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Ibach et al.

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[54] PRESS FREE TEXTILE FABRIC

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[63] Continuation-in-part of Ser. No. 690,099, Dec. 13, 1967, abandoned.

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[58] **Field of Search**.....2/243; 8/120; 28/75, 76; 57/157; 139/420, 425; 156/148

[56] **References Cited**

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[57] **ABSTRACT**

Press-free polyester-cotton fabrics of improved durability are obtained by applying a textile resin only to the yarns that travel in one direction in the textile fabric, e.g., either the warp yarn or the filling yarn.

9 Claims, No Drawings

PRESS FREE TEXTILE FABRIC

This application is a continuation-in-part of application, Ser. No. 690,099, filed Dec. 13, 1967, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to press-free textile fabrics of improved durability which are composed of polyester and cellulosic fibers.

2. Description of the Prior Art

Warnock and Hubener in U.S. Pat. No. 2,974,432 set forth "an improved method of production of garments of variable sizes, types and styles which, despite numerous and repeated washings, are free from wrinkles, retain all pleating and creases made therein during manufacture, and require no pressing to afford presentable, attractive and neat appearing apparel." The method of obtaining such apparel has as its initial step the impregnation of fabric in a bath of resin. While such a method does accomplish the objective of providing a press-free fabric, the resin promotes degradation of the cellulosic component in the constituent yarns causing a decrease in fabric durability.

A number of methods have been proposed to cure this defect of press-free articles. These include the application of the textile resin to one side of the fabric only, thus preferentially treating the cellulosic component on that side. Other methods such as the use of a lesser amount of textile resin in treating the fabric have been tried. In spite of the continued research efforts to improve the level of durability of these fabrics, none have been entirely satisfactory. Either the durability is improved with consequent reduction in press-free characteristics or press-free characteristics are improved with consequent decrease in durability.

SUMMARY OF INVENTION

It has been discovered that a fabric having yarns of one fabric direction which are untreated with a textile resin and contain polyester fibers, the yarns of the other direction containing resin treated cellulosic fibers, has press-free characteristics as well as good durability in wear. In contrast to the normal method of producing press-free textile fabrics by impregnating the woven fabric with resin by dipping or padding, the fabric of this invention is made by weaving the fabric of yarns, one of which has a cellulosic component and which has been resin treated in one of the conventional yarn handling steps such as coning or quilling. The woven fabric is not dipped in a resin bath or otherwise impregnated with resin as in prior art methods. Such treatment would destroy the improvement of the invention since the cellulosic fibers of the previously untreated yarn would be degraded. Only where the untreated yarn consists entirely of polyester would such treatment not have a deleterious effect on its strength. Articles of apparel may therefore be prepared in accordance with this invention by weaving the novel fabric of treated and untreated yarns, as described, manufacturing the articles therefrom, pressing them and thereafter curing the textile resin, without the initial step of resin impregnating the fabric.

Either the warp or the filling yarn of the fabric may be resin treated. The one so treated must contain a cellulosic component such as cotton or rayon. It may also contain an additional component such as polyester fibers. The untreated yarn must contain polyester fibers and may also contain cellulosic fibers. Such fabric exhibits the surprising combination of properties of resistance to abrasion, wrinkle resistance, and press-free characteristics. The fabric must have polyester and cellulosic components as described, as it has been found that 100 percent polyester fabrics and 100 percent cotton fabrics do not exhibit the surprising properties of the novel fabric of this invention. It is preferred that the yarn of each fabric direction be a blend of polyester and cotton. Cotton is composed of natural cellulosic fibers.

The most unexpected characteristic of the novel fabric of this invention is the fact that it has press-free characteristics equivalent to those of conventional press-free fabrics even though only the yarns of one fabric direction are resin treated. It would be expected that a fabric containing fewer resin treated yarns would have diminished press retention, but surprisingly this is not true of the fabric described and claimed herein. The behavior of this fabric is particularly surprising in view of the fact that, as described in Example II, resin treatment of the yarns of one direction of a 100 percent cotton fabric did not result in a fabric having press-free characteristics.

STANDARDS AND DEFINITIONS

The terms and tests used to describe the invention and compare it with the prior art are described below.

The terms "textile resin" and "resin" are used as in the jargon of the garment trade and are not in the classical sense. Thus, a cyclic urea which reacts with cellulose to form a cross-linked structure is not, intrinsically, a resin in the classical sense, but will be called a resin herein. This use of terms is not intended to imply that a plurality of monomers cannot be applied to the surface of a fiber and polymerized thereon as this is intended to lie within the spirit and scope of the present invention. Suitable thermosetting resins for treating the cellulose-containing yarn include urea-formaldehyde resins, methylated methylol melamine, and carbamates. A preferred textile resin is dimethyloldihydroxyethyleneurea. U.S. Pat. No. 2,974,432 to Warnock and Hubener describes several textile resin mixtures that may be used.

The Wyzenbeek Test as used to determine the abrasion resistance of fabrics in the Examples which follow is reported in ASTM Standards, 1958, part 10, at page 436 (Oscillatory Cylinder Method D1175–55–t) with exceptions noted below. The Wyzenbeek Tester, also called the Wycor Precision Wear Test Meter, is commercially available from Wyco Tool Company Lab-E-Vator Division, Des Plaines, Ill. In the test, a piece of fabric is rubbed back and forth with abrasive cloth. The number of cycles necessary to produce a hole (localized warp and fill yarn breakage) in the fabric is recorded. The following modifications are made to the standard test:

1. 320–J aluminum oxide cloth (available from Behr-Manning Company, Troy, New York) is used instead of zero emery paper as the abradant.
2. Two aluminum rods measuring 0.25 inch in diameter are mounted under the abradant on the top of the drum surface, each extending the length of the drum. Two ridges formed by the rods localize the abrasion and provide a sudden increase in tension and severe bending in the specimen during each cycle.
3. The sample is conditioned in the laboratory at 24° C. ± 2° C. and 55 percent ± 2 percent relative humidity for a minimum of 24 hours prior to testing.

Accelerotor Weight Loss is measured by means of an AATCC Accelerotor available from Atlas Electrical Devices Co., Chicago, Illinois. The use of this device is described by H. W. Steigler et al. in American Dyestuff Reporter, 9/10/56. The fabric specimen is tumbled by a rotating impeller in the abradant-lined cylinder of accelerotor. The samples to be evaluated are cut to 4.5 inch square swatches; approximately 0.125 inch is ravelled from the edge of each specimen. Ubabond Cement No. 551, available from Union Bay Chemical Co., 491 Main Street, Cambridge, Massachusetts, 01922, is diluted with methylethylketone and applied to the ravelled edge to prevent further ravelling. The sample is conditioned at 54.5° C. ± 10° C. for a minimum of 2 hours and then at 21° C. and 65 percent relative humidity for at least 16 hours prior to testing. A 4.5 inch impeller is used. The abradant is 400–E Closkote, "Durite" in 2.75 by 17.125 inch strips, available from T. C. Ulmer Company, Philadelphia, Pa. 19100. Each abrasive liner is inserted face-out into a collar. A strip of cellophane tape about 4 inches long is placed over the over-

lapping ends. The ends of the tape are fastened over the outside of the collar. Samples are weighed to the nearest milligram. The collar is inserted into the Accelerotor chamber and the sample is crumpled and inserted into the chamber directly into the path of the impeller. Fabric weight loss after 1, 3, and 5 minutes of abrasion is recorded as per cent of original weight.

"Edge Abrasion", abrasion along the fold of a fabric, is measured by means of an AATCC Accelerotor available from Atlas Electrical Devices Company, as stated above. The use of this device to determine Edge Abrasion is described by Anthony R. Markezich in American Dyestuff Reporter, 11/21/66. The fabric specimen is tumbled by a rotating impeller in the abradant-lined cylinder of Accelerotor. Fabric specimens 3 inches by 6 inches are folded and creased into 3 inch squares, pressed (5 seconds steam/10 seconds bake/ 5 seconds vacuum) and cured 10 minutes at 160° C. The pinked edges are sealed with Ubabond Cement No. 551, as mentioned above, diluted with methylethylketone. A seam is sewn one-fourth inch from the edges of the three open sides. The sample is conditioned at 54.5° C. ± 10° C. for a minimum of 2 hours and then at 21° C. and 65 percent relative humidity for at least 16 hours prior to testing. A 4.5 inch impeller is used. The abradant is 400–E Closkote, "Durite" in 2.75 by 17.125 inch strips, available from T. C. Ulmer Co., as stated above. Each abrasive liner is inserted face out into a collar. A strip of cellophane tape about 4 inches long is placed over the overlapping ends. The ends of the tape are fastened over the outside of the collar. The collar is inserted into the Accelerotor chamber and the sample is inserted into the chamber directly into the path of the impeller. Samples are abraded for 1, 3 and 5 minutes. The stitches are then removed and the unfolded, abraded samples are placed on a light box and compared with photographic standards. A rating of 1.0 corresponds to severe abrasive damage.

The term "polyester fiber" as used herein is defined in "The 1960 Supplement to Book of ASTM Standards," Part 10, at page 53. The preferred polyester fibers are poly(ethylene terephthalate) and copolymers thereof. The term "cellulosic fiber" denotes a fiber containing cellulose molecules, such as cotton and rayon. "Warp yarn" and "filling yarn" are conventional terms denoting yarns of different fabric directions.

DETAILED DESCRIPTION

The fabric of this invention has yarn of one fabric direction treated with a textile resin and yarn of the other fabric direction untreated with said resin. The resin treated yarn contains cellulosic fibers whose molecules are cross-linked when the resin is cured. This yarn may consist entirely of cellulosic fibers, or it may contain non-cellulosic fibers in addition to the cellulosic fibers. The untreated yarn contains polyester fibers which impart wrinkle resistance and contribute to the unique properties of the fabric. This yarn may consist entirely of polyester fibers, or it may contain other fibers in addition to the polyester fibers. Preferred fabrics are composed of treated and untreated yarns both of which are a blend of polyester fibers and cellulosic fibers. Preferred blends range from 50 to 65 percent polyester, the remainder being cellulosic. Cotton, a natural cellulosic, is most often used. Blends of polyester and cotton exhibit exceptionally desirable properties in fabric form. They are superior in resisting wrinkling in normal wear to blends of cotton and other synthetics due to the high modulus and other inherent properties of polyester.

The treated yarn may be prepared by impregnating it with an aqueous resin system as hereinafter described. In contrast to the treated yarn, the untreated yarn must not contain any substantial amount of resin treated cellulosic fibers since its strength would thereby be diminished. Exposure of polyester fibers to resin generally has little or no effect on their strength. The "untreated" yarn must therefore be untreated by the resin in any way that would substantially decrease its strength. When the preferred yarns, which are a blend of polyester and cotton, are used, it is desirable that the untreated yarn be entirely free of resin.

The resin treated yarn is preferably prepared by effecting a 40 to 75 percent wet pickup of one of the conventional latent-cure resin systems comprising, for example, an aqueous mixture of: (1) 25 percent by weight textile resin which is dimethyloldihydroxyethyleneurea (cyclic molecular structure), (2) 5 percent by weight zinc nitrate solution (40 percent zinc nitrate in water) which is used to catalyze the reaction, (3) 0.25 percent by weight of wetting agent such as octylphenoxypolyethoxyethanol. A wet pickup of about 65 percent is preferred. The amount and type of resin to be used must be sufficient to impart press-free characteristics to the particular fabric being produced.

The dimethyloldihydroxyethyleneurea is commercially available as "Permafresh 183", the trade name of Warwick Chemical Company. The zinc nitrate can be purchased under the trade name "Catalyst X–4", also a product of Warwick Chemical Company, and the wetting agent can be secured under the trade name "Triton X–100" from Rohm and Haas. The preferred combination is well known and described in the Koratron Fabric Finishing Manual, published in 1961 by the Koratron Company, Inc.

In the present invention the resin system is applied to the cellulosic fibers in only the yarns of one fabric direction. Thus, it can be applied exclusively to the warp yarn, or preferably, especially if the warp yarn will predominate on that fabric surface receiving the most abrasion in wear, it is applied exclusively to the filling yarn. In the case of fabrics designed for use in trousers wherein crease retention is important, it is preferred to apply the resin exclusively to the filling yarn. If the resin system is to be applied exclusively to the filling yarns of the fabric, it may be done conveniently by the application in one of the conventional yarn-handling steps such as coning or quilling. Other convenient methods of application will be apparent to those skilled in the art.

EXAMPLES

These examples are intended to illustrate the best mode of carrying out the instant invention. They are not intended to be in any way limitative.

EXAMPLE I

This example illustrates a preparation of a fabric according to the present invention and compares its abrasion resistance with a prior art fabric.

A denim test fabric of 3 × 1 left twill (72 ends/inch × 32 picks/inch loom construction) is prepared from 8/1cc yarns comprising a blend of 65 percent by weight poly(ethylene terephthalate) staple fiber and 35 percent by weight cotton. Before weaving, the yarn to be used as the filling is passed through a textile resin bath comprising the preferred mixture described above in the preferred weight combination. The yarn is dried at about 104° C. on a slasher. The finished fabric weight is 12 ounces/yard^2 (408 gm./m.^{2}).

A control fabric is prepared in the same manner as the test fabric above with the exception that the filling yarn is not treated separately with the textile resin, but after weaving, the entire fabric is padded to 73 percent wet pickup in the same type of bath as was used for the impregnation of the filling yarn in the test fabric. The fabric is then dried at about 104° C. The finished fabric weight is 12 oz./yd.^{2} (408 gm./m.^{2}).

Samples of each fabric are pressed in conventional fashion (5 seconds steam, 10 seconds bake, and 5 seconds vacuum at 160° C.), cured for 10 minutes at 160° C. and then laundered five times in conventional fashion in 60° C. water prior to laboratory testing. Each of the samples is tested for Accelerotor Weight Loss and Abrasion Resistance. Results are shown in Table I.

TABLE I

	Test Fabric	Control Fabric

Accelerotor Weight Loss (% wt. loss after 1, 3 and 5 minutes)	2.4/5.5/8.1	7/8/11.3
Abrasion Resistance (cycles)	201	153

The retention of press-free characteristics (after laundering) of both samples is equivalent. However, as shown in the Table, the test sample made in accordance with the present invention showed significantly greater durability upon exposure to abrasion than did the control sample.

EXAMPLE II

This example shows that fabrics made entirely of cotton do not respond favorably to the method of the present invention.

Two denim fabrics are made in a manner similar to the test fabric in Example I.

For the first fabric the loom construction is 72 ends/inch (28.4 ends/cm.) × 39 picks/inch (15.4 picks/cm.) and the yarn is a blend comprising 50 percent by weight, polyethylene terephthalate and 50 percent by weight cotton. The weight of the fabric is 11.8 ounces per square yard.

The second fabric is similar except that no polyethylene terephthalate is used in the yarn. The loom construction is 72 ends/inch (28.4 ends/cm.) × 39 picks/inch (15.4 picks/cm.) and the weight of the fabric is 11.6 ounces per square yard.

Each fabric is prepared as described in Example I for the test fabric. Finished fabric construction for the first fabric is 76 ends/inch (30 ends/cm.) × 40 picks/inch (15.8 picks/cm.) and for the second fabric is 75 ends/inch (29.5 ends/cm.) × 42 picks/inch (16.5 picks/cm.).

Each fabric is tested for abrasion sensitivity as in Example I. In the Accelerotor test, however, appearance of the fabric after 5 minutes abrasion is the only variable measured. Results are shown in Table II.

TABLE II

	First Fabric	Second Fabric (100% Cotton)
Edge Abrasion*	10	5
Abrasion Resistance (cycles)	269	186

*A rating of 10 represents no sign of Abrasion and a rating of 1 corresponds to severe damage. A rating of 5 represents moderate damage.

Thus, it is shown, as would be expected, that the polyester/cotton fabric is less sensitive to abrasion than the cotton fabric. The cotton fabric which is treated with textile resin only in its filling direction is less sensitive to abrasion than one treated conventionally. However, when both fabrics are washed and rated as to their press-free characteristics, the polyester/cotton fabric (first fabric) is press-free while the 100 percent cotton fabric (second fabric) is severely wrinkled.

STATEMENT OF UTILITY

Fabrics produced in accordance with the present invention are press-free and have outstanding resistance to abrasion in wear. Accordingly, they are not only useful in those textile articles such as dress shirts and trousers which have heretofore been made press-free, but also in other articles which have been denied the benefit of press-free characteristics because of the hard wear they experience.

What is claimed is:

1. A textile fabric having yarns of one fabric direction containing a blend of synthetic polyester fibers with cellulosic fibers and being treated with a textile resin, and yarns of the other fabric direction containing synthetic polyester fibers and being untreated with said resin, the yarns in said other fabric direction being predominant on the wear surface of the fabric.

2. The textile fabric of claim 1 wherein the yarns of both fabric directions are comprised of a blend of about 50 to about 65% by weight of said synthetic polyester fibers and from about 50 to about 35% by weight of said cellulosic fibers.

3. The textile fabric of claim 2 wherein said synthetic polyester fibers are poly(ethylene terephthalate) and said cellulosic fibers are cotton.

4. The textile fabric of claim 1, the treated yarn being comprised of cotton.

5. The textile fabric of claim 1, said cellulosic fibers being rayon.

6. A press-free textile fabric of improved durability composed of warp yarn and filling yarn, said yarns being comprised of a blend of synthetic polyester fibers and natural cellulosic fibers, the yarn of one fabric direction being treated with a textile resin, the yarn of the other fabric direction being untreated with said resin and being predominant on the wear surface of the fabric.

7. The fabric of claim 6 wherein the warp yarns are treated with said resin.

8. The fabric of claim 6 wherein the filling yarns are treated with said resin.

9. The fabric of claim 6 wherein the yarns are a blend of cotton and poly(ethylene terephthalate).

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