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PATENTE DE INVENCION

EXPEDIENTE No

05-122744

TITULO MÉTODO PARA ELABORAR TELA ELASTICA DE
DO CIRCULAR QUE COMPRENDE ESPANDEZ E
LAZAS FUERTES

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71 SOLICITANTE INVISTA TECHNOLOGIES s.á.r.l.

DOMICILIO LUXEMBURGO, SUIZA

74 APODERADO ALVARO CORREA ORDOÑEZ
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3 REPRESENTANTE O APODERADO	Nombre: ALVARO CORREA ORDÓÑEZ Dirección: Avenida E2 No.10-63 Piso 6o. Teléfono: 634 1500 Fax: 376 2211 E-Mail: patenta.bogota@belscom.net.com	IDENTIFICACION C.C. ☒ NIT ☐ C.E. ☐ Otro ☐ Cual _____ Número 79.143.264 de Usaquén TP 38.281	
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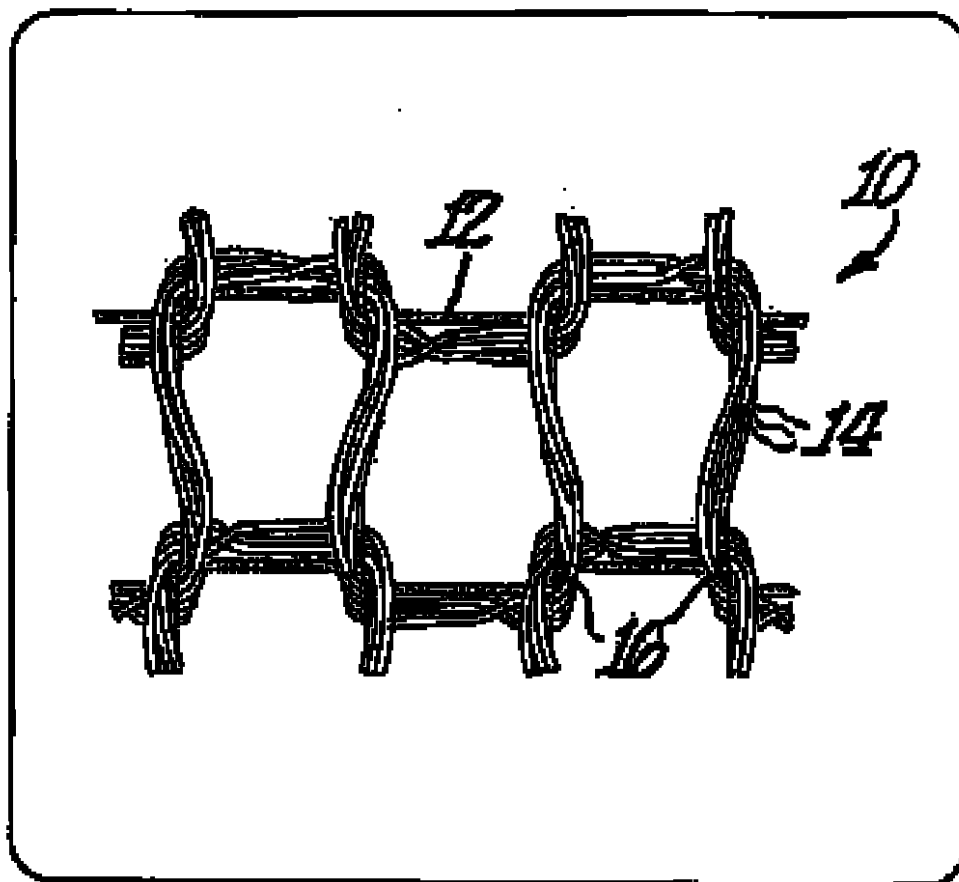
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ANEXOS

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- ☒ Comprobante de pago de la tasa de presentación de la solicitud
- ☐ Documento que acredite la existencia y representación legal cuando el solicitante sea persona jurídica
- ☐ Poderes, si fuere el caso
- ☐ Documento de cesión del inventor al solicitante o a su causante
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- ☐ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
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- ☐ De ser el caso, modificaciones efectuadas a la solicitud internacional.
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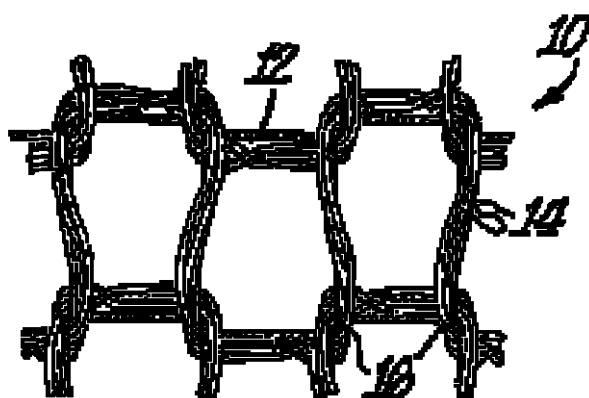
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mine News on Credit and Advertisements" appearing at the begin-
ning of each regular issue of the FCT Gazette.

(4) TITLE: METHOD TO MAKE CIRCULAR-KNIT ELASTIC FABRIC COMPOSING SPANDEX AND HAIRY YARNS



(57) Abstracts: Circular-knit, elastic, single-knit jersey fabric (18), of spun acetate continuous filament yarns (14) with base spandex (12) placed in every course, has a cover factor in the range of 1.3 to 1.9, a basis weight from 140 to 240 g/m², an elongation of 60% or more and low shrinkage. This circular knit, single-knit jersey fabric is produced by maintaining the draft of the spandex at or below 2X (100% elongation) and maintaining the finishing and drying temperature(s) below the spandex heat set temperature. The knit fabric meets the end-use specifications without heat setting.

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METHOD TO MAKE CIRCULAR-KNIT ELASTIC FABRIC COMPRISING SPANDEX AND HARD YARNS

FIELD OF THE INVENTION

This invention relates to circular knitting yarns into fabrics, and specifically to
5 elastic single-knit jersey fabrics comprising both spun and/or continuous filament hard
yarns, and bare spandex yarns.

BACKGROUND OF THE INVENTION

Single-knit jersey fabrics are broadly used to make underwear and top-weight
10 garments, such as T-shirts. Compared to woven structures, the knit fabric can more
easily deform, or stretch, by compressing or elongating the individual knit stitches
(comprised of interconnected loops) that form the knit fabric. This ability to stretch by
stitch rearrangement adds to the wearing comfort of garments made from knit fabrics.
Even when knit fabrics are constructed of 100% hard yarns, such as cotton, polyester,
15 nylon, acrylics or wool, for example, there is some recovery of the knit stitches to
original dimensions after imposed forces are removed. However, this recovery by knit
stitch rearrangement generally is not complete because hard yarns, which are not
elastomeric, do not provide a recovery force to rearrange the knit stitches. As a
consequence, single-knit fabrics may experience permanent deformations or 'bagging' in
20 certain garment areas, such as at the elbows of shirt sleeves, where more stretching
occurs.

To improve the recovery performance of circular, single-knit fabrics, it is now
common to co-knit a small amount of spandex fiber with the companion hard yarn. As
used herein, "spandex" means a manufactured fiber in which the fiber-forming substance

is a long-chain synthetic polymer comprised of at least 85% of a segmented polyurethane. The polyurethane is prepared from a polyether glycol, a mixture of diisocyanates, and a chain extender and then melt-spun, dry-spun or wet-spun to form the spandex fiber.

For jersey knit constructions in circular knit machines, the process of co-knitting spandex is called "plating." With plating, the hard yarn and the bare spandex yarn are knitted parallel, side-by-side relation, with the spandex yarn always kept on one side of the hard yarn, and hence on one side of the knitted fabric. FIG. 1 is a schematic illustration of plated knit stitches 10 wherein the knitted yarn comprises spandex 12 and a multi-filament hard yarn 14. When spandex is plated with hard yarn to form a knit fabric, additional processing costs are incurred beyond the added cost of the spandex fiber. For example, fabric stretching and heat setting usually are required in the finishing steps when making elastic knit jersey fabrics.

By "circular knitting" is meant a form of weft knitting in which the knitting needles are organized into a circular knitting bed. Generally, a cylinder rotates and interacts with a cam to move the needles reciprocally for knitting action. The yarns to be knitted are fed from packages to a carrier plate that directs the yarn strands to the needles. The circular knit fabric emerges from the knitting needles in a tubular form through the center of the cylinder.

The steps for making elastic circular-knit fabrics according to one known process are outlined in FIG. 4. Although process variations exist for different fabric knit constructions and fabric end uses, the steps shown in FIG. 4 are representative for making jersey knit elastic fabrics with spun hard yarns, such as cotton. The fabric is first circular knit at conditions of high spandex draft and feed tensions. For example, for single-

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knit jersey fabrics made with bare spandex plated in every knit course, the prior-art feed tension range is 2 to 4 cN for 22 dtex spandex; 3 to 5 cN for 33 dtex; and 4 to 6 cN for 44 dtex (DuPont Technical Bulletin L410). The fabric is knit in the form of a tube, which is collected under the knitting machine either on a rotating mandrel as a flattened tube, or in
5 a box after it is loosely folded back and forth.

In open-width finishing, the knitted tube is then slit open 44 and laid flat. The open fabric is subsequently relaxed 46, either by subjecting it to steam, or by wetting it by dipping and squeezing (padding). The relaxed fabric is then applied to a tenter frame and heated (for heat setting 46) in an oven. The tenter frame holds the fabric on the
10 edges by pins, and stretches it in both the length and width directions in order to return the fabric to desired dimensions and basis weight. This heat setting is accomplished before subsequent wet processing steps and, consequently, heat setting is often referred to as "pre-setting" in the trade. At the oven exit, the flat fabric is released from the stretcher and then tacked 48 (sewed) back into a tubular shape. The fabric then is processed in
15 tubular form through wet processes 50 of cleaning (scouring) and optional bleaching/dyeing, e.g., by soft-flow jet equipment, and then dewatered 52, e.g., by squeeze rolls or in a centrifuge. The fabric is then "de-tacked" 54 by removing the sewing thread and re-opening the fabric into a flat sheet. The flat, still wet, fabric is then dried 56 in a tenter-frame oven under conditions of fabric overfeed (opposite of
20 stretching) so that the fabric is under no tension in the length (machine) direction while being dried at temperatures below heat-setting temperatures. The fabric is slightly tensioned in the width direction in order to flatten any potential wrinkling. An optional fabric finish, such as a softener, may be applied just prior to the drying operation 56. In

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some cases a fabric finish is applied after the fabric is first dried by a belt or tenter-frame oven, so that the finish is taken up uniformly by fibers that are equally dry. This extra step involves re-wetting the dried fabric with a finish, and then drying the fabric again in a tenter-frame oven.

5 Heat setting "sets" spandex in an elongated form. This is also known as redensifying, wherein a spandex of higher denier is drafted, or stretched, to a lower denier, and then heated to a sufficiently high temperature, for a sufficient time, to stabilize the spandex at the lower denier. Heat setting therefore means that the spandex permanently changes at a molecular level, so that recovery tension in the stretched spandex is mostly
10 relieved and the spandex becomes stable at a new and lower denier. Heat setting temperatures for spandex are generally in the range of 175 to 200°C. For the prior art process 40 shown in FIG. 4, the heat setting 45 commonly is for about 45 seconds or more at about 190°C.

If heat-setting is not used to "set" the spandex, after the fabric is knitted and
15 released from the constraints of the circular knitting machine, the stretched spandex in the fabric will retract to compress the fabric stitches so that the fabric is reduced in dimensions compared to what those dimensions would be if the spandex were not present. Compression of the stitches in the knitted fabric has three major effects that are directly related to elastic knit fabric properties, and thereby usually renders the fabric
20 inappropriate for subsequent cut and sew operations.

First, stitch compression reduces fabric dimensions and increases fabric basis weight (g/m^2) beyond desired ranges for single jersey knit fabrics for use in garments. As a result, the traditional finishing process for elastic circular-knit fabric includes a fabric

stretching and heating step, at sufficiently high temperatures and sufficiently long residence time, so that the spandex yarn in the knit will "set" at desired stretched dimensions. After heat setting, the spandex yarn will either not retract, or will retract only modestly below its heat-set dimension. Thus, the heat-set spandex yarn will not significantly compress the knit stitches from the heat-set dimensions. Stretching and heat setting parameters are chosen to yield the desired fabric basis weight and elongation, within relatively tight limits. For a typical cotton-jersey elastic single-knit, the desired elongation is at least 60%, and the basis weight ranges from about 140 to about 240 g/m².

Second, the more severe the stitch compression, the more the fabric will elongate on a percentage basis, thus far exceeding minimum standards and practical needs. When a plated knit with elastic yarn is compared with a fabric knit without elastic yarn, it is common for the plated elastic knit fabric to be 50% shorter (more compressed) than the fabric without elastic yarn. The plated knit is able to stretch in length 150% or more from this compressed state, and such excessive elongation is generally undesirable in jersey knits for cut and sew applications. This length is in the warp direction of the fabric. Fabrics with high elongation in length (stretch) are more likely to be cut irregularly, and are also more likely to shrink excessively upon washing. Similarly, stitches are compressed by spandex in the width direction, so that fabric width is reduced about 50% as well, far beyond the 15 to 20% as-knit width reduction normally encountered with rigid (non-elastic) fabrics.

Third, the compressed stitches in the finished fabric are at an equilibrium condition between spandex recovery forces and resistance to stitch compression by the companion hard yarn. Washing and drying of the fabric can reduce the hard-yarn

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resistance, probably in part because of agitation of the fabric. Thus, washing and drying may permit the spandex recovery forces to further compress the knit stitches, which can result in unacceptable levels of fabric shrinkage. Heat-setting the knit fabric serves to relax the spandex and reduce the spandex recovery force. The heat setting operation, therefore improves the stability of the fabric, and reduces the amount that the fabric will shrink after repeated washings.

Heat setting is not used for all varieties of weft knit elastic fabrics. In some cases a heavy knit will be desired, such as in double knits/trips and flat sweater knits. In these cases, some stitch compression by the spandex is acceptable. In other cases, the bare spandex fiber is covered with natural or synthetic fibers in a core-spinning or spindle-covering operation, so that the recovery of the spandex and resultant stitch compression is restrained by the covering. In still other cases, bare or covered spandex is plated only on every second or third knit course, thereby limiting the total recovery forces that compress the knit stitches. In seamless knitting, a process wherein tubular knits are shaped for direct use while being knitted on special machines, the fabric is not heat set because dense, stretchy fabrics are intended. For circular-knit jersey elastic fabrics made for cutting and sewing, however, wherein bare spandex is plated in every course, heat setting is almost always required.

Heat setting has disadvantages. Heat setting is an extra cost to finish knit elastic fabrics that contain spandex, versus fabrics that are not elastic (rigid fabrics). Moreover, high spandex heat-setting temperatures can adversely affect sensitive companion hard yarns, e.g., yellowing of cotton, thereby requiring more aggressive subsequent finishing operations, such as bleaching. Aggressive bleaching can negatively affect fabric tactile

properties, such as "hand," and usually requires the manufacturer to include fabric softener to counteract bleaching. Also, heat-sensitive hard yarns, such as those from polyacrylonitrile, wool and acetate, cannot be used in high-temperature spandex heat-setting steps, because the high heat-setting temperatures will adversely affect such heat-sensitive yarns.

The disadvantages of heat setting have long been recognized, and, as a result, spandex compositions that heat-set at somewhat lower temperatures have been identified (US Pat. Nos. 5,948,875 and 6,472,494 B2). For example, the spandex defined in US Pat. No. 6,472,494 B2 has a heat set efficiency greater than or equal to 85% at approximately 175-190°C. The heat set efficiency value of 85% is considered a minimum value for effective heat setting. It is measured by laboratory tests comparing the length of stretched spandex before and after heat setting to the before-stretched spandex length. While such lower heat setting spandex compositions provide an improvement, heat setting is still required, and the costs associated with it have not become significantly reduced.

The traditional practice of making and heat setting circular-knit fabrics has further disadvantages. The knit fabric emerges from a circular knitting machine in the form of a continuous tube. As the tube is formed in knitting, it is either rolled under tension onto a mandrel, or it is collected as a flat tube under the knitting machine by plaiting, or loose folding. In either case, the fabric establishes two permanent creases where the fabric tube has been folded or flattened. Although the fabric is "opened" by slitting the fabric tube along one of the creases, subsequent use and cutting of the fabric usually must avoid the

remaining crease. This reduces the fabric yield (or the amount of knit fabric that can be further processed into garments).

New methods are sought for making circular-knit, elastic, single-knit jersey fabrics that have bare spandex plated in every knit course, and that avoid the costs and disadvantages associated with heat setting.

SUMMARY OF THE INVENTION

We have surprisingly found that a circular knit, elastic, single jersey fabric that includes bare spandex plated with spun and/or continuous filament hard yarns can be manufactured with commercially acceptable properties without a need for in-fabric spandex heat setting if: (1) the spandex draft is limited during the knitting process; and (2) certain desired single knit jersey fabric parameters are maintained. "Hard yarns" include spun staple yarns, spun staple and continuous filament yarns and continuous filament yarns.

The first aspect of the invention is a method for making a circular knit, single jersey fabric in which bare spandex yarn from 17 to 33 dtex, preferably from 22 to 33 dtex, is plated with a hard yarn of spun and/or continuous filament yarn, or blends thereof, with yarn count (Nm) from 35 to 85, preferably from 44 to 68, most preferably from 47 to 54. Preferably, hard yarn is spun staple yarn of cotton or cotton blended with synthetic fibers or yarn. Other natural and synthetic fibers may be selected for the hard yarn, including nylon, polyester, acrylics and wool, for example.

The spandex and the hard yarn are plated in every knit course. The circular knit, single jersey fabric produced by this knitting method has a cover factor of from 1.3 to 1.9. During the knitting, the draft on the spandex feed is controlled so that the spandex

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yarn is drafted no more than 2X its original length when knit to form the circular knit, single jersey fabric.

In addition, the knit fabric is finished and dried without heat setting the fabric or the spandex within the fabric. Thus, the fabric is dried at temperatures below the heat setting temperature of the spandex. Finishing may comprise one or more steps, such as cleaning, bleaching, dyeing, drying, and compacting, and any combination of such steps. Preferably, the finishing and drying are carried out at one or more temperatures below 160°C. Drying or compacting is carried out while the knit fabric is in an overfeed condition in the warp direction.

The resulting circular knit, elastic, single jersey knit fabric preferably has a spandex content of from 3.5% to 14% by weight based on the total fabric weight per square meter, more preferably from 5% to 10% by weight based on the total fabric weight per square meter. In addition, such fabric preferably has a cover factor of 1.4.

The second and third aspects of the invention are the circular knit, elastic, single jersey fabrics made according to the inventive method, and garments constructed from such fabrics. The fabric produced by the inventive method preferably is formed with hard yarns of cotton or cotton blends and has a basis weight of 140 to 240 g/m², most preferably of 170 to 220 g/m². The fabric preferably also has an elongation of 60% or more, preferably from 60% to 130% in the length (warp) direction, and a shrinkage after washing and drying of about 7% or less, preferably less than 7% in both length and width. Garments may include underwear, t-shirts, and top-weight garments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates plated knit stitches comprising a hard yarn and spandex;

FIG. 2 is a schematic diagram of a portion of a circular knitting machine fed with
5 a spandex feed and a hard yarn feed;

FIG. 3 illustrates a series of single jersey knit stitches and highlights one stitch of
stitch length "L";

FIG. 3A shows the single stitch of FIG. 3 straightened to illustrate stitch length
"L";

10 FIG. 4 is a flow chart showing prior art process steps for making circular-knit,
elastic, single-knit jersey fabrics that have bare spandex plated in every knit course; and

FIG. 5 is a flow chart showing the inventive process steps for making circular-
knit, elastic, single-knit jersey fabrics that have bare spandex plated in every knit course.

While the invention will be described in connection with preferred embodiments
15 below, it is to be understood that the invention is in no way intended to be limited by
such description. On the contrary, it is intended to cover all alternatives, modifications
and equivalents as may be included within the true spirit and scope of the invention as
defined by the claims appended hereto.

20 DETAILED DESCRIPTION OF THE INVENTION

The subject of this patent is circular knitting, and in particular the manufacture of
specific knit elastic fabrics for subsequent 'cut and sew' use. Regarding circular
knitting, FIG. 2 shows in schematic form one feed position 20 of a circular knitting
machine having a series of knitting needles 22 that move reciprocally as indicated by the
25 arrow 24 in response to a cam (not shown) below a rotating cylinder (not shown) that

holds the needles. In a circular knitting machine, there are multiple numbers of these feed positions arranged in a circle, so as to feed individual knitting positions as the knitting needles, carried by the moving cylinder, are rotated past the positions.

For plating knit operations, a spandex yarn 12 and a hard yarn 14 are delivered to
5 the knitting needles 22 by a carrier plate 26. The carrier plate 26 simultaneously directs both yarns to the knitting position. The spandex yarn 12 and hard yarn 14 are introduced to the knitting needles 22 at the same or at a similar rate to form a single jersey knit stitch 10 like that shown in FIG. 1.

The hard yarn 14 is delivered from a wound yarn package 28 to an accumulator
10 30 that meters the yarn to the carrier plate 26 and knitting needles 22. The hard yarn 14 passes over a feed roll 32 and through a guide hole 34 in the carrier plate 26. Optionally, more than one hard yarn may be delivered to the knitting needles via different guide holes in the carrier plate 26.

The spandex 12 is delivered from a surface driven package 36 and past a broken
15 end detector 39 and change of direction roll(s) 37 to a guide slot 38 within the carrier plate 26. The feed tension of the spandex 12 is measured between the detector 39 and drive roll 37, or alternatively between the surface driven package 36 and roll 37 if the broken end detector is not used. The guide hole 34 and guide slot 38 are separated from one another in the carrier plate 26 so as to present the hard yarn 14 and spandex 12 to the
20 knitting needles 22 in side by side, generally parallel relation (plated).

The spandex preferably is a commercially available elastane product for circular knitting, such as Lycra® types T162, T169 and T562.

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The spandex stretches (drafts) when it is delivered from the supply package to the carrier plate and in turn to the knit stitch due to the difference between the stitch use rate and the feed rate from the spandex supply package. The ratio of the hard yarn supply rate (meters/min) to the spandex supply rate is normally 2.5 to 4 times (2.5X to 4X) greater, and is known as the machine draft. This corresponds to spandex elongation of 150% to 300%, or more. The feed tension in the spandex yarn is directly related to the draft (elongation) of the spandex yarn. This feed tension is typically maintained at values consistent with high machine drafts for the spandex.

We have found that improved results are obtained when the total spandex draft, as measured in the fabric, is kept to about 2X or less. This draft value is the total draft of the spandex, which includes any drafting or drawing of the spandex that is included in the supply package of as-spun yarn. The value of residual draft from spinning is termed package relaxation, "PR", and it typically ranges from 0.05 to 0.15 for the spandex used in circular knit, elastic, single jersey fabrics. The total draft of the spandex in the fabric is therefore $MD \cdot (1 + PR)$, where "MD" is the knitting machine draft. The knitting machine draft is the ratio of hard yarn feed rate to spandex feed rate, both from their respective supply packages.

Because of its stress-strain properties, spandex yarn drafts (draws) more as the tension applied to the spandex increases; conversely, the more that the spandex is drafted, the higher the tension in the yarn. A typical spandex yarn path, in a circular knitting machine, is schematically shown in FIG. 2. The spandex yarn 12 is metered from the supply package 36, over or through a broken end detector 39, over one or more change-of-direction rolls 37, and then to the carrier plate 26, which guides the spandex to the

knitting needles 22 and into the stitch. There is a build-up of tension in the spandex yarn as it passes from the supply package and over each device or roller, due to frictional forces imposed by each device or roller that touches the spandex. The total draft of the spandex at the stitch is therefore related to the sum of the tensions throughout the spandex path.

The spandex feed tension is measured between the broken end detector 39 and the roll 37 shown in FIG. 2. Alternatively, the spandex feed tension is measured between the surface driven package 36 and roll 37 if the broken end detector 39 is not used. The higher this tension is set and controlled, the greater the spandex draft will be in the fabric, and vice versa. The prior art teaches that this feed tension should range from 2-4 cN for 22dtex spandex, and from 4-6 cN for 44dtex spandex in commercial circular knitting machines. With these feed tension settings and the additional tensions imposed by subsequent yarn-path friction, the spandex in commercial knitting machines will be drafted significantly more than 2X.

This invention does not anticipate all the ways that spandex friction can be minimized between the supply package and the knit stitch. The method requires, however, that friction be minimized to keep the spandex feed tensions sufficiently high for reliable spandex feeding when the spandex draft is 2X or less.

After knitting a circular knit, elastic, single jersey fabric of plated spandex with hard yarn per the method of this invention, the fabric is finished in either of the alternate processes 60 illustrated diagrammatically in FIG. 5. Drying operations can be carried out on circular knit fabric 62 in the form of an open width web (top row of diagram, path 63a), or as a tube (bottom row of diagram, path 63b). For either of these paths, wet

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finishing process steps 6-4 (such as scouring, bleaching and/or dyeing) are carried out on the fabric while it is in tubular form. One form of dyeing, called soft-flow jet dyeing, usually imparts tension and some length deformation in the fabric. Care should be taken to minimize any additional tension applied during fabric processing and transport from wet finishing to the dryer, and also enable the fabric to relax and recover from such wet finishing and transport tensions during drying.

Following wet finishing process steps 64, the fabric is dewatered 66, such as by squeezing or centrifuging. In process path 63a, the tubular fabric is then slit open 68 before it is delivered to a finish/dry step 70 for optional finish application (e.g., softener by padding) and subsequent drying in a tenter-frame oven under conditions of fabric length overfeed. In process path 63b, the tubular fabric is not slit open, but is sent as a tube to the finish/dry step 70. Finish, such as softener, can be optionally applied by padding. The tubular fabric is sent through a drying oven, e.g., laid on a belt, and then to a compactor to separately provide fabric overfeed. A compactor commonly uses rolls to transport the fabric, usually in a steam atmosphere. The first roll(s) is driven at a faster speed of rotation than the second roll(s) so that the fabric has an overfeed. Generally, the steam does not "re-wet" the fabric so that no additional drying is required after compacting.

The drying step 70 (path 63a) or the compacting step 72 (path 63b), is operated with controlled, high fabric overfeed in the length (machine) direction so that the fabric stitches are free to move and rearrange without tension. A flat, non-wrinkled or non-buckled fabric emerges after drying. These techniques are familiar to those skilled in the art. For open width fabrics, a tenter-frame is used to provide fabric overfeed during

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drying. For tubular fabrics, forced overfeed is typically provided in a compactor 72, after belt drying. In either open-width or tubular fabric processing, the fabric drying temperature and residence time are set below the values required to heat set the spandex.

The structural design of a circular knit fabric can be characterized in part by the "openness" of each knit stitch. This "openness" is related to the percentage of the area that is open versus that which is covered by the yarn in each stitch (see, e.g., FIGs. 1 and 3), and is thus related to fabric basis weight and elongation potential. For rigid, non-elastic weft knit fabrics, the Cover Factor ("Cf") is well known as a relative measure of openness. The Cover Factor is a ratio and is defined as:

10
$$Cf = \sqrt{(tex) + L}$$

where tex is the grams weight of 1000 meters of the hard yarn, and L is the stitch length in millimeters. FIG. 3 is a schematic of a single knit jersey stitch pattern. One of the stitches in the pattern has been highlighted to show how the stitch length, "L" is defined. For yarns of metric count Nm, the tex is 1000 ÷ Nm, and the Cover Factor is alternatively expressed as follows:

15
$$Cf = \sqrt{(1000/Nm) + L}$$

We have found that commercially useful circular knit, elastic, single jersey fabrics plated from bare spandex and a hard yarn can be made without heat setting if the spandex draft is kept about 2X or less, and if the knit fabric is designed and manufactured within the following preferred limits:

- The Cover Factor, which characterizes the openness of the knit structure, is between 1.3 and 1.9, and is preferably 1.4;

- The hard yarn count, Nm, is from 35 to 85, preferably from 44 to 68, and most preferably from 47 to 54;
- The spandex has 17 to 33 dtex, preferably 22 to 33 dtex;
- Preferably, the content of spandex in the fabric, on a % weight basis, is from 3.5% to 14%, and is most preferably from 5% to 10%;
- The knit fabric so formed has a shrinkage after washing and drying of about 7% or less, preferably less than 7% in both the length and width directions;
- The knit fabric has an elongation of 60% or more, preferably from 60% to 130%, in the length (warp) direction; and
- Preferably, the hard yarn is spun staple yarn of cotton or cotton blended with synthetic fibers or yarns.

While not wishing to be bound by any one theory, it is believed that the hard yarn in the knit structure resists the spandex force that acts to compress the knit stitch. The effectiveness of this resistance is related to the knit structure, as defined by the Cover Factor. For a given hard yarn count, Nm, the Cover Factor is inversely proportional to the stitch length, L. This length is adjustable on the knitting machine, and is therefore a key variable for control.

Because the spandex is not heat set in the process of the invention, the spandex draft should be the same in the circular knit, elastic, single jersey as-knit fabric, the finished fabric, or at fabric-processing steps in-between, within the limits of measurement error.

For circular knit, elastic, single jersey fabric, the appropriate gauge of knitting machine is selected according to prior art relationships between hard yarn count and knitting machine gauge. Choice of gauge can be used to optimize circular knit, elastic, single jersey basis weight, for example.

5 The benefits of this invention are evident when the prior art process shown diagrammatically in FIG. 4, is compared with the inventive process shown diagrammatically in FIG. 5. Traditional knitting and finishing require more process steps, more equipment, and more labor-intensive operations than does either alternative method of the invention shown in FIG. 5. Further, by eliminating high-temperature heat set previously required (see FIG. 4), the inventive process reduces heat damage to fibers like cotton, requires less or no bleaching, and thus improves the "hand" of the finished fabric. As a further benefit, heat sensitive hard yarns can be used in the invention process to make circular knit, elastic, single jersey fabrics, thus increasing the possibilities for different and improved products.

15 The use of a softener is optional, but commonly a softener will be applied to the knit fabric to further improve fabric hand, and to increase mobility of the knit stitches during drying. Softeners such as SURESOFT or SANDOPERM SEI are typical. The fabric may be passed through a trough containing a liquid softener composition, and then through the nip between a pair of pressure rollers (padding rollers) to squeeze excess
20 liquid from the fabric.

Also surprisingly, circular knit, elastic, single jersey fabrics knitted by the method of the invention and collected by folding (plaiting), do not crease to the same extent as prior art circular knit single jersey fabrics. Fewer or less visible fold creases in the

finished fabric can result in an increased yield for cutting and sewing the fabric into garments. Also unexpectedly, the circular knit, elastic, single jersey fabrics of the invention have significantly reduced skew during process in either open-width or tubular finishing processes, compared to prior art fabrics. With excess skew or spirality, fabrics are diagonally deformed and courses are "on the bias", and are unacceptable. Garments made with skewed fabric will twist on the body.

The following examples demonstrate the invention and its benefits. The invention is capable of other and different embodiments, and its several details are capable of modifications in various apparent respects, without departing from the scope and spirit of the present invention. Accordingly, the examples are to be regarded as illustrative in nature and not as restrictive.

Examples

Fabric Knitting and Finishing

Circular knit elastic single jersey fabrics with bare spandex plated with hard yarn for the examples were knit on Pai Lung Circular Knitting Machines, either: (1) Model PL-FS3B/T, with 16 inches cylinder diameter, 28 gauge (needles per circumferential inch), and 48 yarn feed positions; or (2) Model PL-XS3B/C, with 26 inches cylinder diameter, 24 gauge, and 78 yarn feed positions. The 28-gauge machine was operated at 24 revolutions per minute (rpm), and the 24-gauge machine at 26 rpm.

The broken end detector in each spandex feed path (see FIG. 2) was either adjusted to reduce sensitivity to yarn tension, or removed from the machines for these

examples. The broken end detector was a type that contacted the yarn, and therefore induced tension in the spandex.

The spandex feed tension was measured between the spandex supply package 36 and the roller guide 37 (FIG. 2) with a Zivy digital tension meter, model number, EN-10. For examples of the invention, the spandex feed tensions were maintained at 1 gram or less for 20 and 30-denier spandex. These tensions were sufficiently high for reliable and continuous feeding of the spandex yarn to the knitting needles, and sufficiently low to draft the spandex only about 2X or less. We found that when the feed tensions were too low, the spandex yarn wrapped around the roller guides at the supply package and could not be reliably fed to the circular knitting machine.

All the knitted fabrics were scoured, dyed and dried per the open-width process 63a of FIG. 5. With the exception of Example 1A, all knitted fabrics were finished in the same way, and without heat setting. The fabric of Example 1A was also stretched and heat set at 190°C for a residence time of 60 seconds.

Fabrics were scoured and bleached in a 300-liter solution at 100°C for 30 minutes. All such wet, jet finishing, including dyeing, was done in a Tong Geng machine (Taiwan) Model TGRU-HAF-30. The water solution contained Stabilizer SIFA (300g) (silicate free alkaline), NaOH (45%, 1200g), H₂O₂ (35%, 1800g), IMEROL ST (600g) for cleaning, ANTIMUSSOL HT2S (150g) for antifoaming, and IMACOL S (150g) for softening. After 30 minutes, the solution and fabric were cooled to 75°C and then the solution was drained. The fabric was subsequently neutralized in a 300 liter solution of water and HAC (150g) (hydrogen + domo, acetic acid) at 60°C for 10 minutes.

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The fabrics were dyed in a 300-liter solution of water at 60°C for 60 minutes, using reactive dyes and other constituents. The dye solution contained R-3BF (215g), Y-3RF (129g), Na₂SO₄ (18,000g), and Na₂CO₃ (3000g). After 10 minutes, the dyebath was drained and refilled to neutralize with HAC (150g) for 10 minutes at 60°C.

5 After neutralization, the bath was again drained and refilled with clean water for a 10-minute rinse. Subsequent to neutralization, the 300-liter vessel was again filled with water, and 150g of SANDOPUR RSK (soap) was added. The solution was heated to 98°C, and the fabrics were washed/scaped for 10 minutes. After draining and another 10 minute clean-water rinse, the fabrics were unloaded from the vessel.

10 The wet fabrics were then de-watered by centrifuge, for 8 minutes.

For the final step, a lubricant (softener) was padded onto the fabrics in a 77-liter water solution with SANDOPERM SEI liquid (1155g). The fabrics were then dried in a tenter oven at 145°C for about 30 seconds; at 50% overfeed.

The above procedure and additives will be familiar to those experienced in the art of textile manufacturing, and circular knitting of single jersey knit fabrics.

15

Analytical Methods

Spandex Draft—The following procedure, conducted in an environment at 20°C and 65% relative humidity, is used to measure the spandex drafts in the Examples.

- 20
- De-knit (unravel) a yarn sample of 200 stitches (needles) from a single course, and separate the spandex and hard yarns of this sample. A longer sample is de-knit, but the 200 stitches are marked at beginning and end.

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- Hang each sample (spandex or hard yarn) freely by attaching one end onto a meter stick with one marking at the top of the stick. Attach a weight to each sample (0.1 g/denier for hard yarn, 0.001 g/denier for spandex). Lower the weight slowly, allowing the weight to be applied to the end of the yarn sample without impact.
- Record the length measured between the marks. Repeat the measurements for 5 samples each of spandex and hard yarn.
- Calculate the average spandex draft according to the following formula:

$$\text{Draft} = (\text{Length of hard yarn between marks}) + (\text{Length of spandex yarn between marks}).$$

If the fabric has been heat set, as in the prior art, it is usually not possible to measure the in-fabric spandex draft. This is because the high temperatures needed for spandex heat setting will soften the spandex yarn surface and the bare spandex will tack to itself at stitch crossover points 16 in the fabric (FIG. 1). Because of such multiple tack points, one cannot de-knit fabric courses and extract yarn samples.

Fabric Weight—Knit Fabric samples are die-punched with a 100cm diameter die. Each cut-out knit fabric sample is weighed in grams. The "fabric weight" is then calculated as grams/square meters.

Spandex Fiber Content—Knit fabrics are de-knit manually. The spandex is separated from the companion hard yarn and weighed with a precision laboratory balance.

or torsion balance. The spandex content is expressed as the percentage of spandex weight to fabric weight.

Fabric Elongation—The elongation is measured in the warp direction only.

5 Three fabric specimens are used to ensure consistency of results. Fabric specimens of known length are mounted onto a static extension tester, and weights representing loads of 4 Newtons per centimeter of length are attached to the specimens. The specimens are exercised by hand for three cycles and then allowed to hang free. The extended lengths of the weighted specimens are then recorded, and the fabric elongation is calculated.

10

Shrinkage—Two specimens, each of 60 x 60 centimeters, are taken from the knit fabric. Three size marks are drawn near each edge of the fabric square, and the distances between the marks are noted. The specimens are then sequentially machine washed 3 times in a 12-minute washing machine cycle at 40°C water temperature and air dried on a table in a laboratory environment. The distances between the size marks are then remeasured to calculate the amount of shrinkage.

15

Face Curl—A 4-inch x 4-inch (10.16cm x 10.16cm) square specimen is cut from the knit fabric. A dot is placed in the center of the square, and an 'X' is drawn with the dot as the center of the 'X'. The legs of the 'X' are 2 (5.08 cm) inches long and in line with the outside corners of the square. The X is carefully cut with a knife, and then the fabric face curls of two of the internal points created by the cut are measured immediately and again in two minutes, and averaged. If the fabric points curl completely in a 360°

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circle, the curl is rated as 1.0; if it curls only 180°, the curl is rated ½; and so on. Curl values of ½ or less are acceptable.

Examples 1-10

Table 1 below sets forth the knitting conditions for the example knit fabrics.

Lyora® types T169 or T562 were used for the spandex feeds. Lyora® deniers were 40,
5 30, and 20, or 44dtex, 33dtex, and 22dtex, respectively. The stitch length, L, was a
machine setting. Table 2 below summarizes key results of the tests for both as-knit
fabrics (prior to any finishing), and for finished fabrics. Values of curl were acceptable
for all test conditions, and will not be further discussed below. Spandex feed tensions are
listed in grams. 1.00 grams equal 0.98 centiNewtons(cN).

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TABLE 1
Knitting Conditions

Example	Lycra® Type	Lycra® Denier	Spun Yarn Type	Spun Yarn Count, Nm	Stitch Length, L, mm	Cover Factor, Cf	Lycra® Feed Tension, grams	Machine Gauge, needles per inch
1	T169	40	Cotton	54	3.06	1.4	5	28
1A	T169	40	Cotton	54	3.06	1.4	5	28
2	T169	20	Cotton	54	3.06	1.4	1	28
3	T169	20	Cotton	54	3.06	1.4	0.8	28
4	T169	20	Cotton	54	2.3	1.87	1	28
5	T169	20	Cotton	54	3.57	1.2	1	28
6	T169	20	Cotton	68	3.06	1.25	1	28
7	T169	20	Cotton	54	3.06	1.4	1	24
8	T169	30	Cotton	68	2.75	1.4	1	28
9	T169	20	Cotton- Polyester	55	3.06	1.4	1	28
10	T562	20	Cotton	54	3.06	1.4	1	28

TABLE 2- RESULTS

Example	As-Knit		Finished					
	Base Weight, g/m ²	Maximum Length Elongation %	Lycra® Draft	Base Weight, g/m ²	Maximum Length Elongation %	Lycra® Content in Fabric, % Weight	Shrinkage %, Warp by Weft	Face Curl, Fraction of 360°
1	266	169	2.7	308	169	7.6	7.4 x 5.7	1/4
1A	266	169	NA	204	115	7.6	5.1 x 0.8	1/4
2	191	109	2	218	108	5.9	3.3 x 4.2	1/4
3	194	92	1.8	208	98	6.4	2.6 x 4.2	1/4
4	200	84	1.9	229	65	8	2.9 x 3.8	1/4
5	204	138	2.2	204	114	4.8	16.1 x 0.7	1/4
6	164	123	2	178	96	7.1	12.4 x 2.7	1/4
7	191	147	1.9	208	104	6	4.0 x 4.3	1/4
8	168	99	1.7	178	89	12.1	5.6 x 4.4	3/4
9	173	80	2	229	112	5.9	2.4 x 1.3	1/4
10	190	104	1.9	207	98	8.4	3.3 x 3.7	1/4

Example 1—High Draft without Heat Setting (prior art)

The 40-denier spandex feed tension was 5 grams (4.9 cN), which is in the range of 4 to 6 cN recommended in the prior art. Because of the compressive forces of the spandex, the as-knit fabric basis weight was high (266g/m²), and higher still in the finished fabric (306g/m²). Shrinkage also exceeded 7% in the length direction. These values exceed commercial objectives, and the knit fabric would need to be heat set before it could be made into a garment.

Example 1A—High Draft with Heat Setting (prior art)

The knit fabric of Example 1 was stretched and heat set at 190°C for 60 seconds. The as-knit weight and elongation properties were the same as for Example 1, but heat setting reduced the finished fabric to 204 g/m² and 115% elongation, which are both desirable for circular knit elastic single jersey fabric. Shrinkage was acceptable.

Spandex draft and content could not be measured by the analytical methods above, as the heat-set fabric could not be de-knitted because the bare spandex tacked together. The spandex content, however, was the same as for Example 1. Examples 1 and 1A demonstrate that heat setting is required for prior methods of making circular knit elastic single jersey fabrics that incorporate plated bare spandex.

Example 2—Invention: Best Mode

Parameters were set at the most preferred values. Cotton count was 54 Nm, the cover factor was 1.4, the spandex denier was 20, and the spandex draft was 2.0. The

spandex was Lycra® Type 169. The knit fabric was not heat set. Knit fabric finished values of basis weight, elongation and shrinkage were acceptable.

Example 3—Invention: Reduced Tension and Draft

5 The 20-denier spandex feed tension was lowered to 0.8 grams (0.78 cN). For the Pai Lung knitting machine and spandex yarn path, this was a minimum value for feed tension to maintain continuity of spandex takeoff from the supply package. The knit fabric was not heat set. Finished values of basis weight, elongation, and shrinkage were acceptable.

10

Example 4—Invention: High Cover Factor

The stitch length was reduced to 2.3 mm so that the cover factor was 1.87, near the upper limit of the invention. The knit fabric was not heat set. The finished fabric weight was relatively high (229 g/m²) and the elongation was 65%, practically at the lower limit of 60%, as defined by commercial usefulness. Shrinkage was quite low:

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Example 5—Comparison: Below-Limit Cover Factor

The stitch length was increased to 3.57 mm in order to reduce the cover factor to a value of 1.2. This value is below the limits of the invention (lower limit - 1.3). The knit fabric was not heat set. Finished fabric weight and elongation were acceptable, but the shrinkage was not (length 16.1%). The spandex draft was also slightly above 2.2 because, probably because of interactions of spandex drafting by knitting needle friction at longer stitch lengths.

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Example 6— Comparison: Higher Spun Yarn Count and Below-Limit Cover Factor

Cotton spun yarn count was increased from 54 to 68 Nm for this example. Stitch length was maintained at 3.06 mm, so that the cover factor was reduced to 1.25 by this change in spun yarn count. The knit fabric was not heat set. Again, the fabric weight and elongation were acceptable, but the shrinkage was not (12.4% in length).

Example 7—Invention: Different Machine Gauge

Knitting machine model PL-XS3B/C, with a gauge of 24 needles per circumferential inch, was used to knit the fabric of this example. All knitting and fabric design variables were within the invention. The knit fabric was not heat set. Fabric weight (208g/m²), elongation (1.04%) and shrinkage (4.3% max) were all acceptable, and directly comparable to results of Example 1A, wherein the knit fabric had been heat set.

Example 8—Invention: High Spandex Content

The spandex denier was increased to 30 denier, and the cotton count was increased to 68 Nm (denier reduced), so that the % spandex content in the fabric increased to 12.1%. This content was higher than the other examples, but still within the limits of the invention. Stitch length was reduced to maintain the cover factor at 1.4. The knit fabric was not heat set. Fabric weight, elongation and shrinkage were all acceptable.

Example 9—Invention: Different Type Spun Yarn

Two hard yarns were plated, together with the spandex, into the knit stitches. The first hard yarn was spun cotton with count 60 Ne, or 101.6 Nm. The second hard yarn was continuous filament polyester yarn of 83 dtex and 34 filaments. These were plated together with 22 dtex (20 denier) spandex. The combined hard yarn count was 55 Nm. The knit fabric was not heat set. Fabric weight, elongation and shrinkage were all acceptable.

Example 10—Invention: Best Mode-Different Type Spandex Yarn

Process parameters were the same as in Example 2, except that a different spandex yarn, Lycra® Type 562 ('easy-set') was used for the spandex feed. The knit fabric was not heat set. Results were acceptable, and comparable to example 2.

WE CLAIM:

1. In a method for making a circular knit, single jersey fabric in which bare spandex yarn from 17 to 33 dtex is plated with one or more spun or continuous filament hard yarns, or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 2X its original length when knit to form the circular knit, single jersey fabric; and

finishing and drying the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

2. The method of claim 1, wherein the knit fabric is maintained at temperatures below 160°C during finishing and drying.

3. The method of claim 1, wherein the knit fabric has a length in the warp direction and is dried or compacted while subject to an overfeed in its length.

4. The method of claim 1, wherein the knit fabric has a spandex content of from 3.5% to 14% by weight based on the total fabric weight per square meter.

5. The method of claim 4, wherein the knit fabric has a spandex content of from 5% to 10% by weight based on the total fabric weight per square meter.

6. The method of claim 1, wherein the cover factor of the knit fabric is 1.4.

7. The method of claim 1, wherein finishing comprises one or more steps selected from the group consisting of: cleaning, bleaching, dyeing, drying, and compacting and any combination of such steps.

8. The method of claim 1, wherein the hard yarn is selected from the group consisting of spun cotton and cotton blended with synthetic fiber or yarn.

9. A method for making a circular knit, elastic, single knit jersey fabric, consisting essentially of:

5 placing a bare spandex yarn with a hard yarn, wherein the spandex is from 17 to 33 den and can be heat set within a heat setting efficiency of at least 85% at a heat setting temperature, and wherein the hard yarn has a total yarn count (Nm) of 35 to 85;

circular knitting the plated bare spandex yarn and hard yarn in every knit course to form a single knit jersey fabric having a cover factor of from 1.3 to 1.9;

10 controlling the feed of the spandex so that the spandex in the fabric is drafted no more than 2X its original length; and

maintaining the fabric below the heat setting temperature of the spandex during further processing.

10. The method of claim 9, wherein the spandex is present in the fabric in an amount from 3.5% to 14% by weight based on the total fabric weight per square meter.

11. The method of claim 10, wherein the spandex is present in the fabric in an amount from 5% to 10% by weight based on the total fabric weight per square meter.

12. The method of claim 9, wherein the fabric has a cover factor of 1.4.

13. The method of claim 9, further comprising drying or compacting the fabric in an overfed condition.

14. The method of claim 9, wherein the fabric is maintained at temperatures below 160°C during further processing.

15. The method of claim 9, wherein further processing comprises one or more steps selected from the group consisting of: cleaning, bleaching, dyeing, drying, and compacting, and any combination of such steps.

16. A circular knit, elastic, single knit jersey fabric made by the method of
5 claim 1.

17. The circular knit, elastic, single knit jersey fabric of claim 16, wherein the hard yarn is cotton or a cotton blend, and the fabric has a basis weight of from 140 to 240 g/m²,

18. The circular knit, elastic, single knit jersey fabric of claim 16, wherein the
10 fabric has an elongation of at least 60% in its length (warp) direction.

19. The circular knit, elastic, single knit jersey fabric of claim 16, wherein the fabric has a shrinkage of 7% or less after washing.

20. A circular knit, elastic, single knit jersey fabric made by the method of claim 9.

15 21. The circular knit, elastic, single knit jersey fabric of claim 20, wherein the hard yarn is cotton or a cotton blend, and the fabric has a basis weight of from 140 to 240 g/m².

22. The circular knit, elastic, single knit jersey fabric of claim 20, wherein the fabric has an elongation of at least 60% in its length (warp) direction.

20 23. The circular knit, elastic, single knit jersey fabric of claim 20, wherein the fabric has a shrinkage of 7% or less after washing.

24. A garment made from the circular knit, elastic, single knit jersey fabric of claim 16.

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25. A garment made from the circular knit, elastic, single knit jersey fabric of claim 17.

26. A garment made from the circular knit, elastic, single knit jersey fabric of claim 20.

5 27. A garment made from the circular knit, elastic, single knit jersey fabric of claim 21.

Fig. 1

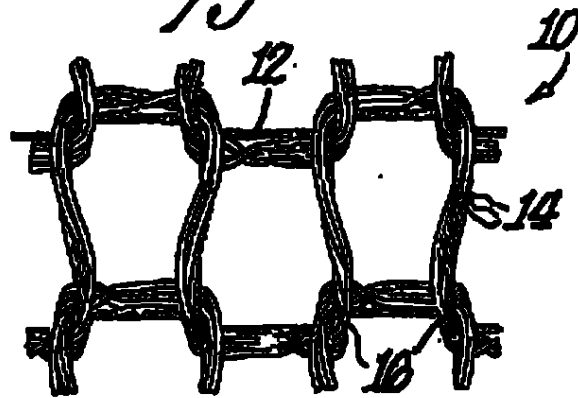


Fig. 2.

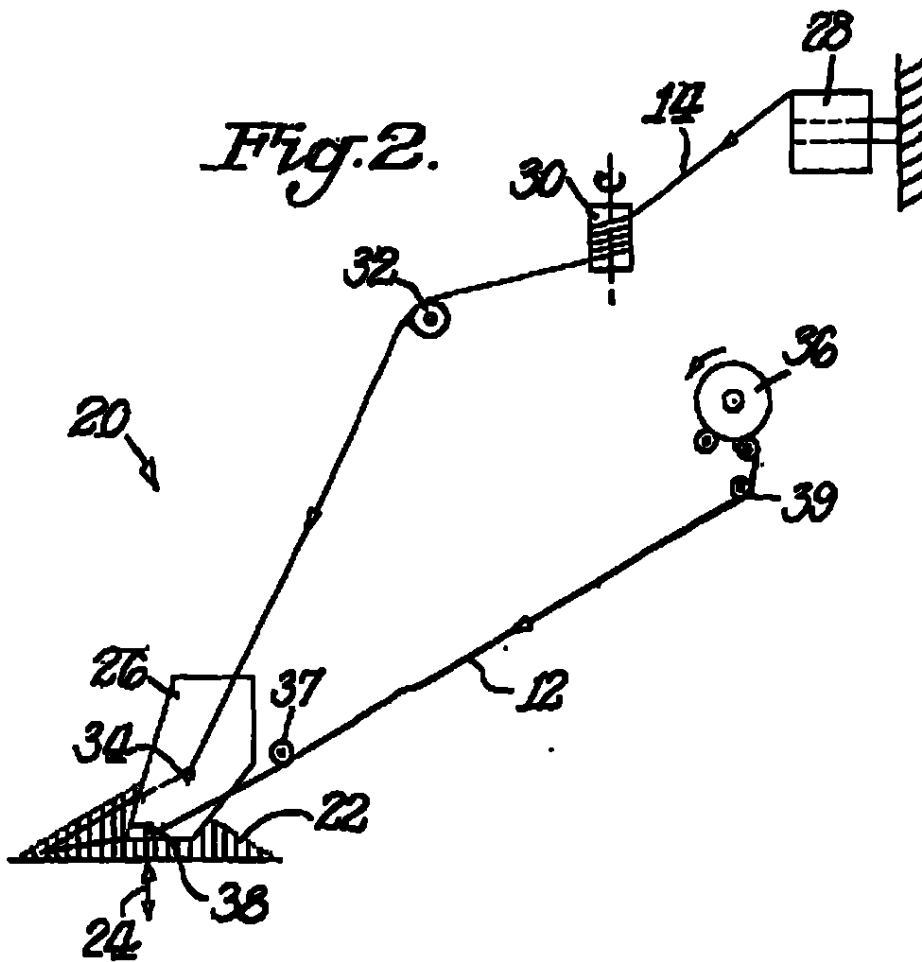
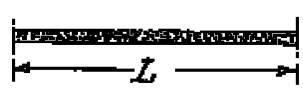


Fig. 3.



Fig. 3A.

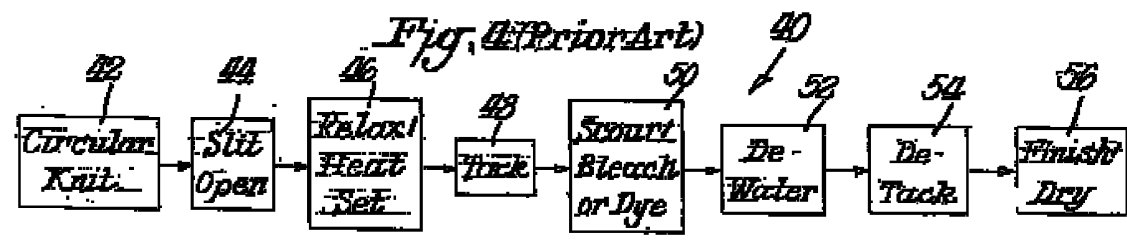


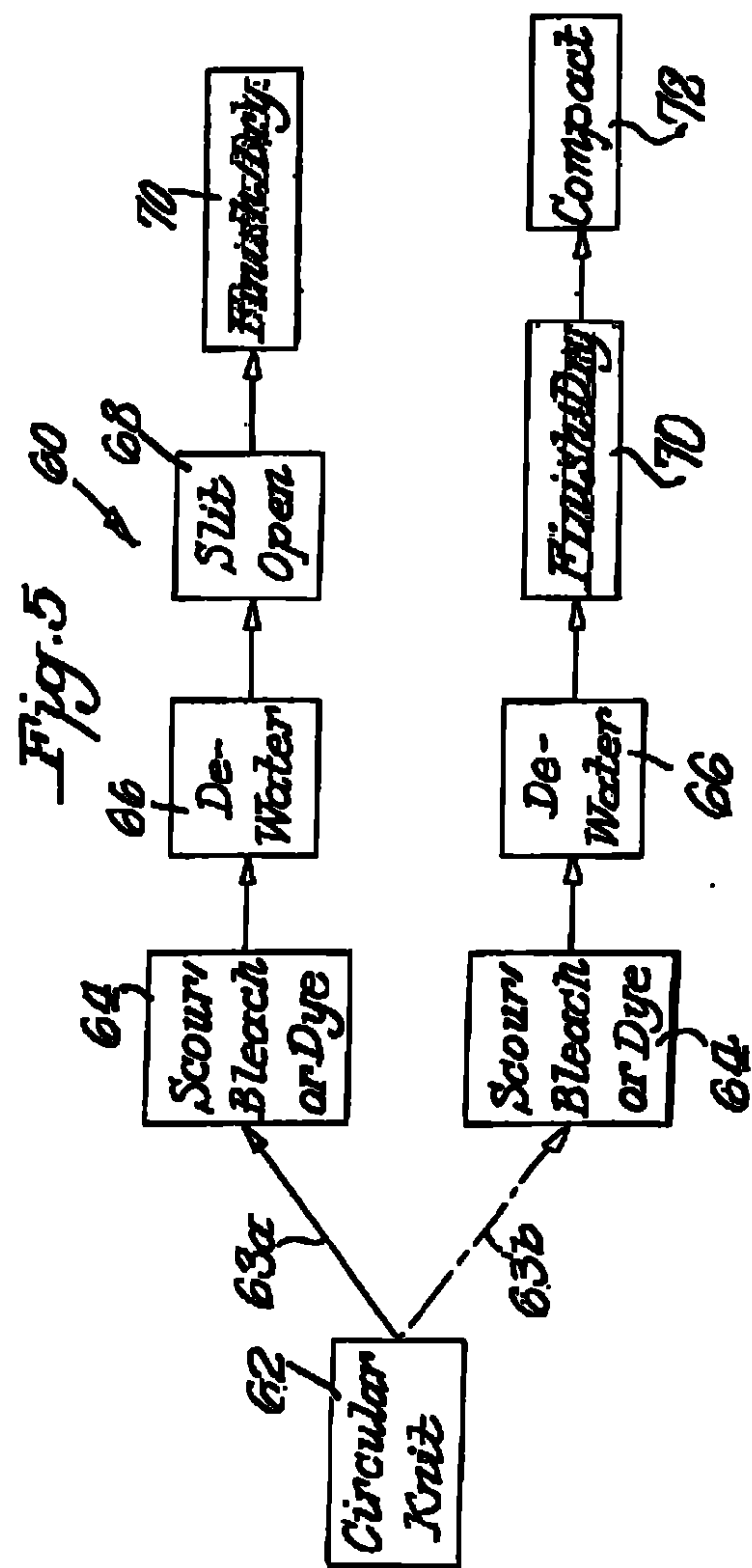
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FIG. 3A

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Fig. 4 (Prior Art)



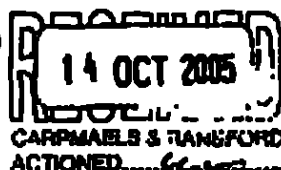


PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

COCKERTON, Bruce Roger
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PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(PCT Rule 71.1)

Date of mailing
(day/month/year)

11.10.2005

Applicant's or agent's file reference
LP5340PCT

IMPORTANT NOTIFICATION

International application No.
PCT/US2004/017384

International filing date (day/month/year)
01.08.2004

Priority date (day/month/year)
02.06.2003

Applicant

INVISTA TECHNOLOGIES S.A.R.L. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)
(PCT Article 36 and Rule 70)

Applicant's or agent's for reference LP5340PCT	FOR FURTHER ACTION		See Form PCT/PEA/16
International application No. PCT/US2004/017364	International filing date (day/month/year) 01.08.2004	Priority date (day/month/year) 02.08.2003	
International Patent Classification (IPC) or national classification and IPC D04B1/18			
Applicant INVISTA TECHNOLOGIES S.A.R.L. et al.			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 6 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ sent to the applicant and to the International Bureau a total of 11 sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.18 and Section 807 of the Administrative Instructions). ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the opinion ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement ☒ Box No. VI Certain documents cited ☒ Box No. VII Certain defects in the international application ☐ Box No. VIII Certain observations on the international application			
Date of submission of the demand 15.03.2005		Date of completion of this report 11.10.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2369 - 0 Fax: +49 89 2369 - 4485		Authorized Officer Uhlig, R Telephone No. +49 89 2369-7683	



INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2004/017364

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

Description, Pages

1-8, 9-11, 13, 14, 19, 21, 22, 24-29 as originally filed

7, 8, 12, 15-18, 20, 23 received on 15.03.2005 with letter of 10.03.2005

Claims, Numbers

1-13 filed with telex on 12.09.2005

Drawings, Sheets

1/3-3/3 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (specify):
- ☐ any table(s) related to sequence listing (specify):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (specify):
- ☐ any table(s) related to sequence listing (specify):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/US2004/017364

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	1-13
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

and /or

2. Non-written disclosures (Rule 70.9)

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/US2004/017364**1. References**

Reference is made to the following documents cited in the international search report:

D1: US-A-5 687 587

D2: US-A-5 931 023

D3: US-A-5 198 288

D4: EP-A-0 119 536

D5: EP-A-1 375 717

RE Item VI**2. Certain Documents**

Document D5 represents prior art according to Rule 64.3 PCT and consequently is not considered part of the prior art for the purpose of assessing novelty and inventive step in the framework of the Patent Cooperation Treaty (PCT).

D5 was published on 02.01.2004, filed on 26.06.2003, claiming priority of 27.08.2002 (Rule 70.10 PCT).

RE Item V**3. Independent Claim 1**

3.1 Based on the documents mentioned in the search report, the subject-matter of claim 1 appears to be new and inventive according to Articles 33 (1) and 33 (3) PCT.

3.2 Document D1 appears to disclose to knit bare spandex yarns of 22 dtex at an elongation of 200% on a circular knitting machine in a plated manner for certain loops in every knit course with hard yarns. The fabric does not have to be heat set afterwards (Fig., col. 2, ll. 45 -56).

3.3 The subject-matter of claim 1 differs in that the fabric is a single jersey fabric.

3.4 The technical effect of this distinguishing feature is that the fabric has two distinguishable sides.

3.5 A skilled person could reapply the teaching of D1 for double knit fabrics to a fabric knit with plain stitches, but there is no hint in D1 or any other document of the search report to do so. Moreover, the stretch characteristics of single and double knit, especially

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interlock knit, fabrics are quite different. Consequently, a skilled person would not consider to apply the teaching of D1 to a plain knit / single jersey fabric.

- 3.6 Document D2, col. 3, ll. 5 to 64, claim 1 appears to disclose to plate spandex yarn with a hard yarn for plain knit fabrics. This combination is then plated with another hard yarn such as cotton. However, D3 appears to remain silent regarding heat setting. Document D3 equally appears to remain silent regarding heat setting. Document D4 appears to require heat setting, which is contradictory to the teaching of the present application.

- 3.7 Consequently claim 1 fulfils the requirements according to Articles 33 (1), 33 (2) and 33 (3) PCT.

4. Independent Claim 9

- 4.1 The subject-matter of claim 9 - as far as understood (see PCT Guidelines PCT Guidelines 5.26 and A5.26[1] - appears to be new and inventive according to Articles 33 (1) and 33 (3) PCT.

- 4.2 Claim 9 is formulated as a product-by-process claim, containing all the features of method claim 1 which appears to be new and inventive. The final fabric according to claim 9 appears to be distinguishable over the prior art D1 and D4, because a skilled person is able to distinguish a heat set fabric from a not heat set fabric (tack points - no tack points) and a circular knit fabric from a flat knit fabric (different skew and spirality).

5. Dependent Claims 2-8, 10-13

Dependent claims 2-8, 10-13 are regarded - from a formalistic point of view - as being new and inventive, as they refer directly or indirectly to independent claims 1 or 9 which are considered to be new and inventive.

RE Item VII

6. Formal/Further Objections

- 6.1 Neither independent claims 1 and 9 are in the two-part form in accordance with Rule 6.3(b) PCT with those features known in combination from the prior art (D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in

**INTERNATIONAL PRELIMINARY
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the characterising part (Rule 6.3(b)(ii) PCT) nor, when drafting the claims in the one part form, the features of the subject-matter of claims 1 and 9 which are already known in combination from D1 are mentioned in the description.

- 6.2 It is clear for a skilled person that for a measured value and the method for obtaining the value are directly linked and these methods generally apply to all embodiments of the invention. However, the methods are not placed in the chapter "Summary of the invention", e.g. as of p. 9, bottom of the page or at least in front of the specific examples, e.g. on p. 18 as of li. 7.
- 6.3 The feature "made at a temperature below such temperature required to heat set the spandex" in claims 10-13 appears to be superfluous, given that this feature is already defined in claim 9.
- 6.4 The protection conferred by a method claim for manufacturing a product extends to the products directly obtained by such a method. Consequently at least claims 9 to 12 appear to be superfluous.

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properties, such as "hand," and usually requires the manufacturer to include fabric softener to counteract bleaching. Also, heat-sensitive hard yarns, such as those from polyacrylonitrile, wool and acetate, cannot be used in high-temperature spandex heat-setting steps, because the high heat-setting temperatures will adversely affect such heat-sensitive yarns.

The disadvantages of heat setting have long been recognized, and, as a result, spandex compositions that heat-set at somewhat lower temperatures have been identified (US Pat. Nos. 5,948,875 and 6,472,494 B2). For example, the spandex defined in US Pat. No. 6,472,494 B2 has a heat set efficiency greater than or equal to 85% at approximately 175-190°C. The heat set efficiency value of 85% is considered a minimum value for effective heat setting. It is measured by laboratory tests comparing the length of stretched spandex before and after heat setting to the before-stretched spandex length. While such lower heat setting spandex compositions provide an improvement, heat setting is still required, and the costs associated with it have not been significantly reduced. US Pat. No. 5,687,587 discloses classified double knit fabrics which do not require heat setting.

The traditional practice of making and heat setting circular-knit fabrics has further disadvantages. The knit fabric emerges from a circular knitting machine in the form of a continuous tube. As the tube is formed in knitting, it is either rolled under tension onto a mandrel, or it is collected as a flat tube under the knitting machine by plaiting, or loose folding. In either case, the fabric establishes two permanent creases where the fabric tube has been folded or flattened. Although the fabric is "opened" by slitting the fabric tube along one of the creases, subsequent use and cutting of the fabric usually must avoid the

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remaining crease. This reduces the fabric yield (or the amount of knit fabric that can be further processed into garments).

New methods are sought for making circular-knit, elastic, single-knit jersey fabrics that have bare spandex plated in every knit course, and that avoid the costs and disadvantages associated with heat setting.

SUMMARY OF THE INVENTION

We have found that a circular knit, elastic, single jersey fabric that includes bare spandex plated with spun and/or continuous filament hard yarns can be manufactured with commercially acceptable properties without a need for in-fabric spandex heat setting if: (1) the spandex draft is limited during the knitting process; and (2) certain desired single knit jersey fabric parameters are maintained. "Hard yarns" include spun staple yarns, spun staple and continuous filament yarns and continuous filament yarns.

The first aspect of the invention is a method for making a circular knit, single jersey fabric in which bare spandex yarn from 17 to 33 dtex, preferably from 22 to 33 dtex, is plated with a hard yarn of spun and/or continuous filament yarn, or blends thereof, with yarn count (Nm) from 35 to 85, preferably from 44 to 68, most preferably from 47 to 54. Preferably, hard yarn is spun staple yarn of cotton or cotton blended with synthetic fibers or yarn. Other natural and synthetic fibers may be selected for the hard yarn, including nylon, polyester, acrylics and wool, for example.

The spandex and the hard yarn are plated in every knit course. The circular knit, single jersey fabric produced by this knitting method has a cover factor of from 1.3 to 1.9. During the knitting, the draft on the spandex feed is controlled so that the spandex

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The spandex stretches (drafts) when it is delivered from the supply package to the carrier plate and in turn to the knit stitch due to the difference between the stitch use rate and the feed rate from the spandex supply package. The ratio of the hard yarn supply rate (meters/min) to the spandex supply rate is normally 2.5 to 4 times (2.5X to 4X) greater, and is known as the machine draft. This corresponds to spandex elongation of 150% to 300%, or more. The feed tension in the spandex yarn is directly related to the draft (elongation) of the spandex yarn. This feed tension is typically maintained at values consistent with high machine drafts for the spandex.

We have found that improved results are obtained when the total spandex draft, as measured in the fabric, is kept to 2X or less. This draft value is the total draft of the spandex, which includes any drafting or drawing of the spandex that is included in the supply package of as-spun yarn. The value of residual draft from spinning is termed package relaxation, "PR", and it typically ranges from 0.05 to 0.15 for the spandex used in circular knit, elastic, single jersey fabrics. The total draft of the spandex in the fabric is therefore $MD \cdot (1 + PR)$, where "MD" is the knitting machine draft. The knitting machine draft is the ratio of hard yarn feed rate to spandex feed rate, both from their respective supply packages.

Because of its stress-strain properties, spandex yarn drafts (draws) more as the tension applied to the spandex increases; conversely, the more that the spandex is drafted, the higher the tension in the yarn. A typical spandex yarn path, in a circular knitting machine, is schematically shown in FIG. 2. The spandex yarn 12 is metered from the supply package 36, over or through a broken end detector 39, over one or more change-of-direction rolls 37, and then to the carrier plate 26, which guides the spandex to the

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drying. For tubular fabrics, forced overfeed is typically provided in a compactor 72, after belt drying. In either open-width or tubular fabric processing, the fabric drying temperature and residence time are set below the values required to heat set the spandex.

The structural design of a circular knit fabric can be characterized in part by the "openness" of each knit stitch. This "openness" is related to the percentage of the area that is open versus that which is covered by the yarn in each stitch (see, e.g., FIGs. 1 and 3), and is thus related to fabric basis weight and elongation potential. For rigid, non-elastic weft knit fabrics, the Cover Factor ("Cf") is well known as a relative measure of openness. The Cover Factor is a ratio and is defined as:

$$Cf = \sqrt{(tex) \div L}$$

where tex is the grams weight of 1000 meters of the hard yarn, and L is the stitch length in millimeters. FIG. 3 is a schematic of a single knit jersey stitch pattern. One of the stitches in the pattern has been highlighted to show how the stitch length, "L" is defined. For yarns of metric count Nm, the tex is $1000 \div Nm$, and the Cover Factor is alternatively

expressed as follows:

$$Cf = \sqrt{(1000/Nm) \div L}$$

We have found that commercially useful circular knit, elastic, single jersey fabrics plated from bare spandex and a hard yarn can be made without heat setting if the spandex draft is kept 2X or less, and if the knit fabric is designed and manufactured within the following preferred limits:

- The Cover Factor, which characterizes the openness of the knit structure, is between 1.3 and 1.9, and is preferably 1.4;

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- The hard yarn count, Nm, is from 35 to 85, preferably from 44 to 68, and most preferably from 47 to 54;
- The spandex has 17 to 33 dtex, preferably 22 to 33 dtex;
- Preferably, the content of spandex in the fabric, on a % weight basis, is from 3.5% to 14%, and is most preferably from 5% to 10%;
- The knit fabric so formed has a shrinkage after washing and drying of 7% or less, preferably less than 7% in both the length and width directions;
- The knit fabric has an elongation of 60% or more, preferably from 60% to 130%, in the length (warp) direction; and
- Preferably, the hard yarn is spun staple yarn of cotton or cotton blended with synthetic fibers or yarns.

While not wishing to be bound by any one theory, it is believed that the hard yarn in the knit structure resists the spandex force that acts to compress the knit stitch. The effectiveness of this resistance is related to the knit structure, as defined by the Cover Factor. For a given hard yarn count, Nm, the Cover Factor is inversely proportional to the stitch length, L. This length is adjustable on the knitting machine, and is therefore a key variable for control.

... Because the spandex is not heat set in the process of the invention, the spandex draft should be the same in the circular knit, elastic, single jersey as-knit fabric, the finished fabric, or at fabric-processing steps in-between, within the limits of measurement error.

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For circular knit, elastic, single jersey fabric, the appropriate gauge of knitting machine is selected according to prior art relationships between hard yarn count and knitting machine gauge. Choice of gauge can be used to optimize circular knit, elastic, single jersey basis weight, for example.

5 The benefits of this invention are evident when the prior art process shown diagrammatically in FIG. 4, is compared with the inventive process shown diagrammatically in FIG. 5. Traditional knitting and finishing require more process steps, more equipment, and more labor-intensive operations than does either alternative method of the invention shown in FIG. 5. Further, by eliminating high-temperature heat
10 set previously required (see FIG. 4), the inventive process reduces heat damage to fibers like cotton, requires less or no bleaching, and thus improves the 'hand' of the finished fabric. As a further benefit, heat sensitive hard yarns can be used in the invention process to make circular knit, elastic, single jersey fabrics; thus increasing the possibilities for different and improved products.

15 The use of a softener is optional, but commonly a softener will be applied to the knit fabric to further improve fabric hand, and to increase mobility of the knit stitches during drying. Softeners such as SURESOFT® (Surrey Chemical, North Carolina, USA) or SANDOPERM® SEI (Clariant),

are typical. The fabric may be passed through a trough containing a liquid
20 softener composition, and then through the nip between a pair of pressure rollers (padding rollers) to squeeze excess liquid from the fabric.

Also, circular knit, elastic, single jersey fabrics knitted by the method of the invention and collected by folding (plaiting), do not crease to the same extent as

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prior art circular knit single jersey fabrics. Fewer or less visible fold creases in the finished fabric can result in an increased yield for cutting and sewing the fabric into garments. Also unexpectedly, the circular knit, elastic, single jersey fabrics of the invention have significantly reduced skew during process in either open-width or tubular finishing processes, compared to prior art fabrics. With excess skew or spirality, fabrics are diagonally deformed and courses are "on the bias", and are unacceptable. Garments made with skewed fabric will twist on the body.

The following examples demonstrate the invention and its benefits. Accordingly, the examples are to be regarded as illustrative in nature and not as restrictive.

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Examples

Fabric Knitting and Finishing

Circular knit elastic single jersey fabrics with bare spandex plated with hard yarn for the examples were knit on Pai Lung Circular Knitting Machines, either: (1) Model PL-FS3B/T, with 16 inches cylinder diameter, 28 gauge (needles per circumferential inch), and 48 yarn feed positions; or (2) Model PL-XS3B/C, with 26 inches cylinder diameter, 24 gauge, and 78 yarn feed positions. The 28-gauge machine was operated at 24 revolutions per minute (rpm), and the 24-gauge machine at 26 rpm.

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The broken end detector in each spandex feed path (see FIG. 2) was either adjusted to reduce sensitivity to yarn tension, or removed from the machines for these

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The fabrics were dyed in a 300-liter solution of water at 60°C for 60 minutes, using reactive dyes and other constituents. The dye solution contained R-3BF (215g), Y-3RF (129g), Na₂SO₄ (18,000g), and Na₂CO₃ (3000g). After 10 minutes, the dye bath was drained and refilled to neutralize with HAC (150g) for 10 minutes at 60°C. After neutralization, the bath was again drained and refilled with clean water for a 10-minute rinse. Subsequent to neutralization, the 300-liter vessel was again filled with water, and 150g of SANDOPUR R&K (soap) was added. The solution was heated to 98°C, and the fabrics were washed/soaped for 10 minutes. After draining and another 10 minute clean-water rinse, the fabrics were unloaded from the vessel.

The wet fabrics were then de-watered by centrifuge, for 8 minutes.

For the final step, a lubricant (softener) was padded onto the fabrics in a 77-liter water solution with SANDOPERM® SEI liquid (1155g). The fabrics were then dried in a tenter oven at 145°C for about 30 seconds, at 50% overfeed.

The above procedure and additives will be familiar to those experienced in the art of textile manufacturing, and circular knitting of single jersey knit fabrics.

Analytical Methods

Spandex Draft—The following procedure, conducted in an environment at 20°C and 65% relative humidity, is used to measure the spandex drafts in the Examples.

- De-knit (unravel) a yarn sample of 200 stitches (needles) from a single course, and separate the spandex and hard yarns of this sample. A longer sample is de-knit, but the 200 stitches are marked at beginning and end.

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circle, the curl is rated as 1.0; if it curls only 180°, the curl is rated ½; and so on. Curl values of ¾ or less are acceptable.

Cover Factor:

The Cover Factor is a ratio and is defined as:

$$Cf = \sqrt{\text{tex}} + L$$

where tex is the grams weight of 1000 meters of the hard yarn, and L is the stitch length in millimeters. FIG. 3 is a schematic of a single knit jersey stitch pattern. One of the stitches in the pattern has been highlighted to show how the stitch length, "L" is defined. For yarns of metric count Nm, the tex is $1000 \div Nm$, and the Cover Factor is alternatively expressed as follows:

$$Cf = \sqrt{1000/Nm} + L$$

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2-09-2005 1:02PM INVISTA

NO. 121 US0417364

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-Substitute Sheet-**WE CLAIM:**

1. A method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 dtex is plated with one or more spun or continuous filament hard yarns (14), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

2. The method of claim 1, wherein the knit fabric (62) is maintained at temperatures below 160°C during finishing and drying (70).

3. The method of claim 1, wherein the knit fabric (62) has a length in the warp direction and is dried (70) or compacted (72) while subject to an overfeed in its length.

4. The method of claim 1, wherein the knit fabric (62) has a spandex content of from 3.5% to 14% by weight based on the total fabric weight per square meter.

5. The method of claim 4, wherein the knit fabric (62) has a spandex content of from 5% to 10% by weight based on the total fabric weight per square meter.

6. The method of claim 1, wherein the cover factor of the knit fabric (62) is 1.4.

7. The method of claim 1, wherein finishing comprises one or more steps selected from the group consisting of: cleaning (64), bleaching (64), dyeing (64), drying (70), and compacting (72) and any combination of such steps.

8. The method of claim 1, wherein the hard yarn (14) is selected from the group consisting of spun cotton and cotton blended with synthetic fiber or yarn.

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12-09-2005 1:02PM INVISTA

NO. 121 US0417364

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9. A circular knit, elastic, single knit jersey fabric (62) made by a method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 dtex is plated with one or more spun or continuous filament hard yarns (14), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

10. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the hard yarn (14) is cotton or a cotton blend, and the fabric, made at a temperature below such temperature required to heat set the spandex, has a basis weight of from 140 to 240 g/m².

11. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the fabric, made at a temperature below such temperature required to heat set the spandex, has an elongation of at least 80% in its length (warp) direction.

12. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the fabric at a temperature below such temperature required to heat set the spandex resulting in a fabric having a shrinkage of 7% or less after washing.

13. A garment made from the circular knit, elastic, single knit jersey fabric (62), made at a temperature below such temperature required to heat set the spandex, of claim 9.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)Date of mailing
(day/month/year) see form PCT/ISA/219 (second sheet)Applicant's or agent's file reference
see form PCT/ISA/220FOR FURTHER ACTION
See paragraph 2 belowInternational application No.
PCT/US2004/017364International filing date (day/month/year)
01.08.2004Priority date (day/month/year)
02.08.2003International Patent Classification (IPC) or both national classification and IPC
D04B1/18Applicant
INVISTA TECHNOLOGIES S.A.R.L.

GET NOTED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 58.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office
D-60298 Munich
Tel: +49 89 2339 - 0 Tlx: 923885 apm d
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Authorized Officer

Uhlig, R

Telephone No. +49 89 2339-7023



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/US2004/017364**Box No. I Basis of the opinion**

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

 International application No.
PCT/US2004/017364

Box No. II Priority

1. ☐ The following document has not been furnished:

- ☐ copy of the earlier application whose priority has been claimed (Rule 43bis.1 and 88.7(a)).
☐ translation of the earlier application whose priority has been claimed (Rule 43bis.1 and 88.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☒ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43bis.1 and 84.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

see separate sheet

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-15
	No: Claims	16-27
Inventive step (IS)	Yes: Claims	1-15
	No: Claims	16-27
Industrial applicability (IA)	Yes: Claims	1-27
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/US2004/017364

1. References

1.1 Reference is made to the following documents cited in the international search report:

D1: US-A-5 687 587

D2: US-A-5 931 023

D3: US-A-5 198 288

D4: EP-A-0 119 536

D5: EP-A-1 375 717

1.2 Document D5 may represent prior art according to Rule 64.3 PCT (see paragraph 2). D5 was published on 02.01.2004, filed on 26.06.2003, claiming priority of 27.06.2002 (Rule 70.10 PCT).

RE Item II

2. Priority

The claimed priority of 02.06.2003 does not appear to be valid. US application 10/454,746 published on 17.08.2004 with publication number US6776014 B1 appears to be filed on 20.10.2003.

RE Item VIII

3. Clarity

3.1 Although claims 1 and 9 resp. claim 16 and 20 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

3.2 Independent claim 1 is not clear according to Art. 6 PCT, as it is not clear whether the claim refers to the entire process or only to specific steps (In a method ... the improvement ...)

3.3 Independent claim 9 does not appear to be clear according to Art. 6 PCT in combination with The PCT Guidelines 5.24 (c), because it is not unambiguously clear how the term "consisting essentially" should be interpreted.

3.4 Independent claims 1 and 9 do not appear to be clear according to Art. 6 PCT, as it is not clear to which extend the spandex is drafted. When merely reading the claims,

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/US2004/017364

It may be construed that the yarn may be stretched up to 200% of its original length, thereby delivering a total length of 300% of the unstretched yarn (length of unstretched yarn corresponds to 100%). However, when referring to the abstract or to p. 12, ll. 3-10, stretch of only 100% appears to be meant.

3.5 It is clear for a skilled person that for a measured value and the method for obtaining the value are directly linked. However, the methods are partly mentioned in the embodiments and not in the chapter of the summary of the invention (p. 15, ll. 4-16, p. 20, ll. 17 - p. 23, ll. 2).

3.6 The term 'about' used in the description on p. 12, ll. 10 and p. 15, ll. 19 and p. 18, ll. 6 in the context of ranges is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claims unclear when the description is used to interpret them (Article 6 PCT).

3.7 Claims 19 and 23 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

3.8 The vague and imprecise statement in the description on page 18, ll. 9 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT in combination with the PCT Guidelines 5.30) when used to interpret them.

RE Item V

4. Independent Claims 1 and 9

4.1 Based on the documents mentioned in the search report, the subject-matter of claims 1 and 9 - as far as understood - appears to be new and inventive according to Articles 33 (1) and 33 (3) PCT.

4.2 Document D1 appears to disclose to knit bare spandex yarns of 22 dtex at an elongation of 200% on a circular knitting machine in a plated manner for certain loops in every knit course with hard yarns. The fabric does not have to be heat set

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

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afterwards (Fig. col. 2, ll. 45 -56).

4.3 The subject-matter of claims differs in that the fabric is a single jersey fabric.

4.4 The technical effect of this distinguishing feature is that the fabric has two distinguishable sides.

4.5 A skilled person could reapply the teaching of D1 for double knit fabrics to a fabric knit with plain stitches, but there is no hint in D1 or any other document of the search report to do so. Moreover, the stretch characteristics of single and double knit, especially interlock knit, fabrics are quite different. Consequently, a skilled person would not consider to apply the teaching of D1 to a plain knit / single jersey fabric.

4.6 Document D2, col. 3, ll. 5 to 64, claim 1 appears to disclose to plate spandex yarn with a hard yarn for plain knit fabrics. This combination is then plated with another hard yarn such as cotton. However, D3 appears to remain silent regarding heat setting.

Document D3 equally appears to remain silent regarding heat setting.

Document D4 appears to require heat setting, which is contradictory to the teaching of the present application.

Document D5, [0024], [0032] appears to disclose to minimize heat setting of spandex/elastane yarn, which defines that there is a certain heat setting.

4.7 Consequently claims 1 and 9 fulfill the requirements according to Articles 33 (1), 33 (2) and 33 (3) PCT.

5. Dependent Claims 2 - 8, 10-15

The dependent claims 2 - 8, 10-15 are regarded - from a formalistic point of view - as being new and inventive, as they refer directly or indirectly to the independent claims 1 or 9 which are considered to be new and inventive.

6. Independent Claims 18 and 20

6.1 The subject-matter of claims 18 and 20 - as far as understood - does not appear to be new according to Article 33(1) and (2) PCT in combination with the PCT Guidelines 5.28 and A5.28(1).

6.2 The document D4, claims 1, 4, 8 appears to disclose all the product features of

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/US2004/017364

claims 16, 20 and 24. Moreover, the applicant appears to admit on p. 2, l. 19 - p. 3, l. 9 that the product of single jersey fabrics made of plated spandex / hard yarns is already disclosed by the prior art.

Z. Dependent Claims 17-19, 21-27

The dependent claims 17-19, 21-27 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the EPC with respect to novelty and inventive step. The features are regarded as normal measures of a skilled person respectively as parameters which are not supported by technical features to obtain the parameters.

RE Item VII

B. Formal/Further Objections

- 8.1** Independent claims 1 and 9 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
- 8.2** The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 8.3** The document D1, which is considered to be the most relevant prior art document, is not identified in the description and its relevant contents is not indicated as required by Rule 5.1(a)(ii) PCT.
- 8.4** Patents are granted for inventions, not for discoveries ("surprisingly", p. 8, l. 9, p. 17, l. 21)
- 8.5** Suresoft and Sandoperm Sel appear to be trademarks and should be labelled as such.

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FACSIMILE TRANSMISSION: 011 49 89 2399 4486

PCT International Preliminary Examining Authority
European Patent Office
D-80298 Munich

Applicant:	INVISTA TECHNOLOGIES S. a. r. l.
Application No.:	PCT/US2004/017364
International Filing Date:	June 1, 2004
Priority Date:	June 2, 2003
Written Opinion:	R. Uhlig

RESPONSE TO WRITTEN OPINION

This is Applicant's response to the Written Opinion mailed July 19, 2005.

Appendix A shows all claim amendments in redlined format.

Appendix B contains subtitula pages showing amended claims.

Amendments to the Claims

1. Please amend claims 1-6 and 8-13 as shown in the attached substitute sheets.

Response to Comments on Clarity/Unity

- 2.1 The Written Opinion states that independent claim 1 is not clear according to Art. 6 PCT. Accordingly, claim 1 has been amended.
- 2.2 The Written Opinion states that the methods and measured values are directly linked. As such, the methods are given as part of the Examples section under the heading "Analytical Methods".
- 2.3 The Written Opinion states that claim 16 lacks unity with claim 1. Accordingly claim 16 has been amended.

Response to Rule 68.2(a)(ii)

- 3.1 The Written Opinion states that the subject matter of claim 1 is new and inventive.
- 3.2 The Written Opinion states that D1 discloses circular knit fabric that does not have to be heat set.

- 3.3 The Written Opinion states that subject matter of claim 1 differs from subject matter of D1.
 - 3.4 The Written Opinion states that there is a technical distinguishing feature of the subject matter of claim 1.
 - 3.5 The Written Opinion states that a skilled person would not consider applying the teaching of D1 to a plain knit fabric.
 - 3.6 The Written Opinion states that neither reference D1-D4 discloses the invention.
 - 3.7 The Written Opinion states that claim 1 fulfills the requirements according to Articles 33(1), 33(2) and 33(3) PCT.
-
- 4. The Written Opinion states that dependent claims 2-8 are new and inventive.
 - 5.1 The Written Opinion states that claim 16 does not appear to be new.
 - 5.2 The Written Opinion states that D4, in claims 1, 4, and 8, appears to disclose all the product features of claim 16. D4 claims 1 and 4 (there is no claim 8) do not disclose a fabric absent heat setting spandex. Applicant's claim 16 (in reference to the method of claim 1) discloses drafting spandex no more than 2X in knitting and finishing at a temperature below that required to heat set spandex. D4 does not disclose "no more than 2X knitting draft or no more than 100 % elongation in knitting" and teaches away by disclosing fabrics that have been heat set. Examiner states that the applicant admits that the product of single jersey fabrics made of plated spandex/hard yarns is disclosed as prior art, page 2, line 19 to page 3, line 9. A heat set fabric does not have the same product features as the inventive fabric which has not been heat set. The Examiner cannot see a structural difference between the final product of the prior art over the product obtained by the process of claim 1. Heat set fabrics have different properties than fabrics that have not been heat set. For instance, heat set fabrics with spandex in every course will have tack points where the spandex yarns have fused together. Thus, it is possible via mechanical analysis of the fabric to distinguish a heat set fabric from one that has not been heat set. Examiner also states that a circular knit and flat knit fabric can only be distinguished when they come directly from the machine if the edges are present. A flat knit and circular knit fabric piece, cut from the as-knit fabric, will be distinguishable based on skew and spirality. Thus, it is possible to distinguish between a flat knitted and circularly knitted fabric through careful visual inspection of the fabric.

Attorney Docket LP5340PCT
Application No. PCT/US2004/017364

- 6.0 Written Opinion states that dependent claims 17-19 and 24 do not appear to contain additional features to meet the requirements for novelty and inventive step. If claim 16 from which they depend is novel, then likewise, claims 17-19 and 24 are novel.

Response to Other Formal/Further Objections

- 7.1 The Written Opinion states that Rule 6.3(b) PCT has not been followed in claims 1 and 16. Claim 1 and amended claim 16 include the phrase "wherein the improvement comprises" which satisfies the rule. D1 discloses a double knit fabric. The claimed single jersey knit fabric is not a double knit fabric. Double knit fabrics and single knit fabrics are made on different machines and are made with different technical knitting specifications. Accordingly, D1 is not an appropriate reference for claim 1 and claim 16 preamble.
- 8.2 Claims have been amended to comply with Rule 6.2(b) PCT.
- 8.3 Claims have been renumbered to comply with Rule 6.1(b) PCT.

Dated: Sept 12, 2005

Respectfully submitted,



Robert B. Furr, Jr.
Attorney for Applicant
Registration No. 32,985
Invista Technologies S.à r.l.
Three Little Falls Centre
2801 Centerville Road
Wilmington, DE 19806 USA

WE CLAIM:

1. A method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 denier is plated with one or more spun or continuous filament hard yarns (14), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

2. The method of claim 1, wherein the knit fabric (62) is maintained at temperatures below 160°C during finishing and drying (70).

3. The method of claim 1, wherein the knit fabric (62) has a length in the warp direction and is dried (70) or compacted (72) while subject to an overfeed in its length.

4. The method of claim 1, wherein the knit fabric (62) has a spandex content of from 3.5% to 14% by weight based on the total fabric weight per square meter.

5. The method of claim 4, wherein the knit fabric (62) has a spandex content of from 5% to 10% by weight based on the total fabric weight per square meter.

6. The method of claim 1, wherein the cover factor of the knit fabric (62) is 1.4.

7. The method of claim 1, wherein finishing comprises one or more steps selected from the group consisting of: cleaning (64), bleaching (64), dyeing (64), drying (70), and compacting (72) and any combination of such steps.

8. The method of claim 1, wherein the hard yarn (14) is selected from the group consisting of spun cotton and cotton blended with synthetic fiber or yarn.

9. A circular knit, elastic, single knit jersey fabric (62) made by a method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 den is plated with one or more spun or continuous filament hard yarns (14), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

10. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the hard yarn (14) is cotton or a cotton blend, and the fabric, made at a temperature below such temperature required to heat set the spandex, has a basis weight of from 140 to 240 g/m².

11. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the fabric, made at a temperature below such temperature required to heat set the spandex, has an elongation of at least 60% in its length (warp) direction.

12. The circular knit, elastic, single knit jersey fabric (62) of claim 9, wherein the fabric at a temperature below such temperature required to heat set the spandex resulting in a fabric having a shrinkage of 7% or less after washing.

13. A garment made from the circular knit, elastic, single knit jersey fabric (62), made at a temperature below such temperature required to heat set the spandex, of claim 9.

WE CLAIM:

1. A method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 dtex is plated with one or more spun or continuous filament hard yarns (149), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plated in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than ~~2X~~ 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex.

2. The method of claim 1, wherein the knit fabric (62) is maintained at temperatures below 160°C during finishing and drying (70).

3. The method of claim 1, wherein the knit fabric (62) has a length in the warp direction and is dried (70) or compacted (72) while subject to an overfeed in its length.

4. The method of claim 1, wherein the knit fabric (62) has a spandex content of from 3.5% to 14% by weight based on the total fabric weight per square meter.

5. The method of claim 4, wherein the knit fabric (52) has a spandex content of from 5% to 10% by weight based on the total fabric weight per square meter.

6. The method of claim 1, wherein the cover factor of the knit fabric (62) is 1.4.

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7. The method of claim 1, wherein finishing comprises one or more steps selected from the group consisting of: cleaning (64), bleaching (64), dyeing (64), drying (70), and compacting (72) and any combination of such steps.

8. ~~8.~~ The method of claim 1, wherein the hard yarn (14) is selected from the group consisting of spun cotton and cotton blended with synthetic fiber or yarn.

9. ~~Cancelled~~

10. ~~Cancelled~~

11. ~~Cancelled~~

12. ~~Cancelled~~

13. ~~Cancelled~~

14. ~~Cancelled~~

15. ~~Cancelled~~

16. A circular knit, elastic, single knit jersey fabric (62) made by a method for making a circular knit, single jersey fabric (62) in which bare spandex yarn (12) from 17 to 33 denier is plied with one or more spun or continuous filament hard yarns (14), or blends thereof, with yarn count from 35 to 85, and in which the spandex and hard yarn(s) are plied in every knit course to produce the circular knit, single jersey fabric (62) with a cover factor of from 1.3 to 1.9, wherein the improvement comprises:

controlling the draft on the spandex feed so that the spandex yarn is drafted no more than 100 % elongation of its original length when knit to form the circular knit, single jersey fabric (62); and

finishing and drying (70) the knit fabric while maintaining the fabric at a temperature below such temperature required to heat set the spandex. by the method of claim 1 at a temperature below such temperature required to heat set the spandex resulting in a fabric.

107. The circular knit, elastic, single knit jersey fabric (62) of claim 246, wherein the hard yarn (14) is cotton or a cotton blend, and the fabric, made at a temperature below such temperature required to heat set the spandex, has a basis weight of from 140 to 240 g/m².

118. The circular knit, elastic, single knit jersey fabric (62) of claim 246, wherein the fabric, made at a temperature below such temperature required to heat set the spandex, has an elongation of at least 60% in its length (warp) direction.

129. The circular knit, elastic, single knit jersey fabric (62) of claim 246, wherein the fabric at a temperature below such temperature required to heat set the spandex resulting in a fabric having a shrinkage of 7% or less after washing.

20. Cancelled

21. — Cancelled

22. — Cancelled

23. — Cancelled

2413. A garment made from the circular knit, elastic, single knit jersey fabric (62), made at a temperature below such temperature required to heat set the spandex, of claim 246.

25. Cancelled

26. Cancelled

PATENT COOPERATION TREATY

31 000078

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 52bis.1 and
Administrative Instructions, Section 422)

To:

FURR; Robert, B., Jr.
INVISTA Technologies S.A.R.L.
4417 Lancaster Pike
Chestnut Run Plaza 722 - 1032
Wilmington, Delaware 19806
United States of America

Date of mailing (day/month/year)
22 March 2005 (22.03.2005)

Applicant's or agent's file reference
LP5340PCT

IMPORTANT NOTIFICATION

International application No.
PCT/US2004/017364

International filing date (day/month/year)
01 June 2004 (01.06.2004)

1. The following indications appeared on request concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

INVISTA TECHNOLOGIES S.A.R.L.
4417 Lancaster Pike
Chestnut Run Plaza 722 - 1032
Wilmington, Delaware 19806
United States of America

State of Nationality
US

State of Residence
US

Telephone No.
302-999-4342

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

INVISTA TECHNOLOGIES S.A.R.L.
Three Little Falls Center
2801 Canterbury Road - Room 1052
Wilmington, DE 19806
United States of America

State of Nationality
US

State of Residence
US

Telephone No.
302-999-4342

Facsimile No.

Teleprinter No.

EPO - DG 1

01.04.2005

3. Further observations, if necessary:

153

4. A copy of this notification has been sent to:

☒ the receiving Office ☒ the designated Office concerned
☐ the International Searching Authority ☐ the elected Offices concerned
☐ the International Preliminary Examining Authority ☐ other

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 28, Switzerland

Facsimile No. 41-221 338 87 80

Authorized officer

V. BLANC

Telephone No. 41-221 338 8606

THE INTERNATIONAL BUREAU OF WIPO
and
THE EUROPEAN PATENT OFFICE

000078

In the Application of:

INVISTA Technologies S.à r.l.

Case No.: LP5340

International Application No.: PCT/US04/17384

International Filing Date: 01/JUN/2004

For: METHOD TO MAKE CIRCULAR-KNIT ELASTIC FABRIC COMPRISING
SPANDEX AND HARD YARNS

Wilmington, Delaware 19808
Date: 09 November 2005

THE INTERNATIONAL BUREAU OF WIPO
34 Chemin des Colombettes
1211 Geneva 20
SWITZERLAND
SENT VIA FACSIMILE
#9-011-41-22-338-8270

EUROPEAN PATENT OFFICE
Erhardstrasse 27
D-88331 Munchen
GERMANY
SENT VIA FACSIMILE
#9-011-48-89-2399-4469

**REQUEST PURSUANT TO PCT RULE 92^{bis}.1(a)(i)
ADDITION OR CORRECTION OF APPLICANT'S ADDRESS**

Applicant is filing this paper to inform the RO that the above applicant wishes to correct the Applicant's Address ONLY:

AS IS: INVISTA Technologies S.à r.l.
Intellectual Property Record Center
Three Little Falls Centre
2801 Centerville Road - Room 1052
Wilmington, Delaware 19808
U.S.A.

SHOULD BE: INVISTA Technologies S.à r.l.
Talstrasse 80
8001 Zürich
Switzerland

For the avoidance of doubt, all official correspondences should be sent to the applicant/nominated agent at the following address: INVISTA TECHNOLOGIES S.À R.L., Intellectual Property Record Center, Three Little Falls Centre, 2801 Centerville Road, Room 1052, Wilmington, Delaware 19808 U.S.A.

ALL THE OTHER INFORMATION REMAINS THE SAME. Please update all the necessary records to reflect this change and republish the application.

Respectfully submitted,
INVISTA TECHNOLOGIES S.à r.l.

Charles E. Krukiel
By: _____
Charles E. Krukiel
Authorized Signatory

77 16

RECEIVED
19-12-12
SECRETARÍA DE ECONOMÍA
ESTADO DE GUATEMALA

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

	USUARIO	RADIADOR
PATENTE DE INVENCION		
MODELO DE UTILIDAD		
Indicacion de que se solicita la concesion de una patente	()	()
Datos de identificacion del solicitante o de la persona que presenta la solicitud	()	()
Descripcion de la invencion	()	()
Dibujos de ser estos pertinentes	()	()
Comprobante de Pago de las tasas establecidas	()	()
COMPLETA ()		
INCOMPLETA ()		
DISEÑO INDUSTRIAL ()		
Indicacion de que se solicita el registro de Diseño Industrial	()	()
Datos de identificacion del solicitante o de la persona que presenta la solicitud	()	()
Representacion grafica y fotografica del Diseño Industrial o muestra del Material que incorpora el diseño	()	()
Comprobante de pago de las tasas establecidas	()	()
COMPLETA ()		
INCOMPLETA ()		
ESQUEMA DE TRAZADO ()		
Indicacion de que solicita el registro de un Esquema de trazado	()	()
Datos de identificacion del solicitante o de la persona que presenta la solicitud	()	()
Representacion grafica del esquema de trazado	()	()
Comprobante de pago de las tasas establecidas	()	()
COMPLETA ()		
INCOMPLETA ()		

Firma Responsable. 

Fecha