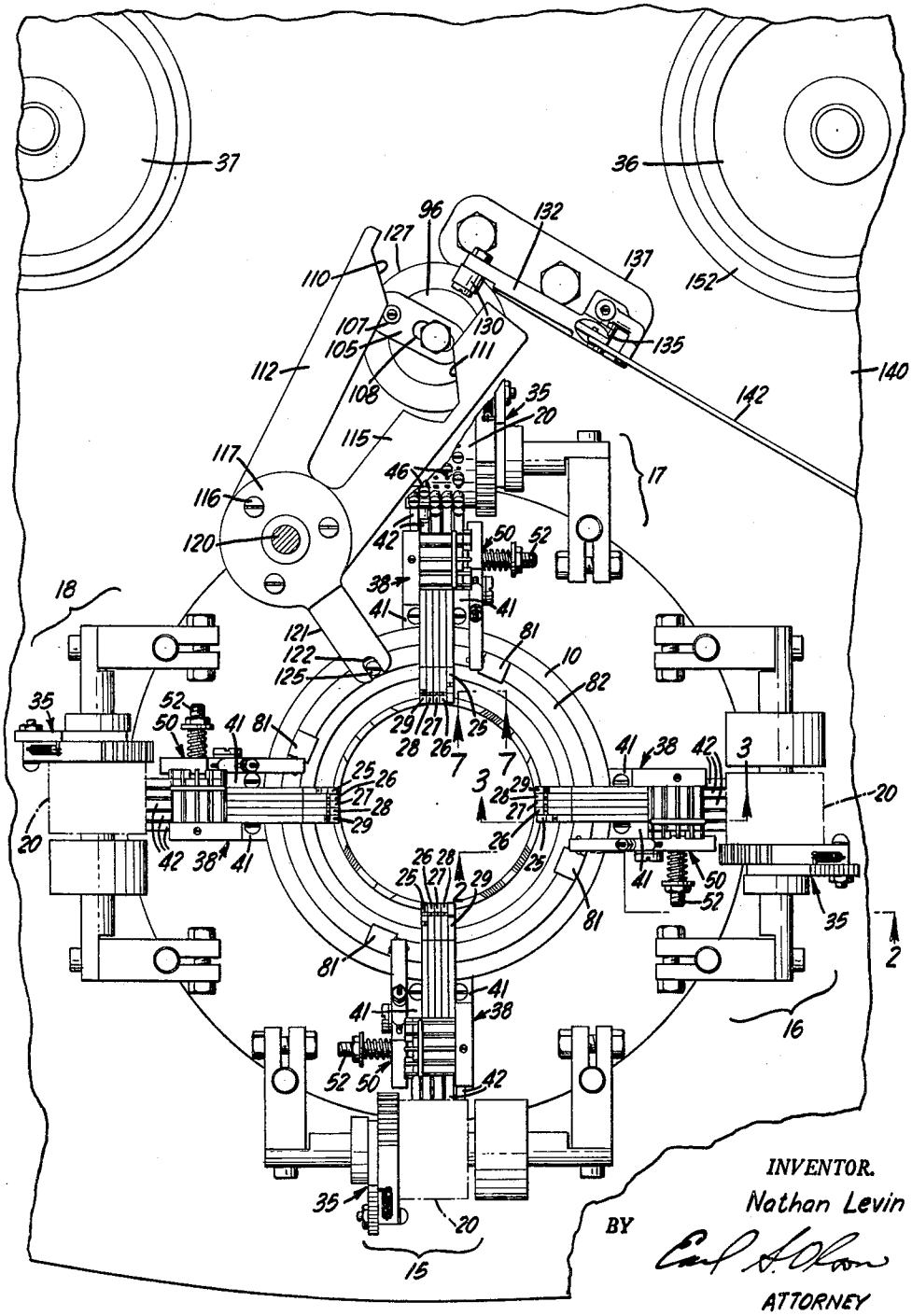
Nov. 14, 1961 N. LEVIN 3,008,316

YARN FEEDING CONTROL MEANS FOR CIRCULAR KNITTING MACHINES

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Fig. 1



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YARN FEEDING CONTROL MEANS FOR CIRCULAR KNITTING MACHINES

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Fig. 2

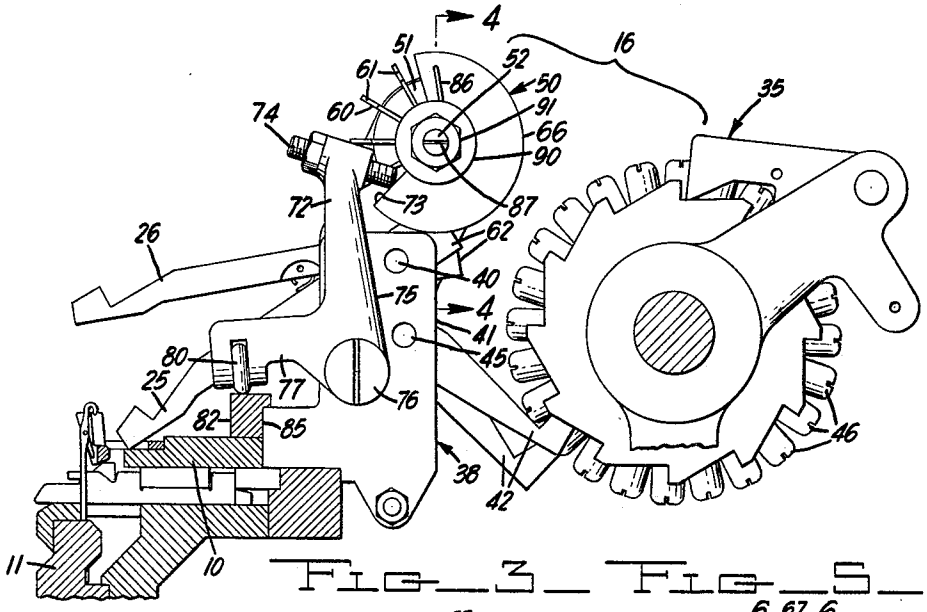


Fig. 3

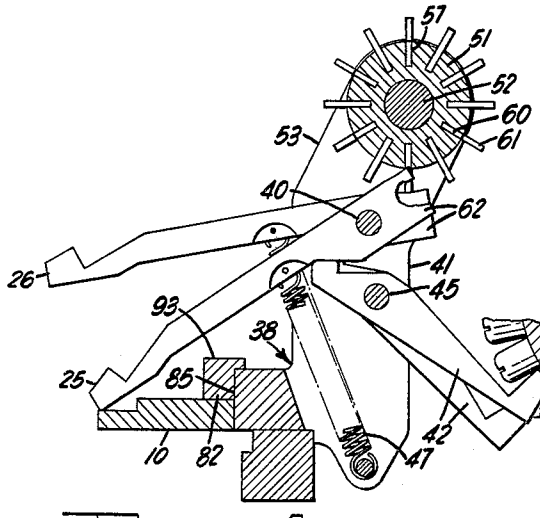


Fig. 5

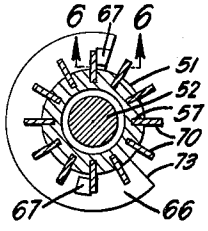


Fig. 6

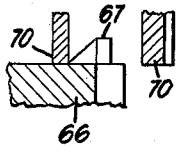


Fig. 7

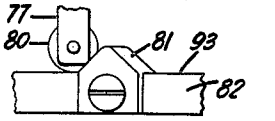
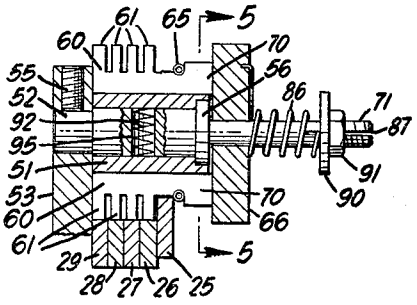


Fig. 4



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Fig. 8

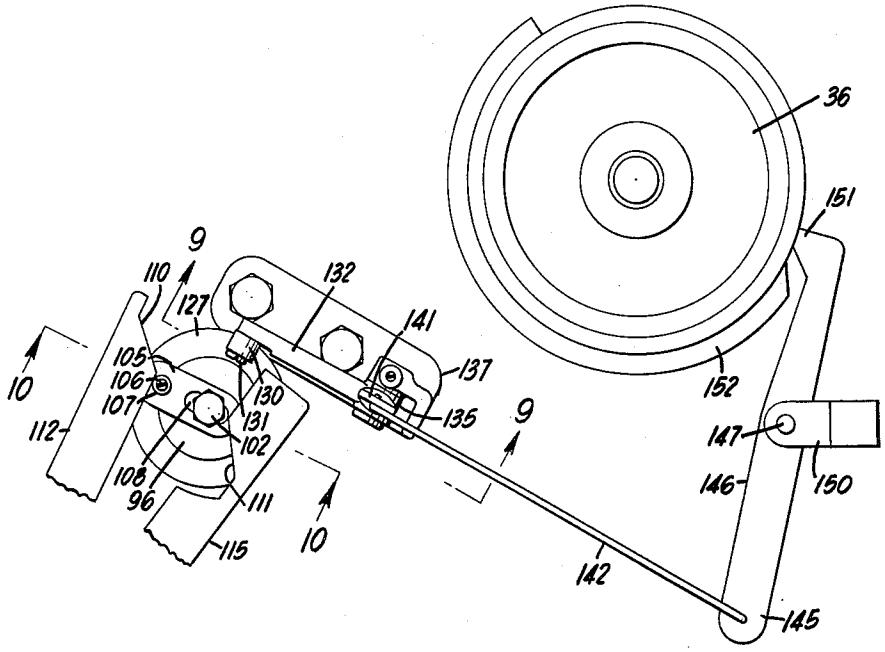


Fig. 9

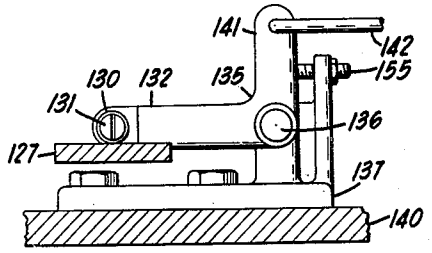


Fig. 10

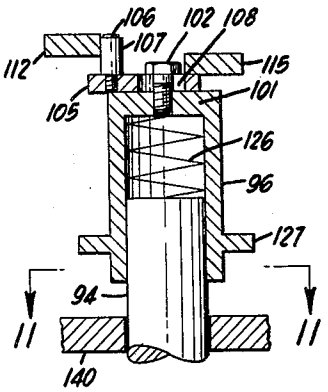
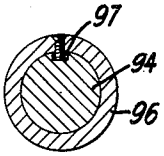


Fig. 11



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3,008,316

YARN FEEDING CONTROL MEANS FOR CIRCULAR KNITTING MACHINES

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Filed June 30, 1958, Ser. No. 745,586
9 Claims. (Cl. 66—138)

This invention relates to circular knitting machines and more particularly to means in such machines for controlling movements of the yarn fingers between active and inactive positions.

In multi-feed circular knitting machines of the type for knitting tubular fabrics for stockings and the like having suture joined pattern areas, yarn fingers at each of the feeds are moved into and out of knitting position under the control of a main pattern means. It has also been known to provide additional control means at each of the feeds for alternately moving certain of the yarn fingers into and out of knitting position in successive knitting strokes of the machine. Heretofore, such additional control means provided was adapted to control only certain of the fingers with the result that the use of the fingers in forming pattern areas was limited.

It is therefore an object of the invention to provide auxiliary means in a knitting machine of the type adapted to knit patterned areas in tubular fabrics, to control the operation of the yarn fingers whereby all of the yarn fingers at each of a plurality of knitting stations may be moved into and out of feeding position according to the required sequence to form the patterned areas.

A further object of the invention is the provision of means in a knitting machine for moving the yarn fingers into and out of feeding position at each of a plurality of knitting stations, which means includes means for operating the fingers, when moved to yarn feeding position by the main pattern means, to cyclically move them into and out of knitting position during successive knitting strokes of the machine.

Another object of the invention is the provision of means in a circular knitting machine for operating the yarn fingers at each of a plurality of knitting stations, said means including a main pattern means for moving the fingers into and out of feeding position and an auxiliary pattern means for independently operating any fingers moved to feeding position by the main pattern means, to cyclically move them out of and into feeding position during individual reciprocatory knitting strokes of the machine, said means further including means for operating the auxiliary pattern means during successive knitting strokes.

With these and other objects in view, which will become apparent from the following detailed description of the illustrative embodiment of the invention shown in the accompanying drawings, the invention resides in the novel elements, features of construction and cooperation of parts, as hereinafter more particularly pointed out in the claims.

In the drawings:

FIGURE 1 is a top plan view of a portion of a multi-feed circular knitting machine having pattern mechanism for controlling the yarn fingers according to the invention incorporated therein;

FIG. 2 is a cross-sectional view on an enlarged scale of one of the knitting stations taken substantially along the line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view on an enlarged scale taken along the line 3—3 of FIG. 1;

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is a cross-sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is a cross-sectional view on an enlarged scale taken along the line 6—6 of FIG. 5;

FIG. 7 is a detail view on an enlarged scale of actuating means for the pattern mechanism as seen in the direction of the arrows 7—7 on FIG. 1;

FIG. 8 is a view of a portion of the mechanism of FIG. 1 showing control means therefor;

FIG. 9 is a cross-sectional view taken along the line 9—9 of FIG. 8;

FIG. 10 is a cross-sectional view taken along the line 10—10 of FIG. 8; and

FIG. 11 is a cross-sectional view taken along the line 11—11 of FIG. 10.

The mechanism of the instant invention is preferably associated with a multi-feed circular knitting machine of the type disclosed in the application of Benjamin Franklin Coile, Serial No. 329,801, filed January 6, 1953, and in the corresponding British Patent No. 790,141 published February 5, 1958, hereinafter collectively referred to as the "Coile Disclosure," to which reference may be made.

Referring to FIGS. 1 and 2 of the drawings, the machine shown includes a stationary sinker cap 10 which is associated with a needle cylinder 11 adapted to rotate at times and to reciprocate at other times, the extent of the reciprocation being generally 360 degrees in each direction. The machine is also provided with four circumferentially spaced knitting stations generally indicated at 15, 16, 17 and 18, and, as a portion of the component parts of each of the knitting stations, there is provided a plurality of pivotally mounted individual yarn guide fingers moved into and out of action under the control of a yarn control drum 20. The yarn fingers, five in number at each of the stations, are similarly indicated at 25, 26, 27, 28 and 29 and are under the control of the individual yarn control drums associated therewith at each of the stations. Each of the control drums 20 is adapted to be selectively indexed by suitable ratchet and pawl mechanism 35 under the control of main pattern drums 36 and 37 of the machine (FIGS. 1 and 8). The pattern drums 36 and 37 are preferably the same in construction and operation as pattern drums R and L of the said Coile Disclosure.

The yarn fingers 25 to 29 at each of the knitting stations are pivotally supported within a housing 38 upon a horizontal pin 40 supported in and extending between opposite side walls 41 of the housing (FIGS. 1, 2 and 3). Also supported within the housing 38 are lifters or levers 42 one for operating each of the yarn fingers, the levers 42 being pivotally mounted on a horizontally extending pin 45 supported by the side walls 41 of the housing. The levers 42, individually associated with the yarn fingers, are adapted to selectively move the fingers under the control of buttons 46 on the outer face of the control drum 20, the buttons being spaced in accordance with the yarn finger selections desired. There is provision for a

row of buttons 46 on the drum 20 for each lever 42 and a button will move the lever to raise its associated yarn finger to inactive position, this being the highest level indicated in FIGS. 2 and 3. In the absence of a button 46, the associated yarn finger is moved to its active yarn feeding position, this being the lowest position shown in FIGS. 2 and 3, by a tension spring 47 suitably connected between the finger and the housing 38. Hence, at each of the knitting stations 15 to 18, there is pattern means in the form of control drum 20 for individually controlling the positions of the yarn fingers 25 to 29.

In accordance with the instant invention, there is provided means which is particularly adapted to be used in the method of knitting set forth in my prior application Serial No. 630,101 filed December 24, 1956, now Patent No. 2,959,946, covering the reciprocatory knitting of sutur joined areas of tubular fabric. My said prior application describes the formation of an eight section fabric, the instant invention however permitting the formation, with appropriate needle selection of as high as sixteen or more of such sections around the tube. The device of the invention may also be used in other methods where a large number of yarn changes are desired. The means of the invention includes in addition to the control drums 20 an auxiliary pattern means 50 to periodically move yarn fingers 25 to 29, at each of the stations, into and out of feeding positions, when the drum 20 at that feeding station permits this to take place, that is, during the absence of buttons 46 on the drum 20 opposite the yarn fingers. Auxiliary pattern means 50 comprises a drum 51 which is mounted for rotative movement on a stud 52 secured in fixed position in an extension 53 of one of the side walls 41 of the housing 38 by means of a locking screw 55 (FIG. 4). Suitably, the drum 51 is held against movement axially of the stud 52 between the extension 53 and a shouldered portion 56 of the stud. The periphery of the drum 51 is provided with a series of axially extending slots 57 for jacks 60 having butts 61 for engaging tail end portions 62 of the yarn fingers 25 to 29 (FIGS. 3 and 4), the butts acting on the tail end portions to move the yarn fingers out of yarn feeding position. In the absence of the butts opposite any of the fingers such fingers remain in yarn feeding position. Suitably, the jacks 60 are retained in the slots 57 by a garter spring 65, as shown in FIG. 4.

The drum 51 is indexed to present the jacks 60 to the yarn fingers, the arrangement of the butts on the jacks determining the order in which the yarn fingers are moved out of or into feeding position. For the purpose of indexing the drum 51 a pawl 66 in the form of a disc is provided, the pawl preferably having inwardly projecting cam shaped teeth 67 which are spaced to engage end portions 70 of jacks 60 on diametrically opposite sides of the drum 51 (FIGS. 5 and 6). The pawl 66 is loosely mounted on a reduced end portion 71 of the stud 52 for oscillating movement, the pawl being moved in a counterclockwise direction as viewed in FIG. 2 or clockwise as viewed in FIG. 5, to engage the teeth 67 with the end portions 70 of the jacks 60 and index the drum 51, and in the opposite direction for resetting. For so oscillating it, pawl 66 is provided with a radially extending surface 73 which is adapted to be engaged by a contact screw 74 adjustably carried in one arm 72 of a bell crank 75. Bell crank 75 is mounted for pivotal movement on a stud 76 fixed in one wall 41 of the bracket 38. A second arm 77 of the bell crank 75 carries a roller type follower 80 for engagement by a cam lug 81 secured in fixed position on a ring member 82 (FIGS. 1 and 7). The ring member 82 is mounted on the sinker cap 10 between suitably formed bearing surfaces 85 on the housing 38 at each of the four knitting stations and is intermittently oscillated by means hereinafter set forth to move the cam lug 81 in opposite directions past the bell crank 75 to thereby operate it to turn the pawl 66.

After each movement of the pawl 66 by the bell crank 75 to index the drum 51, the pawl is returned to its position of FIGS. 2 and 5 by a torsion spring 86 which is mounted on the portion 71 of the stud 52 between the pawl 66 and a washer 90, opposite ends of the spring being anchored in the pawl and a slot 87 formed in the end of the portion 71 respectively (FIG. 4). The spring 86 also permits movement of the pawl 66 axially of the portion 71 by the camming action of the teeth 67 as they are moved past the jacks 60 on the return or resetting movement of the pawl. A nut 91, threadably carried on the end portion 71, maintains the washer 90 in adjusted position on said end portion. The ends of a compression spring 92 carried within a bore 95 in the stud 52 (FIG. 4) acts against the inner surface of the bore in the drum 51 to hold the drum in the positions to which it is moved by the pawl 66.

Normally, the follower 80 is in engagement with an upper surface 93 of the ring member 82 and the ring member is oscillated in opposite directions during the forward and reverse reciprocatory strokes of the needle cylinder 11 to move the cam lug 81 past the bell crank 75 during which movement the pawl 66 is operated to index the drum 51 a distance equal to the spacing between two jacks 60. The ring member 82 is driven in its oscillating movements from a suitable power source, as, for example, an upright shaft 94 of the machine. The shaft 94, which may be the same as shaft 176 of said Coile Disclosure, is adapted to make one revolution during the time the needle cylinder makes two successive reciprocatory strokes, that is, a movement of 360 degrees in one direction and a movement of 360 degrees in the opposite direction.

Mounted on the upper end of the shaft 94 for rotation therewith and for axial movement relatively thereto is a cap member 96 which is provided with a key 97 for engagement in a keyway suitably formed in the shaft (FIGS. 10 and 11). At its upper closed end 101 the cap member 96 carries a crank arm 105 having a stud 106 for rotatably mounting a roller type follower 107. A stud or bolt 102 extending through a slot 108 in the crank arm 105 and threaded in the closed end 101, acts to secure the crank arm in adjusted position on the cap member 96 (FIG. 10). Roller 107 is adapted to engage cam shaped surfaces 110 and 111 formed on a pair of rocker arms 112 and 115, respectively (FIGS. 8 and 10). The rocker arms 112 and 115 are secured in fixed relation, by screws 116, to a member 117 pivotally mounted on a vertically extending shaft 120 (FIG. 1). An arm 121 extending from the member 117 overlies the ring member 82 and is slotted at 122 for engagement with a pin 125 carried in the ring member. With this arrangement, as the cap member 96 is rotated with the shaft 94, the follower 107 alternately engages cam surfaces 110 and 111 to oscillate the rocker arms 112 and 115 in opposite directions. The rocker arms in turn oscillate the ring member 82 and cam lugs 81 in opposite directions, the cam lugs thereby acting to operate the bell cranks 75 at each of the feeds during each of the oscillating movements to index their drums 51.

At times when the drums 51 are not to be operated to selectively position the yarn fingers, the cap member 96 is moved downwardly on the shaft 94 against the action of a compression spring 126 positioned between the closed upper end 101 of the cap member and the top of the shaft (FIG. 10) to thereby move the roller 107 out of the path of the cam surface 110 of the rocker arm 112. This inactivates the ring member 82 in the position to which it was oscillated by the cam surface 111. For so moving the cap member 96 downwardly, it is provided with a flange 127 which is adapted to be engaged by a roller 130 rotatably mounted on a stud 131 carried in the end of one arm 132 of a bell crank 135 (FIGS. 8 and 9). Bell crank 135 is pivotally mounted on a pin 136 supported in fixed position in a bracket 137 secured to a fixed part 140 of the machine. A second arm 141 of the bell crank 135 is connected by a link 142 to one end 145 of a lever 146 which

is pivoted intermediate its ends on a pin **147** supported on a fixed part **150** of the machine the part **150** being preferably the same as the post p–3 of the Coile Disclosure. At its other end lever **146** has a follower portion **151** for engagement with a cam member **152** mounted on the pattern drum **36**. When the cam member **152** is removed from beneath the lever **146**, spring **126** acts to raise the cap member **96** to move the roller **107** into the path of cam end **110** of the rocker arm **112** and turn the bell crank **135** clockwise as viewed in FIG. 9, these movements of the cap member and bell crank being limited by engagement of the arm **141** with an adjustable stop screw **155** threadably carried in the bracket **137** (FIG. 9).

As will be apparent from the foregoing, the mechanism of the invention provides an additional control for the yarn fingers whereby the yarn fingers, after being moved into yarn feeding position under the control of the drums **20**, may be moved into and out of yarn feeding position in successive reciprocatory strokes of the machine or in multiples thereof to produce design effects in the fabric being knit. Further, the mechanism is such that variations in the sequence of operation of the yarn fingers may be readily effected by changing the jacks in the auxiliary pattern drums. It will also be obvious that although the mechanism is shown as being applied to a machine having five yarn fingers at each of four feeding stations, the mechanism is equally adaptable to control a greater or lesser number of yarn fingers in machines having only one or a greater number of feeding stations.

It will be understood that the improvements specifically shown and described by which the above described results are obtained can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

I claim:

1. In a circular knitting machine having a plurality of knitting stations and adapted to be reciprocatorily knit at each of said stations, a plurality of yarn feeding fingers at each of said stations, a main pattern drum at each of said stations having means for moving each of said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at each of said stations having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active position by said main pattern drum, and means for operating said auxiliary pattern drum.

2. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving each of said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, and means for inactivating said cam means.

3. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means, and means for controlling the operation of said actuating means.

4. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station,

a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means, and means for inactivating said actuating means.

5. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means, and means for moving said actuating means between active and inactive positions between individual reciprocatory knitting strokes.

6. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means including a member movable between active and inactive positions, means for moving said member between active and inactive positions, and pattern means for controlling said moving means.

7. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means including a member movable between active and inactive positions, and means for moving said member between active and inactive positions.

8. In a circular knitting machine having a knitting station and adapted to reciprocatorily knit at said station, a plurality of yarn feeding fingers at said station, a main pattern drum at said station having means for moving said fingers between active yarn feeding and inactive positions, an auxiliary pattern drum at said station having means for moving said fingers out of and into yarn feeding positions when said fingers are moved to active positions by said main pattern drum, and means for operating said auxiliary pattern drum including a pawl, cam means for operating said pawl, means for actuating said cam means including a member movable between active and inactive positions, means for moving said member to active position, and pattern means for moving said member to inactive position.

9. In a circular knitting machine having a plurality of knitting stations and adapted to reciprocatorily knit at each of said stations, a plurality of yarn feeding fingers

at each of said stations, a main pattern drum at each of said stations having means for moving each of said fingers between active yarn feeding and inactive positions, an auxiliary pattern means at each of said stations having means operating directly on said fingers for moving said fingers out of and into yarn feeding positions during individual strokes of reciprocatory knitting when said fingers are moved to active position by said main pattern drum, and means for operating said auxiliary pattern means.

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