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Description

The invention relates to a method of making a cover fabric for V belts for power transmission and the like. The invention also relates to cover fabrics for power transmission belts or the like.

Conventional belt cover fabrics, such as in US-A-3,784,427 and 4,062,989 have been generally suitable for performing the intended function for normal V belt life. In such power transmission belt cover fabric constructions, the end of normal wear-life is typically indicated when the cover fabric becomes abraded enough to show the undyed white filaments or fibres making up the yarns of the cover fabric. While this has been a safe practice, V belt manufacturers are presently applying dye to the tubular or square woven cover fabrics for coating to improve the cosmetic effect of the raw cut fabric edge along the belt. It is felt by some producers that transmission belt life is extended by dyeing the white fiber components of the cover fabrics to a darker shade. This "cosmetic" treatment has the effect of extending the usage of the transmission belt—sometimes dangerously. This is because such cosmetic effects do not extend the wear-life of the V belt, but tend to unduly prolong replacement because of the longer time needed to detect abraded fibers.

The invention as claimed is intended to provide a remedy. It solves the problem of how to improve wear-life compared to prior art cover fabrics.

This increase in cover fabric wear-life is accomplished by impregnating the fiber bundle of the yarns making up the fabrics employed (typically bias cut woven tubular fabric, although knitted or non-woven fabrics may also be suitable), so as to coat or encapsulate the individual fibers thereof, by passing a continuous strip of bias cut woven fabric into a fluid mixture comprising an elastomeric polymeric material and a dark pigment. The polymeric material is dissolved or emulsified in a fluid mix having a relatively low viscosity in order to accomplish complete impregnation of the fiber bundle. The desired viscosity is about 200 mPa . s or less, and is preferably 150 mPa . s $\pm$ 25 mPa . s. Where pressurized or evacuated systems are available, or where exceptionally long paths in dip tanks are provided, complete impregnation can be achieved utilizing fluid mixes having viscosities somewhat higher than 200 mPa . s, and may be as high as 4000 mPa . s.

The dark pigment in the impregnating fluid is e.g. conductive black. One purpose of the pigment is to improve sales appeal by covering the fibers to eliminate the objectionable whiteness of the raw cut edges of the fabric. However, this pigmentation effect is to be distinguished from dyeing. If dyeing is practiced, it is difficult to determine when abrasion of the fabric/fibers has occurred, necessitating belt replacement.

LU-A-69082 discloses a method of treating a cover fabric for V belts using pigments in combination with an impregnating fluid for such

cover fabrics. However, it does not teach nor suggest to use a second coating to increase cover fabric wear-life.

According to the present invention, the impregnating and encapsulating polymeric materials hold the pigment on the fabric and fiber components until the pigment is abraded off with the coating. When such abrasion occurs, white fibers begin to show, signalling the time for belt replacement. Greater flex life and greater wear life are nevertheless achieved, because of the polymeric encapsulation of the individual fibers in the yarn bundle of the cover fabric, which protects such fibers from premature abrasion. Nevertheless, when there is serious abrasion the white fibers begin to appear, signalling that the belt is worn and should be replaced.

The fiber bundle impregnation according to the present invention is practiced by passing the continuous strip of bias cut fabric into a dip tank, and removing excess fluid mix by utilizing a pair of textile pad rolls. After impregnation the cover fabric is treated by following the conventional steps of U.S. Patents 3,784,427 and 4,062,989. That is, an elastomeric coating is applied to the fabric strip, the strip is stretched in its width direction to increase the angular relation of the yarns or threads of the fabric relative to its longitudinal axis, and the thus coated strip is dried. There is usually no drying between impregnation and coating, although in some circumstances that may be feasible. After coating and drying, the continuous strip is longitudinally slit into a plurality of tapes, and the tapes are used for covering a V belt or the like.

Brief description of the drawings

Figure 1 is a flow diagram of the preferred method according to the present invention; and

Figure 2 is a cross-sectional view illustrating a V belt covered with fabric produced according to the present invention.

Detailed description

A tubular woven fabric that provides the starting point for practicing the method according to the present invention is illustrated generally at 10 in Figure 1. A typical fabric is tubular woven from 35 filling picks per inch and 35 warp ends per inch using 7.5 singles yarns of a 50/50 nylon/cotton blend or a 50/50 polyester/cotton blend, although various weaves, yarns, fibers, and blends will be suitable according to the invention. The interwoven filling picks or weft yarns normally intersect the warp yarns at an angle of about 90°. The tubular fabric is bias cut into a continuous strip of fabric, the slitting normally being at an angle of 15, 30, 45 or 60° (angles between about 15 and 60° are commonly used). The tension encountered in bias cutting tends to pull down the angle between the warp and weft yarns between 80 and 90°, and normally about 85°. The continuous fabric strip 12 formed during slitting is then treated with a fluid mix of elastomeric polymeric material to impregnate in the

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yarn bundles thereof and to encapsulate the individual fibers of such yarn bundles with the polymeric material effective to increase the wear-life of the fabric when used as a cover fabric for V belts or the like. This is preferably accomplished by immersing the strip 12 in a fluid mix 13 in a conventional dip tank 14 or the like, which is normally maintained at room temperature. The strip 12 is then passed through two standard textile squeeze or pad rolls illustrated at 15 for leveling and for removing excess fluid mix. By practicing the impregnation step according to the present invention, the flex life of the cover fabric is greatly extended, and by utilizing a dark pigment rather than a dyestuff in the fluid mix, any cosmetic objection due to the whiteness of the raw cut edge of the fabric strip 12 is eliminated, without eliminating the wear life indicator effect when the fabric becomes worn by abrasion.

The fluid mix 13 according to the present invention preferably has a low viscosity so that impregnation of the fibers is insured. Normally, the room temperature viscosity will be about 200 mPa . s or less, and preferably 150 mPa . s $\pm$ 25 mPa . s. However, in circumstances where exceptionally long pathways in dip tanks can be provided, or where it is desirable to impregnate the fabric strips under pressure or with the aid of vacuum or increased temperature, then fluid mixes having a viscosity somewhat higher than

200 mPa . s may be utilized, and room temperature viscosities up to 4000 mPa . s may be suitable in such cases.

The presently preferred polymeric material for use in the fluid mix 13 is Neoprene® (a polychloroprene (CR) product of DuPont). However, a wide variety of elastomeric polymeric materials are suitable for use in the invention, such as other chlorinated polyethylenes, various chlorosulphonated polyethylenes (such as Hypalon®, also a DuPont product), natural rubber, natural rubber blended with styrene butadiene type synthetic rubbers, and ethylene polypropylene diene monomer (usually blended with other polymers).

A solvent mix may be provided comprising a major portion of a polychloroprene elastomeric polymer (such as Neoprene®), a minor portion of dark pigment, and a suitable solvent such as toluene; or an aqueous mix comprising the same polymer and pigment with water as the fluid carrier. The solids content of the solvent mix normally will be 2 to 20%, the solids content depending upon the exact polymer and solvent utilized, the purpose being to provide a solvent mix of suitable viscosity permitting effective yarn bundle impregnation to coat the individual fibers. The preferred dark pigment is a conductive carbon black.

An example of a particularly useful solvent mix according to the present invention is as follows:

Ingredient	Part
Neoprene® GN or GNA	26.31
Neoprene® GRT	26.31
Black XC-72, a conductive black	26.31
Zinc oxide, a vulcanizer	2.63
Magnesium oxide, a vulcanizer and scorch inhibitor	2.10
Stearic acid, a lubricant	0.53
Octamine, an antioxidant	2.10
Cis-4-Poly butadiene, for resilience and abrasion	0.80
Factice, an extender and plasticizer	3.95
Schenectady SP567, a phenolic resin	3.95
Natro Rez #10, a coumarone-indene resin	4.48
	100.00
Toluene (to 10% solids)	900.00
	1000.00

The mix described above will have a viscosity of approximately 150 mPa . s.

When employing an aqueous mix, the solids

content may vary from that provided for a solvent mix, for example from 5 to 50% solids, again the purpose being to provide a mix of suitable

viscosity that will permit effective impregnation of the fibers in the yarn bundle. An example of a suitable aqueous mix for practicing the impregnation according to the invention is:

Ingredients	Parts
Neoprene® L-101	425
Cymel® 303, a melamine resin	40
PC-1, a magnesium chloride catalyst	40
Picconol® 400, a tackifier	180
Aqua Black 15, a conductive black	100
Bostex® 24, an antioxidant	16
E-678, a thickener	20
ASE-60 in ammonia, a thickener	20
Water	136

The mix described above will have 44% total solids and a viscosity of about 150 mPa.s.

After impregnation of the fabric strip 12, the rest of the steps that are practiced for producing the end product cover fabric are substantially conventional, such steps being more fully described in U.S. Patents 3,784,427 and 4,062,989. The strip 12 may be dried directly after impregnation but preferably is not. After impregnation, an elastomeric coating (similar in composition to the impregnating mix, although less fluid, may be employed if a higher viscosity is desired) is applied to the strip at station 16 which is also normally maintained at room temperature.

Suitable coating compositions according to the invention may be made using the same elastomeric polymers listed above for the impregnating composition. Preferably the coating composition has a higher solids content in the range of 46—48%, although the solids content may range from 30 to 60%. The coating composition is pigmented with a conductive carbon black, and it may be made with a solvent or an aqueous base. The invention has been tested with good results using an aqueous base impregnating material, followed by application of a solvent base coating without intermediate drying.

After coating, the strip is stretched in its width direction to increase the angular relation of the threads of the fabric (see U.S. Patent 3,784,427) relative to its longitudinal axis at a stretching station 18. The stretching step changes the angle between the warp and weft yarns of the bias cut fabric strip to an angle in the range of 90—125°, preferably about 110°. The strip is then passed on to the drying station 20 for fluid carrier (solvent or

water) removal, and cooled to room temperature at cooling station 22 by passing it over cooling cans or the like. Drying is normally carried out at a temperature in the range of 51.6—135°C, the purpose being to remove excess fluid carrier from the impregnating and coating materials. The polymeric material on the treated product is not cured at this stage however. Curing normally takes place when the treated product is subjected to its intended end use. In the case of a V belt, curing would take place after the treated cover fabric 30 is wrapped around the V belt 28 (see Figure 2).

After drying and cooling, the treated fabric strip may then be collected and shipped to another facility for actually forming the strip into a configuration suitable for cover fabric use, and for covering the belts, or these steps can be practiced at the same site. In any event, ultimately the dried strip passes to a slitting station 24 where the continuous strip is slit longitudinally of itself into a plurality of long tapes, each of which is of sufficient width to completely cover a V belt, and at station 26 the tapes are used to cover the V belt to provide the finished product. A schematic representation of the finished product is illustrated in Figure 2, the V belt 28 being wrapped in the longitudinal direction by the tape of cover fabric 30 that is formed according to the present invention.

The power transmission belt cover fabric produced according to the present invention has been found to provide substantially improved flex life and wear life as compared to prior art V belt cover fabrics. Additionally, it is improved cosmetically since there are no adverse cosmetic effects along the raw cut edge of the belt. The white fibers do not appear prematurely, nor is their appearance unduly delayed by dyeing (dyeing tends to fully penetrate the fiber in the yarn, turning the fiber to the color of the dye and tending to prevent detection of an abraded fiber; the present invention deliberately avoids dyeing in favor of coloring only the fiber surface by pigmentation). Since each of the fibers of the present cover fabric is encapsulated with the impregnating polymeric material, the wear life is believed to be a surprising 2—3 times the normal wear life.

While the invention herein has been shown and described in what is presently conceived to be the most practical and preferred embodiment thereof, it will be apparent to those of ordinary skill in the art that modifications thereof may be made within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent methods, compositions and fabrics.

Claims

1. A method of making a cover fabric for V belts or the like, comprising the steps of:

viscosity that will permit effective impregnation of the fibers in the yarn bundle. An example of a suitable aqueous mix for practicing the impregnation according to the invention is:

Ingredients	Parts
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Suitable coating compositions according to the invention may be made using the same elastomeric polymers listed above for the impregnating composition. Preferably the coating composition has a higher solids content in the range of 46—48%, although the solids content may range from 30 to 60%. The coating composition is pigmented with a conductive carbon black, and it may be made with a solvent or an aqueous base. The invention has been tested with good results using an aqueous base impregnating material, followed by application of a solvent base coating without intermediate drying.

After coating, the strip is stretched in its width direction to increase the angular relation of the threads of the fabric (see U.S. Patent 3,784,427) relative to its longitudinal axis at a stretching station 18. The stretching step changes the angle between the warp and weft yarns of the bias cut fabric strip to an angle in the range of 90—125°, preferably about 110°. The strip is then passed on to the drying station 20 for fluid carrier (solvent or

water) removal, and cooled to room temperature at cooling station 22 by passing it over cooling cans or the like. Drying is normally carried out at a temperature in the range of 51.6—135°C, the purpose being to remove excess fluid carrier from the impregnating and coating materials. The polymeric material on the treated product is not cured at this stage however. Curing normally takes place when the treated product is subjected to its intended end use. In the case of a V belt, curing would take place after the treated cover fabric 30 is wrapped around the V belt 28 (see Figure 2).

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The power transmission belt cover fabric produced according to the present invention has been found to provide substantially improved flex life and wear life as compared to prior art V belt cover fabrics. Additionally, it is improved cosmetically since there are no adverse cosmetic effects along the raw cut edge of the belt. The white fibers do not appear prematurely, nor is their appearance unduly delayed by dyeing (dyeing tends to fully penetrate the fiber in the yarn, turning the fiber to the color of the dye and tending to prevent detection of an abraded fiber; the present invention deliberately avoids dyeing in favor of coloring only the fiber surface by pigmenting). Since each of the fibers of the present cover fabric is encapsulated with the impregnating polymeric material, the wear life is believed to be a surprising 2—3 times the normal wear life.

While the invention herein has been shown and described in what is presently conceived to be the most practical and preferred embodiment thereof, it will be apparent to those of ordinary skill in the art that modifications thereof may be made within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent methods, compositions and fabrics.

Claims

1. A method of making a cover fabric for V belts or the like, comprising the steps of:



* C L M S *

- a) cutting a woven fabric into a continuous strip of fabric;
- b) impregnating the individual fibers in the continuous strip of fabric with an elastomeric polymeric material effective to increase the wear-life of the fabric when used as a cover fabric for V belts or the like;
- c) applying an additional elastomeric coating to the strip;
- d) stretching the strip in its width direction to increase the angular relation to the threads of the fabric relative to its longitudinal axis; and
- e) drying the thus coated strip;

characterized in that step b) is accomplished by impregnating the fabric with a fluid mix comprising an elastomeric polymer and a dark pigment,

and further characterized by practicing the steps in the sequence a), b), c), d), and e).

2. A method as recited in claim 1 further characterized in that step b) is practiced by immersing the strip in a low viscosity fluid mix of polymeric material, and removing excess mix, prior to practicing step c).

3. A method as recited in claim 2 further characterized in that excess mix is removed utilizing a pair of textile pad rolls through which the fabric passes after immersing in a dip tank.

4. A method as recited in claim 1 further characterized in that steps c) and d) are practiced directly after step b), with no drying in between.

5. A method as recited in claims 1, 2, or 4 further characterized in that step b) is accomplished by impregnating the fabric with a fluid mix having a viscosity of about 200 mPa . s or less.

6. A method as recited in claims 1, 2, or 4 further characterized in that step b) is accomplished by impregnating the fabric with a fluid mix comprising a major portion of an elastomeric polymer and a minor portion of dark pigment, and the the fluid mix having a viscosity of about 200 mPa . s or less.

7. A method as recited in claim 1 further characterized in that step b) is accomplished by impregnating the fabric with a solvent mix comprising a major portion of a elastomeric poly-chloroprene compound and a minor portion of dark pigment, and the solvent mix having a solids range of about 2—20%, and a viscosity of about 150 mPa . s $\pm$ 25 mPa . s.

8. A method as recited in claim 1 further characterized in that step a) is accomplished by slitting the fabric to obtain an angle of between 15 and 60°.

9. An industrial cover fabric for power transmission belts or the like, consisting of a strip of bias cut fabric woven from blended fiber yarns, the individual fibers of said yarn being encapsulated in a first dried elastomeric polymer, and said yarns and encapsulated fibers being over-coated with a second dried elastomeric polymer, the angular orientation between the warp and weft yarns of said woven fabric being increased to

an angle greater than 90° and being held in that position by the dried elastomeric coating, characterized in that the first elastomeric polymer used for encapsulating the individual fibers of said yarn contains a pigment being adapted to abrade off with said polymer to reveal unpigmented portions of said fibers when said fabric has outlived its usefulness.

Revendications

1. Procédé de fabrication d'un tissu de recouvrement pour courroies trapézoïdales ou similaires, comprenant les opérations de:

- a) coupe d'un tissu sous la forme d'une bande de tissu continue;
- b) imprégnation des fibres individuelles contenues dans la bande de tissu continue avec une matière polymère élastomère destinées à augmenter la durée d'usage du tissu utilisé comme tissu de recouvrement des courroies trapézoïdales ou similaires;
- c) application d'une enduction élastomère supplémentaire sur la bande;
- d) étirage de la bande dans le sens de sa largeur afin d'améliorer la relation angulaire des fils contenus dans le tissu par rapport à son axe longitudinal;
- e) séchage de la bande ainsi enduite;

caractérisé par le fait que l'opération b) s'effectue en imprégnant le tissu avec un mélange fluide comprenant un polymère élastomère et un pigment foncé, et par le fait que les opérations s'effectuent dans l'ordre a), b), c), d) et e).

2. Procédé selon la revendication 1, caractérisée en outre par le fait que l'opération b) s'effectue en plongeant la bande dans un mélange fluide de faible viscosité d'une matière polymère et en éliminant le mélange excessif, avant de passer à l'opération c).

3. Procédé selon la revendication 2, caractérisé en outre par le fait que le mélange excessif est éliminé en utilisant une paire de rouleaux de foulardage textile à travers lesquels le tissu passe après avoir été plongé dans une cuve d'immersion.

4. Procédé selon la revendication 1, caractérisé par le fait que les opérations c) et d) s'effectuent directement après l'opération b), sans séchage intercalé.

5. Procédé selon les revendications 1, 2 ou 4, caractérisé par le fait que l'opération b) s'effectue en imprégnant le tissu avec un mélange fluide ayant une viscosité d'environ 200 mPa . s ou moins.

6. Procédé selon les revendications 1, 2 ou 4, caractérisé par le fait que l'opération b) s'effectue en imprégnant le tissu avec un mélange fluide composé en majeure partie d'un polymère élastomère et en faible partie d'un pigment foncé, le mélange fluide ayant une viscosité d'environ 200 mPa . s ou moins.

7. Procédé selon la revendication 1, caractérisé



par le fait que l'opération b) s'effectue en imprégnant le tissu avec un mélange dissolvant composé en majeure partie d'un composé polychloropropène élastomère et en faible partie d'un pigment foncé, et le mélange de solvants ayant une proportion de substances solides d'environ 2 à 20% et une viscosité d'environ 150 mPa . s $\pm$ 25 mPa . s.

8. Procédé selon la revendication 1, caractérisé par le fait que l'opération a) s'effectue en découpant le tissu afin d'obtenir un angle compris entre 15 et 60°.

9. Tissu de recouvrement industriel pour courroies de transmission de force ou similaires composé d'une bande de tissu coupée en biais constituée de fils de fibres mélangés, les fibres individuelles dudit fil étant emprisonnées dans un premier polymère élastomère séché, et lesdits fils et fibres emprisonnées étant enduits d'un second polymère élastomère séché, l'orientation angulaire entre les fils de chaîne et de trame dudit tissu étant augmentée pour former un angle supérieur à 90° et étant maintenue dans cette position par l'enduction élastomère séchée, caractérisé par le fait que le premier polymère élastomère utilisé pour emprisonner les fibres individuelles dudit fil, contient un pigment capable de s'éliminer par frottement avec ledit polymère afin de révéler des parties non pigmentées desdites fibres lorsque ledit tissu est devenu inutilisable.

Patentansprüche

1. Verfahren zur Herstellung einer Umhüllungsbespannung für Keilriemen o.ä., welches die Schritte aufweist:

- a) Schneiden einer gewebten Bespannung zu einem zusammenhängenden Bespannungstreifen;
- b) Imprägnieren der einzelnen Fasern in dem Zusammenhängenden Bespannungstreifen mit einem elastomeren polymeren Material, welches in der Lage ist, die Verschleißfestigkeit der Bespannung bei der Verwendung als Umhüllungsbespannung für Keilriemen o.ä. zu verlängern;
- c) Aufbringen einer zusätzlichen elastomeren Beschichtung auf den Streifen;
- d) Strecken des Streifens in Richtung seiner Breite zur Vergrößerung der Fadenwinkel der Bespannung in bezug auf deren Längsachse; und
- e) Trocknen des so beschichteten Streifens;

dadurch gekennzeichnet, daß der Schritt b) durch Imprägnieren der Bespannung mit einer Fluidmischung durchgeführt wird, die ein elastomeres Polymeres und einen dunklen Farbstoff aufweist,

und ferner dadurch gekennzeichnet, daß die Schritte in der Reihenfolge a), b), c), d) und e) durchgeführt werden.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Schritt b) durchgeführt wird, indem der Streifen in eine Fluidmischung von polymerem Material getaucht wird, die eine geringe Viskosität hat, und daß überschüssige Mischung vor Durchführung des Schrittes c) entfernt wird.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die überschüssige Mischung unter Verwendung eines Paares von Walzen mit Textilaufgabe entfernt wird, durch welche die Bespannung nach dem Untertauchen in einem Tauchtank durchläuft.

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Schritte c) und d) unmittelbar nach dem Schritt b) durchgeführt werden, ohne daß dazwischen ein Trocknen erfolgt.

5. Verfahren nach Anspruch 1, 2 oder 4, ferner dadurch gekennzeichnet, daß der Schritt b) durchgeführt wird, indem die Bespannung mit einer Fluidmischung imprägniert wird, die eine Viskosität von etwa 200 mPa . s oder weniger hat.

6. Verfahren nach Anspruch 1, 2 oder 4, ferner dadurch gekennzeichnet, daß der Schritt b) durch Imprägnieren der Bespannung mit einer Fluidmischung durchgeführt wird, die einen größeren Anteil eines elastomeren Polymeren und einen kleineren Anteil eines Farbstoffs aufweist, und daß die Fluidmischung eine Viskosität von etwa 200 mPa . s oder weniger hat.

7. Verfahren nach Anspruch 1, ferner dadurch gekennzeichnet, daß der Schritt b) durchgeführt wird, indem die Bespannung mit einer Lösungsmittelmischung imprägniert wird, die einen größeren Anteil einer elastomeren Polychloroprenverbindung und einen kleineren Anteil eines dunklen Farbstoffs aufweist, und daß die Lösungsmittelmischung Feststoffe im Bereich von etwa 2 bis 20% aufweist und eine Viskosität von etwa 150 mPa . s $\pm$ 25 mPa . s hat.

8. Verfahren nach Anspruch 1, ferner dadurch gekennzeichnet, daß der Schritt a) durchgeführt wird, in dem die Bespannung geschlitzt wird, um einen Winkel zwischen 15 und 60° zu erzielen.

9. Industrielle Umhüllungsbespannung für Kraftübertragungsriemen o.ä. mit einem Streifen aus schräg geschnittener Bespannung, die aus gemischten Fasergarnen gewebt ist, wobei die einzelnen Fasern des Garnes in ein erstes getrocknetes elastomeres Polymer eingeschlossen sind und die Garne und die eingeschlossenen Fasern mit einem zweiten getrockneten elastomeren Polymeren beschichtet sind, wobei die Winkelausrichtung zwischen den Kettenfäden und den Schußfäden der gewobenen Bespannung auf einen größeren Winkel als 90° gebracht und in dieser Lage von der getrockneten elastomeren Beschichtung gehalten ist, dadurch gekennzeichnet, daß das erste elastomere Polymer, das zum Einschließen der einzelnen Fasern des Garnes verwendet ist, einen Farbstoff enthält, der so angelegt ist, daß er mit dem Polymeren abgerieben wird, um ungefärbte Teile der Fasern freizulegen, wenn die Bespannung ihren Zweck nicht mehr erfüllt.

