Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 1

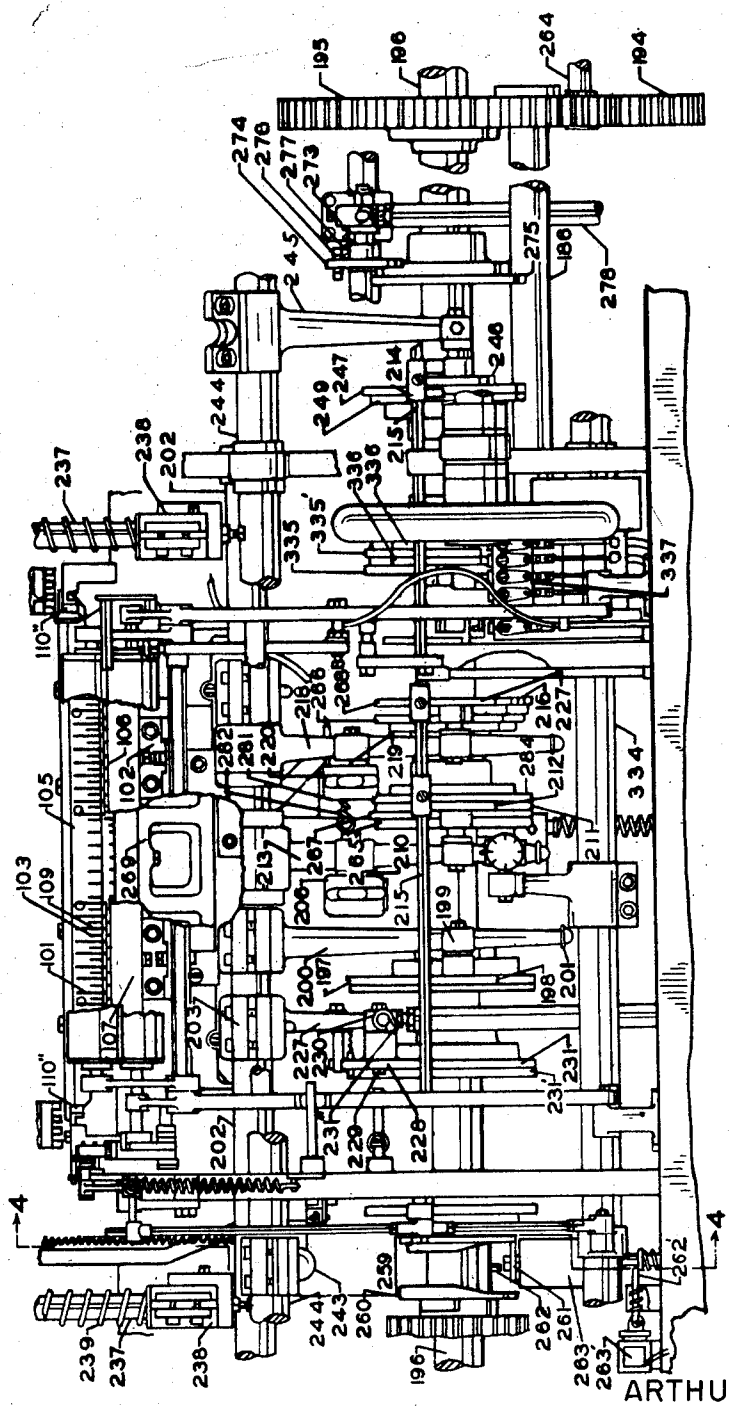


FIG 1

Inventor

ARTHUR J. COBERT

By

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 2

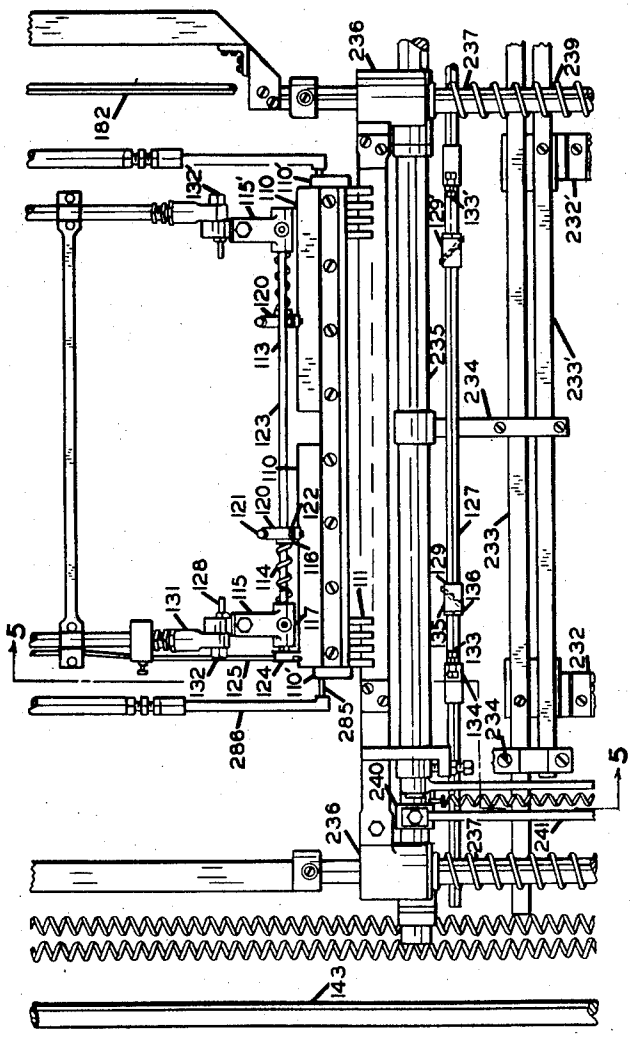


FIG 2

Inventor

ARTHUR J. COBERT

By

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 3

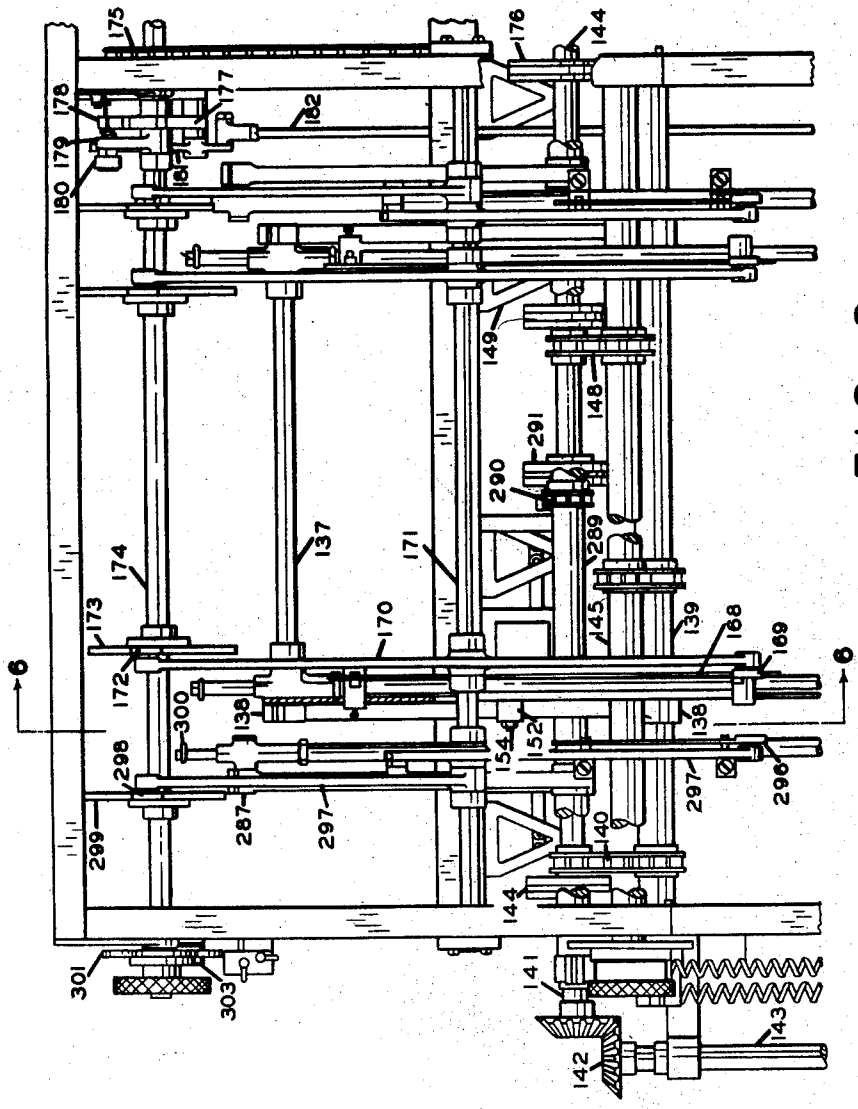


FIG 3

Inventor

ARTHUR J. COBERT

By Edwin C. Newton

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 4

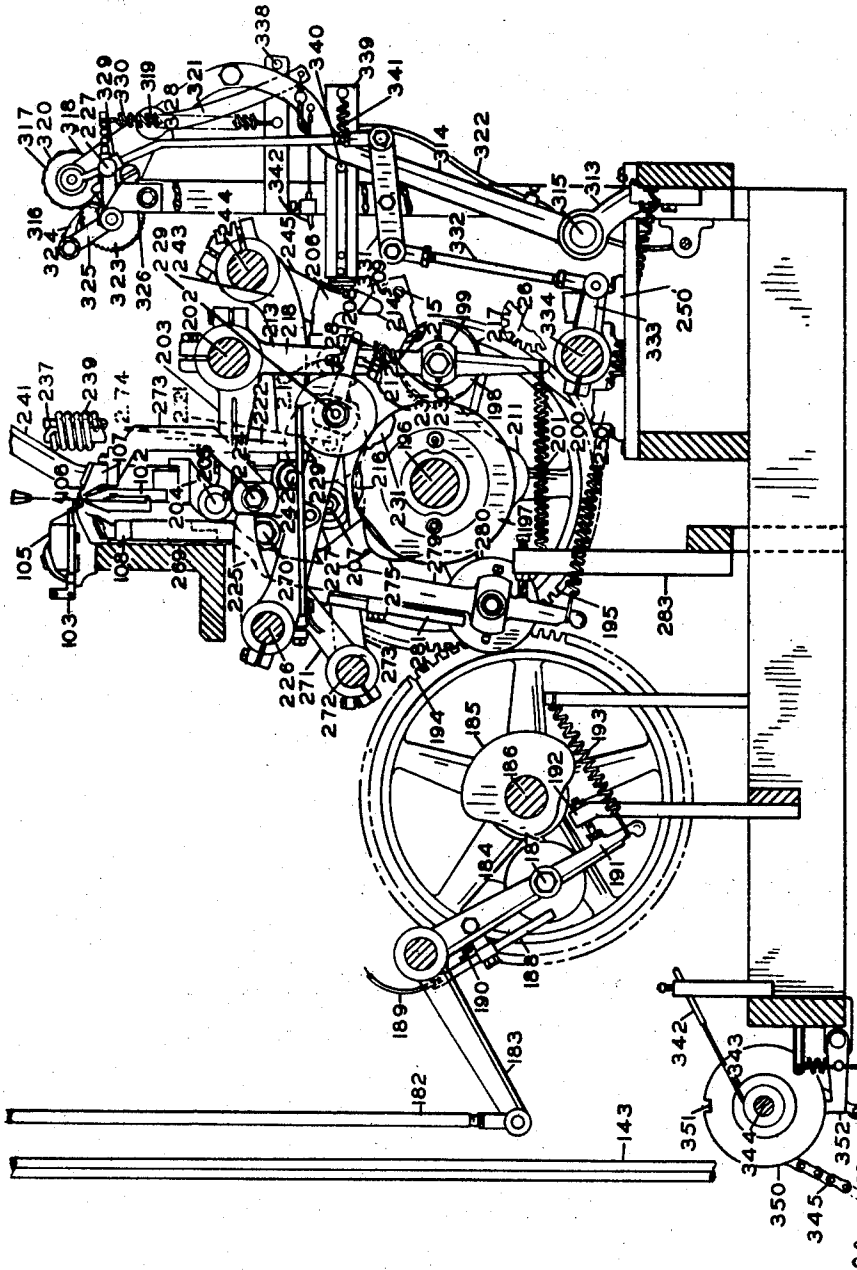


FIG 4

Inventor

ARTHUR J. COBERT

By

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 5

Fig. 4a.

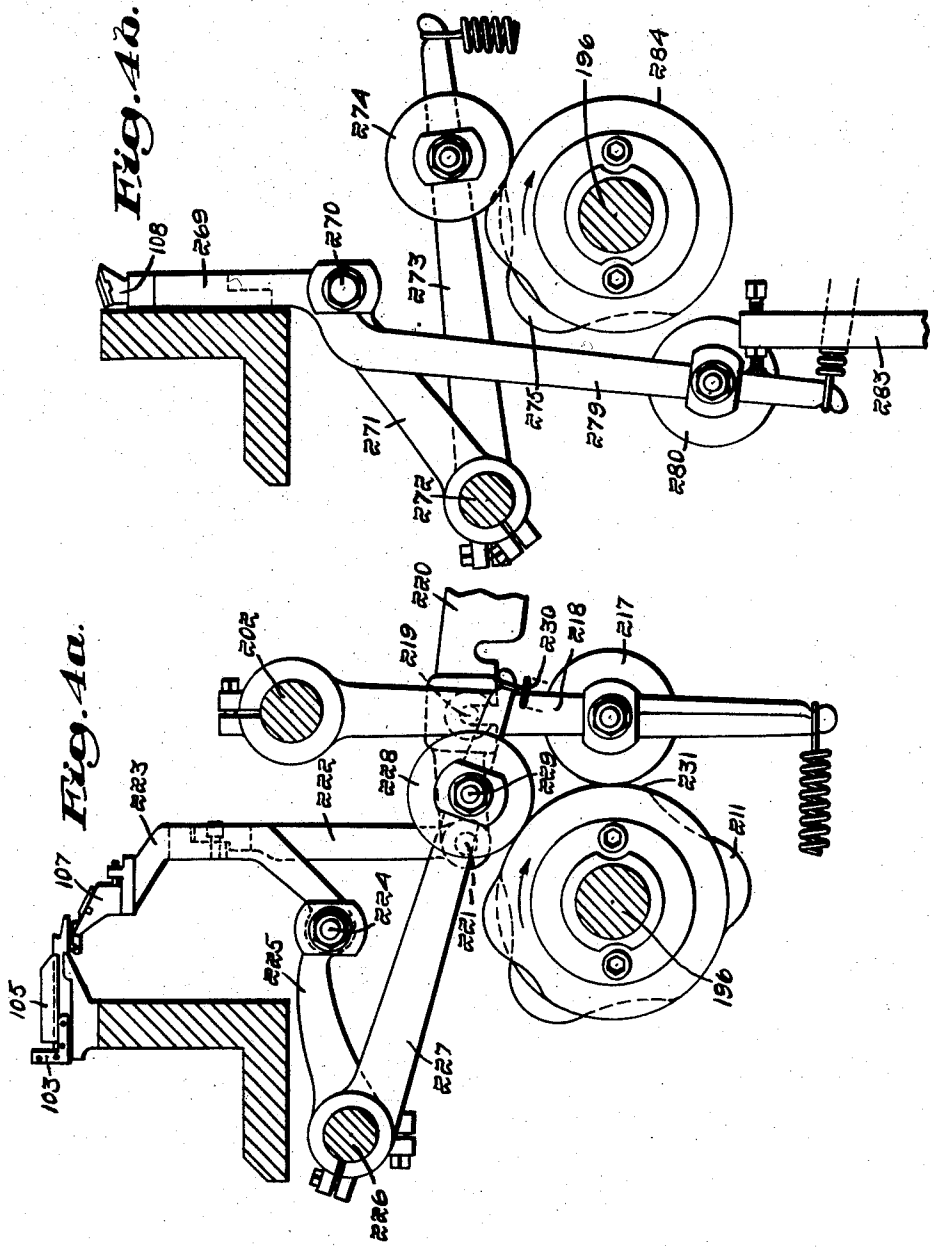


Fig. 4a.

Inventor:
Arthur J. Cobert,
by Maxwell Fish
Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 6

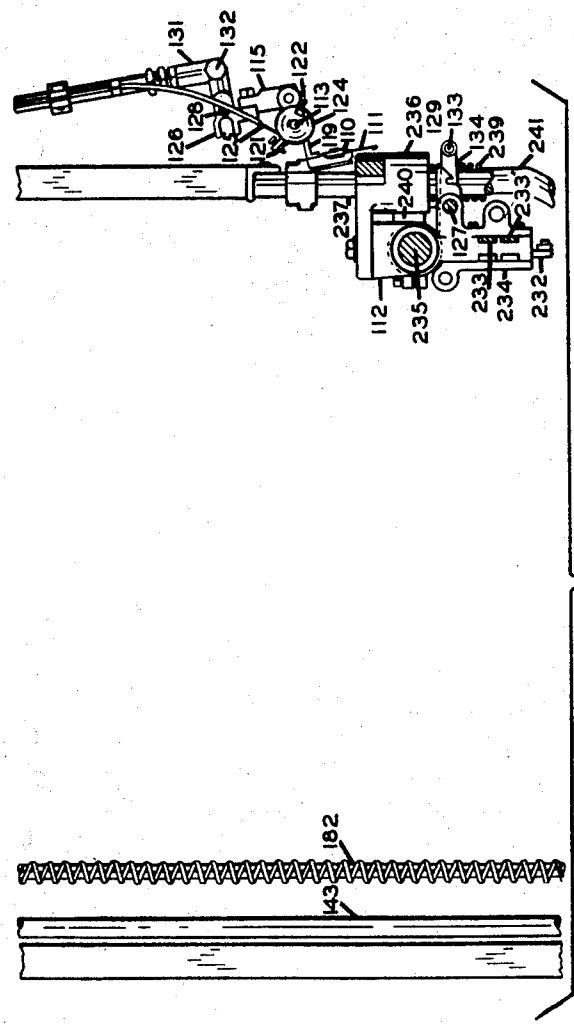


FIG 5

Inventor

ARTHUR J. COBERT

By Edw. T. Newton

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 7

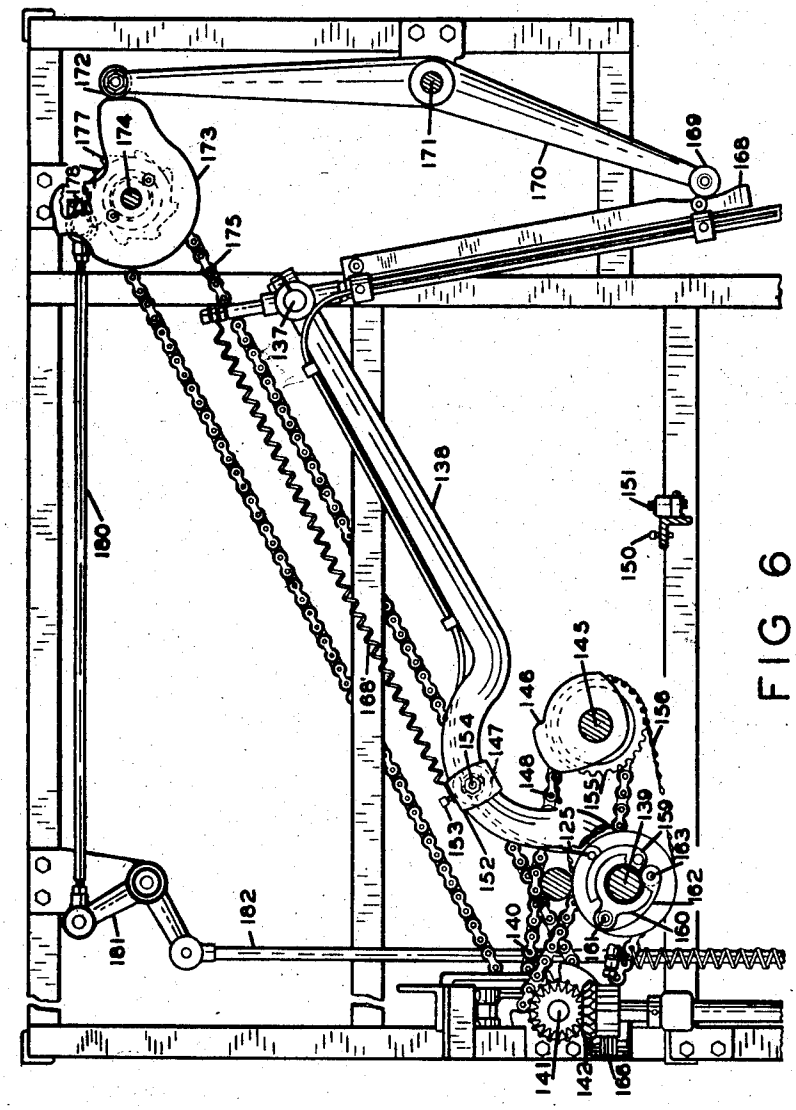


FIG 6

Inventor

ARTHUR J. COBERT

By

Attorney

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AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 8

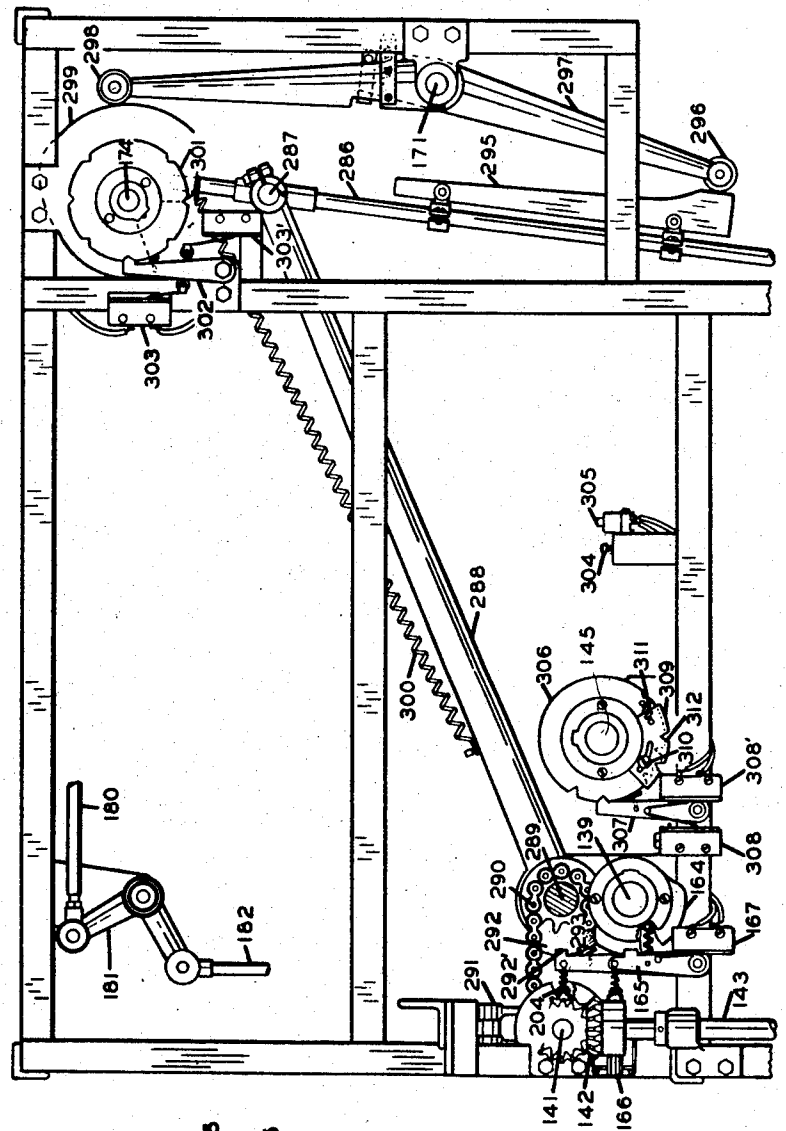


FIG 8

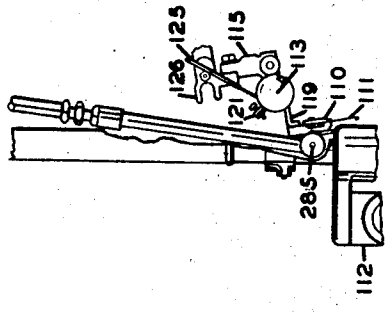


FIG 7

Inventor

ARTHUR J. COBERT

Edwin C. Hutchison

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 9

FIG 9

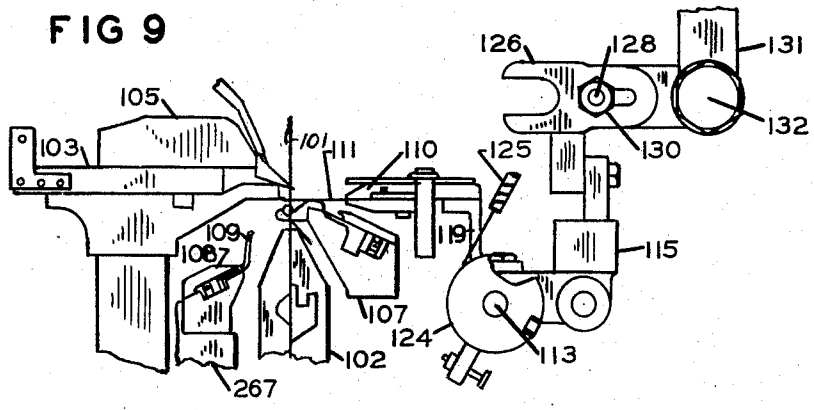


FIG 10

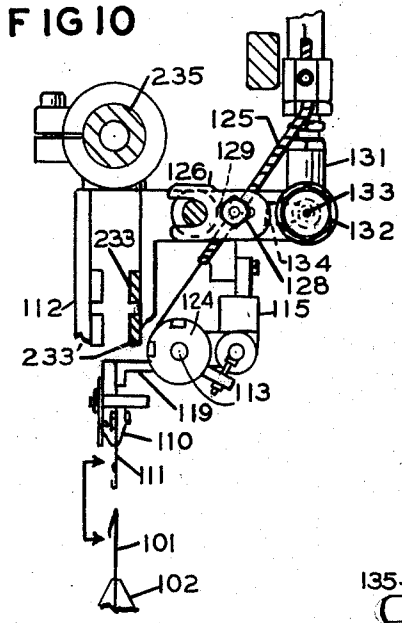


FIG 12

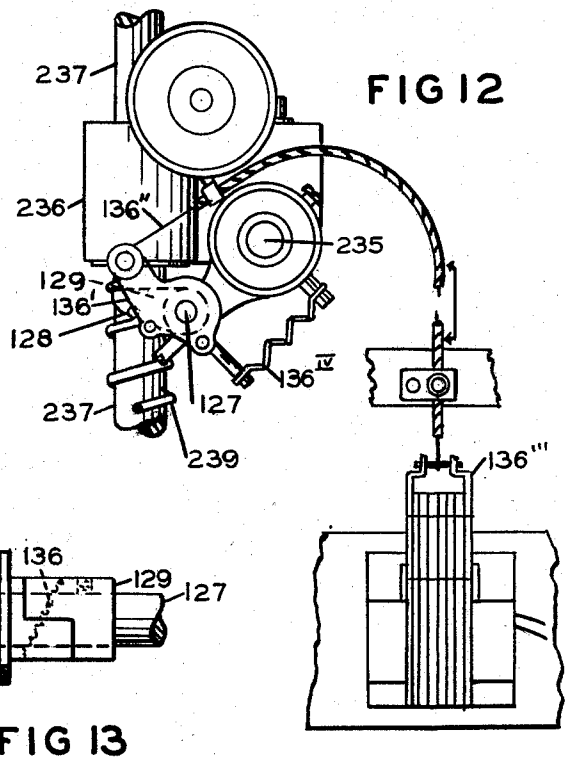


FIG 13

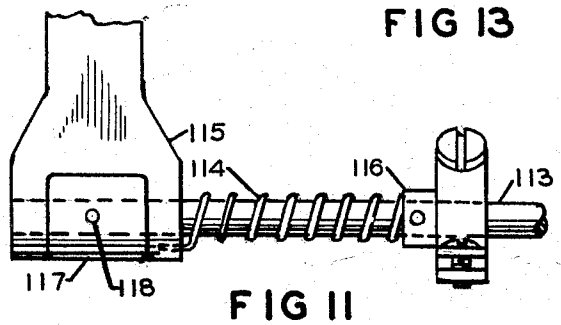


FIG 11

INVENTOR.
ARTHUR J. COBERT
BY Edwin T. Newton
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Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 10

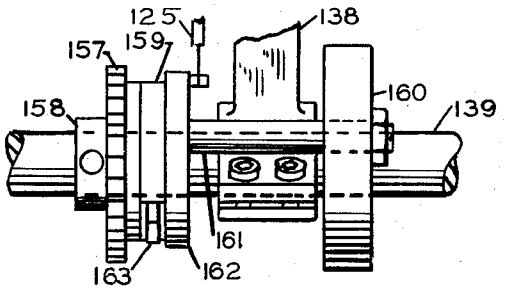


FIG 14

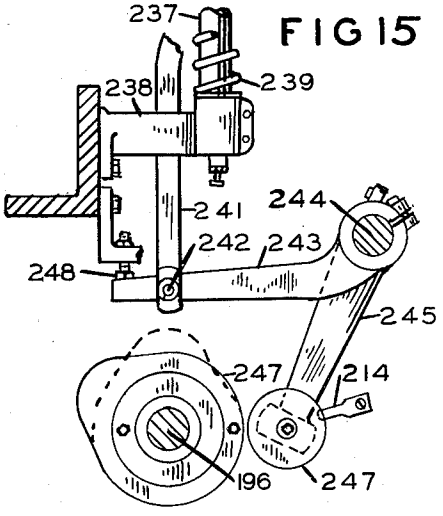


FIG 15

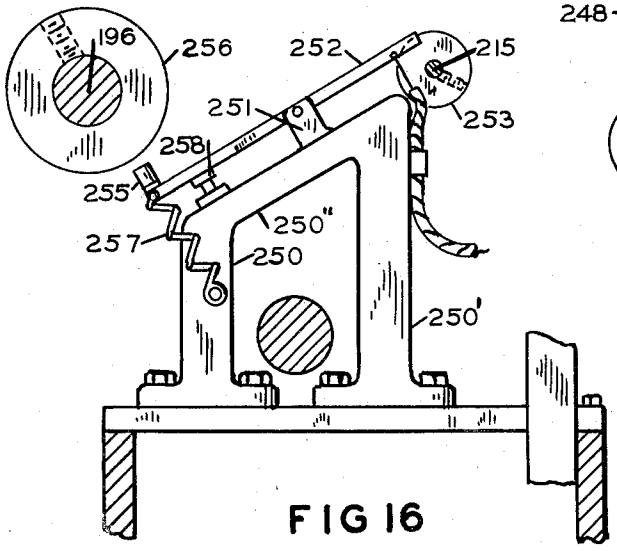


FIG 16

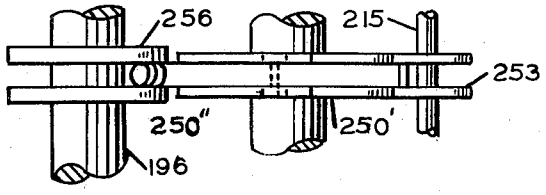


FIG 17

INVENTOR.
ARTHUR J. COBERT
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Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 11

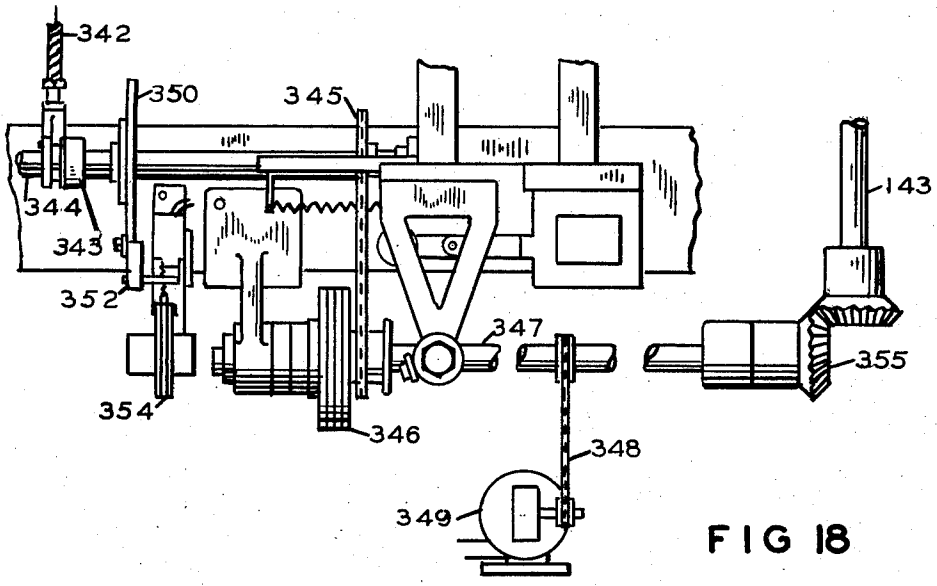


FIG 18

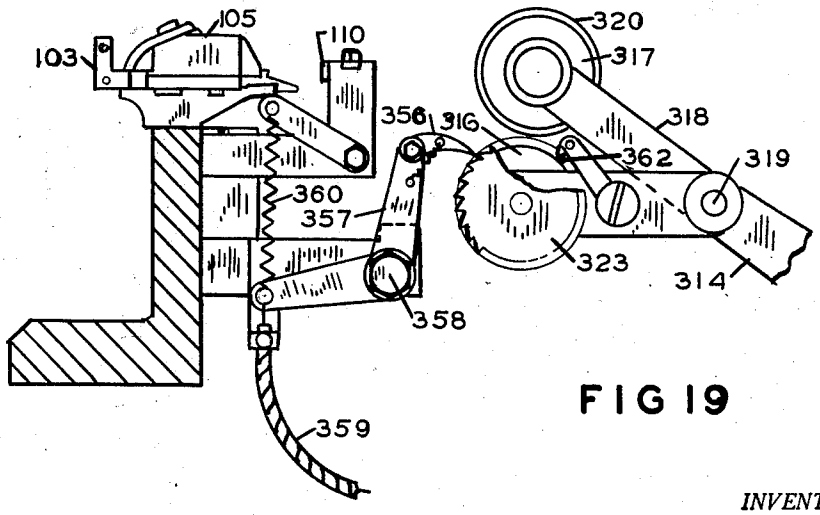


FIG 19

INVENTOR.

ARTHUR J. COBERT

BY

ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 12

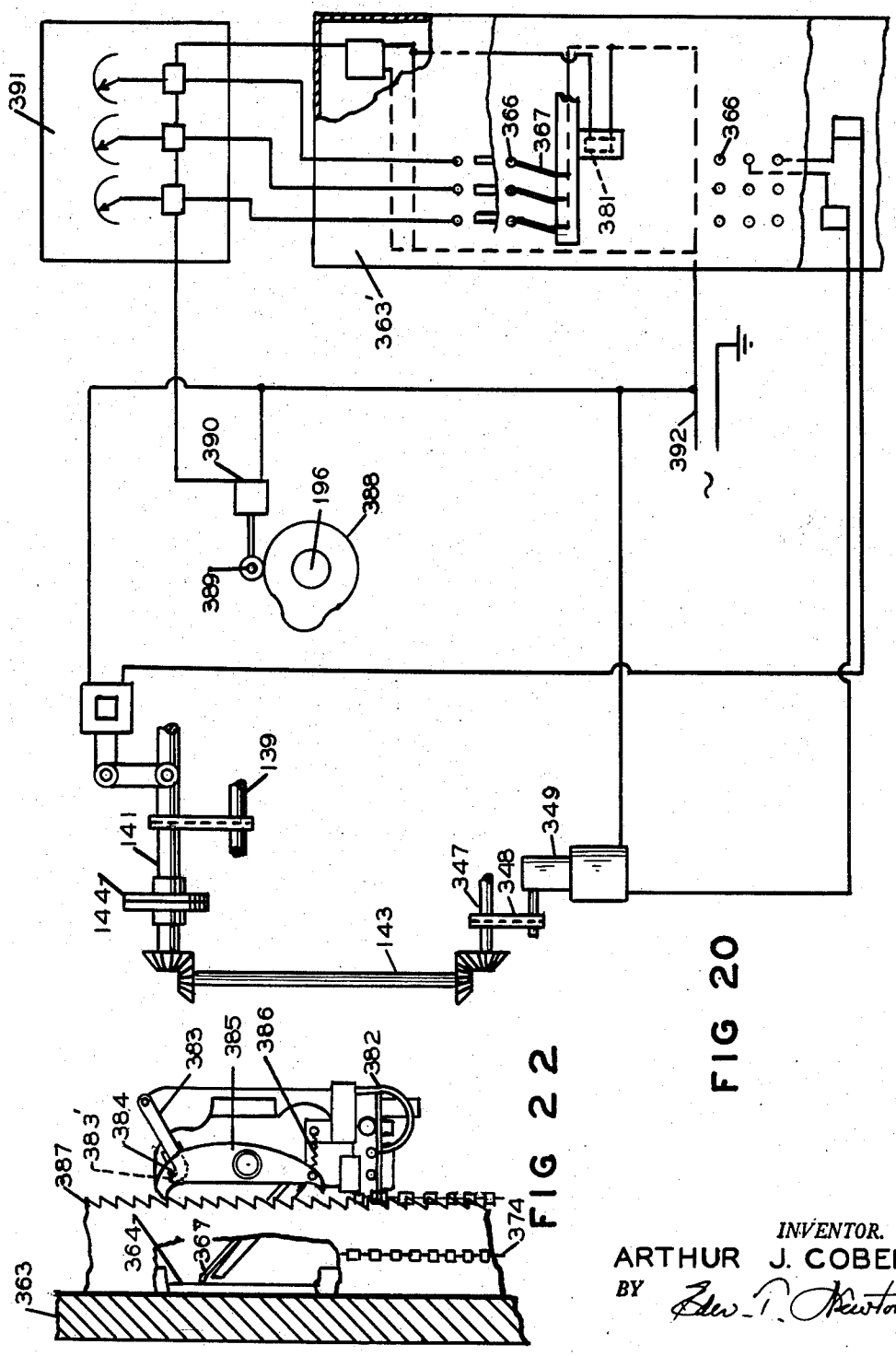


FIG 20

FIG 22

INVENTOR.
ARTHUR J. COBERT
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ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 13

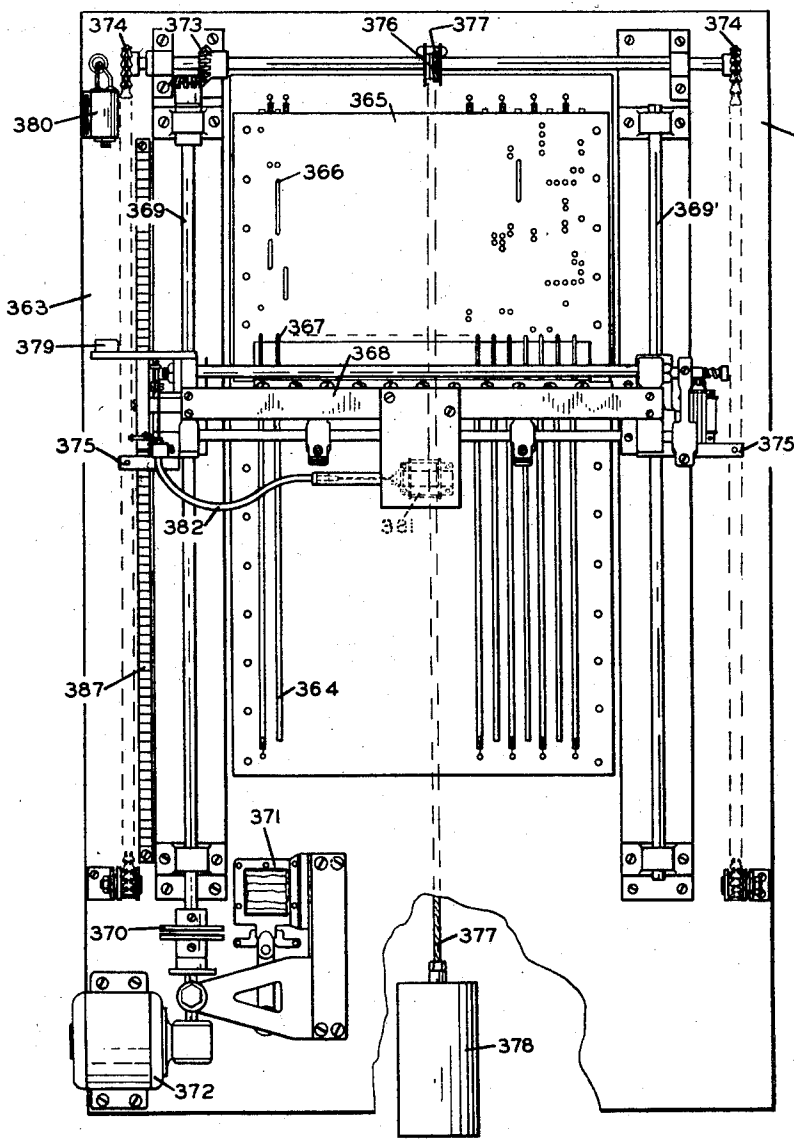


FIG 21

Inventor

ARTHUR J. COBERT

By

Attorney

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 14

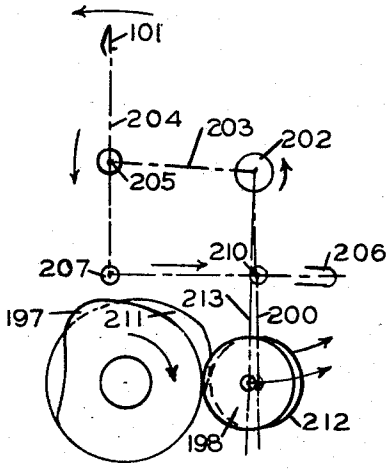


FIG 23

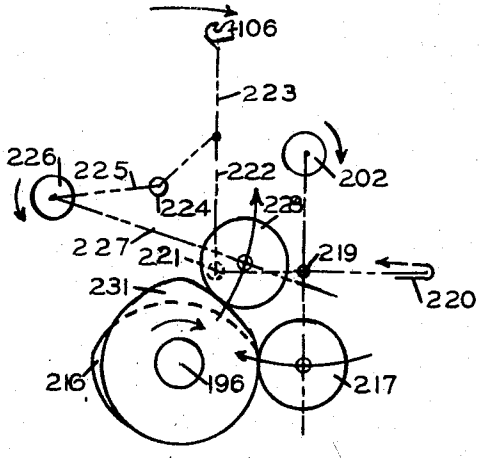


FIG 24

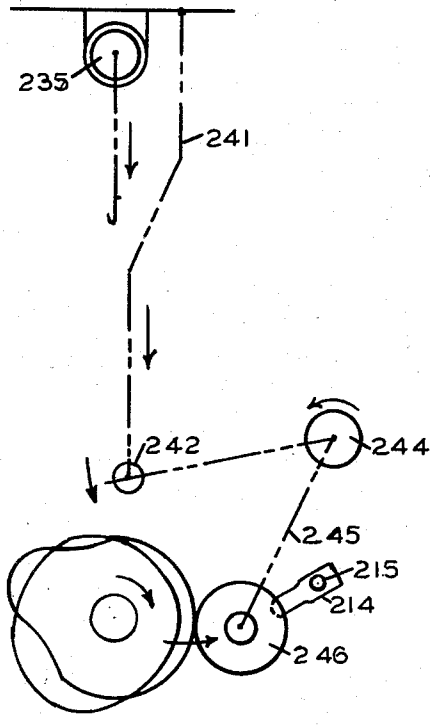


FIG 25

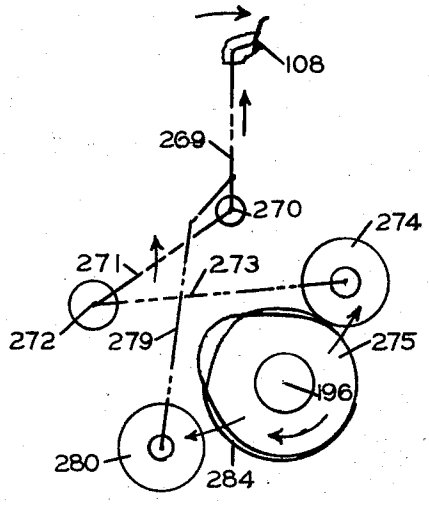


FIG 26

INVENTOR.
ARTHUR J. COBERT
BY
Edwin C. Newton
ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 15

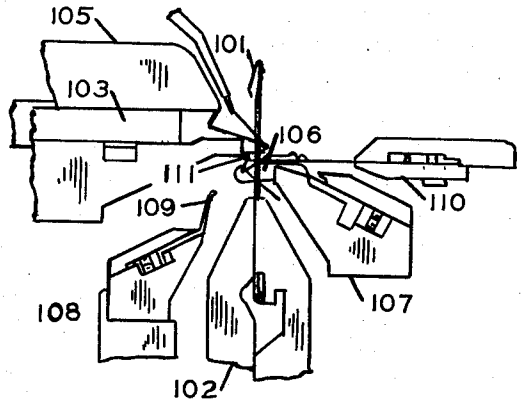


FIG 27

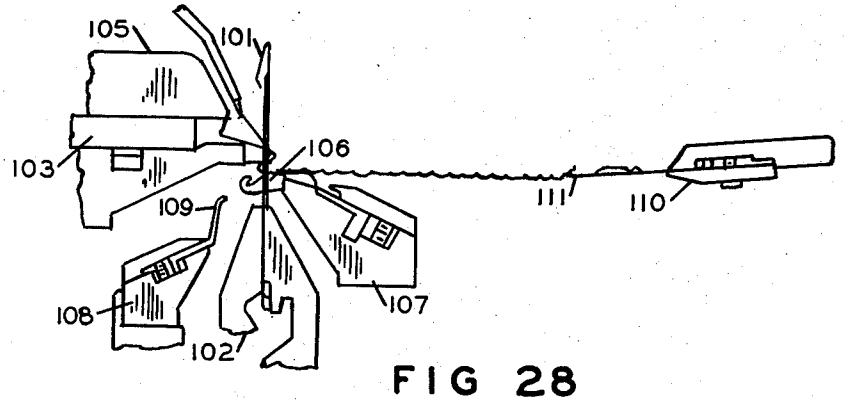


FIG 28

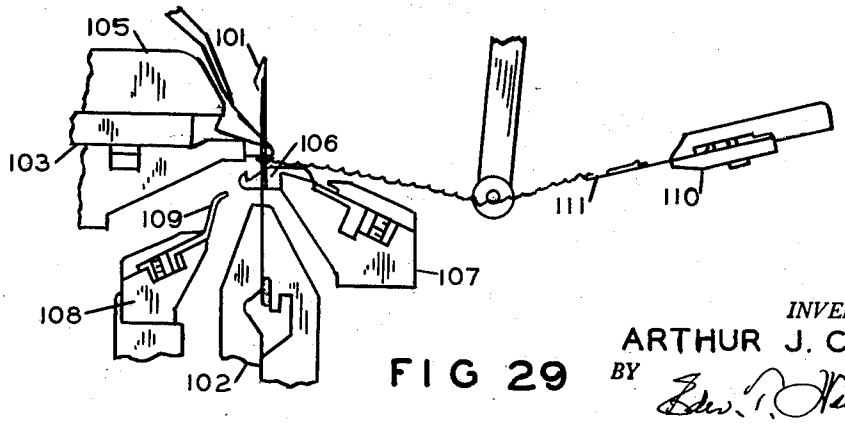


FIG 29

INVENTOR.
ARTHUR J. COBERT
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ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 16

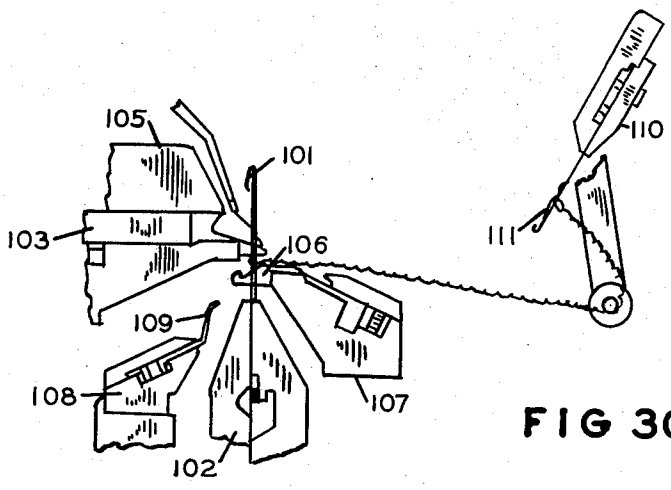


FIG 30

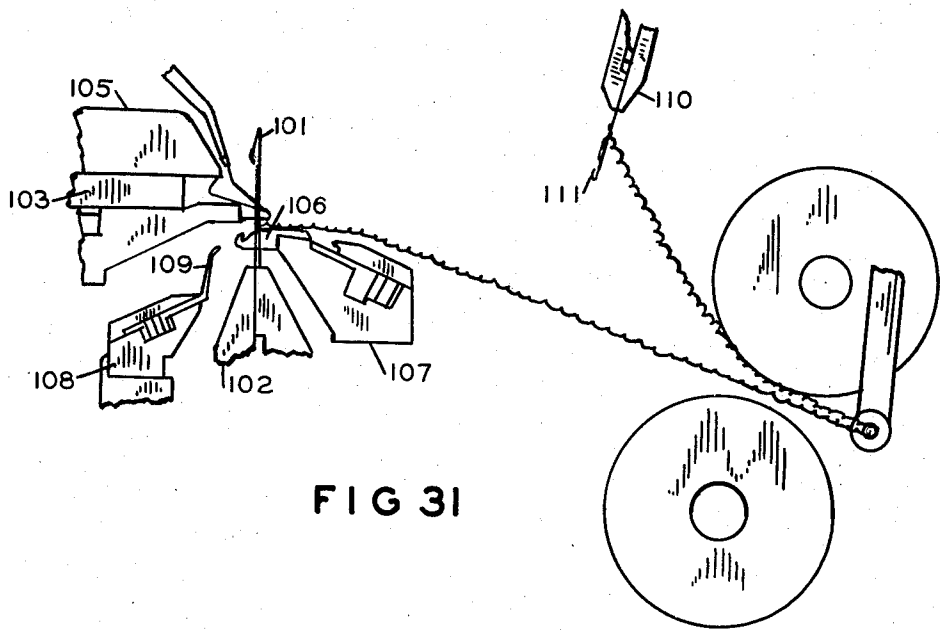


FIG 31

INVENTOR.
ARTHUR J. COBERT
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ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Filed June 21, 1952 19 Sheets-Sheet 17

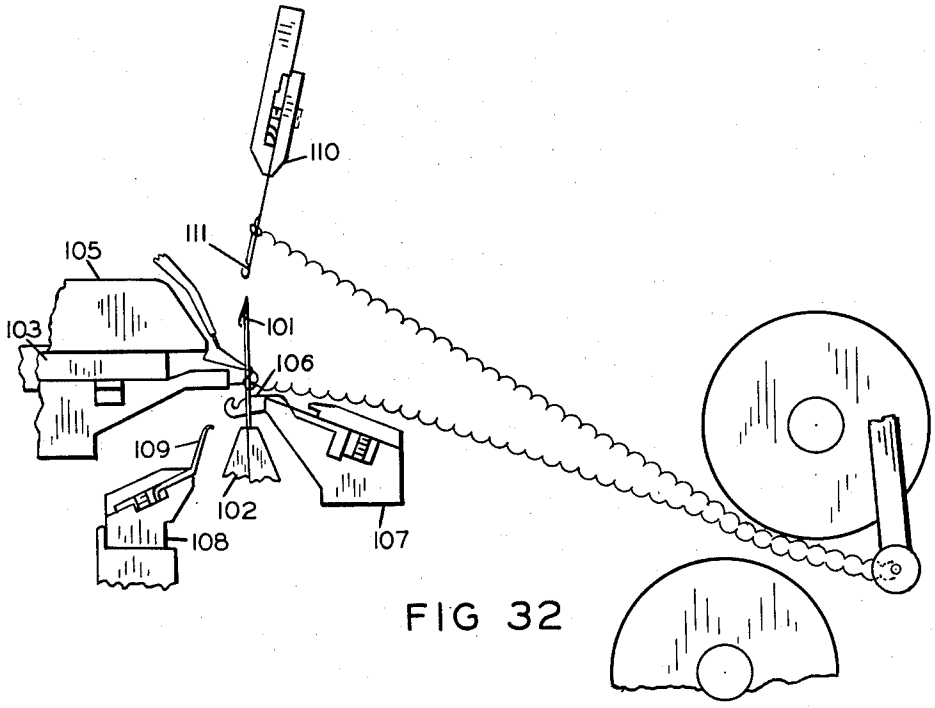


FIG 32

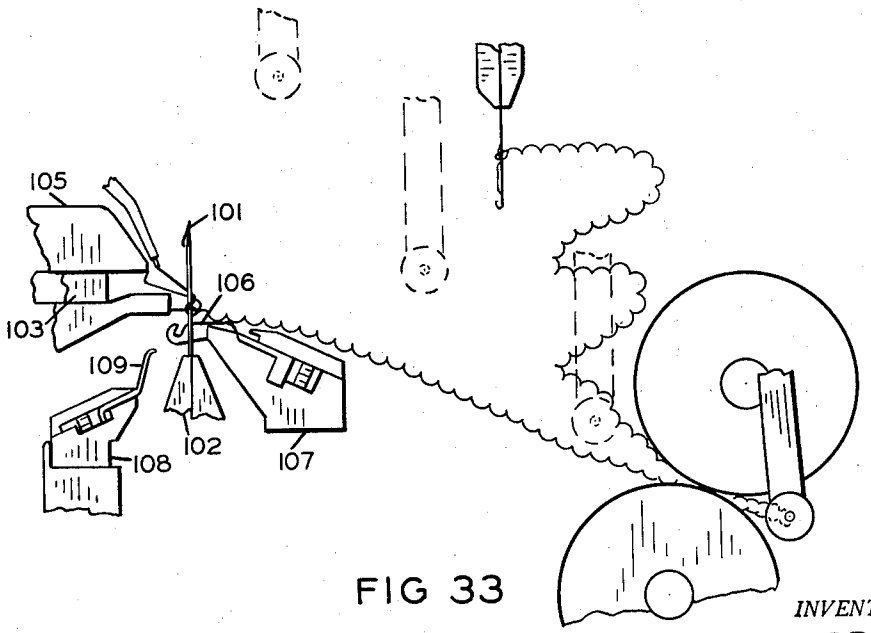


FIG 33

INVENTOR.
ARTHUR J. COBERT
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Nov. 18, 1958 A. J. COBERT 2,860,501
AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES
Filed June 21, 1952 19 Sheets-Sheet 18

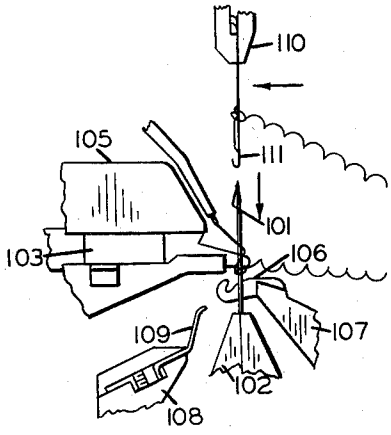


FIG 34

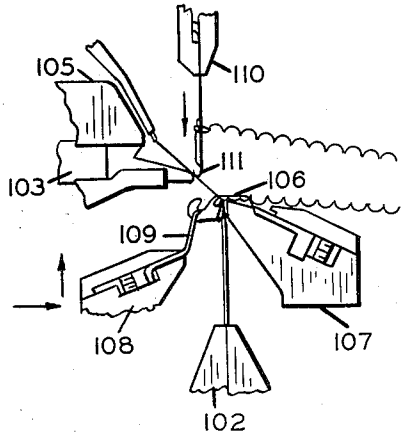


FIG 35

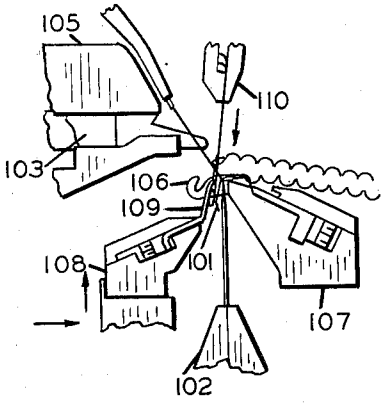


FIG 36

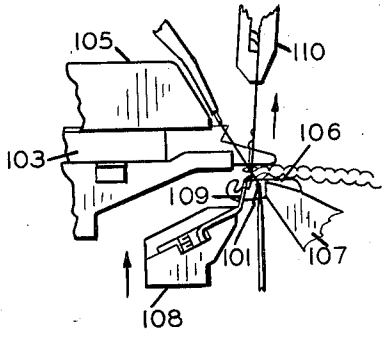


FIG 37

INVENTOR.
ARTHUR J. COBERT
BY Edw. T. Newton
ATTORNEY

Nov. 18, 1958 A. J. COBERT 2,860,501
AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES
Filed June 21, 1952 19 Sheets-Sheet 19

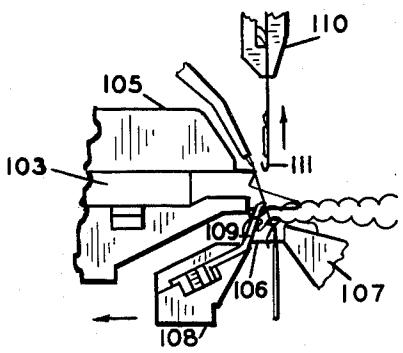


FIG 38

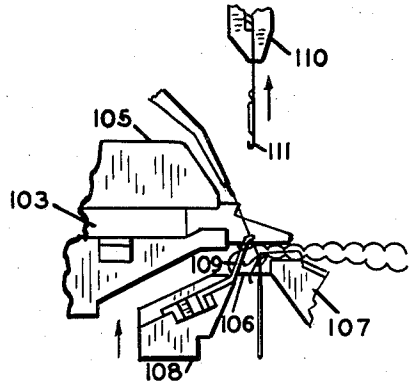


FIG 39

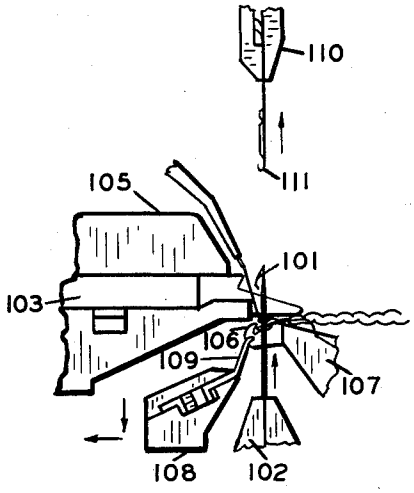


FIG 40

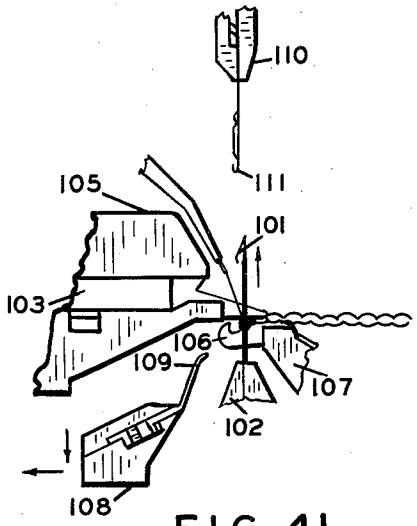


FIG 41

INVENTOR.
ARTHUR J. COBERT
BY

ATTORNEY

United States Patent Office 2,860,501
Patented Nov. 18, 1958

2,860,501

AUTOMATIC WELT TURNING MECHANISM FOR STRAIGHT BAR KNITTING MACHINES

Arthur J. Cobert, Chattanooga, Tenn.

Application June 21, 1952, Serial No. 294,804

32 Claims. (Cl. 66—96)

This invention relates to straight bar knitting machines, and more particularly to automatic welt turning mechanism for straight bar knitting machines.

Prior art welt turners require manual operation at the beginning of each knitting cycle with consequent loss of time and the necessity of manual labor. It is, therefore, an object of my invention to provide welt turning mechanism which is completely automatic and in which there is no loss of time when changing from one cycle to the next.

Another object of my invention is to provide a straight bar knitting machine having automatic welt turning mechanism to produce stockings which are essentially the same as if made by hand-turned apparatus, and which have the same fine appearance with no larger openings or bulkiness at the junction of transfer.

Another object of my invention is to provide a straight bar knitting machine having automatic welt turning mechanism which is electrically controlled and is extremely safe in operation, being provided with safety switches to assure synchronization at the moment of transfer.

Another object of my invention is to provide an automatic straight bar knitting machine which is positive and efficient in its operation, and which is simple to adjust and maintain.

Other and further objects and advantages of my invention will become apparent from the following description taken in conjunction with the accompanying drawings in which like characters of reference designate the same parts throughout the several views, and wherein:

Fig. 1 is a partial front elevation showing the lower section of a knitting machine embodying my invention.

Fig. 2 is a partial elevation showing the middle section of a knitting machine embodying my invention.

Fig. 3 is a partial elevation showing the upper section of a knitting machine embodying my invention.

Fig. 4 is a cross-sectional view taken along the line 4—4 in Fig. 1.

Figure 4*a* is a detail view on a somewhat enlarged scale of the knock-over bit bar supporting and actuating mechanism, the parts being substantially in the position shown in Fig. 4.

Figure 4*b* is a detail view on a somewhat enlarged scale of the transfer bar and its supporting and actuating mechanism, the parts being substantially in the position shown in Fig. 4.

Fig. 5 is a cross-sectional view taken along the line 5—5 in Fig. 2.

Fig. 6 is a cross-sectional view taken along the line 6—6 in Fig. 3.

Fig. 7 is an end view of a detail of the welt bar assembly.

Fig. 8 is an end view of the upper portion shown in Fig. 3.

Fig. 9 is a side view of a detail showing the welt bar in the hook-up or starting position.

Fig. 10 is a side view of a detail showing the welt bar locked in the position for transferring the first row of loops.

Fig. 11 is a side view of a portion of the welt bar assembly.

Fig. 12 is a side view looking from the right hand end of the machine of a detail showing the locking mechanism for the welt bar assembly.

Fig. 13 is a front view of a detail showing the latch for the welt bar locking mechanism.

Fig. 14 is a rear view of a detail showing mechanism for tilting the welt bar.

Fig. 15 is a side view of a detail showing mechanism for controlling vertical movement of the narrowing frame.

Fig. 16 is a side view of a detail showing mechanism for shifting cam followers to the welt turning cams.

Fig. 17 is a top view of a portion of the mechanism shown in Fig. 16.

Fig. 18 is a rear view of a detail showing mechanism for moving the take-up rollers in and out.

Fig. 19 is a side view of a detail showing mechanism for rotating the take-up rollers.

Fig. 20 is a schematic view of the main control mechanism.

Fig. 21 is a front elevation of the electrical control mechanism.

Fig. 22 is a side view of a detail of the control carriage.

Fig. 23 is a diagrammatic view of the needle bar motion.

Fig. 24 is a diagrammatic view of the knocking over bar motion.

Fig. 25 is a diagrammatic view of the narrowing frame motion.

Fig. 26 is a diagrammatic view of the welt transfer bar motion.

Figs. 27 through 41 are pictorial views showing successive steps in the welt-turning cycle.

CONSTRUCTION

Referring now in detail to the embodiment chosen for purpose of illustration, needles **101** are arranged in the customary manner in needle bar **102**, and between the needles there are arranged in the customary manner the usual sinkers **103** and dividers **104** which are mounted in the sinker head **105** (see Figs. 4 and 27–41, inclusive). For the purpose of this invention the customary knocking over bits **106** have been arranged on the front side of the needle bar, rather than on the back side as in the standard knitting machine, and are here mounted in the knocking over bar **107**.

In the space that is usually occupied by the knocking over bar in the conventional knitting machine, I have placed a new bar which I term a transfer bar **108** in which is mounted a series of slightly curved transfer points **109**. The welt bar **110** carrying welt hook **111** is suspended from the upper part of the machine and placed in a position somewhat above the narrowing frame **112** in such manner as not to be an obstruction to the free operation of the machine. The inoperative position of the welt bar just described is best shown in Fig. 5. The welt bar **110** is pivotally mounted on shaft **113** (see Figs. 2, 7 and 9–13, inclusive), for the purpose of placing the bar in either horizontal or vertical position as needed in the operation of the welt turner and as more fully described hereinafter. Coil spring **114** (see Fig. 2) is wound about the shaft **113** in such manner as to bias the welt bar, with the aid of gravity, in the vertical position shown in Fig. 5. For this purpose, the spring **114** has one end anchored in a stationary part of hinge **115**, and the other end anchored in collar **116** which is fixed to the shaft **113**. The shaft **113** is pivotally mounted in the hinge **115** and is held therein by means of collar **117** which is fixed to

the shaft 113 by means of set screw 118 (see Figs. 2 and 5). This collar 117 carries the hinge arm 119 upon which the welt bar 110 is mounted. Also mounted on shaft 113 are a pair of toggle levers 120 and 120' which carry adjustable set screws 121 and 122 which are used for the purpose of limiting the movement of the welt bar in the horizontal and vertical positions, respectively. These stops work against support shaft 123 which is mounted in stationary hinge parts 115 and 115' and secured thereto by set screws as shown in Fig. 2.

The rotation of the welt bar is accomplished through a pulley 124 about which is wound a Bowden wire 125.

To the upper part of stationary hinge part 115 is fastened a yoke 126 which is used for the purpose of locating the welt bar, when it is in the welt turning position, by fastening it onto rock shaft 127. This yoke permits accurate adjustment of the height of the welt bar in relation to the needle height. Yoke 126 carries pin 128 which engages latch 129 on rock shaft 127 to secure the welt bar against horizontal movement with respect to the needles, as shown in Fig. 11. Also, pin 128 is mounted in an elongated hole which permits limited adjustment of the horizontal movement of the welt bar in relation to the needle bar. To accomplish this limited adjustment, the nut 130 on pin 128 can be loosened and then tightened to attain the desired setting.

Attached to yoke 126 is a vertical welt support rod 131 fastened by means of machine screw 132 which serves a double purpose; it permits accurate adjustment of the angle between yoke 126 and vertical welt support rod 131 and at the same time acts as a stop plate for the lateral movement of the welt bar. In order to limit lateral movement of the welt bar and to keep it adjusted in perfect register with the needles, set screw 133 is mounted on bracket 134 which in turn is mounted on rock shaft 127. When the welt bar is in the welt turning position, set screws 133 and 133' are adjusted in such manner as to produce substantially zero tolerance between stop plate 132 and 132'.

In reference to latch 129 which is mounted on shaft 127 in close proximity to latch 129 is stop collar 135 which is secured to shaft 127 by a set screw. Latch 129 and stop collar 135 are held close together by means of spring 136. The action of latch 129 is as follows: when pin 128 comes into engagement with latch 129, latch 129 is forced upwardly because of the angle on the front of it. As pin 128 arrives into the slot of latch 129, spring 136 pulls latch downwardly and secures pin 128 in the slot. This spring 136 is relatively light so that very little pressure is needed to raise latch 129. However, when it is needed to unlock latch 129, a rocking movement of shaft 127 will force stop collar 135 against the projection of latch 129 raising it to unlock the welt bar. The individual springs 136 are used on the latches 129, 129' so that a very light pressure can be used in locking the welt bar in the welt turning position. However, since it is necessary to raise all latches simultaneously, the construction described is used successfully. Since stop bracket 134 is also mounted upon rock shaft 127, it will be seen that this stop bracket 134 will also be raised at the time that the latches are unlocked. The raising of these stop brackets has no bearing upon the action of the welt bar but this arrangement saves an additional shaft.

The vertical welt support rod 131 is pivotally mounted at 137 to the horizontal welt support lever 138 (see Fig. 6) which is fixed to the welt bar assembly shaft 139 which is mounted for oscillatory movement. Welt bar assembly shaft 139 is rotated through its arc by means of chain drive assembly 140 which receives its motive power from horizontal transmission shaft 141 through miter gears 142 and vertical transmission shaft 143. The engagement between the welt bar assembly shaft 139 and horizontal transmission shaft 141 is accomplished by solenoid operated clutch 144 which is constructed in a manner similar to the construction of the clutch shown in Fig. 13 and hereinafter described.

The vertical movement of the welt bar is controlled in two ways. The first, by means of horizontal welt support lever 138 through its shaft 139 and also by welt bar positioning shaft 145 (see Fig. 6). Mounted on welt bar positioning shaft 145 is a cam 146 which is brought into contact with cam follower 147 which is mounted in an intermediate position on horizontal welt support lever 138. When lever 138 is lowered by means of shaft 139 cam follower 147 comes to rest on cam 146. The rotation of shaft 145, by means of chain assembly 148, is accomplished by means of a solenoid operated clutch 149 from horizontal transmission shaft 141.

There are two reasons why the welt bar must be operated from two different shafts. It is not possible to rotate a shaft of this character accurately through a given arc by means of a chain and sprocket assembly. This means can be used only for the purpose of raising and lowering the welt bar assembly where no close synchronization or accurate movement is required. For example, if it is necessary to lower the welt bar assembly from its uppermost position to its lowest point, the chain and sprocket means is satisfactory even though the action during this movement is not too smooth in operation. When the welt bar assembly reaches its lowest point, it will hit a different adjustable stop 150 and its motion is released by switch 151, in the operating circuit of solenoid operated clutch 149. However, when it is necessary to raise the welt bar to its welt turning position, the described method cannot be relied upon to stop the welt bar at the proper level. Hence shaft 145 was designed to accomplish this purpose. Assuming that the cam follower 147 is at the lowest point of cam 146, it is readily seen that by rotating cam 146 a smooth and accurate movement for the raising of the welt bar can be accomplished and the height of the welt bar controlled accurately.

Cam follower 147 is carried by the cast shoulder 152 on welt support lever 138. The cam follower is accurately adjustable on this shoulder by means of set screw 153 which operates against the cam follower shaft 154 which is movable in the elongated slots provided in the shoulder 152, as seen in Fig. 6.

Mounted on shaft 145 in close proximity to cam 146 is a ladder chain sprocket 155 which is secured to shaft 145 by a set screw. Ladder chain 156 connects sprocket 155 to sprocket 157 which is mounted for free rotation on shaft 139. Sprocket 157 is connected to a cam hub 158 which in turn has secured upon it cam 159. It can be seen that by rotating shaft 145, which in turn moves the ladder chain assembly, cam 159 will also be rotated. Mounted on shaft 139 and in close proximity to the aforementioned assembly is a pivoted lever arrangement composed of retaining bracket 160, stud 161, lever 162 and roller 163. This assembly is mounted so that the roller will be in engagement with cam 159. Cam 159 has a high point and a low point, both of which are quite broad. When cam 159 is rotated while roller 163 is on the low point of the cam it will force the lever to a new position, as the high point of the cam is reached, to pull Bowden wire 125, and this movement is transferred to pulley 113 which rotates welt bar 110 through approximately a 90° arc. Since the cam arrangement is mounted to shaft 139 it can be seen that rotation of shaft 139 will produce a like movement in the lever assembly. This arrangement has been selected to be able to move bracket 138 through an arc without disturbing the position of the welt bar provided that the cam 159 and roller 163 are in such position that this rotation will not affect the tension on the Bowden wire 125, either when the roller is on the high point of the cam or on the low point of the cam and not near the rise of the cam itself. In actual operation, when it is desired to lower the welt bar, a combination movement

of welt bar shaft **139** and shaft **145** will produce the change in the tension of the Bowden wire, tilting the welt bar approximately 90°. However, once this new position is reached, continued downward movement of the welt bar assembly will not affect the tension on the Bowden wire **125** and the rotation of the lever **162** continues while roller **163** is on the low part of the cam. Later, at the time when it is necessary to raise the welt bar to the welt turning position, the cam arrangement is timed in such manner that the arm **138** is raised by cam **146** and this same rotation will rotate cam **159**, thus changing the position of the welt bar to a vertical from a horizontal position. This arrangement permits perfect synchronization of the raising of the welt bar, and at the same time tilting to the vertical position.

In order to hold the welt bar assembly locked in the uppermost or inoperative position, lock dial **164** is mounted on shaft **139**, and the pivoted lock lever **165** is arranged for releasable engagement with the square cut notch in the lock dial **164**. Lock lever **165** is disengaged from lock dial **164** by means of a solenoid **166** at the moment when it is necessary to lower the welt bar assembly to the operative position. There are no other notches on lock dial **164** since it is not necessary to have these at any time while the welt bar is in the operative position. The release of lock lever **165** is simultaneous with the engagement of clutch **144** when it is desired to place the welt bar assembly in the operative position. When the finger on lock lever **165** drops into the notch of lock dial **164**, the lock lever opens switch **167** to energize the solenoid operated clutch **144** and stops the motion of the welt bar assembly.

I have just explained the construction for operation of the welt bar assembly in its vertical movement including the tilting of the welt bar from its vertical to horizontal position and vice-versa. I will now explain the construction provided for the horizontal movement of the welt bar assembly. The combination movements vertically and horizontally produce the necessary motions for engaging the assembly either in the starting position of the welt turning position and retracting the assembly back to its inoperative position.

Mounted on vertical welt support rod **131** is a bayonet cam arrangement **168**. Arranged for engagement with bayonet cam **168** is a cam follower **169** which is mounted on horizontal welt control arm **170** which is fulcrumed for rocking motion on shaft **171** and is provided on its opposite end with cam follower **172** which is arranged for engagement with horizontal welt motion cam **173** which is mounted for rotation with shaft **174**. Shaft **174** is adapted for rotation in two different manners. One method of rotation of the shaft **174** is by means of the sprocket and chain arrangement **175** (see Fig. 6) which is operatively connected to horizontal transmission shaft **141** through solenoid operated clutch **176**, shown in Fig. 3. The other method of rotation of the shaft **174** is by means of ratchet wheel **177** which is mounted on shaft **174** for actuation by pawl **178** which is carried by bracket **179** which is mounted for free rotation on shaft **174**. Attached to the bracket **179** is the reciprocating rod **180** which is pivotally mounted at its opposite end on pivoted lever **181** which is connected to the upper end of push rod **182**. The lower end of push rod **182** is pivotally connected to the lever **183** (see Fig. 4) for reciprocating motion thereby. Motion is imparted to the lever **183** by means of cam follower **184** which is mounted on an arm of the lever **183** for selective engagement with welt bar horizontal motion control cam **185** which is mounted on auxiliary cam shaft **186**. Cam follower **184** is mounted for free rotation and slidable movement on stud **187**. In order to selectively engage cam follower **184** with cam **185**, it is slid along stud **187** by means of the pivoted yoke **188** to which Bowden wire **189** is operatively connected. Bowden wire **189** is connected for operation by a solenoid

(not shown). The cam follower **184** is biased to disengage it from cam **185** by means of spring **190**. To provide clearance between cam follower **184** and cam **185** a stop screw **191** is mounted on adjustable stop bracket **192** for arresting engagement with the free extremity of lever **183**. Lever **183** is biased against stop screw **191** by means of spring **193**. The purpose of the cam arrangement just explained for moving the welt bar horizontally is to insure perfect synchronization of the horizontal movement of the welt bar in relation to the needle movement at the beginning of the knitting cycle. Since auxiliary cam shaft **186** is geared to the main cam shaft and since the needle bar arms are controlled from the main cam shaft, it can be readily seen that the movement of the welt bar will be perfectly synchronized at the start of the knitting cycle.

Rotation of auxiliary cam shaft **186** is accomplished by means of spur gear **194** (see Fig. 4) mounted thereon and enmeshed with spur gear **195** which is in turn mounted on main cam shaft **196**. Main cam shaft **196** is driven by means of a cam shaft drive motor (not shown).

Engagement of the welt bar at the initial or starting course of knitting is first of all accomplished by the rotation of cam **185**; however, it must be remembered at this time that the welt bar assembly must be lowered to its operative position and the welt bar tilted to a horizontal position. Engagement of the welt bar with the needles then takes place by a horizontal movement from cam **185**. At the same time when this movement takes place, the needle bar **102** is made to move downward in order to form the first row of loops. This first row of loops is engaged by the welt hooks. The needle bar **102** has two distinct movements, one vertically and one horizontally, the combination of which will roughly describe a figure "8."

The vertical motion of the needle bar is controlled by the following mechanism. Needle bar vertical movement cam **197** (see Figs. 1 and 4) is mounted for rotation with shaft **196**. Arranged for operative engagement with cam **197** is cam follower **198**. Cam follower **198** is adjustably mounted on boss **199** which is a part of lever arm **200**. Cam follower **198** is adjustable on boss **199** in a manner similar to the adjustment of cam follower **147** on the shoulder **152**. Cam follower **198** is biased into engagement with cam **197** by means of spring **201**. Lever arm **200** is fixed on needle bar rock shaft **202** for imparting oscillatory motion thereto. The rocking motion of shaft **202** is imparted to split lever arm **203** which is clamped thereto. Needle bar support bracket **204** carries at its upper end the needle bar **102**, and is pivotally attached to the free end of split lever arm **203** at the pivot point **205**. At the lower end of the needle bar support bracket **204** there is pivotally attached a needle bar handle **206** for manual manipulation of the needle bar. The handle **206** is adjustably mounted on the lower end of the needle bar support bracket **204** by means of the stud **207** and is adjustable in a manner similar to the adjustment of the cam follower shaft **154**. The handle **206** is provided along its lower edge with a pair of notches **208** and **209** for selectively positioning and locking the needle bar **102** in operative and inoperative positions, respectively, by engaging one of the notches **208**, **209** over the stud **210**.

Also mounted on the main cam shaft **196** is a needle bar horizontal motion cam **211** against which there is biased a cam follower **212** which is adjustably mounted on needle bar horizontal lever arm **213** in a manner similar to the adjustment of cam follower **198** on the boss **199**. Also, the cam follower **212** is mounted for slidable movement on its mounting stud in a manner similar to the arrangement of the cam follower **184** on the mounting stud **187**, except that in the present instance the cam follower **212** is slidable by means of the yoke **214** which is mounted on cam follower shifter rod

215 for reciprocating movement therewith. The lever arm 213 is freely fulcrumed at its upper end about the rock shaft 202. Fig. 16 illustrates the needle bar motion incorporating both the vertical and horizontal movements.

Also mounted on the main cam shaft 196 is a knocking over bit horizontal control cam 216 (see Figs. 4 and 4a). Biased for operative engagement with cam 216 is a cam follower 217 which is mounted on lever arm 218 in a manner similar to the adjustable and slidable mounting of the cam follower 212 on lever arm 213. The upper end of lever arm 218 is freely fulcrumed about rock shaft 202 in a manner similar to the mounting of lever arm 213 on that shaft. Lever arm 218 is provided with a stud 219 similar to the stud 210 on lever arm 200. A knocking over bar handle 220 for manual manipulation of the knocking over bar 107 is constructed in a fashion similar to needle bar handle 206 and is notched along its lower edge in a similar manner for engagement with the stud 219 for selectivley positioning and locking the knocking over bar in operative and inoperative positions. The knocking over bar handle 220 is pivotally connected at pivot point 221 to the lower end of a knocking over bar bracket arm 222 which is fastened at its upper end to the knocking over bar bracket 223. The knocking over bar 107 is carried by the upper end of the knocking over bracket 223, and this bracket is pivotally and adjustably connected at its lower end 224 to the free end of the knocking over bar and vertical movement control arm 225. The other end of arm 225 is fixed to knocking over bar rock shaft 226. Rocking motion is imparted to the shaft 226 through the knocking over bar rock shaft control arm 227 which is clamped to the shaft 226 at one end and is provided near its free end with a cam follower 228 which is adjustably and slidably mounted on the stud 229 in a manner similar to the mounting of the cam follower 198. The cam follower 228 is biased by means of springs 230 for operative engagement with knocking over bar vertical movement cam 231 which is fixed to main cam shaft 196.

Fig. 17 diagrammatically illustrates the above described motions of the knocking over bar assembly and the operative parts.

Narrowing fingers 232, 232' (see Fig. 2) are mounted, respectively, on the transverse narrowing rods 233, 233' which are slidably mounted in bearing brackets 234 which are clamped to the narrowing shaft 235. The narrowing shaft is supported by sliding bearing 236 on vertical slide rods 237 which are fixed at the lower end in brackets 238 on the main frame, as shown in Fig. 1. The narrowing frame 112 is biased upwardly by means of coil springs 239 which are wound about the vertical slide rods 237.

Up and down movement is imparted to narrowing frame 112 (see Fig. 5) for the narrowing operation through bracket 240, having one end surrounding the narrowing shaft and the other end fixed to the upper end of vertical link 241. The lower end of the vertical link 241 is pivotally connected at the movable pivot point 242 to the horizontal link 243 which is clamped to the rock shaft 244 (see Fig. 15). Also clamped to the rock shaft 244 is a cam follower arm 245 (see Fig. 1) on the lower free end of which the cam follower 246 is adjustably and slidably mounted in a manner similar to the mounting of the cam follower 217. Cam follower 246 is arranged for cooperation with narrowing cam 247 which is fixed for rotation with main cam shaft 196; however, alignment of the cam follower 246 and narrowing cam 247 does not occur on cooperative engagement of these elements except as hereinafter explained in connection with the shogging of the main cam shaft 196. Cam follower 246 is biased toward narrowing cam 247 by the lifting action of springs 239 against the narrowing frame; however, clearance is maintained between cam follower 246 and narrowing cam 247 by means of set screw 248 which is mounted on a bracket on the main frame and against which the free end of horizontal link 243 abuts, as shown in Fig. 15.

When it is desired to turn the welt, narrowing fingers 232, 232' (see Fig. 2) are moved transversely of the machine into an outward or inoperative position beyond the limits of the needle bar 102 by a racking mechanism (not shown) of ordinary construction which is familiar to those skilled in the art. The position of the narrowing fingers now assumes the same relation as they would when making the picot which is also familiar to those skilled in the art. By operation of the welt bar mechanism previously described, the welt bar 110 is brought down into operative position and locked to the narrowing frame, as previously described, and as shown in Fig. 10.

With the welt bar locked to the narrowing frame, the required motion is imparted to the welt bar for the turning of the welt by means of bracket 240, vertical link 241, horizontal link 243 and cam follower arm 245 which are arranged in the above described manner; however, in order that the cam follower 246 may impart the desired motion to the welt bar for the turning of the welt, it is necessary that this cam follower coact with a cam other than the narrowing cam 247 inasmuch as the movements of the welt bar are different from the desired movement of the narrowing fingers. In order to accomplish the desired movement of the welt bar in the turning of the welt, cam follower 246 is shifted on its mounting stud by means of one of the yokes 214, a plurality of such yokes being mounted on the cam follower shifter rod 215, as shown in Fig. 1 for a purpose to be hereinafter described. When thus shifted by yoke 214, cam follower 246 is arranged to coact with welt turning cam 249 which is fixed for rotation with the main cam shaft 196; however, lateral shifting of the main cam shaft 196 is necessary in order to bring the welt turning cam 249 in position for coaction with cam follower 246.

In order to accomplish lateral shifting of the cam follower shifter rod 215 which carries the yokes 214, I have provided mechanism, best shown in Fig. 16 comprising a pair of upright standards 250, 250' which support a universal joint 251 upon which is mounted the toggle lever 252 for universal movement thereon. One end of the toggle lever 252 is positioned between a pair of collars 253 which are secured to the cam follower shifter rod 215. On this same end of the toggle lever 252 there is attached a Bowden wire 254. On the other end of the toggle lever 252 there is mounted a roller 255 which is arranged for selective entry between a pair of collars 256 secured to the main cam shaft 196. In the inoperative position, the roller 255 is biased from entry between the collars 256 by means of a spring 257 which is attached to the end of the toggle lever 252 upon which the roller 255 is mounted, the opposite end of the spring 257 being anchored to the upright standard 250. An adjustable stop member 258 is provided on the connecting member 250'' to limit movement of the toggle lever 252 by the spring 257. The arrangement of the mechanism just described permits shifting of the cam follower shifter rod 215 by means of lateral movement of the cam shaft 196. Such lateral movement or shifting of the cam shaft is called shogging, and it is accomplished by the shogging assembly comprising shifter cam 259 and return cam 260, both of which are fixed to cam shaft 196 for rotation therewith. Mounted adjacent the cams 259, 260 is a shogging roller 261 which is arranged for operation by the shogging roller cam 262 mounted on the hub of the return cam 260. All of the above described shogging mechanism is of well known construction, as is the shogging roller latch mechanism (not shown) contained within the shogging roller housing 263; however, in the ordinary construction of shogging mechanism, the shogging roller latch is released by mechanical means whereas I prefer to release the shogging roller latch by

electromechanical means including a solenoid. As is well understood, shogging of the cam shaft takes place while the cam shaft is rotating. Rotary movement is imparted to the main cam shaft **196** through spur gear **195**, spur gear **194** and pinion **264** which is operatively connected to an electric motor or other suitable source of motive power.

Tension applied to the Bowden wire **254** by means of a solenoid (not shown) shifts the toggle lever **252** into operative position so that cam follower shifter rod **215** is moved to the left when the main cam shaft **196** shogs to the right, and vice versa. This simultaneous movement of the main cam shaft **196** and the cam shaft follower shifter rod **215** in opposite directions positions cam followers **212**, **217** and **246** into operative alignment with welt turning cam **249**, welt turner presser cam **265** and welt turner horizontal knocking over cam **266**, respectively. In this position, welt turning cam **249** lowers the narrowing frame which has the welt bar locked on the end and brings it into the welt turning position, as will be more fully described hereinafter. Also in this position, welt turner presser cam **265** operates to control the horizontal motion of the needle bar **102** during the welt turning cycle, to be more fully described hereinafter. Furthermore, in this position, welt turner horizontal knocking over cam **266** operates to control the horizontal movement of the knocking over bar during the welt turning cycle as will be more fully described hereinafter.

If tension is not applied to Bowden wire **254** (see Fig. 16) when the main cam shaft **196** is shogged, spring **257** holds roller **255** in its inoperative position beyond the periphery of the collars **256** so that lateral movement of the cam shaft does not cause lateral shifting movement of the cam follower shifter rod **215**. Therefore, as the main cam shaft **196** is shogged without movement of the cam follower shifter rod **215**, cam followers **212**, **217** and **246** are aligned by the movement of the main cam shaft **196** with narrowing presser cam **267**, narrowing horizontal knocking over cam **268** and narrowing cam **247**.

The action of the narrowing cam **247** controls the vertical movement of the narrowing fingers **232**, **232'**, into engagement with the needles **101** during the narrowing cycle, as previously explained with regard to the arrangement of the associated structure. Narrowing presser cam **267** acting through **212** controls the horizontal motion of the needles **101** during the narrowing cycle. Narrowing horizontal knocking over cam **268** controls the horizontal movement of the knocking over bar **107** during the narrowing cycle.

TRANSFER BAR MOTION MECHANISM

The transfer bar **108** is mounted on a transfer bar bracket **269** (see Figs. 4 and 4*b*) which is pivoted, at pivot point **270**, to the transfer bar vertical movement short arm **271** at one end thereof, the other end of this short arm being mounted on rockshaft **272**. Also mounted on rockshaft **272** is the transfer bar vertical movement long arm **273**, on the opposite end of which is mounted the cam follower **274** by which motion is imparted to the arm **273** from cam **275** which is mounted for rotation with the main cam shaft **196**.

The cam follower **274** is adjustably and slidably mounted upon its mounting stud in a manner similar to the mounting of cam follower **246**, sliding motion being imparted to the cam follower **274** by means of pivoted yoke **276** (see Figs. 2 and 8) which is solenoid operated and spring returned by means of spring **277**. The purpose of the sliding motion of cam follower **274** on its mounting stud is to selectively engage this cam follower with the cam **275** which is mounted on the main cam shaft **196**. The cam follower **274** is in positive engagement with the cam **275** only during the welt-turning cycle. In order to permit the sliding motion of the cam follower **274** upon its mounting stud, the cam follower is held away from the cam **275** by means of the stop member **278** in a manner similar to the holding action of stop member **231''**.

In order to impart horizontal movement to transfer bar **108**, the transfer bar bracket **269** has connected thereto at an immediate point the transfer bar horizontal movement arm **279** with the cam follower **280** adjustably and slidably mounted upon its lower end.

The mounting of cam follower **280** is similar to the mounting of cam follower **274**, and sliding motion of the cam follower **280** along its pivotal mounting stud is accomplished by means of the pivoted yoke **281** which is solenoid operated and spring returned by means of spring **282**. The cam follower **280** is held away from the cam with which it operates during the welt-turning cycle by means of the stop member **283** inasmuch as cam follower **280** is needed for engagement with the cam **284** only during the welt-turning cycle, cam **284** being mounted for rotation with the main cam shaft **196**.

Welt wire **285** is secured to the lower end of vertical welt wire support rod **286**, which is pivotally mounted at **287** to the outer end of horizontal welt wire support lever **288**, the inner end of welt wire support lever **288** being fixed to the welt wire assembly shaft **289** which is mounted for oscillatory movement. Welt wire assembly shaft **289** is rotated through its arc by means of chain drive assembly **290** which receives its motive power from horizontal transmission shaft **141** through miter gears **142** and vertical transmission shaft **143**. The engagement between welt wire assembly shaft **289** and horizontal transmission shaft **141** is accomplished by means of chain drive assembly **290** and solenoid operated clutch **291** which is similar in operation to solenoid operated clutch **144**.

In order to hold the welt wire assembly locked into the uppermost or inoperative position, lock dial **292** is mounted on shaft **289**, and the pivoted lock lever **293** is arranged for releasable engagement with the square cut notch **292'** in the lock dial **292**. Lock lever **293** is disengaged from lock dial **292**, by means of a solenoid indicated at **294** and which is similar to solenoid **166**, at the moment when it is necessary to lower the welt wire assembly to the operative position. There are no other notches on lock dial **292**, since it is not necessary to have these at any time while the welt wire is in the operative position. The release of lock lever **293** is simultaneous with the engagement of clutch **291** when it is desired to place the welt wire assembly in the operative position. When the tooth on lock lever **293** drops into the notch of lock dial **292**, the lock lever opens a switch (not shown) to de-energize the solenoid operated clutch **291** and stop the motion of welt wire assembly in a manner similar to the operation of switch **167**.

We will now take in consideration of the welt wire assembly. Mounted on welt wire support rod **286** is a bayonet cam arrangement **295** (see Fig. 8), and arranged for engagement with bayonet cam **295** is a cam follower **296** which is mounted on horizontal welt wire control arm **297**, which is fulcrumed for rocking motion on shaft **171** and is provided on the opposite end with cam follower **298**, which is arranged for engagement with horizontal welt wire motion cam **299** which is mounted for rotation with shaft **174**.

Spring **300** is arranged as shown in Fig. 8 to bias welt wire support rod **286** to hold bayonet cam **295** in engagement with cam follower **296**. Indexing of shaft **174** is accomplished by means of lock dial **301** which is fixed for rotation with the shaft **174** and is provided with indexing notches, as shown in Fig. 8, for cooperation with centering pawl **302**. The pivoted action of centering pawl **302** opens and closes switch for a purpose to be hereinafter described, the switch **303** being connected in the operating circuit of solenoid operated clutch **176**.

Going back to the vertical movement of the welt wire

assembly, when the welt wire assembly reaches its lowest point, it will hit an adjustable stop 304 and its motion is arrested by switch 305 in the operating circuit of solenoid operated clutch 149.

The indexing of shaft 145 is accomplished by means of a lock dial 306 to the shaft 145 as shown in Fig. 7. Lock dial 306 is similar in many respects to lock dial 301, except that the notches in this lock dial are not uniformly placed, but are placed according to the particular needs for indexing shaft 145. Arranged for cooperation with lock dial 306 is a centering plunger 307 which is pivoted at its lower end and arranged to operate switches 308, 308', which are connected in the operating circuit of solenoid operated clutch 149.

A cover latch 309 is slidably affixed to the lock dial 306 by means of the shoulder screw 310. The latch 309 is biased by means of a spring 311 which has one end fixed to the lock dial 306. The latch 309 is provided along its outer perimeter with a plurality of notches 312, and the purpose of this latch and the notches therein will be fully explained hereinafter.

TAKE-UP ROLLER ASSEMBLY

The take-up roller assembly (see Figs. 4, 12 and 19) comprises the take-up roller bracket 313 which is mounted on the main frame and to which the take-up roller arm 314 (see Fig. 4) is pivotally attached at pivot point 315. A lower take-up roller 316 is mounted for rotation on the upper end of the take-up roller arm 314, and an upper take-up roller 317 is mounted for rotation on the free end of the bracket 318 which is pivotally attached to the take-up roller arm 314 at the pivot point 319. Both of the take-up rollers 316 and 317 are covered with material like sponge rubber 320, the upper take-up roller 317 is pressed against the take-up roller 316 by means of gravity. At times it is desirable, when necessary, to separate the take-up rollers and for this purpose a pivoted arm 321 (see Fig. 4) is secured at its upper end to the shaft 319 to which the bracket 318 is fixed. Movement is imparted to the arm 321 by means of Bowden wire 322 which is operated by means of a solenoid (not shown). In order to impart positive rotation to the take-up rollers, a ratchet 323 is secured to the shaft upon which the lower pick-up roller 316 is mounted. A pawl 324 (see Fig. 4) is arranged for engagement with the ratchet 323 and is pivotally mounted on the upper end of pawl arm 325 which is pivotally mounted, at a point intermediate its length, on the pawl mounting bracket 326. A stud 327 is fixed to the other end of pawl arm 325, and this stud is provided with an oversize hole through which the upper end of pawl actuating rod 328 projects. A stop collar 329 is affixed to the pawl actuating rod just beneath the stud 327, so that the pawl actauting rod 328 can move the pawl arm 325 against the action of spring 330. It will be noted that this arrangement permits the upward motion of the rod 328 to positively actuate the pawl 324; however, the pawl 324 only actuates the ratchet 323 when the spring tension 330 is sufficiently strong. Downward movement of the rod 328 merely causes the upper end of this rod to slide in the oversize hole in the stud 327 unless the pawl arm 325 is returned by pressure of the spring 330. Up and down motion is imparted to actuate rod 328 through toggle lever 331 to which the pawl actuating rod 328 is pivotally attached at its lower end. To the other end of the toggle lever 331 is pivotally attached a rod 332 which is pivotally attached at its lower end to an arm 333 which is secured to regulator shaft 334 for rocking motion therewith. Regulator shaft 334 derives its rocking motion from a main cam shaft 196 through regulator cams 335, 335' which are fixed for rotation with the main cam shaft 196, and hence through cam followers 336, 336' and regulator assembly 337. Regulator assembly 337 is fixed to the regulator shaft 334 and the derivation of motions for the regulator shaft from the main cam shaft is standard practice.

The take-up roller assembly is biased in the outward position against the stop member 338 by means of the slide assembly 339 in which the slide rod 340 works and to which the spring 341 is attached to pull the slide rod 340 to bear against the take-up roller arm 314.

In the operation of the welt-turning cycle, it is necessary to pull the take-up roller assembly inwardly toward the welt bar. In order to accomplish this, a Bowden wire 342 is attached to the take-up roller arm 314, as best shown in Fig. 4. The Bowden wire 342 extends rearwardly through the machine and is attached to pulley 343 which is mounted for rotation on the shaft 344 to which motion is imparted through chain assembly 345 and solenoid operated clutch 346 (see Fig. 18). Power is transmitted through the clutch 346 from lower horizontal transmission shaft 347 which receives power through chain-drive assembly 348 from the transmission drive motor 349.

On the shaft 344 is mounted a lock dial 350 having a single notch 351 in the periphery thereof. Arranged for cooperation with the notch 351 in the lock dial 350 is a centering latch 352 which is biased into engagement with the notch 351 by means of spring 353. The centering latch is arranged to be disengaged from the notch 351 by means of solenoid 354 for a purpose to be hereinafter described.

Power is transmitted from the lower horizontal transmission shaft 347 to the vertical transmission shaft 143 through miter gears 355.

When the take-up rollers are rocked inwardly toward the sinker head 105, they appear as shown in Fig. 19, and in this figure it is apparent that the ratchet 323 has left the vicinity pawl 324 and is now positioned for cooperative engagement with auxiliary pawl 356 which is mounted pivotally on the upper end of the auxiliary pawl arm 357 which is pivoted at a point 358 intermediate its length and is provided at its opposite end with a Bowden wire 359 which derives its power from arm 333 which is connected to the regulator shaft 334, as shown in Fig. 4. The pawl 356 is biased against the ratchet 323, as shown in Fig. 19, by means of spring 360 which is connected at one end to the auxiliary pawl arm 357 and at the other end to the adjustable bracket 361 which is mounted on the same frame member as the welt bar guide bracket 110''. Also mounted on the take-up roller arm 314 adjacent the lower take-up roller 316 are a pair of back-up pawls 362 (see Fig. 19) which are pivotally mounted at their lower ends and biased against the ratchet 323 to prevent backing of the take-up rollers.

ELECTRICAL CONTROL MECHANISM

All the switches and solenoids above mentioned are connected electrically into a central control panel 363 (see Fig. 21) in the cabinet 363' in a manner similar to the cable connection to the solenoid operated clutch 144, as shown in Fig. 13. The panel 363 and its related mechanisms are specifically designed, as shown in Fig. 14, for selectively controlling the operation of the various switches and solenoids above described at the time and in the sequences as will be hereinafter described in full explanation of the operation of this automatic equipment.

The panel 363 (see Fig. 21) is provided with a plurality of contact bars 364, one or more such bars being provided for each switch or solenoid. Over the contact bars 364 is placed a pattern card 365 which is perforated, as shown at 366, in order to permit selective contact with the contact bars 364 by means of contact fingers 367 which are carried by a control carriage 368. A contact finger 367 is provided immediately above and in line with each contact bar 364. The control carriage 368 is slidably mounted upon slide rods 369 and 369'. The slide rod 369' is fixedly mounted to panel 363, whereas the slide rod 369 is journaled for rotation through slip clutch 370 which is electrically operated by solenoid 371 for driving movement by means of electric motor 372. As

the slide rod 369 is rotated, it drives through miter gears 373 to cause ladder chain drive 374 to raise the control carriage 368 which is connected to the ladder chain drive 374 by bracket arm 375. As the movable carriage 368 is raised, the pulley 376 unreels the cable 377 to which the counterbalance weight 378 is attached, the weight of the counterbalance 378 being adjustable to more or less balance the weight of the control carriage 368. Counterbalance weight 378, however, is never weighted sufficiently to overcome entirely the weight of the movable carriage 368, inasmuch as this carriage is allowed to move downward by means of gravity. Upward movement of the carriage 368 is stopped when the stop arm 379 strikes the switch 380 which is fixed to the panel 363 and electrically connected in the operating circuit of solenoid 371.

The carriage 368 is movable downwardly in definite steps by means of solenoid 381 which is connected through Bowden wire 382 (see Fig. 22) which is operatively connected to the pivoted lever 383 which is provided on its opposite end with a finger 383' which engages the pin 384 on the double ended pawl 385. Pawl 385 is biased by means of spring 386 into engagement with a ratchet rack 387. The rack 387 is affixed to the panel 363 as shown in Fig. 21.

On the main cam shaft 196 (see Fig. 20) is mounted a switch cam 388 which cooperates with the cam follower 389 for operation of the control switch 390, as shown in Fig. 20. The switch 390 is connected to the counter mechanism 391 which in turn is connected to the control panel 363 which is in turn connected to solenoid 381. Each movement of the switch 390 by means of cam follower 389 will energize solenoid 381 to index the movable carriage 368 downwardly one notch on the rack 387, unless an impulse has been transmitted to the counter mechanism 391 by means of a pattern perforation 366 acting through a finger 367 on a contact bar 364, in which event the counter mechanism will pick up a preselected count while solenoid 381 is idle; and at the end of the preselected count by the counter mechanism 391, solenoid 381 will again be energized to index the movable rack downwardly as will be more fully explained hereinafter.

Power is supplied to the control cabinet 363' through input cable 392.

OPERATION OF WELT TURNER

In order to understand the operation of my automatic welt turner, it is desirable to start at the beginning of the knitting cycle, having the welt turning mechanism at rest in the inoperative position.

Step 1

The first several revolutions or strokes of the knitting machine are simply idling strokes, during which time the welt-turning mechanism is automatically placed in the starting position for hooking up, or engaging the initial course of knitting. However, this is only true if the machine is started from an empty position, that is, if no stocking has been knit upon it preceding this immediate cycle. If, however, a stocking has been knit upon the machine, it is desirable to start the welt-turning mechanism before the stocking is completed, preferably when it is nearing the end of the toe, so that when the cycle is completed, and the finished stocking is cast from the needles, the welt-turning mechanism will be in position to make the hook-up. This obviates the necessity of idling the machine while the welt-turning mechanism is being placed in the operative position.

Approximately 28 or 30 revolutions, or courses before the stocking is completed, the control carriage 368, Fig. 14, is indexed one time, which, by having the proper holes perforated in the pattern card, will set into motion several functions. The first function to start will be the rotation of the auxiliary motor 349, Fig. 18, in the clockwise direction. This movement will also rotate the horizontal transmission shaft 141, Fig. 6, in the same direction. On the same revolution, solenoid operated clutch 149 is engaged, which sets into motion the welt bar positioning shaft 145, through its chain assembly 148. The speed of the auxiliary motor is approximately 2 R. P. M., giving the welt bar positioning shaft 145 the same speed. This action of moving the welt bar positioning shaft at this time will start tilting welt bars 110 from their nearly vertical position, as shown in Fig. 5, toward a nearly horizontal position. The tilting mechanism for the welt bars 110 operates as follows: when the welt bar positioning shaft 145 is rotated in a clockwise direction, ladder chain 156 and sprocket 155, Fig. 6, are also rotated since sprocket 155 is fixed to the shaft 145; this in turn rotates sprocket 157, which is rotatably mounted on shaft 139, but has fixed to it a cam 159, Fig. 14. As cam 159 rotates, its roller 163 is urged toward the high point of the cam and moves lever 162 to pull on Bowden wire 125, Fig. 5. This causes pulley 124 mounted on welt bar shaft 113 to rotate, and consequently tilts welt bars 110 toward a horizontal position. Continued rotation of cam 159, after the horizontal position of the welt bars is reached, will have no effect on the position of the bars, since the high point of the cam has been reached, and this point is quite broad in order to allow limited continued rotation of the cam.

Step 2

Since the knitting machine is operating at a speed of approximately 75 to 90 courses per minute at this time, very little rotation of the welt bar positioning shaft can take place in one revolution of the machine. Immediately, on the following revolution after starting the welt bar positioning shaft in operation, the horizontal welt bar motion shaft 174, Fig. 6, is set in motion in the clockwise direction. This is accomplished by energizing solenoid operated clutch 176, Fig. 3. This movement will start the welt bar assembly, on which welt bars 110 are mounted, outwardly away from the narrowing frame 112, Fig. 5. As shaft 174 is rotated in clockwise direction, cam followers 172 are urged by springs 168' to follow a depression in the cams, which causes levers 170 to move in the opposite direction at their opposite end, allowing the welt bar assembly to follow in the same direction, by the urging of the springs 168'. We now find welt bars 110 moving outwardly as well as being tilted simultaneously.

Step 3

On the third revolution, the movable carriage 168 is stopped for five revolutions, through the counter mechanism 391, Fig. 20, which is predeterminedly set by the pattern card for such a delay. This is sufficient time for the welt bars to move outwardly and tilt to the nearly horizontal position. The movement of shaft 174 is stopped upon the completion of one index of the indexing dial 301, Fig. 7. A limit switch 303 is provided for this purpose. The circuit controlling the energization of solenoid operated clutch 176, Fig. 3, which controls the movement of shaft 174 at this time, is so arranged that a single impulse at the control panel will lock in a relay (not shown) holding the circuit closed until the limit switch 303 is acted upon. This limit switch is opened when centering pawl 302 drops into the next notch of lock dial 301. This in turn breaks the circuit to clutch 176, which stops the rotation of shaft 174. This circuit is also arranged so that when it is necessary to move the shaft to its next index, the open limit switch 303 is shunted until the shaft has started its rotation. A change in direction of rotation can be made by merely reversing the direction of the auxiliary motor 349 through the proper contact in the pattern card. However, in the case of shaft 145, a somewhat different arrangement of the indexing dial 306 is necessary. Here it is required to rotate the shaft over a series of notches, or indices, without stopping at any of them until the last index is reached,

This is relative to the clockwise movement of the shaft. However, when this shaft is rotated in the counter-clockwise direction, it is desirable to stop its movement at every index. This is acomplished in the following manner. A cover latch 309, Fig. 7, is arranged to prevent indexing pawl 307 from falling into any of the notches on dial 306 until the last notch is reached, when the shaft is rotating in the clockwise direction. However, when it is desired to operate the shaft in the counter-clockwise direction, the indexing pawl 307 is made to fall into each of the notches, since cover latch 309 is urged away by the stud 307' to uncover the notches in dial 306 until the last index is reached, then the latch will be returned by spring 311 to again cover the notches in the dial.

Step 4

After a delay of five revolutions by the counter 391, the movable carriage 368 is again started into operation. This is accomplished in the following manner. As main cam shaft 196, Fig. 20, is rotated one revolution for each course of the machine, it will operate switch 390, one make and break for each revolution. This impulse is transmitted by wires to the control box 363', energizing the solenoid 381 which will move control carriage down one index for each impulse. The operation of the control carriage is as follows. When solenoid 381 is energized, it will pull Bowden wire 382 which in turn will actuate double-ended pawl 385, pulling out the top pawl tooth away from the ratchet 387, and pulling in the bottom pawl tooth into another tooth of the rachet 387. This action will lower the carriage by one-half index of the rachet, then when the solenoid is released, the double-ended pawl 385 returns to its original position by action of spring 386. The return action of the pawl will drop the carriage another one-half index, so that now one full index is completed. On the following revolution a contact is engaged in the pattern panel through pattern card 365, which energizes solenoid operated clutch 144, Fig. 3, causing the welt bar assembly shaft 139 to rotate in a clockwise direction. On this same revolution, however, solenoid 166, Fig. 7, is engaged and pulls out safety pawl 165 which releases shaft 139 from its locked position, allowing it to be rotated. Ordinarily, the weight of the welt bar assembly would be great enough so that when the safety pawl 165 is released the assembly would have a tendency to fall with considerable force; however, this tendency is overcome by counter-balancing springs 139', Figs. 3 and 6, whereby very little gravitational force remains in the assembly. Nevertheless, this force increases somewhat as the assembly reaches its lower levels, even though the springs are more extended, because the spring lever arms are arranged to permit this. This increased gravitational force is desirable so that it is not necessary to hold the welt bar assembly down when in the welt-turning position. When the welt bar assembly reaches its lowest point of movement, contact is made with adjustable stop 150 and limit switch 151, Fig. 6. This stops the downward movement of the assembly and the rotation of shaft 139, by releasing solenoid operated clutch 144.

Step 5

On the revolution following the starting of the downward movement of the welt bar assembly, the cam shaft 174 is rotated one index through its clutch 176 and chain assembly 175, Fig. 3. The clockwise rotation of this shaft at this time, through horizontal welt motion cams 173, causes the welt bar assembly to move inwardly toward the needles. It will be observed that since the downward movement of the assembly was not completed when the inward movement was started, the welt bar assembly will be moving in two directions simultaneously. This is desirable to shorten the time cycle and give the assembly a more graceful movement than otherwise.

By the time this dual movement is completed, 12 or 15 revolutions will have elapsed, and an additional 10 or 12 revolutions are run on counter mechanism 391 before the actual hook-up is made. The welt bars are now in the starting position for the hook-up. This position is similar to that of Fig. 9, except the welt hooks will be approximately ½" away from the needles.

Since it will be necessary to engage the first row of loops in one revolution of knitting, it is desirable to have the welt hooks as close as is practical on the revolution preceding the hook-up, hence the position of the welt hooks as above described. It is essential that the welt bar motion on the hooking-up course be coordinated precisely with the needle motion. This is accomplished by rotating cam shaft 174 in such a manner that its motion will be synchronized with the needle motion which in turn derives its motion from the main cam shaft 196. Through gearing 194, 195, Fig. 4, the auxiliary cam shaft 186 is rotated in synchronization with main cam shaft 196. This now becomes the source of motive power for rotating shaft 174 in synchronization with the main cam shaft.

Step 6

On the 27th course or revolution of the machine, the speed of the machine is reduced to approximately 20 courses per minute. This is automatically switched from the control panel to the main drive motor (not shown). Then, on the following course, the welt thread carrier is automatically locked in the operative position, and the loose course attachment (not shown) is engaged, in a manner well known in the art, so that an enlarged row of loops will be knit on the first row of actual knitting. During the running of this stroke, the cam shaft 174 is rotated one index in the clockwise direction, but this time by means of auxiliary cam shaft 186. Bowden wire 189, Fig. 4, is actuated by a solenoid (not shown) from an impulse in the control panel. This movement places cam follower 184 in the operative position to be engaged with cam 185. As cam shaft 186 rotates, it will also rotate shaft 174 through pushrod 182, link 181, rod 180, pawl 178 and ratchet 177, which last is fixed to shaft 174, all as seen in Figs. 4, 5 and 6. Through this geared and timed motion, the welt hooks are positively and accurately positioned between the needles 101 at the proper instant, and on the same revolution are drawn away from the needles when the first row of loops are cast upon them. The cams 173 are contoured so that this will take place. The position of the welt-hooks after the hook-up is made is shown in Fig. 9 and also in Fig. 27. The welt hooks are positioned accurately between the needles by welt bar guide brackets 110", Fig. 1.

Step 7

Knitting is then continued for approximately 100 courses, as indicated in Fig. 28, at which time the welt wire assembly, which holds welt wire 285, Fig. 8, is started downwardly. From the proper perforation in the pattern card, welt wire assembly shaft 289 is started downward through the release of the solenoid operated pivoted lock lever 293 and the energization of solenoid operated clutch 291. When the welt wire assembly reaches its lowest point, it is stopped by stop 304 and the limit switch 305, Fig. 7, which releases the clutch 291. The object of moving the welt wire assembly downward is to position the welt wire on the newly knit fabric, in preparation for holding and folding the welt fabric in the turning of the welt. Fig. 29 shows the welt wire positioned on the fabric as above described. There are now approximately 130 courses knit in the welt, the exact amount being determined of course by the length required in the welt and the speed of the machine.

Step 8

By this time the welt bars have reached a point where they can no longer move away from the needles. This is

governed by the contour of cams **173**, and the pressure of springs **168'**. The cams now act as a stop for the welt bars at this point. Approximately 2¾" of fabric have been knit into the welt and this is the distance that the tip of the welt hooks would be away from the needles. Also the welt bars **110** will have moved slightly higher than at first, because of the arc in which they travel, the assembly being pivoted at point **137**, Fig. 6.

Step 9

The welt wire will start to depress the fabric somewhat, as shown in Fig. 29. This affords the welt wire an opportunity to move under the welt bars, pushing the fabric back away from the hooks. When the depression in the fabric becomes sufficient, the welt wires are permitted to move freely away from the needles. This is accomplished by rotating shaft **174** one index in the clockwise direction. Cams **299** on shaft **174** are contoured so that this indexing movement will permit cam followers **298**, Fig. 7, to fall into a depression in the cams. However, they will not fall because the welt wires are tensioned against the fabric by springs **300**. As the fabric is knit, cam followers **298** come closer to the hollow of the cams, but do not reach the bottom at any time. This is to insure proper tensioning of the fabric at all times. It is to be understood also, that the tension on the fabric can be changed at will by moving springs **300** up or down on the grooved studs **300'**.

Step 10

After the fabric is knit out sufficiently so that the first row of loops has slid back on the welt hooks up to the small barb **111'**, the welt bars are raised and tilted simultaneously. This will be approximately 300 courses after the welt is started, and the position is shown in Fig. 30. The barb **111'** acts as a stop for the initial row of loops, preventing them from sliding back in the hooks beyond this point. The importance of this barb will be explained in a later paragraph.

The movement of raising and tilting the welt bars is accomplished by rotating welt bar positioning shaft **145** one index in the counterclockwise direction. At the proper time, and by closing the proper circuit from the pattern card, clutch **149** is energized, revolving welt bar positioning shaft **145**. It is to be understood that the auxiliary motor **349** is now to operate in the counterclockwise direction, through the proper switching in the pattern control. As shaft **145** is revolved counterclockwise, it will turn cams **146** which are fixed to it, as shown in Fig. 6. These are contoured to produce the desired movement, because at this time the cam followers **147** are resting on the cams. The tilting of the welt bars is accomplished in the reverse manner as was described in an earlier paragraph, Step 1, on tilting. However, since the assembly now is much lower than in the inoperative position and resting against cams **146**, a dual motion is described, namely, raising and tilting simultaneously.

The raising and tilting of the bars at this time serves several purposes. In the first place, this action is necessary to allow the welt wire free movement outwardly as the fabric is knit out. Secondly, the bars are placed closer to the welt-turning or transferring position, requiring less movement later. Lastly, the bars must be moved upwardly to allow tension rollers **316** and **317** to be moved inwardly as shown in Fig. 31.

The usual picot design can now be knit in the center of the welt, when sufficient fabric has been made to warrant this. The picot attachment is not shown since it is well known in the art and has no bearing upon the present invention.

Step 11

When approximately 500 courses have been knit into the welt, the welt bars **110** and the tension rollers **316** and **317** are moved inwardly. Their relative positions are shown in Fig. 31. Note that the rollers are separated, or held open, so that the welt wires can enter between them without any resistance from the rollers. The rollers are moved inwardly in the following manner. When clutch **346**, Fig. 18, is energized through the proper perforation in the pattern card, shaft **344** is caused to rotate, in this case in a counterclockwise direction. This winds up Bowden wire **342** on pulley **343**, causing the rollers to move inwardly toward the needles, Fig. 4. When lock dial **350**, mounted on the same shaft, is turned sufficiently, lock pawl **352** falls into the square notch **351**, causing it to lock and simultaneously break the circuit to clutch **346** through limit switch **352'**, Fig. 18. The tension rollers will now be positioned close enough to the fabric to receive the welt wires between them.

The upper roller **317** is opened away from the lower roller **316** by action of lever **321**, Fig. 4. When Bowden wire **322** is actuated by a solenoid (not shown), the upper roller is urged upwardly, being limited by the length of the solenoid stroke. Merely de-energizing the solenoid will cause the roller to drop again, resting on lower roller **316** by gravity, or a light spring tension, if desired.

Step 12

Approximately 50 courses after the rollers have been moved inwardly, the welt bars are again moved inwardly by rotating shaft **174** one index in the clockwise direction. The position is that as shown in Fig. 32. Note that the welt bars are still tilted as in Fig. 31. This is to prevent the first row of loops from sliding down the hooks away from the barb **111'**. The purpose of this movement is to more nearly center the fabric on the welt wires, so that when the next movement takes place, the wire will be more centrally located in the welt. This movement also affords an opportunity to slacken the top fabric in the next movement as shown in Fig. 33.

Step 13

The next movement, which takes place approximately 55 to 60 courses later, is to retract the welt bars to the position as shown in Fig. 33. Also, in the same movement, the rollers are closed and the welt wires are moved inwardly toward the needles. The movement of the welt bars and the welt wires is accomplished by rotating shaft **174** one index in the clockwise direction. Cams **173** and **299** are contoured and timed so that simultaneously the welt bars will move outwardly and the welt wires will move inwardly. At the same time, the upper roller control solenoid (not shown) is released and the upper roller **317** is permitted to close on the lower roller **316**. Since the action of this solenoid is much faster than the movement of cam shaft **174**, the rollers will close over the fabric before the welt wires have an opportunity to move away from between the rollers. This allows the fabric to remain between the rollers while the wires are moved away free of the fabric. The rollers, being of a soft, adhering type of material such as sponge rubber, and the wires being made of a smooth, thin metal, such as stainless steel, will create a tendency for the fabric to remain between the rollers. Since there is very little pressure between the rollers when they are closed, the wires are easily forced from between them, especially since this motion is a positive cam action, but the fabric will not slip on the rollers and will remain between them after the welt wire has been withdrawn.

Note in Fig. 33 that the fabric is somewhat folded or slacked very loosely between the welt bars and the rollers. This is most desirable for the subsequent movements. This slack in the fabric is needed to prevent the first row of loops from being pulled down when the welt bars are to be positioned for the transfer of loops. Up until now, the angle of the welt bars prevented these loops from sliding down when the welt bars were moved inwardly. There is enough friction between the loops

and welt hooks to hold the fabric against the barbs **111'** as long as the bars are somewhat inclined, as in Figs. 31 and 32. The pulling action on the fabric will not force the loops downwardly toward the hooks unless the welt hooks are substantially in a vertical position; however, if enough slack is permitted in the fabric, as in Fig. 33, then the bars can be tilted to the vertical position and then moved inwardly. If this precaution were not taken, and the loops should slide or be pulled to the bottom of the hooks, there is a possibility that some of the loops might become unhooked, causing runs or ladders in the fabric.

Step 14

Immediately upon completion of the above movement, the welt bars are raised to the locking level and tilted to a somewhat vertical position. This is accomplished by rotating shaft **145** one index in the counterclockwise direction. This movement is similar to the earlier tilting movement explained in Step 10. However, the welt bar assembly has now reached the locking level, so that only one more horizontal movement inwardly will lock the welt bar assembly to the narrowing frame. Cams **146**, Fig. 6, have been rotated so that their highest point is now contacting cam followers **147** and they are resting on the cams.

Step 15

The next movement, approximately 7 courses later, is to retract the welt wires **285** to their upper and inoperative position, Figs. 7 and 8. This is accomplished by rotating shaft **289** in the counterclockwise direction, until pivoted lock lever **293** falls into the square notch cut into lock dial **292**. This actuates limit switch **293'**, breaking the circuit to the clutch **291** which had been energized to rotate shaft **289**. The welt wire assembly will now be in the inoperative position.

Step 16

The next movement, approximately 7 courses later, is to lock the welt bars to the narrowing frame **112**, Fig. 5, in preparation for the transfer of the upper portion of the fabric to the needles. The movement of the welt bar assembly inwardly is accomplished in one revolution of the machine by rotating cam shaft **174** in a clockwise direction, one index, by means of the ratchet mechanism, as explained in Step 6, rather than by the clutch and chain arrangement. The machine is slowed down to approximately 20 or 25 courses per minute during this revolution, so that the movement of the welt bar assembly will not be too rapid. When the indexing of shaft **174** is completed, the welt bars will be in close proximity to the narrowing frame, as shown in Fig. 10, and positioned as shown in Fig. 34. The latches **129** are in the locking position at this time, and when the welt bar assembly reaches its innermost position, these latches fall in place over pins **128**, locking the assembly securely in this direction of movement. In addition to this, set screws **133, 133'** which are mounted on bracket **134**, Fig. 2, act as retaining stops to prevent lateral movement of the bars. These stops are adjustable to permit close register of the welt hooks with the transfer points **109** when the hooks are lowered into the transferring position. Also, yokes **126** fit over rock shaft **127** to prevent vertical movement of the welt bars, except as permitted by the movement of the narrowing frame. These three sets of guides and locks hold the welt bar assembly securely to the narrowing frame so that the only motion which can be made by the welt bars must be derived from the narrowing frame. This makes the movement of the bars while transferring the loops a very positive and well controlled movement.

Step 17

On the following course after locking the welt bars in position, shafts **174** and **145** are rotated one index in the counter-clockwise direction, through their respective clutches. When shaft **145** is rotated to this new position, it will position cams **146** in such a manner that followers **147** are no longer in contact with the cams. The cams move so that a low point is diametrically opposite the cam followers **147**. Since the welt bar assembly is now locked to the narrowing frame, it will not fall when the cams **146** are moved in the above described manner, and these cams must be in this position to allow the assembly free movement downwardly with the narrowing frame.

Cam shaft **174** is also moved at this time, as earlier stated, so that the high points of cams **173** can be moved away from the cam followers **172**. As the welt bar assembly moves downward on the transfer course, it is essential that cam followers **172** are not resting against cams **173**. This downward motion of the welt bar assembly would cause undue pressure between cams and cam followers. The arc through which pivot point **137** travels would cause this increased pressure; hence, clearing the cam followers from the high points of the cams is essential. Ordinarily, cam followers **172** are biased against cams **173** by springs **168'**; but when the welt bar assembly is locked to the narrowing frame, this would not be true. The welt bars are now in the welt-turning position.

Step 18

Before describing the next movement, it may be well to explain certain requirements and features of the transfer of loops from the welt bars to the needles. The normal shifting mechanism of the main cam shaft **196** is used when turning the welts by my method. This is accomplished through the use of the shogging assembly, comprising the shogging cams **259** and **260**, Fig. 1, and the shogging roller **261**, together with its component parts. The shifting of the main cam shaft is the same for turning welts as for making a conventional narrowing; however, certain motions of the machine are altered during the welt-turning cycle in order to provide the proper motion for transferring the loops, as well as several new motions are added. For example, it is necessary to change the horizontal motion of the needles from standard narrowing to welt-turning, as well as the horizontal knocking over motion and the vertical motion of the narrowing frame. All these new motions are provided for by additional cams which are mounted on the main cam shaft **196** and are located in close proximity to the main cams. These cams are so arranged that the lateral movement of their cam followers, when moved the distance of the thickness of one cam, will bring them into operative engagement with the welt-turning cams, providing the cam shaft is also shifted a like amount in the opposite direction. For example, ordinarily the horizontal needle bar motion cam followers **212**, Fig. 1, are in operative engagement with needle bar horizontal motion cam **211**; but, when the cam shaft is shifted to the right the distance of one cam thickness during a regular narrowing cycle, the cam follower will be in operative engagement with horizontal needle narrowing cam **267**. However, when it is desired to place the machine into the welt-turning cycle, cam follower **212** must come into operative engagement with horizontal needle welt-turning cam **265**. This is accomplished by shifting cam follower **212** to the left the distance of one cam thickness space, while shifting main cam shaft **196** to the right the same distance, crossing over, but not remaining on cam **267**. The means for operating the cams and cam followers in this manner will now be described.

A shifter rod **215**, Fig. 1, is provided for this purpose, as well as yokes **214**, fitting over the cam followers **212, 217** and **246**. An assembly for shifting the rod **215** is shown in Fig. 16, which is solenoid operated through Bowden wire **254**. The action of this assembly is explained more fully in the description of the welt turner.

On the course preceding the transfer of the loops from the welt bars to the needles, which is approximately 7 courses after step 17 has commenced, Bowden wire **254**, Fig. 16, is actuated through its solenoid which raises roller **255** between collar cams **256**. Now, when the main cam shaft **196** is shifted to the right into the narrowing position on the following course, this action will urge toggle lever **252** also to the right at the roller end, while its other end, through universal joint **251**, will be urged to the left. This will cause shifter rod **215** to move accordingly, shifting all the yokes **214** the distance of one cam thickness to the left.

The cam followers that are to be shifted during the welt-turning cycle are the needle bar horizontal motion cam followers **212**, the knocking-over bit horizontal control cam followers **217**, and the narrowing cam followers **246**. All of these cam followers, shown in Fig. 1, are held between similar yokes **214**. In addition to the above cam followers, there are certain other cam followers which must be shifted during this cycle, and which are independently solenoid operated to bring them into operative engagement with their respective cams. These are the transfer bar vertical motion cam followers **274**, Fig. 1, and transfer bar horizontal motion cam followers **280**, Fig. 4.

As earlier stated, on the preceding course, prior to turning the welt, toggle lever **252** is actuated, as well as the solenoids (not shown) to move cam followers **274** and **280** to the operative position. These last two followers do not engage their respective cams immediately when shifted, but when the main cam shaft **196** is shifted they are then in operative engagement with their cams.

Now, on the welt-turning course, the main cam shaft **196** is shifted through the shogging assembly as earlier described, and all of the cam followers involved are shifted to the welt-turning position. Then the narrowing frame, with the welt bars locked securely in place, starts moving downwardly in preparation for engagement with the transfer bar points **109** in bars **108**. Fig. 35 illustrates the present position.

As the welt hooks **111** come closer to the sinkers, transfer bar **108** starts moving upwardly and horizontally toward the needles. This is shown by the arrows in Fig. 35. The movement of the transfer bars is controlled by cam followers **274** and **280** and their respective cams **275** and **284**. The movement of the narrowing frame is controlled by cam follower **246** and cam **249**, Fig. 1. The vertical movement of the needles is controlled by cam follower **198** an cam **199**. This is the standard narrowing vertical needle bar motion, while the horizontal movement of the needles is controlled by cam follower **212** and cam **265**, which is the special motion for the welt-turning cycle.

As the welt hooks **111** come into register with the transfer points **109**, the position is that shown in Fig. 36. The hook of the welt hook imbeds itself into the groove of the transfer point, while the curved point of the transfer point imbeds itself into the groove of the welt hook. Notice that the upper loop is above the point of contact between the transfer point and welt hook, Fig. 36, but far enough down on the hook so that when the sinkers **103** start outwardly, the fabric will be below the sinkers. The small barb **111'** prevents the fabric from sliding up too high on the hooks. Needles **101** at this time are moved into a somewhat inoperative position. The sinkers **103** are moved backward to allow free passage of the upper fabric to a point where it will be below the sinker. The sinker movement is the standard narrowing movement and is not changed or altered for the purpose of turning the welt. Sinker movement is controlled by cam followers and cams not shown since these are standard movements well known to those skilled in the art.

After the welt hooks **111** and transfer points **109** are meshed together securely, a synchronized upward movement of the hooks and points is started, while the sinkers are also started outwardly in the normal course of their movement. This action is shown in Fig. 37, especially by the arrows. Here the bottom ledge of the sinkers acts as a stop for the loops in the upper fabric, preventing them from rising any farther than this point. This action forces the loops downwardly upon the transfer points, while permitting the welt hooks to rise clear of the upper fabric. The freed welt hooks are shown in Fig. 38; also, at the same time, the transfer bar is moved slightly backward toward the sinker head as indicated by the arrows in Fig. 38. Note that the loops in the upper fabric are held on the transfer points by the sinkers from sliding upwardly, retaining them on the points until the needles receive them.

Now the needles **101** are moved inwardly to mesh with the transfer points **109**, and then the needles and points are started upwardly, as indicated by the arrows in Fig. 39. The head of the needle is imbedded in the groove of the transfer point to permit the needle to slide through the loop in the upper fabric. The loops in the lower fabric have been positioned upon the needles ever since they were knit there during the last course of knitting. When the needles are securely meshed with the transfer points and are started moving upwardly, transfer of the loops in the upper fabric is made to the needles, as shown in Fig. 40. The needles then continue upwardly, while the transfer points start downwardly and backwardly as shown by the arrows in Fig. 40. As soon as the welt bars are clear of the loops, the narrowing frame continues to carry the welt bars upwardly to a position of rest. After the transfer is made, the transfer bars assume the inoperative position of rest, shown in Fig. 41, and the needles reach their upper or knitting position in readiness for the next course of knitting.

Step 19

When the transfer is completed, the main cam shaft **196** is shogged back to the knitting position, which returns, at the same time, shifter rod **215**; and this, in turn, shifts cam followers **212**, **217** and **246** to their respective knitting positions. Also, the independently controlled welt-turning cam followers **274** and **280**, are returned to their inoperative positions by releasing their respective solenoids. The machine is then ready for continued knitting.

The first course that is knit after the transfer is made locks the upper and lower fabrics together, making a bond to form the welt, while subsequent courses are added to complete the stocking in the usual manner.

Step 20

It is necessary now to retract the welt bar assembly from its locked position on the narrowing frame and place it in the inoperative position shown in Fig. 5. This is accomplished in the following manner: immediately following the first course of knitting after turning the welt, cam shafts **145** and **174** are rotated one index in a clockwise direction through their respective clutches. Shaft **145** is rotated to bring the high points of cams **146** under cam followers **147**, so that when the welt bars are unlocked from the narrowing frame, the assembly will not fall downwardly, but will remain substantially at the same level. Shaft **174** is rotated so that the high points of cams **173** are brought into contact with cam followers **172**. This action is to bring the welt bars again under the control of the horizontal motion cams **173**.

Step 21

Now, the latches **129**, Fig. 10, are unlocked by energizing solenoid **136'''**, Fig. 12. When this solenoid is energized from a perforation in the control panel, Bowden wire **136''** pulls lock arm **136'**, rotating lock

shaft **127**, which pulls latches **129** upwardly, releasing them from pins **128**. This action takes place approximately seven courses after shafts **145** and **174** are started into rotation.

Step 22

After the welt bar assembly is unlocked, shaft **174** is rotated one index in a counter-clockwise direction by means of its clutch and chain assembly. This will move the welt bar assembly away outwardly from the narrowing frame sufficiently far enough to allow upward movement of the assembly without interference or striking the various members of the frame.

Step 23

Then, approximately seven courses later, shaft **139** is rotated one index in the counter-clockwise direction which raises the welt bar assembly upwardly and continues this until lock pawl **165** falls into the square notch of lock dial **164**. Limit switch **167** breaks the circuit, releasing the clutch and stopping the welt bar assembly at its inoperative level.

Step 24

On the courses following the turning of the welt, tension rollers **316** and **317**, through their assembly, are released from their inward position by releasing centering latch **352**, Fig. 18, from the square notch in lock dial **350**. The rollers will now have a tendency to drop outwardly away from the needles; but, since they are holding the welt fabric between them, only sufficient movement takes place to insure proper tension of the fabric during knitting. Springs **341**, Fig. 4, acting on studs **340**, keep the tension constant until sufficient fabric is knit whereby the roller assembly is urged against studs **338**, Fig. 4. Automatic tensioning pawls are provided to apply proper tension to the fabric through the tension rollers. When the tension rollers are in the position shown in Fig. 4, tension pawl **324** is actuated through its mechanism to impart the proper tension to the fabric. This pawl acts upon lower tension roller **316** through ratchet **323** while back-stop pawl **324'** prevents the rollers from backing up during the return stroke of pawl **324**. Tension can be varied through adjustment of spring **330**. However, the arrangement of tension pawl **324** is such that when the roller assembly is moved inwardly to the welt-turning position this pawl will allow free movement of the rollers and operate idly until the roller assembly is returned to the position shown in Fig. 4.

When the roller assembly is in the welt-turning position, auxiliary tension pawl **356**, Fig. 19, will be in action. This auxiliary tension pawl assembly is connected to the motion of the main tension pawl **324** through Bowden wire **359** so that each movement of pawl **324** will also be reflected in the movement of pawl **356**. The auxiliary pawl **356** will keep proper tension on the fabric while the tension rollers are in the welt-turning position; and, after the release of the roller assembly outwardly, will continue the function until the ratchet **323** is no longer in its path. Then pawl **356** will continue to move idly during the rest of the knitting cycle. While the rollers are moving outwardly, no pawls are required for tensioning, since the action of the roller assembly moving outwardly will tension the fabric correctly. After the rollers are positioned outwardly, pawls **324** will take over. The upper tension roller **317** is merely actuated by friction from roller **316** while resting against it. The fabric positioned between the rollers does not destroy the effectiveness of the upper roller **317**. This concludes the welt-turning cycle.

Having thus described my invention, it will be obvious to those skilled in the art that my invention provides a machine of great convenience and usefulness, and that while I have illustrated and described my invention in a very practical embodiment thereof without attempting to illustrate or describe other embodiments and adaptations which I contemplate, various changes may be made without departing from the scope of my invention as defined in the following claims.

I claim:

1. In a straight bar knitting machine arranged for the transfer of a series of loops held on a loop supporting implement bar to the needles, the combination of a needle bar provided with a series of needles, a knocking over bar provided with a series of knocking over bits on the front side of said needle bar, and a transfer bar provided with a series of transfer points on the back side of said needle bar.

2. In a straight bar knitting machine arranged for the transfer of a series of loops held on a loop supporting implement bar to the needles, the combination of a needle bar, a plurality of needles carried by said needle bar, a sinker head on one side of said needle bar, a plurality of sinkers and dividers carried by said sinker head, a knocking over bar on the other side of said needle bar, a plurality of knocking over bits carried by said knocking over bar, a transfer bar on the same side of said needle bar as said sinker head, and a plurality of transfer points carried by said transfer bar.

3. In a full-fashioned knitting machine having spring beard needles movable as a unit, means to press the needles, yarn measuring sinkers, and a series of knock-over bits, the combination of a series of transfer points supported and arranged in an upwardly projecting position at the beard side of the needles, a welt bar having welt hooks arranged for a substantially vertical position of said hooks to cooperate with the points for the transfer of loops held on the hooks to the points and thence to the needles.

4. In a full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, a series of knocking-over bits, the combination of a welt transfer mechanism comprising a welt transfer bar having a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, a welt bar having a series of welt hooks arranged to cooperate with the points, and means for imparting vertical positioning movements to said welt hooks and cooperating movements to the welt transfer points and needles to transfer an initial course of welt loops held on the welt hooks onto the transfer points, and thence onto the needles.

5. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means located at the beard side of the needles to press the needle beards, yarn measuring sinkers, a series of knock-over bits and a knock-over bit bar on which the knock-over bits are supported at the side of the needles opposite said pressing means, and a welt mechanism comprising a welt bar having hooks supported in a vertical position for the transfer of loops held on the hooks to the needles to close the welt, a welt transfer bar comprising a series of transfer points extending upwardly from beneath said pressing means at the beard side of the needles, each point having a loop entering tip and a recess arranged to cover successively the hook portion of the welt hook and the beard portion of an associated needle, and supporting means on which said welt transfer bar is supported for forward and back and vertical movements.

6. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means located at the beard side of the needles to press the needle beards, yarn measuring sinkers, a series of knock-over bit and a knock-over bit bar on which the knock-over bits are supported at the side of the needles opposite said pressing means, and a welt mechanism comprising a welt bar having hooks supported in a vertical position for the transfer of loops held on the hooks to the needles to close the welt, a series of transfer points and a supporting bar on which points are mounted projecting upwardly from beneath the pressing means at the beard sides of

the needles, supporting and actuating means on which the transfer point bar is arranged for forward and back and vertical movement, means for moving the welt bar and hooks vertically downwardly by the transfer points in the needles, and means for imparting cooperating movements to the transfer points to transfer a series of loops on the welt hooks to the transfer point, and means operative thereafter to impart relative positioning movements to the transfer points and needles to transfer said initial course of welt loops from the transfer points onto the needles.

7. In a flat full-fashioned knitting machine having a series of spring beard needles, means located at the beard side of the needles to press the needle beards, yarn measuring sinkers, a series of knock-over bits and a knock-over bit bar on which the knock-over bits are supported at the side of the needles opposite said pressing means, and a welt mechanism comprising a welt bar having a series of welt hooks supported in a vertical position for the transfer of loops held on the hooks to the needles to turn the welt, a series of transfer points and a supporting bar on which the points are mounted projecting upwardly from beneath the pressing means at the beard sides of the needles, means for moving said welt bar and hooks vertically downwardly between the transfer points and needles, and means for imparting cooperating movements to the transfer points and welt hooks and to the transfer points and the needles to remove an initial course of welt loops from the welt hooks onto the transfer points and thence onto the needles.

8. In a flat full-fashioned knitting machine having spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a welt mechanism including a welt bar having welt hooks supported in a vertical position for the transfer of loops held on the hooks to the needles to close a welt, a welt transfer bar comprising a series of transfer points extending upwardly from beneath said pressing means at the beard side of the needles, each said point having a loop entering tip and a recess arranged to cover successively the hook portion of the welt hook and the beard portion of an associated needle, means for imparting relative forward and back and vertical positioning movements to the welt hooks and narrowing points for the transfer of said loops onto the transfer points, and means for imparting relative forward and back and vertical positioning movements to the transfer points and needles to transfer the loops from the transfer points onto the needles.

9. In a flat full-fashioned knitting machine having spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a welt mechanism including a welt bar having a series of hooks arranged for movement horizontally between the needles for taking a setting-up group of sinker wale loops from the needles and for movement to a vertical position for transferring said loops to the needles to close the welt, a welt transfer bar comprising a series of transfer points extending upwardly from beneath said pressing means at the beard side of the needles, each point having a loop entering tip and a recess arranged to cover successively the hook portion of the welt hook and the beard portion of an associated needle, supporting means on which the welt hooks are supported and moved vertically between the needles and transfer points for said loop transfer operation, means for imparting relative positioning movements to the welt hooks and narrowing points to transfer the loops from the welt hooks onto the transfer points, and means for imparting relative positioning movements to the transfer points and needles to transfer the loops from the transfer points onto the needles.

10. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a narrowing machine having a frame movable vertically toward and away from the needles, a welt transfer mechanism comprising a welt transfer bar having a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, a welt bar having welt hooks supported in a vertical position for the transfer of loops held on the hooks for the needles to close a welt, means securing the welt bar for movement vertically with the narrowing frame, and means imparting relative positioning movements to the transfer bar and to the narrowing frame with the welt hooks to remove an initial course of welt loops from the welt hooks onto the transfer points.

11. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a narrowing machine having a frame movable vertically toward and away from the needles, a welt transfer mechanism comprising a welt transfer bar having a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, a welt bar comprising a series of welt hooks, a hanging frame on which said welt hooks are supported for forward and back and vertical movements for setting up and for closing the welt, means for securing the welt bar supported from said hanging frame for vertical movement as a unit with the narrowing frame, and means for imparting relative positioning movements to the transfer bar and narrowing frame with the welt hooks secured thereto to transfer an initial course of welt loops from the welt hooks onto said transfer points, and means for imparting relative movement to the transfer points and needles to transfer said loops from the transfer points onto the needles to close the welt.

12. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a narrowing machine comprising a narrowing machine frame supported for vertical sliding movements with relation to the needles with narrowing points rockably mounted on the frame, and a welt mechanism including a welt transfer bar comprising a series of transfer points extending upwardly and between said pressing means at the rear side of the needles, a welt bar having hooks supported in a vertical position for the transfer of loops onto the hooks for the needles to close the welt, means securing the welt bar to move as a unit with the narrowing frame, and means for imparting relative positioning movements to the transfer bar and to said narrowing frame with the welt hooks secured thereto to transfer an initial course of welt loops from the welt hooks onto transfer points, and means for thereafter imparting relative positioning movements to the transfer points and needles to transfer said loops from the transfer points onto the needles.

13. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a narrowing machine having a frame movable vertically toward and away from the needles, and a welt transfer mechanism comprising a welt transfer bar having a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, a welt bar comprising a series of welt hooks, a hanging frame on which said hooks are supported horizontally for setting up and vertically for closing the welt, means for securing the welt bar supported from said hanging frame for vertical movement as a unit with the narrowing frame, means for imparting relative positioning movements to the transfer bar and narrowing frame to transfer an initial course of groups from the welt hooks onto said transfer points, means for imparting relative movements to the transfer points and needles to transfer said loops from said transfer points onto the needles to close the welt, and means timed with

the operation of the machine for controlling the operation of said welt transfer mechanism including the securing of the welt bar to the narrowing frame in accordance within an automatic cycle.

14. In a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and knock-over bits, the combination of a narrowing machine having a frame movable vertically toward and away from the needles, a welt transfer mechanism comprising a welt transfer bar having a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, a welt bar comprising a series of welt hooks, a hanging frame on which said hooks are supported horizontally for setting up and vertically for closing the welt, locking means including a spring latch for securing the welt bar supported from said hanging frame for vertical movement as a unit with the narrowing frame, actuating means for controlling said hanging frame and welt hooks to position a row of setting-up loops on the hooks, means for drawing off the welt fabric as knitted, means for moving the welt hooks to a vertical position and for engaging said lock, means for imparting relative movements to the narrowing frame and transfer bar to transfer said loops to the transfer points, means for imparting relative movements to the transfer points and needles to transfer said loops from the transfer points to the needles, means to release said spring latch to disengage the welt bar from the narrowing frame, and pattern means timed with the operation of the machine for controlling the operation of said welt transfer mechanism in accordance with an automatic cycle.

15. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, welt mechanism comprising welt setting-up implements, and means for moving said implements and fabric supported thereby away from the needles in the direction of take-up, a welt wire, supporting means on which the welt wire is moved away from the needles beyond said implements to form a fold of welt fabric, fabric tensioning means comprising a pair of nip rollers, and means to relatively move the welt wire and nip rollers to engage the folded welt portion between the rollers and to remove the welt wire from engagement with the folded welt fabric.

16. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising welt setting-up implements, means for moving said implements and the fabric supported thereby away from the needles in the direction of take-up, a welt wire, supporting means on which the welt wire is moved away from the needles and relatively to said implements to form a fold of welt fabric, fabric tensioning means comprising a pair of nip rollers, means to relatively move the welt wire and nip rollers to engage the folded welt between the rollers, and means rotating the rollers to take-up said folded welt fabric.

17. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising welt setting-up implements, means for moving said implements and the fabric supported thereby away from the needles in the direction of take-up, a welt wire, supporting means on which the welt wire is moved away from the needles beyond said implements to form a fold of welt fabric, fabric tensioning means comprising a pair of nip rollers, means to relatively move the welt wire and nip rollers to engage the folded welt between the rollers, and means to remove the welt wire from the folded welt fabric, and means for rotating said rollers to take up the fabric.

18. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising welt setting-up implements, means for moving said implements and the fabric supported thereby away from the needles in the direction of take-up, a welt wire, supporting means on which the welt wire is moved away from the needles beyond said implements to form a fold of welt fabric, fabric tensioning means comprising a support on which rollers are movable between limit positions toward and away from the needles, means to locate the nip rollers toward the needles to receive therebetween the welt wire and said folded welt portion, means operable in the limit position of the roller support toward the needles for imparting a fabric take-up rotational movement to the rollers, means imparting a fabric take-up movement to the rollers away from the needles, and means operable for said limit position away from the needles to impart further rotational fabric take-up movements to the rollers.

19. In a flat knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism comprising welt setting-up implements, means for moving said implements and fabric supported thereby away from the needles in the direction of take-up, a welt wire, supporting means on which the welt wire is moved away from the needles and relatively to said implements to form a fold of welt fabric, fabric tensioning means comprising a pair of nip rollers and supporting means on which the rollers are located to receive therebetween the welt wire and folded welt fabric, means for rotating said nip rollers in a direction to take-up the folded welt fabric, and means for removing the welt wire rearwardly from between the rollers and from engagement with the folded welt fabric.

20. In a flat full-fashioned knitting machine for knitting welt having knitting devices including a needle series, a welt mechanism adapted for setting-up and for knitting a fold of welt fabric, and a fabric take-up device comprising a pair of nip rollers, supporting means on which the rollers are located to receive therebetween the folded welt fabric and on which the rollers are movable between limit positions toward and away from the needles, means for moving the take-up rollers in a take-up direction to said limit position away from the needles, and means for imparting fabric take-up rotational movements to said rollers.

21. In a flat full-fashioned knitting machine for knitting welt fabric having knitting devices including a needle series, a welt mechanism adapted for setting up and for knitting a folded welt fabric, and a fabric take-up device comprising a pair of nip rollers, supporting means on which the rollers are located to receive therebetween the folded welt fabric, and on which rollers are movable between limit positions toward and away from the needles, actuating means including a pawl operative in the limit position toward the needles for imparting stepped taking-up movements to the rollers, means for moving said roller support away from the needles in a take-up direction, and actuating means including a pawl operative in the limit position of the rollers away from the needles to impart a fabric take-up rotational movement to said rollers.

22. Automatic welt turning mechanism for a straight bar knitting machine including a needle bar, a plurality of needles carried by said needle bar, a welt bar, a plurality of welt hooks carried by said welt bar and movable to take from said needles a first row of loops at the beginning of a knitting cycle, tension means for receiving and tensioning fabric knit upon said machine, welt bar actuating means selectively operable to cause said welt bar during a predetermined period to draw off fabric hooked to its welt hooks and to tilt said welt bar through an angle of approximately 90° into a vertical hook transfer position, a transfer bar disposed at the beard side of the needles, a plurality of transfer points carried by said transfer bar extending upwardly therefrom, means for moving the welt hooks outwardly into points relatively thereto to receive said loops from said welt hooks and transfer the same back onto said needles to complete the turning of the welt.

23. Apparatus according to claim 22 including electrical control mechanism connected to time movements of said needle bar, said welt bar, said tension means, and said transfer bar to make the turning of the welt completely automatic.

24. The method of drawing off a fold of welt fabric from the needles of a straight bar knitting machine having loop engaging instrumentalities including said needles and a welt bar, which comprises the steps of forming a setting up course and drawing off the fabric from the needles with said welt bar, engaging a welt wire with the fabric, manipulating the welt wire and welt bar to form a fold of said welt fabric, engaging a separate take-up with the folded welt fabric and withdrawing the welt wire from the fabric fold, further manipulating the loop engaging instrumentalities of the machine including the needles and welt bar to close the welt, and continuing the drawing off of the fabric by said separate take-up.

25. The method of knitting a welt on a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers, and a series of knocking-over bits, a welt transfer bar with a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles, and a welt bar with welt hooks, which comprises the steps of knitting a setting up course on the needles and on said hooks inserted horizontally between the needles, drawing off the welt bar to take up the fabric, forming a fold in the fabric as knitted and drawing off the folded welt fabric, moving the welt bar to a vertical position and downwardly between the needles and transfer points, imparting relative positioning movements to the welt hooks and transfer bar to transfer the initial welt loops to the transfer points, and thereafter imparting relative movements to the transfer points and needles to transfer the initial fabric course of the needles.

26. The method of knitting a welt on a flat full-fashioned knitting machine having a series of spring beard needles movable as a unit, means to press the needle beards, yarn measuring sinkers and a series of knocking-over bits, a welt transfer bar with a series of transfer points projecting upwardly from beneath said pressing means at the beard side of the needles and a welt bar with hooks which comprises the steps of moving the welt bar vertically downwardly between the needles and transfer points, and for imparting cooperating movements to the transfer bar to position the initial loops of the welt from the welt hooks on the transfer points, and thereafter imparting relative positioning movements to the transfer points and needles to transfer the initial course of welt loops to the needles.

27. In a flat full-fashioned knitting machine the combination of a series of spring beard needles, yarn measuring sinkers, and a mechanism for setting-up, folding and topping onto the needles a welt portion of said fabric, including a series of welt instrumentalities to receive and draw off from the needles an initial course of welt loops, a welt wire, means for moving the welt wire against the welt fabric as it is knitted, means for relatively moving the welt instrumentalities and welt wire to form a fold of welt fabric, and means acting during the subsequent knitting of the fabric to withdraw the welt wire from the fabric fold.

28. In a flat full-fashioned knitting machine the combination of a series of spring beard needles, yarn measuring sinkers, and a mechanism for setting-up, folding and topping onto the needles a welt portion of said fabric, including a series of welt instrumentalities to receive and draw off from the needles an initial course of welt loops, a welt wire, means for moving the welt wire against the welt fabric as it is knitted, means for relatively moving the welt instrumentalities and welt wire to form a fold of welt fabric, and an auxiliary fabric take-up device adapted to be connected to said fabric fold independently of said welt wire to further draw off said fabric.

29. In a flat full-fashioned knitting machine the combination of a series of spring beard needles, yarn measuring sinkers, and a mechanism for setting-up, folding and topping onto the needles a welt portion of said fabric, including a series of welt instrumentalities to receive and draw off from the needles an initial course of welt loops, a welt wire, means for moving the welt wire against the welt fabric as it is knitted, means for relatively moving the welt instrumentalities and welt wire to form a fold of welt fabric, an auxiliary fabric take-up device adapted to be connected to said fabric fold independently of the welt wire to further draw off said fabric, and means relatively moving the welt wire and auxiliary fabric take-up device to connect the auxiliary fabric take-up device with the fabric fold.

30. In a flat full-fashioned knitting machine the combination of a series of spring beard needles, yarn measuring sinkers, and a mechanism for setting-up, folding and topping onto the needles a welt portion of said fabric, including a series of welt instrumentalities to receive and draw off from the needles an initial course of welt loops, a welt wire, means for moving the welt wire against the welt fabric as it is knitted, means for relatively moving the welt instrumentalities and welt wire to form a fold of welt fabric, an auxiliary fabric take-up device adapted to engage said fabric fold to further draw off said fabric, and means relatively moving the welt wire and auxiliary fabric take-up device to connect the folded welt portion with the auxiliary fabric take-up and to remove the welt wire from engagement with the folded welt fabric.

31. In a full fashioned knitting machine, a bed of needles, means for operating said needles to knit loops of knitted fabric, means for drawing said fabric from said needles, stripping rolls for stripping said fabric from said machine, means engaging said fabric, means for moving said engaging means to draw said fabric between said stripping rolls, means for rotating said stripping rolls upon completion of the knitting of said fabric to strip said fabric from said machine.

32. In the manufacture of a full fashioned hose, a method of handling said hose as it issues from the knitting machine, which comprises, placing a welt wire in the fabric of said hose, turning a welt around said welt wire, drawing said hose from the needles of said machine by said welt wire, drawing said welt and said welt wire between rolls, turning said rolls to draw said hose from said machine, withdrawing said welt wire from said welt as said hose is being drawn by said rolls.

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