United States Patent Office

2,743,194

Patented Apr. 24, 1956

2,743,194

SIZING OF TEXTILE YARN

Robert G. Berner and Edgar Dare Bolinger, Stamford, Conn., assignors, by mesne assignments, to Deering Milliken Research Corporation, near Pendleton, S. C., a corporation of Delaware

No Drawing. Application October 21, 1949, Serial No. 122,837

6 Claims. (Cl. 117—139.5)

This invention relates to the sizing of textile yarn and, more particularly, to the sizing of warp and weft yarn prior to weaving with aqueous solutions of partially hydrolyzed polyvinyl acetate.

Weft and warp yarns are frequently sized with solutions of partially hydrolyzed polyvinyl acetate during repackaging in order to improve their weaving properties. However, if the yarn is formed of fibers which have a high absorption of water, difficulties are encountered when aqueous sizing solutions are employed. It is necessary to dry the yarns immediately after sizing, before winding, when aqueous solutions are employed, for after the yarn has been wound on the quill or beam, it swells and stretches while still wet and then after it has been dried, returns to its original diameter but not to its original length. This results in soft quills and warp beams.

It has now been determined that when water-soluble partially hydrolyzed polyvinyl acetate is applied from an aqueous solution containing at least 35% of a water-soluble volatile aliphatic alcohol, there is no need for a separate drying step, for swelling and stretching of weft and warp yarns are inhibited or completely eliminated, while the beneficial results of application of the resin as a sizing agent are not affected.

The aliphatic alcohol should be very soluble in or completely miscible with water and have a boiling point below 100° C., so that it may volatilize at room temperature or be readily removed during drying of the yarn, and may be any of the following: methyl alcohol, ethyl alcohol, isopropyl alcohol, tert-butyl alcohol, and propyl alcohol. Methyl alcohol is preferred because of its low boiling point, which facilitates its dissipation from the yarn, without a separate drying step, and because it is the most compatible with partially hydrolyzed polyvinyl acetate.

The process of the invention is applicable to natural fibers as a class, such as cotton, linen, silk, and wool, and to synthetic fibers as a class, formed of cellulose derivatives such as cellulose acetate, cellulose propionate, and ethyl cellulose, or synthetic resins such as nylon, polyacrylonitrile (Orlon), polyvinyl chloride polymers (Vinyon and Vinyon N), copolymers of vinyl chloride and vinyl acetate, and polyvinylidene chloride (Saran).

Partially hydrolyzed polyvinyl acetate which is completely soluble in water and in a mixture of water and an aliphatic alcohol of the above-mentioned characteristics is contemplated for use in the invention. Polyvinyl acetates having these properties are from 75 to 98% hydrolyzed. Aqueous solutions of these partially hydrolyzed polyvinyl acetates will tolerate a maximum of from about 40% (for the 98% hydrolyzed polyvinyl acetate) to about 85% (for the 75% hydrolyzed polyvinyl acetate) alcohol by weight. Higher amounts of alcohol cause precipitation of resin, or formation of a two-phase resin emulsion. While it is desirable, in order to minimize swelling and stretching of the yarn being treated, to keep the alcohol content of the solution at a maximum, it is, however, essential that the partially hydrolyzed polyvinyl acetate

be completely dissolved, that is, that a true aqueous solution thereof be employed.

Ordinarily, the concentration of partially hydrolyzed polyvinyl acetate in the size solution depends upon a number of factors, including water absorption of the yarn fibers, denier and twist of the yarn, type and pressure of the squeeze rolls, immersion time, temperature and the construction of the fabric to be made therefrom. For treating viscose yarns, aqueous solutions containing 8 to 13% partially hydrolyzed polyvinyl acetate are preferred, while for treating cotton and cellulose acetate yarns, aqueous solutions containing from 5 to 10% partially hydrolyzed polyvinyl acetate are desirable. For treating nylon yarns, from 8 to 15% partially hydrolyzed polyvinyl acetate should be present. Concentrations higher than these increase the tendency of the sized yarns to stick together, while lower concentrations do not materially improve weaving properties.

The following method for preparation of the sizing solutions of the invention is preferred: The hydrolyzed polyvinyl acetate is stirred into water at up to about 30° C., and the water then warmed at 75° C. to 90° C. until solution is complete. As concentrated an aqueous solution as is possible is prepared. Alcohol is then added to this solution until the solution just becomes cloudy, and then sufficient water is added to clear up the cloudiness. The solution is then ready for application to the yarn.

In some cases it is desirable to add a lubricant, such as a small amount of a polyhydric alcohol, for example, ethylene glycol, diethylene glycol, or glycerol, to the sizing solution in order to decrease the coefficient of friction of the sized yarn.

It is usually advisable to apply the sizing solution at about 25° C. and a viscosity of 5 to 10 cps. when a wick applicator is used, or of 35 to 50 cps. when a roll applicator is used. The solutions vary in viscosity with concentration and temperature, however, and, therefore, a temperature which permits use of a solution of the desired viscosity at the concentration necessary should of course be employed.

After weaving, the partially hydrolyzed polyvinyl acetate may readily be removed by immersion of the fabric in hot water, as during the boil-off.

The following examples illustrate the invention:

EXAMPLE I

A single end of cellulose acetate yarn, 150 denier, 40 filament, zero twist, is treated with a solution containing 8.5% of an 88% hydrolyzed polyvinyl acetate, 34% water and 57.5% methyl alcohol at room temperature by a wick applicator during the quilling operation, using tapered butt quills. The yarn is then woven as filling in a satin weave fabric and compared with fabric woven from untreated filling yarn of the same type. Results obtained in actual practice and typical of those to be expected are as follows:

Table I

	Treated		Untreated
Quality:			
B, percent	100	100	
X, do			20.8
XX, do			79.2
Filling Defects—Points/100 yards:			
Broken filaments	4	10	10.9
Broken picks			0.8
Heavy marks			2.5
Jerk backs			7.1
Light marks			1.5
Roped off filling			
Slack picks	2	1	6.9
Strip-backs			8.6
Waste	5	1	10.1
Stretched filling			
Total	11	12	48.4

EXAMPLE II

A single end of viscose crepe yarn, 100 denier, 60 filament, having a twist of 58 turns per inch, Z or S, is treated with a solution containing 11% of an 88% hydrolyzed polyvinyl acetate, 1.1% ethylene glycol, 33% water and 54.9% methyl alcohol, on an applicator attached to a Universal #90 winder, in which each yarn is drawn through individual grooves on a roll rotating in a bath of the treating solution. The amount of resin picked up by the yarn is determined by the speed of the roll, which is set at 14 r. p. m. The applicator is well shielded to prevent undue evaporation of methyl alcohol. The yarn may then be woven as weft to form a plain weave fabric.

Quills wound from this yarn were observed to be hard and firm, and the yarn had no tendency to jump off the quill during unwinding.

EXAMPLE III

A single end of tissue faille viscose yarn, 100 denier, 60 filament, a twist of 52 turns per inch, Z or S, 2 ply, is treated by means of the roll applicator of Example II with a bath containing 11% of an 88% hydrolyzed polyvinyl acetate, 1.1% ethylene glycol, 33% water and 54.9% methyl alcohol. The solution has a viscosity of 40 cp., using a Zahn No. 2 cup. Application to the yarn is made at a roll speed of 14 to 25 r. p. m. The yarn is then woven as weft in a plain weave fabric.

Quills wound from this yarn were hard and firm, and the yarn thereon displayed no noticeable liveliness.

EXAMPLE IV

A warp of cellulose acetate yarn, 75 denier, 24 filament, zero twist, is treated with a solution containing 8.5% of a 98% hydrolyzed polyvinyl acetate, 56.5% water and 35% methyl alcohol, by a wick applicator. Each yarn is drawn across the wick individually, and the amount of resin solution picked up by the yarn is determined by the speed of the warp beam. The applicator is well shielded to prevent undue evaporation of methyl alcohol. The yarn is allowed to dry at room temperature on the warp beam. The yarn may then be woven as warp to form a plain weave fabric.

The warp beam wound from this yarn was observed to be hard and firm.

EXAMPLE V

A single end of viscose crepe yarn, 100 denier, 40 filament, a twist of 52 turns per inch, Z or S, 2 ply, are treated by means of the roll applicator of Example II with a bath containing 11% of a 75% hydrolyzed polyvinyl acetate, 1.1% ethylene glycol, 17.9% water and 70% methyl alcohol. Application to the yarn is made at a roll speed of 14 to 25 r. p. m. The yarn is then woven as weft or warp in a plain weave fabric.

Quills wound from this yarn are hard and firm, and the yarn thereon displays no noticeable liveliness.

The process of the invention, in addition to preventing soft quills or warp beams, also kills the liveliness of crepe yarns, and eliminates effectively their tendency to jump off quills. Also, it makes possible the weaving of zero-twist yarn as warp or weft, because by adhering the filaments together, it prevents strip backs.

In the specification and claims, all parts and percentages are by weight.

The following is claimed:

1. In a process of sizing yarn, the improvement which comprises impregnating said yarn with an aqueous solution of a water-soluble, partially hydrolyzed polyvinyl acetate containing at least 35 per cent of a water-soluble, volatile aliphatic alcohol whereby said yarn may be collected without subjecting the same to a high temperature drying operation.

2. The process of sizing textile yarn which comprises impregnating a moving strand of such yarn with an aqueous solution of a water soluble, partially hydrolyzed polyvinyl acetate containing substantially a maximum quantity of a water soluble, volatile aliphatic alcohol and immediately thereafter collecting said yarn without drying the same.

3. In a process of sizing yarn, the improvement which comprises impregnating said yarn with an aqueous solution containing from about 8 to 15% of a water soluble, partially hydrolyzed polyvinyl acetate and containing at least 35% of a water soluble, volatile, aliphatic alcohol, and collecting the yarn immediately thereafter without drying.

4. The method of claim 3 wherein the water soluble aliphatic alcohol is methyl alcohol.

5. The method of claim 4 wherein the aqueous solution contains from 40 to 85% methyl alcohol and the polyvinyl acetate is from about 75 to 98% hydrolyzed.

6. The method of claim 5 wherein the yarn comprises viscose rayon.

References Cited in the file of this patent

UNITED STATES PATENTS

2,133,125	Voss et al.	Oct. 11, 1938
2,184,600	Knup et al.	Dec. 26, 1939
2,300,074	Strain	Oct. 27, 1942
2,385,920	Jenkins	Oct. 2, 1945
2,413,931	Stamatoff	Jan. 7, 1947
2,417,885	Powell et al.	Mar. 25, 1947
2,418,927	Freund	Apr. 15, 1947
2,421,122	Haefele	May 7, 1947
2,449,812	Hervey et al.	Sept. 21, 1948
2,468,345	Porter	Apr. 26, 1949

FOREIGN PATENTS

346,267	Great Britain	Aug. 26, 1930
397,711	Great Britain	Aug. 31, 1933

OTHER REFERENCES

"Elvanol" published by Du Pont, 1947.