

Sept. 20, 1960

H. E. CRAWFORD

2,953,003

CIRCULAR MULTI-FEED HOSIERY AND METHOD

Filed June 11, 1956

4 Sheets-Sheet 1

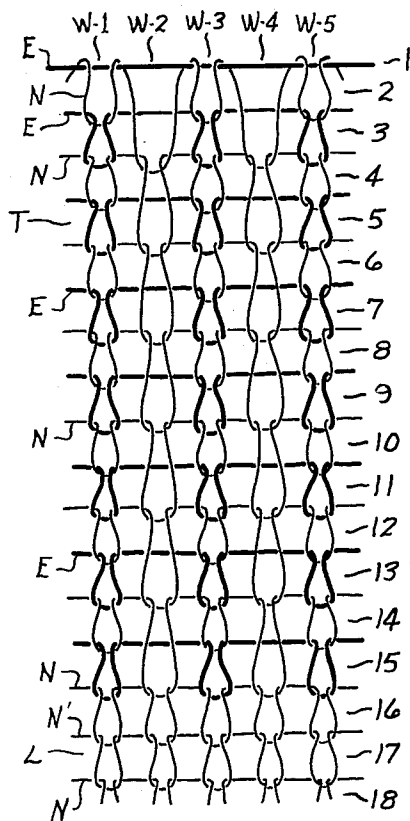
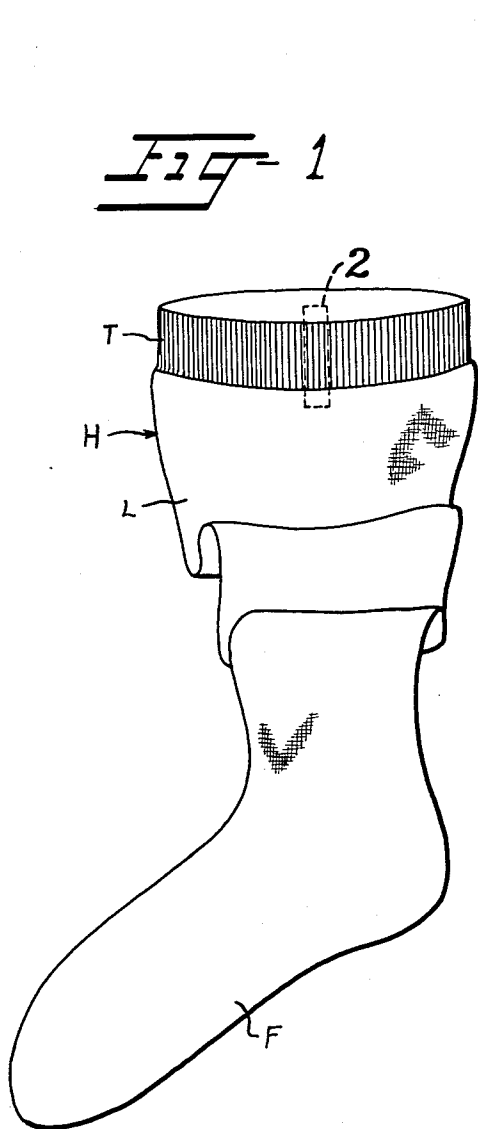


FIG-2

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4 Sheets-Sheet 2

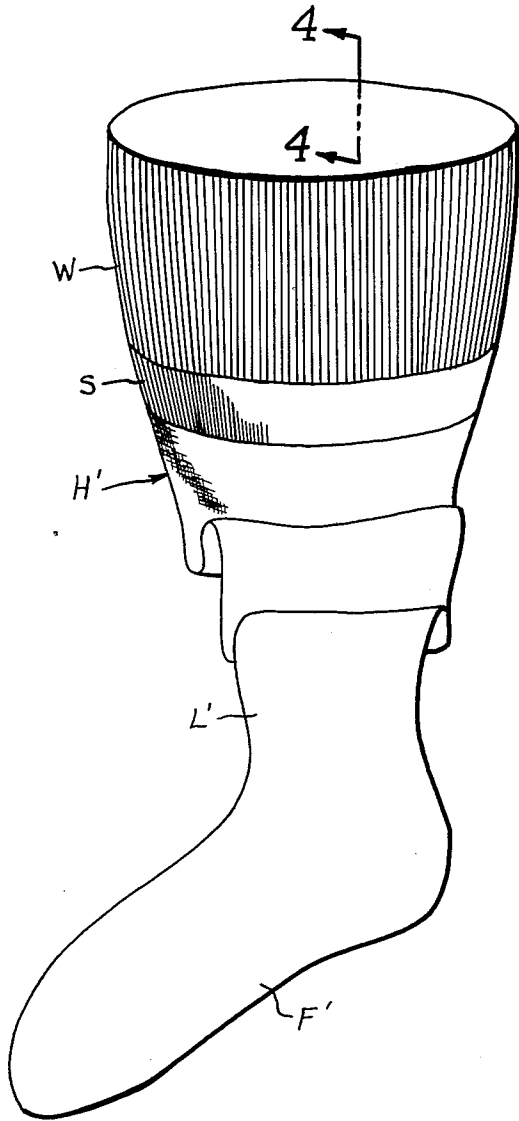


FIG-3

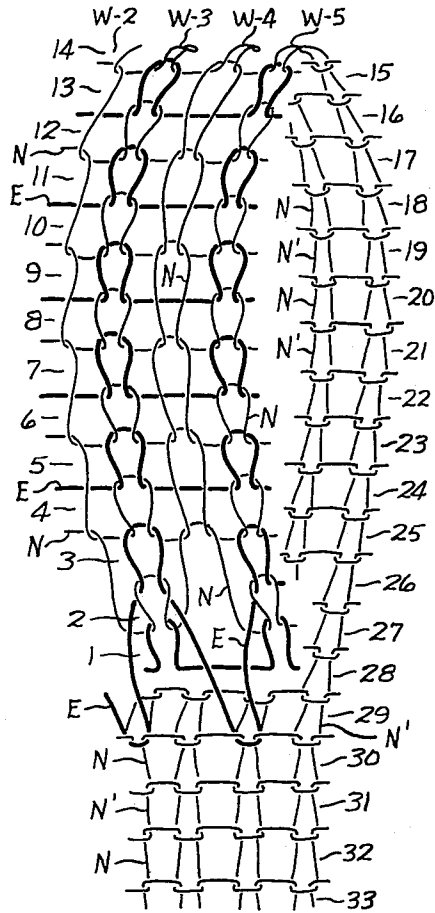


FIG-4

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4 Sheets-Sheet 3

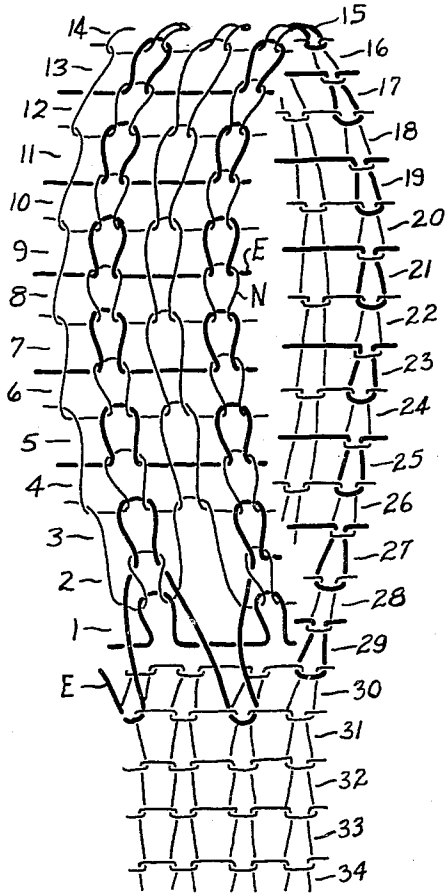


Fig-5

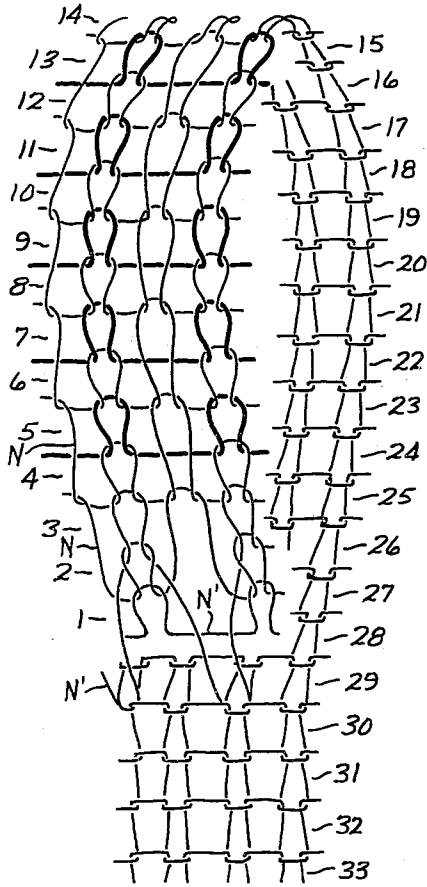


Fig-6

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4 Sheets-Sheet 4

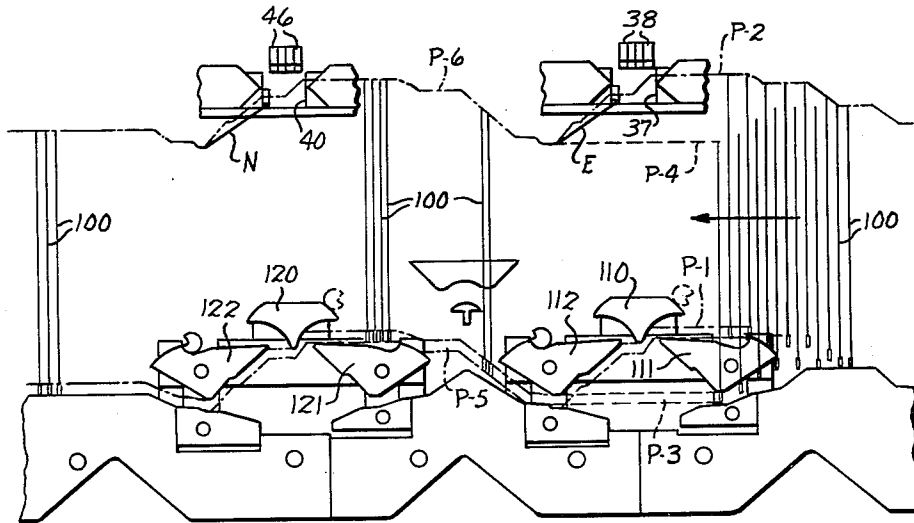


FIG-7

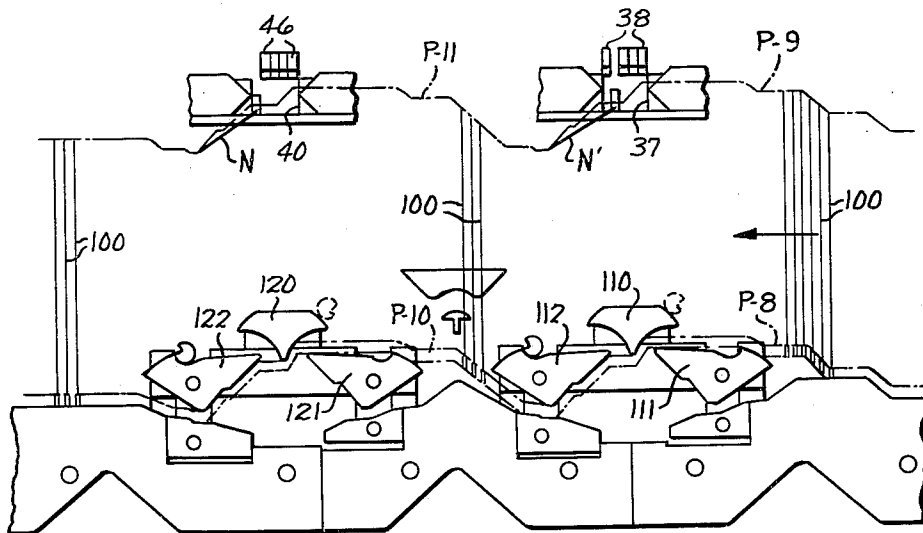


FIG-8

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2,953,003

CIRCULAR MULTI-FEED HOSIERY AND METHOD

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4 Claims. (Cl. 66—41)

This invention relates to circular multi-feed knit hosiery and more especially to a top for this type of hosiery and to a method of knitting hosiery tops on a multi-feed machine wherein at least one yarn is an elastic yarn and one yarn is an inelastic yarn and with both of said yarns being knit at different and separate knitting stations.

It is an object of this invention to provide a novel tubular fabric and method of knitting wherein an elastic yarn is knitted in spaced courses and an inelastic yarn knitted in intervening courses to form a stretchable top or welt portion of women's fine gage hosiery where the hosiery is knit on a machine adapted to knit a plurality of courses with each revolution of the needle cylinder.

It is another object of this invention to provide a tubular knit fabric top for hosiery which includes the knitting in of elastic in a manner to prevent a ribbed appearance while allowing a maximum amount of stretch. Knitting in the elastic yarn, rather than laying in the elastic as is the common practice at present, has an important advantage in that the elastic yarn will stabilize the stitches formed of the inelastic yarn and provide the proper amount of stretch to make the hose self supporting on the leg of the wearer.

It is still another object of this invention to provide a multi-feed knit top in which the elastic yarn is knit in the top in either a straight top or a turned welt top. The elastic yarn is knit at one feeding and knitting station on only selected ones of the needles and the inelastic yarn is knitted on all needles at another feeding and knitting station to thus form a course of elastic yarn knit on only selected needles and a course of inelastic yarn knit on all of the needles with each revolution of the needle cylinder.

This improved multi-feed top may be knit on any type of knitting machine which is adapted to knit multi-feed in rotary knitting such as the one shown in my pending application entitled Multi-Feed Circular Knitting Machine, Serial Number 586,587, filed May 22, 1956, now Patent No. 2,861,440. Other machines on which this invention may be carried out are shown in the patents to R. W. Lawson Patent No. 2,440,280 of April 27, 1948 or the J. J. McDonough Patent No. 2,576,962 of Dec. 4, 1951. Although the machines shown in the above mentioned patents as well as the machine in my co-pending application, are adapted to knit a complete hose multi-feed, this invention could be carried out equally as well on any machine where multi-feed is done in rotary knitting only.

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 drawings in which—

Figure 1 is a side elevation of a lady's seamless hose with one form of elastic top attached thereto;

Figure 2 is an enlarged fragmentary elevation of the

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portion enclosed by the dotted line rectangle indicated at 2 in Figure 1;

Figure 3 is a view similar to Figure 1 except showing a modified form of top which is known as a welt top attached thereto;

Figure 4 is a greatly enlarged vertical sectional view taken substantially along the line 4—4 in Figure 3;

Figure 5 is a view similar to Figure 4 and showing a modified form thereof;

Figure 6 is a view similar to Figure 5 and showing still another modification thereof;

Figure 7 is a diagrammatic development of the knitting cams and yarn feeding fingers of a typical multi-feed knitting machine adapted to carry out this invention; and

Figure 8 is a view similar to Figure 7 except showing the needles traveling in a different path from that shown in Figure 7.

Referring more specifically to the drawings, the letter H indicates a lady's hose, in Figure 1, in which a straight elastic top of a single ply tubular fabric is used and this hose is usually knit so that the top T surrounds the leg just below the knee. The top T is attached and knitted as an integral part of the hose H and is also provided with the usual leg portion L and a foot portion F.

The enlarged diagrammatic illustration of the manner in which the elastic top T is knit is shown in Figure 2 and illustrated by courses 1 thru 18 and wales W-1 thru W-5. The top T is illustrated as comprising the courses 1 thru 15 and it is to be understood that this is merely an illustration and in actual practice there would probably be about 50 to 75 courses in the top T, rather than only 15. The courses 16 thru 18 represent the first few courses of the leg portion L of the hose H.

Referring to Figures 7 and 8 there is shown one form of needle cam layout on which the present invention may be carried out and the form shown in Figures 7 and 8 is similar to the needle cam layout in my co-pending application, filed May 22, 1956. It is to be understood that any other form of needle cam layout could be used where it is possible to select needles to take and knit yarn at one station and to cause all of the needles to take and knit another yarn at another knitting station. The illustration in Figures 7 and 8 shows a first or main knitting station comprising respective right and left hand stitch came 111 and 112 and a top center cam 110. Spaced in vertical alignment with and above the top center cam 110, at this first knitting station, is a yarn feeding throat 37 having yarn feeding fingers 38 mounted therein. A second or auxiliary knitting station comprising respective right and left hand stitch cams 121 and 122 and a top center cam 120 is spaced away from the first knitting station and has a yarn feeding station comprising a throat opening 40 in vertical alignment with and above the top center cam 120 and which is provided with yarn feeding fingers 46.

Each of the needles 100 has a selector jack mounted therebeneath in a conventional manner, to cause pattern controlled vertical movement of the needles 100 as desired. The selector jacks may be selected in the manner set forth in my said co-pending application so that, with the cooperation of a jack raising cam, the needles 100 are divided and the jacks will raise the non-selected needles so that the butts thereof will be raised above the right hand stitch cam 111 at the first knitting station. The needles 100 whose butts are raised to pass above the right hand stitch cam 111 will follow a pathway P-1 so that the hooks thereof will follow a pathway P-2, in Figure 7, and take an elastic yarn E from one of the yarn feeding fingers 38 which is threaded with this elastic yarn E. The butts of the needles 100 passing above the right hand stitch cam 111 then engage and are moved down-

wardly by the inclined surface of the left hand stitch cam 112 to draw stitches with the elastic yarn E as the needle butts pass beneath the left hand stitch cam 112. The butts of the needles 100 which are selected to remain in a lowered position and pass beneath the stitch cam 111 will follow a pathway P-3 beneath the left hand and right hand stitch cams 111 and 112 so that the hooks of these needles 100 follow a pathway P-4 and thus miss the elastic yarn E at the first feeding station or throat opening 37.

In the illustrations shown in Figure 7 alternate needles are raised to take and knit the elastic yarn E at the first station and intervening needles remain in a lowered position to pass beneath the elastic yarn E but it is to be understood that any desired number of needles may be selected to take and knit the elastic yarn E supplied at the first feeding station while the remaining needles will pass below the right hand stitch cam 111 and miss the elastic yarn E.

As the butts of the needles 100 leave the stitch cam 112 they are all raised by the selector jacks to follow a pathway P-5, in Figure 7, in the manner described in my said co-pending application while the hooks thereof are raised to follow a pathway P-6 and to take the inelastic yarn indicated at N at the second throat opening 40. Thus all of the needles 100 draw stitches at the second knitting station as the needle butts pass down the inclined surface of the left hand stitch cam 112.

After the desired number of courses incorporating the elastic yarn E are knit and in order to resume plain knitting, it is necessary to remove the yarn feeding finger 38 which is supplied with the elastic yarn E and insert another yarn feeding finger 38 which is supplied with an inelastic yarn N', in Figure 8, and to cause the butts of all of the needles 100 to follow a pathway P-8, in Figure 8, and the hooks of all of the needles 100 to follow a pathway P-9 so that all of the needles take and knit the yarn N' at the throat opening 37 at the first feeding station. After the butts of the needles 100 pass beneath and draw stitches under the left hand stitch cam 112, at the first knitting station, they are all raised to follow a pathway P-10 and the hooks thereof follow a pathway P-11 so that all the hooks of all of the needles 100 take and knit the inelastic yarn N at the second throat opening 40.

In order to knit the fabric shown in Figure 2, the first course is knit on alternate needles at the first knitting station but since the loops of the previously knit article are cast off and removed from the needles, the loops drawn with the elastic yarn E at the first knitting station are straightened out as the needles are raised again along the pathway P-6, in Figure 7, and the elastic yarn E is merely stretched around the outer diameter of the needles 100 as they approach the second knitting station. All of the needles take and knit the yarn N at the second knitting station and these loops are formed around the elastic yarn E to form a selvage or make-up with the first revolution of the needle cylinder. Thus the first course illustrated at 1 in Figure 2 is merely a straight elastic yarn E while the second course shows loops in every wale of the inelastic yarn N. As the needle cylinder makes another revolution the third course is formed from the yarn E on alternate needles indicated at wales W-1, W-3 and W-5 at the first knitting station. The intervening needles at the wales W-2 and W-4 follow the pathway P-4 in Figure 7 and the elastic yarn E is floated across these wales at the first knitting station. The course 4 is formed at the second knitting station from the yarn N on every needle in each of the wales W-1 thru W-5 to thus form stitches with the inelastic yarn N at alternate courses or even numbered courses, in Figure 2, on every needle while forming elastic courses on the odd numbered courses on alternate needles. This knitting is continued for any desired length of elastic top T that is desired and automatic pattern controlled means on the knitting

machine will change the yarn feeding fingers 38 at the throat opening 37 and the selector mechanism will operate to cause all of the butts of all of the needles to follow the pathway P-8, in Figure 8, so that all of the needles knit the inelastic yarn N' in course 17, Figure 2, and plain fabric is formed in the leg L of the hose H.

In the hose illustrated at H' in Figure 3, a top of the turned welt type is provided and indicated at W, and a shadow welt or mock welt S is knit integral therewith and a leg portion L' attached thereto as well as a foot portion F'. The turned welt W is formed by the use of transfer hooks which are conventional in a knitting machine having a dial driven in timed relation to the needle cylinder. In the modifications of the turned welt W, in Figures 4, 5 and 6, the first illustration, in Figure 4, shows the elastic yarn E incorporated on the inside only of the welt W while the outside of the welt W is plain knitting and the make-up and transfer loops are formed with the elastic yarn E. The illustration in Figure 5 shows the elastic yarn being used throughout the welt portion, both inside and outside and then a plain fabric knit in the shadows S which is a one ply or single thickness. The illustration shown in Figure 6 is similar to the fabric shown in Figure 4 except that the elastic yarn is not incorporated in the make-up or the transfer loops of the fabric with the inelastic yarn N being used solely for the make-up and transfer loops.

The manner of knitting the fabric shown in Figure 4 comprises forming a first course with the elastic yarn E on alternate needles at the first knitting station and shown in wales W-3 and W-5, forming a second course with the inelastic yarn N on every needle at the second knitting station and thus, the first and second courses, made with a single revolution of the needle cylinder, form a make-up or selvage for the hose H. The third course is formed by alternate needles, in wales W-3 and W-5, taking and knitting the elastic yarn E at the first knitting station and with the transfer hooks in the dial being extended at the first knitting station so that the elastic yarn E is laid in the hooks and held thereon by these hooks for any predetermined length of time until it is desired to again transfer these loops back to the cylinder needles to form a turned welt in a conventional manner. The fourth course is knit at the second feeding station from the inelastic yarn N on every needle in the needle cylinder. This procedure is followed with alternate or odd numbered courses being knit on alternate needles, in wales W-3 and W-5, from the elastic yarn E and intervening or even numbered courses being knit with all of the cylinder needles with the inelastic yarn N for as long as desired to produce the inside ply of the turned welt. In the illustration shown in Figure 4, the inside ply of the turned welt comprises a total of 14 courses in which the elastic yarn E is used and the outside ply of the turned welt comprises the courses 15 thru 29 in which only inelastic yarn is used.

In order to resume plain knitting in the courses 15 thru 29, it is merely necessary to change the yarn feeding finger 38 supplied with the elastic yarn E and move into operation a yarn feeding finger 38 which is supplied with an inelastic yarn N' and to remove the selector mechanism so that the butts of all of the needles 100 are raised to follow a pathway P-8, in Figure 8, and the hooks thereof will pass along the pathway P-9 to thus take and draw stitches with the inelastic yarn N' at the first knitting station. Thus plain knitting is resumed in the courses 15 thru 29 with the odd numbered courses being knit at the first or main knitting station with yarn N' and the even numbered courses being knit at the second or auxiliary knitting station with the yarn N.

Upon the proper number of courses being knit, the transfer takes place as the course 29 is knit and is effected by moving the transfer bits outwardly of the dial over the cylinder needles in the wales W-2 and W-4 before they reach the first knitting station and then in-

wardly again after the cylinder needles 100 have been raised along the pathway P-9, in Figure 8, to thus transfer the loops held by the dial bits back to the cylinder needles. All of the cylinder needles then pass thru the first knitting station and draw stitches with the inelastic yarn N' to form the course 29, in Figure 4. The course 30, in Figure 4, is formed as the hooks of all of the needles follow the pathway P-11 in Figure 8, to thus draw stitches with the inelastic yarn N at the second or auxiliary knitting station.

The fabric illustrated in Figure 5 is identical to the fabric illustrated in Figure 4 thru the course 14, therefore a further description thereof is deemed unnecessary. The courses 15 thru 30 differ from the courses 15 thru 29 in Figure 4 in that the elastic yarn E is knit in the outside ply as well as in the inside ply of the turned welt of the stocking and the needles and yarn feeding fingers will remain in the position shown in Figure 7 thru the course 29. At the transfer course 30 the yarn feeding finger 38 with the elastic yarn E therein will be exchanged for another yarn feeding finger 38 which has the inelastic N' therein to form plain knitting at both of the knitting stations in the subsequent courses 31 thru 34 in Figure 5.

The fabric shown in Figure 6 is another modification of the fabric shown in Figure 4 and the courses 4 thru 33 are identical to that shown in Figure 4. The only difference in the fabric shown in Figure 6 is that the make-up courses 1 and 2 are both formed with inelastic yarns and the course 3, placed on the transfer hooks, is also formed with an inelastic yarn. It might be pointed out that the first three courses in Figures 4, 5 and 6 are the same except that regular or inelastic yarn is used at both feeding stations in Figure 6 while the knitting sequence is the same to produce the fabric shown in Figures 4, 5 and 6. It might also be pointed out that the method shown in Figure 6 could be practiced on a straight top sock or hose such as illustrated in Figures 1 and 2 and the elastic yarn E in courses 1 and 3 of Figure 2 could be in inelastic yarn N' in an identical manner to that shown in Figure 6.

It is thus seen that I have provided a novel fabric which incorporates the knitting of an elastic yarn in selected wales at spaced courses and the knitting of an inelastic yarn in every wale at intervening courses to thus form a fabric which has very high stretchability as well as a neat appearance. Although several variations of fabric are shown, it is to be understood that this invention is not limited strictly to the illustrations shown.

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 purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. The method of producing a circular knit seamless fabric forming a turned welt hosiery top which has an elastic yarn and an inelastic yarn both of which are knit in said fabric comprising the steps of: feeding the elastic yarn to alternate needles and forming loops of a first course thereon, feeding the inelastic yarn to every needle and forming loops of a second course thereon, feeding said elastic yarn and forming loops of a third course with elastic yarn on said alternate needles and transfer hooks of a dial, knitting a first plurality of courses of loops consisting of alternate courses of elastic yarn and

intervening courses of inelastic yarn, knitting a second plurality of courses of loops of alternate and intervening courses both of which are knit from inelastic yarn, and transferring the loops on said transfer hooks back to the needles to form a turned welt.

2. The method of producing a circular knit seamless fabric forming a turned welt hosiery top which has an elastic yarn and an inelastic yarn both of which are knit in said fabric comprising the steps of: feeding elastic yarn to alternate needles and forming loops of a first course thereon, feeding inelastic yarn to every needle and forming loops of a second course thereon, feeding said elastic yarn and forming alternate loops on said alternate needles and intervening loops on transfer hooks of a dial in a third course, knitting a plurality of subsequent alternate courses of loops of elastic yarn on alternate needles, knitting a plurality of intervening courses of loops of inelastic yarn on all needles, and transferring the loops on said transfer hooks back to the needles to form a turned welt.

3. The method of producing a circular knit seamless fabric forming a turned welt hosiery top which has an elastic yarn and an inelastic yarn both of which are knit in said fabric comprising the steps of: feeding the inelastic yarn to alternate needles and forming loops of a first course thereon, feeding the inelastic yarn to every needle and forming loops of a second course thereon, feeding said inelastic yarn and forming loops of a third course on said alternate needles and transfer hooks of a dial, knitting a first plurality of courses of loops consisting of alternate courses of elastic yarn knit on said alternate needles and intervening courses of inelastic yarn knit on all needles, knitting a second plurality of courses of loops of alternate and intervening courses both of which are knit from inelastic yarn, and transferring the loops on said transfer hooks back to the needles to form a turned welt.

4. The method of producing a circular knit seamless fabric forming a turned welt hosiery top which has elastic and inelastic yarns all of which are knit in said fabric comprising the steps of: feeding one of said yarns to alternate needles and forming loops of a first course thereon, feeding another of said yarns to every needle and forming loops of a second course thereon, feeding one of said yarns forming said first and second courses and forming alternate loops on said alternate needles and intervening loops on transfer hooks of a dial in a third course, knitting a plurality of courses of loops in which at least one group of said courses consists of alternate courses of elastic yarn knit on alternate needles and intervening courses of inelastic yarn knit on all needles, and transferring the loops on said transfer hooks back to the needle to form a turned welt.

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