Dec. 18, 1951 G. F. TEAGUE 2,579,161

NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 1

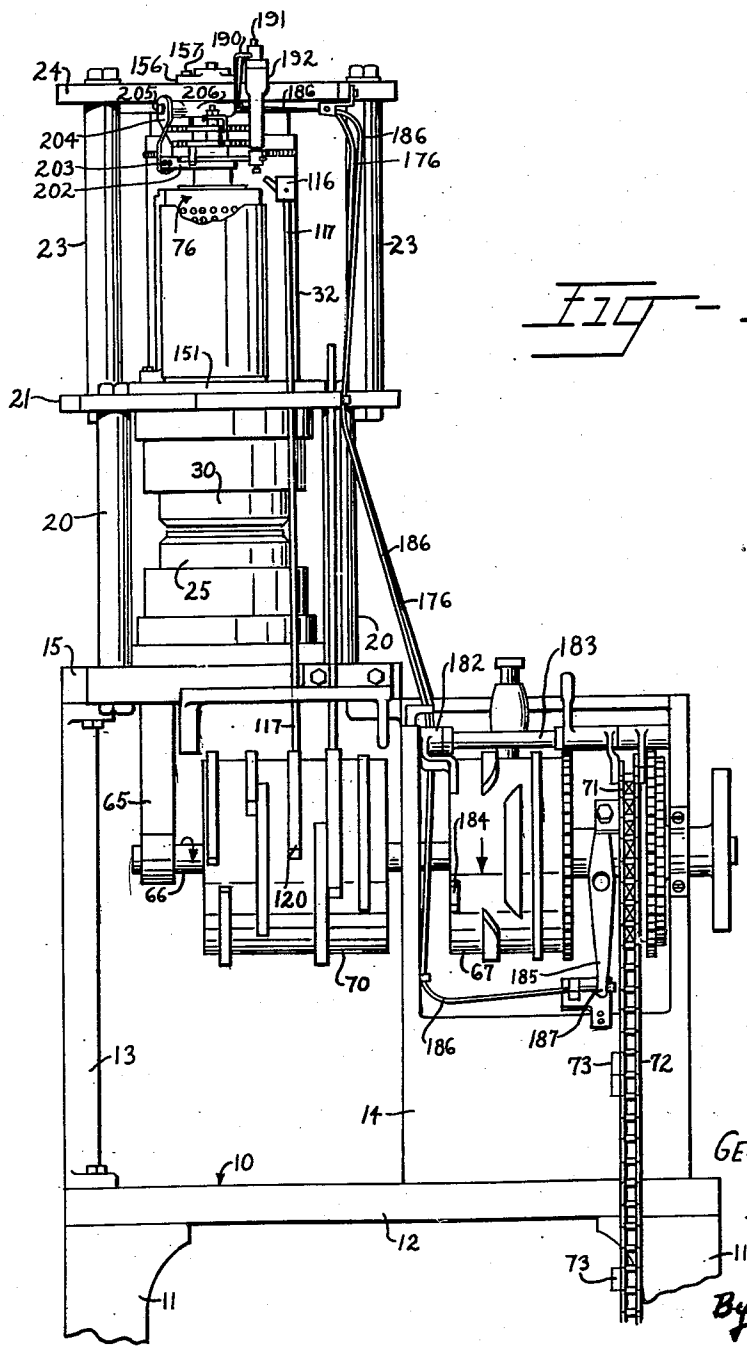


Fig - 1

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NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 2

Fig - 2

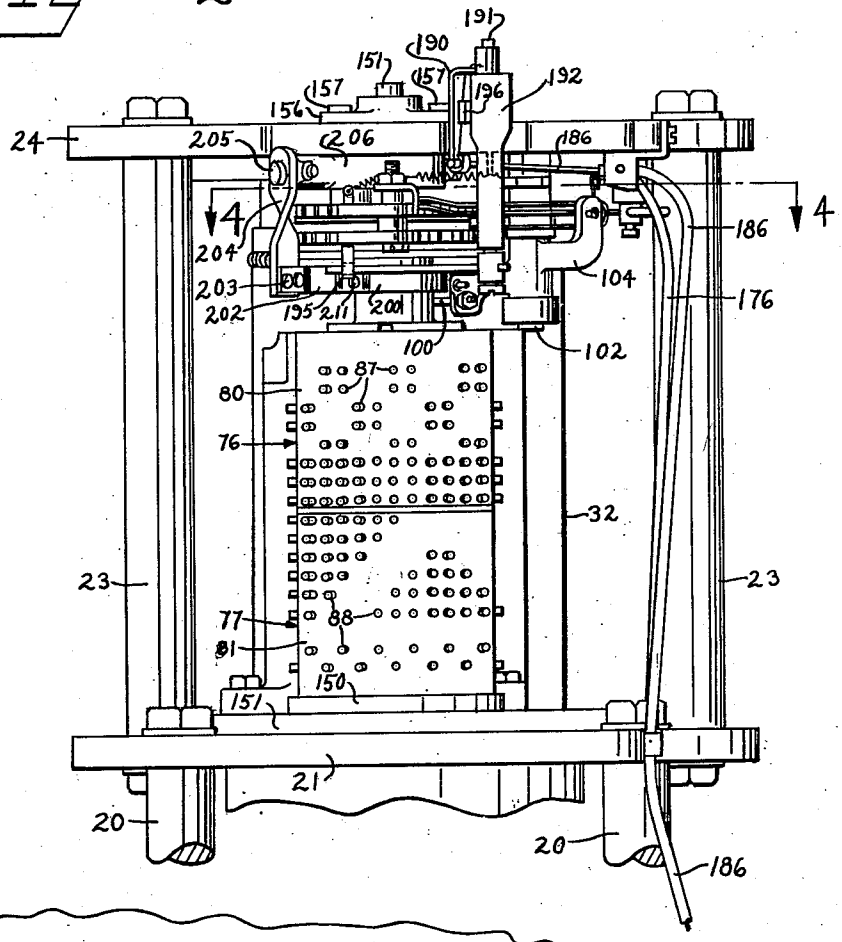
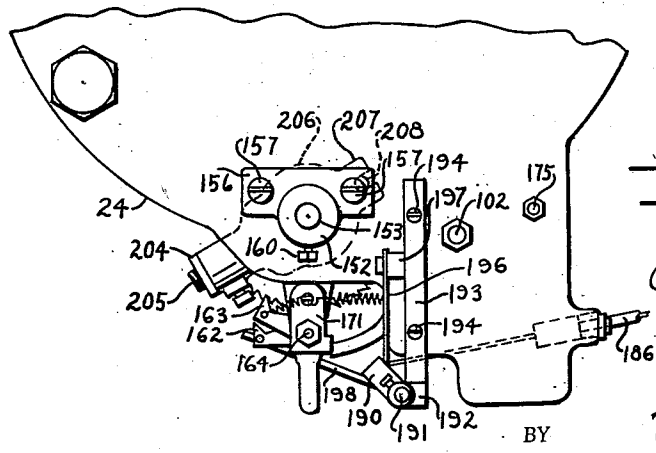


Fig - 3



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NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 3

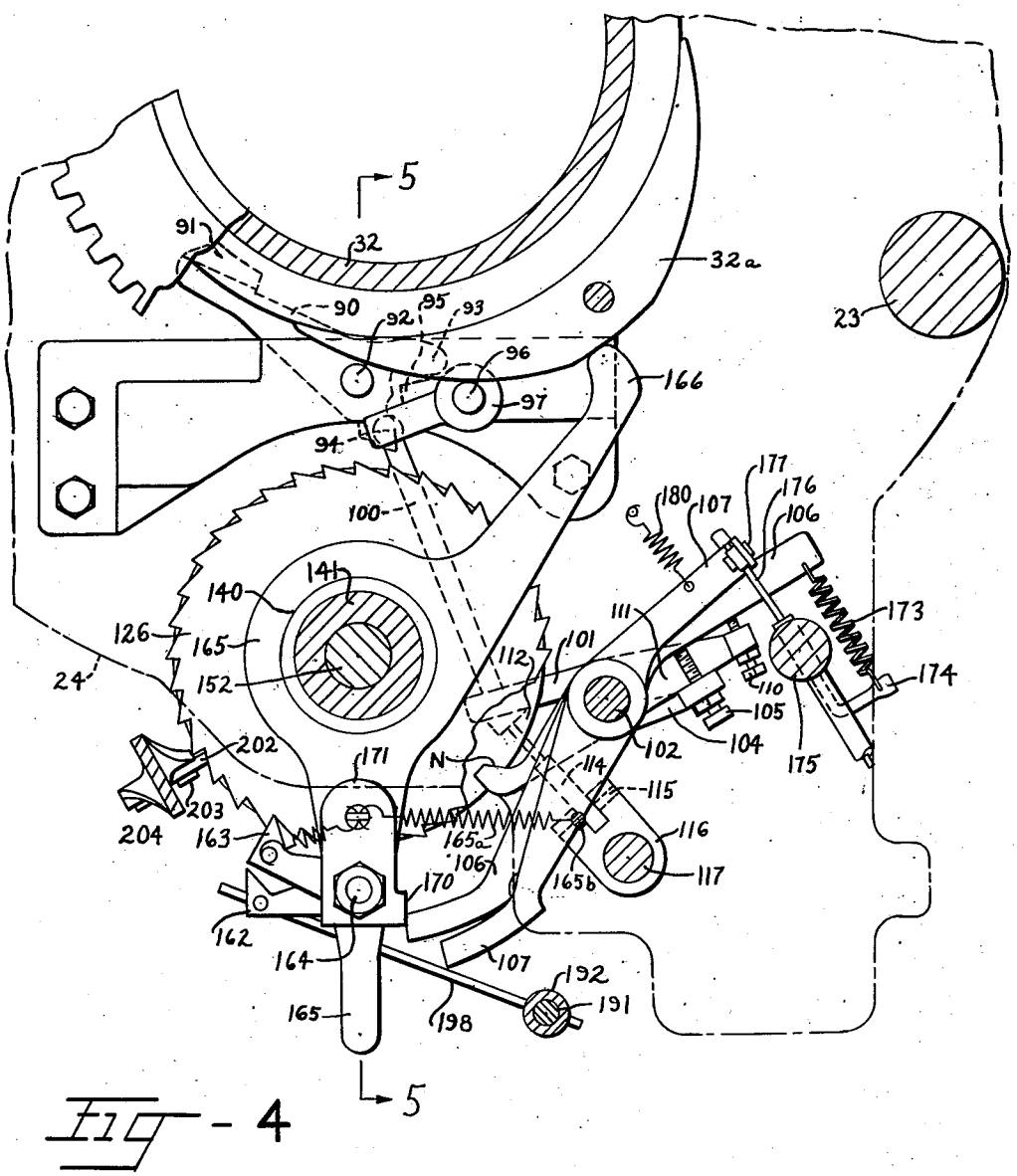


Fig - 4

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NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 4

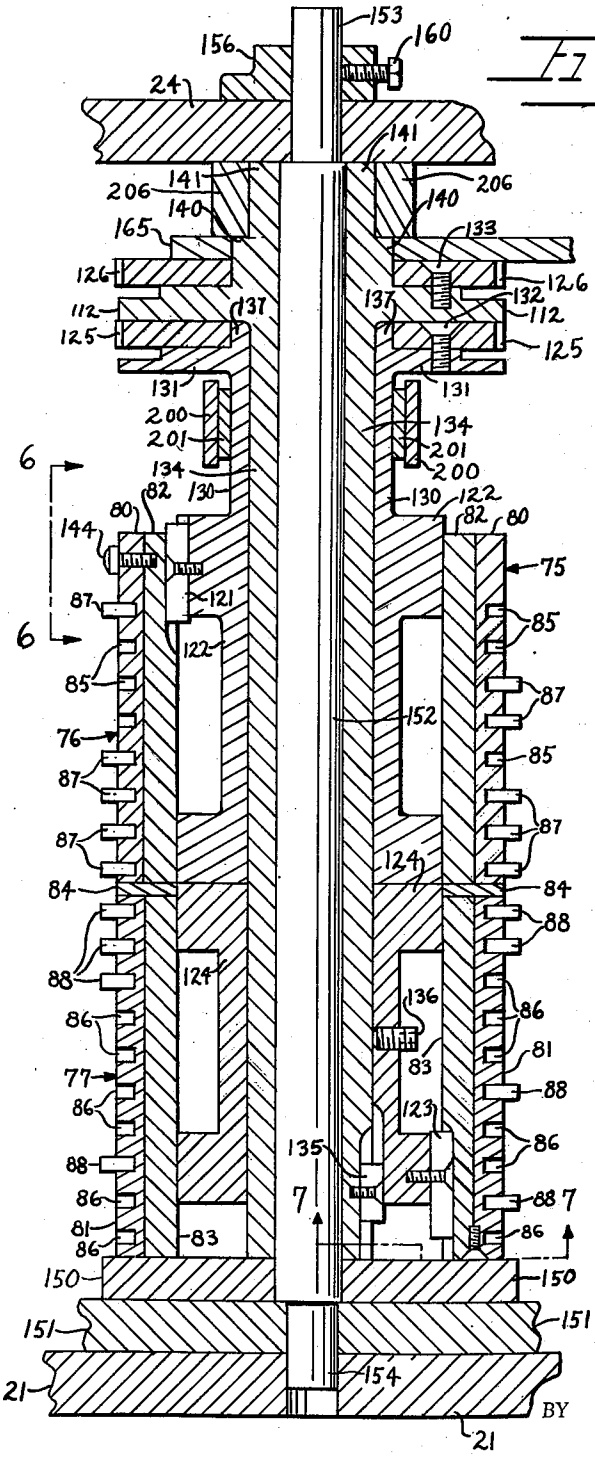


Fig - 5

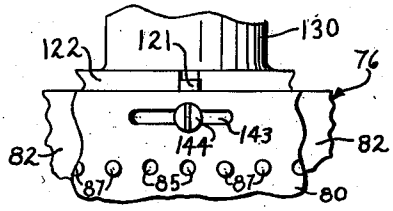


Fig - 6

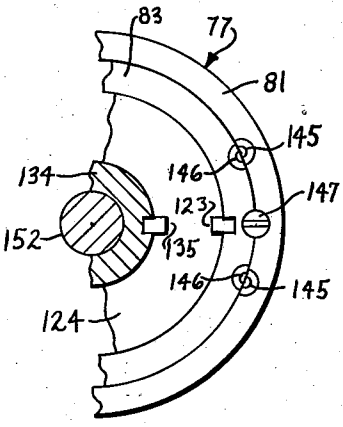


Fig - 7

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NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 5

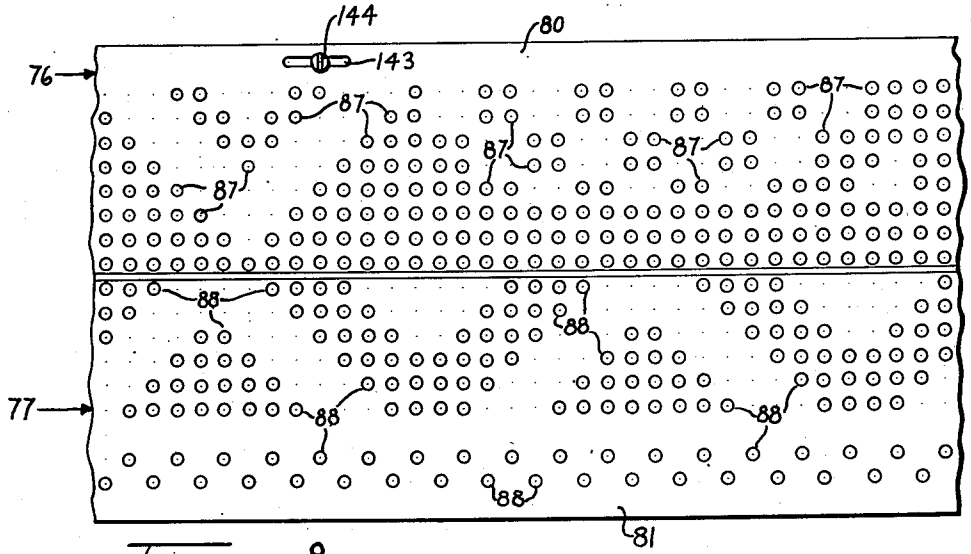


Fig - 8

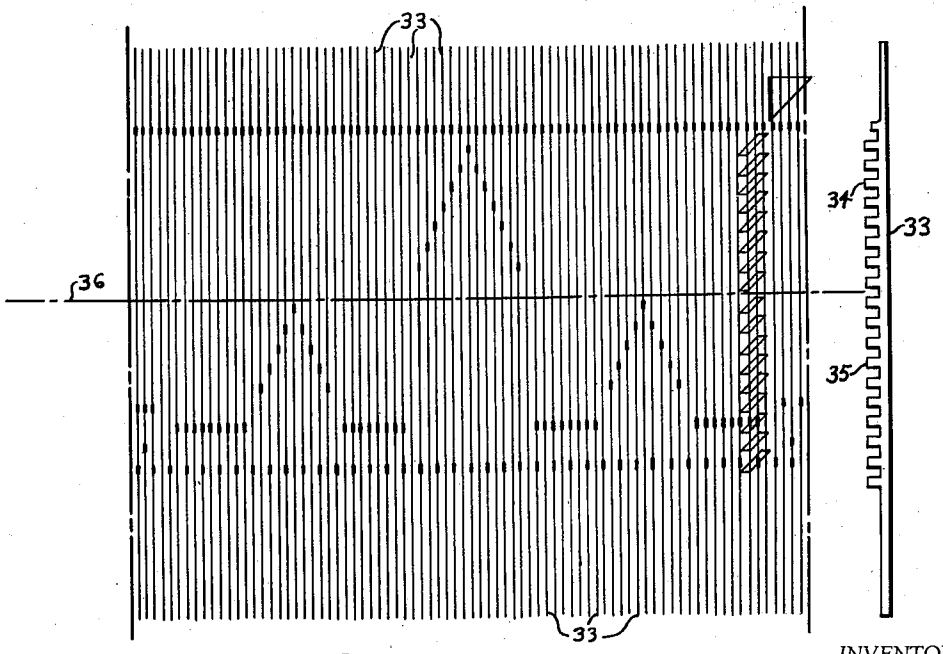


Fig - 9

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Dec. 18, 1951 G. F. TEAGUE 2,579,161

NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

Filed Oct. 2, 1950 6 Sheets-Sheet 6

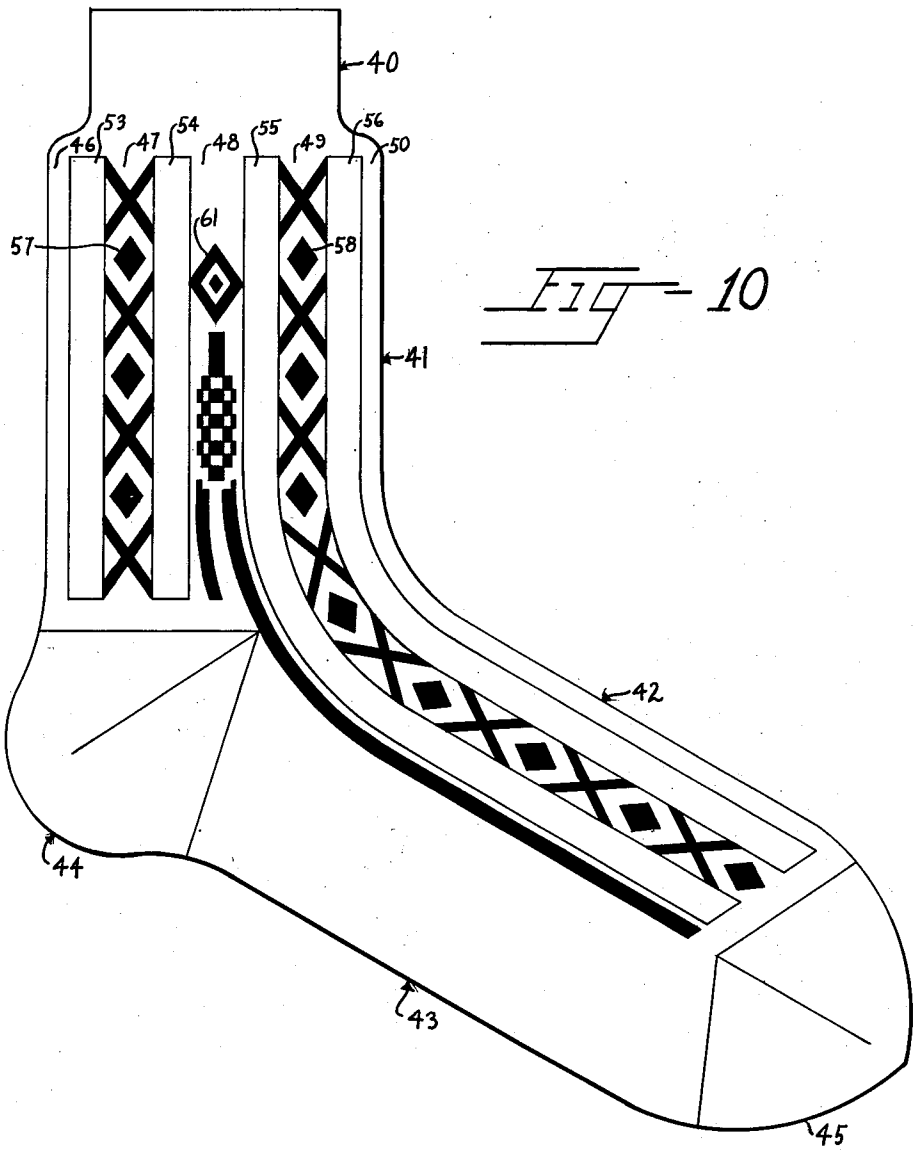


Fig. 10

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Patented Dec. 18, 1951 2,579,161

UNITED STATES PATENT OFFICE

2,579,161

NEEDLE SELECTOR MECHANISM FOR KNITTING MACHINES

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Application October 2, 1950, Serial No. 187,957

5 Claims. (Cl. 66—14)

1

This invention relates to circular independent needle knitting machines and more especially to an improved means for controlling the operation of the needles, including improvements in the selector pattern drum and the means for imparting step-by-step rotation thereto.

It is the primary object of this invention to provide improved means for controlling operation of the needles of an independent needle circular knitting machine to render possible a wide variety of patterns in the manufacture of stockings and the like during continuous uninterrupted operation of the knitting machine.

A selector pattern drum, which is also termed a trick wheel, is the usual part of many types of circular knitting machines and is instrumental in effecting operation of selector fingers which, in turn, cause certain needles to be elevated for taking yarn to subsequently pass through the stitch cams. Usually, a selector pattern drum of this type has a step in rotation imparted thereto either upon each revolution of the needle cylinder or the steps being controlled by conventional pattern means during the knitting of the heel and toe pockets. However, as is well known to those familiar with the art, the selector pattern drum associated with most knitting machines is of relatively small diameter and moves a step with each revolution of the needle cylinder thus limiting the variations in patterning as transmitted from the pattern drum to the needles.

It is, therefore, another object of this invention to provide a pair of selector pattern drums, preferably disposed on the same vertical axis, adjacent the needle cylinder and having individual means associated with each of the pattern drums for imparting step-by-step rotation thereto and whereby the butts on one of the selector pattern drums may be arranged differently from those of the other of the selector pattern drums, the butts on the selectors being arranged so that certain groups of needles will be affected by one of the pattern drums while other groups of needles will be affected by the other of the pattern drums so as to produce a variation in the ornamental appearance of a stocking, particularly where wrap striping is employed, and wherein a plurality of designs may be knitted in the same courses of the knitted fabric. This is particularly desirable in conjunction with a rib knitting machine in which a pair of coaxial cylinders are employed and in which needles are transferred from one cylinder to the other in accordance with a desired pattern.

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—

2

Figure 1 is a front elevation of a Links and Links knitting machine omitting the lower portion thereof, many of the parts being shown schematically and other parts being omitted for purposes of clarity and showing the invention in association therewith.

Figure 2 is an enlarged elevation of the upper portion of Figure 1 showing the improved selector drums and the cover which normally surrounds the same being removed for purposes of clarity;

Figure 3 is a fragmentary top plan view of Figure 2, omitting the rear portion of the machine and showing parts of the control means for controlling the imparting of step-by-step rotation to the selector drums;

Figure 4 is an enlarged fragmentary plan view showing the means for imparting step-by-step rotation to the selector drums and taken substantially along the line 4—4 in Figure 2;

Figure 5 is an enlarged vertical sectional view through the selector drum assembly taken substantially along the line 5—5 in Figure 4 and showing only fragmentary parts of the knitting machine in association therewith;

Figure 6 is a fragmentary elevation looking substantially along the line 6—6 in Figure 5 and showing the manner in which the outer shell of the upper or first selector drum section may be adjusted relative to the inner shell thereof;

Figure 7 is a fragmentary inverted plan view looking substantially along the line 7—7 in Figure 5 showing the manner in which the outer shell of the lower or second pattern drum is locked relative to the inner shell thereof;

Figure 8 is a schematic developed view showing the arrangement of the butts on the upper and lower selector drums for producing a sock of the type shown in Figure 10;

Figure 9 is a schematic developed view showing the arrangement of one-half of the butts on the selectors which cooperate with the butts on the selector drum sections, through the medium of the conventional selector levers or fingers for producing a sock of the type shown in Figure 10;

Figure 10 is an enlarged elevation showing one side of a stocking with a combination of two of many types of ornamental patterns which may be knitted into the leg and instep of a stocking in association with a knitting machine, by means of a pair of superposed coaxial independently operable selector pattern drum sections.

Referring more specifically to the drawings, the numeral 10 broadly designates the frame of a circular knitting machine, the particular type of knitting machine shown in the drawings being of a type such as is manufactured by Scott and Williams and is commonly known as a Komet, Links and Links double indexing circular knitting machine. This particular type of machine has coaxial superposed needle cylinders with selector mechanism for transferring selected needles from one cylinder to the other, many of the conventional parts of the machine being identical to a machine described in U. S. Letters Patent to P. L. Thurston, No. 2,316,823 of April 20, 1943.

The frame 10 comprises legs 11 which support a conventional oil tray 12 having the lower edges of lower bed plate support members 13 and 14 secured thereto. The upper ends of the plate support members 13 and 14 have a lower bed plate 15 secured thereon on which the lower ends of intermediate bed plate support pillars 20 are mounted. The upper ends of the pillars 20 have a conventional intermediate bed plate 21 mounted thereon. The intermediate bed plate 21 has the lower ends of vertically disposed upper bed plate supporting pillars 23 mounted thereon, on the upper ends of which is suitably secured a conventional upper bed plate or cap plate 24. The knitting machine also includes a conventional lower needle cylinder 25 which is provided with the usual vertically movable sliders, not shown, located in the grooves thereof.

An upper needle cylinder 30 is disposed in coaxial alinement with the lower needle cylinder 25 and the needle cylinders 25 and 30 are provided with conventional sliders, not shown, which cooperate in transferring conventional double ended needles, not shown, between the upper and lower needle cylinders 30 and 25, respectively, in a manner well known to those familiar with the art. A further illustration and description of these needle cylinders and associated parts are deemed unnecessary.

The upper needle cylinder is provided with an extension 32 which is shown schematically in Figure 1 and a portion of which is shown in Figure 9 in developed form so as to expose the arrangement of the butts of conventional vertically movable selectors 33 located in grooves which form continuations of the grooves in the upper needle cylinder 30. These selectors 33 are conventional in all respects. However, the butts thereon are divided into upper and lower groups for purposes of description, the butts forming the upper group being indicated at 34 and the butts included in the lower group being indicated at 35. Also, for purposes of description, a division line 36 is provided to serve as a guide to the reader in differentiating the butts in the upper and lower groups. It is evident that the line 36 would not be necessary on the actual extension of the upper needle cylinder 30.

There are many different types of cam arrangements which may be provided for effecting movement of the conventional sliders, not shown, which transfer the needles between the upper and lower needle cylinders 25 and 30 respectively. Varied slider cam arrangements are shown in Figures 15, 15*a*, 15*b* and 18 of said Patent No. 2,316,823 and wherein two separate yarn feeding points are also provided. The present mechanism is particularly applicable in association with the cam and yarn feed arrangement of said patent so the design areas may be knitted of only a first of two of the yarns, the remaining portions of the stocking being knitted of the second yarn and, in which event, the second yarn would be floated past the design areas knitted of the first yarn.

In Figure 10, there is shown a typical man's hose or stocking including a top 40, a leg 41, an instep 42, a sole 43 and heel and toe pockets 44 and 45. This stocking, in Figure 10, shows one of many different design combinations which may be knitted into stockings by means of the present apparatus in association with a Links and Links type of knitting machine. It will be evident, as the description proceeds, that the particular features of this invention need not necessarily be limited to the Links and Links machine, the particular stocking shown and the various mechanism associated with the present invention being shown by way of illustration only.

In knitting the stocking shown in Figure 10, the top 40 may be knitted of the 1:1 rib and also including the laying in of the usual elastic yarn. The leg of the stocking is then knitted in which the opposite sides of the stocking may appear identical and, in the present instance, the stocking is knitted of two different yarns, although it is evident that it may be knitted of a single yarn, if desired. The leg has spaced areas 46 to 50, inclusive, knitted of inwardly facing stitches and intermediate areas, indicated at 53 to 56, inclusive, are knitted of outwardly facing stitches, it being well known, to those familiar with the art, that the inwardly facing stitches of the areas 46 to 50, inclusive, are knitted with the corresponding needles in the upper cylinder 30 and the outwardly facing stitches employed in forming the areas 53 to 56, inclusive, are formed while the corresponding needles are disposed in the lower cylinder 25.

It will be noted that the areas 47 and 49 of the inwardly facing stitches have patterns knitted therein which are indicated at 57 and 58 while the area 48, of inwardly facing stitches, has a different patterned area 61 knitted therein. These patterned areas 57, 58 and 61 may be knitted of the same yarn as the remaining portions of the stocking in the event of a single yarn being employed in knitting the stocking or, as shown in said patent, No. 2,316,823, these areas 57, 58 and 61 may be knitted of only one of two yarns employed in knitting the remaining portions of the stocking and, in which event, the other of the yarns would be floated back of the areas 57, 58 and 61. The arrangement of the yarns, that is, using a single yarn or using more than one yarn is inconsequential with respect to the present invention, the present invention being particularly concerned with knitting these patterned areas 57, 58 and 61 with outwardly facing stitches on a background of inwardly facing stitches to produce an embossed effect on the areas 47, 49 and 48 respectively.

Heretofore it has not been possible to produce a patterned area, such as the area 61, with as many extremely different characteristics therein relative to the characteristics of the patterned areas 57 and 58 as exemplified by the stocking shown in Figure 10. In other words, all of the areas 47, 48 and 49 would normally have identical or similar patterned areas therein, or one or more of the areas 46 to 50, inclusive, would not have any embossed design incorporated therein. Therefore, the main feature of the present invention is to provide means for controlling the needles knitting in particular wales, for trans-

ferring the needles from one cylinder to another independently of adjacent groups of needles, or groups of needles spaced from the groups knitting in said particular group of wales, so as to produce extremely varied patterned areas in spaced groups of wales in a knitted tubular fabric and wherein the selected needles knitting said patterned areas may knit stitches facing in the opposite direction from the areas on which they are superimposed.

It will be noted that the outwardly facing stitched areas 55 and 56 extend through the instep portion 42 of the stocking shown in Figure 6 as does the inwardly facing stitched area 49 and a part of the inwardly facing stitched area 48, the outwardly facing patterned portion 61 of the area 48 also being extended into the instep of the stocking to provide a margin between the instep 42 and the sole 43 of the stocking shown in Figure 10. It is evident that the needles which had been knitting in the portion of the area 43 disposed above the heel pocket 44, as well as those needles knitting in the areas 46 and 47, are transferred to the lower cylinder before going into the knitting of the heel pocket 44 and, of course, these last-named needles also remain in the lower cylinder 25 during the knitting of the sole 43 so the heel pocket 44, the sole 43 and the toe pocket 45 are knitted with outwardly facing stitches.

Now, in order to produce the variations in patterning, such as are exemplified by the areas 57 and 61, in the same group of courses, an improved selector pattern drum is provided which includes an upper and a lower section which are independently controlled as to step-by-step rotation so the upper section of said selector pattern drum may control the selectors 33 having one or more of the butts 34 in the upper group thereon and the lower section of the selector pattern drum may control those selectors 33 (Figure 9) having one or more of the butts 35 of the lower section thereon. It is evident that, although the selector 33 shown in Figure 9 has a plurality of butts 34 and 35 thereon, it is unlikely that there would be any of the butts 35 on the same selectors 33 on which any of the butts 34 are disposed other than the lowermost butts in the group 35, these being instrumental in controlling the introduction of the elastic yarn to the top 40 of the stocking as shown in Figure 10 in the usual manner. The improved selector pattern drum will be later described.

Referring again to Figure 1, the lower bed plate 15 has a conventional bearing member 65 depending therefrom which has one end of a horizontally disposed shaft 66 journaled therein, this shaft 66 also being journaled in the bed plate support member 14. The shaft 66 is driven in a conventional manner and has a conventional clutch drum 67 and a quality drum 70 fixedly mounted thereon. The shaft 66 also has a sprocket wheel 71 mounted thereon which is driven in timed relation to the clutch drum 67 and which has a pattern chain 72 thereon provided with special links 73 which are instrumental in controlling step-by-step movement of one of the sections of the pattern drum to be presently described.

Referring to Figure 5, the improved selector pattern drum is shown in detail and is broadly designated at 75. This selector pattern drum 75 includes an upper or first pattern drum section broadly designated at 76 and a lower or second pattern drum section broadly designated at 77. For purposes of adjustability the upper and lower pattern drum sections 76 and 77 include respective outer shells 80 and 81 which are secured for rotary adjustment to respective inner shells 82 and 83, these shells 80 to 83, inclusive, being of tubular construction.

The shells 80 and 82 of the upper selector pattern drum section 76 are separated from the shells 81 and 83 of the lower selector pattern drum section 77 by a suitable spacing ring 84 which may preferably be of a non-ferrous metal so as to serve as a thrust bearing, since the upper shells 80 and 82 are supported by the lower shells 81 and 83. The outer shells 80 and 81 of the respective upper and lower selector pattern drum sections 76 and 77 are provided with a plurality of respective bores 85 and 86 in some of which a plurality of pattern pins or selector drum butts 87 and 88, respectively, may be inserted in accordance with a desired pattern.

It will be observed, in Figure 8, that only the pins are illustrated in the upper and the lower sections 76 and 77 of the selector pattern drum 75, the arrangement of these pattern pins 87 and 88 being illustrated specifically for producing a stocking pattern such as that shown in Figure 10. The upper pattern pins 87 coincide with the upper group of selector butts 34 (Figure 7) and the lower pattern pins 88 on the selector pattern drum 75 coincide with the lower group of selector butts 35 on the selectors 33. The pattern pins 87 and 88 on the improved selector pattern drum 75 actuate the selectors 33 by means of conventional selector levers or fingers 90 only one of which is shown in Figure 4.

There is usually provided one of these selector levers 90 at the level corresponding to the level of each of the selector butts 34 and 35 on the selectors 33 and each of the selector levers 90 is provided with the usual cam incline 91 adapted to engage selector butts disposed at a corresponding level to move the associated selector downwardly. The selector levers 90 are pivoted on a common vertical shaft 92 (Figure 4) and the ends of the selector levers 90 remote from the cam incline 91 are bifurcated to provide a heel portion 93 and a toe portion 94, these toe portions being urged by conventional spring means, not shown in the present drawings but clearly shown in said patent, No. 2,316,823, into engagement with the peripheries of the upper and lower sections 76 and 77, respectively, of the selector pattern drum 75.

These toe portions 94 are disposed at levels corresponding to the levels of the corresponding selector or pattern pins 87 and 88 of the respective upper and lower sections 76 and 77 of the selector pattern drum 75. It is evident that, upon any of the selector pins 87 and 88 engaging the corresponding toe portions 94 of the selector levers 90, these selector levers 90 will be pivoted about the shaft 92 in a counter-clockwise direction to move the cam incline 91 associated therewith out of the paths of the butts 34 and 35 on the selectors 33.

It is well known, to those familiar with the art, that during the knitting of the heel and toe pockets 44 and 45, respectively, it is necessary that the cam inclines 91 of the selector levers 90 be disposed in an inoperative position so as to permit the butts of the selectors 33 to pass thereby during reciprocatory movement of the needle cylinders 25 and 30 and the extension 32 of the upper cylinder 30. Thus, there is provided a vertically disposed selector lever blocking bar 95

which is disposed in the horizontal plane of the heel portions 93 of the selector levers 90 and is controlled by conventional means, to be presently described, for engaging these heel portions 93 to swing the selector levers 90 to inoperative position. This bar 95 is fixed on a vertically disposed shaft 96 on the upper end of which an arm 97 is fixedly mounted. This arm 97 has one end of a connecting rod 100 universally connected thereto which extends outwardly and is universally connected to one end of an arm 101 oscillatably mounted on a post 102 depending from the upper bed plate 24.

This arm 101 also has another arm 104 integral therewith which is penetrated by an adjustment screw 105 which engages the outer portion of a lower pawl interrupting lever 106 which is disposed immediately below a second or upper pawl interrupting lever 107, these levers 106 and 107 being oscillatably mounted intermediate their ends on the post 102.

An abutment in the form of an adjustment screw 110 also engages the outer portion of the lower pawl interrupting lever 106 and threadably penetrates the outer end of a conventional indexing lever 111 which is disposed below the lever 106 and also oscillatably mounted on the post 102. The outer portion of this indexing lever 111 is also engaged by the arm 104 and the inner end of the indexing lever 111 normally rides against the periphery of an indexing disk 112 (Figures 4 and 5) having a notch N therein into which the reading or working end of the indexing lever 111 is adapted to be moved in "setting up" the patterning in the pattern drum 75 for knitting a subsequent article.

Now, the arm 101 has one end of a link 114 universally connected thereto which extends outwardly and downwardly in Figure 4 and is pivotally connected, as at 115, on a horizontal axis, to a cuff member 116 fixed adjacent the upper end of a vertically disposed thrust rod 117. This rod 117 and the selector lever blocking bar 95 and intervening connections are conventional and function in a conventional manner. The thrust rod 117 is mounted for vertical sliding movement in the intermediate bed plate 21 (Figure 1) and extends downwardly and is adapted to engage the periphery of the quality drum 70 and, at times, is engaged by a cam 120 fixed on the quality drum 70. It is evident that there would be several thrust rods actuated by the cams on the quality drums 70. However, these thrust rods and the remaining cams on the quality drum 70 are not pertinent to the present invention and an illustration and description thereof are deemed unnecessary.

Now, referring again to Figures 5, 6 and 7, it will be observed that the upper selector pattern drum section 76 is keyed, as at 121, to a tubular hub member 122 and the inner shell 83 of the lower selector pattern drum 77 is keyed, as at 123, to a lower tubular hub member 124. The upper tubular hub member 122 may be supported by and have sliding rotational engagement with the lower tubular hub member 124. The upper and lower sections 76 and 77 of the selector pattern drum 75 are driven by means of respective ratchet wheels 125 and 126, the upper tubular hub member 122 having a tubular extension 130 integral therewith and projecting upwardly therefrom which is provided with a flange 131 to the upper surface of which the ratchet wheel 125 is suitably secured as by a screw 132.

The upper ratchet wheel 126 is suitably secured, as by a screw 133, to the upper surface of the indexing disk 112, this disk 112 being an integral part of a vertically disposed inner tubular member 134. The inner tubular member 134 extends downwardly and has the tubular hub member 122 rotatably mounted thereon and the lower end thereof has the lower hub member 124 keyed thereto, as at 135, and is also secured thereto by a set screw 136. The flange 131 on the extension 130 of the upper hub member 122 has a reduced annular portion 137 extending upwardly therefrom on which the ratchet wheel 125 is mounted. The inner tubular member 134 has stepped reduced portions 140 and 141 at the upper end thereof, the ratchet wheel 126 being mounted on the reduced portion 140. It will be noted that sliding rotational movement between the upper surface of the ratchet wheel 125 and the lower surface of the indexing disk 112 is possible.

In order that the pattern pins 87 and 88, on the respective pattern drum sections 76 and 77, may register accurately with the toe portions of the corresponding selector levers 90, means are provided for adjusting the outer shells 80 and 81 of the upper and the lower sections 76 and 77, respectively, relative to the inner shells 82 and 83. Referring to Figure 6, it will be observed that the outer shell 80 has a circumferentially extending slot 143 therein which is slidably penetrated by a screw 144, this screw 144 being threadably embedded in the inner shell 82. The slot 143 permits relative adjustment between the outer and inner shells 80 and 82, respectively.

It will be observed, in Figure 7, that the proximate lower edges of the outer and inner shells 81 and 83 of the lower section 77 are provided with a plurality of semi-circular threaded cavities 145 and 146, respectively, and, when adjacent cavities 145 and 146 are alined, they are adapted to receive a locking screw 147 for securing the outer shell in adjusted position relative to the inner shell 83. In this instance, the others of the corresponding cavities 145 and 146 will be disposed in staggered relation to each other and, in the event that it is desired to adjust the outer shell 81 about the inner shell 83, the screw 147 may be removed from the mating cavities 145 and 146 and may be inserted in another of the sets of mating cavities 145 and 146, after adjusting the shell 81 to the desired position about the shell 83.

The lower selector pattern drum section 77 is supported for rotational sliding movement on a substantially circular bearing plate 150 which rests upon the upper surface of the conventional cam plate 151, this cam plate 151 being secured in a conventional manner, not shown, to the upper surface of the intermediate bed plate 21. The inner tubular member 134 is mounted for rotation on a vertically disposed pattern drum support shaft 152 which has reduced eccentric end portions 153 and 154 integral therewith. The lower reduced portion 154 slidably penetrates the cam plate 151 and the intermediate bed plate 21. The upper reduced portion 153 of the shaft 152 slidably penetrates the upper bed plate 24 and a block 156.

This block 156 is suitably secured, as by screws 157 (Figures 1, 2 and 3), to the upper surface of the upper bed plate 24 and has a set screw 160 threadably penetrating one of the walls thereof and which bears against the reduced portion 153 of the shaft 152 for holding the shaft in adjusted position. It is thus seen that the position of the selector pattern drum 75, in-

wardly and outwardly relative to the needle cylinder extension 32 may be adjusted by loosening the screw 160 in the block 156 and rotating the shaft 152 about the axis of the reduced end portions 153 and 154.

Referring to Figures 1, 2, 3, 4 and 5, it will be observed that the driving mechanism for the selector drum sections 76 and 77 comprises lower and upper or first and second ratchet pawls 162 and 163 which are pivotally mounted in vertically spaced relation to each other on a suitable stud 164 which is fixedly secured on the outer end of a pawl carrying arm 165. The pawl carrying arm 165 is freely rotatable on the reduced portion 149 of the inner tubular member 134 and in sliding engagement with the upper surface of the second ratchet wheel 126 (Figure 5).

The pawl carrying arm 165 has an extension 166 integral therewith which extends inwardly and is adapted to be engaged by a projection or cam portion 32*a* on the extension 32 of the needle cylinder 30 so that one or the other, or both, of the selector pattern drum sections 76 and 77 are moved one step forward upon each revolution of the needle cylinder according to the desired pattern arrangement.

One of the selector pattern drum sections which, in this instance, is the lower pattern drum section 77 in Figure 5, is controlled in a substantially conventional manner similar to that shown in said Patent No. 2,316,823.

In order to utilize the peripheral area of the lower pattern drum section to its fullest extent, it is necessary that the extension 166 of the pawl carrying arm 165 be held out of engagement with the cam portion 32*a* of the needle cylinder extension 32 during the knitting of the heel pocket. Therefore, means are provided which operate simultaneously with movement of the selector lever blocking bar into engagement with the heels of the selector levers 90, for moving the working end of the second pawl interrupting or blocking lever 107 in a clockwise direction in Figure 4 to engage a down-turned portion 170 of a plate 171, suitably secured to the upper surface of the pawl carrying arm 165, to thus hold both the pawls 162 and 163 at the end of their strokes against the action of a spring 165*a*. One end of this spring 165*a* is connected to the plate 171 and the other end thereof is connected to a projection 165*b* depending from the lower surface of the top bed plate 24. This will hold the extension 166 of the arm 165 out away from the cylinder extension 32 and prevent its actuation by the projection 32*a*.

The upper blocking lever 107 is moved into operative position for holding the pawl carrying arm 165 at the forward end of its stroke during the knitting of the heel pocket by means of a Bowden wire 176 pivotally connected to the outer end of the upper blocking lever 107 as at 177. A tension spring 180 is also connected at one end thereof to the outer end portion of the blocking lever 107, its other end being suitably connected to the lower surface of the upper bed plate 24 for returning the lever 107 to inoperative position. The housing of the Bowden wire 176 fixedly penetrates a post 175 and is then curved downwardly, as shown in Figures 1 and 2, the lower end of the Bowden wire being suitably connected to the inner end of a pivoted lever 182 oscillatably mounted intermediate its ends on a horizontally disposed shaft 183 mounted in the frame 14.

The free end of the lever 182 is normally urged into engagement with the periphery of the clutch drum 67 by the tension spring 180 (Figure 4) and is adapted to be engaged by a cam member 184 on the clutch drum 67 for moving the blocking lever 107 in a clockwise direction in Figure 4 for preventing oscillation of the pawl carrying arm 165 and to hold the projection 166 thereon out of engagement with the projection 32*a* on the cylinder extension 32. It is evident that, upon the cam member 184 moving out of engagement with the reading end of the control lever 182 (Figure 1) the tension spring 180 (Figure 4) again moves the blocking lever 107 in a counter-clockwise direction to assume substantially the position shown in Figure 4.

The driving mechanism for the selector pattern drum sections 76 and 77 is also interrupted during the knitting of the toe pocket upon the lower pattern drum section 77 to be rotated, in a step-by-step manner, to a predetermined position so as to properly effect the transfer of the needles between the cylinders 25 and 30 upon going into the knitting of the leg of a subsequent stocking and following the knitting of the top thereof.

Following the knitting of the instep and sole portions of a stocking, the thrust rod 117 again moves upwardly, or toward the observer in Figure 4, to cause the selector lever blocking bar 95 to again engage the heels 93 of all of the selector levers 90 to move the inclined cam portions 91 thereof away from the needle cylinder to inoperative position. It is evident that this will cause the arms 101 and 104 to move in a clockwise direction, in Figure 4, to assume the position shown and, in which event, the outer portion of the first pawl blocking lever 106 may also swing in a clockwise direction in Figure 4.

Now, since the abutment 105 is in engagement with the lever 106, this will cause the free end of the indexing lever 111 to ride against the periphery of the indexing disk 112. However, inasmuch as the free end of the indexing lever 111 is in engagement with the periphery of the indexing disk 112, it will still prevent the working end of the lever 106 from engaging the down-turn portion 170 of the plate 171 on the pawl carrying arm 165. Thus, although the cam inclines 91 on the selector levers 90 are held out of engagement with the cylinder extension 32 during the reciprocatory knitting of the toe pocket, the pawl 163 may continue to impart step-by-step movement to the ratchet wheel 126 and the corresponding lower pattern drum 177. The indexing disk 112 is provided with a notch N into which the indexing lever 111 will drop upon registering therewith, and into which it is urged by a tension spring 173 on the free end of of the pawl blocking lever 107, and, of course, the working end of the pawl blocking lever 106 will then be moved into engagement with the down-turned portion 170 of the plate 171 on the pawl carrying arm 165 as shown in Figure 4. The notch N is so located that when it is engaged by the lever 111, the lower pattern drum section 77 is in proper position for starting each of successive articles produced by the machine.

The tension spring 173 is connected at one end thereof to the outer end of the pawl blocking lever 106, its other end being connected to a projection 174 extending from the post 175. Upon knitting a succeeding stocking and during the knitting of the top of said succeeding stocking, it is evident that, upon the vertically dis-

posed blocking bar 95 being moved to inoperative position, responsive to downward movement of the thrust rod 117, the arms 101 and 104 move in a counter-clockwise direction to thus move the pawl blocking lever 106 out of engagement with the downwardly projecting portion 170 of the plate 171 on the ratchet pawl carrying arm 165, whereupon the extension 166 of the pawl carrying arm 165 may again be moved inwardly by the spring 165a to be actuated by the projection 32a on the cylinder extension 32 for again imparting step-by-step rotation to the corresponding lower pattern drum section 77 through the medium of the pawl 163 and the ratchet wheel 126.

Due to the shape of the notch N and the mating portion of the indexing lever 111, the indexing lever 111 will ride out of engagement with the notch N upon the pawl 163 engaging the ratchet wheel 126 to impart step-by-step rotation thereto, the indexing lever 111 being moved out of the notch N due to the fact that the lever 106 will have been moved in a counter-clockwise direction by the arm 104 as the arms 101 and 104 are moved in the same direction upon downward movement of the thrust rod 117.

An important feature of the present invention is a pattern controlled means for imparting step-by-step rotation to the upper selector pattern drum section 76 at varying intervals during which the lower pattern drum section 77 moves a step in unison with each step in movement of the upper selector pattern drum section 76 and between which the lower selector pattern drum section 77 may continue step-by-step movement independently of the upper selector pattern drum section 76.

In order to control step-by-step movement of the upper selector pattern drum section 76 independently of the lower selector pattern drum section 77, the lower pawl 162 is controlled as to its movement inwardly and outwardly relative to the ratchet wheel 125 by means of the projections 73 on special links of the pattern chain 72 engaging the upper end of a pawl control lever 185, to the lower end of which one end of a Bowden wire 186 is connected, as at 187. The projections 73 will swing the lever 185 in a counter-clockwise direction in Figure 1 causing the Bowden wire 186 which extends upwardly in Figures 1 and 2 and is connected to the lower end of an arm 190, to move from left to right in Figure 2. This arm 190 extends upwardly and is then bent horizontally and is fixedly mounted on the upper end of a shaft 191.

The shaft 191 is oscillatably mounted in a vertically extending tubular bearing member 192 which has a rearwardly extending portion 193 integral therewith (Figure 3) which is suitably secured, as by screws 194, to the upper surface of the upper bed plate 24. One end of a horizontally disposed rod 198 is adjustably secured in the enlarged lower end of the vertically disposed shaft 191 and this rod 198 loosely penetrates a cuff member 195 which depends from and is oscillatably mounted in the free end of the pawl 162.

It is thus seen that upon movement of the Bowden wire from left to right in Figure 2, the shaft 191 will move in a clockwise direction in Figure 4 to cause the rod 198 to impart like movement to the pawl 162 to thus move the same into engagement with the corresponding ratchet wheel 125. Now, in order to return the pawl 162 to inoperative position, upon the projections 73 on the pattern chain 72 (Figure 1) moving out of engagement with the lever 185, there is provided a leaf spring member 196 which is fixed at its rear end, in Figure 3, on a projection 197 extending from one side of the rearwardly extending portion 193 on the bearing 192. This leaf spring member 196 extends forwardly and is bent at its front end in such a manner as to engage the inner surface of the vertically extending arm 190 to thus tend to move the arm 190 and the corresponding vertically disposed shaft 191 in a counter-clockwise direction in Figures 3 and 4. It is evident that this would cause the pawl 162 to be moved outwardly to assume the position shown in Figure 4.

Inasmuch as the upper selector pattern drum section 76 is slidably supported by the lower selector pattern drum section 77, a braking means is provided for resisting movement of the upper pattern drum section 76. This braking means comprises a brake bank 200 (Figures 2 and 5) which encircles the tubular portion 130 of the upper hub member 122 and which has adhesively secured to the inner face thereof, a suitable friction material 201, such as leather or the like, which frictionally engages said tubular portion 130 of the hub member 122. The brake band 200 has an outwardly extending portion 202 integral therewith which is secured, as by screws 203, to the lower end of an arm 204.

This arm 204 extends upwardly and is bent spirally and is suitably secured, as by screws 205, to the outer end of a cuff member 206. The cuff member 206 extends inwardly and is slidably penetrated by the reduced upper portion 141 of the inner tubular member 134 (Figure 5). The cuff member 206 is bifurcated, as at 207 (Figure 3), so as to straddle a locking pin 208 depending from the lower surface of the upper bed plate 24 to prevent rotation of the cuff member 206 about the reduced upper portion 141 of the tubular member 144. It is evident that this will prevent rotation of the brake bank 200 about the tubular portion 130 of the tubular hub member 122 and suitable means, in the form of a screw 211, is provided for clampingly securing the opposed portions of the brake bank 200 together so as to cause the same to frictionally engage the tubular portion 130 of the hub member 122 to thus resist rotation thereof.

It is unnecessary, in this particular instance, to provide means for resisting rotation of the lower selector pattern drum section 77 as rotation is imparted to the upper selector pattern drum section 76 because, whenever a step is imparted to the upper pattern drum section 76, a step in rotation is also imparted to the lower pattern drum section 77. However, there may be many times when a step in rotation is imparted to the lower selector pattern drum section 77 when it is not imparted to the selector pattern drum section 76.

It is thus seen that I have provided a means for controlling the selected transfer of needles from one cylinder to the other through the medium of selectors having a plurality of groups of selector butts thereon and the selector butts of one group being engageable by selector levers responsive to one pattern drum section, the selector butts of another section or group being responsive to selector levers controlled by the other pattern drum section which operates independently of the first-named pattern drum section to thus produce a Links and Links fabric wherein it is possible to produce a stocking hav-

ing spaced sections each comprising a plurality of wales in which the stitches formed face inwardly and wherein certain of these sections may have ornamental designs formed therein with outwardly facing stitches and the ornamental appearance of the designs in any one or more of the sections may be varied in any desired manner relative to other sections although the various designs may be disposed in the same course. The ornamental appearance of the stocking shown in Figure 10, exemplifies one of many types of design combinations which may be formed of outwardly facing stitches on areas formed of inwardly facing stitches.

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 of limitation, the scope of the invention being defined in the claims.

I claim:

1. In a circular knitting machine having vertically movable needles and selectors associated with the vertically movable needles and being provided with selector butts thereon, said knitting machine also having a plurality of selector levers adapted to be moved into engagement with the butts on certain of the selectors, an improved pattern drum for moving the selector levers into and out of operative position in predetermined order comprising an upper pattern drum section and a lower pattern drum section disposed in coaxial relation to each other, the upper pattern drum section being frictionally supported by the lower pattern drum section, an inner tubular member on which the lower pattern drum section is fixedly mounted, said upper pattern drum section being rotatable on said inner tubular member, a vertically disposed shaft on which the inner tubular member is rotatably mounted, a first ratchet wheel fixed on the inner tubular member and a second ratchet wheel fixed on the upper pattern drum section, pawl carrying means adjacent the ratchet wheels, means for driving the pawl carrying means in an oscillatory manner for imparting step-by-step rotation to the upper and lower sections of the pattern drum, means for rendering the pawl carrying means inoperable with respect to one of the ratchet wheels and maintaining operation of the pawl carrying means with respect to the other of the ratchet wheels so as to impart step-by-step rotation to one of the selector pattern drum sections independently of the other pattern drum section.

2. In a circular knitting machine having vertically movable needles and selectors associated with the vertically movable needles and being provided with selector butts thereon, said knitting machine also having a plurality of selector levers adapted to be moved into engagement with the butts on certain of the selectors, an improved pattern drum for moving the selector levers into and out of operative position in predetermined order comprising an upper pattern drum section and a lower pattern drum section disposed in coaxial relation to each other, the upper pattern drum section being frictionally supported by the lower pattern drum section, an inner tubular member on which the lower pattern drum section is fixedly mounted, said upper pattern drum section being rotatable on said inner tubular member, a vertically disposed shaft on which the inner tubular member is rotatably mounted, a first ratchet wheel fixed on the inner tubular member and a second ratchet wheel fixed on the upper pattern drum section, pawl carrying means adjacent the ratchet wheels, means for driving the pawl carrying means in an oscillatory manner for imparting step-by-step rotation to the upper and lower sections of the pattern drum, pattern controlled means for rendering inoperable with respect to one of the ratchet wheels and maintaining operation of the pawl carrying means with respect to the other of the ratchet wheels so as to impart step-by-step rotation to one of the selector pattern drum sections independently of the other.

3. In an independent needle circular knitting machine having selectors for operating upon the needles and also having selector levers for operating upon the selectors, said knitting machine also having an upper and an intermediate bed plate spaced substantially apart from each other, improved pattern controlled means for moving the selector levers into and out of operative position in predetermined order, comprising a vertically disposed shaft having eccentrically located reduced end portions removably secured in the upper and lower bed plate, an inner tubular member rotatably mounted on said shaft between the upper and lower bed plates, a hub member fixed on the lower end of the inner tubular member and having an inner tubular shell fixed thereon, an outer tubular shell forming a lower pattern drum section adjustably secured on the inner tubular shell and having a plurality of butts thereon for engaging certain of the selector levers according to a desired pattern, an upper tubular hub member rotatably mounted on the inner tubular member and in sliding engagement with the upper surface of the lower tubular member, an inner tubular shell fixed on the upper tubular member, an outer tubular shell forming an upper pattern drum section adjustably secured on the inner tubular shell of the upper hub member and also having a plurality of butts thereon for engaging certain selector levers according to a desired pattern, and independently operable means for imparting rotation to each of the hub members and their corresponding upper and lower pattern drum sections, one independently of the other or simultaneously as desired, whereby said shaft may be adjusted about the axis of the reduced eccentrically located end portions of said shaft for attaining a desired displacement between the needle cylinder and the peripheries of the upper and lower pattern drum section.

4. In an independent needle circular knitting machine having selectors for operating upon the needles and also having selector levers for operating upon the selectors, said knitting machine also having an upper and an intermediate bed plate spaced substantially apart from each other, improved pattern controlled means for moving the selector levers into and out of operative position in predetermined order, comprising a vertically disposed shaft having eccentrically located reduced end portions removably secured in the upper and lower bed plate, an inner tubular member rotatably mounted on said shaft between the upper and lower bed plates, a hub member fixed on the lower end of the inner tubular member and having an inner tubular shell fixed thereon, an outer tubular shell forming a lower pattern drum section adjustably secured on the inner tubular shell and having a plurality of butts

thereon for engaging certain of the selector levers according to a desired pattern, an upper tubular hub member rotatably mounted on the inner tubular member and in sliding engagement with the upper surface of the lower tubular member, an inner tubular shell fixed on the upper tubular member, an outer tubular shell forming an upper pattern drum section adjustably secured on the inner tubular shell of the upper hub member and also having a plurality of butts thereon for engaging certain selector levers according to a desired pattern, and independently operable means for imparting rotation to each of the hub members and their corresponding upper and lower pattern drum sections, one independently of the other or simultaneously as desired, whereby said shaft may be adjusted about the axis of the reduced eccentrically located end portions of said shaft for attaining a desired displacement between the needle cylinder and the peripheries of the upper and lower pattern drum sections, said means for adjusting the outer shell relative to the inner shell of the lower pattern drum section including a plurality of sets of circularly spaced threaded semi-circular cavities in the proximate lower edges of the inner and outer shells, one set of adjacent semi-circular cavities in the inner and outer shells coinciding with each other as the remaining sets thereof are disposed in staggered relation to each other whereby the outer shell may be moved about the inner shell to where one of the other sets of semi-circular cavities will be disposed in alinement with each other to change the position of the outer shell relative to the inner shell.

5. In a circular knitting machine having a needle cylinder with independent vertically movable needles therein and selectors associated with the needles and provided with selector butts at different levels and also having selector levers movable into operative position to act upon selector butts of said selectors for positioning selected needles for knitting the desired patterns, means for independently controlling separate sets of selector levers to maintain either set of levers inoperative while the other set of levers is moved into and out of operative position comprising a pattern drum including an upper and a lower section mounted on a common axis, independently operable driving mechanism for each of the sections of the pattern drum, means for stopping at least one of the sections of the pattern drum at predetermined intervals during the knitting of each article independently of the other of the sections of the pattern drum so as to maintain the same needle selections responsive to one of the pattern drums for a plurality of courses, and brake means associated with the pattern drum and arranged to resist rotation of one of the sections during rotation of the other of the sections.

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