YARN FEEDING MECHANISM FOR STRAIGHT KNITTING MACHINES

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Application June 24, 1933, Serial No. 677,443

8 Claims. (Cl. 66—127)

This invention relates to mechanism for selectively actuating yarn carriers in knitting machines in predetermined order in succeeding courses of a fabric during the knitting thereof, and is particularly applicable to knitting machines of the type employed to knit articles, such as ladies' silk stockings, from yarn which varies in evenness or exhibits different characteristics in various lengths thereof tending to detrimentally affect the appearance of the knitted article.

The thread silk from which hosiery and similar articles of wearing apparel are knit is graded according to its “evenness,” expressed in percentage, the silk varying from 68% evenness, usually regarded as a low grade silk, to 92% which is an extra fine grade. Not only does thread silk of different grades differ in evenness, but in silk of the same grade there is often a variation in evenness of the yarn, and various lengths of the yarn, often several yards long, will have a diameter either greater or less than the average diameter of the yarn, this condition occurring at more or less regular intervals throughout the yarn.

In the production of hosiery, particularly ladies' stockings, this variation in evenness of the silk frequently causes one or more coursewise extending rings or bands to appear in the stocking which differ in shading and appearance from the body of the stocking, these effects being especially noticeable when the stocking is stretched on the leg of the wearer. The number of stockings showing the effects of variation in evenness often reaches large proportions, resulting in an excessive number of “seconds,” thus materially increasing the cost of manufacture of the stockings and substantially curtailing production.

The foregoing effects in variation of evenness may be minimized or prevented by knitting the stocking or other article from two or more separate main body yarns of the same grade and kind, the yarns being alternately employed in succeeding courses throughout substantially the entire stocking length, whereby the variation in evenness in any particular length of one of the yarns is compensated for and its effect minimized by the adjacent yarn or yarns, and thus the overall effect is free from rings or other noticeable effects ordinarily caused by variation in evenness of the silk.

One object of the invention, therefore, is to provide suitable mechanism for automatically alternating in predetermined order two or more yarn carriers feeding separate yarns respectively in succeeding courses of a fabric during the knitting thereof.

Another object is to provide a friction box or equivalent device which is common to two or more yarn carrier rods, and having mechanism associated therewith for automatically causing the friction box to successively engage and actuate said carrier rods in predetermined order.

Another object resides in carrier control mechanism of the character described having the form of an attachment which may be used with standard types of straight knitting machines without entailing changes in the construction or manner of operation of the machines, which attachment is simple in construction and may readily be applied to existing installations.

A further object of the invention resides in the device of the character described which operates generally in the manner of the usual friction box, and which is controlled by cam operated means without requiring a pattern chain or similar mechanism, and which does not interfere in any manner with the usual operation of the machine in the production of either plain knit or special loop fabrics.

An additional object is to provide automatic mechanism for alternating two or more yarn carriers feeding separate yarns in predetermined order, in which each of said carriers may be operatively engaged by the mechanism at opposite sides of the knitting section in succeeding courses, respectively, whereby a single course of any one of said yarns may be produced intermediate adjacent courses of another yarn or yarns without recourse to an idle course motion.

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

In the drawings:

Fig. 1 is a partial front plan view of a full fashioned stocking knitting machine embodying my invention:

Fig. 2 is a fragmentary front plan view of various friction boxes employed for connecting the yarn carrier rods to the friction rod in the machine of Fig. 1:

Fig. 3 is a cross sectional view of the knitting machine taken substantially along the line 3—3 of Fig. 1:

Fig. 4 is a fragmentary sectional detail view taken substantially as indicated along the line 45.
4—4 of Fig. 1, showing only the narrowing machine lift mechanism;
Fig. 5 is a cross sectional view, taken substantially along the line 5—5 of Fig. 1, showing various details of one form of yarn carrier control device in accordance with the invention;
Fig. 6 is a detail view of certain cam members shown in Fig. 5;
Fig. 7 is a front view, looking in the direction of the arrow A in Fig. 5, showing details of the carrier control device;
Fig. 8 is a fragmentary view of latch structure for holding the carrier control device in inactive position;
Fig. 9 is a view taken along the line 9—9 of Fig. 1, showing details of certain ratchet elements employed in the carrier control device;
Fig. 10 is a top plan view looking down upon the ratchet elements of Fig. 9;
Fig. 11 is a view taken along the line 11—11 of Fig. 1, showing details of a friction brake member employed in the control device;
Fig. 12 is a longitudinal sectional view taken along the line 12—12 of Fig. 11;
Fig. 13 is a cross sectional view taken along the line 13—13 of Fig. 1, showing details of certain stop elements employed with my device;
Fig. 17 is a detail view, similar to Fig. 5, of certain ratchet elements employed in combination with the modified form of control device shown in Figs. 15 and 16;
Fig. 18 is a longitudinal sectional view taken along the line 18—18 of Fig. 17;
Fig. 19 is a view of the structure of Fig. 17 in a different operating position;
Fig. 20 is a perspective view of certain parts involved in laying three yarns alternately in succeeding courses of a fabric during the knitting process;
Fig. 21 is a front perspective view of a full fashioned stocking produced on a machine embodying the carrier control device shown in Figs. 1 to 14;
Fig. 22 is a diagrammatic view of the flat knitted blank of the stocking of Fig. 21;
Fig. 23 is an enlarged diagrammatic view of the loop formation of the fabric of Figs. 21 and 22;
Fig. 24 is an enlarged diagrammatical view of the loop formation of a fabric produced with the modified form of carrier control device shown in Fig. 15;
Fig. 25 diagrammatically illustrates the movements of the yarn carriers in knitting the stocking of Figs. 21 and 22;
Fig. 27 diagrammatically illustrates the movements of the yarn carriers with the control device of Figs. 15, 17, 18 and 19;
Fig. 29 diagrammatically illustrates the movements of the yarn carriers when using the control device of Figs. 16 to 19 inclusive;
Fig. 30 shows various parts of a Reading full fashioned knitting machine embodying the mechanism and elements of my invention.

For the sake of clearness I have illustrated only those parts of the various mechanisms necessary for an understanding of the invention; the various other parts and mechanisms and their manner of operation are well known in the art, and are shown and described in detail in the "Reading" full fashioned knitting machine catalogue (copyright 1929) published by the Textile Machine Works.

Referring particularly to Figs. 1 and 3, the machine is shown as comprising a frame of conventional construction including front and back beams 10 and 11, front and center beds 12 and 13, and end and center frames 14 and 15. The power mechanism includes the usual cam shaft 16 associated with the usual cam shaft shifting device B manipulated by the usual chain motion mechanism C. The main shaft carries the usual cams for the various motions and attachments, certain of which have been omitted from Fig. 1 for the sake of clarity. The cams should include the narrowing head actuating cams 17, shogging cams 18 and 19, narrowing lift cams 20, and cams 22 and 23 for actuating the carrier control device hereinafter described. The cam shaft is driven by a prime mover, such as an electric motor, through a suitable clutch connection in the usual manner.

The chain motion mechanism C, Fig. 1, is of the usual construction, comprising a pattern chain 24 travelling around a power drum or sprocket 25, and having suitable buttons 26 clamped to gear 27 adapted to engage with the selected courses, a lock lever 27 pivotally mounted on stud shaft 28. The cam shaft 16 is shifted to the right for narrowing or other purposes, in a manner well known in the art, whenever the buttons 26 strike the lock lever and raise it out of a groove 29 in main stud 30 as the buttons pass around the sprocket wheel 25, at which time the main stud is released and is pulled inwardly by a contractile spring 32; this brings the cam roller 33, which revolves freely on the end of the main stud 30, into contact with the side face of the right side shifting cam 19, shifting the cam shaft 16 inch, or the width of one cam, to the right, and causing rollers 34 carried by levers 35 to engage the narrowing left cams 20 on the cam shaft, thus imparting, through lift levers 36 pivotally connected to the front narrowing shaft 31, Figs. 3 and 4, the necessary vertical movement to the narrowing mechanism, the shaft 37 being connected by guide arms 31 to the rear narrowing shaft 21 in the usual manner.

After the cam shaft has made one revolution and the narrowing or other loop shifting operation has been completed, the main stud 30 is returned to its original position when the cam piece 35 strikes a roller 33 and moves guide bracket 40 out, and lock lever 27 falls in the groove 29 of the main stud and locks it in its regular position. This causes the cam roller 33 to be brought into operative engagement with the left side shifting cam 18, and the cam shaft is shifted to the left returning to the plain knitting position shown in Fig. 1, in which position the rollers 34 engage the left side shifting cam 18, and thus no movement is imparted to the narrowing mechanism.

In Fig. 3 the narrowing lift cam and lever members 20, 34, 35 and 41 shown in the section broken away in Fig. 1 at the right hand end of the machine and therefore do not show in Fig. 1, but it will be understood that these elements are identical with those shown in Fig. 4.

The narrowing heads D at opposite ends of the machine are of the usual construction, each comprising a ratchet device 42 actuated by a lever 43 carrying a roller 44 which, when the cam shaft is shifted to the right in the manner above de-
scribed, engages the narrowing head actuating cams 17. The ratchet device 42 is operatively associated with the usual ratchets 45 and 46 mounted on the narrowing rod and carrier rod spindles 47 and 48, respectively. The narrowing heads in function in the usual manner to control the position of the usual narrowing rods 49, 50, Figs. 3 and 4, and the narrowing fingers or combs carried thereby, and also to control the traverse of the yarn carrier rods Nos. 1 to 8 inclusive in the well known manner, i.e., the spindles 47 of the narrowing rods and their associated devices intermittently rack the narrowing fingers in each knitting section inwardly during the narrowing operations in the production of plain knit fabric, and the yarn carrier spindles 48 control the position of the various ends stops 52 to progressively decrease the traverse of the yarn carrier rods which carry the yarn carriers Nos. 1a to 8a respectively. The carrier rods are supported in brackets 51, Figs. 3 and 5, which form an angle of approximately 40 degrees with the horizontal in order that all carriers 1a to 8a may be approximately the same length and thus eliminate the vibration attendant to a long horizontal carrier section.

The row of needles 53, Figs. 3, 7 and 20, of each knitting section are supported in the needle bar 54 which gives the necessary vertical and horizontal movements by the needle bar actuating levers 55, 56 controlled by needle lever and presser levercams on the main cam shaft in the well known manner. The sinker and divider mechanism is comprised of the swing sinkers 57 and dividers 58 mounted in a sinkerhead 59; it will be understood that the sinkers and dividers are operated in proper time relation to enable the needles to form loops and to coact with the yarn carrier control mechanism hereinafter described.

In the illustrative embodiment shown in the drawings, the yarn carrier control mechanism, Figs. 1 to 3 and 5 to 7, comprises a special main friction box 60 which is common to a plurality of yarn carrier rods, a rotatable splined shaft 63 carried in journals between the endwise movement of the lever member 65 carried by the friction box to different operative positions for selectively connecting any of said carrier rods to the friction rod 67, and a ratchet device 68 controlled by cam 23 on the main cam shaft for rotating the cams 64 and 65 thereby to reciprocate said yarn carrier rods alternately in predetermined order in succeeding courses of the fabric during the knitting thereof.

Referring particularly to Figs. 5, 6 and 7 the friction box 60 is shown as comprising friction shoes 69, 70 carrying leather strips 72 engaging the friction rod 67, the pressure on said shoes being maintained by means of a bowed spring 73 which coacts with the upper shoe 69 and a U-shaped bracket 74 to exert pressure on the friction cam when the lever member 15a is thrown in such position (to the right as viewed in Figs. 1 and 2) as to cause a cam surface 75 to exert pressure on the spring 73, thereby causing the friction box to engage the friction rod in slidable frictional gripping engagement therewith in the usual manner. The securing to and extending from the friction box housing 76 is a bracket structure 77 having two arms 77a, 77b between which is mounted, by means of a shaft 78 rotatably mounted in the two arms, the lever member 66 which is thereby adapted to be rotated through a limited angle to different operative positions relative to the yarn carrier rods. The various positions of the lever 66 are determined by the contour of the cams 64 and 65 which engage rollers 79 and 80 carried by the lever, the lever being rotated or oscillated to different positions by rotation of the cams in the direction indicated by the arrow in Fig. 6.

The lever 66 has bifurcated portions 66a, 66b, between which is slidable mounted a member 82 secured to a rod 83 slidable in the bore of the lever. The slide members 82 are adapted, through manipulation of the rod 83 and hand lever 84, to be lowered into the position shown in the drawings to enable one or the other of the selector members, or tongues, 85, 86 to selectively engage dogs 87, 88 and 89 on certain of the yarn carrier rods to impart the reciprocating movement of the friction rod to a selected carrier rod in laying the yarn for any given course. A spring pressed detent ball 80 adapted to engage detents in rod 83 serves to hold the slide 82 in either active or inactive position relative to the dots on the carrier rods. Thus, if the hand lever 84 is pulled to raise the slide to a position such that the tongues 85, 86 will clear the dogs on the carrier rods, the rods may be independently connected to the friction rod by the usual friction boxes, such as boxes 82a and 82b shown in Fig. 2, any one of which may be made individual or inactive in position, as shown, the position of the lever 66 relative to the respective yarn carrier rods being determined by the position of the cams 64 and 65 relative to rollers 79 and 80. In the position shown in Figs. 5 to 7, the rollers are in contact with the cams 64 and 65 at the points 2c and 2d respectively, Fig. 6, at which time the lever 66 has been rotated to a position such that the tongue 85 on the slide engages the dog 87 on yarn carrier rod No. 2; rotation of the shaft 63 and cams 64 and 65 in a counterclockwise direction, as viewed in Figs. 5 and 6, causes the lever member 65 to engage the rollers at the points 5c and 5d respectively, in which position the lever 66 has been rotated in a clockwise direction to a position such that tongue 85 is released from dog 87 on carrier rod 2 and tongue 86 engages the dog 88 on No. 3 carrier rod; further rotation of the shaft 63 and cams 64, 65 causes the cams to engage the rollers at the points 3c and 3d respectively, in which position the lever 66 has been rotated in a counterclockwise direction to a position such that the tongue 86 is disengaged from dog 88 and engages dog 89 on carrier rod No. 5. Continued rotation of the shaft 63 and cams 64 and 65 causes the foregoing cycle of operation to be repeated, thus enabling three main yarns of the same grade and kind to be alternately laid in succeeding courses, whereby the effect of variation in yarn tension in any one of the yarns will be compensated for or minimized by the adjacent yarns, so that the overall effect is free from ripples or other noticeable effects ordinarily caused by variation in evenness of the silk.

As shown in Figs. 5 and 7, the cams 64 and 65 have extending sleeve portions 95 and 96 forming bearings for the cams which are slidable along the splined shaft 63, the splitting of which prevents rotation of the cams relative to the shaft. The sleeve portions of the cams are journaled in bearings 98 and 99 extending from bracket 77, and endwise movement of the sleeves 75
in their bearings is prevented by collars 100 and 102 secured, as by machine screws, to the sleeves. The foregoing arrangement permits free sliding movement of the cams and shafts 63, the cammers being in unison with the friction box and being reciprocated thereby across the knitting field.

The shaft 63 may be mounted in bearings 103, 104, 105, Fig. 1, secured to the machine frame, as in any other manner, as by extending the bushing 106, Figs. 11 and 12, of the friction rod bearing 107 carried by the friction rod bracket 108 which also provides a support for the friction box guide rod 109. Mounted on the extension of the bushing 106, and secured thereto by a set screw 110, is a bracket 112 having an extending lug 113 and set screw 114 for engaging the friction rod bracket 108 and having another lug 116 and screw 118 for engaging the friction box guide rod 109, thereby to securely clamp the bearing 103 in proper position. A collar 117 secured to the shaft 63 prevents endwise movement of the shaft in one direction, and movement in the opposite direction is prevented by a dished resilient metal friction disk 118 having a central opening through which a reduced portion 119 of the shaft 63 extends, the disk being locked by nuts 120 against a shoulder portion 121 of the shaft so that it rotates therewith. The disk has a leather washer 122 riveted thereto which bears against the end of bearing 103, the assembly providing a friction brake which prevents the shaft 63 during rotation thereof. The shaft is supported at its other end by a bearing 105, Fig. 1, which may conveniently be secured to the splinting stop bracket 123 which carries splinting blocks commonly employed to limit the travel of splinting carriers in the well-known manner. An intermediate bearing 104 is secured to a friction rod bearing in the manner of bearing 103. A hand wheel 124 is secured to the shaft 63 to permit manual rotation of the shaft.

The rotation of the cams 64 and 65 by the ratchet device 68 in proper time relation with respect to the various other mechanisms of the knitting machine is effected by means of a cam moving in time relation to the rotational movement of the cam shaft, or to the movement of the loop forming members such as the cam member 125, Figs. 1 and 3, on the machine cam shaft 16, acting through rigger 125 carried by a lever 126 pivotally mounted at 127 to a bracket member 128 secured to the rear rail 11, the lever 126 being pivotally connected to 128 to an upright lever 130. The lever 130 is pivotally connected by means of a stud 131, Figs. 9 and 10, to a bracket member 132 carried by and freely rotatable on shaft 63. The bracket 132 carries a pawl 133 pivotally mounted on a stud 134 secured to the bracket, the pawl being held into engagement with a ratchet 135 by means of a contractile spring 136. The ratchet is fastened to shaft 63 by a set screw 137 so that as the ratchet is stepped around by the pawl the shaft 63 will be stepped around accordingly. If desired, the pawl may be thrown out of engagement with the ratchet by means of the handle 138 secured to the pawl, the handle and pawl being turned in a clockwise direction, as viewed in Fig. 9, until the handle strikes a stop 139, in which position the spring 136 will hold the pawl out of engagement with the ratchet.

Rotation of the machine cam shaft 16 causes rotation of the shaft 63 and cams 64 and 65 carried thereby in a counterclockwise direction, as viewed in Figs. 3, 5, 6 and 9, when the cam 23 passes from its low point z to the high point y, this movement raising roller 125 and rotating the lever 126 and bracket 132, as shown in full in Figs. 1 and 3 in the plain knitting position shown in Fig. 1.

The cams 64 and 65, Figs. 5 and 6, are thus intermittently rotated in a counterclockwise direction and oscillate the lever 126 to different operative positions in succeeding courses, respectively, as the fabric is knit, thereby alternating the yarns in predetermined order.

The bracket 77 and cams 64 and 65 are reciprocated along the splined shaft 63 in accordance with the reciprocating movement of the friction rod 67 and friction box 59, and the lever 66 and tongues 85 and 86 carried thereby may be rotated or oscillated to different operative positions at each side of the knitting section, so that the carriers may be engaged or disengaged at either side of the section, and thus a single stroke fed by the carriers may be produced without the necessity of using an idle course motion to return the friction box to the opposite side of the section to engage the next carrier.

When the cam shaft is in shifted position, as during narrowing or other loop shifting operation, the cam 22, Figs. 1 and 3, is in engagement with roller 125; cam 22 is smaller than cam 23 so that the pawl 133, Fig. 9, is not rotated to step the ratchets 135 around, the pawl having a slight overtravel relative to the ratchet teeth, as will be seen from the figure, so that any slight movement caused by cam 22 will not change the position of the ratchet.

In order to prevent misalignment of the loops 61, 68, 69 relative to the tongues 85 and 86 of lever 66 caused by rebound of the carrier rods when their travel is arrested by striking the usual end stops 52, there are provided, Figs. 1, 13 and 14, special rebound preventing devices comprising, in the illustrative form shown, plate members 144 secured to the carrier rods near their end thereof and spring pressed plunger 142 with tapered surfaces or detents 142a which engage, at the end of the travel of the carrier rods, complementary surfaces 141a of recesses or notches 141 in the plate members and prevent rebound of the carrier rods. Preferably, and as seen in Fig. 14, when the carrier rod is at the end of its travel the surface 141a of each plunger engages only that surface 141a which is adjacent the end of the carrier rod, thereby to prevent lost motion between these members due to wear or other cause in service, and obviating the necessity of fine adjustment of the members relative to each other. The depth of the recesses 141 and the taper of the surfaces 141a and 142a is such as to readily permit movement of the carrier rods when connected to the friction rod and ratchet therewith. The plunger or detent members 142 are enclosed in housings 143 which may conveniently be clamped to the arresting lever brackets 144 carrying arresting levers 145, 146 commonly employed to give certain of the yarn carriers a predetermined lead with respect to the sinkers, the brackets 144 being connected to the narrowing nuts 51 on the yarn carriers 45 so as to move with the end stops 52 in the well known manner.
the fabric in which the effects due to variation in evenness are to be avoided.

Fig. 27 is a diagrammatic representation of the path of travel of the yarn carriers in a further modification of the carrier control device shown in Fig. 16, in which three separate yarns are employed to form the main body yarn of the stocking, with the respective carriers 1, 3 and 5, starting from the same side of the knitting section, and situated in preselected order as determined by the contour of cams 64b, 65b, each carrier laying the yarn for two adjacent courses of the stocking, generally in the manner shown in Fig. 27.

As shown in Fig. 27, the yarn in the first two courses is laid by No. 1 carrier; in the next two courses the yarn is laid by No. 3 carrier; and in the succeeding two courses the yarn is laid by No. 5 carrier, this cycle of operation of the carriers being repeated throughout substantially the length of the stocking.

Preferably, although not necessarily, two cams 64, 65 are employed so that the lever 66 is positively actuated in either direction of its movement by a cam surface, thus obviating the necessity of biasing the lever 66 into engagement with the actuating cam by a spring or other means, as would be required if one cam only was used.

While the invention is particularly applicable to silk yarn, it is also applicable to various other kinds of yarn or thread, such as artificial silk, cotton, or other yarn in which variation in appearance of different lengths of the yarn tends to detrimentally affect the appearance of the articles knit therefrom. The invention is obviously not limited to stockings, since it may be applied to various other articles of wearing apparel, such as knit to the use of carrier control mechanism of the character herein disclosed to thereby prevent or minimize undesirable effects caused by variations in evenness or appearance of the yarn employed.

The operation of the carrier control mechanism herein disclosed has been described in connection with the use of a plurality of separate yarns of the same grade and kind in succeeding courses of the fabric, but it is to be understood that the mechanism may be employed to automatically actuate the selected yarn carriers in predetermined order in succeeding courses of the fabric, regardless of the purpose for which the respective yarns are employed and irrespective of the nature of the yarns, for example, the mechanism may be employed for stripping, plaing, or for various other purposes in which selected courses have yarns of specifically different characteristics, and the selected yarn carriers may be caused to traverse either the entire knitting field or a portion thereof only, dependent upon the purpose for which the yarns are used, the aforesaid limited traverse of the yarn carriers being obtainable by various well known mechanisms in the art adapted to arrest the carriers short of their usual traverse.

In the illustrative embodiment illustrated, the leg and foot portions of the stocking are knit on separate machines, viz., a legger and a footer, and will be understood that the stocking or other article may or may not be fashioned, and may be produced on single unit machines or on various other machines of the type in which a plurality of yarn carriers may be selectively reciprocated across the knitting field.

Of course, the improvements specifically shown and described, by which I obtain the above results may be changed or modified in various ways without departing from the scope of the invention herein described and hereinafter claimed.

I claim:

1. A full fashioned stocking knitting machine comprising, in combination, a machine cam shaft, a plurality of yarn carrier rods, yarn carriers on said rods respectively feeding separate yarns, a friction rod, a friction box on said rod having a member movably mounted thereon for selective engagement with any of said carrier rods, means including a rotatable shaft having pattern cam structure thereon for actuating said movable member thereinto in engagement with said carrier rods in predetermined order in succeeding courses of the fabric, said pattern cam structure being journaled to the friction box, and means including a cam on the machine cam shaft individual to said pattern cam structure for actuating said pattern cam structure to different operative positions.

2. A full fashioned stocking knitting machine comprising, in combination, a plurality of yarn carrier rods, yarn carriers on said rods respectively feeding separate yarns, a friction rod, a friction box on said rod having a member movably mounted thereon for selective engagement with any of said carrier rods, and means including a rotatable splined shaft having pattern cam structure slidably mounted thereon, said cam structure being journaled to the friction box and actuating the movable member into engagement with said carrier rods in predetermined order in succeeding courses of the fabric.

3. A full fashioned stocking knitting machine comprising, in combination, a machine cam shaft, a plurality of yarn carrier rods, yarn carriers on said rods respectively feeding separate yarns, a friction rod, a friction box on said rod having a member movably mounted thereon for selective engagement with any of said carrier rods, means including a rotatable shaft having ratchet structure and a pattern cam thereon for actuating said movable member into engagement with said carrier rods in predetermined order in succeeding courses of the fabric, said pattern cam being journaled to the friction box, and a second cam member rotating in correspondence with the machine cam shaft for actuating said ratchet structure thereby to rotate the pattern cam into different operative positions.

4. A full-fashioned stocking knitting machine comprising, a pattern chain, a plurality of yarn carrier bars with yarn carriers thereon, a friction rod, a friction box for connecting the carrier bars with said rod, selector control mechanism carried by the friction box and including an actuating element and a selector positioned by said element for engaging a bar to be traversed, an axially fixed shaft wherein said element is splined, a ratchet fast on said shaft, a movable pawl engaging the ratchet, means for governorship of the pattern chain for controlling the motion of said pawl, and means on the shaft adapted to be moved, incident to the turning of said shaft in positioning the actuating element, to hold the shaft against rotational drifting.

5. In a full fashioned knitting machine, the combination of a rotatable and axially shiftable cam shaft, a plurality of yarn carrier rods, yarn carriers on said rods respectively feeding separate yarns, a reciprocable friction rod, a friction box on said rod, a movable member carried by said friction box for selectively connecting any one of said carriers to said friction rod for reciprocation therewith, and selector mechanism for causing said movable member to automatically...
In order that the friction box 60 may be initially positioned so that the tongues on the slide 52 will be in register with the dogs on certain of the carrier rods 56 preparatory to putting the carrier control device into operation, there is provided an adjustable stud 147, Figs. 7 and 8, carried by a boss 146 on the friction box, and adapted to properly position the friction box with those carriers which initially start from the right hand side of the knitting section. When the friction box 60 is not in use it is held at the right hand side of the section by a hand operated latch 149 pivoted on bearing 150, Fig. 8, the latch having a slot 148a adapted to engage a lug 150 clamped to the boss 146 by means of the lock nut 151 on the stud 147. The spring 152 holds the latch in either engaged or disengaged position, the upper limit of travel of the latch being determined by a lug 152 extending from bearing 150.

The friction box also carries a lever 155, Figs. 3 and 7, pivotally mounted at 150 to lug 153 on the friction box housing and adapted to 25 carry into engagement with shock absorber rods 156 and co-acting therewith in the usual manner for progressively decreasing the speed of the carrier rods 2, 3 and 5 near the end of their stroke to reduce the shock attendant to striking the end stops 52.

Figs. 20, 22 and 25 illustrate the operation of the mechanism in knitting the blank of the stocking of Fig. 21 in which three main yarn carriers are used to form the main body yarn of the stocking well and leg.

In Fig. 22 the horizontal lines between the picot edge 165 and the end of the instep 162 diagrammatically represent the path of travel of the main yarn carriers. The arrows on the lines indicate the direction of travel of the yarn carriers in successive courses, shown in this instance as carriers Nos. 2, 3 and 5, although various other through carriers may be employed, if desired. Fig. 20 shows the yarn box 145 partially broken away to disclose three bobbins feeding silk yarns 2b, 3b and 5b of the same grade and kind, the yarns 3b, 4b and toe 155.

Figs. 20, 22 and 25 illustrate the operation of the mechanism in knitting the blank of the stocking of Fig. 21 in which three main yarn carriers are used to form the main body yarn of the stocking well and leg.

In Fig. 22 the horizontal lines between the picot edge 165 and the end of the instep 162 diagrammatically represent the path of travel of the main yarn carriers. The arrows on the lines indicate the direction of travel of the yarn carriers in successive courses, shown in this instance as carriers Nos. 2, 3 and 5, although various other through carriers may be employed, if desired. Fig. 20 shows the yarn box 145 partially broken away to disclose three bobbins feeding silk yarns 2b, 3b and 5b of the same grade and kind, the yarns 3b, 4b and toe 155.

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cally engage and reciprocate said yarn carrier rods in predetermined order in succeeding courses of the fabric during the knitting thereof; said selector mechanism comprising a first cam structure carried by and rotating with said cam shaft, a second cam structure journalled to the friction box and actuated by the first cam structure, and cam follower means for said second cam structure operatively connected with said movable member for positioning the same relative to said carrier rods, said second cam structure determining the throw of said movable member thereby to determine which of said carrier rods shall be engaged by the movable member in pre-selected courses, respectively.

6. In a straight knitting machine, the combination of a plurality of yarn carrier rods, yarn carriers on said rods respectively feeding separate yarns, a friction rod, a friction box on said rod, a movement imparting member operatively connected with said friction rod for selective engagement with any of said yarn carrier rods, means journalled to the friction box for causing said member to automatically engage and reciprocate said yarn carrier rods in predetermined order in succeeding courses of the fabric, means comprising stop members for limiting the traverse of said carrier rods, and means comprising resilient plunger members having tapered surfaces adapted to engage complementary tapered surfaces on the carrier rods for preventing rebound of the carrier rods when arrested by said stop members.

7. A carrier bar operating attachment for full fashioned hosiery knitting machines comprising, in combination, a power device, a set of yarn carrier bars, a friction box rod, a friction box frictionally mounted on said rod, a member mounted on said box to oscillate in a plane transverse to said bars, tongues on said member spaced in the path of motion of the member, each of said tongues adapted to act in both directions of motion of said box to drive one or other of said bars, and operating mechanism for said member adapted to move said tongues selectively into and out of locking engagement with the carrier bars at the end of travel of said friction box in either direction, said mechanism connected to said friction box to travel therewith and periodically operated by said power device.

8. A carrier bar operating attachment for full fashioned hosiery knitting machines comprising, in combination, a power device, a set of yarn carrier bars, a friction box rod, a friction box frictionally mounted on said rod, a member mounted on said box to oscillate in a plane transverse to said bars, tongues on said member spaced in the path of motion of the member, each of said tongues adapted to act in both directions of motion of said box to drive one or other of said bars, and operating mechanism for said member adapted to move said tongues selectively into and out of driving engagement with the carrier bars at the end of travel of said friction box in either direction, said mechanism connected to be periodically operated by said power device.

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