June 7, 1960 B. F. COILE ET AL 2,939,303

METHOD OF MAKING A HOSIERY HEEL POCKET

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Fig. 1

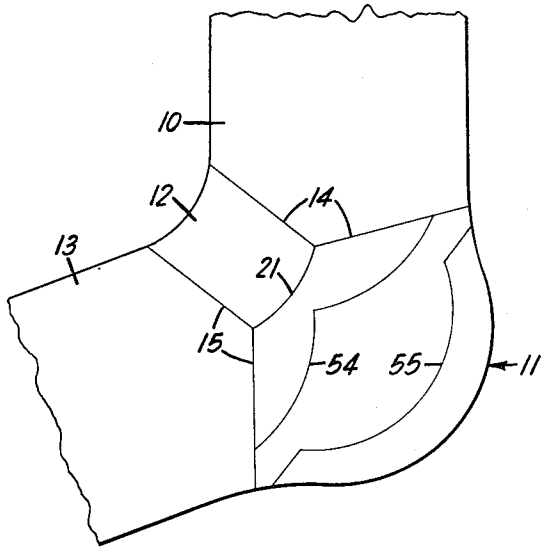
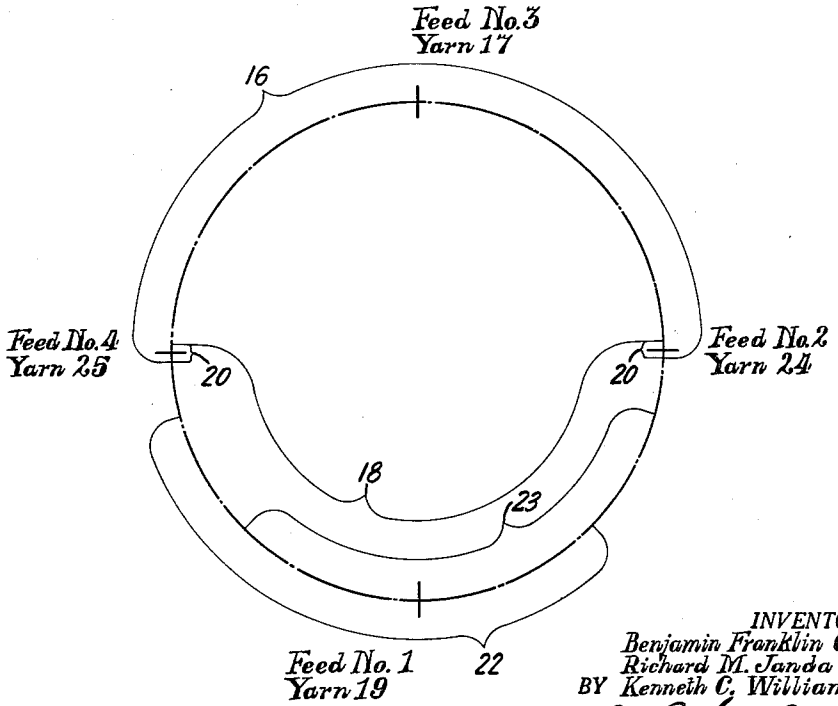


Fig. 3

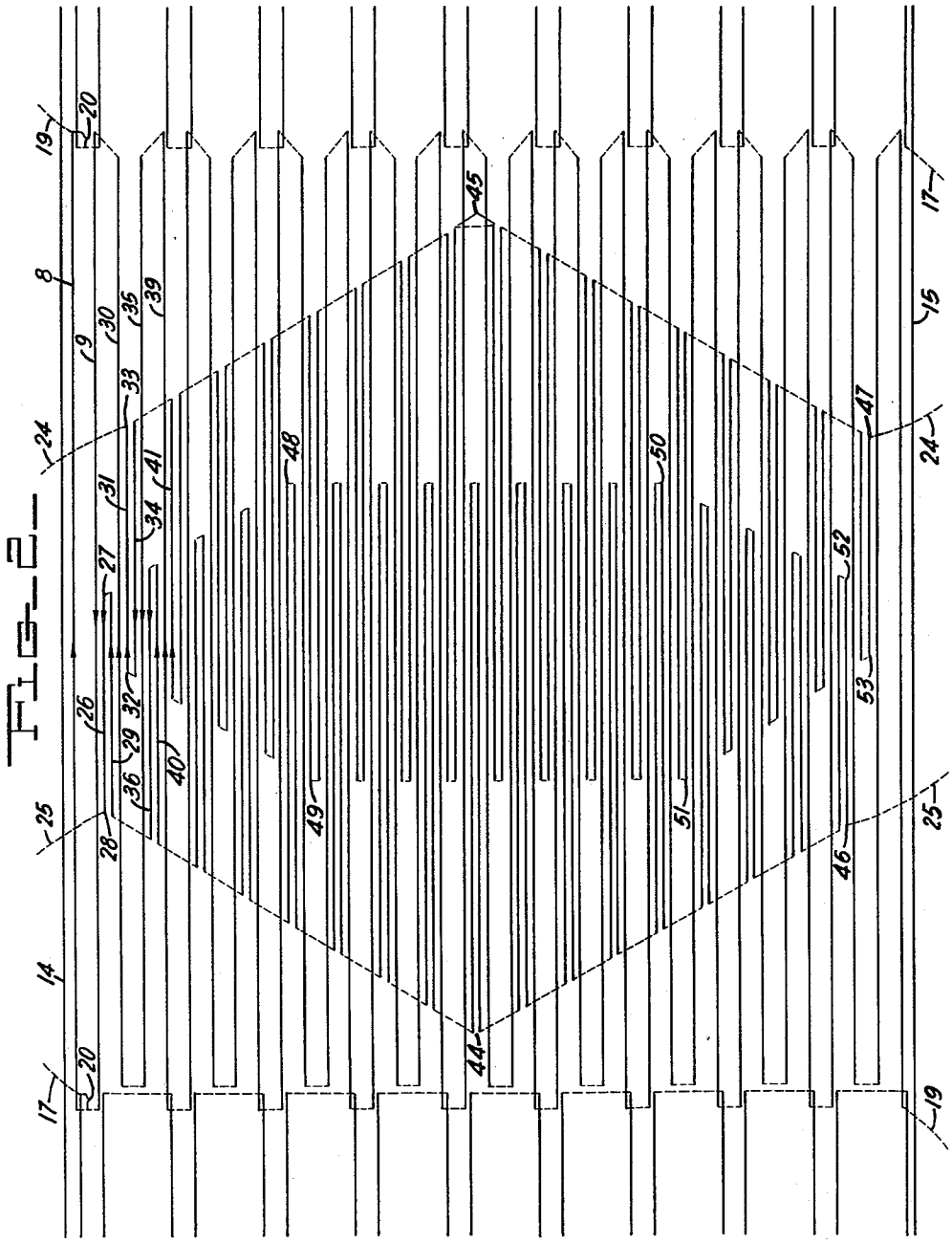


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METHOD OF MAKING A HOSIERY HEEL POCKET

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5 Claims. (Cl. 66—43)

The instant invention relates to circular knit fabrics such as hosiery fabrics, and more particularly to integrally formed pockets in such fabrics and to a method of knitting the same.

While the invention may be employed for a variety of purposes in knitted fabrics, it will be recognized that it is particularly applicable to heel pockets of hosiery and hence this embodiment has been selected for purposes of illustration. In conventional circularly knit stockings the heel pocket is formed during a period of reciprocating knitting by the use of a single feed irrespective of the number of feeds on the machine. It will be understood that the term "feed" is used herein in a sense to include the means for knitting the yarn supplied at such feed. In the conventional method approximately half the circle of the needles which knit the instep are inactivated and allowed to hold their loops while knitting proceeds on the remaining needles with needles being progressively withdrawn from operation until a predetermined minimum number remain in action. The withdrawn heel needles are then progressively returned to action in the reverse order until all are again knitting. The resulting heel pocket is composed of two substantially trapezoidal sections connected at opposite sides by diagonally extending sutures. It will be recognized that due to the fact that the heel pocket is knit by a single feed, the formation of the pocket is necessarily relatively time consuming particularly as compared to multifeed knitting as may be used in other portions of the stocking. Also such heel construction does not have the wear resistance desired.

The instant invention has for its principal object the provision of a method of knitting a hosiery heel pocket on a multifeed circular machine in which a plurality of the feeds are employed.

Another object of the invention is the provision of a stocking or sock made by knitting on a plurality of feeds and in which the diagonally extending suture seams are eliminated.

A still further object of the invention is the provision of such stocking or sock which is stronger at the usual fatigue areas due to the provision of extra courses within said areas.

A further object of the invention is a method of knitting a heel pocket, simultaneously with the knitting of an opposite instep portion, on a four feed machine in reciprocating motion with each of the feeds in operation.

A still further object of the invention is the provision of such method in which the pocket is formed with a different number of courses of yarn in different areas.

Our invention will be more fully understood and further objects and advantages will become apparent when reference is made to the following detailed description and to the accompanying drawings in which—

Figure 1 is a side elevational view of a heel portion of a tubular stocking incorporating the instant invention;

Fig. 2 is a diagrammatic layout view of the course structure of the heel portion and a part of the instep; and

Fig. 3 is a diagrammatic view representing a needle circle and feeding stations of a four feed circular machine and illustrating the selection of needles at said four feeds to perform the method of the instant invention.

For the carrying out of the method of the instant invention and the attainment of the foregoing objects, a four feed machine adapted for reciprocatory operation and with needle selection at each feed is employed such as that shown and described in the co-pending application of Benjamin Franklin Coile, Serial No. 329,801, filed January 6, 1953, to which reference may be made for details of the machine structure and operation. As fully explained in said Coile application, the machine described therein may be operated in both rotary and reciprocating movements. Needle selection is provided at each of the four feeds whereby a group of needles of any desired number may knit at each feed in both directions of reciprocation. These features of the machine are employed in the method of the instant invention and to produce the product thereof as will be more fully explained below.

Referring now to the drawings, there is shown in Fig. 1 a portion of a stocking or sock illustrating the heel construction of the invention, the stocking including a leg **10**, a heel pocket **11**, an instep portion **12** and a foot **13**. The leg and foot may be made in any suitable manner as their construction is not involved in the instant invention, but for purposes of example, they may be considered as being made by round and round knitting at all four feeds whereby high speed production is attained. In Fig. 1 the last course of the leg is indicated at **14** and the first course of the foot is indicated at **15**, the leg and foot being separated by the instep portion **12** and the heel pocket **11** previously referred to.

In carrying out the method on a four feed machine having individual needle selection at each feed as disclosed in said Coile application, at the completion of the leg **10**, the machine, under the control of its patterning mechanism, is thrown into reciprocating operation. Referring now particularly to Fig. 3, where the circle of needles of such machine is indicated by the dot and dash line and the distribution of the four feeds, feeds Nos. 1 to 4 inclusive, around the circle of needles is shown, the needle selecting mechanism of the machine is set up to cause the needles to be selected to knit as they approach certain feeds in two major groups **16** and **18** and two minor groups **22** and **23**, both of the latter being included within the group **18**. The number of needles in major group **16** remains constant and, with the exception noted below, the same is true of group **18**, but the number of needles in the minor groups will be varied from time to time as will be explained later. Major group **16** comprises substantially one-half of the needles and the selection is made so that such needles take and knit a yarn **17** at feed No. 3. Major group **18** comprises the remaining substantially one-half of the needles and the selection is made so that these needles as a group take and knit yarn **19** at feed No. 1. The yarn **17** knit by the needles of group **16** forms the instep portion **12** and the yarn **19** knit by the needles of group **18** form full courses of the heel pocket **11**. Where complete courses are formed consisting of semi-circular instep and heel partial courses, groups **16** and **18** actually each consist of slightly more than one-half of the total number of needles whereby certain needles indicated at **20** are common to both groups and hence take both yarns **17** and **19** to form a suture **21** (see Fig. 1) between the instep portion **12** and the heel

pocket 11. In other full heel courses, where there is no corresponding instep courses, group 18 is reduced by the number of needles in the suture groups 20 as will be later more fully explained. The number of needles in minor groups 22 and 23 vary from time to time and are selected to take and knit yarns 25 and 24 at feeds Nos. 4 and 2, respectively.

Referring now particularly to Fig. 2, when the knitting of the leg 10 is completed with the final course of circular knitting 14, and the machine is in reciprocating motion, in a first forward stroke (a counterclockwise stroke), the needles of groups 16 and 18, both groups including the suture needles 20, take yarns 17 and 19 at their respective feeding stations 3 and 1, to knit a composite continuous course 8 extending the full circumference of the stocking or sock, the two semi-circular sections of the composite course being connected by suture stitches knit of both yarns by needles 20. On the return stroke with the cylinder moving in a clockwise direction a second composite continuous course 9 is knitted by the needles of groups 16 and 18, the two sections of the course again being connected by suture stitches. During this return stroke as the needles of group 18 which have already taken and knit yarn 19 at feed No. 1 approach feed No. 4 certain ones thereof, as determined by the needle selecting mechanism, are selected to constitute group 22 and these take and knit yarn 25 at feed No. 4 to form a first partial course 26, the needle selection being such that, for the embodiment illustrated, the course extends from a point 27 at or relatively adjacent the rear median line of the heel to a point 28 on the opposite side of the median line.

On the second forward stroke of the machine no needles are selected for group 16 so no yarn is taken or knit at feed No. 3 and no semi-circular instep course is formed during this stroke, the needles of the group including the suture needles holding their loops. Also in this stroke the needles of group 22, which may be the same in number as in the forward stroke but are preferably of increased number, take and knit yarn 25 at feed No. 4 to form a second partial course 29 below and successive to partial 26 and, where the number of needles is increased, extending past both ends of the latter course. All the needles of group 18 except the suture needles but including the needles of group 22 then take and knit yarn 19 at feed No. 1 to form a full heel course 30. As the needles of group 18 approach feed No. 2 selection is made of the needles to constitute group 23 which take and knit yarn 24 at feed No. 2 to form a partial course 31. The selection of needles to knit at feed No. 2 is such that the partial course 31 begins at a point 32 at the opposite side of the median line from point 27 and extends across the median line to a point 33.

In the second return stroke of reciprocation the instep needles again are not selected and do not take yarn but the needles of group 23, preferably of increased number over the previous stroke, are selected for knitting at feed No. 2 and take and knit yarn 24 to form partial course 34 successive to partial course 31 and extending past both ends of the latter course. As the needles of group 18, which include the needles of group 23, but not the suture needles, pass feed No. 1 they take and knit yarn 19 to form the complete heel course 35 and as such needles approach feed No. 4, a number thereof is selected to constitute an expanded group 22 to take an knit yarn 25 at feed No. 4 to form partial course 36 extending past both ends of course 29. On the third forward stroke the instep needles of group 16 including the suture needles are again selected for knitting at feed No. 3. A group 22 of the heel needles, preferably increased in number over that of group 22 of the preceding stroke take and knit yarn 25 at feed No. 4 to form partial course 40 successive to and extending past both ends of course 36 and the needles of major group 18, which include both the needles of group 22 and the

suture needles, take and knit yarn 19 at feed No. 1 to form the hull heel course 39 suture connected to the instep course. As the needles of group 18 approach feed No. 2 they are selected to constitute group 23, the selected needles taking and knitting yarn 24 at feed No. 2 to form the partial course 41. The number of needles in group 23 on this stroke is again increased.

On the next return stroke, the instep needles of group 16 are again selected to knit and together with the needles of group 18, and the suture needles forming portions of both groups, form a suture joined complete course. The needles of groups 22 and 23 take and knit yarn at their respective feeds in the manner described above but with a proportionate increase in the number of needles constituting the groups. The operations described above are repeated for the number of courses required to produce the heel pocket 11 and instep portion 12 except that the numbers and arrangements of needles selected to constitute groups 22 and 23 is changed as knitting proceeds as will be observed from Fig. 2. As illustrated by that figure, needles are so selected that the outer ends of the partial courses form diverging lines from points 28 and 33 to approximate points 44 and 45 respectively and then converging lines from points 44 and 45 to points 46 and 47 respectively, and the inner ends of the partial courses form diverging lines from the points 27 and 32 to the points 48 and 49 respectively, then form parallel lines to the points 50 and 51 and finally form converging lines from the points 50 and 51 to the points 52 and respectively.

It will be understood that the disclosure of Fig. 2 is diagrammatic and that the number of courses and the spacing between courses as shown in such figure is only for the purposes of illustration and does not represent the true number of courses or the appearance of the knitted fabric. In the actual product, loops of all courses are drawn of the same or substantially the same length and the added heel courses and partial heel courses provide an excess of fabric causing the same to bulge and form the heel pocket as disclosed in Fig. 1. The lines defined by the ends of the partial courses in one side of the heel product are indicated in this figure at 54 and 55. It will be noted that for each course of the instep portion 12, with the exception of the initial course when reciprocating knitting is started on a forward stroke as described above, there are two courses in the area between suture line 21 and line 54, four courses in the area between lines 54 and 55 and six courses between line 55 and its counterpart on the opposite side of the heel.

The heel structure of the instant invention is free from conventional suture lines and has short suture lines 21 extending substantially longitudinally of the stocking or sock. The partial heel courses of different lengths provide extra material at the points of greatest wear to increase the life of the product. Inasmuch as a multiple number of feeds are employed in the knitting of the heel, production time is greatly reduced over the conventional method. The method of the invention also increases the speed of production over the conventional method due to the fact that a portion of the instep is produced at the same time the heel pocket is knitted.

It will be understood that while the invention is described as using single yarns at each of the feeds, additional reinforcing yarns may be employed as desired, no problem being created thereby. Also, the arrangements and lengths of the partial courses may be varied depending upon the particular results desired, the disclosures of Figs. 1 and 2 in this respect representing a preferred embodiment.

Having thus described our invention in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may be made, all falling within the scope of the invention as defined by the following claims.

We claim:

1. A method of making a hosiery heel pocket during strokes of reciprocatory knitting of a multiple feed circular knitting machine comprising the steps of knitting semi-circular courses of loops on a group of needles at a feed of the machine, knitting partial courses of loops on other groups of needles forming parts of said first mentioned group at another feed, and knitting further partial courses on further groups of needles forming parts of said first mentioned group at a further feed.

2. The method of knitting hosiery during reciprocatory strokes of a circular knitting machine having multiple feeds and needle selection at said feeds, the steps of operating said machine through a stroke of reciprocation and during said stroke selecting a group of needles and knitting thereon at a feed to form a semi-circular instep course, selecting another group of needles and knitting thereon at another feed to form a semi-circular heel course, and selecting a further group of needles constituting a portion of said second mentioned group and knitting thereon at a further feed to form a partial course.

3. The method of knitting hosiery during reciprocatory strokes of a circular knitting machine having multiple feeds and needle selection at said feeds, the steps of operating said machine through a stroke of reciprocation and during said stroke selecting a group of needles and knitting thereon at a feed to form a semi-circular instep course, selecting another group of needles and knitting thereon at another feed to form a semi-circular heel course, and selecting a further group of needles constituting a portion of said second mentioned group and knitting thereon at a further feed to form a partial course, operating said machine through a return stroke of reciprocation and during said return stroke selecting a still further group of needles and knitting thereon at said third mentioned feeding station to form a partial course, reselecting said second mentioned group of needles and knitting thereon at said second mentioned feed to form a semi-circular course and selecting a still further group of needles from said second mentioned group and knitting thereon at a still further feeding station to form a partial course.

4. A method of making a hosiery heel pocket during strokes of reciprocatory knitting on a multiple feed circular knitting machine comprising the steps of knitting semi-circular courses of loops on a group of needles at a feed of the machine, knitting partial courses of loops on other groups of needles forming parts of said first mentioned group at another feed, and knitting further partial courses on further groups of needles forming parts of said first mentioned group at a further feed, the numbers of needles in said other groups and in said further groups varying in successive strokes of reciprocation of the machine.

5. A method of making a hosiery heel pocket and an instep portion during strokes of a period of reciprocatory knitting on a multiple feed circular knitting machine comprising the steps of knitting semi-circular heel pocket courses on a group of needles at a feed of the machine in each stroke of reciprocation during said period, knitting semi-circular instep courses of loops on another group of needles at another feeding station in certain only of the strokes of reciprocation during said period, and knitting at least one partial course of loops on at least one further group of needles, forming a part of said first mentioned group, in each stroke of reciprocation during said period.

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