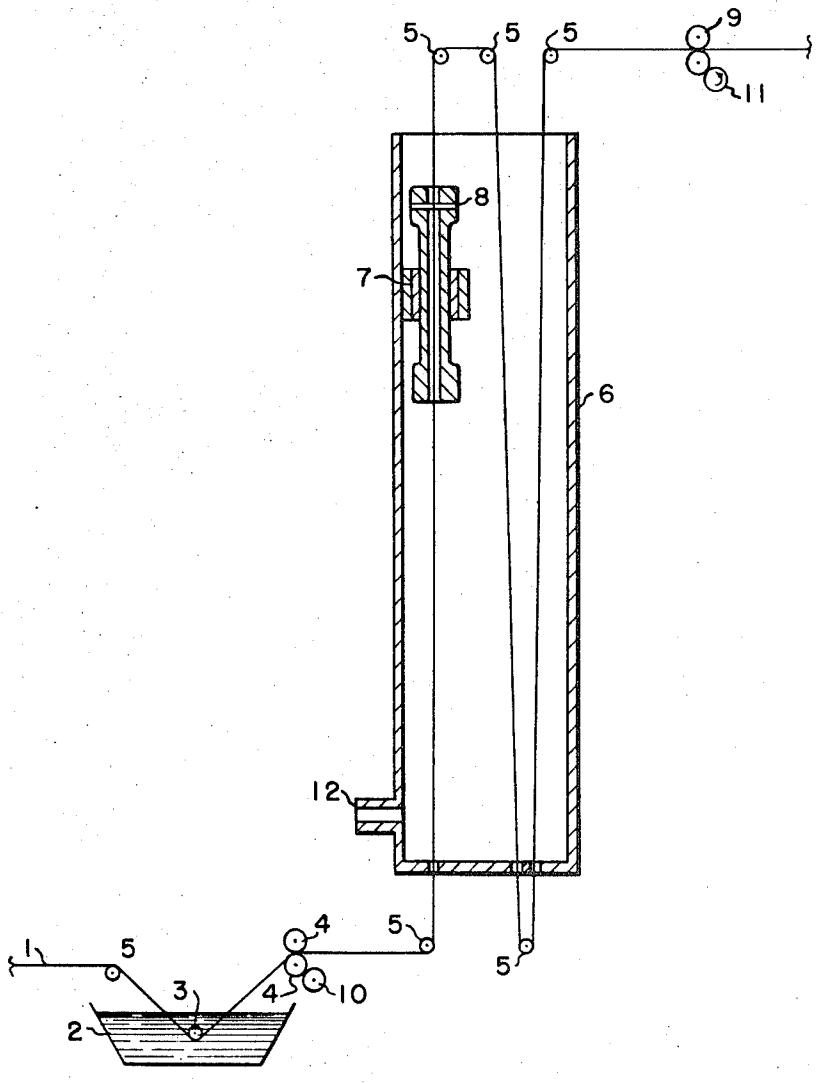
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SIZED TWISTLESS YARNS

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SIZED TWISTLESS YARNS

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ABSTRACT OF THE DISCLOSURE

A twistless yarn containing at least some fibers having interlocking characteristics is described. The yarn is sized with a sizing agent comprising a frictioning agent, a binding agent and, optionally, an insolubilizing agent. An example of a frictioning agent is colloidal silica.

This application is a division of copending application Ser. No. 596,657 filed Nov. 23, 1966 now U.S. Patent 3,512,232, which in turn is a continuation of abandoned application Ser. No. 250,320 filed Jan. 9, 1963.

This invention relates to a process for the preparation of twistless yarn and more specifically to a method for the preparation of twistless yarn from fibers having interlocking characteristics and to fabrics produced from such yarns.

Because of the great expense involved in each turn of twist imparted to a yarn, efforts have been made to prepare yarns with reduced twist or preferably zero twist. Zero twist yarns produced from broken bundles of synthetic continuous filaments have been disclosed in U.S. Patent No. 2,946,181. Zero twist yarns produced from synthetic and naturally occurring vegetable staple fibers have been disclosed in U.S. Patent No. 2,689,813. Zero twist or twistless yarn such as disclosed in the aforementioned patents is, however, lacking in strength. Lack of strength in the broken bundles of twistless synthetic monofilaments and in synthetic and naturally occurring vegetable staple fibers is due in part to the nature of the fibers. While producing a crimp in a fiber will promote interfiber cohesion, fibers having no surface characteristics in and of themselves which will promote an interlocking action have, in the absence of twist, little strength.

One class of naturally occurring fiber and more specifically the class consisting of wool and wool-like fibers has certain surface characteristics which promote interfiber bonding even in the absence of twisting. Wool and wool-like fibers which include rabbit fur, llama, camel hair, mohair, alpaca, vicuna and guanaco have outside surfaces made up of flat irregular horny cells or scales. The scales overlap, not unlike the shingles of a roof with the free end projecting outward and pointed toward the tip of the hair. When one wool or wool-like fiber is moved against another, a friction is set up. As might be expected from the existence and orientation of the scales, this friction is directional, being greatest when the fibers are being moved with the tip end leading. The ability of wool or wool-like fibers to interlock is known as the directional friction effect.

In addition to the ability of wool or wool-like fibers to interlock, it should be noted that wool or wool-like textile materials have great value for their ornamental properties and are often useful in fields where exceedingly high strength is not a prerequisite to their usage. Woven felt for instance, because of its fine finish, uniform thickness and frictional qualtities finds application as coverings for tennis balls, filtering cloths, and cushioning elements for

devices such as pianos and typewriters. Woolen fabrics with soft hand and high nap are also desirable for the manufacture of two ply fabric of the type used in the manufacture of sports clothing. The two ply fabrics of this type may have both plies of fabric material or may have one woolen ply backed with a ply consisting of a polymeric resin sheet material.

It is therefore an object of this invention to provide a method for the preparation of a twistless yarn, from fibers having interlocking characteristics, which has sufficient strength to produce a commercial fabric.

It is another object of this invention to provide a method for the preparation of a sized twistless woolen yarn which has sufficient strength to produce a commercial fabric.

It is still another object of this invention to prepare a fabric from a twistless woolen yarn and subject the fabric to a post weaving operation which will result in a greatly strengthened product.

In accordance with this invention it has now been discovered that it is possible to impart unexpected amounts of strength to a twistless yarn containing at least some fibers having the ability to interlock by sizing the yarn with a sizing composition containing an adhesive agent and preferably a sizing composition comprising an adhesive agent and a frictioning agent. It should be understood that while some wool or wool-like fibers having the ability to interlock must be present, that blends of synthetic and vegetable fibers with the wool or wool-like fibers are also within the scope of this invention.

Where an exceptionally soft fabric is desired, the sizing composition employed should be a water-soluble sizing composition. The water-soluble sizing composition will provide the strength necessary to weave the twistless yarn, but will be easily removable by washing operations once the fabric is formed. The fabric which is free of sizing composition will therefore be a fuller and softer fabric. Where, however, fabric strength is of greater importance than softness and fullness, a water-insoluble sizing composition or a composition which is capable of being insolubilized should be employed.

The frictioning agent is preferably a frictioning agent of the colloidal silica type. The adhesive agent may be an adhesive agent such as, for instance, gelatin, egg albumin, vinyl alcohol-vinyl acetate copolymer. In addition to the frictioning agent and adhesive agent components of the sizing composition, the sizing composition may contain insolubilizing agents for fixing larger amounts of sizing compound in the finished product. Without the presence of an insolubilizing agent, substantially all of the sizing composition is removed from the fabric in finishing operations. The insolubilizing agent may be an agent, such as, for instance formaldehyde or a formaldehyde donor such as $MeOMe_2$ hydantoin (methoxy dimethyl hydantoin).

The following specific examples of sizing compositions are given for purposes of illustration and should not be considered as limiting the spirit or scope of this invention. The individual components of the various sizing compositions are given in percent by weight.

EXAMPLE I (REMOVABLE SIZING COMPOSITION)

	Percent
Gelatin	12.0
Glycerol	1.9
Surfonic N–95 (nonyl phenyl polyoxyethylene glycol ether having 9.5 ethoxide groups marketed by Jefferson Chemical Co.)	0.1
Water	86.0

EXAMPLE II (REMOVABLE SIZING COMPOSITION)

	Percent
Gelatin	12.0
Glycerol	1.8
Syton DS (colloidal dispersion of 30% SiO in water marketed by Monsanto Chemical Co.)	1.3
Surfonic N–95 (nonyl phenyl polyoxyethylene glycol ether having 9.5 ethoxide groups marketed by Jefferson Chemical Co.)	0.1
Water	84.8

EXAMPLE III (REMOVABLE SIZING COMPOSITION)

Egg albumin	12.0
Cellulose methyl ether (0.5% water solution having a viscosity of 400 cps.)	1.8
Syton DS (colloidal dispersion of 30% SiO_2 in water marketed by Monsanto Chemical Co.)	1.3
Surfonic N–95 (nonyl phenyl polyoxyethylene glycol ether having 9.5 ethoxide groups marketed by Jefferson Chemical Co.)	0.1
Water	84.8

EXAMPLE IV (PERMANENT SIZING COMPOSITION)

Elvanol 51–05 (polyvinyl alcohol-polyvinyl acetate copolymer marketed by E. I. du Pont de Nemours & Co.)	12.0
$MeOMe_2$ hydantoin	1.8
Syton DS (colloidal dispersion of 30% SiO_2 in water marketed by Monsanto Chemical Co.)	1.3
Surfonic N–95 (nonyl phenyl polyoxyethylene glycol ether having 9.5 ethoxide groups marketed by Jefferson Chemical Co.)	0.1
Water	84.8

EXAMPLE V (PERMANENT SIZING COMPOSITION)

Gelatin	12.0
Glycerol	0.75
$MeOMe_2$ hydantoin	0.15
Syton DS (colloidal dispersion of 30% SiO_2 in water marketed by Monsanto Chemical Co.)	3.3
Water	83.3

The sizing compositions are applied by contacting a running length of sliver or roving with a sizing composition and then passing the sized roving into a heated chimney where the roving is dried simultaneously to being compacted by means of a false twisting operation carried out within the heated chimney. It should be understood that the compacting operation need not be a false twisting operation but may be a compacting operation produced by other means such as, for instance, by passing the sized roving into a reciprocating pair of rollers or a reciprocating pair of apron webs. It also should be understood that the rovings employed are rovings prepared according to the woolen process, that is to say, the rovings in contradistinction to rovings prepared according to the worsted process have fibers which are thoroughly intermingled without regard to direction.

An evaluation of the twistless yarns of this invention was made by comparing sized twistless yarns and more specifically yarns sized with the sizing composition of Example V with a twistless wool yarn which is free of size, the data from the comparison being set forth in the table designated as Table I.

The comparisons were based on determinations of elongation and breaking strength. Elongation may be defined as deformation caused by a tensile force expressed in terms of the original length. Breaking strength may be defined as the ability of yarns to resist rupture by means of tension. The breaking strength is determined by placing a single strand of each yarn being tested into the jaws of an Instron machine. The Instron machine, which is a

constant-rate-of-traverse machine, applies an increasing load to the test strand until the breakage point is reached. The average single strand breaking load is an arithmetic mean of a plurality of breaking tests.

The breaking elongation of the test strand is determined by measuring the specimen at zero load and at break and by applying the following formula:

$$\text{Breaking elongation, percent} = \frac{(\text{length at break-normal gage length}) \times 100}{\text{nominal gage length}}$$

The average breaking elongation percent is again an arithmetic mean of a plurality of breaking tests.

All samples were 87/13 wool/nylon rovings having a denier size of 728.

TABLE I

Sizing composition	Break strength, grams	Average break strength, grams	Percent elongation	Average percent elongation
Unsized	47.0	39.2	27.2	26.5
	38.5		27.4	
	39.0		30.5	
	39.5		27.4	
	32.0		20.2	
Example V	189	180	15.6	16.7
	186		15.6	
	197		22.4	
	181		19.7	
	146		10.5	

As can be seen from the data of Table I, the sized twistless wool yarn of this invention has vastly increased break strength and improved elongation resistance over unsized twistless wool yarn. The improvements obtained by sizing enable the twistless wool yarn to be employed in weaving or knitting operations, the knitting operations being the preferred usage.

After weaving the twistless wool yarn of this invention into a fabric, the fabric is preferably subjected to a fulling operation. The fulling operation involves moisture, friction and heat and is essentially a shrinking process whereby the length and width of the fabric is reduced and whereby the inter-fiber bonding of the fibers having interlocking characteristics is increased. The fulling operation carried out in this invention may be carried out by means of a stock or hammer fulling mill, or by means of a rotary fulling mill. Prior to fulling, the fabric of this invention is subjected to those preparatory treatments common to fulling operations such as tacking and soaping.

A better understanding of the invention may be had from a discussion of the drawings. In the drawing, a roving **1** is passed over guide roll **5** under immersion roll **3** through sizing bath **2** and then into the nip of a pair of idler rolls **4**. The sized roving is then passed around guide roll **5** into chimney **6** which is heated by passing hot air into chimney **6** through pipe **12**. The sized roving is passed through a false twisting device **7** whereby the roving is compacted through a length extending from the nip of idler rolls **4** to the pin member **8** of false twisting device **7**. The compacted yarn is then passed over guide rolls **5** a plurality of times in order to complete the drying of the sized compacted yarn and then passed through an additional pair of idler rolls **9**. Idler rolls **4** and idler rolls **9** are driven by drive rolls **10** and **11** respectively, which are geared in a manner so as to advance the yarn at a uniform speed and thereby prevent any undesirable tension from building up on the yarn.

The twistless yarn produced by the process of this invention may be woven by any of the systems well-known to the art. It is preferred, however, that the twistless yarn be employed as filling yarn in a warp prepared from twisted yarn. The woven fabric may then be desized in the event that a soft, full fabric is desired and is preferably fulled to increase strength by interlocking the fibers of the filling yarns with the fibers of the warp yarns.

The finished fabric has a pleasing appearance and a soft hand and is especially suitable for use in con-

junction with a polyurethane foam sheet. By laminating the fabric of this invention to a polyurethane foam sheet, a product is produced which has high strength and pleasing hand and appearance. While foam backed fabrics are commonly referred to as laminated fabrics, that is, fabrics secured to a preformed sheet of foam material, the foam portion may also be applied by coating the fabric with a foamable composition and then foaming the composition in place.

That which is claimed is:

1. A compacted twistless wool-containing yarn prepared from a roving according to the woolen process and containing at least some fibers having interlocking characteristics, said yarn being sized with a sizing composition oomprising a colloidal silica frictioning agent and an organic adhesive agent.

2. The yarn of claim **1** wherein said sizing composition further comprises a formaldehyde insolubilizing agent.

3. The twistless yarn of claim **1** wherein the organic adhesive agent comprises gelatin, egg albumin or a vinyl alcohol-vinyl acetate copolymer.

4. A woven fabric containing at least some compacted twistless wool-containing yarn prepared from a roving according to the woolen process, said yarn being sized with a sizing composition comprising a colloidal silica frictioning agent and an organic adhesive agent.

5. The woven fabric of claim **4** wherein the organic adhesive agent is gelatin, egg albumin or a vinyl alcohol-vinyl acetate copolymer.

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