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PROCESS FOR RENDERING WOOL-CONTAINING GARMENTS STABLE TO WATER WASHING AND DRYING

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ABSTRACT OF THE DISCLOSURE

Wash-and-wear wool-containing garments are made by constructing a garment from a chemically and mechanically stabilizing wool-containing fabric and dimensionally stable components, wetting the garment with an aqueous solution of a disulfide bond disrupting reducing agent, forming the wetted garment into its desired configuration, subjecting the formed garment to heat and pressing, and drying the garment. The wetting of the garment may be facilitated by the addition of a wetting agent to the solution of the reducing agent.

This application is a continuation-in-part of our application Ser. No. 227,728 filed Oct. 2, 1962, now abandoned.

This invention relates to a method for rendering wool-containing garments stable to conventional water washing and drying to thereby provide garments having improved wash-and-wear characteristics.

In general, wool-containing garments present an unsightly appearance after laundering and air or tumble drying. This holds true for garments cut from ordinary wool-containing fabrics or from wool-containing fabrics which have been rendered generally dimensionally stable in laundering and drying by chemical treatment. Even though fabrics are known which perform well when laundered in the fabric form, garments cut from them tend to show pucker, bulkiness, and fuzz formation at the seams, hems, waistbands, etc., and have closed seams after laundering and tumble drying.

It has been found that garment construction, chemical treatment of the fabric, or chemical treatment of the garment alone will not result in a satisfactory wash-and-wear garment. Further, it has been found that in order to impart satisfactory wash-and-wear characteristics to garments, the fabric must have been subjected to prior chemical stabilization treatment followed by removal of any relaxation shrinkage; the garments made from such fabric must have been particularly constructed and the garments must have been subjected to a finishing chemical treatment. Each of these requirements will be described in detail hereinafter.

Garments constructed and finished in accordance with the foregoing requirements result, for the first time, in commercially acceptable wash-and-wear products.

It is an object of the present invention to provide a process for rendering wool and wool-containing garments stable during conventional laundering and drying operations.

A further object of the improved process is to provide increased resistance to seam pucker, formation of bulk and fuzz at seams, hems, waistbands, and the like, and to closing of the seams of wool and wool-containing garments.

It is a further object of the present invention to provide such a process that may be generally inexpensively applied

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without adversely affecting the hand and appearance of the garments.

Another object is to provide a process wherein the garments are cut from wool or wool-containing fabrics which have been previously treated and constructed in accordance with prior art methods for rendering the fabric dimensionally stable to felting and shrinking or for rendering them dimensionally stable as well as resistant to wrinkling and fuzzing during laundering and air or tumble drying.

Another object is to provide a process for treating wool or wool-containing garments which will eliminate fuzzing, pilling, wrinkling, localized cockling and puckering which presently occur in wool-containing garments after laundering and air or tumble drying.

These and other objects and advantages are provided by a method of treating wool-containing woven, knitted, felted and the like garments which comprises constructing a garment from chemically and mechanically stabilized fabric and dimensionally stable components, wetting the garment with an aqueous solution of a water-soluble reducing agent, forming the garment into its desired configuration and subjecting the formed garment to heat and pressing and drying.

Throughout the specification and claims, the terms "washing" and "laundering" mean the cleaning of garments with aqueous solutions of household detergents in, for example, an automatic home-type washing machine which may incorporate a center post reciprocating and/or rotating agitator.

The term "drying" includes simply hanging the garments on a clothes line in a natural environment or tumbling them in a home-type, heated drum dryer.

Therefore, in this specification the term "wash-and-wear" defines garments which have been subjected to the above-defined washing and drying operations and are essentially free from fuzz, rolls, wrinkles, seam pucker, have smooth hems, waistbands and zipper regions, and retain their creases, so that they need little or no ironing or only a light touch-up ironing for optimum appearance.

The term "components" means all parts and elements of a garment which are not constructed from the basic or main apparel fabric and thus include sewing thread, zippers, lining and pocketing materials, tapes, etc.

FABRIC SELECTION

As discussed hereinabove, one of the requisites of this invention is the use of wool or wool-containing fabrics which are dimensionally stable to laundering. Thus, the fabric selected must be treated or have been treated to prevent the natural tendency of the fabric to undergo a progressive loss in area (i.e., felting) with repeated launderings.

The following processes have been found to provide satisfactory fabrics for construction of garments in accordance with this invention.

Example I

A woven wool fabric is passed through a bath containing about 3% permonosulfuric acid and preferably a trace of a conventional wetting agent. With the bath temperature at about 77° F. and at a pH of about 2, two seconds retention in the bath is satisfactory. Following squeeze-roll extraction, the fabric is exposed to air for 10 seconds, immersed for 30 seconds in a 10% solution of sodium sulfite at 77° F., rinsed with water, and squeeze-roll extracted to complete the treatment.

Example II

Another anti-felt process is one which is particularly advantageous for the continuous treatment of low-strength woolen fabrics. It involves the application of

less than 5% of a suitable polymer such as polyhexamethylene sebacamide on the fabric by the interfacial polymerization technique. The fabric is padded consecutively through an aqueous solution of 1% hexamethylene diamine and 2% sodium carbonate and Stoddard solvent containing 2% of sebacyl chloride. The treated fabric is thoroughly scoured and is then ready for further processing as set forth hereinafter.

Example III-A

A particularly effective method for the bath treatment of wool-containing woven and knitted fabrics is known in the trade as the WB-7 process, wherein the fabric is loaded into a dye kettle containing a suitable volume of a saturated sodium chloride solution at about 110° F. After wetting the fabric with the salt solution, 4-6% of potassium permanganate based on the weight of wool in the fabric is added to the bath. As the treatment progresses, the bath's initial deep purple coloration gradually turns brown due to the gradual development of water-insoluble manganese dioxide. When the bath is a dark brown, the bath is replaced with clear water for a brief rinse. Following the rinse the kettle is filled with water to which are added 5-10% sodium bisulfite and an equal quantity of acetic acid in order to clear the fabric of the brown stain. This operation requires about 30 minutes at room temperature. Then the fabric may be rinsed again and is ready for additional processing as to be discussed below.

After the fabric has been chemically stabilized, it is necessary to remove latent strains therefrom because garments cut from wool-containing fabrics, even though adequately anti-felt treated by the methods described above, may also undergo non-progressive shrinkage the first time they are laundered. In the trade this type of consolidation is known as relaxation shrinkage. Briefly, it is the relaxation of latent strains introduced by stretching the fabric during earlier processing stages, particularly drying. It is, of course, advantageous to keep this shrinkage at a very low level (about 1% in warp and filling) to insure proper fit of a garment after the first laundering cycle.

We have found that it is possible to produce fabrics with acceptable levels of relaxation shrinkage by first drying on a single- or multi-pass tenter dryer with maximum warp overfeed to prevent or, in the case of fabrics which already contain relaxation shrinkage, to eliminate warp relaxation shrinkage. The fabric is then re-wet and again dried using, for example, a conveyor dryer (a type of dryer which is essentially completely free of tensions) to prevent or eliminate filling relaxation shrinkage.

Throughout the specification and claims removal of relaxation shrinkage at least includes the foregoing procedures and will be referred to as mechanical stabilization.

CONSTRUCTION OF WASH-AND-WEAR WOOL-CONTAINING GARMENTS

Although styling will follow the dictates of fashion at any one time, proper styling can help substantially to give improved wash-and-wear garments. The simplest styles are generally preferable. Exceptions are style features which tend to de-emphasize wool's tendency to undergo small dimensional changes. Such features would be elasticized waistbands, pleated rather than unpleated slacks, etc.

Trousers should be of conventional design and preferably with front pleats, belt loops, true side pockets, e.g., with the edges of pockets lying along outside seams, double welt hip pockets with a worked buttonhole, and a conventional waistband.

Skirts should be of a simple design, for example, with a single kick pleat in back and without a seam in the fold area, an interfaced waistband, and a simple side zipper placket.

The first step in the construction of garments is cutting of the fabric into garment pieces. For optimum wash-and-wear performance with wool-containing garments cutting should take into consideration the following:

A. Pattern sizes should be chosen (1) to accommodate dimensional fabric changes due to garment setting, (2) to allow for 5/8-inch seam allowances in the seams of trouser legs and skirts, (3) for beveled multiple fabric layers, e.g., at the waistband, the edges of the various fabrics layers should not coincide to avoid bulk and localized abraded areas after laundering.

B. Stretchy fabrics, for example, wool fabrics which have been dried without tension tend to be more "elastic or stretchy" than ordinary fabrics, must be handled prior to and during cutting and sewing without undue tension.

The wash-and-wear characteristics of components which go into a garment, such as "waistband canvases," zippers, interlinings, etc., are as important as the basic fabric itself. Generally, all components should (1) be dimensionally stable, (2) hold their shape, (3) maintain their initial firmness, and (4) maintain their color through chemical setting and laundering. For example, it is important to use zippers which not only do not shrink but also lie smooth and flat after laundering and drying. It has been found that zippers with tape composed of a nylon warp and a cotton filling generally meet these requirements. Most commercial "waistband canvases" used in men's trousers, even if dimensionally stable, are not desirable because they become limp and lose their shape and firmness after a few launderings. A more suitable "waistband canvas" consists of an all-nylon or nylon warp, cotton filling fabric lining and a firm 2-2.5 ounce/square yard nylon marquisette fabric as interfacing. The latter material holds its shape and firmness through wear and repeated launderings, thereby providing a better-looking trouser. This type of nylon marquisette has been used as an interfacing in women's skirt waistbands with the same favorable results.

Sewing thread is a component employed in all garments. To minimize development of pucker at seams a heat-set, non-shrinking nylon or Dacron thread of the smallest size consistent with proper seam strength should be used. The color, of course, should be stable to laundering and the chemical setting treatment.

Sewing, that is, the joining together of two or more pieces of fabric with sewing thread, should be carried out so as not to introduce distortion or pucker into the seam or seam area. The sewing step is important for wash-and-wear garments because the consumer will observe any distortions present after perhaps only one laundering and drying. Normally, the consumer is not aware of faulty sewing in conventional wool-containing garments because they are professionally pressed before sale and after each cleaning to give a perfectly smooth appearance. Assuming the use of a stable thread, smooth seams durable to laundering are the result of careful handling of the fabric layers during sewing and of proper sewing machine settings. The fabric layers must be fed to the sewing machine with a minimum of tension and in concert. The following machine settings have been found to result in optimum wash-and-wear performance.

(1) Lowest thread tension consistent with acceptable machine performance.

(2) Smallest needles which can be used with the chosen thread.

(3) Smallest throat plate hole consistent with needle size.

(4) Lowest presser foot pressure possible.

(5) Use of fine tooth feed dog, set low. Use of needle advance or roller feed machines is advantageous; however, a good operator can produce pucker-free seams on ordinary machines.

(6) Reduced sewing speed.

During tailoring, most garments are subjected to inter-

mediate pressings in order to smoothen and better form certain garment areas such as the fly in a man's trouser, the darts in a women's skirt, etc. Such pressing operations can introduce low levels of relaxation shrinkage, particularly in wool-containing garments. Following laundering of such a garment this relaxation shrinkage can give rise to unsightly distortions. This is especially true when a subsequent stitching operation is performed in the pressed area. Therefore, we have found that it is important to remove this localized relaxation shrinkage by a tensionless steaming operation after pressing.

After construction of the garment it is wetted with an aqueous solution of a water-soluble reducing agent, formed into the desired configuration and then subjected to heat and pressure and drying.

Water-soluble reducing agents which have been found to be effective are salts of sulfurous acid such as the alkali metal, ammonium, and amine salts; typical examples are sodium sulfite, bisulfite, or meta bisulfite, monoethanolamine sulfite or bisulfite, and the like. Other reducing agents which are effective are water-soluble thiol compounds and particularly salts of thioglycolic acid. A preferred member of this class is ammonium thioglycolate, but monoethanolamine thioglycolate may also be used.

Particularly satisfactory wash-and-wear characteristics are imparted to wool-containing garments constructed as hereinbefore set forth when treated with a neutral solution of monoethanolamine sulfite at concentrations of from about 2 to about 15% or sodium bisulfite at concentrations of from about 1 to about 10%. Uniform and complete wetting of the garment is facilitated by adding to the solution a small amount of a wetting agent such as an alkylaryl polyether alcohol. A commercial wetting agent known as Triton X-100 manufactured by Rohm & Haas Company has provided very satisfactory results. The presence of the wetting agent in the treating composition assists in the even distribution of the reducing agent throughout the garment. When multiple layer areas are present in the garment, it has been found to be advantageous to apply the treating composition more freely to the multiple fabric layer areas. When the garment is treated by immersion followed by mechanical extraction, uniform distribution of the treating agent even in the multiple layer areas of the garment has been found to be particularly good. In general, at least about 30% increase in weight of the garment by the treating solution will provide satisfactory results.

It will be appreciated by those skilled in the art that the amount of treating solution added to the garments will depend to a large extent on the concentration of the soluble reducing agent in the treating solution. However, where the concentration of the reducing agent is from about 2 to about 15%, 30 to 100% increase in weight of the garment by the treating solution is satisfactory as set forth hereinabove.

Following the wetting with a solution of the reducing agent and wetting agent, the garment is placed on a garment press and steam is applied at least at about 30 pounds per square inch gauge to the garment for periods of from about 10 to about 30 seconds and, preferably, in the order of about 15 seconds. The garment press is maintained in a closed position for a further period of, for example, about 45 seconds without the application of steam. A vacuum may then be subsequently applied to the garment in the open press for drying and if the garment is still damp, it is hung to air dry.

The following specific examples are illustrative of the principles of the invention:

Example III

An all-wool flannel fabric shrinkproofed as set forth in Example I and subjected to mechanical stabilization to remove relaxation shrinkage was constructed into trousers following the construction methods as set forth herein.

The trousers were sprayed to a 70 to 100% increase in weight with an aqueous solution containing 3.5% monoethanolamine sulfite and a wetting agent. The aqueous solution was prepared by mixing one gallon of 70% monoethanolamine sulfite, 2.5 ounces of Triton X-100 wetting agent and 19 gallons of water.

The wet trousers were formed by hand into a smooth condition with the trouser legs formed into flat tube configurations with particular attention being given to maintaining the seams open and flat on the lower buck of the steam press. The formed and wet trousers were subjected to pressing and steaming at a pressure of about 90 p.s.i.g. for 15 seconds and baking, press closed, without the application of steam, for 45 seconds. The steamed and pressed trousers were then air dried.

After repeated machine launderings and tumble dryings, the treated trousers were found to be superior to similar untreated trousers particularly in respect to freedom from pucker and in retention of the initial open flat seam configuration as well as crease retention. The trousers were considered to have true wash-and-wear characteristics as defined hereinabove.

Example IV

An all-wool flannel fabric, treated as set forth in Example I, was subjected to mechanical stabilization to remove relaxation shrinkage and tailored into a straight skirt following the garment construction methods as set forth herein. The skirt was sprayed with 3.5% monoethanolamine sulfite solution prepared as set forth in Example III. The treating solution was not applied in one seam area and in one-half of the hem area of the skirt. The sprayed skirt was then steamed and baked on a press as described in Example III. After one laundering and tumble drying, the treated seams were open, had a better appearance, and were less fuzzy than the untreated seam area. The treated hem segment was found to be substantially less puckered and neater looking than the untreated hem area.

Example V

A pleated skirt was tailored following the garment construction methods described herein from a shrinkproof, all-wool flannel fabric. Shrinkproofing of the fabric was carried out following the procedures of Example I, and the fabric was then subjected to mechanical stabilization to remove relaxation shrinkage. The skirt was sprayed except in the waistband area with an aqueous solution of the neutral water-soluble sulfite salt, formed and pressed in accordance with the procedure set forth in Example III. The treated pleated skirt was laundered and tumble dried. Upon inspection of the laundered and tumble dried skirt, it was found that the untreated waistband was fuzzy and puckered while the hem area and body of the skirt showed better retention of initial appearance. Pleated crease lines in the tailored pleated skirt were distinct and could serve as guidelines in hand pressing, thereby markedly reducing the usual amount of labor involved in hand pressing a pleated skirt.

Example VI

One of two trouser legs prepared following the garment construction methods described herein from a shrinkproof, all-wool, uniform type, worsted fabric was sprayed and pressed as described in Example III. Shrinkproofing of the fabric was carried out following the procedures of Example III-A, and the fabric was subjected to mechanical stabilization to remove relaxation shrinkage. The other leg was given a five-second steam pressing and a five-second baking to simulate a typical commercial pressing. After one laundering and tumble drying, the treated leg exhibited an acceptable crease and its seam was open and flat while the untreated leg lost its crease and the seam closed. On repeated mild laundering and tumble drying, the treated trouser leg showed superior retention of its initial appearance in terms of smoothness at double

layers, low fuzz development, seam openness, crease retention, and general all-over appearance.

Example VII

A washable fabric containing 85% wool, and 15% nylon was treated as set forth in Example I, mechanically stabilized to remove relaxation shrinkage and constructed into a man's shirt following the construction method as described herein. One-half of the shirt was sprayed to a 70% to 100% increase in weight with an aqueous solution containing 2.4% sodium bisulfite and a wetting agent. The treating solution was prepared by mixing 1.02 pounds of sodium bisulfite, and 0.7 ounce of Triton X-100 in 5 gallons of water. The treated shirt was formed and following forming was steam pressed by subjecting the shirt to a steam pressure of about 90 p.s.i.g. for 15 seconds and baking in a closed press without steam for 45 seconds. The treated shirt half was found to have a more attractive and less fuzzy appearance than the untreated portion of the shirt following two laundering and tumble drying cycles.

Example VIII

A pleated skirt was constructed following the construction methods described herein from a washable, all-wool, flannel fabric treated as set forth in Example I and subjected to mechanical stabilization to remove relaxation shrinkage. The skirt was sprayed over its entire surface with a 2.4% sodium bisulfite solution containing a wetting agent prepared as set forth in Example VIII to approximately 85% pickup by weight. The sprayed and pleated skirt was formed, pressed and dried as set forth in Example III and after repeating laundering and tumble drying cycles, the treated skirt was found to have good retention of its initial appearance and handle, was open and flat in the seams and had a minimum of pucker and distortion in the multiple layers of fabric.

Example IX

A pair of women's slacks was constructed following the garment construction procedures of this application from a washable, all-wool, flannel fabric treated as set forth in Example VII and then finished by spraying the slacks to approximately 100% pickup with a 2.4% sodium bisulfite solution containing the wetting agent set forth in Example VII. The sprayed slacks were formed, steam-pressed and dried as is set forth in Example III.

After repeated laundering and tumble drying cycles, the slacks had good retention of their initial appearance and handle with a minimum of pucker and distortion, particularly in the multiple layers of the fabric.

Example X

A straight skirt with a double layer decorative seam down its front was made following the construction methods set forth herein from a washable, all-wool, flannel fabric which had been treated with a 1% sodium bisulfite solution, steamed while in a flat, smooth state and dried to give the fabric a memory for its smooth state. The fabric was then mechanically stabilized to remove relaxation shrinkage. One-half of the skirt was then spray treated with 2.4% sodium bisulfite solution containing a wetting agent as set forth in Example V. The sprayed skirt was steam-pressed following the procedure set forth in Example III. After repeated laundering and air and tumble drying, the treated half of the skirt in all-over appearance was far superior to its non-treated counterpart. The treated zipper plackets, hems, seams and other multiple layer areas remained smoother and neater appearing than comparable sections in the untreated portion of the garment.

Example XI

A man's suit coat was tailored following the garment construction methods set forth herein from a suiting weight, all-wool, worsted fabric which had been shrink-proofed as set forth in Example III-A and then me-

chanically stabilized. The coat was treated with a 1% solution of sodium bisulfite, steamed while wet for 2 minutes, and dried. One-half of the suit coat was sprayed with a 2.4% sodium bisulfite solution containing wetting agent and steamed and held in a closed press as described in Example III.

After laundering and drying, the treated half of the suit coat was superior to the untreated half in retention of the initial pressed condition and in over-all appearance. In particular, the seams, hem along the back panel, collar and lapel areas, and pocket flap and pocket area which had been set were less puckered and smoother looking than these same features and areas in the untreated portion of the suit coat.

Example XII

Straight skirts were constructed following the garment construction methods as set forth herein from an all-wool, washable knitted fabric (8 oz./sq. yd.). The knitted fabric was shrinkproofed following the procedures of Example III-A and then subjected to mechanical stabilization to remove relaxation shrinkage. The skirts were sprayed to 60% increase in weight with either a 2.5, 5, or 10% solution of sodium bisulfite. Each of the treating solutions also contained 0.1% of a nonionic wetting agent. The wet garments were then formed by hand into the desired shape on the lower buck of a tailor's press, steamed and pressed as described in Example III, and allowed to air dry. The treated skirts and an identical untreated skirt were subjected to repeated mild machine washing and tumble drying cycles. After laundering the treated garments had a considerably better over-all appearance, maintained their initial shape better, and were much less fuzzy than the untreated garment. Specifically, the treated hems, waistbands, and seam areas were smoother and flatter than these garment features in the untreated garment.

Example XIII

A straight skirt was prepared following the construction methods of the invention from an all-wool, shrink-proofed, apparel weight felt. The fabric had been shrink-proofed as set forth in Example III-A and subjected to mechanical stabilization. The skirt was sprayed to a 60% increase in weight with a 2.5% solution of sodium bisulfite containing 0.1% of a nonionic wetting agent, shaped by hand on a tailor's press, and steamed and pressed as described in Example III. After two launderings and air dryings the treated skirt had a generally better appearance, particularly at the hem and waistband, than a similar untreated felt skirt laundered with the treated garment.

Example XIV

A straight skirt was constructed from an all-wool, shrinkproofed, flannel fabric. The construction methods and shrinkproofing of the fabric followed the procedures as set forth in Example VII. The skirt was sprayed to a 50% increase in weight with a 2.5% aqueous solution of ammonium thioglycolate containing 0.1% of a nonionic wetting agent. The pH of the solution was 7. The wet garments were formed by hand into the desired configuration on the lower buck of a tailor's press and steamed and baked as described in Example III.

After three mild machine laundering and tumble drying cycles the hem, waistband and seam areas of the treated skirt presented a smoother and neater appearance than these same features in a similar, untreated skirt after laundering. Also, the treated garment was noticeably less fuzzy than the untreated one.

We claim:

1. A method of making wash-and-wear wool-containing garments which comprises constructing a garment from chemically and then mechanically stabilized wool-containing fabric and dimensionally stable components,

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wetting the garment with an aqueous solution of a disulfide bond disrupting reducing agent, forming the garment into its desired configuration, subjecting the formed garment to heat and pressure, and drying the garment, thereby rendering the garment stable during conventional washing and drying operations.

2. A method as defined in claim 1 wherein the aqueous solution of reducing agent includes a wetting agent.

3. A method as defined in claim 1 wherein the reducing agent is sodium bisulfite.

4. A method as defined in claim 1 wherein the reducing agent is monoethanolamine sulfite.

5. A method as defined in claim 1 wherein the reducing agent is ammonium thioglycolate.

6. A method as defined in claim 1 wherein the aqueous solution contains at least 2% of the reducing agent and at least 30% of the solution by weight is applied to the garment.

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