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KNITTED FABRIC HAVING SUPERTWISTED VARIEGATED AREAS AND METHOD OF MANUFACTURE

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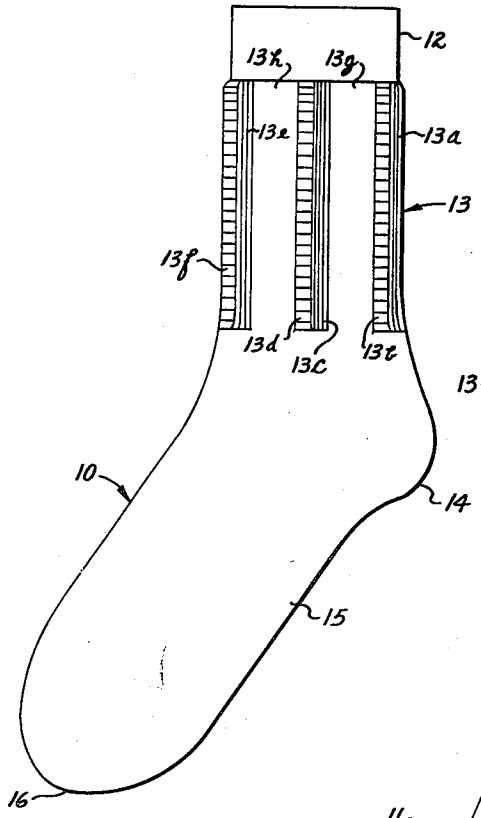

Fig-1

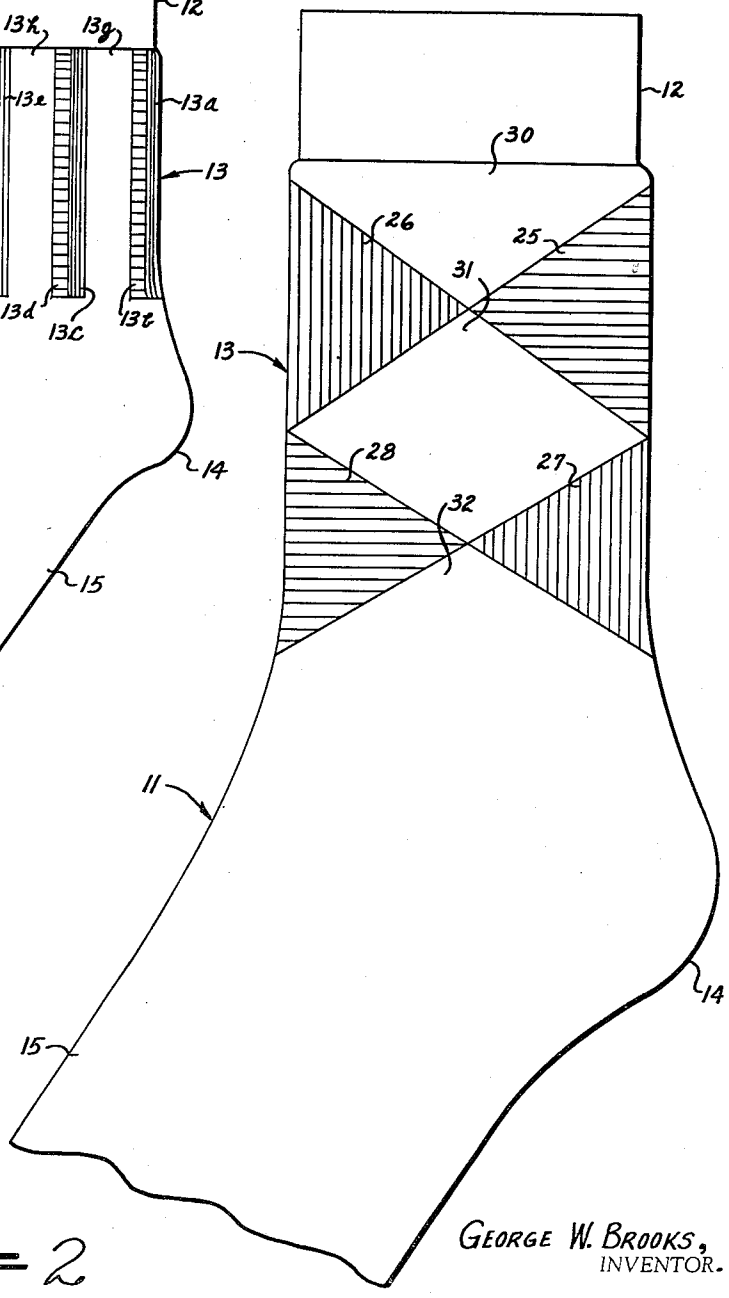

Fig-2

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KNITTED FABRIC HAVING SUPERTWISTED VARIEGATED AREAS AND METHOD OF MANUFACTURE

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10 Claims. (Cl. 66—180)

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This invention relates to knitted fabric and, more especially, to an improved resilient, yieldable or stretchable fabric having variegated ornamental areas therein, and the method of producing same.

This application is a continuation-in-part of my co-pending application, Serial Number 355,405, filed May 15, 1953, and entitled Thermoplastic Yarn and Method of Making.

It is the primary object of this invention to provide a knitted fabric, such as men's or ladies' hose, which is knitted from a plurality of different colored stretchable yarns to form a stretchable or yieldable fabric having variegated ornamental areas thereon.

It is another object of this invention to provide a knitted fabric, such as men's or ladies' hose, which is made from a plurality of different colored supertwisted multifilament synthetic polyamide and polyester yarns to produce a fabric which not only has a plurality of different colored areas, but is also stretchable or yieldable in all directions throughout. Included in this category of synthetic yarns are nylon, which is a synthetic linear condensation polyamide, or a synthetic polymeric amide yarn, and "Dacron," which is a synthetic linear condensation polyester yarn.

Heretofore, such yarns have been treated to give the same a wool-like effect by increasing the elasticity or curliness of the yarn by means of imparting a supertwist thereto. Such prior processes are disclosed in Patents No. 2,019,183, 2,019,185, 2,564,245, and 2,585,518. This prior process is known as the "Helanca" process, or the supertwisting process. According to this prior process, artificial yarns are provided with increased elasticity and curliness by imparting a super number of twists to the yarn, setting the twist, and thereafter, untwisting the yarn. However, due to the thermoplastic nature of artificial yarns of this type, it has heretofore been impossible to dye the yarns while in the yarn state since the increased temperatures necessary in the dyeing processes would take out or unset the elasticity or curliness which had heretofore been imparted in the supertwisted yarn. For this reason, it has been necessary to knit or weave articles from such supertwisted yarn before dyeing the same and, of necessity, such articles had to be a solid color.

It is, therefore, another object of this invention to provide a knitted article and method of making the same, wherein the article is formed from a plurality of different colored yarns which are supertwisted and dyed in accordance with

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the process disclosed in said co-pending application; that is, one first strand of thermoplastic artificial material is twisted a plurality of turns in one direction, pre-set and dyed under the necessary high temperature and pressure, then additional twists are imparted to the strand in the same direction, then the strand is again set after which additional twists are imparted to the strand in the same direction up to the total number of turns per inch desired. The strand is then set, dried and twisted in a reverse direction back to the point zero, or beyond.

Thereafter, a second strand, treated in the same manner as the first strand, but twisted in the opposite direction, is loosely intertwisted with the first strand to form the yarn and a plurality of such yarns, dyed different colors, are then knitted to form separate areas of the knitted article, wherein junctures of adjacent areas are interknitted thereby obviating the necessity of dyeing the article after it is knitted, to produce an article which is stretchable or yieldable and which also has a plurality of different colored areas formed therein.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawing, in which—

Figure 1 is a side elevation of a stocking which is illustrative of a fabric knitted according to the present method;

Figure 2 is an enlarged elevation of the upper portion of a stocking similar to that shown in Figure 1, but wherein the ornamental areas are formed as an "Argyle" pattern.

In Figures 1 and 2 of the drawing, two forms of patterns are illustrated which may be produced by the improved method and, although men's stocking or half hose are illustrated, the stockings are merely exemplary of any type of knitted stretchable fabric having variegated ornamental areas and it is evident that the stockings may be knitted on rotary or circular knitting machines or on full-fashioned knitting machines. Of course, if the stockings are knitted on full-fashioned knitting machines, it is evident that they would be seamed up the back.

The stocking shown in Figure 1 is broadly designated at 10 and the stocking shown in Figure 2 is broadly designated at 11. Each of the stockings 10 and 11 includes a top or welt 12, an ornamental area or leg portion broadly designated at 13, a heel or heel pocket 14, a foot 15 and a toe pocket 16. The toe pocket 16 is omitted from the illustration in Figure 2. The top or welt 12,

the heel pocket 14, the foot 15 and the toe pocket 16 of the stocking 10 (Figure 1) are shown as being knit from a solid colored yarn, which may be termed a body yarn, and portions of the leg or ornamental portion 13 of the stocking 10 are also shown as being knit from the solid colored yarn.

The leg 13 of the stocking 10 has a plurality of vertical stripes or narrow ornamental areas thereon indicated at 13*a* to 13*f*, inclusive, which are knitted from different colored yarns and wherein each area may be a different color from the others. In the present instance, the areas 13*a*, 13*c* and 13*e* are shown as being knitted from a red yarn and the areas 13*b*, 13*d* and 13*f* are shown as being knitted from a blue yarn. It is evident that both sides of the stocking 10 in Figure 1 may be identical. Of course, areas 13*g* and 13*h* are knitted from the body yarn between the areas 13*b*, 13*c*, 13*d* and 13*e*.

Now, it will be observed in Figure 2 that the top 12, the heel pocket 14 and foot 15 of the stocking 11 are also knitted from a body yarn which may be white and the leg 13 thereof has variegated diamond-shaped or gusset-shaped areas therein indicated at 25, 26, 27, and 28, each of which is knitted from a different colored yarn and which differs in color from the body yarn. The areas 25 and 28 are shown as being knitted from a blue yarn and the areas 26 and 27 are shown as being knitted from a red yarn. A gusset 30 is knitted between the upper portions of the areas 25 and 26 and a diamond 31 is knitted between the lower portions of the areas 25 and 26 and between the upper portions of the areas 27 and 28. A lower gusset 32 is also knitted between the lower portions of the areas 27 and 28. The areas 30, 31 and 32 are also shown as being knit from a white yarn or from the body yarn in Figure 2. Thus, the junctures of the adjacent areas extend at an angle relative to the wales and courses, and, it is evident that these areas may be interknitted at their junctures for one or more wales.

Although yarns of a specific color are set forth herein, it is to be understood that the various areas of each of the stockings 10 and 11 may be of any desired contrasting color, and also, the body yarn in both stockings 10 and 11 may be of any desired color.

Now, each of the yarns employed in knitting each of the areas of each stocking 10 and 11 are supertwisted pre-dyed yarns; that is, each of the yarns is a thermoplastic or synthetic artificial yarn which is formed from two or more strands wherein each strand is twisted in one direction, preset, then dyed, then again twisted in the same direction, and then twisted in the reverse direction and then intertwisted with a similarly treated strand which has previously been twisted in the opposite direction from the first of the strands, in accordance with the process disclosed in said co-pending application. In accordance with said process, one multi-filament strand of polyamidic or polyester yarn is twisted a plurality of turns in one direction, after which the yarn is pre-set, then the yarn is dyed under the necessary high temperature and pressure, then additional twists in the same direction are imparted to the yarn, then the yarn is again set after which it is pre-shrunk. Then, if desired, additional twists may be imparted to the yarn in the same direction up to the total number of turns or twists desired. If additional twists are added, the yarn is then set and dried. The yarn is then untwisted or twisted in a reverse direction back to the point zero, or beyond. A strand of yarn, thus treated, is then twisted with a yarn treated in a similar manner, but twisted in the opposite direction and the yarn, thus treated, may be formed into various types of articles, as desired, and further dyeing or processing is not necessary.

The amount of twist necessary to produce the supertwist depends upon the denier of the yarn and also upon the effect desired, as more or less curl is sought. For example, twenty to forty denier yarn is usually twisted as high as a total of one hundred turns per inch, while forty to one hundred denier yarn is only twisted as high as fifty turns. If heavier than one hundred denier yarn is used according to this process, the amount of twist imparted thereto should be somewhat less than fifty turns.

The invention is not limited to any particular type of dye and the whole range of dyes having affinity for the particular polyamide or polyester being twisted, may be used. For example, in treating nylon according to this process, the following dyes are suitable:

1. Anthraquinone Green, GW, Color Index 1078;
2. Anthraquinone Blue, RXO, Color Index 1076;
3. Dupont Milling Yellow, 5–G, Color Index 642;
4. Dupont Milling Orange, RTR 152 (no color index or prototype no.);
5. Dupont Milling Red, SWB, Color Index 430;
6. Dupont Neutral Grey, GL (no color index or prototype no.);
7. Dupont Neutral Brown, BGL (no color index or prototype no.);

Now, it is well known that nylon can be dyed with almost any type of dye and the above examples are listed by way of illustration only.

Various indigoid types of dyes are suitable for dyeing "Dacron," as well as nylon. For example:

1. Indanthrene Red Violet RH, Color Index 1212;
2. Helidone Pink R. Ex., Prototype 109;
3. Indanthrene Brown, RRD, Prototype 121;
4. Vat Khaki GP Powder, Indigo M. I/4B, Color Index 1184;
5. Indigo MI/2B, Color Index 1183;
6. Helidone Rx, Color Index 1217;
7. Indigo Yellow G (Ciba), Color Index 1196;
8. Sulfanthrene Black PG, Double Paste Dupont;

Also, various acetate dyes will produce good results on nylon, and "Dacron." For example:

1. Acetamine Yellow N (no prototype or color index no.);
2. Orange GR Concentrate, Prototype 43;
3. Cibacete Red, 3B, Prototype 61;
4. Celliton Blue FFR, Prototype 228;
5. Celliton Fast Yellow G, Prototype 242;
6. Celliton Fast Rubine 3B, Prototype 239;

Also, various vat pigments, neutral, chrome, direct and acid colors may be utilized according to well known processes in practicing this invention.

Example

One 70 denier multi-filament (34 ends) nylon yarn is twisted twenty-five turns per inch to the right. This is done in a conventional twisting machine and then the yarn is removed and is subjected to a pre-setting treatment which comprises subjecting the yarn to steam for three periods of approximately one and one-half hours each. The yarn is then rewound on perforated

metal dye tubes and is dyed at temperatures between 180 degrees and 300 degrees Fahrenheit preferably around 240 to 265 degrees Fahrenheit and under super-atmospheric pressure. The yarn is dried after the dyeing operation and is rewound onto bobbins and an additional 25 turns of twist per inch are imparted thereto to the right, or the same direction in which the first turns of twist were imparted.

The yarn is then given a second setting by subjecting the same to steam for three periods of approximately one and one-half hours each. The yarn on the bobbins is then placed in a preboarding machine and is subjected to wet steam or water for a period of approximately one hour at temperatures from 250 degrees Fahrenheit to 270 degrees Fahrenheit at pressure of from 22 to 28 pounds. This is a pre-shrinking operation which causes the yarn to shrink. The yarn is then dried at a temperature of from 150 degrees Fahrenheit to 170 degrees Fahrenheit for a period of 12 hours, or until dry. After the yarn is dry, any additional twist which is desired is added to the right, or in the same direction up to a total number of turns of twist approximately 100 turns per inch depending upon the denier. In using 70 denier yarn, no additional twist is necessary.

After the final twist has been imparted to the yarn, the yarn is set an additional time by subjecting the same to steam for three periods approximating one and one-half hours each. The yarn is then twisted in the opposite direction, or untwisted with the total number of turns which have been imparted thereto. In this instance, the yarn is twisted back to the left up to 100 turns per inch, or to the point zero. If desired, the twist may go back slightly beyond the point zero to give some additional twist to the yarn.

A second 70 denier, multi-filament nylon yarn is treated in an identical manner, except that the twist imparted thereto is to the left or opposite to the direction in which the twist is imparted to the first nylon yarn. These two yarns are then twisted or plied together at approximately two turns per inch to form a single multiply strand and the yarn thus formed may be knitted or woven into articles of various types and no additional dyeing or treating is necessary.

The above example may be followed in treating other polyamidic or polyester yarns in accordance with this invention and it should be noted that the number of turns of twist may be varied in accordance with the denier of the yarn and the desired elasticity or curliness.

In imparting the initial twist, it is desirable to impart between 20 and 30 turns per inch, preferably 25 turns. In the second twisting operation, it is again desirable to impart 20 to 30 turns per inch in the same direction, preferably 25 turns. In the case of yarns of greater than 40 denier, after the total of 50 turns has been imparted thereto, the twist is locked and preshrunk and dried and no additional twist is added thereto before backing out or untwisting the yarn a like number of turns.

Where it is desired to impart a total number of turns greater than 50, such as in yarn of between 20 and 40 denier, after the second twisting process and after the preboarding and drying, the additional twist is added thereto after which, the yarn is set and then untwisted as above set forth.

After the presetting or first steaming operation, the yarn is preferably wound on perforated metal dye tubes in order to facilitate the dyeing thereof.

In the steaming operations used in pre-setting the yarn and in the additional pre-setting processes, the yarn in loose condition is subjected to steam for a period of approximately one and one-half hours, after which there is a short lag period, during which time the yarn will tend to dry out and then it is again subjected to steam for two additional periods approximating one and one-half hours each with a lag period therebetween. This setting is preferably done in a regular conditioning box or twist setter, such the "H. W. Conditioner" manufactured by Industrial Drier Corporation.

The pre-shrinking operation under high temperature, shrinks yarn and the yarn on collapsible bobbins is placed in a conventional preboarding machine and is subjected to wet steam or water. The pre-shrinking time is preferably one hour at 265 degrees Fahrenheit and 25 pounds pressure for nylon, but may vary between 250 degrees Fahrenheit and 270 degrees and the pressure may vary between 22 and 28 pounds. If desired, the yarn may be in loose form when pre-shrunk.

In the drying operation, which is subsequent to the pre-shrinking operation, only dry heat is used which is preferably accomplished by placing the yarns in a drying room equipped with a heater and an exhaust fan. Apparently, approximately 12 hours is the minimum time necessary to dry the yarns, but a different amount of time, more or less, is not harmful provided the yarn is thoroughly dried. The preferred temperature is 160 degrees Fahrenheit for nylon and Dacron and may range between 150 degrees and 170 degrees Fahrenheit.

It is thus seen that I have provided a method of knitting a stocking or any other knitted article from thermoplastic yarns of different colors and wherein the resultant fabric is capable of being stretched and which has a resiliency which will cause the fabric, upon being stretched, to return to its original shape.

Heretofore, it has not been possible to form such an article of stretchable yarns due to the fact that the supertwisted yarns could not be dyed prior to knitting. Now, according to the present invention an article such as a stocking or the like may be provided with ornamental areas and also be stretchable or yieldable.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only, and not for the purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. That method of knitting a stretchable multi-colored fabric of multi-filament polyamidic and polyester yarns of from 20 to 100 denier which comprises twisting one of said yarns at least 5 turns per inch in one direction, setting the twisted yarn, dyeing the yarn, twisting the yarn an additional plurality of turns per inch in the same direction to provide a total twist of from 40 to 100 turns per inch, setting and preshrinking the yarn, and untwisting the yarn to substantially zero twist, then repeating the above operation on a second of said yarns by applying reverse twist thereto, then twisting the two yarns together to form a composite yarn, then knitting some areas of said fabric with said composite

yarn and knitting other areas of said fabric with composite yarns treated in a like manner but dyed a different color.

2. A fabric formed according to the method of claim 1.

3. That method of forming a stretchable multi-colored fabric of multi-filament polyamidic and polyester yarns of from 20 to 100 denier which comprises imparting from 20 to 30 turns of twist thereto in one direction to a first of said yarns, setting the yarn, dyeing the yarn in its twisted state, imparting 20 to 30 turns of additional twist thereto in the same direction as before, setting and pre-shrinking the yarn, then imparting additional turns of twist thereto in the same direction as before to provide a total twist not exceeding 100 turns per inch, setting the yarn, then untwisting the yarn a number of turns substantially equal to the total number of turns imparted thereto, then treating a second of said yarns as above outlined but imparting the twists in the opposite direction from that imparted to the first yarn, then plying the two yarns together at a relatively low twist to form a composite yarn, then knitting some areas of said fabric with said composite yarn and knitting other areas of said fabric with composite yarns treated in a like manner but dyed a different color.

4. A fabric formed according to the method of claim 3.

5. A method for producing a stretchable multi-colored stocking of polyamidic and polyester yarns having permanent crimping and fluffing properties which consists in highly twisting one of said yarns, setting said yarn, dyeing said yarn in twisted state at a high temperature and at superatmospheric pressure, additionally highly twisting said yarn, setting said yarn, shrinking said yarn and then back twisting the yarn to substantially zero twist, then treating a second of said yarns in a like manner but twisting the second of said yarns in an opposite direction, then plying the two yarns together at a relatively low twist to form a composite yarn, then knitting the body portion of said stocking with said composite yarn and knitting certain areas of said stocking with other composite yarns treated in a like manner but dyed a different color.

6. A stocking formed according to the method of claim 5.

7. A process of knitting a stretchable multi-colored stocking of synthetic multi-filament polyamidic and polyester yarns consisting in separately supertwisting two of said multi-filament yarns in opposite directions, subjecting the twisted yarns to heat to set the same, dyeing said yarns in twisted state at high temperature at superatmospheric pressure, further supertwisting the yarns in their respective original directions, again subjecting them to heat to set the same, shrinking said yarns, untwisting the two yarns to a substantially zero twist, twisting the two yarns together in a relatively low twist, thereby producing a multiple strand dyed yarn with latent crimp effecting physical properties, then knitting a portion of a stocking with said multiple strand dyed yarn and knitting other portions of said stocking with other multiple strand dyed yarns treated in the same manner but dyed a different color and interknitting adjacent edges of adjacent areas together.

8. A stocking formed according to the method of claim 7.

9. That method of knitting stretchable argyle socks utilizing multi-filament polyamidic and polyester yarns of from 20 to 100 denier which comprises twisting one of said yarns at least 5 turns per inch in one direction, setting the yarn, dyeing the yarn under high temperature and pressure, twisting the yarn an additional plurality of turns per inch in the same direction as before to provide a total twist of from 40 to 100 turns per inch, then setting and pre-shrinking the yarn, then untwisting the yarn a number of turns per inch approximating the total number of turns per inch which has previously been applied thereto, then repeating the operation on a second of said yarns but twisting the second of said yarns in the opposite direction, then plying the two yarns together at a relatively low twist to form a composite dyed yarn, then knitting the body portion of a sock with said composite yarn and knitting a plurality of diamond-shaped areas in said sock of other composite dyed yarns treated in a like manner but dyed different colors and interknitting adjacent edges of adjacent areas together.

10. An argyle sock formed according to the method of claim 9.

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