

Oct. 19, 1965

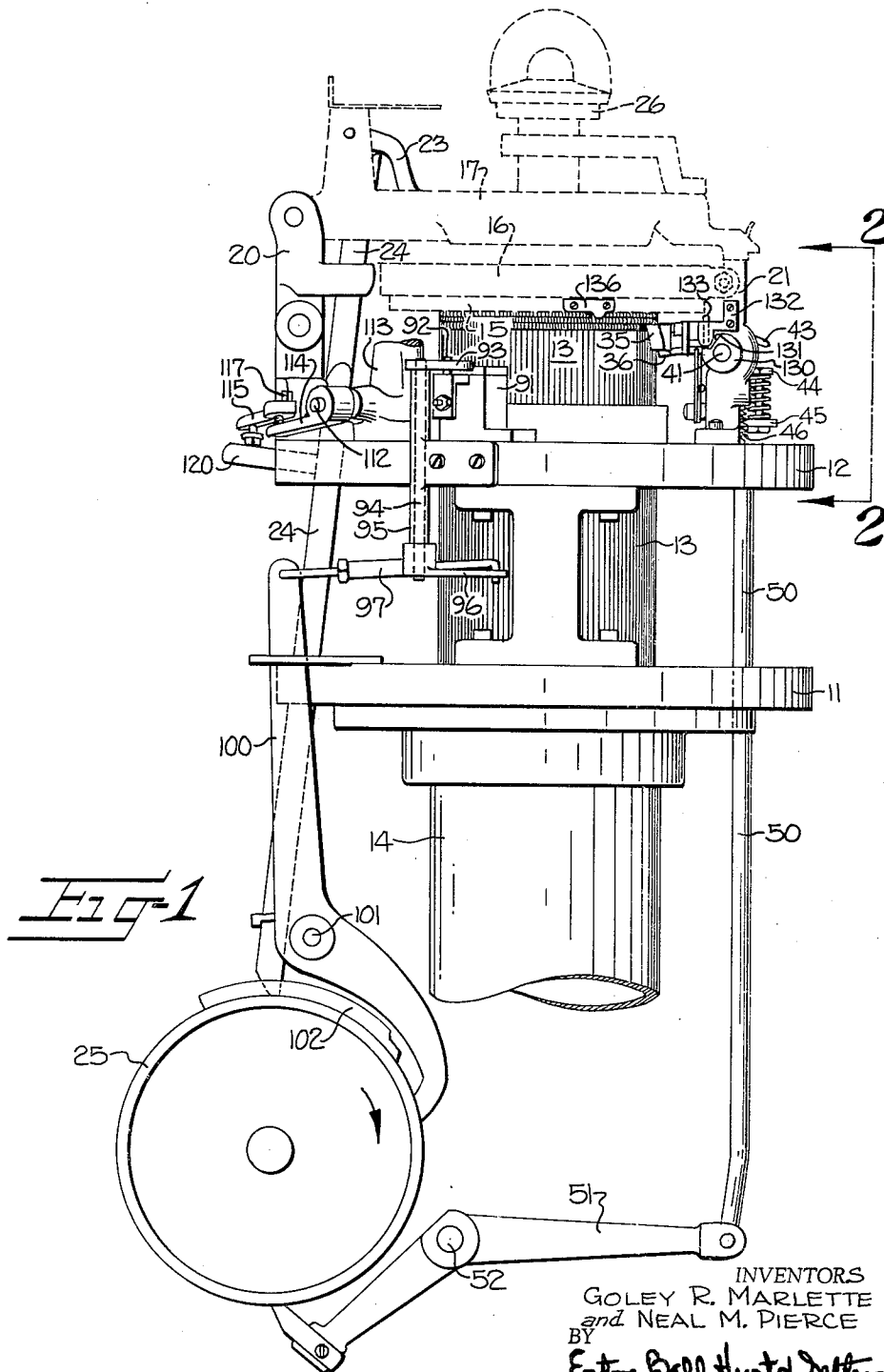
G. R. MARLETTE ET AL

3,212,300

CIRCULAR HOSIERY KNITTING MACHINE

Filed Aug. 3, 1962

4 Sheets-Sheet 1



INVENTORS  
GOLEY R. MARLETTE  
and NEAL M. PIERCE  
BY  
Eaton, Bell, Hunt & Seltzer

ATTORNEYS

Oct. 19, 1965

G. R. MARLETTE ETAL

3,212,300

CIRCULAR HOSIERY KNITTING MACHINE

Filed Aug. 3, 1962

4 Sheets-Sheet 2

Fig-2

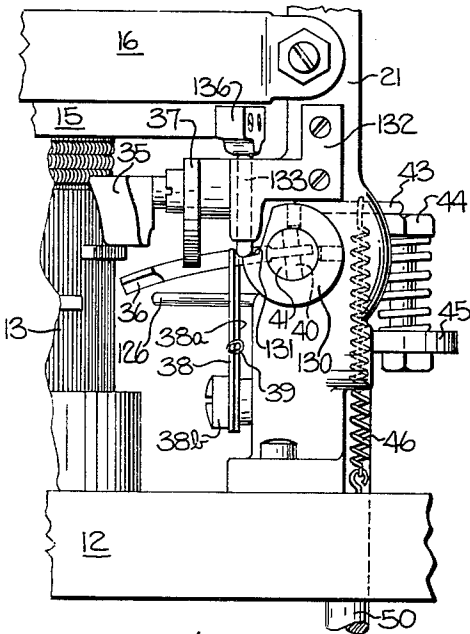
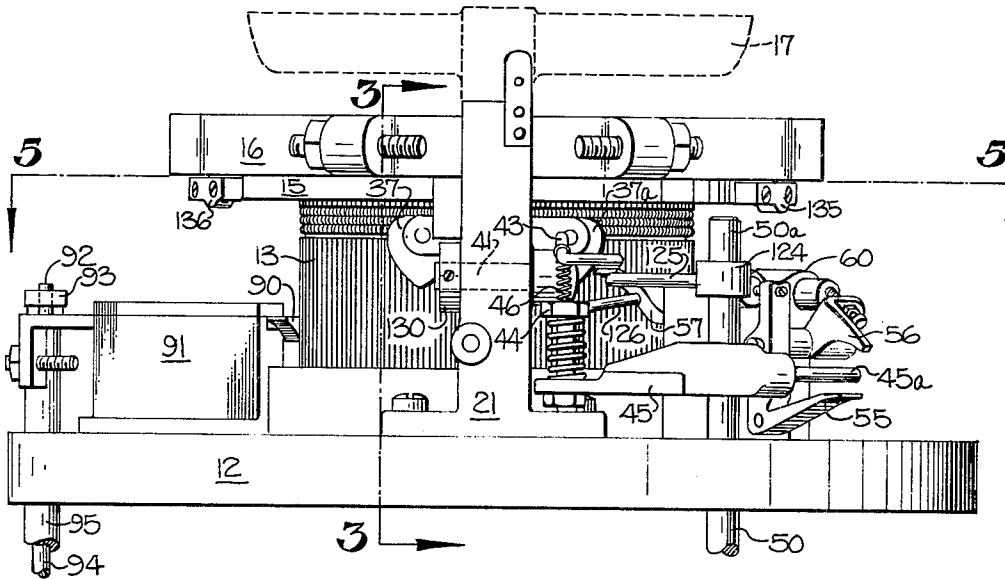


Fig-3

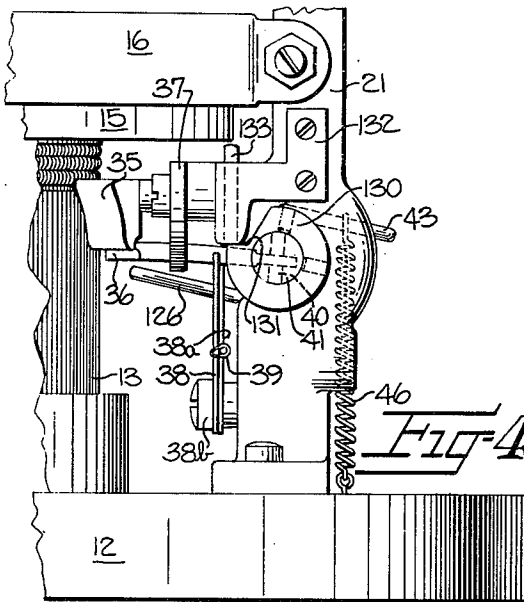


Fig-4

INVENTORS  
GOLEY R. MARLETTE and  
NEAL M. PIERCE  
BY  
Eaton, Bell, Hunt & Seltzer

ATTORNEYS

Oct. 19, 1965

G. R. MARLETTE ET AL

3,212,300

CIRCULAR HOSIERY KNITTING MACHINE

Filed Aug. 3, 1962

4 Sheets-Sheet 3

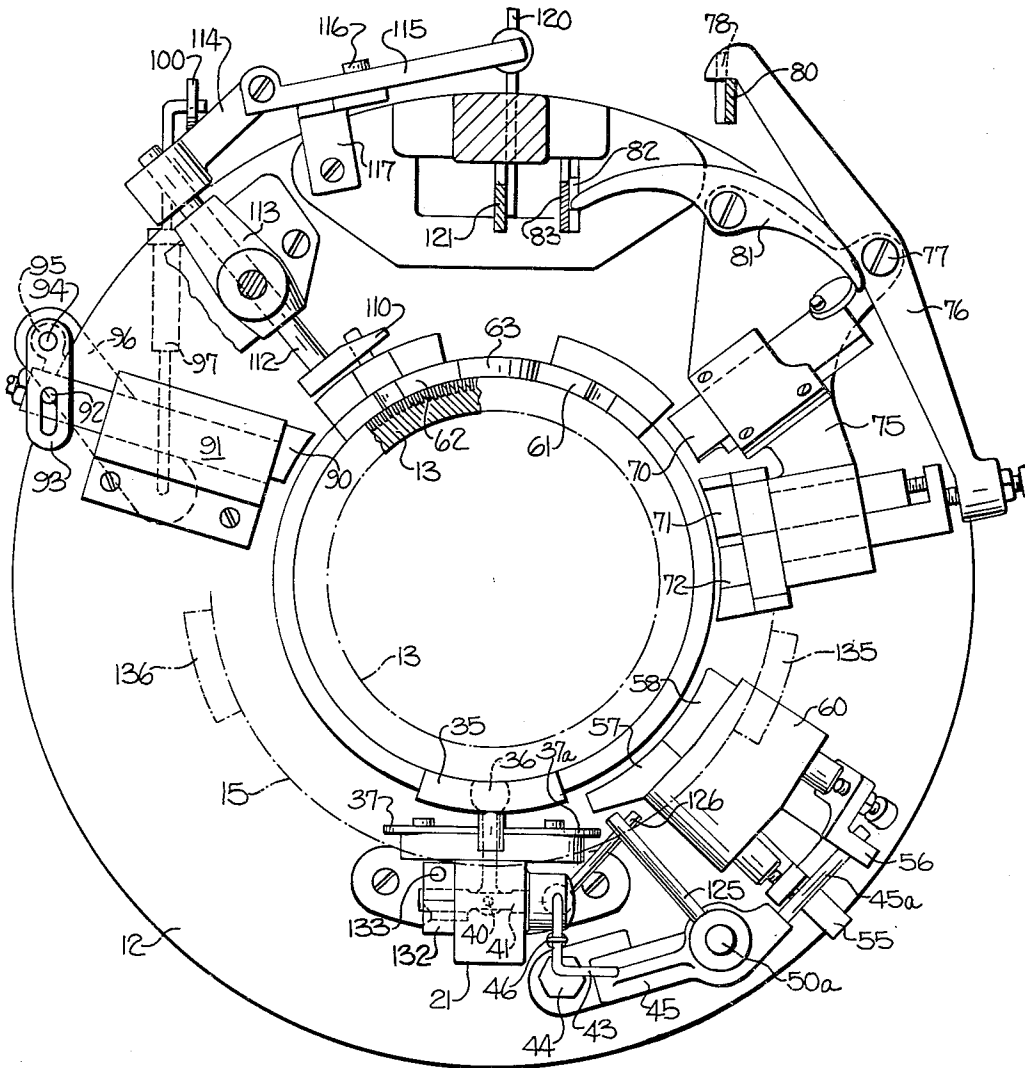


Fig-5

INVENTORS  
GOLEY R. MARLETTE and  
NEAL M. PIERCE  
BY  
*Eaton, Bell, Hunt & Dutton*  
ATTORNEYS

Oct. 19, 1965

G. R. MARLETTE ETAL

3,212,300

CIRCULAR HOSIERY KNITTING MACHINE

Filed Aug. 3, 1962

4 Sheets-Sheet 4

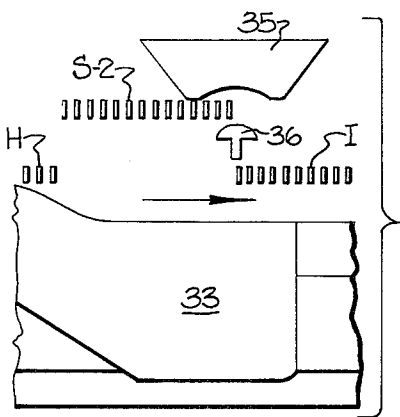
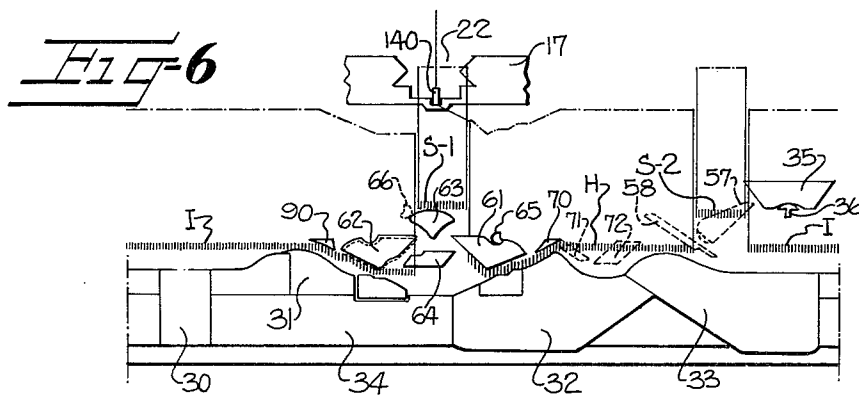


Fig-7

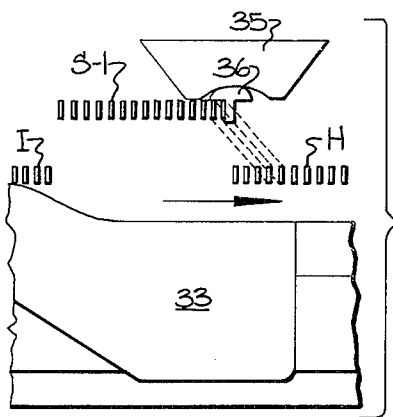


Fig-8

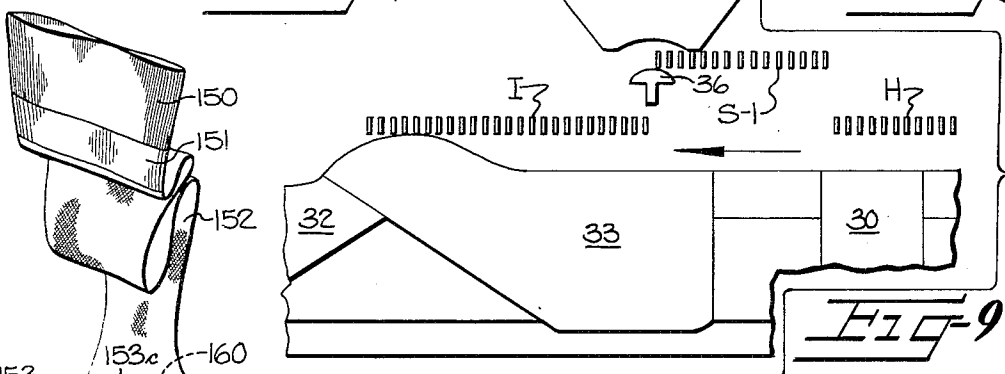


Fig-9

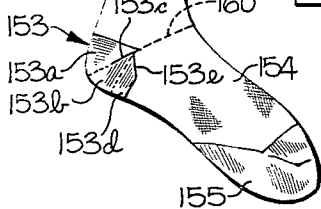


Fig-10

INVENTORS:  
GOLEY R. MARLETTE and  
NEAL M. PIERCE  
BY  
Eaton, Bell, Hunt & Deetz

ATTORNEYS

1

3,212,300

**CIRCULAR HOSIERY KNITTING MACHINE**  
Goley R. Marlette and Neal M. Pierce, High Point, N.C.,  
assignors, by mesne assignments, to Vac Hosiery Cor-  
poration, High Point, N.C., a corporation of North  
Carolina

Filed Aug. 3, 1962, Ser. No. 214,545

6 Claims. (Cl. 66—48)

This invention relates generally to an improved circular hosiery knitting machine and method for controlling the idled instep needles during the knitting of heel pockets and the like and for controlling the widening pick while the heel pocket is being knit. More particularly, the present invention is concerned with controlling the needles of a circular knitting machine of the type which is set up to knit non-run seamless hosiery having regularly recurring tucks in the courses of the leg and foot portions and a reciprocatorily knit heel pocket.

In circular hosiery knitting machines, it is the usual practice to knit a heel pocket by raising the instep needles to an inoperative or idle position where they will pass above the stitch cams and then activate the narrowing and widening picks to form the narrowed and widened gussets of the heel pocket. Then, when the heel pocket is completed, the inactive or idle instep needles are brought back into knitting action by lowering them so that they pass through the stitch cams. When the instep needles are raised to pass over the stitch cams, any stitches on the needles are moved below the needle latches and will be shed or cast from the needles when they are again lowered to stitch drawing level. This raising of the instep needles to an inactive position to pass above the stitch cams is satisfactory when only plain stitches are held on the raised instep needles. However, when recurring tuck stitches are formed in the leg and foot, any tuck stitches retained on the raised instep needles will be moved below the latches to form plain stitches when these needles are again lowered to knitting position. This will cause plain stitches to be formed in every wale across the instep and form a break in the pattern of tuck stitches in the leg and foot, thereby causing a noticeable defect in the hose.

With the foregoing in mind, it is a primary object of the present invention to provide an improved hosiery knitting machine and method for controlling the needles during the knitting of the heel pocket of a non-run hose and for retaining tuck stitches on the instep needles while the heel pocket is being formed, thereby preventing the formation of an undesirable line of plain stitches across the instep of the hose.

The present invention is of particular value in knitting non-run seamless hosiery of the type disclosed in copending application Serial No. 192,925, filed May 7, 1962 and entitled non-run hosiery and method of forming same. However, it is to be understood that the present invention may also be used to prevent the formation of plain stitches across the instep of other types of hosiery in which the leg and foot portions are knit with recurring tuck stitches.

It is another object of the present invention to provide an improved circular hosiery knitting machine including needle cam means for maintaining the instep needles in a lowered inactive position and for directing the same beneath the stitch cams during reciprocation of the needle cylinder and to thereby retain the stitch loops below the latches during the knitting of the heel pocket.

It is a further object of the present invention to provide an improved circular hosiery knitting machine of the type described which also includes cam means carried by the sinker head for rendering the needle widening pick or

2

dropper inactive during certain portions of each swing of the needle cylinder during the knitting of the heel pocket.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary elevation looking at one side of a circular hosiery knitting machine and illustrating portions of the present invention applied thereto;

FIGURE 2 is an enlarged fragmentary front elevation looking in the direction of the line 2—2 in FIGURE 1;

FIGURE 3 is a fragmentary elevation looking in the direction of the line 3—3 in FIGURE 2 and showing the widening pick in a lowered or inoperative position;

FIGURE 4 is a view similar to FIGURE 3 but showing the dropper in a raised or active position;

FIGURE 5 is a sectional plan view taken substantially along the line 5—5 in FIGURE 2 and illustrating some of the cams on the upper bed plate which operate on the needles in the needle cylinder;

FIGURE 6 is a developed view of the needle cams surrounding the needle cylinder and showing the yarn feeding throat in the latch ring;

FIGURE 7 is an enlarged fragmentary elevation of the right-hand end of FIGURE 6 illustrating one position of the widening pick as the butts of the needles pass thereby;

FIGURE 8 is a view similar to FIGURE 7 and showing the widening pick in another position;

FIGURE 9 is a view similar to FIGURES 7 and 8 and showing the widening pick in an inactive position; and

FIGURE 10 is a side elevation of a non-run seamless hose of the type which has a pattern of tuck stitches formed in the leg and foot portions and a reciprocatorily knit heel pocket.

As illustrated in the drawings, the present invention is shown associated with a circular hosiery knitting machine of the type manufactured by Scott & Williams, however, it is to be understood that the present invention may also be applied to other types of circular hosiery knitting machines. Only those parts of the conventional knitting machine which are necessary to an understanding of the present invention are shown in the drawings and these conventional parts of the knitting machine will first be described.

Referring particularly to FIGURE 1, the machine includes a lower bed plate 11 which is supported on the frame, not shown, and an upper bed plate 12 which is supported in spaced relation above the bed plate 11. A needle cylinder 13 is supported for rotational movement in the bed plates 11 and 12 and its lower end is supported on the upper end of a cylinder raising and lowering tube 14 which extends upwardly into the lower bed plate 11. The upper end of the needle cylinder 13 has a sinker head 15 suitably secured thereto in a conventional manner and the sinker head 15 is provided with radial slots in which the usual sinkers, not shown, are mounted. A sinker cap 16 is supported on the sinker head 15 and contains the usual sinker cams, not shown, which control the radial inward and outward movement of the sinkers.

A latch ring 17 is supported in spaced relationship above the sinker cap 16 and its rear portion is pivotally supported on the upper end of a support post 20 and its front portion is supported on the upper end of a bunter or widening pick support post 21. The lower ends of the support post 20 and bunter post 21 are suitably secured to the upper bed plate 12 in a conventional manner. The latch ring 17 contains a yarn feeding throat, indicated at 22 in FIGURE 6, which usually has a plurality of yarn feeding fingers 23 supported on the latch ring 17, as shown

in FIGURE 1, and movable into and out of yarn feeding position. The yarn feed fingers 23 are operated by conventional thrust rods 24, the lower ends of which are at times engaged by suitable cams on a main pattern drum 25. The main pattern drum 25 is moved in a step-by-step manner under control of a pattern chain, not shown, and normally makes one complete revolution during the knitting of each hose.

A dial containing transfer points, not shown, is supported for rotation within the latch ring 17 and is driven by conventional drive means, including a bevel gear indicated at 26 in FIGURE 1. The machine also includes the conventional needle cams (FIGURE 6) which surrounds the needle cylinder 13 and engage the butts of the needles *N* to control their vertical movement in the slots of the needle cylinder 13. The fixed needle cams which are supported on the upper bed plate 12 include a jack gate 30, a left-hand end cam 31, a right-hand end cam 32, a side cam 33 and a filling-in cam 34. A needle leveling cam 35 is supported on the inner end of a stem which extends outwardly and is suitably secured in the bunter support post 21 (FIGURES 3, 4 and 5) in a conventional manner. The inner end of a widening pick or dropper 36 is at times moved to operative position with its upper portion in a depression in the lower portion of the needle leveling cam 35 (FIGURE 8). A pair of cam plates 37 and 37a (FIGURE 2) are supported on the bunter post 21 and adjacent opposite sides of the widening pick 36. A pair of widening pick retaining plates 38 and 38a (FIGURE 3) are pivotally supported at their lower ends as at 38b and their upper ends are resiliently urged into engagement with opposite sides of the widening pick by a tension spring 39 which is connected at opposite ends to the widening pick retaining plates 38 and 38a. The outer end of the widening pick 36 (FIGURE 3) is pivotally supported on a pivot pin 40 which is in turn secured in a pivot shaft 41 mounted for movement in the bunter post 21 in a conventional manner.

As shown in FIGURE 5, the right-hand end of the pivot shaft 41 is enlarged and has one end of a conventional widening pick control wire 43 fixedly secured therein. The control wire 43 is bent and extends outwardly to overlie the upper end of a bunter 44 which is resiliently supported in one end of a switch cam control arm 45. The upper end of a tension spring 46 is suitably secured to the control wire 43 and its lower end is suitably secured to the bed plate 12. The tension spring 46 thus urges the pivot shaft 41 in a clockwise direction in FIGURES 3 and 4 to thereby normally raise the inner end of the widening pick 36 up into operative position with its upper portion extending up into the depression in the needle leveling cam 35.

The control arm 45 is fixedly secured adjacent the upper end of a vertically disposed control rod 50 which extends through and is slidably supported in the bed plates 11 and 12 and its lower end is suitably secured to the forward end of a control lever 51 (FIGURE 1). The control lever 51 is pivotally supported on a shaft 52 and its rearmost end engages the main pattern drum 25 and conventional operating cams thereon, not shown. The cams on the main pattern drum 25 thus control vertical movement of the control rod 50 to thereby raise and lower the control arm 45 and move the bunter 44 into and out of engagement with the control wire 43. Thus, when the bunter 44 and control arm 45 are lowered, the spring 46 will pull the widening pick up into the active position shown in FIGURE 4 and when the bunter 44 and control arm 45 are raised to engage the control wire 43, the shaft 41 will be rotated in a counterclockwise direction to thereby lower the inner end of the widening pick 36 to the inoperative position shown in FIGURE 3.

As shown in FIGURE 5, the control arm 45 is provided with an extension 45a which extends outwardly from the control rod 50 in a direction opposite the bunter 44 and the extension 45a is adapted to engage operating

levers 55 and 56 of respective switch cams 57 and 58. The switch cams 57 and 58 are mounted for radial sliding movement in a cam block 60 which is suitably secured to the upper bed plate 12 in a conventional manner. The switch cam 57 is normally referred to as a needle lowering switch cam and it may be moved inwardly to engage the butts and lower any needles which have previously been traveling a high inactive path above the stitch cams. The switch cam 58 is a needle raising cam and is normally moved inwardly to engage the butts and raise certain groups of needles to a high or inactive position where they pass above the switch cams and do not knit.

The control arm 45 is shown in an intermediate position in FIGURE 2 with both of the switch cams 57 and 58 in their rearmost or inoperative positions and the bunter 44 out of engagement with the widening pick control wire 43. When the control arm 45 is lowered, the extension 45a will engage the control lever 55 to move the switch cam 57 inwardly to an operative position. On the other hand, when the control arm 45 is raised upwardly, the extension 45a will engage the lever 56 and move the switch cam 58 inwardly to operative position and the bunter 44 will engage the control wire 43 to lower the widening pick 36 to inoperative position.

The machine is also provided with the usual needle operating cams at the knitting station (FIGURE 6) including a right-hand stitch cam 61, a left-hand stitch cam 62, a top center cam 63 and a lower center cam 64. The stitch cams 61 and 62 have the usual narrowing or needle raising picks 65 and 66 associated therewith. The right-hand stitch cam 61 is supported for radial movement inwardly and outwardly of the needle cylinder in a conventional manner, not shown, and the left-hand stitch cam 62 is mounted for vertical movement so that the length of stitch being formed may be varied as desired. The manner in which the left-hand stitch cam 62 is raised and lowered will be later described.

As shown in FIGURE 6, the machine is also provided with the usual needle lowering or dividing cam 70 and respective needle raising and lowering cams 71 and 72 which are employed during the make-up and transfer in a conventional manner. However, the conventional dividing cam 70 is also employed in the present invention to lower certain needles to pass beneath the stitch cam 61, for purposes to be later discussed. As shown in FIG. 5, the needle cams 70, 71 and 72 are supported for radial sliding movement in a cam block 75 which is in turn supported on the upper bed plate 12. The needle cams 70, 71 and 72 are normally urged outwardly in the cam block 75 by conventional spring means, not shown, and the position of the needle cams 71 and 72 is controlled by an operating lever 76 which is pivotally supported intermediate its ends as at 77 and its rear end engages a cam plate 78 which is fixed on one side of a thrust rod 80. The lower end of the thrust rod 80 engages the main pattern drum 25 and is at times raised and lowered by suitable cams, not shown, to operate the needle cams 71 and 72 in a conventional manner.

The needle cam 70 is controlled by a lever 81, one end of which engages an adjustable abutment on the outer end of the needle cam 70 (FIGURE 5) and the other end of which engages a cam plate 82 that is secured to one side of a thrust rod 83. The lower end of the thrust rod 83 also engages the main pattern drum 25 and is at times raised and lowered by suitable cams, not shown, to thereby move the needle cam 70 inwardly and outwardly of the needle cylinder.

The parts heretofore described are conventional parts of a circular hosiery knitting machine and while some of these parts, particularly the needle cam 70 and the widening pick 36 are operated in a special manner in accordance with the present invention, these parts are also operated in the conventional manner during the knitting of the portions of other than the knitting of the heel pocket.

5

In order to retain the tuck stitches on the inactive instep needles during the knitting of the heel pocket, the knitting machine has been modified slightly and these modifications will now be described. As has heretofore been mentioned, it is the usual practice when starting the knitting of the heel pocket to raise all of the instep needles to a high inactive level where they will pass above the top center stitch cam 63 (FIGURE 6) and the needles which knit the heel pocket remain at lower level and pass through the stitch cams while the needle cylinder reciprocates. During the knitting of the heel pocket, the narrowing picks 65 and 66 and the widening pick 36 are operated in a conventional manner to knit narrowed and widened gussets in any desired order, in accordance with the type of heel pocket to be formed. Then upon completion of the heel pocket, the switch cam 57 is moved inwardly to lower all of the inactive needles and start rotary knitting in the formation of the foot portion.

On the other hand, in accordance with the present invention, the inactive instep needles are maintained at a low level during the knitting of the heel pocket so that the tuck stitches on the instep needles will remain above the latches. These low instep needles are passed beneath the left-hand stitch cam 62 when the needle cylinder swings in a clockwise direction by a needle lowering cam 90 (FIGURES 5 and 6). The needle lowering cam 90 is mounted for radial sliding movement in a cam block 91 which is in turn suitably supported on the bed plate 12.

An upstanding pin 92 is secured in the outer end of the stem of the cam 90 and passes through the slotted end of a control lever 93. The other end of the control lever 93 is suitably secured to the upper end of a control shaft 94 which is supported for movement in a tubular bracket 95 (FIGURE 1) fixed to the outer periphery of the upper bed plate 12. The lower end of the control shaft 94 has one end of a control lever 96 fixed thereto and the other end of which is suitably connected to the forward end of a control link 97. The rearmost end of the control link 97 is connected to the upper end of a control lever 100, the medial portion of which is pivotally supported on a shaft 101. The lower end of the control lever 100 is shown in engagement with the outer periphery of the main pattern drum 25 and when it moves to the position it occupies when the machine is knitting the heel of a hose, a cam 102 will move under the lever 100 thereby moving the needle lowering cam 90 inwardly to the operative position shown in FIGURE 6.

When forming recurring tuck stitches during the knitting of the leg and foot portions of a hose, it is preferred that the left-hand stitch cam 62 be lowered to elongate the stitches. In the present instance, the stitch cam 62 is lowered to the dotted line position shown in FIGURE 6 by a yoke member 110 (FIGURE 5) one end of which straddles a control pin secured in the left-hand stitch cam 62. The other end of the yoke member 110 is fixed on the inner end of a shaft 112 which is supported for oscillation in a latch guard support post 113. The outer end of the shaft 112 has one end of a lever 114 fixed thereto, the opposite end of which is engaged by an adjustable abutment carried in one end of a lever 115. The lever 115 is pivotally supported intermediate its ends as at 116 on a bracket 117 which is suitably secured to the upper bed plate 12. The other end of the lever 115 has an adjustable abutment which engages an outwardly extending plate 120 which is in turn secured to a thrust rod 121. The lower end of the thrust rod engages the main pattern drum 25 and is at times raised by suitable cams, not shown, to in turn lower the left-hand stitch cam 62.

As shown in FIGURE 2, the upper end of the control rod 50 has an extension 50a which extends upwardly above the control arm 45. A collar 124 is adjustably secured to the extension 50a and has one end of an inwardly projecting control rod 125 suitably secured therein. The control rod 125 extends inwardly and its inner

6

end is normally spaced above the free end of an auxiliary widening pick control wire 126 (FIGURES 2 and 5). The other end of the control wire 126 extends beneath the enlarged end of the pivot shaft 41 and is suitably secured thereto.

The left-hand end of the pivot shaft 41 (FIGURE 2) is provided with a control collar 130 which is fixed on the shaft 41 and is provided with a step or cam surface 131 (FIGURES 3 and 4). A guide bracket 132 is suitably secured to one side of the support post 21 and has a plunger or control pin 133 mounted for vertical movement in its inner end. The lower end of the pin 133 engages the cam surface 131 on the control collar 130 and the upper end thereof normally extends above the surface of the guide bracket 132 when the widening pick 36 is in its raised or operative position, as shown in FIGURE 4.

The upper end of the control pin 133 is positioned adjacent the outer periphery of the sinker head 15, as shown in dash-dot lines in FIGURE 5, and is in alignment with a pair of control cams 135 and 136 (FIGURES 2 and 5) which are suitably secured to the outer periphery of the sinker head 15. As is most clearly shown in FIGURES 2 and 3, the control cams 135 and 136 extend downwardly below the level of the lower surface of the sinker head 15 and with reciprocation of the needle cylinder 13, during the knitting of the heel pocket, the cams 135 and 136 alternately engage and lower the plunger or control pin 133 to thereby rotate the control collar 130, the pivot shaft 41 and lower the widening pick 36 to the inoperative position shown in FIGURE 3. As soon as the cam 135 or 136 passes the control pin 133, the tension spring 46 will return the widening pick 36 to the operative position shown in FIGURE 4. The purpose of lowering the widening pick 36 for short periods during each reciprocation of the needle cylinder will be described in connection with the method of operation which follows.

As shown in FIGURE 6, the throat opening 22 in the latch ring 17 is provided with a special yarn feeding finger 140 as well as the conventional yarn feeding fingers, not shown. The yarn feeding finger 140 is used to feed the yarn to the needles during the knitting of the heel pocket. Since the instep needles are maintained in a low inactive position during the knitting of the heel pocket, it is necessary to feed the heel yarn at a lower than normal elevation to prevent the yarn from becoming cut by the trimmer, not shown, which is positioned at the outer edge of the dial of the knitting machine. As shown in FIGURE 6, the yarn feed finger 140 is positioned in a groove in the throat plate and the lower surface of the throat plate extends below the level of the latch ring 17.

#### Operation

In order to facilitate the description of the operation of the machine, the knitting of a complete hose, such as that illustrated in FIGURE 10, will be described. As shown in FIGURE 10, the hose includes a conventionally knit turned welt 150, a shadow welt 151, a leg portion 152, a heel pocket 153, a foot portion 154 and a toe pocket 155.

The hose is knit from top to toe and the turned welt 150 is formed in the conventional manner by the use of the transfer points, not shown, and then the shadow welt 151 is formed. During the knitting of the welt 150 and shadow welt 151, all of the needles N are active and move from right to left in FIGURE 6. The needles are raised to shed level by the right-hand stitch cam 61, pick up yarn in their hooks from the usual yarn feed finger in the throat opening 22 and are then lowered to stitch drawing position by the left-hand stitch cam 62.

In the present instance, the leg 152 is knit in the manner disclosed in said copending application and will be only briefly described in the present application. During the knitting of the leg 152, the right-hand stitch cam 61 is moved outwardly to inoperative position and the left-hand stitch cam 62 is moved to the dotted line posi-

tion in FIGURE 6 to form longer than normal stitches. As explained in said copending application, the non-run fabric is formed by feeding yarns at the yarn feeding station 22 at two different elevations while operating the conventional selecting means in one course to cause every other needle to be raised to shed level and pick up both yarns while the remaining needles are raised to tuck level and pick up only one of the yarns while the other yarn is floated therebehind. Then in the next course the needles which had knit in the preceding course form tucks and the needles which had formed tucks then knit. Thus, in every circular course of the leg 152, half of the needles are raised to form tucks of one of the yarns while the other yarn is floated therebehind. Thus, each course of the leg 152 has regularly recurring tucks, including the last circular course which is knit before making the heel pocket 153. The last circular course of the hose (FIGURE 10) extends completely around the hose and immediately above the upper line of the heel pocket 153 and along the dash-dot line indicated at 160, which extends from one side of the heel pocket and across the instep of the hose to the other side of the heel pocket.

In the present instance, the instep needles, that is, the needles which knit that portion of the last circular course which is indicated by the dash-dot line 160 in FIGURE 10 have longer operating butts than the remaining needles in the cylinder. During the knitting of the last circular course of the leg 152, the needle lowering cams 70 and 90 (FIGURE 6) are moved inwardly to operative position far enough to engage and lower all the instep needles, which have the longer needle butts thereon. Then as the needle cylinder 13 is reciprocated to knit the heel pocket, the cams 70 and 90 alternately lower the instep needles to pass the same below the stitch cams 61 and 62, the stitch cam 61 having been moved back into operative position to knit the heel pocket 153 when the machine goes into reciprocary knitting.

Thus, as the needles travel in a counterclockwise direction or from right to left in FIGURE 6, the long butt inactive instep needles will be lowered by the needle lowering cam 70 to pass beneath the right-hand stitch cam 61. Then, as the needles move in a clockwise direction or from left to right, as shown in FIGURE 6, the needle lowering cam 90 will engage and lower the instep needles to pass beneath the left hand stitch cam 62. During each reciprocary stroke of the needle cylinder, the long butt instep needles are passed beneath the stitch cams by the needle lowering cams 70 and 90 and they do not again form stitch loops until the cams 70 and 90 are withdrawn with completion of the heel pocket 153. Thus, since these instep needles are not raised to shed level at any time during the knitting of the heel pocket, they retain their tuck stitches in their hooks and therefore the pattern of tuck stitches in the leg and foot 152 and 154 is not interrupted by a course of plain stitches along the dash-dot line 160 at the instep of the hose.

The fashioning of the heel pocket of the hose may be accomplished by any one of several known narrowing and widening methods, other than the specific method to be described herein. In any event the instep needles must be maintained at a low level and therefore an additional control for the widening pick 36 has been provided. This control includes the cams 135 and 136 which are fixedly secured to the outer periphery of the sinker head 15 and which engage the plunger or pin 133 (FIGURE 3) to lower the widening pick 36 in timed relationship to reciprocation of the needle cylinder 13 and sinker head 15.

The operation of the instep needle control attachment will be best understood by describing its operation during the knitting of the particular heel pocket shown in FIGURE 10. Following the knitting of the last circular course of the leg 152, the long butt instep needles, those needles which knit that portion of the course indicated by the dash-dot line 160, are passed beneath the stitch cams by the needle lowering cams 70 and 90 (FIGURE 6) dur-

ing reciprocation of the needle circle or cylinder in each direction.

During the knitting of the heel pocket 153, a narrowed gusset, indicated at 153a, is first formed by allowing the narrowing picks 65 and 66 to alternately raise a single needle at the leading end of the group of active heel needles, the group of needles indicated at H in FIGURE 6. As heretofore indicated, this group of needles H have shorter operating butts than the group of instep needles, indicated at I in FIGURE 6, and therefore the heel needles H are not lowered by the cams 70 and 90 so that they pass through the stitch cams during reciprocary knitting of the first narrowed heel gusset 153a. During the knitting of the narrowed gusset 153a the narrowing picks 65 and 66 raise the leading needle of the group H to inoperative or inactive position above the center stitch cam 63 where they form groups of inactive suture or gore line needles indicated at S-1 and S-2.

When the proper number of needles have been idled by the narrowing picks 65 and 66 to complete the narrowed heel gusset 153a, the widening pick 36 is brought into active position by lowering the control arm 45 from the position shown in FIGURE 3 to the position shown in FIGURE 2 to start the knitting of the widened gusset 153b (FIGURE 10). Then the narrowing pick 36 will move up into the needle leveling cam 35 to active position, as shown in FIGURE 6. With the needles traveling from left to right in FIGURE 6, and the widening pick 36 in active position, the leading two needles of the inactive group S-2 would normally engage and be lowered to active level by the widening pick 36. However, before the leading two needles of this group S-2 reach the widening pick 36, the cam 136 will engage and lower the pin 133 to move the widening pick 36 downwardly to inoperative position, as shown in FIGURE 7, so that the widening pick will not lower the first two needles in this group S-2. The widening pick 36 is held in a lower inoperative position by the cam 136 just long enough for the leading needles of group S-2 to pass and then it is released so that the spring 46 will return it to the active position in the needle leveling cam 35, as shown in FIGURE 8. Then, as the butts of the first two inactive needles of group S-1 engage the widening pick 35, they will be lowered and added to the trailing end of the active needles in the heel group H, in the manner indicated in dotted lines in FIGURE 8.

With the next swing of the needle cylinder, the needles will travel from right to left, as shown in FIGURE 9, and the widening pick 36 will be lowered to inactive position by the cam 135 engaging the pin 133 just before the leading two needles of the group S-1 reach the widening pick. Then, the widening pick 36 will be released as the cam 135 passes over the pin 133 so that it can move up into the space between the groups of needles S-1 and S-2 and above the active heel needles H. The widening pick 36 will then be in position to engage and lower the leading two needles in the group S-2 so that they are added to the trailing end of the active heel needles H. Thus, during the formation of the widened gusset 153b two needles are brought into action with each swing of the needle cylinder while one needle is moved to inactive position by the narrowing picks and a gore or suture line 153c is formed between the narrowed gusset 153a and the widened gusset 153b.

After the widened gusset 153b is completed, the control arm 45 is again raised to the position shown in FIGURE 3 to thereby maintain the widening pick 36 in a lowered or inoperative position while an additional narrowed gusset 153d (FIGURE 10) is formed. This narrowed gusset 153d is formed by use of the narrowing picks 65 and 66 only. When the ends of the partial courses of the narrowed gusset are later joined to the stitch loops of the first circular course of the foot 154, they form a gusset or suture line 153e. When a sufficient number of narrowed partial courses have been formed to complete the heel pocket 153, the machine again switches into circular



knitting and the needles which have been raised by the narrowing picks are lowered to active level by the switch cam 57. The switch cam 57 is moved inwardly by lowering the control arm 45 and this moves the control rod 125 into engagement with the wire 126 to thereby hold the widening pick 36 in a lowered inoperative position during rotary knitting so that the cams 135 and 136 do not needlessly move the pick up and down.

After completion of the heel pocket 153 the needle lowering cams 70 and 90 are moved back out of action and the right-hand stitch cam 61 is moved outwardly and the selector mechanism operates on the needles to again produce the pattern of tuck stitches. The left-hand stitch cam 62 is again lowered to form elongated stitches and any desired number of circular courses are knit in the foot portion 154.

In the present instance, a special toe pocket 155 is formed so that the hose may be seamed along the lower portion and the seam will extend longitudinally along the bottom of the foot.

However, it is to be understood that the toe pocket may be formed in any desired manner and it is not necessary to retain tuck stitches on the inactive needles since no pattern of tuck stitches is formed after the toe pocket is completed.

By the use of the presently disclosed machine and method any type of pattern can be knit in the leg of the hose and held on the inactive instep needles during the knitting of a heel pocket so that the pattern can be continued without interruption in the foot portion.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes in limitation, the scope of the invention being defined in the claims.

We claim:

1. An improved circular hosiery knitting machine having a needle cylinder, drive means for reciprocating said needle cylinder during the knitting of a heel pocket, a group of independent vertically movable heel needles in one side of said needle cylinder and a group of instep needles in the other side of said needle cylinder, all of said needles having outwardly extending butts thereon, a knitting station including a pair of stitch cams engageable with the butts of a group of active heel needles during reciprocary knitting of the heel pocket and with each swing of the needle cylinder in each direction, narrowing picks associated with said stitch cams and being operable to engage the butts of the endmost active heel needles and raise the same to an inactive level above said stitch cams during the knitting of the heel pocket, a widening pick being operable to engage the butts of the endmost inactive needles and lower the same to active level during portions of the knitting of the heel pocket, and a sinker head fixedly supported on said needle cylinder and supporting radially movable sinkers which cooperate with the needles in the formation of knit stitch loops, said improvement comprising the combination of

- (1) needle butt engaging cam means positioned in advance of each of said stitch cams for directing said instep needles beneath said stitch cams while retaining previously formed stitches thereon,
- (2) cam means fixed on said sinker head and aligned above said instep needles, and
- (3) operator means positioned for engagement by said cam means and being operable to move said widening pick to an inoperative position when engaged by said cam means.

2. An improved circular hosiery knitting machine according to claim 1 wherein said group of instep needles have longer butts than said group of heel needles, and said needle butt engaging cam means is supported for radial movement relative to said needle cylinder and is

movable inwardly far enough to engage only the longer butts of said group of instep needles.

3. An improved circular hosiery knitting machine according to claim 1 wherein the cam means on said sinker head comprises a pair of spaced apart cams secured to the outer periphery of said sinker head and have cam portions depending downwardly therefrom.

4. An improved circular hosiery knitting machine according to claim 1 wherein said widening pick is supported at one end in a pivot shaft and said operator means comprises a collar fixed on one end of said pivot shaft and having a cam surface thereon, and a plunger having one end in engagement with the cam surface of said collar and its other end positioned to be engaged by said cam means fixed on said sinker head.

5. An improved circular hosiery knitting machine having a needle cylinder, a sinker head fixedly supported on said needle cylinder and supporting radially movable sinkers which cooperate with the needles in the formation of knit stitch loops, a widening pick movable between a raised operative and a lowered inoperative position, and main pattern control means normally operable to render said widening pick continuously operative during the reciprocary knitting of widened gussets in the heel pocket of a hose, said improvement comprising the combination therewith of

- (1) auxiliary widening pick control means operable during portions of each swing of the needle cylinder in each direction to temporarily move said widening pick to a lowered inoperative position during portions of each swing of the needle cylinder in each direction, said auxiliary widening pick control comprising

(a) spaced apart cam means carried by said sinker head, and

(b) operator means interposed between said cam means and said widening pick and engageable by said cam means to move said widening pick to inoperative position while said cam means is in engagement with said operator means.

6. Improved widening pick control means for a circular hosiery knitting machine having a needle cylinder, a sinker head fixed on said needle cylinder, a widening pick supported at one end in the medial portion of a pivot shaft, a post supporting said pivot shaft in a horizontal position, resilient means normally urging said widening pick to an operative position, a first control wire fixed at one end in the upper portion and at one end of said pivot shaft and extending outwardly therefrom in a first direction, a vertically extending control rod, pattern control means at the lower end of said control rod for raising and lowering the same, a control arm fixed on the upper end of said control rod and having a portion adapted to engage said first control wire and move said widening pick to an inoperative position when said control rod is raised to an uppermost position, said improved widening pick control means comprising the combination therewith of

- (1) a second control wire fixed at one end in the lower portion and at said one end of said pivot shaft and extending outwardly therefrom in a second direction,
- (2) an extension on the upper end of said control rod extending upwardly beyond said control arm,
- (3) a second control rod fixed at one end on said extension and having a free end overlying said second control wire and adapted to engage the same and move said widening pick to an inoperative position when said control rod is moved to a lower position,
- (4) cam means fixed on said sinker head,
- (5) a collar fixed on the other end of said pivot shaft and having a cam surface thereon, and
- (6) a vertically disposed plunger having one end in engagement with the cam surface of said collar and its other end positioned to be engaged and lowered by said cam means fixed on said sinker head to there-

**11**

by move said widening pick to its inoperative position while said cam means engages said plunger.

**References Cited by the Examiner****UNITED STATES PATENTS**

596,933	1/98	Burleigh	66—47
818,295	4/06	Rowe	66—47
1,853,519	4/32	Page	66—48
1,893,589	1/33	La Montagne	66—48 X
1,945,227	1/34	La Montagne et al.	66—48
2,217,022	10/40	Lawson et al.	66—43

5

**12**

2,358,641	9/44	Holmes et al.	66—48 X
2,423,989	7/47	Manger et al.	66—50
2,890,577	6/59	Lawson	66—42
3,013,416	12/61	Fregeolle	66—48
3,143,869	8/64	Smith	66—48

**FOREIGN PATENTS**

825,460	12/59	Great Britain.
---------	-------	----------------

10 DONALD W. PARKER, *Primary Examiner*.RUSSELL C. MADER, *Examiner*.