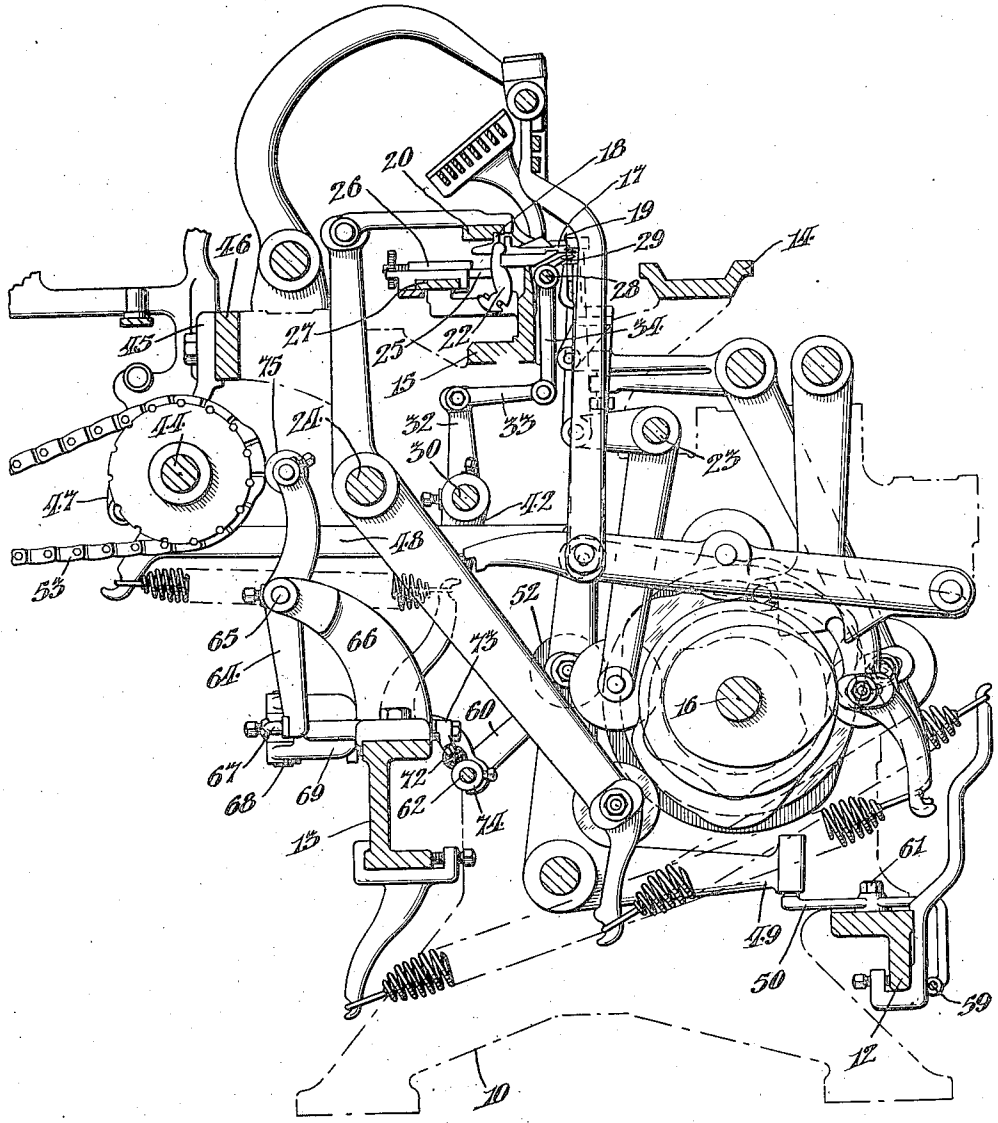
Sept. 1, 1936. M. RICHTER 2,053,225

KNOCKOVER BIT CONTROL MEANS FOR KNITTING MACHINES

Filed March 9, 1935 4 Sheets-Sheet 1

Fig. 1.



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KNOCKOVER BIT CONTROL MEANS FOR KNITTING MACHINES

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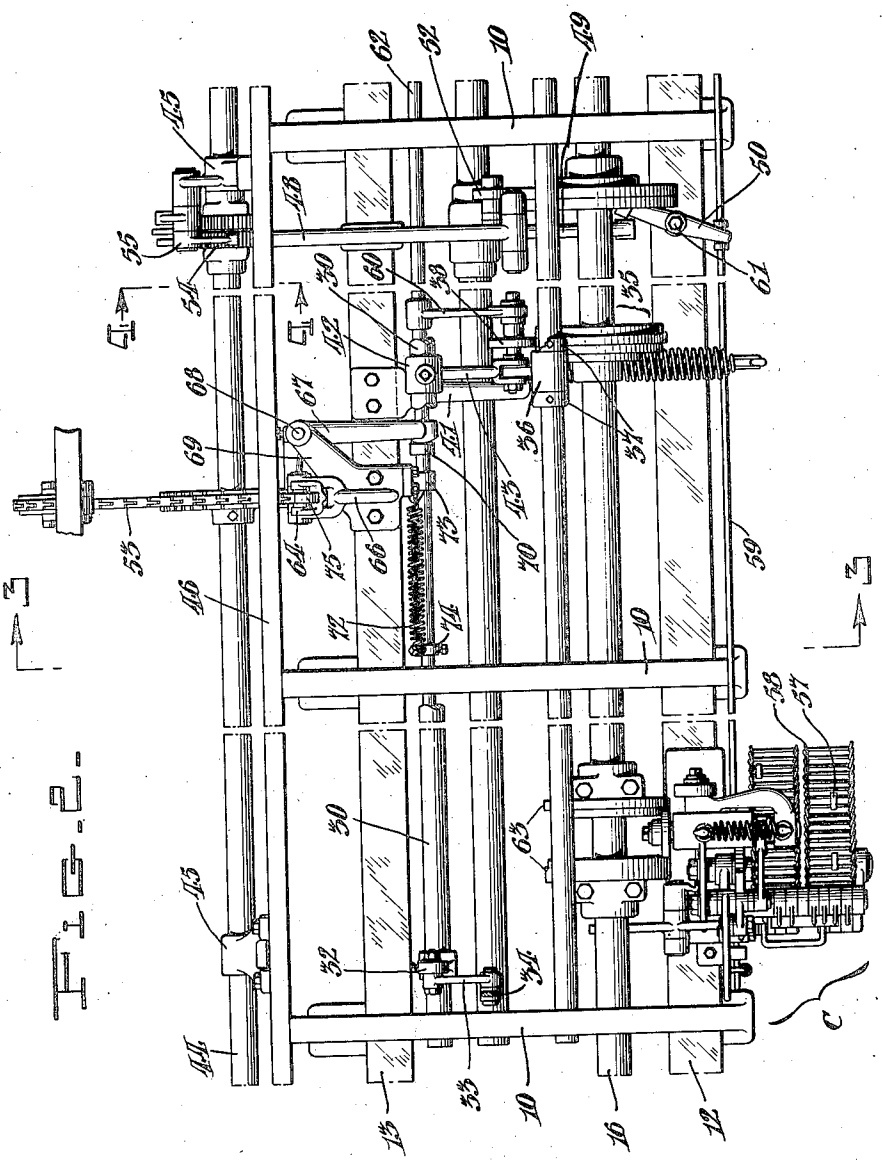


Fig. 2.

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KNOCKOVER BIT CONTROL MEANS FOR KNITTING MACHINES

Filed March 9, 1935 4 Sheets-Sheet 3

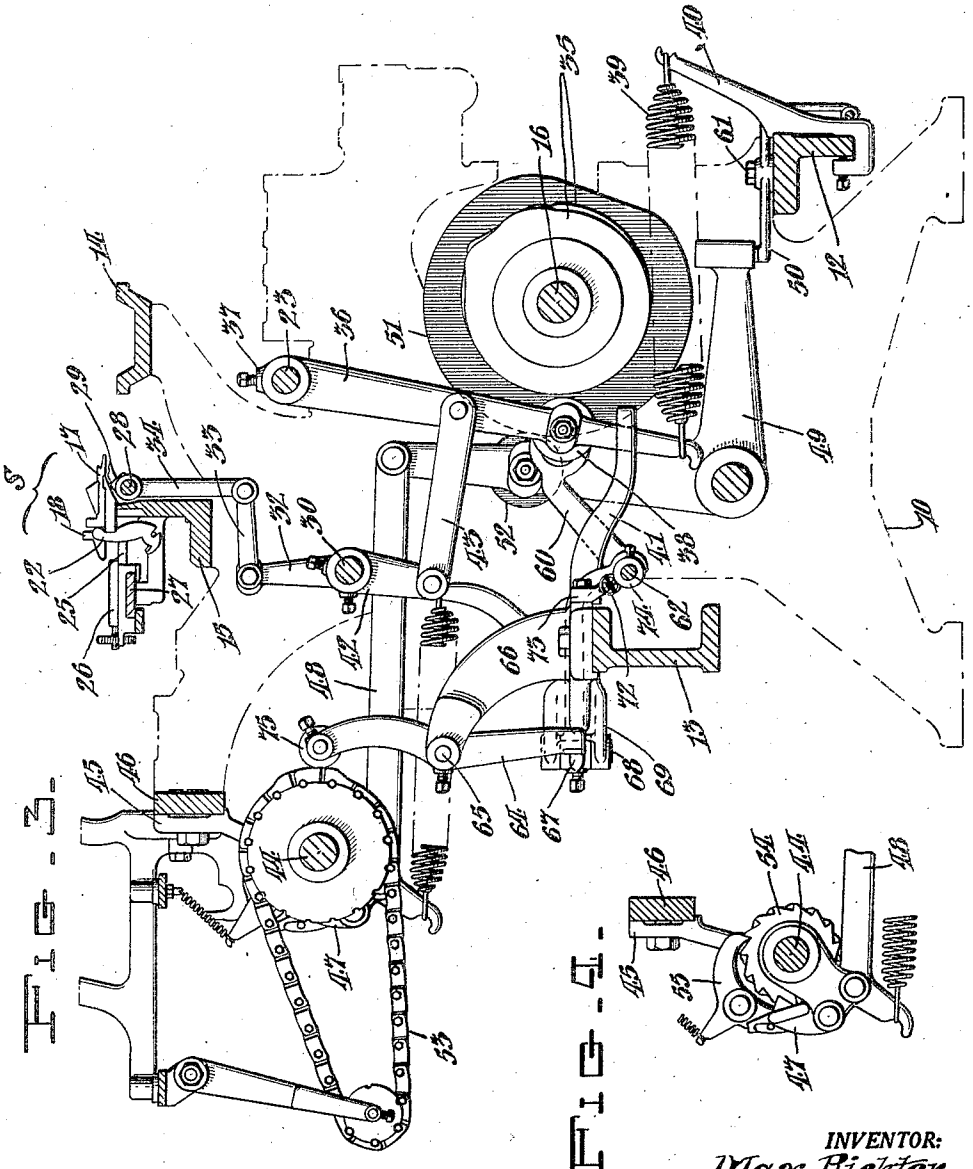


Fig. 3.

Fig. 4.

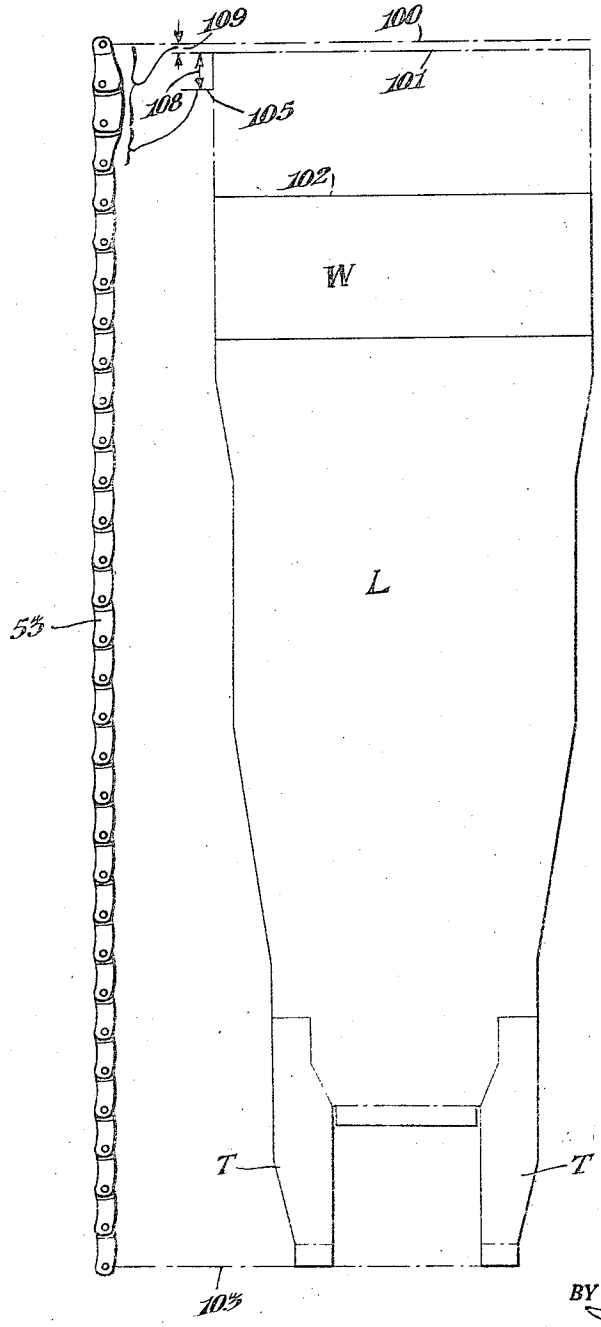
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KNOCKOVER BIT CONTROL MEANS FOR KNITTING MACHINES

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FIG. 5.



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UNITED STATES PATENT OFFICE

2,053,225

KNOCKOVER-BIT CONTROL MEANS FOR KNITTING MACHINES

Max Richter, West Reading, Pa., assignor to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

Application March 9, 1935, Serial No. 10,170

13 Claims. (Cl. 66—109)

My invention relates to knockover-bit control means for knitting machines and particularly to means for automatically selectively positioning knockover bits of a straight knitting machine, as in accordance with the thickness of the yarn, the size of the loops, and the position of the welt hooks.

In the construction of a full fashioned knitting machine of a well known make, a series of three cams is provided, each cam of which operates as an actuating member, for selectively imparting cyclic movements to the knockover bit structure, in accordance with the various portions of stocking fabric being produced. As shown in Patent No. 1,150,567, granted to M. Zwicky, August 17, 1915, and assigned to the Textile Machine Works, Wyomissing, Pennsylvania, operation of the mechanism, by a selected cam of the series, is effected through a cam follower, which is manually shifted from one cam to another.

However, in high-speed production, the manually operable means is slow, uncertain and costly, and it is an object of this invention to provide novel control means whereby the cam follower members may be automatically positioned in accordance with a pattern, whereby the operation is accelerated, the likelihood of error is reduced, and economy and other advantages are obtained.

Also, altho various mechanisms of knitting machines have been operated automatically, and from auxiliary pattern units, as controlled by main pattern devices and although I am not aware that cam selecting means for the knockover bits of a straight knitting machine have been so operated and controlled, a device heretofore suggested for operating such mechanisms, other than those for operating the knockover bits, by such auxiliary pattern unit and main pattern device, has employed a constantly operating element for periodically operating the auxiliary pattern unit through one linkage, and another device operating through another linkage for controlling the effective operation of the constantly operating element. This arrangement of parts causes undue noise, vibration and wear of the parts, is more likely to get out of order and has other disadvantages.

It is accordingly, a further object of the invention, in association with a straight knitting machine embodying automatic cam selecting means for the knockover bit control mechanisms, to eliminate such constantly operating part, and the necessity for the above-mentioned separate linkages, and to provide a mechanism which operates only when necessary, and through a single linkage, in a manner hereinafter more particularly pointed out, whereby to reduce noise, vibration, wear, expense, number of parts and other incidental objections, and to provide a device that is simple and durable in construction, economical to manufacture and effective in its operation.

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

In the drawings:

Figure 1 is a vertical cross sectional view of a full fashioned knitting machine, showing the invention in combination therewith;

Fig. 2 is a partial top plan view of the structure shown in Fig. 1;

Fig. 3 is a view taken substantially along the line 3—3 of Fig. 2;

Fig. 4 is a detail view taken substantially along the line 4—4 of Fig. 2; and

Fig. 5 is a diagram of the leg blank of a full-fashioned stocking, together with a pattern chain, as developed or opened out along a straight line in side elevation from its normally looped shape, indicating the positions along the blank at which the extent of movement of the knockover bits is changed and the corresponding links of the chain by which such changes are effected.

The drawings illustrate parts of a Reading full fashioned stocking machine, and the mechanism of my invention. For clearness, only those parts of the machine necessary for an understanding of the invention are shown, the other parts and the manner of operation thereof being well known in the art, as shown and described in the "Reading" Full Fashioned Knitting Machine Catalogue, copyright 1929, and published by the Textile Machine Works, Reading, Pennsylvania.

Referring to the drawings:

A full fashioned knitting machine, for which the invention is adapted, includes usual center frames 10, which support and are maintained in spaced relation to each other by a front rail 12, a back rail 13, a front bed 14 and a center bed 15, in a usual framework upon which the operating parts of the machine are positioned. A series of bearing members are fixed to the frame members 10 for supporting the various shafts, which are operated by cam discs carried by a main

cam shaft 16 that is rotatable and axially shiftable.

Cooperating with a sinker head assembly S, to move sinkers 17 and dividers 18 into and out of operation with needles 19, are a catch bar 20 and jacks 22. The catch bar 20 receives its motion from members carried by front and back catch shafts 23 and 24, which are operated by suitable cams carried by the main cam shaft 16. The jacks 22 are moved forwardly by slur cams 25 carried by cock boxes 26, which are reciprocated upon a bar 27, by the cam shaft, through intermediate motion transmitting mechanism (not shown). Although the sinkers 17 are slurred forward by the jack members 22, retraction of the sinkers and consequently, similar movement of the jacks, in addition to forward and backward movement of the dividers 18, is effected by the back catch shaft 24, through the medium of the catch bar 20. Lowering and raising of the catch bar 20 into and out of engagement with the sinkers, to permit independent forward movement of the latter by the slur cams, is effected by means connected to the front catch shaft 23.

A knockover bit bed 28, which maintains a series of knockover bits 29 in alignment with the sinkers and dividers, is suspended from bearings held by the sinkerhead, and is oscillated by means associated with the knockover bit shaft 30. This means comprises a section lever 32 carried by the knockover bit shaft, a connecting lever 33, and a lever 34 attached to the knockover bit bed 26. The knockover bit shaft 30 is selectively operated by one of the cams in a series of cams 35, see Figs. 2 and 3, carried by the main cam shaft.

A lever 36, loosely turnable on the front catch shaft 23, and axially fixed thereon by collars 37, has its free end held in yielding engagement with a latch member 41, that is secured to the back rail 13. This relation is effected by a spring 39, that is anchored to a bracket 40 on the front rail 12. The latch 41 operates to prevent the cam follower 38 from engaging the round portions of the operating cams, to thereby permit axial shifting of the follower, see Fig. 3.

The working parts of the respective cams are sufficiently high to coact with the cam follower, and to move the lever 36 from engagement with the latch 41 to operate the knockover bits. A lever 42, which operates the knockover bit shaft 30, is secured thereto, and linked to the lever 36, by a connecting lever 43. All movements of the lever 36 are thereby transmitted to the knockover bit shaft 30, and to the knockover bits 29, as determined by the profile of the cam with which the cam follower 38 cooperates.

A control shaft 44, carried by bearings 45, which are bolted to a bar 46 extending longitudinally of the machine, has fixed thereto a ratchet wheel 54, see Fig. 4, which is intermittently rotated by a pawl 47 that is movably mounted on the shaft. The pawl 47 is connected to a link 48, to rotate the ratchet and the shaft, when the horizontal arm of a toggle lever 49 is released by a support lever 50. The lever 50 is pivotally mounted, by a vertical pin 61, on the front rail 12.

Removal of the support 50, from beneath the lever 49, permits a cam follower 52, which is rotatably carried by the lever 49, to follow the contour of its cam 51, which imparts racking motion to the pawl 47 once during each revolution. This action imparts movement to the ratchet wheel 54 and consequently, to the control shaft 44, whereupon a control chain 53, carried by the shaft 44, is advanced.

A pawl 55 cooperate with the ratchet 54 to prevent reverse movement of the control shaft, during inoperative movements of the pawl 47. Buttons 57 on a main pattern chain 58, determine the sequence of operation of the lever 50 through the operation of a rod 59 by a lever carried by a usual chain motion mechanism C.

A forked lever 60, carried by an axially movable rod 62, has its legs permanently disposed in an annular recessed portion in the hub of the cam follower 38, see Fig. 2, to align the follower 38 with a selected cam of the series 35 simultaneously with axial shifting of the rod 62.

Shiftable cams 63, secured to the cam shaft 16, cooperate with the chain motion mechanism C for axially moving the cam shaft to operatively position the cam members, and to thereby selectively effect plain knitting, or fashioning cycles of the knitting machine.

During the downward travel of the needles into the knockover structure, the newly formed loops are drawn by the needles over the noses of the sinkers and dividers, as the latter are retracted in unison by the catch bar 20. Meanwhile, the knockover bits 29 elevate the fabric supported thereby to catch the newly formed loops, and to facilitate the interlacing of these loops with loops of the previous course.

However, aside from the fact that the lowermost position of the knockover bits remains the same during the knitting of the entire stocking, which position is determined by the stop or latch 41, nevertheless, the upward travel of the knockover bits 29 generally should be varied during the knitting of different portions of the fabric. For this purpose, cams of different character are included in the series 35.

Thus, when the welt bars are operating between the sinker and knockover structures, very little, if any, upward travel of the knockover bits is permissible, if working clearance for the welt hooks is to be maintained. Since knitting with a heavy yarn necessitates a change in the operation of the knockover bits, relative to the operation thereof during the time that the welt hooks are operating between the sinker and knockover structures, these operations must again be altered when a light weight yarn is fed to the needles.

Consequently, since different portions of the stocking require certain definite movements of the knockover bits, a plurality of sets of cams, as of two or three cams each, are spaced on different sections of the cam shaft, corresponding cams of the various sets being simultaneously operable for selectively changing the magnitude and timing of the knockover bit movements. Selective operation of the cams is determined by the axial position of the roller 38 relative to its supporting stud.

Cams of high, low and a medium height are ordinarily included for selectively operating the knockover bit bars. The low cam is employed to operate the knocking over mechanism, at the start of the welt forming operation, for confining the upward movement of the knockover bits to provide ample clearance for the welt hooks, while the latter are operating between the sinker and knockover structures.

After sufficient fabric has been knit to permit the welt hooks to clear the knockover structure, the cam follower 38 is shifted into alignment with a second cam of the series. The highest cam, which moves the knockover bits to their highest position, is employed when knitting a heavy thread, in which case, it is necessary to form

a longer loop, and the knockover bits must be high enough to permit the needle to pull the new loops fully through the loops of the previous course, and clear the fabric. The intermediate cam is employed when knitting with a light thread.

For mechanically shifting the rod 62, mechanism of the type shown in Figs. 2 and 3 is provided. In this mechanism, a lever 64 is pivotally supported on a pin 65 in a bracket 66, which is secured to the back rail 13. A bell crank 67, pivoted on a vertical pin 68, see Fig. 2, to an arm 69, of the bracket 66, transmits motion between the lever 64 and the rod 62, one end of the bell crank 67 coacting with the lower part of the lever 64 and the other end engaging a collar 70 carried by the rod 62.

The collar 70 is held in engagement with the forward end of the bell crank 67 by a tension spring 72, one end of which is anchored by a member 73, to the bracket 66, and the other end of which is connected to the rod 62 by a collar 74. The spring 72 maintains a follower 75, of the lever 64, in yielding engagement with the control chain 53, through the intermediate members shown in Figs. 2 and 3.

The control chain 53 comprises sets of low and high links for cooperation with the follower 75 to selectively align the cam follower 38 with the right and center cams of the series of cams 35. With a high link in the position indicated in the drawings, the cam follower 38 will be aligned with the middle cam of the series 35. This cam will continue to impart the operative movements to the shaft 30, so long as a high link on the chain 53 is in engagement with the roller 75.

Movement of the control chain 53 will engage the low links thereof with the roller 74, whereupon the cam follower 38 will be aligned with the cam at the right hand end of the series 35 for actuating the knockover bits.

As above set forth, each series of cams 35 includes cams of high, low and medium height for selectively operating the knockover bits. However, in the present instance. only two of these cams are necessary in the production of a stocking fabric. To shift the cam follower 38 in alignment with the third cam on the left hand of the series 35, a link substantially higher than the present high link of the control chain 53 must be provided.

The hook member 41, anchored to the back rail 13, coacts with the lower portion of the lever 36 to hold the follower 38 out of engagement with the idle portions of the knockover bit cams, thereby maintaining the knockover bits in the lowermost position during the entire couliering operation irrespective of the cam with which the follower 38 is aligned. The timing and extent of upward travel of the knockover bits, during the downward travel of the needles, is governed by the lug or high portions of the roller-aligned cam discs which coact with the cam follower to actuate the knockover bits.

The above-described arrangement of parts also permits shifting of the cam follower during substantially every half revolution of the cam shaft, when the round portions of the cams are passing the cam follower while the follower 38 is restrained by the hook 41 from engaging the same.

The links of the control chain 53 determine the sequence of operation of the knockover bit cams during the production of a stocking leg blank. The control chain 53 as diagrammatically indicated in Fig. 5, controls the action of the knockover bits; the length of the chain being indicated as extending from a line 100 to the course 103 of the heel tabs T. In this figure, the line 100 represents the last course of the next previously knitted blank, and the lines 101 and 103 represent the first and last courses, respectively, of the blank shown, whereby, a line corresponding to the line 100 of the next succeeding blank would lie coincident to, or be the same as, the line 103 shown.

As indicated in Fig. 5, the stocking leg blank L extends from the top edge 102 of the folded or finished welt portion W to the course 103 of the heel tabs T, where the stocking is pressed off the needles 19. The line 101 indicates the first course of loops of the welt W in an open state.

After the stocking leg blank is pressed from the needles 19 at the course 103, the control chain 53 is operated for a distance corresponding to the distance 109 which extends from the line 100 to the course 101 of the welt W to align the roller 38 with the lowest cam of the series 35, so that the welt hooks may be inserted into the fabric at the course 101. The roller 38 is maintained in alignment with the lowest cam of the group 35 a distance 108 from the course 101 to the course 105, at which position the control chain operates to align the roller 38 with a cam for normally operating the knockover bits. This position is maintained to the course 103, at which position the fabric is again pressed from the needles 19.

As above set forth, there is a single linkage connection, including the link 48, between the auxiliary follower unit, represented by the shaft 44, the chain 53, the sprocket wheels and other parts, at one end of the linkage, and the cam shaft 16 and the main pattern device or chain 57, at the other end of the linkage.

This linkage not only transmits the driving power of the cam shaft to the auxiliary pattern chain 53, but is directly affected at a position locally associated with the cam shaft, in accordance with the selective operation thereof by the main pattern chain. Thus, by throwing the follower 52 intermittently into and out of engagement with the cam 51, no part of the linkage to the shaft is under constant operation, but operates only in accordance with the pattern.

The improvement shown and described, by which the above results are obtained, may be modified in various ways, without departing from the invention as set forth in the appended claims.

I claim:

1. A straight knitting machine comprising knitting mechanism including knockover bits, an auxiliary pattern unit for controlling cyclic movements of the knockover bits in accordance with the pattern, a cam shaft, a cam on the shaft, linkage including a cam follower for connecting the auxiliary pattern unit to, and disconnecting it from, the cam shaft, and means including a main pattern device for controlling said linkage to effect said connections and disconnections.

2. A straight knitting machine comprising knitting mechanism including knockover bits, an auxiliary pattern unit for controlling cyclic movements of the knockover bits in accordance with the pattern, a cam shaft, a cam element on the shaft, linkage between the auxiliary pattern unit and the cam shaft including a follower element for the cam element, said elements being movable relative to each other between operative and inoperative positions affecting the operation of said auxiliary pattern unit, and means including a main pattern device for controlling

said relative movement of the cam and follower elements.

3. A straight knitting machine comprising knitting mechanism including knock-over bits, a cam shaft, means including a plurality of auxiliary cams on the shaft and an auxiliary follower for selective cooperation with the auxiliary cams for controlling operation of the knock-over bits, an auxiliary pattern unit for controlling the selective cooperation between said cams and said follower, a main cam element on the shaft, linkage between the auxiliary pattern unit and the cam shaft including a main follower element for the main cam element, said elements being movable relative to each other between operative and inoperative positions affecting the operation of said auxiliary pattern unit, and means including a main pattern device for controlling said relative movement of the main cam and follower elements.

4. A straight knitting machine comprising knitting mechanism including knock-over bits, an auxiliary pattern unit for controlling cyclic movements of the knock-over bits in accordance with the pattern, a cam shaft, linkage between the auxiliary pattern unit and the cam shaft including an element for cooperation with an element locally associated with the cam shaft, said elements being movable relative to each other between operative and inoperative positions affecting the operation of said auxiliary pattern unit, and means including a main pattern device for controlling the relative movement of said elements.

5. A straight knitting machine comprising knitting mechanism including knock-over bits, an auxiliary pattern unit including a variable link chain for controlling cyclic movements of the knock-over bits in accordance with the pattern, a cam shaft, a cam element on the cam shaft, linkage between the auxiliary pattern unit and the cam shaft including a follower element for the cam element, said elements being movable relative to each other between operative and inoperative positions affecting the operation of said auxiliary pattern unit, and means including a main pattern device for controlling said relative movement of the cam and follower elements.

6. A straight knitting machine comprising knitting mechanism including knock-over bits, an auxiliary pattern unit for controlling cyclic movements of the knock-over bits in accordance with the pattern, a cam shaft and a main pattern device for, respectively, operating and selecting the operation of, the unit, and means providing only a single linkage connection from the cam shaft and the main pattern device to said unit for affecting the unit in accordance with both the operating effect of the cam shaft and the selecting effect of the main pattern device.

7. A straight knitting machine comprising knitting mechanism including knock-over bits, an auxiliary pattern unit for controlling cyclic movements of the bits in accordance with the pattern, a cam shaft, linkage between the shaft and the unit for operating the unit, and a main pattern device for controlling the operation of the unit by the shaft.

8. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams on the shaft for controlling cyclic movements of the bits in accordance with the pattern, linkage including a follower for selective cooperation with any one of said cams, means for shifting the follower and the cams relative to each other to effect said selection, an auxiliary shaft, an auxiliary pattern unit on said shaft for controlling the actuation of said shift means, a main cam on the cam shaft, a main pattern device, and linkage between the main cam and the main pattern device for operating and controlling the auxiliary pattern unit.

9. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams on the shaft for controlling cyclic movements of the bits in accordance with the pattern, said cams being held against turning relative to the shaft and having axially-registered blank portions, linkage including a follower for selective cooperation with any of said cams, said follower being normally held in position freely clearing said blank cam portions but for engagement with pattern portions of the cams, means for shifting the follower to effect said selection, an auxiliary shaft, an auxiliary pattern unit on said shaft for controlling the actuation of said shift means, a main cam on the cam shaft, a main pattern device, and linkage between the main cam and the main pattern device for operating and controlling the auxiliary follower unit.

10. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams on the shaft, linkage between said mechanism and the cams including a follower for selective cooperation with any one of said cams, said cams being fixed against turning relative to the shaft and having axially-registered blank portions, linkage including a follower for selective cooperation with any of said cams, said follower being normally held in position freely clearing said blank cam portions, but for engagement with pattern portions of the cams, means for shifting the follower and the cams axially relative to each other when said blank cam portions are opposite the follower to effect said selection, an auxiliary shaft, an auxiliary pattern unit on said shaft for controlling the actuation of said shift means, a main cam on the cam shaft, linkage between the main cam and said unit including a bell crank and a follower for the main cam carried by one arm of the bell crank, mechanism cooperating with the other arm of the bell crank to normally hold the main cam follower against following its cam, and a main pattern device for controlling said main cam follower holding mechanism.

11. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams fixed to the shaft, linkage between said mechanism and the cams including a follower for selective cooperation with any one of said cams, the latter having axially registered blank portions, a rod, a yoke axially slidable on the rod for shifting said follower in selecting a cam to operate said mechanism, means for normally holding the follower freely axially clearing said blank cam portions during shifting of the follower, but for engagement with pattern portions of the cams, means for shifting the yoke, an auxiliary shaft, an auxiliary pattern unit on said shaft for controlling the actuation of said shift means, a main cam on the cam shaft, linkage between the main cam and said unit including a bell crank and a follower for the main cam carried by one arm of the bell crank, mechanism cooperating with the other arm of the bell crank to hold the main cam

follower against following its cam, and a main pattern device for controlling said main cam follower holding mechanism.

12. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams fixed to the shaft, linkage between said mechanism and the cams including a follower for selective co-operation with any one of said cams, the latter having axially registered blank portions, a rod, a yoke axially slidable on the rod for shifting said follower in selecting a cam to operate said mechanism, means for normally holding the follower freely axially clearing said blank cam portions during shifting of the follower, but for engagement with pattern portions of the cams, means for shifting the yoke, an auxiliary shaft, an auxiliary pattern unit for controlling the actuation of said shift means, including a sprocket wheel on said auxiliary shaft, an idler sprocket wheel, a variable link pattern chain on said wheels, a chain follower and linkage connector between the chain follower and said shift means, a main cam on the cam shaft, linkage between the main cam and said unit including a bell crank and a follower for the main cam carried by one arm of the bell crank, mechanism for cooperation with the other arm of the bell crank to hold the main cam follower against following the cam, and a main pattern chain for controlling said main cam follower holding mechanism.

13. A straight knitting machine comprising a knitting mechanism including knock-over bits, a cam shaft, a plurality of auxiliary cams fixed to the shaft, linkage between said mechanism and the cams including a follower for selective co-operation with any one of said cams, the latter having axially registered blank portions, a rod, a yoke axially slidable on the rod for shifting said follower in selecting a cam to operate said mechanism, means for normally holding the follower freely axially clearing said blank cam portions during shifting of the follower, but for engagement with pattern portions of the cams, means for shifting the yoke, an auxiliary pattern unit for controlling the actuation of said shift means, including a sprocket wheel on said auxiliary shaft, an idler sprocket wheel, a variable link pattern chain on said wheels, a chain follower and linkage connector between the chain follower and said shift means, a main cam on the cam shaft, linkage between the main cam and said unit, including a bell crank and a follower for the main cam carried by one arm of the bell crank, mechanism, including a pivoted lever for cooperation with the other arm of the bell crank to hold the main cam follower against following its cam, a main pattern chain, and button means on the main pattern chain for actuating said pivoted lever.

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