

Feb. 5, 1935.

E. E. CARLSON

1,989,913

RUNPROOF OR RUN RESISTANT KNITTED FABRIC AND METHOD OF KNITTING SAME

Filed June 1, 1931

3 Sheets-Sheet 1

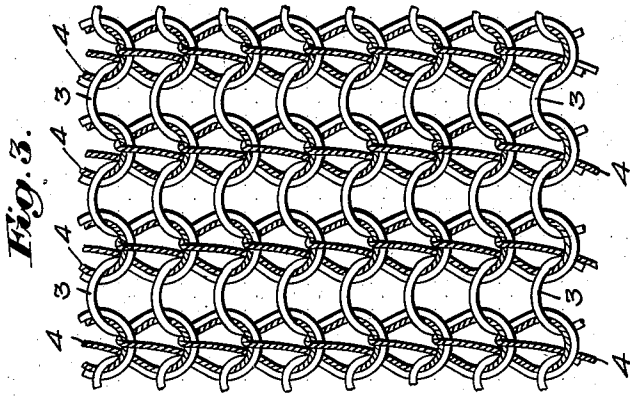


Fig. 2.

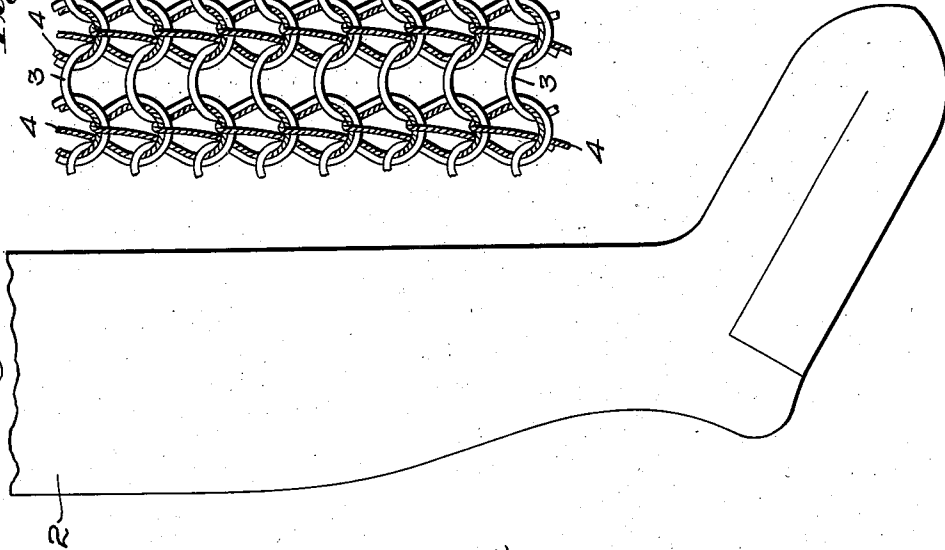
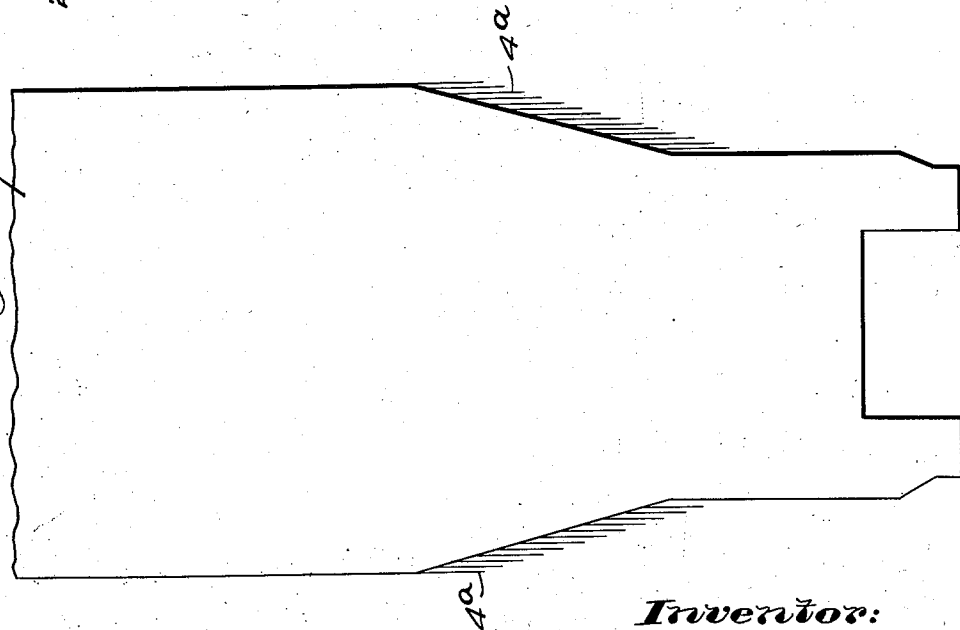


Fig. 1.



Inventor:
Ellsworth E. Carlson
by Emery Booth Varney & Townsend
Attys.

Feb. 5, 1935.

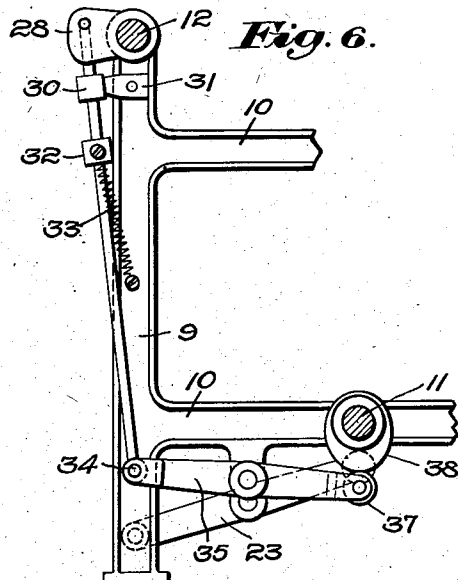
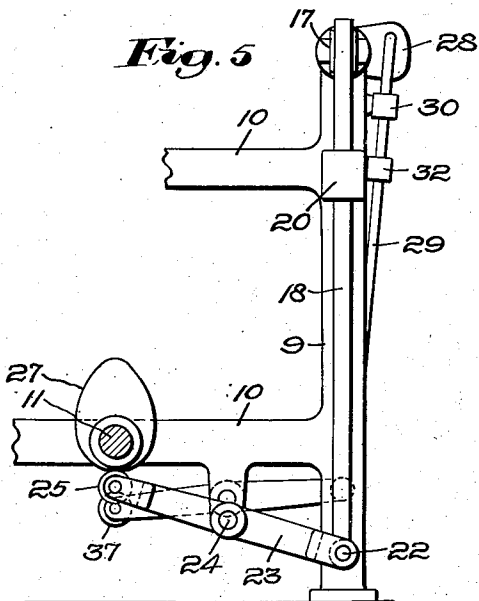
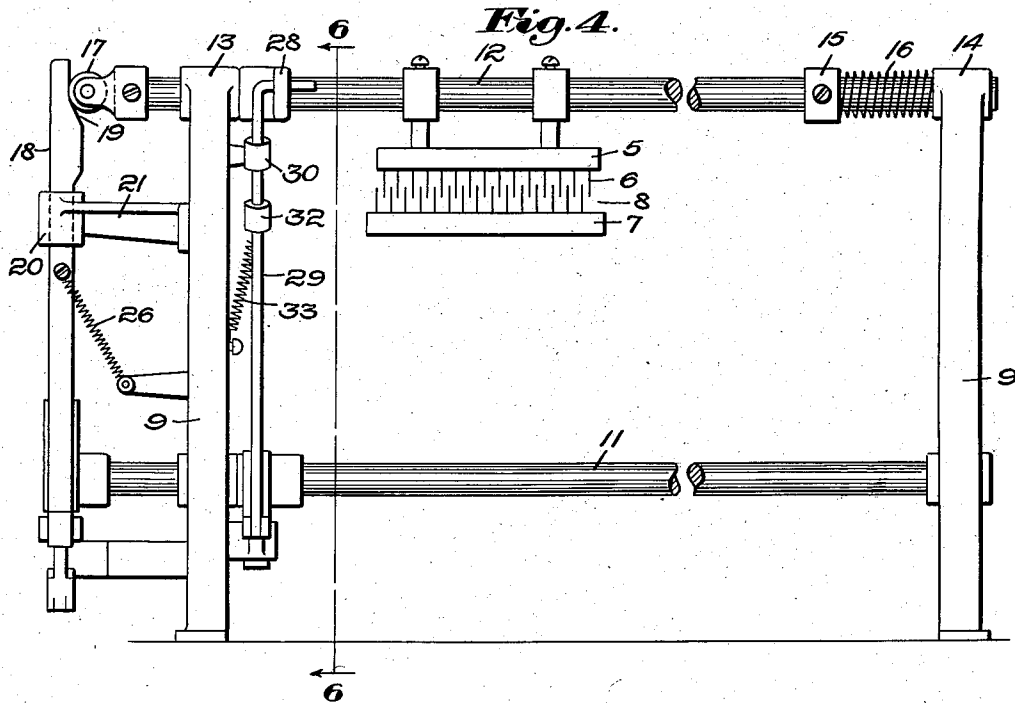
E. E. CARLSON

1,989,913

RUNPROOF OR RUN RESISTANT KNITTED FABRIC AND METHOD OF KNITTING SAME

Filed June 1, 1931

3 Sheets-Sheet 2



Inventor:
Ellsworth E. Carlson,
by Emery Booth Varney Townsend
Attys

Feb. 5, 1935.

E. E. CARLSON

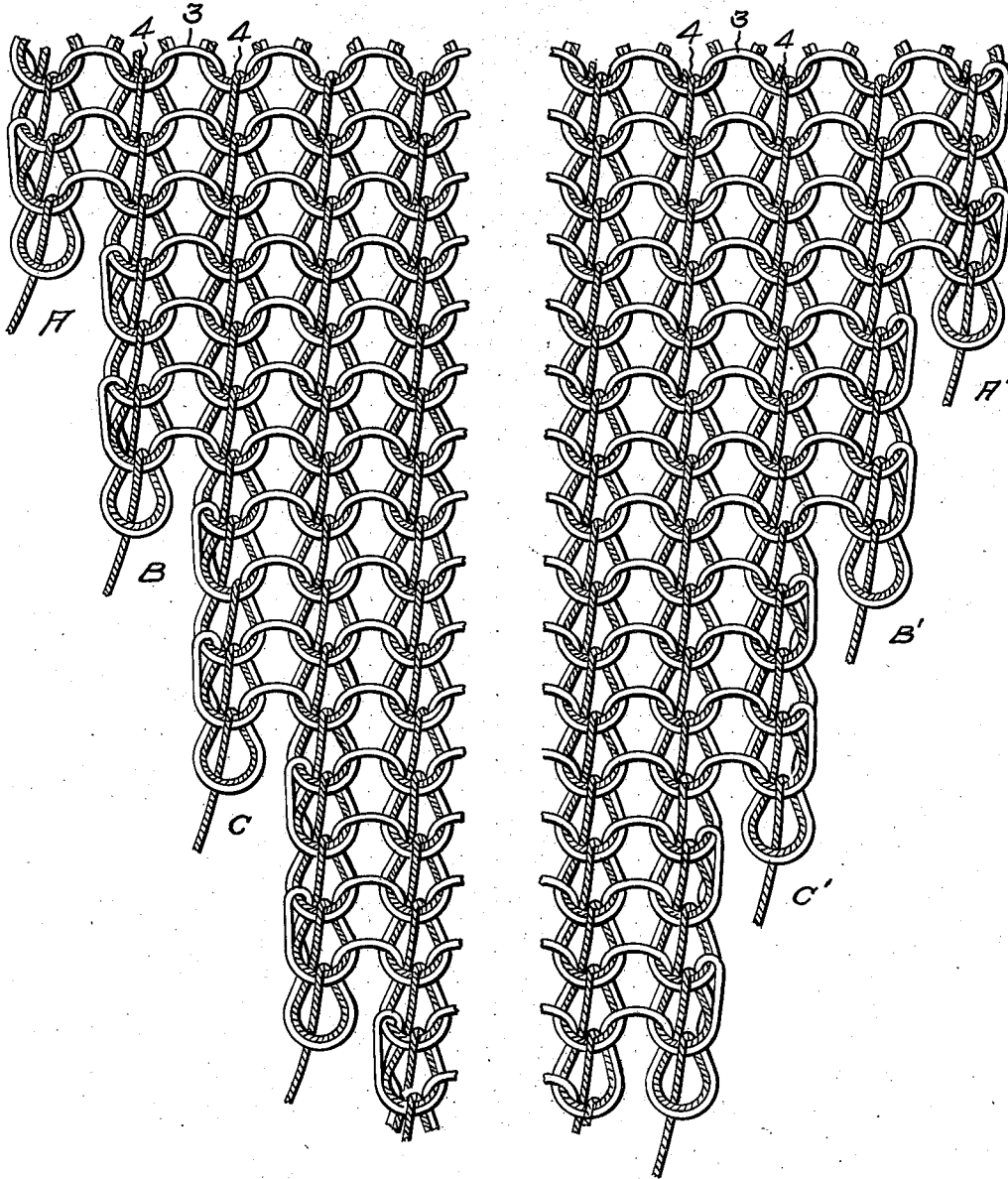
1,989,913

RUNPROOF OR RUN RESISTANT KNITTED FABRIC AND METHOD OF KNITTING SAME

Filed June 1, 1931

3 Sheets-Sheet 3

Fig. 2.



Inventor:
Ellsworth E. Carlson
by Emory Booth, Vining and Townsend
Attys.

UNITED STATES PATENT OFFICE

1,989,913

RUNPROOF OR RUN-RESISTANT KNITTED FABRIC AND METHOD OF KNITTING SAME

Ellsworth E. Carlson, Hornell, N. Y., assignor to Van Raalte Company, New York, N. Y., a corporation of New York

Application June 1, 1931, Serial No. 541,245

5 Claims. (Cl. 66—172)

This invention relates to run-proof or run-resistant knitted fabric, and to the method of and mechanism for knitting the same.

In accordance with the preferred embodiment of the invention, the fabric is a plain fabric made upon a full-fashioned machine and is particularly adapted to be used for hosiery, but within the scope of my invention may be used for other purposes.

In order that the principle of the invention may readily be understood, I have disclosed in the accompanying drawings one embodiment of the fabric of my invention and one form of means for making the same, and shall describe the best mode known to me for making the fabric, and shall also refer to mechanism whereby certain subsidiary or adjunctive operations are carried out in connection with and as a part of the invention.

In the said drawings—

Fig. 1 is a plan view of part of a full-fashioned stocking blank made in accordance with my invention, the foot portion of the stocking not being shown;

Fig. 2 is a side elevation of the completed stocking, the upper part thereof being broken away;

Fig. 3 is a detail, upon a very greatly enlarged scale, of the outer face of the fabric to show the main yarn or thread and the additional yarns or threads which are introduced into all the needle wales in order to make the fabric run-proof or run-resistant;

Fig. 4 is a front elevation of parts only of a full-fashioned knitting machine, merely to show how the movements are imparted to the guide bar for the additional or secondary yarns or threads;

Fig. 5 is a left hand end elevation of the structure shown in Fig. 4;

Fig. 6 is a vertical transverse section on the line 6—6 looking toward the left in said figure; and

Fig. 7 is a detail, upon a very greatly enlarged scale, of the outer face of the fabric to show the main yarn or thread and the additional or warp yarns or threads introduced into all the needle wales to render them run-proof or strongly run-resistant and showing how the fabric is fashioned by discontinuing needle wales, the central portion of the fabric being broken away to save space.

While the invention is not restricted to a fabric to be used only for hosiery, the invention is particularly adapted to such use, I have therefore chosen to illustrate my invention as a full-fashioned stocking and have illustrated sufficient

of the mechanism to make the same, in order that the invention may be understood.

The knitted fabric may be and preferably is a plain fabric such as made upon a full-fashioned hosiery machine having a large number of sections upon each of which a stocking leg, or if desired a stocking leg and foot, is knitted. Any suitable hosiery yarn or thread may be employed as the main yarn, as, for example, silk, artificial silk, rayon, cotton or wool. In Fig. 1, I have represented at 1 the blank which includes part of the leg, the ankle and the heel, and in Fig. 2 I have represented the stocking at 2, the upper part thereof being broken away, but it preferably having the usual welt at the upper end. The yarns or threads may be changed from time to time in knitting the stocking as may be necessary, for example, at the end of the welt. Also reinforcing yarns may be introduced at the desired points, as, for example, in the heel and in the sole, and at the toe.

In Fig. 3 I have at 3 indicated the stitches or loops made by the main knitting yarn or thread. A fabric made only as indicated by the yarn 3 is not run-proof or run-resistant. It is the purpose of my invention to make a fabric which is run-proof in both directions or run-resistant throughout the entire extent thereof. This I accomplish, in accordance with the disclosed embodiment of the invention, by introducing into each needle wale a separate yarn or thread, four of which are shown in Fig. 3 at 4.

Each of the threads or yarns 4, which themselves may be of any suitable material but preferably silk, is introduced by means of a guide bar indicated at 5 in Fig. 4 and having yarn or thread guides 6, one for each needle, the latter being spring beard needles. The said guides are mounted in suitable relation to the needle bar 7 and the needles 8 thereof. The guides and the needles are shown merely diagrammatically and not for the purpose of showing the actual number or the actual spacing thereof. It will be understood that the number of needles and the number of guides are sufficient for the purpose of knitting the stockings and that as many heads or units will be provided in the machine as may be necessary. The main yarn 3 is introduced in the manner used in full fashioned machines, being traversed from edge to edge of each section of the fabric, and the loops or stitches of the main yarn are formed in the usual manner.

As shown most clearly in Fig. 3 each yarn 4 is introduced into all the loops of its own needle wale only. The knitting yarn, as stated, is intro-

duced in the usual manner by a yarn guide that is traversed back and forth the entire width of the fabric but, as will be pointed out hereinafter, the fashioning of the fabric is preferably not effected by transferring the loops, but by successively shortening the traverses of the yarn guide for the main knitting yarn or thread. As shown in Fig. 3, each yarn 4 lies in parallelism with the loop of the knitting yarn inside the same, and at the top of the loop the yarn or thread 4 passes to the back of the previous loop and the yarn 4 therein, and then passes in front of the same down through the next loop when the same has been completed, passing to the back of such loop and then participates in the formation of the next loop in the next course, and the described operation is continued from course to course. The said yarns or thread 4 do not enter into or become incorporated in the sinker wales. Each and every needle stitch is accurately measured by reason of the fact that in full-fashioned knitting machines, the sinkers and dividers apportion accurately the amount of thread which shall enter into each needle loop and the spring beard needles are all drawn down together. This avoids the inevitable slight robbing incident to the production of circular knit fabric made by independently operated needles.

The warp threads 4 for each section of the machine are or may be mounted upon a single short beam, so that all the threads for that section are controlled from a single point. Preferably I provide suitable tensioning means for each such beam, which may be of a positive let-off character, instead of the spring tension ordinarily used upon a Tricot machine. Thus, each warp needle stitch lies in accurate position in essential parallelism throughout with the corresponding stitch of the main knitting thread. By causing each warp thread to pass entirely around a needle in the formation of the warp thread stitch, I further guard against any deformation to either the needle stitches or the adjacent sinker stitches.

In order to incorporate the said yarns or threads 4 with the main knitting yarn 3, I impart to the support for the guide bar 5 a longitudinal movement (that is, one lengthwise of the machine) and also a rocking movement (that is, one transverse to the needles). The construction is preferably such that each yarn or thread guide 6 enters between two needles from rear to front, is then moved lengthwise of the machine a distance of one needle, is then swung rearwardly so that each such yarn guide 6 passes between the next two needles, and then is moved longitudinally in the opposite direction, thereby completing a square or rectangle.

In order to impart the described movements, I preferably provide the following mechanism.

Sufficient of the framing of the machine is indicated in Figs. 4, 5 and 6 at 9, the same constituting uprights and cross members 10. In the framing is suitably mounted the cam shaft 11 driven in any suitable manner, and thereon are mounted suitable cams to impart both an axial movement and a rocking movement to a shaft 12 suitably mounted in the upper part of the framing in parallelism with the cam shaft 11. Said axially movable or sliding shaft 12 has suitably secured to and depending therefrom all of the guide bars 5 hereinbefore referred to and only one of which is shown, the said shafts 11 and 12 being broken away so that only a small part of the entire machine is shown. The purpose of imparting both an axial or sliding movement and

a rocking movement to the shaft 12 is to impart the desired movements to the series of thread guides 6 as described. It will be understood that the shape of the cams or other means for imparting the axial and rocking movement to the shaft 12 is varied in accordance with the exact extent and character of said movements, the purpose of the movements being to introduce the series of yarns or threads 4 to the needles so that the said yarn 4 will be incorporated into the fabric as already described.

The following means is shown for imparting the described movements to the shaft 12, and it is to be understood that any other suitable means may be used for the purpose. The said shaft 12 is mounted for axial or sliding movement in the bearings 13, 14 of the framing and is secured thereto by a collar 15 between which and the bearing 14 is a suitable coiled spring 16 tending to slide the shaft 12 to the left viewing Fig. 4. At the opposite end of said shaft 12 is secured a roll 17 which takes against a slide 18 having a cam surface 19. The said slide 18 is mounted for vertical sliding movement in the bearing 20 of a guide bracket 21 secured to one of the uprights 9 of the framing. Said guide 18 at its lower end is pivotally secured at 22 to a lever 23 pivoted at 24 upon the framing and having at its opposite end a cam roll 25 and the said cam roll is held constantly in engagement by means of a spring 26 with a cam 27 fast upon and rotating with the cam shaft 11. The contour of the cam 27 is such as to impart the necessary sliding or axial movements to the shaft 12 so that the yarns or threads 4 will be suitably introduced to the needles which are desirably of the spring beard needle type, as is customary in full fashioned hosiery machines.

In order to impart rocking movement to the said shaft 12 the latter has fast thereon an arm 28 laterally extending therefrom and having suitably connected thereto a rod or link 29 which is mounted for up and down or sliding movement in a bearing 30 upon a guide bracket 31 secured to the frame. The said rod or link 29 has connected thereto a collar 32 to which is connected one end of a coil spring 33, the other end being secured to the framing of the machine. To the lower end of the rod or link 29 is pivotally secured at 34 a lever 35 itself pivotally secured at 36 to the framing and having at its other end a roll 37 bearing against the periphery of a cam 38 fast upon the cam shaft 11. The roll 37 is held constantly in engagement with said cam 38 by the spring 33, and the contour of said cam 38 is such as to impart the necessary rocking movements to the shaft 12 to insure the laying of the threads or yarns 4 in the needles as already described.

I have not illustrated the support for the threads or yarns 4, but it is to be understood that they are wound upon a small warp beam and that the number of the said threads or yarns 4 is the same as the number of active needles (that is, the same as the greatest number of needles active at any time in the production of the hosiery fabric). The number of guides 6 of course is the same as the total number of threads or yarns 4.

Instead of narrowing by transferring stitches as is done at present upon full-fashioned machines, I am able, because of the introduction of the threads 4 throughout the fabric, to fashion without transferring stitches and merely by shortening, preferably automatically, the traverse of the yarn carrier or carriers at those points where it is desired to fashion the fabric, as, for ex-

ample, in the knitting of the calf portion and ankle of the stocking. My invention, however, is not limited to such procedure.

In Fig. 1, I have represented at 4a the free or depending ends of the threads or yarns 4 which exist at those portions of the fabric at the opposite edges thereof where the traverse of the main yarn carrier is made successively shorter as already described. The said free ends 4a are to be trimmed off after the narrowing is effected.

In Fig. 7, I have represented the same structure of fabric that is shown in Fig. 3, it being composed of the main knitting or weft thread 3 and a warp thread 4 for each needle wale and confined thereto. The said figure shows that the fabric is fashioned at the desired points, as for example, at the ankle or calf portion, as indicated in Fig. 1, by terminating from time to time the edge or selvage needle wales. In said figure, I have represented the discontinuance of the two selvage wales A, A', then the discontinuance of the selvage wales B, B', then the discontinuance of the selvage wales C, C', thus indicating that those wales are discontinued without lateral transfer of the terminal stitches thereof, as in the narrowing operation where transfer points are employed. By reason of the presence of warps 4 in the respective fashioning wales A, A', B, B', C, C', etc., all danger of the running of terminal stitches in those wales is prevented.

Where heretofore fashioning has been attempted by terminating needle wales through the action of shortening the traverse of the weft thread, there has always been, so far as I am aware, great danger or liability of the running of the terminated wales, so that any attempt to sew together the selvaged fashioned edges would have to be attended by the most painstaking handling of the fabric.

By providing a warp thread in each selvage or terminated or fashioning needle wale, all danger of the running of stitches in said terminated wales is prevented, and the fabric can be handled with the utmost freedom prior to and during the seaming-up operation.

The foot of the stocking may be made in any suitable manner and may be made directly upon the machine herein disclosed or the legs may be transferred to a footer. Preferably the foot is of the English full-fashioned type with seams upon the sides of the foot. For making the foot I may provide a footer made up of a greater number of sections or may provide a unit foot machine. I have pointed out that in the stocking of my invention, each warp thread is confined throughout to its own needle wale, there being a warp thread for each needle wale and the sinker wales being devoid of warp threads. Inasmuch as it is impossible to maintain during knitting precisely the same minutia of tension on each warp thread as one on the body or weft thread, and as this can only be closely approximated, therefore by keeping the sinker wales devoid of warp threads, there is in my stocking more lateral play or relative yielding between (that is, with respect to) adjacent needle wales with consequent greater lateral expansibility, than if adjacent needle wales were in effect bound together by warp threads each in two or three or other plurality of needle wales; that is, if the warps were incorporated in the intervening sinker wales.

Furthermore, the lateral expansibility of the stocking of my invention is essentially uniform throughout; that is, it is not greater at some points than at others, as would be the case if the

inevitable varyings in tension were not counteracted, as in the stocking of my invention, by keeping the warp threads out of the sinker wales, and therefore not permitting relative yielding.

Contrasting the stocking of my invention with a circular knit stocking wherein the sizes of the stitches vary because of inevitable stitch robbing, it is apparent that there would have to be a corresponding varying in the size of the warp thread portion or element of those stitches, if such a thing were possible. Therefore, there would have to be a varying or different total length or amount of warp thread in different needle wales, which would give a non-uniform appearance and non-uniform openness or closeness of structure of loops in the different needle wales. This would be a very faulty construction.

Furthermore, in a circular knit fabric, the shaping thereof is accomplished by varying the stitch length from time to time or changing the tension of the main knitting thread from time to time, or both. Neither of these procedures would properly cooperate with warp threads in the respective needle wales. When the stitch length is lessened, the warp in each stitch would have to be lessened, and this would accentuate more than before the difference in appearance at the different areas where the stitch length has been changed. If the tension on the warps were changed in a circular knit fabric during the knitting to correspond to changes in the tension of the body or weft thread, then the lateral expansibility would be different at the different zones or parts of said circular knit stocking.

It will be observed, therefore, that in the full-fashioned stocking of my invention, the provision of warp threads in the respective needle wales cooperates with the measured stitches of the weft thread, with the result that all the weft thread portions of the stitches are of the same size in each wale, and accordingly there is the same apportionment of warp threads to each of said equal size stitches, with the consequence that the stocking is of uniform appearance and structure throughout.

In my co-pending application Ser. No. 756,742, filed December 10, 1934, I disclose and claim the generic feature of my invention herein specifically claimed as to one embodiment of said generic invention, which generic invention (irrespective of the manner of fashioning the fabric) involves the knitting of a non-run or strongly run-resistant fabric for flat-knit hosiery in which substantially all the stitches thereof, being composed of warp and weft threads, are all of uniform length throughout because of their non-robbed characteristic and because the warp and weft constituents of each loop of a course thereof are all formed at the same time. In this application I claim only that specific form of the said generic invention, wherein a fabric of the said type is fashioned by shortening the traverse of the weft thread at intervals so as thereby to discontinue edge needle wales.

Having thus described one illustrative embodiment of this invention, it is to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

I claim:

1. A full-fashioned or flat-knit, run-proof or strongly run-resistant stocking, consisting of a main or body yarn incorporated into all the wales from edge to edge and all the courses thereof and

a series of additional threads or yarns, one for substantially each needle wale from edge to edge of the fabric and each knitted into all the stitches of its own needle wale and restricted thereto, so that the sinker wales are devoid of additional threads, said stocking being fashioned at intervals along the selvage portions by reason of uncut needle wales discontinued at said intervals without lateral transfer and the traverse of the main or body yarn being correspondingly shortened at the terminal end of each of said discontinued needle wales, each said discontinued needle wale having its said additional thread knitted into each of the stitches thereof from end to end of said wale, each said discontinued needle wale being throughout its entire extent equally run-proof or strongly run-resistant with the needle wales between the said selvage portions, said opposite selvage edges, including the shaped but uncut part of the fashioning wales, therefore presenting acceptable seaming edges along which the stocking is seamed at the back of the leg.

2. A full-fashioned or flat-knit, run-proof or strongly run-resistant, plain-knit stocking of the so-called English foot type, consisting of a main or body yarn incorporated into all the wales from edge to edge and all the courses thereof, and a series of additional threads or yarns, one for substantially each needle wale from edge to edge of the fabric, and each knitted into all the stitches of its own needle wale and restricted thereto, so that the sinker wales are devoid of additional threads, said additional threads extending uninterruptedly throughout the leg portion of the stocking and the instep of the foot, said stocking being fashioned at intervals along the selvage portions by reason of uncut needle wales discontinued at said intervals without lateral transfer and the traverse of the main or body yarn being correspondingly shortened at the terminal end of each of said discontinued needle wales, each said discontinued needle wale having its said additional thread knitted into each of the stitches thereof from end to end of said wale, each said discontinued needle wale being throughout its entire extent equally run-proof or strongly run-resistant with the needle wales between the said selvage portions, said opposite selvage edges, including the shaped but uncut part of the fashioning wales, therefore presenting acceptable seaming edges along which the stocking is seamed at the back of the leg.

3. That method of knitting a full-fashioned or flat-knit, run-proof or strongly run-resistant stocking, including the following steps: knitting a main yarn or thread by traversing the same from edge to edge of the blank in successive courses, to form a flat, selvaged blank for the leg of a stocking, and in so doing shortening said traverse at intervals to terminate, at the selvages at such intervals respectively, the fashioning wales without lateral transfer and thereby shaping or fashioning the said blank at said intervals; throughout the knitting of said leg blank introducing and knitting a separate warp thread into substantially each needle wale of the fabric from edge to edge of the fabric including said fashioning wales, and in so doing restricting each said

warp thread to its own needle wale throughout the extent of such wale; whereby the said blank is rendered run-proof or strongly run-resistant throughout the extent thereof from edge to edge including said fashioning wales and shaped but uncut selvage edges are provided; knitting the foot, heel and toe and seaming the blank including the seaming together of said shaped, uncut, selvaged edges of the leg portion of the said blank.

4. That method of knitting a full-fashioned or flat-knit, run-proof or strongly run-resistant stocking, including the following steps: knitting a main yarn or thread by traversing the same from edge to edge of the blank in successive courses, to form a flat, selvaged blank for the leg and instep of the foot of a stocking, and in so doing shortening said traverse at intervals to terminate, at the selvages at such intervals respectively, the fashioning wales without lateral transfer and thereby shaping or fashioning the said blank at said intervals; throughout the knitting of said leg and foot-instep blank introducing and knitting a separate warp thread into substantially each needle wale of the fabric from edge to edge of the fabric including said fashioning wales and in so doing restricting each said warp thread to its own needle wale throughout the extent of such wale; whereby the said blank is rendered run-proof or strongly run-resistant throughout the extent thereof from edge to edge including said fashioning wales and shaped but uncut selvage edges are provided; knitting the remainder of the foot and the heel and toe, and seaming the blank including the seaming together of said shaped, uncut, selvaged edges of the leg portion of the said blank.

5. A full-fashioned or flat-knit run-proof or strongly run-resistant stocking or blank therefor, comprising a main or body yarn incorporated into all the wales from edge to edge and all the courses of at least the leg thereof, and a series of additional or warp threads or yarns, one for substantially each needle wale from edge to edge of the said fabric and collectively knitted into substantially all the stitches of all said needle wales, so that substantially each stitch of the main yarn of the said fabric has a stitch of an additional or warp thread, to render the resulting fabric of a non-run character throughout, said stocking being fashioned at intervals along the selvage portions by reason of uncut needle wales discontinued at said intervals without lateral transfer, and the traverse of the main or body yarn being correspondingly shortened at the terminal end of each said discontinued needle wale, each said discontinued needle wale having warp thread loops in substantially all the main yarn stitches thereof, from end to end of said wale, so that each said discontinued needle wale is throughout its entire extent equally run-proof or strongly run-resistant with the needle wales between the said selvage portions, said opposite selvage edges, including the shaped but uncut part of the fashioning wales, therefore presenting acceptable seaming edges along which the stocking is seamed at the back of the leg.

ELLSWORTH E. CARLSON.