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(54) **STRETCHABLE AND DIMENSIONALLY STABLE WOVEN FABRIC MADE FROM POLYTRIMETHYLENE TEREPHTHALATE BASED CORE SPUN YARNS.**

DEHNBARER UND FORMSTABILER WEBSTOFF AUS AUF POLYTRIMETHYLENTEREPHTHALAT BASIERENDEN KERNSPINNGARNEN

TISSU ÉTIRABLE ET DE DIMENSION STABLE FABRIQUÉ À PARTIR DE FILÉS À ÂME À BASE DE POLY(TÉRÉPHTALATE DE TRIMÉTHYLÈNE)

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Description

[0001] This application claims the benefit of India provisional patent application 3626/DEL/2011 filed December 13, 2011.

FIELD OF THE INVENTION

[0002] This invention utilises polytrimethylene terephthalate (PTT) based core spun yarns, wherein the core of the yarn comprises a stretchable spandex filament and the sheath comprises polytrimethylene terephthalate based staple fiber in combination with a second staple fiber.

[0003] This invention thus relates to highly stretchable fabrics that exhibit high recovery and low growth, wherein the PTT based core spun yarn is in the weft direction and the warp yarn comprises cotton.

BACKGROUND OF THE INVENTION

[0004] The apparel industry has a constant demand for better and newer varieties of fabrics to cater to the insatiable and evolving needs of the discerning consumers. One of the needs of the apparel industry is a demand for stretchable fabrics with a wearable feel.

[0005] Core spun yarns (CSY) are widely used for manufacturing stretch fabrics used for manufacturing denims, bottoms and shirts. CSY's known in the art typically have cotton, polyethylene terephthalate (PET), viscose, nylon or their blends as their sheath component with Lycra or spandex filament forming the core. The CSY garments have stretch level ranging from 7 to 35% depending upon the percentage of spandex in the core. The fabric manufactured with stretch level 8 to 15 % is called a comfort stretch fabric. The fabric with stretch level 16 to 35 % is called as super stretch fabric. A fabric with a stretch level of 35% has a high spandex percentage (about 9 to 10%). This leads to high growth % or low recovery potential which is undesirable. A fabric with almost 15 % stretch level has almost 5 % growth and only 70 % recovery level. This causes baggy formation and dimensional instability in the final garment after some usage.

[0006] WO 2008130563 discloses elastic composite yarn used as warp and filling yarn for woven fabric comprising a filamentary core comprising elastic performance filament(s) and inelastic control filament(s), and a fibrous sheath comprising spun staple fibers.

[0007] Document JP 2004036016 A discloses a fabric having weft yarns and warp yarns, the weft and warp yarns comprising an elastic yarn made by winding a fiber bundle (B) comprising only filaments wound around a periphery of a fiber bundle (A) made of a core spun yarn with the core made of elastic fiber surrounded by staple fibers. There lies a need in the market for fabrics with high stretch properties and high dimensional stability with low growth and high recovery. These properties would generally afford fabrics that are more durable and offer superior levels of comfort and aesthetics.

SUMMARY OF THE INVENTION

[0008] Described herein is a core spun yarn comprising a core comprising a stretchable spandex filament surrounded by a sheath comprising a polytrimethylene terephthalate based staple fiber in combination with a second staple fiber.

[0009] The invention is a fabric comprising the core spun yarn described hereinabove as the weft, wherein the warp yarn comprises cotton.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a schematic representation of core spun yarn production.

Figure 2 is a schematic representation of fabric (denim) production using core spun yarn.

DETAILED DESCRIPTION OF THE INVENTION

[0011] A fabric made of a core spun yarn (CSY) is described herein. Also described is the CSY which comprises polytrimethylene terephthalate based staple fibers. A CSY is a yarn that consists of an inner core yarn surrounded by staple fibers. The surrounding staple fibers thus form the sheath of the CSY. A core spun yarn combines the strength and/or elongation of the core thread and the characteristics of the staple fiber sheath which form the surface.

[0012] The fabric is a stretchable, dimensionally stable woven fabric that is comfortable to wear, has high stretch properties coupled with good stretch recovery and less growth.

[0013] The fabric, in addition to above features, also addresses practical aspects of growth in highly stretchable, heavy fabrics like denims, bottom fabrics, and suiting fabrics.

[0014] As used herein the terms "polytrimethylene terephthalate" or "PTT" are used interchangeably. The polytrimethylene terephthalate is bio-sourced, bio-based or petroleum based.

[0015] As used herein the term "staple fiber" refers to a fiber of standardized length unlike a continuous fiber which is known as a filament. Staple fibers are cut to a specific length from the continuous filament fiber. Usually the staple fiber is cut in lengths ranging from 1-1/2 inches to 8 inches long.

[0016] A core spun yarn has an inner core comprising a stretchable filament and is surrounded by a sheath of polytrimethylene terephthalate staple fibers in combination with a second staple fiber.

[0017] The stretchable filament is a spandex filament. Spandex is a polyurethane-polyurea copolymer known for its elasticity and stretch. A continuous spandex filament gives stretch to the CSY.

[0018] As used herein the term "polytrimethylene terephthalate based staple fibers" refers to 100% polytrimethyelene terephthalate (PTT) staple fibers or PTT in combination with another polymer selected from nylon, styrene, polyethylene terephthalate (PET) or blends thereof staple fibers.

[0019] In one embodiment of the invention, the PTT based staple fibers are in combination with a second staple fiber selected from: cotton, polyester, viscose, nylon, modal, tencel, wool or combinations thereof. In one embodiment the polytrimethylene terephthalate based staple fibers is in combination with cotton and viscose. These form the sheath of the core spun yarn.

[0020] In another embodiment, the polytrimethylene terephthalate content in the outer sheath is from 10% to 60%, or from 25% to 50%, or from 35% to 40%. The percentage of polytrimethylene terephthalate used in weft yarn of the sheath contributes to the stretch recovery properties in the CSY .

[0021] A "woven fabric" is used to define a fabric manufactured by interlacing of two sets of yarn called warp yarns (warp) and weft yarns (weft). Warp runs in the fabric in a length-wise direction and weft yarns runs in the fabric in a width-wise direction. The fabrics are woven by the techniques well known in the art such as plain weave, satin weave, and twill weave.

[0022] The core of the CSY is a stretchable spandex filament. In one embodiment of the invention the stretchable fiber percentage in the yarn was in the range of 2% to 10%, or 5 to 8 %, or 5 to 6%.

[0023] In the invention the fabric comprises a weft yarn being the CSY as described herein, and a warp yarn that is a cotton staple fiber.

[0024] The term "stretchable" as used herein refers to the property of a fabric to extend to a certain length percentage when a fixed amount of load is applied. A fabric with good stretch property is defined by the ability of the fabric to extend to its maximum and recover with a minimum amount of growth left in the fabric, after removal of the applied load. An example of good stretch property in a fabric is approximately 15% stretch. Such fabrics are called "comfort-stretch" fabrics. Stretch property and growth is measured using standard ASTM international procedures (see Table 1).

[0025] The fabrics of this invention have high "dimensional stability" which means that they have maximum recovery and minimum growth left in the fabric after the stretch is released.

[0026] The term "stretch recovery" used herein refers to the ability of the fabric to extend to its maximum and recover with minimum amount of growth left in the fabric, after removal of the applied load. An acceptable stretch recovery has more than 70% stretch recovery. A recovery of more than 70% and a growth of less than 2.5% in a fabric make it a dimensionally stable fabric. The stretch recovery and growth properties of the fabrics remain constant throughout the life of the fabric.

[0027] Other properties of the fabric like weight, tensile strength and tear strength were also described using standard ASTM international procedures (see Table 1).

[0028] ASTM refers to American Society for Testing and Materials (ASTM International; West Conshohocken, PA). ASTM International publishes the Annual Book of ASTM Standards each year.

[0029] In one embodiment the fabric of this invention has stretch recovery in the range of 75 to 95 %, or 80 to 95%.

[0030] In another embodiment, the fabric of this invention has growth of less than 2.5%, or less than 2.3%.

[0031] Apart from high stretchability (of more than 15%) high recovery (of more than 70%) and low growth (of less than 3%), the fabrics of this invention have a good wearable feel, provide ultraviolet protection, provide acid and alkali resistance during washing because of the PTT sheath in the core spun yarn of the fabric.

[0032] The fabric of the invention is selected from plain fabric, denim fabric, bottom fabric, shirt fabric, piece-dyed fabric, printed fabric, checked fabric, and striped fabric.

[0033] The fabric described herein may be used, for example, in the manufacture of garments, sheeting material like bed sheets, furnishings, or upholstery.

[0034] The method of manufacturing the core spun yarn, wherein the sheath is a bicomponent fiber comprising PTT and cotton staple fibers, comprises the steps of:

(a) blow-room process for the cotton staple fiber;

(b) carding for the cotton staple fiber;
(c) sliver lapping;
(d) ribbon lapping, lap formation of the cotton staple fiber;
(e) combing of the cotton staple fiber;
(f) opening of the PTT based fiber and cotton staple fiber obtained from the combing step;
(g) mixing of the two fibers;
(h) blow-room process;
(i) carding;
(j) drawing;
(k) roving;
(l) yarn manufacturing;
(m) winding; and
(n) conditioning.

[0035] The steps (a) to (e) apply to cotton staple fiber. After the combing of the cotton staple fiber, the cotton fiber is mixed with the PTT based fiber and are subjected to the process steps (f) to (n) as mentioned above.

[0036] The term "blow-room process" refers to a process where the fiber after opening and mixing is processed in a "blow-room line". A blow-room line consists of a number of machines used in succession to open and clean the cotton fiber. About 40% to 70% trash is removed in the blow-room section. The objects (cotton and PTT staple fibers) of the blow-room are opened followed by cleaning where the fibers are opened from a larger tuft size (in hundreds of grams) to a smaller tuft size (in mgs). This is followed by cleaning which removes dirt, dust, broken seeds, broken leaves, and other unwanted materials from the fiber. Both the processes are accompanied with mixing and blending to make a good quality yarn and to decrease production. This is followed by lap or fleece formation where the opened and cleaned fiber is transferred into sheet form having definite width and length which is called lap or in a modern system this sheet can be directly feed to the carding machine into fleece form.

[0037] The term "carding" refers to a process of disentangling fiber bunches into individual fibers and arranging them in a parallel direction after individualizing the fiber. It also further eliminates trash and other foreign materials and fibers that are unacceptable for manufacture. The operation is performed on cotton, wool, waste silk, and synthetic staple fibers by a carding machine that consists of a moving conveyor belt with fine wire brushes and a revolving cylinder. The material delivered from the carding machine is called a sliver or a card sliver.

[0038] The carding process opens up the collected mass of fibers so that the fibers become individual fibers. However, the fibers in the card sliver are not completely aligned or oriented in the fiber axis. Some fibers lie haphazardly in the sliver. Thus, the card sliver is given a minimum of two drafting processes before it goes to the next machine. In this process, the sliver is passed between sets of rollers that are running at different speeds, each succeeding pair rotating faster than the previous so that the fibers are pulled in a lengthwise direction. These two drafting operations can also be achieved by the sliver lap and ribbon lap machines. To improve the uniformity of the sliver, slivers are subjected to a process called doubling. Doubling is the process of combining a number of slivers. By this process, the thin and thick places present in the sliver are evened out. In the sliver lap machine, 16-20 card slivers are creeled and passed through the feed table to three pairs of drafting rollers for the drafting operation. The drafted slivers are then taken to two pairs of calender rollers that compress the sliver material. This drafted and compressed sliver material called lap is wound on a spool. This process is known as "lap formation".

[0039] "Combing" is an additional fiber alignment operation performed on very fine yarns intended for finer fabrics. (Inexpensive and coarser fabrics are made from slivers processed without this further refining.) Fine-tooth combs are applied to the sliver from combing, separating out the shorter fibers, called noils, and aligning the longer fibers to a higher level of parallelism. The resulting strand is called a comb sliver. With its long fibers, the comb sliver provides a smoother, more even yarn.

[0040] The term "drawing" refers to a process (after carding) where several slivers are combined into one strand that is drawn to be longer and thinner. The sliver that comes out of the carding machine has a high mass/length variation along the length. To minimize this, doubling and drafting processes are carried out in a draw frame machine. There are normally two such drawing processes to reduce the mass/length variation in a sliver at a minimal level and to orient the fiber along the length direction. The first process of drawing is called a breaker drawing and the second process of drawing is called a finisher drawing. Drawing frames have several pairs of rollers through which the slivers pass. Each successive pair of rollers runs at a higher speed than the preceding pair so that the sliver is pulled longer and thinner as it moves through the drawing frame. The operation is repeated through several stages.

[0041] The sliver delivered from the finisher draw frame has a minimal mass/length variation and fibers oriented toward the strand axis contribute to tensile properties. However, the linear density of the sliver is approximately 140 times of the required final yarn. This needs to be further reduced to the required yarn linear density. This can be done in a further process of drafting and is done in a two strep drafting process being a speed frame machine and a ring frame machine.

This two-step process of drafting is recommended because drafting in single steps leads to the introduction of high mass/length variations. However, as the number of fiber in the sliver keeps on decreasing, the fibers need to held to each other in a continuous form and need to have strength so that the fibers can be processed on the next machine. For imparting the strength to the fiber fleece, it is given a partial twist in the speed frame machine. The whole process of partial drafting and twisting is called roving preparation. By this drafting operation, the sliver becomes finer, and the resultant product is called the "roving."

[0042] The term "yarn spinning" refers to the process of the formation of the final yarn. The core spun yarn has a core of elastomeric fiber and a sheath of staple fibers. Core-spinning is a process by which fibers are twisted around an existing yarn, either filament or staple spun yarn, to produce a sheath- core structure in which the already formed yarn is the core. Core-spun yarns are produced by many spinning systems, for example, ring spinning system, core wrap spinning method, patterned spinning system, core-twin spinning system, composite electrostatic spinning system, rotor spinning system, friction spinning system, or air jet spinning system. These are conventional systems which are well known to a person skilled in the art. An embodiment of this invention is the spinning of a PTT based fiber-cotton sheath using a ring spinning system to produce the core spun fiber as described herein. The process is schematically shown in Figure 1.

[0043] Ring spinning produces yarn in a small package called cop or bobbin. Since cops from ring frames are not suitable for further processing, the winding process serves to achieve additional objectives made necessary by the requirements of the subsequent processing stages.

[0044] The term "winding" refers to a process of obtaining a larger package from several small ring bobbins. This conversion process provides one with the possibility of cutting out unwanted and problematic objectionable faults. The process of removing such objectionable faults is called as yarn 'clearing'.

[0045] Finally the yarn needs to be conditioned. The term "conditioning" refers to the process to provide an economical device for supplying the necessary moisture in a short time, in order to achieve a lasting improvement in quality and processability of yarn in a subsequent process by reducing the snarling tendency. Moisture in the atmosphere has a great impact on the physical properties of textile fibers and yarns. Relative humidity and temperature will decide the amount of moisture in the atmosphere. High relative humidity in different departments of spinning is not desirable. But on the other hand, a high degree of moisture improves the physical properties of yarn. Moreover, it helps the yarn to attain the standard moisture regain value of the fiber.

[0046] The method of manufacturing the core spun yarn, wherein the sheath is a blend or combination of PTT and any staple fiber other than cotton, comprises the steps of;

(a) opening;
(b) mixing;
(c) blow room process;
(d) carding
(e) drawing
(f) roving;
(g) core yarn manufacturing;
(h) winding; and
(i) conditioning.

[0047] The method of manufacturing a denim fabric, using the core spun yarn of the invention and indigo dyed cotton staple fiber yarn, comprises the steps of;

(a) warping of cotton yarn;
(b) Indigo dyeing and sizing of warp yarn;
(c) weaving of indigo dyed cotton fiber with the PTT based core spun yarn;
(d) singeing;
(e) desizing;
(f) heat setting;
(g) mercerizing (optional);
(h) finishing; and
(i) sanforizing.

[0048] A general pictorial representation of the process is shown in Figure 2.

[0049] The method of manufacturing a plain bottom-weight fabric, using the core spun yarn of the invention and any other staple fiber yarn, comprises the steps of:

(a) warping;
(b) sizing;
(c) weaving;
(d) desizing;
(e) scouring;
(f) bleaching;
(g) heat setting
(h) finishing;
(i) sanforizing;
(j) optionally steps of mercerizing are performed prior to the finishing step after the heat setting step for cotton based fabrics;
(k) optionally steps of piece dyeing is performed for piece dyed fabrics. The dyeing step precedes the finishing step.

[0050] The method of manufacturing a striped fabric, using the core spun yarn of the invention and any other staple fiber yarn, comprises the steps of:

(a) yarn dyeing;
(b) sectional warping;
(c) sizing;
(d) weaving;
(e) desizing;
(f) scouring;
(g) finishing;
(h) sanforizing;
(i) optionally, further steps of mercerizing and bleaching are performed for cotton based fabrics.

[0051] Some of the steps in the manufacturing process can be modified depending on the desired final product. For example, the steps of mercerizing followed by bleaching are done prior to the finishing step only when cotton staple fiber yarns are present in the fabric. The process of dyeing is required only for colored fabrics. It is obvious for someone with skill in the art that the step of dyeing is omitted when a plain fabric is desired.

[0052] The term "printed" refers to the fabric which is printed in the fabric form.

[0053] The term "warping" used herein refers to a process of winding the yarns on a warp beam.

[0054] The term "sizing" used herein refers to a process of coating the threads normally with starch.

[0055] The term "weaving" used herein refers to a process where the fabric is manufactured on a loom in a weaving process with warp threads coming from weavers beam interlaced with weft yarns put in width wise direction.

[0056] The term "desizing" used herein refers to a process of removing the sizing applied on the warp with the help of enzyme or any other suitable chemicals.

[0057] The term "scouring" used herein refers to a process of chemical washing on cotton fabric to remove natural wax and non-fibrous impurities from the fibers and any added soiling or dirt. Scouring is usually carried out in iron vessels called kiers. The fabric is boiled in an alkali, which forms a soap with free fatty acids (saponification). A kier is usually enclosed, so the solution of sodium hydroxide can be boiled under pressure, excluding oxygen which would degrade the cellulose in the fiber. If the appropriate reagents are used, scouring will also remove sizing from the fabric although desizing often precedes scouring and is considered to be a separate process known as fabric preparation. Preparation and scouring are prerequisites to most of the other finishing processes. At this stage even the most naturally white cotton fibers are yellowish.

[0058] The term "heat setting" is a thermal process taking place mostly in dry heat (160 °C to 180 °C for 30 to 45 s) environment. The effect of the process gives the fabric a dimensional stability and, very often, other desirable attributes like wrinkle resistance or temperature resistance.

[0059] The term "mercerizing" used herein refers to a process of treating the fabric with alkali. This process removes convolutions from a cotton fiber structure and makes it round which improves the hand feel of the fabric, making it more lustrous. In cotton based fabric, mercerizing improves the strength of the fabric as well.

[0060] The term "bleaching" used herein refers to a process where any contaminations, colored or oil stain are removed from the fabric. Bleaching is normally done by treating the fabric with sodium hypochlorite or hydrogen peroxide solution.

[0061] The term "dyeing" used herein refers to a process where the fabric after bleaching is dyed with a color. For a piece-dyed fabric, the warp cotton yarn and the weft PTT based yarn are dyed separately by a respective known dyeing method. For checked or striped fabric, the warp yarn or PTT based core weft yarn may be dyed separately or together, and patterns are formed accordingly.

[0062] The term "finishing" used herein refers to a process performed to the fabric after weaving to improve the look,

performance, or "hand" (feel) of the finished textile or clothing. The different finishing techniques are bio-polishing, raising, fulling, calendaring, anti-microbial finishing, anti-static finishing, non-slip finishing and others known in the art. Suitable finishing agents are used for these finishes.

[0063] The term "sanforizing" used herein refers to a process of treatment used particularly for cotton fabrics and other textiles made from natural or chemical fibers. It is a method of stretching, shrinking and fixing the woven cloth in both length and width, before cutting and producing to reduce the shrinkage which would otherwise occur after washing.

[0064] The term "yarn dyeing" used herein refers to a process where the yarn in warp and weft need to be dyed. This is done in a high temperature and high pressure dyeing machine.

[0065] The term "sectional warping" used herein refers to a process of winding the yarns on a drum as per color pattern. Once all the yarn patterns are wound on the drum they can be wound to a warper beam to insert in the fabric as per stripe effect needed in the fabric.

[0066] The term "denim" used herein is a rugged cotton twill textile, in which the weft passes under two ("double") or more warp threads. Denim was traditionally colored blue with indigo dyes.

[0067] The term "indigo dyeing" used herein refers to a process of dyeing the cotton warp fibers with indigo dye using standard indigo dyeing processes like indigo rope dyeing process, indigo one-sheet dye slashing, indigo double sheet dyeing etc.

[0068] The term "singeing" used herein refers to a process of burning off loose fibers sticking out of textile goods. Singeing is a part of the pretreatment processes carried out in textile processing, and is usually the first step carried out after weaving. Singeing is often carried out on cotton fabrics, or fabrics with cotton blends and results in increased wettability (better dyeing characteristics, improved reflection, no "frosty" appearance), a smoother surface (better clarity in printing), improved visibility of the fabric structure, less pilling, and decreased contamination through removal of fluff and lint. Singeing usually involves passing/exposing one or both sides of a fabric over a gas flame to burn off the protruding fibers. Other methods of singeing include infra-red singeing and heat singeing for thermoplastic fibers. Singeing of yarns is called "gassing." Cellulosic fibers such as cotton are easily singed because the protruding fibers burn to a light trace ash which is easily removed.

[0069] The following non limiting examples are for illustration and are should not be construed to limit the scope of the invention.

EXAMPLES

[0070] All chemicals mentioned were commercially sourced unless otherwise stated. All machinery used are well known machines in the art.

EXAMPLE 1

[0071] This example illustrates a process of making core spun yarn using polytrimethylene terephthalate staple fibers and cotton staple fibers.

[0072] Polytrimethylene terephthalate staple fibers (35 kg, 38 mm fiber length, 1.5 Denier) and staple cotton (from combed sliver) fibers (65 kg, 31 mm upper quartile mean length, 4.0μg/inch) were used. The fibers were opened manually, and then mixed together. The fibers were mixed by laying 2 layers of cotton and 1 layers of PTT. This process is called a stack mixing process. Then the entire fiber mass was taken from the stack by vertically withdrawing the material, and fed into a blow-room line. The process parameters of the blow-room line selected for PTT/cotton fiber processing were:

- Feed rollers and beaters blades setting =1.7 mm
- Lap linear density = 400 g/m
- Waste collection setting was set to ’0’
- Coarse opening beater speed=400 rpm
- Fine opening beater speed=450 rpm

[0073] After the blow-room line, the fiber fleece was fed to a carding machine using an aero-pneumatic aero feeding system. The process parameters for the carding machine were:

- Machine Production = 28 kg/hr
- Feed Plate and Licker in gauge = 32 thou

- Flat gauge = 12,12,10,10,10 thou
- Trumpet size = 4.0 mm
- Sliver linear density = 4.5 g/m
- Licker in Speed= 750 rpm
- Cylinder Speed= 350 rpm
- Flat speed = 5 inch/min (12.7 cm/min)

[0074] A sliver came out of the carding machine having a very high mass/length variation along the length. To minimize the variation the carding slivers were doubled together and simultaneously drafted six times to further orient the fibers in the resultant sliver along the length direction. The doubling and drafting process was carried out on a draw frame machine. Two such drawing processes were done to reduce the mass/length variation in the sliver to a minimal level, and to orient the fiber along the length direction. The card sliver was processed on two sets of draw frames with the listed parameters.

- Bottom Roller gauge Front/Back= 40/44 mm
- Trumpet diameter = 3.8 mm
- Sliver linear density (at both breaker and finisher) = 4.6 g/m
- Break drafts =1.7 in breaker, 1.3 in finisher draw frame
- Web tension draft= 1
- Creel tension draft = 1.02-1.03
- Delivery speed = 200-250 mpm in breaker draw frame, 350-400 mpm in finisher draw frame
- Doubling = 6 for both breaking and finisher draw frame

[0075] The sliver from the finisher draw frame was converted to roving on the speed frame with the process parameters as listed:

- Spacer size = 5.5 mm
- Spindle speed = 750 rpm
- Twist Multiplier = 1.2
- Roller Gauge = 48/64mm
- Saddle gauge=54/60.5mm

[0076] The roving made on the speed frame converts into the yarns by drafting it further along the final spinning machine called a ring frame. The yarn count spun was 9.6s Ne. The denier of core spandex filament was 70 D. Spandex was given a draft of 2.1 before putting it into the yarn. The spandex % in the final yarn was 6.3%. The process parameters of the ring frame were:

- Roller gauge= 42.5/65mm
- Saddle gauge=51/66 mm
- Cots hardness (Front/Back) = 68/83°
- Break draft= 1.2
- Twist Multiplier = 4.3

[0077] The final package (Cop) which was obtained from the machine weighed (net) approximately 800 gm.
[0078] These small cops of 80 g each were joined and cleared for any yarn defect and finally wound on a large final package called a cone on a winding machine. The process parameters kept on the winding machine are:

- Speed =1000 mpm
- Yarn tension= 5 - 6 % of yarn breaking load

- Package Hardness Setting: Minimum
- Cone Weight= 2.0 kg

[0079] The yarn was conditioned in an autoclave at 70 °C for 50 min. The yarn cones were directly used as weft in the fabric manufacturing process where stretch in the fabric is required in a widthwise direction. However, these yarns can be used in a lengthwise direction also to get a warp way stretch or bi-stretch fabrics.

EXAMPLE 2

[0080] This example illustrates a process of making denim fabric using core spun yarn obtained from Example 1 as weft.
[0081] The fabric was manufactured using an airjet weaving machine. The warp was 100% indigo dyed cotton staple fibers. The weft was the core spun yarn obtained from Example 1. The process parameters of the machine were:

- Loom Speed = 750 rpm
- Fabric width = 68 inches (172.72 cm)
- Twill =3/1 right hand twill
- Ends per inch = 70
- Picks per inch = 44
- Warp count = (7.2s + 6.4s) Ne (1 + 1), 100 % cotton ring yarn
- Weft count = 9.6s Ne with 70 D spandex (6.27 %) core spun yarn

[0082] The fabric obtained was singed on a fabric singeing machine by passing over a set of burners at 80 mpm. The protruding fibers on the surface were burnt, therefor removed. The fabric was then desized by padding with enzymes for 12 to 18 hrs. The fabric is then washed with water. The fabric was mercerized by treating it with 18.5% NaOH solution at 65 °C at 40 mpm. The fabric was then dried at 105 °C by passing it through a set of calendar rollers. The fabric was then passed through a sanforizing machine adjusting skew, length and width shrinkage by passing it over a rubber roller in a steam chamber (Monforte) at 50 mpm. This made a final garment dimensionally stable, with an acceptable percentage of shrinking and improved hand feel of the fabric. The resultant fabric was a ready finished fabric and can be converted into garments.
[0083] Table 1 below shows the tests results for the desired properties of a denim fabric made by the example above.

TABLE 1: Fabric Test results for denim fabric

Tests	Method type	Units	Results
Warp (Cotton) Weft Count (PTT / Cotton CSY)		Ne	7.15 + 6.4 9.6 (70 D Lycra)
Warp, EPI Weft, PPI		Threads/ Inch (2.54 cm)	73 46
Fabric Weight	ASTM-D-3776	g/m^2	444.2
Overall Width of the Fabric		Inches	55.5 (140.97 cm)
Stretch Growth Recovery %	ASTM-D-3107	% %	18.1 2.2 87.8
Tensile Strength	ASTM-D-5034	Kg Warp Weft	119.5 55
Tear Strength	ASTM-D-1424	g Warp Weft	10.87 5.830

Claims

1. A fabric having weft yarns and warp yarns, the weft yarns comprising a core spun yarn **characterised in that** said core comprises a stretchable spandex filament surrounded by a sheath comprising a polytrimethylene terephthalate-

based staple fiber in combination with a second staple fiber, wherein the warp yarn comprises cotton and the fabric has a stretch recovery in the range of 75 to 95 % and a growth of <2,3%.

2. The fabric of claim 1 wherein the second fiber of the core spun yarn is selected from the group consisting of cotton, viscose, polyester, nylon, modal, tencel, wool and combinations thereof.

3. The fabric of claim 1 wherein the polytrimethylene terephthalate-based staple fiber content in the sheath of the core spun yarn is in the range of 10% to 60%.

4. The fabric of claim 1 wherein the spandex filament content of the core spun yarn is in the range of 2 to 10%.

5. The fabric of claim 1 wherein the second staple fiber of the core spun yarn is a cotton staple fiber.

6. The fabric of claim 1 for use in an application selected from the group consisting of garments, sheeting material, furnishings, and upholstery.

Patentansprüche

1. Gewebe mit Schussfäden und Kettfäden, wobei die Schussfäden ein kerngesponnenes Garn umfassen, **dadurch gekennzeichnet, dass** der Kern umfasst
ein dehnbares Spandexfilament, umgeben von einer Hülle, die eine Stapelfaser auf Polytrimethylenterephthalatbasis in Kombination mit einer zweiten Stapelfaser umfasst, worin das Kettgarn Baumwolle umfasst und das Gewebe eine Streckerholung im Bereich von 75 bis 95 % und ein Wachstum von <2,3 % aufweist.

2. Gewebe nach Anspruch 1, wobei die zweite Faser des kerngesponnenen Garns ausgewählt ist aus der Gruppe bestehend aus Baumwolle, Viskose, Polyester, Nylon, Modal, Tencel, Wolle und Kombinationen davon.

3. Gewebe nach Anspruch 1, wobei das Gehalt der Stapelfaser auf Polytrimethylenterephthalatbasis in der Hülle des kerngesponnenen Garns im Bereich von 10% bis 60% liegt.

4. Gewebe nach Anspruch 1, wobei der Elasthanfilamentgehalt des kerngesponnenen Garns im Bereich von 2 bis 10% liegt.

5. Gewebe nach Anspruch 1, wobei die zweite Stapelfaser des kerngesponnenen Garns eine Baumwollstapelfaser ist.

6. Gewebe nach Anspruch 1 zur Verwendung in einer Anwendung, ausgewählt aus der Gruppe bestehend aus Bekleidung, Folienmaterial, Mobiliar und Polsterung.

Revendications

1. Tissu comportant des fils de trame et des fils de chaîne, les fils de trame comprenant un fil filé à âme **caractérisé en ce que** ladite âme comprend :
un filament extensible en spandex entouré d'une gaine comprenant une fibre discontinue à base de polytriméthylène téréphtalate en combinaison avec une deuxième fibre discontinue, dans laquelle le fil de chaîne comprend du coton et le tissu a une récupération élastique dans la gamme de 75 à 95% et une croissance de <2,3%.

2. Tissu selon la revendication 1, dans lequel la deuxième fibre du fil filé à âme est choisie dans le groupe constitué par le coton, la viscose, le polyester, le nylon, le modal, le tencel, la laine et leurs combinaisons.

3. Tissu selon la revendication 1, dans lequel la teneur en fibre discontinue à base de polytriméthylène téréphtalate dans la gaine du fil filé à âme se situe dans la gamme allant de 10% à 60%.

4. Tissu selon la revendication 1, dans lequel la teneur en filaments de spandex du fil filé d'âme se situe dans la gamme allant de 2 à 10%.

5. Tissu selon la revendication 1, dans lequel la deuxième fibre discontinue du fil filé à âme est une fibre discontinue

de coton.

6. Tissu selon la revendication 1, destiné à être utilisé dans une application choisie dans le groupe constitué des vêtements, matériaux en feuille, articles d'ameublement et meubles rembourrés.

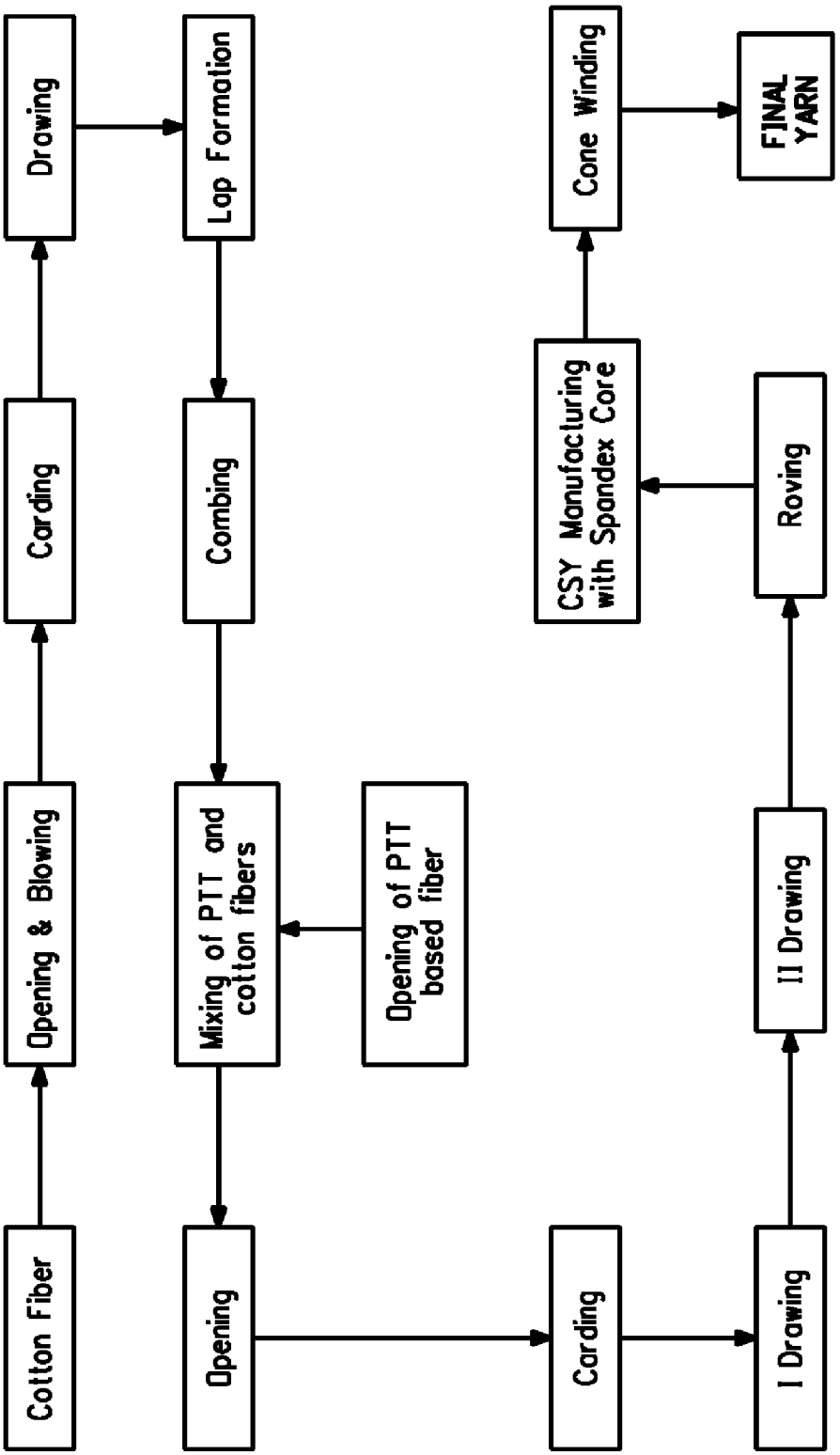
Cotton Fiber
Opening & Blowing
Carding
Drawing
Lap Formation
Combing
Opening of PTT based fiber
Mixing of PTT and cotton fibers
Opening
Carding
I Drawing
II Drawing
Roving
CSY Manufacturing with Spandex Core
Cone Winding
FINAL YARN

FIG. 1

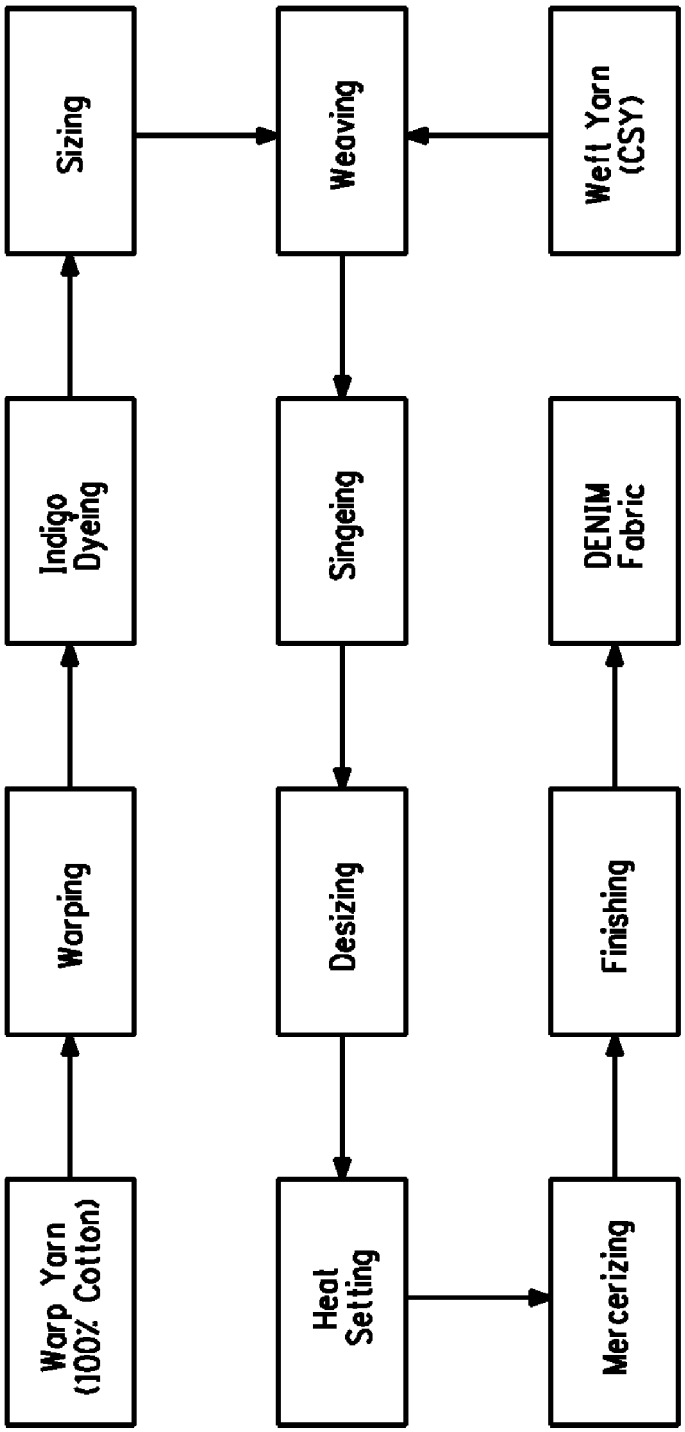
Warp Yarn (100% Cotton)
Warping
Indigo Dyeing
Sizing
Heal Setting
Desizing
Singeing
Weaving
Mercerizing
Finishing
DENIM Fabric
Weft Yarn (CSY)

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IN 3626DEL2011 **[0001]**
- WO 2008130563 A **[0006]**
- JP 2004036016 A **[0007]**