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PROCESS FOR INCREASING THE TRANSPARENCY OF FABRICS CONTAINING FILAMENT YARNS

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4 Claims. (Cl. 117—65)

This invention relates to novel fabrics which are composed at least in part of multifilament yarns, the filaments of which are at least partially bonded with a transparent, film-forming, water-insoluble thermoplastic resin.

It has heretofore been the practice to size filamentous yarns with special starches or gelatin in order to facilitate the weaving of the yarns into fabrics. After the weaving operation it has been the usual practice to wash out the gelatin or remove the starch, even though the harshness of the sized yarn may have been lessened by mechanical action during weaving. If woven cloth is not desired, it becomes hard and stiff when wet and subsequently dried. Furthermore the presence of such sizes in filamentous fabric dulls the color of dyes, increases opacity, and generally yields a less attractive fabric than an unsized one.

Replacement of starch or gelatin sizes with certain resinous materials has been proposed. While certain properties of the resulting cloth may thus be rendered more permanent, the general appearance of the cloth has not been altered thereby or the general character of the fabric changed except with regard to such qualities as handle or resistance to crushing.

It is now found that novel fabrics result from sizing multifilament yarn with an aqueous dispersion of certain thermoplastic resins as will herein be described, incorporating the sized yarn into a fabric, wetting the fabric with water, and drying by heating the wet fabric without subjecting the resin-impregnated yarn to tension. The resulting fabric possesses unique properties as to both handle and appearance and may be best described as semi-transparent. It exhibits excellent draping qualities.

In the manufacture of yarn to be impregnated there may be used any type of filament, such as that prepared from viscose, cuprammonium cellulose, cellulose esters, glass, vinyl resins, oriented diamine-dicarboxylic acid resins, etc. Yarn composed of multifilaments is preferably used for the warp, but the invention is not so limited, as it may be used for filling or for both warp and filling. When impregnated multifilament yarn is used for warp, the filling may consist of unimpregnated yarn of the same type of material, or of a different type of material, including cotton, silk, linen, wool, or the like. Similarly, these other types may compose the warp threads while the filling threads represent the impregnated yarns. It should be noted that the filamentous yarns may be composed of several kinds of filaments.

Thermoplastic resins which are useful are not confined to any single kind of resin, but may be selected from such types as the acrylic, alkacrylic, vinyl and other thermoplastic resins

and their co-polymers or thermoplastic resinous compositions containing these substances. The suitable thermoplastic resins are more accurately defined by the properties which are essential for their utilization in this invention. Thus, for use in this invention the resinous composition must possess a relatively low softening point. Effective compositions have a softening point below about 100° F. and yet remain amorphous solids.

The suitability of the resinous composition, it has been established, depends further upon a property which may be described as the "fluxing point." This is the temperature at which the thermoplastic resin will adhere to a smooth surface. It may be determined by slowly raising the temperature of a small light plate of metal while a piece of the resin is repeatedly raised and lowered onto the metal plate. At the fluxing point the metal plate will firmly adhere to the piece of resin. The temperature at which this phenomenon is observed may be easily determined with the simplest of apparatus within $\pm 5^\circ$ F. Thermoplastic resins or resinous compositions having fluxing points within the range of 100° F. and 250° F. have been found effective in producing the desired finish in textile fabrics.

Various water-insoluble thermoplastic resins may be prepared meeting the defined conditions by controlling the degree of polymerization. Furthermore, the necessary conditions as to softening point and fluxing point may be attained by the use of softeners or plasticizers. Plasticized resins are often permissible if due regard be given the possible use to which the particular finished fabric is to be put and the question of absorption of plasticizer by fibers or their loss in cleaning solutions likely to be used upon the fabric.

The water-insoluble thermoplastic resin is applied to the yarn from an aqueous emulsion or dispersion prepared with a wetting agent, emulsifying agent, and/or protective colloid. In preparing an emulsion the resin may, if desired, be first taken up with a small amount of an organic solvent. The dispersions may also be modified with lubricants such as oils or waxes. The dispersions used for the impregnation of filamentous yarn may contain up to 25% of the dispersed material and from about 2% to about 15% of thermoplastic resin may be deposited on the yarn.

The preparation of fabrics according to this invention is illustrated by the following examples.

Example 1

Black dyed viscose rayon yarn of 100 denier and 40 filaments was passed through a size box containing a dispersion prepared with 8% of a mixture of 85 parts of ethyl acrylate and 15 parts of acrylonitrile which had been emulsified with

octadecyl dimethyl benzyl ammonium bromide and polymerized with a peroxide catalyst. The dispersed resin had a softening point at approximately room temperature and a fluxing point of 120° F. The impregnated yarn was dried as it was passed over five steam-heated drying cylinders at such a rate that the moisture content of the yarn leaving the cylinders was 5%. The dry yarn was wound on a loom beam and used for the warp of an all viscous rayon fabric in which the filling consisted of black-dyed, unsized 100 denier, 40 filament viscose yarn. During the weaving operation there was no breaking of filaments. Consequently there was freedom from "balling-up" and breakage of yarn or end breakage. In this respect the resin sizing of the yarn was distinctly superior to the sizing obtained with starch, gelatin or other protein. The fabric which was thus woven was padded through water and dried without warp tension in a frame operating at about 250° F.

The resulting fabric was semi-transparent, flexible, bright-colored, full and mellow. When rubbed between the fingers, there was no distortion of the construction whereas a similar gelatin-sized fabric showed considerable displacement of the yarns. The interstices were free of extraneous material whereas fabrics with gelatin-sized yarns showed filling of these areas. The gelatin-sized fabric had an abrasion-resistance by the T. B. L. test of 887 cycles and the resin-sized fabric of over 1300. The breaking strength of the resin-sized warp was 102 lbs. whereas the breaking strength of warp which had been sized with gelatin was 91 lbs.

Example 2

A sizing bath was prepared by mixing 7 parts of a dispersion containing 30% of a co-polymer made from 10 parts of acrylonitrile and 90 parts of ethyl acrylate which were mixed as monomers, emulsified with soap, and polymerized by heating with a peroxide, 5 parts of a 50% aqueous dispersion of a co-polymer prepared from a mixture of 25 parts of ethyl acrylate and 75 parts of vinyl acetate which was emulsified with octyl phenoxyethoxyethoxy sodium sulfonate and polymerized by heating, one-half part of a "self-emulsifying" light petroleum oil, and 60 parts of water. The softening point of the resinous materials was determined as about 70° F. and the fluxing point as 110° F.

This sizing bath was applied to a web of blue-dyed bright 150 denier 50 filament rayon yarn (cuprammonium) on a slasher (Johnson) and dried on steam-heated cans. The sized warp was woven into a fabric with unsized yarn of the same sort. In the weaving of the fabric no difficulty was experienced from balling-up or breakage. The woven fabric was then wet out with atomized water and dried on a stack of motor-driven steam-heated cans without tension.

The resulting fabric was exceptionally sheer in appearance, semi-transparent, full and mellow, free from distortions, and improved in strength.

Example 3

A sizing bath was prepared by mixing 8 parts of a 30% aqueous dispersion of a co-polymer made from 70 parts of ethyl methacrylate, 30 parts of methyl acrylate and one part of octylphenoxyethoxyethoxy ethyl sodium sulfonate, 2 parts of a 25% aqueous dispersion of a co-polymer made from 90 parts of ethyl acrylate and 10

parts of acrylonitrile with one part of the above wetting agent, one-half part of the hydroxybenzyl dimethylamine salt of octylphenoxyethyl sulfate, and 70 parts of water. The co-polymer of ethyl methacrylate and methyl acrylate had a softening point of 95° F. and a fluxing point of 230° F., while the copolymer of ethyl acrylate and acrylonitrile had a softening point below room temperature and a fluxing point of 110° F.

The sizing bath was applied to a web consisting of 125 denier 30 filament yarns by immersing in a size box and dressing between rollers. The web was then passed through a hot air dryer and wound on a loom beam. The sized yarn was woven into a lining fabric with a filling consisting of the same original yarn, which had been impregnated in a bath containing a dispersion of 2% of the same co-polymer of ethyl acrylate and acrylonitrile as used above and 1% of a self-emulsifying petroleum oil. The woven fabric was padded through water and dried on a frame at 260° F. and wound on a roll.

The fabric was crisp yet flexible, very smooth, sheer and semi-transparent. The porosity of this fabric is particularly adapted for cool linings in summer garments.

I claim:

1. The process of preparing a novel fabric containing multifilament yarn which comprises sizing multifilament yarn with an aqueous dispersion of a co-polymer of an acrylic acid ester and acrylonitrile having a softening point below 100° F. and a fluxing point between about 100° F. and about 250° F., preparing a fabric with the sized yarn, wetting the fabric with water, and drying the wet fabric by heating above the fluxing point of the said resin without subjecting the resin-impregnated yarn to tension.

2. The process of preparing a novel fabric containing a regenerated cellulose multifilament yarn which comprises sizing multifilament yarn with an aqueous dispersion of a co-polymer of an acrylic acid ester and acrylonitrile having a softening point below 100° F. and a fluxing point between about 100° F. and about 250° F., preparing a fabric with the sized yarn, wetting the fabric with water, and drying the wet fabric by heating above the fluxing point of the said resin without subjecting the resin-impregnated yarn to tension.

3. A porous, semi-transparent, flexible, mellow fabric free from distortion when rubbed between the fingers and having interstices free of resins, the warp of which consists of multifilament yarn of regenerated cellulose, the filaments of which are bonded with and carry about 2% to about 15% of a co-polymer of an acrylic acid ester and acrylonitrile having a softening point below 100° F. and a fluxing point between about 100° F. and about 250° F.

4. In the process of preparing a porous, semi-transparent, flexible, mellow fabric which has interstices free from resins and which is made with regenerated cellulose multifilament yarns sized with an aqueous dispersion of a copolymer of an acrylic acid ester and acrylonitrile having a softening point below 100° F. and a fluxing point between about 100° F. and about 250° F., the steps which comprise wetting with water a fabric made with said sized yarns and drying the wet fabric by heating above the fluxing point of said resin without subjecting the resin-impregnated yarns to tension.

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CERTIFICATE OF CORRECTION.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 14, for the word "desired" read --desized--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of June, A. D. 1945.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.