Dec. 16, 1969 H. W. FUHR 3,484,332

SHRINK-PROOF CELLULOSIC FABRIC

Original Filed July 5, 1960

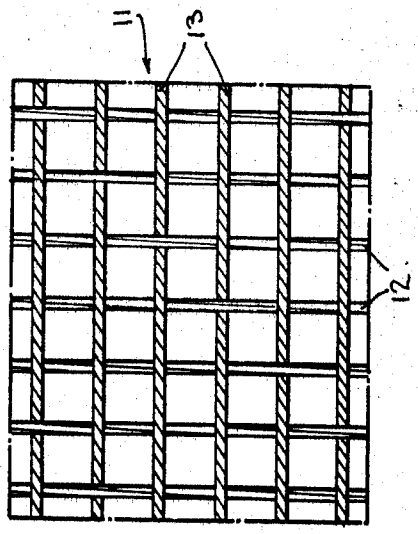

Fig. 1.

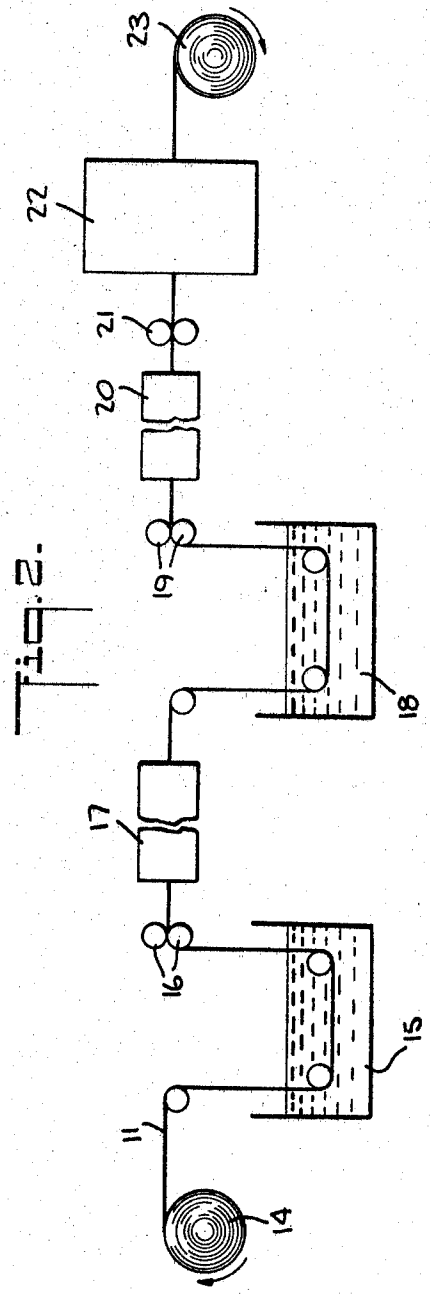

Fig. 2.

United States Patent Office 3,484,332 Patented Dec. 16, 1969

3,484,332

SHRINK-PROOF CELLULOSIC FABRIC

Herbert William Fuhr, Neuhofen, Pfalz, Germany, assignor to Celanese Corporation, New York, N.Y., a corporation of Delaware

Original application July 5, 1960, Ser. No. 40,659, now Patent No. 3,166,824, dated Jan. 26, 1965. Divided and this application Nov. 20, 1964, Ser. No. 412,886

Int. Cl. D03d 13/00, 15/04

U.S. Cl. 161—91 4 Claims

ABSTRACT OF THE DISCLOSURE

A printed substantially shrink-proof woven fabric interwoven in a manner such that one face of the fabric is predominantly warp and the other face predominantly filling, the filling face being the printed face, the filling consisting of chemically shrink-proof cellulose selected from the group consisting of cotton and rayon and the warp consisting of mechanically compacted cellulose acetate.

This application is a divisional application of United States patent application Ser. No. 40,659, filed July 5, 1960, now United States Patent No. 3,166,824 issued Jan. 26, 1965.

The present invention relates to a novel fabric characterized by low shrinkage and other desirable properties.

Drapery fabrics formed of cellulose acetate yarns are characterized by excellent appearance but shrink appreciably on washing. Even if the yarns are blends of cellulose acetate and other fibers, synthetic or natural, the fabrics will still shrink appreciably.

It is an object of the present invention to provide novel processes for producing substantially shrink-proof fabrics composed in large measure of cellulose acetate.

Other objects and advantages of the invention will become apparent from the following detailed description and claims.

In accordance with the present invention it has been found that woven fabrics comprising fibrous cellulose fillings, i.e. rayon or cotton, and warps of cellulose acetate can be rendered substantially shrink-proof by subjecting the fabrics to chemical treatment with finishes which render cellulose fibers shrink-proof and to mechanical treatment to effect longitudinal compaction. As employed herein the term "substantially shrink-proof" has reference to a shrinkage of less than about 2.5% warp-wise and less than about 2% filling-wise when washed at 50° C. in an automatic washer and line dried.

It is most surprising that these treatments can produce the requisite shrink-proofness since neither 100% cellulose acetate fabrics nor fabrics having cellulose warps and cellulose acetate fillings nor fabrics having warps and fillings which are blends of cellulose acetate are rendered shrink-proof by the identical treatments.

The chemical treatment can be carried out with formaldehyde or oxymethylated, i.e. methylol, compounds, precondensates or resins such as are produced by reaction of formaldehyde with urea, melamine, ethylene urea, or other nitrogen-containing substance, phenol, and the like. Other substances for shrink-proofing cellulose fibers, such as glyoxal or higher aldehydes, can also be employed in conventional manner. Such shrink-proofing agents are generally applied from aqueous solution or dispersion, in a concentration of about 5 to 30% and preferably about 15 to 25% by weight and in an amount to provide about 2 to 15% and preferably about 5 to 10% by weight of the cellulose fibers. The solution or dispersion may also contain small amounts of acidic substances to catalyze the further condensation of precondensates and/or the reaction of the shrink-proofing agents with the fibers. Softeners and/or other substances such as optical whiteners may also be present. Representative softeners include silicones, polyethylene, polyalkylene glycols, quaternary ammonium compounds, fatty amides, fatty imadazolinium compounds, and the like, applied in about 0.1 to 2% by weight of the fabric.

The chemical treatment is then completed in conventional manner as by drying at about 90° C. followed by curing at elevated temperature, e.g., 3 to 4 minutes at 150° C. Variations from this cure are permissible, the particular conditions being correlated with the chemical composition of the finish. While the chemical treatment apparently effects some measure of cross-linking, it does not significantly alter the fibrous nature of the fibers making up the warps and fillings. They retain their individuality and substantially retain their flexibility and appearance. The chemical treatment is apparently of only little effect on the cellulose acetate warps which have a relatively low free hydroxyl content and are relatively hydrophobic as compared with cellulose. This minimal effect on the cellulose acetate is evidenced by the inefficacy of such treatment on a 100% cellulose acetate fabric as contrasted with a 100% cellulose fabric.

The mechanical compaction can be carried out on any equipment available for this purpose such as compressive shrinking apparatus of the type that employs a rubber or felt blanket for holding the fabric against a driven roll such as is shown in United States Patent No. 1,861,424. Other suitable apparatuses are described in "An Introduction to Textile Finishing," by J. T. Marsh, Chapman & Hall Ltd., 1953, pages 248 to 253, and in "A Handbook of Textile Finishing," by A. J. Hall, Chemical Publishing Co., Inc., 1955, pages 188 to 193. The degree of compaction should be such that the compacted length of the fabric generally ranges from about 90 to 99% and preferably from about 94 to 97% of its length before compaction.

The invention is especially useful in rendering shrink-proof antique satin fabrics comprising closely arranged warps of continuous filament yarns of cellulose acetate having an acetyl value of about 50 to 60% and preferably about 54 to 57% calculated as combined acetic acid and less closely arranged fillings of nubby spun rayon interwoven in a manner such that one face of the fabric is predominantly warp and the other face predominantly filling. Such fabrics are especially popular for draperies since the nubby rayon face has a silk-like appearance while the lustrous acetate face gives the appearance of a lining. With these fabrics it is possible to obtain with regularity shrinkages of less than about 2% warp-wise and less than about 1.5% filling-wise.

In accordance with another aspect of the invention when it is desired to print such fabrics it has been found that this should preferably be carried out before the mechanical compaction. If printing follows mechanical compaction articles made from the treated fabric may shrink somewhat in the initial laundering. When resin finishing is to precede printing, desirably the resin formulation does not include a silicone as softener or for any other purpose since its presence will result in a less deep shade than softeners which are only moderately hydrophobic.

The invention will be further described with reference to the accompanying drawing wherein:

FIG. 1 is an enlarged plan view of a portion of a preferred fabric operated upon in accordance with the invention; and

FIG. 2 is a schematic flow sheet of a process in accordance with the invention.

Referring now more particularly to the drawing, in FIG. 1 there is shown a woven fabric **11** comprising

warp yarns **12** made up of continuous filament cellulose acetate yarns and filling yarns **13** made up of rayon staple fibers.

As shown in FIG. 2, the fabric **11** from a bolt **14** is passed through a bath **15** containing an aqueous solution of dimethylolethylene urea, between nip rolls **16**, through an oven **17** where it is dried and cured, through wash water **18**, between nip rolls **19**, through a drier **20** fed by rolls **21** to a mechanical compactor **22** and taken up at **23**.

The invention will be further described in the following illustrative example.

EXAMPLE

35 continuous filaments of cellulose acetate, acetyl value of 55% calculated as combined acetic acid, twisted together with 22 turns per inch into a 150 denier yarn are woven in conventional manner as warps into a 108 x 49 construction in a 5 shaft satin weave with a 10/1 filling of nubby rayon staple fibers. By weight, the fabric comprises 40% of cellulose acetate and 60% of rayon. The fabric is impregnated with 80% of its weight of an aqueous solution containing 200 grams per liter of dimethylolethylene urea, 20 grams per liter of a 35% solution of zinc nitrate and 15 grams per liter of 30% polyethylene dispersion as a softener. The fabric is dried at 90° C. for 60 sec. in a clip tenter and cured at 150° C. for 4 minutes in a curing range, washed with water and a mildly alkaline detergent at about 60° C. and again dried. The fabric is printed on its predominantly rayon face with a water-in-oil resin-bonded pigment emulsion (Interchemical Aridye process) and is then dried and cured. The fabric is then sprayed to pick up about 25% by weight of water and mechanically compacted in longitudinal direction on a Rigmel machine to decrease its length by 6%. The resulting fabric shrinks less than 0.4% over wide ranges of temperature and humidity. Different samples of the fabric when washed at 120° F. regularly shrunk less than 1% in warp and filling and this did not increase significantly even after five washings.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A printed substantially shrink-proof woven fabric interwoven in a manner such that one face of the fabric is predominantly warp and the other face predominantly filling, the predominantly filling face being the printed face; the filling consisting of a chemically shrink-proof cellulose selected from the group consisting of rayon and cotton and the warp consisting of mechanically compacted cellulose acetate.

2. A printed substantially shrink-proof woven fabric interwoven in a manner such that one face of the fabric is predominantly warp and the other face predominantly filling, said filling face being the printed face, the filling consisting of an oxymethylated cellulose selected from the group consisting of rayon and cotton and the warp consisting of mechanically compacted cellulose acetate.

3. A printed substantially shrink-proof woven fabric interwoven in a manner such that one face of the fabric is predominantly warp and the other face predominantly filling, said filling face being the printed face, said filling consisting of a chemically shrink-proof rayon staple and said warps consisting of mechanically compacted cellulose acetate continuous filament.

4. The fabric according to claim **3** wherein said fabric has a warp-wise shrinkage of less than about 2% and a filling-wise shrinkage of less than about 1.5%.

References Cited

UNITED STATES PATENTS

2,338,983	1/1944	Thackston et al.	26—18.5
2,370,946	3/1945	Finlayson et al.	139—426
2,765,513	10/1956	Walton	26—18.6
3,142,109	7/1964	Stoll et al.	161—91

OTHER REFERENCES

Gruntfest, I. J., and D. D. Gagliardi: "Modification of Cellulose by Reaction with Formaldehyde," Textile Research Journal, vol. XVIII, No. 11, November 1948, pp. 643–650.

Bendure, Zelma, and Gladys Pfeiffer: America's Fabrics, The MacMillan Co., New York, 1947, pp. 648–649.

ROBERT F. BURNETT, Primary Examiner

L. M. CARLIN, Assistant Examiner

U.S. Cl. X.R.

139—426