

March 30, 1943.

I. H. C. GREEN

2,315,119

FABRIC AND METHOD OF KNITTING

Filed Dec. 12, 1941

3 Sheets-Sheet 1

FIG. 1.

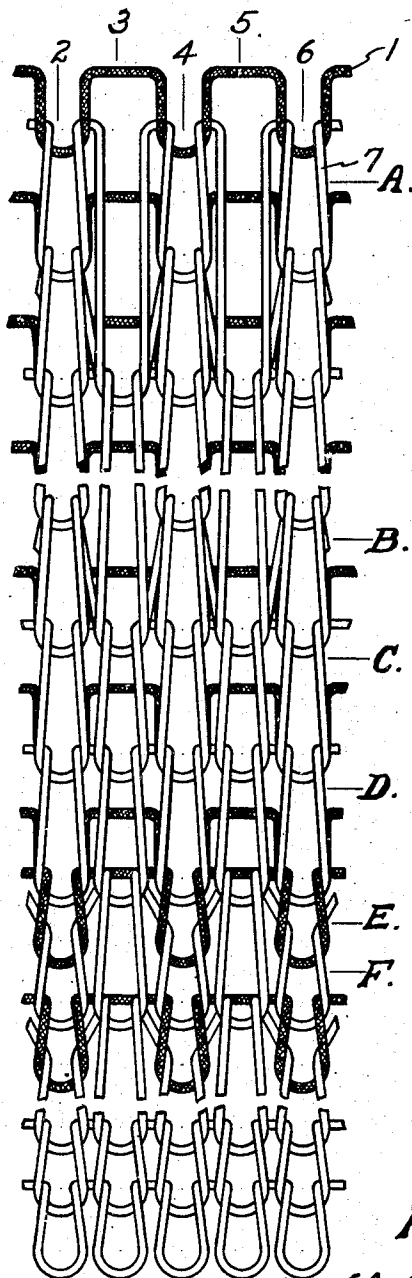


FIG. 2.

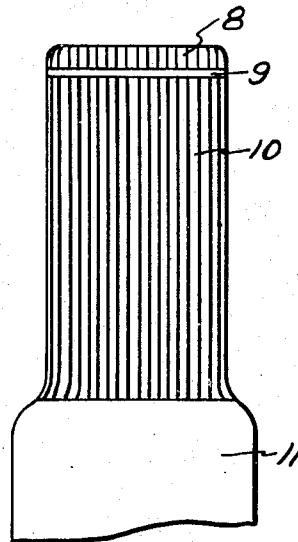


FIG. 3a.

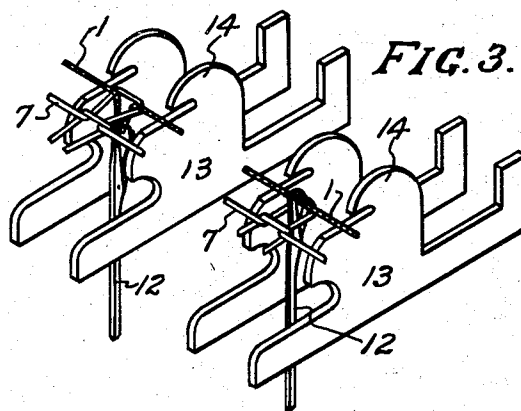
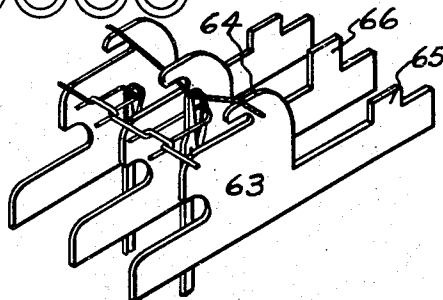


FIG. 4.



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FIG. 5.

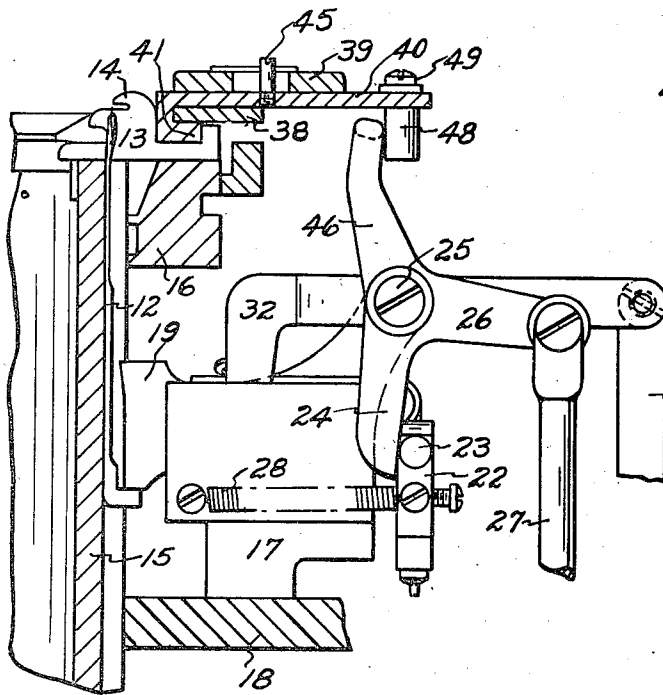


FIG. 9.

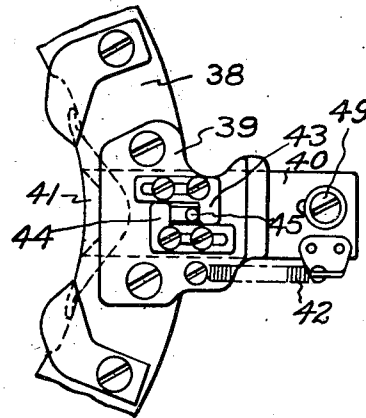


FIG. 8.

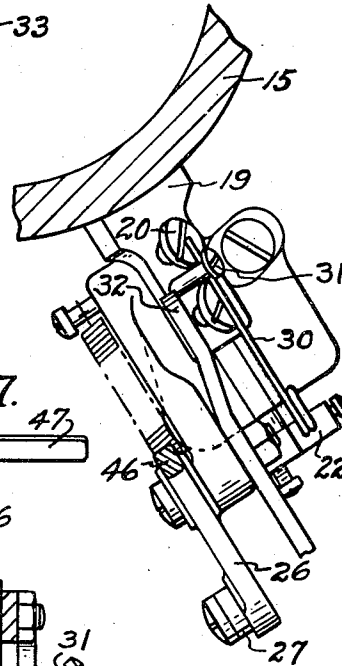


FIG. 6.

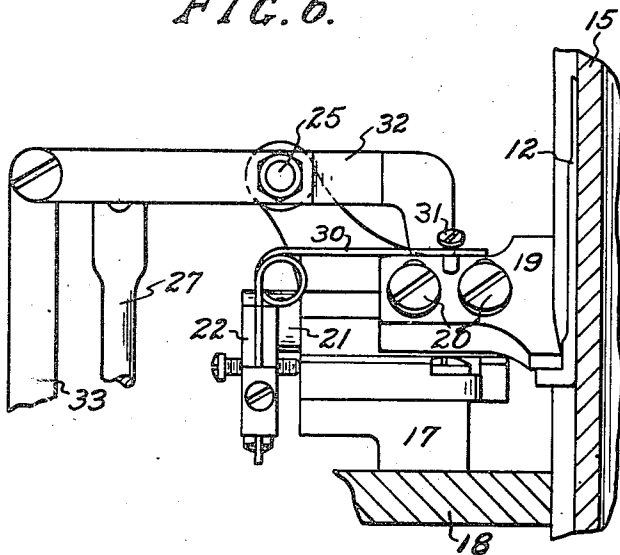
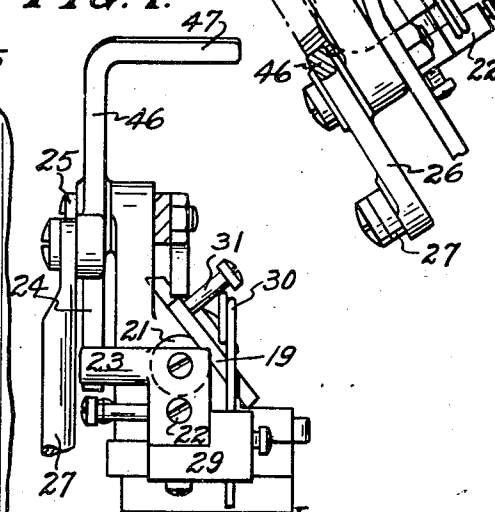


FIG. 7.



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FIG. 12.

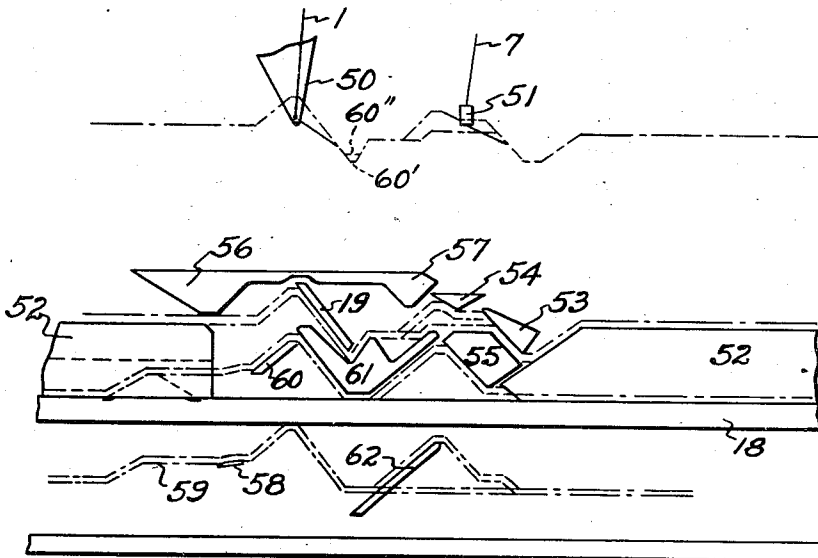


FIG. 10.

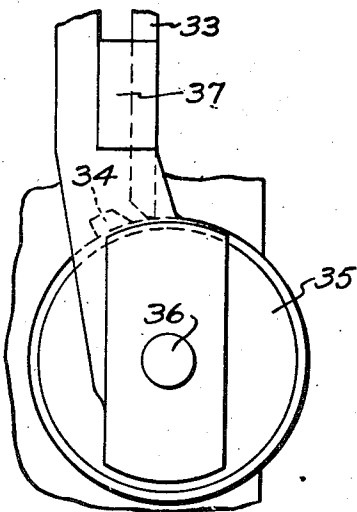


FIG. 11.

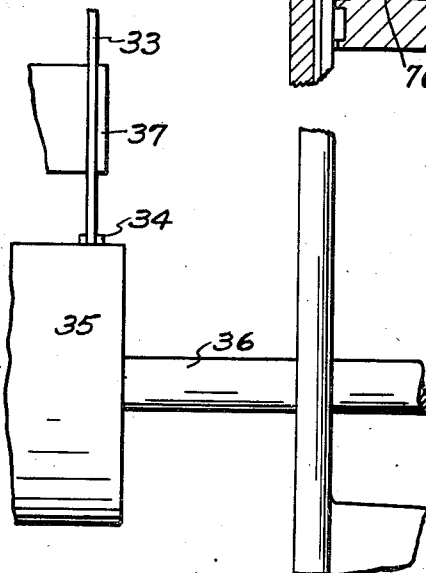
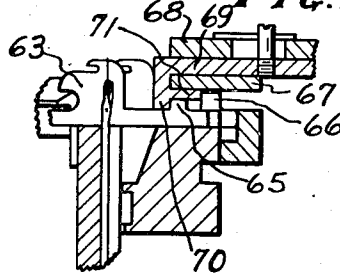


FIG. 13.



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2,315,119

FABRIC AND METHOD OF KNITTING

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poration of Massachusetts

Application December 12, 1941, Serial No. 422,622

8 Claims. (Cl. 66—172)

This application concerns an invention in knitted fabrics, more especially elastic knitted fabrics having a selvage, and the method and mechanism for producing the same.

In the figures of the drawings:

Fig. 1 is a conventional showing of a section of fabric knitted in accordance with the invention, the same being to a greatly enlarged scale;

Fig. 2 is an elevation of a stocking top representing the manner in which the invention is applied to a particular problem;

Fig. 3 is an isometric view showing needles and sinkers and the steps involved in inlaying elastic yarn;

Fig. 3a is a similar view showing steps involved in knitting the elastic yarn;

Fig. 4 is a similar isometric view but showing a modification in which the elastic yarn is drawn over sinker ribs;

Fig. 5 is a section through part of the machine showing an elastic yarn stitch drawing cam, a sinker cam and part of the control for these cams;

Fig. 6 is a sectional view showing the elastic yarn stitch drawing cam and some details of the control means operable upon that cam;

Fig. 7 is an elevation showing the elastic stitch drawing cam and controlling means as seen from its outermost end;

Fig. 8 is a plan view of the elastic stitch drawing cam and part of its associated mechanism;

Fig. 9 is a plan of a section of the sinker cam cap and showing certain parts associated with the movable sinker cam at the elastic yarn feed;

Fig. 10 is an elevation of a small section of the lower part of the machine illustrating one of the cam drums and cam means thereon for controlling the elastic stitch drawing cam;

Fig. 11 is a view showing the mechanism of Fig. 10 as seen from a different angle;

Fig. 12 is a diagrammatic view showing cams and the pathways of needle and jack butts;

Fig. 13 is a section similar to Fig. 5 but showing only a sinker and sinker cam operable thereon such as would be used with the modified method of Fig. 4.

In United States Patent #2,131,720 an elastic stocking top has been disclosed and claimed in which the elastic yarn is knitted independently at a separate yarn feed and in which the selvage has also been produced by what we would normally call knitting the elastic. By that it is meant that the elastic yarn at the selvage as well as throughout the remaining part of the top is taken within the hooks of needles rather than

being inlaid as it would be if it were taken below needle latches or if taken in needle hooks and subsequently cleared below needle latches prior to taking a non-elastic yarn and thereafter casting off the elastic yarn. United States Patent #2,247,343 is the subject of a selvage in which the elastic yarn is inlaid in contrast to knitting, that is, the elastic yarn has been cleared below needle latches prior to taking and being cast off after the taking of inelastic yarn at a subsequent or so-called main feeding station. In this later mentioned patent the elastic yarn is not only inlaid in the selvage but is similarly treated throughout the remaining portion of the stocking top.

The knit-in elastic top is particularly desirable from the standpoint of satisfactory service since it is comfortable, has an extreme amount of stretch laterally and is also stretchable in a longitudinal direction, this latter feature being something not obtainable with the so-called laid-in elastic method of knitting. The laid-in system as employed in Patent #2,247,343 is, however, more desirable for purposes of a selvage since the same lends itself to the production of a special tuck selvage as shown and claimed in the patent, and superior in appearance and in its ability to stand upright and resist rolling or curling. Heretofore it has not been possible to combine these two systems of knitting in a product which, if the same could be done, would obviously be more suitable and desirable since it would combine the best selvage with a main body portion of a garter or stocking top best adapted to give comfort and satisfaction to the wearer.

In this application an inlaid selvage such as constitutes the subject matter of Patent #2,247,343 is combined with a main body portion of a stocking top knitted in accordance with Patent #2,131,720. When "selvage" is referred to here the terminal course only is not contemplated, but rather, the first few courses which go to make up about $\frac{1}{4}$ " to $\frac{1}{2}$ " at the edge of the top. That much of the top which is termed selvage is to be formed by inlaying, but, of course, it is to be understood that some latitude is allowed as to just how much of the edge shall be inlaid as that may vary with different gages and with different materials.

Now referring to Fig. 1, an elastic yarn is first taken in the hooks of alternate needles, that is, needles knitting in wales 2, 4 and 6. The elastic yarn is preferably fed at a separate yarn feeding station at which, as will hereinafter be described, there are a knitting cam and sinker controlling

cams which may be so positioned as to cause needles to knit or to inlay. A needle dividing or selecting means (not shown) is to be employed which will raise these alternate needles for taking the elastic yarn to the exclusion of raising intermediate needles such as would knit in wales 3 and 5. Such needle dividing means are well-known and need not be described in detail in this case. At a subsequent yarn feeding station which is preferably the main mouthpiece or feeding station of the machine an inelastic yarn 7 will be fed to all needles. In a machine having one elastic and one inelastic yarn feed, the knitting will continue from the first inelastic yarn course which is designated as A down to a course B at each course of which the elastic yarn is fed by taking the same within the needle hooks by clearing below needle latches prior to taking the inelastic yarn 7. That means that at each course of knitting one inelastic yarn course will be formed in which, at alternate needles, the elastic yarn will have been taken, cleared below latches, and cast off into the fabric by the method known as inlaying.

Furthermore, as disclosed in Patent #2,247,343, the intermediate needles knitting in wales such as 3 and 5 tuck at every other revolution of the machine so that they form what is known as a two course tuck. Since the elastic inlaid by taking the same upon alternate needles will, when cast off, be held in wales corresponding to intermediate needles, the elastic will be maintained against lateral displacement in the intermediate or tuck wales. All that has been disclosed in the patent just above mentioned and need not be described more fully here. The elastic yarn is knitted under tension, preferably a relatively light tension, although that may be varied within certain limits depending upon the weight of the elastic yarn and upon other factors later to be mentioned.

The first course A is herein shown as having a single course or strand of the elastic yarn 1 passing through each sinker wale thereof. That merely illustrates one way in which the edge can be started, and by way of modification, several courses of elastic yarn may be loaded in the hooks of needles before clearing latches initially when the first inelastic yarn 7 is to be taken so that this initial course will have several stretches of elastic yarn threaded through these initial sinker loops rather than the one course illustrated here.

After the course B, knitting may be switched directly to the knit-in method although in accordance with a preferred system, two courses such as C and D are preferably knitted with elastic inlaid as in courses A—B except for the fact that tucking is discontinued. The control for tucking is through the front stitch cam which by automatic means is projected in and out at every other or desired courses. A special tuck cam later to be described is also involved. At the courses C and D the tuck control is merely rendered inoperative.

Immediately after the knitting of course D, the elastic yarn drawing stitch cam is moved to a lowermost position at which it causes needles to knit which have heretofore been drawn to a level sufficient only for measuring off the elastic yarn without casting off the previously drawn inelastic yarn stitch. Now the elastic yarn will actually be drawn as at elastic yarn course E into independent, elastic stitches thereby casting off in the alternate wales the previously drawn inelastic yarn. Incidentally, that will cast off the last

inlaid elastic so that at that particular point elastic will temporarily be drawn through elastic yarn although the first elastic on the needles was merely inlaid so that no difficulty is experienced as might be if one series of elastic yarn stitches was to be knitted through a series of elastic yarn stitches which had also been drawn into knitted loops.

After the course E at the elastic feed, course F is knitted from inelastic yarn at the main side and then the process continues as in Patent #2,131,720.

In Fig. 2 a stocking top has been conventionally shown in which the selvage indicated by numeral 8 is knitted in accordance with courses A—B. Then the two or more courses similar to C and D would be represented at 9 while the remainder of the top 10 would be knitted in accordance with courses E and F. Thereafter a leg 11 may be knitted in any desired manner. The inlaid selvage naturally knits a little tighter than the continuing section of the top which is knitted. That causes the edge to be drawn in as shown in this Fig. 2 rather than flaring outwardly as has sometimes been experienced.

In Fig. 3 a needle 12 is shown cooperating with two sinkers 13 having nibs 14. In this particular figure inlaying the elastic yarn 1 is shown and it can be seen that the needle is drawn down far enough to take the elastic yarn in its hook, but not far enough to cast off the previously drawn stitch of inelastic yarn 7. Of course, this all takes place at an auxiliary elastic yarn feeding station which may be at any convenient point in advance of the inelastic feeding mouthpiece or station.

In Fig. 3a the same needles and sinkers are shown and the position is such as would prevail during knitting the elastic. The needle 12 is here drawn down far enough to draw a stitch of the elastic yarn 1 and the previously drawn inelastic yarn stitch has been cast from the needle. The sinkers move in a stitch wave at this particular time being drawn outwardly so as to have the elastic drawn in front of the nibs as is the ordinary practice. Later the said sinkers will move in for knocking over the cast off loop in the event the elastic is knitted, but in the case of inlaying, will merely move in to take the elastic yarn beneath nibs or in the throats so that it may be held down when needles move upwardly to clear latches and take the inelastic yarn 7.

Mechanism for accomplishing this has been shown in Figs. 5-9 and will now be described in detail. A needle cylinder 15 is slotted in the usual way for the needles 12 and has a sinker head 16 in which the sinkers 13 are slidable. In Fig. 5, for example, a bracket 17 is mounted on a cam plate 18 and this bracket forms a sliding support or carrier for the needle stitch drawing cam 19. This cam is inclined at a suitable stitch drawing angle and is in more or less the form of a plate. It bears against the inclined side of the bracket and is vertically slidable thereon since it is retained in position by means of shoulder screws 20 which pass through slots vertically disposed in the cam plate.

These shoulder screws 20 are threaded into a cam stem 21 which is slidable radially of the machine and within the bracket 17, and of course, when so moved will draw the cam 19 outwardly away from the cylinder to allow the same to move in against the cylinder. The cam stem 21 has connected at its outer end an angular piece 22 having a projection 23 extending to the left, Fig.

7, and which is engaged by a downwardly extending arm 24 of a three armed lever pivoted at 25. This lever has a horizontal arm 26 to which is connected a depending link 27 and by means of which the lever is actuated at proper intervals all in accordance with cam control not shown in this case.

The cam 19 is normally urged inwardly against the cylinder by a spring 28 connected at one end to the bracket and at its other end to a pin extending from the piece 22 fixed at the end of the cam stem. This piece 22 has an additional connection 29 attached thereto which might preferably be integral, but the purpose of which is to support a spring 30, under tension, and which engages a projecting screw 31 in the cam plate 19. The purpose of this spring is to urge the cam into its uppermost position.

Against the tension of spring 30 a lever 32 bent downwardly to press against the upper edge of the cam plate 19, is adapted to hold the cam in its lowermost position when desired. Lever 32 also pivots at 25 and has a link 33 connected at its outer end, said link projecting downwardly to be engaged by a cam 34, Figs. 10 and 11. This cam 34 is carried by cam drum 35 on the main cam shaft 36. Link 33 is guided in a suitable slot in bracket 37.

When the inlaid top is formed the timing of the cam shaft is such that cam 34 will encounter link 33 thereby swinging lever 32 in a direction to push cam 19 downwardly against the tension of spring 30 and to a knitting position. In that position needles will be drawn down as in Fig. 3a thereby drawing independently knitted stitches of elastic yarn. Of course, the lever 24 has been actuated just prior to or simultaneously with lever 32 to allow cam 19 to move inwardly against the cylinder. Of course, it will move in on short butts and will actually complete its movement as long butts engage the cam allowing it to pass inwardly to its extreme position.

Referring to Figs. 5 and 9, the sinker cam cap 38 has a slotted plate 39 attached at its upper surface, the rectangular slot formed between the two allowing working movement of a cam stem 40. This cam stem 40 has at its inner end a center sinker cam 41 which engages in front of the sinker butts. Normally this cam is urged inwardly by means of a spring 42 and movement either inwardly or outwardly is limited by adjustable stops 43 and 44 engaged by pin 45. This pin 45 projects up through an elongated slot in the plate 39, Fig. 5. The three armed lever pivoted at 25 has arms 24, 26 and an upwardly extending arm 46 which is bent as at 47, Fig. 7, to engage a projection 48 adjustably attached by the screw 49 at the outer end of cam stem 40. As the link 27 is moved to actuate this three armed lever, center sinker cam 41 and elastic stitch drawing cam 19 are simultaneously moved. As the cam 19 is projected in to control needles to knit or to inlay the elastic, the sinker cam will move outwardly thereby setting up a sinker wave at the appropriate point in the cycle. Opposite movement as when there is no elastic yarn feeding withdraws cam 19 and allows cam 41 to move inwardly so that there will be no sinker wave at the auxiliary or elastic yarn feeding point.

In Fig. 12, cams have been shown diagrammatically while dot and dash lines indicate pathways taken by needle and jack butts and at the top of the figure, by needle hooks. A yarn feeding finger 50 feeds elastic yarn 1 while one of a

series of inelastic yarn feeding fingers 51 feeds the inelastic yarn 7 at a different point. On the cam plate 18 is the usual raise cam 52 and a main cam block carries the back stitch cam 53, top center cam 54 and a lower center cam 55. Of course, there is a front stitch cam but since that is movable when tucking, it is not shown in this particular figure.

At the elastic yarn feed a top instep cam 56 extends along to a point at which a second part of the cam 57 acts to lower needle butts for contact with cam 54 in a manner described in Patent #2,260,020. A series of selecting cams 58, only one of which is shown here, will select butts which are moving in a pathway 59 so that a master butt on the jacks may engage a cam 60 to be raised for taking the elastic yarn 1. The elastic stitch cam 19 is here shown in a position for drawing needles down to a lower or knitting level. If moved upwardly, as before explained, needles would only be drawn down far enough to inlay the elastic yarn. At the upper part of Fig. 12 the pathway of needle hooks is represented by a dot and dash line and at 60' the lowest point of draw as for knitting is shown, while at 60'' the path of needle hooks for inlaying is evident.

The cam 61 which is fixed raises needles high enough to take the inelastic yarn at the main mouthpiece but does not raise them to a latch clearing position. The tuck cam 62 does raise those needles having jacks to a latch clearing position so that so long as the tuck cam is in against the cylinder, alternate needles will be raised for clearing and knitting while intermediate needles tend to be raised only to a height for taking yarn. The front stitch cam which is movable in and out as described in co-pending application Serial #391,231, may be moved at every other course and when in position, will raise all needles for clearing and knitting. This makes it possible to tuck at every other or at desired courses on intermediate needles, that is, those having no jacks.

The cam 41, Fig. 5, being in outermost position when cam 19 is in against the cylinder will set up the necessary sinker wave at the elastic yarn feed and thus sinkers are moved outwardly so that the elastic may be measured forwardly of the sinker nibs, but thereafter, when sinkers move inwardly, the said elastic yarn will be engaged in the throats and will be held down as needles are later manipulated at a subsequent point.

Referring to Fig. 4 a modified form of the invention is shown in which the elastic yarn is drawn over the nibs of sinkers. This makes it possible to get a greater amount of elastic into the fabric so that lateral extensibility may be increased. Sinkers 63 have flat topped nibs 64 over which the elastic yarn may be drawn. As these sinkers approach the elastic feeding point, they are specially controlled since alternate sinkers have short butts 65 while intermediate sinkers have long butts 66.

Now referring to Fig. 13 which is very similar to Fig. 5 the construction of the movable center cam for controlling sinkers at this point includes a sinker cam cap 67, a plate 68 attached thereto and forming a groove or slot within which the sinker cam stem 69 is free to slide radially, all as described with respect to the original form of the invention. The sinker cam itself has two steps, one of which is indicated at 70 and the other of which is designated by numeral 71. The

step 10 affects short butts 65 only. The step 71 affects long sinker butts 66. It can be seen that as sinkers approach the elastic yarn feeding point, this double stepped sinker cam will move sinkers having long butts outwardly while those having short butts will be allowed to pass the elastic feeding point in such position that they will have the elastic yarn drawn over the tops of their nibs as shown in this Fig. 13. Immediately thereafter the sinkers having long butts will be pushed in to a position as indicated in Fig. 4 where the nib of each intermediate sinker will engage over the elastic yarn to hold the fabric down and also to cast off the old loop in the event the elastic yarn is actually being knitted.

In this form of the invention, as in that previously described, the elastic yarn may be drawn down to such an extent that the old loop will be cast from the needle thereby forming independent stitches of elastic yarn. For inlaying, the needle is not drawn down to such an extent as for knitting and the old loop is not cast off. Of course, in this modified form of the invention tension on the elastic is much greater than in the form first described. By varying the tension ultimate lateral stretch of the product will be regulated.

The elastic yarn is drawn over nibs of alternate sinkers and the intermediate sinkers are controlled as just described above for casting off (in the event of knitting) and in either knitting or inlaying, serve to hold the fabric down on the needles as they are eventually raised prior to approaching the main yarn feeding or next following feeding station.

In the operation of the machine for producing a stocking top such as illustrated in Figs. 1 and 2, upon starting off, the elastic yarn 1 is thrown into operative engagement with needles at the elastic yarn feed. Needle dividing means also becomes effective to raise alternate needles for taking that yarn and one or more revolutions of the machine are made depending upon the number of strands of elastic ultimately to be present in the first inelastic yarn course. After the requisite amount of elastic yarn has been loaded in needle hooks, the inelastic yarn 7 starts to feed at the main feeding point. At this particular time the movable, elastic stitch cam 19 will be in its raised position since the cam 34 will not be affecting lever 32 to push that cam downwardly. Also the control of the said cam as affected by the three armed lever will have been operative so that cam 19 will have moved inwardly to draw needles down to the inlaying level while cam 41 or double step cam 70—71, as the case may be, will have been pulled outwardly thereby setting up a sinker wave as has been explained.

For a predetermined number of revolutions of the machine, courses will be knitted such as from A to B, Fig. 1, in which the elastic yarn will be inlaid. In addition to the control of cams at the elastic yarn feeding station, the front stitch cam (not shown) will be specially controlled to move in and out at every other course thereby causing the production of tuck stitches in intermediate wales.

Courses C and D may or may not be knitted before the change to knitting the elastic is effected, but if they are, the tuck control as by the front stitch cam is discontinued. If desired, more than two courses such as C and D may intervene.

Beginning after the course D, upon a definite

and predetermined movement of the main cam shaft, drum 35 will advance cam 34 raising link 33 so that cam 19 will move down to stitch drawing position, it being understood that adjustments are such that both the inlaying and the stitch drawing position of this cam will properly carry out its function for either the method practiced in Figs. 3 and 3a or that of Fig. 4. Also tension on the elastic yarn will be varied accordingly. After cam 19 moves down to stitch drawing level, the fabric will be knitted in accordance with courses E and F in which the elastic yarn is knitted and inelastic cast off at alternate wales and in alternate courses, that is, if we are to consider the course of elastic yarn as an independent and distinct course in the fabric. It is probably more properly termed a separate and distinct course insofar as the method of knitting is concerned, while from the point of view of the finished fabric, when the tension in the elastic has contracted it so that the stitches lose their identity and the elastic pulls alternate wales together thereby simulating a rib appearance, it does not appear a distinct course in the fabric. This may be continued throughout the remainder of the top portion 10, Fig. 2, and is carried to any desired extent.

The fabric and method as herein described are incidental to knitting this type of fabric on circular, independent needle knitting machines such as the well-known Banner hosiery knitter, but the principles of the invention apply insofar as they pertain to other types of knitting machines and the scope of the invention is limited only by the appended claims.

I claim:

1. A plain (not rib) knitted stocking top having a selvage and being formed from elastic and inelastic yarns and wherein the said elastic yarn is incorporated under tension to be held at spaced wales by inlaying in the first few wales adjacent the selvage and in the remaining part of the top by knitting.

2. A plain (not rib) knitted stocking top having a selvage and being formed of elastic and inelastic yarns, the elastic yarn being incorporated under tension and being held at spaced wales as an inlaid yarn at alternate wales of an inelastic yarn fabric for a few wales adjacent the selvage, and being held throughout the remainder of the top in which the elastic is incorporated, as a knitted elastic yarn at the same alternate wales.

3. A plain (not rib) knitted stocking top formed from elastic and inelastic yarns and having a selvage in which an elastic yarn is passed through all loops of an initial inelastic yarn course, several courses following said selvage being knitted at alternate wales from the inelastic yarn and having that said yarn tucked at intermediate wales while the elastic yarn is incorporated to be held as an inlaid elastic yarn, the fabric following said few courses being knitted of inelastic yarn at alternate courses and with elastic yarn knitted independently at intermediate courses but at alternate wales only.

4. A plain (not rib) knitted stocking top formed from elastic and inelastic yarns and having a selvage in which an elastic yarn is passed through all wales of an initial inelastic yarn course, several courses following said selvage having an inelastic yarn knitted at alternate wales and tucked at intermediate wales while the elastic yarn is inlaid to be held at tucked wales of said inelastic yarn, fabric following throughout the remainder of the

top having inelastic yarn knitted at all wales and elastic yarn held by knitting at alternate wales in some of the courses.

5. A plain (not rib) knitted stocking top formed from elastic and inelastic yarn and having a sel-
 5 vage in which an elastic yarn is passed through all loops of an initial elastic yarn course, several fol-
 lowing courses having the said inelastic yarn knitted at alternate wales and tucked at inter-
 10 mediate wales with the elastic yarn inlaid to be held in tuck wales, and following courses through-
 out the remainder of the top being alternately knitted from inelastic yarn drawn into stitches at
 all wales and elastic yarn drawn into independ-
 15 ently knitted stitches at alternate wales only.

6. A method of forming a plain knitted (not
 rib) elastic stocking top including the steps
 of knitting a selvage at which elastic yarn pre-
 vents running of a first inelastic yarn course,
 knitting inelastic yarn throughout the remainder
 20 of the top and inlaying elastic yarn to be held at
 spaced courses for a few courses following the
 selvage and then knitting said elastic yarn at
 spaced courses throughout the remainder of the
 said top.

7. A method of forming a plain knitted (not

rib) elastic stocking top including the steps of
 forming a selvage by incorporating an elastic yarn
 to pass through all loops of an initial course of
 inelastic yarn, continuing the knitting of said in-
 elastic yarn throughout the remainder of the top
 and tucking said yarn at spaced wales, inlaying
 an elastic yarn to be held at said tucked spaced
 wales for the first few courses and thereafter
 knitting said inelastic yarn at spaced courses and
 10 knitting said elastic yarn at spaced wales only in-
 termediate said spaced inelastic yarn courses.

8. A method of forming a plain knitted (not
 rib) elastic stocking top including the steps of
 forming a selvage by incorporating an elastic yarn
 in such a manner as to pass through loops of an
 initial inelastic yarn course and to lock said
 course against raveling, then continuing the knit-
 ting of said inelastic yarn by knitting it continu-
 15 ously at spaced wales and tucking at intermediate
 wales while incorporating the elastic yarn to be
 held at intermediate tucked wales by inlaying, and
 thereafter knitting said inelastic yarn and incor-
 porating the elastic yarn by knitting it at spaced
 wales but floating it over intermediate wales.

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