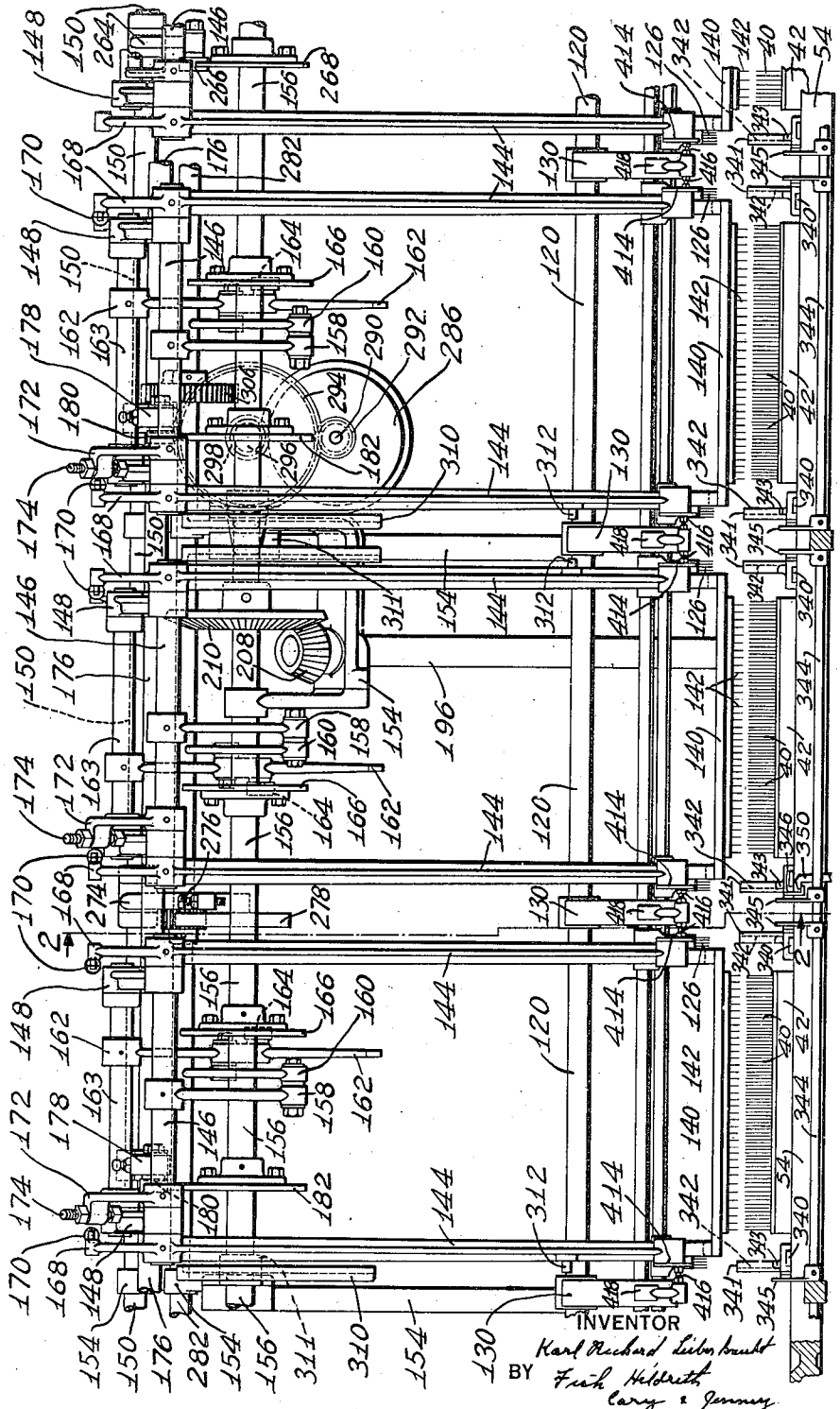
Jan. 13, 1942. K. R. LIEBERKNECHT 2,269,463

KNITTING MACHINE

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Fig. 1



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Jan. 13, 1942. K. R. LIEBERKNECHT 2,269,463

KNITTING MACHINE

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Fig. 3

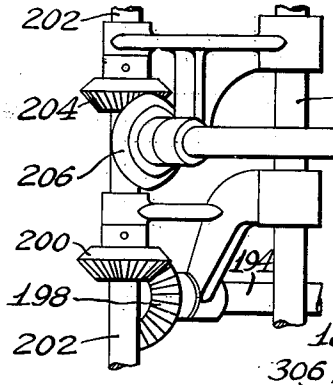


Fig. 2

INVENTOR

Karl Richard Lieberknecht

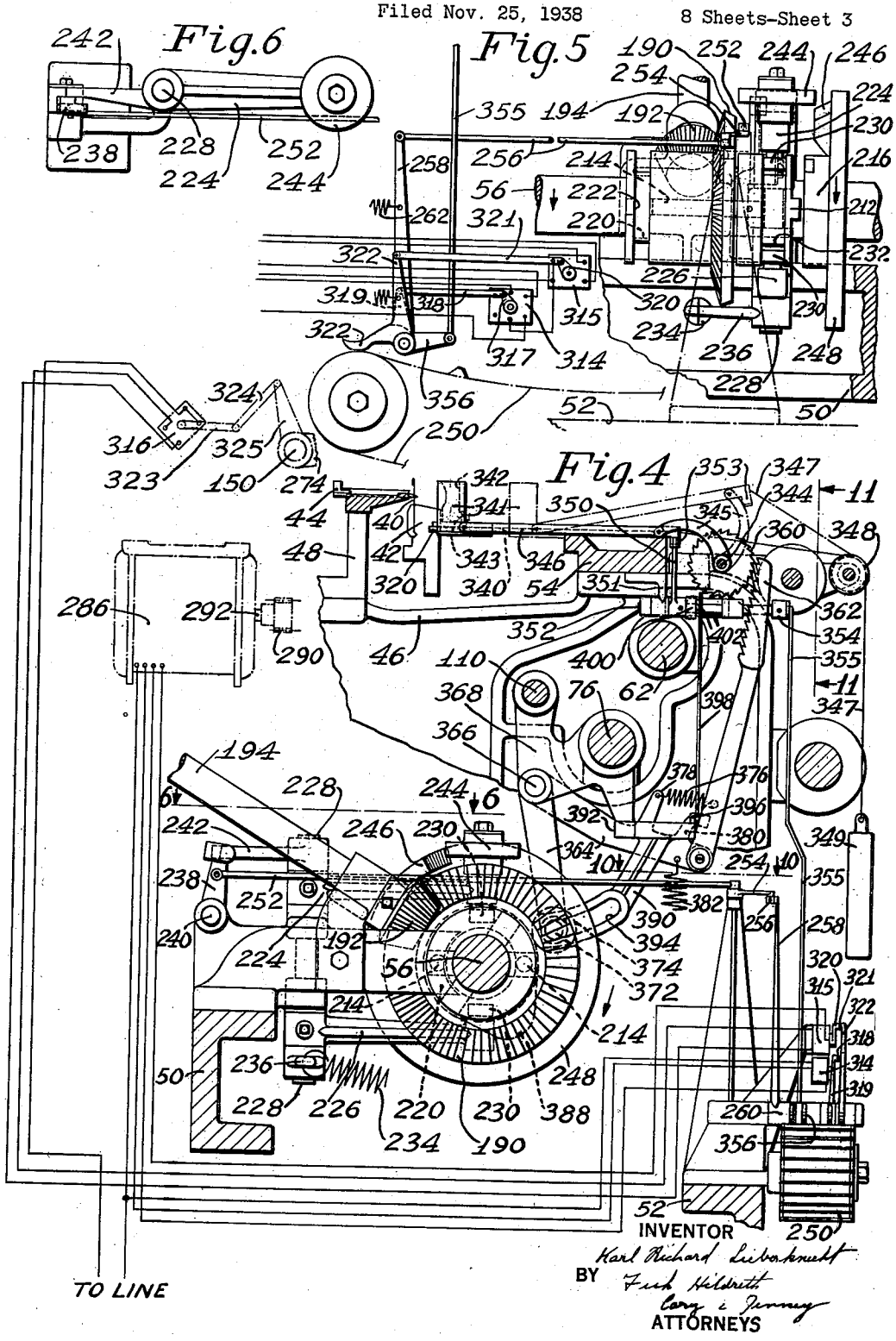
BY Fish Gildredth Carey & Jenney

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Jan. 13, 1942. K. R. LIEBERKNECHT 2,269,463

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Fig. 8

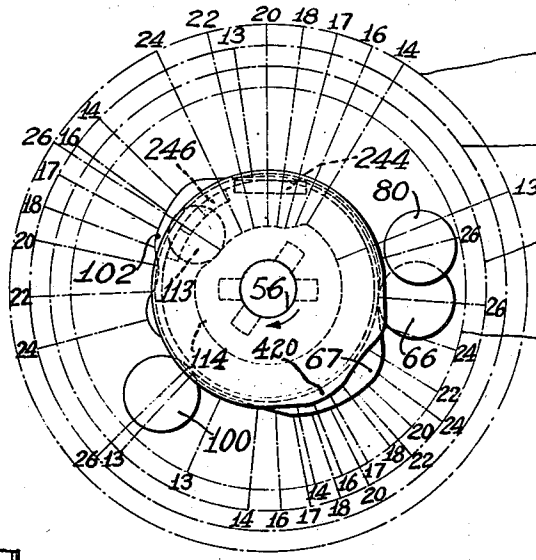
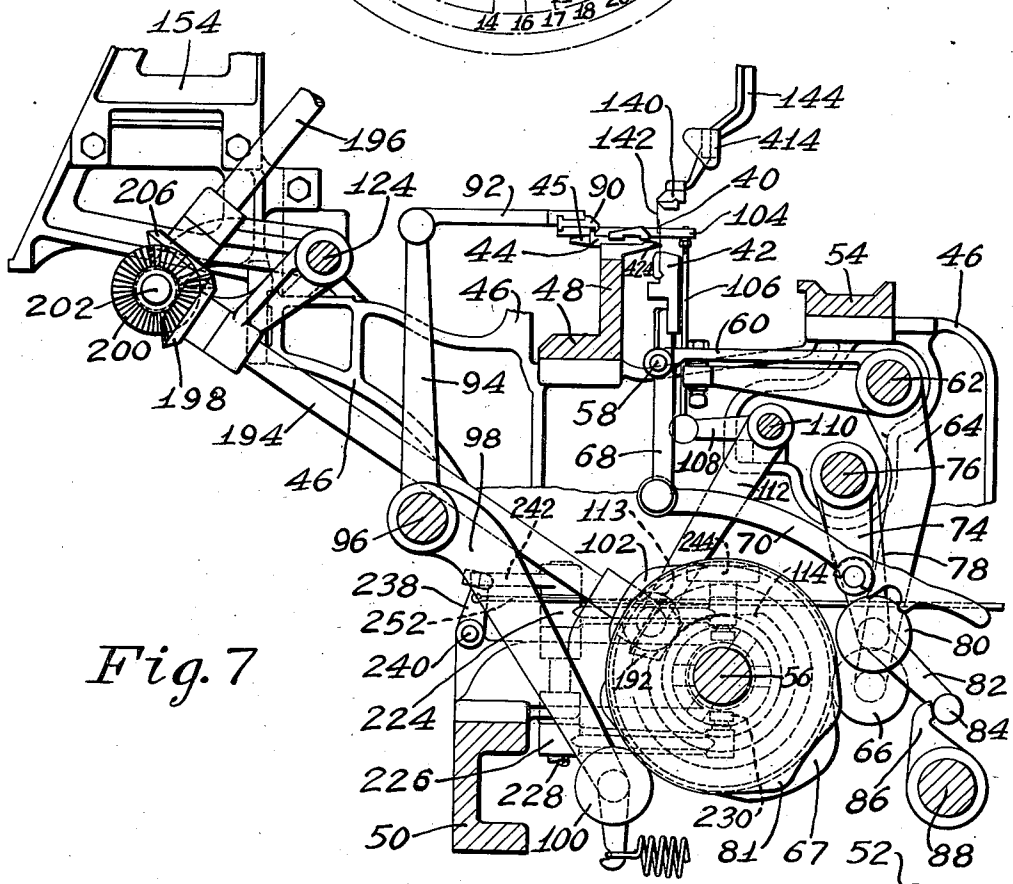


Fig. 7



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Fig. 12

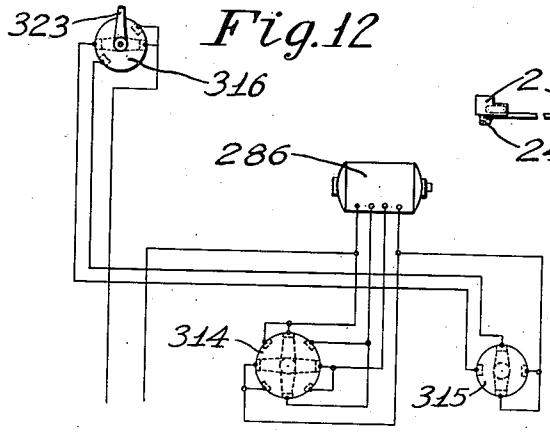


Fig. 10

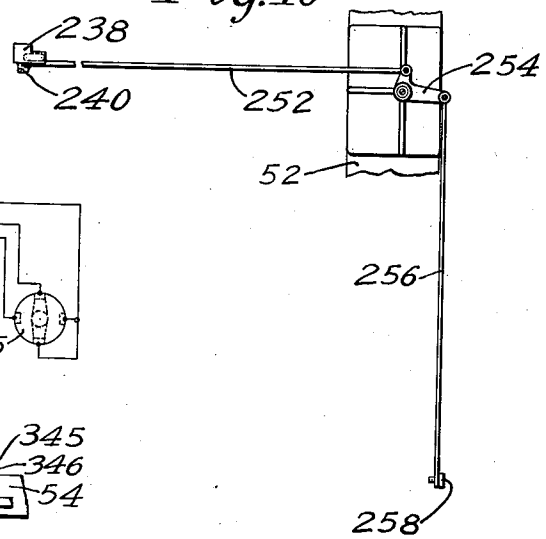


Fig. 11

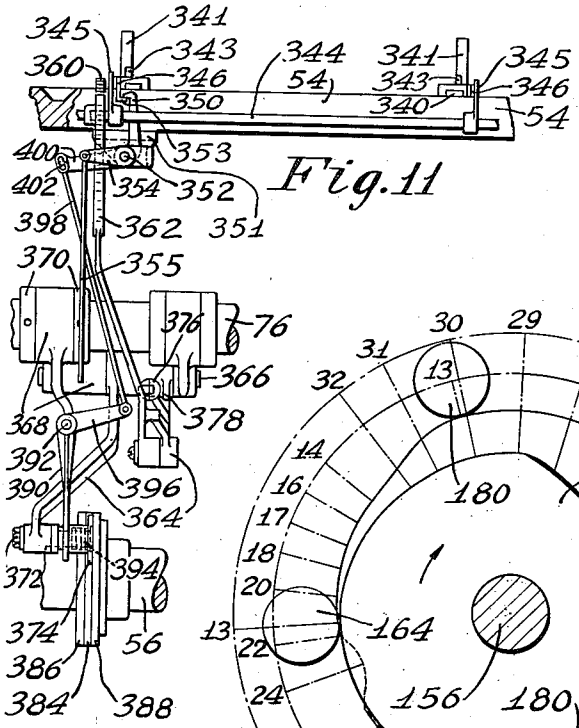
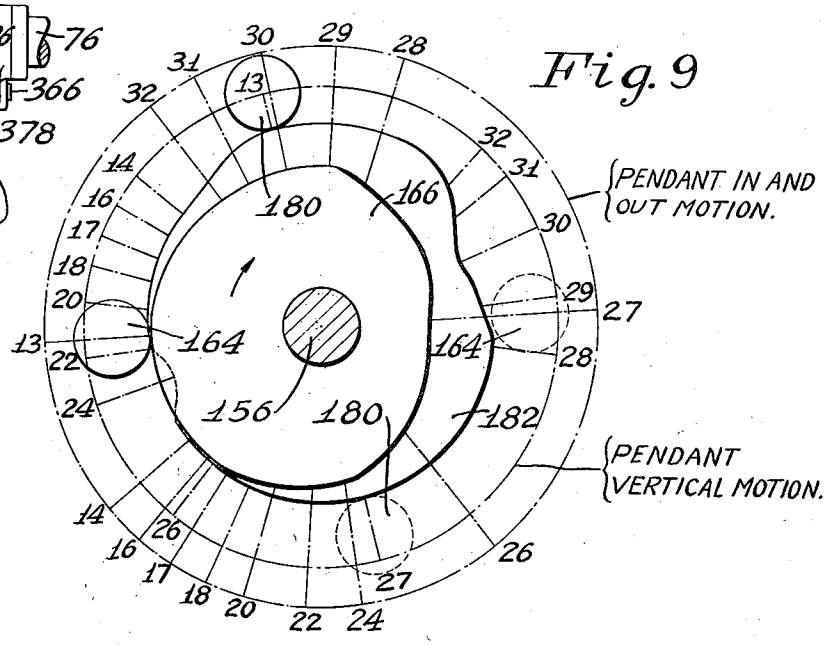


Fig. 9



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Fig. 13

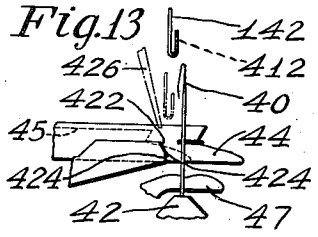


Fig. 14

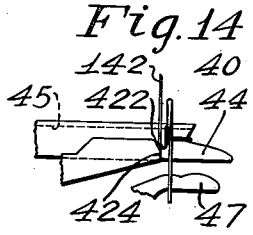


Fig. 16

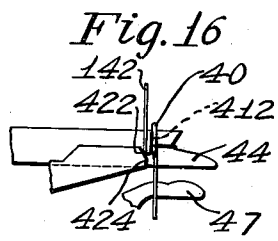


Fig. 15

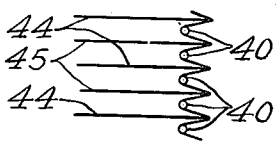


Fig. 17

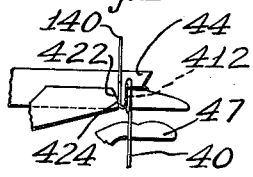


Fig. 18

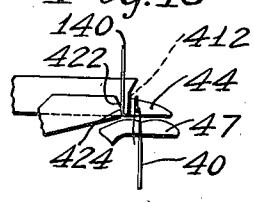


Fig. 19

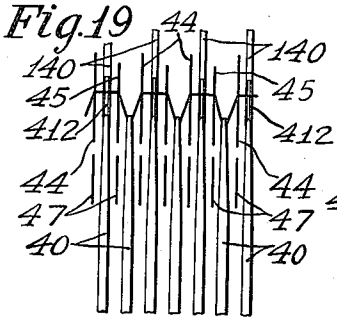


Fig. 20

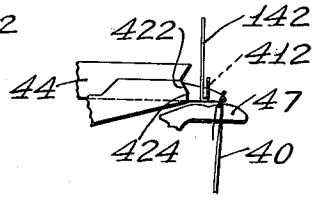


Fig. 21

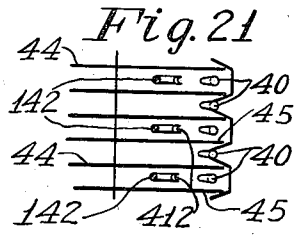


Fig. 22

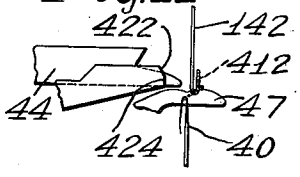


Fig. 23

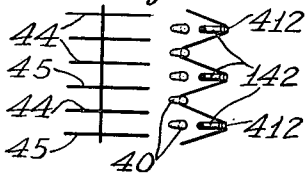


Fig. 24

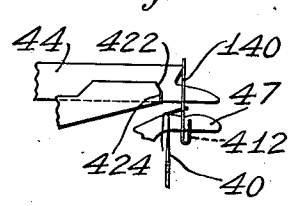


Fig. 25

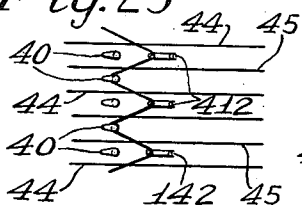


Fig. 26

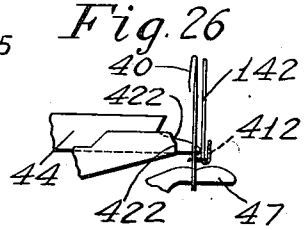
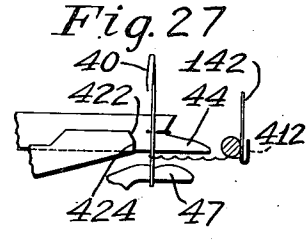


Fig. 27



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Fig. 28

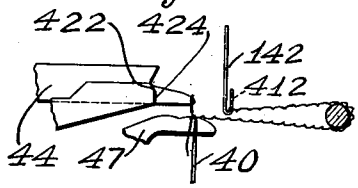


Fig. 29

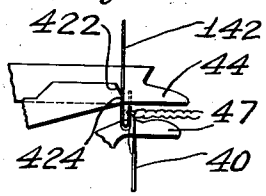


Fig. 30

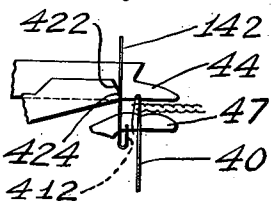


Fig. 31

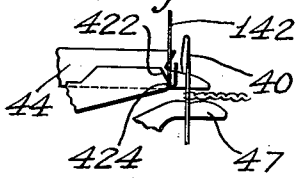


Fig. 32

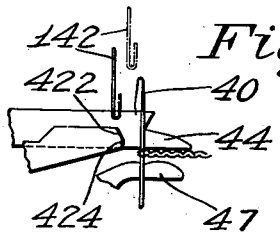


Fig. 33

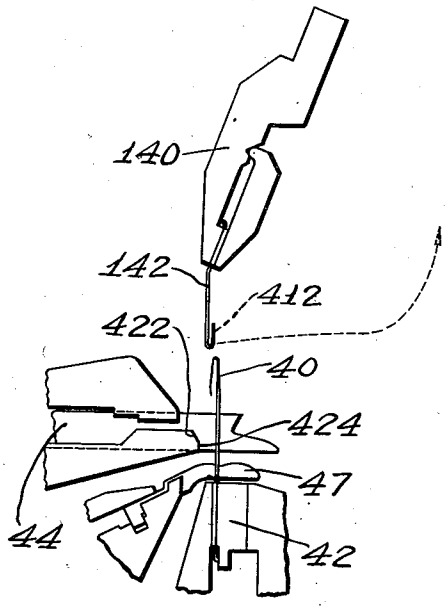


Fig. 34

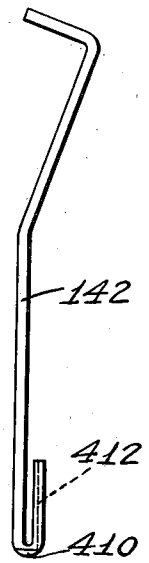
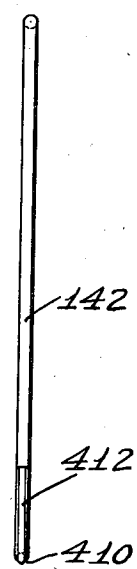


Fig. 35



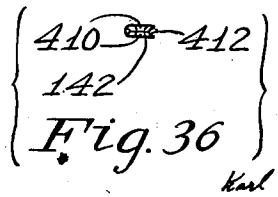


Fig. 36

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KNITTING MACHINE

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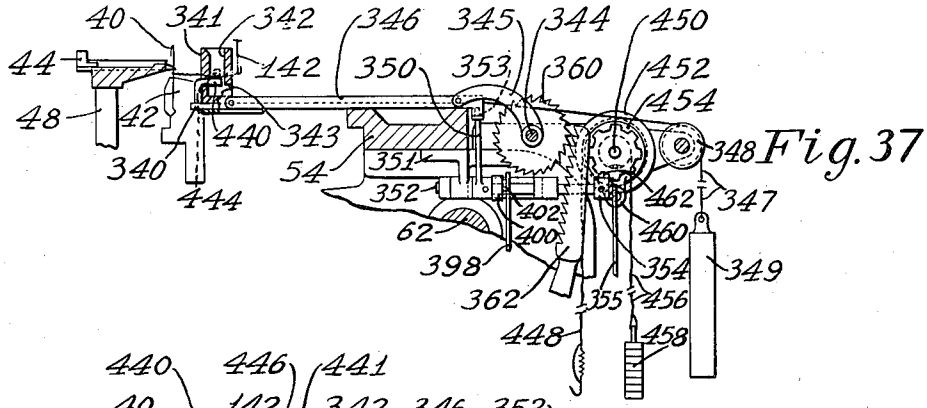


Fig. 37

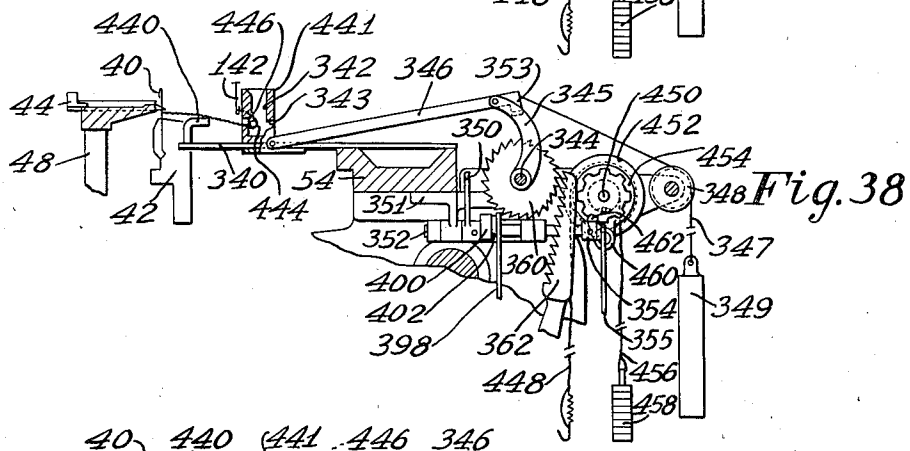


Fig. 38

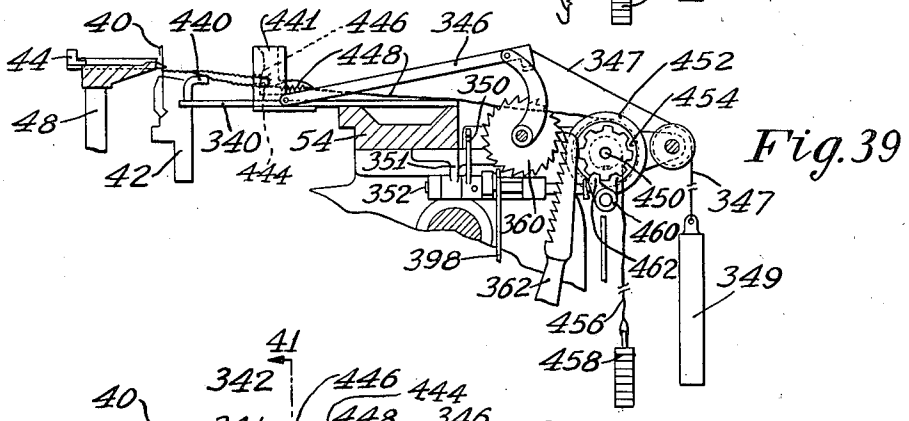


Fig. 39

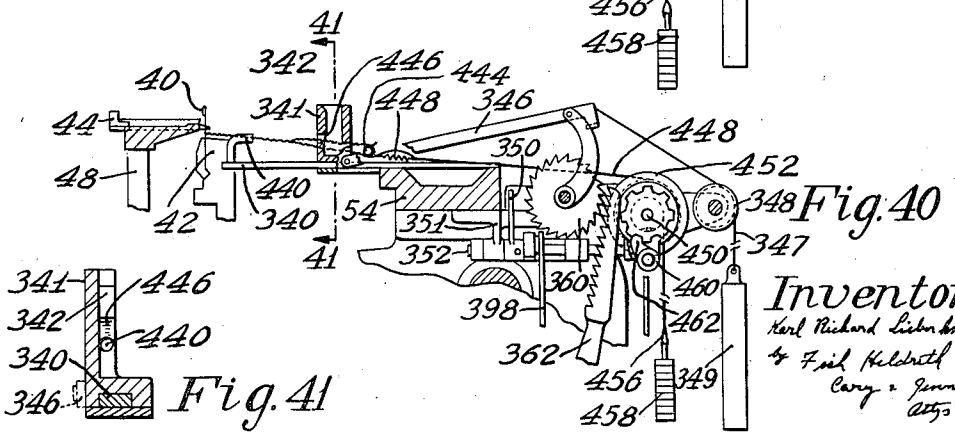


Fig. 40

Fig. 41

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Attys.

Patented Jan. 13, 1942

2,269,463

UNITED STATES PATENT OFFICE

2,269,463

KNITTING MACHINE

Karl Richard Lieberknecht, Oberlungwitz, Germany, assignor to Knitting Machine Corporation, a corporation of Delaware

Application November 25, 1938, Serial No. 242,340
In Germany July 26, 1937

67 Claims. (Cl. 66—96)

The present invention relates to improvements in knitting machines, and is herein disclosed as embodied in a flat full-fashioned type knitting machine having mechanism for automatically turning the welt.

It is a principal object of the present invention to provide in a machine of this description novel and improved mechanism which is well adapted for automatic operation for setting up an initial course of fabric loops on the needles, and for taking up the fabric during subsequent knitting.

It is another object of the invention to provide in a machine of this description means for mechanically moving the welt mechanism to and from an inoperative position away from the needles, in which the welt mechanism will not obstruct the subsequent operation of the knitting devices in the production of the fabric.

It is another object of the invention to provide in a flat knitting machine adapted for automatic operation to knit the welt and leg portions of a full-fashioned hosiery blank by continuous knitting, a novel and improved take-up means which is well adapted to permit attachment of a fabric take-up to the welt portion of the fabric, and to permit the continued function of the take-up during continuous machine operation.

It is another object of the invention to provide a novel construction and mode of operation of applicant's welt hooks to disengage selected needle wale loops from the needles, and to engage said loops in the welt hooks for the subsequent knitting of the welt fabric.

It is a further object of the invention to provide in a machine having mechanism for mechanically turning the welt, a novel and improved actuating means for the welt mechanism which will be simple in construction and efficient in operation to effect the setting up and subsequent turning of the welt.

With these and other objects in view as may hereinafter appear, the several features of the invention consist in the devices, combinations and arrangement of parts hereinafter described and claimed, which together with the advantages to be obtained thereby will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawings, in which Fig. 1 is a view in front elevation of applicant's improved welt mechanism as applied to a multiple section flat full-fashioned knitting machine, only so much of the machine being herein disclosed as is believed necessary to show the connection of the present invention therewith; Fig. 2 is a cross sectional view looking from the left and taken on the line 2—2 of Fig. 1; Fig. 3 is a detail sectional plan view taken on the line 3—3 of Fig. 2; Fig. 4 is a somewhat fragmentary view looking from the left and partly in section, showing portions of the driving and control devices for the machine located in the base, and more particularly the welt mechanism located in the machine base; Fig. 5 is a somewhat fragmentary detail view in front elevation showing the pattern chain and drive for the auxiliary cam shaft shown in Fig. 4; Fig. 6 is a detail plan view of the clutch shift lever and certain of the control devices therefor as taken on the line 6—6 of Fig. 4; Fig. 7 is a cross sectional view looking from the left, showing particularly the portions of the drive for the supplemental cam shaft and the needle knitting motions of the machine; Fig. 8 is a somewhat detail view of the knitting cams with diagrammatic radiating lines showing the relation between these cams and the welt pendant operating cams; Fig. 9 is a detail view looking from the left showing a pair of picot operating cams with radiating lines to indicate their relationship to the knitting cam shown in Fig. 8; Fig. 10 is a detail plan view taken on the line 10—10 of Fig. 4; Fig. 11 is a detail view in front elevation taken on the line 11—11 of Fig. 4; Fig. 12 is a wiring diagram showing particularly the connections of the pendant idling motion with various control switches; Figs. 13 to 32 inclusive are a series of somewhat diagrammatic views showing successive positions of the knitting devices including needles, sinkers and knockover bits, and of the welt hooks relatively thereto during the operations of setting an initial course on the needles, and turning the welt; of these views Figs. 13, 14, 16, 17, 18, 20, 22, 24, 26 and 27 illustrate successive steps in the setting up operation, and Figs. 28 to 32 inclusive illustrate successive steps in the operation of turning the welt; Fig. 15 is a plan view corresponding to Fig. 13, but with the dividers advanced; Fig. 19 is a view in front elevation corresponding to Fig. 18; Fig. 21 is a plan view corresponding to Fig. 20; Fig. 23 is a plan view corresponding to Fig. 22; and Fig. 25 is a plan view corresponding to Fig. 24, but with the sinkers and dividers removed; Fig. 33 is a partial end view on an enlarged scale looking from the left, illustrating the welt hooks in starting position with relation to the knitting devices; Fig. 34 is a detail view of a welt hook in side elevation; Fig. 35 is a front view of the welt hook shown in Fig. 34; Fig. 36 is a bottom plan view of the hook; Figs. 37 to 40 inclusive,

show successive positions of the auxiliary take-up and welt wire supported thereon during the knitting and turning of the welt, and illustrating the manner of attaching and tensioning the regular take-up straps against the welt wires during the subsequent knitting of the leg portion of the fabric blank, these views being illustrations in modified form of the auxiliary take-up mechanism as shown in Fig. 4, in that the stationary pin supports are provided for supporting the welt wires above the fabric when laid into the auxiliary take-up holders in welt wire receiving position; and Fig. 41 is an enlarged sectional view taken on the line 41—41 of Fig. 40, to illustrate the relative positions of the pin support and the holder of the auxiliary take-up in the modified form.

The machine disclosed in the drawings, comprises a multiple section full-fashioned knitting machine which may be of ordinary description comprising for each section of the machine, a series of spring beard needles 40 which are supported to move as a unit on a needle bar 42, individually movable sinkers 44, dividers 45 and knockover bits 47. The supporting structure of the machine comprises the usual cross frames 46 located at spaced intervals along the machine length, connected by means of longitudinally extending rails which include a sinker rail 48, a lower rear rail 50, a lower front rail 52 and a work table 54. The several cooperating instrumentalities of the machine are driven from a main cam shaft 56 which extends along the length of the machine.

In accordance with the usual construction of full-fashioned knitting machines, the needle bars 42 associated with each pair of knitting sections, are mounted on a frame 57 which is pivotally mounted at 58 on a horizontally disposed lever arm 60 rigidly secured to a vertical motion rock shaft 62 extending along the length of the machine. The shaft 62 is provided at intervals with downwardly extending cam levers 64, each such lever 64 having mounted thereon a roller 66 for engagement with a vertical motion knitting cam 67 on the cam shaft 56. Operating connections for imparting forward and back motions to the needles, comprises for each pair of knitting sections, a downwardly extending arm 68 forming part of the supporting frame 57 which is connected by means of a link 70 with a downwardly extending actuating lever 74 secured to the needle in-and-out motion rock shaft 76 extending along the length of the machine. The shaft 76 is provided at spaced intervals along its length with downwardly extending cam levers 78 each having mounted thereon a cam roller 80 for engagement with a needle in-and-out knitting cam 81 on the main cam shaft 56. As best shown in Fig. 7 of the drawings, each needle in-and-out motion cam lever 78 is provided with a downwardly extending portion 82 and a stud 84 which is arranged to be engaged by the usual stitch regulator lever 86 carried on regulator shaft 88 extending along the length of the machine.

For controlling the operation of the dividers and sinkers, the machine is provided with a catch bar 90 which is supported and controlled by means of the usual connections including front and rear catch bar motions generally shown in Fig. 7 of the drawings. The catch bar 90 has secured thereto at intervals along its length, rearwardly extending links 92, each of which is pivotally connected to the upper end of a lever arm 94 rigidly secured to a back catch bar rock shaft 96. Operation of the rock shaft 96 is controlled by means of one or more downwardly extending cam levers 98 which may be secured at spaced intervals to the shaft 96, each of which is provided at its lower end with a roller 100 for engagement with a catch bar cam 102. The catch bar 90 also has secured thereto at intervals along its length, forwardly extending arms 104 which are supported at their forward ends upon vertically extending front catch bar links 106 pivotally connected at their lower ends to horizontally extending lever arm 108 on a front catch bar rock shaft 110. Operation of the rock shaft 110 is controlled by means of one or more cam levers 112 which may be secured to the shaft at intervals along its length, each having a roller 113 arranged to be acted upon by a front catch bar cam 114 on the main cam shaft 56.

The narrowing machine, as generally shown in Fig. 2 of the drawings, comprises a lengthwise supporting rod 120 mounted on lever arms such as 122 at spaced intervals along the length of the machine for movement about a pivot shaft 124, to move the narrowing machine toward and away from the needles. The usual narrowing points for performing fashioning operations, are generally indicated at 126, and are supported on narrowing rods 128 slidably supported in depending brackets 130 secured to the supporting rod 120. Inasmuch as the actuating and controlling devices for the narrowing machine are well known in the art, and form specifically no part of the present invention, no further description or illustration thereof is believed necessary.

In carrying out the present invention, applicant provides a novel and improved welt mechanism adapted for automatic operation to take an initial course of welt fabric loops, and for subsequently returning these loops to the needles to turn the welt. The welt mechanism comprises a welt bar 140 associated with each knitting section, having supported thereon a series of welt hooks 142 which are adapted to remove alternate needle wale kinks of the setting-up course from alternate needles, and subsequently to return these loops to the needles to turn the welt. The hooks 142 and welt bar 140 for each section of the machine, are supported for vertical and forward and back motions on a hanging frame or pendant 144 comprising two upwardly extending arms which are secured to opposite ends of a hollow rock shaft or tube 146 pivotally supported in bearings formed on two forwardly extending supporting lever arms 148, which are in turn supported at their rear ends on a pivot shaft 150 extending along the machine length. The pivot shaft 150 and other associated parts of the welt mechanism hereinafter described, are supported above the knitting machine in a gallows formed by a series of supporting frames 154 mounted on the machine at spaced intervals along the length thereof. Vertical and forward and back positioning movements are imparted to the pendants 144 and welt hooks 142 supported thereby, both for setting up an initial course of fabric, and for subsequently turning the welt by means of connections from a supplemental cam shaft 156 which is supported in an upper part of the machine in bearings formed in the frames 154.

With the present construction, mechanism is provided for separately controlling the forward

and back movements of each pendant 144. To this end there is secured to each rock shaft 146, a depending arm 158 which is connected by a link 160 curved to clear the welt cam shaft 156, to a downwardly extending cam lever 162 pivotally supported at its upper end on a short rock shaft or tube 163 carried by the forwardly extending supporting arms 148, the lever 162 being provided intermediate its length with a cam roll 164 adapted to engage with a forward and back motion welt cam 166 on the welt cam shaft 156. Each of the pendant lever arms 144 is provided with an upward extension 168 to which is attached a tension spring 170 acting to maintain the in-and-out cam roll 164 in engagement with its cam 166, and also providing tensioning means for moving the pendants 144 and welt hooks 142 yieldingly in a forward direction to take up the fabric during the knitting of the initial welt courses. In order to arrest the forward or fabric take-up action of the pendants, each pendant rock shaft 146 has also secured thereto a stop lever 172 having mounted thereon an adjustable stop screw 174 adapted for engagement against the top surface of one of the forwardly extending supporting levers 148.

With the present construction, mechanism is provided for imparting simultaneous vertical positioning movements to the several pendants 144 and associated welt hooks 142, which is constructed and arranged to permit any particular section to be raised out of operative position by the operator without interfering with or affecting the continued operation of the welt devices associated with other knitting sections of the machine, in the event that the operator finds it necessary to disconnect any particular knitting section from active operation. The mechanism for imparting vertical motions to the pendants 144, comprises a lifting rod 176 which extends along the length of the machine beneath the forwardly extending supporting levers 148, and is supported at intervals in forwardly extending cam levers 178 which at their forward ends are provided with cam rollers 180 for engagement with cooperating vertical motion cams 182 secured to the welt cam shaft 156. In order to provide an accurate vertical adjustment in the position of each pendant 144 with relation to the lifting rod 176 and vertical motion cams 182, each supporting arm 148 has mounted thereon an adjustable stop screw 184 for engagement with the lifting rod 176. There is also provided with each supporting lever 148, a spring clip 186 which is arranged to snap around the lifting rod 176 to maintain the supporting levers 148 in spring-pressed engagement therewith.

In accordance with one feature of the present invention, a novel driving mechanism is provided for the welt cam shaft 156 which is constructed and arranged to drive the welt cam shaft 156 through one-half revolution only during each of the setting-up and subsequent welt turning operations in timed relation to the main cam shaft 56, and then to lock the welt cam shaft 156 in either of two predetermined angular positions. The mechanism through which the welt cam shaft 156 is driven from the main cam shaft 56 comprises a bevel driving gear 190 loosely mounted on the main cam shaft 56 which meshes with a bevel pinion 192 on a connecting drive shaft 194, which in turn drives a second connecting drive shaft 196 through bevel gear connections comprising a bevel gear 198 on the shaft 194 which meshes with a bevel gear 200 on a short laterally extending stub shaft 202, a second bevel gear 204 on the shaft 202 being arranged to mesh with a bevel gear 206 on the upper connecting drive shaft 196. Adjacent its upper end the connecting shaft 196 carries a bevel pinion 208 adapted to mesh with a bevel gear 210 rigidly secured to the welt cam shaft 166. The construction and arrangement of these driving connections is such that the welt cam shaft 158 will be driven in a clockwise direction as viewed in Fig. 2. The driving connections above described, are rendered operative to drive the welt cam shaft 156 through successive increments of one-half revolution only from the main cam shaft through connections which comprise a single tooth clutch member 212 which is supported to turn with the driving gear 190 and to slide axially with relation thereto, by means of two pins 214 secured to the clutch member 212, and extending axially through bores formed in the hub of the gear 190. The clutch member 212 is arranged for engagement with the cooperating driving clutch member 216 rigidly secured to the main cam shaft 56. A stationary guide member 220 secured to the machine frame, is arranged for engagement with an annular groove 222 formed in the hub portion of the drive gear 190 to prevent axial movement of the gear, and to maintain a constant meshing relationship of the gear with pinion 192.

The driving clutch member 212 is moved into and out of operative engagement with the driving clutch member 216 to start and stop the rotation of the welt cam shaft 156 by means of connections which comprise clutch shifting levers 224 and 226 secured to a vertically extending rock shaft 228, and provided at their forward ends with follower rolls 230 arranged to engage in an annular groove 232 formed in the periphery of the slidable clutch member 212. A tension spring 234 connected to a laterally extending arm 236 on the lower end of the vertical rock shaft 228, tends to move the single tooth clutch member 212 into operating engagement with the driving clutch member 216. The clutch member 212 is, however, held normally at a retracted inoperative position by the engagement of a vertically extending detent lever 238 carried on a fixed pivot 240 with a rearwardly extending arm 242 secured to the upper end of the vertical rock shaft 228. Upon movement of the detent lever 238 rearwardly out of engagement with the cooperating arm 242, the clutch member 212 will be moved under the pressure of its spring 234 into operative engagement with the driving clutch member 216. After the main cam shaft has rotated through a partial revolution, and when the welt cam shaft 156 has turned through substantially one-half revolution, the clutch member 212 is again moved to its inoperative position to disconnect the drive to the welt cam shaft 156 by the engagement of a roller 244 supported on the upper clutch shifting lever 224 with a throw-out cam 246 on the face of a disk 248 forming part of the driving clutch member 216. The subsequent movement of the detent lever 238 into locking position in engagement with the arm 242, serves to lock the parts in inoperative position shown, for example, in Figs. 4 and 5 of the drawings.

With the construction shown, the operation of the welt mechanism as above described, is automatically controlled from the usual pattern chain of the machine generally indicated at 250. Connections through which this control is effected, comprise a forwardly extending link 252 secured at its rear end to the detent lever 238,

and at its forward end to one end of a bell-crank 254, the other arm of which is connected by means of a link 256 to an upwardly extending arm 258 of a pattern chain lever 260. A tension spring 262 attached to the arm 258 tends to maintain these parts in the position shown in Figs. 4 and 5, to maintain the detent lever 238 normally in locking position.

In order that the welt cam shaft 156 may be accurately stopped in a predetermined angular position until again rendered operative through the engagement of the clutch 212, a locking lever 264 (see Fig. 2) is provided, loosely supported to turn on the shaft 150, and provided at its forward end with a roller 266 which rides on the periphery of a disk 268 on the welt cam shaft 156. The disk 268 is provided with two cup-shaped slots 270 which are located to receive the roller 266 at the end of each one-half revolution of the welt cam shaft 156. A tension spring 272 acting on the lever 264, tends to hold the roller 266 yieldingly in engagement with the engaging slot 270 to accurately center and to lock the welt cam shaft 156 in either of its two angular stop positions.

In accordance with another feature of the invention, applicant provides mechanism for mechanically raising the welt mechanism to a high inoperative position after the turning of the welt, in order that this mechanism may not interfere with subsequent operation of the machine. This mechanism operates to raise simultaneously all the pendants 144 and their associated supporting and actuating levers along the length of the machine to the high dot-and-dash position shown in Fig. 2, and subsequently to lower these parts again to their operating position when needed. In the preferred embodiment of the invention shown, these operations are performed by means of a reversible electric motor automatically controlled to effect the raising and lowering of the welt mechanism during machine operation, and without the necessity of any particular attention on the part of the operator. As best shown in Figs. 1 and 2 of the drawings, a number of segment levers such as that shown at 274, are loosely mounted to turn on the shaft 150 at spaced intervals along the length of the machine. Each of these levers 274 is provided at its outer end with an adjustable stop screw 276 which is adapted for engagement with the under side of the shaft 176. Each of these levers has formed thereon an internal gear segment 278 which meshes with a pinion 280 formed on a rotatable shaft 282 which extends along the length of the machine, it being understood that a pinion 280 is provided on the shaft 282 for engagement with each segmental lifting lever 274. The shaft 282 is rotated in one direction or the other to raise or lower the pendants 144 by means of a reversible electric motor 286 rigidly supported on a bracket 288 secured to one of the gallows frames 154. The connections through which the shaft 282 is driven from the motor 286 comprise a pinion 290 mounted on the rotor shaft 292 of the motor, which meshes with a large gear 294 on a forwardly extending stub shaft 296. A worm 298 formed on the shaft 296 drives a worm gear 300 on an intermediate shaft 302 which is in turn connected to drive the shaft 282 by means of intermeshing pinions 304 and 306 supported respectively on the two shafts.

In lifting the welt mechanism to the high inoperative position shown, for example, in dot-and-dash lines in Fig. 2 of the drawings, it has been found desirable to provide means for swinging the pendants 144 rearwardly against the pressure of their springs 170, so that the pendants and welt hooks 142 will be located in a rearwardly withdrawn position to provide easy access by the operator to the several knitting sections during subsequent knitting. To this end, guideways 310 are mounted on forward extensions 311 of the gallows frames 154 between each pair of sections, these guideways 310 being arranged for engagement with cooperating pins 312 formed on the adjacent pendant arms 144, so that as the welt mechanism is raised, the pins 312 will be brought into engagement with the guideways 310, thus causing the lower ends of the rising pendants 144 and welt bars 140 to be moved rearwardly to the relatively withdrawn position shown in dot-and-dash lines in Fig. 2.

In order that the pendant 144 associated with each individual section may be separately raised and locked in a high inoperative position which will be independent of the operation of the power mechanism above described, there is provided at the upper end of each guideway 310, a recess 313 into which the lugs 312 may be moved by manual manipulation of the pendant 144. As indicated in Fig. 2 of the drawings, this recess 313 is located somewhat above the position to which the pendants 144 and lugs 312 are brought through the power operation of the welt raising mechanism.

In the construction shown, connections are provided for controlling the operation of the lifting motor 286 from the pattern chain 250 of the machine, to effect the automatic lowering of the welt mechanism to operative position prior to the beginning of each new set on the machine, and the subsequent raising of the welt mechanism to the high inoperative position shown in dot-and-dash lines in Fig. 2, at some point subsequent to the completion of the welt turning operation. These connections include a one-eighth turn ratchet snap motor reversing switch 314, a quarter turn ratchet snap motor starting switch 315, and a motor stop switch 316, these switches being connected as shown in the electrical diagram Fig. 12, to control the operation of the lifting motor 286 which may be assumed to be a reversible direct current motor of ordinary description. As shown in Figs. 4 and 5 of the drawings, the position of the motor reversing switch 314 is controlled from the pattern chain to be turned through successive increments of one-eighth turn to reverse the motor connections through connections which include a switch rocker arm 317 connected by a link 318 to a pattern chain lever 319. The motor starting switch 315 is similarly controlled from the pattern chain of the machine to be turned through successive increments of one-quarter turn to start the motor through connections including a switch rocker arm 320, link 321 and pattern lever 322. The motor stop switch 316 is arranged to be operated directly from the welt mechanism lifting and lowering devices including particularly the segment levers 274 to automatically disconnect the motor when the welt mechanism reaches either of its alternative high inoperative or low operative positions. These connections, as best shown in Fig. 2, include a stop switch rocker arm 323, link 324 and a lever arm 325 rigidly secured to turn with one of the segment levers 274.

The operation of the electrical circuit includ-

ing the three switches 314, 315 and 316 shown in Fig. 12, may be briefly described as follows:

At some point during the operation of the machine after the welt mechanism has been moved, for example, to its high position, the position of the motor reversing switch 314 is shifted through the actuation of the bump on the pattern chain lever to set the motor for operation in a direction to lower the welt mechanism. This may be assumed to be the illustrated position of switch 314 in Fig. 12. The motor, however, does not start owing to the fact that the circuit is open through the starting and stopping switches 315 and 316 which may be assumed to be in the positions illustrated in Fig. 12. When the motor is to be started, the starting switch 315 is now shifted one-quarter turn to its alternative position, thus closing the circuit through stopping switch 316 and starting the motor. As the welt mechanism now reaches the low full line position of Fig. 2, the stopping switch 316 will be shifted from the position illustrated in Fig. 12, to its alternative position, thus again opening the circuit to stop the motor. The operation of these connections including switches 314, 315 and 316 to move the welt mechanism to its high inoperative position, is the reverse of that previously described. The reversing switch 314 is shifted one-eighth turn reversing the two inside terminals to cause the motor when subsequently rendered operative, to operate in a reverse direction to lift the welt mechanism. The subsequent shifting of the motor starting switch 315 through one-quarter turn to the position shown in Fig. 12, the stop switch 316 being at this time in the alternative position from that illustrated, will close the circuit through switch 316 to start the motor. As the welt mechanism then reaches the high inoperative position of Fig. 2, the stop switch 316 will be again shifted to the position illustrated in Fig. 12, to open the circuit.

In accordance with another fetaure of the present invention, a novel and improved take-up mechanism is provided including movable welt supports, adapted to receive welt wires which may be laid in during the knitting of an early portion of the welt fabric, and an auxiliary take-up device cooperating with the welt wire supports to tension the said supports and the welt wires supported thereby forwardly to take up the fabric during the subsequent knitting of the welt and adjoining leg portions of the fabric. These welt wire supports are constructed and arranged to permit the usual fabric take-up straps to be attached by the operator to the welt wires held in their supports during the continued knitting of the stocking blank. The welt wire supports above referred to, are constructed and arranged for movement through a sufficient distance under the influence of the auxiliary take-up referred to, so that the operator will have time after the completion of the welt turning operation and during continued knitting of the leg fabric to attach the usual take-up straps to the welt wires along the length of the machine. Further in accordance with the present invention, the welt wire supports are constructed and arranged to permit the welt wires when acted upon by the usual take-up straps attached in this manner, to move forwardly out of engagement with the welt wire supports which are then returned to their initial rearward position preparatory for the knitting of the next succeeding set upon the machine.

As best shown in Figs. 1, 2 and 4 of the drawings, there are provided with each knitting section, two supplementary welt rod guideways 340 which are rigidly secured to the work table 54, one at each side of the needle series. These guideways provide support for welt wire slides or holders 341, each of which is provided in the face adjacent the needle series, with a vertically extending groove or slot 342 open at its upper end to receive the usual welt wire (not shown), and having at its lower end an opening 343 toward the front of the machine to permit the welt wire to be drawn forwardly away from the welt wire support 341 by the operation of the regular take-up straps when subsequently attached thereto by the operator. As will be clearly evident from Fig. 4 of the drawings, each of the guideways 340 is supported on the table 54 in such a manner that the rear end thereof projects considerably below the level of the sinkers and associated knockover bits. For the rearward or starting position of the holders 341, the opening 343 will be located below the line of fabric tensioned by the take-up welt hooks. It will also be noted that the rear walls of the slots 342 opposite the openings 343 are recessed to provide means for holding or trapping the welt wire in position against the welt fabric. It has been found otherwise that the continued jiggling of the fabric during the knitting of the welt fabric, would tend to throw the welt wires out of their holders. The holders 341 provided with these recesses, act substantially as hook take-up elements when the auxiliary take-up is rendered operative to tension the welt wires against the fabric. During continued knitting, the take-up holders 341 move rearwardly on their slides 340 in a direction which converges with a take-up line extending from the sinkers across the table to the racked fabric take-up, so that the opening 343 moves relatively upwardly into a position in which the welt wires will be readily moved outwardly through this opening when the usual take-up straps are attached thereto.

The movement of the welt wire supports 341 on their slides 340 is controlled through connections from a rock shaft 344 extending along the length of the machine, which include a lever arm 345 for each welt wire support 341 rigidly secured to the rock shaft 344, and a connecting link 346 attached at one end to the welt wire support, and at its other end to the corresponding lever arm 345. A take-up action is imparted to the rock shaft 344 and the welt wire supports 341 connected thereto, by means of a take-up strap 347 which is connected at one end to one of the lever arms 345, passes forwardly over an idler roller 348, and has attached to its other end a take-up weight 349.

The rock shaft 344 and the welt wire supports 341 attached thereto, are normally held in a fully retracted position by means of connections which include a latch lever 350 mounted on a forwardly extending rock shaft 352, and arranged for engagement with a cooperating offset lug 353 formed on the forward end of one of the links 346 adjacent the point of pivotal connection with the associated lever arm 345 (see Figs. 2 and 11). The rock shaft 352 is supported in a bearing 351 formed in a bracket secured to the under side of the work table 54. The auxiliary take-up including the welt wire supports 341, are arranged to be automatically released to take up the welt fabric by means of connections from the pattern chain 250 which include a laterally extending lever arm 354 which

is secured to the forward end of the latch lever shaft 352, and is connected by means of a link 355 to a pattern chain lever 356 (see Figs. 4 and 5).

In the illustrated construction, mechanism is also provided for automatically relieving the auxiliary take-up tension by the weight 349 during the operation of returning the initial course of welt loops to the needles to turn the welt, it being understood that the auxiliary fabric take-up is at this time in active position, the regular take-up straps not as yet having been operatively connected to the welt wires carried in the welt wire supports 341. The relieving mechanism is arranged to be actuated from the main cam shaft of the machine in timed relation to the operation of the welt mechanism to turn the welt, and is arranged to be controlled automatically from the pattern chain 250 of the machine. The relieving mechanism comprises a ratchet 360 rigidly secured to turn with the auxiliary take-up rock shaft 344 and a cooperating rack pawl lever 362 which is pivotally secured at its lower end to one arm of a cam actuated lever 364. The lever 364 is pivotally supported at 366 on a stationary bracket 368 sleeved on the operating shafts 76 and 110, and further supported against axial movement thereon between two collars 370 pinned to the shaft 76. A second arm of the cam actuated lever 364 carries on the lower end thereof, a stud 372 on which is mounted a shiftable cam roller 374 (see Figs. 4 and 11). A small tension spring 376 connected at one end to the rack pawl lever 362, and at its other end to a lug 378 on the lever 364, tends to move the rack lever toward the ratchet, this movement being limited by engagement of the rack pawl lever 362 with a lug 380 on the cam actuated lever 364. A tension spring 382 connected to the cam actuated lever 364, tends to move the lever in a clockwise direction as shown in Fig. 4, to maintain the roller 374 in engagement with its operating cam or disk, and to maintain the rack pawl lever 362 supported as above described, out of engagement with the ratchet 360. As best shown in Fig. 11 of the drawings, the cam roller 374 is normally supported upon a disk 384 on the main cam shaft 56 in the inoperative position shown, for example, in Fig. 4 of the drawings. An identical disk 386 supported at the left of the disk 384 as viewed in Fig. 11, provides a support for the roller 374 when the cam shaft 56 is shogged to the right for the usual narrowing operation of the machine. To the right of the disk 384 is located an operating cam 388 having thereon a rise portion which is adapted to rock the cam lever 364 in a counterclockwise direction as viewed in Fig. 4, to engage the rack pawl lever 362 with the ratchet 360, and thus to relieve temporarily the take-up action of the auxiliary take-up during the welt turning operation.

The cam roller 374 is shifted into and out of operative relation to the operating cam 388 through connections actuated from the pattern chain 250 of the machine, which include the previously described pattern chain lever 356, link 355 and forwardly extending latch lever rock shaft 352 for tripping the auxiliary take-up mechanism into active operation. A low bump on the pattern chain operates to rock the latch lever 350 out of engagement with the cooperating lug 353, and thereby to render the auxiliary take-up mechanism operative to take up the welt fabric. At a subsequent point in the operation when the pendants 144 and welt hooks 142 are to be moved rearwardly to return the initial course of welt loops to the needles, and while the auxiliary take-up is still in active operation, a high bump rides under the pattern lever 356 to rock the shaft 352 still further in a clockwise direction, and thereby to shift the roller 374 onto the actuating cam 388, the roller being subsequently permitted to return to its inoperative position at the end of the welt turning operation as the subsequent racking of the pattern chain 250 moves the high bump from beneath the pattern lever. The connections through which this operation of the cam roller 374 is effected, include a roller shifting lever 390 which is supported to turn on a forwardly extending pivot 392 on a depending portion of the stationary bracket 368, and is provided at its lower end with a long slotted portion 394 engaging a groove formed in the sleeve hub of the cam roller 374. The slotted portion 394 is of sufficient length to permit freedom of movement of the cam actuated lever 364 under the influence of the actuating cam 388. A laterally extending arm 396 formed on the hub of the clutch shifting lever 390, is operatively connected by means of a link 398 with an arm 400 rigidly secured to the rock shaft 352. A pin and slot connection 402 between the link 398 and the lever arm 400, permits the rocking of the shaft 352 under the influence of a low bump on the pattern chain to release the latch lever 350 without shifting the roller 374 from the inoperative position shown in Fig. 11. The relatively greater rocking movement imparted to the shaft 352 and lever 350 by the subsequent engagement of the high bump under the pattern lever 356 does, however, operate to lift the link 398 and shift the roller 378 onto its operating cam 388 as above set forth.

Other features of applicant's invention relate to the provision of an improved welt hook 142 and in the improved mode of operation of the welt hooks and associated knitting elements including particularly the needles 40, to remove wale kinks from alternate needles to form the setting-up course of welt fabric, and subsequently to return these loops to the needles. Applicant's welt hook, as best shown in Figs. 34 and 35 of the drawings, comprises a vertically extending shank portion having the lower end thereof doubled over into a parallel position with the shank to form the hook. The bottom of the hook is provided with lateral tapered portions 410 to facilitate the engagement of the welt hook between the adjoining sinkers and knockover bits during the downward movement thereof to the beard side of the needles, as more fully hereinafter described. The doubled-over or hook portion is also provided on the outer face thereof with a groove 412 which extends vertically the full length of the doubled-over portion of the hook. In the construction shown, the individual welt hooks 142, one for each alternate needle, are rigidly clamped in the welt bars 140 which are in turn rigidly secured to the lower ends of the pendant lever arms 144. In order to insure an accurate alignment of the hooks 142 with the needles and between the adjacent sinker and webholder elements of the machine, each pendant frame 144 is provided on opposite sides thereof, with wing plates 414 which are adapted for engagement between positioning screws 416 mounted on extensions 418 rigidly secured to the depending brackets 130 on the narrowing machine.

The operation of applicant's welt hooks 142

to take an initial setting-up course of welt loops from the needles, and subsequently to return these loops to turn the welt, will be described in connection with the illustrative views Figs. 13 to 32 inclusive, and in connection with Figs. 8 and 9, Fig. 8 showing in somewhat diagrammatic form, corresponding positions of the needle and catch bar motion cam rollers with respect to their operating cams on the main cam shaft, and Fig. 9 similarly showing corresponding positions of the vertical and in-and-out motion cam rollers with respect to their actuating cams on the welt cam shaft 166. During the setting-up operation, the needle in-and-out motion cam roller 80 is controlled by a special cam designated at 420 in Fig. 8. In this connection, it will be noted that the designation of the successive positions of the needles corresponding to Figs. 13 to 27 inclusive, are noted with relation to cam 420 for the forward and back positions of the needles. It will be understood that the cam 420 is rendered operative to control the in-and-out needle motion during the setting up, by any convenient means as, for example, by shifting the in-and-out needle motion cam roller 80 to the right from its normal operating position. This motion is preferably controlled from the main pattern shaft of the machine through connections including a pattern lever and a shifting fork associated with roller 80, these parts being not shown, since this construction is common in full-fashioned machines of the type disclosed.

In accordance with the present invention, applicant employs a novel mode of operation of his welt hooks with relation to the needles and other cooperating instrumentalities to perform the setting-up operation. The welt hooks are moved downwardly between adjacent sinkers and dividers to the beard side of the needles at the completion of the yarn sinking and dividing operation, to rest against a bevel 422 of the usual press edge 424 to provide a sturdy support for the welt hooks which then cooperate with the needles to press off alternate needles above the usual yarn sinking level. As the needles are now moved forwardly and down to the knockover position, the welt hooks are moved forwardly over the tops of the needles to engage the outer surface of the hooks against the pressed-off bars of yarn as these drop onto the knockover bits, so that these bars of yarn are held in a forward position as the needles now move rearwardly toward the press. The hooks are then moved downwardly to the backs of the needles, causing the cast-off bars or kinks of yarn to be engaged within the hooks. This mode of operation of the hooks has the specific advantage of insuring a positive control of the yarn during the formation of the setting-up course while maintaining the hooks at all times subsequent to the pressing-off operation, out of engagement with the needles, thus eliminating the possibility of damage to the parts through faulty adjustment or operation of the needles and hooks which might otherwise result in damage to the machine parts.

Referring specifically to Figs. 13 to 27, illustrating successive steps of the setting-up operation, Fig. 13 shows the hooks in their starting position during the operation of the yarn carrier shown in dot-and-dash lines at 426 to lay an initial course of yarn. At this time the welt hooks 142 start their downward movement reaching the dot-and-dash position shown in Fig. 13, as the dividers complete their forward movement as shown in Fig. 15. The hooks 142 continue their downward movement into engagement with the bevel portion 422 of the press edge 424, the needle beards then moving into pressing engagement with the doubled-over portion of the hooks above the yarn sinking level as shown in Fig. 14. Figs. 16 and 17 show the subsequent position of the needles which have now moved downwardly to cause the alternate needle wale kinks to be landed on the outside of their needle beards, while at the same time the hooks also move downwardly with the needles onto the press edge 424. The special in-and-out needle cam 420 operates during this movement of the needles to maintain an adequate but not excessive pressing engagement of the needles with the hooks during these movements. Figs. 17, 18, and 20 illustrate successive positions of the needles during their forward movement to draw the kinked yarn forwardly over the ends of the sinker nibs, the welt hooks 142 following closely this mode of movement. Fig. 19 is a somewhat diagrammatic view in front eelvation showing the parts substantially in the position shown in Fig. 18. Fig. 21 is a plan view showing the parts substantially in the positions taken in Fig. 20. In Fig. 22, the needles in accordance with the usual operation of these parts, have moved downwardly to the knockover level, the welt hooks 142 having at the same time moved forwardly and slightly downwardly between adjacent knockover bits 47 to engage with and position the bars of yarn cast off from alternate needles, and now supported on the knockover bits 47 in their forward position as the needles move rearwardly toward the press edge 422. Fig. 23 is a plan view showing the parts in substantially the position shown in Fig. 22. During the continued operation of the machine, the welt hooks 142 now move downwardly to the backs of the needles as shown in Fig. 24, causing the pressed-off bars of yarn to fall against the shanks of the welt hooks. Fig. 25 is a plan view of the parts in the positions shown in Fig. 24. Fig. 26 shows the completion of the setting-up operation in which the needles have again moved to their high position ready for the laying of the next course, the hooks having been again lifted so that the bottom ends thereof are slightly above the knockover bits 47. For this position of the parts, the pendant in-and-out cam roller 164 will stand opposite a low portion of its actuating cam 166, so that the pendants 144 will be permitted to follow the in-and-out motion of the needles under the influence of the take-up springs 170 (see Fig. 2), to take up additionally knitted fabric. During the knitting of subsequent courses, the welt hooks 142 will then be moved away from the needles as shown in Fig. 27. At the end of the first setting-up course, the needle in-and-out motion cam roller 80 will again be shifted to the left into operative engagement with the usual knitting cam 81 for subsequent knitting on the machine. As previously described, the welt cam shaft 166 is rotated through one-half revolution only during the setting-up operation in timed relation to the rotation of the main cam shaft 56 of the machine, being then held stationary during the subsequent knitting of the welt fabric.

The operation of transferring the loops held on the welt hooks 142 back to the needles to complete the turning of the welt, may be briefly described in connection with Figs. 28 to 32 of the drawings, and also in connection with Figs. 8 and 9, which illustrate the corresponding positions of the cam rollers with relation to their operating

cams during this welt turning operation. During this return operation the welt hooks 142 are moved rearwardly against the press edge 124, and over the tops of the needles as these are moved downwardly and rearwardly in their knockover position, Fig. 28 showing the position of the parts as the welt hooks 142 start their rearward movement. Fig. 29 shows the subsequent position in which the welt hooks are engaged against the press edge 424 and the needles have started their upward movement engaging within the grooves 412 in the outer surface of the turned-over portion of the welt hooks, while at the same time the hooks have started to move downwardly to disengage the initial course of loops therefrom. In Fig. 30, the hooks have been moved to their extreme downward position, while the needles continue to move upwardly between the sinkers, the initial course of welt loops being supported on the outside of the needle beards. Figs. 31 and 32 show successive positions of the needles and welt hooks, in which the needles are moved to their high position preparatory for the knitting of the next succeeding course, while the welt hooks have been moved upwardly to their high inoperative position as shown in dot-and-dash lines in Fig. 32.

Figs. 37 and 40 inclusive, illustrate the several positions taken by the welt wire take-up mechanism, and more particularly the auxiliary fabric take-up during the succeeding steps of laying in the welt wire in the holders of the auxiliary take-ups, the turning of the welt, and the subsequent attaching and tensioning of the regular take-up straps against the welt wires. These views illustrate the steps precisely as above described, with the modification from the construction shown in Fig. 4 of the drawings, that a stationary pin support has been provided to support the welt wires when laid in the holders above the level of the fabric.

Fig. 41 is an enlarged detail view showing the operating relationship of the holder and pin support. Inasmuch as the parts shown in these figures are in every respect identical with, and have the same mode of operation as the corresponding parts shown in Fig. 4, with the exception of the specific construction of the auxiliary take-up holders themselves, and the newly added pin supports, the several parts with the exception of the holders and pin supports are given the identical reference numerals according to the parts in the preceding figures of the drawings. While as previously described, the take-up tension on the welt fabric may be considered adequate to prevent the welt wires when positioned in the holders, from inadvertently dropping to the bottom thereof, and falling out through the opening 343, and while the holders are of sufficient height normally to prevent the welt wire from being bounced out of the slots, under certain conditions of operation, it has been found that a momentary variation or slackening of the fabric tension, may cause the welt wire to become dislodged from the holders. In order to obviate this possibility, in the modified form of the invention illustrated in Figs. 37 to 41 inclusive, supporting means are provided in the form of pin supports 440 which are arranged when the holders designated in the modification of Figs. 37 to 41 inclusive, at 441, are in their rearward or welt wire receiving position to prevent the welt wire from dropping to the bottom of its slot, and to support the welt wire substantially above the plane of the fabric being drawn off by the usual welt hooks. There is one such pin support 440 provided to cooperate with each holder 441, being rigidly secured to the rear end of the corresponding fixed guideway 340. These pins extend upwardly and thence forwardly through small apertures formed in the rear walls of the holders 441, and thence across the slotted portion thereof when the holders are in their rearward welt wire receiving position. Except for the apertures referred to, the holders 441 are in every respect identical with the holders 341 previously described. When a take-up tensioning strain is now applied to the holders 441 to tension the welt wires against the welt fabric, forward movement of the holders 441 from their position shown in Fig. 37 toward the position shown in Fig. 38, causes the relatively stationary pins 440 to be withdrawn from beneath the welt wire designated at 444, which is now permitted to move downwardly in the slots riding on the cammed surface 446 into the recess formed in the rear wall of the slots 342. Fig. 39 shows the position of the auxiliary take-up including the holders 441 subsequent to the turning of the welt, at a time when the operator has manually attached the usual take-up straps 448 to the welt wires, but prior to the tensioning of the usual fabric take-up. This take-up as shown in detail in Figs. 37 to 40 inclusive, and also as indicated in Fig. 4, comprises the usual take-up shaft 450 extending along the length of the machine, and having mounted thereon fabric take-up rollers 452, to which are attached the take-up straps 448. Further in accordance with the usual practice, there is loosely mounted on the shaft 450, a pulley 454 having connected thereto a take-up cord 456 and take-up weight 458, together with a crank 460 attached to the pulley 454, and a pawl and ratchet connection generally indicated at 462 between the pulley and the take-up shaft 450. It will be understood that the operator after having attached the take-up straps to the several welt wires along the length of the machine, will wind up the take-up in order to apply the regular take-up tension to the welt wires. During subsequent knitting, the welt wires are then moved forwardly away from the auxiliary take-up holders 441 as previously described, and as specifically illustrated in Fig. 40 of the drawings.

This application is a continuation in part, and is intended to take the place of applicant's copending application Serial No. 212,088, filed June 6, 1938.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a flat knitting machine having operating devices including a needle series for producing knitted fabric, a welt mechanism comprising instrumentalities to set up an initial course of welt fabric and to return said initial course to the needles to turn the welt, operating means for said instrumentalities, supporting means independent of the operating means on which said instrumentalities can be lifted to an inoperative position in which the welt mechanism will not obstruct the subsequent operation of said devices in the production of the fabric, means actuating said supporting means for lifting said instrumentalities to an inoperative position in which the welt mechanism will not obstruct sub-

sequent operation of said devices in the production of the fabric, and control means operative to lift the welt mechanism to said inoperative position after the forming of the welt, and for lowering said welt mechanism prior to the setting up of a new fabric on the needles.

2. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising instrumentalities arranged to cooperate with the needles to turn the welt, operating means for said instrumentalities, and means including an auxiliary electric motor operable to lift said instrumentalities to an inoperative position away from said operating devices in which the welt mechanism will not obstruct the subsequent operation of said devices in the production of the fabric.

3. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising instrumentalities arranged to cooperate with the needles to turn the welt, operating means for said instrumentalities, means including an auxiliary electric motor for lifting and lowering said instrumentalities to and from an inoperative position away from said operating devices, supporting means for the motor, and means to automatically disconnect the motor upon the completion of said lifting and lowering operations.

4. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising instrumentalities arranged to cooperate with the needles to turn the welt, operating means for said instrumentalities, means including an electric motor for lifting said instrumentalities to an inoperative position away from said operating devices in which the welt mechanism will not obstruct the subsequent operation of said devices in the production of the fabric, and control means for the motor including a starting switch, a motor stop switch, and means operable by the welt mechanism for actuating the stop switch when the welt mechanism reaches said inoperative position.

5. In a flat knitting machine having operating devices including a needle series, and pattern means for controlling the operation of said devices to produce a knitted fabric, a welt mechanism comprising instrumentalities arranged to cooperate with the needles to set up an initial course on the needles and to return said course to the needles to turn the welt, operating means for said instrumentalities, means including a reversible electric motor for moving said instrumentalities to and from an inoperative position away from said operating devices, switch connections for starting, stopping and reversing the motor, pattern control means for actuating said starting and reversing switches, and connections controlled by the movement of said welt mechanism to and from said inoperative position to actuate said motor stop switch.

6. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising instrumentalities arranged to cooperate with the needles to turn the welt, operating means for said instrumentalities, mechanically operable means for lifting and lowering said instrumentalities to and from a high inoperative position in which the welt instrumentalities are disconnected from said actuating means and are positioned away from said operating devices, and means independent of said lifting means for locking the said welt instrumentalities in a high inoperative position.

7. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising welt instrumentalities arranged to cooperate with the needles to turn the welt, a pendant on which said instrumentalities are movable toward and away from the needles, a vertically movable pivotal support for the pendant, a welt cam shaft and cams for imparting vertical and swinging movements to the pendant to turn the welt, mechanically operable means for raising and lowering the pendant to and from an inoperative position in which the pendant is disconnected from its actuating cams and is positioned away from said operating devices, and means independent of said lifting means for locking the pendant in an inoperative position.

8. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising a series of instrumentalities arranged to cooperate with the needles to turn the welt, a pendant on which said instrumentalities are movable toward and away from the needles, a vertically movable lever support for the pendant, actuating means for imparting swinging and vertical movements to the pendant, mechanically operable means acting on said lever support to lift the pendant to a high inoperative position away from said operating devices, and guiding means operable during said lifting movement to move the pendant rearwardly on its support.

9. In a flat knitting machine having operating devices including a needle series for producing a knitted fabric, a welt mechanism comprising a series of instrumentalities arranged to cooperate with the needles to turn the welt, a pendant on which said instrumentalities are movable toward and away from the needles, a vertically movable lever support for the pendant, actuating means including cams for imparting swinging and vertical movements to the pendant to turn the welt, and lifting means comprising a vertically movable support arranged to engage beneath said lever support, and actuating connections for said latter support operable to raise and lower the lever support and pendant to and from a high inoperative position away from said operating devices.

10. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising welt instrumentalities associated with each needle series for turning the welt, means for simultaneously operating said welt instrumentalities associated with the several sections to turn the welts, mechanism including an electric motor and connections therefrom for simultaneously lifting said welt instrumentalities associated with the several sections to a high inoperative position in which the welt instrumentalities are disconnected from their actuating means, and in which the welt mechanism is positioned away from the operating devices, and means for controlling said mechanism for simultaneously moving the welt instrumentalities associated with the several sections to and from inoperative position.

11. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising welt instrumentalities associated with each needle

series for turning the welt, a pendant associated with each section on which said instrumentalities are movable toward and away from the needles, vertically movable lever supports for said pendants, means for imparting swinging and vertical movements to the pendants for simultaneously turning the welts, and mechanically operable lifting means arranged to act upon said vertically movable lever supports for simultaneously lifting the pendants to a high inoperative position.

12. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising welt instrumentalities associated with each needle series for turning the welt, a pendant associated with each section on which said instrumentalities are movable toward and away from the needles, vertically movable lever supports for said pendants, means for imparting swinging and vertical movements to the pendants for simultaneously turning the welts, mechanically operable lifting means arranged to act upon said vertically movable lever supports for simultaneously lifting the pendants to a high inoperative position, and a locking device associated with each section operable to lock individual pendants in a high inoperative position independently of the operation of said lifting mechanism.

13. In a multiple section flat full-fashioned knitting machine having operating devices including knitting needles associated with the several sections, and driving and pattern mechanisms therefor for producing knitted fabric, certain of said devices being selectively operable, and supported and arranged to be lifted to high inoperative position to permit unobstructed operation of other of said devices, and auxiliary mechanism for lifting certain of said devices associated with each of the several sections simultaneously to and from said high inoperative positions in which said devices are disconnected from said driving mechanism, said auxiliary mechanism including lifting means arranged to lift simultaneously said certain devices associated with each of the several sections, a reversible electric motor, and control means for the motor.

14. In a multiple section flat full-fashioned knitting machine having operating devices including knitting needles associated with the several sections, and driving and pattern mechanisms therefor producing knitted fabric, certain of said devices being selectively operable, and supported and arranged to be lifted to high inoperative position to permit unobstructed operation of other of said devices, and auxiliary mechanism for lifting certain of said devices associated with each of the several sections simultaneously to and from said high inoperative positions in which said devices are disconnected from said driving mechanisms, said auxiliary mechanism comprising a vertically movable lever support extending along the length of the machine operable to engage beneath and lift said certain devices, and mechanically operable means for raising and lowering said lever support.

15. In a multiple section flat full-fashioned knitting machine having operating devices including knitting needles associated with the several sections, and driving and pattern mechanisms therefor for producing knitted fabric, certain of said devices being selectively operable, and supported and arranged to be lifted to high inoperative position to permit unobstructed operation of other of said devices, and auxiliary mechanism for lifting certain of said devices associated with each of the several sections simultaneously to and from said high inoperative positions in which said devices are disconnected from said driving mechanisms, said auxiliary mechanism comprising a vertically movable lever support extending along the length of the machine operable to engage beneath and lift said certain devices, and power means for raising and lowering said lever support.

16. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, mechanism for setting up an initial course of fabric on the needles comprising vertically arranged hooks having forwardly facing doubled-over portions associated with alternate needles, and means for moving said hooks away from the needles in the direction of take-up, means to sink an initial course of yarn on the needles, means for pressing the beards of said alternate needles to cast off their loops, and means for moving the hooks to bring the outer surface of said doubled-over portions against the cast-off loops and thereafter to move the hooks downwardly to the back side of the needles to engage said cast-off loops within the hooks.

17. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, mechanism for setting up an initial course of fabric on the needles comprising vertically arranged hooks having forwardly facing doubled-over portions associated with alternate needles, and means for moving said hooks away from the needles in the direction of take-up, means to sink an initial course of yarn on the needles, means for pressing the beards of said alternate needles to cast off their loops, and means for moving the hooks to bring the outer surface of said doubled-over portions against the cast off loops and thereafter to move the hooks downwardly to the back side of the needles, and then upwardly to engage said cast off loops within the hooks.

18. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, mechanism for setting up an initial course of fabric on the needles comprising vertically arranged hooks having forwardly facing doubled-over portions associated with alternate needles, and means for moving said hooks away from the needles in the direction of take-up, means to sink an initial course of yarn on the needles, means for pressing the beards of said alternate needles to cast off their loops, and means for moving the hooks forwardly over the needles to bring the outer surface of said doubled-over portions against the cast off loops and thereafter to move the hooks downwardly to the back side of the needles to engage said cast off loops within the hooks.

19. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards and cooperating sinkers and knockover bits associated therewith, mechanism for mechanically turning the welt including welt hooks associated with alternate needles having substantially vertical shank portions and forwardly

facing doubled-over portions, and means for imparting forward and back and dipping movements to said hooks, means to sink an initial course of yarn on all the needles, means to press the beards of said alternate needles to cast off their loops, and means for moving the hooks forwardly over the needles to engage the outer surface of said doubled-over portions against said cast off loops beyond the back line of the needles, and thereafter to impart a dipping movement to said hooks positioned to the backs of the needles to engage said cast off loops within the hooks.

20. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, vertically arranged welt hooks associated with alternate needles, means to sink an initial course of yarn on all the needles, means for relatively moving the hooks and needles to press the beards of alternate needles against the hooks above the yarn sinking level to cast off alternate loops, and means for moving the hooks over the needles to support the cast-off loops against the outer surface of the hooks, and thereafter to move the hooks downwardly to the back side of the needles to engage said cast-off loops within the hooks.

21. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, vertically arranged welt hooks associated with alternate needles, means to sink an initial course of yarn on all the needles, means for relatively moving the hooks and needles to press the beards of alternate needles against the hooks above the yarn sinking level to cast off alternate loops, means operative during the subsequent movement of the needles to the knockover level to move the hooks forwardly over the needles, and to engage the outer surfaces thereof against the cast-off loops supported on the knockover bits, and thereafter during the subsequent rearward movement of the needles toward the press to move the hooks downwardly between the knockover bits to the back side of the needles to engage said cast-off loops within the hooks.

22. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, welt hooks associated with alternate needles, means for sinking an initial course of yarn on all the needles, means for positioning the hooks to the beard side of the needles, and with the doubled-over portion thereof extending upwardly to engage with and press the beards of alternate needles above the yarn sinking level to cast off alternate loops, means operative during the subsequent movement of the hooks to the knockover level to move the hooks over the needles to engage with and support the cast-off loops against the outer surface of the hooks, and thereafter during subsequent rearward movement of the needles toward the press to move the hooks downwardly between the knockover bits to the back side of the needles to engage said cast-off loops within the hooks.

23. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, welt hooks associated with alternate needles, means for sinking an initial course of yarn on all the needles, means for positioning the hooks to the beard side of the needles in engagement with the press edge and with the doubled-over portions thereof extending upwardly to engage with and press the beards of alternate needles above the yarn sinking level to cast off alternate loops, means operative during movement of the needles to the knockover level to move the hooks over the needles to engage the cast-off loops supported on the knockover bits against the outer surface of the hooks, and thereafter during rearward movement of the needles toward the press to move the hooks downwardly to the back side of the needles to engage said cast-off loops within the hooks.

24. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, welt hooks associated with alternate needles, means for sinking an initial course of yarn on all the needles, means for positioning the hooks to the beard side of the needles in engagement with the press edge and with the doubled-over portions thereof extending upwardly to engage with and press the beards of alternate needles above the yarn sinking level to cast off alternate loops, means including a setting-up forward and back motion needle cam for moving the needles against said doubled-over hook portions to press off said alternate needles above the yarn sinking level, means operative during subsequent movement of the needles to the knockover level to move the hooks over the needles to engage with and support the cast-off loops against the outer surface of the hooks, and thereafter during the subsequent rearward movement of the needles toward the press to move the hooks downwardly between the knockover bits to the back side of the needles, and again upwardly to engage said cast-off loops within the hooks.

25. In a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, and cooperating sinkers and knockover bits associated therewith, welt hooks associated with alternate needles, means for sinking an initial course of yarn on all the needles, means for positioning the hooks to the beard side of the needles in engagement with the press edge and with the doubled-over portions thereof extending upwardly to engage with and press the beards of alternate needles above the yarn sinking level to cast off alternate loops, means including a setting-up forward and back motion needle cam for moving the needles against said doubled-over hook portions to press off said alternate needles above the yarn sinking level, means operative during subsequent movement of the needles to the knockover level to move the hooks over the needles to engage with and support the cast-off loops against the outer surface of the hooks, and thereafter during the subsequent rearward movement of the needles toward the press to move the hooks downwardly between the knockover bits to the back side of the needles, and again upwardly to engage said cast-off loops within the hooks, and means for applying a take-up tension to the hooks.

26. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with

a welt wire of an auxiliary take-up comprising a holder into which the welt wire can be laid manually prior to the time it is required to tension the fabric, and auxiliary take-up tensioning means attached to the holder, means to cause the auxiliary take-up to act to take up the fabric before the setting-up implements cease to act to take up the fabric, said auxiliary take-up being arranged to take up the fabric during the knitting of a portion only of the complete fabric, and a main fabric take-up attachable to the welt wire to take up the fabric during continued knitting.

27. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire of an auxiliary take-up comprising a holder into which the welt wire can be laid manually prior to the time it is required to tension the fabric, and auxiliary take-up tensioning means for the holder, means to cause the auxiliary take-up to act to take up the fabric, said auxiliary take-up being arranged to take up the fabric during the knitting of a portion only of the complete fabric, and a main fabric take-up for the welt wire to take up the fabric during continued knitting.

28. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire of an auxiliary take-up comprising a holder into which the welt wire can be laid manually prior to the time it is required to tension the fabric, and auxiliary take-up tensioning means for the holder, pattern mechanism for the machine, means rendered operative thereby to cause the auxiliary take-up to act to take up the fabric, said auxiliary take-up being arranged to take up the fabric during the knitting of a portion only of the complete fabric, and a main fabric take-up for the welt wire to take up the fabric during continued knitting.

29. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric setting-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of an auxiliary take-up comprising a holder into which the welt wire can be laid prior to the time it is required to tension the fabric, an auxiliary take-up, tensioning means for the holder, means to cause the auxiliary take-up to take up a fold of welt fabric, means for closing the welt, a main fabric take-up, means operative during the welt closing operation to relieve the auxiliary take-up tension, and means operative subsequent to the welt closing operation for rendering said auxiliary take-up inoperative and said main take-up operative to take up the welt wire and fabric attached thereto.

30. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising implements to set up and turn the welt, and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of an auxiliary take-up comprising a holder having a limited movement in a take-up direction, and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire in the holder subsequent to the knitting of initial fabric courses, means to cause the auxiliary take-up to act to take up the fabric before the welt setting-up implements cease to act to take up the fabric, and a main fabric take-up arranged to be connected to the welt wire subsequent to the turning of the welt to take up the fabric during continued knitting.

31. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising implements to set up and subsequently to turn the welt, and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of an auxiliary take-up comprising a holder having a limited movement in a take-up direction to draw off the fabric prior to and subsequent to the welt turning operation, and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the laying in of the welt wire in the holder prior to the time when it is required, means to cause the auxiliary take-up to act to take up the fabric before the setting up implements cease to act to take up the fabric, and means to relieve the action of said intermediate take-up during the welt turning operation, and a main fabric take-up arranged to be connected to the welt wire subsequent to the turning of the welt to take up the fabric during continued knitting.

32. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, welt mechanism comprising implements to set up and subsequently to turn the welt, and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of an auxiliary take-up comprising a holder having a limited movement in a take-up direction to draw off the fabric prior to and subsequent to the welt turning operation, and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire in the holder subsequent to the knitting of initial fabric courses, means to cause the auxiliary take-up to act to take up the fabric before the take-up implements cease to take up the fabric, and a main fabric take-up connectible to the welt wire to take up the fabric during continued knitting subsequent to the turning of the welt.

33. In a multiple section flat knitting machine for knitting welt fabrics having associated with each knitting section, knitting devices including a needle series, welt mechanism comprising implements to set up and turn the welts, and means for moving said implements away from the needles in the direction of take-up, the combination with welt wires, of auxiliary take-ups for the several sections comprising a holder for each section having a limited movement in a take-up direction to draw off the fabric prior to and subsequent to the welt turning operation, and auxiliary take-up tensioning means connected to the holders, means for positioning the auxiliary take-ups including the several holders for the manual laying in of the welt wires in the holders subsequent to the knitting of initial fabric courses, means to cause the auxiliary take-ups simultaneously to act to take up the fabrics before the setting-up implements cease to act to take up the fabric, and a main fabric take-up

comprising connecting elements attachable to the welt wires associated with the several sections to take up the fabrics during continued knitting.

34. In a multiple section flat knitting machine for knitting welt fabrics having associated with each knitting section, knitting devices including a needle series, welt mechanism comprising implements to set up and turn the welts, and means for moving said implements away from the needles in the direction of take-up, the combination with welt wires, of auxiliary take-ups for the several sections comprising a holder for each section having a limited movement in a take-up direction to draw off the fabric prior to and subsequent to the welt turning operation, and auxiliary take-up tensioning means for the holders, means for positioning the auxiliary take-ups including the several holders for the manual laying in of the welt wires in the holders subsequent to the knitting of initial fabric courses, means to cause the auxiliary take-ups simultaneously to act to take up the fabrics, and a main fabric take-up comprising connecting elements attachable to the welt wires associated with the several sections to take up the fabrics during continued knitting.

35. In a multiple section flat knitting machine for knitting welt fabrics having associated with each knitting section, knitting devices including a needle series, welt mechanism comprising implements to set up and turn the welts, and means for moving said implements away from the needles in the direction of take-up, the combination with welt wires, of auxiliary take-ups for the several sections comprising a holder for each section having a limited movement in a take-up direction to draw off the fabric prior to and subsequent to the welt turning operation, and auxiliary take-up tensioning means for the holders, means for positioning the auxiliary take-ups including the several holders for the manual laying in of the welt wires in the holders subsequent to the knitting of initial fabric courses, pattern mechanism for the machine, means rendered operative thereby to cause the auxiliary take-ups simultaneously to act to take up the fabrics, and a main fabric take-up comprising connecting elements attachable to the welt wires associated with the several sections to take up the fabrics during continued knitting.

36. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a main fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a holder movable in a take-up direction and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire therein subsequent to the knitting of initial fabric courses, said holder being constructed to receive and to support the welt wire against the welt fabric under the unfluence of said auxiliary take-up tensioning means and to permit unobstructed movement of the welt wire in the direction of the take-up away from said holder under the influence of the main take-up means when subsequently attached thereto.

37. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a main fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a holder movable in a take-up direction and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire therein subsequent to the knitting of initial fabric courses, and means for rendering said auxiliary take-up operative to tension the fabric during continued knitting of the welt, said holder being constructed to receive and to support the welt wire against the welt fabric under the influence of said auxiliary take-up tensioning means and to permit unobstructed movement of the welt wire in the direction of the take-up away from said holder under the influence of the main take-up means when subsequently attached thereto.

38. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a main fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a holder movable in a take-up direction and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire therein subsequent to the knitting of initial fabric courses, and means for rendering said auxiliary take-up operative to tension the fabric during continued knitting of the welt, said holder being constructed to receive and to support the welt wire against the welt fabric under the influence of said auxiliary take-up tensioning means and to permit unobstructed movement of the welt wire in the direction of the take-up away from said holder under the influence of the main take-up means when subsequently attached thereto, and means for rendering said main take-up operative to take up fabric.

39. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a main fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a holder movable in a take-up direction and auxiliary take-up tensioning means connected thereto, means for positioning the auxiliary take-up including the holder for the manual laying in of the welt wire therein subsequent to the knitting of initial fabric courses, a guideway on which the holder is movable in the direction of take-up, means for actuating said auxiliary take-up means to tension fabric during and subsequent to the turning of the welt, said holder being constructed to permit movement of the welt wire in the direction of take-up away from said holder under the influence of the main take-up means when subsequently attached thereto.

40. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a holder into which the welt wire

can be laid against the fabric subsequent to the knitting of initial fabric courses, a guideway on which the holder is movable in the direction of take-up, a rotatable take-up shaft, a lever on the shaft, and a link connected with the holder, means acting on the shaft for positioning the holder to permit manual laying in of the welt wire, take-up tensioning means acting on the shaft, and means for rendering said tensioning means operative to tension the holder and welt wire supported thereon against the fabric during continued knitting of the welt, said holder being constructed to permit movement of the welt wire in the direction of take-up away from said holder under the influence of the first take-up means when subsequently attached thereto.

41. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire and an auxiliary fabric take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders arranged to be moved in a take-up direction by said auxiliary take-up tensioning means and having formed therein vertical slots into which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, and a forwardly extending opening from said slot through which welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up, and means for throwing said first take-up into operation.

42. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders connected to said auxiliary tensioning means having formed therein vertical slots into which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, and forwardly extending openings from said slots through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when subsequently attached thereto.

43. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders attached to said auxiliary means having formed therein vertical slots in which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, and at the lower end of said slots a forwardly extending opening through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when subsequently attached thereto, and guideways on which said holders are movable in the direction of take-up, said guideways being disposed to position the holders in welt wire receiving position with said openings below the line of fabric take-up.

44. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, and an auxiliary take-up comprising a pair of welt holders having formed therein vertical slots into which the welt wire can be laid subsequent to the knitting of initial fabric courses, auxiliary take-up tensioning means attached to the holders for moving said holders in the direction of take-up, means for positioning said holders for the manual laying in of the welt wire, a stationary support arranged for said position of the holders to support the welt wire in the slots above the fabric, said holders having a forwardly extending opening from said slots through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when rendered operative.

45. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders movable in the direction of take-up and connected to said auxiliary tensioning means, said holders having formed therein vertical slots into which the welt wire can be laid for engagement with the fabric subsequent to the knitting of initial fabric courses, and forwardly extending openings from said slots through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first-mentioned fabric take-up when rendered operative, and means for positioning said holders for the laying in of the welt wire.

46. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders movable in the direction of take-up and connected to said auxiliary tensioning means, said holders having formed therein vertical slots into which the welt wire can be laid for engagement with the fabric subsequent to the knitting of initial fabric courses, and forwardly extending openings from said slots through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first-mentioned fabric take-up when subsequently attached thereto, and means for throwing said auxiliary take-up into operation to tension the welt fabric.

47. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up comprising a holder into which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, and means for drawing said holder away from the needles in a take-up direction, means for supporting the holder for the

manual laying in of the welt wire, and a separate support arranged for the welt wire receiving position of the holder to support the welt wire in the holder out of fabric contact, and upon movement of the holder in the take-up directions to be disengaged from the welt wire.

48. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up comprising a holder into which the welt wire can be laid adjacent the fabric subsequent to the knitting of initial fabric courses, supporting means on which the holder is movable in a take-up direction, and means for drawing said holder away from the needles in a take-up direction, and a separate support arranged for the welt wire receiving position of the holder to support the welt wire in the holder out of fabric contact, and upon movement of the holder in the take-up direction to be disengaged from the welt wire.

49. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up comprising a holder into which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, and means for drawing said holder away from the needles in a take-up direction, means for supporting the holder for the manual laying in of the welt wire, and a stationary support arranged for the welt wire receiving position of the holder to support the welt wire in the holder out of fabric contact, and upon movement of the holder in the take-up direction to be disengaged from the welt wire.

50. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up comprising a holder into which the welt wire can be laid adjacent the fabric subsequent to the knitting of initial fabric courses, and means for drawing said holder away from the needles in a take-up direction, means for supporting the holder for the manual laying in of the welt wire, a relatively stationary support arranged for the welt wire receiving position of the holder to support the welt wire in the holder out of fabric contact, and means to cause the take-up to act to take up the fabric and thereby to disengage the welt wire from said support.

51. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements, and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up comprising a pair of welt wire holders having formed therein vertical slots into which the welt wire can be laid subsequent to the knitting of initial fabric courses, take-up means arranged to act upon the holders, guideways on which said holders are movable in the direction of take-up, and a stationary support arranged to cooperate with the holders in welt wire receiving position to support the welt wire at an intermediate position in said slots.

52. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders attached to said auxiliary means having formed therein vertical slots into which the welt wire can be laid subsequent to the knitting of initial fabric courses, and at the lower end of said slots, a forwardly extending opening through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when subsequently attached thereto, guideways on which said holders are movable in the direction of take-up, and stationary supports arranged with the holders in welt wire receiving position to support the welt wires in the slots above said openings.

53. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attached to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders attached to said auxiliary means having formed therein vertical slots in which the welt wire can be laid subsequent to the knitting of subsequent fabric courses, and at the lower end of said slots a forwardly extending opening through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when subsequently attached thereto, guideways on which said holders are movable in the direction of take-up, said guideways being disposed to position the holders in welt wire receiving position with said openings below the line of fabric take-up, and a stationary support cooperating with the holders in welt wire receiving position to positively support the welt wire above said openings.

54. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, fabric set-up implements and means for moving said implements away from the needles in the direction of take-up, the combination with a welt wire, of a fabric take-up attachable to the welt wire, an auxiliary take-up comprising auxiliary take-up tensioning means, a pair of welt wire holders attached to said auxiliary means having formed therein vertical slots into which the welt wire can be laid against the fabric subsequent to the knitting of initial fabric courses, said holders having formed in the rear wall of the slotted portion thereof a recess for holding the welt wire during movement of the holders under the influence of their take-up means, and in the lower portion of the forward wall of said slotted portion, an opening through which the welt wire can be drawn in the direction of take-up away from said holders under the influence of said first take-up means when subsequently attached thereto, and guideways on which said holders are movable in the direction of take-up.

55. The method of operation of a flat knitting machine adapted for knitting welt fabric having knitting devices including a needle series, and welt mechanism comprising implements movable to set up and turn the welt, and means for mov-

ing said implements in a take-up direction, a welt wire, a main fabric take-up attachable to the welt wire, and an auxiliary fabric take-up including a welt wire holder arranged to permit the laying in of the welt wire therein against the fabric subsequent to the knitting of initial fabric courses and movable in a take-up direction, and auxiliary fabric take-up tensioning means attached to the holder, which comprises setting up and knitting initial fabric courses, manually laying a welt wire in said holder, tensioning said holder and welt wire against the fabric before the set-up implements cease their take-up action, turning the welt, and thereafter manually attaching said main take-up to the welt wire to continue the fabric take-up action before the auxiliary take-up ceases to act.

56. The method of operation of a multiple section flat knitting machine adapted for knitting welt fabrics having with each knitting section knitting devices including a needle series, and welt mechanism comprising implements movable to set up and turn the welt, and means for moving said implements in a take-up direction, a welt wire for each knitting section, a main fabric take-up for the welt wires, and an auxiliary fabric take-up including for each knitting section a welt wire holder arranged to permit the laying in of the welt wire against the fabric subsequent to the knitting of initial fabric courses and movable in a take-up direction, and auxiliary fabric take-up tensioning means for the holders, which comprises simultaneously setting up and knitting initial fabric courses on the several knitting sections, manually laying the welt wires in said holders, simultaneously tensioning said holders and wires against the fabric before the setting-up implements initiate their setting up action, simultaneously turning the welts, and thereafter manually attaching said main take-up to the several welt wires to continue the fabric take-up action before the auxiliary take-up ceases to act.

57. The method of forming an alternate needle set-up on a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, cooperating sinkers and knockover bits associated therewith, and mechanism for forming the set-up including a series of vertically arranged hooks having forwardly facing doubled-over portions spaced to cooperate with alternate needles, which comprises sinking an initial course of yarn on the needles, manipulating said set-up hooks to engage said hooks against the beards of said alternate needles to cast off their loops, moving said hooks forwardly over the needles to bring the outer surface of the doubled-over portions against the cast off loops, and thereafter moving the hooks downwardly to the back side of the needles to engage said cast off portions within the hooks.

58. The method of forming an alternate needle set-up on a flat knitting machine having knitting instrumentalities including a series of spring beard needles, means for pressing the needle beards, cooperating sinkers and knockover bits associated therewith, and mechanism for forming the set-up including a series of vertically arranged hooks having forwardly facing doubled-over portions spaced to cooperate with alternate needles, which comprises sinking an initial course of yarn on the needles, pressing the beards of alternate needles to cast off their loops, moving said hooks over the needles to bring the outer surface of the doubled-over portions against the cast off loops, and thereafter moving the hooks downwardly to the back side of the needles to engage said cast off loops within the hooks.

59. In a flat knitting machine having knitting devices including a needle series for producing knitted fabric, instrumentalities arranged to cooperate with the needles for the performance of operations auxiliary to knitting, a cam shaft for the machine, and an additional cam shaft and cams thereon for operating said additional instrumentalities, means for intermittently driving the auxiliary cam shaft from the first cam shaft including a clutch, and means for controlling the operation of said clutch to start and to stop said auxiliary cam shaft in predetermined angular positions.

60. In a flat knitting machine having knitting devices including a needle series for producing knitted fabric, instrumentalities arranged to cooperate with the needles for the performance of operations auxiliary to knitting, a cam shaft for the machine, and an additional cam shaft and cams thereon for operating said additional instrumentalities, means for intermittently driving the auxiliary cam shaft from the first cam shaft including a clutch, and means for controlling the operation of said clutch to drive the auxiliary cam shaft through a half revolution, and thereafter to stop said auxiliary cam shaft in a predetermined angular position.

61. In a flat knitting machine for knitting welted fabric having knitting devices including a needle series, and welt instrumentalities mechanically operable to set up and to turn the welt, a main cam shaft for the machine, an auxiliary cam shaft and cams thereon for operating said welt instrumentalities to set up and subsequently to turn the welt, and means for driving the auxiliary cam shaft from the main cam shaft including a clutch operable to drive the auxiliary cam shaft through a half revolution and to stop the auxiliary cam shaft in a predetermined angular position, and pattern means for connecting said clutch to drive the auxiliary cam shaft through successive one-half revolutions to set up and to turn the welt.

62. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising for each knitting section, a welt bar, a pendant on which the welt bar is movable toward and away from the needles, a vertically movable lever support for the pendant, and means for imparting vertical and swinging movements to the pendants for simultaneously turning the welts comprising cam and follower connections associated with each knitting section for simultaneously imparting forward and back movements to the pendants, and cam actuated means for imparting simultaneous vertical movements to the pendants and welt bars supported thereby comprising a supporting member for said lever supports extending the length of a plurality of knitting sections, and cam means for actuating said supporting member to impart simultaneous vertical movements to said lever supports.

63. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising for each knitting section, a welt bar, a pendant on which the welt bar is movable toward and away from the needles, a vertically movable lever support for

the pendant, and means for imparting vertical and swinging movements to the pendants for simultaneously turning the welt comprising a cam shaft underlying the lever supports, cam and follower connections including cams on said cam shaft for simultaneously imparting forward and back movements to the pendants and welt bars supported thereby, cam actuated means for imparting simultaneous vertical movements to the pendants comprising a supporting member for said lever supports extending the length of a plurality of sections, and cam and follower connections from said cam shaft for actuating said member to impart simultaneous vertical movements to said lever supports.

64. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising for each knitting section, a welt bar, a pendant on which the welt bar is movable toward and away from the needles, a vertically movable lever support for the pendant, and means for imparting vertical and swinging movements to the pendants for simultaneously turning the welts comprising cam and follower connections associated with each knitting section for simultaneously imparting forward and back movements to the pendants and welt bars supported thereby, and cam actuated means for imparting simultaneous vertical movements to the pendants and welt bars supported thereby comprising a supporting member for said lever supports extending the length of a plurality of knitting sections, cam means for actuating said supporting member to impart simultaneous vertical movements to said lever supports, and a mechanically operable lifting device arranged to act upon said member for simultaneously lifting the pendants to a high inoperative position.

65. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising for each knitting section, a welt bar, a pendant on which the welt bar is movable toward and away from the needles, a vertically movable lever support for the pendant, and means for imparting vertical and swinging movements to the pendants for simultaneously turning the welts comprising cam and follower connections associated with each knitting section for simultaneously imparting forward and back movements to the pendants, and cam actuated means for imparting simultaneous vertical movements to the pendants comprising a supporting member for said lever supports extending the length of the several sections, cam means for actuating said supporting member to impart simultaneous vertical movements to said lever supports, and mechanically operable lifting means arranged to act upon said supporting member for simultaneously lifting the pendants to a high inoperative position comprising a rock shaft, a plurality of lifting members loosely pivoted on the rock shaft for engagement with said lifting member, an operating shaft, gear segment and pinion operating connections between said lifting members and the operating shaft, and means for rotating the operating shaft.

66. In a flat full-fashioned knitting machine having operating devices including a needle series for producing knitted fabric, welt mechanism comprising a welt bar, a pendant on which the welt bar is movable toward and away from the needles, a vertically movable lever support for the pendant, a pivot for said lever support, a cam shaft underlying the lever support, means for imparting vertical movements to the pendant comprising a vertical motion cam on said cam shaft, a vertical motion cam lever cooperating therewith mounted to turn about the same pivotal axis with the lever support and overlying the cam shaft for engagement beneath the lever support, and means for detachably securing the lever support to move with the cam lever, a forward and back motion cam on said cam shaft, a forward and back motion cam lever pivotally mounted on said lever support rearwardly of the cam shaft for engagement with said forward and back motion cam, and a link connection between said forward and back motion cam lever and pendant overlying the cam shaft.

67. In a multiple section flat knitting machine having operating devices including a needle series associated with each section for producing knitted fabric, welt mechanism comprising welt instrumentalities associated with each needle series for turning the welt, a pendant associated with each section on which said instrumentalities are movable toward and away from the needles, vertically movable lever supports for said pendants, means for imparting swinging and vertical movements to the pendants for simultaneously turning the welts, mechanically operable lifting means arranged to act upon said vertically movable lever supports for simultaneously lifting the pendants to a high inoperative position, and pattern means for controlling the operation of said lifting means.

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