July 19, 1955 C. ROBBINS II, ET AL 2,713,193

TEXTILE FABRICS AND METHODS FOR PRODUCING THE FABRICS

Filed Jan. 14, 1950 2 Sheets-Sheet 1

Fig. 1.

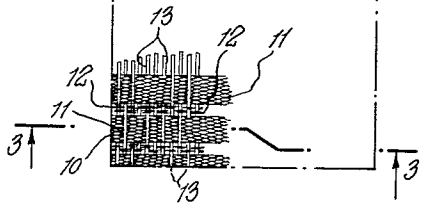
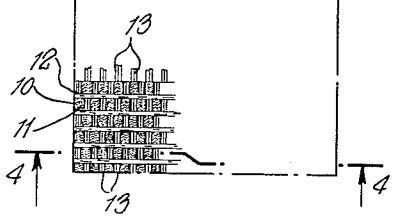



Fig. 2.



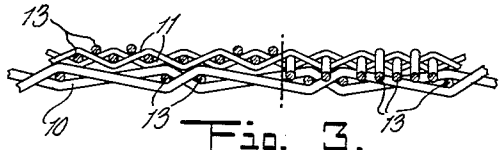




Fig. 3.

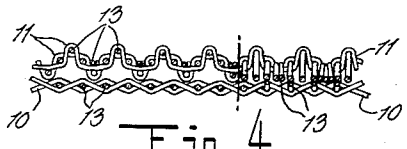



Fig. 4.

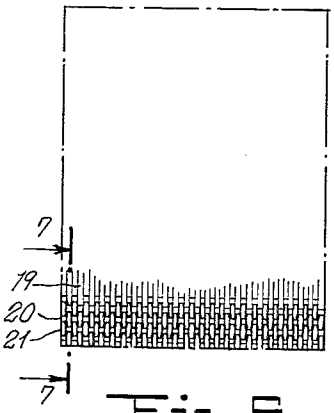



Fig. 5.

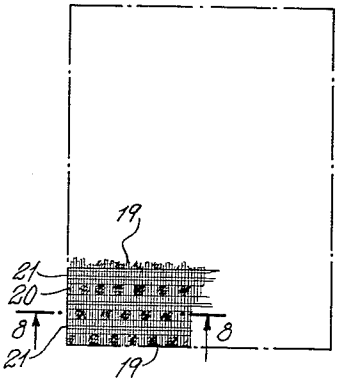



Fig. 6.

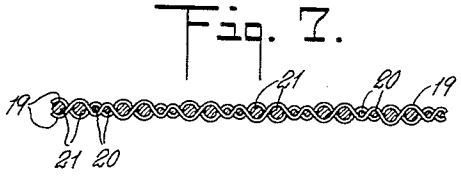



Fig. 7.

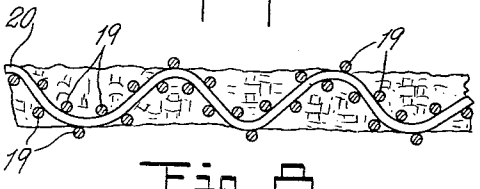



Fig. 8.

INVENTORS
CHANDLER ROBBINS II
BY EDWIN J. HODGKINS
Campbell, Brumbaugh, Free & Graves
ATTORNEYS

July 19, 1955 C. ROBBINS II, ET AL 2,713,193

TEXTILE FABRICS AND METHODS FOR PRODUCING THE FABRICS

Filed Jan. 14, 1950 2 Sheets-Sheet 2

Fig. 9.

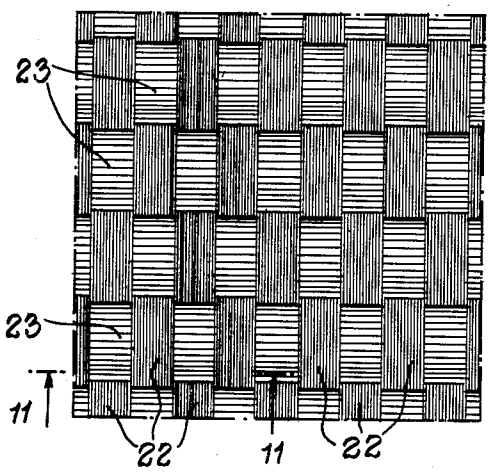



Fig. 10.

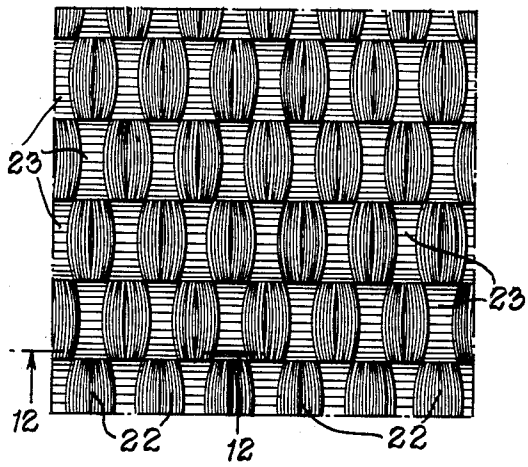
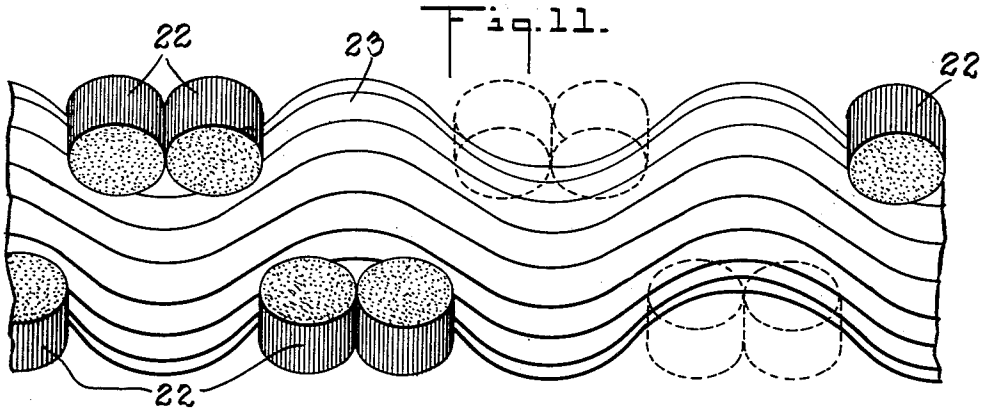



Fig. 11.



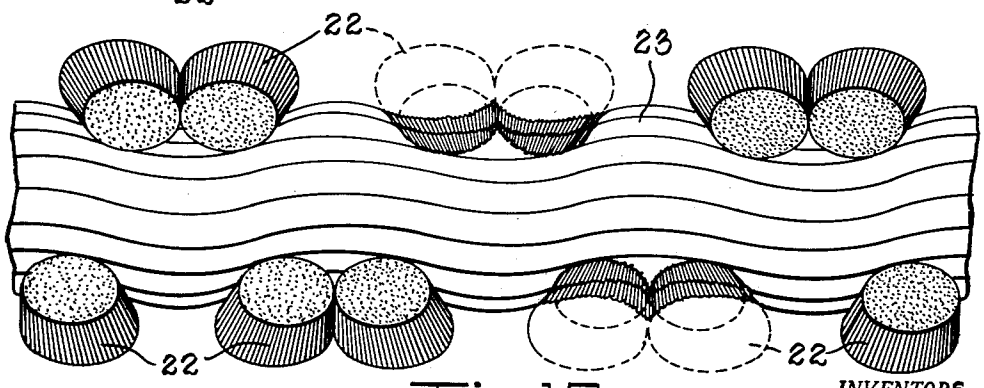




Fig. 12.

INVENTORS
CHANDLER ROBBINS II
EDWIN J. HODGKINS
BY
Campbell, Brumbaugh, Free & Graves
ATTORNEYS

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# TEXTILE FABRICS AND METHODS FOR PRODUCING THE FABRICS

Chandler Robbins II and Edwin J. Hodgkins, Auburn, Maine, assignors to Bates Manufacturing Company, a corporation of Maine

Application January 14, 1950, Serial No. 138,608

13 Claims. (Cl. 28—76)

This invention relates to fabric manufacture. More particularly it is concerned with the production of woven textile fabrics wherein the fabric after looming is modified by supplemental treatment to impart new and different characteristics thereto.

Weaving textile fabrics other than those comprising plain and light weaves generally requires the use of loom machinery of corresponding mechanical complexity or weight. Rugs, tapestries and many upholstery fabrics for example, are presently woven on cumbersome, low-speed looms in which high filament tensions and intensive beating operations may be required. Likewise certain of the lighter fabrics having unusual surface characteristics such as crepe and seersucker require special looming procedures such as twisting, disproportionate tensioning, or otherwise manipulating the yarns during weaving to achieve the desired characteristics in the finished product. Thus the preparation of fabrics having unusual or distinguishing characteristics may result in either lower production rates or increased machinery costs. In addition there are certain useful characteristics in fabrics, such as extraordinary tightness or compactness of the weave, which are practically unattainable by conventional weaving techniques.

It is accordingly an object of this invention to provide various novel fabrics having complex weave characteristics using only conventional high-speed loom equipment.

It is another object of the invention to provide fabrics having distinguishing properties in their weaves which cannot ordinarily be imparted in a weaving operation but which are, rather, brought about by treatment according to the invention subsequent to the initial weaving operation. The invention thus contemplates the formation of fabrics having a tightness of weave equal to and in some instances greater than can be attained with the heaviest tapestry or carpet looms, but nevertheless using simple weaving machinery suitable for light weight apparel or decorative fabrics.

Yet another object of the invention is to provide a fabric woven of dissimilar yarns, wherein one yarn has good tensile or elastic properties to impart strength to the fabric and the other has superior abrasion-resistant qualities, the interwoven yarns being reorinentated in a novel manner subsequent to weaving to yield a relatively complex weave in which the abrasion-resistant yarn almost completely textures at least one surface of the fabric and the yarn having high tensile strength forms a durable body or matrix for the fabric. The result is a strong, long-wearing fabric of good appearance.

The several objects of the invention may be attained by incorporating in woven fabrics preestablished proportions of filaments or yarns formed of materials which may, upon treatment subsequent to the weaving operation, be radically shrunk or contracted by virtue of high energies of contraction which are utilized in a novel manner either to modify existing characteristics or to impart new characteristics to the fabrics. In no case however, do



the filaments require special tensioning at the time of weaving nor do they require twisting or doubling prior to weaving to yield the results set forth herein.

There follows a description of specific fabrics formed in accordance with the invention. The accompanying drawing is provided to supplement the written disclosure where suitable with a pictorial representation of certain of the fabrics described, in which:

Fig. 1 is a full surface view of a fabric woven according to the invention and showing the weave of the fabric prior to supplementary treatment;

Fig. 2 is a raised-surface fabric evolved subsequent to the weaving operation by supplementary treatment of the fabric shown in Fig. 1;

Fig. 3 is a cross-section of the fabric shown in Fig. 1 taken along the stepped line 3—3;

Fig. 4 is a cross-section of the fabric shown in Fig. 2 taken along the stepped line 4—4;

Fig. 5 is a full surface view of another woven fabric shown prior to supplemental treatment;

Fig. 6 is an irregular-surface type fabric evolved by supplemental treatment from the fabric shown in Fig. 5;

Fig. 7 is a view in cross-section taken along the line 7—7 of Fig. 5;

Fig. 8 is a view in cross-section taken along the line 8—8 of Fig. 6;

Fig. 9 is a full surface view of another fabric formed in accordance with the invention and as seen prior to treatment;

Fig. 10 is a full surface view of a fabric which evolves after treatment of the fabric of Fig. 9;

Fig. 11 is a view in cross-section taken on the line 11—11 of Fig. 9; and

Fig. 12 is a view in cross-section taken on the line 12—12 of Fig. 10.

It is known in the art of fabric manufacture that several materials from which filaments and yarns are made have high shrinking characteristics under the influence of certain treatments such as heat, for example. These characteristics in certain cases have been detrimental to the production of useful or serviceable fabrics for the reason that the high degree of shrinking may cause stiffness, filament breakage and other undesirable effects. The shrinkage characteristic of certain yarns has also been utilized to tighten the weave of fabric by the obvious expedient of shrinking the filaments subsequent to weaving, thereby to increase the density or closeness of the weave as a matter of degree.

The instant invention contemplates the novel use of the high energy of contraction of certain yarn materials to alter inherent characteristics of the fabrics into which they are woven and to bring about new and distinguishing features in the weave.

Referring to Figs. 1–4, there is shown a fabric comprising a multiplicity of monofilament strands formed of polyethylene and a multiplicity of cotton yarn strands. The initial weave as shown in Figs. 1 and 3 comprises a mock pique, twelve harness weave with ribs of ten polyethylene monofilament strands **10** and nine cotton stuffer strands **11** with two polyethylene monofilaments **12** being disposed between the ribs in the warp. The filler consists of polyethylene monofilament strands **13** interwoven as shown. In this fabric the polyethylene monofilament preferably has a diameter of .010 inch.

The polyethylene strands in the relatively loosely woven fabric are at any time subsequent to the initial weaving operation subjected to a suitable shrinking treatment, such as heating to a temperature of 100° C. in either a dry or steam atmosphere or by immersing in heated water or other media. Polyethylene strands of the nature used in this fabric, although shrinking as much as 65% of their length under similar thermal treatment

before being woven into a fabric, are able to shrink a relatively lesser amount, or from 15% up to any amount less than 65% of their original length, depending upon the closeness and nature of the initial weave. The lengthwise contraction of the strands is thus inhibited, and consequently high tensile forces are developed within the initially woven fabric.

In contracting, the polyethylene warp and filling strands first act to tighten the weave to form a tight body or matrix of polyethylene strands. In addition the cotton stuffer strands 11, being shrunk a lesser amount, if at all, are raised into loops, populating the surface of the fabric to form the raised or irregular surface effect shown in Figs. 2 and 4. The outermost plane of the surface of the modified or treated fabric is textured completely of cotton with polyethylene strands being embedded or concealed therein. The contracted strands forming the fabric body may exhibit a tightness or density which exceeds that which can be obtained by conventional weaving operations using heavy tapestry or carpet looms, it being remembered that only a light high-speed loom is required in the initial preparation of the fabric above described.

The fabric in its final form, as shown in Fig. 2, is suitable for use as upholstery fabric and the like, and may be provided according to the invention in a great number of weights and textures.

The specific nature of the shrinking treatment, as well as the time at which the fabric, as initially loomed, is subjected to the treatment may be varied within wide limits to suit the particular demands of the materials used in the contracting yarns and the facilities for performing the shrinking operations. Thus the untreated fabric may be subjected to shrinking treatment such as heating for example, immediately upon emerging from the loom, as by contact with heated elements or exposure to thermal gases or fluids in any one of several known methods. Alternatively the fabric may be subjected to a multiplicity of intervening processing operations prior to the actual contracting operation to impart new characteristics to the weave.

Referring to Figs. 9–12 a fabric may be provided according to the invention by loosely weaving a preliminary fabric containing warp strands 22 of 70 denier nylon and filling strands 23 of 740 denier polyethylene multifilaments consisting of 18 unannealed filaments preferably of .003 inch in diameter and having no twist. A plain weave is provided with the nylon being woven two ends as one in the warp. This fabric as it emerges from the loom should show substantial spacings between warp ends as seen in Figs. 9 and 11. The orientation of the strands or threads is such that each surface of the fabric is textured of a combination of polyethylene and nylon strands. The fabric is then subjected to any suitable shrinking treatment such as described above to contract the polyethylene strands, the resulting fabric (Figs. 10 and 12) presenting, due to the high energy of contraction of the polyethylene, two surfaces composed or textured almost entirely of nylon, with the polyethylene strands disposed deeply within the weave to a point where the nylon strands are disposed to withstand alone most surface abrasion to which the fabric might be subjected. A fabric of this type would be difficult, if not impossible to prepare directly upon the loom, and if achieved upon a loom, would in any case involve a difficult and costly weaving operation.

According to the invention modifications or changes in the surface coloring of certain fabrics may be attained concurrently with the attainment of new characteristics in the fabric weave, both being imparted by the high energy of contraction of filaments or fibres in the weaving strands. For example, a fabric (not illustrated) may be woven having warp strands of 140 denier Vinyon "N" and filling strands of colored 700 denier multifilaments of polyethylene, the initial weave being plain. The coloring and texture of the preliminary fabric may be irregular



for the reason that both warp and filling strands may be visible on the surface thereof. The fabric is then subjected to a supplemental shrinking treatment as described resulting in contraction of the polyethylene, wherein the initial fabric evolves into a closely woven chambray-type in which the filling strands are substantially invisible on at least one surface.

By providing the last described fabric with highly colored warp strands an iridescent effect may be achieved wherein the filling filaments, although not readily visible on the surface of the finished fabric nevertheless favorably effect the "depth" of the coloring of the fabric.

Another example of a fabric which may be produced according to the invention is the irregular-surface fabric as shown in Fig. 6. A fabric (Fig. 5) is first prepared comprising a plain weave having warp strands of Vinyon "N" 19 (140 denier being suitable) and a filling of both Vinyon "N" 20 and 700 denier polyethylene strands 21, the weave being plain with two picks of Vinyon "N" and two picks of polyethylene alternated in the filling. When subjected to appropriate shrinkage treatment an irregular-surface fabric (Fig. 6) is evolved due to disproportionate energies of contraction of the Vinyon "N" and polyethylene strands. Thus a complex-weave fabric is attained using box loom apparatus to provide initially a plain weave fabric. Accordingly, no special tensioning or twisting of the filaments during the weaving operation is required.

With respect to the heat treatment, it is to be noted that the polyethylene filaments tend to conform to external and internal fabric stresses under the influence of heat and take positions in the construction of cloth with less tendency to straighten out. This has the effect of locking the threads of polyethylene, as well as interwoven threads of other materials, in place against physical strains imposed on the cloth. Hence remarkable stability is imparted to fabrics made in accordance with this invention.

It will be understood that in certain instances, steps normally used in the process of manufacturing fabrics may be combined with the contracting or shrinking operation. Thus, for example, a wet heat dyeing operation may be combined with the strand shrinking operation to enable a saving of time and expense in the preparation of the fabric. Accordingly a fabric may be woven in any suitable manner, using heat contractible materials, anticipating the amount of contraction at the dyeing temperature, and then processing the fabric by a combination dyeing and shrinking treatment to yield a finished product.

It will be understood that although the several fabrics selected for purposes of illustration of the invention utilize polyethylene as the material for providing the necessary high energy of contraction, other contractible materials may be incorporated in fabrics to attain identical or related results. For example, any thermoplastic resin which can be combined with or formed into a weaving strand to impart high energies of contraction thereto, as defined, may be woven into fabrics of the type described with results substantially similar to those attained utilizing polyethylene. As stated, the yarn should possess such potential energies of contraction that lengthwise shrinkage equal to or exceeding 15% is achieved by treatment subsequent to the initial weaving operation.

Moreover the specific type of contractible strands or yarns used may be varied widely to suit particular requirements. For example, composite strands comprising a continuous filament portion of contractible material with a staple fibre portion combined therewith may be incorporated in a woven fabric to provide both the energy of contraction and a surface texturing material. Likewise strands formed of contractible staple fibres may be utilized in lieu of strands formed of continuous filaments of contractible material.

It is to be recognized that a staple yarn will exhibit

lower linear shrinkage than filament yarn of the same chemical constitution under correspondingly similar influences of heat. The use of such yarns should be accompanied, therefore, by suitable compensation, such as increased heat in the contracting operation, in order to provide the requisite energies of contraction.

While specific embodiments of the invention have been described above, the invention is not to be limited thereto but is susceptible of numerous changes in form and style within the scope of the following claims.

We claim:

1. The method of manufacturing a textile fabric including weaving a fabric comprising a multiplicity of strands of at least two different types having relatively different lengthwise shrinking characteristics, said fabric having at least one surface composed at least partially of strands of both types, and shrinking subsequent to the weaving operation the strands having the greater shrinking characteristics to redispose the other strands in the weave so that one surface is composed substantially of strands of one type.

2. A fabric comprising a filling of strands formed of a given first material, a stuffer of strands of a given second material, and strands interwoven with those of the first and second materials, said first and second materials providing strands having widely different lengthwise shrinking characteristics, said strands of first material shrinking the greater amount and being shrunk in situ after weaving, wherein the diminution of length of the strands of said first material is not less than 15% with the energy of contraction causing spaced bunching of the strands of said second material to effect the formation of a raised-surface fabric from an initially smooth-surface weave.

3. A fabric comprising a warp of polyethylene strands, a filling of polyethylene strands, a stuffer of strands of a given second material, said fabric being initially woven as a smooth surface weave, the polyethylene strands being selectively shrunk subsequently to weaving to contract said polyethylene filaments by an amount not less than 15% of their respective lengths to raise said second filaments, thereby to form a raised surface fabric having a body of polyethylene strands.

4. An irregular surface fabric comprising warp strands of Vinyon N, first filling strands of Vinyon N, second filling strands of polyethylene, said strands being initially disposed in a smooth-surface weave with two picks of Vinyon N and two picks of polyethylene alternated throughout the filling, said polyethylene strands being subjected to lengthwise shrinking treatment whereby the energy of contraction distorts the fabric into an irregular-surface weave due to disproportionate shrinkage of Vinyon N and polyethylene in the filling.

5. The method of manufacturing a fabric comprising the steps of weaving a fabric of a multiplicity of weaving strands of a first material and a multiplicity of weaving strands of a second material, said first and second materials having widely different shrinking characteristics, said strands of first material having good abrasion resistant properties, said woven fabric having at least one surface composed of both first and second materials, and shrinking said weaving strands subsequent to weaving wherein the energy of contraction of said strands causes one surface to be composed substantially of said abrasion resistant strands.

6. A fabric including a plurality of adjacent parallel strands of a first heat-shrunk material affording a diminution of length in situ exceeding 15%, a plurality of strands of a second relatively non-shrinking material overlying said strands of shrunk material, and interwoven transverse strands holding the said strands of first and second material in contiguous relationship at points spaced along the length of the said overlying strands, said shrunk material by virtue of its contraction in situ causing bunching of the strands of second material between the said interwoven transverse strands to form a raised textured surface on at least one surface of said fabric.



7. A fabric including a plurality of adjacent parallel strands of a first heat-shrunk material affording a diminution of length in situ exceeding 15%, a plurality of strands of a second relatively non-shrinking material overlying said strands of shrunk material, and interwoven transverse strands holding the said strands of first and second material together at points spaced along the length of the said overlying strands, said shrunk material by virtue of its contraction in situ causing bunching of the strands of second material between said interwoven transverse strands to form a raised textured surface on one surface of the fabric, the other surface of said fabric being comprised of strands of said heat-shrunk material, said other surface being substantially flat.

8. The method of making a raised surface fabric which comprises weaving a fabric having a plurality of parallel weaving strands formed of a material having a high shrinking characteristic in the influence of heat, a plurality of strands of a second material overlying the strands of the first material, parallel therewith, and interwoven transverse strands holding the said parallel strands together at spaced-apart intervals and heating the fabric so as to contract the strands having the greater shrinking characteristics to cause the overlying strands to bunch and form a raised surface on at least one side of the fabric.

9. A single-ply woven corrugated fabric, consisting of a fabric of single-ply throughout and formed of alternate parallel rows of heat-shrunk synthetic strands and non-shrunk synthetic strands, the heat-shrunk and non-shrunk strands consisting of different materials, and strands interwoven with said parallel rows, the heat-shrunk rows being sufficiently shrunken to hold the non-shrunk rows in an undulated condition to form a corrugated fabric.

10. The method of making a single-ply corrugated fabric, which comprises weaving a single-ply fabric having extending lengthwise thereof alternate parallel rows of heat-shrinkable strands and non-heat-shrinkable strands, the heat-shrinkable and non-heat-shrinkable strands consisting of different materials, and heating the fabric so that the heat-shrinkable yarns will contract and cause the non-heat-shrinkable strands to bend and form corrugations.

11. A fabric comprising a multiplicity of polyethylene mono-filament strands and a multiplicity of strands formed of a different material less susceptible to shrinking under heat treatment, the weave comprising a mock pique, multi-harness weave with ribs comprising a plurality of said polyethylene strands and overlying strands formed of said different material, one or more polyethylene strands being disposed between the ribs, said polyethylene strands being heat-shrunk subsequent to weaving to form a fabric body of polyethylene, and a surface populated with raised loops of said different material.

12. A method for making a fabric having a raised surface of a preestablished pattern, including the steps of weaving a fabric using for the strands running in at least one direction in the weave first and second parallel strands which are, respectively, relatively shrinkable and non-shrinkable when subjected to a given shrinking treatment and constraining the second strands at predisposed, spaced-apart points along their lengths while subjecting the fabric to said given shrinking treatment to shrink the first strands so as to force the second strands to raise in undulations between constraining points, thereby to form the preestablished surface pattern in the fabric.

13. A fabric having a preestablished undulation pattern in its surface comprising first and second yarns of different materials disposed in parallel relationship and strands interwoven with said first and second strands, said first and second strands being shrinkable in widely different amounts when subjected to a given shrinking

treatment, at least a portion of said strands being shrunken by said given shrinking treatment after weaving to draw the lesser shrunk strands into undulations, said lesser shrunk strands having been constrained at preestablished spaced-apart points to establish the undulation pattern for the lesser shrunk strands.

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