Oct. 29, 1957 P. E. CONNER 2,811,029

NON-RUN BARRIER FOR HOSIERY

Filed Sept. 10, 1954

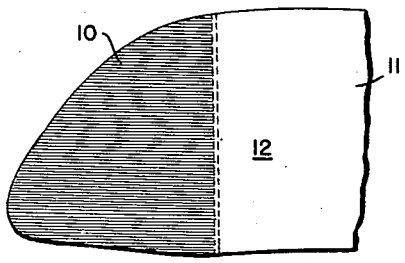

FIG. 1.

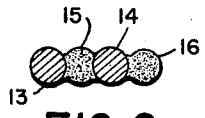

FIG. 2.

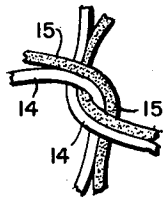

FIG. 4.

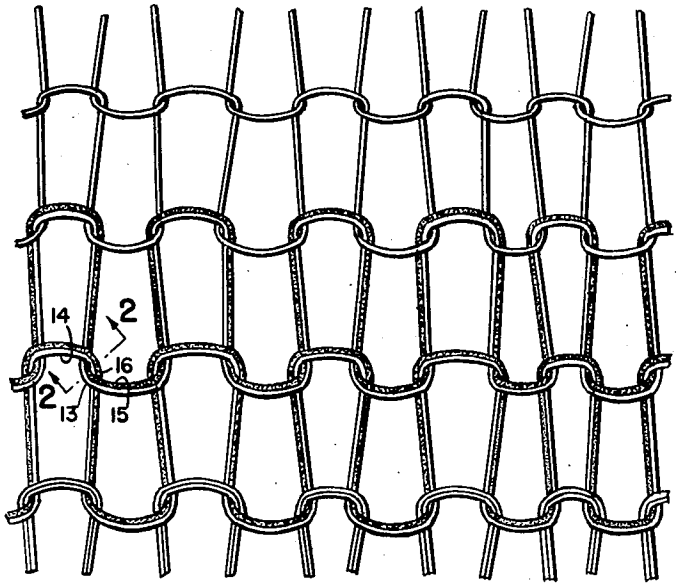

FIG. 3.

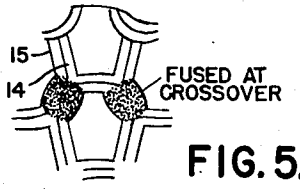

FIG. 5.

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United States Patent Office

2,811,029

Patented Oct. 29, 1957

2,811,029

NON-RUN BARRIER FOR HOSIERY

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Application September 10, 1954, Serial No. 455,206

4 Claims. (Cl. 66—172)

The present invention relates to non-run barrier for hosiery and the purpose of the invention is to stop runs at strategic points in a stocking.

An object of the invention is to introduce an additional barrier yarn into the knitted fabric without involving any changes in the conventional knitting machine or in standard knitting procedures which yarn is of such character that it may become welded or bonded to the normal yarn composing such fabric.

It is a further object of the invention to achieve this welding or bonding by subjecting a barrier yarn having a lower melting point than the normal yarn of the fabric or stocking to the melting temperature of such barrier yarn, whereupon the barrier yarn will become soft or tacky which will cause it to become fused to the fabric yarn at substantially all points of contact therewith to the end that a strong bond will be created between this barrier yarn and a great number of points in the fabric resulting in interposing an effective barrier to the passages of runs from one side of the barrier to the other; and it is a further object of the invention to secure these advantageous results without in any way altering or modifying the standard steps of procedure in the manufacture of ladies' hosiery in that the particular barrier yarn selected may be possessed of a melting point of the order of the pre-boarding temperature to which the stockings are normally subjected in the ordinary course of manufacture, the pre-boarding operation therefore accomplishing automatically the fusion, bond or weld of the barrier yarn to the fabric.

A further object of the invention is to secure the fusing, bond or weld of the barrier yarn to the fabric yarn or yarns by a solvent operation in which the tacky or soft condition of the barrier yarn is produced by subjecting the same to the action of a chemical solvent; it being preferable that the barrier yarn be of such character or composition that it will flow under the action of a solvent which will not affect the normal yarn of the fabric so that the solvent treatment may be carried on following the knitting operation in which the barrier yarn is incorporated in the fabric.

It has been known heretofore that two yarns may be bonded at their cross-over points, for example as illustrated in U. S. Patent No. 2,460,674 wherein a non-thermoplastic yarn and a thermoplastic yarn are bonded at cross-over points to permanently fix the three-dimensional shape of the fabric without being unduly rigid. While the teachings set out above apply to three-dimensional articles such teaching is inadequate for the formation of nylon hosiery for women which must be soft and extremely flexible, in fact elastic. I have found that both yarns must be thermoplastic in order to maintain the desired degree of flexibility and elasticity. Two thermoplastic yarns, having differential tacky temperatures, which are fused at their cross-overs produce a highly desirable hosiery fabric highly resistant to running

or laddering and flexible enough to elastically conform to the contour of the leg of the wearer.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

Figure 1 is a fragmentary plan view of a stocking showing a barrier yarn included therein in accordance with the present invention between the toe and instep portions.

Figure 2 is a cross-sectional view taken on an enlarged scale on the line 2—2 of Figure 3.

Figure 3 is an enlarged plan view of a section of the fabric composing the stocking or the like and having incorporated therein a barrier yarn pursuant to the invention.

Figure 4 is a fragmentary perspective view of a cross-over between parallel yarns prior to subjecting the yarns to pre-boarding temperature.

Figure 5 is a fragmentary perspective view of the cross-over of Figure 4 after the yarns have been subjected to pre-boarding temperature and the yarns have fused at cross-over.

Referring more particularly to the drawings, and for the present to Figure 1, **10** designates the toe portion and **11** the instep portion of the foot of a stocking knitted pursuant to current practices on a standard form of circular knitting machine, and **12** represents a non-run barrier extending across the fabric between these two portions of the stocking.

Referring more particularly to Figure 2, **13** and **14** represent spaced strands of the normal yarn, while **15** designates a strand of the barrier yarn interposed between the normal yarn strands **13** and **14** and fused or bonded thereto. The strand **16** of the barrier yarn is also shown as bonded or welded to the opposite side of the normal yarn **14**.

In Figure 3, it is indicated that the barrier yarn **15**, **16** may be knitted in any desired number of courses.

Currently ladies' hosiery is knit from what is generally known as "nylon" which is a trade-name for a synthetic linear polyamide or artificial fiber. This nylon is a thermoplastic substance having a higher melting point than the preboarding temperature used at present in the manufacture of hosiery, the same being of the order of 265° F. The invention involves the use of a second or barrier thermoplastic knitting yarn of a separate and lower melting point than the pre-boarding temperature, for instance a barrier yarn having a melting point of the order of 250° Fahrenheit. Consequently, the barrier yarn will melt at the normal pre-boarding temperature for nylon hosiery, thus becoming sticky or tacky sufficiently to weld together the loops of the nylon which it touches.

As an example of a barrier yarn, might be cited Vinyon HH which is a product of American Viscose Corporation. This yarn is a synthetic fiber spun from a solution of copolymerized vinyl chloride and vinyl acetate. The raw material is a thermoplastic copolymer of vinyl chloride and vinyl acetate. The end product is a resin produced by the simultaneous polymerization of mixtures of the monomers of the vinyl chloride and vinyl acetate. The melting point of this product is substantially 250° Fahrenheit.

This product also lends itself compatibly to solvent treatment. It may be dissolved for instance by acetone or by ketones and softened or partly dissolved by esters, ethers, aromatic hydrocarbons and some amines and halogenated hydrocarbons.

This product has wet strength as well as dry strength and will not easily be broken down or severed by snag-

ging. It exhibits good bonding equalities and has a tacky temperature ranging from 185–215° degrees F.

It is not absolutely essential that the barrier yarn should have a melting point lower than that of nylon or the normal yarn of the knit fabric. It sufficies if it has a tacky temperature lower than nylon. It is also not necessary in the case of the use of solvents, that a solvent be selected which will completely dissolve the barrier yarn. In fact this would be undesirable. It is only necessary that those solvents which will soften or partly dissolve the barrier yarn be used. Certain of these solvents have already been listed hereinabove. It is only essential to the invention that, through heat or the application of solvent, the barrier yarn melts sufficiently or becomes tacky enough to adhere to the nylon fibers and thus weld the strands of the barrier yarn to the regular nylon knitting loops to the adjoining nylon yarn loop wherever the two cross each other. Another material for the barrier yarn may be acetate rayon which melts at approximately 350 to 375° F. as against the melting point for nylon of 482° F. Here it is necessary to nicely control the heat so that the nylon will not be damaged in the heat setting operation. The ideal tacky temperature for the barrier yarn is approximately 250° F. since the normal pre-boarding temperature of nylon hosiery is in this range so that the fusion can occur without danger of damage to the nylon fabric.

Such alditional barrier yarn may be introduced at any strategic point in the knit fabric, and particularly in hosiery to weld the stitches together and thus form a substantial run-stop barrier. A yarn of 50 or 75 denier continuous filament type is suitable for bonding the loops together in hosiery fabric.

Another example of the present invention would be as applied to Figure 1 wherein **10** would designate the toe portion and **11** the instep portion of the foot of a stocking knitted of thermoplastic yarn pursuant to current practices on a standard form of circular knitting machine and **12** represents a non-run barrier of thermoplastic yarn extending across the fabric between these two portions of the stocking. As shown in Figure 2 in this modified form, **13** and **14** would represent spaced strands of the normal thermoplastic yarn, while **15, 16** designates a strand of the thermoplastic barrier yarn interposed between the normal yarn strands **13** and **14** and fused or bonded thereto. An example of the thermoplastic yarn designated as **14** would be that known commercially as nylon or "Dacron."

While Figure 1 shows the non-run barrier interposed between the toe **10** and instep portion **11** it will be understood that the same may be introduced in any other strategic point in the stocking.

The barrier yarn is incorporated by simply knitting the same into the fabric on the knitting machine by the addition of the barrier yarn in the same manner as reinforcing yarns are normally knit into hosiery material.

Patent No. 2,584,944 granted February 5, 1952 to Roy E. Tilles shows a method of incorporating an additional yarn which may be followed in connection with the instant barrier yarn.

The Tait Patent No. 2,636,369, granted April 28, 1953 also shows a method which may be followed in introducing the barrier yarn of the present invention into the knit fabric. Preferably the present barrier yarn will lie very closely in relation to the nomal loops of the stocking fabric. In fact the barrier yarn probably lies parallel with the yarn forming the loops at practically all times. Either yarn could be the barrier yarn pursuant to the method disclosed in the Tait patent.

Reference is also made to the Margerison Patent No. 2,019,232 granted October 29, 1935 which proposes to

introduce a non-run barrier course into the knitted stocking and this illustrates a further modification by which the barrier yarn of the present invention can be incorporated in the knit fabric. The barrier yarn may or may not be twisted with the nylon yarn before knitting. Such twisting may increase the intimate contact between the yarns and prove beneficial in that great contacting areas of the yarns will be bonded together.

The Bihaly Patent No. 2,460,674 mentioned herein before teaches the fusing of two yarns at cross-over points by incorporating an additional yarn with the fabric yarn; however, I propose employing two thermoplastic yarns to avoid obtaining an unduly rigid finished article such as a brassiere.

Two thermoplastic yarns having the degrees of elasticity of Vinyon and nylon will make a soft flexible hose which will conform to the leg of the wearer and which may be readily rolled and maintained in a substantially flat condition for transportation.

The nylon yarns **14** may also be bonded at the cross-over points of the bights of each loop by dissolving Vinyon HH in a ketone and applying the solution to the nylon yarn in a manner similar to the way size is applied to twisted yarns.

It will be understood that the present method and barrier yarn may be employed both with monofilament or multifilament knit fabric constructions. The barrier yarn may be a spun yarn or may be a continuous filament or a continuous multifilament yarn of the character of the Vinyon or other yarns of this type.

Although I have disclosed herein the best form of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims.

What is claimed is:

1. In a nylon fabric knit mainly from nylon, a non-run barrier yarn knit therein and bonded to said nylon, said barrier yarn consisting of a synthetic fiber produced by the simultaneous polymerization of mixtures of the monomers of vinyl chloride and vinyl acetate.

2. In a nylon knit fabric knit mainly of nylon, a non-run barrier yarn therefor comprising a yarn of Vinyon HH knit into the fabric and bonded to the nylon at a strategic point and becoming welded to the nylon yarn at cross-over points when the fabric is subjected to the temperature of the pre-boarding operation.

3. In a knit fabric of nylon, a non-run barrier knit therein and having the characteristic to be softened or partly dissolved by any one of the group consisting of esters, ethers, aromatic hydrocarbons, amines and halogenated hydrocarbons by which the barrier yarn may become bonded to the nylon yarn at cross-over points.

4. In a nylon knit fabric, a non-run barrier knit therein comprising a yarn of lower tacky temperature than nylon and soluble in solvents not affecting nylon whereby by the use of heat or solvents, the barrier yarn may be softened and bonded to the nylon at cross-over points.

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