

Jan. 3, 1961

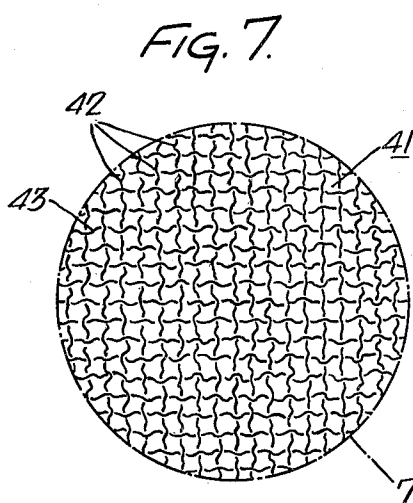
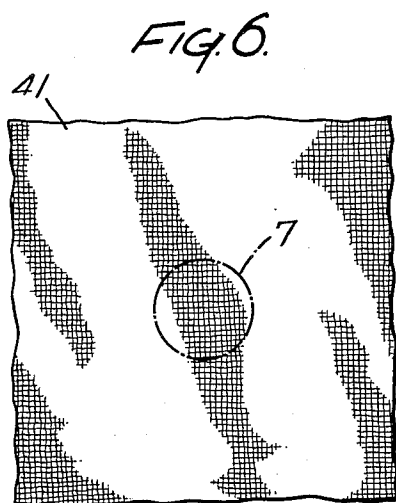
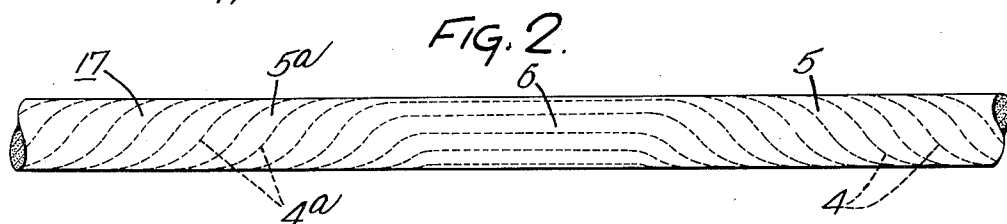
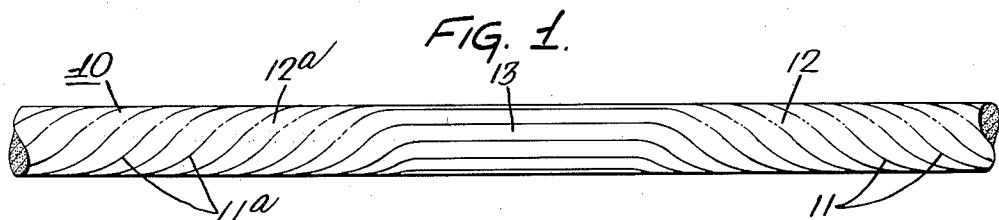
W. A. SEEM ET AL

2,966,775

YARNS AND FABRICS MADE THEREFROM

Filed April 25, 1955

2 Sheets-Sheet 1



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FIG. 3

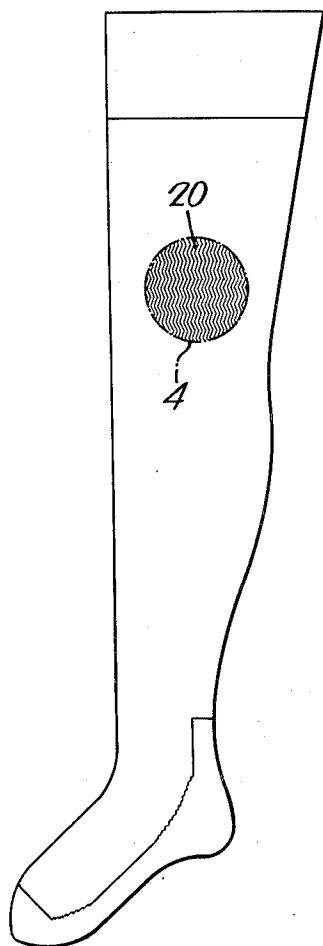


FIG. 4

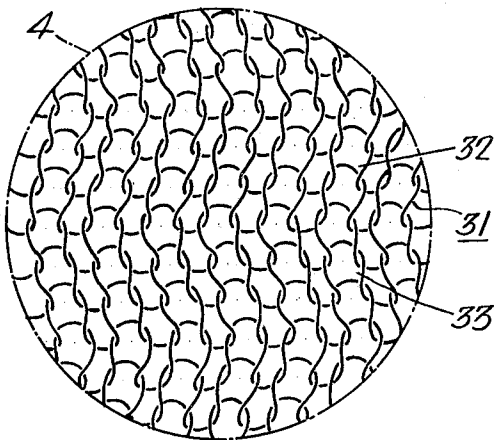
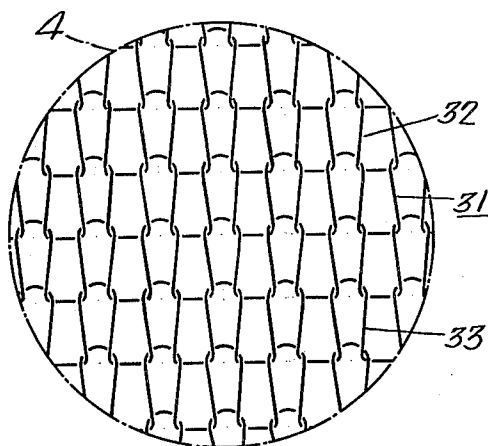


FIG. 5



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YARNS AND FABRICS MADE THEREFROM

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18 Claims. (Cl. 57—140)

The present invention relates to mono-filament, multi-filament and spun staple fibre yarns having, in various sections of their continuous length, torsional forces or twist in varying degrees or directions and the fabrics made therefrom.

The invention contemplates continuous lengths of yarn which have in alternate sections of the length, torques or twist in opposite directions. It is to be understood that in the specification and claims, "torque" is intended to mean a force which produces or tends to produce rotation or torsion of the yarn about its axis, irrespective of the degree of actual twist, if any, in the yarn. The opposed torsional forces or twist are of sufficient magnitude to produce distinctive results in the fabrication, appearance, or utility of the fabrics produced therefrom. The invention also includes continuous lengths of yarn which have selected sections of the length with varying degrees of torque or twist in one direction, the variation in torque or twist being of sufficient magnitude to produce distinctive results in the fabrication, appearance, and utility of the fabrics produced therefrom. Generally, the yarns having torque or twist in opposite directions produce more distinctive results than the yarns having varying degrees of torque or twist in the same direction, but a combination of both is frequently beneficial.

In the prior art, yarn is produced so as to have uniform torque or twist throughout its continuous length, one measure of the quality of the yarn being the degree of uniformity of torque or twist. With prior art yarns, in order to employ yarn having different torsional forces or twist in a single fabric, it has been necessary to employ two or more yarns which have different degrees or directions of torque or twist. Not only does the use of plural yarns involve a greater expense than the use of a single yarn but also certain machines and many fabrics are not commercially adapted to employ plural yarns.

A primary object of the invention is to make possible the production of novel yarns or fabrics having appearance and utility not heretofore possible.

Another object of the invention is to more economically produce known fabrics or similar fabrics having improved appearance or utility.

These and other objects of the invention and the various features and details of the construction and use thereof are more fully set forth hereinafter with reference to the accompanying drawings in which:

Fig. 1 shows a yarn having sections embodying opposed twists made in accordance with the present invention;

Fig. 2 is a view similar to Fig. 1 showing a yarn having opposed torques in selected sections and in which the actual twist is removed;

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Fig. 3 is a view of a stocking formed of a fabric knit with yarns made in accordance with the present invention, the fabric being in relaxed condition;

Fig. 4 is an enlarged view of an area of the fabric shown in Fig. 3 and indicated by the circle shown in broken lines at 4;

Fig. 5 is a view similar to Fig. 4, but showing the fabric when stretched on the leg;

Fig. 6 is a view of a woven fabric employing yarns made in accordance with the present invention; and,

Fig. 7 is a diagrammatic view enlarged of the area of the fabric indicated by the broken lines at 7 in Fig. 6.

Fig. 1 represents a continuous length of yarn 10 having in alternate sections of its length, torque or twist resulting from both Z and S twisting of the yarn. This yarn was produced by twisting on a double twist spindle by first rotating the spindle in a Z direction and then in an S direction. The diagonal unbroken lines 11 and 11a represent the twist inserted into the yarn. Section 12 of the yarn represents that section of the yarn with Z twist and section 12a represents that section of the yarn with S twist and section 13 represents that section intermediate the sections 11 and 12 where there is neither Z nor S twist. The sections 12 and 12a alternate along the length of the yarn, being separated by untwisted sections such as indicated at 13 which may be of negligible length, or any desired finite length.

One apparatus for producing a yarn having opposite twist in various sections of its length includes a double twist hollow spindle. The yarn is drawn continuously from a stationary supply package through the spindle which is alternately rotated in opposite directions. Tension devices are provided to minimize the back twisting or untwisting of the yarn in the interval when the spindle is reversed.

Fig. 2 diagrammatically represents a continuous length of yarn 17 having in alternate sections of its length, torque in opposite directions. This yarn was produced by twisting upon a false twist spindle which was made to alternately rotate opposite directions with the yarn being thermally set while twisted before passing through the spindle which reverse twists the yarn exactly as many turns per inch as twisted. Although there is no actual twist remaining in the finished yarn as a result of the false twisting, the twisting, heat setting and reverse twisting inserts into the yarn substantial torsional forces which are illustrated in Fig. 2 by broken lines 4 and 4a. Thus, the torque is effected by an untwisted or reverse twisted twist set in one direction. Section 5 of the yarn represents that section of the yarn having torsional forces resulting from an untwisted Z twist which has been set and section 5a represents that section of the yarn having torsional forces resulting from an untwisted S twist which has been set. The section 6 is an intermediate section where there is no torsion.

One practical apparatus producing a yarn having opposite torque in various sections of its continuous length includes a hollow twisting-and-untwisting spindle in combination with a tension device and a thermally isolated heated zone mounted upon a conventional up-twister. By this method, for example, mono-filament nylon is drawn from an unprocessed delivery package, through the tension device, through the thermally isolated heated zone, continuously passed through the false twist (or twisting-and-untwisting) spindle which is caused to rotate alter-

nately in opposite directions and thence to a continuously revolving take-up package. The mono-filament nylon yarn of this illustration is twisted thirty turns per inch between the spindle and the tension device, and the heated zone interposed between thermally sets the yarn so that the reversing of the twist as the yarn leaves the false twist spindle causes a substantial degree of torsion in one direction. As the yarn continues to travel without interruption, the spindle is quickly stopped and reversed with the result that an opposite torque of the same magnitude is inserted in the adjacent sections of the same continuous yarn. In our U.S. patent application, Serial No. 489,693, filed February 21, 1955, it is disclosed that yarns need not be inherently thermoplastic to thermally set them, since non-thermoplastic yarns may be impregnated or coated with thermoplastic or thermal setting materials to render yarn setting or twist setting by heat possible.

Other methods of producing yarns of the invention which have in various sections of their continuous length, torque or twist of varying degrees, include the varying of the twist in different sections of the yarn by regulation of spindle speed or take-up speed, and the varying of the degree of twist setting in different sections of the yarn. Such methods are disclosed more fully and claimed in our copending application, Serial Number 600,837, which is a continuation-in-part of the present application.

It is intended, without enumerating all of the methods, that regardless of how produced, any continuous length of yarn of constant cross section having sections of yarn with torque or twist in one direction and other sections with torque or twist in the opposite direction or more or less torque or twist in the same direction and any and all fabrics produced therefrom fall within the scope of the invention.

The yarn of the present invention has particular utility in the knitting of ladies' hosiery. Full fashioned hosiery has recently appeared on the market which is knitted with a series of courses formed of yarn having a torque or twist in one direction alternating with a series of courses formed of yarn having torque or twist in the opposite direction. When the fabric formed in this manner is taken from the knitting machine and if required the latent torsional forces of the yarns are activated, and the fabric is permitted to relax, the yarn in the first series of courses tends to twist on itself in the one direction causing the wales to exhibit an angular or oblique position relative to the length of the stocking. The yarn in the second series of course tends to twist on itself in the opposite direction, causing the wales in this portion of the stocking to exhibit an angular or oblique position opposite to the aforementioned position. Thus, the stocking fabric is formed with a herringbone pattern. The twisting of the yarns causes the fabric to be smaller than the size as knit, but when the stocking is worn, it is stretched over the leg and the stretching removes a substantial part of the twist, allowing the yarns to assume the stitch configuration with which they were knitted, thereby returning the fabric to the size with which it was knit. In the knitting of fabrics embodying this construction, it is necessary to employ two yarn carriers in a full-fashioned knitting machine. One carrier lays in the first yarn which forms the first series of courses, and the second carrier lays in the second yarn which forms the second series of courses. The fabrics formed in this manner are called stretch fabrics.

A stocking of stretch fabric fits better than a stocking in which all of the loops are normally shaped and without torque since the loops of the stretch fabric straighten from their oblique formation to the extent required to conform the fabric to the contour of the leg and movements thereof when wearing.

Prior to the present invention, it was impossible to knit stretch fabrics on knitting machines having only one yarn carrier. With only one carrier, all of the yarn in the fabric would have a tendency to twist in a single direc-

tion. When relaxed, a fabric of this character would simply twist into a spiral or formless ball, since there would be no counteracting force opposing the torque in the single direction. Such a fabric would be difficult to handle and would have an objectionable appearance which would make it commercially impractical.

The yarn of the present invention has particular utility in the production of sheer stretch seamless stockings for ladies on conventional circular knitting machines. In this respect, it is noted that circular knitting machines because of considerable mechanical difficulties customarily at the present time have only one leg yarn feed finger. By the use in this one feed finger, of monofilament nylon formed as described above having about four yards of its length with a high degree of torque or twist in one direction alternating with about four yards of its length with a high degree of torque or twist in the opposite direction, a stretch fabric having a herringbone or accordion pattern is formed, for example as indicated at 20 in Fig. 3.

With reference to Figs. 3-5 inclusive, a stocking knit of stretch fabric is shown in relaxed condition in Fig. 3, and Fig. 4 shows an enlargement of the stitch formation. It is noted with reference to the latter figure that the single leg yarn 31 which may be formed in the manner of either of the yarns 10 and 17, exhibits a tendency to twist on itself in one direction, for example as indicated at 32, in the portion of the fabric, and a tendency to twist in the opposite direction, for example as indicated at 33, in an adjacent portion of the fabric. By reason of the tendency to twist, the yarn in the loops of each course assume an oblique formation, as shown. However, when the fabric is stretched, for example when on the leg, the tension in the yarn overcomes the tendency to twist and the yarn assumes the normal loop formation with which it was knit. The tendency of the yarn to twist and foreshorten the fabric insures a snug fit on the leg at all times.

The yarn of the invention also makes possible more economical production of full fashioned stockings having the same general appearance and utility as the stretch stocking shown in Figs. 3-5. Substantial economies over the prior art method described above are effected by the use of only one carrier and one continuous length of yarn instead of two. The resulting fabric exhibits the same desirable characteristics as those described above.

The yarn of this invention may have the alternate sections of different torque or twist, and the intermediate untwisted sections of any predetermined length to create the desired herringbone or modified herringbone pattern or opposing oblique loop formations in the aforementioned women's full-fashioned and seamless hosiery. Such regular patterns or lack of patterns may be utilized for appearance or consumer appeal only and generally are not visible when on the leg. However, the invention embraces the creation in heavier hosiery of patterns of loop formations which are visible when on the leg and include improvements in fabrics such as shown in U.S. Patent 2,102,730, but formed from continuous length yarn having opposed torque or twist in different sections of its length. It is to be pointed out that the shorter the walewise lengths of the adjacent sections indicated at 32 and 33, the less noticeable will be the herringbone or accordion pattern of the loops of the knitted fabric. This can be carried to a point where no definite pattern results, even though the fabric is constituted entirely of loops of counter-balanced opposed oblique formations, as described above.

The yarn of the present invention may also be employed to produce woven fabrics, including crepes. Normally in the production of crepes, two or more shuttles containing yarn of different torque are used. By the use of only one continuous length of yarn in which selected sections of its length have different torques, a crepe fabric may be produced with only one shuttle.

Figs. 6 and 7 illustrate a fabric formed in this manner.

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The fabric 41 is composed of a plurality of warp yarns 42 which are interwoven with a single continuous weft yarn. The warp yarn may be either conventional yarns which are balanced, or have a torque in one direction throughout their length, or may be yarns similar to one of the yarns 10 and 17. The weft yarn 43, on the other hand is a continuous yarn having in selected sections, torque or twist of different characteristics, for example one of the yarns 10 and 17. It is preferred to employ a yarn having opposite torque or twist in adjacent sections in order to provide a balanced fabric which does not exhibit a tendency to spiral or twist. The different characters of torque in adjacent sections causes the fabric to contract and pucker. The puckers in the areas embodying yarn having torque in one direction project from one face of the fabric, whereas the puckers in the areas embodying yarn having opposite torque project from the opposite face, thereby producing the desired crepe effect.

Within the scope of the invention are continuous length yarns of opposed or different twist, as for example the yarn of Fig. 1, even though the degree of torque or twist setting of the yarn may be such that little or no perceptible or latent torsion is present. Such continuous length yarn does not produce stretch or crepe fabrics because of the lack of torsion, but does produce ornamental effects in fabrics due to the difference in light reflection and light diffusion.

While only selected embodiments of the present invention have been herein illustrated and described, it should be apparent that the yarn having different torque characteristics in selected sections of its continuous length may be substituted in any known fabric which now employs separate yarns having different torque or twist characteristics. It is also anticipated that the use of the yarn of the present invention by itself or plied with other yarns will create fabrics and patterns which heretofore have been impossible or impractical to produce, because of the great number of yarn carriers or shuttles necessary to lay in the conventional yarns having only a single torque or twist characteristic throughout its length. Thus, the invention is not limited to the illustrated and described embodiments, but changes and modifications may be made therein and thereto within the scope of the following claims.

We claim:

1. A continuous-length textile yarn of uniform cross section having in one predetermined section of its length a uniformly constant torque in one direction and in another predetermined section of its length a uniformly constant torque in the opposite direction.

2. A continuous-length textile yarn of uniform cross section having in one predetermined section of its length a given uniformly constant torque provided by an unbalanced twist in one direction, and in another predetermined section a different uniformly constant torque provided by an unbalanced twist in the opposite direction.

3. A continuous-length textile yarn of uniform cross section having a plurality of sections of length, alternate predetermined sections having a uniform torque in one direction, and the intermediate sections having a uniform torque in the opposite direction.

4. A continuous-length textile yarn according to claim 3 wherein said uniform torque in one direction is provided by an untwisted twist set in one direction, and said uniform torque in the opposite direction is provided by an untwisted twist set in the opposite direction.

5. A yarn according to claim 1 consisting of a single monofilament of thermoplastic material.

6. A textile fabric comprising a continuous length textile yarn of uniform cross section having in selected predetermined sections of its length a uniformly constant torque in one direction, and in other predetermined sections of its length a uniformly constant torque in the opposite direction, and in still other sections an absence of torque.

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7. A seamless stocking having a leg portion knit of a single continuous-length textile yarn of uniform cross section having in selected predetermined sections of its length a uniformly constant torque in one direction, and in other predetermined sections of its length a uniformly constant torque in the opposite direction, the knit loops formed of said selected predetermined sections of the yarn when relaxed being twisted upon themselves in one direction and the knit loops formed of said other predetermined sections of the yarn when relaxed being twisted upon themselves in the opposite direction, said loops when tensioned being untwisted.

8. A full fashioned stocking having a leg portion knit of a continuous-length textile yarn of uniform cross section having in selected predetermined sections of its length a uniformly constant torque in one direction, and in other predetermined sections of its length a uniformly constant torque in the opposite direction, the knit loops formed of said selected predetermined sections of the yarn when relaxed being twisted upon themselves in one direction and the knit loops formed of said other predetermined sections being twisted upon themselves in the opposite direction, said loops when tensioned being untwisted.

9. A woven crepe fabric comprising a continuous-length weft yarn of uniform cross section forming the picks of the fabric, said yarn having in selected predetermined sections of its length a torque in the one direction, and in other predetermined sections of its length a torque in the opposite direction, said selected predetermined sections being in selected picks of the fabric and said other predetermined sections being in other picks of the fabric.

10. A continuous length textile yarn of uniform cross section having in selected predetermined sections of its length, a uniformly constant torque in one direction; in other predetermined sections of its length, a uniformly constant torque in the reverse direction; and in predetermined sections intermediate said selected predetermined sections and said other predetermined sections, an absence of torque.

11. A continuous length textile yarn of uniform cross section having in a first predetermined section of its length, a uniformly constant torque provided by an unbalanced twist in one direction; in a second predetermined section, a uniformly constant torque provided by an unbalanced twist in the opposite direction; and in a third predetermined section intermediate said first and said second sections, an absence of torque.

12. A continuous length textile yarn of uniform cross section having in a first predetermined section of its length, a uniformly constant torque provided by an untwisted twist set in one direction; in a second predetermined section, a uniformly constant torque provided by an untwisted twist set in the opposite direction; and in a third predetermined section intermediate said first and second sections, an absence of torque.

13. A textile fabric comprising at least one continuous length textile yarn of uniform cross section having in selected predetermined sections of its length, a given torque in one direction; and in other predetermined sections of its length, torque in the opposite direction.

14. A continuous-length textile yarn of uniform cross section having in one predetermined section of its length a uniform torque in one direction and in another predetermined section of its length a uniform torque in the opposite direction.

15. A textile fabric comprising a continuous-length textile yarn of uniform cross section having in one predetermined section of its length a uniform torque in one direction and in another predetermined section of its length a uniform torque in the opposite direction.

16. A knitted stocking having a leg portion composed of a single continuous length textile yarn of uniform cross section having in one predetermined section of its length a uniform torque in one direction and in another

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predetermined section of its length a uniform torque in the opposite direction.

17. A continuous nylon yarn having alternating heat-set sections of opposite torques, said torques being sufficient to impart stretchability to a fabric knit from said yarn. 5

18. A stretchable nylon hose comprising a continuous nylon yarn having alternating heat-set sections of opposite torques, said torques being sufficient to produce stretchability in said hose. 10

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Disclaimer

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Hereby enters this disclaimer to claims 17 and 18 of said patent.

[*Official Gazette February 18, 1964.*]

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