Nov. 21, 1939. H. E. HOUSEMAN 2,180,708

KNITTING MACHINE

Filed Aug. 30, 1938 4 Sheets-Sheet 1

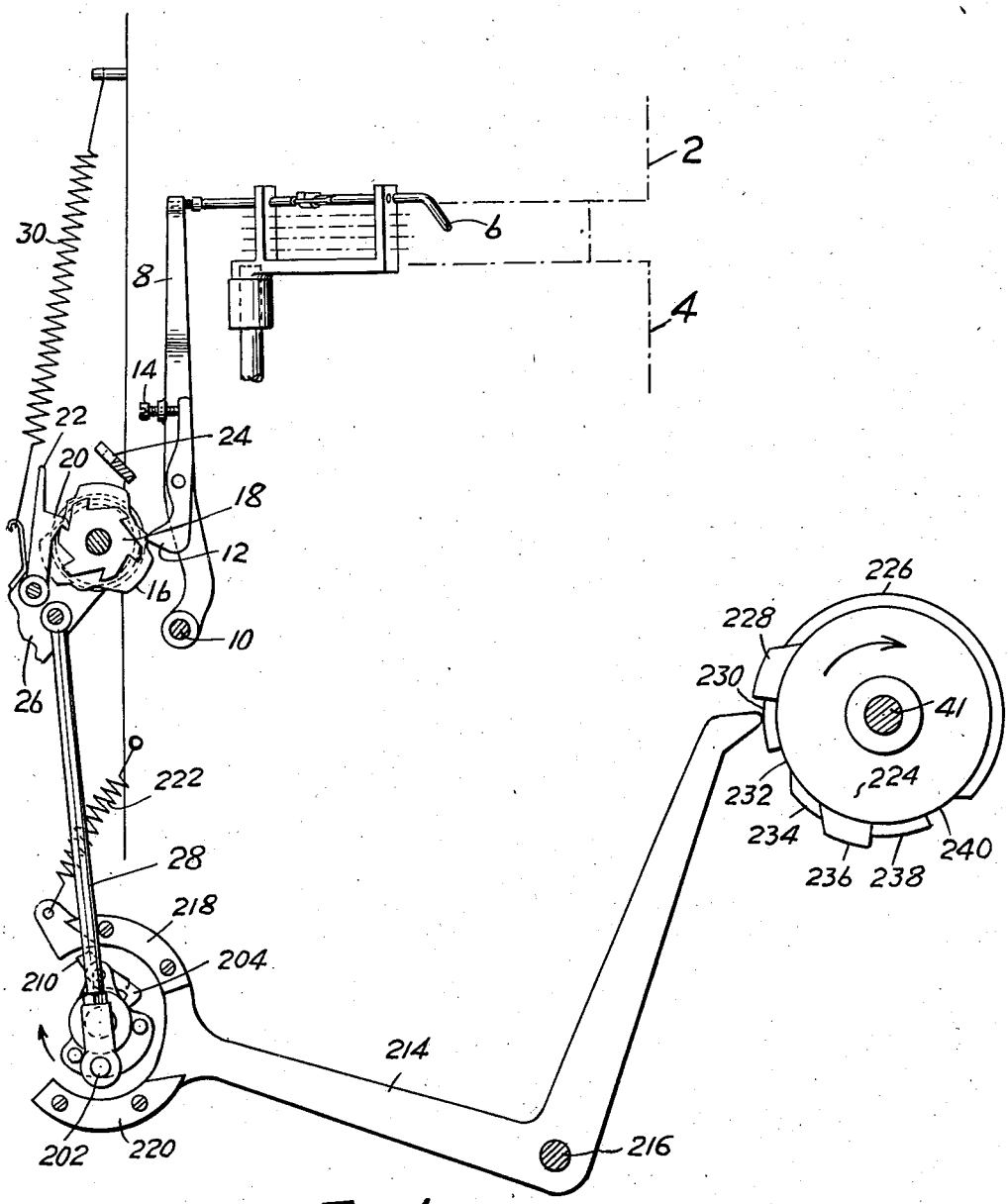


FIG. 1.

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KNITTING MACHINE

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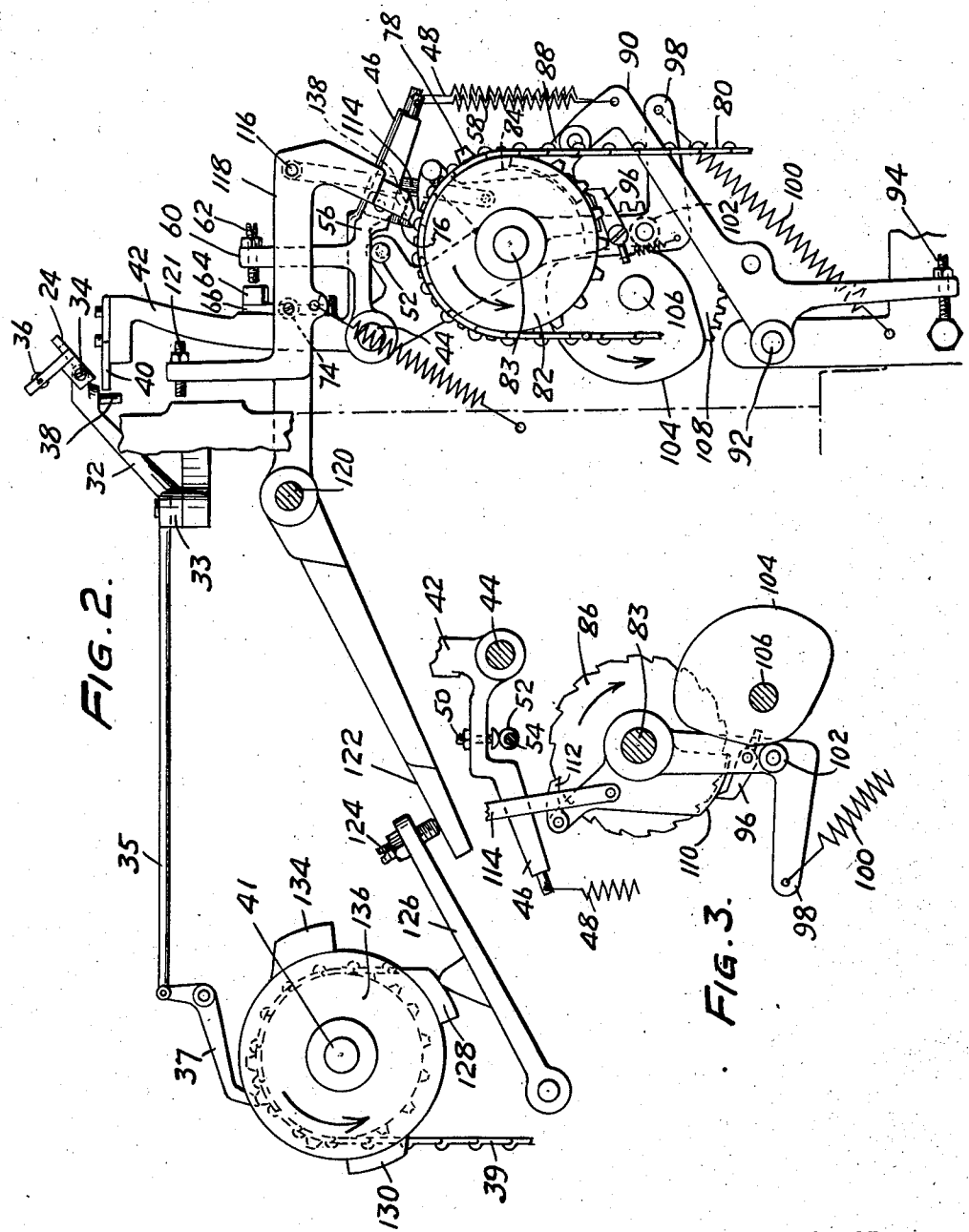


FIG. 2.

FIG. 3.

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KNITTING MACHINE

Filed Aug. 30, 1938 4 Sheets-Sheet 3

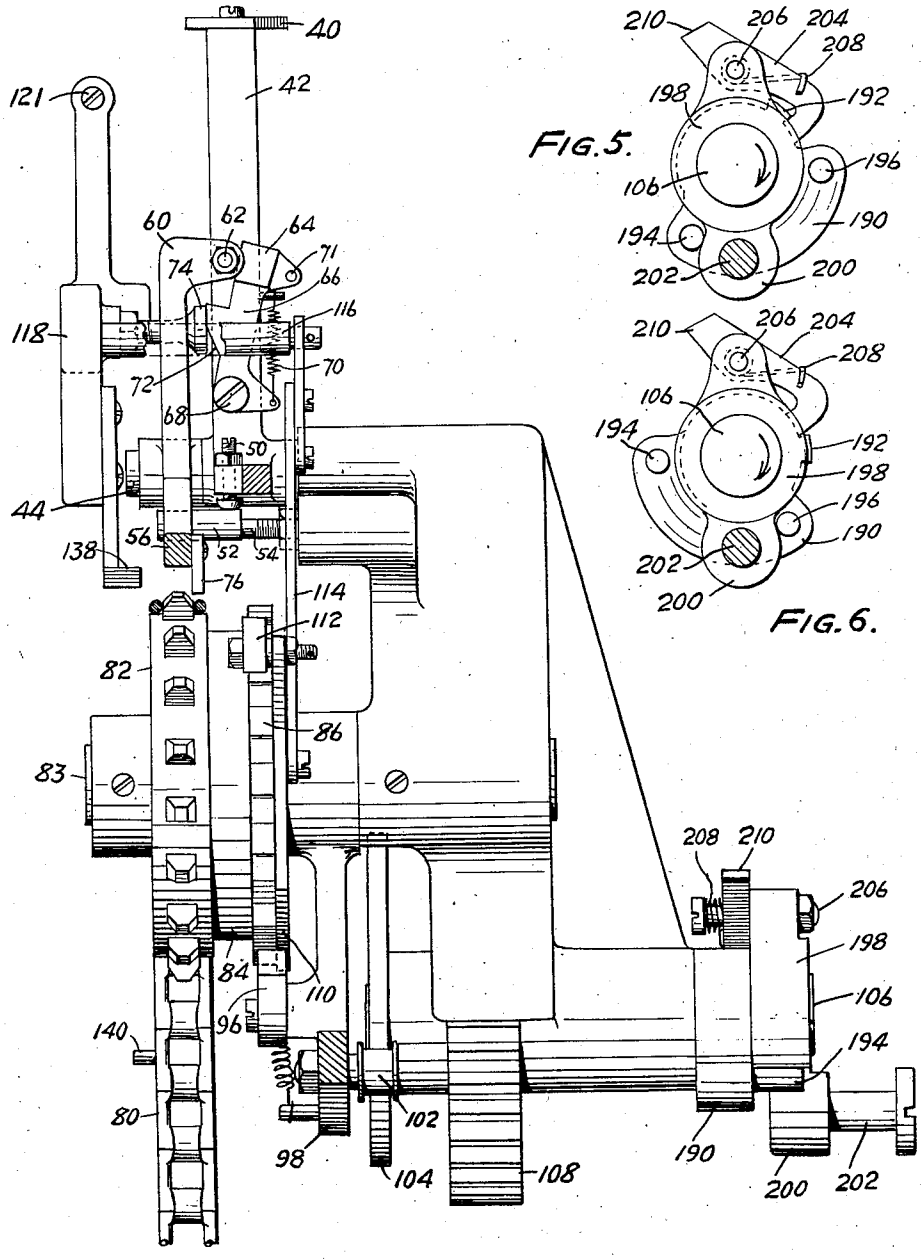


FIG. 4.

FIG. 5.

FIG. 6.

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Nov. 21, 1939. H. E. HOUSEMAN 2,180,708

KNITTING MACHINE

Filed Aug. 30, 1938 4 Sheets-Sheet 4

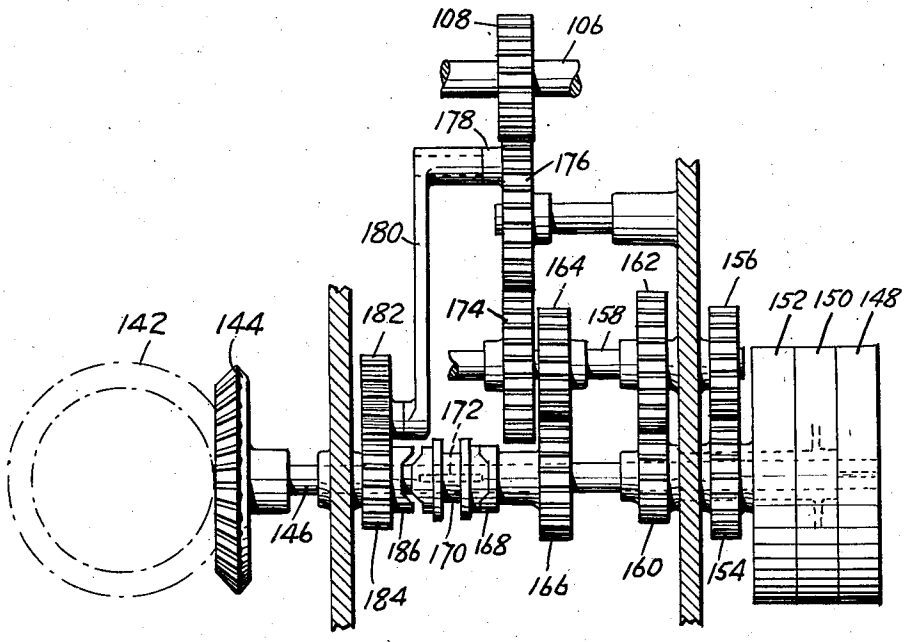


FIG. 7.

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Patented Nov. 21, 1939 2,180,708

UNITED STATES PATENT OFFICE

2,180,708

KNITTING MACHINE

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Application August 30, 1938, Serial No. 227,452

23 Claims. (Cl. 66—138)

This invention relates to a knitting machine, and particularly to striping devices for such machine.

In the production of striping in knitted fabric by the changing of yarns, it is common to have the striping changes take place in a cyclical fashion. On the other hand, certain yarn changes do not take place cyclically, for example, the yarn changes for the formation of the heel and toe and other structural portions of a stocking. It is one object of the present invention to provide a knitting machine in which a selector is arranged for independent control by pattern means, one of which is designed to control the major series of yarn changes in the formation of a stocking, and the other of which is designed to control cyclical striping changes with a resultant simplicity of the set-up of the pattern means and the possibility of using the primary pattern means for the formation of stockings containing different arrangements of stripes. The invention is also applicable to an arrangement in which two pattern means may control striping to provide a striping arrangement which is, in part, cyclical and in part non-cyclical.

Another object of the present invention is to provide means for insuring that the overlap of striping yarns occurs in the proper portion of a stocking during both rotary and reciprocatory knitting. Usually, in the transition from rotary to reciprocatory knitting a timing change occurs so that without special precautions the introductions of yarns would occur on different groups of needles during the two kinds of knitting. Specifically, in accordance with the present invention the controlling means for the yarn changes has its timing shifted with respect to the driving means to secure overlap in the desired fashion.

Further objects of the invention particularly relate to details of construction whereby the general objects are satisfactorily attained, and these will be better understood from a consideration of the following description, read in conjunction with the accompanying drawings, in which:

Figure 1 is a diagrammatic vertical section showing certain of the elements concerned with the yarn changing in a conventional type of knitting machine;

Figure 2 is a fragmentary elevation showing the major portions of the yarn change controlling means;

Figure 3 is a vertical section looking at the same from the side opposite that illustrated in Figure 2;

Figure 4 is a front elevation of the same partly in section and showing various details;

Figures 5 and 6 are vertical sections showing the arrangement for shifting the timing of a crank pin to control the formations of proper overlaps during both rotary and reciprocatory knitting; and

Figure 7 is a sectional plan view of the driving mechanism for the needle cylinders and for the yarn changing controlling means illustrating particularly the necessity for the change in timing of the yarn change control means in passing from rotary to reciprocatory knitting.

The machine to which the invention is shown as applied is of the type illustrated in Bentley et al. Patent 1,838,651, to which patent reference may be made for details of construction which are not illustrated herein. Referring first to Figure 1, in which there are shown various elements of the type of the machine shown in the patent, and from which the relationship of the novel parts involved in the present invention to the conventional parts of the machine may be understood, the upper and lower cylinders of the machine are indicated at 2 and 4, which cylinders are provided in the usual fashion with double ended needles which may be transferred from one cylinder to the other for the production of ribbed and plain fabric in the formation of a stocking. Various yarns are fed to these needles by a series of yarn fingers, of which only one is illustrated at 6. These yarn fingers have imparted to them their individual motions by the conventional means, including individual levers 8 pivoted at 10 and provided with follower portions 12 adjustable as indicated at 14. The followers 12 are acted upon by cams 16 driven by individual ratchets 18 having alternate high and low teeth and adapted to be advanced by means of pulling pawls 20, which are provided with extensions 22 designed to selectively engage stepped portions of a slide 24 arranged to be selectively positioned laterally of the machine. The various pawls 20 are pivoted to a frame 26, which is continuously oscillated during the operation of the machine through the medium of a link 28 connected to an adjustable crank described in detail hereafter. A strong spring 30 serves to urge the pawl carrying frame 26 in a clockwise direction as viewed in Figure 1.

The various parts so far described are quite conventional and illustrated fully in said Bentley et al. patent. From the mechanical standpoint, as applied to this machine, the present invention is concerned with two matters, first the selective positioning of the slide 24 laterally of the machine to provide selective actuation of the ratchets 18 and accordingly of the yarn fingers, and secondly the angular shift of the crank driving the link 28 to insure the changing of yarn at proper times. The first phase of the invention will be first considered with particularly reference to Figures 2, 3 and 4.

The slide 24, which is conventionally mounted

in the machine for endwise movements, has such endwise movements imparted to it by means of a lever 32 pivoted on a vertical pivot and provided with a rearwardly extending arm indicated at 33, to which there is connected a link 35 actuated by means of a lever 37, which rides lugs of various heights upon the main pattern chain 39 mounted upon a sprocket journalled on the main control shaft 41 of the machine. The main pattern chain has, as usual, a number of links equal to half the number of courses of the stocking and is therefore advanced a half link for each rotation of the cylinders. The lever 32 is adapted to engage an adjustable screw 34 carried by the slide 24, which is urged in a direction away from the observer as viewed in Figure 2 by a spring 36. The various elements just mentioned are similar to those illustrated in the Bentley et al. patent.

In accordance with the present invention, an additional control is provided for the lever 32. The lever is provided with a downwardly extending pin 38 adapted to be engaged by a cam 40 carried by the upper end of a lever 42 pivoted on a stud 44 carried by the frame of the machine. The lever 42 has a forwardly extending arm 46 which is urged downwardly by a spring 48 to bring an adjustable stop screw 50 into contact with an eccentric portion 52 carried by a screw 54 and functioning as an adjustable stop.

A lever 56 is mounted on the stud 44 alongside the lever 42 and is pulled downwardly by means of a spring 58. The lever 56 is provided with an upper extension 60 in which is threaded a screw 62 adapted to engage a block 64 carried by the upper end of a lever 66 pivoted at 68 to the lever 42 and urged in a counterclockwise direction by a spring 70 to a position limited by the engagement of a stop pin 71 carried by the lever 66 with the side of the lever 42. The lever 66 is provided with a lateral extension 72 arranged to be engaged as, for example, under the conditions illustrated in Figure 4 by the head of a screw 74 carried by a lever 118 hereafter described.

The lever 56 is provided with a cam following extension 76 which is designed to ride on lugs 78 of various heights provided on a pattern chain 80 carried by a sprocket 82, which is journalled upon a stud 83 carried by the frame. The sprocket 82 is provided with a hub portion 84 to which is secured a ratchet 86. In order to prevent overrun of the chain, a brake 88 engages the hub 84, the brake being in the form of a member faced with friction material such as leather and pivoted to a lever 90 mounted on a stud 92 fixed to the frame and adapted to be adjusted by means of a screw 94 abutting a stud on the frame in such fashion as to secure the proper frictional drag upon the hub. The springs 48 and 58 heretofore described may be conveniently anchored to the lever 90.

The advance of the ratchet 86 is effected by means of a pawl 96 spring urged into engagement with the ratchet and pivotally mounted upon a lever 98 journalled upon the stud 83 and urged in a counter-clockwise direction by a spring 100 as viewed in Figure 3 to bring a following roller 102 carried by it into contact with an actuating cam 104, carried by the shaft 106, which also carries a gear 108 by means of which it is driven from the cylinder driving mechanism of the machine so as to make one rotation to each rotation of the needle cylinders.

A pawl guard 110 is pivoted upon the stud 83 and carries a pawl 112 spring urged into engagement with the teeth of the ratchet 86. The purpose of this pawl is to secure advance of the ratchet after timing up of the pattern chain. The pawl guard 110 is adapted to be oscillated through the medium of a link 114, which is pivoted to a lateral extension 116 of a main control lever 118, which is pivoted upon a stud 120 carried by the machine frame and provided with a portion 122 arranged to be engaged by an adjustable screw 124 carried by a lever 126 having a follower portion adapted to be acted upon by a series of cams 128, 130, and 134 carried by the main cam drum 136 journalled on the shaft 41 and arranged to be advanced at irregular intervals under the control of the main chain 39 in the usual manner. At its right hand end as viewed in Figure 2, the main control lever 118 is provided with a lateral extension indicated at 138 adapted to cooperate with a pin 140 carried by the pattern chain 80 for the purpose hereafter described.

The second phase of the invention, which is concerned with the angular shifting of the crank pin which actuates the link 28, will be best understood from a preliminary consideration of the type of driving mechanism for the needle cylinders which is provided in the machine illustrated in the above mentioned patent. This mechanism is illustrated in diagrammatic form in Figure 7. The cylinders are connected to a bevel gear indicated at 142, which is driven by a bevel gear 144 secured to a shaft 146 having suitable bearings in the frame. At the right hand end of this shaft as viewed in Figure 7 are three pulleys, 148, 150 and 152. The pulley 148 is a loose pulley, 150 the slow speed pulley and 152 the fast speed pulley. Secured to the fast speed pulley 152 is a pinion 154 which meshes with a pinion 156 secured to a counter-shaft 158 having suitable bearings in the frame. The slow speed pulley is secured through the medium of a sleeve surrounding the shaft 146 to a pinion 160 which meshes with a substantially larger pinion 162 secured to the counter-shaft 158. Also secured to the counter-shaft is a gear 164 which meshes with a gear 166 carrying the clutch element 168 and rotating freely upon the shaft 146 being held in suitable manner from endwise movement thereon. Arranged to cooperate with the clutch element 168 is a moving clutch element 170 splined to the shaft 146 as indicated at 172.

A gear 174 fixed to the counter-shaft 158 meshes with a gear 176 with which meshes the pinion 108 on the shaft 106 previously described. The gear 176 carries a crank pin 178 to which is connected a link 180 the other end of which embraces a crank pin carried by a quadrant 182 which is pivoted to the frame and meshes with a pinion 184 journalled on the shaft 146 and carrying a clutch element 186 which is also adapted to be engaged by the clutch element 172. The clutch element 170 may be moved alternatively into engagement with either of the elements 168 and 186 under the control of a clutch shifting device actuated from the main cam drum of the machine.

The parts so far described are old in this type of machine. During normal rotary knitting, the driving belt engages the fast speed pulley 152 and the clutch 170 is in its right hand position as illustrated in Figure 7. Under such conditions, the drive of the shaft 146, and hence the needle cylinders, is through pinions 154 and 156, pinions 164 and 166, and clutch elements 168 and

170. When a slow speed pulley is used, as, for example, during the making of certain yarn changes, the belt drives pulley 150 and then the drive of the shaft 146 is through pinions 160 and 162, 164 and 166 and clutch elements 168 and 170. The lower ratio between pinion 160 and 162 effects the slower drive.

During both rotary drives, as just described, the gear 176 is driven and this in turn drives the pinion 108 controlling the oscillation of the frame 26 and the advance of the pattern chain 80. Automatic changes from high to low speed are effected by means of a shipper arrangement under control of the pattern devices of the machine.

During rotation of the needle cylinders, the link 180 oscillates the quadrant 182 and hence produces oscillations of the pinion 184. When oscillation of the needle cylinder is to take place, the clutch member 170 is moved into the left hand position and the shaft 146 then oscillates with the pinion 184. It will be noted that rotation of the pinion 108 nevertheless continues. In this type of machine reciprocation always takes place with drive through the slow speed pulley.

As will be brought out more fully hereafter in connection with the description of the operation, the change from rotation to reciprocation necessitates a shift of the crank pin driving the link 28 in order to provide proper yarn changes.

Referring now to Figures 4, 5 and 6, the shaft 106 has secured to its right hand end a member 190 which is provided with an outwardly extending ear 192 and axially extending pins 194 and 196. Rotatably mounted on the end of the shaft there is a collar 198 which is provided with an extension 200 carrying the crank pin 202 to which the link 28 is connected. The extension 200 has a freedom of movement between the limiting pins 194 and 196. Mounted on a pivot pin 206 in the sleeve 198 diametrically opposite the crank pin 202 there is a pawl 204 which is adapted to engage opposite sides of the projection 192 as illustrated in Figures 5 and 6. The pawl 204 is urged inwardly by means of a spring 208 and is provided with a cam-engaging tail 210.

In Figure 1, there are illustrated controlling devices for the pawl 204. The controlling devices comprise a bell crank 214 pivoted at 216 to the frame and provided with a forked end carrying cams 218 and 220 adapted to selectively engage the tail 210 of the pawl. A spring 222 urges the bell crank in a clockwise direction to bring its upwardly extending arm into engagement with cams on a cam drum 224 which rotates on the shaft 41 along with the cam drum 136. The cam surfaces 226 to 240, inclusive, will be described hereafter.

The operation of the machine will be first described with reference to what occurs during rotary knitting, for example, of the leg and instep of a stocking. The main chain 39 of the machine is provided with some links adapted to act upon the follower lever 37 for control of the major yarn changes such as those involved in the formation of the heel and toe and for the production of tips as hereafter described. Additionally, this chain may be provided with lugs of varying heights adapted to act on the follower 37 to produce striping in addition to the cyclical striping controlled by the auxiliary chain 80.

The lugs just mentioned are carried by one side of the main chain 39, while the other side of the chain carries lugs adapted to control the advance of the pattern drums 136 and 224 in the usual fashion. As pointed out above, the chain 39 contains one link for every two courses of a stocking. By control of the advance of the pattern drums by links on this chain, the drums are caused to move only for control of the major events in the production of the stocking and hence require only a limited number of cam carrying positions for complete control. The control of the cam drums by such chain is conventional. Heretofore, however, the cam drums were generally used for the control of yarn changes. In the present case the yarn changes, except those striping yarn changes controlled by the chain 80, are produced by means of the lugs on the chain 39. The chain 80 is advanced one link for every course and by reason of the different height lugs which control the position of the selector 24 striping is effected in a fashion which will be obvious from consideration of the mechanism of Figure 1 and the disclosure of said Bentley patent.

The advantage of the use of a chain 80, which goes through a number of cycles for each complete cycle of the main chain 39, will be obvious. In general the chain 39 will be set up in such fashion as not to control any striping. This is the case because usually striping is effected in cyclical fashion. Under such conditions the chain 39 will contain only those lugs which control advance of the pattern drums and which control the yarn changes for the production of heels and toes and for tipping or other special events. It will be obvious, therefore, that when a chain 39 is made up it may be used for the production of many varieties of stockings so long as the size and structural parts remain the same, whereas the striping designs may be changed by changes of the relatively short striping chains 80. Thus there is greatly facilitated the changing of patterns. As an example, suppose the striping sequence involved ten links repeated through a stocking say ten and one-half times. In the present machine only ten striper links would be required on the chain 80. The majority of the links on the chain 39 would then be plain ones. On the other hand, if the chain 39 were used for the striping control, it would be necessary to use one hundred and five striper links carefully arranged with proper height lugs and necessarily changed if a change in the striping design was to be made. In the case of the present machine, on the other hand, if the design was changed so as to have twelve stripes in a sequence, it would only be necessary to replace the ten link chain by a twelve link chain having a proper sequence of links. The chain 39 would remain the same.

The mechanism which has been described effects the shifting of the yarn changing mechanism, i. e., the selector 24 and its associated elements, from one chain to the other. During the time of formation of the leg, the follower 126 will be located on the portion of the pattern drum preceding the cam 128, which corresponds to the formation of the heel. Under such conditions, the lever 118 is in its clockwise position as viewed in Figure 2 and the block 64 is in alignment with the screw 62 so that the movements imparted to the lever 56 by the various height lugs on the pattern chain 80 will effect the location of the selector 24 in various positions to control the striping. At such time, plain links will be riding beneath the lever 37 so that the sole control of the selector 24 is by the chain 80.

When the formation of the heel is to take place, the cam 128 acts upon the lever 126, depressing it as indicated in Figure 2. This raises the right

hand end of lever 118 to the position illustrated in Figure 2, in which, through the link 114, it causes the pawl guard 110 to move into a position to prevent engagement of the pawl 96 with the teeth of the ratchet 86. As a consequence of this the pawl 96 oscillates idly without advancing the ratchet and the chain 80, so that when knitting of the instep is resumed the pattern will run continuously from the leg into the instep at the front of the stocking. At the same time, the rise of the lever 118 cause the block 64 to be moved to the position indicated in Figure 4, in which it will not be engaged by the screw 62. Accordingly, even though the follower 76 may be upon a lug on the chain 80 the lug will not control the position of the selector 24 since the cam 40 will be retracted from the pin 38. At this time, therefore, the selector 24 may come under the control of one or more lugs on the chain 39 to effect suitable yarn changes in the heel. At this time a timing change takes place, but for simplicity of explanation the description of the patterning will be continued without reference to this timing change, which is described hereafter.

After the completion of the formation of the heel, the cam 128 releases the follower 126, whereupon the guard 110 clears the pawl 96, permitting it to advance the ratchet 86. At the same time, the block 64 is freed to move into the path of the screw 62, so that pattern control by the chain 80 is again resumed.

When the toe is reached, the cam 130 causes a depression of the lever 126, but to a less extent than that effected by the cam 128. Again, the right hand end of the lever 118 is raised, but this time its rise is not sufficient to cause the pawl guard 110 to remove the pawl 96 from cooperation with the ratchet 86. The rise, however, is such as to bring the inturned cam edge 138 of the lever 118 into the path of the pin 140 so that the lever 118 may be further raised by the pin 140 when that pin comes around to engagement with it, which engagement corresponds to the initial position of the chain 80. Thus timing up of the pattern chain is effected, the pin 140 when it engages the cam 138 causing an added rise of the lever 118 which effects movement of the guard 110 into position to prevent cooperation of the pawl 96 with the ratchet. Before the pin 140 engages the cam 138, however, the lever 118 will have risen to such position as to move the block 64 out of the path of the screw 62. Accordingly, even though the lever 56 is caused to move by the lugs on the chain 80, the pattern control is not effected by the chain 80, but rather by the chain 39. Thus yarn changes may be made in the toe of the stocking under the control of the latter chain.

In the beginning of the next stocking on a machine of the double cylinder type herein described, there is first formed a ribbed top which is generally plain. A number of additional movements of the drum 136 accordingly take place, but it is not necessary that the toe cam 130 should continue to control the lever 126 because the lever 118 will now be held in its upper position by the pin 140, and consequently the chain 80 will remain stationary until patterning is to be resumed by it in the leg.

To cause a resumption of patterning in the beginning of the leg knitting, there is provided an extra high cam 134, which engages the lever 126 raising the end of the lever 118 to an extra high position in which it causes the pawl 112 (Figure 3) to advance the ratchet 86 about the distance of half a link. This takes the pin 140 from beneath the cam 138 so that when the starter cam 134 frees the lever 126 the control lever 118 is free to fall, permitting the pawl 96 to act upon the ratchet 86 to advance the chain 80.

If during the knitting of the leg or instep it is desired to provide an interruption in the cyclical control by the chain 80 to introduce, for example, special stripes, it is only necessary to cause a cam of the height of 128 to engage the lever 126, with the result that the control of the patterning may revert to the chain 39, while the chain 80 remains stationary to resume patterning as soon as the control cam on the drum 136 releases the lever 126. Thus both cyclical and noncyclical pattern changes may be interrelated to produce elaborate effects.

It will be noted that the effect of the provision of the removable block 64 is to permit the operation of the lugs on the chain 80 upon the reading lever 56 without controlling the position of the selector 24. Thus during heel and toe knitting, or at other times, the pattern control may be shifted to the main chain 39. Furthermore, timing of the chain 80 may take place without interfering with independent control of the selector 24.

The crank shifting devices illustrated in Figures 1, 5 and 6 are provided to alter the yarn change timing in order to compensate for the change in needle cylinder timing with respect to the driving means when it changes from the rotary driving gearing to the reciprocatory driving gearing. If it were possible to operate the yarn changer from the cylinder gear, then yarn changes would always be on the same group of needles; however, since the cylinder gear sometimes rotates and sometimes oscillates with the cylinders, this cannot be satisfactorily accomplished. In this type of machine, as heretofore constructed, the crank driving the yarn changer has been set to produce the yarn change laps in a striped stocking in the center of the short butt group of needles, i. e., the group of needles which forms the heel and toe. However, due to the mechanism described above and illustrated in Figure 7, when the clutch is changed as the machine goes into the heel or toe to produce reciprocatory rather than rotary knitting, the timing which formerly existed between the yarn changing mechanism and the needle cylinder is so altered that the lap of yarns takes place near the end of the short butt needles, i. e., at the side of the stocking. It is often desirable to put a colored tip in the heel or the toe or both. In such cases, after about half the gore needles have been picked out of action, the yarns are changed. The new yarn then remains in action while the rest of the narrowing operation takes place and until the pocket has been widened to that width where the color was previously altered, whereupon the yarns are again changed. As the yarn change lap must necessarily take place on active needles, it must occur somewhere close to the center of the short butt group. However, because of the shift in timing, it has not been possible in the past to embody in the one stocking both striping in the leg and instep and tipping in the heel and toe. If a stocking having a plain leg but a tipped heel and toe was to be made, the yarn change crank was permanently set so that if yarn changes had been made in the leg the laps would occur about 50° ahead of the center, i. e., at the side of the leg. This would not be particularly objectionable

if only two or three yarn changes were made in the leg, but it would be quite unsatisfactory to make a considerably striped stocking having the laps that far off center. By so advancing the crank the laps occur in the center of the short butt series during heel and toe knitting, and tipping is thus made possible, however, at the expense of no striping.

In accordance with the present invention the crank which effects the striping changes may be located in either of two positions, which are about 50° apart. The leg yarn changes are made with the crank in the back position, i. e., in the position illustrated in Figure 6. In such case the projection 200 is engaged and driven by the pin 196 and the pawl 204 lies to the rear of the lug 192. Just prior to the clutch change to reciprocatory knitting for the heel or toe, the crank is moved to the advanced position of Figure 5, where it remains until just before the machine comes out of the heel or toe, when it slips back to the position of Figure 6. By such control the laps in the changes off the heel or toe occur in the center of the short butt group of needles, and as a result every yarn change lap throughout the stocking is made on substantially the same group of needles representing the back of the stocking.

The shifts of the crank are accomplished by the controlling cams 218 and 220 in Figure 1, with the cooperation of the strong spring 30, which tends to move the bracket 26 upwardly. It will be noted that the ratchet devices 18 offer no resistance to this upward movement of the bracket 26, since this is the idle direction of movement of the pawls 20.

In going on to the heel the cam 228 acts upon the bell crank 214 to cause the cam 218 to move downwardly. The cam 218 engages the tail of the pawl 204 as the crank 202 is moved beyond its lower dead center position. When the pawl 204 is released from the lug 192 and as the crank 202 passes lower dead center, the spring 30 will advance the crank more rapidly than the shaft 106. Accordingly, the crank shifts from the position of Figure 6 to the position of Figure 5, with respect to the shaft 106. As soon as the pawl 204 clears the cam 218, it snaps in front of the lug 292, thereby preventing rearward movement of the crank. Immediately after this shift takes place, the cam drum 224 moves presenting a low cam 230 to the lever 214, moving both the cams 218 and 220 to positions clear of tail 210 of the pawl 204. Thus the timing of operation of the bracket 26 is shifted forwardly to secure the proper laps in yarn changes in the heel, for example, for tipping as well as the yarn change in going into the heel.

Just before the knitting comes out of the heel a low region 232 is presented to the bell crank 214 and the cam 220 is then moved upwardly to engage the tail 210 of the pawl 204. In this case engagement takes place just as the crank pin 202 passes its upper dead center position, and at this time the spring 30 is acting in opposition to movement of the crank. Accordingly, the crank is retarded with respect to the shaft 106 and moves backwardly with respect thereto to the position illustrated in Figure 6. After clearing the cam 220 the pawl engages behind the lug 192 locking the crank in its new position. Immediately after this action a low cam 234 engages the bell crank again moving both the cams 218 and 220 to positions clearing the pawl. The same action is repeated by the cams 236 and 238 in going into the toe and just before completing the toe the low portion 240 and the cam 226 cause a shift of the crank back to its retarded position. The cam 226, therefore, holds the bell crank in its neutral position until the change to the heel is again to take place.

As a result of the crank shifts just described, the proper laps are caused to take place at the rear of the stocking throughout its entire formation and thus striping throughout the leg and instep, and tipping in the heel and toe may be effected in the same stocking.

What I claim and desire to protect by Letters Patent is:

1. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector which is normally inactive, said selector being adapted to be variously positioned to determine yarn changes, a cyclically movable pattern device, means for operating said selector from said pattern device, and control means adapted to cause the pattern device as it moves either to variously position the selector or to allow it to remain in its normally inactive position.

2. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a pattern device, a follower for the pattern device, means providing an interruptible connection between said follower and said selector, and means for interrupting said connection to prevent control of the selector by the follower while the latter is actuated by the pattern device.

3. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a pattern chain containing lugs of various heights, a follower for the pattern chain continuously under the control thereof, and means for determining whether or not said follower shall position said selector in accordance with the heights of lugs on the chain controlling the follower.

4. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a cyclically operating pattern device, a follower for the pattern device continuously under the control thereof, connections between said follower and selector whereby the former controls the latter, means for locating the pattern device in an initial position after a period of control of yarn changes thereby, and means for interrupting the connections between the follower and selector after such period of control of yarn changes and while the pattern device is being located in initial position.

5. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a cyclically operating pattern device, means for intermittently advancing said pattern device, a follower for the pattern device continuously under the control thereof, connections

between said follower and selector whereby the former controls the latter, means for interrupting the intermittent advance of the pattern device, and means for interrupting the connections between said follower and selector whenever said advance of the pattern device is interrupted.

6. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a primary cyclically operating pattern device, a secondary cyclically operating pattern device normally adapted to operate through a plurality of cycles for each cycle of the primary pattern device, means for effecting independent control of said selector by said pattern devices, and means for alternatively either stopping the advance of said secondary pattern device during control of the selector by the primary pattern device, or for providing for continued advance of said secondary pattern device during control of the selector by the primary pattern device.

7. A knitting machine comprising a circular series of needles, means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a primary cyclically operating pattern device, a secondary cyclically operating pattern device normally adapted to operate through a plurality of cycles for each cycle of the primary pattern device, means for effecting independent control of said selector by said pattern devices, and means for stopping the advance of said secondary pattern device during the control of the selector by the primary pattern device.

8. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a primary cyclically operating pattern device, a secondary cyclically operating pattern device normally adapted to operate through a plurality of cycles for each cycle of the primary pattern device, means for effecting independent control of said selector by said pattern devices, and means for providing for continued advance of said secondary pattern device during control of the selector by the primary pattern device.

9. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; means for producing relative rotation between the needles and yarn feeding means; means for producing relative reciprocation between the needles and yarn feeding means; driving means for both the last named means, the arrangement being such that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means during rotation and reciprocation; and means through which said yarn changing means is actuated to effect yarn changes on substantially the same group of needles during both rotation and reciprocation.

10. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; means for producing relative rotation between the needles and yarn feeding means; means for producing relative reciprocation between the needles and yarn feeding means; driving means for both the last named means, the arrangement being such that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means during rotation and reciprocation; and means through which said yarn changing means is actuated to effect yarn changes on substantially the same group of needles during both rotation and reciprocation; the last means including devices for changing the timing of the actuation of the yarn changing means with respect to the driving means.

11. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; means for producing relative rotation between the needles and yarn feeding means; means for producing relative reciprocation between the needles and yarn feeding means; and a single train of mechanism for timing the actuation of the yarn changing means to effect yarn changes on substantially the same group of needles during both rotation and reciprocation.

12. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; driving means; means for moving the needles with respect to the feeding means in such fashion that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means; and means for altering the time of operation of the yarn changing means to effect yarn changes on substantially the same group of needles during said different timings of the needles with respect to the feeding means, said last named means comprising a shiftable crank driven by said driving means, and means for adjusting the angular position of the crank.

13. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; driving means, means for moving the needles with respect to the feeding means in such fashion that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means; and means for altering the time of operation of the yarn changing means to effect yarn changes on substantially the same group of needles during said different timings of the needles with respect to the feeding means, said last named means including a shiftable crank driven by said driving means, a member driven by said crank, a spring acting upon said member whereby at each revolution of the machine said spring tends during part of each revolution to advance said crank, and during another part of each revolution to retard said crank, a pawl for retaining the crank in either an advanced or retarded position, and means for tripping the pawl selectively at either of two predetermined times so that the spring may locate the crank in either its advanced or retarded position.

14. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; driving means; means for moving the needles with respect to the feeding means in such fashion that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means; and means for altering the time of operation of the yarn changing means to effect yarn changes on substantially the same

group of needles during said different timings of the needles with respect to the feeding means, said last named means including a shiftable crank driven by said driving means, a member driven by said crank, a spring acting upon said member whereby at each revolution of the machine said spring tends during part of each revolution to advance said crank, and a pawl for retaining the crank in its advanced position after it is moved to such position by said spring.

15. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; driving means; means for moving the needles with respect to the feeding means in such fashion that location of predetermined needles in yarn receiving relationship with the yarn feeding means occurs at different positions of the driving means; and means for altering the time of operation of the yarn changing means to effect yarn changes on substantially the same group of needles during said different timings of the needles with respect to the feeding means, said last named means including a shiftable crank driven by said driving means, a member driven by said crank, a spring acting upon said member whereby at each revolution of the machine said spring tends during part of each revolution to retard said crank, and a pawl for retaining the crank in its retarded position after it is moved to such position by said spring.

16. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; and driving means therefor including a shiftable crank, a spring acting upon said crank whereby at each revolution of the crank said spring tends during part of each revolution to advance said crank, and during another part of each revolution to retard said crank, a pawl for retaining the crank in either an advanced or retarded position, and means for tripping the pawl selectively at either of two predetermined times so that the spring may locate the crank in either its advanced or retarded position.

17. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means; and driving means therefor including a shiftable crank, a spring acting upon said crank whereby at each revolution of the crank said spring tends during part of each revolution to advance said crank, and during another part of each revolution to retard said crank, and means for controlling the action of said spring upon said crank.

18. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; and yarn changing means including a cyclically operating pattern device having a long cycle, a cyclically operating pattern device having a short cycle, means through which each of said pattern devices may control the feeding means to effect selective feeding of the same group of yarns to produce a knit product having different striping sequences therein, and means rendering the short cycle pattern device ineffective during striping control by the long cycle pattern device.

19. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means including two pattern devices and a selector arranged to be variously positioned to determine yarn changes by the action of either of said pattern means; means for cyclically moving at least one of said pattern devices through a plurality of cycles during the knitting of a stocking and means for timing said pattern device so moving through a plurality of cycles to bring it to a predetermined initial position during the knitting of a portion of a stocking involving no patterning under its control.

20. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means including a pair of pattern chains and means through which each of said pattern chains may control the feeding means to effect selective feeding of the same group of yarns to produce a knit stocking having different striping sequences therein; means for cyclically moving at least one of said pattern chains through a plurality of cycles during the knitting of a stocking; and means for timing said pattern chain so moving through a plurality of cycles to bring it to a predetermined initial position during the knitting of a portion of a stocking involving no patterning under its control.

21. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a primary pattern means and a secondary pattern means, said two pattern means being arranged to effect independently the same type of operations of said selector; means for cyclically moving said secondary pattern means through a plurality of cycles during the knitting of a stocking; and means for timing said secondary pattern means to bring it to a predetermined initial position during the knitting of a portion of a stocking involving no patterning under its control.

22. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means including a selector arranged to be variously positioned to determine yarn changes, a primary cyclically operating pattern device, a secondary cyclically operating pattern device normally adapted to operate through a plurality of cycles for each cycle of the primary pattern device, and means for effecting independent control of said selector by said pattern devices to effect the same type of positioning of the selector by each pattern device; and means for timing said secondary pattern device to bring it to a predetermined initial position during the knitting of a portion of the stocking involving no patterning under its control.

23. A knitting machine comprising a circular series of needles; means for selectively feeding a plurality of yarns to said needles; yarn changing means including primary and secondary pattern chains and means through which each of said pattern chains may control the feeding means to effect selective feeding of the same group of yarns to produce a knit stocking having different striping sequences therein; means for effecting advance of the primary pattern chain throughout the formation of a stocking independently of the secondary pattern chain; and means through which the primary pattern chain controls movements of the secondary pattern chain.

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