

[54] **METHOD OF KNITTING CLOSED TOE HOSIERY**

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Related U.S. Application Data

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Foreign Application Priority Data

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[52] **U.S. Cl.**..... **66/95, 66/173, 66/187**
[51] **Int. Cl.**..... **D04b 9/56, D04b 9/54**
[58] **Field of Search** **66/95, 21, 173, 187, 9 R**

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[57] **ABSTRACT**

A closed toe for a circularly knit hose made upon the machine making the hose and comprising a deformed two-ply closed tubular welt structure wherein the circular seam joining the plies of the welt together is located in the outer ply of the welt between the ends thereof whereby the seam and the deformation of the welt are located on the sole side of the toe portion of the hose. The method of making the aforesaid closed toe construction by knitting a pair of nested separate tubular sections of fabric of unequal lengths as extension of the tubular foot of the hose and of then joining together the terminal portions of the tubular fabric extensions.

1 Claim, 12 Drawing Figures

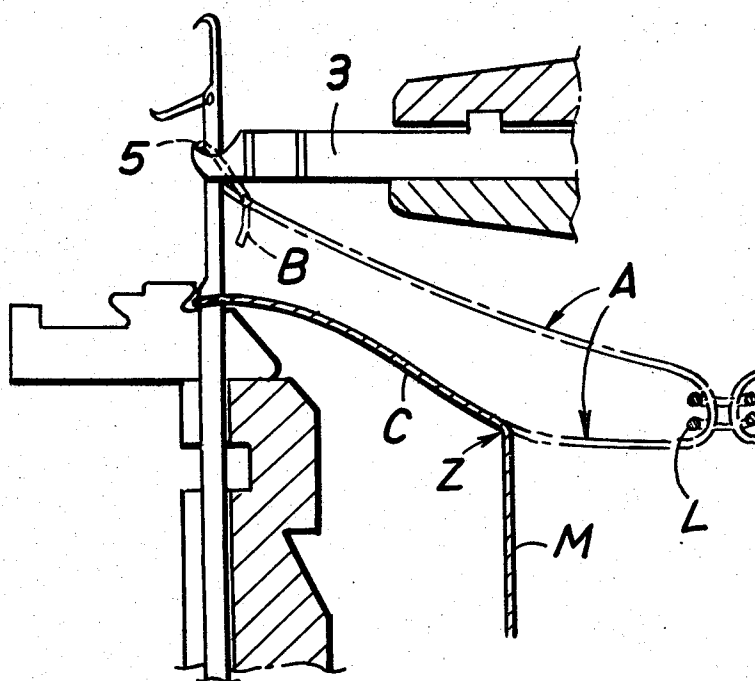


Fig. 1

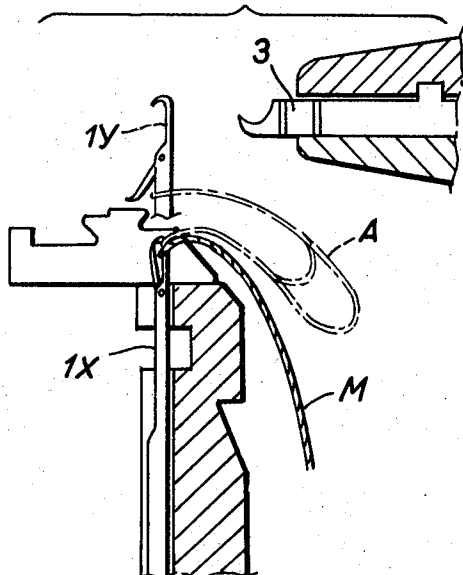


Fig. 2

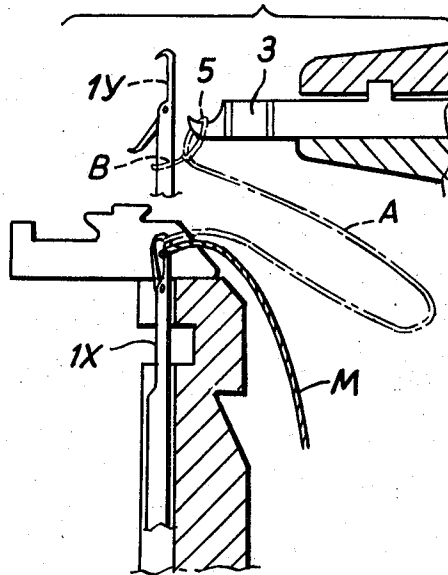


Fig. 3

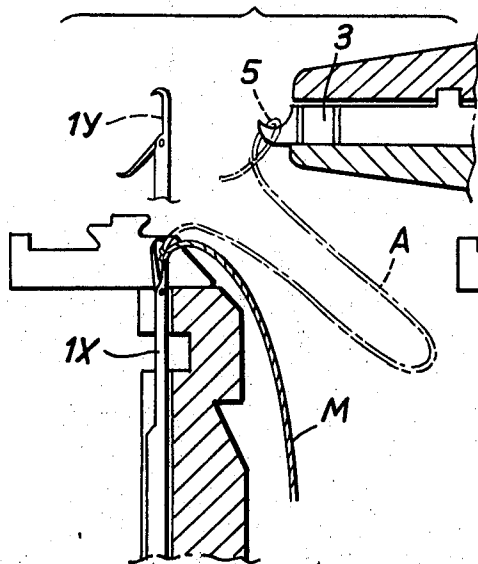


Fig. 4

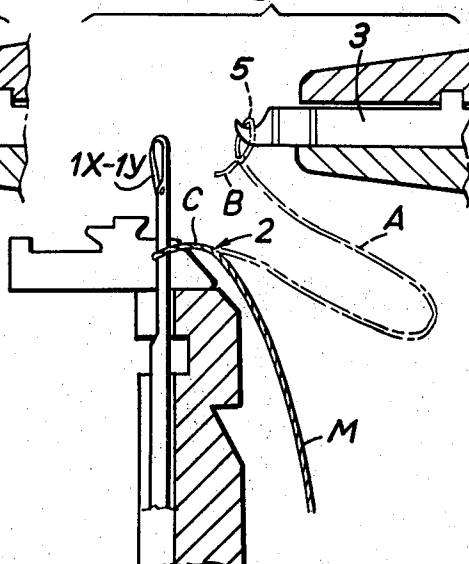


Fig. 5

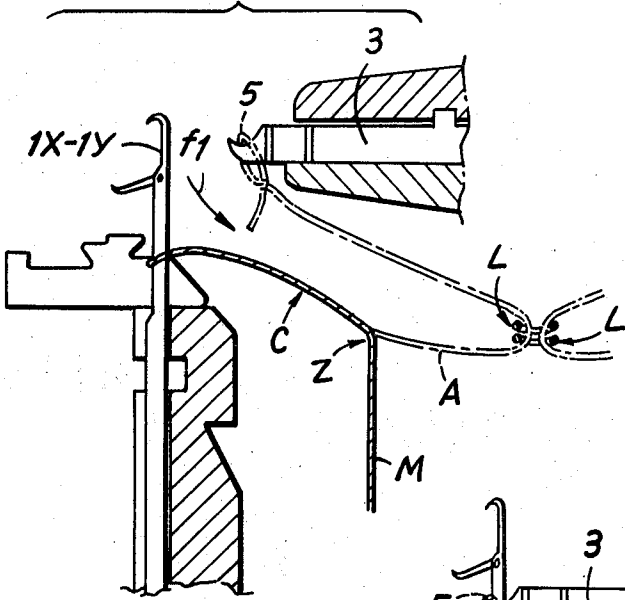


Fig. 6

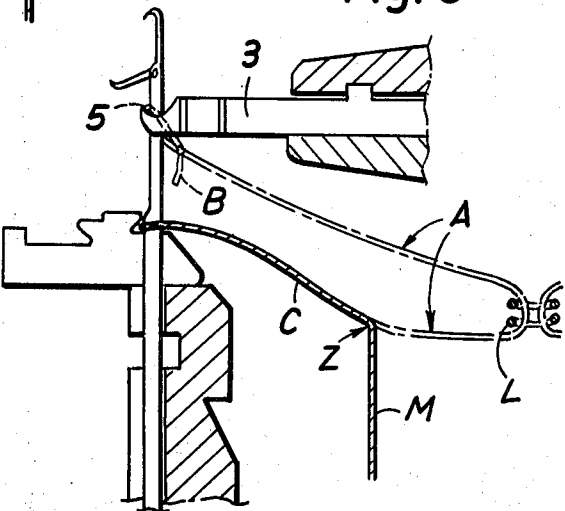
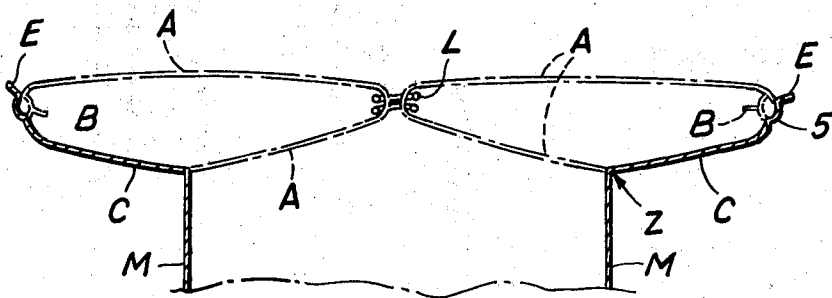
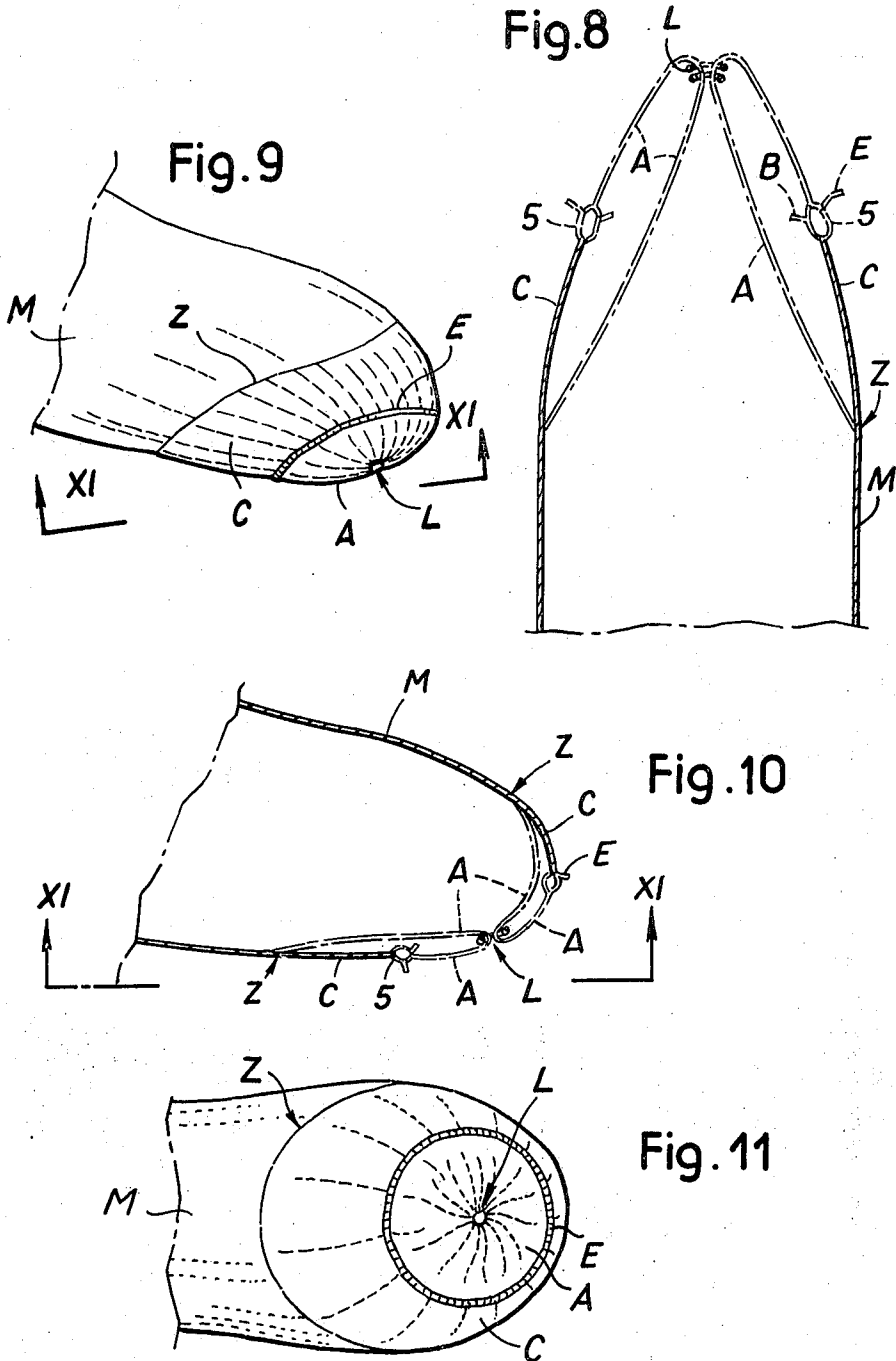


Fig. 7





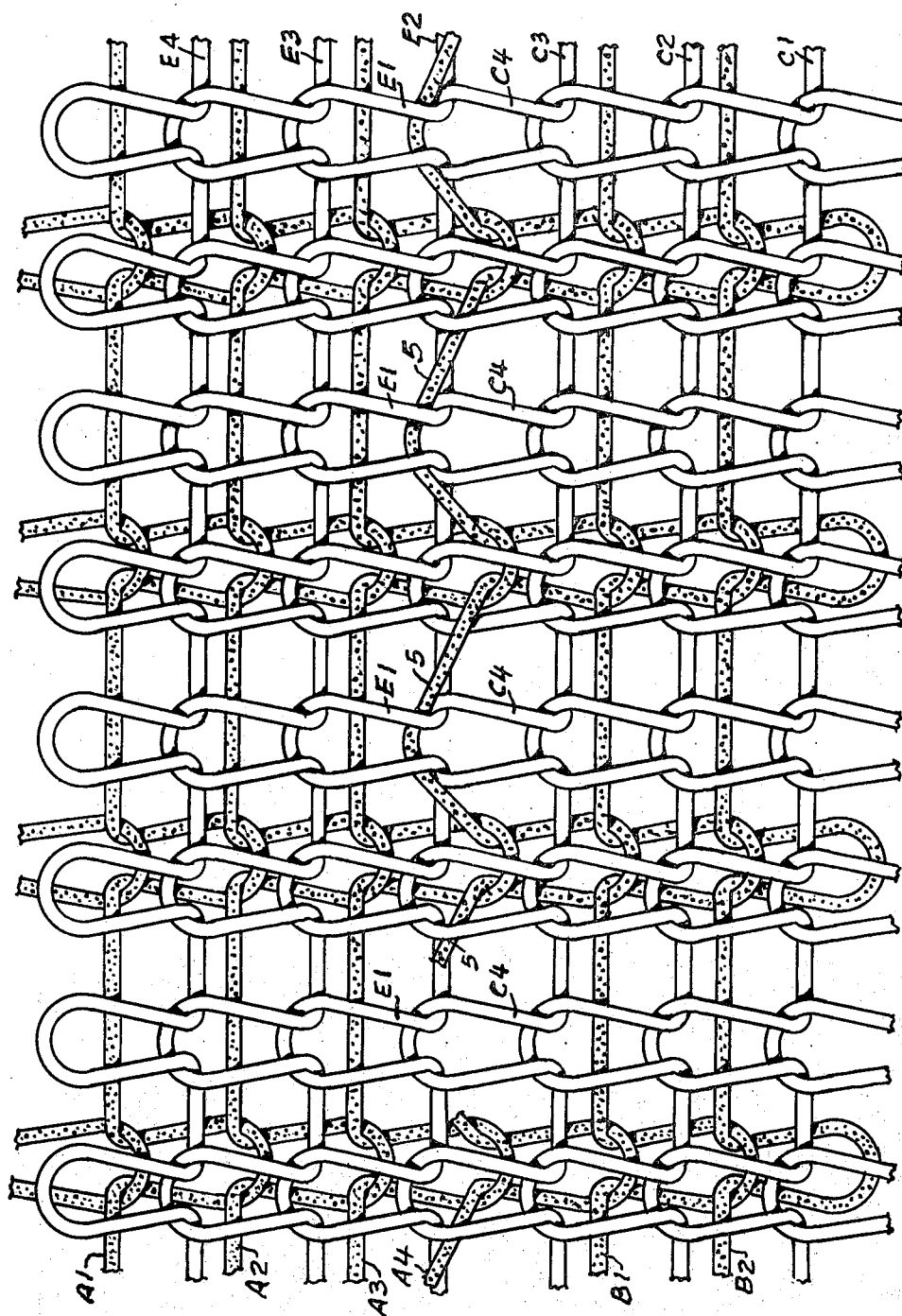


Fig. 12.

METHOD OF KNITTING CLOSED TOE HOSIERY

The present application is a Division of Application Ser. No. 820,088, filed Apr. 29, 1969, now U.S. Pat. 3,721,111 issued March 20, 1973.

THE INVENTION

The present invention relates generally to the art of knitting and more particularly to circularly knit hose having the toes thereof closed on the machine making the hose and to the method of making the same.

In the art of circular knit hose the toes of which are closed on the machine making the hose, a two-ply tubular welt is provided for the toe of the hose and the closing of the toe is effected, on the machine, by special manipulation or deformation of the plies of the welt, prior to the completion of the welt itself, so that when the welt is completed, its deformed plies form a closed or constricted end for the toe of the hose. One method of special manipulation for the plies of the welt is to twist the same relative to each other at the fold line of the welt as disclosed in U.S. Pat. No. 3,327,500, and, in a second method, a plurality of turns of yarn are placed about the fold line of the welt to constrict the same as disclosed in Italian Patent Numbers 814,164 granted June 1, 1968 and 837,903 granted Feb. 15, 1969. Other disclosures of the said second or wrap method are in Belgian patent 721,933 granted Dec. 13, 1968; the Hosiery Trade Journal, March, 1968; and Knitted Outerwear Times, April, 1968.

Once the welt plies have been so manipulated, the welt itself is completed by joining together the first and the last courses thereof along what may be termed a welt juncture course. The overall walewise length of the two plies of the completed welt must be sufficient, as a minimum, to permit the plies of the welt to be twisted or to be otherwise constricted while stitches of at least one of the plies are still on the cylinder needles of the machine upon which the welt is being made. The welt juncture course is spaced from the fold line of the welt by half the overall length of the two plies of the welt and, since there is a minimum length for the welt fabric (which is determined by the diameter of the needle cylinder of the machine), the result is that the welt juncture course is spaced from the end of the toe sufficiently so that it encircles the toe of the finished hose and, particularly in the case of hose which are knit from top to toe, causes the toe to present an unsightly appearance with the juncture line and the toe constriction being visible.

It is the principal object of the present invention to provide circularly knit hose with an improved closed toe made on the machine making the hose wherein the appearance of the toe portion of the hose is more pleasing than that of the prior art and to provide a method of making the same.

It is an important object of the present invention to provide circularly knit hose with a two-ply tubular closed welt structure made on the machine making the hose in which the closure of the welt and the welt juncture course are disposed on the sole side of the toe portion of the hose and to provide a method of making the same.

It is also an object of the present invention to provide circularly knit hose with a two-ply welt closed toe structure made on the machine making the hose in which the welt juncture course is disposed within one

of the plies of the welt between the ends thereof and to provide a method of making the same.

It is a still further object of the present invention to provide a circularly knit hose with a two-ply tubular welt structure for the toe portion of the hose wherein the welt is formed of a pair of tubular sections of fabric of unequal lengths and to provide a method of making the same.

The several objects and advantages of the present invention will be readily apparent from the following detailed description of a preferred embodiment thereof and of the process for making the same to be read in connection with the accompanying drawings showing the same and from the appended claims.

IN THE DRAWINGS

FIG. 1 is a diagrammatically illustrated vertical section of portions of the needle cylinder and of the welt dial of a circular knitting machine upon which my invention may be performed and showing the start of the process of forming my improved two-ply closed tubular welt toe structure for a circular knit stocking wherein the tubular fabric of the foot of the stocking has been made upon all of the cylinder needles and wherein the fabric which will form part of the two-ply toe welt is being made upon alternate cylinder needles while the foot fabric is retained upon the inactive intervening cylinder needles.

FIG. 2 is a view similar to FIG. 1 showing the next stage in the process wherein the formation of the fabric on the alternate cylinder needles has been completed, wherein yarn of a course of the aforesaid fabric adjacent the end thereof has been placed upon the transfer hooks of the welt dial and wherein a plurality of courses have been knit following the aforesaid transfer course, the final course of fabric still being upon the alternate cylinder needles.

FIG. 3 is a view similar to FIG. 2 showing the next step in the process wherein the fabric is cast off from the alternate cylinder needles knitting the same and leaving the cast off fabric impaled upon the transfer hooks.

FIG. 4 is a view similar to FIG. 3 showing the next stage of the process wherein all of the cylinder needles commence knitting tubular fabric in extension of the foot fabric.

FIG. 5 is a view similar to FIG. 4 showing a still later stage in the process wherein all of the fabric of the foot extension has been knit and wherein the fabric previously knit upon the alternate needles has been constricted about the axis of the needle cylinder.

FIG. 6 is a view similar to FIG. 5 showing the final stages in the process wherein the course of fabric previously held upon the transfer hooks is transferred to the cylinder needles preparatory to knitting a plurality of courses of fabric thereon and after which the completed hose is cast off from the machine.

FIG. 7 is a diagrammatically illustrated section through the constricted two-ply toe welt and the adjacent portion of the stocking foot as it comes from the machine.

FIG. 8 is a view similar to FIG. 7 showing the change in the relative disposition of the two-ply welt induced by boarding.

FIG. 9 is a side elevational view of my improved closed toe and the adjoining foot portion of the stocking after being shaped in the boarding process.

FIG. 10 is a diagrammatically illustrated vertical section through the foot and toe portions of the stocking shown in FIG. 9.

FIG. 11 is a bottom plan view of the foot and toe portions of the stocking shown in FIGS. 9 and 10 as taken on lines XI — XI thereof.

FIG. 12 is a schematic diagram showing the stitches along the courses where the terminal portion of the fabric knit upon all of the needles is joined to the terminal portion of the fabric knit upon the alternate needles to join the two ply toe welt structure.

The construction of my improved closed toe formation for circular knit hose and the method of making the same may be understood by referring to the drawings in which, in FIGS. 1 through 6, the cylinder needles of the machine are indicated at IX and at IY of which the needles IY are the alternate ones and the needles IX are the intervening ones. The machine, which may be of the usual type for the formation of ladies' hose, is provided with a welt dial adjacent the upper end of the needle cylinder and in which there is a circular series of conventionally shaped radially slidable transfer hooks 3.

Referring now to FIG. 1, the tubular fabric of the stocking foot, which has been knit upon all of the cylinder needles, IX and IY, is indicated at M. At this point, the intervening needles IX are made inactive and are retained in lowered idle position with the corresponding intervening stitches of the terminal course of fabric M thereon while the alternate needles IY continue to knit tubular fabric in continuation of the corresponding alternate stitches of the terminal course of fabric M, the fabric so being knit upon half of the needles IY being indicated by dotted lines at A. The fabric A, two progressive positions of which are shown in FIG. 1 as the knitting thereof proceeds, is folded over upon itself between its starting point, on the needles IX, and the needles IY upon which it is being knit. The fabric A will form the inner ply and part of the outer ply of the finished two-ply welt of which the closed toe is to be formed.

The knitting of fabric A continues, as shown in FIG. 2, until a predetermined amount thereof is made, the amount of fabric A made, is greater in length than the radius of the first tubular fabric, but is insufficient in itself to permit the folded-over central portion thereof to reach to the axis of the needle cylinder and is therefore insufficient to form a closed toe. Terminal courses of fabric A are indicated at A1, A2 and A3 of FIG. 12. Thereafter, the transfer hooks 3 are moved radially outward in position to receive thereon loops 5 of a course A4 of the fabric A and then the needles IY continue to knit a plurality of terminal courses B1 and B2 indicated at B. While only two courses B1 and B3 are shown, for illustrative purposes, it will be understood that the number of such courses will be sufficient to form the band of fabric B. The courses or band of fabric B is pressed off to form a free edge thereon and the band B serves to prevent the formation of runs once the fabric B has been cast off from the needles and this is shown in FIG. 3 where the loops 5 of the fabric A are still retained upon the transfer hooks 3.

Then, as shown in FIG. 4, knitting commences upon all of the cylinder needles, IX and IY, to knit tubular fabric C, starting along the line Z, in continuation of the foot fabric M. It may be noted that the start of fabric A was also from the line Z of the fabric M. After a

sufficient amount of the fabric C has been knit, as shown in FIG. 5, to permit the fold in fabric A to reach to the axis of the needle cylinder, the total fabric, comprising the tubular sections A and C of which the latter is shorter, which now extends between the needles IX and IY and the hooks 3 and which together are to form two plies of a tubular welt, may be acted upon to deform the welt plies to close the end of the knit tube. The welt dial, containing the hooks 3 upon which one end of the fabric A is impaled, may be stopped from rotating, relative to the needle cylinder, for one rotation of the machine whereby the two plies of the welt will be twisted relative to each other to close the end of the tube or the tube may be closed by yarn wrapping as shown at L. It will be seen that the fabric A forms one ply of the welt and part of the second ply, the remainder of which is formed by the fabric C. Terminal courses of fabric C are indicated at C1, C2 and C3, FIG. 12.

Once the welt structure has been centrally closed, the loops 5 of the fabric A are transferred from the hooks 3 to the intervening needles, FIG. 6, upon which there are the stitches C4 of course C3 of fabric C, these loops 5 and stitches C4 then being joined together by stitches E1 of course E2 to close the welt by knitting on the cylinder needles IX and IY, the needles continuing to knit a plurality of terminal courses E3 and E4 indicated at E, FIG. 7. While only two courses E3 and E4 are shown, for illustrative purposes, it will be understood that the number of such courses will be sufficient to form the band of fabric E. The courses or band of fabric E serve to prevent the formation of runs once the fabric E, as well as the completed hose, has been cast off from the machine. The yarn of courses A1, A2, A3, A4, B1, and B2, indicating fabrics A and B, respectively, are shown stippled, while the yarn of courses C1, C2, C3, E2, E3, and E4, indicating fabrics C and E, respectively, are shown plain.

The foot and toe fabric, as it comes from the machine, FIG. 7, is not properly proportioned to fit the foot of the wearer for the reason that the extent of the fabric A, inside the toe, between the turns of yarn L and the course Z, is substantially less than the extent of the fabric A plus the fabric C, outside the toe, between the same two points. When the foot and toe are placed upon an appropriately shaped form, such as may be used as part of the boarding process in which hose made of thermoplastic yarns are heat shaped, the constriction of the welt, whether it be by twisting or by turns of the yarn L, is caused to be moved to the end of the toe, as shown in FIG. 8, wherein the inner and outer plies of the welt are now of substantially equal extent. It will be seen that the band of fabric B is between the two plies of the welt, the band of fabric E is on the outer side of the outer ply and that the juncture closure for completion of the welt, where the bands of fabric B and E are located, is in the outer ply of the welt approximately midway between the end of the toe and the line Z at which the two welt plies began. The position of the welt juncture, where the bands E and B are located, will vary depending upon the relative lengths of the fabrics A and C, the total extent of the fabrics A and C together being sufficient to permit the twisting — or the yarn constriction of the welt plies on the machine before the welt plies are joined together.

In the heat shaping process, when the foot and toe of the hose are placed upon the shaped boarding forms,

the fabric of the foot and toe is manipulated on the forms so that it assumes the relationship shown in FIG. 9 and, once the heat setting process is finished, the foot and toe permanently retain such relationship. In this arrangement it will be noted that the welt juncture line with its bands of fabric B and E, as well as the central toe closure indicated at L, are located on the bottom or sole side of the toe of the hose and are not visible on the upper or instep side of the foot and toe when the hose is worn. Thus a more pleasing effect is provided when the hose is worn, since the only portion of the closed toe welt structure visible on the top of the foot and toe is the fabric C in which there may be a pattern of mesh or of other decorative stitches to further increase the appearance of the hose. It is because the present construction provides for the joining together or the juncture of the welt plies to be located nearer to the end of the toe, that the juncture of the welt plies, the bands of fabric B and E and the closed end of the toe are disposed on the bottom side of the finished stocking toe.

It may be noted that inasmuch as the point of novelty of the present invention is primarily in the construction of and the manner in which the two ply toe welt structure itself is made, (of a pair of circularly knit tubular fabric sections of unequal lengths), it follows that any method, conventional or otherwise, of deforming or gathering or constricting the welt structure to close the same, may be used since the point of novelty, (the formation of the welt itself), has no specific interrelationship with the manner in which the welt structure is closed.

What I claim is:

1. The method of knitting a two-ply tubular welt and constricting it on a circular knitting machine having a circle of needles and a circle of cooperating transfer

hooks, which method comprises:

- a. knitting a first tubular fabric on said circle of needles;
- b. idling intervening needles in said circle of needles with stitches of said first tubular fabric thereon,
- c. knitting a second tubular fabric of a length greater than the radius of the first tubular fabric on alternate needles in said circles of needles,
- d. moving the transfer hooks radially outwardly to receive thereon loops of a terminal course of said second tubular fabric,
- e. knitting a plurality of courses of a non-run band of fabric on said alternate needles while the loops of the terminal course of said second tubular fabric are carried by said transfer hooks,
- f. casting off the stitches of the terminal course of said non-run band of fabric from said alternate needles, thereby pressing off said non-run band of fabric to form a free edge thereon,
- g. knitting a third tubular fabric on said circle of needles,
- h. constricting said second tubular fabric after the formation of said third tubular fabric and while the stitches in the terminal course of said second tubular fabric are carried by the transfer hooks,
- i. returning the stitches in the terminal course of said second tubular fabric from said transfer hooks to said intervening needles,
- j. knitting a plurality of courses of a non-run band of tubular fabric on said circle of needles to form a non-run band of fabric on said third tubular fabric,
- k. casting off the stitches of said non-run band of fabric on said third tubular fabric from the circle of needles.

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