

Nov. 14, 1939.

W. LARKIN

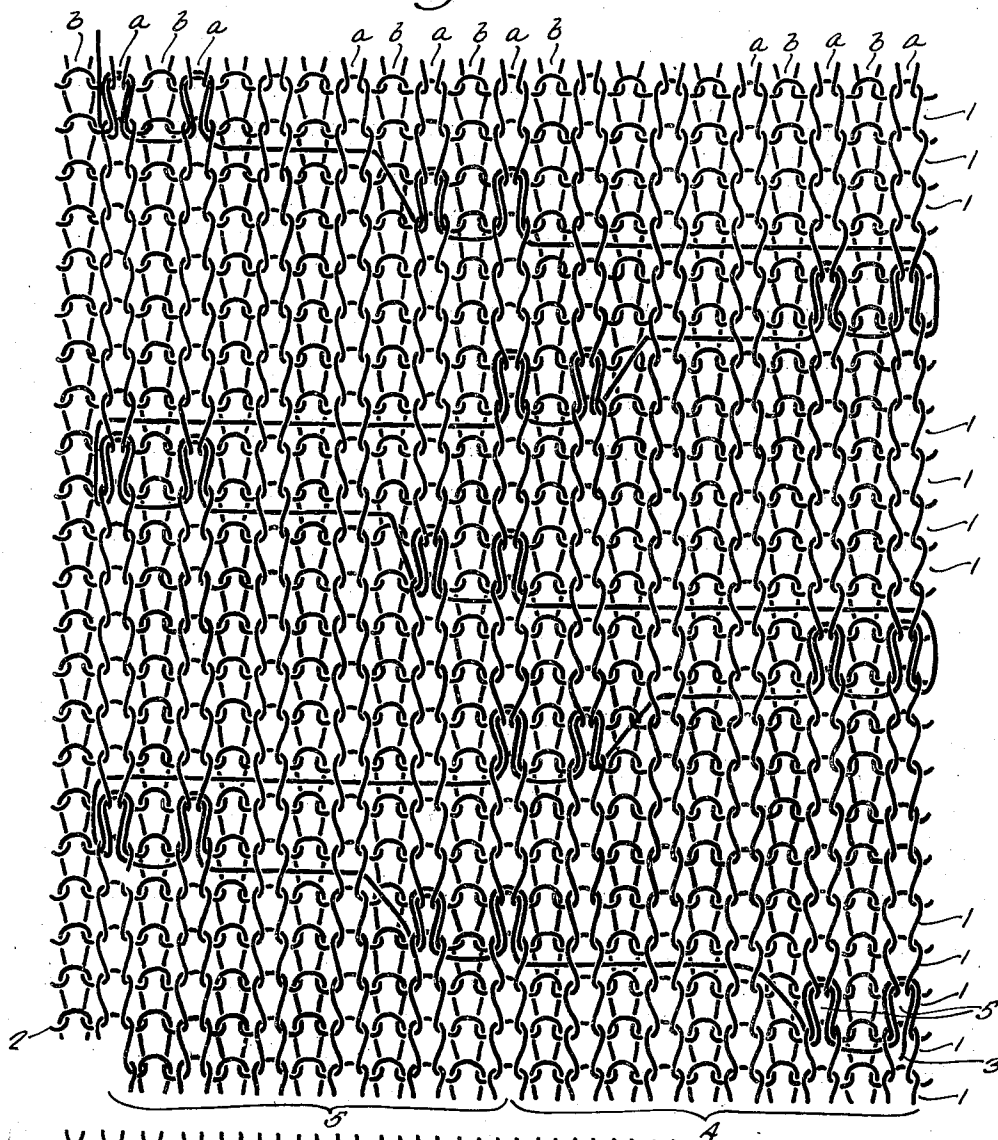
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ELASTIC TOP FOR HOSIERY

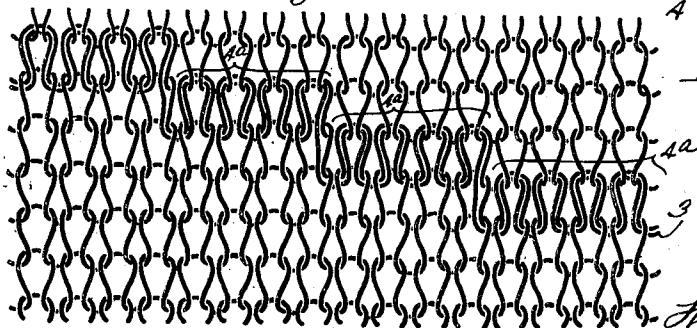
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6 Sheets-Sheet 1

*Fig. 1.*



*Fig. 2.*



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6 Sheets-Sheet 2

Fig. 4.

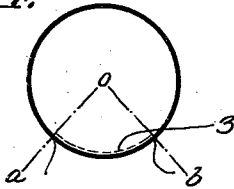


Fig. 3.

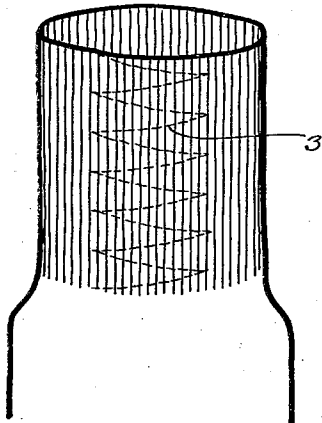


Fig. 6

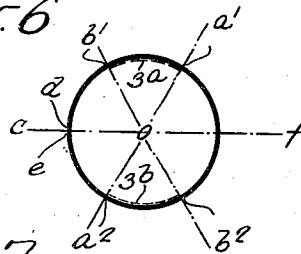


Fig. 7.

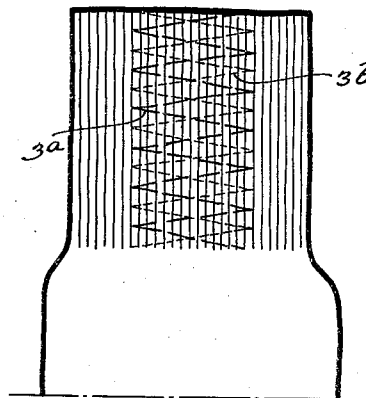


Fig. 5.

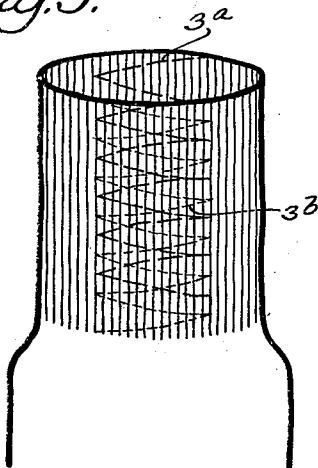
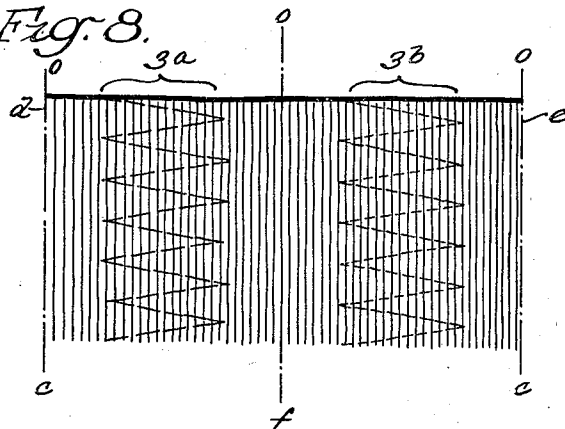


Fig. 8.



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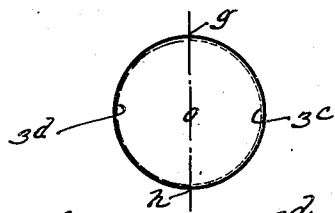
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ELASTIC TOP FOR HOSIERY

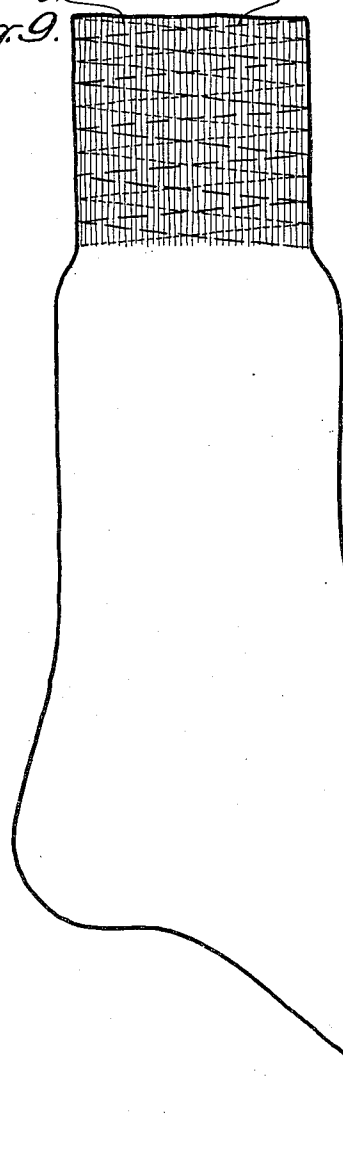
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6 Sheets-Sheet 3

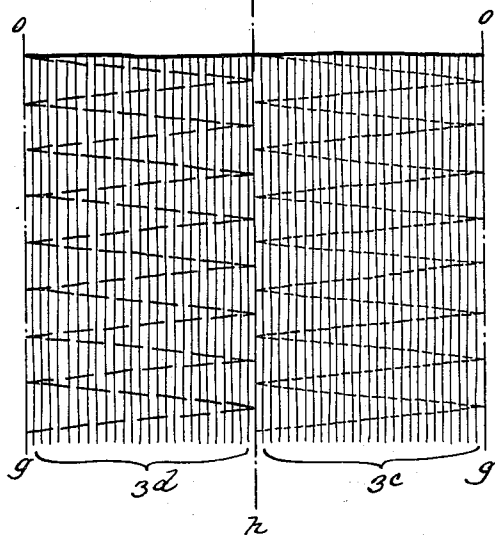
*Fig. 10.*



*Fig. 9.*



*Fig. 11.*



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Fig. 13.

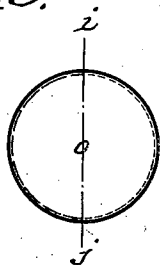


Fig. 12.

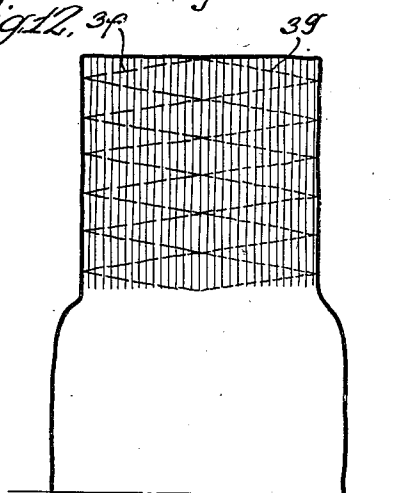


Fig. 14.

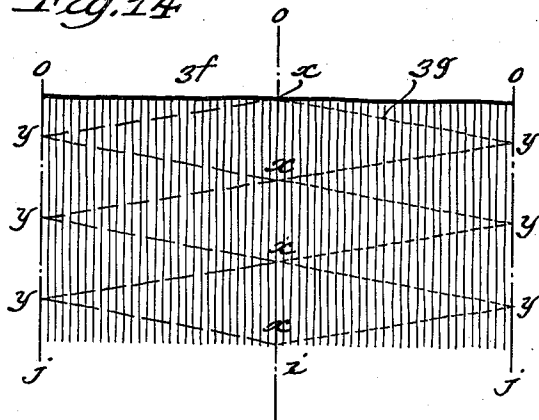
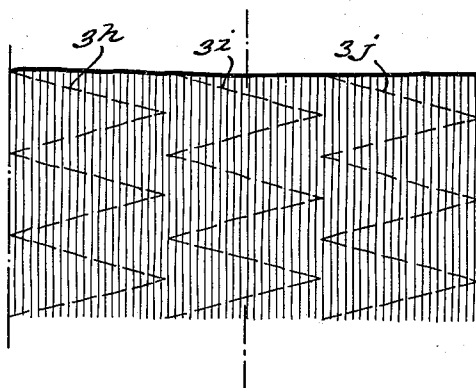


Fig. 15.



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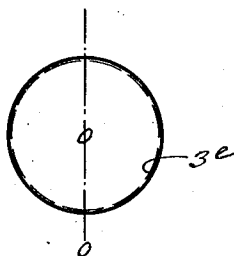
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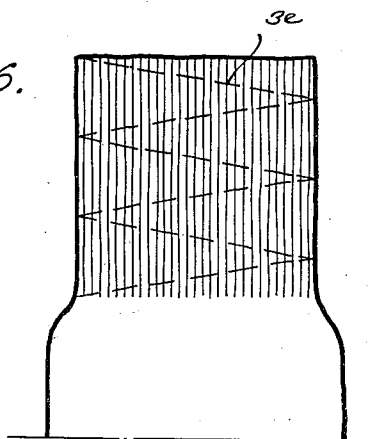
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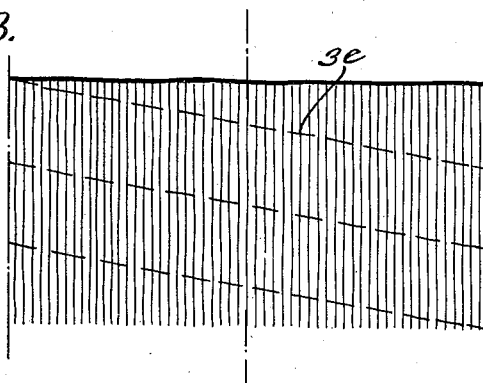
*Fig. 17.*



*Fig. 16.*



*Fig. 18.*



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6 Sheets-Sheet 6

Fig. 19.

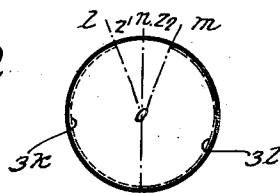
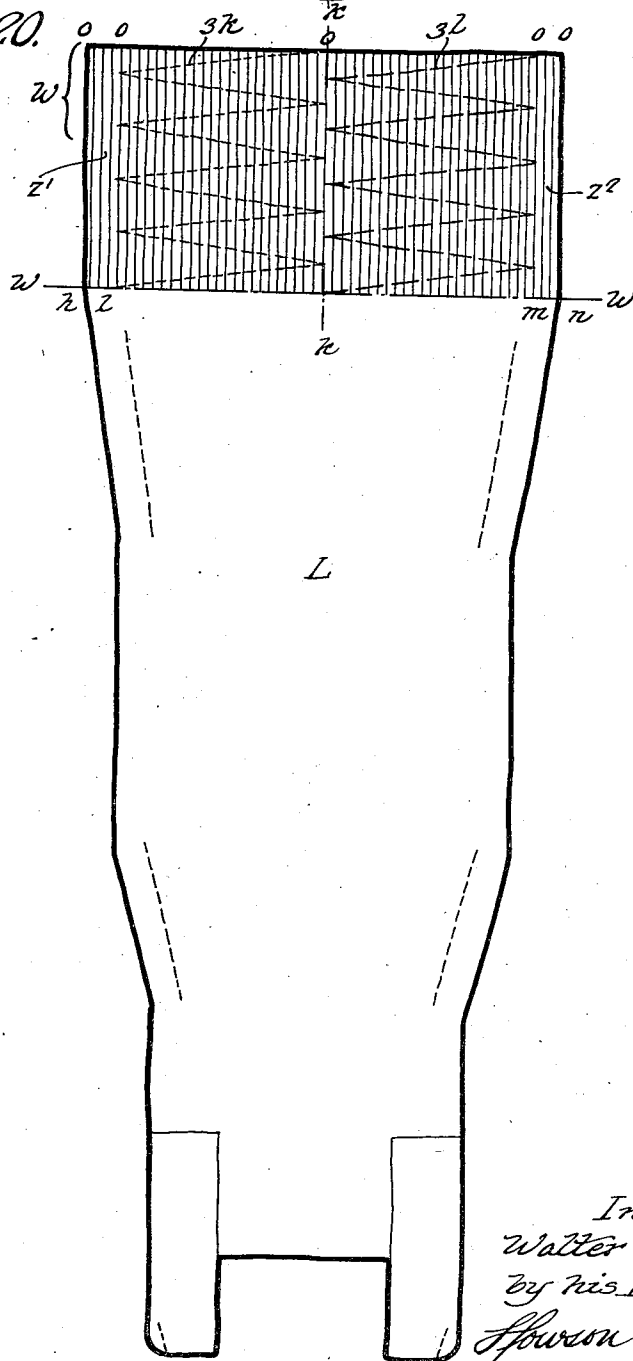


Fig. 20.



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## UNITED STATES PATENT OFFICE

2,180,247

## ELASTIC TOP FOR HOSIERY

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Application December 4, 1937, Serial No. 178,159

5 Claims. (Cl. 66—172)

This invention relates to knitted fabrics having elastic, i. e., bare or covered rubber, incorporated therein in such a manner as to supplement the normal inherent coursewise elasticity of the fabric.

It is and, prior to the present invention, has been common practice to incorporate a rubber strand in each course, or in relatively spaced courses respectively, of the stitches of which the fabric is composed, with the rubber in each instance extending the full length of each of the stitch courses in which the elastic is incorporated.

Elastic fabrics of the type noted are commonly employed as the wrist bands of gloves, or as the tops of men's half hose and children's socks, and in some instances as the tops or welts of ladies' knee, thigh, or full-length stockings, with the elastic fabric formed as an integral part of or permanently attached to the article for the purpose of keeping the glove top in close contact with the wrist and for maintaining the hosiery in correct position on the limb of the wearer in lieu of the ordinary detachable suspender or band types of stocking garters.

Elastic bearing fabrics are most satisfactorily and most economically produced on circular knitting machines, in the form of seamless tubes. In cases where the fabric is to include a rubber strand in each course of stitches, the fabric is produced, in most instances, on a single feed knitting machine, wherein the elastic strand is fed to and/or across the needles of the machine by a guide separate from but located adjacent the regular yarn feed guide for the regular textile thread or yarn of which the body of the fabric is composed. The two guides supply the respective filaments to the needles continuously throughout the knitting of each round or course of stitches; and as the machine operates continuously in one direction only the stitch courses and rubber strands assume spiral forms in the finished fabric.

In some instances the fabric is produced on multi-feed machines wherein each round of knitting produces a plurality of stitch courses corresponding to the number of feeds of regular textile knitting threads employed in the machine. Where rubber is desired in every course a rubber feed guide is employed adjacent the feed guide for each body thread.

Fabrics having rubber in every course have met with disfavor for use as stocking tops, etc., because of the high degree of tension such large amounts of rubber produce in the fabric. High tension elastic fabrics tend to retard blood cir-

culation and to place restriction on the free muscular movement of the limb of the wearer. For this reason, the more modern elastic fabrics have been produced with rubber in every third or fourth course, for example.

Fabrics having rubber in relatively spaced courses may be readily produced on multi-feed machines but can not be produced with any degree of satisfaction on single feed machines. Prior to the present invention, manufacturers equipped with only single feed machines have been faced with the necessity of either purchasing new multi-feed machines or going to heavy expense in converting the single feed machines into multi-feed machines. In some instances, due to the character of the machine, the latter method has been found impractical, because the machine could not be converted. In other instances this course may be undesirable because the machine is equipped to produce fancy designs on the face of the fabric, which latter is highly desirable in children's socks, for example. Fabrics of such fancy variety are disclosed in my prior Patent No. 1,772,400, dated August 5, 1930; and a machine for producing such fabrics is disclosed in my prior Patent No. 1,841,249, dated January 12, 1932. The fabric forming the subject matter of the present invention may be readily produced in plain colors or with stripes or designs or a combination thereof on a machine of the type above noted, which is of the rib type or on a machine of the non-rib type. The fabric may also be produced on flat machines of the Lamb type or the Cotton type. In each instance the machine would be equipped with a rubber feed guide capable of movement in steps of a length equal to but a fractional portion of the full length of a stitch course.

The primary object of the present invention is to produce a knitted fabric, either plain or ribbed, having a continuous elastic strand incorporated in but fractional portions respectively of different courses of stitches of which the fabric is composed, with said incorporations produced in staggered or laterally offset relation to each other, with each incorporation embracing a plurality of the wales of the fabric, and with the offsets occurring progressively and successively in one direction across the fabric, in one section thereof, and in an opposite direction in another section thereof, whereby the effect of rubber in relatively spaced courses may be readily produced on single feed machines, whether or not the machine is equipped to produce ornamented fabrics, or equipped with yarn changing devices for pro-

ducing stripes, or just single color effects, or whether the machine is of the twin needle set type capable of producing ribbed fabrics or the single needle set type capable of producing just plain, i. e., non-ribbed, fabrics.

The fabric forming the subject matter of the present invention, and several modifications and practical applications thereof are disclosed in the accompanying drawings, of which:

10 Fig. 1 is a diagrammatic stitch view of a rib knit fabric showing an elastic strand incorporated therein in accordance with the principles of the present invention;

15 Fig. 2 is a view similar to Fig. 1 and illustrates a modification of the invention as applied to a plain or non-ribbed fabric;

20 Fig. 3 is a diagrammatic prospective view of a glove or stocking top made in accordance with the principles of the present invention and showing the elastic strand incorporated in one side only thereof;

Fig. 4 is a diagrammatic plan view of the structure shown in Fig. 3;

25 Fig. 5 is a view similar to Fig. 3 but showing a pair of elastic strands respectively incorporated in diametrically opposite portions of the tubular fabric;

Fig. 6 is a diagrammatic plan view of the fabric shown in Fig. 5;

Fig. 7 is a flattened side view of the structure shown in Figs. 5 and 6;

Fig. 8 is a flat development of the fabric shown in Figs. 5, 6 and 7 with the fabric split and opened on the line *o-c* Fig. 6;

Fig. 9 is a flattened side view of a sock provided with an elastic top having two elastic strands incorporated therein in accordance with the principles of the present invention;

Fig. 10 is a diagrammatic plan view of the top shown in Fig. 9;

Fig. 11 is a flat development of the top shown in Figs. 9 and 10 with the fabric split and opened up on the line *o-g*, Fig. 10;

Fig. 12 is a view similar to Fig. 9 showing a different arrangement of elastic strands therein;

Fig. 13 is a plan view of the structure shown in Fig. 12;

Fig. 14 is a flat development of the structure shown in Figs. 12 and 13 with the fabric split and opened up on the line *o-j*, Fig. 13;

Fig. 15 is a view similar to Fig. 14 but showing three elastic strands incorporated in the fabric;

Fig. 16 is a view similar to Fig. 9 but showing a single elastic strand completely encircling the stocking top;

Fig. 17 is a plan view of the fabric shown in Fig. 16;

60 Fig. 18 is a flat development of the fabric shown in Figs. 16 and 17 with the fabric split and opened up on the line *o-o*, Fig. 17;

Fig. 19 is a diagrammatic plan view of a circular knit fabric with two elastic strands incorporated in opposite sides respectively of the fabric; and

Fig. 20 is a flat development of a fabric of Fig. 19 with the same split and opened up on the line *o-n*, Fig. 19 and with the split tubular fabric applied to a flat knit full-fashioned stocking blank.

70 The fabric shown in Fig. 1 is composed of a multiplicity of successively interknit courses *1, 1* respectively composed of regular knitted stitches formed of any desired kind of textile foundation thread *2*. The courses *1, 1*, collectively form a multiplicity of reversely extending stitch wales *a, a* and *b, b* which are respectively drawn to and

form the opposite faces of the fabric, producing the ribbed effect of the fabric.

A continuous elastic strand *3* is incorporated in fractional portions *4* and *5* respectively of different courses *1*, progressively throughout the length of the fabric. Each incorporation of the elastic strand *3* preferably embraces a plurality of the wales *a, a* and *b, b*. At one end of each of the fractional stitch course portions in which the elastic strand *3* is incorporated, said strand *3* is knit into the fabric together with the foundation thread *2*, in a plurality of stitches in adjacent wales, as indicated at *5*. In this instance the elastic strand *3* is knit in with the stitches of adjacent wales *a, a* on one face of the fabric only and floats across an intermediate wale *b* disposed on the reverse face of the fabric. The remainder of the portion of the elastic strand *3* which is incorporated in each fractional stitch course portion floats across the fabric in one of the courses between the wales *a, a* on the one face of the fabric and the wales *b, b* on the opposite face of the fabric, as indicated at *6*.

It will be noted that the incorporations of the elastic strand *3* in the fractional stitch course portions *4* and *5* are in staggered relation to each other and each is in a relatively spaced course with respect to the preceding and succeeding incorporations. Thus, the elastic strand *3* extends in a zigzag manner through the fabric, throughout the length thereof, while the individual incorporations forming the respective legs of the zig-zag arrangement extend in a general coursewise direction in the fabric and in the finished fabric assume an angle to both the courses and the wales of the fabric, as diagrammatically illustrated in Figs. 3, 5, 7, 8, 9, 11, 12, 14, 15, 16, 18 and 20.

Fig. 1 illustrates the fabric as being of the ribbed type, as above noted, while Fig. 2 illustrates the fabric as being of the plain non-ribbed type, i. e., the fabric wherein all the stitches forming the wales are drawn in the same direction to but one face of the fabric. The elastic strand *3* is shown in Fig. 2 as being knit into the fabric with each and every base fabric stitch in the fractional portions of the courses embraced by the respective incorporations. However, it is possible to incorporate the elastic strand *3a* in the plain fabric of Fig. 2 by knitting the elastic strand into and with but one or more stitches in each fragmental portion of one stitch course and floating the thread across a predetermined number of wales to be knit into the fabric again with another stitch or stitches in the same fractional course portion in the same course or in another fractional course portion of a different course, as in Fig. 1. The elastic thread *3* of Fig. 2 however, is shown as being knit into all the stitches of a group constituting each of the fractional course portions *4a*, whereby floats are eliminated.

It will be further noted that in Fig. 2 the fractional course portions into which the elastic strand *3* is respectively incorporated are offset laterally with respect to each other in successively knit courses and progress in one direction diagonally across the fabric. This progression may continue in one direction only whereby the incorporations would follow a spiral course in a tubular fabric or the progression may reverse its direction in different successively knit sections of the fabric, in the same general manner as illustrated in Fig. 1, whereby the incorporations

of the elastic strand would follow a zigzag path throughout the length of the fabric.

Figs. 3 and 4 illustrate the elastic strand 3 as being knit into a plurality of fractional course portions offset laterally with respect to each other in a zigzag path confined to a single segmental area of the fabric which, as illustrated in Fig. 4, is of the circular seamless, tubular type, and which is defined by the lines  $a-o$ ,  $o-b$ .

Figs. 5, 6, 7 and 8 illustrate a fabric wherein a plurality of elastic strands 3a and 3b are incorporated in the fabric at opposite sides respectively thereof, in the same manner in each instance as the elastic 3 is incorporated in the fabric of Figs. 3 and 4. The elastic 3a is confined to the segmental area included between the radial lines  $a1-o-b1$ , while the elastic 3b is confined in that segment of the fabric defined by the lines  $a2-o-b2$ .

Fig. 8 shows the fabric of Figs. 6 and 7 as being split on the line  $o-c$  with the severed edges  $d$ ,  $e$  disposed at opposite sides of the center line  $o-f$ , thus Fig. 8 shows the incorporations of the elastic strands 3a and 3b as being duplicates of each other with each of said threads being confined and zigzagging across relatively narrow longitudinally extending strip areas the fabric and which as shown in Figs. 4 and 6 are included in angles of, for example, 60 degrees respectively. Obviously, the fabric shown in Figs. 3 to 8 inclusive may be employed as the top of a glove, the top of a man's half hose, the top of a child's sock, or the top of a woman's stocking.

Fig. 9 shows a circular knit fabric of the same general type as shown in Figs. 3 to 8, with the fabric applied to a man's or child's sock and wherein a pair of elastic strands 3c and 3d are each incorporated in a segment of the circular knit fabric of substantially 180 degrees with the extreme edges of the zigzag paths of said strands abutting along common lines  $o-g$ ,  $o-h$ .

In and during the knitting of the successive courses of stitches 1, 1, of which the fabric disclosed in Figs. 1 to 11 inclusive is composed, the elastic strands 3, 3a and 3b are fed to the needles of the machine on which the fabric is being knitted by a guide independent of and movable relative to the guide by which the base fabric yarn 2 is fed to the needles. The elastic strand guide is moved intermittently for relatively short distances with respect to the foundation thread guide and thereby effect the incorporation of the elastic in the fractional portions of different successively knit courses. To obtain the zigzag path of the elastic strand, the elastic strand guide is moved intermittently in one direction for any predetermined number of incorporations of the elastic strand and then in the opposite direction for a desired number of incorporations. The guide for the elastic strand however, may move intermittently in one direction only, and thus produces a continuous spiral around the fabric, as illustrated at 3e in Figs. 16, 17 and 18.

In another instance separate guides may be used for separate elastic strands 3f and 3g, as illustrated in Figs. 12, 13 and 14, and wherein the separate guides would move in opposite directions simultaneously or at different times and each carry its elastic strand around one half of the fabric, the two threads meeting at the points  $x$ ,  $x$  and  $y$ ,  $y$  along lines  $o-i$ ,  $o-j$  respectively.

Fig. 15 illustrates three elastic strands 3h, 3i, and 3j incorporated in the fabric in substan-

tially the same manner as previously disclosed in regard to the fabrics of Figs. 5, 6, 7 and 8. In this instance, in producing the fabric of Fig. 15, the three elastic strands 3h, 3i, and 3j would be fed by separate guides all mounted on a common carrier movable intermittently first in one direction and subsequently in the opposite direction.

Fig. 19 shows a circular knit fabric with two elastic strands 3k and 3l incorporated in opposite sides of the fabric in segments of approximately 175° each, as defined by the lines  $k-o-l$  and  $k-o-m$  respectively, with the one side of the incorporations of the strands 3k and 3l terminating along a common line  $o-k$  and with the opposite sides of the incorporations of the strands 3k and 3l terminating on the lines  $o-l$  and  $o-m$  respectively, it being noted that the segment  $z$  of the fabric, defined by and between the lines  $l-o-m$ , is devoid of any elastic strand.

The circular fabric of Fig. 19 is split along the line  $o-n$ , bisecting the segment  $z$ , and providing marginal areas  $z1$  and  $z2$  between the terminal lines  $l$  and  $m$  of the elastic strands 3k and 3l and the line  $o-n$  on which the fabric is split longitudinally.

The circular fabric is subsequently laid flat to form the welt W or top of a lady's full-fashioned stocking, which is joined to the leg portion L of the stocking along the line  $w-w$ , either by topping and direct knitting, sewing, looping, etc. The stocking blank of Fig. 20, after the foot portion (not shown) has been applied thereto, is then folded upon the longitudinal center line of the blank in the usual manner and the opposite marginal edges of the blank sewn together in the usual manner, including the edges  $o-n$ ,  $o-n$  of the top or welt W, said edges  $o-n$ ,  $o-n$  being joined together with stitches confined to the areas  $z1$ ,  $z2$ .

By making the top of a lady's full-fashioned stocking in the manner above noted none of the elastic strands in the upper portion W are severed, either by splitting of the circular knit fabric forming the top W or by the needle used in stitching the opposite edges of the blank together to complete the stocking. The seam produced by joining the edges  $o-n$ ,  $o-n$  of the top W is smaller than would be possible if the elastic ran from edge to edge of the fabric by reason of the elastic being eliminated from the zones  $z1$  and  $z2$  which are joined together to form the seam at the back of the stocking.

I claim:

1. A knitted fabric produced from a continuous inelastic yarn running throughout and forming each of a multiplicity of complete successively interknit courses of stitches forming the body of said fabric, and a continuous elastic yarn incorporated with said inelastic yarn in short fractional portions solely of each of a predetermined number of said courses in such relation to said inelastic yarn as to be substantially hidden in the fabric with said short incorporations staggered alternately to the right and to the left of a predetermined stitch wale of said fabric.

2. A knitted fabric produced from a continuous inelastic yarn running throughout and forming each of a multiplicity of complete successively interknit courses of stitches forming the body of said fabric, and a continuous elastic yarn incorporated with said inelastic yarn in short fractional portions solely of each of a predetermined number of said courses in such relation to said inelastic yarn as to be substantially hidden in

the fabric with said short incorporations staggered alternately to the right and to the left of a predetermined stitch wale of said fabric, said elastic strand being knitted in predetermined stitches of said fabric with said inelastic yarn at least at one end of each of said short incorporations.

3. A knitted fabric produced from a continuous inelastic yarn running throughout and forming each of a multiplicity of complete successively interknit courses of stitches forming the body of said fabric, and a continuous elastic yarn incorporated with said inelastic yarn in short fractional portions solely of each of a predetermined number of said courses in such relation to said inelastic yarn as to be substantially hidden in the fabric with said short incorporations staggered alternately to the right and to the left of a predetermined stitch wale of said fabric, said elastic strand being knitted in predetermined stitches of said fabric with said inelastic yarn at least at one end of each of said short incorporations and laid coursewise in said fabric between alternate stitch wales respectively passing in front of and behind said elastic yarn throughout the remainder of each of said short incorporations.

4. A circular knitted fabric produced from a continuous inelastic yarn running throughout and forming each of a multiplicity of complete successively interknit courses of stitches forming the body of said fabric, and a continuous elastic yarn incorporated with said inelastic yarn in short fractional portions solely of each of a pre-

determined number of said courses in such relation to said inelastic yarn as to be substantially hidden in the fabric with said short incorporations staggered alternately to the right and to the left of a predetermined stitch wale of said fabric, said elastic strand being knitted in predetermined stitches of said fabric with said inelastic yarn at least at one end of each of said short incorporations and laid coursewise in said fabric between alternate stitch wales respectively passing in front of and behind said elastic yarn throughout the remainder of each of said short incorporations.

5. A circular rib knitted fabric produced from a continuous inelastic yarn running throughout and forming each of a multiplicity of complete successively interknit courses of stitches forming the body of said fabric, and a continuous elastic yarn incorporated with said inelastic yarn in short fractional portions solely of each of a predetermined number of said courses in such relation to said inelastic yarn as to be substantially hidden in the fabric with said short incorporations staggered alternately to the right and to the left of a predetermined stitch wale of said fabric, said elastic strand being knitted in predetermined stitches of said fabric with said inelastic yarn at least at one end of each of said short incorporations and laid coursewise in said fabric between alternate stitch wales respectively passing in front of and behind said elastic yarn throughout the remainder of each of said short incorporations.

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