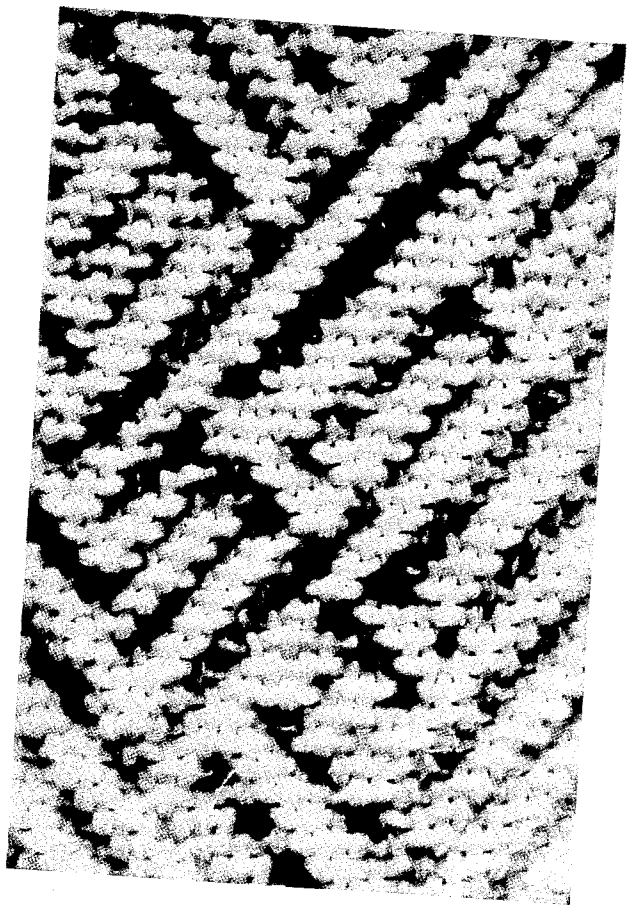
Aug. 3, 1954

J. H. BRANT

2,685,120

FABRIC HAVING CONTOURED DECORATIVE SURFACE

Filed March 24, 1950



INVENTOR
JOSEPH H. BRANT

BY

Campbell, Brumbaugh, Free and Graves,
ATTORNEYS.

Patented Aug. 3, 1954

2,685,120

UNITED STATES PATENT OFFICE

2,685,120

FABRIC HAVING CONTOURED DECORATIVE SURFACE

Joseph H. Brant, West Auburn, Maine, assignor to Bates Manufacturing Company, a corporation of Maine

Application March 24, 1950, Serial No. 151,629

4 Claims. (Cl. 28—78)

1

The present invention relates to textile fabrics having ornamental contoured surface effects and to a novel method of producing such fabrics.

The fabrics of the present invention are characterized by an extremely attractive appearance that is quite different from those of other fabrics available on the market. The ornamental effects are in the form of pattern lines of random length that run substantially on a bias and in two directions, with the result that the pattern lines running in different directions have random intersections. The pattern lines are visible not only in bas-relief but by transmitted light as well.

The single figure of drawing forming a part of this description illustrates, on a greatly enlarged scale, the appearance of a fabric produced in accordance with the present invention. This is a photographic reproduction, wherein the pattern lines of random length are marked by the shade lines running on a bias.

The prior art fabrics most closely resembling in appearance the fabrics of the present invention are believed to be those ordinarily referred to as creped fabrics. In these prior art fabrics, however, the crepe or ridge lines are not on a bias and run in only one direction. Their methods of manufacture are also quite different from that employed in accordance with the present invention.

Perhaps the most common method now in general use for manufacturing creped fabrics is that of weaving the fabric with highly twisted threads, i. e., having twists of the order of 60 or more turns per inch, in the case of yarns suitable for usual dress weight fabrics, which threads may be employed in the warp or filling or both, and then subjecting the woven fabric to a shrinking and swelling action to partially untwist the highly twisted thread and thereby produce a crepe effect. This method has the disadvantage of requiring the use of highly twisted threads which must be coated with a gum, size, colloid or other material prior to the weaving to prevent premature untwisting. An additional limitation is that two beam or box looms are frequently necessary.

Another method is that of selectively changing the lengths, by shrinking or elongation, of

2

some of the threads or certain parts of all of the threads after they have been woven into a fabric. One such method contemplates straining, prior to weaving, continuous filaments beyond their elastic limit at intervals along their length and then subjecting a fabric woven therewith to shrinking, the crepe being brought about by the differential contraction between the strained and unstrained portions of the thread. Another such method contemplates weaving a fabric with yarns having different degrees of extensibility and then utilizing the difference in extensibility, exhibited during subsequent dyeing, finishing and other operations, to produce the crepe. These methods, while not necessarily requiring highly twisted threads, nevertheless have the disadvantage of requiring treatments of the threads prior to weaving and reduce the selection of yarns with which the fabrics may be woven.

The ornamental contoured surface effects in the fabrics of the present invention are obtained on woven fabrics without requiring the threads to be highly twisted or to have been subjected to any unconventional treatment prior to weaving. The threads used in weaving the fabric may have virtually no twist or only a relatively slight twist, i. e., of the order of three turns per inch. The ornamental effects are generated on a fabric so woven simply by subjecting the greige fabric to appropriate agitation, while in a relaxed condition, before the fabric is subjected to any other finishing operation that involves wet tensioning.

In the preferred method of the invention, the agitation of the greige fabric is carried out in water. The water may, if desired, contain such materials as soap, synthetic detergent, a water-soluble thermosetting resin or a dyestuff. The water may be at room temperature or at a suitable elevated temperature up to about 212° F., or the temperature of the water may be raised from room temperature to an elevated temperature during the agitation step. The ornamental effects become apparent during agitation, are not removed upon drying the material with little or no tension and remain substantially permanent.

Suitable means of agitation include tumbling in a rotary laundry wheel either of the reversing

or continuously rotating types. The agitation may also include repeated multidirectional flexing of the fabric, preferably in contact with water and it may also include any other means of agitation which applies compressional energy to the wet fabric in a random manner. In all these operations it is necessary that virtually no tension be applied to the fabric in any direction if the most pronounced effect is to be obtained.

After the material has been subjected to agitation in water, it may be subjected to any of the well known finishing processes conventional in the textile industry.

If through mishandling, such as drying under too great tension or through application of too great pressure to the surface of the fabric typified by strenuous calendering or ironing, the design is partially or highly obliterated, it may be fully restored by subsequent wetting out in a tensionless state with or without agitation. This remarkable feature contributes greatly to the use performance of fabrics of this type.

Surprisingly enough the described ornamental effects can be produced on fabrics woven from one or more of a large variety of materials. Thus, e. g., the threads used in the weaving of the fabric may be natural or synthetic, e. g., cotton, "rayon" (cellulosic fibers and yarns made under viscose, acetate, cuprammonium or nitrocellulose or other process), "Fortisan" (a regenerated cellulose, made from cellulose acetate fibers, which are oriented by stretching), "nylon" (a synthetic polymeric amide having a protein-like chemical structure), "Vinyon" (co-polymers of vinyl chloride and vinyl acetate), "Orlon," "Saran" and "Permalon" (resins derived from vinylidene chloride polymers and copolymers), and "Velon" (made from vinylidene chloride) or any desired mixture thereof. The yarns are preferably filament yarns but effects may also be produced by the use of spun yarns. Furthermore, it has been found that yarns from all leading manufacturers, whether bright or dull in luster, perform in approximately the same manner.

It has also been found that the type of weave of the fabric, while not critical, is significant. Excellent results are obtained, for example, with taffeta or plain weave fabrics and effects of diminished prominence are obtained with twill weaves.

One advantage of the present invention is that it avoids, in the manufacture of fabrics having ornamental surface contour effects, the necessity for using highly twisted and coated threads in the weaving operation, as well as the use of acids or alkalis in an after-treating operation to remove the coating material and effect the selective shrinking, swelling or untwisting of the threads.

Another advantage of the method of this invention is that it makes possible an economically desirable method of effecting, in an uninterrupted process, an ornamental effect, a dyeing of the fabric and, if desired, the application thereto of a thermosetting material to render the fabric crease-resistant. Such an application of thermosetting material also contributes greatly to the stability of the final product and is of particular advantage on garment fabrics requiring a high degree of washability.

These and other advantages, as well as the novelty and utility of the invention will become more apparent from the detailed description in the following examples.

Example 1

A fabric having a 92 x 68 construction, a taffeta or plain weave, a warp of 100 denier, continuous 60 filament, dull viscose rayon yarn having a twist of 3 turns per inch, and a filling of 150 denier, continuous 90 filament, dull viscose rayon yarn having a twist of 3 turns per inch, was taken directly from the loom and agitated for 7 minutes with an 0.05% aqueous solution of a synthetic detergent of the polyether type at a temperature of about 140° F. in a mechanized tumbling barrel type washing machine. The fabric was then centrifugally extracted, and air dried under slight tension. When dried, the fabric exhibited a pleasing bias pattern line configuration composed of interlocking or overlapping rectangles, the major lines of which lie substantially in a fabric bias direction.

Example 2

A greige fabric similar to that described in Example 1 was placed in a mechanized washing machine of the tumbling barrel type with water at 160° F. A quantity of polyether type detergent equal to 0.05% of the weight of water, 1.0% of a direct viscose dyestuff and 10.0% of sodium chloride (both of these latter materials based on the original weight of dry cloth) were introduced and agitation of the fabric maintained for 20 minutes. The solution was then drained, the fabric given a brief running 140° F. rinse and centrifugally extracted. The machine was then refilled with fresh water at 140° F. and the fabric agitated for 10 minutes. This was followed by a brief 120° F. running rinse and a second centrifugal extraction. The fabric was then air dried under light tension.

Upon examination the fabric was found to be evenly and uniformly dyed and to exhibit as well a high degree of ornamental surface effect similar to that noted in Example 1.

Example 3

A greige fabric similar to that described in Example 1 was placed in a 20" diameter by 20" long mechanized tumbling barrel type washing machine containing cold water and agitated for 15 minutes. The water was then run out and the machine refilled. The temperature was raised to 120° F. and an amount of higher alcohol sulfate type detergent "Duponol D" equal to 0.5% of the water weight was added. A suitable amount of a dyestuff of the class known as "developed colors" "Zambesi Black VA Conc." was added with a trace of a silicone type anti-foaming agent "DC Antifoam." The fabric was then agitated continuously while the water temperature was raised over a period of 15 minutes to 212° F. and maintained at this point for 20 minutes. Suitable additions of the above mentioned dyestuff and 25% (based on original dry fabric weight) of sodium chloride were introduced during this time. The solution was then run out, the machine refilled with cold water, the fabric agitated for 5 minutes and this water emptied.

The dyestuff was next diazotized by agitating the fabric 20 minutes at 70° F. in an aqueous solution containing suitable amounts of sodium nitrite and sulfuric acid. The fabric was then subjected to another 5 minute rinsing in cold, fresh water.

The dyestuff was then developed by agitating the fabric 20 minutes at 70° F. in an aqueous solution containing suitable quantities of sodium carbonate and meta-toluylene diamine. The

fabric was then rinsed 5 minutes in cold, fresh water, 5 minutes in fresh water at 140° F., scoured 10 minutes in water at 140° F. containing 0.05% synthetic detergent of the polyether type, rinsed 5 minutes at 120° F., centrifugally extracted and air dried under slight tension.

The fabric displayed an evenly dyed appearance with good penetration of dyestuff into the fibers along with a most attractive and pleasing ornamental surface effect.

Example 4

A fabric similar to the fabric described in Example 1 was floated in a tank of water wherein the water was moving rapidly in the direction of motion of the cloth. A spray of water was caused to impinge on the surface of the fabric and directed so that the impact of the spray tended to drive the fabric in the direction in which the water was moving. It was found that after drying the fabric so treated under slight tension, ornamental surface effects substantially similar to those described in Example 1 were permanently produced on the fabric.

Example 5

A greige fabric similar to the fabric described in Example 1 was placed in a mechanized washing machine of the tumbling barrel type with an aqueous solution containing 10% methylated methylol melamine resin-forming material "Aerotex Resin M-3," 0.3% diammonium phosphate and 0.5% synthetic detergent of the alkylaryl-sulfonate sodium salt class "Santomerse D" and agitated for 10 minutes at a temperature of 70° F. The fabric was then centrifugally extracted and air dried under light tension. The impregnated fabric was then heated at a temperature of 325° F. for a period of 2 minutes while under light tension.

The final washing step of the process consisted of agitating the fabric 10 minutes in an aqueous solution at 140° F. containing 0.05% synthetic detergent of the polyether type in the tumbling barrel machine previously described. This was followed by a brief centrifugal extraction, a 5 minute rinse in fresh water at 120° F. and a final centrifugal extraction. The fabric was then air dried under light tension.

The resulting fabric was found to exhibit a highly contoured surface appearance of pleasing configuration of a type similar to that described under Example 1. In addition, the resin treatment was found to contribute greatly enhanced stability during subsequent washing and ironing together with noticeably improved crease resistance and the ability of the fabric to be dyed with acid type dyes.

Example 6

A greige fabric having a 98 x 68 construction, a plain or taffeta weave and having warp and filling threads of continuous 34 filament nylon with a denier of 100 and a twist of 7 turns per inch was subjected to agitation in an 0.05% aqueous solution of a polyether type synthetic detergent for 25 minutes at 150° F. while in a relaxed state in the manner described in Example 1.

After centrifugal extraction and drying under slight tension, it was found that while the fabric did not exhibit a highly prominent ornamental surface effect, a distinct bias pattern line configuration was visible by transmitted light and in bas-relief.

Example 7

A fabric having a plain weave of 50 x 46 construction, 300 denier continuous 60 filament bright viscose rayon yarn having a twist of 3 turns per inch in both warp and filling was taken directly from the loom and agitated 7 minutes in water at 65° F. in a tumbling barrel type washer. It was then centrifugally extracted and air dried under light tension. The sample then showed a readily discernible, attractive contoured surface appearance.

Example 8

A fabric having a plain weave of 60 x 60 construction, 150 denier continuous 90 filament dull viscose rayon yarn with a twist of 3 turns per inch in the warp and 1.8 turns per inch in the filling was taken directly from the loom and treated as in Example 7 with similar results.

Example 9

A greige fabric having a construction sometimes known to the trade as a "satin stripe," was treated in the same manner as the fabric of Example 7. The ground portion of this fabric is of plain weave, 92 x 68 construction, 100 denier continuous 60 filament dull viscose rayon yarn, having a twist of 2.2 turns per inch in the warp and 150 denier continuous 90 filament dull viscose rayon yarn, having a twist of 1.8 turns per inch in the filling. The stripes are of 5 harness satin weave, 130 x 68 construction, 100 denier continuous 26 filament bright acetate rayon yarn, having a twist of 3 turns per inch in the warp. Each stripe contains 224 warp ends and the stripes are separated by 100 ends in the ground design.

After drying, the fabric showed a highly accentuated contoured surface effect in the ground portion of the weave. This effect was not generated in the stripe portion to a perceptible degree. The contrasting areas of the fabric produced a most attractive and novel overall appearance.

Example 10

A fabric having a plain weave of 50 x 46 construction, 300 denier continuous 60 filament bright viscose rayon yarn having a twist of 3 turns per inch in both warp and filling was taken directly from the loom and agitated fifteen minutes with cold water in a tumbling barrel type washer. The water was then run off and the machine refilled with fresh water at about 70° F. With the machine running the temperature of the water was raised by the injection of steam to 180° F. over a 30 minute period. The bath was again run off and the fabric given a 5 minute 70° F. rinse in fresh water.

The goods were next transferred in rope form to a dye beck and dyed garnet using a dye from the class known as developed colors. This entailed exhausting the dyestuff from an aqueous bath onto the cloth by substantive attraction, diazotizing the dyestuff with sodium nitrite and acid and finally coupling the diazotized dyestuff with a suitable material such as B naphthol followed by scouring excessive dyestuff from the goods. The fabric was next centrifugally extracted, opened to full width and dried on a loop dryer operating at 230–250° F. The next step consisted of steaming lightly in a clip tenter under gentle tension to straighten the goods, flatten

out undesirable creases and eliminate folded over selvedges.

The cloth was then impregnated with a resin solution having the following composition:

	Per cent
"Rhonite R–1" (50% resin solids believed to be an aqueous solution of methylol ammelin)	6.20
Monsanto "Catalyst AC" (believed to be the hydrochloride salt of 2-amino butanol)	0.31
Sodium Alkyl Aryl Sulfonate Wetting Agent ("Santomerse D"—Monsanto Chem. Co.)	0.50
Water at room temperature	92.99

The impregnation was carried out in a two roll padding machine running at about four yards per minute. The thread-up used was one dip and one nip. The roll pressure corresponded to 108 lbs. per inch of roll width. One roll was of moderately resilient and soft rubber composition while the other was fairly hard.

The weight of resin solution picked up by the fabric equalled 87.1% of its own dry weight. After resin impregnation the cloth was dried at room temperature in a slack condition and cured in a roller type curing oven at 325° F. for 3 minutes 55 seconds.

The goods were next tumble washed about 7 minutes at 160° F. with 0.05% soda ash and 0.05% polyether type detergent ("Sted"—Monsanto) followed by 3 rinses in fresh water and centrifugal extraction.

The cloth was then dried in a roller type oven at 200–215° F., softened by padding in the same machine used for resin impregnation with a 1.5% aqueous solution of a cationic softening agent ("Softener H"—American Cyanamid Co.) at 110–120° F. and redried in the roller oven.

The finished fabric not only displayed a very pronounced and pleasing biased pattern line effect, but also possessed an excellent handle, characterized by a high degree of resiliency coupled with superior draping qualities, and satisfactory dimensional stability after washing and ironing.

The following data illustrate the stabilizing influence imparted to the goods by the resin treatment. The wash test employed was as follows, using 22'' x 22'' fabric swatches with 18'' x 18'' plot marks.

The swatches were conditioned at 70° F., 65% relative humidity and the plot markings applied with indelible ink. The swatches were then washed in a tumbling barrel type washer, with automatic reversal of the drum direction, 15 minutes at 120° F. with a running suds of neutral soap. They were next given two separate 5 minute rinses at 105° F., removed from the washer and spread flat in a forced air circulation type oven at 239° F. to remain until dry. They were then removed, sprinkled lightly with water and pressed flat in a flat bed press at 300° F. They were finally reconditioned, the plotmarks remeasured, and the percentage change in dimensions caused by this method of laundering were calculated.

Comparative dimensional changes for the above prepared fabric with the complete resin treatment against the same fabric taken just prior to resin impregnation appear below, the minus signs denoting shrinkage and the plus sign denoting gain.

	Warp, percent	Filling, percent
Without resin	−9.6	−4.6
With resin	−1.8	+3.2

Example 11

A fabric having a 92 x 68 construction, a plain weave, a warp of 100 denier, continuous 60 filament, dull viscose rayon yarn having a twist of 3 turns per inch, and a filling of 150 denier, continuous 90 filament, dull viscose yarn having a twist of 3 turns per inch, was taken directly from the loom and tumble washed 10 minutes in water containing 0.06% of polyether type detergent ("Sted"—Monsanto). During this wash, the temperature was raised from 70° F. to 160° F. by injection of steam.

The bath was then dropped and fresh water added at 120° F. With the machine running, a quantity of a suitable direct cotton dyestuff, National Erie Black NCW–175% (Color Index 539) was added and the temperature raised to 210° F. over a period of about 25 minutes. A second addition of the same dyestuff was made at 180° F. After the dyeing had proceeded at 210° F. for 10 minutes a quantity of sodium chloride was added to the bath and dyeing then continued at that temperature for 30 minutes more.

At the end of this time the dyebath was dropped, the machine refilled with cold water and allowed to run for 5 minutes, after which the water was run off and the fabric centrifugally extracted. The cloth was removed and dried at room temperature on a pin frame under moderate tension.

At this stage the surface of the fabric presented an extremely pronounced bias pattern line appearance and was evenly dyed. The dry cloth was then soaked 15 minutes in the following solution with occasional agitation.

	Per cent
Methylol melamine ("Resloom HP"—Monsanto)	10.0
Monsanto "Catalyst AC" (thought to be the hydrochloride of 2 amino butanol)	0.6
Water at room temperature	89.4

The impregnated cloth was then centrifugally extracted. This operation left a weight of solution on the cloth equal to 120% of the dry cloth weight. The wet cloth was again dried at room temperature on a pin frame under moderate tension. When dry the resin was cured by baking the fabric two minutes at 320–325° F. in a roller type curing oven.

The cloth was next tumble washed 7 minutes at 160° F. in a running suds of a polyether type detergent ("Sted"—Monsanto) followed by 3 brief rinses, centrifugal extraction and pin frame drying at room temperature as before.

The finished fabric presented an intensely surface-contoured appearance of considerable uniformity. The fabric was found in service to possess adequate dimensional stability for the dress and blouse trade.

Example 12

A fabric having the same greige construction as that of Example 11 was treated in the manner described under Example 10. The goods were not dyed, however, but were given a moderate peroxide bleach in the dye beck.

After bleaching the goods were centrifugally

extracted, opened to full width, dried in a loop dryer and steam framed lightly as in Example 10. They were next impregnated on a quetsch machine with the resin solution having the following composition:

	Per cent
"Rhonite R–1" (50% resin solids)	16.0
Ammonium chloride	0.4
Wetting agent	Trace
Water approximately	83.6

A quetsch machine is similar to a padder but the goods are not immersed in the liquor, depending for impregnation on the liquid carried up to the nip by the lower roll which is immersed. This operation proceeded at about 20 yards per minute and was carried on in such a way that the goods retained an amount of solution approximately equal to their own dry weight.

After impregnation the cloth was dried in an Air-Lay type dryer at about 250° F. and steam framed lightly to straighten out doubled selvedges, undesirable wrinkles and the like. The resin was then cured by baking the goods 3–4 minutes at 300° F. in a loop type fabric oven. Rope washing was accomplished in a machine similar to a dye beck with the assistance of a small amount of borax and synthetic detergent at a temperature of 140–160° F. for ½ hour. The goods were then rinsed in fresh water at 120° F., centrifugally extracted, opened to full width and dried in a loop dryer at 250° F. They were next softened by padding with a 0.5% solution of a cationic softening agent followed by loop drying and finally steam framing under light tension.

Cloth treated in this manner displayed a prominent and pleasing biased pattern line appearance. The drape and handle of the goods were highly satisfactory. That the dimensional stability was adequate is demonstrated by the following data showing the change in measurements produced by a launderability test similar to that described under Example 10.

	Resin Stabilized, percent	Before Resin Treatment, percent
Warp	−0.8	−11.6
Filling	+0.6	−4.5

Example 13

A fabric having a plain weave of 72 x 48 construction, 150 denier continuous 40 filament dull viscose rayon yarn warp having a Z twist of 2.5 turns per inch and a plied yarn filling consisting of one 300 denier continuous 50 filament bright viscose rayon yarn having an S twist of 2.5 turns per inch and one 55 denier continuous 20 filament bright cellulose acetate rayon yarn having an S twist of 1.2 turns per inch plied with Z twist of 4.6 turns per inch was taken directly from the loom and agitated 15 minutes in cold water in a tumbling barrel type washing machine. The water was then run off, the washer refilled with cold water and run 30 minutes with the temperature gradually raised to 180° F. over this time by the injection of steam. This bath was dropped and the fabric given a short rinse in cold water followed by centrifugal extraction.

The goods were then transferred to a dye beck and dyed with "Cuprophenyl Grey GRL" (an aftertreated type of direct cotton color manufactured by Geigy) and "Cibacete Scarlet BRN" (a direct on acetate type of dye manufactured by Ciba). After the dyestuffs had been exhausted onto the fibers, the goods were rinsed and aftertreated in an aqueous bath of copper sulfate and acetic acid, to develop the maximum fastness of the Cuprophenyl dye, followed by rinsing.

The goods at this stage presented a novel appearance. The bias pattern lines, although of the same general type as obtained in the previous examples, were of somewhat more rounded nature with fewer sharp angles formed by the intersection of the pattern lines. The effect was also somewhat less intense and more subtle than that obtained on some of the other fabrics. The main body of the goods was grey in color inasmuch as the viscose rayon had been dyed that shade by the Cuprophenyl dye. The acetate rayon, however, was a brilliant scarlet as a result of dyeing with the Cibacete dyestuff. This cross dyed effect served to accent the appearance of the pattern lines as the most intense scarlet shade seemed to coincide with many of the pattern lines.

The wet goods were centrifugally extracted and dried on a pin frame under moderate tension at room temperature. When dry the fabric was padded in a 2 roll padding machine, with the following solution.

	Per cent
Dimethylol urea	12.00
Diammonium acid phosphate	0.36
Sodium alkylaryl sulfonate wetting agent ("Santomerse D"—Monsanto)	0.50
Water at room temperature	87.14

The weight of solution picked up at the pad by the cloth equalled 118% of its own dry weight. The goods were air dried at room temperature on a pin frame under moderate tension and cured 4 minutes at 300° F. in a roller type oven. Scouring was carried out for 7 minutes at 160° F. in a tumbling barrel type machine using 0.1% polyether type detergent ("Sted"—Monsanto) and 0.1% soda ash followed by 3 brief rinses, centrifugal extraction and pin frame drying at room temperature as before.

The finished fabric presented a moderately surface contoured appearance coupled with an interesting cross dyed effect. Its dimensional stability, as evaluated by the laundering test described in Example 10 was −0.6% warp, 0.0% filling.

Example 14

A fabric having a 61 x 56 construction, a plain weave, a warp of 20/1 and a filling of 22/1 carded cotton yarns of usual twist multipliers was taken directly from the loom and tumble washed 8 minutes at 160° F. in an 0.1% solution of synthetic detergent (fatty acid amide condensation product—"Hymolon," Hart Products Corp.) followed by two 3 minute cold rinses. The goods were next centrifugally extracted and tumble dried, attaining a maximum temperature of 215° F.

Upon inspection biased pattern lines similar in appearance to the type obtained in the previous examples were easily noticeable in the fabric.

It is to be understood that numerous changes and modifications will readily occur to those skilled in the art upon reading the foregoing description. It is intended that all such changes and modifications come within the scope of the appended claims in this specification.

I claim:

1. A woven fabric having an ornamental sur-

face effect, said effect having the appearance of a multiplicity of intersecting pattern lines of random length displaced above and below the plane of the fabric and running on a bias and in two distinct intersecting directions, the pattern lines lying in any one of the two intersecting directions being closely adjacent one another.

2. A woven fabric as defined in claim 1 impregnated with a thermosetting resin.

3. A woven fabric having an ornamental surface effect, said effect having the appearance of a multiplicity of pattern lines of random length displaced above and below the plane of the fabric and running on a bias and in two distinct intersecting directions, each pattern line intersecting at least two pattern lines running in the other direction.

4. A woven fabric as defined in claim 3, impregnated with a thermosetting resin.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
D. 95,581	Forstmann	May 14, 1935
D. 103,852	Forstmann	Mar. 30, 1937
1,680,497	Brown et al.	Sept. 7, 1922
2,100,712	Emmey	Apr. 13, 1936
2,470,453	Alexander	May 17, 1949
2,525,543	Guttman et al.	Oct. 10, 1950

FOREIGN PATENTS

Number	Country	Date
555,575	Great Britain	Aug. 30, 1943