STRETCHABLE TUBULAR KNIT FABRIC OF YARN COATED WITH ELASTOMER

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The present invention relates to a novel and useful elastomer-impregnated fabric suitable for garment use, to a process for producing such a fabric, and to a process for adapting such a fabric to a finished garment. More particularly, it relates to a fabric equally stretchable in both dimensions and characterized by exceptional modulus which may be made on conventional weaving and/or knitting machinery. Broadly considered, an elastic fabric is any fabric capable of recovering shape and size after deformation. Thus, technically considered, knit fabrics and fabrics woven or knitted with textured yarn may be considered to be elastic. However, the industry has further defined the term “elastic” so that fabrics are considered elastic only if they also possess power (i.e., modulus) and speed of recovery.

In the standard shuttle weave, the resulting fabric has no elasticity except insofar as is imparted thereto by the physical properties of the fibers themselves. If the individual threads have no elasticity, neither does the resulting cloth.

The conventional method for producing an elastic fabric (i.e., one possessing not only the ability of recovering size and shape after deformation but also including power and high speed recovery) is to weave or knit an elastomeric thread of natural rubber or of a synthetic elastomer with a hard, nonstretch thread. To provide the appearance, dyability and hand desired in the finished product, it is conventional to cover the elastomeric thread with a hard fiber such as cotton, rayon, etc. In covering the elastic thread, the fiber is fed vertically in a machine of special design and as it travels in the perpendicular, the hard fibers are spiraled around the elastic thread. Normally, there are two stations for covering, with one covering fiber traveling in a clockwise direction and the next fiber traveling in a counterclockwise direction. The speed at which the elastomeric thread travels and the speed of the covering fiber are varied to obtain specific characteristics of modulus and ultimate elongation. These covered elastic threads are then woven and/or knitted with hard threads to produce an elastic fabric. The tension applied to the elastic thread in the weaving or knitting process again affects the characteristics of modulus and elongation of the finished fabric. Size and physical characteristics of the elastomeric threads must be carefully chosen to obtain specified results in the finished fabric. All phases of the manufacture of an elastic fabric are critical to the finished quality. Restrictions imposed by the weaving process and high speed textile machinery limit the use of elastic threads in shuttle weave cloth to its presence in the warp only. The industry has long sought to produce textiles possessing both stretchability and modulus.

Prior to the existence of elastic fibers, stretchability was imparted to standard fibers, such as cotton, wool, etc., by a particular weave known as a knit weave. The basic knit weave, termed the “circular weave,” produces only tubular goods. Circular weave imparts stretchability to the resulting fabric, but with little accompanying modulus, i.e., the force returning the fabric to its original dimension when stretched is very low. More recently, machinery has been devised that produces flat cloth with a knit structure, thus obtaining a flat fabric having stretchability. The advantage of the resulting flat textile is obvious, in that it permits cutting and shaping the fabric to precise garment needs. In the tricot knit, the knit goods produced are flat but do not have stretchability in only one dimension. The rachel knit also produces a flat, knitted fabric but possessing stretchability in two dimensions. However, the stretchability in the one dimension is significantly better than in the other. The kidde knit produces a flat cloth having equal stretchability in both dimensions. Thus, by means of various knits and weaves, it is possible to impart stretchability but not modulus to a textile. The knit weaves, particularly those designed to produce a flat fabric, are expensive to produce, primarily because of the costly start-up times after a break. It is possible to impart modulus to a knitted fabric by using an elastic thread for all or part of the fabric. The necessity of running the machines at just below the break point of the fabric leads to difficult mechanical problems and to costly start-up time and other expenses due to the frequent breaks which result from using this type of fiber under these conditions (any elastomer has significantly reduced tensile strength at maximum elongation as compared to its tensile strength at normal elongation). textile machinery is operated just below the break point of the fiber used.

There have recently been developed a number of processes for textured a yarn whereby considerable extensibility is imparted to the yarn. Such processes are applicable to any of the basic yarn forms as multi-filament, spun staple or plied yarn with resulting yarn being termed a “stretch yarn.” The processes for producing stretch yarns are generally divided into two major classifications: the non-torque and torque processes. In general, non-torque processes involve crimping the yarn as by passing the yarn over a heated edge, through a stuffer box, etc. Commercial processes utilizing such means include Agilon, Ban-Lon, etc. The torque processes involve twisting the yarn to produce the desired degree of deformation. Different processes involving different combinations of heat setting and twisting have been developed, including the monofil process, the false twist process, and many variations of these basic processes. The most commonly used torque process is known under the trademark “Telanca” and is described in U.S. 2,564,245. At the present time, such stretch yarns are generally confined to thermoplastic fibers. However, this limitation is not inherent and stretch yarns may be made from wool, cotton, etc., as described for example, by Finlayson et al. in U.S. 2,089,196. In general, any yarn which may be set in a compacted condition such that the set is permanent to any chemical or physical action that the yarn will encounter in its normal life can be made into a satisfactory stretch yarn.

By means of these various processes, considerable stretchability may be imparted to the resulting yarns. Further, when such a yarn is subjected to being put through a standard textile making machinery, there is no loss in strength in the fiber in contrast to elastic fibers which have considerably reduced strength under tension and thus are subject to breaks and costly start-up time delays. This results from the fact that the tensile strength of the textured yarn far exceeds the strength of any of the elastomeric yarns. Consequently, there is greatly reduced breakage during the knitting process which permits higher knitting speeds. This results in considerably lower knitting costs. However, the textiles produced using stretch yarns, while displaying considerable extensibility, have very little modulus.

Accordingly, it is an object of the present invention to impart a high degree of modulus to a fabric whether woven in a standard shuttle weave or any of the knit weaves.
Another object of the invention is to produce an elastic fabric possessing a high modulus and high speed of recovery using textured yarns prepared from hard fibers. It is another object of the invention to produce an elastic fabric possessing high modulus and high speed of recovery having controlled modulus varying across the garment by a simple molding process, i.e., substantially free of seams.

Still another object is to produce a high strength elastic fabric possessing good "counter appeal.

Another object of the invention is to produce an elastic fabric having excellent durability.

A further object of the invention is to produce a fabric from spun staple yarn which does not pill.

These and other objects of the invention will become apparent in the following description of the invention.

These objects are accomplished by the present invention which provides a fabric having high modulus with high durability, excellent counter appeal, and with unimpaired dyeability and permeability, by thoroughly impregnating a fabric prepared from a stretch yarn with a normally tacky settable elastomer while the fabric is in its relaxed state, controlling the degree of impregnation of the fabric so that only the individual yarns of the fabric are coated by the elastomeric solution, and curing the impregnated fabric whereby each individual yarn of the fabric becomes an elastic member without loss of permeability or counter appeal. By "yarn" is meant a multi-filament strand used for the warp and weft in weaving, knitting or other interlacing that form cloth.

The present invention is applicable to textiles prepared solely from stretch yarns but without limitation as to whether the stretch yarn is a plied yarn, spun staple yarn or multifilament yarn prepared from continuous filaments. The invention may also be used with textiles containing a stretch yarn in only the warp or the weft in which case modulus and speed of recovery are imparted to the stretch yarn in a fabric. It is preferred to use a multifilament yarn prepared from continuous filaments. When such a yarn is impregnated and cured according to the invention, even the small individual impregnated filaments act as elastic members by pulling the fabric to its original shape upon release of tension.

Any process for texturing the yarn to impart stretchability thereto may be used, including both torque and nontorque processes. Any standard weave or knit may be used in making the textile, including shuttle weave, leno weave, circular knit, tricot knit, ravel knit, kidde knit, etc. The stretch yarns may be prepared from any type of fiber, including natural fibers such as cotton, wool, and the like, and synthetic fibers such as the nylon, polyesters, polyacrylonitriles, polyyvinyl alcohol, polyureas, polyurethanes, cellulose esters and other such known materials. It is preferred to employ nylon, i.e., poly(hexamethylene adipamide), both by reason of the commercial availability of stretch nylon yarns and the high inherent strength of such stretch nylon yarns.

The invention is illustrated in the figures wherein Fig. 1 is a photomicrograph of a knit fabric prepared from a texturized nylon yarn (Helanca) which has not been impregnated, and Fig. 2 is a photomicrograph of a knit fabric prepared from a texturized nylon yarn (Helanca) impregnated with an elastomeric polyurethane resin in accordance with the instant invention.

As can be seen from Fig. 2, the individual yarn fibers retain their distinct identity when treated in accordance with the instant invention, thereby imparting permeability and breathability to the resulting fabric.

The precise process for impregnating the yarn fabric in accordance with the instant invention is not critical and will vary, depending on the elastomeric material employed and the nature of the product to be produced. Thus, the textile may be impregnated by immersion, spraying, roller coating, continuous dipping, etc. Certain of these processes, such as spraying, may be adapted on a continuous basis to control the degree of saturation of the textile and thus eliminate the necessity for any subsequent step to remove any undesired excess of impregnating elastomeric material.

The advantages of the instant process are many. Thus it is extremely difficult to impregnate and cure a single textured yarn in its relaxed state. However, the present process which impregnates the yarn when made up into a fabric is simple, easily automated, and much less costly. In addition to the greater ease, practicability and lower cost of the impregnating and curing steps themselves, it is also much less expensive to knit or weave a fabric with a textured yarn than a fabric containing elastic yarns. Whereas only a portion of the yarns of present elastic fabrics are themselves elastic, in the fabrics produced by the instant invention, each texturized yarn becomes an elastic yarn. In addition, the amount of modulus and speed of recovery may be easily regulated by controlling the degree of impregnation, the nature of the elastomer used, the amount of tension applied during curing, etc. Further, many novel effects can be obtained in knitting and weaving without elastic yarns. Moreover, fabrics can be produced from stretch yarns on standard weaving and knitting equipment, whereas such equipment requires modifications to handle elastic yarns and then only at a considerably lower production rate. The cost of producing an elastic fabric is, thus, reduced substantially and the style, hand and design of the finished fabrics will be limited only by the limitations of the knitting and weaving machinery. The instant process which permits the use of textured yarns to the exclusion of elastic yarns is thus a significant improvement in this regard.

A particularly preferred embodiment of the invention is to mold the impregnated fabric just prior to the curing step into a desired shape or form and then cure the impregnated fabric on the mold. The elastic resin may be employed not only imparts modulus to the resulting cured textile but also permanent set. In addition, the degree of modulus in the fabric varies inversely with the degree of stretching in the molding operation, thus permitting imparting variable modulus to the fabric without any cutting or shaping being necessary.

Such properties in the resulting product render the process particularly applicable in the production of various women's garments and other uses wherein such properties are desirable. For example, in producing a swimming suit, a circular knit stretch nylon tube of a circumference desired for the particular size to be produced is immersed in an elastomeric solution, rolled flat to remove the excess impregnating solution, and the tube is then placed on a form simulating the female figure. The wet impregnated tube will conform faithfully to the mold. The form is then cured in a circulating air oven and, after curing is completed, the form is removed from the oven and the impregnated stretch nylon tube is removed from the form. The resulting nylon tube now has the exact shape of the original mold and needs only the top and bottom selvage edges to become a finished bathing suit. Further, with the exception of such edges, there are no bulky seams or stitches in the garment. In addition, the suit will have excellent modulus which, in turn, will vary across the suit; the hip areas having less modulus and the stomach areas having a greater degree of modulus, as is desirable in this type of product.

Any elastomeric material which is soluble or dispersible in a liquid carrier and is settable to a resilient, tack-free
elastomer may be used for impregnating the fabric. Such elastomers include, without limitation, those prepared from polyacrylate rubber, styrene-butadiene, butadiene-acrylonitrile, butyl rubber, chlorosulfonated polyethylene, polyester elastomers, cis-polyisoprene, fluorocarbon rubbers, polyester-polyamide elastomers, cis-polybutadiene, chloroprene rubber, urethane elastomers prepared from either polyethers or polyesters, etc. It is preferred to use a polyurethane prepared from either a polyester-diisocyanate or a polyether-diisocyanate. The terms "polyester-diisocyanate" and "polyether-diisocyanate" indicate a polymer which contains relatively low molecular weight polymer or polyether chains which are capped or extended by diisocyanates to give a prepolymer containing urethane linkages and free isocyanate groups which can be cured by difunctional or polyfunctional compounds containing active hydrogen radicals, such as water, diol, etc., as disclosed, for example, by Kirschner in U.S. patent application Serial No. 327,550, filed November 13, 1962.

The resulting cured segmented polyurethane is of relatively high molecular weight, being close to or exceeding the molecular weight required for film-forming properties.

The polyesters suitable for use in preparing the polyester-diisocyanate prepolymer useful in the present invention are of relatively low molecular weight, having a molecular weight below that which is required for film formation. In general, the suitable polyesters have a molecular weight of from about 1,500 to about 5,000 and are liquid or have a low melting point generally not substantially in excess of 100°C. The polyesters are formed from glycols and dicarboxylic acids or ester-forming derivatives thereof by a simple condensation reaction, and the resulting products are primarily linear, although small amounts of cross-linking agents, such as tricarboxylic acids, glycerol or unsaturated acids, may be used to produce a variation in the final product. Saturated aliphatic dicarboxylic acids, such as adipic, succinic, glutaric, pimelic, azelaic, sebacic, malonic, and the like, may be employed with aliphatic glycols, such as ethylene glycol, diethylene glycol, triethylene glycol, decamethylene glycol, 1,10-decane-diol. Aromatic acids, such as isophthalic, p-phenylenedicarboxylic, acid, and allicyclic acids, such as hexahydrotetraphthalic acid, may likewise be used. An excess of the glycol is used so that the polyester has terminal aliphatic hydroxyl groups. The polymerization may be carried out without catalysts, or, if desired, known esterification catalysts, such as dibutyltin-dilaurate or tin octoate, may be used to hasten the reaction.

As an alternative to the polyesters or in conjunction therewith, there may be used one or more polyethers. Such polyethers are anhydrous chain-extended polyethers having ethereal oxygen atoms separated by hydrocarbon chains either aliphatic or aryl in nature. The ether should also contain terminal groups reactive to isocyanate, such as alcoholic hydroxyl groups. Such materials are generally linear in structure but may be branched somewhat. For example, typical polyols include pentane-diol-1,5; 2-ethylpropane-diol-1,3; 2-methylpropane-diol-1,3; hexanediol-3,4-dihydroxyxycyclohexane and its polyethers; xylenol, alpha, alpha' diols; trimethylolpropanes; hexanetriols and triols with polypropylene or ethylene chains; etc. Preferred ethers contain the structure HO(R)OR, where in R is a hydrocarbon radical and n is an integer sufficiently high to give a molecular weight of preferably from about 500 to about 5,000. Such ethers are prepared by condensing an alkyylene oxide, such as ethylene oxide or propylene oxide or a mixture of both, or other alkylene oxides, such as styrene oxide, etc. Condensation products may also be prepared by condensing such alkylene oxides with diols, triols, etc., as those disclosed above.

Further examples of suitable polyethers and polyesters for use as the polyol in preparing polyurethanes are described in U.S. Patents 2,814,606; 2,801,990; 2,801,648; 2,777,831; 2,606,162, and 2,432,148. These patents also teach the method of preparing such polyols.

Where the elastomers used with the impregnating step of the present invention is a polyurethane, it is understood that the polyurethane will be in the form of a suitable prepolymer containing free isocyanate groups. Because of the presence of the reactive isocyanate groups, the polyurethane will necessarily be applied to the fabric as a solution or dispersion in an inert organic solvent. The isocyanates used in preparing the prepolymer are those customarily used in the polyurethane art, such as the toluene diisocyanates (particularly the 80-20 mixture of 2,4- and 2,6-toluene diisocyanate), the naphthalene diisocyanates, m,p-diphenylmethane diisocyanate, p-phenylene diisocyanate, and the like. A more complete list of polyisocyanates is set forth by Sieckens in Annalen, volume 562, pages 122-135 (1949).

The prepolymer is formed by reacting the polyester or polyether with the diisocyanate under anhydrous conditions at a slightly elevated temperature. In general, a temperature of from about 55°C to about 150°C is employed, although temperatures somewhat lower can be used with an undesirable increase in reaction time. When employing a temperature within the range of 50°C to 150°C, a reaction time of about 5 to 60 minutes is generally required, with the lower temperatures requiring the longer time intervals. The preparation of the prepolymer is not critical for the present invention, and any method known to those skilled in the art may be used therefor.

Upon the formation of the prepolymer, it is dissolved in an inert organic solvent. The concentration of prepolymer in the solvent is not critical so long as the viscosity of the solution is low enough to permit ready absorption by the textured yarn and so high as to support itself in forming a film between the yarns. In general, the concentration will vary with the nature of the prepolymer and the solvent, the method of application to the textile, the type of after-treatment necessary to remove excess elastomer, the efficiency of the solvent recovery process, etc. Generally, such solutions contain from about 5 to about 50% prepolymer based on the weight of the acid. A relatively inexpensive inert solvent that is satisfactory for the prepolymer is 1,1,1-trichloroethane, which boils at about 74°C, although other volatile solvents, such as carbon tetrachloride, chloroform, other halogenated hydrocarbons, ethers, aromatic hydrocarbons, etc., may likewise be used. A small amount of water, diol and/or other curing agent may be emulsified or dispersed in the prepolymer solution used to impregnate the fabric or, alternatively, the curing agent may be separately applied in liquid and/or vapor form after the fabric has been impregnated.

The use of other elastomeric materials is less critical than the polyurethanes, due to the relative absence of highly reactive groups in the elastomer. Accordingly, such elastomers may be applied as solutions, emulsions, or dispersions from either organic liquid carriers or from water. By reason of the ease of handling, lack of toxicity, cheapness and absence of solvent recovery steps, it is preferred to use an emulsion or tacky dispersion of the elastomer in water for impregnating the textile with such elastomers. Again, it is important that the viscosity of the impregnating solution or dispersion or emulsion be low enough to permit ready absorption by the textured yarn and not so high as to support itself in forming a film between the yarns.

After impregnation, the fabric may be immediately cured or, if an excess of elastomer has been picked up by the fabric, the excess is expressed from the fabric by any suitable means, such as squeezing, etc., prior to the curing treatment. The time and temperature of curing will vary with the nature of the elastomer and of the liquid carrier for the elastomer. Generally, for any particular
elastomer-liquid combination, the higher the temperature, the shorter the time of curing. In general, a temperature within a range of from 50° C. to about 250° C. is employed, although ambient temperature can be used if time is not important. At temperatures of from about 50° C. to 250° C., the liquid carrier readily evaporates and curing is generally accomplished within an hour and frequently within minutes. If desired, a partial cure may be effected by heating, and the final curing completed at room temperature. Where an organic solvent is used, it is preferred that at least some heating be carried out to evaporate the solvent so that it can be condensed for recovery purposes.

While the process is described herein as a batch process, it is adaptable to be run on a continuous basis, using apparatus already known for impregnating fabrics. Thus, in many instances, a change in the machinery currently employed is not even necessary to convert to the present process. For example, the molding and curing process as described herein may be carried out on a conventional Tubex equipment if desired.

The following examples are given to illustrate the invention and are not intended to limit it in any way. All parts are by weight unless otherwise so stated.

**Example 1**

An aqueous dispersion containing 45% of an emulsion copolymer of about 0.8% of acrylamide, 98% of ethyl acrylate, and 1.2% of N-methylolacrylamide was prepared by emulsion copolymerization. The emulsion may be used to impregnate a textured rayon.

As applied to a textile prepared from staple rayon, 2-denier, 1.5-inch length, and weighing about 0.5 ounce per square yard, the fabric was padded through the polymer dispersion to provide a 125% wet pickup. After air-drying, the treated web was heated at 300° F. for five minutes. The resulting bonded web was quite flexible and soft and withstood laundering in an automatic washer employing 3/4 cup of a commercial laundry detergent (available under the trade name Tide) in 15 gallons of water at 140° F. The fabric also withstood dry-cleaning in a cleaning fluid formed of three gallons of carbon tetrachloride, one ounce of water, and 4.5 grams of the sodium salt of dicyclopentadiene. The dry-cleaning was effected in a portable agitator-type washer for a period of 30 minutes.

The bonded fabric was also bleached and scourerd according to the AATCC test for “damage caused by retained chlorine” (69–1958). No discoloration of the fabric occurred as a result of this treatment.

**Example 2**

A solution is prepared of four parts of sodium lauryl sulfate in 100 parts of water. A mixture of 32 parts of ethyl acrylate and 59.5 parts of vinylidene chloride is added with stirring to the solution. The resulting mixture is cooled to 18° C. A solution of 0.2 part of ammonium persulfate in three parts of water is then added, followed by the addition of 0.25 part of sodium hydrosulfite in three parts of water. Stirring is continued throughout the reaction. In a short time, the temperature of the mixture begins to rise and continues to rise to 40° C., where it is maintained with the aid of an ice bath. At the end of the reaction, the product is cooled to 18° C. It is then adjusted to a pH of 9.5 with ammonium hydroxide. The testing of the latex is shown in Example 4.

**Example 3**

A solution is prepared of 3.5 parts of the sodium salt of dioctyl sulfosuccinic acid in 150 parts of water. A mixture of 32 parts of ethyl acrylate and 33.9 parts of vinylidene chloride is added with stirring to the solution. The resulting mixture is then cooled to 17° C. A solution of 0.15 part of ammonium persulfate in two parts of water is then added, followed by the addition of 0.2 part of sodium hydrosulfite in four parts of water. Stirring is continued throughout the reaction. In a short time, the temperature of the mixture begins to rise and continues to rise to 40° C., where it is maintained with the aid of an ice bath. At the end of the exothermic reaction, the reaction mixture is cooled to 25° C. and 32 parts of vinylidene chloride are slowly added to the reaction mixture over a period of 25 minutes to effect grafting of this latter portion of vinylidene chloride on to the initially-formed copolymer. At the end of this time, 0.1 part of ammonium persulfate in two parts of water and 0.12 part of sodium metabsulfite in three parts of water are added to the reaction mixture. After completion of the reaction, the pH is adjusted to 8.5 with triethylamine. The testing of the material is shown in Example 4.

**Example 4**

To about 143 gms. of a aqueous latex of natural rubber containing 70% rubber solids are added 0.5 gms. KOH, 1 gms. sodium diocyl succinate, 1.6 gms. 2,2-methylene-bis (4-ethyl, 6-tertiary butyphenol) as an antioxidant, 0.26 gms. BaSO₄, 0.18 gms. butyl zimate, 0.83 gms. zinc-2-mercaptobenzothiazole, 1.7 gms. of sulfur, 3 gms. zinc oxide, and 0.1 gms. sodium sulfide. After thorough mixing, the latex was diluted with H₂O to give 60% solids.

The latexes of Examples 2–4 are each applied to a stretch nylon fabric (Helanca), and the impregnated fabrics are lightly squeezed to remove any excess elastomer. The impregnated fabrics are cured in a circulating air oven for 15 minutes, care being taken to maintain the fabric in an almost completely relaxed state during both immersion and cure. The resulting fabric has both increased crispiness and stretch, as well as excellent modulus in all directions. Further, the resulting textiles are completely permeable and without significant alternation in their physical appearance from their appearance prior to impregnation.

**Example 5**

A prepolymer was prepared using a commercial polyether having the trade name D–6 (Rubber Corporation of America). The polyester has a molecular weight of about 3,700, an acid number of about 0.8, a hydroxyl number of about 35, and contains less than 0.1% water. The glycol used to prepare the polyester is a mixture of about 94 ethylene glycol, about 4 isopropylene glycol, and a small amount of triethylene glycol. The polyester is degassed for two hours at 80° C. to 90° C. and 10 mm. of mercury pressure. To 100 parts of this polyester are added about 15 parts of tolylene dicyanate, an 80–20 mixture of 2,4- and 2,6-tolylenedicyanate and about 0.5 part of a tin catalyst (dibutyl tin dilaurate). The mixture is reacted for one hour, while maintaining the temperature at 80° C. to 90° C. to give a prepolymer having about 4% free NCO content. Then, while maintained under a nitrogen blanket, they are stirred in at 80° C. five parts of toluene containing 0.5 part of a commercial ultraviolet absorber (the product tradenamed Timuin P is used), and 0.1 part of a blue dye (trade name Solfast Blue), followed by 590 parts of 1,1,1-trichloroethane. After solution is complete, 7.9 parts of water are emulsified into the solution. A stretch nylon fabric (Helanca) is then immersed in this solution for ten seconds, removed, squeezed lightly to remove excess solution, and cured in a circulating air oven at about 120° C. for 12 minutes. The fabric is then maintained in a relaxed state during impregnation and cure. There is obtained a textile wherein each individual fiber of the textile is an elastic fiber possessing excellent modulus. Moreover, when the fabric is stretched to maximum elongation, there is no loss in strength at such maximum elongation. The fabric is completely breathable and is not appreciably changed.
in physical appearance from its appearance prior to impregnation.

If desired, the pickup of the elastomer from the emulsions or dispersions may be improved in some cases by the use of a cationic agent, preferably as the emulsifier or dispersing agent. These and other modifications of the process will be apparent to those skilled in the art.

By carrying out the impregnating and curing steps on the textile rather than on the separate yarns prior to weaving and knitting, the problem of maintaining the stretch yarns in a relaxed condition during such treatment is tremendously simplified. Further, the instant invention permits the weaving or knitting steps to be carried out on the stretch yarn while the yarns are still in a “nonelastic” state, i.e., having little modulus. This permits faster and easier operation of conventional textile machinery. While the impregnating and curing steps illustrated above are carried out on the textile in a substantially relaxed condition (i.e., only that tension necessary to control the continuous feed of the fabric), it is understood that tension may be applied to selected portions of the impregnated fabric, which tension is maintained during the curing operation to produce a product having variable modulus. Such a process is exemplified above in the molding process for producing a bathing suit. Thus, the process is applicable to textiles which are either substantially relaxed or which have tension applied only to selected areas thereof.

What is claimed is:

A garment possessing high modulus, the degree of modulus varying across the garment, said garment being free from seams other than selvedge edges, said garment comprising a tubular knit fabric prepared from a stretch yarn, each yarn being coated with a thin elastomeric coating conforming to the individual yarns, the interstices between said yarns being unfilled by said coating to preserve substantially all of the natural interstices between said yarns, said elastomer having been cured while varying tension is applied to the fabric comprising said garment.

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