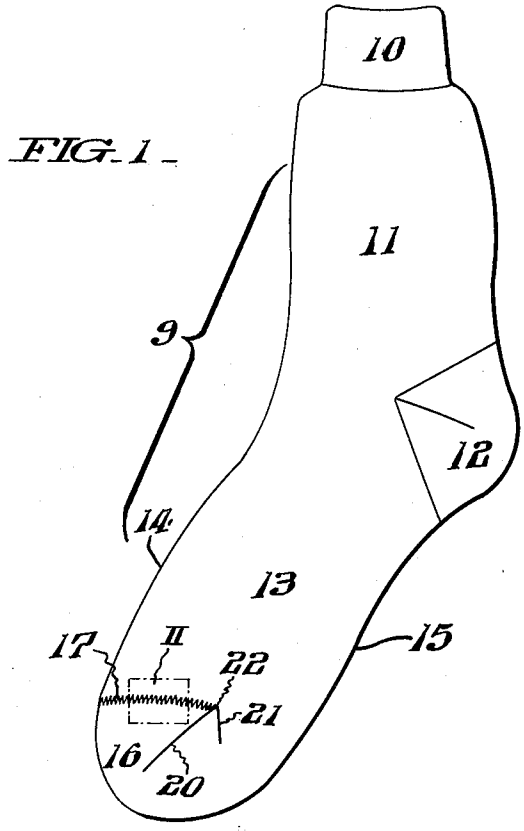
April 25, 1961 J. C. SLANE 2,980,917

CIRCULAR KNIT HOSIERY AND METHOD OF CLOSING THE TOE THEREOF

Filed June 22, 1959 3 Sheets-Sheet 1

FIG. 1



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FIG. 2

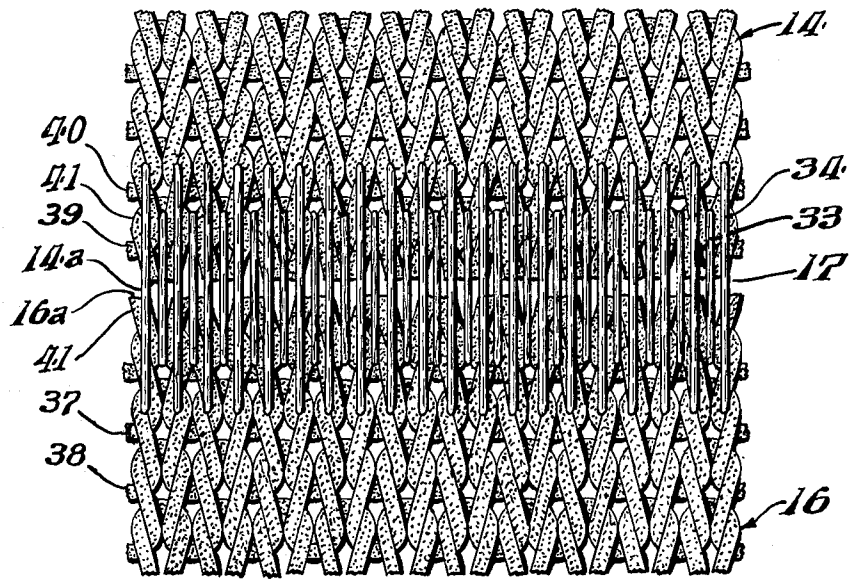
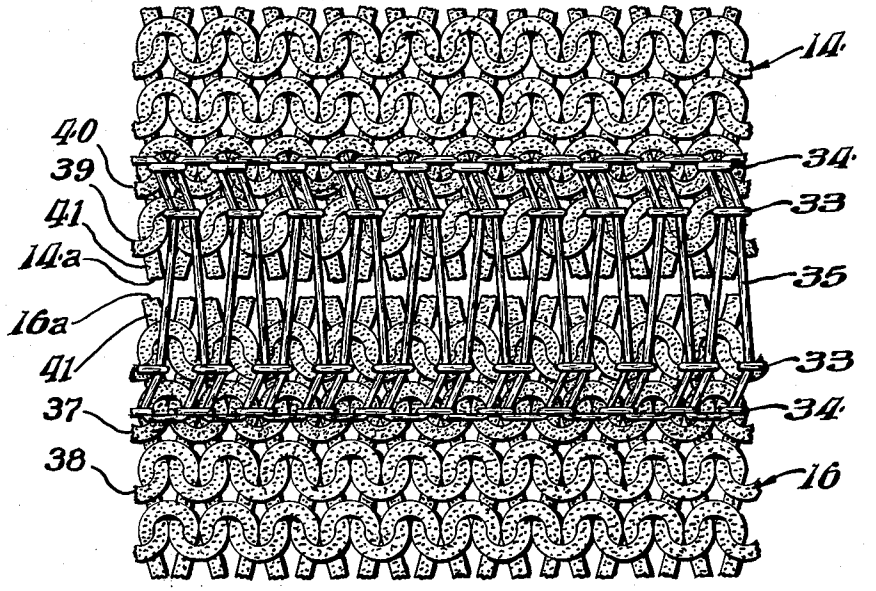


FIG. 3



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FIG. 4.

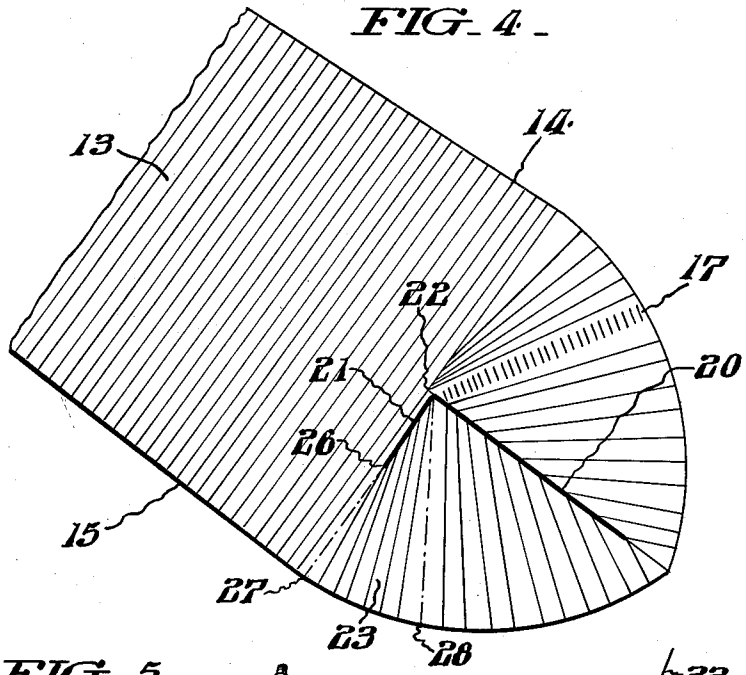
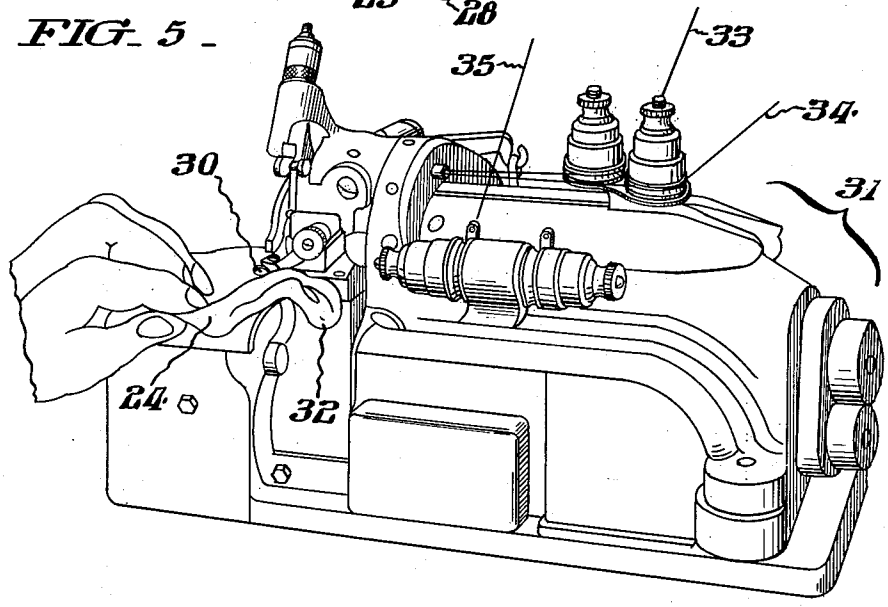


FIG. 5.



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2,980,917

CIRCULAR KNIT HOSIERY AND METHOD OF CLOSING THE TOE THEREOF

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7 Claims. (Cl. 2—239)

This invention relates to circular knit hosiery, and particularly relates to a method of closing the toe thereof.

For many years, the toes of circular knit hosiery, whether women's stockings, men's half hose or children's anklets, have been closed by a looping operation which involves impaling, by hand, individual loops of the stocking upon the points of a looping machine. Such looping operation is costly and time consuming, and requires the use of skilled loopers who must first undergo many months of meticulous training.

Because of the high cost involved in looping circular knit hosiery, it has become common practice in recent years to close the toes of inferior quality half hose, known in the trade as "seconds" and "thirds," by seaming together the opposing raw edges of the toe pocket and instep by conventional sewing machines. Such seams, particularly with respect to men's half hose, are bulky, result in crinkles or puckers in the fabric and generally are undesirable when compared to a looped toe stocking.

In recent years, due to improvements made in sewing machines, and the advent of strong, relatively fine yarns, such as fine denier nylon yarn, it has become possible to successfully close the toes of ladies' fine denier seamless hosiery by sewing a seam longitudinally of the bottom of the foot in lieu of the usual looping. Examples of such seaming are disclosed in Getaz Patents Nos. Re. 24,314 and 2,740,279. While such sewed seam closures along the bottom of the foot have proven to be satisfactory for ladies' seamless stockings, the making of the toe pocket for such closures requires special mechanisms on the knitting machine and involves considerable additional knitting time.

The present invention pertains to a novel method of closing the toes of seamless hosiery which does not involve the use of special knitting mechanisms, nor the expenditure of any significant additional knitting time, while at the same time achieving a highly satisfactory closure seam which is not bulky and which is free of fabric puckering or crinkling. More particularly, this invention involves the formation of a gusset in the foot of the stocking prior to knitting the toe pocket, whereby a hinging action is achieved permitting the closing of the toe by a traverse sewed seam without the incidental formation of crinkles or puckers in the fabric, and further involves the seaming of the toe by a three thread two needle overedge sewing machine using sewing threads comprising multifilament nylon of 100 denier or less, or equivalent threads.

Accordingly, the chief object of this invention is to provide a sewed toe circular knit stocking wherein the seamed fabric is free of puckers or crinkles and wherein the seam is free of bulk while, at the same time, being sufficiently strong to adequately and securely close the toe.

A further object of this invention is to provide a method of closing the toe of circular knit hosiery which dispenses with the time consuming and expensive looping operation and at the same time does not involve additional knitting time or the use of special mechanisms on the knitting machine.

A further object of this invention is to provide a sewed toe circular knit stocking wherein the toe may be rapidly and securely seamed by a three thread two needle overedge sewing machine along the normal looper line of the stocking.

Other objects and advantages of this invention will be apparent from the following description of the attached drawings wherein:

Fig. 1 is a view in side elevation of a sock embodying this invention.

Fig. 2 is an enlarged fragmentary view of that portion of the sock within the dot-dash rectangle II of Fig. 1 showing the outside of the seam of the sock.

Fig. 3 is a view similar to Fig. 2 showing the inside of the seam of the sock.

Fig. 4 is an enlarged fragmentary, more or less diagrammatic, view of the toe portion of the sock.

Fig. 5 is a perspective view of a conventional three thread two needle overedge sewing machine showing the manner in which a circular knit sock of this invention is fed to such machine for the purpose of closing the toe thereof.

While this invention shall be described herein with specific reference to socks, such as men's half hose, it is to be understood that the invention is readily adaptable to all types of circular knit hosiery, including ladies' hosiery and children's anklets.

In Fig. 1, the sock **9** is shown as having the usual elastic top **10**, leg portion **11**, heel pocket **12**, foot portion **13**, with the instep indicated at **14** and the sole at **15**, and the toe portion **16**. The sock **9** may be knit on any well known revolving needle cylinder seamless hosiery machine, such as the well known Scott & Williams type of machine. As shown, the toe is closed by a transverse sewn seam **17** which secures the top of the toe portion **16** to the instep portion **14**. Formed in the toe portion of the stocking, on each side thereof, are two sutures **20** and **21** which intersect at points **22** on each side of the toe of the stocking. The suture **20** is the usual suture formed during the knitting of the conventional toe pocket.

As is more clearly shown in Fig. 4, suture **21** is formed as the result of the knitting of a gusset **23** in the stocking following the knitting of the foot portion **13** and prior to the knitting of the conventional toe pocket. The gusset **23** is a wedge-shape portion of fabric disposed between the line **22—26—27**, adjacent the foot portion of the stocking, and line **22—28**, adjacent the toe pocket thereof. The gusset **23** may be formed, following the knitting of the last full circular course of the foot, by first raising out of action not only all of the long butt needles used for knitting the instep **14**, but also a few of the short butt needles disposed immediately on each side of the long butt needles, and then reciprocating the needle cylinder in the usual manner. Thus, the gusset is initially formed by using less needles than are normally used in commencing knitting of the toe pocket. The gusset provides extra fabric at the bottom of the toe opposite the toe opening and thus allows the edges of the toe opening to be brought together and joined by a seam without formation of puckers, crinkles or pockets near the ends of the sutures, even when the seam does not start or finish precisely at the suture junctures **22**, which frequently may be the case in actual practice. Ordinarily, when the seam does not start or finish at the suture junctures **22**, the puckers or crinkles tend to become enlarged or more emphasized in the fabric. However, with the addition of the gusset **23**, the formation of puckers or crinkles is eliminated regardless of whether or not the seam **17** starts or ends at the suture junctures **22**.

As the needle cylinder reciprocates to form the gusset

23, the lowering pick is placed into action so as to lower two of the raised short butt needles upon each reciprocation of the needle cylinder, while the raising pick is placed into action to lift one of the two needles back to raised position. This results in a single short butt needle being added to the actively knitting needles upon each reciprocation of the needle cylinder, thereby resulting in the gradual widening of the gusset 23 and the incidental formation of suture 21. Preferably, the widening action continues until all of the short butt needles have been returned to active position, and only the long butt needles are left out of action. Thereupon, the lowering pick is placed out of action and the usual toe pocket is knit in the usual way, by first narrowing and then widening by the conventional use of the picks, resulting in the incidental formation of the suture 20 on each side of the toe pocket. As will be readily understood, the points of intersection 22 of each pair of sutures 20, 21 necessarily will be disposed in the same course of the sock.

Following the knitting of the toe pocket, the usual looper courses comprising full circular courses are knit. In view of the fact that the toe of the sock is not to be closed by the conventional looping operation, it is not necessary to knit enlarged stitches in the course comprising the normal looper line of the toe fabric. To facilitate the closing of the toe by the seaming operation which will be subsequently described, it is preferred that the several courses of fabric knitted subsequent to the knitting of the looper line be knit of a yarn either of a contrasting color or contrasting texture with the yarn used to knit the courses preceding the looper line. The purpose of effecting such a yarn change is to make the looper line, along which the toe of the stocking is to be seamed, readily discernible to the sewing machine operator. If desired, instead of effecting a yarn change for this purpose, some other detection means may be resorted to, such as the knitting of tuck stitches in one or more of the courses subsequent to the course comprising the looper line.

As the sock is removed from the knitting machine, it is turned inside out. In preparing for seaming of the stocking, the fabric formed of the full circular courses which are knit following the knitting of the toe pocket is flattened, as shown at 24 in Fig. 5, so as to be disposed in contiguous relation with itself. In flattening the fabric in this manner, the course comprising the looper line is superimposed upon itself starting adjacent one of the suture intersection points 22 at one side edge of the folded fabric and extending over and adjacent to the other suture intersection point 22 on the opposite side edge of the fabric. With the fabric thus flattened, it is passed under the foot 30 of a conventional three thread two needle overedge sewing machine 31, such as the well known Singer or Merrow machines, as shown in Fig. 5, so that the transverse seam 17 is sewed across the normal looper line of the stocking, such seam overlapping at least two courses on each side of the flattened fabric. The seam 17 extends coursewise from one suture intersection point 22 to the other suture intersection point 22, thereby securely joining loops of the toe portion of the stocking with the opposing loops of the instep portion thereof. As shown in Fig. 5, the waste courses 32 adjacent the seam 17 are cut off as the stocking is seamed.

As is well known, the conventional three thread two needle overedge sewing machine forms a seam from two needle threads 33 and 34 and from a looper thread 35. In the practice of this invention, it is preferred that both the needle and looper threads be multifilament nylon of 100 denier or less, or else comprise a thread having the strength of a nylon thread of 100 denier or less. In practice, it has been found that a highly satisfactory seam of sufficient strength and wearability, and without excessive bulk, may be formed from needle and looper threads of 70 denier nylon each. By using such relatively fine sewing threads, it is possible to pass more sewn stitches through the seamed portion of the knitted fabric than there are wales thereof, thus insuring against the formation of runs in the stocking fabric.

By forming the gusset 23, extra fabric is provided in the toe portion of the stocking which allows a hinging action about an axis passing through the suture intersection points 22, thereby greatly facilitating the bringing of the raw edges of the toe and instep portions of the sock into juxtaposition for the seaming operation. Additionally, the formation of the gusset 23 in the toe portion of the stocking avoids the formation of the crinkles or puckers in the sock fabric which otherwise result from the seaming operation. This is true regardless of whether or not the sewed seam starts or ends exactly at the juncture 22 of the sutures.

Shown in Figs. 2 and 3, respectively, are outside and inside views of the seamed sock fabric with the fabric flattened out. The cut edge of the toe fabric 16 is shown at 16*a* and the cut edge of the instep fabric 14 is shown at 14*a*. As shown in Figs. 2 and 3, the seam 17 is of a width to overlap at least two courses 37, 38 of the toe fabric 16 and at least two courses 39, 40 of the instep fabric 14. The cut loop portions 41 of the waste courses 32 which remain in the fabric 14 and 16 are bound into the seam 17 and aid in securing the sewed fabrics against runs. As is clearly shown in Fig. 2, due to the use of the relatively fine denier seaming threads, each wale of the sock contains a plurality of sewn stitches. While Fig. 2 shows diagrammatically, for purposes of illustration, three sewn stitches in each fabric wale, in actual practice there may be only two sewn stitches in some wales and more than three sewn stitches in other wales. In any event, the fact that there are a plurality of sewn stitches in each fabric wale serves to insure against runs in the seamed fabric.

As mentioned above, it is desirable to have at least two stitches in each wale so that even though the stitches are placed irregularly, each wale is securely held. As also mentioned above, this is best accomplished by a two-needle, three-thread machine, because by using two spaced needles, the desired number of stitches per wale may be obtained without placing the stitches so close together that the needles might injure the fabric and without causing the seam to become bulky due to excessive looper thread. As shown in Figures 2 and 3, the two transverse rows of needle loops on each side on the toe opening are parallel with the cut edges of the fabric, and are spaced apart a substantial distance, equal to the spacing of the points of the needles in the seaming machine. Moreover, the fabric penetration points of the two needles are preferably slightly staggered along the length of the seam so that if, by any chance, a wale is missed by one needle, it is sure to be caught by the other.

If the stitches of these two needle threads are of the same relatively short length so as to pull the two layers of knitted fabric close together, it is not possible to open the seam except to the limited extent permitted by stretching of the thread of the outside needle or by distortion of the knitted fabric. One of the main purposes of this invention is to provide a flat seam which will not form a ridge in the fabric, and this purpose preferably is accomplished by making the stitches of the outside needle, as shown by thread 34, longer than is required merely to pass through the two layers of fabric by an amount approximately equal to twice the distance between either of the outer rows of needle stitches and the cut edges of the fabric. This provides sufficient length of thread for the outside needle stitches to permit the fabric to be opened up flat with the opposing cut fabric edges disposed in edge to edge abutting relationship in substantially the same plane, as shown in Figs. 2 and 3. Preferably, but not necessarily, the stitches of the inside needle thread, as shown by the

thread 33, are shorter than the stitches of the outside needle thread by an amount approximately equal to twice the space between the fabric penetration points of the two needles, i.e. twice the spacing between the two transverse rows of needle loops on either side of the toe opening. Thus, when the fabric is opened up, with the cut edges 14*a* and 16*a* disposed in edge to edge abutting relation, the stitches of both the inside and outside needle threads are pulled out straight, but without any tension on either the knitted loops of the fabric or the threads of the stitches of the seam. This difference in length or size of stitches of the two needle threads may be obtained by any suitable known means used in connection with the seaming machine. Alternatively, such abutting relation of the cut fabric edges may be achieved by using elastic yarn for the needle threads. If desired, the stitches of the inside needle thread may be made as long as, or nearly as long as, the stitches of the outside needle thread, but a less attractive seam will result, due to the relatively excessive length of the inside needle thread stitches. With such a seam, the two rows of needle thread loops on each side of the toe opening will tend to slide together over the looper thread.

While a preferred embodiment of this invention has been described in detail, it will be obvious to one skilled in the art that various modifications may be made therein without departing from the invention as hereinafter claimed.

Having thus described my invention, I claim:

1. A circular knit stocking having a toe opening defined by opposing cut fabric edges disposed in abutting relation in substantially the same plane, said opening being closed by a seam composed of two needle threads anchored by a single looper thread, the needle threads being disposed in two rows of fabric penetrating loops on each side of the toe opening, the individual loops of each of the two outermost rows of needle thread loops generally passing through different courses of the knitted fabric than the next adjacent loops of the next adjacent inner row of needle thread loops, the two outermost rows of needle thread loops being connected together to form plural stitches of one needle thread and the two inner rows of needle thread loops being connected together to form plural stitches of the other needle thread.

2. The stocking of claim 1 wherein the connecting portions of the stitches of the outermost rows of needle thread loops have a length at least equal to twice the distance between the fabric penetration points of the loops of either outer row and the next adjacent cut edge of the fabric.

3. A circular knit stocking formed with a plurality of cylinder needle wales and having a toe opening defined by opposing cut fabric edges disposed in substantially the same plane in abutting relation to each other, said toe opening being closed by a transverse seam composed of two separate needle threads each forming a plurality of needle thread stitches, the needle thread stitches of one of said needle threads generally passing through different courses of knitted loops at each side of said toe opening than the needle thread stitches of the other of said needle threads and the needle thread stitches of both of said needle threads being anchored by a single looper thread, said needle thread stitches together comprising in number at least three times the number of cylinder needle wales in the stocking.

4. A circular knit stocking formed with a plurality of needle wales and having a toe opening defined by opposing cut fabric edges disposed in abutting relation in substantially the same plane, said toe opening being closed by a seam containing a first plurality of needle thread stitches overlapping at least one knitted course of said fabric on each side of the toe opening, said needle thread stitches being greater in number than the needle wales of the stocking; and a second plurality of needle thread stitches extending further into the fabric on each side of the toe opening than said first plurality of stitches, said second plurality of needle thread stitches also being greater in number than the needle wales of the stocking; and a single looper thread disposed on one side of the fabric and anchoring all of said needle thread stitches.

5. The stocking of claim 4 further including a gusset formed adjacent the toe thereof.

6. The stocking of claim 5 wherein the seam and gusset are disposed, respectively, adjacent opposite sides of the toe.

7. The stocking of claim 5 wherein the seam is disposed adjacent the top of the toe and the gusset is formed adjacent the bottom of the toe.

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Dedication

2,980,917.—*John C. Slane*, High Point, N.C. CIRCULAR KNIT HOSIERY AND METHOD OF CLOSING THE TOE THEREOF. Patent dated Apr. 25, 1961. Dedication filed Dec. 4, 1963, by the assignee, *Frank D. DeLong, Jr.*

Hereby dedicates to the public the entire term of said patent subsequent to November 15, 1963.

[*Official Gazette February 18, 1964.*]