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TOMLIN

(54) **WOVEN TOWEL**

(71) Applicant: **Linen Holdings LLC**, Gibbsboro, NJ (US)

(72) Inventor: **Gerald L. TOMLIN**, Cherry Hill, NJ (US)

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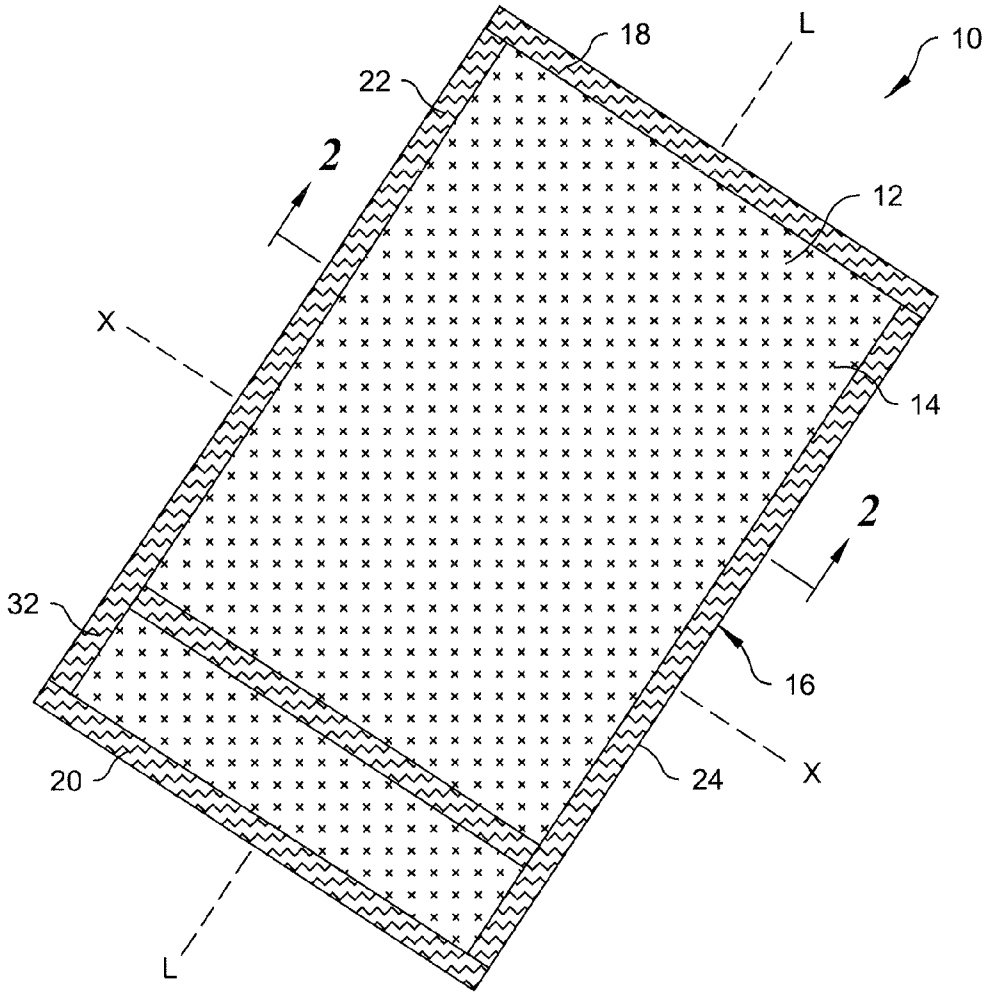
(57) **ABSTRACT**

A woven towel includes a ground fabric having a set of warp yarns woven together with a set of weft yarns and a plurality of pile yarns interlaced with the ground fabric. The warp yarns and weft yarns are polyester vortex spun fibers or polyester air-jet spun yarns. The pile yarns are cotton spun yarns or cotton/polyester blended spun yarns. The warp yarns, the weft yarns and the pile yarns are woven together in a terry weave.



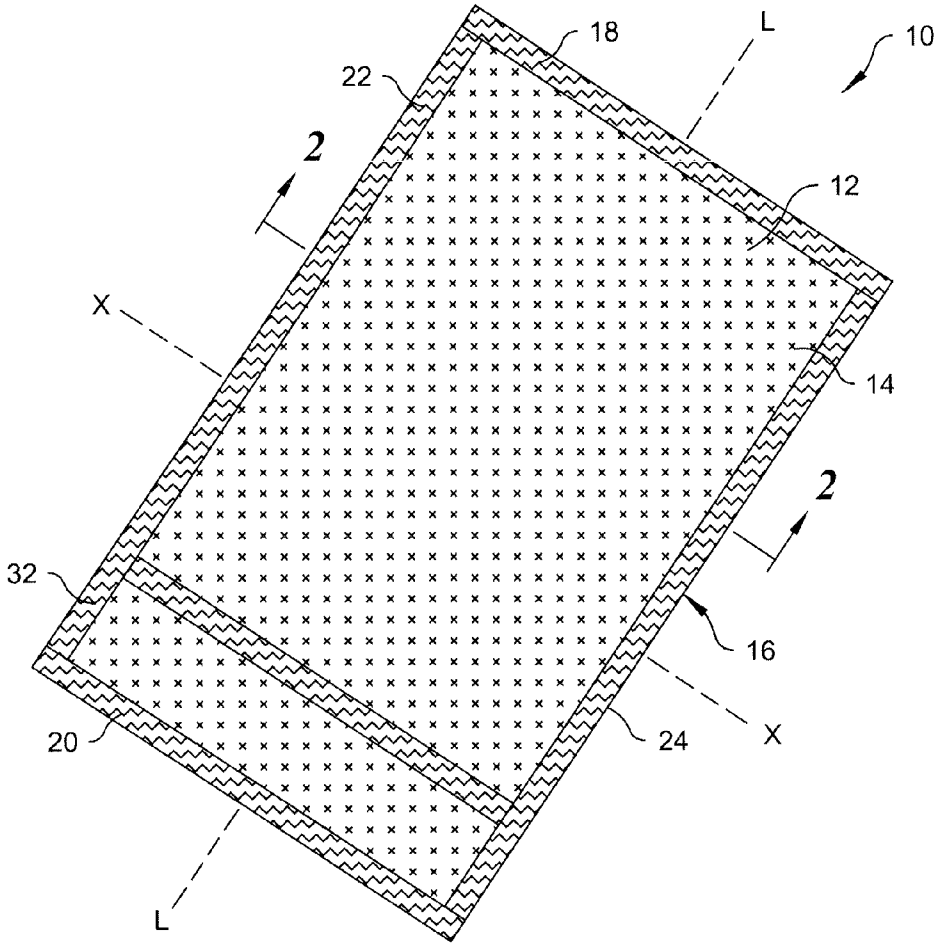


Fig. 1

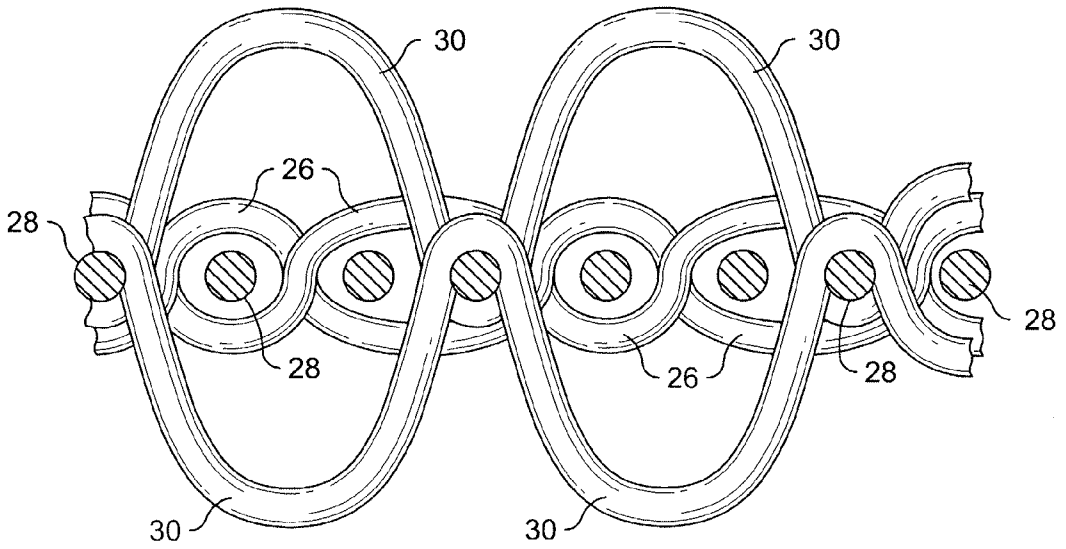


Fig. 2

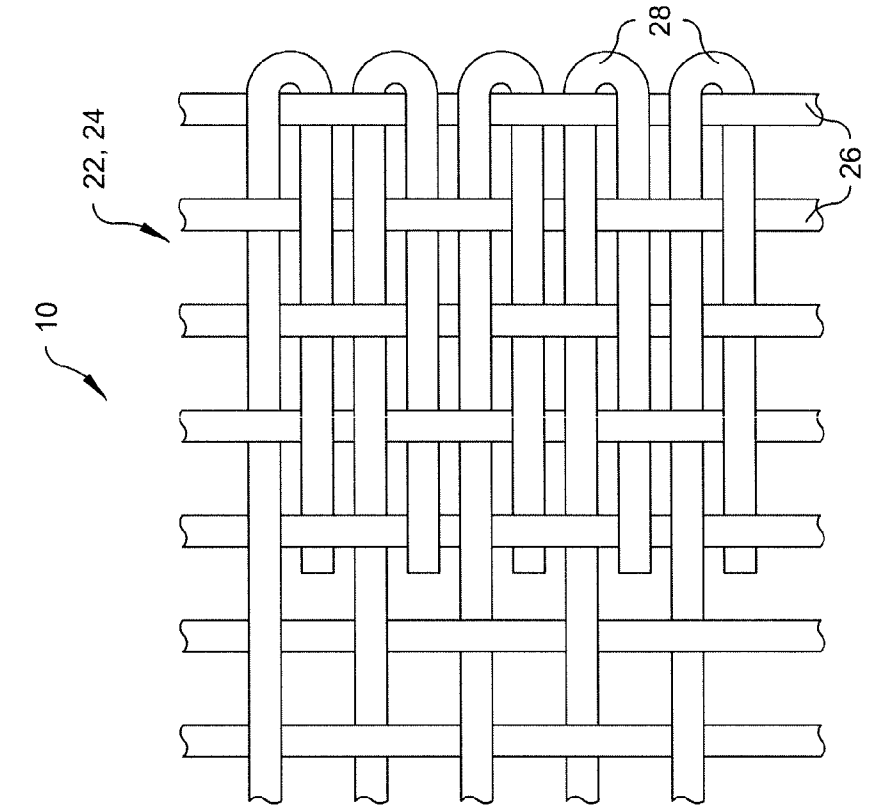


Fig. 4

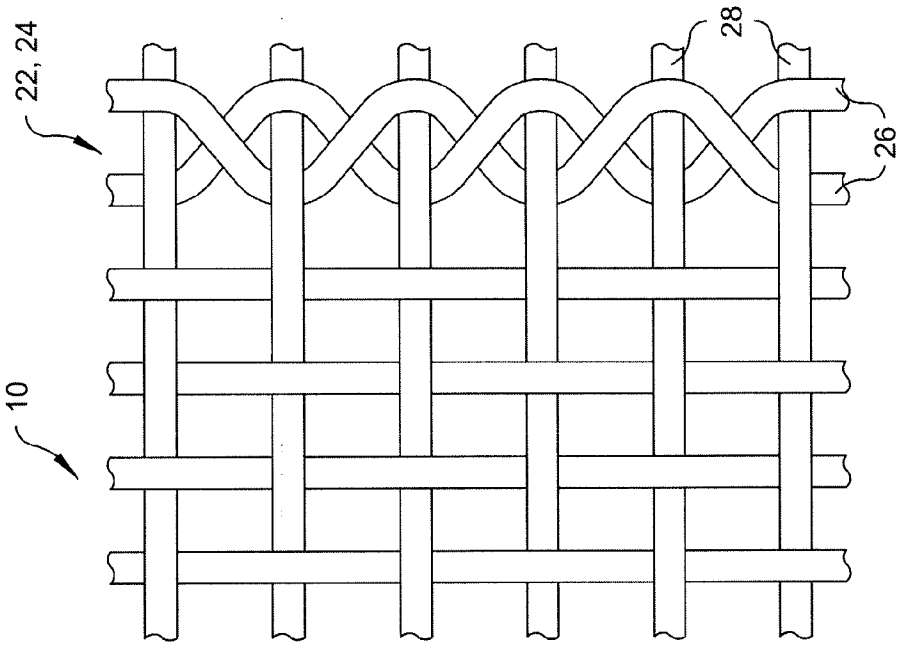


Fig. 3

WOVEN TOWEL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 61/916,531, filed on Dec. 16, 2013, entitled "Woven Fabric," the entire contents of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] An embodiment of the present invention relates generally to a woven terry fabric and, more particularly, to a woven terry towel composed of spun polyester yarns.

[0003] Most conventional woven terry fabrics are constructed from cotton warp yarns, cotton weft yarns and cotton pile yarns woven together. Other known fabrics utilize a blend of cotton and cellulose fibers for the warp or weft yarns. Cotton is primarily used to make such conventional woven fabrics because it is inexpensive and highly absorbent. However, cotton has several drawbacks. Specifically, because conventional woven cotton fabrics are primarily constructed of cotton, such fabrics have a relatively short useful life and cannot withstand multiple launderings. In particular, such conventional woven cotton fabrics suffer from shrinkage when subjected to the high temperatures usually associated with laundering and particularly drying.

[0004] Terry fabrics that use materials other than cotton, such as polyester, have also been developed. For example, the woven fabric of U.S. Pat. No. 7,673,656 utilizes non-moisture transporting synthetic polyester filament yarns for the warp or weft yarns. As well known to those of ordinary skill in the art, a polyester filament yarn is a single piece of extruded polyester. However, polyester filaments do not readily absorb moisture and thus woven fabrics formed thereof have significantly inferior absorption properties as compared with cotton woven fabrics.

[0005] Thus, it is desirable to provide a woven fabric that exhibits a high moisture absorption rate, a high resistance to shrinkage, a high resistance to abrasion of the selvage and hem areas, a high overall tensile strength, and a long life cycle, while still retaining the feel, appearance and absorption properties of conventional cotton fabrics, particularly cotton towels.

BRIEF SUMMARY OF THE INVENTION

[0006] One aspect of the present invention is directed to a woven towel comprising a ground fabric including a set of warp yarns woven together with a set of weft yarns and a plurality of pile yarns interlaced with the ground fabric. The warp yarns and weft yarns are polyester vortex spun fibers or polyester air-jet spun yarns. The pile yarns are cotton spun yarns or cotton/polyester blended spun yarns. The warp yarns, the weft yarns and the pile yarns are woven together in a terry weave.

[0007] Another aspect of the present invention is directed to a woven terry towel comprising a ground fabric including a set of warp yarns woven together with a set of weft yarns a plurality of pile yarns interlaced with the ground fabric. The warp yarns and weft yarns are polyester Murata Jet Spun yarns and the pile yarns are 100% by weight cotton spun yarns.

[0008] Another aspect of the present invention is directed to a woven terry towel comprising a ground fabric including a set of warp yarns woven together with a set of weft yarns a plurality of pile yarns interlaced with the ground fabric. The warp yarns and weft yarns are polyester Murata Jet Spun yarns and the pile yarns are 100% by weight cotton spun yarns. The woven towel exhibits an overall dimensional shrinkage rate of 1% or less after multiple launderings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] The following detailed description of preferred embodiments of the present invention will be better understood when read in conjunction with the appended drawings. For the purposes of illustrating the invention, there are shown in the drawings embodiments which are presently preferred. It is understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0010] FIG. **1** is a perspective view of a woven terry towel in accordance with a preferred embodiment of the preset invention;

[0011] FIG. **2** is a greatly enlarged partial cross-sectional elevational view of a portion of the woven terry towel taken along line **2-2** of FIG. **1**;

[0012] FIG. **3** is a greatly enlarged partial cross-sectional elevational view of a selvage of a woven terry towel in accordance with a preferred embodiment of the preset invention; and

[0013] FIG. **4** is a greatly enlarged partial cross-sectional elevational view of a selvage of a woven terry towel in accordance with another preferred embodiment of the preset invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Certain terminology is used in the following description for convenience only and is not limiting. The words "right", "left", "lower", and "upper" designate directions in the drawings to which reference is made. The words "inwardly" and "outwardly" refer to directions toward and away from, respectively, the geometric center of the fabric and designated parts thereof The terminology includes the above-listed words, derivatives thereof, and words of similar import. Additionally, the words "a" and "an", as used in the claims and in the corresponding portions of the specification, mean "at least one."

[0015] Referring to the drawings in detail, wherein like numerals and characters indicate like elements throughout, there is shown in FIGS. **1-2** a presently preferred embodiment of a woven fabric in accordance with the present invention.

[0016] With particular reference to FIGS. **1-2**, the woven fabric, generally designated **10**, is preferably a woven terry fabric, and more preferably a woven terry towel. It will be understood that the woven terry towel **10** may be a bath towel, a bath mat, a hand towel, a beach towel, a wash cloth, or any other towel or the like. It also will be understood that the woven fabric **10** may be in the form of various garments or other objects, such as sheets, pillow cases, blankets, robes, beach cover-ups, seat covers and the like.

[0017] As shown in FIG. **1**, the woven fabric **10** comprises a main body **12** having a first or front surface **14** and an opposing second or rear surface **16**. A longitudinal axis L of the main body **12** extends from a first or top end or hem **18** toward an opposing second or bottom end or hem **20**. Left and right selvages **22**, **24** of the towel **10** extend generally parallel

to the longitudinal axis L of the main body **12** between the top and bottom ends/hems **18**, **20**. A lateral axis X of the main body **12** extends generally perpendicular to the longitudinal axis L from the left selvage **22** toward the right selvage **24**, and vice versa. A border **32** of the woven terry towel **10** is formed of the top and bottom hems **18**, **20** and the left and right selvages **22**, **24**.

[0018] As shown in FIG. **2**, the woven fabric **10** comprises a plurality of ground warp yarns **26** which extend generally parallel to the longitudinal axis L and the left and right selvages **22**, **24**. The woven fabric **10** also comprises a plurality of ground weft (or fill) yarns **28** which extend generally parallel to the lateral axis X and generally perpendicular to the warp yarns **26**. The ground warp and weft yarns **26**, **28** are woven together, preferably at a relatively high tension, to form a ground fabric of the woven fabric **10**. The warp and weft yarns **26**, **28** may be woven together using any known and conventional weaving techniques to form any known or conventional weave configuration, such as a plain weave, a satin weave, or a twill. Preferably, the warp and well yarns **26**, **28** are woven together using a shuttle or shuttleless weaving loom.

[0019] Both the warp and weft yarns **26**, **28** are preferably made of spun yarns, and more preferably of polyester spun yarns formed from staple polyester fibers. The polyester spun yarns preferably extend the entire length and width of the woven fabric **10**, such that the top and bottom hems **18**, **20** and the left and right selvages **22**, **24** (and thus the entire border **32**) are all formed of the polyester spun yarns. The left and/or right selvages **22**, **24** may be constructed as either a "tuck in" selvage (shown in FIG. **3**) or a "raw leno" hemmed selvage (shown in FIG. **4**), depending on the loom used to weave the woven fabric **10** and the end use of the woven fabric **10**.

[0020] The polyester spun yarns of the warp **26** and weft **28** may be formed from any known or conventional spinning technique. For example, the polyester spun yarns may be ring spun yarns, open end yarns, friction spun yarns, vortex spun yarns, air-jet spun yarns, or the like. Ring spinning, open end (rotor) spinning, friction spinning, vortex spinning and air-jet spinning are all techniques which are well known to those of ordinary skill in the art for forming spun yarns and thus are not described herein in detail. However, brief descriptions of each are provided herein.

[0021] Ring spinning involves twisting staple fibers into yarn and simultaneously winding the twisted yarn onto bobbins for storage. Open end (rotor) spinning involves twisting staple fibers together within a rotor rotating at high speeds Friction spinning involves introducing staple fibers in between two revolving perforated drums, wherein the rotation of the drums causes the fibers to twist and become entangled with each other. Vortex spinning involves spinning fibers using a vortex flow of compressed air to form a yarn consisting of a core of parallel fibers held together by wrapper fibers. Finally, air-jet spinning is a pneumatic process which involves passing staple fibers through one or two fluid (e.g., air) nozzles to form a yarn consisting of an untwisted core of staple fibers and a surface wrapping of the fibers.

[0022] In the present embodiment, the polyester spun yarns are preferably vortex spun fibers or air-jet spun yarns. More preferably, the polyester spun yarns are air-jet spun yarns, and most preferably Murata Jet Spun yarns. The Murata jet spinning process and Murata Jet Spun (MJS) yarns are well known to those of ordinary skill in the art and thus are not described herein in detail. Generally, polyester MJS yarns consist of polyester fibers wrapped around polyester core fibers, with the core fibers being of a longer length than the wrapped fibers. Due to such a structure, MJS yarns have less hairiness and a smoother initial appearance than other types of spun yarns. Also, unlike traditional polyester filaments, which do not readily absorb moisture and instead simply move moisture around, polyester MJS yarns have a high moisture absorption rate.

[0023] Also, while conventional cotton yarns are usually twisted to form a two-ply construction to provide increased strength, polyester MJS yarn is stronger than cotton yarn, such that single-ply MJS yarns may be used, thereby decreasing manufacturing time and costs associated with the twisting process necessary to form two-ply yarns. However, it will be understood that the warp yarns **26** and/or the weft yarns **28** may be comprised of two or more polyester MJS yarns twisted together to form plied warp and/or weft yarns **26**, **28**.

[0024] The polyester MJS warp and weft yarns **26**, **28** may be formed of any desired denier, length, size and shape. More particularly, the properties (e.g., denier, length, size, shape or the like) of the polyester MJS warp and weft yarns **26**, **28** may vary depending on the end form or use of the woven fabric **10**. Preferably, both the polyester MJS warp yarns **26** and the polyester MJS weft yarns **28** have a circular cross-sectional shape and are of a size that ranges from 10 singles to 14 singles, and most preferably approximately 12 singles. It will be understood that the denier, length, size and/or shape of the polyester MJS yarns may differ between the warp yarns **26** and the weft yarns **28**. Preferably, however, the polyester MJS yarns of both the warp **26** and the weft **28** have the same or similar properties (e.g., denier, length, size, shape or the like). It will also be understood that the polyester MJS yarns of the warp **26** and/or the weft **28** may be formed in any size, as long as the woven fabric **10** has the desired degrees of moisture absorption, tensile strength, abrasion resistance and shrinkage resistance.

[0025] While the warp yarns **26** and the weft yarns **28** of the present embodiment are preferably both spun yarns, and more preferably MJS yarns formed of 100% by weight of polyester fibers, it will be understood that minor amounts of non-polyester fibers may be present in the warp and/or weft yarns **26**, **28**, if desired, as long as the resulting woven fabric **10** still exhibits the desired moisture absorption rate and resistance to shrinkage.

[0026] The woven fabric **10** may be made in a balanced weave, where the number of warp yarns **26** is equal to the number of well yarns **28** per a square inch of fabric, or may be made in an unbalanced weave, where the number of warp yarns **26** is greater or less than the number of well yarns **28** per square inch of fabric. Also, the total number of warp and weft yarns **26**, **28** per square inch of fabric may vary depending on the intended application or end form or use of the woven fabric **10**, and particularly depending on the weight and size of the end form of the woven fabric **10**.

[0027] As shown in FIG. **2**, in the present embodiment, the woven fabric **10** preferably further comprises a plurality of pile yarns **30** interlaced or interwoven with the ground polyester MJS warp and well yarns **26**, **28**. The plurality of pile yarns **30** extend generally parallel to the longitudinal axis L, the warp yarns **26**, and the left and right selvages **22**, **24**. The pile yarns **30** may be formed of any known or conventional yarn, such as a spun yarn, a filament yarn, a texturized yarn, or the like. The pile yarns **30** are preferably spun yarns. The pile yarns **30** may also be formed of any known or conven-

tional material, such as cotton, polyester, cellulose (i.e., rayon), and the like and blends thereof Preferably, the pile yarns **30** are cotton spun yarns or cotton/polyester blended spun yarns. More preferably, the pile yarns **30** are 100% by weight cotton spun yarns. The pile yarns **30** form a plurality of loops that extend away from the ground fabric in the direction of both the front and rear surfaces **14**, **16**. More particularly, the plurality of loops formed by the cotton pile yarns **30** form the front and rear surfaces **14**, **16** of the woven fabric **10** which are provided for contact with a user of the woven fabric **10**.

[0028] The cotton pile yarns **30** may be formed of any desired denier, length, size and shape. More particularly, the properties (e.g., denier, length, size, shape or the like) of the cotton pile yarns **30** may vary depending on the end form or use of the woven fabric **10**. Preferably, the cotton pile yarns **30** have a circular cross-sectional shape and are of a size that ranges from 10 singles to 24 doubles. Most preferably, the cotton pile yarns **30** have a size of approximately 12 singles. It will be understood that the cotton pile yarns **30** may be formed in any size, as long as the woven fabric **10** has the desired degrees of moisture absorption, tensile strength, abrasion resistance and shrinkage resistance.

[0029] The warp and weft yarns **26**, **28** and the pile yarns **30** may be woven together in any desired pick pattern. Preferably, the warp and weft yarns **26**, **28** and the pile yarns **30** are woven together in a weave ranging from a two-pick terry weave to an eight-pick terry weave. More preferably, the warp and weft yarns **26**, **28** and the pile yarns **30** are woven together in a two-pick terry weave or a three-pick terry weave. Most preferably, the warp and weft yarns **26**, **28** and the pile yarns **30** are woven together in a three-pick terry weave pattern. It will be understood by those skilled in the art that while higher pick patterns are often avoided due to increasingly high costs, any pick pattern may be used to form the woven fabric **10**.

[0030] The ground fabric, formed solely of polyester MJS yarns in both the warp **26** and welt **28**, results in the woven fabric **10** exhibiting properties which essentially mimic those of a woven fabric formed primarily of spun cotton yarns. Specifically, since the ground fabric is formed solely of polyester MJS yarns, the woven fabric **10** has a high moisture absorption rate, similar to woven fabric formed of spun cotton yarns. Also, since MJS yarns consist of the above-described wrapped structure and do not have any twisted fibers, the woven fabric **10** also exhibits less shrinkage than fabrics made of other types of yarns. The woven fabric **10** is also relatively light, and has a greater resistance to piling, a greater moisture absorption rate and a faster drying rate than fabrics made of other types of yarns.

[0031] Preferably, when the woven fabric **10** is a woven terry towel, the woven terry towel **10** exhibits an overall shrinkage rate of 1% or less in both the length and width of the woven fabric **10**. The woven terry towel **10** also preferably exhibits a tensile strength that is 50% or greater than known or conventional towels (e.g., cotton towels) in the warp direction (i.e., at least a 50% increased warp tensile strength versus conventional towels). The woven terry towel **10** also has a drying time that is at least 23% less than that of know or conventional towels. Using polyester MJS yarns in both the warp **26** and the weft **28** also eliminates puckering of the border **32** and bowing of the woven terry towel **10**.

[0032] Using polyester MJS yarns in both the warp **26** and the weft **28** also results in the woven terry towel **10** far outlasting known or conventional (e.g., cotton) towels which are subjected to the same processing conditions (e.g., laundering, drying or the like), while still having the same feel as known or conventional cotton towels. Also, since the woven terry towel **10** retains its original size and shape, even after being subjected to processing such as laundering, there is a lesser need for replacement of the towel **10**, which is particularly beneficial for hotels which utilize a great number of towels on a daily basis. Finally, the woven terry towel **10** also exhibits at least the same, and preferably a greater, moisture absorbency rate than known or conventional (e.g., cotton) towels.

[0033] Also, since polyester MJS yams have a high tensile strength, particularly as compared to natural (i.e., cotton) yarns, the woven terry towel **10** has a relatively high tensile strength. Preferably, the woven terry towel **10** has a tensile strength in the warp direction of approximately 150 to 180 ft./lb.-force, and more preferably approximately 160 to 170 ft./lb.-force, and most preferably approximately 165 to 170 ft./lb.-force. Preferably, the woven terry towel 10 has a tensile strength in the weft direction of approximately 180 to 210 ft./lb.-force, and more preferably approximately 190 to 200 ft./lb.-force, and most preferably approximately 190 to 195 ft./lb.-force.

[0034] In one embodiment, the woven terry towel **10** exhibits the following properties, summarized in Table 1, as compared with a 100% conventional cotton towel:

TABLE 1

Property	Woven Towel 10	100% Cotton Towel	% Improvement of Woven Towel 10 v. 100% Cotton Towel
Tensile Strength (Warp) (ft./lb.-force)	168	118	42%
Tensile Strength (Weft) (ft./lb.-force)	193	114	69%
Shrinkage (Length)	−1.4%	−5.2%	73%
Shrinkage (Width)	1.0%	1.2%	17%
Post Extraction (Weight) (grams)	1353	1542	12%
Post Extraction (% Water Retained)	112.7%	141.3%	20%
Drying Time (minutes)	33.0	40.5	19%

[0035] Particularly as a result of its high tensile strength, the woven fabric **10** also has a high durability (i.e., long useful life), since the woven fabric **10** can better withstand the stresses of laundering, such as high temperatures. Preferably, the woven fabric **10** can endure multiple laundry cycles without exhibiting significant shrinkage (e.g., 1% or less in both length and width) or abrasion at the selvages **22**, **24**.

[0036] In one embodiment, the warp yarns **26** and/or the weft yarns **28** are preferably subjected to one or more finishing treatments. For example, the warp yarns **26** and/or the weft yarns **28** may be treated with a flame-retardant for providing or adding flame-inhibiting properties to the warp and/or weft yarns **26**, **28**; an antimicrobial finish for providing a resistance to the growth of biological organisms such as bacteria or fungi to the warp and/or weft yarns **26**, **28**; or a stain-resistant finish for providing a resistance to the absorption of stain-causing materials to the warp and/or weft yarns **26**, **28**.

[0037] It will also be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. Also, based on this disclosure, a person of ordinary

skill in the art would further recognize that the relative proportions of the components illustrated could be varied without departing from the spirit and scope of the invention. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

I claim:

1. A woven towel comprising:

a ground fabric comprising a set of warp yarns woven together with a set of weft yarns, the warp yarns and weft yarns being one of polyester vortex spun fibers and polyester air-jet spun yarns; and

a plurality of pile yarns interlaced with the ground fabric, the pile yarns being one of cotton spun yarns and cotton/polyester blended spun yarns,

wherein the warp yarns, the weft yarns and the pile yarns are woven together in a terry weave.

2. The woven towel of claim **1**, wherein the warp yarns and the weft yarns are polyester air-jet spun yarns.

3. The woven towel of claim **2**, wherein the warp yarns and the weft yarns are polyester Murata Jet Spun yarns.

4. The woven towel of claim **3**, wherein the warp yarns and the weft yarns are 10 to 14 singles yarn.

5. The woven towel of claim **4**, wherein the warp yarns and the weft yarns are 12 singles yarn.

6. The woven towel of claim **1**, wherein the pile yarns are 100% by weight cotton spun yarns.

7. The woven towel of claim **6**, wherein the cotton spun pile yarns are 10 singles to 24 doubles yarn.

8. The woven towel of claim **7**, wherein the cotton spun pile yarns are 12 singles yarn.

9. The woven towel of claim **1**, wherein the warp yarns, the weft yarns and the pile yarns are woven together in a three-pick terry weave.

10. The woven towel of claim **1**, wherein the woven towel exhibits an overall dimensional shrinkage rate of 1% or less after multiple launderings.

11. The woven towel of claim **1**, wherein the woven towel has a tensile strength in a warp direction of approximately 150 to 180 ft./lb.-force.

12. The woven towel of claim **11**, wherein the woven towel has a tensile strength in the warp direction of approximately 160 to 170 ft./lb.-force.

13. The woven towel of claim **12**, wherein the woven towel has a tensile strength in the warp direction of approximately 165 to 170 ft./lb.-force.

14. The woven towel of claim **1**, wherein the woven towel has a tensile strength in a weft direction of approximately 180 to 210 ft./lb.-force.

15. The woven towel of claim **1**, wherein the woven towel has a tensile strength in the weft direction of approximately 190 to 200 ft./lb.-force.

16. The woven towel of claim **1**, wherein the woven towel has a tensile strength in the weft direction of approximately 190 to 195 ft./lb.-force.

17. A woven terry towel comprising:

a ground fabric comprising a set of warp yarns woven together with a set of weft yarns, the warp yarns and weft yarns being polyester Murata Jet Spun yarns; and

a plurality of pile yarns interlaced with the ground fabric, the pile yarns being 100% by weight cotton spun yarns, wherein the woven towel exhibits an overall dimensional shrinkage rate of 1% or less after multiple launderings.

18. The woven terry towel of claim **17**, wherein the warp yarns, the weft yarns and the pile yarns are woven together in a three-pick terry weave

19. A woven terry towel comprising:

a ground fabric comprising a set of warp yarns woven together with a set of weft yarns, the warp yarns and weft yarns being polyester Murata Jet Spun yarns; and

a plurality of pile yarns interlaced with the ground fabric, the pile yarns being 100% by weight cotton spun yarns.

20. The woven terry towel of claim **19**, wherein the warp yarns, the weft yarns and the pile yarns are 12 singles yarn.

* * * * *