

Sept. 4, 1945.

A. E. PAGE

2,383,986

METHOD OF KNITTING

Original Filed Nov. 21, 1941

4 Sheets-Sheet 1

Fig. 1.

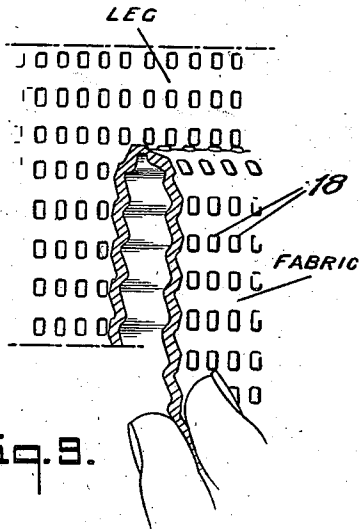
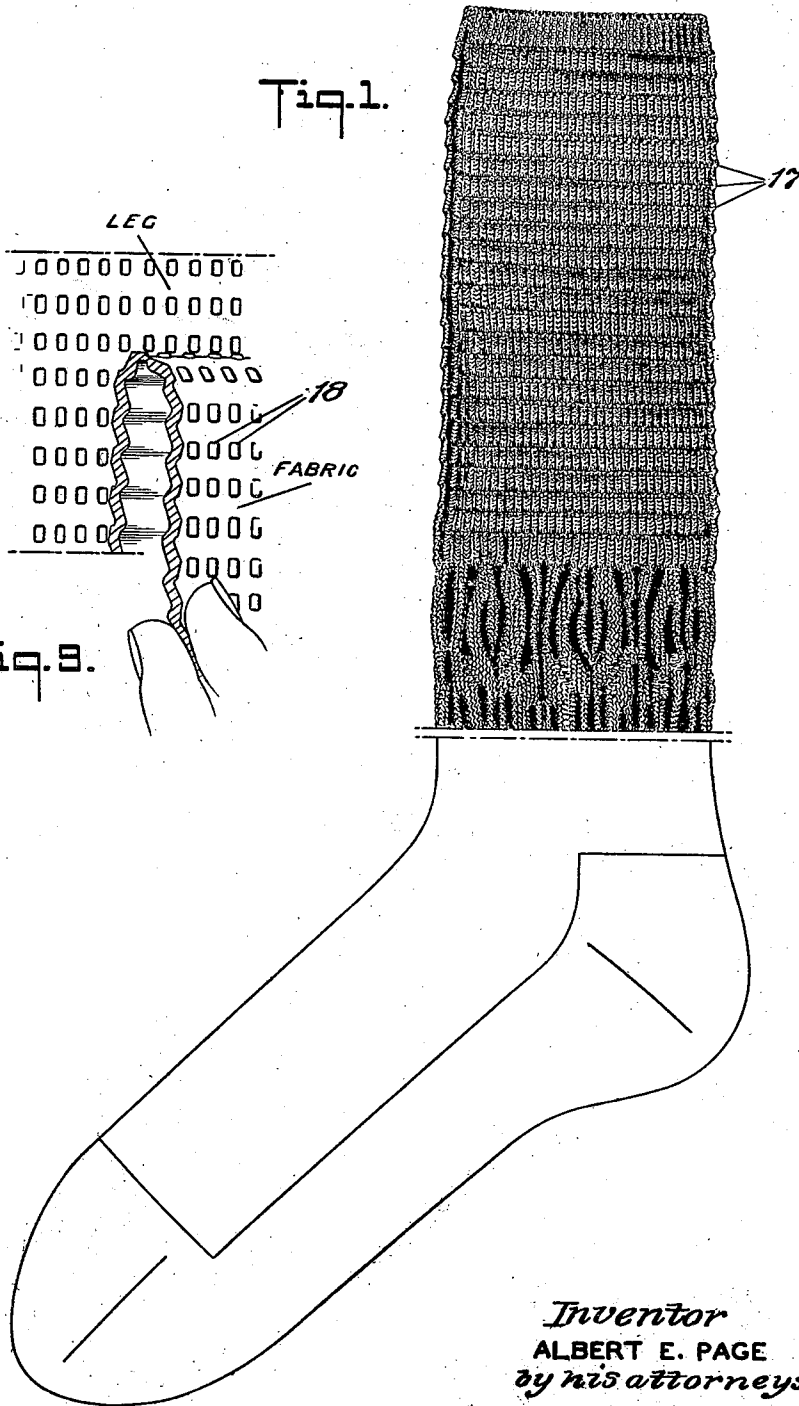


Fig. 2.



Inventor
ALBERT E. PAGE
by his attorneys

Howson and Howson

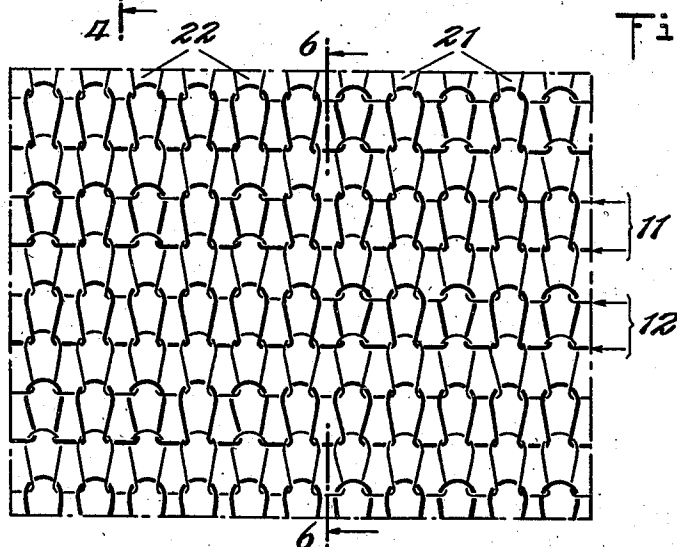
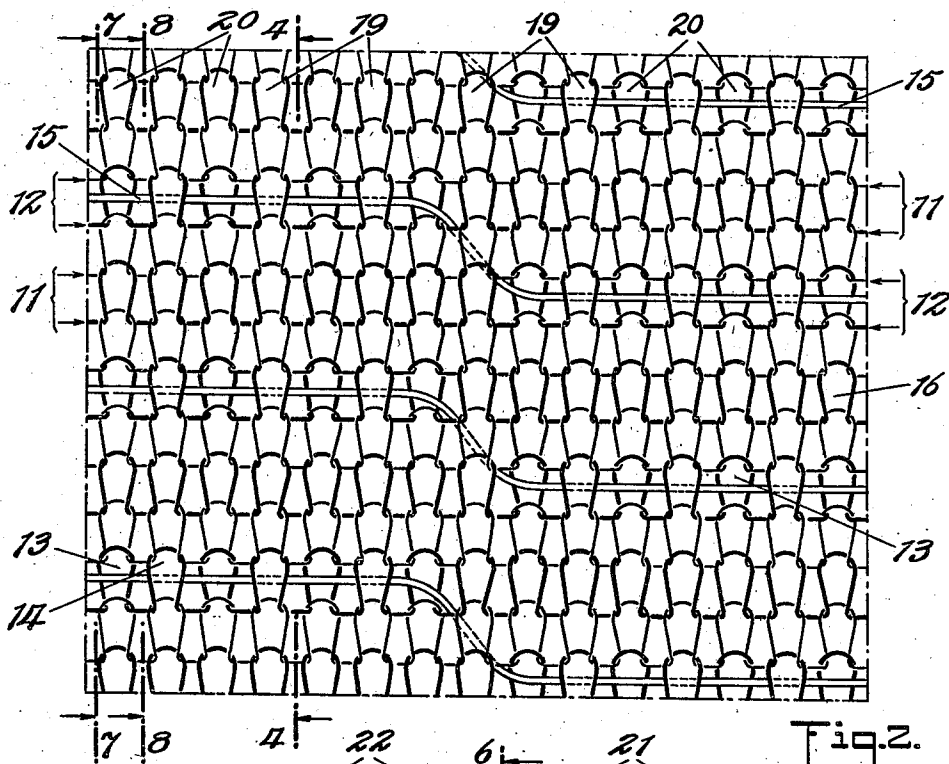
Sept. 4, 1945.

A. E. PAGE

2,383,986

METHOD OF KNITTING

Original Filed Nov. 21, 1941 4 Sheets-Sheet 2



Inventor
ALBERT E. PAGE
by his attorneys

Howson and Howson

Sept. 4, 1945.

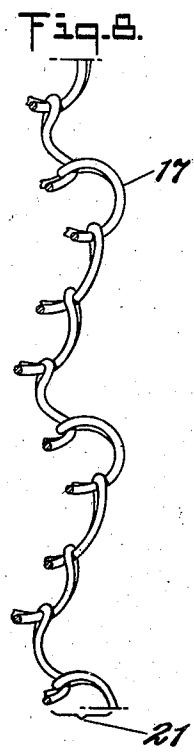
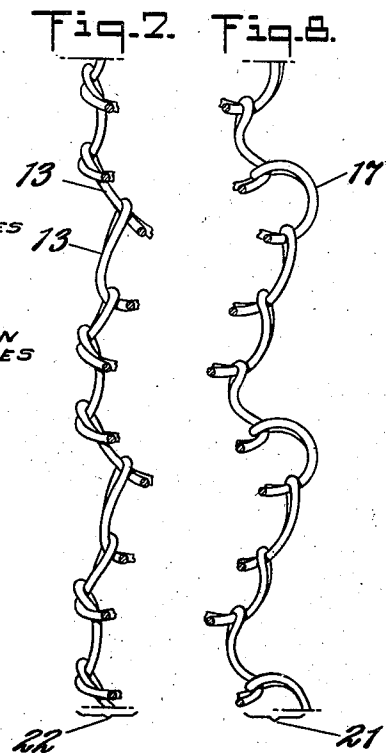
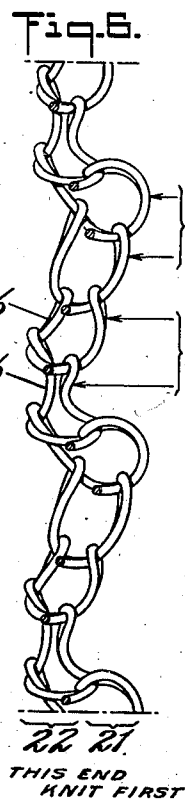
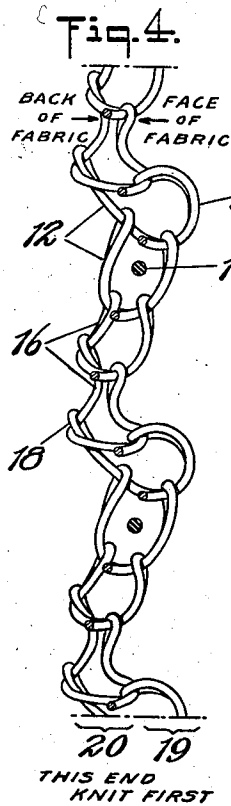
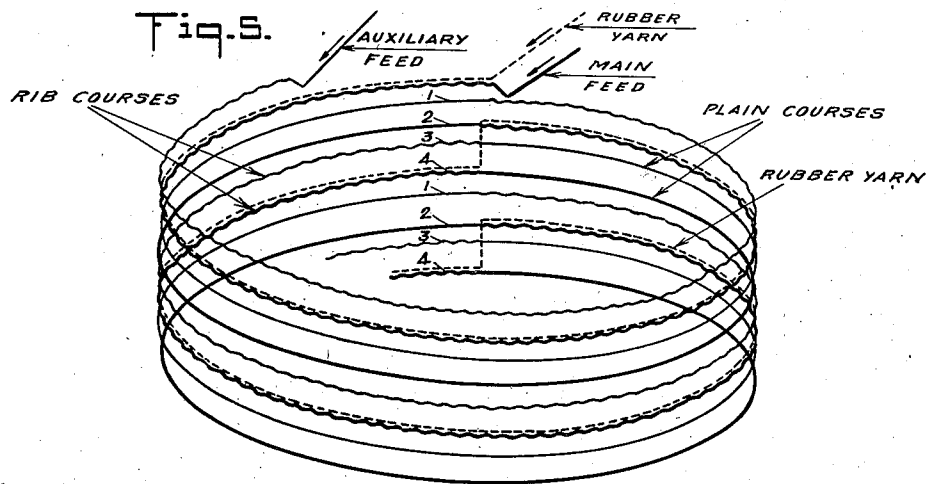
A. E. PAGE

2,383,986

METHOD OF KNITTING

Original Filed Nov. 21, 1941

4 Sheets-Sheet 3



Inventor
ALBERT E. PAGE
by his attorneys

Howson and Howson

Sept. 4, 1945.

A. E. PAGE

2,383,986

METHOD OF KNITTING

Original Filed Nov. 21, 1941

4 Sheets-Sheet 4

FIG. 10



Inventor

Albert E. Page

By *Howson and Howson*

Attorneys

UNITED STATES PATENT OFFICE

2,383,986

METHOD OF KNITTING

Albert E. Page, Laconia, N. H., assignor to Scott & Williams, Incorporated, Laconia, N. H., a corporation of Massachusetts

Original application November 21, 1941, Serial No. 420,027. Divided and this application September 9, 1942, Serial No. 457,765

8 Claims. (Cl. 66—9)

This invention relates to a method of knitting fabric on a circular knitting machine and more particularly to a method of feeding a yarn (e. g., rubber) on a double-ended needle machine. One object of the invention is to provide a simplified means of starting and stopping the feeding of the rubber yarn. The fabric is a combined rib and plain course fabric.

This application is a division of my application Serial No. 420,027, filed November 21, 1941, entitled "Knitted fabric," of which an application Serial No. 463,690, filed October 28, 1942, is a continuation-in-part. In the present application the method of knitting is claimed.

In the drawings:

Fig. 1 is a side view of a half hose stocking in which the novel fabric is incorporated in the top;

Fig. 2 is an expanded view of the loop structure of a plurality of wales and courses in the novel top of Fig. 1, the fabric being knit from bottom to top in this view, and the view showing the back of the top where the course changes occur;

Fig. 3 is an expanded view of the loop structure of a plurality of wales and courses of a fabric according to the present invention, containing no rubber or elastic;

Fig. 4 is a diagrammatic view in vertical section through the sinker wales between an all-plain-wale and a rib-and-plain wale, looking toward the former, of the fabric of Fig. 2, and taken on the line 4—4 of that figure, the fabric in the present figure and Figs. 6, 7 and 8 being knit from bottom to top;

Fig. 5 is a diagram showing in spiral form the course sequence of the yarns and loop structure of the fabric of Fig. 2 when knit on a two-feed circular knitting machine adapted to knit plain or rib fabric;

Fig. 6 is a diagrammatic view in vertical section similar to Fig. 4 but of the fabric of Fig. 3, taken on the line 6—6 of that figure;

Fig. 7 is a diagrammatic view in vertical section showing the stitches of a rib wale of the fabric of Fig. 3;

Fig. 8 is a diagrammatic view similar to Fig. 7, showing the stitches of a plain wale of the fabric of Fig. 3;

Fig. 9 is a diagrammatic view of a portion of the novel fabric being stripped off the leg, the view showing the protuberances on the fabric and the indentations on the leg; while

Fig. 10 is a photographic view in perspective of the inside of a fabric according to my invention, showing the protuberances.

It has heretofore been customary to use rib fabric in the tops of half hose or anklets to make them self-sustaining, and it has been known to lay the rubber in between the plain and rib stitches in such fabric. Rubber has also been incorporated in plain knit fabric to produce horizontal floats of rubber on the inside of the fabric, which indent the flesh in horizontal lines. These exposed floats of rubber are objectionable in that they are liable to catch and break; and furthermore, bare or covered rubber is objectionable against the flesh. Again, these horizontal welts or lines which are made in the flesh by this type of construction are objectionable to many and tend to stop circulation of the blood. I have invented a fabric which avoids all these objections and is more self-sustaining than any of the hosiery above described.

In this application the novel fabric will be considered from the face or front, and the stitches drawn through to the face of the fabric will be called plain stitches, and the stitches drawn through to the back of the fabric will be called rib stitches. The courses containing both rib and plain stitches will be designated as rib courses. Courses containing stitches all drawn through to the same side of the fabric will be designated as courses of like stitches, and if they are composed entirely of plain stitches, may also be called plain courses.

My novel knitted fabric claimed in my parent application Ser. No. 420,027, and continuation-in-part Ser. No. 463,690, above referred to, has spaced rings of protuberances on the inner faces as a means of holding the stocking in place on the wearer's leg. The fabric consists of at least two rib courses in repeated alternation with not more than two courses of like stitches. Preferably a rubber yarn is enclosed in certain courses, i. e., embedded in the fabric without coming in contact with the leg of the wearer.

The fabric has practically double the thickness of either rib fabric or purl fabric. In other words, the two thicknesses appear to be superimposed on each other, rather than a merging of the thickness of normal rib and normal purl fabric. The manner in which these thicknesses are concatenated, combined with the horizontal contraction due to the rib fabric and the vertical contraction due to the purl fabric, produces the spaced horizontal rings of inward projections with gripping strength to make the top self-supporting. The rubber merely emphasizes the gripping effect, and because it is located in the rib or outer layer of the fabric, it is not present in the courses

containing the multiplicity of projections which contact the leg.

With regard to the method of production of the fabric, it is characteristic that the feeding of the rubber is determined by the normal knitting manipulation of the needles without their taking the rubber, rather than moving the yarn finger into or out of action.

Another feature of my invention of the fabric is the fact that the markings on the leg are not deep continuous grooves but series of spaced horizontal rows of points or other markings not deep enough to interfere with the circulation. They keep the stocking up even better than the solid line structures of the prior art.

I will first describe an embodiment of the fabric in which rubber has been included in my novel top. The fabric to be described is shown in Figs. 2, 4 and 5 and has two courses 11 of plain knit fabric recurring between two courses 12 of 1x1 rib fabric with rubber yarn 15 laid in between the rib stitches 13 and plain stitches 14 of the rib course first knit. One kind of rubber suitable for this use is a rubber which is capable of being stretched 265%, and if five inches of rubber are used to encircle the stocking once, it will therefore be capable of stretching to 18 $\frac{1}{4}$ ". When fed to the knitting machine it is preferably under a stretch of about 123%, namely, to a little better than 12" in length. When relaxed the fabric of the stocking top is about 2 $\frac{3}{4}$ " in diameter and consequently very little, if any, of the 123% stretch is left in the rubber when the fabric contracts to this normal width.

In plain knit fabric the new stitch is drawn through the old stitch toward the front or face of the fabric, while in the case of rib fabric the rib stitch is drawn through the previous loop from the front to the back of the fabric.

In the case of ordinary purl fabric having two plain courses recurring with two courses of stitches drawn on the rib side, these directions in which the stitches are drawn through the previous loops predispose the plain courses towards the back of the fabric and the links and links or courses of like stitches towards the front of the fabric. In my fabric, which combines plain courses with rib courses, the attributes of rib fabric and purl fabric are combined in a particularly useful manner. Thus rib fabric, if of the plain 1x1 type (which is the sequence used in the rib courses in the fabric of Fig. 2), is double the thickness and half the width of a corresponding number of plain stitches. On the other hand, a purl fabric, while having the same double thickness that a rib fabric has, is half the length of the corresponding plain fabric. Thus in the new fabric we have the rib effect tending to contract the fabric in a coursewise direction, and the purl effect tending to contract the fabric in a walewise direction. The ridges on the inside of the top are the plain courses 11 which bulge inwardly to the back of the fabric, probably because of the natural outward curl of plain fabric. It will further be noted that in the fabric of Figs. 1 and 4 the protuberances 18 on the inside of the fabric have a saw-tooth shape in vertical section, with the sharp end pointing downward. This definitely is of help in holding the top up on the leg. A similar shape is found on the ridges 17 on the outside of the fabric. When the fabric is expanded the inside ridges break up into a multiplicity of points or protuberances 18 in rows which are spaced vertically from each other about every fourth course, and it can be seen from Fig. 7

that it is these points which press against the flesh. These points 18 are in the plain courses, i. e., the courses in which all the stitches are knocked over on the same side, and they are in the wales 19 where no rib stitches occur, i. e., the wale which is shown in Fig. 8. It will be observed that the points 18 of the fabric which press against the flesh are stitches which are completely devoid of rubber—either bare or covered—so that the bad effects of bare rubber and the rubbing of covered rubber bearing against the flesh are all avoided.

Basically rubber yarn is not necessary to get my novel construction, although it improves and enhances it in quality considerably, and it might be further pointed out that considerable variations in the course sequences of the body yarn and the course sequence of the rubber are possible without departing from the scope of my invention. The outside courses in the example given are 1x1 rib courses, and the courses on the inside ridges are plain knit fabric, but the rib courses can be made to appear on the inside of the fabric by changing the courses in which the stitches are all pulled through on the same side from plain knit to links and links courses on the rib side. Thus if two courses of rib fabric are alternated with two courses of stitches all drawn through on the rib side, the rib fabric will form the ridges on the inside of the fabric.

Another advantage of my novel fabric is that it can be used as a turned-down cuff on hosiery or shirts as well as on a stand-up top, because it has a pleasing appearance on both sides.

The manner in which the stitches arrange themselves in layers in this two-way contracted fabric is believed to be unique, and reference is made to Figs. 4, 6, 7 and 8. The concatenation of the various stitches brings the rib wales 20 of the fabric with rubber (Figs. 2 and 4), as well as the rib wales 22 of the fabric without rubber (Figs. 3, 6 and 7) toward the back of the fabric compared to the respective plain wales 19 and 21. Peculiarly enough, however, the rib courses 12 are nearer the face of the fabric than the plain courses 11. Presumably this is due to the interaction of the purl effect with the rib effect. For example, while one of the plain stitches 16 in the wales 20 containing plain and rib stitches in Fig. 4 forms the apex of the protuberance 18 which indents the leg, it is a plain stitch 14 in the rib course 12 in the plain wale 19 which forms the highest point of the ridge 17 on the outside of the fabric. Thus plain stitches in the rib wales are nearest the back, the rib stitches in those wales and the plain stitches which are in both the plain wales and courses are at intermediate levels, and the plain stitches in the rib courses are at the level nearest the face or outside of the fabric (see Figs. 6, 7 and 8). The relative positions of the adjacent stitches in the rib courses are carried over into the plain courses, thereby breaking up the ridges on the back of the fabric into rows of protuberances 18 (Fig. 10).

Of all modern circular knitting machines, about the only one which is capable of making this fabric is one employing double-ended needles, such as the double cylinder type of machine represented by the Komet machine. I have discovered that in knitting this fabric on such inverted cylinder type machines, if rubber yarn is to be used, a very much simplified method of feeding the rubber yarn is possible. This simplified method will now be described in connection with an in-

verted cylinder machine having a multiplicity of feeds.

Let us assume that on such a machine we are to knit the fabric shown in Fig. 2. In this case the spirals of the yarns in the finished fabric will be as shown in Fig. 5. The regular yarn at the main feed is shown as a heavy black line, and the regular yarn at the auxiliary feed as a light line. Where shown wavy, the course is a rib course. The rubber yarn is shown as a broken line adjacent the course in which it is incorporated. Let us assume that the knitting is at such a point that the next course is to be a rib course. When knitting rib fabric some of the needles are in the upper cylinder. The main feed knits the rib course 4, and at a point just after the knitting point of the main feed the rubber thread 15 is laid in. The needles at the second or auxiliary feed then knit a rib course 3, thus completing enclosure of the fabric over the rubber. The rubber now lies in the fabric with the plain stitches on one side and the rib stitches on the other. After this second course of rib stitches has been drawn, the remainder of the needles are moved into the lower cylinder and two courses 2 and 1 of plain stitches are knit—one at the main feed and one at the auxiliary feed. The rubber thread yarn finger is not moved from its feeding position. As the point where the yarn was last incorporated in the fabric progresses around the machine, the rubber stretches or is pulled out and retrieves either by its own elasticity or by a take-up arm. Retrieving due to the natural elasticity of the rubber is satisfactory for the ordinary situation. As the double-ended needles come around in the lower cylinder to begin knitting of plain stitches again, the rubber yarn finger is above the fabric, i. e., it is in its regular laying-in position, and since there are no threads extending into the upper cylinder from the needles, there is nothing to catch the rubber. It therefore floats across inside the cylinder until the next revolution of the machine, when, alternate needles having been transferred to the upper cylinder, laying in of the rubber begins again. Thus it will be seen that it is entirely the nature of the fabric being knit which determines whether or not the rubber is going to be incorporated in the fabric, and it is not only unnecessary to move the rubber yarn finger at all, but the rubber can be floated across any part of the garment without any slack in that yarn. Furthermore it might be noted that whether or not rubber yarn is incorporated in the fabric, and whether or not it is going to be caught into any part of the knitting, are determined entirely by what is happening at the active feed just preceding it, without regard to what type of fabric is being knit at the other feeds. Thus, for example, as long as the needles knit in the lower cylinder at the main feed, the rubber yarn will not interfere in any way with the knitting of the fabric at any of the other feeds, and the rubber can be floated at parts of the garment where it is not used without requiring a cutter and clamp. These multi-feed machines with inverted cylinders and double-ended needles frequently are made with patterning devices for both cylinders, so that complete variety of fabrics can be obtained in either cylinder. For any given fabric, however, patterning devices are usually needed only in the one cylinder.

It might be noted that if rubber is being used in my novel top, the method of feeding the rubber above described is different when the courses

of stitches which are all drawn through in the same direction are made in the top cylinder at the feed just preceding the point at which the rubber is introduced. In this case the bights of yarn extending from the needles in the top cylinder to the fabric which is lying inside the lower cylinder cause the rubber yarn to float in front of those stitches and not to become incorporated in the fabric until rib knitting is resumed at that feed. However, fabric made in this manner is useful when making turned-down tops for anklets or golf hose, as of course the rubber is incorporated in the rib courses as usual. In the case of a turned-down top there is no tendency for the floats to be distorted by snagging or catching when in use, as they are inside the fold.

If a single-feed inverted cylinder machine is being used, the rubber thread would of course be present in each rib course, or the rubber would have to be cut and clamped for the rib courses in which it was not incorporated in the fabric.

In the specification and claims, where the word "rubber" is used, it should be understood as including bare rubber, covered rubber and thread having rubber-like qualities of stretch and recovery.

I claim:

1. A method of knitting on a circular double-ended needle machine comprising the steps of knitting a course of rib and plain stitches at one feed, laying a rubber strand on said rib and plain stitches at a point after the knitting point, next knitting another course of rib and plain stitches at another feed, thereby enclosing the rubber, then knitting for one or more courses with the needles all in one cylinder while allowing the rubber to float and retrieve, and thereafter commencing knitting again in two cylinders, whereby the rubber once more becomes incorporated in the fabric.

2. A method of knitting on a circular multi-feed double-ended needle machine, comprising the steps of knitting a course of plain and rib stitches at one feed, laying a rubber strand on said stitches near the stitch-drawing point of that feed, whereby the stitches at the next feed enclose the rubber, subsequently knitting only in the lower cylinder at the feed where the rubber is fed in, thus allowing the rubber to float and causing the rubber to again be incorporated in the fabric by resuming knitting with needles in both cylinders at the feed where the rubber is fed, and knitting at the other feeds as desired.

3. A method of knitting on a circular knitting machine adapted to draw stitches through to two sides of the fabric with inelastic threads forming protuberances on the side of the wearer to prevent the fabric from slipping, comprising the steps of laying rubber from a yarn finger on stitches being held by needles drawing stitches to opposite sides of the fabric, stopping the laying of the rubber strand by thereafter drawing all stitches to one side of the fabric for not more than two courses, whereby the rubber lies between the wales drawn to one side of the fabric and the wales drawn to the other side, thereafter resuming incorporation of the rubber in the fabric merely by drawing stitches through to both sides of the fabric.

4. A method of knitting on a circular multi-feed double-ended needle machine, comprising the steps of knitting a course of plain and rib stitches at one feed, laying a rubber strand on said stitches near the stitch-drawing point of

that feed, whereby the stitches at the next feed enclose the rubber, subsequently knitting only in the lower cylinder at the feed adjacent where the rubber is fed in, allowing the rubber to float and retrieve while knitting in the lower cylinder only, and subsequently causing the rubber to again be incorporated in the fabric by resuming knitting with needles in both cylinders at the feed where the rubber is fed, and knitting at the other feeds as desired.

5. A method of knitting on a circular double-ended needle knitting machine, comprising the steps of knitting a course of rib and plain stitches, laying a rubber strand from a yarn finger on said rib and plain stitches at a point after the knitting point, next knitting another course with the needles in either one or both cylinders, thereby enclosing the rubber, then knitting for one or more courses with the needles all in one cylinder while allowing the rubber to float and retrieve, whereby the rubber lies between the wales drawn to one side of the fabric and the wales drawn to the other side, and thereafter commencing knitting again in two cylinders, whereby the rubber once more becomes laid in the fabric.

6. A method of knitting on a circular double-ended needle knitting machine adapted to draw stitches through to both sides of the fabric with inelastic threads forming protuberances on the side of the fabric toward the wearer to prevent the fabric from slipping, comprising the steps of knitting a course of plain and rib stitches, laying a rubber strand from a yarn finger on said stitches near the stitch-drawing point as the stitches are being held by the needles, whereby the stitches at the next course enclose the rubber in such manner that the rubber lies between the

wales drawn to one side of the fabric and the wales drawn to the other side, thereafter knitting one or more courses entirely in the lower cylinder, thus allowing the rubber to float, and thereafter causing the rubber again to be laid in the fabric by resuming knitting with needles in both cylinders and knitting courses thereafter as desired.

7. A method of knitting on a circular double-ended needle knitting machine comprising the steps of knitting in repeated sequence at least two courses of rib and plain stitches and not more than two courses of plain stitches, incorporating a rubber thread in at least one rib and plain stitch course following a plain course, protuberances being formed on the inside of the fabric at the needle wales, adjacent protuberances being spaced by at least two courses of plain and rib stitches.

8. A method of forming protuberances on the inside of circular knitted fabric comprising the steps of knitting a course of rib and plain stitches on a circular double-ended needle knitting machine, laying a rubber strand from a yarn finger on said rib and plain stitches at a point after the knitting point, next knitting another course with the needles in either one or both cylinders, thereby enclosing the rubber with the plain stitches on one side of it and the rib stitches on the other, then knitting for not more than two courses with the needles all in one cylinder while allowing the rubber to float and retrieve, and thereafter commencing knitting again in two cylinders, whereby the rubber once more becomes laid in the fabric.

ALBERT E. PAGE.