

[54] **STOCKING AND METHOD OF MAKING SAME**

[75] Inventor: **Richard M. Janda**, Crestwood, Pa.

[73] Assignee: **North American Rockwell Corporation**, Pittsburgh, Pa.

[22] Filed: **Nov. 29, 1968**

[21] Appl. No.: **779,733**

2,069,021	1/1937	Schuessler.....	66/171
2,522,842	9/1950	Scholl.....	2/21
2,601,771	7/1952	Cameron.....	66/170
2,636,492	4/1953	Wright.....	2/21 X
3,184,236	5/1965	Zens.....	273/82
3,236,070	2/1966	Clayton, Jr.	66/187 UX
3,254,509	6/1966	Tenconi	66/41
3,301,012	1/1967	Tenconi	66/41
3,327,500	6/1967	Currier.....	66/187

[52] U.S. Cl. **66/170, 66/173, 66/187, 66/190**

[51] Int. Cl. **D04b 9/56**

[58] Field of Search.....66/9, 170, 171, 173, 174, 184, 66/185, 186, 187, 201, 41, 1, 146, 190, 172 E; 2/21, 239; 128/155, 156, 295, 296; 273/82

[56] **References Cited**

UNITED STATES PATENTS

2,787,899	4/1957	Getaz.....	66/172 E
761,592	5/1904	Lippitt.....	273/82 UX
966,746	8/1910	Hoefer et al.....	66/1
2,020,556	11/1935	Kirkpatrick	66/1

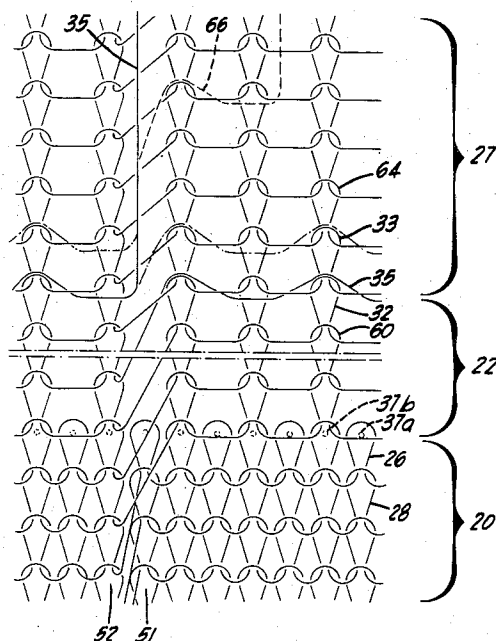
Primary Examiner—Wm. Carter Reynolds

Attorney—John R. Bronaugh, Floyd S. Levison, E. Dennis O'Connor and Richard A. Speer

[57] **ABSTRACT**

Knitted tubular stocking and methods of fabricating the same, said stocking having welt, leg and foot portions and a tubular double ply toe portion with a draw yarn interlaced with the stitches of courses defining the outer end of the double ply toe portion, the draw yarn acting when partially withdrawn from the courses to gather the stitches thereof into a tight bunch to close the outer end of the toe.

8 Claims, 21 Drawing Figures



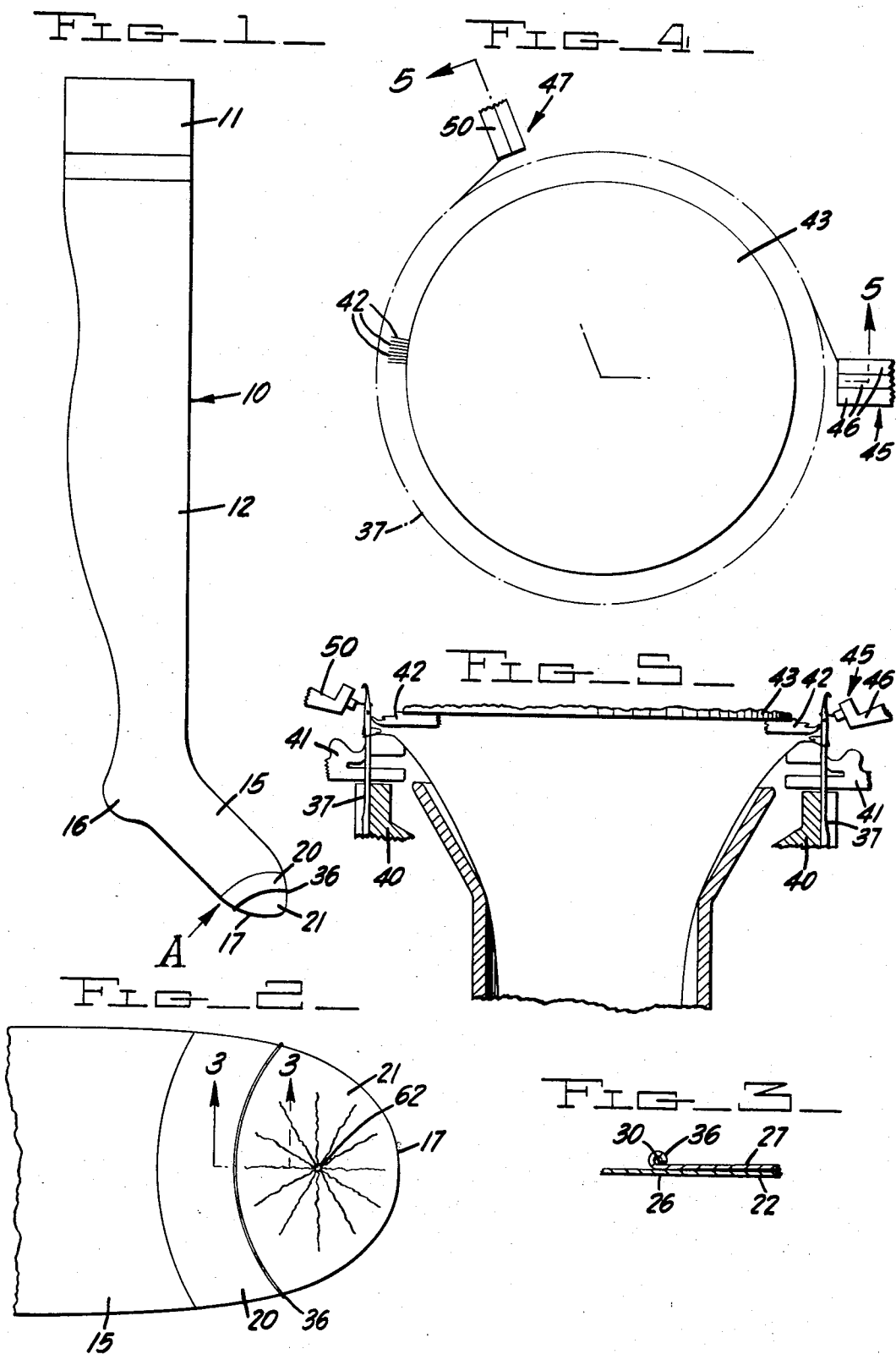


FIG. 6

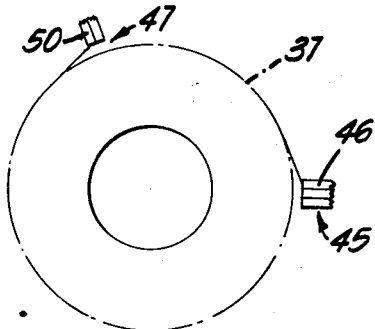


FIG. 7

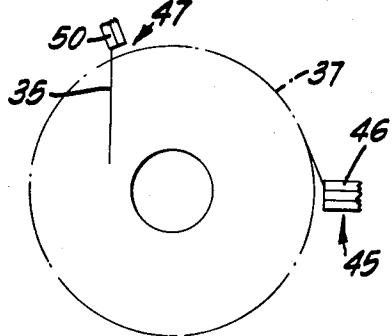


FIG. 8

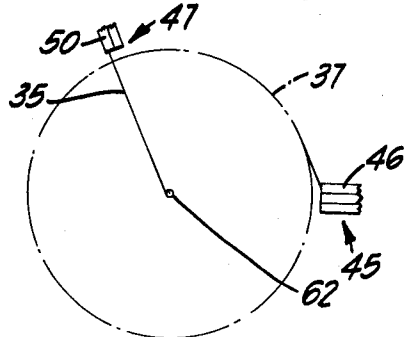


FIG. 9

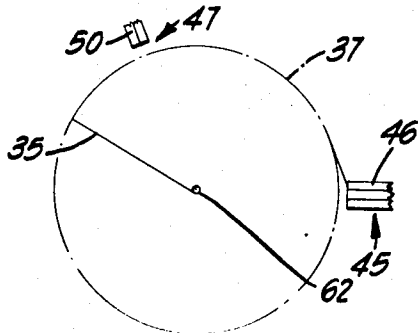


FIG. 10

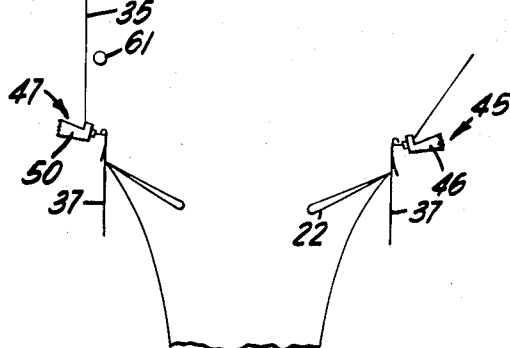


FIG. 11

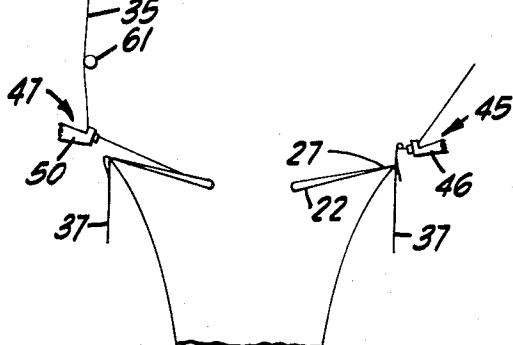


FIG. 12

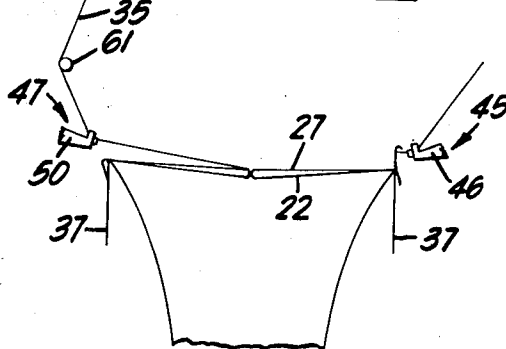


FIG. 13

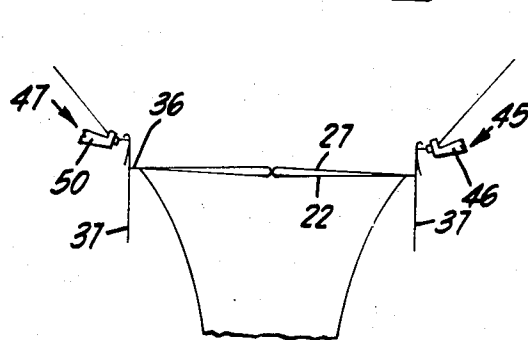


FIG. 15

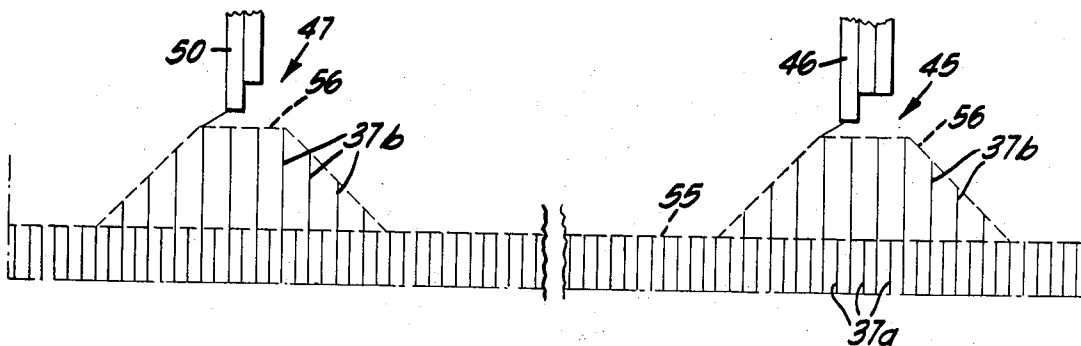


FIG. 16

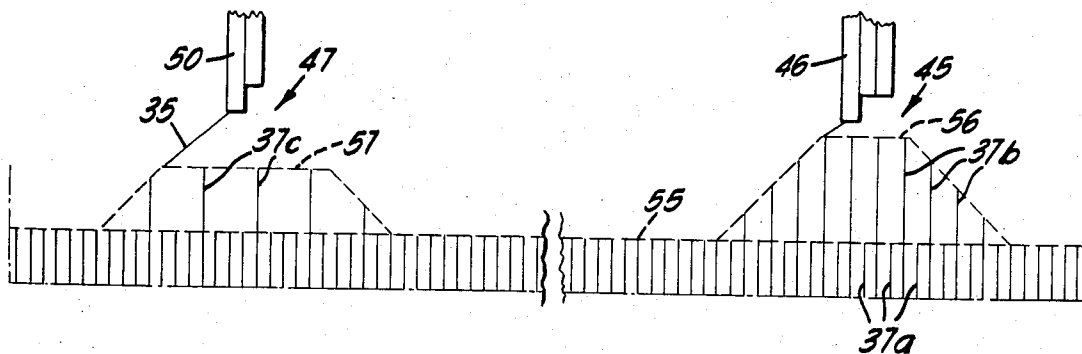


FIG. 17

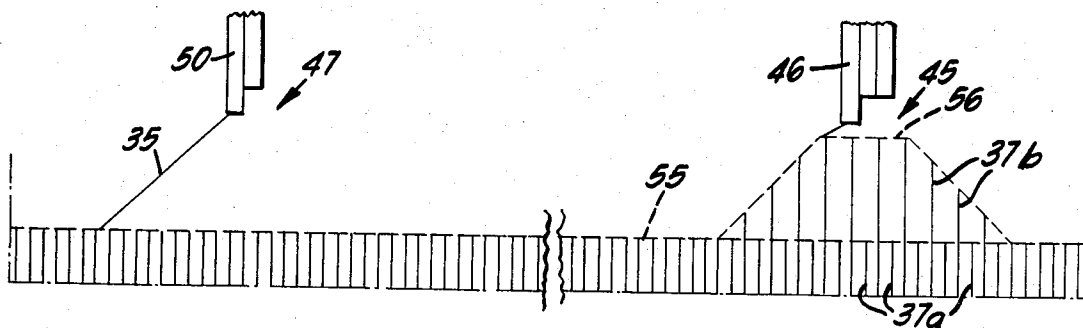
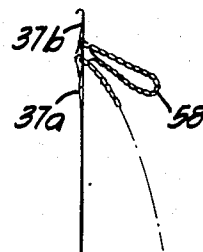
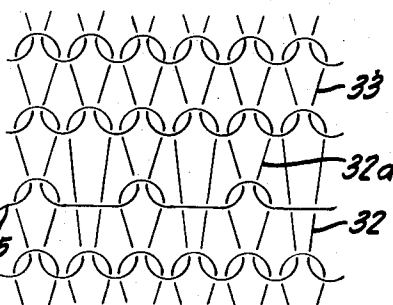
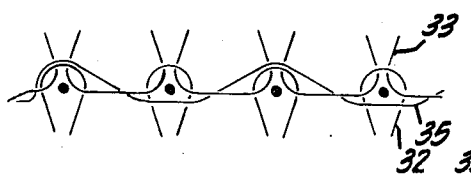
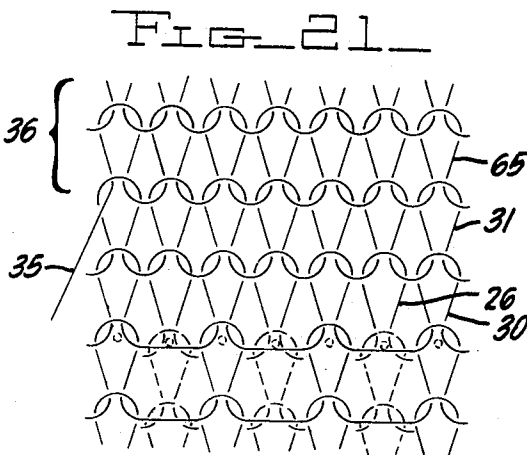
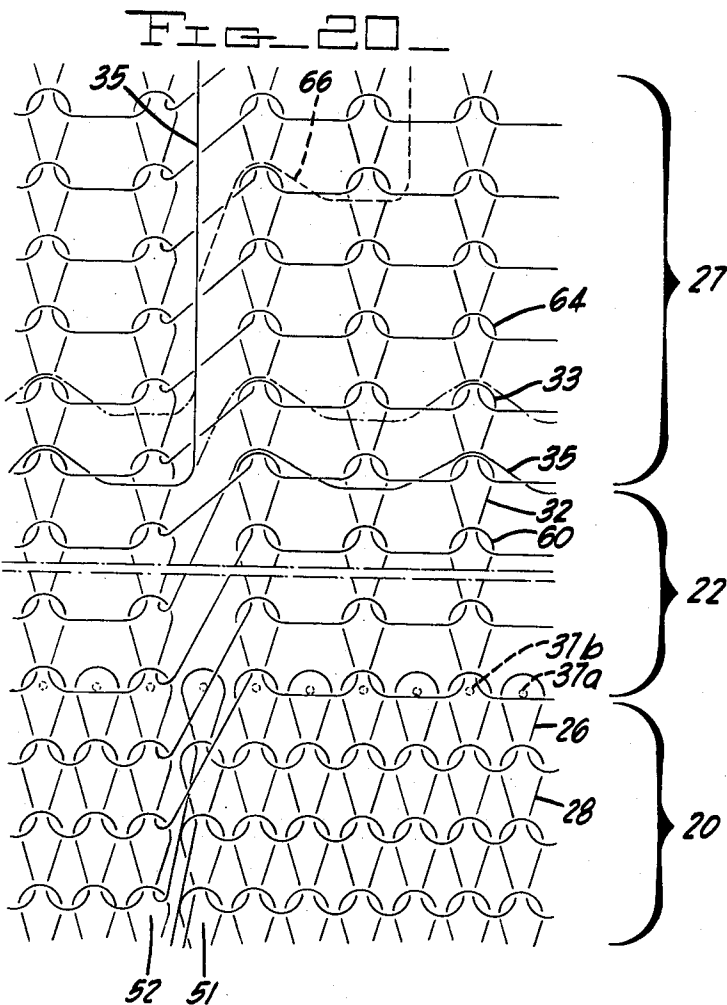


FIG. 15 FIG. 14

FIG. 18





STOCKING AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to fabric tubes and specifically to such fabric tubes for ladies' stockings and to methods of knitting and closing one end of the fabric tubes on a circular knitting machine.

2. Description of the Prior Art

Ladies' tubular stockings as conventionally knitted on circular knitting machines start with a rotary knit tubular double ply welt portion followed by a tubular leg portion, a reciprocatorily knit heel portion, a tubular foot portion and end with a reciprocatorily knit toe portion. During knitting of the toe portion, a gap or opening is formed therein as a result of the fashioning procedure and such opening must be subsequently closed by a slow and tedious looping operation which greatly adds to the cost of the finished stockings. In order to reduce the cost of closing the toes by the looping procedure many of the stockings are now formed by extending the tubular foot portions to also include the toe portions and the toe portions are then shaped and closed by a trimming and seaming operation.

More recently in further efforts to reduce the manufacturing costs of seamless stockings, several procedures have been developed for circular knitting machines by which the stocking is knitted and the toe thereof is closed on the knitting machine. In one of the procedures, such as disclosed in U.S. Pat. No. 3,327,500, the toe is started with the needles and dial bits alternately engaging the yarn of a transfer course in the same manner as in the formation of a conventional welt of seamless stockings. With bights of the yarn of the transfer course held on the dial bits, the needles are operated to knit a fabric portion equal to twice the length of the toe portion. The needles are then rotated approximately 360° relatively to the dial bits and the yarn bights held by the dial bits are returned to the needles to form a closed double ply toe portion in the stocking. When the stocking is knitted in a non-conventional manner from toe to welt in addition to the mechanism required on the knitting machine to effect the relative rotation between the dial and needle cylinder other extensive and costly changes must be made to the machine to reverse the normal conventional knitting procedure. Also, since the double ply welt is knitted last in this procedure the fabric tensioning means of the machine cannot exert the required tension on the welt and this results in an unsightly sleazy stitch formation in the welt. On the other hand when the stocking is knitted in the conventional manner from welt to toe, only the cost of the mechanism for relatively rotating the dial and cylinder is added to the machine. However, the toe fabric is actually formed around the foot portion of the stocking and a separate operation is then required to strip the toe over the end of the foot portion which greatly reduces or entirely eliminates any cost savings made in closing the toe of the stocking on the machine.

In another new procedure developed for knitting and closing the toe of a stocking on the same machine, such as that disclosed in the application of James D. Moyer, Ser. No. 704,809 filed Feb. 12, 1968 and assigned to the assignee of the instant application, the toe, which also has two plies, is started with the needles and dial

bits alternately engaging the yarn of the transfer course. The machine is then operated to form a tubular portion which is slightly less than the combined lengths of the two plies of the toe fabric. The leading ends of one or more wrap yarns are then anchored in the fabric and the wrap yarns are wrapped tightly around the fabric tube at approximately its mid point to draw it into a tight bunch. After anchoring the outgoing end or ends of the wrap yarns the remainder of the toe fabric is completed and the yarn bights held by the dial bits are transferred to the needles of the machine to form the two ply toe portion. With this procedure the stocking must be knitted in the non-conventional manner from toe to welt which, as above set forth, requires extensive changes to the machine to reverse the conventional welt to toe stocking knitting procedure. Also with this procedure the wrap yarns are wrapped around the toe tube in a somewhat haphazard manner that very often causes the two plies of the toe between the wrap yarns and the transfer course to be different in length.

SUMMARY OF THE INVENTION

Briefly summarized the invention resides in the provision of a double ply welt-like toe portion on a seamless stocking having a draw thread interlaced with and acting to gather stitches of courses defining the outer terminal end of the double ply toe portion into a tight bunch to close said terminal end.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of a stocking incorporating the invention in a toe portion thereof;

FIG. 2 is a view on an enlarged scale of a portion of the foot of the stocking of FIG. 1 taken in the direction of the arrow A;

FIG. 3 is a cross-sectional view on an enlarged scale taken on the line and in the direction of the arrows 3—3 of FIG. 2;

FIG. 4 is a schematic plan view of a portion of a multi-feed circular knitting machine adapted to make the stocking of FIG. 1 and showing parts of the machine during one step in the formation of the stocking;

FIG. 5 is a cross-sectional view taken substantially along the line and in the direction of the arrows 5—5 of FIG. 4;

FIGS. 6 to 9 are views similar to FIG. 4 showing further steps in the formation of the toe portion of the stocking;

FIGS. 10 to 13 are views similar to FIG. 5 showing the parts of the machine during the fabric forming steps illustrated in FIGS. 6 to 9, respectively;

FIG. 14 is a view on a greatly enlarged scale taken transversely through a portion of the fabric of FIG. 6 diagrammatically illustrating the direction in which the stitches extend during formation of the two ply toe portion of the stocking;

FIG. 15 is a schematic view showing the path of the needles at the knitting feeds of the machine during the step illustrated in FIGS. 4 and 5;

FIG. 16 is a view similar to FIG. 15 showing the path of the needles at the knitting feeds during the step illustrated in FIGS. 6 and 10;

FIG. 17 is a view similar to FIGS. 15 and 16 showing the path of the needles at the knitting feeds during the steps illustrated in FIGS. 7, 8, 11 and 12;

FIG. 18 is a view on an enlarged scale diagrammatically illustrating one method of interlacing a draw yarn in courses of stitches of the toe portion of the stocking;

FIG. 19 is a view similar to FIG. 18 illustrating another method of interlacing a draw yarn in courses of stitches of the toe portion of the stocking;

FIG. 20 is a schematic view on a greatly enlarged scale of a portion of the stitch formation of the fabric as it progresses through the steps illustrated in FIGS. 4 to 6 and 10; and

FIG. 21 is a view similar to FIG. 19 of the stitch formation of the fabric produced by the step of FIGS. 8 and 12.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2 of the drawings there is shown a ladies' seamless stocking fabric 10 having a tubular preferably double ply welt portion 11, a tubular leg portion 12, a tubular foot portion 15, a heel pocket 16 and a toe 17. The welt which is knitted of a heavy yarn and the leg and foot portions which are knitted of relatively light weight yarn are conventionally formed during rotary knitting on a circular knitting machine, to be hereinafter described, and the heel pocket, which may also be knit of heavy yarn is conventionally formed by rotary knitting or reciprocatory knitting by methods well known in the prior art. The stocking is preferably knit starting at the welt and ending at the toe. The welt, leg and foot portions and the heel pocket are shown to indicate essential parts of the stocking 10 but otherwise form no part of the instant invention.

According to the invention the toe 17 (see FIG. 2) includes a single ply tubular portion 20 which is preferably knitted of heavy yarn and a two ply portion 21 which is preferably knitted of light weight yarn, the two ply portion having an inner ply 22 (FIG. 3) with an inner terminal course 26 interknitted with a terminal course 28 of the single ply portion 20, an outer ply 27 having an inner terminal course 30, and a course 31 connecting the stitches of the courses 26 and 30 to connect the inner courses of the inner and outer plies to each other (see FIGS. 3, 20 and 21). An outer terminal course 32 of the inner ply 22 and an outer terminal course 33 of the outer ply 27 (see FIG. 20) are connected to each other at the approximate median between the inner terminal course 26 of the inner ply 22 and the inner terminal course 30 of the outer ply 27 and a yarn 35 which is interlaced with the stitches of the courses 32 and 33, as hereinafter set forth, is adapted to be partially withdrawn through the stitches of the courses 32 and 33 to gather and hold them in a tight bunch to close the end of the toe 17. The course 31 is the first of a group of courses forming a ravel course area 36 (FIG. 3), the ravel course area having a pattern of run-resist stitches, if desired, to resist run back of the stitches thereof.

The stocking 10 is adapted to be knitted on a conventional circular knitting machine as, for example, one of the type shown in U.S. Pat. No. 3,205,683, issued Sept. 14, 1965. The machine has a usual circle of independently operated latch needles 37 (FIGS. 4 and 5) which are slidably mounted in slots in a cylinder 40, sinkers 41 cooperating with the needles and dial bits 42 which are mounted on a dial 43. The machine has a

main knitting station 45 having yarn fingers 46 for feeding yarn to the needles 37 and cams (not shown) for operating the needles in cooperation with the sinkers to knit yarns fed thereto into courses of stitches during both rotary and reciprocatory operation of the machine in forming the stocking 10. The machine also has a second or auxiliary knitting station 47 having yarn fingers 50 and cams (not shown) for operating the needles to knit yarns fed thereto into courses of stitches with the main knitting station 45 to form multifeed portions of the stocking 10 during rotary operation of the machine. The machine also includes selecting means (not shown) at each of the stations for causing selected needles to follow a knitting path to knit plain stitches, and for causing selected needles to follow tuck and float paths to form design stitches generally in the manner set forth in said U.S. Pat. No. 3,205,683.

In forming the stocking 10 on the machine referred to herein, the stocking is knitted from welt to toe with the welt being formed of courses knit of relatively heavy yarn by all of the needles 37 at both main and auxiliary stations of the machine. After the welt and an afterwelt portion are knitted of the heavy yarns, light yarns are substituted to form the leg portion of the stocking to the start of the heel pocket. When the stocking 10 is to include a reciprocated heel pocket the auxiliary knitting station 47 is inactivated while the heel pocket is reciprocatorily knitted at the main knitting station on a portion of the needles in the usual manner. Following completion of the heel pocket the auxiliary knitting station is again activated to knit with the main knitting station on all of the needles to the start of the single ply portion 20 of the toe 17 where heavy yarns are preferably substituted for the light yarns at both stations. Knitting then continues at both knitting stations (FIGS. 4 and 5) to form the courses of the single ply portion 20 to the course 26 with each new course formed at each station starting on the needle which forms the stitches in a wale 51 and ending on the needle which forms the stitches in wale 52, as shown in FIG. 20.

Following the formation of course 26, which is knitted at the auxiliary station 47, alternate needles indicated at 37a starting with the needle which formed the stitches in wale 51 are operated along a low non-knitting path 55 (FIG. 15) to hold the stitches of course 26 thereon while the intervening needles 37b continue to operate along a knitting path 56 to form a course of stitches. The alternate needles 37a then are operated along the non-knitting path 55 at the auxiliary station 47 and the needles 37a remain in the non-knitting path to hold their stitches of course 26 as courses of the inner ply 22 are formed by the intervening needles 37b at both the main and auxiliary knitting stations. After knitting at least one course of the inner ply at each knitting station, a light weight yarn may be substituted for the heavy yarn thereat. Courses are then knitted of the light weight yarn at both knitting stations to gradually form a double ply fabric portion 58 (see FIG. 14) the combined lengths of the plies of which is substantially equal in length to the inner ply 22. The double ply portion 58 extends from the stitches of course 26 formed by the intervening needles to the stitches on the intervening needles of a course 60 preceding course 32 (FIGS. 6, 10 and 20). Preferably during the forma-

tion of the course 60, which is knitted at the auxiliary station 47, a heavy yarn is substituted for the light weight yarn, the heavy yarn becoming the draw yarn 35 referred to below. Following the formation of the course 32, which is knitted at the main station 45 every other intervening needle, indicated at 37c, is operated along a tucking path 57 (FIG. 16) at the auxiliary station to take the heavy draw yarn 35 fed at the auxiliary station in the hooks thereof while the remaining intervening needles are operated along the low non-knitting path to hold their stitches of the course 32. After the intervening needles 37b are either operated along the tucking or non-knitting paths as above noted for a complete rotation of the needle cylinder all of the intervening needles are operated along the non-knitting path at the auxiliary station 47 throughout the formation of the remaining courses of the outer ply 27 of the two ply toe portion 21 without, however, removing the yarn finger feeding the heavy yarn 35 from active position at this station.

After the intervening needles are operated to take the draw yarn 35 at station 47 as above described all of the intervening needles are operated through the knitting path 56 at the main knitting station 45 to form the course 33 and at this time the draw yarn 35 passes back and forth from the front or hook side of the needles operated through the tucking path to the back of the needles following the non-knitting path and is interlaced with the stitches of the courses 32 and 33 as shown in FIGS. 18 and 20. This type of interlacing is also shown and described in U.S. Pat. No. 2,192,798, issued Mar. 5, 1940. Alternatively, after interlacing the draw yarn with the stitches of the courses 32 and 33 at the main knitting station as above set forth, the intervening needles may again be operated along the tucking and non-knitting paths at the auxiliary station 47 in the same manner to also interlace the draw yarn with the stitches of the course 33 and a course 64 of the outer ply 27 as indicated in dot and dash outline in FIG. 20.

During the formation of the remaining courses of the outer ply 27 at the knitting station 45 a member 61 which may be manually operated or mechanically operated by means not shown herein to apply an outward pull on the draw yarn 35 at the auxiliary station between the yarn finger and yarn supply thereat to gradually withdraw the draw yarn from the courses 32 and 33 (and the courses 33 and 64 when the draw yarn is interlaced therewith), as shown in FIGS. 1, 8, 11 and 12, to gather the stitches of courses 32 and 33 (and courses 33 and 64) into a tight bunch, as indicated at 62 in FIGS. 2, 8 and 12. It is to be noted that the outward pull on the draw yarn to withdraw it from the courses 32 and 33 may be such as to gather the stitches into a tight bunch that completely closes the outer end of the toe 17 or to gather the stitches into a bunch that results in the formation of a small opening. Following formation of the inner terminal course 30 of the outer ply 27 both alternate needles 37a and intervening needles 37b are operated through the knitting path 56 at station 45 to form the course 31 to connect or interknit the stitches of the course 26 held by the alternate needles and the stitches of the course 30 formed by the intervening needles (Fig. 21). All of the needles are then operated through their knitting path at the auxiliary

station 47 to form a ravel course 65 of the yarn 35 at this station thereby anchoring the end of the draw yarn to maintain the stitches of the courses 32 and 33 in bunched condition (FIGS. 2, 9 and 13). Thereafter a few additional ravel courses are formed by all of the needles 37 at stations 45 and 47 to complete the stocking 10.

Instead of raising every other intervening needle 37c to the tucking level 57 while the remaining intervening needles are operated along the low non-knitting path to hold their stitches of the course 32 to interlace the yarn 35 with the stitches of the courses 32 and 33, as above set forth, the needles 37c may be operated along the knitting path 56 at the station 47 to form a partial course of stitches 32a to interlace stitches of the courses 32 and 33 as shown in FIG. 19. The intervening needles are then operated along the non-knitting path at station 47 and the yarn 35 is withdrawn from the course 32a as the courses of the outer ply 27 are knitted at the station 45 to gather the stitches of the courses 32 and 33 into a tight bunch to close the end of the toe 17.

With the above described procedures a long float portion of the draw yarn 35 extends along the outer surface of the outer ply 27 between the median courses 32 and 33 (or courses 33 and 64) and the ravel course 65. Where it is desired this long float portion of the draw yarn may be broken up into a plurality of short float portions by interlacing the draw yarn with a few stitches of spaced courses of the outer ply 27 formed at the main station 45, as shown by the dotted line 66 in FIG. 20, in the same manner that the draw yarn is interlaced with the stitches of the courses 32 and 33, as above set forth.

As above described the courses of the inner ply 22 are knitted at both the main and auxiliary stations and the draw yarn 35 is the same heavy yarn used to form the course 60 at the auxiliary station. Alternatively, the auxiliary station may be inactivated prior to the formation of the inner terminal course 26 of the inner ply 22 of the toe and the courses of the inner ply are then formed only at the main station 45. After interknitting and anchoring the leading end of the draw yarn 35 with stitches of the course preceding the course 32, the needles at the auxiliary station are operated to interlace the draw yarn with the stitches of courses 32 and 33 in the manner above set forth. Furthermore, while the method of the invention has been described herein in connection with a machine having two knitting stations it is believed to be obvious that the same procedure may also be carried out on a machine having more than two knitting stations. For instance, in a machine having four knitting stations, courses of the inner ply are knitted by the intervening needles at all of the knitting stations. The needles at one of the stations are then operated to interlace the yarn of this station with the stitches of the courses 32 and 33 in the manner above set forth. The needles then remain inactive at said one station and the interlaced yarn is withdrawn from the courses 32 and 33 to gather the stitches thereof as the remaining courses of the outer ply are formed at the other three knitting stations of the machine. Following knitting of the course 30 all of the needles are operated to form the course 31 to connect the stitches of the courses 26 and 30 and the needles are again operated at the one station to form the ravel courses with one or all of the other three stations of the machine.

It will be understood that the improvements specifically shown and described by which the above results are obtained can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

I claim:

1. A knitted fabric tube having a tubular double ply portion projecting from one end thereof, said double ply portion being formed of interconnected courses of stitches and including a first ply having an inner terminal course connected to said tube, and a second ply having an inner terminal course connected to said inner terminal course of said first ply, and a draw yarn interlaced with the stitches of outer terminal courses of said double ply portion intermediate said inner terminal courses of said first and second plies, said intermediate courses defining the outer terminal end of said double ply portion, and said draw yarn acting to gather said stitches of said outer terminal courses into a tight bunch to close said outer terminal end of said double ply portion, and in which said inner terminal courses of said first and second plies are connected by a first course of a plurality of ravel courses, and said draw yarn has a leading end anchored in a course of said double ply portion adjacent said intermediate courses and a trailing end forming another of said ravel courses.
2. A fabric tube according to claim 1 in which said draw yarn floats freely across said second ply of said double ply portion between said outer terminal courses and said ravel course formed by said draw yarn.
3. A fabric tube according to claim 1 in which said draw yarn is connected to spaced courses of said second ply between said outer terminal courses and said ravel course formed by said draw yarn.
4. A method of forming and closing a tubular double ply portion projecting from one end of a fabric tube including the steps of
 - a. knitting yarn and forming courses of said fabric tube including a terminal course thereof,
 - b. knitting yarn and forming courses of a first ply of said double ply portion including an inner terminal course connected to said terminal course of said fabric tube,
 - c. knitting outer terminal courses of said yarn to complete said first ply,
 - d. interlacing a draw yarn with the stitches of said outer terminal courses,
 - e. knitting said yarn and forming a second ply of said double ply portion extending from said outer terminal courses,
 - f. gradually withdrawing said draw yarn from said outer terminal courses as said courses of said second ply are formed to gather the stitches of said outer terminal courses into a tight bunch to close the outer end of said double ply portion, and
 - g. knitting yarn and forming a first course of a plurality of ravel courses to connect said inner terminal course of said first ply and an inner terminal course of said second ply.
5. A method according to claim 4 including the additional steps of

tional steps of

- h. anchoring a leading end of said draw yarn in a course of said double ply portion adjacent said outer terminal courses before said draw yarn is interlaced with said stitches of said outer terminal courses, and
- i. knitting a trailing portion of said draw yarn and forming another course of said plurality of ravel courses.
6. In a method of knitting a fabric tube and closing a double portion extending from one end of said fabric tube including the steps of
 - a. knitting yarn and forming courses of said fabric tube including a terminal course thereof,
 - b. knitting yarn and forming courses of a first ply of said double ply portion including an inner terminal course connected to said terminal course of said fabric tube,
 - c. knitting outer terminal courses of yarn to complete said first ply,
 - d. interlacing a draw yarn with the stitches of said outer terminal courses,
 - e. knitting yarn and forming courses of a second ply of said double ply portion extending from said outer terminal courses,
 - f. gradually partially withdrawing one end of said draw yarn from said outer terminal courses as said courses of said second ply are knitted to gather the stitches of said terminal courses into a tight bunch to close the outer end of said double ply portion, and
 - g. knitting yarn and forming a first course of a plurality of ravel courses to connect said inner terminal course of said first ply and an inner terminal course of said second ply.
7. A method according to claim 6 including the additional steps of
 - h. knitting said draw yarn and forming at least one course of said first ply to anchor a leading end of said draw yarn in said double ply portion adjacent said outer terminal courses before said yarn is interlaced with said stitches of said outer terminal courses, and
 - i. knitting a trailing portion of said draw yarn and forming at least one of said plurality of ravel courses.
8. A method according to claim 6 including the additional steps of
 - h. holding alternate stitches of said inner terminal course of said first ply,
 - i. knitting said courses of said first ply, said outer terminal courses, and said courses of said second ply including said inner terminal course thereof to the stitches of said inner terminal course of said first ply intermediate said alternate stitches, and
 - j. knitting said first course of said ravel courses to said alternate stitches on said inner terminal course of said first ply and to stitches of said terminal course of said second ply.

* * * * *