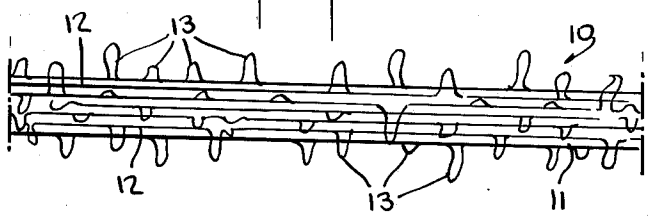
Nov. 13, 1962 A. S. TINGAS 3,063,126

METHOD FOR TREATING CONTINUOUS FILAMENT FABRICS

Filed June 3, 1958

Fig. 1.



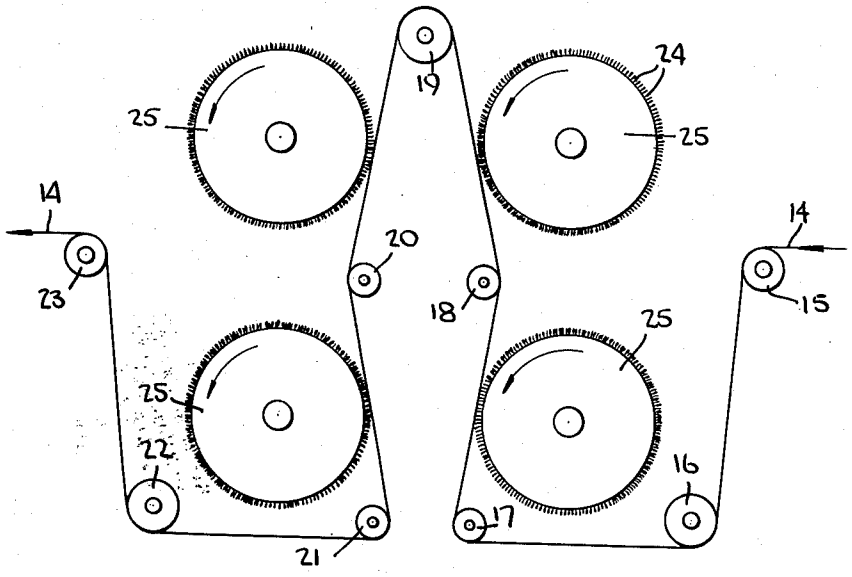


Fig. 2.

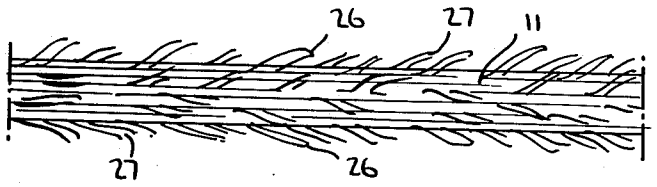


Fig. 3.

United States Patent Office

3,063,126

Patented Nov. 13, 1962

3,063,126

METHOD FOR TREATING CONTINUOUS FILAMENT FABRICS

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Filed June 3, 1958, Ser. No. 739,521

9 Claims. (Cl. 28—72)

The present invention relates to woven fabrics comprising yarns constituted by a plurality of continuous filaments which have been "bulked" so that the continuous filaments of the yarn project from the yarn body at various points along the length of the yarn, these projections being constituted by small loops of individual continuous filaments or by small loops of groups of continuous filaments.

The invention more particularly relates to the modification of woven fabrics of the type described above in order to provide greater cover, improved hand and abrasion resistance, and a soft feel and appearance closely approaching that of fabrics produced from staple fiber. An important feature of the invention is the improvement of cover, hand, feel and appearance as described above without simultaneously encountering loss in tensile strength, tear resistance and wrinkle resistance.

The bulked yarns which may be woven into fabrics and modified in accordance with the invention may be produced in various ways so long as the finished bulked yarn is constituted as described above to possess small loops projecting from the yarn body constituted by a plurality of continuous filaments for in this structure the projecting loops do not substantially contribute to the tensile strength of the yarn and these may be extended or broken significantly to alter the surface characteristics of the yarn without materially modifying the strength of woven fabrics containing these yarns. Desirably, the bulked yarn constituted by a plurality of continuous filaments and having a plurality of small loops projecting from the yarn body at a plurality of points along the length of the yarn is produced by air jet bulking. In air jet bulking the multi-filament yarn is passed into a chamber into which a compressed gas is fed, the yarn and gas leaving the chamber together through a restricted opening which vents to the atmosphere.

In place of air jet bulked yarn, the fabric can be composed of continuous filament yarns bulked, voluminized or textured in any other way which will produce loops projecting from the yarn body capable of being caught by and acted upon by the brushes, such as twisting, setting and untwisting, etc.

In accordance with the present invention, the bulked continuous filament yarn described hereinabove is formed into a fabric by weaving, knitting, felting, or the like and this fabric is then brushed to extend and/or shear many of the loop-like projections which extend from the yarn body. In this manner it has been discovered that the weight, thickness, tensile strength, tear strength and wrinkle resistance of the fabric is not significantly altered. The brushing operation provides a soft feel resembling the feel of wool and the appearance of the product approaches that of fabric produced from staple fiber rather than continuous filament yarn.

In place of brushing, a mild napping operation may be employed to produce substantially the same results as may be achieved by brushing. Accordingly, a mild or gentle nap is intended to fall within the scope of the term "brushing." On the other hand, an extensive napping operation which disrupts the body of the continuous filament yarn is not desired for disruption of the yarn body reduces the ability of the woven fabric to resist tear and

lowers the tensile strength and flex abrasion resistance of the woven fabric.

Brushing in accordance with the invention may be performed on conventional equipment. Some experimental trials are desirable in order to determine the machine settings which will result in the breaking of the projecting filament loops without disrupting the body of the yarn.

Prior to brushing in accordance with the invention the fabric may be treated for the purpose of raising the filament loops on the surface of the fabric. Such pretreatments as compaction or wet processing will relieve the fabric of strain and improve its body, stability and feel. In addition, they facilitate yarn movement and bring more loops to the surface of the fabric.

It is desired to point out that brushing and napping operations are presently used in connection with fabrics constituted by staple fiber. The purpose of this is to raise some of the fiber ends to the surface of the fabric. Continuous filament yarns have substantially no ends, however, and if it were attempted to raise a nap on fabrics formed therefrom it would be necessary to apply considerable force to break the many laterally aligned filaments. Such broken filaments would cease to contribute to load bearing and the tensile strength of the fabric would be decreased markedly. Brushing of fabrics of ordinary continuous filament yarns is thus commercially impractical. In the fabrics produced in accordance with the present invention the load is borne by the body of the yarn, i.e. by the relatively straight lengths of the filaments, and not by the looped portions of the filaments. Consequently when the loops are cut to form ends the strength of the fabric is not diminished and brushing is thus rendered practical.

The invention is diagrammatically illustrated in the accompanying drawing in which:

FIG. 1 is a diagrammatic elevation illustrating a bulked continuous filament yarn having projecting filament loops which is adapted for treatment in accordance with the invention;

FIG. 2 is a schematic view illustrating the treatment of a woven fabric constituted by warp and fill yarn having the structure shown in FIG. 1 and illustrating the brushing of this woven fabric to produce improved softness, hand, and appearance without sacrificing tensile strength and tear strength in accordance with the invention; and

FIG. 3 is a view similar to FIG. 1 and illustrating the appearance of the yarn of FIG. 1 after the same has been brushed in the form of a woven fabric in the manner indicated in FIG. 2.

Referring more particularly to the drawings, there will be seen in FIG. 1 a bulked continuous filament single yarn generally identified by the numeral **10**, the yarn **10** comprising a yarn body **11**, constituted by continuous filaments **12**. The filaments **12** project from the yarn body **11** at spaced apart points along the length of the yarn **10** in the form of small loops identified by the numeral **13**.

As will be evident, the tensile strength of the yarn **10** is governed by the physical characteristics of the yarn body **11**, the yarn loops **13** not contributing in any significant degree to this tensile strength.

After the yarn shown in FIG. 1 has been put into a woven or knit fabric, the resulting fabric may be brushed as is diagrammatically illustrated in FIG. 2 in order to provide the improved continuous filament fabrics of the invention. As will be seen in FIG. 2 woven fabric **14** comprising the yarn of FIG. 1 is pulled along in the direction of the arrows, successively passing about guiding rolls **15** to **23**, inclusive. Between adjacent guiding rolls **17** to **21** the face of the fabric **14** contacts the brushes or bristles **24** which project from brushing rolls **25**, these

rolls being rotated in direction such that the direction of movement of the brushes 24 is opposite that of the fabric where they come in contact. If desired the fabric can be turned and again sent through the apparatus to brush the other side or another bank of brushing rolls can be positioned to act on the other surface in sequence.

A suitable brushing device comprises a Parks Woolson brushing machine provided with nylon brushes. On the other hand, it is feasible to employ other brushing equipment and even napping equipment so long as the brushing force is maintained at a level sufficient to extend and shear the yarn loops 13 without disrupting the yarn body 11.

The yarn modification which is achieved in accordance with the invention will be evident from FIG. 3 where it will be seen that some of the yarn loops designated as 13 in FIG. 1, have been extended and elongated as indicated by the numeral 26 while other of the yarn loops have been sheared by the brushing operation to provide filament ends 27 projecting from the yarn exterior. It will be observed that the yarn body 11 has not been significantly modified and the interiors of the yarns and of the fabric remain substantially free of filament ends as compared with a yarn or fabric formed of staple fibers wherein filament ends are both within the yarn and fabric. Because of the type of brushing, the majority of the projecting filament ends all project in approximately the same direction although this would differ somewhat if there were employed a flat brush having a rotary motion relative to the fabric surface. Those loops which lay inside the fabric originally and were not pulled to the surface during brushing remain unaffected in their original positions, but obviously along these longitudinal lines of the yarns defining the fabric surface and where the loops have been broken in forming the filament ends there will be relatively fewer loops than in other portions of the yarns.

The following example is given to illustrate this invention further:

EXAMPLE

A cellulose acetate yarn having 7 Z-turns per inch and composed of 80 filaments, total denier of 350, was lubricated and bulked in an air jet in conventional manner. The yarn was plain woven into a fabric using a size comprising per 100 gallons of solution 65 pounds of the sodium salt of styrenemaleic anhydride copolymer and 10 pounds of softener, size being applied in amount to effect about 3.5% pick-up of solids. The fabric had a finished width of 47.75 inches with 50 ends per inch and 48 picks per inch.

A length of the fabric was passed through an apparatus as shown in FIG. 2, provided with four brushes to brush one surface four times. A portion of this fabric was then brushed once on the reverse side.

The following table compares the physical properties of unbrushed fabric with fabric brushed four times on one side only and with fabric brushed four times on one side and once on the other side. The Grab Tensile test is described in ASTMD–39–49 and the Elmendorf Tear test in ASTMD–1424–56T.

Table

	Not Brushed	Brushed	
		4X One Side	4X one, 1X other
Weight in oz./sq. yd	4.58	4.62	4.60
Thickness in mils (3.4 p.s.i.)	13.9	14.9	14.8
Grab Tensile Strength, lbs.:			
Warp	45.5	51.6	53.0
Fill	44.9	44.9	44.3
Elmendorf Tear Strength, lbs.:			
Warp	2.5	2.5	2.5
Fill	2.4	2.3	2.4

In addition to the improvements apparent from the table, the brushed fabrics were softer and smoother in appearance than the unbrushed fabric and had a wool-like feel. Surprisingly, the brushed fabrics were usable in flannel-type construction whereas the unbrushed fabric was not so usable. When tested for wrinkling in the apparatus described in U.S. Patent No. 2,701,962 to Reiner G. Stoll, February 15, 1955 (eight cycles each comprising 2 minutes of wrinkling followed by 2 minutes of hanging out) the performance of the brushed fabric was as good as that of the same fabric before brushing.

As previously indicated, the fabric prior to brushing may be treated for the purpose of raising the yarn loops from the body of the yarn to facilitate the brushing operation. An illustrative compacting procedure is outlined in the Textile Research Journal, vol. 26, pp. 441–7 (1956) and wet finishing can be effected as done with wool on rotary fulling mills.

Generally if brushing of the fabric surface is repeated several times the hairiness and wool-like feel increase. Desirably both surfaces of the fabric are brushed and it is a surprising feature of the invention that if one surface has been brushed several times the second surface will attain the same level of improvement with fewer brushings; even a single brushing of the second surface will achieve a markedly improved hand.

While bulked continuous filament yarn of any chemical composition can be employed, such as superpolyamides, e.g. nylon, linear polyesters such as polyethylene terephthalate, acryonitrile polymers and copolymers, and the like, for certain purposes especially good results are achieved when the yarn is composed of an organic acid ester of cellulose such as secondary cellulose acetate or cellulose triacetate, of rayon (regenerated cellulose), or any other material which gives to the fiber a tenacity of less than about 3 and preferably less than about 1.5 grams per denier. With higher tenacities it becomes difficult to pull out the loops and cut them during brushing without damaging the fabric.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention what I desire to secure by Letters Patent is:

1. The method which comprises brushing a fabric from a bulked yarn constituted by a plurality of continuous filaments, said yarn comprising a longitudinally extending multi-filament body having a plurality of filament loops projecting therefrom, said brushing serving to extend said loops and sever the same without substantially disrupting said yarn body.

2. The method recited in claim 1 in which said fabric is compacted prior to said brushing operation to raise said loops away from said yarn body.

3. The method recited in claim 1 in which said fabric is lightly brushed a plurality of times to insure shearing said loops without substantially disrupting said yarn body.

4. The method recited in claim 1 in which said fabric is brushed on both sides thereof.

5. The method recited in claim 1 in which said fabric is brushed a plurality of times on one surface and only once on its other surface.

6. The method recited in claim 1 in which the tenacity of the filaments of said yarn is less than about 3 grams per denier.

7. The method recited in claim 1 in which the tenacity of the filaments of said yarn is less than about 1.5 grams per denier.

8. The method recited in claim 1 in which said yarn is composed of cellulose acetate.

9. The method which comprises brushing a fabric from a bulked yarn constituted by a plurality of continuous filaments, said yarn comprising a longitudinally extending multi-filament body having a plurality of filament loops projecting therefrom, said brushing serving to extend said loops and sever the same without substantially disrupting

said yarn body, said fabric being wet treated and relaxed prior to said brushing operation to raise said loops away from said yarn body.

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