Feb. 5, 1952 F. LAMBACH 2,584,136

STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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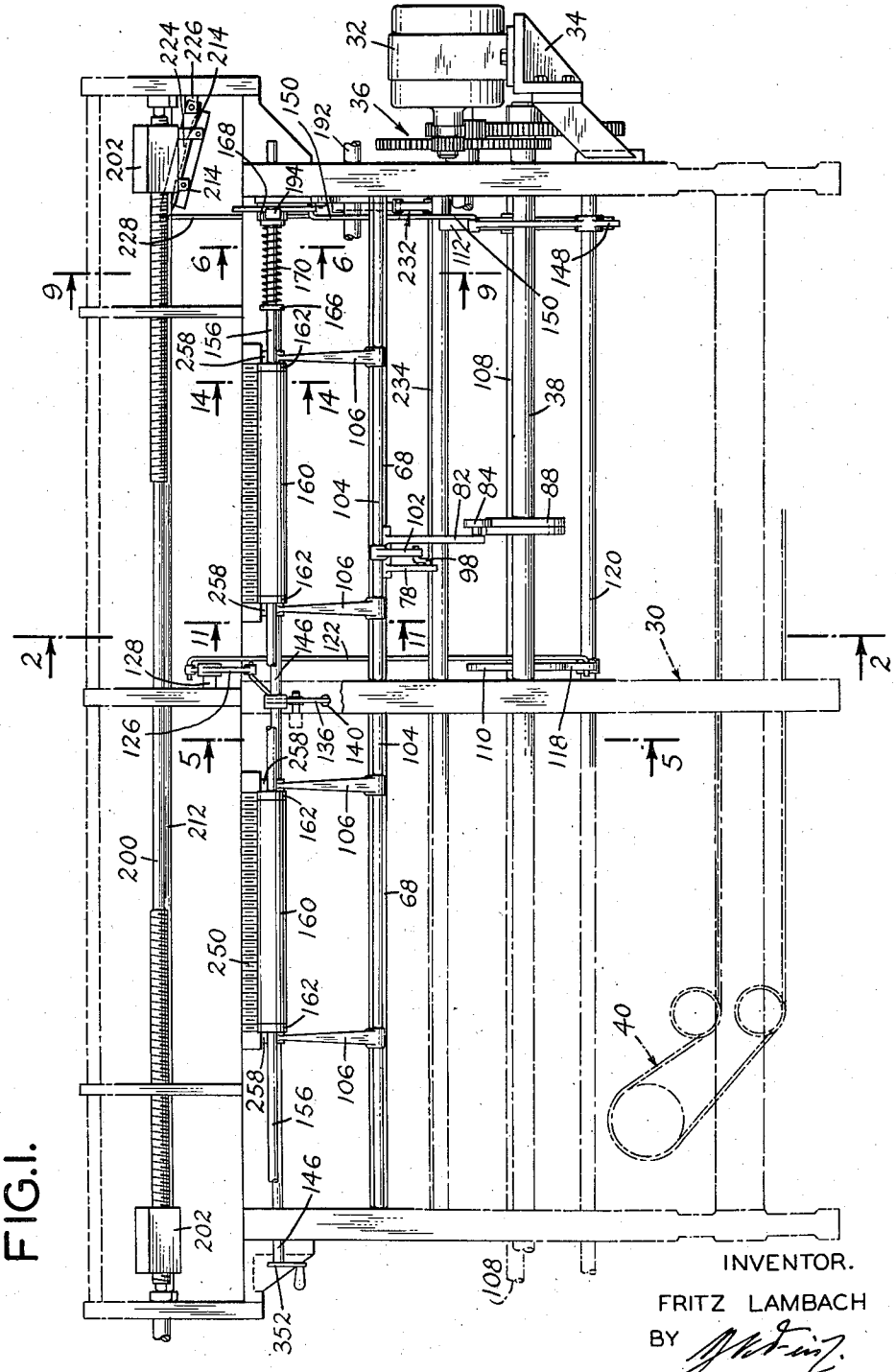


FIG. 1.

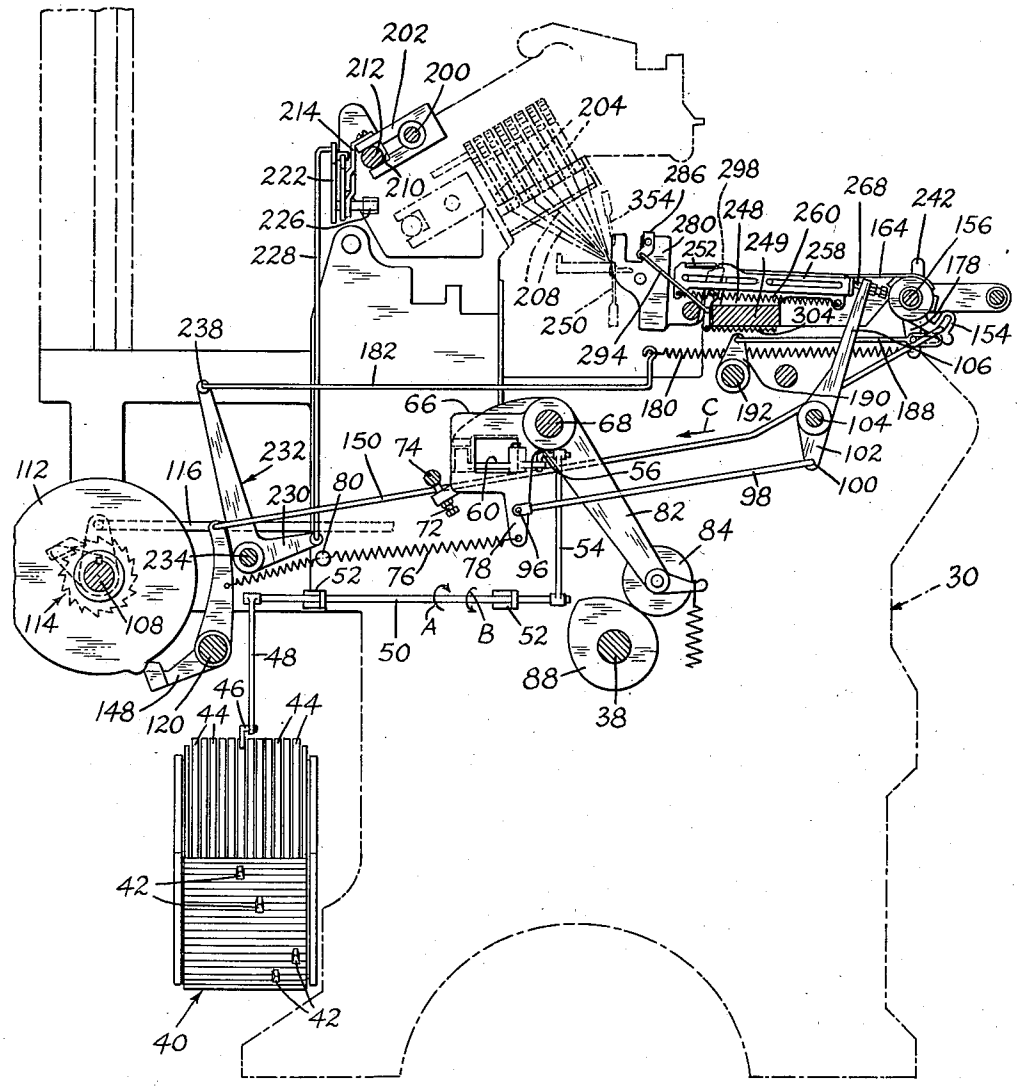
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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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FIG. 2.



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FIG.3.

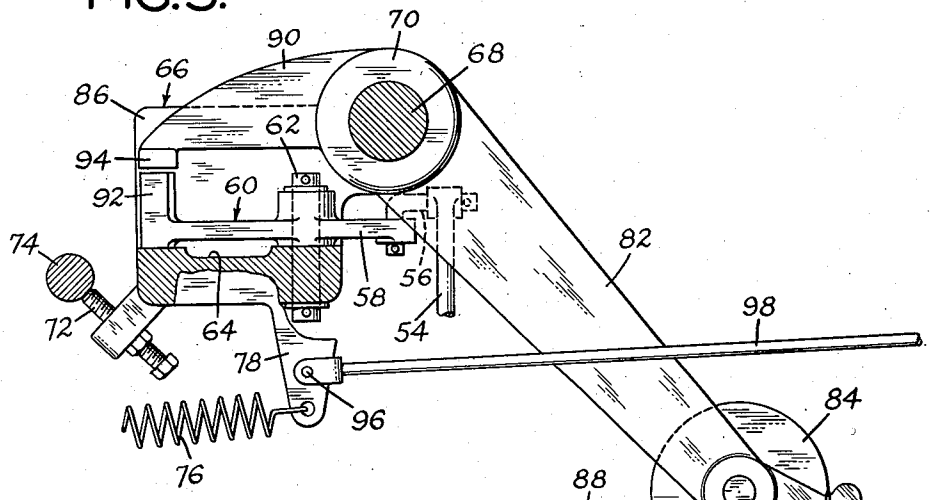
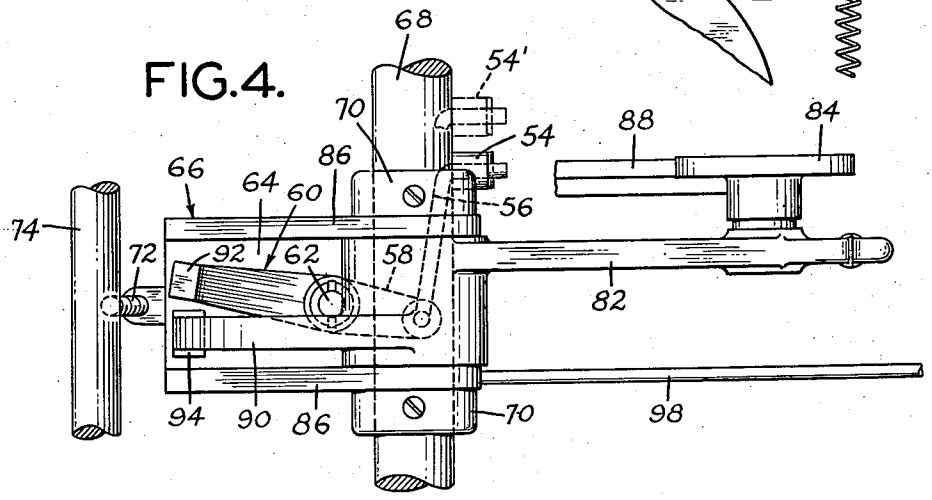


FIG.4.



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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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FIG. 14.

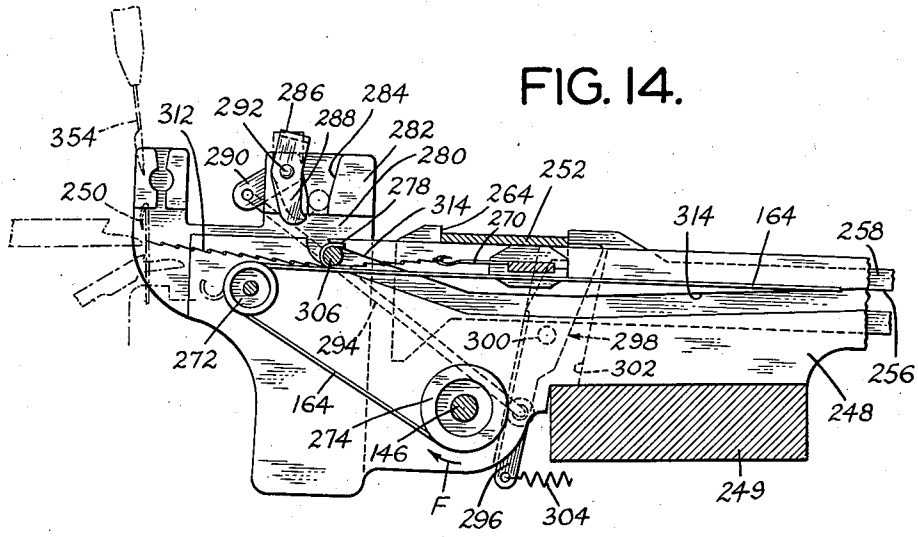
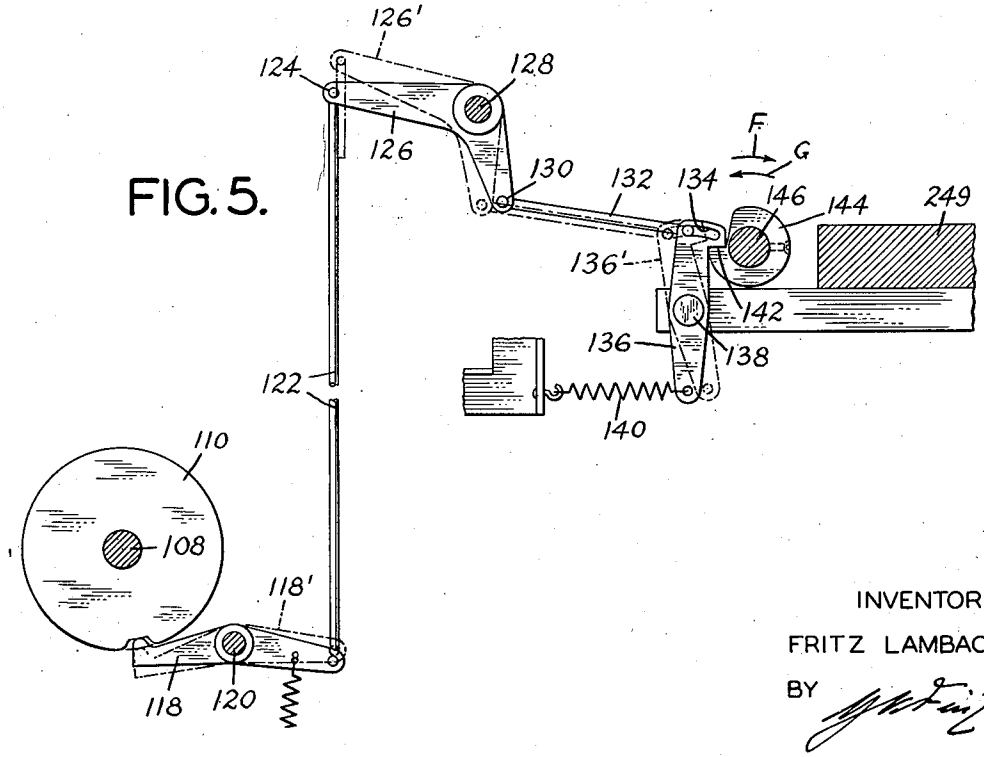


FIG. 5.



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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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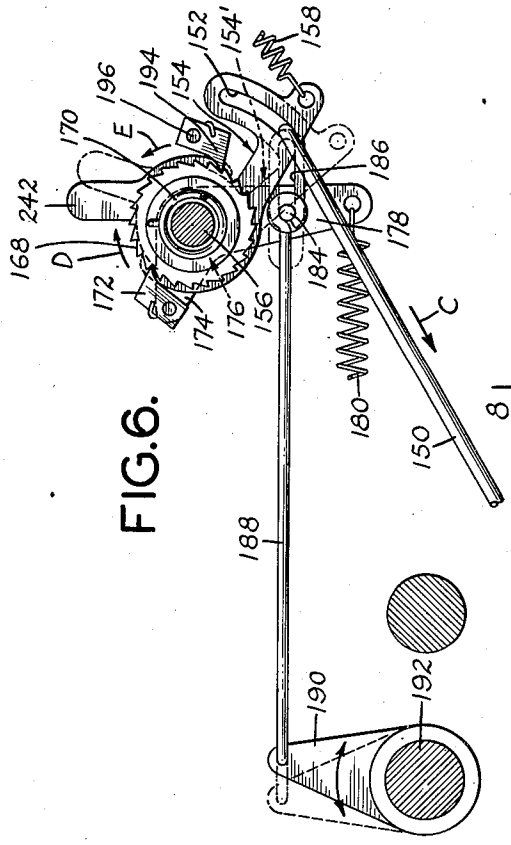


FIG.6.

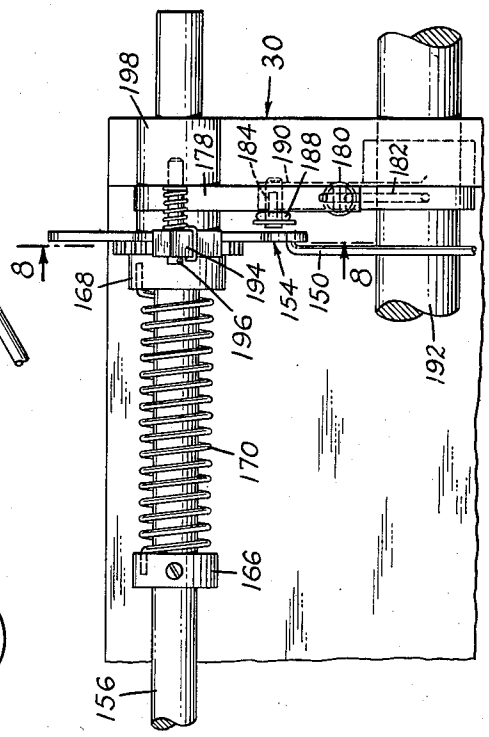


FIG.7.

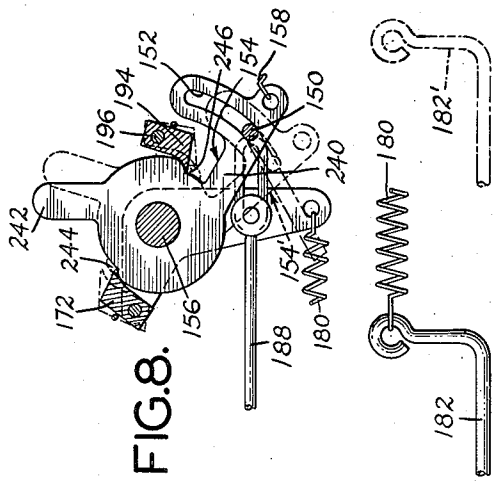
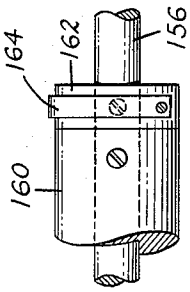


FIG.8.



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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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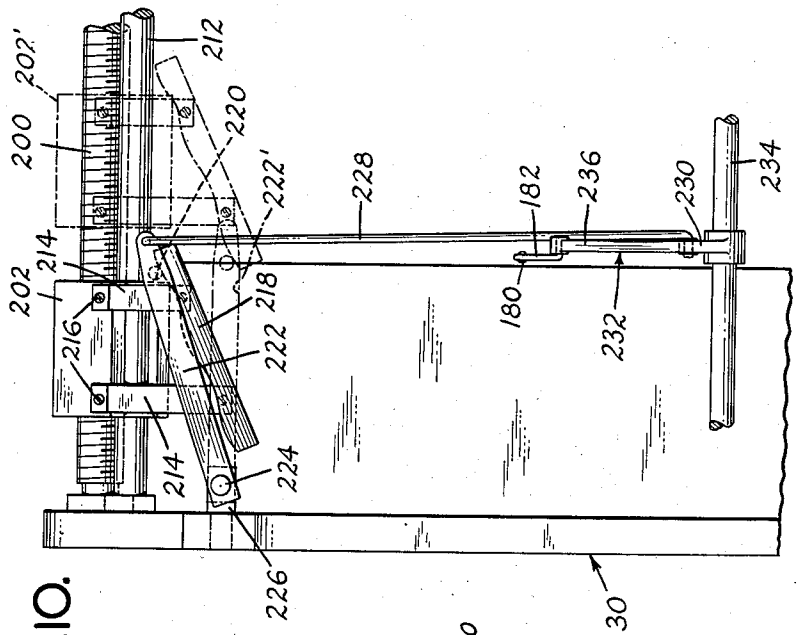


FIG.10.

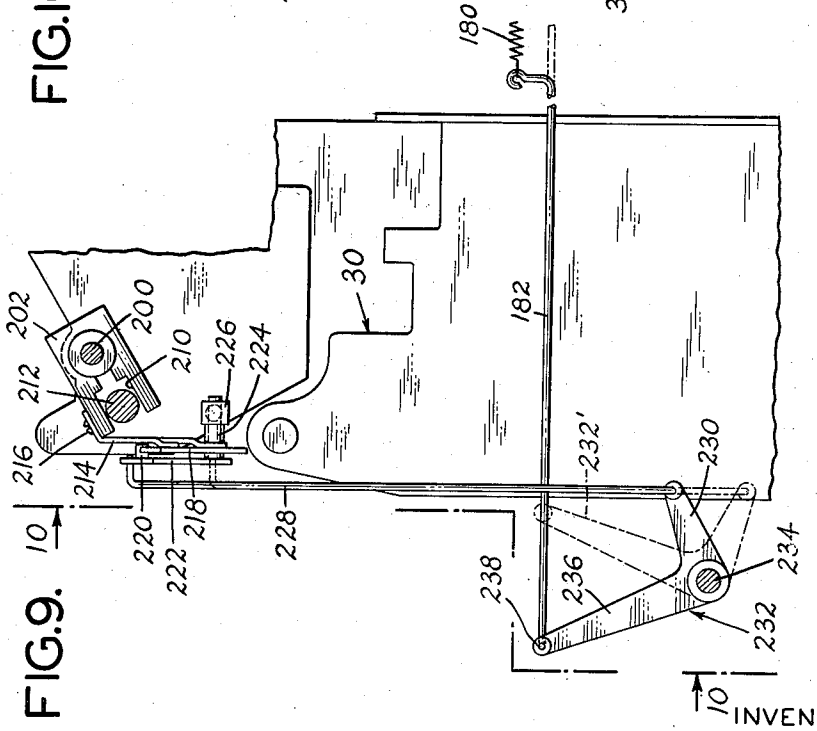


FIG.9.

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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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FIG. 12.

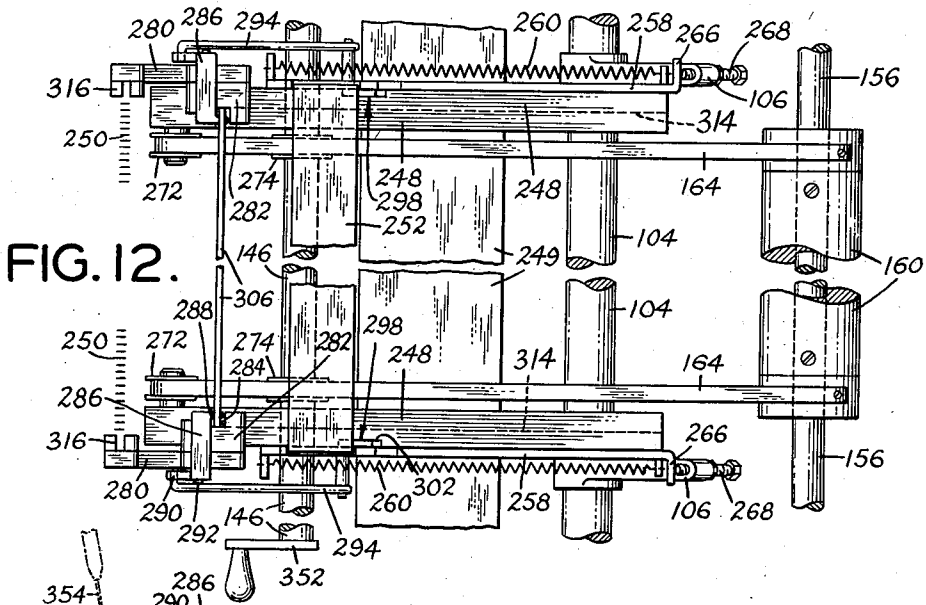


FIG. 11.

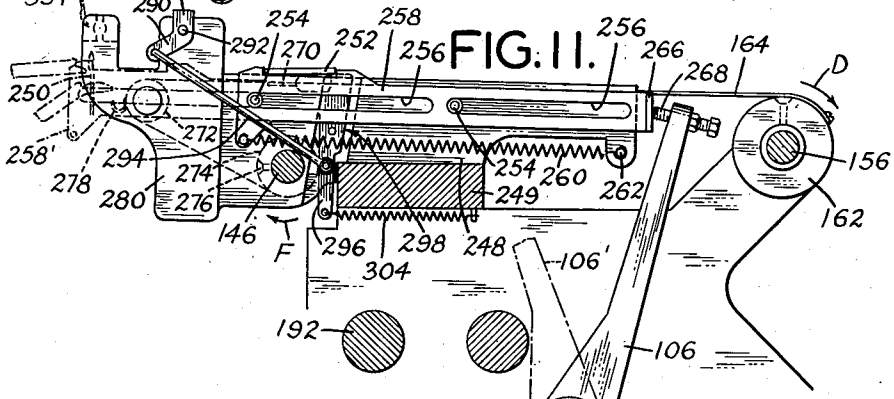
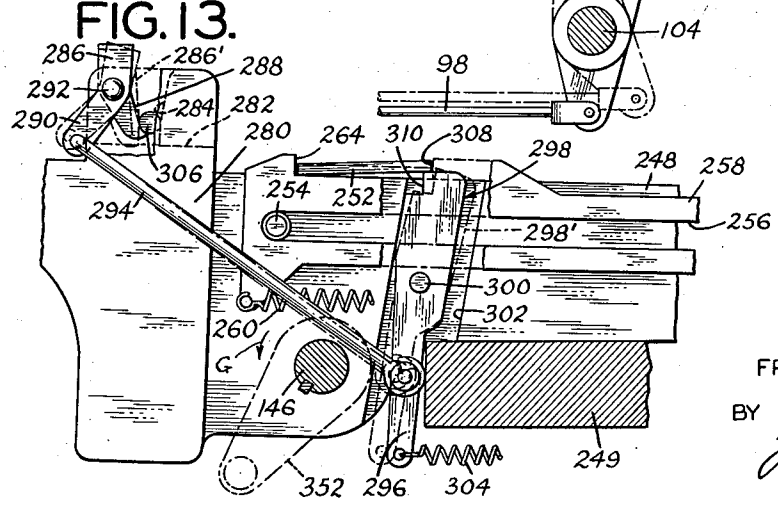


FIG. 13.



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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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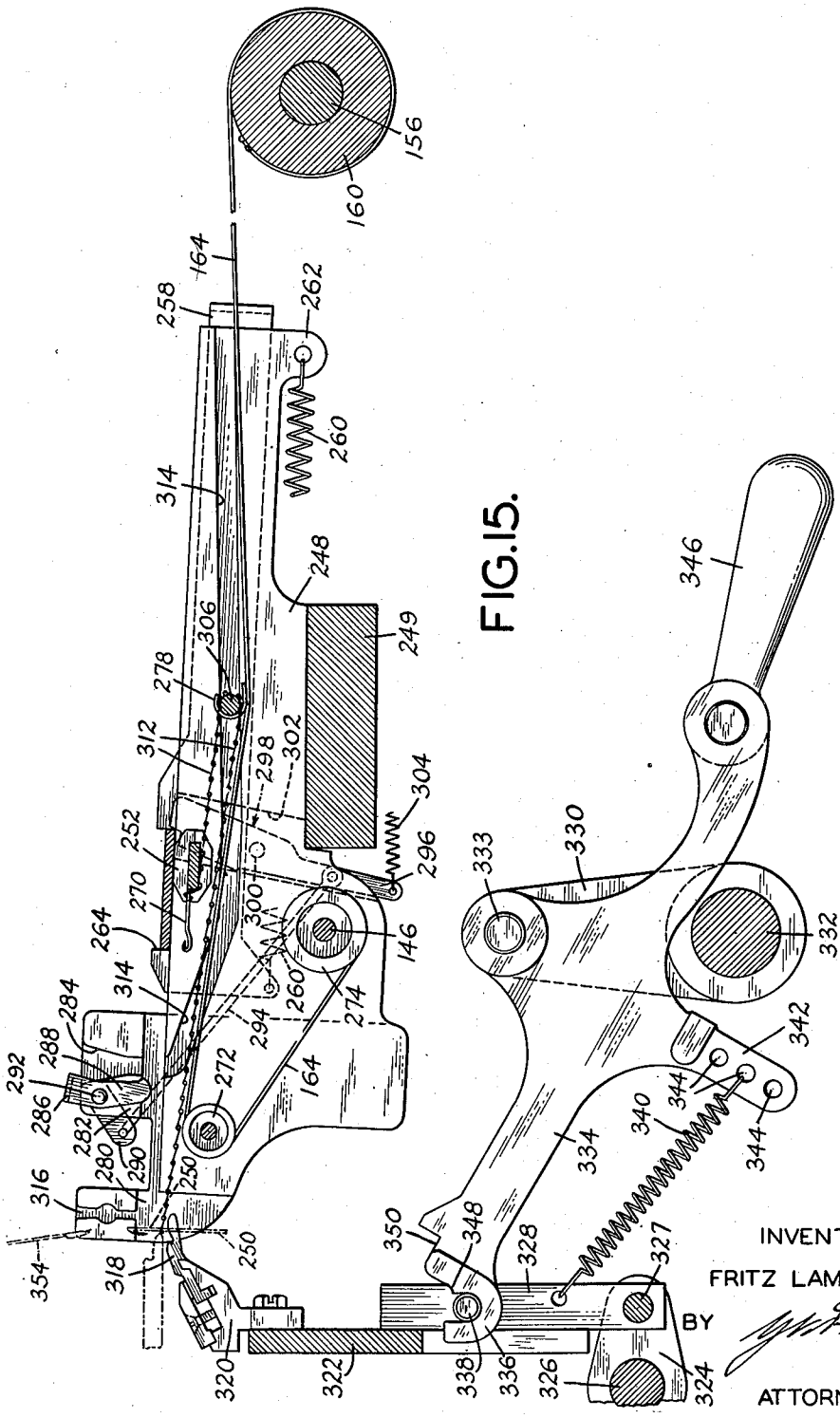


FIG. 15.

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STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

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FIG.16.

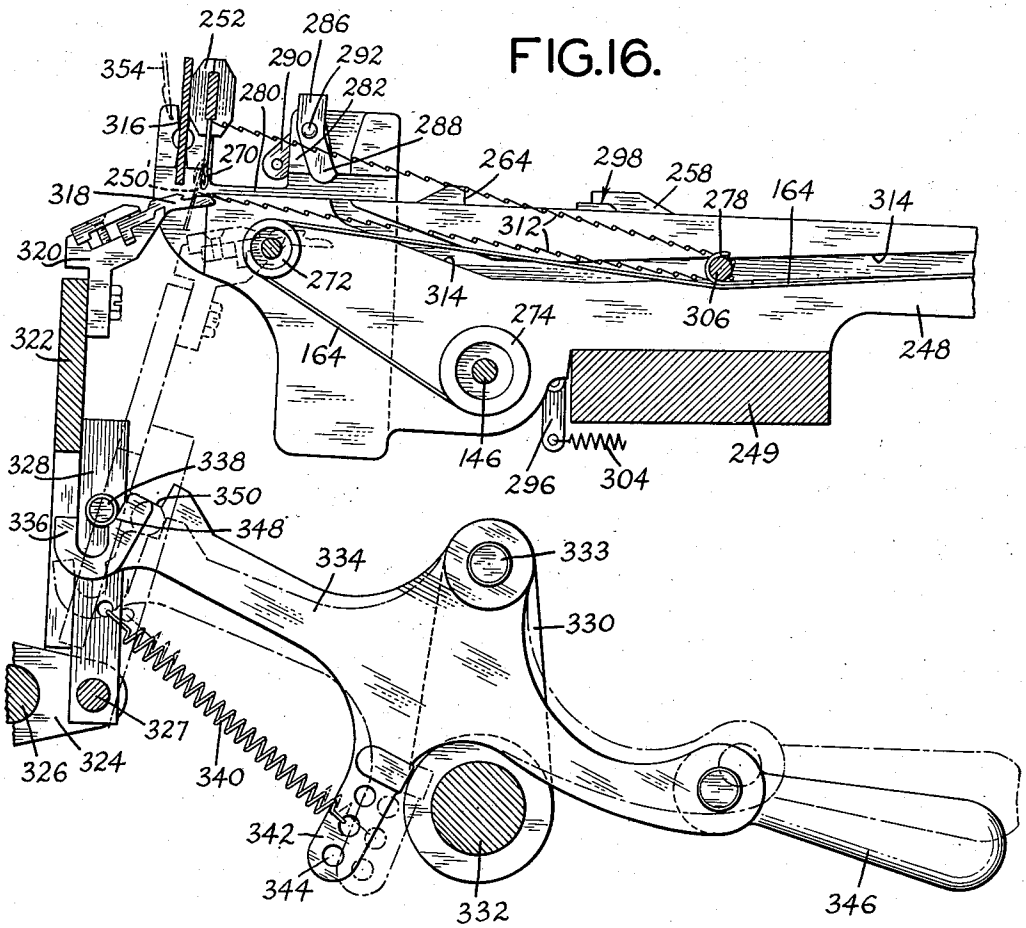
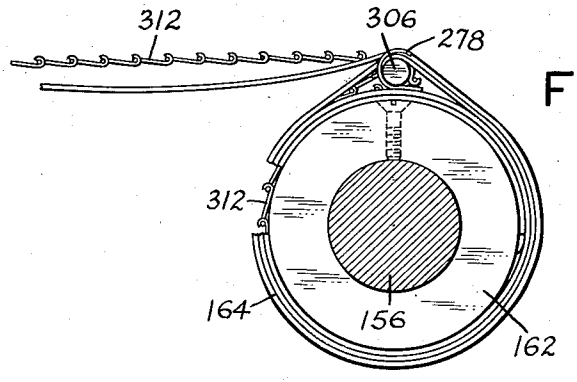


FIG.17.



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Patented Feb. 5, 1952

2,584,136

UNITED STATES PATENT OFFICE

2,584,136

STRAIGHT BAR KNITTING MACHINE AND A METHOD FOR OPERATING SAME

Fritz Lambach, Tenafly, N. J., assignor to Robert Reiner, Inc., Weehawken, N. J.

Application November 26, 1947, Serial No. 788,178

35 Claims. (Cl. 66—96)

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The present invention relates to knitting machines, and more particularly to a straight bar knitting machine or full-fashioned knitting machine.

An object of the present invention is to provide a straight bar knitting machine wherein certain operations are made automatic so as to save on time for the manufacture of stocking blanks.

A further object of the present invention is to provide a straight bar knitting machine, wherein certain manual operations, which might be the cause of faults in the knitted fabric, are replaced by automatic operations.

A further object of the present invention is to equip a straight bar knitting machine with mechanisms facilitating the operations of the welt-turn.

Another object of the present invention is to provide a straight bar knitting machine, wherein the fabric is permanently held under tension during the performance of the welt-turn and transfer of the loops of the fabric from the welt-hooks onto the needles.

With the above and other objects of the invention in view, the invention consists in the novel methods, construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, certain embodiments of the same being described in the specification and being illustrated in the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a somewhat diagrammatical front elevational view of a straight bar knitting machine according to the invention, wherein only those parts are shown, which are necessary for the understanding of the invention,

Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1,

Fig. 3 is an elevational view, partly in section, of an actuating device of the knitting machine according to the invention,

Fig. 4 is a top plan view of the actuating device shown in Fig. 3,

Fig. 5 is a vertical sectional view taken on line 5—5 of Fig. 1, said Fig. 5 illustrating an automatic control for locking and releasing the take-up device,

Fig. 6 is a sectional view taken on line 6—6 of Fig. 1, said Fig. 6 illustrating the take-up drive associated with the take-up reel of the knitting machine,

Fig. 7 is a front elevational view of the take-up drive shown in Fig. 6,

Fig. 8 is a sectional view taken on line 8—8 of Fig. 7,

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Fig. 9 is a vertical sectional view taken on line 9—9 of Fig. 1, said Fig. 9 illustrating the controlling mechanism for controlling the tension to be applied to the take-up reel,

Fig. 10 is a rear elevational view along line 10—10 of Fig. 9,

Fig. 11 is a vertical sectional view taken on line 11—11 of Fig. 1, said Fig. 11 illustrating the mechanism for drawing off the fabric by the welt-bar and take-up reel,

Fig. 12 is a fragmentary top plan view of Fig. 11,

Fig. 13 is an illustration of a portion of the mechanism shown in Fig. 11 in an enlarged scale,

Fig. 14 is a sectional view taken on line 14—14 of Fig. 1, said Fig. 14 illustrating the elements of the drawing-off mechanisms in a different position,

Fig. 15 is a sectional view substantially corresponding to the sectional view shown in Fig. 14, wherein, however, the elements of the drawing-off mechanisms are shown in a different position and wherein a mechanism for a manual advancing of the knocking-over bar is shown,

Fig. 16 is a sectional view substantially corresponding to Fig. 15 wherein the various elements and parts are shown in a position during the performance of a welt-turn, and

Fig. 17 is a side elevational view of the take-up reel with a portion of the fabric wound thereon.

Referring now to Figs. 1 and 2, 30 generally indicates the frame of a two-section straight bar knitting machine. A motor 32 mounted on a bracket 34 carried by the frame 30 of the knitting machine is connected through a train of gears 36 with the main cam shaft 38 rotatably arranged in suitable bearings of the frame of the machine.

40 generally indicates a pattern chain carrying a series of buttons 42 for the control of certain mechanisms of the knitting machine. During the operation of the machine, the pattern chain is intermittently advanced in a manner known per se by any suitable mechanism actuated by a cam keyed to the main cam shaft 38.

Each row of buttons 42 mounted on the pattern chain 40 in a predetermined manner is arranged for cooperation with a swingable spring-loaded jack 44 of a series of jacks. Each jack is connected through wires, levers and rods with a controlling mechanism of the knitting machine. Fig. 2 illustrates only the connection of one jack 44. A wire 46 secured to said jack 44 is pivotally connected with the lower end of a lever 48 secured to the left-hand end (as viewed

in Fig. 2) of a rod 50 rockably mounted in bearings 52 secured to the frame 30 of the machine. A lever 54 secured at its lower end to the right-hand end of the rockable rod 50 is pivotally connected at its upper end with one end of a wire 56 (see Figs. 2, 3 and 4). The other end of said wire 56 is pivotally connected with one arm 58 of a controlling element or controlling latch 60 swingably mounted on a pivot 62 projecting upwardly from the base 64 of a block 66 being substantially of U-shaped cross-section. Said block 66 swingably mounted on a shaft 68 and held in its position by set-collars 70 carries an adjustable stop screw 72 capable of cooperation with a shaft 74 of the machine. A spring 76 stretched between a downward extension 78 of said block 66 and a stationary point 80 of the machine tends to urge said stop screw 72 against said shaft 74, whereby the block 66 is held in a substantially horizontal position.

Furthermore, a double-armed spring-loaded follower 82 carrying a roller 84 is swingably mounted on the shaft 68 between the side walls 86 of the U-shaped block 66. The roller 84 of the cam follower 82 cooperates with a cam 88 keyed to the main cam shaft 38.

During the operation of the machine, the arm 90 of the cam follower 82 may freely rock within the U-shaped block 66, held in its position by the spring 76, in accordance with the shape of the cam 88 engaged with the roller 84 of the follower 82, as long as the controlling element 60 is in the inactive position shown in full lines in Fig. 4. As soon as, however, the rod 50 (Fig. 2) is rocked in the direction of the arrow A owing to an actuation of the spring-loaded jack 44 by a button 42 on the pattern chain 40, the lever 54 connected to said rod 50 is brought from the full line position shown in Fig. 4 into the dash and dot line position 54', whereby the controlling element 60 is swung in counter-clockwise direction (as viewed in Fig. 4) into an active position wherein its upward extension 92 is below an abutment 94 arranged on the arm 90 of the cam follower 82. As soon as said controlling element 60 is thus brought into said active position, the next downward rocking of the arm 90 of the cam follower 82 caused by the rise on the cam 88 results in a swinging of the block 66 against the action of the spring 76 in counter-clockwise direction as viewed in Fig. 3. When the cam follower 82 returns into the position shown in Fig. 3 and, consequently, the arm 90 of said cam follower 82 is lifted, the block 66 follows said movement of the arm 90 in clockwise direction by the action of the spring 76 until the stop screw 72 hits against the shaft 74. Now, when the rod 50 (Fig. 2) rocked in the direction of the arrow B owing to a disengagement of the button 42 on the advancing pattern chain from the spring-loaded jack 44 connected with the rod 50, the lever 54 is returned into its full-line position shown in Fig. 4, whereby the controlling element 60 is returned into its inactive position wherein its upward extension 92 is out of the path of the abutment 94 on the arm 90 of the cam follower 82, so that the latter may again freely rock without influence on the block 66.

The downward extension 78 of said block 66 is pivotally connected at 96 with one end of a rod 98, the other end of which is pivotally connected at 100 with an arm 102 secured to a rotatable shaft 104. Two pairs of pushing elements 106 are secured to said shaft 104 for a purpose to be described hereinafter. Apparently, an oscillation of the block 66 by the cam follower 82 in the manner described above causes an oscillation of the pushing elements 106.

As best shown in Figs. 1 and 2, a control shaft 108 is rotatably mounted in suitable bearings of the frame 30 of the machine. A series of controlling cams is rigidly connected with said control shaft. Each controlling cam is used for the control of a certain mechanism of the machine. The drawings illustrate only two of said controlling cams, the controlling cam 110 and 112. The control shaft 108 is intermittently advanced through the medium of a ratchet-wheel mechanism 114, which is actuated by a connecting rod 116 connected with a U-shaped block of an actuating drive of the type described above in connection with Figs. 3 and 4. Of course, the controlling element swingably mounted in the U-shaped block of said actuating drive is controlled by a row of buttons mounted on the pattern chain 40 for cooperation with a spring-loaded jack 44. A detailed description of the mechanism advancing intermittently said control shaft 108 may be found in my co-pending U. S. patent application Ser. #743,938 filed April 25, 1947, now Patent No. 2,574,487, for "A Straight Bar Knitting Machine."

The controlling cam 110 (see Figs. 1 and 5) cooperates with a spring-loaded cam follower 118 swingably mounted on a shaft 120. Said cam follower 118 is pivotally connected with the lower end of a connecting rod 122, the upper end of which is pivoted at 124 to one arm of a bell-crank lever 126 swingably mounted on a stud 128 carried by the frame 30 of the machine. The other arm of said bell-crank lever 126 is pivotally connected at 130 with one end of a rod 132. The other end of said rod 132 being bent is in slidable engagement with a slot 134 of a locking latch 136 swingably mounted on a stationary part of the machine at 138. A tension spring 140 stretched between the locking latch 136 and a stationary portion of the machine frame tends to urge the hook of the latch 136 into engagement with a notch 142 of a collar 144 rigidly connected with a locking shaft 146 rotatably mounted in suitable bearings of the frame of the machine, when the linkage 118, 122, 126, 132 is in the position shown in full lines. As soon as, upon an advancing of the control shaft 108, the high portion of the controlling cam 110 comes into engagement with the cam follower 118, the latter is brought into the position 118' shown in dash and dot lines, whereby the bell-crank lever 126 is brought into the dash and dot line position 126' and, consequently, the locking latch 136 is swung against the action of the spring 140 into the releasing position 136' wherein its hook is disengaged from the notch 142 of the collar 144. Such a disengagement of the locking latch 136 from the notch 142 of the collar 144 results in a release of the locking shaft 146 for a purpose to be described hereinafter. When, after several intermittent advancing movements of the control shaft 108, the cam follower 118 comes again into engagement with the dwell of the controlling cam 110, the linkage 118, 122, 126, 132 is returned into the position shown in full lines in Fig. 5. If at this time the round portion of the collar 144 should be opposite the hook of the locking latch 136, so that the latter cannot come immediately into engagement with the notch 142, the spring 140 will urge the locking latch 136 against the collar 144 and the bent portion of the rod 132 may slide in the slot 134. As soon as the notch

142 will come opposite to the hook of the locking latch 136 owing to a rotation of the locking shaft 146, the hook of said locking latch 136 may automatically snap into said notch 142 by the action of the tension spring 140.

As best shown in Figs. 1 and 2, the controlling cam 112 secured to the control shaft 108 cooperates with a spring-loaded cam follower 148 swingably mounted on the shaft 120. The upper arm of said cam follower 148 is pivotally connected with one end of a connecting rod 150, the other end of which has a bent portion slidably engaged with a slot 152 (see Figs. 2 and 6–8) of a releasing element 154 swingably but axially immovably arranged on a take-up shaft 156 journalled in suitable bearings of the frame of the machine. The releasing element 154 is under the action of a spring 158 stretched between said releasing element and a stationary point of the machine, which tends to urge said releasing element 154 into the position shown in full lines in Figs. 6 and 8. When, during the operation of the machine, the rise of the cam 112 is brought into engagement with the cam follower 148, the latter causes a movement of the connecting rod 150 in the direction of the arrow C, whereby the releasing element 154 is swung from its full line inactive position into its dash and dot line active position 154' against the action of the spring 158 for a purpose to be described hereinafter. When, during the operation of the machine, the controlling cam 112 is further advanced so as to cause a disengagement of its rise from the cam follower 148, the connecting rod 150 is returned into the position shown in Fig. 6 and the releasing element 154 will be returned into its full line inactive position by the action of the spring 158.

As best shown in Fig. 1, the take-up shaft 156 carries two take-up reels 160, one for each section of the knitting machine. There is a collar 162 on each side of each take-up reel 160. One end of a strap 164 (see Figs. 7, 11 and 12) is rigidly connected with each collar 162 for a purpose to be described hereinafter. Furthermore, as best shown in Figs. 7, 11 and 12, each take-up reel 160 and collar 162 is rigidly connected with the take-up shaft 156 by screws or the like. Moreover, as best shown in Figs. 1 and 7, a collar 166 is rigidly connected with said take-up shaft 156 by a screw or the like. A ratchet-wheel 168 is rotatably but axially immovably arranged on the take-up shaft 156 at a distance from said collar 166. The ends of a torsion spring 170 wound around said take-up shaft 156 and interposed between said collar 166 and said ratchet wheel 168 are positively engaged with said collar 166 and ratchet wheel 168. The ratchet wheel 168 may be advanced step by step in the direction of the arrow D by a spring-loaded actuating pawl 172 mounted on an arm 174 of a bell-crank actuating lever 176 swingably but axially immovably mounted on the take-up shaft 156. The other arm 178 of said bell-crank actuating lever is connected with one end of an actuating tension spring 180, the other end of which is connected with the hook-like end of a tension adjusting rod 182 movably arranged in the machine.

The arm 178 of the bell-crank actuating lever 176 carries a pin 184 slidably engaged with an elongated slot 186 arranged at one end of a tension restoring rod 188, the other end of which is pivoted to an arm 190 keyed to a needle bar shaft 192. Said needle bar shaft 192 is oscillated by a needle bar shaft drive (not shown) in a manner known per se during the operation of the machine, so that, consequently, the arm 190 is reciprocated from the full line position into the dash and dot line position and vice versa.

The ratchet-wheel 168 may be held in its position against the action of the torsion spring 170 by means of a spring-loaded locking pawl 194 carried by a stud 196 secured to a lug 198 of the frame 30 of the machine.

Apparently, the bell-crank actuating lever 176 carrying the actuating pawl 172 may be swung in the direction of the arrow D by the action of the tension actuating spring 180 when the tension restoring rod 188 is moved in left-hand direction (as viewed in Fig. 6) into the position shown in dash and dot lines and when at this time the tension of said tension actuating spring 180 is larger than the tension of the torsion spring 170 connected with the ratchet-wheel 168 and the set-collar 166 to the take-up shaft 156 carrying the take-up reel 160 arranged for taking up fabric knitted by the machine. Depending on the degree of the difference in the tension between the tension actuating spring 180 and the torsion spring 170, the ratchet-wheel 168 will be advanced one or more steps corresponding to the tooth caught by the actuating pawl 172 for tensioning the torsion spring 170 and applying tension to the take-up reel 160. When the tension restoring rod 188 is returned from the dash and dot line position towards the right into the full line position shown in Fig. 6, the bell-crank actuating lever 176 will be swung in the direction of the arrow E by the cooperation of the left-hand edge of the slot 186 with the pin 184 mounted on the arm 178, whereby the tension of the tension actuating spring 180 is restored. The next advancing of the ratchet wheel 168 will occur only after the tension of the tension actuating spring 180 exceeds the tension of the torsion spring 170, although the tension restoring rod 188 is permanently reciprocated and the left-hand edge of its slot 186 is disengaged from the pin 184 at intervals.

Apparently, the tension applied to the take-up reel 160 depends on the tension or torque of the torsion spring 170, which, in turn, depends on the tension of the tension actuating spring 180. It is desirable that the tension applied to the take-up reel 160 drawing off a full-fashioned fabric, for example, a stocking blank, from the needles of the machine is automatically altered at predetermined intervals in dependence on the progress of the knitting of the full-fashioned fabric. For example, if, during the knitting of a full-fashioned stocking blank, the width thereof is reduced, the tension applied to the take-up reel should be reduced in proportion, and if the width of the stocking blank knitted is somewhat increased at a certain part of the stocking blank, the tension applied to the take-up reel should be proportionally increased. In order to obtain this automatic adjustment of the tension applied to the take-up reel in dependence on the width of the fabric knitted, the following adjusting mechanism is arranged in the machine:

In Figs. 1, 2, 9 and 10, 200 indicates a carrier spindle rotatably arranged in the frame of the machine. Said carrier spindle 200 may be intermittently rotated in either direction by a suitable carrier spindle drive known per se (not shown in the drawings). The carrier spindle 200 has two threaded portions, one having a left-hand thread and the other having a right-hand thread. Each threaded portion of the carrier spindle 200 is engaged with a threaded bore

of a so-called carrier spindle nut 202 carrying limiting means (not shown in the drawings) for limiting the strokes of reciprocable carrier rods 204 indicated in Fig. 2, which are reciprocated at predetermined intervals by an actuating drive 206, a portion of which is shown in Fig. 2. Each carrier rod carries a yarn carrier 208 for each section of the machine. The reciprocable yarn carrier rods with the yarn carriers mounted thereon, the actuating drive of said yarn carrier rods and the limiting means mounted on the carrier spindle nuts 202 for limiting the strokes of the reciprocable yarn carrier rods may be of any suitable construction, for example, they could be of the construction shown in my co-pending U. S. patent application Ser. #743,938 filed on April 25, 1947, for "A Straight Bar Knitting Machine." Each carrier spindle nut 202 has a recess 210 (see Figs. 2 and 9) engaged with a stationary guiding rod 212 carried by the frame of the machine. Therefore, when, during the operation of the machine a so-called forward-racking of the carrier spindle 200 is carried out, the carrier spindle nuts 202 are moved forwardly towards each other, and when a so-called back-racking of the carrier spindle 200 is carried out, the carrier spindle nuts 202 are moved backwardly, away from each other. As the position of the carrier spindle nuts 202 determines the length of stroke of the carrier rods, it is in a definite relation to the width of the fabric knitted.

The right-hand carrier spindle nut 202 (as viewed in Fig. 1) carries two holding bars 214 rigidly secured thereto by screws 216 (see Figs. 9 and 10). A bar 218 having an upper cam surface is rigidly connected with said holding bars 214 by screws or the like. The cam surface of said bar or cam 218 is in slidable engagement with a pin 220 mounted on a cam follower 222 swingably arranged at 224 on a block 226 secured to the frame 30 of the machine. Said swingable cam follower 222 is pivotally connected at its end opposite the pivot 224 to the upper end of a connecting rod 228, the lower end of which is pivoted to an arm 230 of a bell-crank lever 232 swingably mounted on a shaft 234 carried by the frame of the machine. The other arm 236 of said bell-crank lever 232 is pivotally connected at 238 with one end of above mentioned tension adjusting rod 182, which at its other end is engaged with the tension actuating spring 180.

When the carrier spindle nut 202 is in the position shown in full lines in Fig. 10, the stroke of the carrier rod or rods is limited in such a way that the fabric knitted by the knitting implements of the machine has a certain width; at the same time, the cam 218 positively coupled with the carrier spindle nut 202 by the holding bars 214 holds the cam follower 222 in the upwardly inclined position best shown in Fig. 10. Consequently, the bell-crank lever 232 connected with the cam follower 222 through the connecting rod 228 is in the position shown in full lines in Fig. 9. When the bell-crank lever 232 is in said position shown in full lines in Fig. 9, the hook-like end of the tension adjusting rod 182 is in the position shown in full lines in Fig. 6, whereby the tension of the tension actuating spring 180 is adjusted to a certain degree required for applying a certain tension to the take-up reel 160 when the fabric knitted is of a width determined by the position of the carrier spindle nut 202 shown in full lines in Fig. 10. Now, when during the knitting cycle, owing to intermittent forward-racking of the carrier spindle 200, the carrier spindle nut 202 is brought into the position 202' shown in dash and

dot lines in Fig. 10, the width of the fabric knitted is reduced. At the same time, the cam follower 222 is brought into the substantially horizontal position 222', which, in turn, causes a rocking of the bell-crank lever 232 into the dash and dot line position 232' shown in Fig. 9. Consequently, the tension adjusting rod 182 is moved into the position 182' shown in dash and dot lines in Fig. 6, whereby the length of the tension actuating spring 180 and thus the tension thereof is reduced, so that, in turn, the tension applied to the takeup reel 160 by means of the torsion spring 170 is reduced in proportion to the reduced width of the fabric knitted. It will be readily understood that, if, during a knitting cycle the carrier spindle nut 202 is back-racked to a certain degree for a certain increase in the width of the fabric at an intermediate portion of its length, the cam 218 will cause a lifting of the cam follower 222 to a certain degree with the result of a certain increase in the tension of the tension actuating spring 180 by a certain displacement of the tension adjusting rod 182.

According to the embodiment shown in Fig. 10, the upper surface of the cam 218 cooperating with the pin 220 of the cam follower 222 is of irregular curved form. Preferably, the shape of the cam surface is selected in such a manner, that it takes care of an adjustment of the cam follower 222 and, through the latter, of the tension adjusting rod 182 as may be required by the presence of reinforcing yarn in the fabric knitted. Moreover, in a preferred embodiment, the cam 218 is detachably mounted on the holding bars 214 so that it may be replaced by a cam having a different cam surface, if a different type of stocking is knitted or if a stocking is knitted of a yarn of different strength.

As best shown in Fig. 6, the actuating pawl 172 and the locking pawl 194 are normally held in engagement with the teeth of the ratchet wheel 168 by the springs acting on said pawls. The locking pawl 194 prevents a rotation of the ratchet wheel 168 in the direction of the arrow E under the action of the torsion spring 170 when the locking pawl 194 is engaged with a tooth of the ratchet wheel 168. The releasing element 154 (see Figs. 6–8) is rotatably arranged on the take-up shaft 156 for cooperation with said actuating pawl 172 and locking pawl 194. As best shown in Fig. 8, said releasing element 154 is substantially in the shape of a disc having an arm 240 provided with the slot 152 and a hand lever 242. The disc-like portion of said releasing element 154 has a recess 244 for cooperation with the actuating pawl 172 and a recess 246 for cooperation with the locking pawl 194. As long as the pawls 172 and 194 are in engagement with said recesses 244 and 246, said pawls may also come into engagement with the teeth of the ratchet wheel 168 as shown in Fig. 6. As soon as, in the manner described above, at the end of a knitting cycle, the rod 150 is automatically moved in the direction of the arrow C, the releasing element 154 is moved in the direction of the arrow D into the dash and dot line position 154' whereby the high round portions of the disc-like member adjacent the recesses 244 and 246 come into engagement with the actuating pawl 172 and locking pawl 194, thus lifting same out of engagement with the teeth of the ratchet wheel 168, so that the take-up reel 160 is released for a winding-off of the fabric. When, at the beginning of a knitting cycle, the rod 150 is automatically returned into the position shown in Fig. 6 and the spring 158 returns

the releasing element 154 into the position shown in full lines in Figs. 6 and 8, the recesses 244 and 246 of the releasing element 154 are again in engagement with the actuating pawl 172 and locking pawl 194 so that the latter may come into engagement with the teeth of the ratchet wheel 168.

If, for any reason whatsoever, the take-up drive shall be rendered ineffective before the end of a knitting cycle is reached, the releasing element 154 may be moved into the releasing position 154' by means of the handle 242, the slot 152 of the arm 240 permitting such a movement relative to the rod 150.

A pair of stationary supporting elements 248 (see Figs. 2 and 12) mounted in any suitable manner on a longitudinal bar 249 attached to the frame of the machine is arranged in each section of the machine in front of the series of needles 250. Said stationary supporting elements 248 are capable of supporting a welt bar 252 placed thereon. Each supporting element 248 carries two guiding- and stop pins 254 (Fig. 11) slidably engaged with slots 256 of a sliding member 258 arranged on the outside of the supporting element 248. A tension spring 260 stretched between each sliding member 258 and a lug 262 of the stationary supporting element 248 tends to urge the sliding member 258 into the position shown in full lines in Figs. 11 and 13, wherein the left-hand ends of the slots 256 are engaged with the guiding- and stop pins 254, thus limiting the extreme end position of the sliding member 258. Each sliding member 258 has a recess 264 capable of engagement with a welt-bar placed on the supporting elements 248. Furthermore, each sliding member 258 has a flange 266 arranged as an abutting surface for a set screw 268 mounted on the pushing element 106 as best shown in Fig. 11. Thus, the slides 258 may be advanced by the pushing elements 106 into an advanced or "hook-up" position 258' shown in dash and dot lines in Fig. 11 towards the needles 250 against the action of the tension springs 260, when the pushing elements 106 are automatically swung into the position 106' by a movement of the connecting rod 98 in response to a controlled actuation of the actuating drive 66, 82, 84, 88 described above in connection with Figs. 2–4. During such a movement of the sliding elements 258 into the advanced or hook-up position 258', a welt-bar 252 placed onto the supporting elements 248 and gripped between walls of the recess 264 of the sliding elements 258 will be pushed towards the needles 250, sliding on the upper surface of the supporting elements 248, so that it is brought into a position wherein the fabric may be hooked up onto the hooks 270 of the welt bar 252. When the hooking-up of the fabric is completed, the pushing elements 106 are automatically returned from the position 106' into the position 106, thus becoming disengaged from the abutting flanges 266 of the sliding elements 258 so that now the tension springs 260 are free to urge the sliding elements 258 into the position shown in Fig. 11, whereby tension is applied to the fabric through the welt-bar 252 caught by the sliding elements 258 for drawing off the fabric.

As best shown in Fig. 12, the straps 164 attached at one of their ends to the collars 162 rigidly connected with the take-up shaft 156 are arranged adjacent the inside of the supporting elements 248. Each strap is trained around an idle roller 272 rotatably mounted on one of the supporting elements 248 and has its other end attached to a roller 274 rigidly connected with the locking shaft 146 by a set-screw 276 (see Fig. 11). A gripping element or hook 278 is secured to each flexible strap 164 for a purpose to be described hereinafter. It will be readily understood that a step by step advancing of the ratchet wheel 168 of the take-up drive shown in Figs. 6 and 7 cannot cause a rotation of the take-up reel 160 and the collars 162 as long as the locking shaft 146 (Figs. 5 and 11) locked by the automatically controlled locking latch 136; during this period, therefore, the hooks 278 attached to the straps 164 will remain in the position shown in Figs. 11 and 14, and the step by step advancing of the ratchet wheel 168 (Figs. 6 and 7) will merely cause a tensioning of the torsion spring 170 interposed between the ratchet wheel 168 and the set collar 166 attached to the take-up shaft 156.

As best shown in Figs. 2 and 11–16 a bracket 280 is attached to the outside of each supporting element 248 in any suitable manner. Each bracket 280 carries a block 282 having a slot 284 (see Figs. 13–16) open at the top and at the bottom. A holding element 286 having a holding arm 288 adjacent the inside of the block 282 and having an actuating arm 290 adjacent the outside of the bracket 280 is swingably mounted on said bracket 280 at 292. The actuating arm 290 of each holding element 286 is pivotally connected with one end of a connecting rod 294, the other end of which is pivoted to an arm 296 of a releasing lever generally indicated by 298, swingably mounted at 300 on the supporting element 248 in a recess 302 thereof. As best shown in Figs. 11–13, said releasing lever 298 is arranged inside of the sliding element 258 within said recess 302 of the supporting element 248. A tension spring 304 stretched between the arm 296 and a stationary point of the bar 249 tends to urge the releasing lever 298 into the position shown in full lines in Figs. 11 and 13, wherein the releasing lever 298 abuts against the wall of the recess 302. When the releasing lever 298 is in said full line position, the upper edge of the releasing lever 298 projects somewhat from the plane of the upper surface of the supporting element 248, so that a welt-bar 252 placed onto the supporting elements 248 is in a slightly inclined position. Furthermore, when said releasing lever 298 is in said full line position shown in Fig. 13, the holding arm 288 of the holding element 286 is in the position shown in full lines in Fig. 13, wherein its lower hook-shaped end projects into the plane of the slot 284 of the block 282. Therefore, when a welt rod 306 is placed into the slots 284 of the blocks 282, the welt-rod will be held in the position shown in Fig. 13 by means of the holding arms 288 of the holding elements 286.

As mentioned above, during the operation of the machine, at first the sliding elements 258 are pushed towards the needles 250 by means of the pushing elements 106, whereby a welt-bar 252 gripped by the sliding elements 258 is, likewise, pushed towards the needles. Shortly after the beginning of said pushing movement, the edge of the welt-bar 252 resting on the projecting portion of the releasing lever 298 held in its position by the tension spring 304 will slip off said projecting portion and rest entirely on the supporting element 248. Furthermore, as mentioned above, after a disengagement of the pushing elements 106 from the sliding elements 258, the ten-

sion springs 260 connected with the sliding elements 258 move said sliding elements away from the needles, so that the welt-bar 252 gripped between the sliding elements 258 is, likewise, moved away from the needles for drawing-off the fabric knitted by the knitting implements of the machine. Shortly before the welt-bar 252 reaches its extreme position limited by an abutment of the left-hand edges of the slots 256 of the sliding elements 258 against the guiding- and stop pins 254, the right-hand edge 308 of the welt-bar 252 (see Fig. 13) abuts against the nose 310 of the spring-loaded releasing lever 298 projecting into its path. During the continuation of the drawing-off of the fabric by the welt-bar 252, the releasing lever 298 is brought by the edge 308 of the welt bar 252 into the releasing position 298' against the action of the tension spring 304 shown in dash and dot lines in Fig. 13. This movement of the releasing lever 298 into the releasing position 298' causes a swinging movement of the holding element 286 into the releasing position 286' shown in dash and dot lines in Fig. 13 through the medium of the connecting rod 294. As soon as the holding element 286 is brought into said releasing position 286', the welt rod 306 drops onto the fabric 312 (see Fig. 14), which is drawn off by the welt-bar 252. When said welt-rod 306 drops onto said fabric 312 its ends become engaged with guiding channels 314 arranged on the inside of each supporting element 248. Now, after above described release of the welt-rod 306 but still before the sliding elements 258 and the welt-bar 252 reach the end position shown in Fig. 14, which is limited by an abutment of the left-hand edges of the slots 256 against the guiding- and stop pins mounted on the supporting elements 248, the locking shaft 146 (see Figs. 5 and 14) is automatically released by the controlling mechanism 110, 118, 122, 126, 132 bringing the locking latch 136 into the releasing position 136', so that now the tension accumulated in the torsion spring 170 (see Fig. 7) by the previous intermittent advancing of the ratchet wheel 168 may become active and cause a sudden rotation of the collars 162 with the result that a portion of the straps 164 is wound on said collars 162 and, consequently, the hooks 278 are suddenly brought from the position shown in dash and dot lines in Fig. 14 into engagement with the welt-rod 306 as shown in full lines in said Fig. 14. As now the locking shaft 146 remains released for a predetermined period, the take-up drive shown in Figs. 6–8 may remain effective and may cause a drawing-off of the fabric by the hooks 278 attached to the straps 164 secured to the collars 162 positively coupled with the take-up reel 160 and take-up shaft 156. Thus, the drawing-off of the fabric 312 is automatically transferred from the welt-bar 252 to the take-up shaft 156 carrying the take-up reel 160 and set collars 162.

Shortly after the gripping of the welt-rod 306 by the hooks 278 on the straps 164, the sliding elements 258 and the welt-bar reach the position shown in Fig. 14, which, as mentioned above, is limited by the stop pins 254 (see Fig. 13). Therefore, the welt bar 252 remains in the extreme position shown in Fig. 14. Now, when the fabric is drawn-off by the straps 164 connected to the take-up reel 160 and the take-up drive, the welt-rod 306 is guided by the guiding channels 314 below and under the now stationary welt-bar 252, so that a loop of the fabric 312 is formed around the welt-rod 306 as shown in Fig. 15.

When a sufficient length of fabric has been knitted, so that the so-called welt-turn can be made, the machine is stopped. Thereafter, the welt bar 252 is removed by hand from the supporting elements 248 and placed into holding guides 316 arranged on the brackets 280 (see Figs. 15 and 16). During this manual operation, the fabric 312 is somewhat stretched against the action of the torsion spring 170 acting on the take-up shaft 156 and the straps 164. The welt-rod 306 remains engaged with the hooks 278 on said straps 164. In order to transfer the loops of the fabric 312 hanging on the stems of the welt-hooks 270 onto the needles 250, the needles are brought into a forwardly inclined position 250' (see Fig. 16) by a mechanism known per se.

According to the invention, the knocking-over bits 318 carried by a knocking-over bar 320 secured to a knocking-over frame 322 may also be advanced or laid out towards the welt-hooks from the position shown in Fig. 15 into the position shown in full lines in Fig. 16. This feature may be obtained by the following mechanism:

As best shown in Fig. 15, an arm 324 keyed to a rockable vertical knocking-over shaft 326 is pivotally connected at 327 with a vertical bar 328 rigidly connected with the knocking-over frame 322. The rockable vertical knocking-over shaft 326 is oscillated in a manner known per se by a suitable actuating drive (not shown). Furthermore, an arm 330 keyed to a horizontal knocking-over shaft 332 is pivotally connected at 333 with a link 334 having a hook 336. Said hook 336 is loosely engaged with a stud or pin 338 mounted on the vertical bar 328. The hook 336 and pin 338 are held in engagement with each other by a tension spring 340 stretched between the vertical bar 328 and an extension 342 having a series of holes 344 for adjustment of the tension of the tension spring 340. The horizontal knocking-over shaft 332 is oscillated by an actuating drive known per se (not shown). During the operation of the machine, when the hook- and pin connection 336, 338 is in engagement as shown in Fig. 15, the vertical bar 328 imparts up- and down movements to the knocking-over bits 318 and the link 334 imparts forward- and backward movements to the knocking-over bits 318 in a coordinated relationship as known per se.

A handle 346 for a manual disengagement of the hook- and pin connection 336, 338 during a standstill of the machine is rigidly connected with the link 334. Furthermore, the link 334 is provided with a first recess 348 adjacent the hook 336 and with a second recess 350 at a certain distance from the first recess 348 for a purpose to be described hereinafter.

When the machine is at a standstill and the welt-turn is to be performed, the handle 346 is swung about the pivot 333 whereby the link 334 is brought from the position shown in Fig. 15 into the position shown in full lines in Fig. 16. This movement of the link 334 results in a disengagement of its hook 336 from the pin 338 on the vertical bar 328. The vertical bar 328 swings about the pivot 327 under the action of the spring 340. When the lever 346 is lifted only into the position shown in full lines in Fig. 16, the pin 338 will snap into the recess 348 of the link 334 which acts as an abutting surface limiting the advanced position of the knocking-over bar connected to the vertical bar 328, as is desirable for the welt-turn. Owing to this advancing or laying-out of the knocking-over bar, it is possible

to lay-out the needles 250 to a substantial extent into a position permitting the performance of a welt-turn without lifting the narrowing machine carrying the narrowing fingers 354 and yet to use only knocking-over bits 318 of normal length, as the laid-out knocking-over bits are sufficiently advanced to embrace the laid-out needles. As will be readily understood, the laying-out of the knocking-over bar eliminates the use of abnormally long knocking-over bits, which would become necessary, if the knocking-over bar cannot be advanced and the needles are advanced to a substantial extent.

When during a standstill of the machine, the lever 346 is lifted into the position shown in dash and dot lines in Fig. 16, the pin 338 will snap into the second recess 350 acting as an abutting surface for limiting a still farther advanced position of the knocking-over bar. Such a farther advanced position of the knocking-over bar permits an easy access to the knocking-over bits in case one or the other of them has to be replaced and eliminates the necessity to remove the entire knocking-over bar from the machine in such a case.

Upon a return of the lever 346 into the position shown in Fig. 15, the hook- and pin connection 336, 338 becomes automatically re-engaged and the machine is ready for further operation.

When the welt-turn is completed and the machine is re-started for knitting fabric, the drawing-off of the fabric 312 is performed by the hooks 278 attached to the straps 164. The welt-rod 306 remains engaged with the fabric 312 remains engaged with the fabric 312 and is drawn onto the take-up reel, whereupon it turns with the take-up reel and the fabric is wound on the take-up reel and around the welt-rod 306 in the manner illustrated by Fig. 17.

The operation of the machine is as follows:

Prior to the start of the knitting machine, welt-bars 252 are taken from suitable brackets (not shown) and are placed on the supporting elements 248 in each section of the machine. Each welt-bar is placed between gripping portions of the sliding elements 258 which are in the position shown in Figs. 11 and 13. Furthermore, welt-rods 306 are taken from suitable brackets (not shown) and are placed in each section of the machine onto the holding arms 288 of the holding elements 286, which are in the position shown in Figs. 11 and 13 so as to hold the welt-rods 306 in the position shown in Fig. 13.

The locking latch 136 (see Fig. 5) is in the locking position shown in full lines in said Fig. 5, whereby the locking shaft 146 is prevented from rotation in the direction of the arrow F. Consequently, the rollers 274 (see Figs. 11 and 14) connected to one end of the straps 164 are likewise prevented from rotation in the direction of the arrow F, and the take-up shaft 156 connected to the other ends of the straps 164 through the medium of the collars 162 is prevented from rotation in the direction of the arrow D. When the knitting machine is started for operation, the locking latch 136 (Fig. 5) controlled by the controlling cam 110 remains in its locking position.

At the beginning of a knitting cycle, a button 42 (see Fig. 2) on the pattern chain 40 renders the actuating drive 66, 82, 88 of the pushing elements 106 active, so that the latter are swung into the position 106' shown in dash and dot lines in Fig. 11, whereby the sliding elements 258 with the welt-bar 252 are pushed into the advanced hook-up position 258'. As soon as, during the knitting of the first course, the fabric has been hooked up to the welt-hooks 270 of the welt-bar 252, the pushing elements 106 are returned by the actuating drive 66, 82, 88 into their original position shown in full lines in Figs. 2 and 11, whereby they become disengaged from the sliding elements 258 now under the action of the tension springs 260; immediately thereafter, the actuating drive 66, 82, 88 is rendered ineffective owing to a control by the pattern chain 40 and remains ineffective during the entire knitting cycle, so that the pushing elements 106 remain in the full line position shown in Figs. 2 and 11.

Furthermore, at the beginning of the knitting cycle, preferably during the knitting of the first course, the releasing element 154 of the take-up drive (see Figs. 6 and 8) is automatically returned by the controlling cam 112 (see Fig. 2) from its releasing position 154' (see Figs. 6 and 8) into the position shown in full lines in said Figs. 6 and 8 whereby the spring-loaded actuating pawl 172 and locking pawl 194 are automatically brought into engagement with teeth of the ratchet wheel 168. Thus, as soon as, at the beginning of a knitting cycle, the releasing element 154 is in the position shown in full lines in Figs. 6 and 8, the ratchet wheel 168 is advanced step by step. This step by step rotation of the ratchet wheel 168, however, does not result in a rotation of the take-up shaft 156 and take-up reel 160 in the direction of the arrow D, as, at this time, the locking shaft 146 (Fig. 11) is still locked; the step by step rotation of the ratchet wheel 168 causes at this time only a tensioning of the torsion spring 170 (see Fig. 7) interposed between the ratchet wheel 168 and the set collar 166. Consequently, the straps 164 carrying the hooks 278 remain in the position shown in Fig. 11.

Therefore, at the beginning of the knitting cycle, the fabric hooked up to the hooks of the welt-bar 252 is drawn off merely by said welt-bar 252 under the action of the tension springs 260 acting on the sliding elements 258.

As soon as the edge 308 of the welt-bar 252 (see Fig. 13) reaches the spring-loaded releasing lever 298 near the end of the drawing-off period by the welt-bar 252, the holding elements 286 holding the welt-rods 306 are tilted about their pivots 292, so that the welt-rods 306 drop from their position above the fabric onto the latter and become engaged with the guiding channel 314 (see Fig. 14). Thereafter, and preferably shortly before the welt-bar 252 reaches its end position shown in Fig. 14, the locking latch 136 (Fig. 5) is automatically brought into the releasing position 136' by the controlling cam 110. Now, the previously tensioned torsion spring 170 (see Fig. 7) may cause a sudden rotation of the take-up shaft 156 in the direction of the arrow D (Figs. 6 and 11), so that the hooks 278 attached to the straps 164 are suddenly moved from the position shown in dash and dot lines in Fig. 14 into the position shown in full lines in said Fig. 14, wherein they are in engagement with the welt-rod 306. Now, the drawing-off of the fabric is caused by the take-up drive shown in Figs. 6–8 through the medium of the straps 164, hooks 278 and welt-rod 306.

After a certain period of time the machine is automatically stopped for the performance of a welt-turn as described above in connection with Fig. 16. As may be gathered from said Fig. 16, the welt-bar 252 is held by the holding guides 316 of the brackets 280 in such a position, that

it does not interfere with the points of the narrowing fingers 354 and the welt-turn may be performed without lifting the narrowing machine carrying the narrowing fingers.

After the performance of said welt-turn, the welt-bars 252 now free from fabric, are removed from the holding guides 316 and placed in a bracket or the like on the machine for keeping same there during the further knitting operation.

When the knitting machine is restarted for the completion of the knitting cycle, the fabric 312 is drawn off by the take-up drive applying a tension to the straps 164 gripping the welt-rod 306 engaged with the fabric 312 by means of the hooks 278. At the beginning, the welt-rod 306 is guided by the guiding channels 314. Later on, the welt-rod reaches the take-up reel 160 and is turned around with the take-up reel 160, so that the fabric 312 is wound on the take-up reel as indicated by Fig. 17.

During the knitting of a stocking blank, the tension applied to the take-up reel 160 by the take-up drive is automatically regulated in the manner described above by an adjustment of the tension of the actuating spring 180 (Figs. 2, 6, 9 and 10) in dependence on the position of the carrier spindle nut 202 and, consequently, in dependence on the width of the fabric knitted.

At the end of a knitting cycle, preferably during the pressing-off of the fabric, the controlling cam 110 (see Fig. 5) is advanced so that the cam follower 118 may come into engagement with the dwell of said controlling cam 110 as shown in full lines in Fig. 5. Thus, the mechanism 118, 122, 126, 132 is returned into the position shown in full lines in Fig. 5 so that the locking latch 136 may be returned towards the locking collar 144 by the action of the spring 140. Thus, the locking latch 136 is made ready for a locking action and may snap into the notch 142 of the locking collar 144 when the latter is brought into a position opposite the nose of the locking latch 136 at the beginning of the next knitting cycle.

Furthermore, likewise, at the end of a knitting cycle and preferably simultaneously with above described actuation of the mechanism 118, 122, 126, 132 associated with the locking latch 136, the releasing element 154 of the take-up drive (see Fig. 6) is automatically brought into the releasing position 154' by an actuation of the connecting rod 150 in the direction of the arrow C by means of the controlling cam 112. Thus, the actuating pawl 172 and locking pawl 194 are automatically disengaged from teeth of the ratchet wheel 168. Therefore, when the machine is stopped, the fabric may be readily wound off from the take-up reel 160 which now is free for rotation in the direction of the arrow E.

In order to wind off the fabric from the take-up reel, a handle 352 keyed to the locking shaft 146 (see Figs. 1, 12 and 13) is rotated in the direction of the arrow G. This rotation may be carried out although the mechanism 118, 122, 126, 132 associated with the locking latch 136 is in the position shown in Fig. 5.

Owing to the shape of the notch 142 of the locking collar 144, the locking latch 136 may snap in and out of the notch when the locking shaft 146 and locking collar 144 are rotated in the direction of the arrow G by means of the handle 352.

When the fabric is wound off from the take-up reel, the machine is ready for a new knitting cycle as the locking latch 136 will prevent the locking shaft 146 from a rotation in the direction of the arrow F, as soon as at the beginning of the new knitting cycle the nose of the locking latch is brought into engagement with the notch 142 of the locking collar 144 after a slight rotation of the locking shaft 146 by means of the handle 352 (Fig. 1) in the direction of the arrow F (Fig. 5).

I have described a preferred embodiment of my invention, but it is understood that numerous changes and omissions may be made without departing from the spirit and scope of the invention set forth in the appended claims.

For example, the invention may also be applied to a straight bar knitting machine having more than two sections.

Furthermore, equivalent mechanisms and controls may be substituted for the mechanisms and controls shown and described.

What I claim is:

1. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks, holding means capable of receiving and holding a welt-rod, said holding means being mounted on said knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, movable take-up means, a take-up drive associated with said take-up means for actuating same, and automatic means for effecting at a predetermined interval a connection of said welt-rod with said take-up means after its engagement with the fabric whereby the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

2. In a straight bar knitting machine as claimed in claim 1, said welt-rod releasing means being in the path of a member of the assembly including the welt-bar and welt-bar actuating means, and said welt-rod being arranged for actuation by said member of the assembly substantially at the end of said predetermined period of drawing-off of the fabric by the welt-bar.

3. In a straight bar knitting machine as claimed in claim 1, movable engaging means capable of engagement with said welt-bar, said welt-bar actuating means being associated with said movable engaging means for actuating same, and said welt-rod releasing means being in the path of a member of the welt-bar-engaging means assembly and being arranged for actuation by said member of said assembly substantially at the end of said predetermined period of drawing-off of the faric by the welt-bar.

4. In a straight bar knitting machine as claimed in claim 1, movable engaging means capable of engagement with said welt-bar, said welt-bar actuating means being associated with said movable engaging means for actuating same, and said welt-rod releasing means being in the path of said welt-bar and being arranged for actuation by the latter substantially at the end of said predetermined period of drawing-off of the fabric by the welt-bar.

5. A straight bar knitting machine comprising: movable engaging means capable of engagement with a welt-bar having a series of welt-hooks,

resilient means connected to said engaging means, a pushing mechanism associated with said engaging means for pushing same towards the needles of the machine into a hook-up position, tensioning at the same time said resilient means and holding said engaging means during a predetermined period in said hook-up position, means associated with said pushing mechanism for rendering same inactive after a hook-up of the fabric to the welt-hooks of the welt-bar has taken place so as to cause a drawing-off of the fabric by the welt-bar through the medium of the previously tensioned resilient means being now released for urging the engaging means away from the needles into a predetermined end position, holding means capable of receiving and holding a welt-rod, releasing means for releasing upon its actuation said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, said releasing means being in the path of a member of the welt-bar-engaging means assembly and being arranged for actuation by said member of said assembly substantially at the end of the movement of the latter away from the needles, movable take-up means, a take-up drive associated with said take-up means for actuating same, and automatic means for causing at a predetermined interval a connection of said welt-rod engaged with the fabric with said take-up means whereby the drawing off of the fabric is automatically transferred from the welt-bar to said take-up means.

6. In a straight bar knitting machine as claimed in claim 5, said pushing mechanism including movable pushing means capable of engagement with said welt-bar engaging means, and an automatic drive associated with said pushing means for causing same to push said welt-bar engaging means towards the needles and to hold same subsequently in the hook-up position and for disengaging said pushing means from said welt-bar engaging means so as to permit the resilient means to urge the welt-bar engaging means away from the needles.

7. In a straight bar knitting machine as claimed in claim 5, said holding means being movable, a load acting on said holding means for keeping same in a position wherein it may hold the welt-rod above the fabric, said releasing means being coupled with said holding means so as to move same upon its actuation against the action of said load into a position wherein the welt-rod may drop from said holding means onto the fabric.

8. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks, holding means capable of receiving and holding a welt-rod, said holding means being mounted on said knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, a power-driven rotatable take-up reel, gripping means connected with said take-up reel, said gripping means being disengaged from said welt-rod when the latter is received by said holding means, and automatic means for effecting at a predetermined interval a connection of said welt-rod with said gripping means after its engagement with the fabric whereby the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up reel.

9. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks, holding means capable of receiving and holding a welt-rod, said holding means being mounted on said knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, a power-driven rotatable take-up reel, a pair of flexible straps, a gripping element secured to each strap, each strap being positively connected to said take-up reel, and automatic means for causing at a predetermined interval a connection of said welt-rod engaged with the fabric with said gripping means whereby the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up reel.

10. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks, holding means capable of receiving and holding a welt-rod, said holding means being mounted on said knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, movable take-up means, gripping means connected with said take-up means, said gripping means being disengaged from said welt-rod when the latter is received by said holding means, a take-up drive associated with said take-up means for actuating same, and automatic means for rendering effective said take-up drive at a predetermined interval after the release of said welt-rod so as to bring said originally disengaged gripping means into engagement with said welt-rod after the engagement of the latter with the fabric whereby the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

11. In a straight bar knitting machine, the combination with welt-bar actuating means arranged for causing during a predetermined period at the beginning of a knitting cycle the drawing-off of fabric hooked up to welt-hooks of a welt-bar by such a welt-bar engaged with said welt-bar actuating means; of holding means capable of receiving and holding a welt-rod, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, a rotatable take-up reel, a pair of flexible straps, a gripping element secured to each strap, a pair of series of rollers, each strap being engaged with a series of rollers and being positively connected to said take-up reel, a take-up drive associated with said take-up reel for actuating same, and automatic means for rendering effective said take-up drive at a predetermined interval after the

release of said welt-rod so as to bring said gripping elements secured to the straps connected to the take-up reel into engagement with said welt-rod engaged with the fabric whereby the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up reel.

12. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks, holding means capable of receiving and holding a welt-rod, said holding means being mounted on said knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, movable take-up means, a take-up drive, a spring, said take-up drive being coupled with said take-up means through the medium of said spring, gripping means connected with said take-up means, locking means capable of locking and releasing said take-up means, and automatic controlling means associated with said locking means for holding same in its locking position during the drawing-off of the fabric by the welt-bar and for bringing same into its releasing position at a predetermined interval after the release of said welt-rod so as to permit an actuation of said take-up means by said spring and said take-up drive whereby said gripping means connected with said take-up means are brought into engagement with said welt-rod engaged with the fabric and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

13. In a straight bar knitting machine as claimed in claim 12, said automatic controlling means being arranged for returning said locking means into its locking position substantially at the end of a knitting cycle.

14. In a straight bar knitting machine, the combination with welt-bar actuating means arranged for causing during a predetermined period at the beginning of a knitting cycle the drawing-off of fabric hooked up to welt-hooks of a welt-bar by such a welt-bar engaged with said welt-bar actuating means; of holding means capable of receiving and holding a welt-rod, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause an engagement of said welt-rod with the fabric, a rotatable take-up reel, a take-up drive, a spring, said take-up drive being coupled with said take-up reel through the medium of said spring, a pair of flexible straps, a gripping element secured to each strap, a pair of series of rollers, a rotatable shaft, a roller of each series of rollers being secured to said shaft, each strap being engaged with a series of rollers and being positively connected to said take-up reel and to the roller secured to said shaft, locking means capable of locking and releasing said shaft, and automatic controlling means associated with said locking means for holding same in its locking position during the drawing-off of the fabric by the welt-bar and for bringing same into its releasing position at a predetermined interval after the release of said welt-rod so as to permit an actuation of said take-up reel by said spring and said take-up drive whereby said gripping elements secured to the straps connected to the take-up reel and to the released shaft are brought into engagement with said welt-rod engaged with the fabric and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up reel.

15. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks and to be held in its position thereafter, holding means capable of receiving and holding a welt-rod above the fabric, said holding means being mounted on the knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause same to drop onto the fabric, guiding means arranged for engagement with the released welt-rod, movable take-up means, a take-up drive associated with said take-up means for actuating same, and automatic means for causing at a predetermined interval a connection of said welt-rod with said take-up means so that the latter displaces said welt-rod, said guiding means being shaped so as to guide said welt-rod during its displacement below and under the welt-bar held in its position whereby the fabric is looped around the welt-rod and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

16. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks and to be held in its position thereafter, holding means capable of receiving and holding a welt-rod above the fabric, said holding means being mounted on the knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause same to drop onto the fabric, guiding means arranged for engagement with the released welt-rod, movable take-up means, gripping means connected with said take-up means, a take-up drive associated with said take-up means for actuating same, and automatic means for rendering effective said take-up drive at a predetermined interval after the release of said welt-rod so as to bring said gripping means connected with said take-up means into engagement with said welt-rod for displacing same, said guiding means being shaped so as to guide said welt-rod during its displacement below and under the welt-bar held in its position whereby the fabric is looped around the welt-rod and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

17. In a straight bar knitting machine, the combination of: a welt-bar having a series of welt-hooks, welt-bar actuating means arranged for engaging said welt-bar and for causing the latter during a predetermined period at the beginning of a knitting cycle to draw-off fabric hooked up to its welt-hooks and to be held in its position thereafter, holding means capable of receiving and holding a welt-rod above the fabric, said holding means being mounted on the knitting machine remote from said welt-bar,

automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause same to drop onto the fabric, guiding means arranged for engagement with the released welt-rod, movable take-up means, a take-up drive, a spring, said take-up drive being coupled with said take-up means through the medium of said spring, gripping means connected with said take-up means, locking means capable of locking and releasing said take-up means, and automatic controlling means associated with said locking means for holding same in its locking position during the drawing-off of the fabric by the welt-bar and for bringing same into its releasing position at a predetermined interval after the release of said welt-rod so as to permit an actuation of said take-up means by said spring and said take-up drive whereby said gripping means connected with said take-up means are brought into engagement with said welt-rod for displacing same, said guiding means being shaped so as to guide said welt-rod during its displacement below and under the welt-bar held in its position whereby the fabric is looped around the welt-rod and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up means.

18. In a straight bar knitting machine as claimed in claim 17, said automatic controlling means being arranged for returning said locking means into its locking position substantially at the end of a knitting cycle.

19. In a straight bar knitting machine, the combination with welt-bar actuating means arranged for causing during a predetermined period at the beginning of a knitting cycle the drawing-off of fabric hooked up to welt-hooks of a welt-bar by such a welt-bar engaged with said welt-bar actuating means; of holding means capable of receiving and holding a welt-rod above the fabric, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause same to drop onto the fabric, guiding means arranged for engagement with the released welt-rod, a rotatable take-up reel, a take-up drive, a spring, said take-up drive being coupled with said take-up reel through the medium of said spring, a pair of flexible straps, a gripping element secured to each strap, a pair of series of rollers, a rotatable shaft, a roller of each series of rollers being secured to said shaft, each strap being engaged with a series of rollers and being positively connected to said take-up reel and to the roller secured to said shaft, locking means capable of locking and releasing said shaft, and automatic controlling means associated with said locking means for holding same in its locking position during the drawing-off of the fabric by the welt-bar and for bringing same into its releasing position at a predetermined interval after the release of said welt-rod so as to permit an actuation of said take-up reel by said spring and said take-up drive whereby said gripping elements secured to the straps connected to the take-up reel and to the released shaft are brought into engagement with said welt-rod for displacing same, said guiding means being shaped so as to guide said welt-rod during its displacewent below and under the welt-bar whereby the fabric is looped around the welt-rod and the drawing-off of the fabric is automatically transferred from the welt-bar to said take-up reel.

20. A straight bar knitting machine comprising: a welt-bar having a series of welt-hooks, movable engaging means capable of engagement with said welt-bar, resilient means connected to said engaging means, a pushing mechanism associated with said engaging means for pushing same towards the needles of the machine into a hook-up position, tensioning at the same time said resilient means and holding said engaging means during a predetermined period in said hook-up position, means associated with said pushing mechanism for rendering same inactive after a hook-up of the fabric to the welt-hooks of the welt-bar has taken place so as to cause a drawing-off of the fabric by the welt-bar through the medium of the previously tensioned resilient means being now released for urging the engaging means away from the needles into a predetermined end position, holding means capable of receiving and holding a welt-rod above the plane of the fabric, said holding means being mounted on the knitting machine remote from said welt-bar, automatic releasing means arranged for releasing at a predetermined interval said welt-rod from said holding means so as to cause a dropping thereof onto the fabric, movable take-up means, welt-rod gripping means connected with said take-up means, said welt rod gripping means being disengaged from said welt-rod when the latter is received by said holding means, a take-up drive associated with said take-up means for actuating same, automatic means for rendering effective said take-up drive at a predetermined interval after the release of said welt-rod whereby said originally disengaged welt-rod gripping means are brought into engagement with said welt-rod for moving same away from the needles, and means arranged for cooperation with the thus moved welt-rod for causing a gripping engagement between the welt-rod and the fabric so as to cause a further drawing-off of the fabric by the take-up means actuated by the take-up drive.

21. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, tensioning drawing-off means of a take-up drive during said welt-bar drawing-off period while holding same disengaged from said welt-rod, thereafter releasing said pre-tensioned drawing-off means by effecting an automatic connection of said drawing-off means with said welt-rod, stopping the knitting machine, performing a welt-turn, restarting thereafter the knitting machine, and continuing the drawing-off of the fabric by said take-up drive.

22. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, automatically releasing thereafter said take-up drive, connecting said welt-rod with gripping means of said take-up drive, drawing-off the fabric by said take-up drive, stopping the knitting machine, performing a manual welt-turn, and restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive.

23. A method for the operation of a straight

bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-rod drawing-off period, automatically releasing thereafter said take-up drive and connecting said welt-rod with gripping means of said take-up drive, continuing the drawing-off of the fabric by said take-up drive, and at the end of the knitting cycle readying a locking of said take-up drive.

24. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-rod drawing-off period, automatically releasing thereafter said take-up drive and connecting said welt-rod with gripping means of said take-up drive, continuing the drawing-off of the fabric by said take-up drive and at the end of the knitting cycle readying a locking of said take-up drive and automatically releasing the tension applied to the fabric.

25. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-rod drawing-off period, automatically releasing thereafter said take-up drive and connecting said welt-rod with gripping means of said take-up drive, continuing the drawing-off of the fabric by said take-up drive, stopping the knitting machine, performing a manual welt-turn, restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive, and at the end of the knitting cycle readying a locking of said take-up drive.

26. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a rotatable take-up reel and tensioning a spring interposed between said take-up reel and a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, automatically releasing thereafter said take-up reel and connecting said welt-rod with gripping means of said take-up reel, and continuing the drawing-off of the fabric by said take-up drive through said take-up reel.

27. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a rotatable take-up reel and tensioning a spring interposed between said take-up reel and a take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, automatically releasing thereafter said take-up reel and connecting said welt-rod with gripping means of said take-up reel, continuing the drawing-off of the fabric by said take-up drive through said take-up reel, and at the end of the knitting cycle readying a locking of said take-up reel.

28. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a rotatable take-up reel and tensioning a spring interposed between said take-up reel and take-up drive during said welt-bar drawing-off period, automatically releasing thereafter said take-up reel and connecting said welt-rod with gripping means of said take-up reel, continuing the drawing-off of the fabric by said take-up drive through said take-up reel, stopping the knitting machine, performing a manual welt-turn, restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive through said take-up reel, and at the end of the knitting cycle readying a locking of said take-up reel.

29. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a rotatable take-up reel and tensioning a spring interposed between said take-up reel and take-up drive during said welt-bar drawing-off period, automatically releasing thereafter said take-up reel and connecting said welt-rod with gripping means of said take-up reel, continuing the drawing-off of the fabric by said take-up drive through said take-up reel, stopping the knitting machine, performing a manual welt-turn, restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive through said take-up reel, and at the end of the knitting cycle readying a locking of said take-up reel and automatically releasing the tension applied by said spring to said take-up reel.

30. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a rotatable take-up reel and tensioning a spring interposed between said take-up reel and take-up drive during said welt-bar drawing-off period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, automatically releasing thereafter said take-up reel and connecting said welt-rod with gripping means of said take-up reel, continuing the drawing-off of the fabric by said take-up drive through said take-up reel, stopping the knitting machine, performing a manual welt-turn, maintaining the connection between the welt-rod and the gripping means of the take-up reel during said manual welt-turn, and restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive through said take-up reel.

31. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, causing automatically the engagement of a welt-rod with the fabric by the movement of a member of the assembly including the welt-bar and its actuating means substantially at the end of said welt-bar drawing-off period, connecting thereafter automatically said welt-rod with gripping means of a take-up drive, and continuing the drawing-off of the fabric by said take-up drive.

32. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, causing automatically the engagement of a welt-rod with the fabric by the movement of a member of the assembly including the welt-bar and its actuating means substantially at the end of said welt-bar drawing-off period, connecting thereafter automatically said welt-rod with gripping means of a take-up drive, continuing the drawing-off of the fabric by said take-up drive, stopping the knitting machine, performing a manual welt-turn, and restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive.

33. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, causing automatically the engagement of a welt-rod with the fabric by the movement of a member of the assembly including the welt-bar and its actuating means substantially at the end of said welt-bar drawing-off period, connecting thereafter automatically said welt-rod with gripping means of a take-up drive, continuing the drawing-off of the fabric by said take-up drive, stopping the knitting machine, performing a manual welt-turn, maintaining the connection between the welt-rod and the gripping means of the take-up drive during said manual welt-turn, and restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive.

34. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period at the beginning of a knitting cycle, locking a take-up drive during said welt-bar drawing-off period, causing automatically the engagement of a welt-rod with the fabric by the movement of a member of the assembly including the welt-bar and its actuating means substantially at the end of said welt-bar drawing-off period, automatically releasing thereafter said take-up drive and connecting said welt-rod with gripping means of said take-up drive, and continuing the drawing-off of the fabric by said take-up drive.

35. A method for the operation of a straight bar knitting machine comprising the steps of: drawing-off the fabric by a welt-bar during a predetermined period, engaging automatically a welt-rod with the fabric substantially at the end of said welt-bar drawing-off period, tensioning drawing-off means of a take-up drive during said welt-bar drawing-off period while holding same disengaged from said welt-rod, thereafter releasing said pre-tensioned drawing-off means for effecting an automatic connection of said drawing-off means with said welt-rod, continuing the drawing-off of the fabric by said take-up drive, stopping the knitting machine, performing a manual welt-turn, maintaining the connection between the welt-rod and the drawing off means of the take-up drive during said manual welt-turn, and restarting thereafter the knitting machine and continuing the drawing-off of the fabric by said take-up drive.

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