July 5, 1949. L. W. GOTTSCHALCK ET AL 2,474,895

SEAMLESS HOSIERY KNITTING MACHINE

Filed April 10, 1947 2 Sheets-Sheet 1

FIG. 1

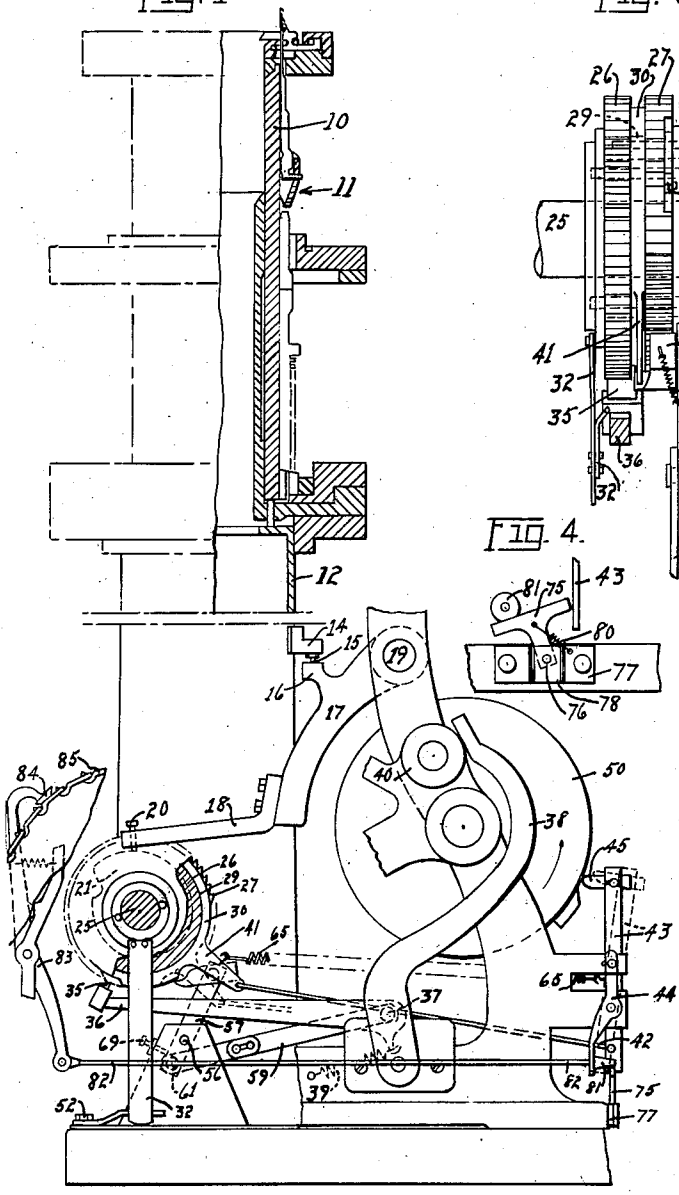


FIG. 3.

FIG 3A

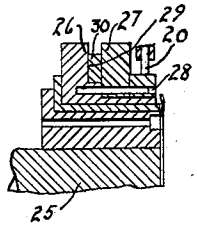


FIG. 4.

FIG. 5.

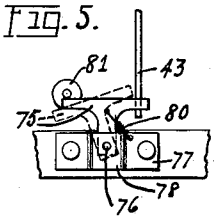
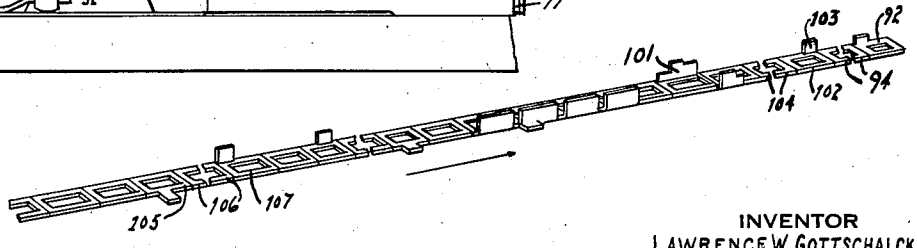


FIG. 6.



INVENTOR
LAWRENCE W. GOTTSCHALCK
AND CHARLES N. WOODROW
BY
Robert Irving Williams
ATTORNEY

July 5, 1949. L. W. GOTTSCHALCK ET AL 2,474,895

SEAMLESS HOSIERY KNITTING MACHINE

Filed April 10, 1947 2 Sheets-Sheet 2

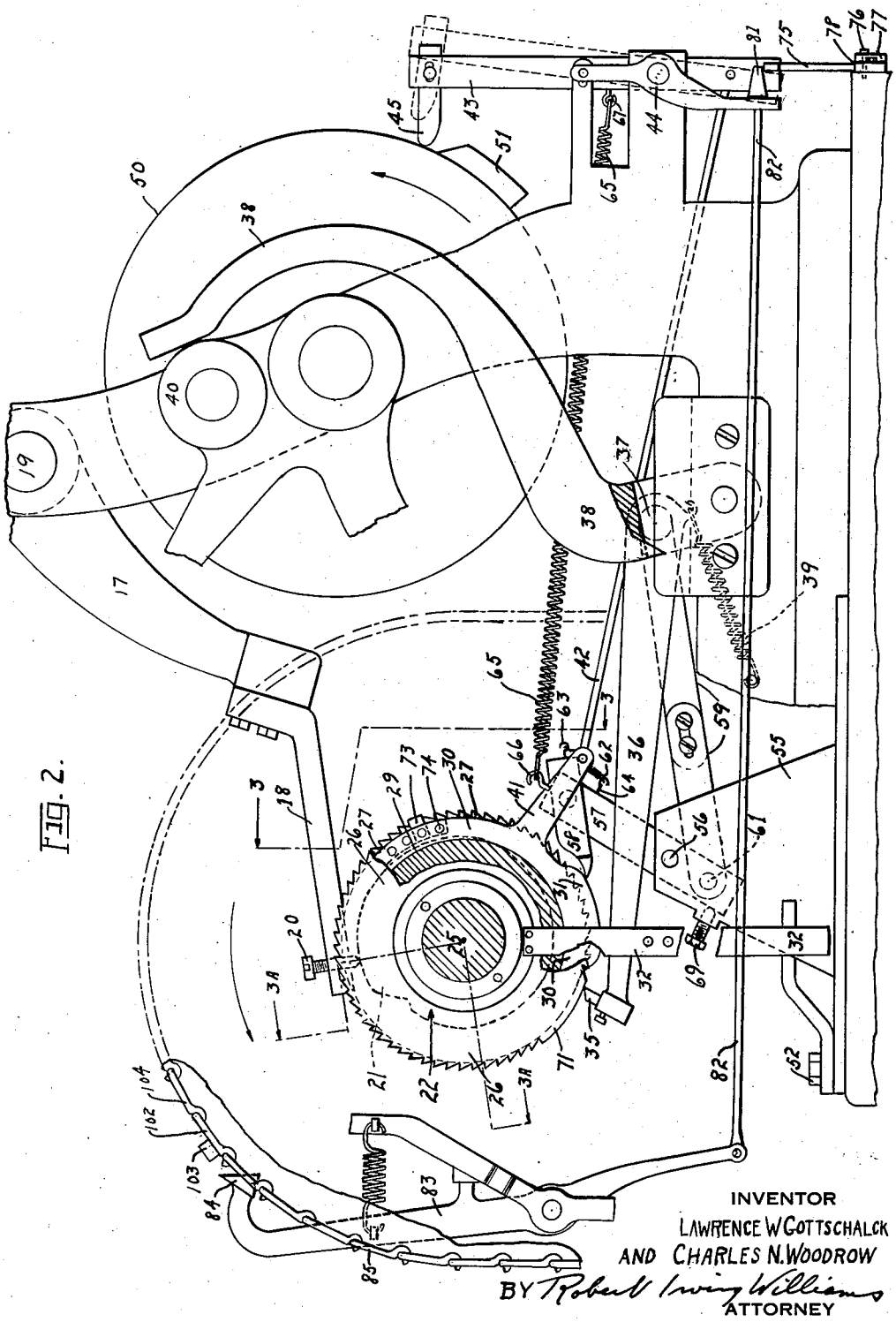


FIG. 2.

INVENTOR
LAWRENCE W GOTTSCHALCK
AND CHARLES N. WOODROW
BY Robert Irving Williams
ATTORNEY

Patented July 5, 1949

2,474,895

UNITED STATES PATENT OFFICE

2,474,895

SEAMLESS HOSIERY KNITTING MACHINE

Lawrence W. Gottschalck, New York, N. Y., and Charles N. Woodrow, Philadelphia, Pa.; said Woodrow assignor to said Gottschalck

Application April 10, 1947, Serial No. 740,593

18 Claims. (Cl. 66—55)

1

This invention relates to knitting machines and particularly to machines for knitting seamless hosiery. Various changes have been made in such machines thru the years but none of them have been adapted to produce seamless hosiery which fits as well in the angle and instep as does fashioned hosiery. The copending application of Lawrence W. Gottschalck, Serial No. 733,741, filed March 11, 1947, is directed to improvements in seamless hosiery and methods and mechanisms for the production thereof whereby the difficulties in common-place seamless hosiery are overcome. It is an object of the present invention to provide a particularly effective and simple type of such mechanism, and one that is certain in operation and readily controllable to produce a wide variety of desirable types of seamless hose. Another object is to provide a machine which departs in small measure mechanically but in large measure functionally from standard seamless-hosiery knitting machines.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevation partly in section and partly broken away of a machine embodying the invention;

Fig. 2 is a similar view of the lower portion thereof on a larger scale;

Fig. 3 is a sectional detail view along the line 3—3 of Fig. 2;

Fig. 3A is a section on the line 3A—3A of Fig. 2;

Fig. 4 is a perspective view of the trip-holding mechanism showing the rocker arm in one position;

Fig. 5 is a similar view showing the rocker arm in its other position; and

Fig. 6 is a schematic view of a part of the pattern chain.

The invention is exemplified as embodied in a standard Scott & Williams seamless hosiery machine of the basic type disclosed in the Scott et al. Patent 1,569,632 and the patents referred to therein.

The exemplified form of construction comprises a needle cylinder 10 and needle-operating means indicated generally at 11 which may be

2

generally similar to the needle cylinders and the needle-operating means of said patents. The cylinder 10 is supported on a column 12 corresponding to column 280 of said Patent 1,569,632. The column is supported by members 14, 15, 16, 17, and 18 corresponding to the members 287, x, 286, 281, and 2810 of said patent; the lever 17 being pivoted at 19, and the extension 18 carrying an adjustable bearing screw 20 which rides on the surface of an annular cam 21 forming a part of an assembly 22 rotatably mounted on a central assembly including parts corresponding to 80, M, N, and O of the last said patent and forming a unit with shaft 25 corresponding to the shaft 89 in the last said patent. At the front (Fig. 2) of the assembly 22 is a rack wheel 26 and at its rear, just forwardly of the cam 21, is a rack wheel 27 the periphery of which may be completely encircled with teeth. The rack wheels 26 and 27 are secured to cam 21 by a screw pin 28. The rack wheel 26 is formed with an annular recess 29 the inner end of which is outward of pin 28. An annulus 30 having a raised lip 31 fits in this recess. A friction arm 32 (E in said patent) is provided. In order to drive the rack wheel 26 and with it the cam assembly there is provided a pawl 35 carried on a reciprocating lever 36 pivoted at 37 to an arm 38 corresponding to the arm S of said Patent No. 1,569,632 and mounted and operated similarly thereto. Arm 38 is drawn by a spring 39 against cam-shaft 40, corresponding to the shaft *t* of said patent. Spring 39 also keeps pawl 35 pressed against rack wheel 26. Ring 30 has a finger 41 the extreme end of which is connected to a rod wire 42 which runs to the lower end of an arm 43 as mounted on the horizontal loose-course actuating rod 44, the upper end of arm 43 having an adjustable finger 45 riding on the main pattern drum 50 (120 in said patent) in the second line of the drum cams which normally is used for the ring toe. In this cam course a new cam 51 is used, the ring toe cam being transferred to the gussetoe cam course.

On the frame of the machine is fastened, by the same bolt 52 and in the same manner as friction arm 32, a bracket 55 at the top of which is a pin 56 which serves as a fulcrum for a link 57 pivotally holding a pawl 58 and pivotally connected to the rocker arm 38 by a lever 59 and fulcrum pins 61 and 37. Back-racking pawl 58, when active, contacts the teeth of rack wheel 27, and is kept pressed against the rack-wheel assembly by a spring 62 extending from a hook 63 on the rear end of pawl 58 to a hook 64 on lever 57.

Likewise, there is a spring 65 extending from a hook 66 on the upper end of lever 57 to a hook 67 on the front side of arm 43, said tension spring serving both to insure the full backward stroke of pawl 58 and to keep lever arm 43 pressing forward so that finger 45 will be following the contour of its cam path at all times. Lever 59 is made adjustable for length to control the throw of link 57 and hence pawl 58. In addition, for refinement of said throw control there is a screw 69 in an extension on the front end of bracket 55 and which contacts the lower end of link 57 below the fulcrum point 61. It will be seen that the turning-in of screw 69, as long as its end contacts the lower end of the link 57 in the most forward position, of the lower end of the link, will cause an increasingly forward movement of the top end of the link and hence of pawl 58. Similarly the turning-out of the screw will lessen the throw as long as the end of the screw is in contact with the link when the link's lower end is in its most forward position.

The rack wheel 26 is provided with a clear space 71, so that when it is racked counter-clockwise its full measure, motion of the assembly 22 stops. The contour of cam 21 is such that the screw 20 has been gradually lowered during this racking, and, at some time during the racking period, has reached a point where the arm 18 no longer raises the cylinder. The cylinder now being in its lowest position, this results in the knitting of the maximum degree of stitch tightness as may be desired in the ankle. The standard chain 85 (mounted and operated similarly to chain 85 of the Scott Patent 1,152,850) for the contour heel operation has the usual quarter-kick link for moving the cam-block preparatory to going into the knitting of the contour heel. By inserting in the chain, at the properly timed place (as indicated hereafter), a chain link having a quarter-kick lug corresponding to the first step in the regular quarter-kick link which appears later in the chain, the quarter-kick turn of the main drum 50 is effected earlier than ordinarily but with the same preparatory cam-block movement. The movement of the main drum 50 causes cam 51 to turn counter-clockwise, from its previous position at this moment, the short distance necessary for finger 45 to mount it, thus thrusting finger 45 and the upper end of arm 43 to the right. Pawls 35 and 58 extend laterally sufficiently to overlap ring 30 as well as their respective rack wheels. Thus when the arm 43 moves clockwise bringing its lower end to the left, the rod 42 shifts ring 30 clockwise to the extent necessary to bring the raised lip 31 from the position shown in full lines in Fig. 1 where it holds pawl 58 out of the tooth circle of rack wheel 27 to a position shown in dotted lines in Fig. 1 where it depresses the pawl 35 sufficiently so that pawl 35 is completely out of the tooth circle of rack wheel 26 and hence rack wheel 26 is idled. At the same time pawl 58 is permitted to rise into the tooth circle of rack wheel 27 and start the back-racking of cam 21 as rack wheel 27 is turned clockwise. As the assembly 22 turns clockwise the fashioning screw 20 will gradually rise as soon as it contacts the ever enlargening arc of cam 21, causing the cylinder gradually to rise and thus automatically slacken the stitch. The back-racking continues until an idling stud 73 (which may be set at varying positions circumferentially according to which of a series of holes 74 in the face of rack wheel 27 it is screwed into) comes to pawl 58. The proper position of the

idling stud depends on the degree of slackness desired at the instep. The rack wheel 27 is now idled for such—if any—remaining part of the instep which is to be knit before going into the heel pocket. During the heel pocket knitting both rack wheels 26 and 27 remain idled and stationary. Cam 51 on the main pattern drum 50 is (as shown) of sufficient length to contact finger 45 for the degrees of drum revolution which take place during the counter-clockwise racking of the drum preparatory to the heel knitting and during the knitting of the heel. Hence it will be seen that rack wheels 26 and 27 are both out of contact with their respective pawls during the heel knitting and cannot start any motion on the part of the assembly 22. On the completion of the heel in the present instance, main pattern drum 50 receives its regular rack and cam 51 is carried counter-clockwise sufficiently to permit finger 45 to drop off the cam and against the drum 50, thus causing rod 42 to move to the right and causing the idling ring 30 to turn counter-clockwise so that the raised lip 31 is returned to the position where it prevents contact of pawl 58 with its rack 27. Idler 73 also holds out pawl 58 at this point but only until pawl 35 starts racking. At the same time pawl 35 is permitted to again engage the teeth of rack wheel 26 and the assembly 22 is again turned counter-clockwise, the screw 20 again slowly dropping together with the needle cylinder 10. Back wheel 26 is turned counter-clockwise until the clear space 71 again reaches the pawl 35 and then the assembly 22 is idled, its cycle of work completed until the next stocking. It will be seen that in the arrangement heretofore described the cylinder is raised and lowered the same distance on each side of the heel pocket in slackening and tightening the body fabric, the steps of slackening and tightening being so gradual as to be imperceptible to the same degree as in the knitting of the stocking from calf to ankle.

It is essential that no movement of rack wheels 26 and 27 take place during the knitting of the heel pocket or otherwise there will be an unsightly break in the size of the stitches at the instep where the before heel and after heel courses meet. Therefore the distance of the chain link with the quarter kick lug from that part of the chain starting the heel pocket knitting must never be less in terms of courses than the number of courses during which pawl 58 is permitted to back-rack rack-wheel 27 to slacken the stitch before being idled by stud 73. There may be a number of courses of maximum slack fabric after the idling stud 73 comes into action and before the heel knitting starts, according to the arrangement of the chain links and the positioning of idler stud 73. With the mechanism and drum moves heretofore described no such uniformly slack fabric can exist after the heel from the end of the heel pocket knitting, the foot fabric being gradually tightened as rack wheel 26 is being moved counter-clockwise from the time the heel knitting concludes. In many instances this is desirable and the previously described mechanism will be utilized without the mechanism hereinafter described. To perform this idling control operation when desired, however, the present invention in certain of its aspects contemplates the provision of a T-shaped rocker arm 75 pivoted at 76 to a bracket plate 77 attached to the rear side of the machine frame, the inner side of said plate being slotted vertically to permit the mounting of the finger in the slot 78. A spring

80 connects the upper end of the rocker arm to the upper right side (Figs. 4 and 5) of the bracket plate, and normally draws the rocker arm against the side of the lower end of arm 43 so that when the finger 45 at the top of the arm 43 mounts the cam 51 the inward movement of the bottom of the arm 43 permits the right T-arm (Figs. 4 and 5) of the rocker arm to extend behind it and to hold the arm 43 in its moved position regardless of the movement of the drum 50 at the end of the heel knitting. The resulting effect is that rod wire 42 remains thrust forward so that the raised lip of idling ring 30 remains in position to idle pawl 35 and to keep rack wheel 26 from turning to tighten the stitch. Likewise pawl 53 cannot motivate rack wheel 27 during this time as the idler stud on wheel 27 is keeping pawl 53 from turning wheel 27. Hence whatever degree of slackening has been achieved before pawl 58 was idled by stud 73, which must take place previous to the heel pocket knitting, will be continued after the heel pocket in the foot fabric until arm 43 is allowed to resume a more vertical position by the withdrawal of the right end of the crossbar of rocker arm which has been blocking arm 43. To accomplish this, there is provided a cone shaped collar 81 mounted on the end of a striper-operating rod 82 so that the smaller end of the cone extends over the left T-arm of rocker arm 75. Rod 82 (which corresponds to the striper-operating wire (301007) on standard Scott & Williams machines) extends from the front side of the machine under the pattern cam drum and is attached to the lower end of the operating rod lever 83 the upper end of which carries a shoe plate 84 which is depressed whenever there passes over the pattern drum a side lug link of the pattern chain 85 corresponding to chain 85 of Scott Patent 1,152,850. The effect of this depressing is to thrust rod 82 backward. Hence by placing in the correct spot in the foot portion of the chain a side lug chain link such as is commonly used for starting the striper drum elsewhere in the stocking and is such as is listed in Scott & Williams catalogue as No. 100774 (as hereinafter described) the rod 82 can be made to thrust backward at the desired moment. The result of this backward thrust is that the cone-shaped collar presses into contact with the upper edge of the left-hand T-arm of rocker arm 75 to swing the rocker arm from behind arm 43 whereupon spring 65 swings it counter-clockwise (Figs. 1 and 2) so that the finger 45 presses against the drum surface (which is now clear of any cam). Thus the lip on idling ring 30 will no longer prevent pawl 35 from turning the rack wheel 26 counter-clockwise to tighten the stitch but is located to idle rack wheel 27 when idling stud 73 is moved out of the idling position as pawl 35 rotates rack wheel 26 and assembly 22.

The pattern drum 50 and the chain 85 comprise, as in said patents, the control means for the needle-operating means and the other operating and actuating mechanism. The pattern chain 85, as in standard practice, is composed of a variety of types of links including links to control the various standard operations. Link 92 is for the starting of the regular stitch-graduating mechanism to tighten the leg gradually from calf to ankle. Following it are plain links 94 in the number required to permit the desired tightening of stitches between the calf and ankle portions at which latter point the cylinder no longer rests on cam 21 thru screw 20, plus the plain links required to knit the desired length of ankle fabric with uniformly maximum tight stitch. These links are all present in the standard chain, in addition to others. One of the other standard chain links is heel pocket link 101. In advance of the link 101 there is inserted in the chain a quarter-kick link 102 carrying a lug 103 adapted to rack the drum to bring cam element 51 into action to operate lever 43 and arm 41 for back-racking. Following link 102 are plain links 104 in whatever number are necessary to secure the amount of back-racking required until idler 73 is reached, plus the number of plain links for the rows of uniform loops before the heel-pocket where uniformly maximum slackness is desired. There is also inserted a link 105 adapted to act against the plate 84 of the operating rod lever 83 to permit element 75 to move from upright position so that the pawl 35 may rack the cam to tighten the stitch. The link 105 is preceded by a plain links 106 in whatever number necessary to knit the length of fabric after the heel-pocket where uniformly maximum slackness is desired. Preceding the links 106 is the standard link 107 which racks the drum for going out of the heel and which movement we have also used to draw the drum cam element 51 from under the finger 45 to bring lip 31 to position where it idles pawl 58 and permits pawl 35 to again rack cam 21 to gradually tighten the stitch as the knitting proceeds.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is particularly to be noted that while the invention has been exemplified as embodied in a modern Scott & Williams spiral gussetoe machine (Model K 25 step) equipped with contour heel the invention is limited neither to any particular model of Scott & Williams machine nor to machines of the Scott & Williams type. The invention is generally applicable basically and in principle to those circular hosiery machines which knit both the leg and foot portion of a stocking.

We claim:

1. In a circular hosiery machine, in combination, a rotary annular loop-varying stocking-shaping cam, means to rotate said cam on its axis for rotative camming action in one direction to make increasingly smaller loops, means to rotate said cam on said axis in the other direction to make increasingly larger loops and control means for determining the timing and extents of movement in said directions.

2. In a circular hosiery machine, in combination, a rotary annular loop-varying stocking-shaping cam, means to rotate said cam on its axis for rotative camming action step-by-step in one direction to make increasingly smaller loops, means to rotate said cam on said axis step-by-step in the other direction to make increasingly larger loops, and control means for determining the timing and extents of movements in said directions.

3. In a circular hosiery machine, in combination, a rotary annular loop-varying stocking-shaping cam, means to rotate said cam on its axis for rotative camming action in one direction to make increasingly smaller loops, means to rotate said cam on said axis a lesser extent in the other

direction to make increasingly larger loops, and means to again move said cam in said first direction.

4. In a circular hosiery machine, in combination, a rotary annular loop-varying stocking-shaping cam, means to rotate said cam on its axis for rotative camming action in one direction to make increasingly smaller loops, means to idle said cam, means to rotate said cam on said axis a lesser extent in the other direction to make increasingly larger loops, means to idle said cam, and means to again move said cam in said first direction.

5. In a circular hosiery machine, in combination, needle-operationg means, means to control the operation of said needle-operating means, a rotary annular loop-varying stocking-shaping cam, means to rotate said cam on its axis for rotative camming action in either of two directions, and control means for said moving means, the last-mentioned control means being synchronized with the first-mentioned control means.

6. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, and control means for operating one of said pawl-and-ratchet means as the knitting of the ankle portion and the knitting of a foot portion of a stocking is approached and for operating the other of said pawl-and-ratchet means as the knitting of the heel pocket is approached.

7. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, means for rendering a pawl ineffective on its ratchet and means for moving the last-mentioned means from a position where it is operative on one pawl to a position in which it is operative on another pawl at various stages in the knitting of a stocking.

8. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, needle-operating means, control means for said needle-operating means, and means synchronized with said control means for rendering one or the other of said pawls inoperative on its ratchet at selective periods in the operation of a machine.

9. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, an arcuately movable element having a lip extending at least to the peripheries of said ratchets, each of said pawls being adapted to bridge its own ratchet and the path of movement of said lip but not the ratchet of the other pawl, and selectively-controlled means to move said arcuately-movable element to carry said lip between a position where it lifts one of said pawls from its ratchet and a position wherein it lifts another of said pawls from its ratchet.

10. In a circular hosiery machine, in combination, a vertically-movable needle cylinder, a series of independent needles thereon, needle-operating means, control means for said needle-operating means, a vertically-movable support for said needle cylinder, a loop-varying cam, means to movably carry said support on said cam, and selectively-controlled two-way ratchet mechanism for operating said cam in selected directions during the operation of said control means.

11. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, needle-operating means, control means for said needle-operating means, means synchronized with said control means for rendering one or the other of said pawls inoperative on its ratchet at selective periods in the operation of a machine, and means for rendering at least one of said pawls inoperative on its ratchet at a predetermined stage in the operation of said machine.

12. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, an arcuately movable element having a lip extending at least to the peripheries of said ratchets, each of said pawls being adapted to bridge its own ratchet and the path of movement of said lip but not the ratchet of the other pawl, selectively-controlled means to move said arcuately-movable element to carry said lip between a position where it lifts one of said pawls from its ratchet and a position wherein it lifts another of said pawls from its ratchet, and a tooth-bridging member adjustably mounted on one of said ratchets for rendering its pawl inoperative when the ratchet and cam have reached a given point in their rotation.

13. In a circular hosiery machine, in combination, needle-operating means, means to control the operation of said needle-operating means, a loop-varying cam, means to move said cam step-by-step in one direction, means to move said cam step-by-step in the opposite direction, control means synchronized with the aforesaid control means for rendering one or the other of said cam-moving means inoperative, and means for rendering one of said cam-moving means inoperative regardless of the operation of said synchronized means.

14. In a circular hosiery machine, in combination, needle-operating means, means to control the operation of said needle-operating means, a loop-varying cam, means to move said cam step-by-step in one direction, means to move said cam step-by-step in the opposite direction, control means synchronized with the aforesaid control means for rendering one or the other of said cam-moving means inoperative, actuating means for said synchronized means, and means to render said actuating means ineffective for a selected idling period.

15. In a circular hosiery machine, in combination, needle-operating means, means to control the operation of said needle-operating means, a loop-varying cam, means to move said cam step-by-step in one direction, means to move said cam step-by-step in the opposite direction, control means synchronized with the aforesaid control means for rendering one or the other of said cam-moving means inoperative, means for rendering one of said cam-moving means inoperative regardless of the operation of said synchronized means, actuating means for said synchronized means, and means to render said actuating means ineffective for a selected idling period.

16. In a circular hosiery machine, in combination, needle-operating means, means to control the operation of said needle-operating means, a loop-varying cam, means to move said cam step-

by-step in one direction, means to move said cam step-by-step in the opposite direction, control means synchronized with the aforesaid control means for rendering one or the other of said cam-moving means inoperative, and means to render both step-by-step means inoperative for a period prior to the effectiveness of said synchronized means in reversing the operation of said cam-moving means.

17. In a circular hosiery machine, in combination, needle-operating means, means to control the operation of said needle-operating means, a loop-varying cam, means to move said cam step-by-step in one direction, means to move said cam step-by-step in the opposite direction, control means synchronized with the aforesaid control means for rendering one or the other of said cam-moving means inoperative, actuating means for said synchronized means, and means controlled by the first-mentioned control means to render said actuating means ineffective for a selected idling period.

18. In a circular hosiery machine, in combination, an annular loop-varying cam, pawl-and-ratchet means for rotating said cam in one direction, pawl-and-ratchet means for rotating said cam in the other direction, an arcuately movable element having a lip extending at least to the peripheries of said ratchets, each of said pawls being adapted to bridge its own ratchet and

the path of movement of said lip but not the ratchet of the other pawl, selectively-controlled means to move said arcuately-movable element to carry said lip between a position where it lifts one of said pawls from its ratchet and a position wherein it lifts another of said pawls from its ratchet, an adjustably mounted idler member on one of said ratchets adapted to reach one of said pawls while the other is rendered inoperative by said lip, a main pattern chain forming part of the first-mentioned control means, and means controlled from said main pattern chain to control said moving means for said arcuately movable element.

LAWRENCE W. GOTTSCHALCK.
CHARLES N. WOODROW.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
933,443	Hemphill	Sept. 7, 1909
1,236,770	Scott	Aug. 14, 1917
1,569,632	Scott et al.	Jan. 12, 1926
1,891,270	Page	Dec. 20, 1932
2,135,185	Lawson et al.	Nov. 1, 1938
2,369,780	Fregeolle	Feb. 20, 1945