

Sept. 18, 1945.

S. C. LILLEY ET AL

2,384,936

ELASTIC FABRIC AND METHOD FOR PRODUCING THE SAME

Filed June 11, 1942

2 Sheets-Sheet 1

Fig. 1.

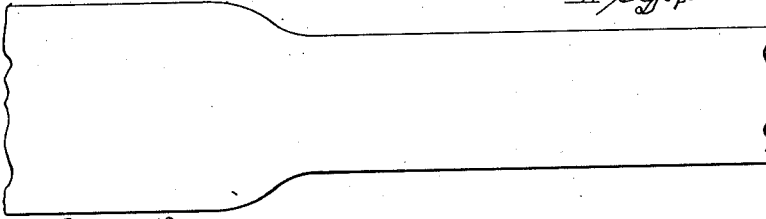


Fig. 3.

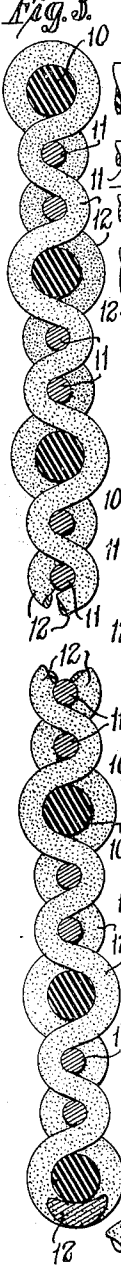


Fig. 2.

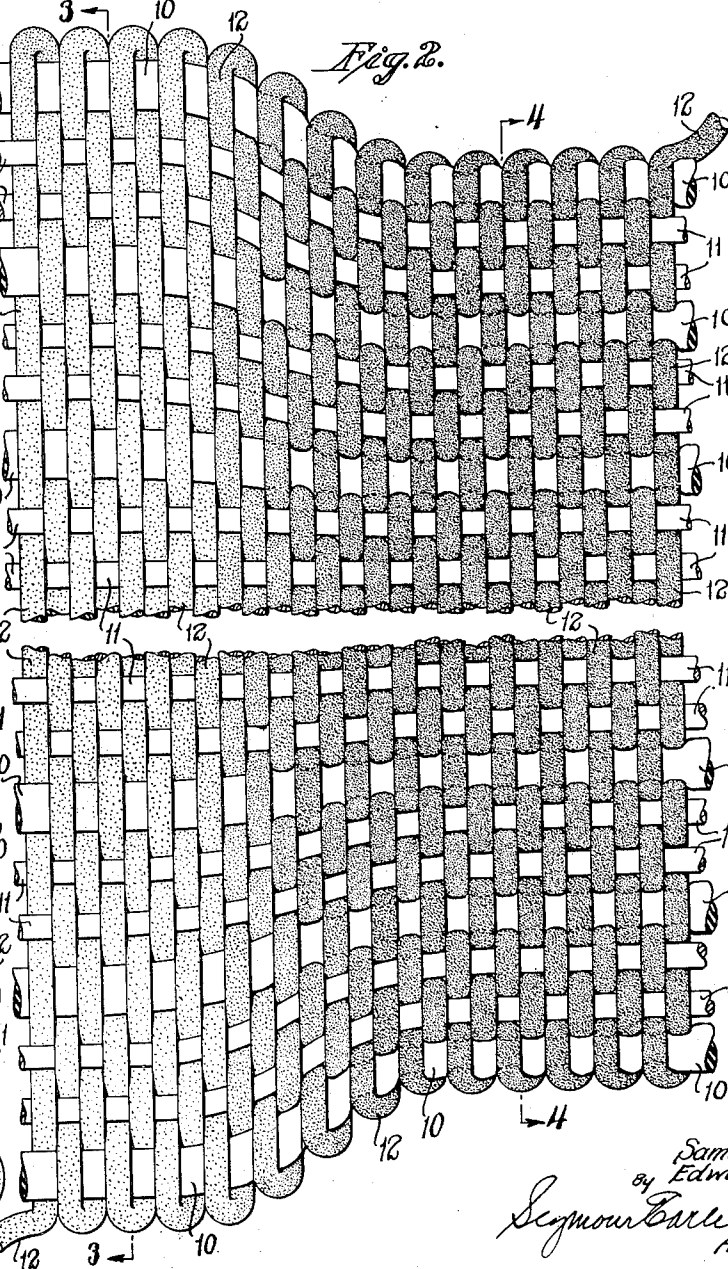
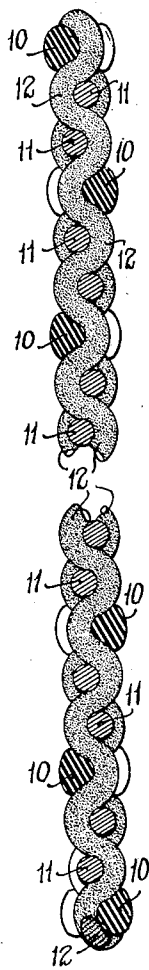


Fig. 4.



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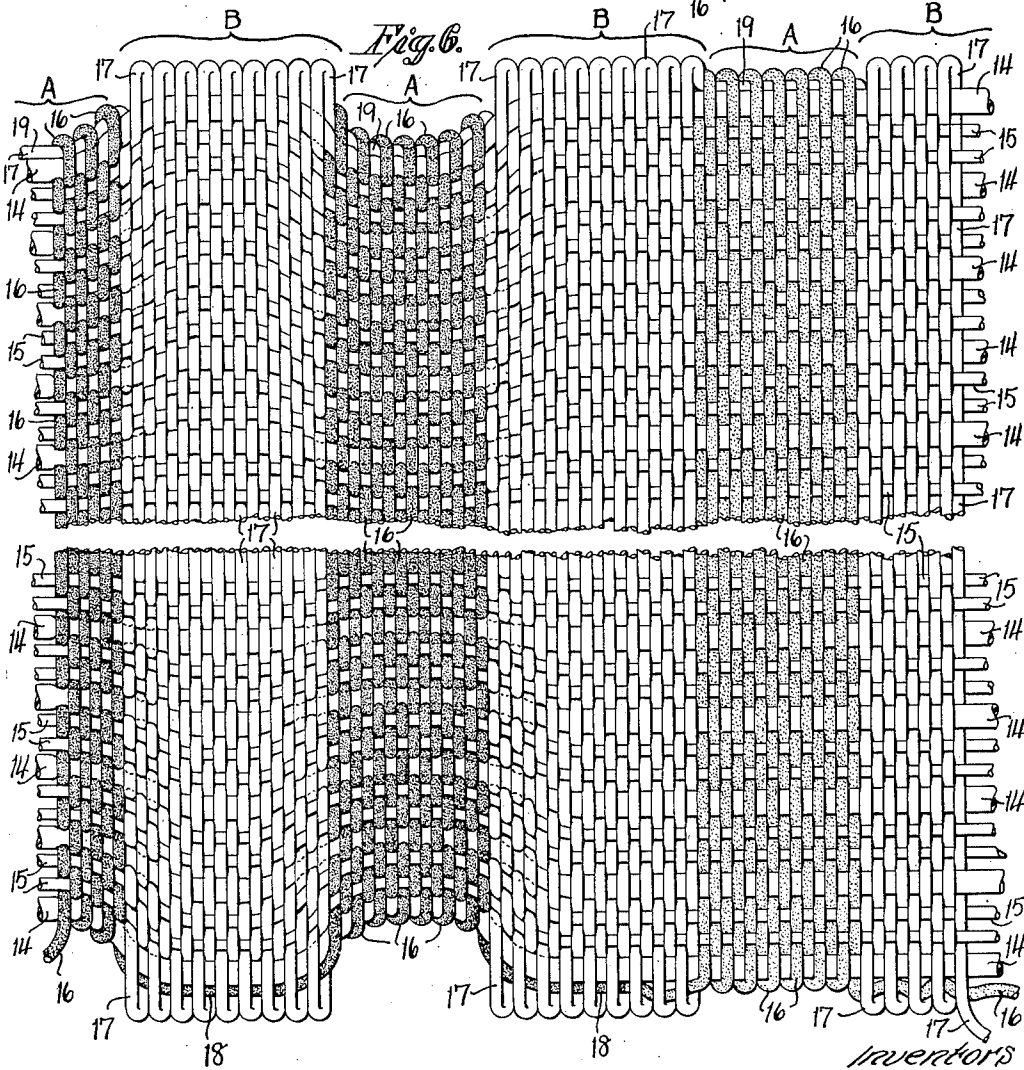
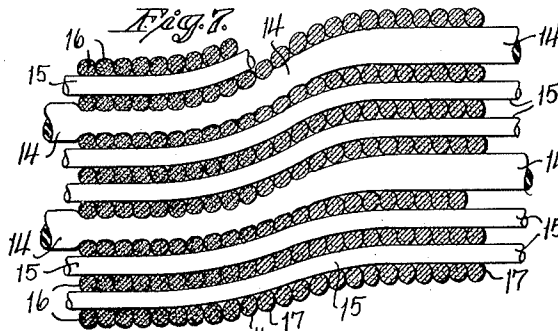
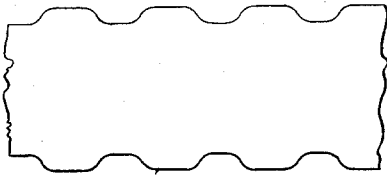
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2 Sheets-Sheet 2

Fig. 5.



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ELASTIC FABRIC AND METHOD FOR
PRODUCING THE SAME

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Application June 11, 1942, Serial No. 446,580

15 Claims. (Cl. 28—73)

The present invention relates to improvements in elastic fabrics, and more particularly to improvements in woven elastic fabrics in which the elastic strands thereof are anchored in the fabric to minimize creepage. The present invention, furthermore, is similar to and is a continuation in part of our co-pending application Serial No. 376,438, filed January 29, 1941.

One of the objects of the present invention is to provide a superior woven elastic fabric in which the elastic strands thereof are anchored to other components of the fabric in such manner as to minimize, if not preclude, the creepage or run-back of the said elastic strands, in the event that the same should become severed.

Another object of the present invention is to provide a superior woven elastic fabric which will be readily stretchable in the direction of the elastic strands but which will be stiffened in a direction transversely with respect to the said elastic strands.

A further object of the present invention is to provide a superior woven elastic fabric which is characterized by a combination of ready stretchability with a relatively-high degree of flexibility along lines running transversely with respect to the component elastic strands and also combined with a relatively-high degree of resistance to flexing along lines paralleling the said elastic strands.

Another object of the present invention is to provide a superior woven elastic fabric having undulating or scalloped edges, and having the elastic strands thereof anchored in the contracted portions of the fabric.

Still another object of the present invention is to provide a superior method whereby an elastic fabric may be readily woven without special handicap and whereby following the weaving operation, the fabric may be subjected to a step which will anchor the component elastic strands therein.

A still further object of the present invention is to provide a superior method whereby subsequent to its being woven an elastic fabric may have unidirectional stiffness imparted to its without requiring the addition of sizing or similar materials to the fabric after its fabrication.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art and which are not claimed in any separate application.

In the accompanying drawings, in which cer-

tain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a face view of a fragment of elastic fabric embodying the present invention and showing part thereof treated and a part thereof untreated by the heating step of the present method;

Fig. 2 is a broken schematic face view of one form of fabric embodying the present invention and showing schematically a portion prior to treatment and a portion subsequent to treatment;

Fig. 3 is a broken transverse sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a similar view taken on the line 4—4 of Fig. 2;

Fig. 5 is a face view of a scalloped-edge elastic fabric embodying the present invention;

Fig. 6 is a broken schematic face view schematically illustrating strand relationships in the fabric of Fig. 5; and

Fig. 7 is a broken central-sectional view taken in a plane paralleling the respective faces of the elastic fabric of Figs. 5 and 6.

The elastic fabric of Figs. 1 to 4 inclusive

The elastic fabric shown comprises a series of laterally-spaced-apart elastic strands 10 which may be of round, rectangular, or other cross-sectional form, and may be composed of rubber or other suitable elastic material. The said elastic strands 10 may be individually covered by wrapping or the like as is a well known practice in the art, or the said strands may be bare as shown.

The particular elastic strands 10 above referred to, form warp strands of the fabric shown, in conjunction with relatively-non-elastic strands 11 woven or otherwise incorporated into the fabric in groups intermediate the said elastic strands 10.

The strands 11 may be formed of any suitable textile material, such for instance as cotton, regenerated cellulose, silk, wool, etc., and when in place in the relaxed fabric, they follow a sufficiently undulatory or serpentine path to thereby permit the fabric to be stretched against the tension of the elastic strands 10, in a manner well understood in the art.

Extending crosswise with respect to the elastic strands 10 and hence also with respect to the relatively-non-elastic strands 11 is a series of cross-strands 12 which intermesh with the said strands 10 and 11. In the particular instance shown, the so-called "strands" 12 are, in fact, one continuous strand and constitute weft picks in the woven fabric, though in effect each of the said weft picks constitutes an independent strand ca-

pable of following a different path from the next adjacent strand 12.

All of the cross-strands 12 are formed either in whole or in part of heat-shrinkable artificial resin or resins, though it is not necessary that each cross-strand 12, or its equivalent, be of this character, since it will suffice if the said heat-shrinkable strands are repeated at certain intervals. The heat-shrinkable strands 12 or their equivalent, whether or not located immediately adjacent each other, may be formed entirely of heat-shrinkable artificial resins or partly thereof, so long as the complete heat-shrinkable strand is inherently capable of being shrunk by heat relative to such other strands as may be employed in the form of cotton, wool, etc.

The said heat-shrinkable strands may be twisted or untwisted and formed, for instance, wholly or in part of a co-polymer of vinylacetate and vinylchloride, polyamides, vinylidenechloride, or the like.

Preferably, the heat-shrinkable artificial resin strands, threads or ribbons are formed by the well-known stretch-spinning process or by a process involving stretching subsequent to spinning.

After the fabric has been woven, knitted, netted or otherwise has its strands interlaced or intermeshed, the fabric may be subjected to a heating operation either while wet or dry to a temperature above the softening point of the artificial resin strands to thereby cause the said strands to contract. The temperatures and the periods of exposure to such temperatures may vary widely and in most instances, variations in temperatures and/or times of exposure to such temperatures will cause variations in the degree of shrinkage of the heat-shrinkable artificial resin strands. Generally speaking, an exposure to a temperature in the vicinity of 175° F. for about 1 to 5 minutes will effect the desired shrinkage which is preferred to be in the order of 30% to 40% contraction. It is to be understood that relatively thin fabrics require less time of exposure to heat than the thicker multi-ply fabrics.

As will be noted by reference to the right-hand portion of Fig. 2 in particular, the heating of the fabric as above described will cause the cross-strands 12 or their equivalent to shrink sufficiently to squeeze portions of the elastic strands 10 to thus secure or anchor the said elastic strands against longitudinal undue creepage in the fabric.

After the fabric has been heated to shrink the cross-strands 12, not only will the elastic strands 10 be tightly gripped and restrained against longitudinal slippage by the said cross strands, but the entire fabric will be transversely compacted and stiffened and will remain relatively flexible in a direction required to permit the fabric to be rolled up from end to end. In other words, after the cross-strands 12 have been shrunk as described, the fabric will greatly resist being bent, folded or curled along lines paralleling the strands 10 and 11, but will be readily flexible along lines paralleling the cross-strands 12.

The fabric of Figs. 5, 6 and 7, inclusive

The fabric schematically illustrated in Figs. 5 to 7 inclusive, comprises a plurality of laterally-spaced-apart elastic strands 14 between each pair of which are preferably located a plurality of relatively-non-elastic strands 15. The elastic

strands 14 just referred to may be formed of any suitable elastic material such, for instance, as has been mentioned in connection with the elastic strands 10, and the relatively-non-elastic strands 15 may be composed of any suitable textile material such, for instance, as the textile materials mentioned in connection with the non-elastic strands 11. In the particular woven fabric shown schematically, the elastic strands 14 and the non-elastic strands 15 constitute warp strands, and each thereof has interlaced with it alternate groups A of heat-shrinkable strands 16 interposed between groups B of relatively-non-heat-shrinkable strands 17.

In the fabric schematically shown, each of the heat-shrinkable strands 16 is, in fact, a continuation of the next adjacent strand of similar material and constitutes a weft-pick of the fabric. Despite this integrality, each of the strands or weft-picks 16 may be viewed as an individual strand, inasmuch as each thereof may independently follow its own prescribed path in the fabric.

In a manner well known in the art, one of the groups A of heat-shrinkable strands may be connected to the next adjacent group A of similar strands by a connecting-reach such as 18. The strands 16 may be formed of the same character of material as mentioned in connection with the strands 12.

The strands 17 may be formed of any suitable textile material such as has been mentioned in connection with the strands 11, 12 and 15, and each group B of the said strands 17 may be interconnected to the next adjacent group B by a connecting-reach 19.

As thus constructed and arranged, the fabric includes areas A of heat-shrinkable cross-strands alternating with areas B of relatively-non-heat-shrinkable material.

When the fabric of Figs. 5 to 7 inclusive is subjected to heat in any suitable manner such for instance as described in connection with the fabric of Figs. 1 to 4 inclusive, the heat-shrinkable strands 16 in the areas A will contract, as is illustrated in the left-hand portion of Fig. 6.

The contraction of the heat-shrinkable strands 16 as above described will result not only in pinching and anchoring the elastic strands 10, but will cause the respective opposite edges of the fabric to assume an undulating or scalloped form.

Furthermore, and as has been described in connection with the fabric of the preceding figures, the shrinkage of the strands 16 or their equivalent will result in stiffening the fabric in the areas A without, however, preventing the fabric from being stretched in the direction of the elastic strands 14. The stiffening action of the strands 16 as just referred to will resist the bending or folding of the fabric along lines paralleling the strands 14 and 15, and in this manner the fabric becomes admirably suited for garters, waistbands and the like, where the transverse rolling-over of ordinary elastic fabrics is an undesirable feature.

General considerations

It is to be understood that the weaves shown in the accompanying drawings are merely schematic and that various of the almost innumerable weaves available may be employed in carrying out the present invention, so long as individual heat-shrinkable strands extend crosswise of a plurality of the elastic strands in order to grip the latter when the said heat-shrinkable strands are

heated and contracted. The heat-shrinkable strands referred to are therefore not limited to being employed as weft strands in a woven fabric but may, as will be fully apparent to those skilled in the art, be employed as warp strands in such woven fabrics as have weft- or filling-picks of elastic material.

The contraction of the heat-shrinkable cross-strands above referred to, will not only serve to anchor the elastic strands against undue axial slippage in the event of a break therein, but will serve to consolidate the fabric in the direction of their pull so that the areas of the fabric in which the said heat-shrinkable strands are incorporated, will possess the appearance of being very tightly woven. This latter result may be achieved without resorting to actual slow and difficult tight weaving, so that, if desired, the fabric may be woven in a relatively-loose condition thus facilitating the weaving operation. Despite such loose weaving, the subsequent heating of the fabric will cause the heat-shrinkable cross-strands to so consolidate and compact the fabric as to hide substantially all cases of any initially-loose weaving.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

We claim:

1. A method for producing woven elastic fabrics which method includes interweaving a plurality of laterally-spaced-apart elastic strands and a plurality of heat-shrinkable strands of artificial resin in such manner that individual strands of the said plurality of heat-shrinkable strands extend crosswise with respect to a plurality of the said elastic strands in position to compress and grip the latter strands when the heat-shrinkable strands are shrunk; and then subjecting the heat-shrinkable strands to the action of heat to cause the same to contract to grip the said elastic strands in the fabric.

2. A method for producing woven elastic fabrics which method includes interweaving a plurality of laterally-spaced-apart elastic strands, a plurality of relatively-non-elastic strands extending substantially parallel with respect to the said elastic strands, and a plurality of heat-shrinkable strands of artificial resin in such manner that individual strands of the said plurality of heat-shrinkable strands extend crosswise with respect to a plurality of the said elastic strands and a plurality of the said relatively-non-elastic strands; and then subjecting the heat-shrinkable strands to the action of heat to cause the same to contract to grip both the said elastic strands and the said relatively-non-elastic strands extending parallel with the said elastic strands.

3. A method for producing woven elastic fabrics which method includes interweaving a plurality of elastic strands, a plurality of relatively-non-elastic strands and a plurality of heat-shrinkable strands of artificial resin, the said strands being arranged so that individual strands of the said plurality of heat-shrinkable strands and individual strands of the said plurality of relatively-non-elastic strands extend crosswise with respect to a plurality of the said elastic

strands; and then subjecting the said heat-shrinkable strands to the action of heat to cause the same to contract to grip the said elastic strands in the fabric.

4. A method for producing woven elastic fabrics which method includes interweaving a plurality of elastic warp strands and a plurality of relatively-non-elastic warp strands with a plurality of heat-shrinkable weft strands of artificial resin in such manner that individual strands of the said plurality of heat-shrinkable weft strands extend crosswise with respect to a plurality of the said elastic warp strands; and then subjecting the said heat-shrinkable weft strands to the action of heat to cause the same to contract to grip the said elastic warp strands and the said relatively-non-elastic warp strands in the fabric.

5. A method for producing woven elastic fabrics which method includes interweaving a plurality of elastic warp strands with a plurality of relatively-non-elastic weft strands and a plurality of heat-shrinkable weft strands of artificial resin in such manner that individual strands of the said plurality of heat-shrinkable weft strands extend crosswise with respect to a plurality of the said elastic warp strands; and then subjecting the said heat-shrinkable weft strands to the action of heat to cause the same to contract and grip the said elastic warp strands in the fabric.

6. A method for producing woven elastic fabrics which method includes interweaving a plurality of elastic warp strands and a plurality of relatively-non-elastic warp strands with a plurality of relatively-non-elastic weft strands and a plurality of heat-shrinkable weft strands of artificial resin in such manner that individual strands of the said plurality of heat-shrinkable weft strands extend crosswise with respect to a plurality of the said elastic warp strands and relatively-non-elastic warp strands; and then subjecting the said heat-shrinkable weft strands to the action of heat to cause the same to contract to grip the said elastic warp strands and the said relatively-non-elastic warp strands in the fabric.

7. A method for producing woven elastic fabrics which method includes interweaving a plurality of groups of heat-shrinkable strands at spaced intervals with a plurality of elastic strands in such manner that individual strands of the said groups of heat-shrinkable strands extend crosswise of a plurality of the said elastic strands, and also interweaving a plurality of groups of relatively-non-elastic strands with the said elastic strands in positions intermediate the groups of heat-shrinkable strands; and then subjecting the said heat-shrinkable strands to the action of heat to cause the same to contract to bind the said elastic strands in the fabric.

8. A method for producing woven scalloped-edge elastic fabrics which method includes interweaving a plurality of groups of relatively-non-elastic weft strands with a plurality of elastic warp strands at spaced intervals along the said elastic warp strands, and also interweaving a plurality of groups of heat-shrinkable weft strands of artificial resin intermediate the other said groups of weft strands in such manner that individual strands of the said groups of heat-shrinkable weft strands extend crosswise of a plurality of the said elastic warp strands; and then subjecting the said heat-shrinkable weft strands to the action of heat to cause the same to contract the fabric in the spaced areas containing

the said heat-shrinkable strands to grip the said elastic warp strands in the said contracted areas of the fabric.

9. An anti-creep woven elastic fabric comprising: a plurality of elastic strands; and a plurality of thermally-shrunk strands of artificial resin interwoven with and extending crosswise with respect to the said elastic strands and contracted in situ to clamp the said elastic strands in the fabric, the individual strands of the said plurality of thermally-shrunk strands extending crosswise of a plurality of the said elastic strands.

10. An anti-creep woven elastic fabric comprising: a plurality of elastic strands; a plurality of relatively-non-elastic strands; and a plurality of thermally-shrunk strands of artificial resin interwoven with and extending crosswise with respect to the said elastic strands and contracted in situ to clamp the said elastic strands in the fabric, the individual strands of the said plurality of thermally-shrunk strands extending crosswise of a plurality of the said elastic strands.

11. An anti-creep woven elastic fabric comprising: a plurality of elastic strands; a plurality of relatively-non-elastic strands extending in substantial parallelism with the said elastic strands; and a plurality of thermally-shrunk strands of artificial resin interwoven with and extending crosswise with respect to both the said elastic strands and the said relatively-non-elastic strands and contracted in situ to clamp the said elastic strands in the fabric, the individual strands of the said plurality of thermally-shrunk strands extending crosswise of a plurality of the said elastic strands.

12. An anti-creep woven elastic fabric comprising: a plurality of elastic strands; a plurality of relatively-non-elastic strands interwoven with and extending crosswise with respect to the said elastic strands; and a plurality of thermally-shrunk strands of artificial resin also interwoven with and extending crosswise with respect to the said elastic strands and contracted in situ to clamp the said elastic strands in the fabric, the individual strands of the said plurality of thermally-shrunk strands extending crosswise of a plurality of the said elastic strands.

13. An anti-creep woven elastic fabric comprising: a plurality of elastic strands; a plurality of relatively-non-elastic strands extending in substantial parallelism with the said elastic strands; a plurality of relatively-non-elastic strands interwoven with and extending crosswise with re-

spect to the said elastic strands and the relatively-non-elastic strands extending parallel therewith; and a plurality of thermally-shrunk strands of artificial resin interwoven with and extending crosswise with respect to the said elastic strands and the other said strands paralleling the same and contracted in situ to bind the said elastic strands in the fabric, the individual strands of the said plurality of thermally-shrunk strands extending crosswise of a plurality of the said elastic strands.

14. An anti-creep woven elastic fabric having both relatively-wide areas and relatively-narrow areas and comprising: a plurality of elastic warp strands; a plurality of groups of relatively-non-elastic weft strands respectively interwoven with and extending crosswise of the said elastic warp strands in the relatively-wide areas of the fabric; and a plurality of groups of thermally-shrunk weft strands of artificial resin respectively interwoven with and extending crosswise of the said elastic warp strands in the relatively-narrow areas between the said groups of relatively-non-elastic weft strands, the said thermally-shrunk weft strands being contracted in situ by heat to clamp the said elastic warp strands in the fabric, the individual strands of the said groups of thermally-shrunk weft strands extending crosswise of a plurality of the said elastic warp strands.

15. An anti-creep woven elastic fabric having both relatively-wide areas and relatively-narrow areas and comprising: a plurality of elastic warp strands; a plurality of relatively-non-elastic warp strands extending in substantial parallelism with the said elastic warp strands; a plurality of groups of relatively-non-elastic weft strands spaced from each other and respectively interwoven with and extending crosswise of the said elastic warp strands in the relatively-wide areas of the fabric; and a plurality of groups of thermally-shrunk weft strands of artificial resin respectively interwoven in the relatively-narrow areas of the fabric with and extending crosswise of the said elastic warp strands and the said relatively-non-elastic warp strands paralleling the same and thermally contracted in situ to grip the said elastic strands in the fabric, the individual strands of the said groups of thermally-shrunk weft strands extending crosswise of a plurality of the said elastic warp strands.

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