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## CRISP SHEER FABRICS AND PROCESS OF MAKING SAME

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This invention relates to the treatment of cellulosic materials, such as cotton, ramie, jute, hemp, linen, artificial silk and the like, for example in the form of fabrics or yarns, also to mixed fabrics and yarns. The invention, however, is particularly applicable to cotton fabrics. More particularly, the invention is concerned with the provision of crisp, sheer fabrics whose desirable properties obtain after repeated laundry washings.

Crisp, thin cotton fabrics have been in demand from time to time according to the styles of women's dress. For many years such fabrics have been produced by well known finishing methods, using starch. However, such finishes possess no permanence in that laundry washing completely destroys the crispness and beauty of the finish. The great desirability of making such finishes permanent has led to the development of parchmentizing processes with this end in view. By such parchmentizing processes suitable light weight cotton fabrics may be rendered permanently sheer, transparent and stiff.

Such parchmentizing is, however, accompanied by a number of undesirable features. When a non-uniform fabric, such as a low grade lawn, is treated, the unevenness and imperfections of its yarns are greatly accentuated: thus, treatment with parchmentizing agents is more suitable to relatively expensive, high grade fabrics which possess a good uniformity. Another defect of the parchmentizing process is that it is accomplished only by treatment with high concentrations of mineral acids or certain salts. Such treatment is costly and requires very careful control of such factors as the concentration and temperature of the parchmentizing agents used, the time of treatment, etc. Even using parchmentizing agents under the best conditions of control it has proved impossible to produce with any consistency gradations of finish, e. g., stiffness, transparency, etc., while still maintaining a satisfactory permanency, because of the inherent violent nature of the parchmentizing reaction. The hazards of treating goods with parchmentizing acids are increased by the destructive tendering effects which traces of such acids exert if not very thoroughly removed prior to any drying of the goods in process. Furthermore, special machinery is required for the successful accomplishment of a parchmentizing process. Thus even with experience and good facilities damages to goods undergoing treatment are frequent.

In treating a cotton fabric with strong sulphuric acid, one of three possibilities results, depending mainly upon the concentration of acid employed. With acid of below 103° Tw. there is substantially no effect on the fabric. With acid of between 103° Tw. and 109° Tw. strength there is a wooling effect, yielding a shrunken, soft, full, woolly fabric. With acid of more than 109° Tw. strength a parchmentizing effect is attained. However, at strengths above 120° Tw. the action is so violent that the fabric cannot remain in contact with the acid for any appreciable length of time. Accordingly for practical reasons the parchmentizing attack must be brief and thus it is more or less confined to the peripheral portions of the cellulose fibers and yarns. Because of this parchmentized fabrics, especially when dyed, are prone to develop white streaks when creased, probably due to superficial surface cracking which exposes a less deeply dyed interior. Moreover, at between 109° Tw. and 120° Tw. while accomplishing parchmentization there is small opportunity to vary the degree of effect while still producing a good permanency. Accordingly, the parchmentizing process is very little adapted to variation to yield semi-crisp goods such as lawns.

An object of the present invention is the provision of permanently crisp, sheer effects on fabrics of the types hereinbefore enumerated. Another object of the invention is the provision of permanently crisp, sheer fabrics having improved properties with respect to luster, brilliance and dyeing possibilities. Still another object of the invention is the provision of a process of conferring crisp, sheer effects on fabrics, which process makes possible ready control of the degree of crispness and/or sheerness of the resulting product. A further object is the provision of a process wherein, in obtaining the effects above described, creation of said effects is not at the expense of the original fiber of the fabric. The above and other objects of invention are attained by recourse to the hereinafter described process.

We have discovered that if the fibers of the fabrics or yarns (e. g., cotton fabric or cotton yarn) are sheathed, more or less completely, with regenerated cellulose and the regenerated cellulose sheathing is treated while under tension with caustic soda or other solution of mercerizing strength and properties, a very unusual and unsuspected result is obtained. Mercerizing the regenerated cellulose under tension produces a fabric which possesses sheerness, considerable stiffness and an improved luster and brilliance. These properties are of good permanence in that

they persist substantially unchanged throughout repeated laundry washings. Fabrics so treated may possess a very low residual shrinkage when laundered, which is another unique property of the invention. It is believed that these properties are for the most part the result of the intense action of a swelling and mercerizing agent, such as caustic soda solution, upon the thin membrane of active regenerated cellulose which more or less completely surrounds the taut fabric threads or yarns, whereby the fibers of the yarns are cemented together. Thus the yarns themselves are refined and compacted by the contracting around them while they are in a stretched condition of a smooth, transparent brilliant sheath of rayon-like material. Because in the absence of regenerated cellulose or a similarly reacting material, no novel effect is obtained with the treatment outlined above, it follows that any novel action of the caustic soda solution must be attributed to this reagent's reaction with the regenerated cellulose alone, while the latter is held upon the tightly stretched yarns or fabric. The maintenance of tension while carrying out the mercerization treatment is a necessary element of the new process, since in the absence of tension the resulting product would be "fulled" and shrunken in its entirety, not even as sheer as the starting material, relatively opaque, and otherwise distinct from the crisp, sheer, lustrous product desired.

One of the merits of the present invention is that inexpensive, low-grade fabrics of relatively poor uniformity can be successfully treated because by the present process such defects are rendered almost unnoticeable, a much more uniform and pleasing fabric being produced. Another merit of the present invention is that gradations of finish are easily and consistently producible by controlling the concentration, the temperature and the time of application of the agents employed.

From the foregoing it is readily apparent that our new process does not have the defects of the previously known parchmentizing process. Our product has the advantage of being a relatively low cost fabric of good permanence, having a controlled crispness and sheerness, and desired luster and brilliance. Moreover, it will be appreciated that we positively add cellulose to the goods, and do not create the described effects at the expense of, or out of, the fibers of the original fabric.

The fabrics produced by the present invention may be dyed without difficulty after the manner employed for cotton. The affinity of the treated fabrics for substantive dyestuffs is somewhat greater than that of untreated fabrics. Dyed fabrics produced by the present process are less susceptible to white streaks resulting from the fabric being creased, which creases cannot be removed, than are dyed parchmentized fabrics. Fabrics produced according to the present invention can be readily printed either before or after treating. Pattern effects can be obtained, either with or without colored effects, by first printing a resist or reserve, which may or may not contain a pigment, a mineral, a metal, or the like, and a suitable binder, and then subjecting this prepared fabric to the process as already described. Pattern effects can also be obtained by first giving the fabric the described treatment and then printing on a pigment, mineral, metal, or other opaque substance using a suitable binder such as a cellulose ester or ether lacquer, insoluble resin, or the like.

The examples which follow are to be considered simply as illustrations of a few practical applications of the present invention and in no way to limit the scope of the invention. Numerous other applications and modifications will occur to those skilled in the application of cellulose solutions in textile and kindred arts.

*Example 1*

A light weight lawn, which may or may not have been mercerized, is impregnated in a rolling mangle, with a solution of viscose which has been made according to any well known method. The concentration of the viscose solution is about 6% cellulose and about 8% sodium hydroxide. The impregnated fabric is dried with or without tension and then is immersed in dilute sulphuric acid solution (e. g., 5% $H_2SO_4$) in order to regenerate cellulose. The fabric thereupon is well washed, and then is mercerized, under tension, with 60° Tw. caustic soda solution (i. e., 27% NaOH) at room temperature. Thereafter, the fabric is bleached and finished, finally being dried under tension on a swinging tenter frame.

*Example 2*

A light weight fabric is printed over portions of its surface with a paste prepared from cellulose acetate and titanium oxide and is then subjected to the treatment described in Example 1.

Instead of the cellulose acetate binder, we may employ nitrocellulose or other non-regeneratable cellulosic binder, or casein or albumen. Instead of titanium oxide, the pigment may be fine zinc oxide, or other suitably fine pigment.

The treatment described in this example results in this, that the non-printed portions of the fabric are made crisp and sheer, while the printed portions are opaque (i. e., rendered more nearly opaque than was the original fabric).

*Example 3*

A light weight fabric is printed with a colored design, steamed, washed, and dried and then treated as in Example 1.

Instead of carrying out the steps of the process in the order indicated in Example 3, we have found that the color printing step may well follow the after-mercerization step with substantially equivalent results. In carrying out the color printing step, in either order, we may employ any of the fast cotton dyes, because (1) in the case where color printing is followed by cellulose sheathing and mercerization, the dye is not subjected to destructive treatment, whereas (2) in the case where color printing follows the after-mercerization the goods are in a sufficiently receptive condition to receive the color paste.

It will be realized that without departing from the spirit of the invention, other soluble modifications of cellulose may be employed, from which cellulose may be regenerated, provided that they cooperate to produce some of the novel effects of the invention. In the case of viscose, various fixing baths known to the art may be employed. Various additions may be made to the viscose or other soluble modifications of cellulose, such as softeners, plasticizers, fillers, pigments, dyestuffs, and the like. In place of caustic soda other mercerizing agents having a similar action upon the regenerated cellulose may be employed.

While we prefer to use as starting material a

fabric (or yarn) which has undergone a mercerization treatment—because of the fact that thereby the final product is given a somewhat more sheer, rich and beautiful appearance—it remains that the carrying out of the above-described process on a non-mercerized fabric is productive of a crisp, sheer product of an appearance very closely similar in every respect to that obtained when using a mercerized starting material.

By the expression "under tension" appearing in the foregoing description and in the appended claims we mean being held taut whereby to be maintained at the same, or at substantially the same, transverse and/or longitudinal dimensions.

We claim:

1. A mercerized textile material comprising yarns of fibrous material including cellulosic fibers, said yarns and fibers being transaxially, but substantially not longitudinally, consolidated by sheathings of added cellulosic material derived in situ from cellulose xanthate, said yarns and fibers being otherwise physically unaltered and said cellulosic sheathings being mercerized.

2. A sheer fabric comprising cellulose fibrous material, fibers of the yarns of which are held together and coated by sheathings of cellulose regenerated from cellulose xanthate, the said sheathings being contracted over the fibers and the latter being consolidated into yarns which are characterized by being durably crisp, compact, smooth, lustrous and of less than their original apparent diameters.

3. A fabric as defined in claim 2, characterized in that in areas thereof portions of the yarns are softer, relatively more opaque and fuller than are yarns in other areas thereof.

4. A fabric as defined in claim 2, characterized in that areas thereof are pigmented.

5. Process of improving a textile composed of woven yarns of fibrous material, which comprises sheathing the fibers of the yarns with cellulose regenerated in situ from cellulose xanthate, and subjecting the so-sheathed product to mercerization treatment while the same is under tension.

6. Process of improving a textile composed of woven yarns of fibrous material including cellulosic fibrous material, which comprises impregnating the yarns of the textile with a solution of cellulose xanthate, regenerating the cellulose in and on the yarns, and mercerizing the resulting sheathing of regenerated cellulose while the textile is maintained under tension.

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