface (136) are secured via the knit structure of the knitted component (106) such as to be bound together and inseparable.

3. The knitted component (106) of any one of the preceding claims, wherein the exposed first surface area (142) is formed by both the first yarn (138) and the second yarn (140).

4. The knitted component (106) of any one of the preceding claims, wherein the second yarn (140) has a tenacity within a range of about 1.5 grams per denier to about 4 grams per denier.

5. The knitted component (106) of any one of the preceding claims, wherein the first yarn (138) has a tenacity of at least 7 grams per denier (g/D).

6. The knitted component (106) of any one of the preceding claims, wherein the exposed first surface area (142) has an area of at least 1 square centimeter.

7. The knitted component (106) of any one of the preceding claims, wherein the exposed first surface area (142) has an area of at least 9 square centimeters.

8. The knitted component (106) of any one of the preceding claims, wherein the second yarn (140) includes a tenacity of less than 4 grams per denier (g/D).

9. The knitted component (106) of any one of the preceding claims, further comprising

a first zone (150),
wherein the exposed first surface area (142) is located in the first zone (150).

10. The knitted component (106) of any one of the preceding claims, further comprising

a second zone (152),
wherein in the second zone (152), the first surface (134) includes an exposed second surface area (154), and
wherein the percentage of the exposed second surface area (154) formed by the first yarn (138) is different than the percentage of the exposed first surface area (142) formed by the first yarn (138).

11. The knitted component (106) of claim 10, wherein less than 60% of the exposed second surface area (154) is formed of the first yarn (138).

12. The knitted component (106) of any one of the preceding claims, wherein the second surface (136) includes an exposed second surface area (154), wherein at least 50% of the exposed second surface area is formed of the second yarn (140).

13. The knitted component (106) of any one of the preceding claims, wherein the first yarn (138) is a polyethylene terephthalate filament yarn.

14. An article of footwear (100) comprising the knitted component (106) of any one of the preceding claims, or an upper (102) formed as the knitted component (106) of any one of the preceding claims.

15. A method comprising

knitting a knitted component (106) having a first surface (134) and a second surface (136) including a first yarn (138) and a second yarn (140),
wherein the first surface (134) and the second surface (136) are secured via a knit structure of the knitted component (106),
wherein the first surface (134) includes an exposed first surface area (142),
wherein at least 70% of the exposed first surface area (142) is formed of the first yarn (138), and
wherein the first yarn (138) has a tenacity of at least 6 grams per denier (g/D).

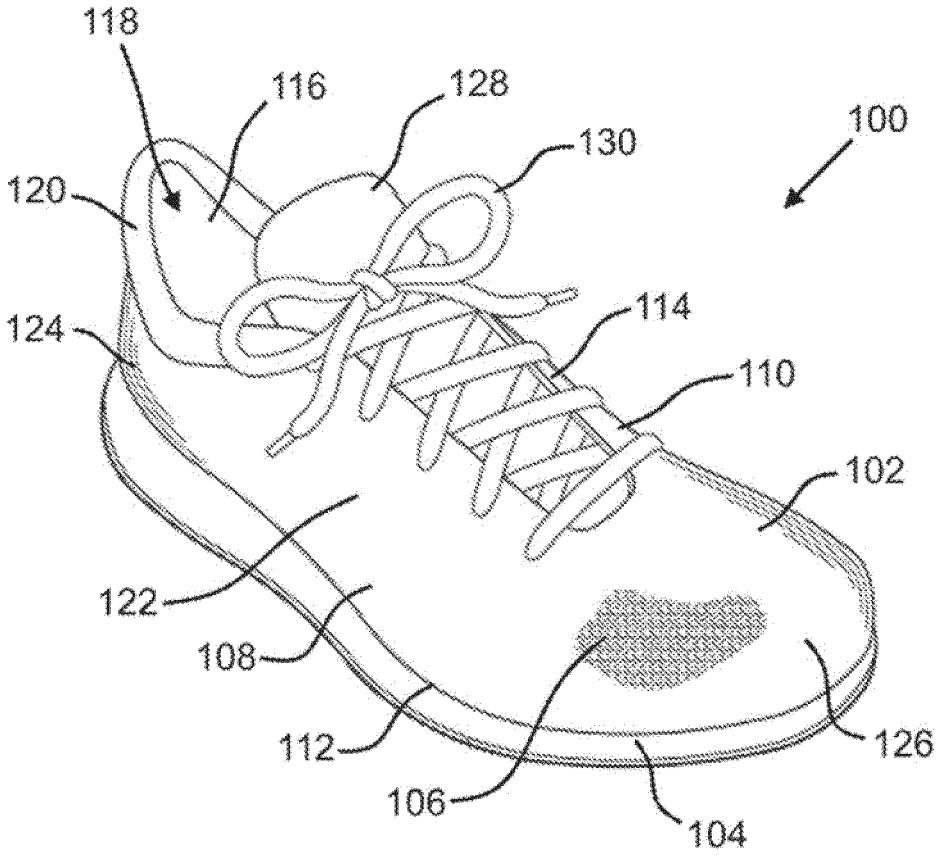

FIG. 1

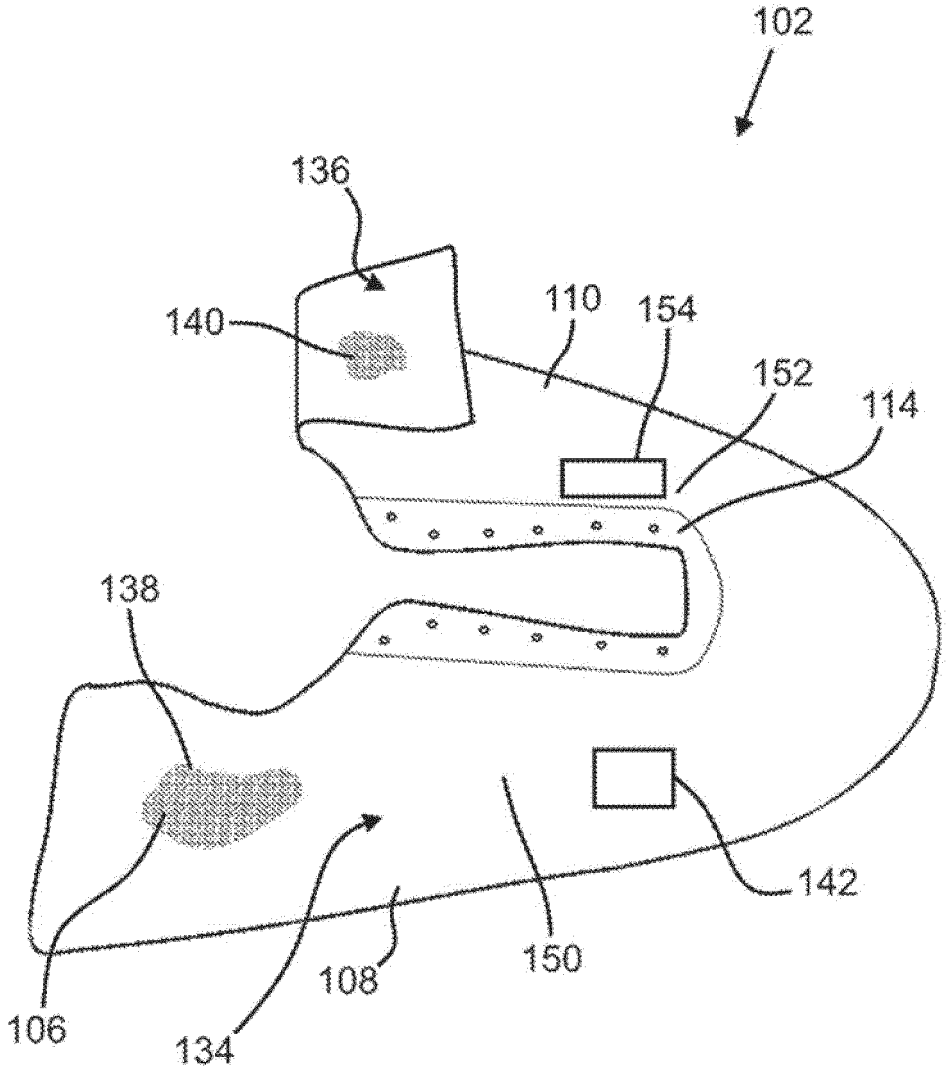

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 62502291 **[0001]**
- US 44380817 **[0025]**