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(54) **WOVEN TEXTILE FABRIC WITH
COTTON/MICRODENIER FILAMENT
BUNDLE BLEND**

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(57) **ABSTRACT**

A fabric includes warp and weft yarns interwoven in a series of repeat units. In the fabric, the warp yarns comprise cotton yarns and the weft yarns comprise microdenier filament bundles. Such a fabric can provide desirable tactile properties for articles such as sheets, pillowcases, blankets and the like.

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WOVEN TEXTILE FABRIC WITH COTTON/MICRODENIER FILAMENT BUNDLE BLEND

FIELD OF THE INVENTION

[0001] The present invention is directed generally to woven fabrics, and more particularly to woven textile fabrics.

BACKGROUND OF THE INVENTION

[0002] Textile fabrics are employed in a number of applications, including clothing, upholstery, draperies, bedding and the like. Some textile fabrics are employed in bedding applications (such as sheets and other bedding articles) and the like that may contact the skin directly. Properties that are typically desirable in such a textile fabric include "hand" (which is the tactile impression that the fabric provides), softness, flexibility and drape.

[0003] Some textile fabrics for bedding applications are woven from 100 percent cotton yarns, which typically provide the desired tactile properties. However, other fabrics used in bedding applications often employ yarns that are intimate blends of cotton and other materials, such as cotton and polyester. A typical intimate yarn is formed of both cotton and polyester fibers that are combined at the beginning of the yarn-manufacturing process, with the result being a yarn that is a relatively homogenous combination of cotton and polyester. Blends of fibers are used to impart properties not possible in fabrics of a single fiber. For example, polyester is often blended with cotton because it adds durability and increases resistance to wrinkling. The cotton component contributes comfort through moisture absorption and softness. The result is often a compromise of the features of each fiber employed.

[0004] Also, with fabrics used in bedding, the thread count (tc), which is the number of total threads in a square inch of material, is often of interest to the consumer, as a higher thread count fabric is typically perceived to be of higher quality. However, in high thread count fabrics (for example, fabrics having a 300 tc or higher), there is a tendency for fabrics of intimate blends to "pill" when woven into the sateen weave pattern often preferred by consumers at high thread counts. "Pilling" is a function of one end of individual fibers slipping and protruding from their twisted bundles when the fabric is abraded. With 100 percent cotton yarns, the fibers are relatively weak, and those that slip and protrude from the bundle tend to simply break off or fall away. However, with intimate yarns the stronger polyester fibers that eventually protrude do not easily break off, and they thus tend to provide an anchoring location for the cotton fibers. The clinging polyester fibers tend to attract other cotton fibers and roll up, or "pill" under further abrasion. The tendency is exacerbated in sateen weaves, as longer floats of cotton are exposed for abrasion. As a result, these high thread count sateen fabrics are typically offered only in 100 percent cotton. Intimately blended fabrics are relegated to twills and plain weave constructions of lower thread counts.

[0005] Less common are non-intimately blended fabrics. For example, a fabric may be made of 100% cotton warp and 100% polyester weft. The polyester wefts can comprise either spun yarns (made from twisting discrete, short lengths of fiber) or continuous filament yarns (made from bundles of small continuous filaments). The latter yarns are typically made of filaments much greater than 1.0 denier per filament,

and are often made with yarns of 4.0 denier per filament, as is the case with typical 150 denier yarns of 36 filaments. The problems in all cases utilizing 100% polyester wefts is the deleterious effect on fabric hand and the propensity of the polyester yarns to pill.

[0006] In view of the foregoing, it may be desirable to provide additional textile fabrics that may be suitable for use in bedding and other applications, and in particular fabrics with non-cotton yarns that can be used at high thread counts without pilling and that actually improve the tactile properties.

SUMMARY OF THE INVENTION

[0007] As a first aspect, embodiments of the present invention are directed to a fabric comprising warp and weft yarns interwoven in a series of repeat units. In the fabric, the warp yarns comprise cotton yarns and the weft yarns comprise microdenier filament bundles. Such a fabric can provide desirable tactile properties for articles such as sheets, pillowcases, blankets and the like.

[0008] As a second aspect, embodiments of the present invention are also directed to a fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein the warp yarns comprise cotton yarns and the weft yarns comprise microdenier filament bundles. In this fabric, the warp yarns and weft yarns are interwoven in a sateen weave pattern. The thread count of the fabric is greater than about 250 threads/square inch. This blended fabric can provide desirable tactile properties at a high thread count without the pilling that has been characteristic of other high thread count blended sateen fabrics.

[0009] As a third aspect, embodiments of the present invention are directed to another fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein the warp yarns comprise cotton yarns and the weft yarns comprise microdenier filament bundles. In this fabric, the warp yarns and weft yarns are interwoven in a plain weave pattern. The thread count of the fabric is greater than about 150 threads/square inch. This fabric can provide superior tactile properties in a less expensive, lower thread count fabric.

[0010] As a fourth aspect, embodiments of the present invention are directed to a fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein the warp yarns comprise cotton-containing yarns and the weft yarns comprise microdenier filament bundles. Such a fabric may be particularly suited for institutional environments.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0011] The present invention will now be described more fully hereinafter, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity.

[0012] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood

that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0013] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein the expression “and/or” includes any and all combinations of one or more of the associated listed items.

[0014] In addition, spatially relative terms, such as “under”, “below”, “lower”, “over”, “upper” and the like, may be used herein for ease of description to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “under” or “beneath” other elements or features would then be oriented “over” the other elements or features. Thus, the exemplary term “under” can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0015] Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[0016] As used herein, the term “plain weave” refers to a simple “over 1/under 1” weave pattern followed by both the warp and weft yarns of the fabric. The term “sateen” refers to a satin weave pattern generally produced by floating warp yarns over weft yarns to form a non-diagonal pattern with the floats (in contrast to a twill, which forms a diagonal pattern with its floats). The term sateen is associated with satin weaves produced using cotton-system spun yarns. Satin is the term commonly applied to these fabrics made with continuous filament yarns. The present invention employs both cotton-system and continuous filament yarns, and herein will be referred to as a sateen fabric as cotton-system yarns dominate the construction. Because more of the weft threads are exposed on one surface, and more of the warp yarns are exposed on the opposite surface, the resulting fabric can be much smoother on one or both surfaces than if it were woven with a typical plain weave. Sateen weaves may be formed with different length floats; for example, sateen weaves may follow an “over 4/under 1,” “over 6/under 1,” or other pattern, or may have even longer floats. An exemplary sateen weave is described in A. K. Sen, *Coated Textiles: Principles and Applications* (CRC Press 2001).

[0017] The fabric of the present invention comprises cotton-containing warp yarns and yarns formed of microdenier filament bundles as weft yarns. As used herein, the term “cotton-containing” means yarns that have at least 40 percent cotton, encompasses both cotton blends (e.g., a 60/40 polyester/cotton blend) and 100 percent cotton yarns (herein “cotton yarns”). The warp yarns can be any cotton-containing

yarns typically employed in the production of textile fabrics. The cotton yarns can be spun in any manner, including rotor, jet or ring. Suitable cotton yarns are sized between about Ne 25/1 and 100/1, with a 40/1 and 60/1 cotton count yarn being typical.

[0018] The weft yarns comprise yarns formed of microdenier filament bundles. The size of the filament yarns is expressed in denier, a direct numbering system that describes the linear densities of silk and most manmade filament yarns (as measured in g per 9000 m of yarn). The size of each individual filament, expressed as denier per filament (dpf), equals the denier of the yarn bundle divided by the number of filaments. As used herein, a “microdenier” filament is a filament that is sized at less than one denier per filament; typical microdenier filaments are sized at about 0.9 denier per filament, 0.7 denier per filament, 0.5 denier per filament or even less. The microdenier filaments are bundled into a yarn; for example, a yarn may contain 100-300 or more microdenier filaments per bundle. In some embodiments, the microdenier filaments are formed of polyester. The microdenier filament bundles may be formed by any technique known by those skilled in this art to be suitable for the formation of microdenier filament bundles.

[0019] The warp and weft yarns may be interwoven with each other by any technique known to be suitable for interweaving yarns. Typically, the yarns are interwoven on a commercial loom. They may be interwoven in a variety of weave patterns, including plain weave, twill, satin and sateen weaves and their derivatives.

[0020] It has been discovered that, when woven with cotton and/or cotton-containing warp yarns, microdenier filament bundles can provide a blended fabric with exceptional hand, softness, drape, appearance, absorption, and moisture transport. The flexibility and suppleness of the microdenier filament bundles can contribute to the improvement of these and other tactile properties.

[0021] A potential attribute of the present invention is that it can be comparatively eco-friendly since it may require less water and detergent vis a vis 100% cotton. Also, the drying time in such a fabric may be faster compared to 100% cotton and, as such, can be said to save energy, as it may require less heat.

[0022] Moreover, it has been discovered that the use of cotton and/or cotton-containing warp yarns and microdenier filament bundles as weft yarns can produce a fabric with little to no pilling, particularly when woven in a sateen weave, even at high (280+) thread counts. For example, a 300 tc fabric having a sateen weave of the construction described in Table 1 has proven to have excellent tactile properties.

TABLE 1

Warp Yarns	Cotton	60/1 cotton count
Weft Yarns	Polyester Microdenier Filaments	0.5 dpf, 155 denier with 288 filaments/bundle
Weave	4:1 Sateen	300 tc

[0023] In a warp-faced sateen weave, much of the face surface of the fabric presents the cotton yarns (for example, with a 4:1 sateen weave, approximately 80 percent of the face surface presents cotton). As a result, the face surface has largely the feel of cotton, yet retains the easy care and durability of a blend, and, due to the predominant presence of the

microdenier filament bundles on the back surface, exhibits little to no pilling. In other embodiments, other variations, such as the sateen weave pattern, the size of the warp and/or weft yarns, and the density of the mesh (e.g., 350 tc or higher), may also be employed.

[0024] The same concepts hold true, but in reverse, for a filling-faced sateen weave wherein cotton filling yarns can float above microfilament warp yarns.

[0025] As another example, plain weave fabrics may also benefit from the use of microdenier filament bundles as weft yarns. A 200 tc plain weave fabric of the construction set forth in Table 2 can exhibit improved softness over conventional blends of similar thread count.

TABLE 2

Warp yarns	Cotton	40/1
Weft yarns	Polyester	0.5 dpf, 75 denier with 144 filaments/bundle
Weave	Plain Weave	118 × 74

Similar results may be observed in plain weave fabrics in which the weft yarns are 155 denier yarns (with 200, 300 or more filaments/bundle). Similar results may also be observed in plain weave fabrics in which the thread count is increased to 220 tc (for a mesh of 118×92) or even higher. Those skilled in this art will recognize other variations in which microdenier filament bundles may be used, such as lower thread counts (e.g., 150 tc).

[0026] As a third example, plain weave fabrics may also employ cotton/polyester blends as warp yarns and microdenier filament bundles as weft yarns. An exemplary 200 tc plain weave fabric is set forth in Table 3.

TABLE 3

Warp yarns	60/40 polyester/cotton	40/1
Weft yarns	Polyester	0.5 dpf, 75 denier with 144 filaments/bundle
Weave	Plain Weave	118 × 74

Such a fabric may be particularly useful in hospitality and health care environments, in which durability and quicker drying may be desirable. This fabric may have excellent hand and may not pill substantially.

[0027] Those skilled in this art may also recognize that other materials may be employed for the microdenier filament bundles. For example, nylon, polytrimethylene terephthalate, polylactic acid, acrylic, modacrylic, rayon, lyocell, modal, acetate, spandex, and olefin or any other man-made fiber may be used as a substitute for polyester. Also, blends of materials formed into microdenier filament bundles may be used, such as nylon and polyester.

[0028] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined by the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That which is claimed is:

1. A fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein:
 - (a) the warp yarns comprise cotton yarns; and
 - (b) the weft yarns comprise microdenier filament bundles.
2. The fabric defined in claim 1, wherein the warp and weft yarns are interwoven in a sateen weave pattern.
3. The fabric defined in claim 1, wherein the thread count of the fabric is greater than 280 threads/square inch.
4. The fabric defined in claim 1, wherein the warp and weft yarns are interwoven in a plain weave pattern.
5. The fabric defined in claim 1, wherein the thread count of the fabric is greater than 150 threads/square inch.
6. The fabric defined in claim 1, wherein the microdenier filament bundles comprise filaments having a denier per filament of less than about 0.7 denier.
7. The fabric defined in claim 1, wherein the microdenier filament bundles include at least 100 microdenier filaments/bundle.
8. The fabric defined in claim 1, wherein the microdenier filament bundles comprise polyester.
9. A bedding article that comprises the fabric defined in claim 1.
10. The bedding article defined in claim 9, wherein the article is constructed such that more than 75 percent of a surface thereof that is intended to contact skin is covered by cotton.
11. A fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein:
 - (a) the warp yarns comprise cotton yarns;
 - (b) the weft yarns comprise microdenier filament bundles;
 - (c) the warp yarns and weft yarns are interwoven in a sateen weave pattern; and
 - (d) the thread count of the fabric is greater than about 250 threads/square inch.
12. The fabric defined in claim 11, wherein the thread count of the fabric is greater than about 300 threads/square inch.
13. The fabric defined in claim 11, wherein the microdenier filament bundles comprise filaments having a diameter of less than about 0.7 denier.
14. The fabric defined in claim 11, wherein the microdenier filament bundles include at least 100 microdenier filaments/bundle.
15. The fabric defined in claim 11, wherein the microdenier filament bundles comprise polyester.
16. A bedding article that comprises the fabric defined in claim 11.
17. The bedding article defined in claim 11, wherein the article is constructed such that more than 75 percent of a surface thereof that is intended to contact skin is covered by cotton.
18. A fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein:
 - (a) the warp yarns comprise cotton yarns;
 - (b) the weft yarns comprise microdenier filament bundles;
 - (c) the warp yarns and weft yarns are interwoven in a plain weave pattern; and
 - (d) the thread count of the fabric is greater than 150 threads/square inch.
19. The fabric defined in claim 18, wherein the thread count of the fabric is greater than 200 threads/square inch.

20. The fabric defined in claim **18**, wherein the microdenier filament bundles comprises filaments having a diameter of less than about 0.7 denier.

21. The fabric defined in claim **18**, wherein the microdenier filament bundles include at least 100 microdenier filaments.

22. The fabric defined in claim **18**, wherein the microdenier filament bundles comprise polyester.

23. A bedding article that comprises the fabric defined in claim **18**.

24. A fabric comprising warp and weft yarns interwoven in a series of repeat units, wherein:

(c) the warp yarns comprise cotton-containing yarns; and

(d) the weft yarns comprise microdenier filament bundles.

25. The fabric defined in claim **24**, wherein the warp yarns comprise a 60/40 blend of polyester/cotton.

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