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(11) **EP 1 536 707 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
02.08.2006 Bulletin 2006/31

(21) Application number: **03725440.6**

(22) Date of filing: **22.05.2003**

(51) Int Cl.:
A41D 1/00 (2006.01)

(86) International application number:
PCT/GB2003/002220

(87) International publication number:
WO 2003/099047 (04.12.2003 Gazette 2003/49)

(54) **A GARMENT HAVING RECOVERABLE STRETCH PROPERTIES AND PROCESSES FOR ITS PRODUCTION**

KLEIDUNGSSTÜCK MIT STRECKEIGENSCHAFTEN UND VERFAHREN ZU DESSEN
HERSTELLUNG

VETEMENT CAPABLE DE REPRENDRE SA FORME INITIALE APRES EXTENSION ET PROCEDES
DE FABRICATION

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**

(30) Priority: **23.05.2002 GB 0211916**

(43) Date of publication of application:
08.06.2005 Bulletin 2005/23

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(1998-04-07)

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Description

Field of the Invention

[0001] This invention relates to a garment having recoverable stretch properties which impart comfort in wear and to processes for producing such a garment. Garments having recoverable stretch properties are in demand for the sportswear and active leisurewear markets and increasingly for more general wear.

[0002] In particular, the invention is concerned with a garment constructed from a woven fabric comprising lyocell yarns which are normally inelastic. In this specification, lyocell yarns are yarns which either comprise only lyocell fibres or comprise a blend of lyocell fibres with fibres of one or more other fibre types such as cellulosic or non-cellulosic fibres, natural or manmade, for example cotton, modal, viscose, linen and fibres of synthetic polymers such as polyester and polyamide. The term "fibres" includes both staple fibres and, where appropriate, continuous filaments.

[0003] Lyocell fibres are produced by extrusion of a solution of cellulose through a spinning jet into a coagulation bath by a process known as solvent spinning, and lyocell fibres are thus otherwise known as solvent-spun cellulose fibres. Such a process is described in US-A-4,246,221 and uses as the solvent an aqueous tertiary amine N-oxide, particularly N-methylmorpholine N-oxide. Lyocell fibres are distinguished from other man-made cellulose fibres which are produced by forming the cellulose into a soluble chemical derivative and then extruding a solution of this derivative into a bath which regenerates the extrudate as cellulose fibres; viscose fibres, including the high strength modal types, are produced in this latter way.

Background

[0004] Garments having recoverable stretch are primarily produced by knitting, which creates a construction of interlocking loops which has the necessary elasticity to impart to the garment the required comfort in wear. Knitted garments dominate the sportswear and active leisurewear markets. The increasing familiarity of the public with clothing having stretch comfort has led to demand for this quality outside the knitwear field. Many garments are traditionally made from woven fabrics including men's and women's trousers, slacks and jeans, men's shirts and women's blouses and skirts. These garments are normally relatively inextensible because the fabrics themselves are relatively inextensible. The approach to the problem of imparting recoverable stretch to such garments has been to make a woven fabric having recoverable stretch and then to construct a garment from that fabric.

[0005] GB-A-1,035,359 discloses a method of imparting stretch to a fabric woven from yarns formed of cellulosic fibres such as cotton or viscose, wherein the fabric

is treated with a swelling agent such as sodium hydroxide to impart crimp to the yarns. However, it is necessary to then treat the fabric with a thermosetting resin or cross-linking reactant in order to maintain the yarns resiliently in their crimped condition.

[0006] Woven fabrics with recoverable stretch are successfully made commercially by weaving yarns which are elastomeric into the fabric, such as the well-known LYCRA yarns made by the Du Pont Corporation (LYCRA is a Trade Mark of Du Pont Corporation). In the main, elastomeric yarns are inserted into the weft of such fabrics, thereby imparting weft-wise recoverable stretch, because it is easier to handle the stretchy yarn in weft insertion compared with dealing with a warp of stretchy yarns. Woven fabrics made from lyocell yarns have also been given a degree of recoverable stretch by incorporating elastomeric yarns into the woven structure.

Disclosure of the Invention

[0007] The present invention provides a garment having recoverable stretch properties constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell yarns, characterised in that the lyocell yarns in the warp and/or the weft of the fabric have a crimped configuration which is set-in and which imparts a stretch in the respective warp and/or weft direction of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent.

[0008] In this specification, the "stretch" of a fabric in a particular direction is expressed as a percentage and means the percentage extension of the fabric when loaded in that direction according to the test method set out in British Standard Test Method BS4952 using a fixed tensile load of 40 Newtons and a dwell time of 10 seconds at full load. Other details of the Test are described later in the specification in relation to the Examples. The same modified BS 4952 Test is used to measure percentage residual extension, which is the amount, expressed as a percentage of the stretch which is residual, i.e. remains after the stretching load has been removed. In this specification, the term used for this parameter is "stretch recovery", also expressed as a percentage, equal to "100 minus percentage residual extension".

[0009] The garment of the invention may have an overall stretch, in both warp and weft directions together, of up to 30 per cent or more. There may be a balanced distribution of stretch between the warp and the weft or the stretch may predominate in one of the warp or weft directions. Preferably, the stretch is at least 20 per cent in one of those directions, preferably the warp direction.

[0010] The stretch recovery is at least 90 per cent and is preferably at least 95 per cent. At the 15 per cent stretch level, stretch recoveries of higher than 95 per cent are obtainable, for example up to a level of 97 per cent. As levels of stretch increase above 20 per cent, the stretch recovery obtainable becomes lower, usually in the range 90 to 95 per cent.

[0011] The fabric used for the garment of the invention preferably comprises just (only) lyocell yarns. Whilst it is possible to insert other yarns, for example cotton yarns, in the warp and/or the weft, this tends to produce reduced levels of recoverable stretch in the product garment. The lyocell yarns themselves may advantageously comprise just (only) lyocell fibres for the same reason, although excellent results have also been produced when the lyocell yarns comprise a blend of lyocell fibres with fibres of cotton or modal or viscose or linen or synthetic polymers such as polyester or polyamide. For blended yarns, it is preferred that the proportion of lyocell fibres is 50 per cent or more.

[0012] The recoverable stretch of the garment of the invention may be supplemented by, additionally, incorporating elastomeric yarns in the warp and/or weft of the fabric used. Preferably, this is done by incorporating elastomeric yarns in the weft of the fabric. This allows the recoverable stretch imparted by the crimped lyocell yarns to be concentrated in the warp direction. The fibres covering the elastomeric filament of the elastomeric yarn may be any suitable fibres such as cotton.

[0013] The garment of the invention has good fabric flex and therefore drape, whereas a degree of stiffness or boardiness might be expected with set-in crimp in a cellulose fabric. Furthermore, the garment has an improved crease-resistance, probably owing to the greater flexibility in the wet of the lyocell yarns, which helps the garment to resist creasing during washing.

[0014] The garment of the invention may be substantially free from set-in creases. Alternatively, it may have an arrangement of set-in creases over the whole of the garment or in one or more of its areas. These set-in creases may be randomly arranged. When the fabric of the garment is a denim fabric dyed with indigo dye, the fabric may show indigo dye loss along the lines of the set-in creases. Such garments having an arrangement of set-in creases have exciting potential in certain fashion areas, particularly in casual clothing for the young.

[0015] The invention includes a process for treating a garment constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell yarns, comprising contacting the garment with a swelling agent for cellulose, washing the resulting garment with a washing liquid to remove swelling agent and then drying the garment, characterised in that the garment is held in an unconstrained and substantially uncreased condition and that in that condition it is immersed successively in a bath of the swelling agent and then in a bath of the washing liquid to cause firstly crimping of the warp and/or the weft normally inelastic lyocell yarns of the fabric under the forces generated as they swell and then setting-in of that crimp when the garment is washed to at least partially remove the swelling agent, the set-in crimp imparting a stretch in the respective warp and/or weft directions of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent to produce a garment having recoverable stretch properties.

[0016] The garment is held in an unconstrained and substantially uncreased condition for two main reasons. The first reason is to avoid any constraints, other than the fabric construction itself, on the ability of the lyocell yarns to swell and crimp in response to being immersed in the bath of swelling agent so that the requisite stretch properties may be obtained. The second reason is to avoid any unwanted creases being set into the garment as the garment is subjected to the swelling and washing steps of the process. Preferably, the garment is held in an unconstrained condition by being suspended from a hanger.

[0017] The sequence which causes the crimp to be set into the lyocell yarns is the constrained swelling of the lyocell yarns to cause yarn buckling and crimping followed by constrained de-swelling as swelling agent is washed out and hydrogen bonding is re-established. This sequence gives rise to certain considerations in relation to processing. If a crease is maintained in the fabric of the garment during processing, it will become set in. For normal garments this is undesirable and so, in this case, the garment should be presented to the process sequence in a substantially uncreased condition, for example suspended on a hanger, and then maintained in that uncreased condition during the swelling stage of the process and during at least the initial part of the subsequent washing stage. For example, garments suspended on hangers hung on a moving rail can be immersed successively in a bath of swelling agent followed by one or more baths of washing liquids, with liquid movement kept to the minimum to achieve the desired treatment or washing action without causing creasing of the garments.

[0018] The invention further includes a process for treating a garment constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell yarns, comprising contacting the garment with a swelling agent for cellulose, washing the resulting garment with a washing liquid to remove swelling agent and then drying the garment, characterised in that the garment is gathered up into a bundle as a whole or in one or more areas and is secured in that configuration before being contacted successively with first the swelling agent and then the washing liquid to cause firstly crimping of the warp and/or the weft yarns of the fabric under the forces generated as they swell and then setting-in of that crimp when the garment is washed to at least partially remove the swelling agent, the set-in crimp imparting a stretch in the respective warp and/or weft directions of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent to produce a garment having recoverable stretch properties and an arrangement of set-in creases.

[0019] Set-in creases can be produced by gathering up the garment into a bundle, as a whole or in one or more areas, and securing it in this configuration, for example by tying it with a cord or a strip of fabric. Creases may be confined, say, to the sleeves of a garment, by just tying those sleeves into a bundle prior to processing.

The tied, bundled garment can then be processed through the successive swelling and initial washing stages of the process, in this case with no need for any restraint on the vigour of liquor movement in these stages. Thus, for example, conventional, commercial garment washing machines may be used.

[0020] When a number of bundled garments are processed together, the tied bundles may be wrapped tightly together in a net bag to facilitate handling and to ensure that no unwanted unbundling takes place during processing. It is preferred that the garments are unbundled part-way through the washing sequence so that further washing of the unconstrained garments can ensure effective washing out of the swelling agent. The washed garments can then be hydro-extracted and tumble-dried in the usual way. The preferred swelling agent for cellulose is aqueous sodium hydroxide solution. This can be used in the conventional concentrations used for causticising fabrics of lyocell yarns, about 9 to 16 per cent by weight, but higher concentrations, for example up to 34 per cent by weight such as are used in mercerising processes, can also be used, particularly if the lyocell yarns are a blend of lyocell and cotton fibres. At a concentration of about 10 per cent by weight sodium hydroxide, which is quite adequate, the treatment time need be no longer than 1 minute at ambient temperatures. There may be a faster swelling rate at below ambient temperatures but not sufficient to justify the use of special cooling facilities.

[0021] The washing liquid used to remove the swelling agent may be aqueous in the case when sodium hydroxide solution is the swelling agent, for example successive baths of warm and then cold water. If necessary or desired, one of the baths may include a weak acid for purposes of neutralisation of any residual sodium hydroxide.

[0022] Lyocell fibres have a great capacity for swelling, for example in 10 per cent by weight sodium hydroxide solution they can swell by upwards of 250 per cent by volume, compared with cotton fibres which swell about 50 per cent by volume under such conditions. Moreover, unlike cotton and viscose fibres, this swelling is almost wholly in a radial direction with minimal swelling lengthwise of the fibre. This great swelling capacity of the lyocell fibres causes the lyocell yarns to swell greatly in a radial direction until they fill the spaces between adjacent yarns. At this point the fabric locks up, whereupon further movement of those yarns in the plane of the fabric is prevented. Continuing swelling forces therefore produce a buckling of the yarns which, because the yarns are gripped tightly at warp/weft crossover points under the swelling action, manifests as an even crimp along the swollen yarns.

[0023] When the swelling agent is washed out of the garment these crimped yarns become set into their crimped configuration, probably by the re-forming of hydrogen bonds, so that the stretch property which the crimp imparts to the yarns is recoverable stretch. In addition, the stretch and recovery forces operating when the crimps are extended and released are comparatively great because lyocell fibres have a high modulus and

resistance to bending compared with other cellulose fibres. The set crimps act like a series of springs and the recoverable stretch property which this imparts to the garment allows it to flex and recover as the wearer moves, so making the garment comfortable to wear.

[0024] The fabric construction influences the distribution of stretch induced between the warp and weft directions. In general, a closer yarn spacing in one direction produces a propensity for those yarns to buckle earlier in the swelling process and so creates greater crimp in that direction. Thus, taking a fabric with the same lyocell yarns in warp and weft but with a larger number of warp ends per centimetre than weft picks per centimetre, and carrying out the process of the invention, will result in a greater warpwise recoverable stretch in the garment compared with that in the weft direction.

[0025] If a greater degree of stretch is required in the weft direction of this fabric, then this can be engineered by weaving the fabric with a lower warp density, for example by weaving the same number of warp ends over a longer loom reed width or by reducing the number of warp ends for the same reed width. This will increase the weftwise crimp but will cause a commensurate reduction in the warpwise crimp.

[0026] As most normal fabric constructions have a larger number of warp ends per centimetre than weft picks per centimetre, it is possible to concentrate the recoverable stretch obtained in the fabric to the warp direction without having to alter warping requirements from those normally used for a particular fabric. The imbalance in stretch between warp and weft directions which this produces may be corrected by supplementing weft stretch by the incorporation of elastomeric yarns in the weft of the fabric, as mentioned earlier.

[0027] Fabrics having conventional weave patterns may be used for the garment of the invention. The yarn counts needed to produce the desired fabric weights, whether that is light, medium or heavy weights, may be used. A particular advantage in processing terms, however, is the ability to construct the garment using fabric that can be handled like a standard woven fabric because it is not a stretch fabric. The stretch properties are not realised until after the garment has been constructed and so the difficulties encountered in making up a garment from stretch fabric can be avoided.

[0028] It has also been found that an arrangement of set-in creases which imparts an attractive visual effect can be produced on a garment knitted from lyocell yarns when such a garment is substituted for the garment made from a woven fabric and is treated by the process of the invention in the same way as the garment made from a woven fabric.

[0029] Garments made from denim fabric constitute an important market for lyocell yarns because of the superior drape and handle which such yarns can impart to the garments, giving a distinct difference from cotton denim garments. One phenomenon which can occur with a denim garment arises when a crease is formed during

wet processing. Dye colouration, in this case indigo dye, can be lost along the lines of the creases by abrasive action during wet processing to leave a white line on the fabric surface where the crease has been, even if the crease has subsequently come out. This is another reason for usually avoiding creasing during the wet processing stages of the present invention. However, in the case of the fashion garment referred to, where an arrangement of set-in creases is desired, this whiteline phenomenon enhances the visual effect of the pattern of creases in a denim garment.

[0030] The process of the invention produces a greater degree of shrinkage of the garment than the normal shrinkage allowed for in the initial wet processing of garments. The garments have to be sized accordingly to compensate for this shrinkage, but this is normal practice and is easily dealt with in the usual trials. This shrinkage has no significant effect on garment seams, and no special measures are required in seaming. Clearly, the seaming threads used need to be capable of withstanding the swelling agent used, and this is true also for any trims or attachments such as buttons put on the garment before treatment.

[0031] Other fabric or garment treatment processes may be carried out as usual. After weaving, the fabric may be desized by a scouring operation and, if necessary, singed to remove surface hairiness. Colouring of the garment may be carried out at any suitable stage. The lyocell yarns may be pigment-dyed or yarn-dyed before weaving as is required for indigo dyeing for denim fabrics, or the fabric may be dyed before garment construction, or the garment itself may be dyed. Garment dyeing may be carried out prior to or subsequent to the swelling and washing stages of the processes of the invention.

[0032] Another process which may be used in conjunction with the processes of the invention is a process for the development and control of the fibrillation to which fabrics made from lyocell yarns are susceptible, in order to produce a soft-touch on the fabric surface. Any hairiness on the fabric surface caused by primary fibrillation during fabric or garment dyeing may be removed by the usual enzyme treatment using a cellulase enzyme. The so-called secondary fibrillation, which gives the desired soft-touch finish to the fabric surface, can then be developed in a subsequent wet process.

[0033] A conventional soft-finish can be applied to the garment after it has been washed to remove swelling agent and before it is finally dried. This can be the wet process in which the secondary fibrillation is developed.

[0034] The invention is illustrated by the following Examples. In all of the Examples, the lyocell fibres comprising the lyocell yarns were produced by Tencel Limited under the Trade Mark TENCEL.

[0035] In the Examples, the figures quoted for stretch and stretch recovery (as hereinbefore defined) were all calculated from measurements carried out on the fabrics according to the method of British Standard Test Method

BS 4952, using an Instron 1122 tensile testing machine. The tests were carried out on fabric specimens measuring 150mm by 50mm (the longer length being the test direction) using a gauge length of 100mm, a cross-head speed of 500mm per minute, a load of 40 Newtons and a dwell-time at full load of 10 seconds. The samples were conditioned prior to testing and were tested at a temperature of 20°C and a relative humidity of 65 per cent. Mean values were calculated from the results for five samples.

Examples

Example 1

[0036] Staple fibre yarns of count 1/24s Ne spun from 100 per cent TENCEL fibres were woven into a 2 by 1 twill fabric of basis weight 190 gsm (grams per square metre). The warp yarns were pre-dyed with an indigo dye and the weft yarns were left in the ecru state in order to create an attractive, lightweight, denim fabric. The fabric had 43 ends per cm (centimetre) and 28 picks per cm.

[0037] A ladies' blouse was constructed from this fabric and was pressed to remove all creases before being suspended from a garment hanger. The suspended blouse was then lowered into a metal vat containing an aqueous solution of sodium hydroxide at a concentration of 10 per cent by weight and at room temperature. The blouse was fully immersed in this solution for 1 minute before being raised out of the vat.

[0038] The treated blouse was then washed to remove the sodium hydroxide solution by dipping it, still suspended from the hanger, into successive baths of cold water until the pH of the final wash water was 7 to 8. Excess water was then removed from the blouse in a spin drier before the blouse was tumble-dried at a temperature of 90°C.

[0039] The blouse retained its attractive handle and appearance, especially its good drape, and it possessed recoverable stretch in both warp and weft directions of the fabric, which made the blouse very comfortable to wear. The fabric construction produced a predominance of stretch in the warp direction of 22 per cent, with a stretch recovery of 97 per cent.

Example 2

[0040] A medium-weight denim fabric (300 gsm) in a 3 by 1 twill weave was woven using staple fibre yarns of count 1/10.5s Ne spun from a blend of 60 per cent by weight TENCEL fibres and 40 per cent by weight cotton fibres. The warp yarns were indigo dyed and the weft yarns were ecru. The fabric had 37 ends per cm and 22 picks per cm.

A pair of men's jeans was constructed from this fabric. The jeans were given an enzyme pre-treatment in a commercial washing machine containing an aqueous solution of 0.5 per cent by weight of Zetex (wetting agent) and 2.0 per cent by weight of an amylase enzyme at a

temperature of 60°C. After 15 minutes, the treatment liquor was drained and the jeans were rinsed with cold water for 3 minutes. On removal from the washing machine, the jeans were spun-dried, tumble-dried at a temperature of 90°C, and then pressed on a Hoffman flat bed press to remove all creases.

[0041] The pressed jeans were laid flat in the bottom of a plastics basket which was then lowered into a metal vat containing an aqueous solution of sodium hydroxide at a concentration of 23 per cent by weight and at room temperature, so that the jeans were fully immersed in the solution. After 2 minutes, the basket was lifted out of the vat and the treated jeans were transferred to a commercial washing machine.

[0042] In the washing machine, the following operations were carried out in succession: a first soaking wash in still water at a temperature of 50°C for 3 minutes; a repeat of the first wash but with normal agitation of the washing machine; a neutralizing wash in cold water containing 1 g/l(gram per litre) of acetic acid for 3 minutes; and then two further cold water washes for 3 minutes each which stabilized the wash liquor to a pH of 7, the latter two washes and the neutralizing wash being carried out with normal agitation. Excess water was removed from the treated jeans in a spin-drier.

[0043] The damp jeans were then placed in another washing machine for a wet-processing treatment designed to produce a distressed denim look in which the dye intensity of the indigo dye is reduced in certain areas, particularly along raised seams. The process involved an enzyme treatment at 10:1 liquor to fabric weight ratio with an aqueous solution of a cellulase enzyme at 4.0 per cent by weight concentration and a temperature of 58°C for 30 minutes. This was followed by two separate cold water rinses, each of 3 minutes, and then a softening treatment for 10 minutes with an aqueous solution of Edunine CSA (a cationic softening agent) at a concentration of 2.0 per cent by weight and a temperature of 40°C, using a liquor to fabric weight ratio of 15:1. Excess water was then removed from the jeans in a spin-drier before they were tumble-dried at a temperature of 90°C.

[0044] The finished jeans had a classic, distressed denim look and an attractive soft handle, and they possessed recoverable stretch, primarily in the warp direction of the fabric where the stretch was 25 per cent, with a stretch recovery of 97 per cent.

Example 3

[0045] A pair of women's jeans was constructed from an ecru woven fabric having weft-wise stretchability owing to the incorporation of an elastomeric yarn. The fabric was a 3 by 1 twill fabric of basis weight 300 gsm. The warp yarns were of count 1/20s Ne and comprised 100 per cent TENCEL fibres. The weft yarns were of count 1/10s Ne and comprised a LYCRA core filament (5 per cent by weight) wrapped with cotton fibres (95 per cent by weight). The overall weight proportions of fibres in the

fabric were 55 per cent TENCEL, 43 per cent cotton and 2 per cent LYCRA. The fabric had 49 ends per cm and 19 picks per cm.

[0046] The jeans were given the same pre-treatments and treatment with aqueous sodium hydroxide solution as described in Example 2 in relation to the men's jeans. The treated jeans were transferred from the plastics basket into a garment dyeing machine (an open pocket Tupesa Ecodye 25 machine) where they were given the same succession of washes described in relation to the washing of the men's jeans in Example 2.

[0047] The jeans were then spun-dried before being given an enzyme treatment in a washing machine. An aqueous solution of an acid cellulase enzyme at a concentration of 2.0 per cent by weight and a temperature of 58°C was used for this treatment, which lasted for 30 minutes, after which the jeans were given two successive rinses in cold water of 3 minutes each.

[0048] Dyeing of the jeans was carried out in the dyeing machine used earlier in the washing process, using the hot exhaust migration dyeing method with the following dye recipe and a final fixation temperature of 80°C:

Procion H-EXL at 2.0 per cent owf (on weight of fabric)
Sodium sulphate at 40 g/l
Sodium carbonate at 15 g/l.

The dyed jeans were rinsed with water and were then treated with a cationic soft finish, Edunine CSA, at 2.0 per cent owf applied from an aqueous bath at a temperature of 40°C. The jeans were hydro-extracted in a spin-drier and then tumble-dried at a temperature of 90°C.

[0049] The finished jeans possessed recoverable stretch in both warp and weft directions of the fabric, the latter from the elastomeric weft yarn and the former as a result of the process of the invention operating on the TENCEL warp yarns. The warp stretch was 19 per cent with 96 per cent stretch recovery and the weft stretch was 14 per cent with 95 per cent stretch recovery.

Example 4

[0050] A number of denim blouses were constructed from a fabric as specified and described in Example 1. The blouses were individually bundled up as tightly as possible and were secured as a tight bundle by tying them with strips of fabric. All of the bundled blouses were put into a net bag made of polyamide filaments, which was then closed as tightly as possible around the bundled blouses.

[0051] The bag of blouses was lowered into a metal vat containing an aqueous solution of sodium hydroxide in a concentration of 10 per cent by weight and at room temperature. After a 1 minute immersion, the bag was raised from the solution and transferred into an open pocket garment washing machine. The bundled blouses, still in the net bag, were then given two successive washes in water at a temperature of 50°C for 3 minutes each.

[0052] The blouses were then released from the bag and individually untied from their bundled states before being put back into the washing machine. They were then washed in an aqueous neutralizing solution containing 1 g/l acetic acid at room temperature for 3 minutes, followed by two further 3 minute washes in cold water to produce a final wash liquor which was of neutral pH. In order to produce a distressed denim look for the blouses, they were then processed according to the procedure for that purpose set out in Example 2 in relation to the men's jeans. The blouses were then hydro-extracted in a spin-drier and tumble-dried at a temperature of 90°C.

[0053] The blouses possessed recoverable stretch which predominated in the warp direction of the fabric at a level of 22 per cent stretch with a stretch recovery of 97 per cent. In appearance, the blouses had a random arrangement of set-in creases over all of their component panels, with indigo colour loss along the line of each crease contrasting with the deeper colour retained in the areas in between. The effect was unusual and attractive.

Example 5

[0054] A number of pairs of men's jeans were constructed from a fabric as specified in Example 2. These jeans were wet processed as described in Example 2 to produce a distressed denim look. However, instead of being pressed and then further processed in a flat state to avoid creasing, each pair of jeans was bundled up as tightly as possible and was secured as a tight bundle by being tied with strips of fabric.

[0055] The bundled jeans were then put into a net bag and were processed in the same way as the bundled blouses as described in Example 4, with the exceptions that the concentration of sodium hydroxide solution used was 23 per cent by weight, and the jeans were released from the net bag and individually untied from their bundled states after the neutralising wash containing acetic acid, rather than before it.

[0056] The men's jeans possessed recoverable stretch which predominated in the warp direction of the fabric at a level of 19 per cent stretch with a stretch recovery of 97 per cent.

[0057] In appearance, the jeans had an attractive, distressed denim look, which was enhanced by the random arrangement of set-in creases over all of their component fabric panels. Indigo colour loss along the line of each crease contrasted with the deeper colour retained in the areas between.

[0058] All forms of the verb "to comprise" used in this specification have the meaning "to consist of or include".

Claims

1. A garment having recoverable stretch properties constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell

yarns, **characterised in that** the lyocell yarns in the warp and/or the weft of the fabric have a crimped configuration which is set-in and which imparts a stretch in the respective warp and/or weft direction of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent when measured according to BS4952.

2. A garment as claimed in claim 1, **characterised in that** the said stretch in the respective warp and/or weft direction is at least 20 per cent.

3. A garment as claimed in claim 1 or claim 2, **characterised in that** the said stretch recovery is at least 95 per cent.

4. A garment as claimed in any one of claims 1 to 3, **characterised in that** the lyocell yarns comprise only lyocell fibres.

5. A garment as claimed in any one of claims 1 to 3, **characterised in that** the lyocell yarns comprise a blend of lyocell fibres and other fibres, at least 50 per cent by weight of the blend being lyocell fibres.

6. A garment as claimed in any one of claims 1 to 5, **characterised in that**, additionally, elastomeric yarns are incorporated in the warp and/or the weft of the fabric.

7. A garment as claimed in claim 6, **characterised in that** the warp of the fabric comprises lyocell yarns having a set-in crimp which imparts a stretch in the warp direction of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent, and the additional elastomeric yarn is incorporated only in the weft of the fabric.

8. A garment as claimed in any one of claims 1 to 7, **characterised in that** the garment is substantially free of set-in creases.

9. A garment as claimed in any one of claims 1 to 7, **characterised in that** the garment has an arrangement of set-in creases over the whole of the garment or in one or more of its areas.

10. A garment as claimed in claim 9, **characterised in that** the set-in creases are randomly arranged.

11. A garment as claimed in claim 9 or claim 10, **characterised in that** the fabric is a denim fabric dyed with indigo dye showing indigo dye loss along the lines of the set-in creases.

12. A process for treating a garment constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell yarns, comprising

contacting the garment with a swelling agent for cellulose, washing the resulting garment with a washing liquid to remove swelling agent and then drying the garment, **characterised in that** the garment is held in an unconstrained and substantially uncreased condition, and that **in that** condition it is immersed successively in a bath of the swelling agent and then in a bath of the washing liquid to cause firstly crimping of the warp and/or the weft normally inelastic lyocell yarns of the fabric under the forces generated as they swell and then setting-in of that crimp when the garment is washed to at least partially remove the swelling agent, the set-in crimp imparting a stretch in the respective warp and/or weft directions of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent when measured according to BS4952 to produce a garment having recoverable stretch properties.

13. A process as claimed in claim 12, **characterised in that** the garment is held in an unconstrained condition by being suspended from a hanger.
14. A process for treating a garment constructed from a fabric woven from warp and/or weft yarns which comprise normally inelastic lyocell yarns, comprising contacting the garment with a swelling agent for cellulose, washing the resulting garment with a washing liquid to remove swelling agent and then drying the garment, **characterised in that** the garment is gathered up into a bundle as a whole or in one or more areas and is secured **in that** configuration before being contacted successively with first the swelling agent and then the washing liquid to cause firstly crimping of the warp and/or the weft normally inelastic lyocell yarns of the fabric under the forces generated as they swell and then setting-in of that crimp when the garment is washed to at least partially remove the swelling agent, the set-in crimp imparting a stretch in the respective warp and/or weft directions of the fabric of at least 15 per cent with a stretch recovery of at least 90 per cent when measured according to BS4952 to produce a garment having recoverable stretch properties and an arrangement of set-in creases.
15. A process as claimed in claim 14, **characterised in that** the garment constructed from woven fabric is substituted by a garment knitted from normally inelastic lyocell yarns.
16. A process as claimed in any of claims 12 to 15, **characterised in that** the swelling agent is aqueous sodium hydroxide solution in a concentration of 9 to 34 per cent by weight.
17. A process as claimed in claim 16, **characterised in that** the washing liquid is aqueous.

Patentansprüche

1. Kleidungsstück mit Stretcheigenschaften, konfektioniert aus einem aus normalerweise unelastische Lyocellgarne umfassenden Kett- und/oder Schußfäden hergestellten Gewebe, **dadurch gekennzeichnet, daß** die im Gewebe als Kette und/oder Schuß vorliegenden Lyocellgarne eine eingefixierte Kräuselstruktur aufweisen, die dem Gewebe in der jeweiligen Kett- und/oder Schußrichtung nach BS4952 ein Dehnungsvermögen von mindestens 15 Prozent bei einer elastischen Dehnung von mindestens 90 Prozent verleiht.
2. Kleidungsstück nach Anspruch 1, **dadurch gekennzeichnet, daß** das Dehnungsvermögen in der jeweiligen Kett- und/oder Schußrichtung mindestens 20 Prozent beträgt.
3. Kleidungsstück nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet, daß** die elastische Dehnung mindestens 95 Prozent beträgt.
4. Kleidungsstück nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die Lyocellgarne ausschließlich Lyocellfasern umfassen.
5. Kleidungsstück nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die Lyocellgarne eine Mischung von Lyocellfasern und anderen Fasern umfassen, wobei die Lyocellfasern in der Mischung mit einem Anteil von mindestens 50 Gewichtsprozent enthalten sind.
6. Kleidungsstück nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** im Gewebe als Kette und/oder Schuß zusätzlich elastomere Garne mit enthalten sind.
7. Kleidungsstück nach Anspruch 6, **dadurch gekennzeichnet, daß** die Kette des Gewebes Lyocellgarne umfaßt, die eine eingefixierte Kräuselung aufweisen, durch die dem Gewebe in Kettrichtung ein Dehnungsvermögen von mindestens 15 Prozent bei einer elastischen Dehnung von mindestens 90 Prozent verliehen wird, und das zusätzliche elastomere Garn ausschließlich im Schuß des Gewebes vorliegt.
8. Kleidungsstück nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, daß** das Kleidungsstück im wesentlichen keine eingefixierten Falten aufweist.
9. Kleidungsstück nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, daß** das Kleidungsstück ganzflächig oder in mindestens einem seiner Bereiche eine Anordnung von eingefixierten Falten aufweist.

10. Kleidungsstück nach Anspruch 9, **dadurch gekennzeichnet, daß** die einfixierten Falten in zufälliger Anordnung vorliegen.
11. Kleidungsstück nach einem der Ansprüche 9 oder 10, **dadurch gekennzeichnet, daß** es sich bei dem Gewebe um ein mit Indigofarbstoff gefärbtes Denimgewebe handelt, welches entlang den Linien der einfixierten Falten einen Verlust an Indigofarbstoff aufweist.
12. Verfahren zur Behandlung eines Kleidungsstücks, konfektioniert aus einem aus normalerweise unelastische Lyocellgarne umfassenden Kett- und/oder Schußfäden hergestellten Gewebe, bei dem man das Kleidungsstück mit einem Quellmittel für Cellulose in Berührung bringt, mit einer Waschflüssigkeit von Quellmittel freiwäscht und anschließend trocknet, **dadurch gekennzeichnet, daß** man das Kleidungsstück in einem unbündigen und im wesentlichen faltenfreien Zustand führt und in diesem Zustand zunächst in ein Bad des Quellmittels und dann in ein Bad der Waschflüssigkeit taucht, wobei zunächst die normalerweise unelastischen Lyocellkett- und/oder -schußfäden des Gewebes unter Einwirkung der bei ihrem Anquellen erzeugten Kräfte eine Kräuselung erfahren und anschließend die Kräuselung beim wenigstens partiellen Freiwaschen von Quellmittel einfixiert wird, wobei durch die einfixierte Kräuselung dem Gewebe in den jeweiligen Kett- und/oder Schußrichtungen nach BS4952 ein Dehnungsvermögen von mindestens 15 Prozent bei einer elastischen Dehnung von mindestens 90 Prozent verliehen wird, wobei man ein Kleidungsstück mit Stretcheigenschaften erhält.
13. Verfahren nach Anspruch 12, **dadurch gekennzeichnet, daß** man zur unbündigen Warenführung das Kleidungsstück auf dem Bügel hängend führt.
14. Verfahren zur Behandlung eines Kleidungsstücks, konfektioniert aus einem aus normalerweise unelastische Lyocellgarne umfassenden Kett- und/oder Schußfäden hergestellten Gewebe, bei dem man das Kleidungsstück mit einem Quellmittel für Cellulose in Berührung bringt, mit einer Waschflüssigkeit von Quellmittel freiwäscht und anschließend trocknet, **dadurch gekennzeichnet, daß** man das Kleidungsstück als ganzes oder in mindestens einem Bereich zu einem Bündel geschnürt zunächst mit dem Quellmittel und dann mit der Waschflüssigkeit in Berührung bringt, wobei zunächst die normalerweise unelastischen Lyocellkett- und/oder -schußfäden des Gewebes unter Einwirkung der bei ihrem Anquellen erzeugten Kräfte eine Kräuselung erfahren und anschließend die Kräuselung beim wenigstens partiellen Freiwaschen von Quellmittel einfixiert wird, wobei durch die einfixierte Kräuselung

dem Gewebe in den jeweiligen Kett- und/oder Schußrichtungen nach BS4952 ein Dehnungsvermögen von mindestens 15 Prozent bei einer elastischen Dehnung von mindestens 90 Prozent verliehen wird, wobei man ein Kleidungsstück mit Stretcheigenschaften und einer Anordnung von einfixierten Falten erhält.

15. Verfahren nach Anspruch 14, **dadurch gekennzeichnet, daß** man das aus Webware konfektionierte Kleidungsstück durch ein als Maschenware aus normalerweise unelastischen Lyocellgarnen hergestelltes Kleidungsstück ersetzt.

16. Verfahren nach einem der Ansprüche 12 bis 15, **dadurch gekennzeichnet, daß** man als Quellmittel eine 9- bis 34-gewichtsprozentige Natronlauge einsetzt.

17. Verfahren nach Anspruch 16, **dadurch gekennzeichnet, daß** man eine wäßrige Waschflüssigkeit einsetzt.

25 Revendications

1. Vêtement avec récupération des propriétés d'extension, construit en un tissu tissé à partir de fils de chaîne et/ou de trame, qui comprennent des fils de lyocell normalement inélastiques, **caractérisé en ce que** les fils de lyocell ont, dans la chaîne et/ou la trame du tissu, une configuration frisée qui est fixe et qui confère une extension dans la direction respective de la chaîne et/ou de la trame du tissu d'au moins 15 pour cent avec une récupération d'extension d'au moins 90 pour cent, mesurée selon BS 49.52.
2. Vêtement suivant la revendication 1, **caractérisé en ce que** ladite extension dans la direction respective de la chaîne et/ou de la trame est au moins de 20 pour cent.
3. Vêtement suivant la revendication 1 ou 2, **caractérisé en ce que** ladite récupération d'extension est au moins de 95 pour cent.
4. Vêtement suivant l'une quelconque des revendications 1 à 3, **caractérisé en ce que** les fils de lyocell comprennent seulement des fibres de lyocell.
5. Vêtement suivant l'une quelconque des revendications 1 à 3, **caractérisé en ce que** les fils de lyocell comprennent un mélange de fibres de lyocell et d'autres fibres, au moins 50 pour cent en poids du mélange étant constitués de fibres de lyocell.
6. Vêtement suivant l'une quelconque des revendica-

- tions 1 à 5, **caractérisé en ce** des fils élastomères sont incorporés en plus dans la chaîne et/ou la trame du tissu.
7. Vêtement suivant la revendication 6, **caractérisé en ce que** la chaîne du tissu comprend des fils de lyocell ayant un frisage fixe qui confère une extension dans la direction de la chaîne du tissu d'au moins 15 pour cent avec une récupération d'extension d'au moins 90 pour cent, et le fil élastomère supplémentaire est incorporé seulement dans la trame du tissu. 5 10
 8. Vêtement suivant l'une quelconque des revendications 1 à 7, **caractérisé en ce que** le vêtement est essentiellement exempt de plis fixes. 15
 9. Vêtement suivant l'une quelconque des revendications 1 à 7, **caractérisé en ce que** ce vêtement a un arrangement de plis fixes sur la totalité du vêtement ou dans une ou plusieurs de ses parties. 20
 10. Vêtement suivant la revendication 9, **caractérisé en ce que** les plis fixes sont disposés de manière aléatoire. 25
 11. Vêtement suivant la revendication 9 ou 10, **caractérisé en ce que** le tissu est un tissu croisé coton teint avec un colorant indigo présentant une perte de colorant indigo le long des lignes des plis fixes. 30
 12. Procédé pour le traitement d'un vêtement construit en un tissu tissé à partir de fils de chaîne et/ou de trame qui comprennent des fils de lyocell normalement inélastiques, comprenant la mise en contact du vêtement avec un agent gonflant pour la cellulose, le lavage du vêtement résultant avec un liquide de lavage pour éliminer l'agent gonflant, et ensuite le séchage du vêtement, **caractérisé en ce que** le vêtement est maintenu dans un état non comprimé et essentiellement non plissé, et que, dans cet état, il est immergé successivement dans un bain de l'agent gonflant puis dans un bain du liquide de lavage pour provoquer d'abord le frisage de la chaîne et/ou de la trame de fils de lyocell normalement inélastiques du tissu sous l'effet des forces générées au cours de leur gonflement puis la fixation de ce frisage lorsque le vêtement est lavé pour au moins éliminer partiellement l'agent gonflant, le frisage fixe conférant une extension dans les directions respectives de la chaîne et/ou de la trame du tissu d'au moins 15 pour cent avec une récupération d'extension d'au moins 90 pour cent, mesurée selon BS 49.52, pour produire un vêtement avec récupération des propriétés d'extension. 35 40 45 50
 13. Procédé suivant la revendication 12, **caractérisé en ce que** le vêtement est maintenu dans un état non comprimé en étant suspendu à un cintre. 55
 14. Procédé de traitement d'un vêtement construit en un tissu tissé à partir de fils de chaîne et/ou de trame qui comprennent des fils de lyocell normalement inélastiques, comprenant la mise en contact du vêtement avec un agent gonflant pour la cellulose, le lavage du vêtement résultant avec un liquide de lavage pour éliminer l'agent gonflant, et ensuite le séchage du vêtement, **caractérisé en ce que** ce vêtement est rassemblé en un « ballot » dans sa totalité ou dans une ou plusieurs de ses parties et est fixé dans cette configuration avant d'être mis en contact successivement d'abord avec l'agent gonflant puis avec le liquide de lavage pour provoquer d'abord le frisage de la chaîne et/ou de la trame de fils de lyocell normalement inélastiques du tissu sous l'effet des forces générées au cours de leur gonflement, puis la fixation de ce frisage lorsque le vêtement est lavé pour au moins éliminer partiellement l'agent gonflant, le frisage fixe conférant une extension dans les directions de la chaîne et/ou de la trame du tissu d'au moins 15 pour cent avec une récupération d'extension d'au moins 90 pour cent, mesurée selon BS 49.52, pour produire un vêtement avec récupération des propriétés d'extension et un arrangement de plis fixes. 5
 15. Procédé suivant la revendication 14, **caractérisé en ce que** le vêtement construit en tissu tissé est remplacé par un vêtement tricoté à partir de fils de lyocell normalement inélastiques. 30
 16. Procédé suivant l'une quelconque des revendications 12 à 15, **caractérisé en ce que** l'agent gonflant est une solution aqueuse d'hydroxyde de sodium à une concentration de 9 à 34 pour cent en poids. 35
 17. Procédé suivant la revendication 16, **caractérisé en ce que** le liquide de lavage est aqueux. 40