Jan. 30, 1940. J. L. GETAZ 2,188,295

PROCESS OF KNITTING

Original Filed April 20, 1937 3 Sheets-Sheet 1

Fig. 1.

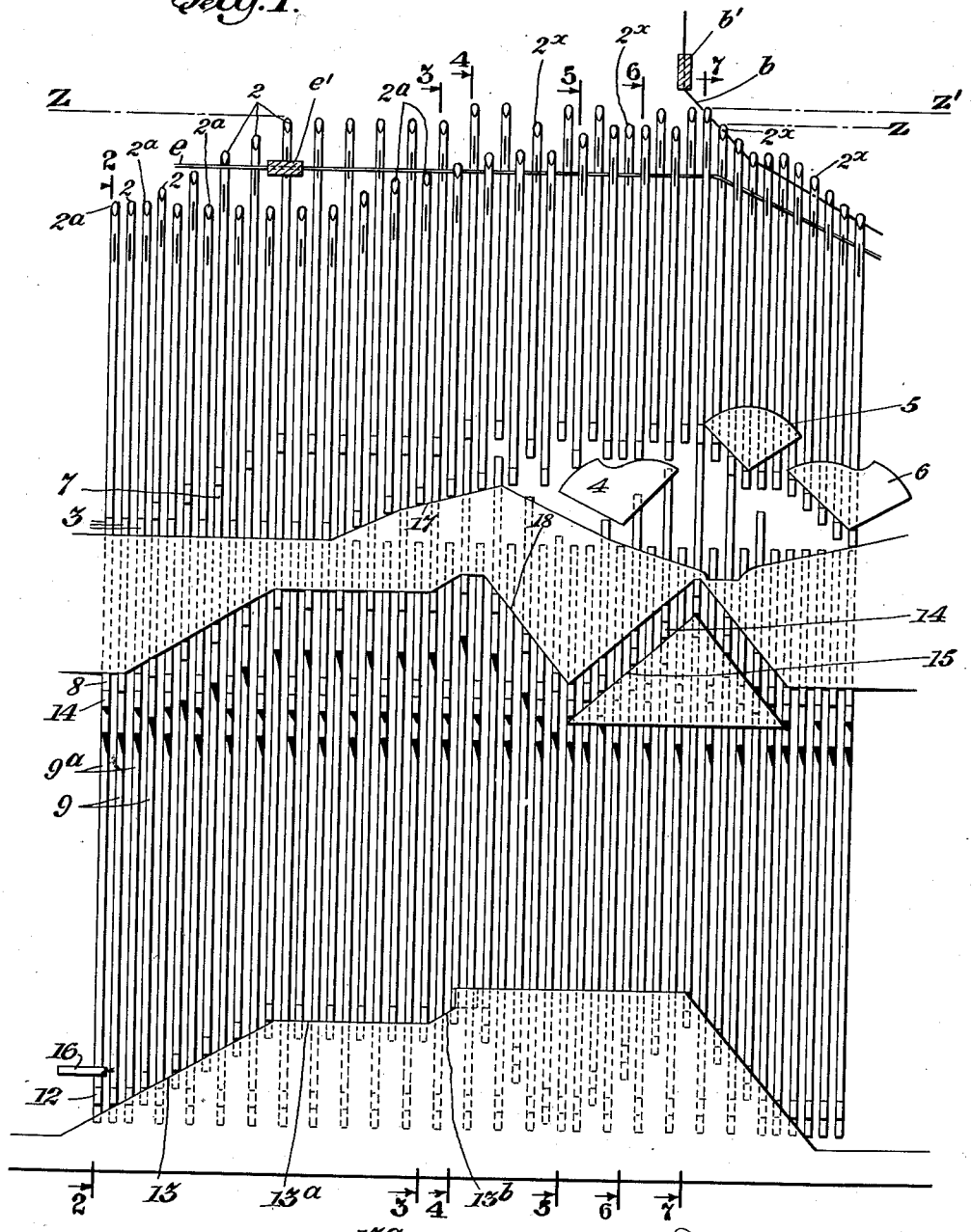
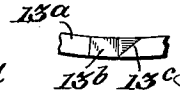


Fig. 1a.



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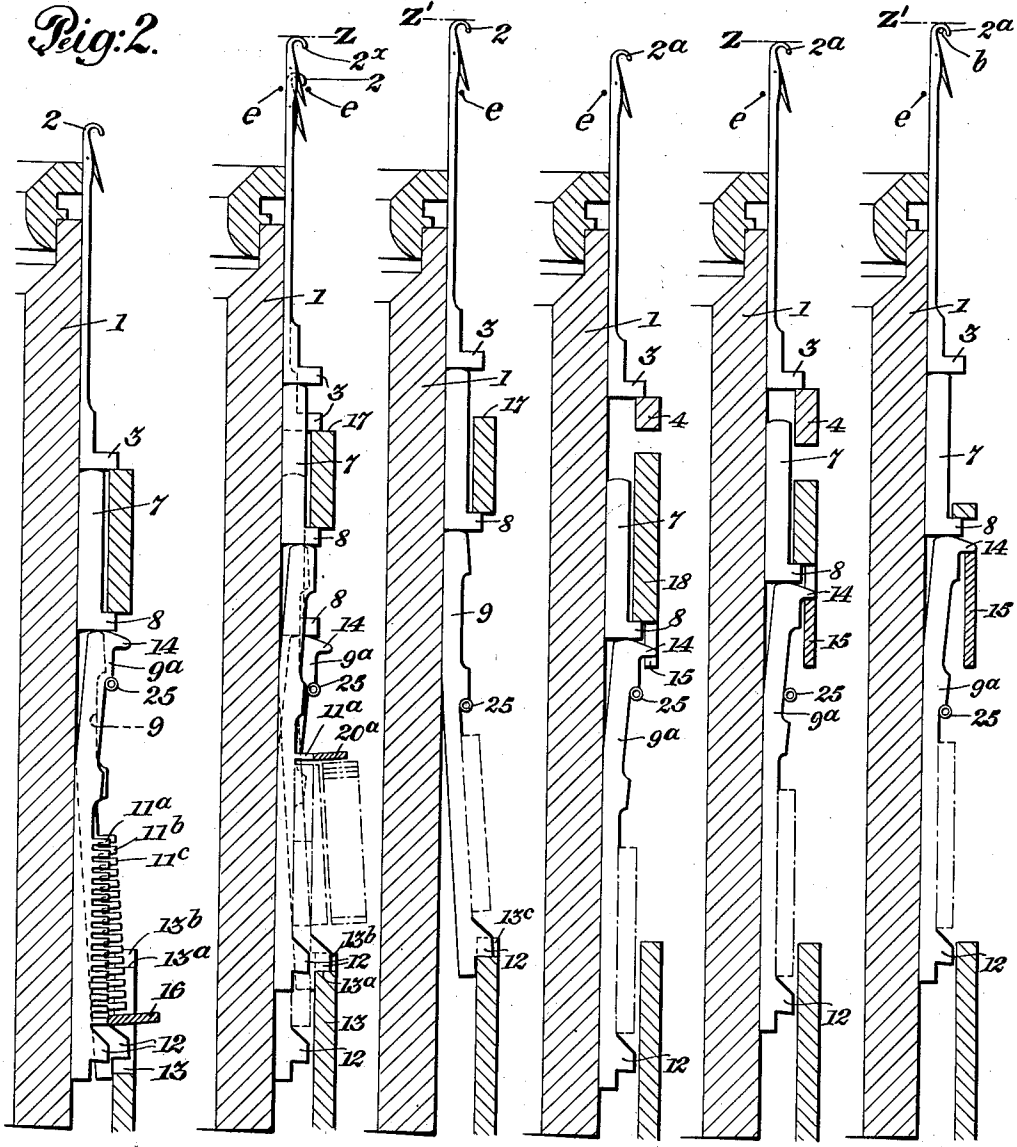
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Fig:3. Fig:4. Fig:5. Fig:6. Fig:7.

Fig:2.



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Fig. 8.

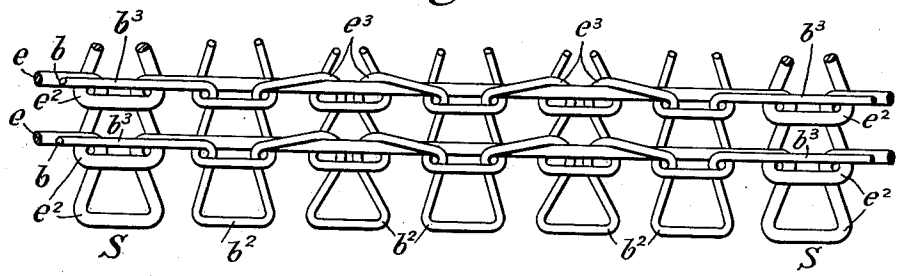


Fig. 9.

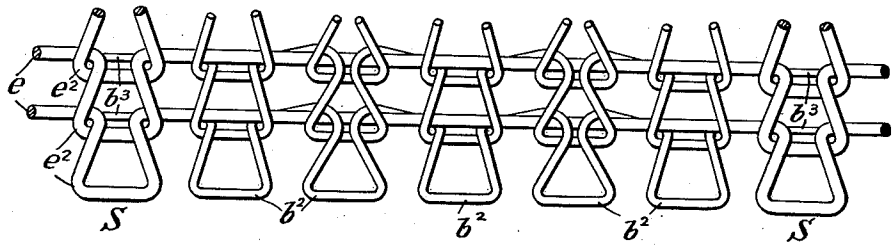


Fig. 10.

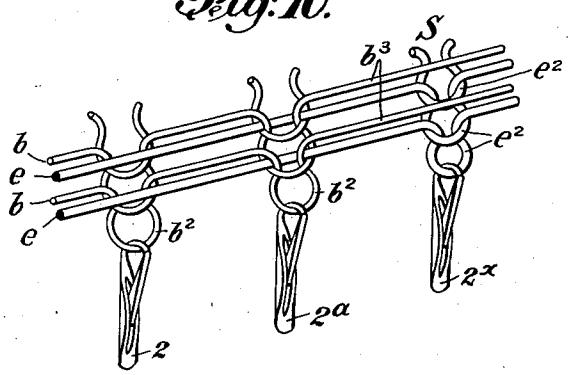
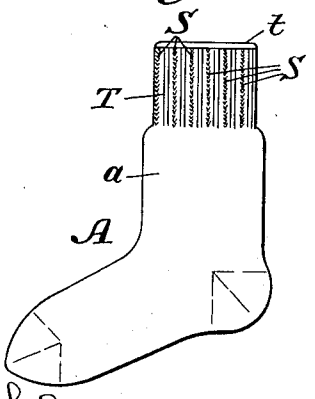


Fig. 11.



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Patented Jan. 30, 1940 2,188,295

UNITED STATES PATENT OFFICE

2,188,295

PROCESS OF KNITTING

James Louis Getaz, Maryville, Tenn.

Original application April 20, 1937, Serial No. 137,903. Divided and this application April 26, 1938, Serial No. 204,301

4 Claims. (Cl. 66—41)

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one embodiment of the same selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

This application is a division of my application Serial No. 137,903, filed in the United States Patent Office April 20, 1937, for improvements in Plain knit ornamented fabric and process of making the same.

My present invention relates to the process of knitting an ornamented, plain knitted fabric, preferably a seamless plain knitted fabric, having an elastic thread incorporated under tension in certain spaced courses (or in all the courses) and secured to the fabric at separated wales in each course in which the elastic thread is present, without the necessity of using any additional thread, or threads, beyond the ordinary body thread or threads and the said elastic thread. In knitting unornamented portions of the fabric, the elastic thread is preferably fed under tension to the needles, in advance of the body thread, and is preferably interlaced between adjacent needles back and forth, passing in front of alternate needles in such manner as to take a position below the latches thereof, and in rear of the intervening needles, so that it is not received in the hooks of any of the needles and no loops of the elastic thread are formed, while the body thread is fed to and knit by all the needles. As the needles draw their loops of the body thread, those needles which have the elastic thread fed below the latches will cast the elastic thread off over the heads of the needles, while the needles in front of the elastic thread will draw their loops over the elastic thread and lock it in the wales formed by such needles, while the elastic thread extends in a substantially straight line in the fabric. The tension of the elastic thread draws the fabric laterally into vertically disposed parallel rib-like ridges and where, as preferred, it is locked in the fabric at alternate wales, those wales in which the elastic thread is locked in the manner described, will be forced to the inner face of the fabric, while the intervening wales will be forced to the outer face of the fabric, and all the wales will be held in close relation, thereby producing a smooth faced ridged fabric closely resembling rib fabric of the 1 x 1 type. Such fabric finds its principal use in the elastic tops of hosiery, particularly for men's women's and children's socks and anklets, and possesses not only the form fitting characteristics of rib work, but in addition, a self-supporting characteristic in that the float portions of the elastic thread on the inner face of the fabric extend substantially continuously around the circular top of the fabric, and will engage and slightly indent the skin of the wearer, so as to support it against longitudinally slipping, without exerting sufficient tension to be objectionable to the wearer and without being even perceptible in most cases.

I have found that such fabric can be ornamented in such manner by employing an elastic thread, which may be of rubber, but is preferably the well known Lastex, in which the rubber is surrounded by a coil or coils of inelastic strands, and which is of different or contrasting color to that of the body thread, and to feed the elastic thread into the hooks of selected needles, which are prevented from receiving the body thread, thus causing the selected needles in a course or courses to draw loops of the elastic thread, while the body thread is floated in rear of such selected needles, where the same needles in each of a number of successive courses, or all the courses of the elastic stocking top, draw loops of the elastic thread in this manner. Each loop of elastic thread is drawn through a loop of elastic thread in the preceding course, thus producing a vertical stripe, or stripes, in the fabric, of contrasting color to the body of the fabric formed of the body thread.

A suitable machine for carrying out my present invention is the well known Scott & Williams spiral circular knitting machine, provided with selecting and pattern mechanism, such as is illustrated, for example, in United States Letters Patent to Ernest W. Marshall and Laurence B. Holt, No. 2,040,946, dated May 19, 1936, and I have illustrated such parts of such a machine as are necessary for an understanding of my invention.

Referring to the accompanying drawings,

Fig. 1 is a diagrammatic view illustrating an arrangement of needles and selecting mechanism therefor, operable in a known type of circular knitting machine for carrying my invention into effect.

Fig. 1*a* is a detail view of a portion of the selecting cam, illustrating a lateral cam grade thereof.

Fig 2 is a vertical sectional view of a portion of the knitting cylinder, on the line 2—2 of Fig. 1, showing a needle with its coacting needle jack and selecting jack.

Fig. 3 is a similar view, on line 3—3 of Fig. 1.

Fig. 4 is a similar view to Fig. 2, on line 4—4 of Fig. 1.

Fig. 5 is a view similar to Fig. 2, on line 5—5 of Fig. 1.

Fig. 6 is a view similar to Fig. 2, on line 6—6 of Fig. 1.

Fig. 7 is a view similar to Fig. 2, on the line 7—7 of Fig. 1.

Fig. 8 is a diagrammatic representation of the inner face of the fabric as it is knitted, the fabric being in the distended condition.

Fig. 9 is a similar view of the face of the fabric, illustrated in Fig. 8, also in distended condition.

Fig. 10 is a detail perspective view showing portions of two courses of the knitted fabric, and looking at the inner face thereof.

Fig. 11 is a side view of a sock, in this instance an anklet, having a top formed of the ornamented fabric herein described.

In the drawings, 1, represents the needle cylinder, which is provided with a circular series of needles. In this instance I have shown the machine arranged to interlace the elastic thread, indicated at *e*, in front of alternate needles and in rear of the intervening needles, and for convenience of reference I have indicated at 2, the alternate needles which receive the elastic thread on the front or outer side, the intervening needles being indicated at 2*a*, each needle being provided with the usual knitting butt, 3, for engaging the usual knitting cams, shown at 4, 5 and 6. Below each needle is a needle jack 7, provided with a cam engaging butt, 8, at its lower end, below which is a selecting jack having portions of its inner edge disposed angularly to other portions, so as to permit it to rock against the action of an encircling spring, 25, engaging the selecting jacks adjacent to their upper ends. Again for convenience of reference, I have indicated the selecting jacks for the needles 2, by the numeral 9, and the selecting jacks for the needles 2*a*, by the numeral 9*a*. Each of the selecting jacks 9, 9*a*, is provided adjacent to its lower end with a plurality of selecting butts, indicated at 11*a*, 11*b*, 11*c*, etc., usually twenty five in number, below which is an operating butt 12, for normally engaging a selector cam, indicated at 13, when the selecting jack is in the position in which it is normally held by the spring, 25. This selector cam 13, is intended to elevate the alternate needles 2, which are to receive the elastic thread *e*, on the front of the needles and eventually below the latch thereof. In order that only the selected needles 2, which are in this instance alternate needles shall be raised by the selecting cam 13, I provide means for knocking down the selecting jacks 9*a*, for the intervening needles 2*a*, that is to say, the lower ends of the jacks 9*a*, for the intervening needles 2*a*, are forced inward so as to carry their butts, 12, out of engagement with the cam 13, as shown in Fig. 2. Any suitable means may be employed for this purpose, and in this instance I have shown an auxiliary selector cam 16 (see Fig. 2) for engaging one of the butts 11, of the jacks for the needles, 2*a*, the corresponding butts for the needles 2, being broken off, so that the jacks for the needles 2, will not be knocked down. The cam 16, is capable of being drawn out of action when the elastic top is completed.

As a result of this selection, all of the needles 2, will be elevated by the selecting cam 13, in this instance to a height at or slightly above the clearing point, as indicated by the dotted line *z*, but high enough to receive the elastic thread *e*, upon the latches of the needles, as indicated in Figs. 1 and 3. The elastic thread *e*, is preferably delivered to the needles 2, by a horizontally movable thread feed guide, indicated at *e'*, located in advance of the thread, which may be swung into and out of operative feeding position in any suitable manner, under the control of suitable pattern mechanism, so as to introduce the elastic thread into all the courses, or certain courses only, spaced from each other as may be desired, and as fully set forth in my former application for Letters Patent, Serial No. 53,824, filed December 10, 1935.

The butts, 12, of the selector jacks of alternate needles 2, after being raised by the cam 13, pass along a horizontal grade, indicated at 13*a*, and at this point the selecting jacks of certain selected needles are knocked down, which needles are those intended to draw a loop of the elastic thread only. They must obviously be certain needles of the group 2, as the needles 2*a*, will be raised in front of the elastic thread, as hereinafter described. These particular or selected needles, I have indicated by the numeral 2*x*, and in this instance for purposes of description, I have shown every sixth needle of the series as being a selected needle, designed to produce a stripe formed of loops of the elastic thread, but it will be understood that any of the needles 2, may be so selected for the production of stripes at any desired intervals all the way around the tubular fabric, or at particular points therein, and at any desired intervals from each other, as may be found desirable.

For the purpose of selecting the needles 2*x*, I find it convenient to employ the well known selecting mechanism of the Scott & Williams spiral machine referred to, comprising a horizontal series of selector cam levers, usually twenty five in number. These levers are selectively operated by a series of butts somewhat similar to the butts, 11*a*, etc., and arranged vertically on a trick wheel, which is moved intermittently in a rotary direction by suitable connections with the pattern mechanism. This mechanism is well known and specifically forms no part of my invention, and it therefore will not be further illustrated or described. It will be understood that one of the selector cam levers as 20*a*, or reader cam levers as they are sometimes termed, will be moved into position by the trick wheel, so as to engage one of the butts, as the butt 11*a*, of the jacks, for the selected needles 2*x*, the butt 11*a*, of the remaining needles 2, being broken off. The selecting jacks of the remaining needles 2, therefore remain in engagement with the horizontal portion 13*a*, of the selecting cam 13, and will engage a secondary elevating grade 13*b*, thereof, thereby raising all of the needles 2, except the selected needles 2*x*, sufficiently to allow the latches to pass above the elastic thread *e*, when they are at a level indicated by the dotted line *z'* (Fig. 1). At this point, the operating butts, 12, of the selecting jacks 9, for all the needles 2, engage a lateral cam face 13*c*, (see Fig. 1*a*) which disengages the said operating butts from the cam 13, and permits the selecting jacks 9, for said needles, as well as for the selected needles, 2*x*, to be returned to normal position by a cam 18, (see Fig. 1) which engages the butts 8, of the corresponding needle jacks, 7, for the alternating needles 2, 2*x*.

In the meantime the selecting jacks 9*a*, for the intermediate needles 2*a*, have remained in their lowermost position, as indicated in Fig. 1. The needles 2*a*, however, have been raised to the clearing point, indicated by the dotted line, *z*, by means of a cam 17, and the upper surface of

the cam 4, as clearly shown in Fig. 1. As the needles 2a, are raised by the cam 17, they will pass in front of the elastic thread e, thus effecting an interlacement of the elastic thread in rear of the needles 2a, and in front of the needles 2 and 2x, as previously described. The upper end of each of the needle jacks 9a, is provided with an auxiliary butt, 14, and these auxiliary butts are engaged by a cam 15, which carries upward the selecting jacks 9a, for the needles 2a, and raises them from the clearing level, indicated by the dotted line z, to the high level, indicated by the dotted line z'.

All of the needles, therefore, with the exception only of the selected needles 2x, reach the higher level, indicated by the dotted line z', where they receive the body thread b, from a suitable thread feed guide b', in their hooks, and thereafter all of the needles are drawn downward by the engagement of their butts 3, with the knitting cams 5 and 6, to form the knitting wave. The selected needles 2x, however, do not receive the body thread, but on the contrary the lowering of the needles, 2x, causes their hooks to engage the elastic thread e, so that all of the needles draw loops of the body thread except the selected needles 2x, which pass in front of the body thread, and draw loops of the elastic thread. This operation is repeated in succeeding courses in each of which the selected needles 2x, will draw a loop of the elastic thread through a loop of the elastic thread in the preceding course, the body thread being floated behind the wales formed by the selected needles.

Fig. 10 illustrates the action of the different needles. Thus, as will be therein seen, each needle 2, which receives the elastic thread e, below the latch, will draw a loop b, of the body thread, while the elastic thread e, will pass up over the latch and over the head of the needle. Each needle 2a, which is raised in front of the elastic thread, will draw a loop b2, of the body thread, over the elastic thread, thereby locking the elastic thread in the fabric at the wales formed by the needles, 2a. Each of the needles 2x, which receives the elastic thread upon the latch and is not thereafter elevated, are drawn down by the knitting cam to form loops e2, of the elastic thread e, while the body thread b, is floated in rear of the wales formed by the selected needles 2x. A succession of loops e2, of the elastic thread, which is of contrasting color to that of the body thread b, will thus form a vertical stripe in the fabric of the contrasting color, which I have indicated at S, as a whole. The floated portion of the body thread in rear of the loop e2, of the elastic thread is indicated at b3. These floated portions, it will be understood, will be in a substantially taut condition, as the fabric is knitted on the machine, in which the fabric will be considerably distended. When the fabric is removed from the machine, however, the tension of the elastic thread will contract the fabric laterally to form the vertical rib-like ridges. In the particular fabric shown, the tension of the elastic thread also forces the wales produced by the needles 2 and 2x, to the outer face of the fabric, while the wales produced by needles 2a, are forced to the inner face of the fabric. This contraction of the fabric necessarily produces slack in the floats b3, of the body thread, so that when the fabric is distended in use, as in pulling the stocking or anklet top over the heel and upon the leg, these floats will not restrict the elasticity of the fabric.

It will be understood that the elastic thread e, is fed under considerable tension and maintained under said tension during the knitting of the fabric, by suitable tension mechanism, as, for example, that shown in my former application hereinabove referred to, the specific details of which, however, form no part of my present invention.

In Fig. 8 of the drawings I have illustrated diagrammatically, the inner face of a portion of the fabric produced in accordance with the foregoing description, in which it will be noted that the loops in each course formed of the elastic thread, indicated at e2, form the stripes S, while the intermediate loops, b2, are formed of the body thread, which is floated at b3, in rear of the elastic loops e2. It will also be seen that the loops b2, formed by the needles 2a, lock the elastic thread into the fabric, as indicated at e3, in alternate wales, in this instance while the elastic thread passes in a substantially straight line between the loops e2, thereof, which form the stripes S.

Fig. 9 is a view similar to Fig. 8, and shows the exterior face of the fabric illustrated in Fig. 8.

It will be understood that the tension on the elastic thread e, will be so regulated as to permit the formation of the loops e2, constituting portions of the stripes S, and which therefore withdraw certain portions of the elastic thread out of the transverse line of the main portions thereof, that the tension of the remaining portions of the elastic thread in the several courses in which it occurs will be under the desired tension to produce the self-supporting feature of the fabric, and at the same time provide the necessary elasticity or stretch to enable the fabric in the case of a stocking top, to be withdrawn over the heel and upon the leg and accommodate itself to the sizes of the leg of the wearer.

It will be understood that, in accordance with my process previously described, the loops e2, of the contrasting elastic thread or Lastex, can be produced at any desired intervals in the fabric by varying the selecting mechanism so that the selected needles 2x, shall occur at the desired points in each course. Thus, the stripes S, may be formed at opposite sides of the sock, or all the way around and located at equal distances apart or at varied distances apart, as may be found desirable.

In Fig. 11 I have shown an anklet A, provided with an elastic top T, constructed in accordance with my improved process and comprising my improved ornamented fabric hereinbefore described. In this figure the vertical rib-like ridges are indicated by parallel vertical lines, and the stripes formed by the loops of elastic thread of a color contrasting with the body thread are indicated at S. The upper edge of the top T, is preferably provided with an anti-ravel edge or selvage, or a suitable welt, indicated at t, and formed in the usual or desired manner. It will be understood that the leg portion a, of the stocking, if knit of plain knitting, may be knit continuously onto the last course of the top T, or the top may be formed separately and united to the leg portion of the anklet or stocking, in any usual or desired manner.

When the leg of the stocking is to be knit integrally with the elastic incorporated top previously described, I prefer to discontinue the operation of the trick wheel for one or more courses at the lower end of the top, so that all of the needles, including the selected needles 2x, will be

raised to the level indicated by the line z', and will take the body thread. This insures that there shall be a loop of the body thread on every needle of the last course of the top. The feeding of the elastic thread is then discontinued, preferably by throwing out of operative position the thread guide e, and clamping the elastic thread in a suitable clamp or binder, which may be provided with a cutter, in the usual manner, if desired, or the elastic thread may be allowed to break, as the knitting of the leg progresses. The machine will then produce plain knitting without the incorporation of the elastic thread and the stocking will be completed in the usual manner.

The fabric produced by my improved process herein described and illustrated is not herein claimed, as it forms the subject matter of my former application for Letters Patent of the United States, Serial No. 137,903, filed April 20, 1937 and hereinbefore referred to.

What I claim and desire to secure by Letters Patent is:

1. A method of forming plain knit ornamented elastic fabric, which consists in knitting the fabric by plain knitting with a body thread, incorporating an elastic thread of contrasting color under tension in certain successive courses of the fabric, locked into the fabric at spaced wales in said courses, and forming certain wales by drawing loops of the elastic thread through loops of elastic thread in corresponding wales of the preceding course and floating the body thread in rear thereof in each course.

2. A method of forming plain knit ornamented elastic fabric, which consists in knitting the fabric by plain knitting with an inelastic body thread, incorporating an elastic thread of contrasting color under tension, in successive courses of the fabric, and locking it into the fabric at spaced wales in said courses, and at predetermined wales in each course drawing loops of the elastic thread through loops of elastic thread in the preceding course, and floating the body thread in rear thereof to form contrasting vertical stripes of the elastic thread on the outer surface of the fabric, the tension of said elastic thread drawing the fabric together into vertical rib-like ridges, and producing slack in the floated portions of the body thread.

3. A method of forming plain knit ornamented elastic fabric, which consists in feeding an elastic thread under tension in front of alternate needles and into the hooks of certain selected needles of said alternate needles, and below the latches of the others of said alternate needles, and in rear of the intervening needles, feeding a body thread of contrasting color to all of the needles except said selected alternate needles, and floating it in rear of said selected needles, and knitting successive courses of plain knitting containing loops of body thread and loops of the said elastic thread drawn by said selected needles through loops of elastic thread in corresponding wales of the preceding course, to lock the elastic thread into the fabric at separated wales in said courses, and form vertical stripes composed of the loops of said elastic thread, the tension of said elastic thread forcing the wales of the fabric formed by said alternate needles, including those formed by said selected needles, to the outer face of the fabric and the wales formed by the said intervening needles to the inner face of the fabric, and producing slack in the floated portions of the body thread.

4. A method of forming plain knit ornamented elastic fabric, which consists in feeding an elastic thread under tension in front of certain needles above the lower ends of the latches thereof, and in rear of the intervening needles and into the hooks of certain selected needles, raising said alternate needles with the exception of said selected needles to bring the elastic thread below the latches and place them in position to receive a body thread, raising the said intervening needles forward of the elastic thread into position to receive the body thread, feeding a body thread of contrasting color into the hooks of all of said needles except said selected needles, and knitting courses of stitches comprising loops of body thread, certain of which lock the elastic thread in the fabric, and forming loops of the elastic thread drawn by said selected needles through loops of elastic thread in corresponding wales of the preceding course, the wales formed by the loops of the elastic thread forming vertically disposed stripes in the fabric, and the tension of said elastic thread contracting the fabric to form vertical rib-like ridges.

JAMES LOUIS GETAZ.