(54) Title: MICRO-FIBER GRIPPING REGION FOR SPORTS APPAREL

(57) Abstract: Articles of clothing containing regions incorporating microfibers which act to hold the clothing in place against the skin of the wearer of the article of clothing, particularly when the wearer is engaged in an athletic activity.
MICRO-FIBER GRIPPING REGION FOR SPORTS APPAREL

TECHNICAL FIELD

The present invention relates to sports apparel including regions of micro-fiber gripping material to keep the apparel in a fixed position against the skin of the wearer.

BACKGROUND OF DISCLOSURE

Sports apparel specifically designed to be worn by athletes, particularly in sports or exercises that include repetitive motion of the legs and arms, often have hems, cuffs, waistbands or the like, with drawstrings, elastic bands, exposed rubber threads, or applied elastomer (such as silicone) to prevent the apparel from moving out of position, or riding up arms or legs or the waist as the exercise progresses. Particularly, bicycling shorts and pants, as well as running jerseys and leggings, have been made with exposed rubber threads or applied elastomer regions in the hems and cuffs to prevent the legs and sleeves of the shorts and jerseys from riding up the legs and arms, respectively, of the wearer. Such movement of the garment out of position on the wearer is uncomfortable, irritating, and may cause the garment to loosen and lose the aerodynamic fit gained by the correct positioning of the garment on the wearer’s body.

Unfortunately, these methods of trying to adhere various parts of a garment in place on the wearer often causes irritation to the skin of the wearer and may limit stretch of fabric(s) making up the athletic apparel. Additionally, the additional materials that have been applied to a surface of the apparel result in additional manufacturing costs, increasing the price of the apparel to the consumer. Thus, a less-irritating means of increasing the adherence of certain portions of athletic apparel to the skin of an athlete are desired, in particular a means that is integrated into the fabric of the apparel thereby reducing cost and manufacturing time for the apparel.

SUMMARY OF INVENTION

The present disclosure provides apparel including fabric regions containing micro-fiber yarns having an increased friction coefficient between the fabric and human skin in order to help maintain the position of the apparel on the body, particularly on the body of an athlete wearing the apparel. This apparel has the advantages of:

- Stays in place – doesn’t ride up the legs or arms of the wearer during athletic activities;
• Lowers skin/fabric interaction that leads to tickling, blisters and hot spots, thereby preventing or eliminating these discomforts in the wearer.

• Improves the feel of the fabric on the skin of the athlete

• Maintains aerodynamic fit of the apparel, particularly spandex running and cycling apparel

• Does not restrict or prevent stretch in the fabric of the athletic garment

• Does not block evaporation of water or sweat from the fabric of the athletic garment

• Does not irritate skin of the wearer, by pulling or stretching the skin

• Easier/less expensive to manufacture, without the addition of materials onto portions of the apparel after manufacture, such as with silicone patterns applied using screen rollers –

• Does not require additional manufacturing steps, such as with silicone patterns applied after the garment is manufactured

• Improves sweat absorption in the garment and away from the skin of the wearer

Thus, according to one aspect of this disclosure, an article of sports apparel is provided comprising at least one region of fabric comprising a microfiber yarn content between about 1% microfiber yarn to about 99% microfiber yarn. The at least one region of fabric may comprise a yarn that is at least one of nylon, polyester, and polypropylene.

Alternatively, the at least one region of fabric comprises microfiber yarn content between about 3% microfiber yarn and about 97% microfiber yarn. The at least one region of fabric may comprise microfiber yarn content of about 50% microfiber yarn and about 50% yarn content selected from at least one of nylon, polyester, and polypropylene or a combination thereof. As an example, the at least one region of fabric may comprise a microfiber yarn content of about 50% microfiber yarn with the remaining 50% of the yarn formed from a combination of non-micro polyester and nylon fibers.

The at least one region of fabric may comprise yarns disposed along the inner surface of the apparel to come in contact with the skin of the wearer.

The article of sports apparel may be bicycling tights and the at least one region of fabric comprises between 0.5 cm and 10 cm proximate the end of at least one leg opening. The at least one region may comprise a hem of each leg, disposed on the inner
surface of the leg of the apparel, configured to come into contact with the skin of a wearer and to cling to the skin, thereby keeping the legs of the tights in a fixed position against the skin of the legs of the wearer. The tights may comprise full length leggings and the at least one region forms a hem that clings to the skin around the ankles of the wearer. Alternatively, the tights comprise three-quarter length leggings and the at least one region forms a hem that clings to the skin around the calves of the wearer. Alternatively, the tights comprise bicycling shorts and the at least one region forms a hem that clings to the skin around the thighs of the wearer. Alternatively, the at least one region may comprise the waist of bicycling tights disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin, thereby helping to keep the waist of the tights in a fixed position against the skin of the wearer.

The article of sports apparel may also be an athletic jersey and the at least one region of fabric may comprise between about 0.5 cm and about 10 cm proximate the end of at least one sleeve. The at least one region may comprise a cuff of each arm disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin, thereby helping to keep the sleeves of the jersey in a fixed position against the skin of the arms of the wearer. Alternatively, the jersey may comprise full length sleeves and the at least one region forms a cuff that clings to the skin around the wrists of the wearer. Alternatively, the jersey comprises three-quarter length sleeves and the at least one region forms a cuff that clings to the skin around the forearms of the wearer. Alternatively, the jersey comprises short sleeves and the at least one region forms a cuff that clings to the skin around the biceps of the wearer. Alternatively, the jersey comprises a sleeve-less jersey and the at least one region forms a cuff that clings to the skin around the shoulder of the wearer. Alternatively, the article of sports apparel is an athletic jersey and the at least one region comprises the waist of the jersey disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin, thereby helping to keep the waist of the jersey in a fixed position against the skin of the wearer.

The article of sports apparel may be running tights and the at least one region of fabric may comprise between about 0.5 cm and about 10 cm proximate the end of at least one leg. The at least one region may comprise a hem of each leg disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin, thereby
helping to keep the legs of the tights in a fixed position against the skin of the legs of the wearer. The tights may comprise full length leggings and the at least one region forms a hem that clings to the skin around the ankles of the wearer. The tights may comprise three-quarter length leggings and the at least one region forms a hem that clings to the skin around the calves of the wearer. The tights may comprise bicycling shorts and the at least one region forms a hem that clings to the skin around the thighs of the wearer. The at least one region may comprise the waist of running tights disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin, thereby helping to keep the waist of the tights in a fixed position against the skin of the wearer.

This Summary is neither intended, nor should it be construed, as being representative of the full extent and scope of the present disclosure. Moreover, references made herein to "the present disclosure," or aspects thereof, should be understood to mean certain embodiments of the present disclosure and should not necessarily be construed as limiting all embodiments to a particular description. The present disclosure is set forth in various levels of detail in this Summary as well as in the attached drawings and the Description of Embodiments and no limitation as to the scope of the present disclosure is intended by either the inclusion or non-inclusion of elements, components, etc. in this Summary. Additional aspects of the present disclosure will become more readily apparent from the Description of Embodiments, particularly when taken together with the figure.

**BRIEF DESCRIPTION OF FIGURE**

Figure 1, shows a photograph of a region of sports apparel containing microfibers according to an embodiment of this disclosure.

**DESCRIPTION OF EMBODIMENTS**

The present disclosure is drawn to an article of apparel, particularly sports apparel, that includes regions containing microfibers, which regions help to keep the article of sports apparel in place against the skin of a person wearing the apparel during periods of movement of the wearer engaged in an athletic activity.

The term "a" or "an" entity refers to one or more of that entity. As such, the terms "a" (or "an"), "one or more" and "at least one" can be used interchangeably herein. It is also to be noted that the terms “comprising”, “including”, and “having” can be used interchangeably.
The phrases "at least one," "one or more," and "and/or" are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions "at least one of A, B and C", "at least one of A, B, or C", "one or more of A, B, and C", "one or more of A, B, or C" and "A, B, and/or C" means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.

The transitional term "comprising" is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.

The transitional phrase "consisting of" excludes any element, step, or ingredient not specified in the claim, but does not exclude additional components or steps that are unrelated to the invention such as impurities ordinarily associated therewith. The transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps and those that do not materially affect the basic and novel characteristic(s) of the claimed invention.

The word microfiber refers to a fiber with less than 1 Decitex per filament (as defined in Textile Terms and Definitions, 11th Edition, published by The Textile Institute). Decitex is a measure of linear density and is commonly used to describe the size of a fiber or filament. Ten thousand meters of a 1-decitex fiber weighs one gram. Some commercial producers use a value of less than 1.3 Decitex to define microfibers. Fibers are combined to create yarns which are knitted or woven in a variety of constructions. While many microfibers are made of polyester (PET), they can also be composed of, but not restricted to, polyamide (PA), polyolefins (PO), polypropylene (PP), or polyethylene (PE), as well as almost any extrudable polymer.

The term "microdenier" refers to a filament fiber that has approximately 1 filament per denier or less (i.e. fibers with denier per filament (dpf) of one or less than one). An example would be a 150 denier polyester fiber that was made from 150 individual filaments. Generally, this applies to polyester and polyaramide filament fibers. In the case of polypropylene, the use of a microdenier configuration is not generally popular due to difficulties in production and then texturization. When using a microdenier polypropylene as the yarn, a similar effect can be obtained by using yarns with 2 denier per filament as well. The scope of this disclosure includes the use of yarns comprising microfibers and/or UMF in conjunction with yarn comprising polymeric fibers.
The term “Ultra Microfibers” (UMF) as used herein, relates to fibers having no less than 10 filaments per denier and usually refers to fibers composed of filaments which have been chemically split to a further reduction in size, or extruded in such a way that the filaments are smaller in thickness than 1 denier per filament. A commonly used fiber would be a 160 denier fiber which is made up of 72 filaments which have each been divided into 16 sub-filaments. While the skilled artisan will appreciate what is intended by the phrase “Ultra MicroFibers” (UMF), such term may be understood to refer to synthetic filament fibers in which a microfiber is further split. The split can be in any number between 10 and 50 sub filaments to a single filament of a normal or micro denier filament, but normally a skilled artisan would expect to see no less than 10 filaments per denier in such a product. These yarns are typically not used in the apparel industry for a variety of reasons, and are generally made from more than one polymer such as nylon (PA) and polyester (PET) or polypropylene (PP), or a combination of different polymers and are used in mops and towels where high levels of moisture gathering is an advantage. Heretofore, UMF yarns have not been used in apparel because they take in the water between the filaments and retain moisture in the spaces between the split filaments, more than normal yarns do, unless this water absorption and retention effect can be controlled, as described in this disclosure.

Microfibers are commonly used in the textile industry but the use of UMF are far less prevalent in apparel. These fibers can take many forms such as a very fine filament made from one polymer, side by side configurations of one or more polymers, or concentric configurations of one or more polymers. In addition, they can be made a wide variety of polymers. Useful polymers for making these fibers in a yarn (either alone or together in a variety of configurations) include: PET (polyester); PEN polyester; Nylon 6,6; PCT polyester; Polypropylene (PP); PBT polyester; Nylon 6; co-polyamides; Polylactic acid (PLA); polystyrene; Acetal; polyurethane (PU); Soluble co polyester; HDPE, LLDPE.

Methods of producing microfibers and UMF are well known to the skilled artisan. In addition, a variety of almost any combination of extruded polymers can be used to obtain the effect. Common names to describe these production methods are “Islands-In-The-Sea” or “Splittable Pie” systems, which ultimately produces the desired effect in the fibers.
For the “Island-In-The-Sea” fiber production method, a multitude of individual small fibers of one polymer are spun inside of a matrix, or “sea,” of another fiber. The “islands” typically compose approximately 80% of the fiber and the “sea” is approximately 20% of the fiber. These microdenier filaments are developed when the sea polymer is dissolved after the yarn or fabric has been woven or knit.

The “Splittable Pies” production method of making microfibers and UMF includes the use of a 2 to 4 dpf bicomponent pie yarn, which is again spun and processed with standard techniques. Once in fabric form, a mild caustic solution is applied to the fabric causing the individual fibers to split apart from the main fiber. Thus, for example, if a 32-segment pie of nylon/polyester is used, the final dpf of the fibers is about 0.1.

Brushing and other types of finishing techniques can be used to finish the production of the regions of apparel of this disclosure that contain the microfibers.

This disclosure provides an article of apparel comprising one or more regions incorporating microfibers or UMF. These regions of the apparel act in contact with human skin to keep the apparel correctly seated against the skin, thereby keeping the apparel correctly positioned on the wearer, particularly while the wearer is engaged in an athletic activity. As described herein, the present invention provides a stretch fabric, capable of producing a high compression force against the body of a wearer of the fabric, yet that is lightweight and noticeably more comfortable to wear. For example, bicycling shorts often include elasticized hems at the waist and/or leg openings to ensure a proper fit and to prevent the legs from riding upward while the wearer is bicycling. Thus, as an example, a region incorporating microfiber yarn(s) of this disclosure, may form the bottom leg hem and the waistband of cycling shorts, replacing the prior art use of elastic gripper materials, which were typically applied to cycling shorts after manufacture to prevent such movement.

The apparel containing region(s) of microfiber materials of this disclosure may include a variety of athletic garments used in a variety of applications where these benefits are desirable. For example, the stretch fabric may be embodied in athletic garments worn by athletes or other sports participants whereby the apparel provides compression or aerodynamic effects to the wearer, and is also comfortable to the wearer. Such garments may include bras, briefs, jock straps, knee braces, ankle braces,
elbow braces, socks and hosiery and other support garments, swimming suits, bicycling
shorts and jerseys, running shorts and shirts, ski pants, bibs, jackets, and bodysuits, luge
and other sledding bodysuits, and other athletic garments.

The region(s) of the sports apparel of this disclosure containing such microfibers
may be formed such that a preponderance of the microfibers are surface-exposed on at
least one surface of the garment that is in direct contact with the skin of a wearer of the
garment, particularly when the wearer is engaged in an athletic activity.

The ratio of these microfibers in the region(s) of the athletic apparel of this
disclosure may range from between about 3% and about 97% microfibers. Alternatively,
the microfiber content of the regions of athletic apparel of this disclosure may range
from between about 10% and about 90% microfibers. Alternatively, the microfiber
content of the regions of athletic apparel of this disclosure may range from between
about 20% and about 80% microfibers. Alternatively, the microfiber content of the
regions of athletic apparel of this disclosure may range from between about 30% and
about 70% microfibers. Alternatively, the microfiber content of the regions of athletic
apparel of this disclosure may range from between about 40% and about 60%
microfibers. Alternatively, the microfiber content of the regions of athletic apparel of this
disclosure may be about 50% of the yarn content of the region. The yarn fibers making up
the remainder of the yarn content of the regions of the athletic apparel of this disclosure
(i.e., the non-microfiber(s) in these region(s)) is nylon, polyester, or combinations
thereof. The combination yarn system in the regions of apparel of this disclosure may
comprise polypropylene (PP) while a plurality of the yarns comprise microfibers.

The athletic apparel of this disclosure containing a region incorporating micro- or
ultra-microfibers may be a knitted textile, and/or a woven textile.

The following is intended to describe what the inventor believes is one
mechanism that affords the enhanced ability of the region(s) of the apparel of this
disclosure to maintain contact with human skin and prevent or reduce the movement of
the region of apparel on the wearer, particularly when the wearer is engaged in an
athletic activity, although there is no intention to be bound by this explanation.

Analysis of the friction of certain fabrics against human skin shows that low
friction materials (i.e., silk) have a friction coefficient of about 0.35, while high friction
materials (i.e., silicone) have a friction coefficient of about 0.65. The microfiber regions of
the apparel of this disclosure are believed to have a friction coefficient against human skin between about 0.4 and about 0.6. Alternatively, the microfiber regions of the apparel of this disclosure may be designed (i.e., by variations in the production of the regions, such as content of the microfiber yarns in these regions) to have a friction coefficient against human skin between about 0.45 and about 0.55.

Thus, this disclosure provides clothing containing at least one region having microfiber content, particularly to be used/worn as active sportswear. The sportswear may be bicycling shorts or tights. Alternatively, the sportswear is a bicycling jersey. Alternatively, the sportswear may be running shorts or tights. Alternatively, the sportswear may be a running shirt. These garments, worn below the waist, may have regions containing microfibers in the hem of the leg openings such that the microfibers are in contact with the skin around the wearer’s ankles, calves and/or thighs, when the wearer is engaged in an athletic activity. Similarly, these garments, worn above the waist, may have regions containing microfibers in the cuff of the arm openings such that the microfibers are in contact with the skin around the wearer’s wrists, forearms, biceps and/or shoulders, when the wearer is engaged in an athletic activity. Similarly, these garments may have regions containing microfibers in the waist of the pants or shirts such that the microfibers are in contact with the skin around the wearer’s waist when the wearer is engaged in an athletic activity.

The garments contemplated herein may include athletic apparel such as shirts, shorts, pants, shorts, bras, and the like. The garments may also be specifically designed for garments adapted for use in cold weather sports. Alternatively or additionally, the garments may also be specifically designed for active infant wear, or for use in a hospital setting.

Figure 1 is a photograph illustrating a region of integrated microfiber yarn woven into the fabric of a region forming the hem at a leg opening of one leg of bicycling shorts. This region provides the required skin friction to keep this region secured against the skin of the wearer and prevents or reduces the region of the leg opening from riding up the leg of the wearer when the wearer is actively bicycling. This microfiber region also improves sweat absorption and does not block sweat evaporation from the wearer’s skin. Additionally, the use of such regions of microfiber yarn woven into the fabric does not
require additional components, materials or manufacturing steps, as was required by the prior art use of applied elastomers, such as silicone.

The improved characteristics of the fabrics containing the microfibers used in the regions of the apparel of this disclosure (beyond the functional characteristics of the material to maintain the position against the skin of a human wearer) include:

a. Strength: these regions are essentially reinforced by the microfibers and have better wear characteristics than the prior art use of applied elastomers such as silicone, and are also abrasion resistant;

b. Elasticity - Stretching and shrinking: these regions fully stretch or compress like the rest of the athletic apparel, as opposed to the prior art use of applied elastomers such as silicone, which prevents stretching and compression of the material in all dimensions;

c. Quick drying: these regions of fabric do not prevent evaporation of water and sweat from the wearer’s skin, in comparison to the prior art use of applied elastomers such as silicone, such that these regions are quick drying;

d. Resilient when wet – these regions maintain their friction and shape characteristics when wet with sweat or water;

ej. Easily washed – these regions require no special washing instructions or procedures beyond the care intended for the rest of the athletic garment.

The foregoing description has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the forms disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention. The embodiments described above are further intended to explain the best mode known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by the particular applications or uses of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

To the extent that the appended claims have been drafted without multiple dependencies, this has been done only to accommodate formal requirements in
jurisdictions which do not allow such multiple dependencies. It should be noted that all possible combinations of features which would be implied by rendering the claims multiply dependent are explicitly envisaged and should be considered part of the invention.
What is claimed is:

1. An article of sports apparel comprising: at least one region of fabric comprising a microfiber yarn content between about 1% microfiber yarn to about 99% microfiber yarn.

2. The article of claim 1, wherein the at least one region of fabric comprises a yarn that is at least one of nylon, polyester and polypropylene.

3. The article of claim 1, wherein the at least one region of fabric comprises microfiber yarn content between about 3% microfiber yarn and about 97% microfiber yarn.

4. The article of claim 1, wherein the at least one region of fabric comprises microfiber yarn content of about 50% microfiber yarn and about 50% yarn content selected from at least one of nylon, polyester, and polypropylene or a combination thereof.

5. The article of claim 1, wherein the at least one region of fabric comprises microfiber yarn content of about 50% microfiber yarn with the remaining 50% of the yarn formed from a combination of non-micro polyester and nylon fibers.

6. The article of claim 1, wherein the at least one region of fabric comprises yarns disposed along the inner surface of the apparel to come in contact with the skin of the wearer.

7. The article of claim 1, wherein the article of sports apparel is bicycling tights and the at least one region of fabric comprises between about 0.5 cm and about 10 cm proximate the end of at least one leg of the bicycling tights.

8. The article of claim 7, wherein the at least one region comprises a hem of each leg disposed on the inner surface of the leg to come into contact with the skin of a wearer to cling to the skin of a wearer, helping to keep the legs of the tights in a fixed position against the skin of the legs of the wearer.

9. The article of claim 8, wherein the tights comprise full length leggings and the at least one region forms a hem that clings to the skin around the ankles of the wearer.

10. The article of claim 8, wherein the tights comprise three-quarter length leggings and the at least one region forms a hem that clings to the skin around the calves of the wearer.
11. The article of claim 8, wherein the tights comprise bicycling shorts and the at least one region forms a hem that clings to the skin around the thighs of the wearer.

12. The article of claim 7, wherein the at least one region comprises the waist of bicycling tights disposed on the inner surface to come into contact with the skin of a wearer to cling to the skin of the wearer, to help keep the waist of the tights in a fixed position against the skin of the wearer.

13. The article of claim 1, wherein the article of sports apparel is an athletic jersey and the at least one region of fabric comprises between about 0.5 cm and about 10 cm proximate the end of at least one sleeve of the athletic jersey.

14. The article of claim 13, wherein the at least one region comprises a cuff of at least one sleeve disposed on the inner surface of the sleeve to come in contact with the skin of a wearer to cling to the skin of a wearer, helping to keep the at least one sleeve of the jersey in a fixed position against the skin of an arm of the wearer.

15. The article of claim 14, wherein the jersey comprises full length sleeves and the at least one region forms a cuff that clings to the skin around a wrist of the wearer.

16. The article of claim 14, wherein the jersey comprises three-quarter length sleeves and the at least one region forms a cuff that clings to the skin around forearms of the wearer.

17. The article of claim 14, wherein the jersey comprises short sleeves and the at least one region forms a cuff that clings to the skin around biceps of the wearer.

18. The article of claim 14, wherein the jersey comprises a sleeve-less jersey and the at least one region forms a cuff that clings to the skin around a shoulder of the wearer.

19. The article of claim 13, wherein the article of sports apparel is an athletic jersey and the at least one region comprises the waist of the jersey disposed on the inner surface of the jersey to come in contact with the skin of a wearer to cling to the skin of the wearer, helping to keep the waist of the jersey in a fixed position against the skin of the wearer.

20. The article of claim 1, wherein the article of sports apparel is running tights and the at least one region of fabric comprises between about 0.5 cm and about 10 cm proximate the end of at least one leg of the running tights.
21. The article of claim 20, wherein the at least one region comprises a hem of at least one leg disposed on the inner surface of the leg to come in contact with the skin of a wearer to cling to the skin of a wearer, helping to keep the at least one leg of the running tights in a fixed position against the skin of a leg of the wearer.

22. The article of claim 21, wherein the running tights comprise full length legs and the at least one region forms a cuff that clings to the skin around an ankle of the wearer.

23. The article of claim 21, wherein the running tights comprise three-quarter length leggings and the at least one region forms a cuff that clings to the skin around a calf of the wearer.

24. The article of claim 21, wherein the running tights comprise running shorts and the at least one region forms a cuff that clings to the skin around thighs of the wearer.

25. The article of claim 13, wherein the article of sports apparel is running tights and the at least one region comprises the waist of the tights disposed on the inner surface of the tights to come in contact with the skin of a wearer to cling to the skin of the wearer, helping to keep the waist of the tights in a fixed position against the skin of the wearer.
### INTERNATIONAL SEARCH REPORT

**International application No.**
PCT/US10/27058

**A. CLASSIFICATION OF SUBJECT MATTER**
- IPC(8) - A41D 27/24, A41D 27/00, A41D 31/00, A41D 13/00, A41D 10/08 (2016.01)
- CPC - A41D 10/84, A41D 13/00, A41D 13/0015, A41D 27/24, A41D 31/0011

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
- IPC(8): A41D 27/7*, A41D 31/7*, A41D 13/7* (2016.01)
- CPC: A41D 27/7*, A41D 31/7*, A41D 13/7*

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
- IPC(8): A41D* (2016.01)
- CPC: A41D*

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
- PatBase, Google Patents, Google Web

Keywords: microfiber, microfibre, yarn, nylon, polyester, polypropylene, elastane, elastic, polyamide, skin, bike, bicycling, cycling, run, running, triathlon, triathlete, fabric, porch, %, sleeve, jersey, short, legging, lights

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Y</td>
<td>US 2012/0117700 A1 (HOWELL et al.) 17 May 2012 (17.05.2012), entire document</td>
<td>1-3, 6-8, 11-12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>X Y</td>
<td>US 2013/0111646 A1 (SEVENANTS) 09 May 2013 (09.05.2013), entire document</td>
<td>1-5, 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10, 15-16, 18, 21-24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1b-1b, 19</td>
</tr>
<tr>
<td>A Q</td>
<td>Men's Black Pearl Elite Bike Short. Datasheet [online]. Aero Tech Designs, 2010 [retrieved on 2017-12-29]. Retrieved from the Internet: &lt;URL: <a href="https://www.youtube.com/watch?v=2QS4XjUw5Sg%3E">https://www.youtube.com/watch?v=2QS4XjUw5Sg&gt;</a>.</td>
<td>21-24</td>
</tr>
</tbody>
</table>


- **Further documents are listed in the continuation of Box C.**

**Special categories of cited documents:**
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- **"T"** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **"X"** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- **"Y"** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- **"&"** document member of the same patent family

**Date of the actual completion of the international search**
17 June 2016

**Date of mailing of the international search report**
26 JUL 2016

**Name and mailing address of the ISA/US**
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300

**Authorized officer:**
Lee W. Young
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 7,748,056 B2 (MICKLE) 06 July 2010 (06.07.2010), entire document</td>
<td>1-25</td>
</tr>
</tbody>
</table>