Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

Filed April 25, 1947 29 Sheets-Sheet 1

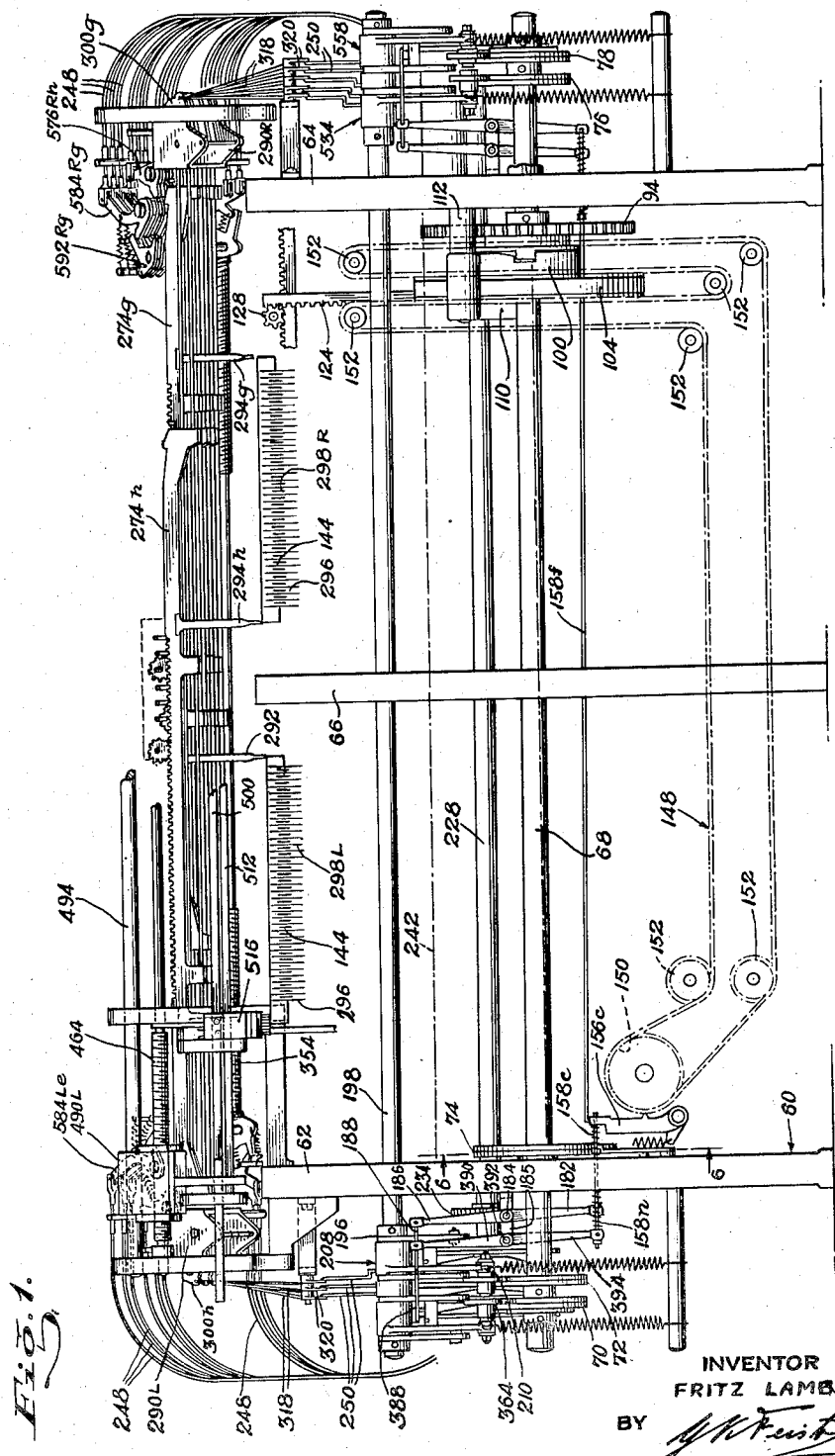


Fig. 1.

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STRAIGHT BAR KNITTING MACHINE

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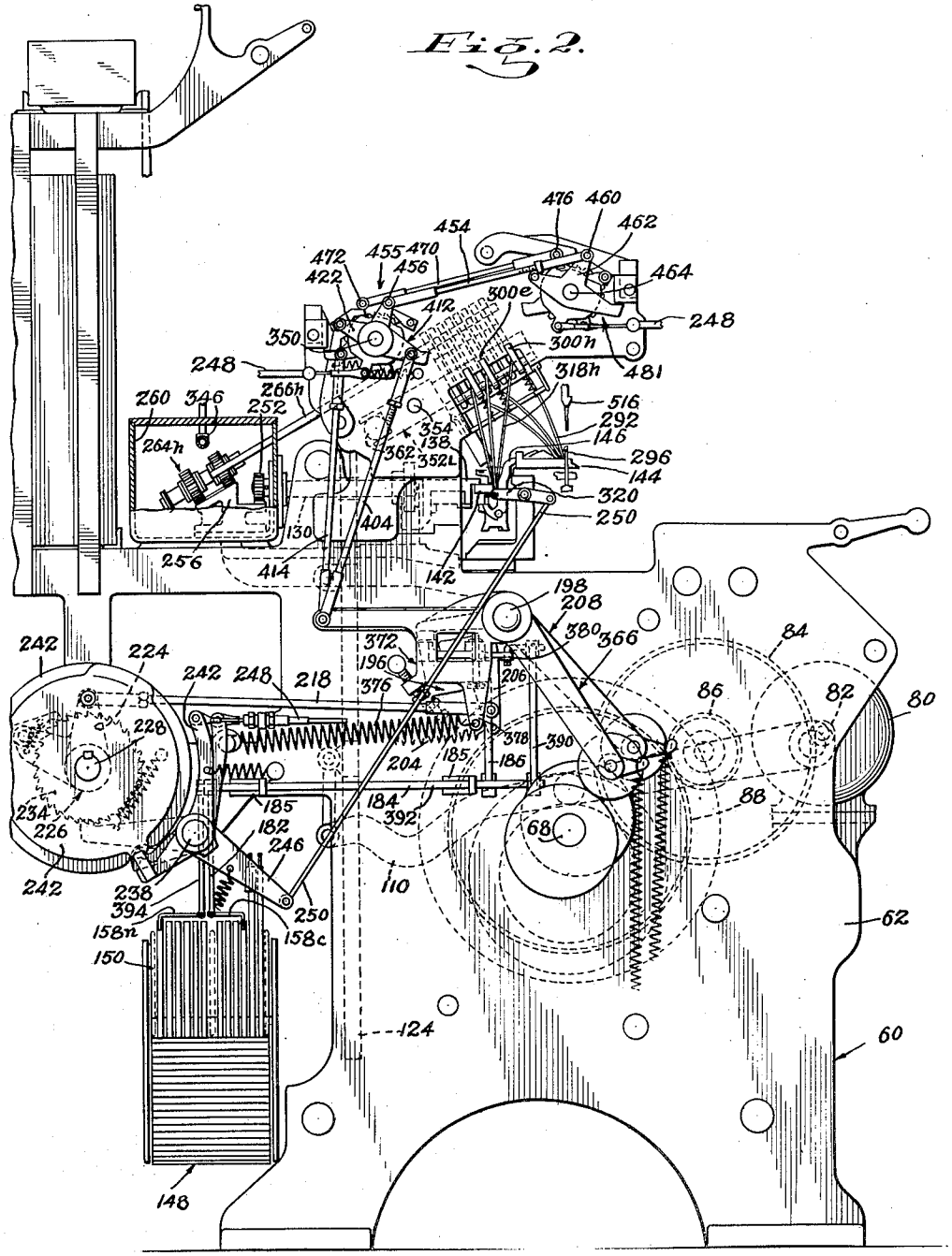
Fig. 2.

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STRAIGHT BAR KNITTING MACHINE

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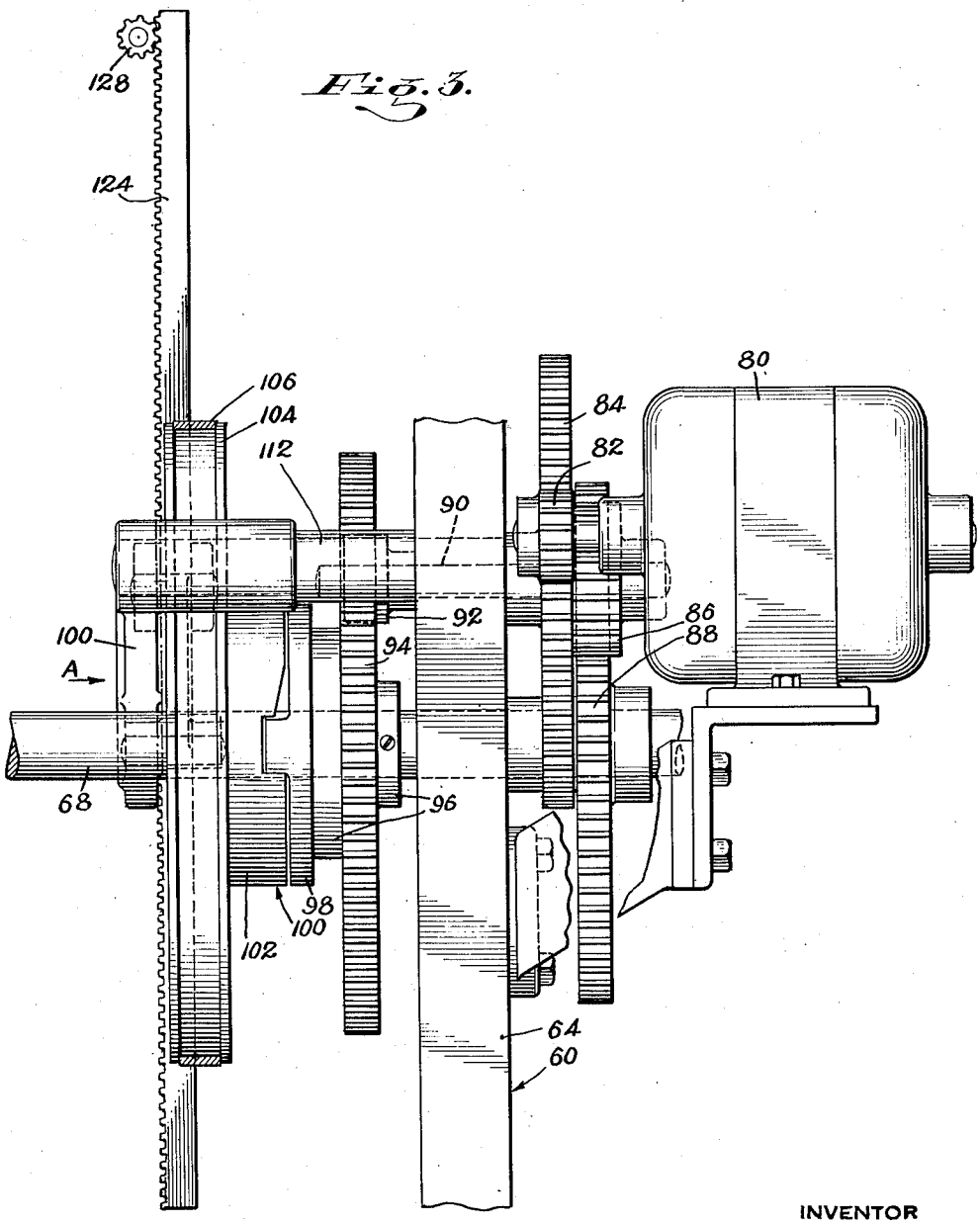
Fig. 3.

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STRAIGHT BAR KNITTING MACHINE

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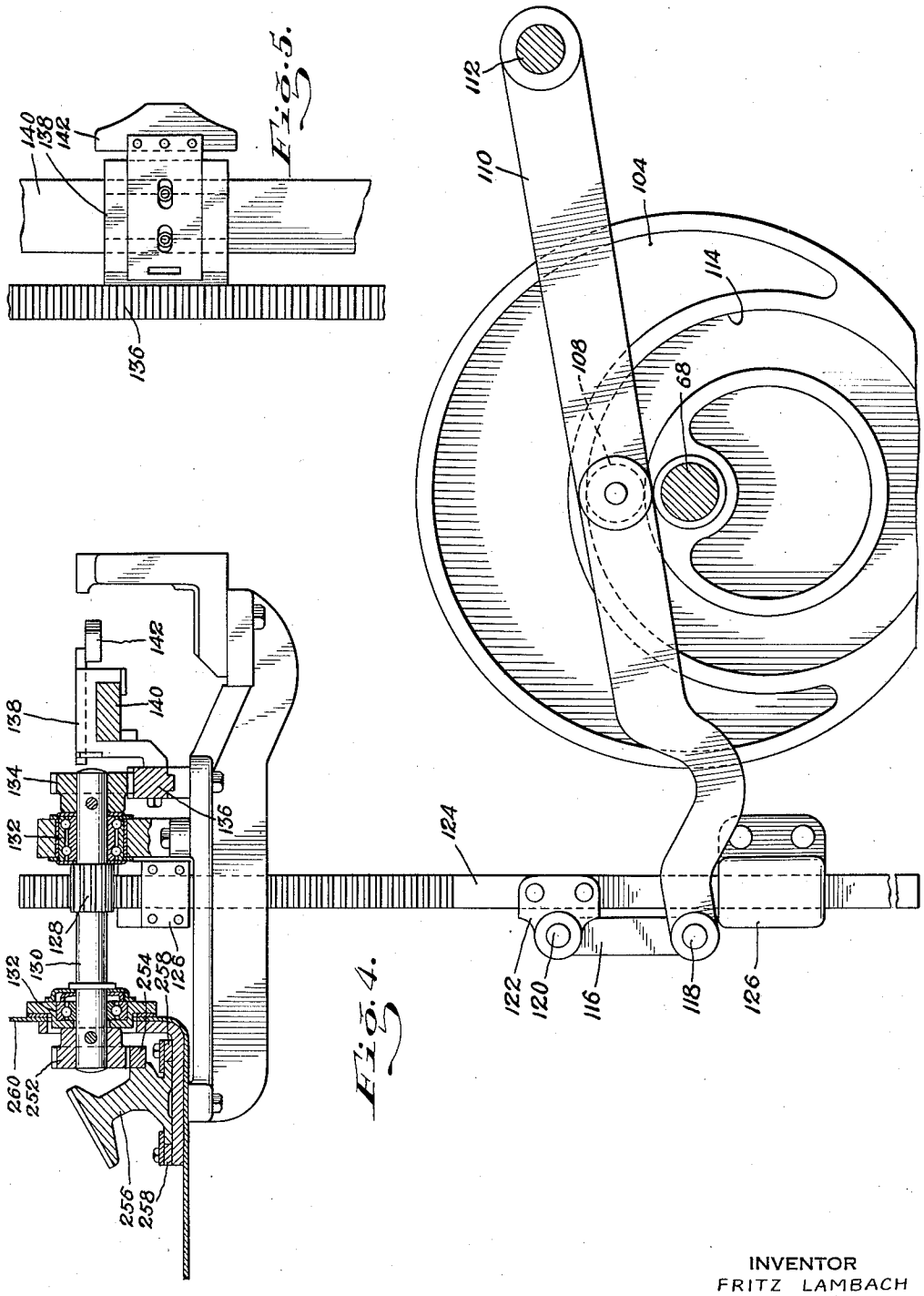


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STRAIGHT BAR KNITTING MACHINE

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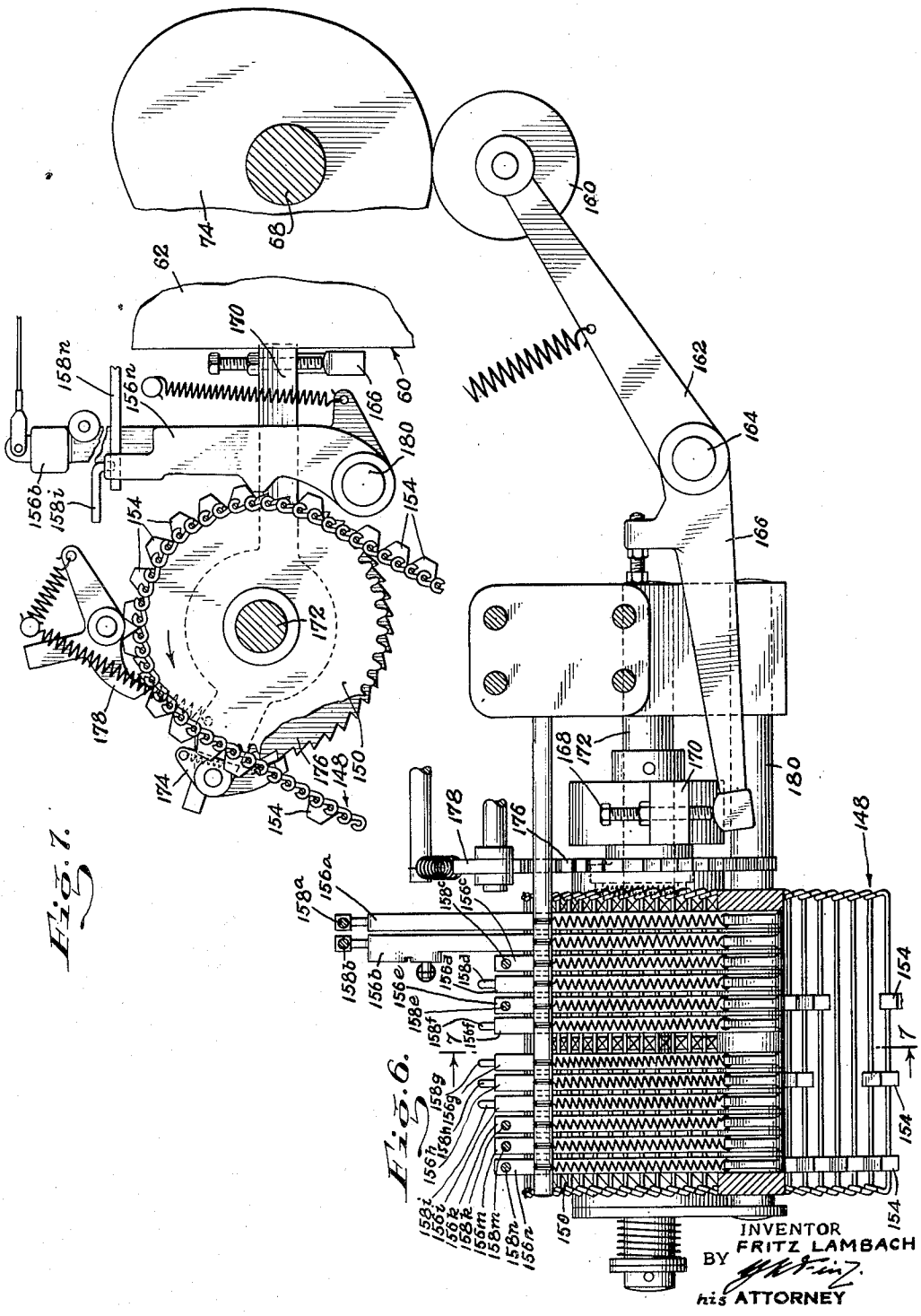


Fig. 7.

Fig. 6.

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STRAIGHT BAR KNITTING MACHINE

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Fig. 8.

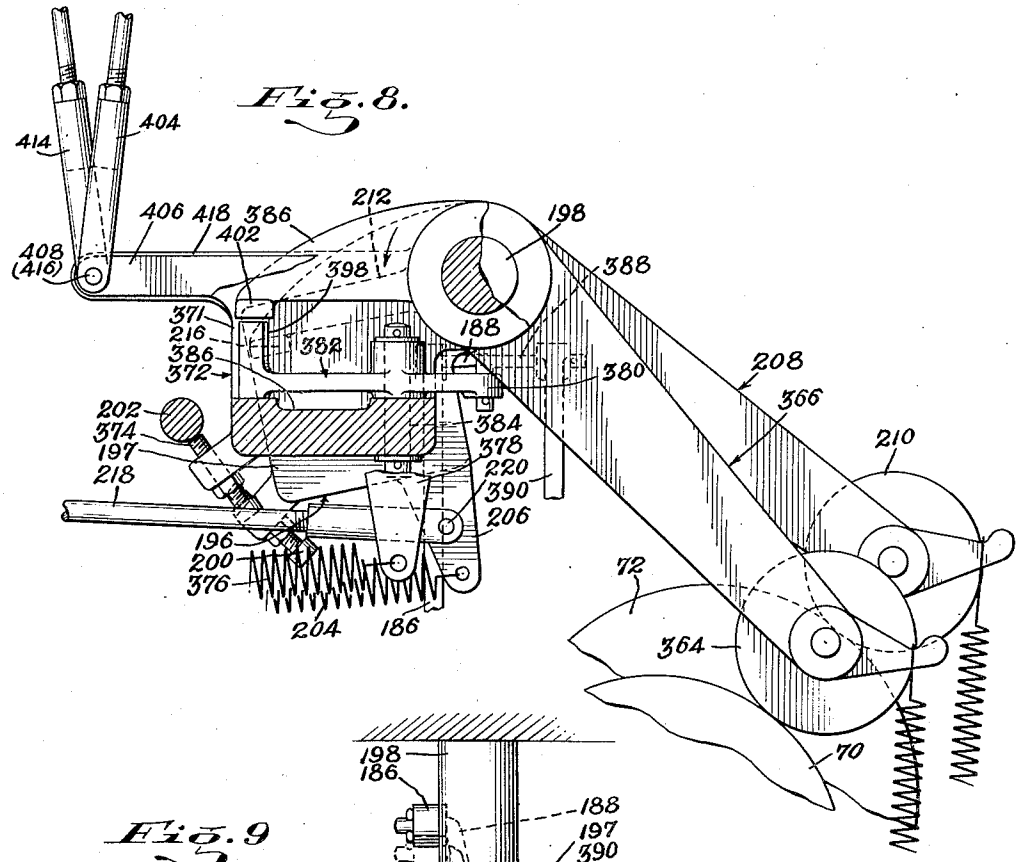
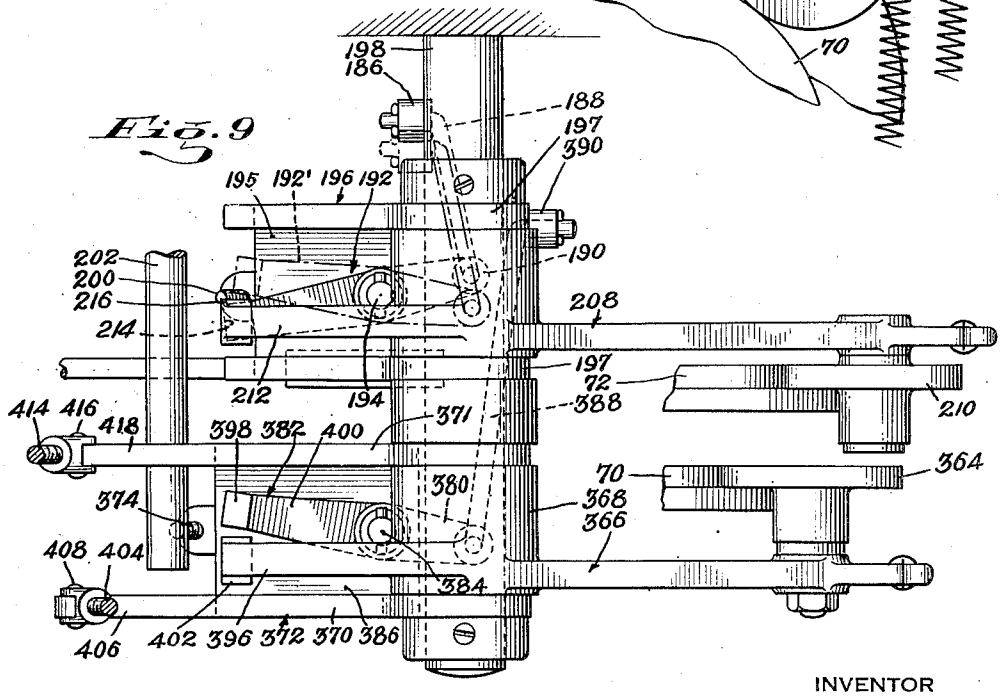



Fig. 9

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STRAIGHT BAR KNITTING MACHINE

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Fig. 10.

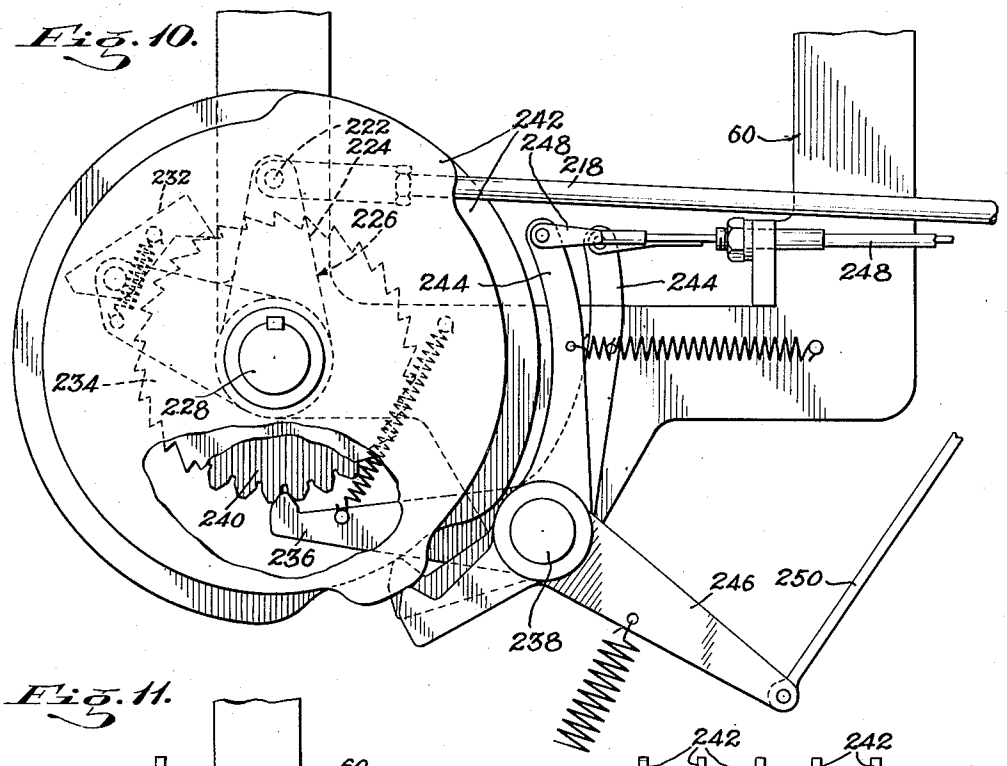
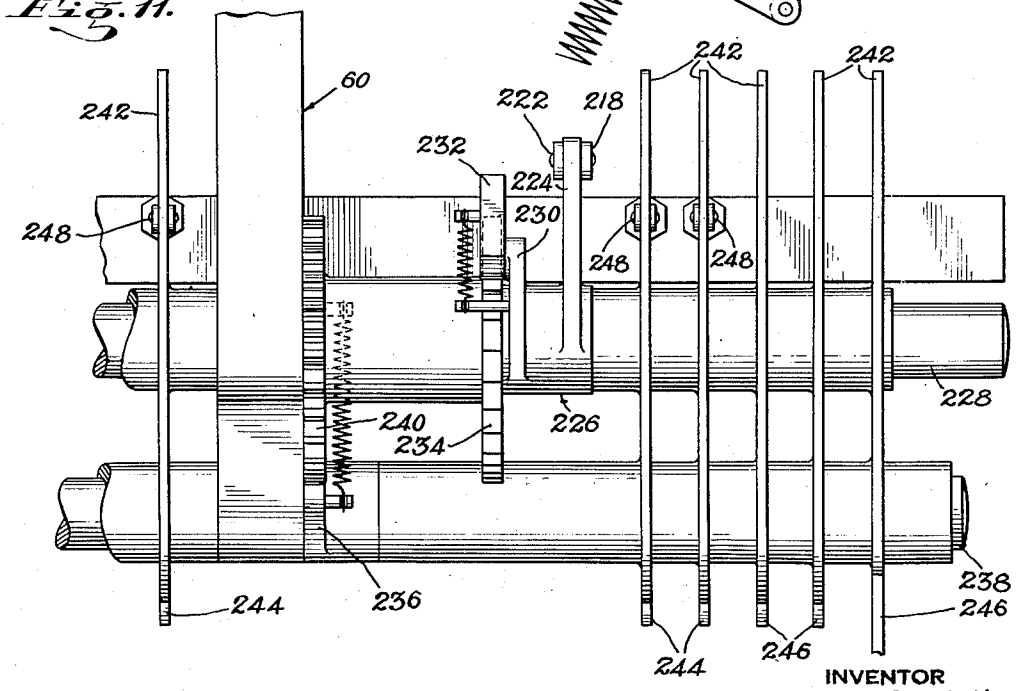



Fig. 11.

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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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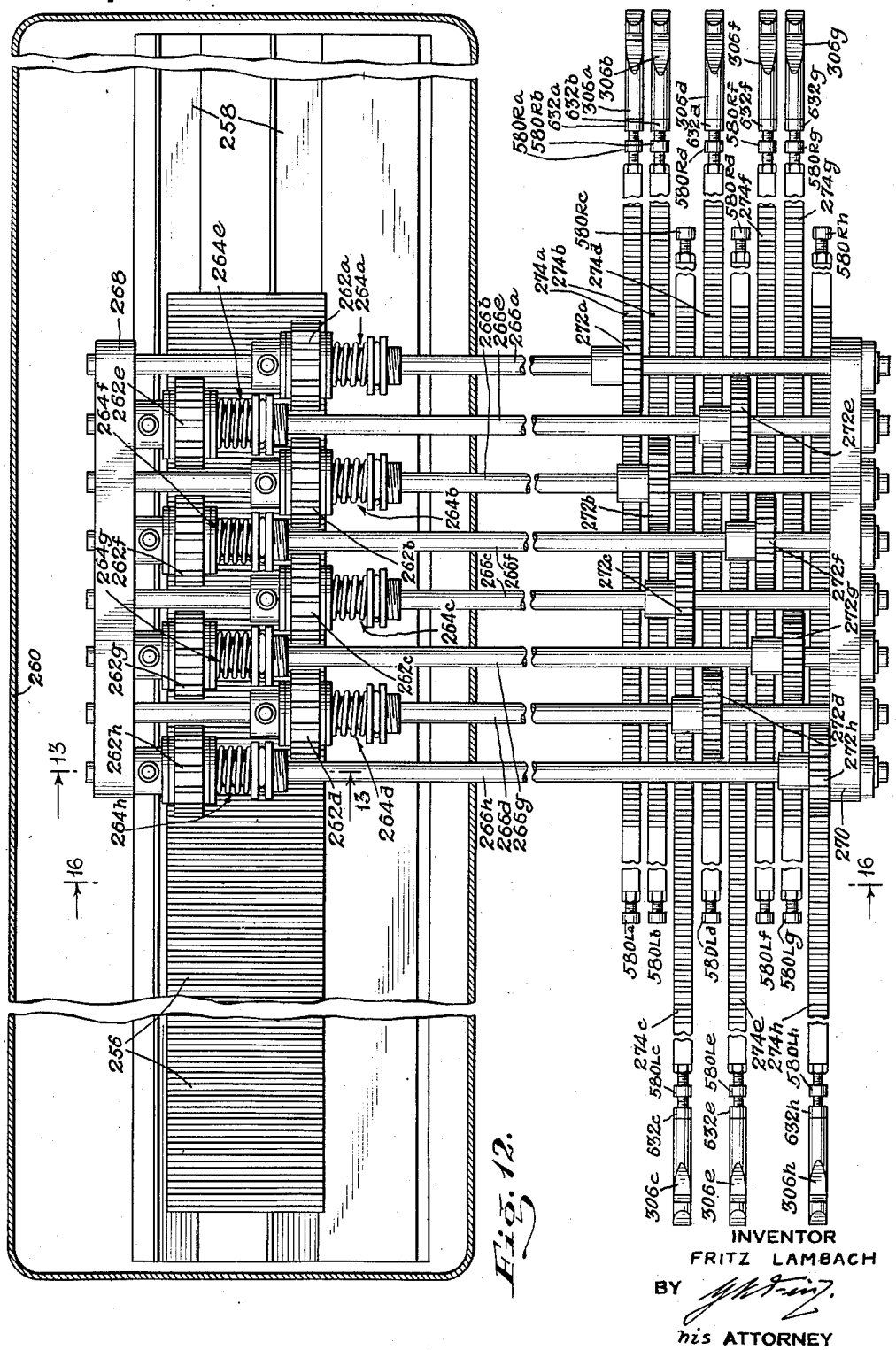


Fig. 12.

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STRAIGHT BAR KNITTING MACHINE

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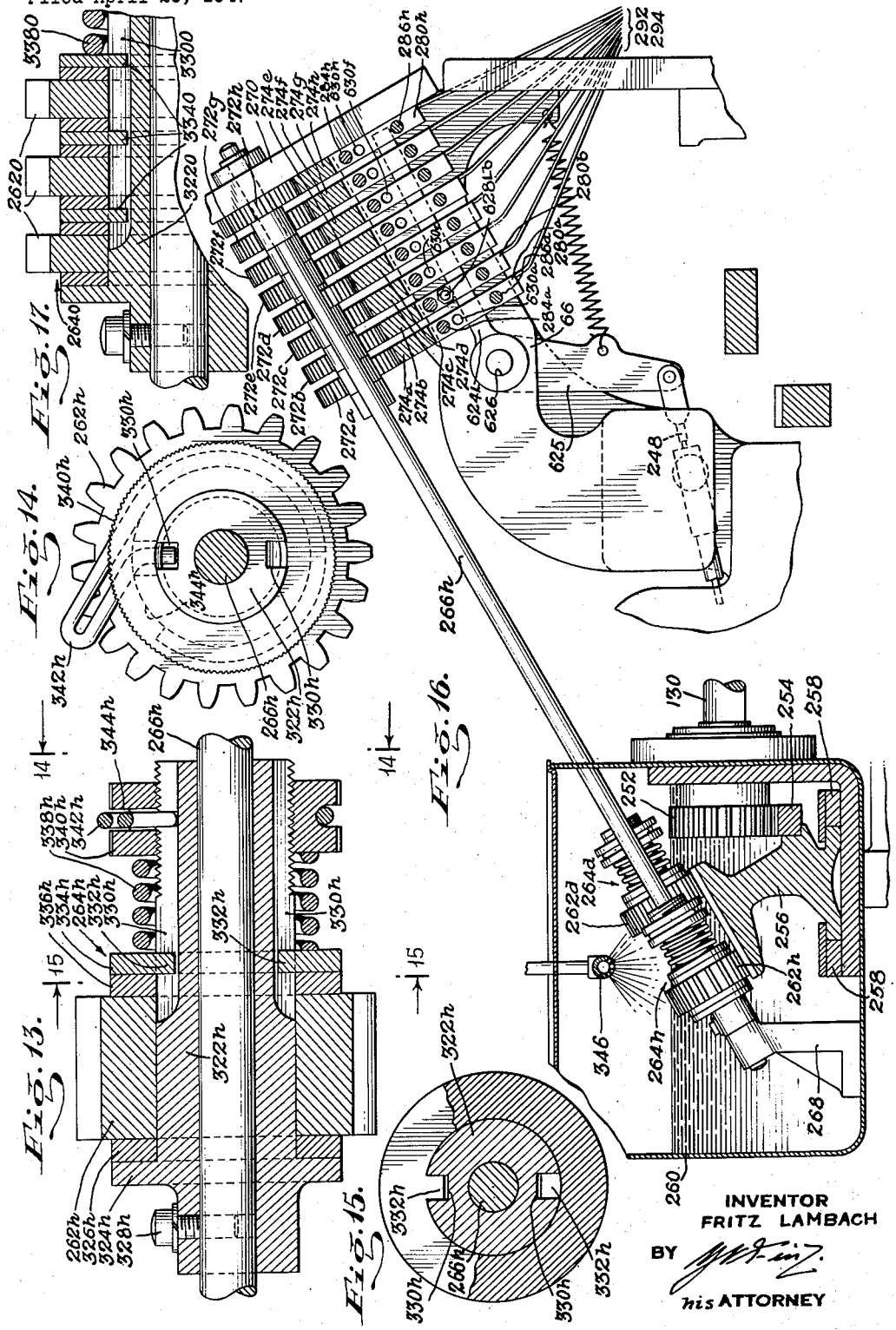

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STRAIGHT BAR KNITTING MACHINE

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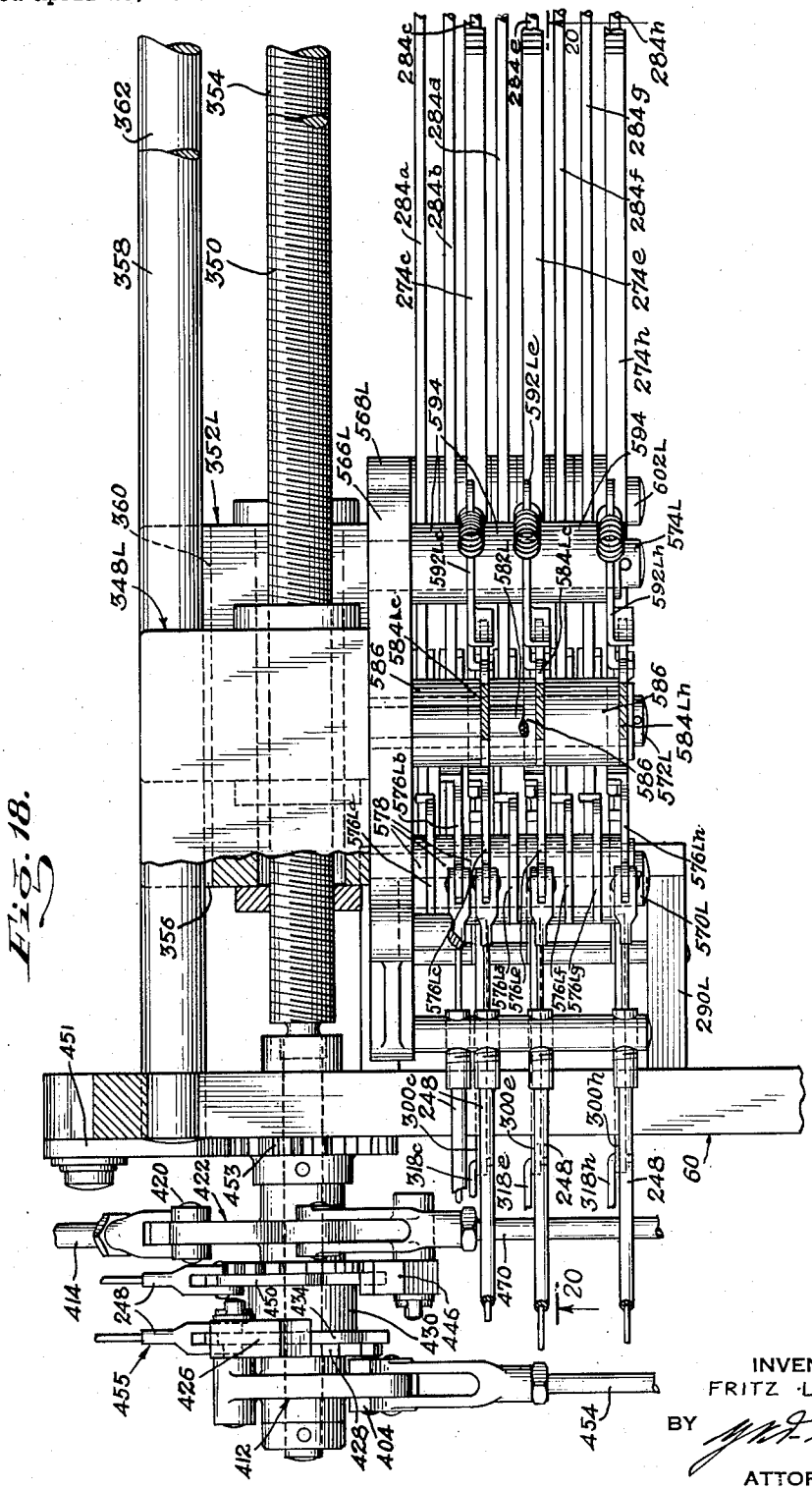


Fig. 18.

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STRAIGHT BAR KNITTING MACHINE

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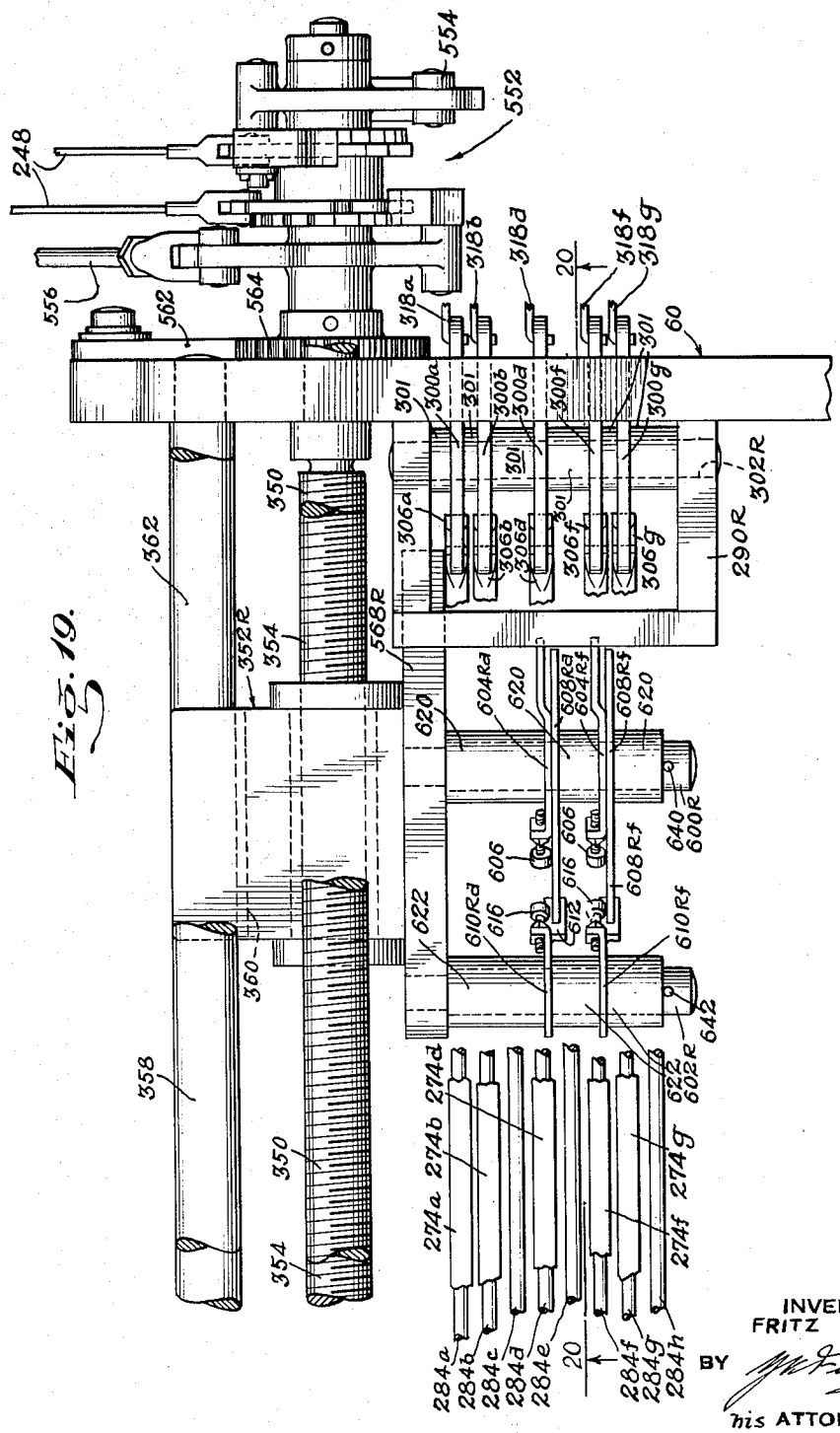


Fig. 19.

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STRAIGHT BAR KNITTING MACHINE

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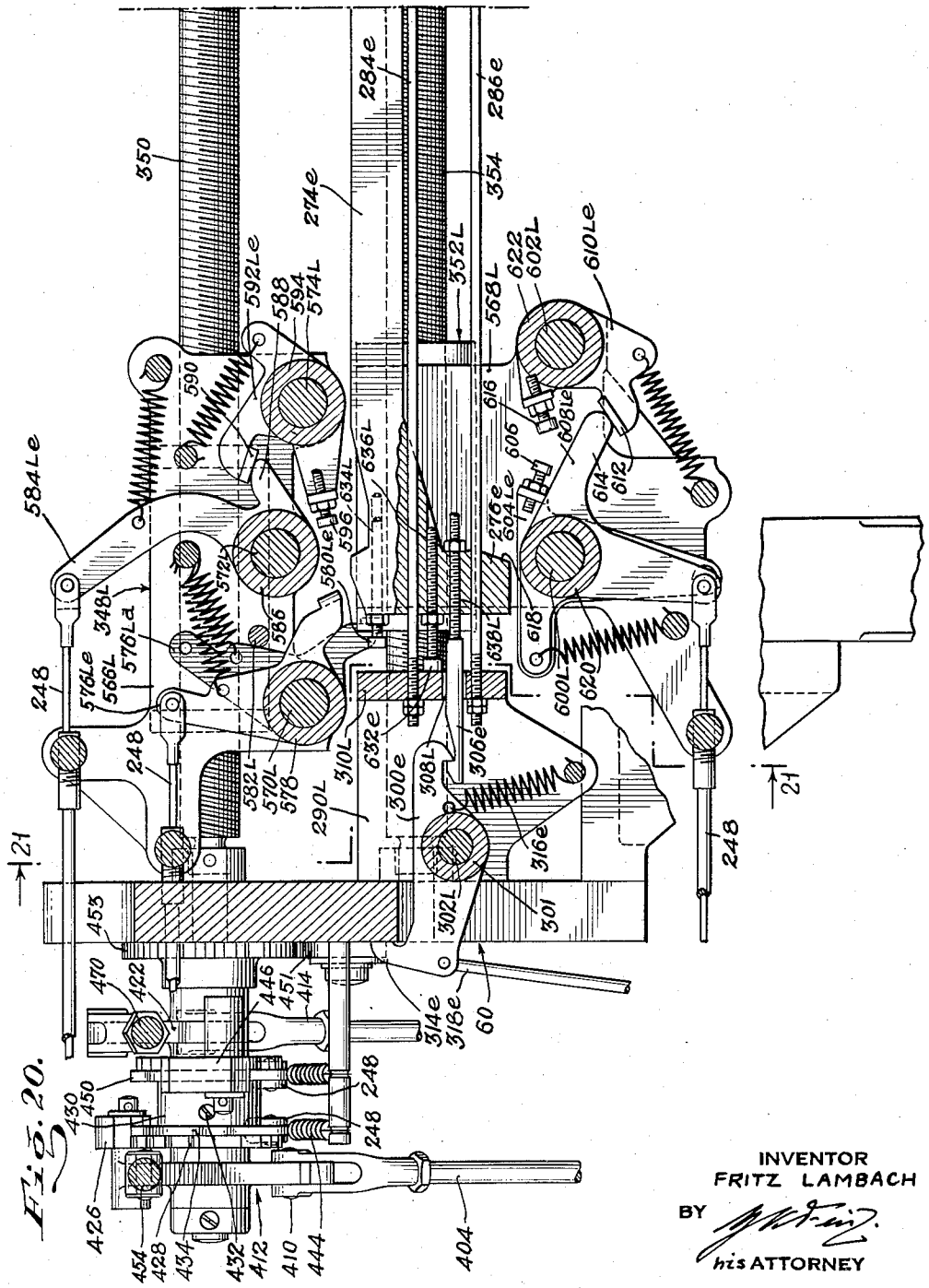


Fig. 20.

INVENTOR
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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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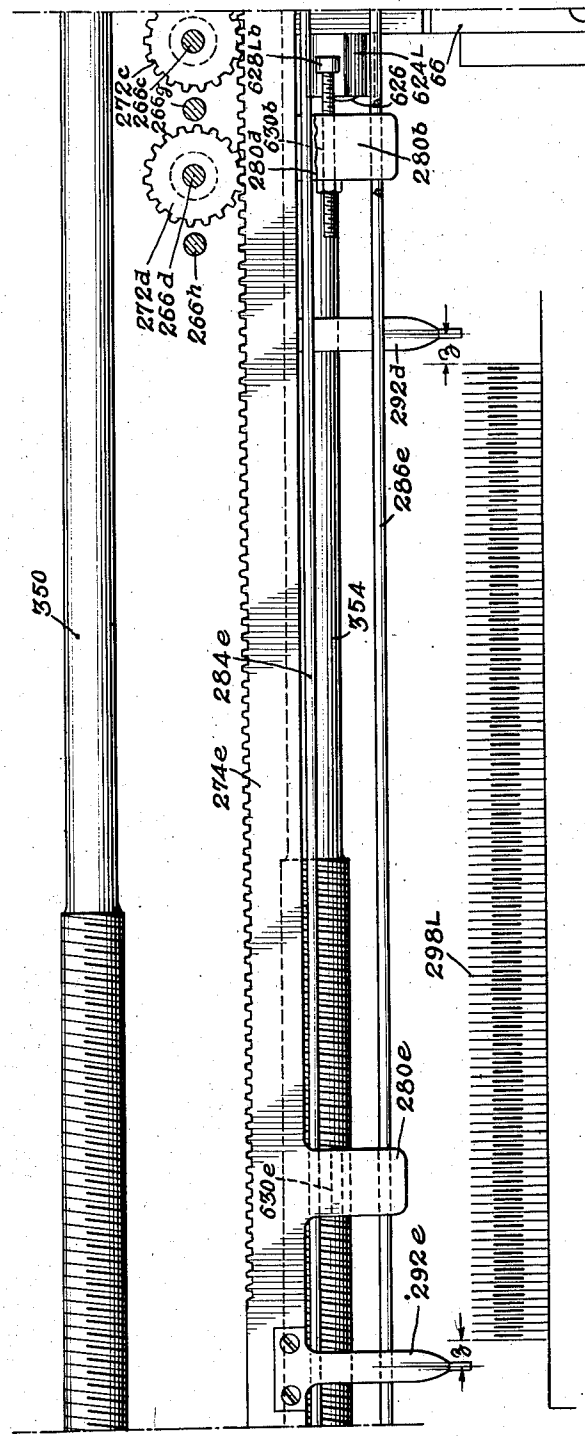


Fig. 20A.

INVENTOR
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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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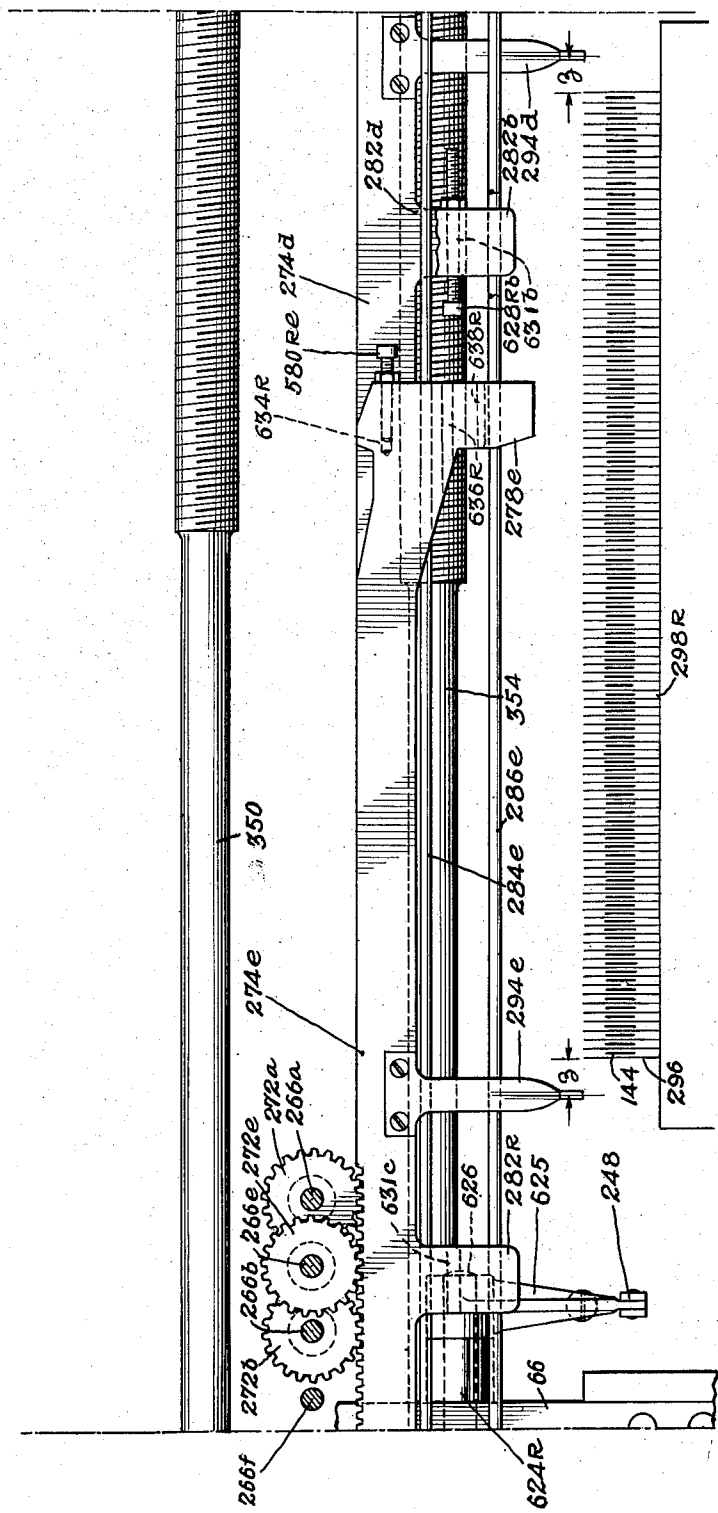


Fig. 20B.

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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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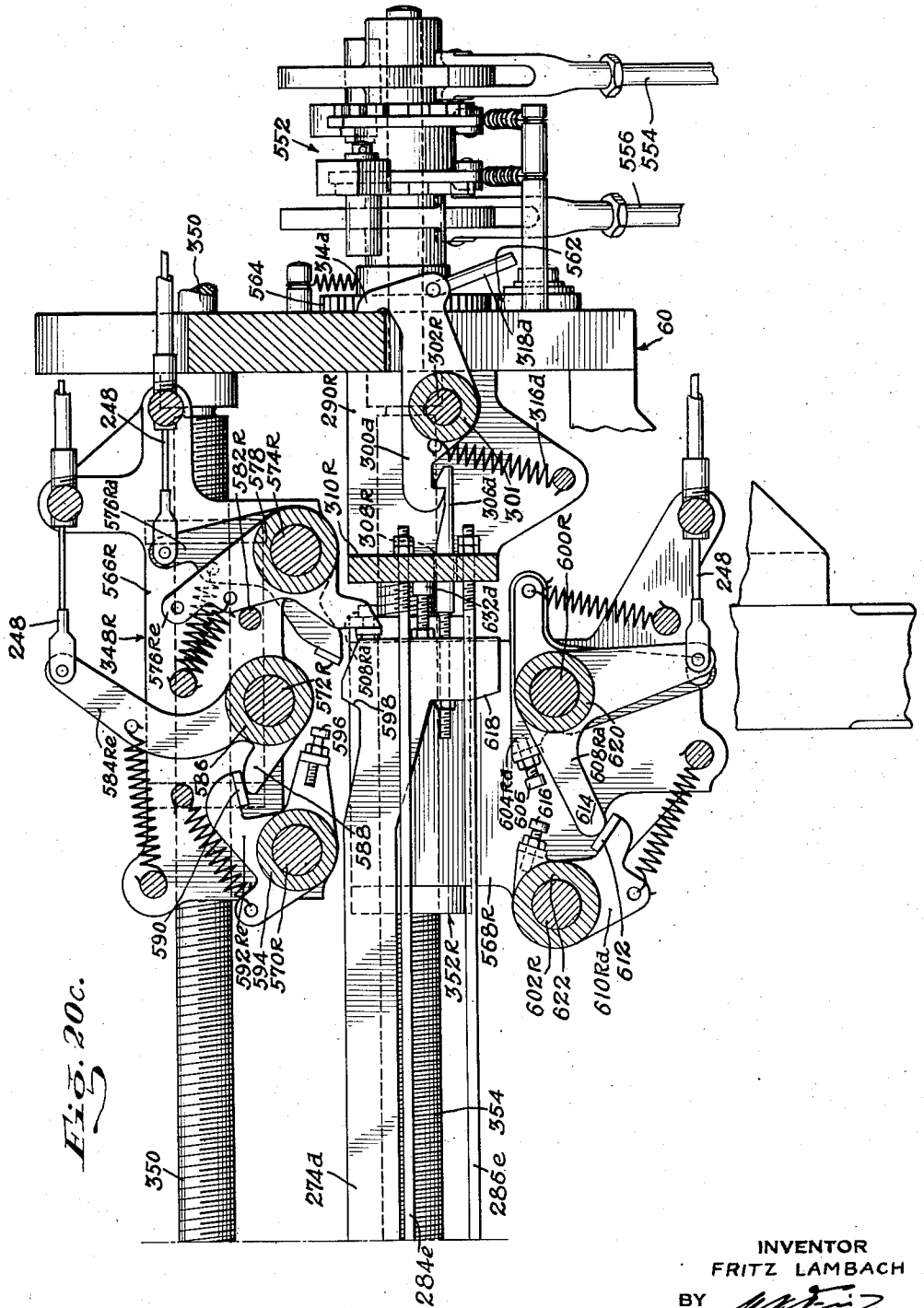


Fig. 20c.

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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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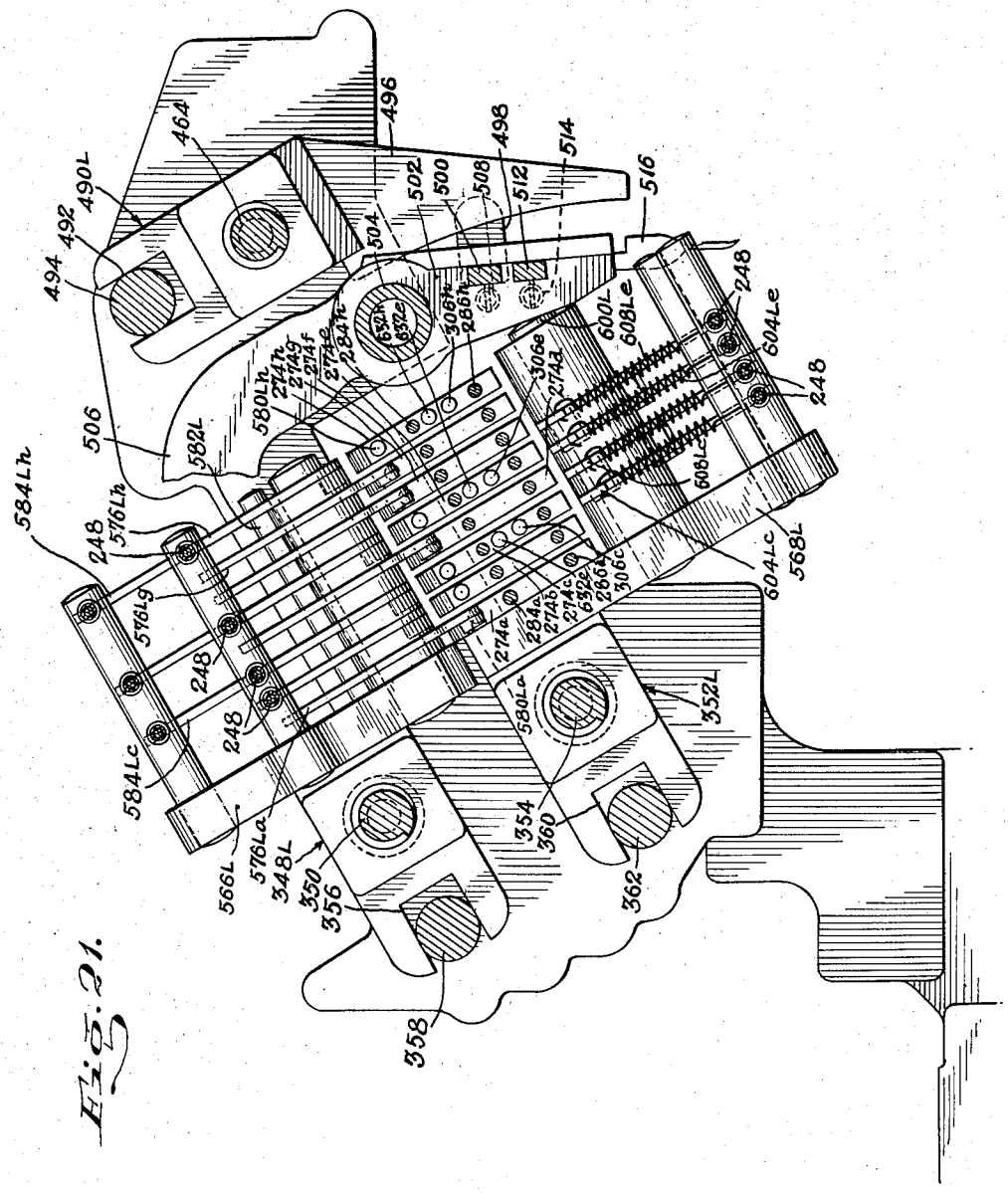


Fig. 21.

INVENTOR
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STRAIGHT BAR KNITTING MACHINE

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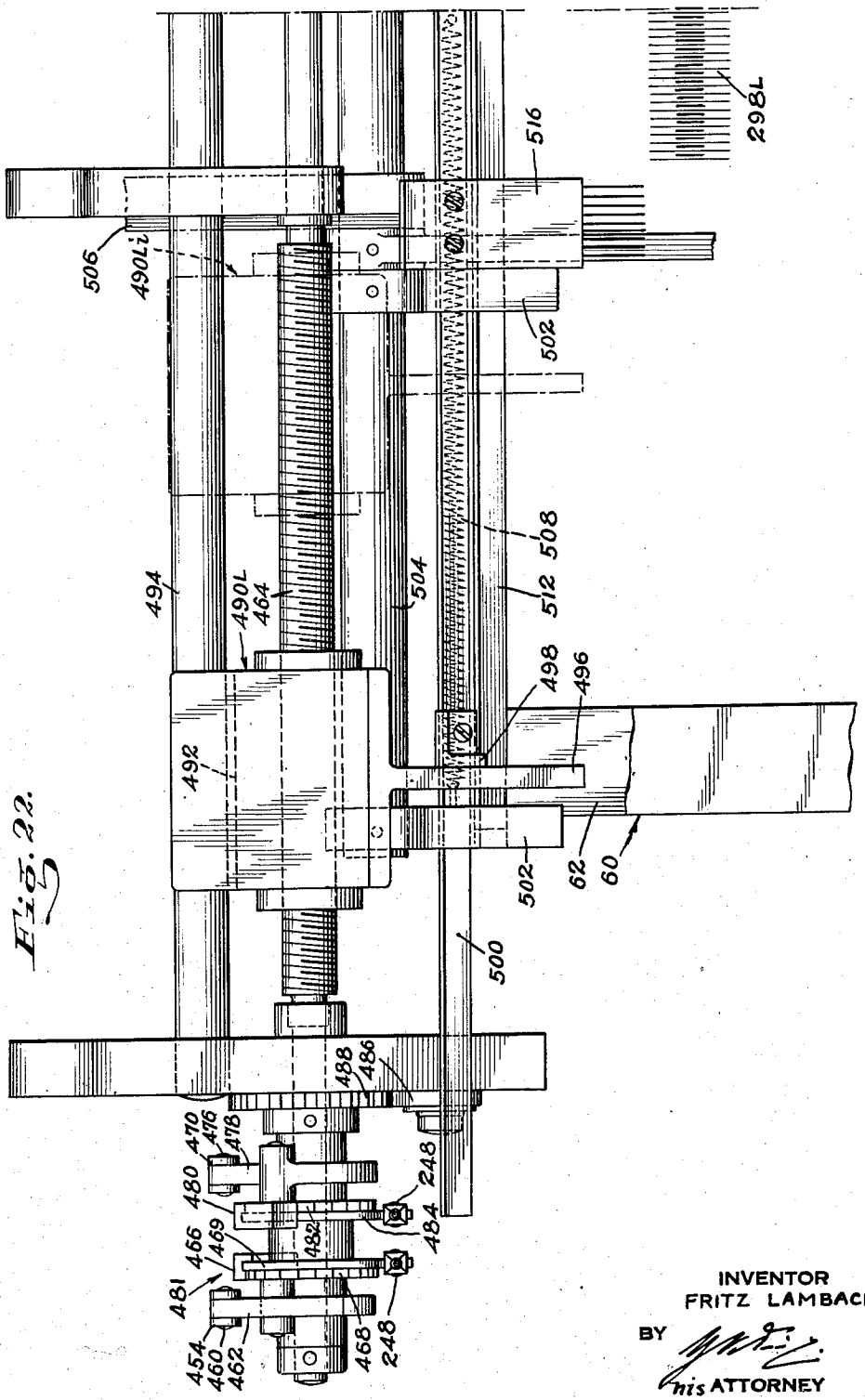


Fig. 22.

INVENTOR
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STRAIGHT BAR KNITTING MACHINE

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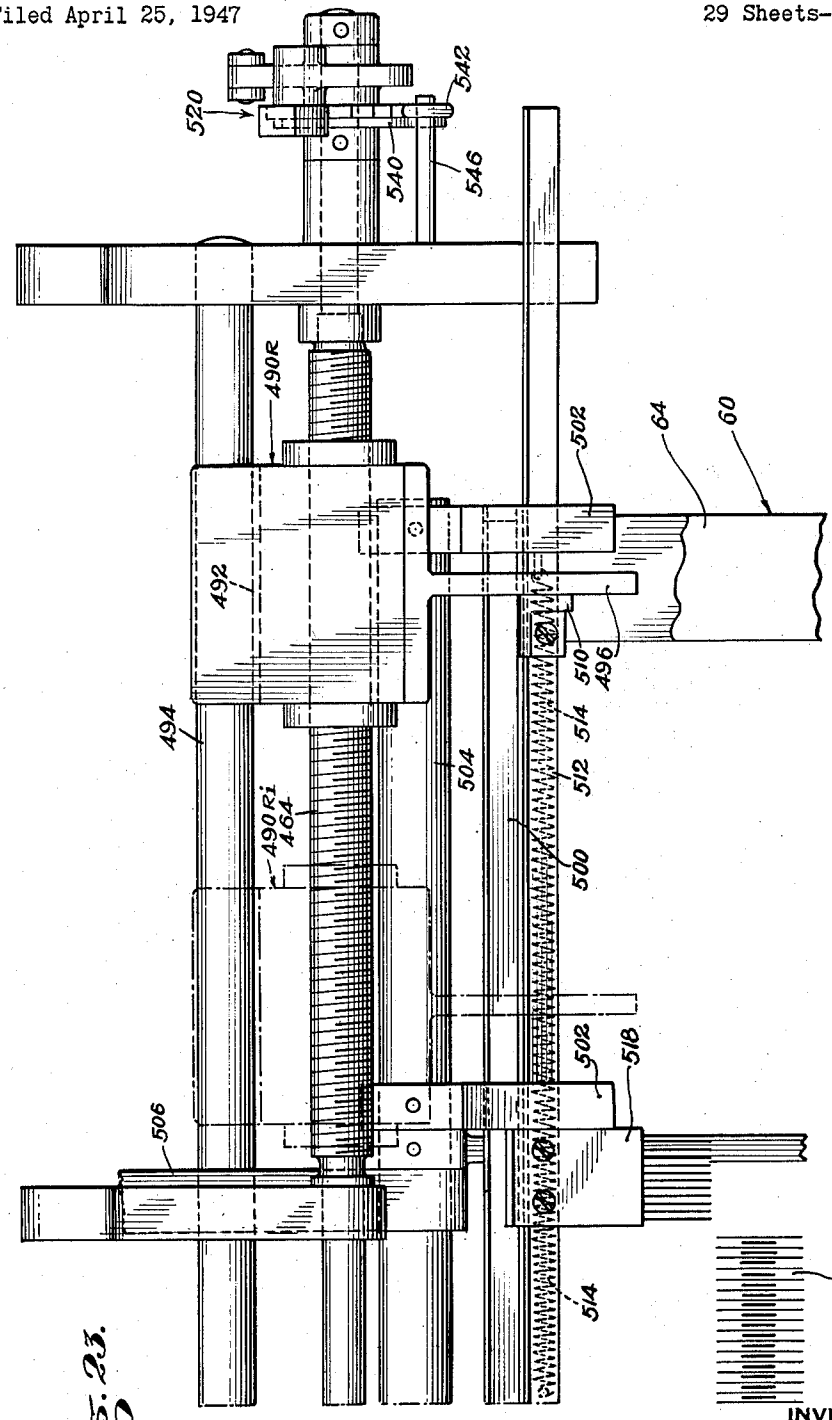


Fig. 23.

INVENTOR
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STRAIGHT BAR KNITTING MACHINE

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Fig. 24.

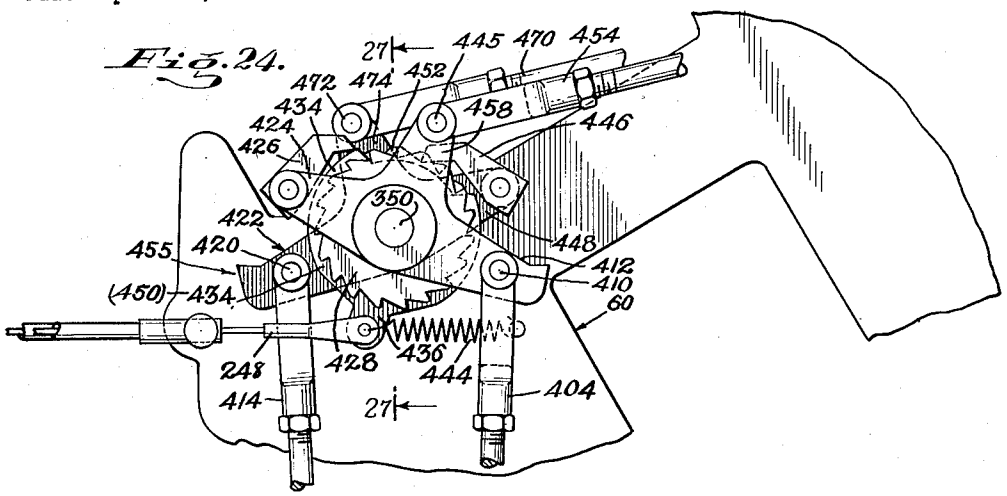



Fig. 25.

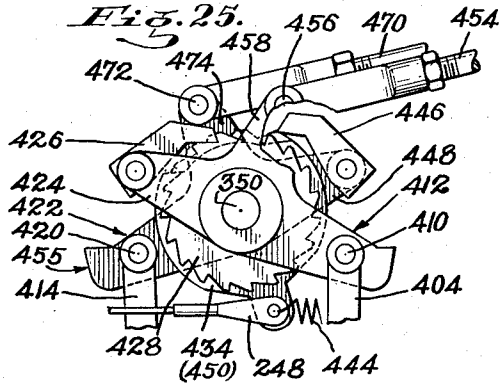
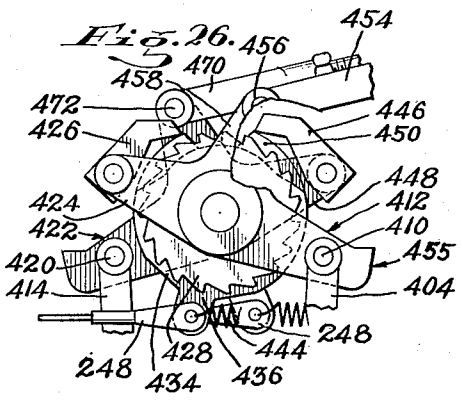



Fig. 26.

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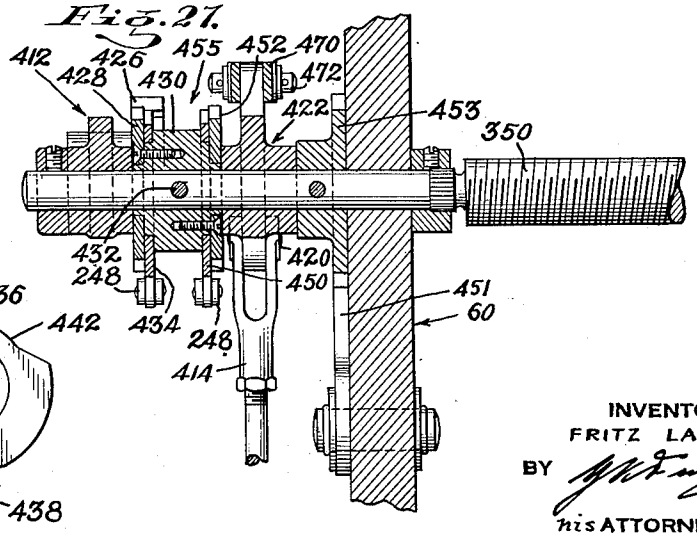


Fig. 28.

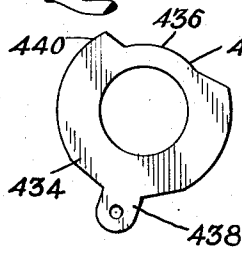


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Fig. 29.

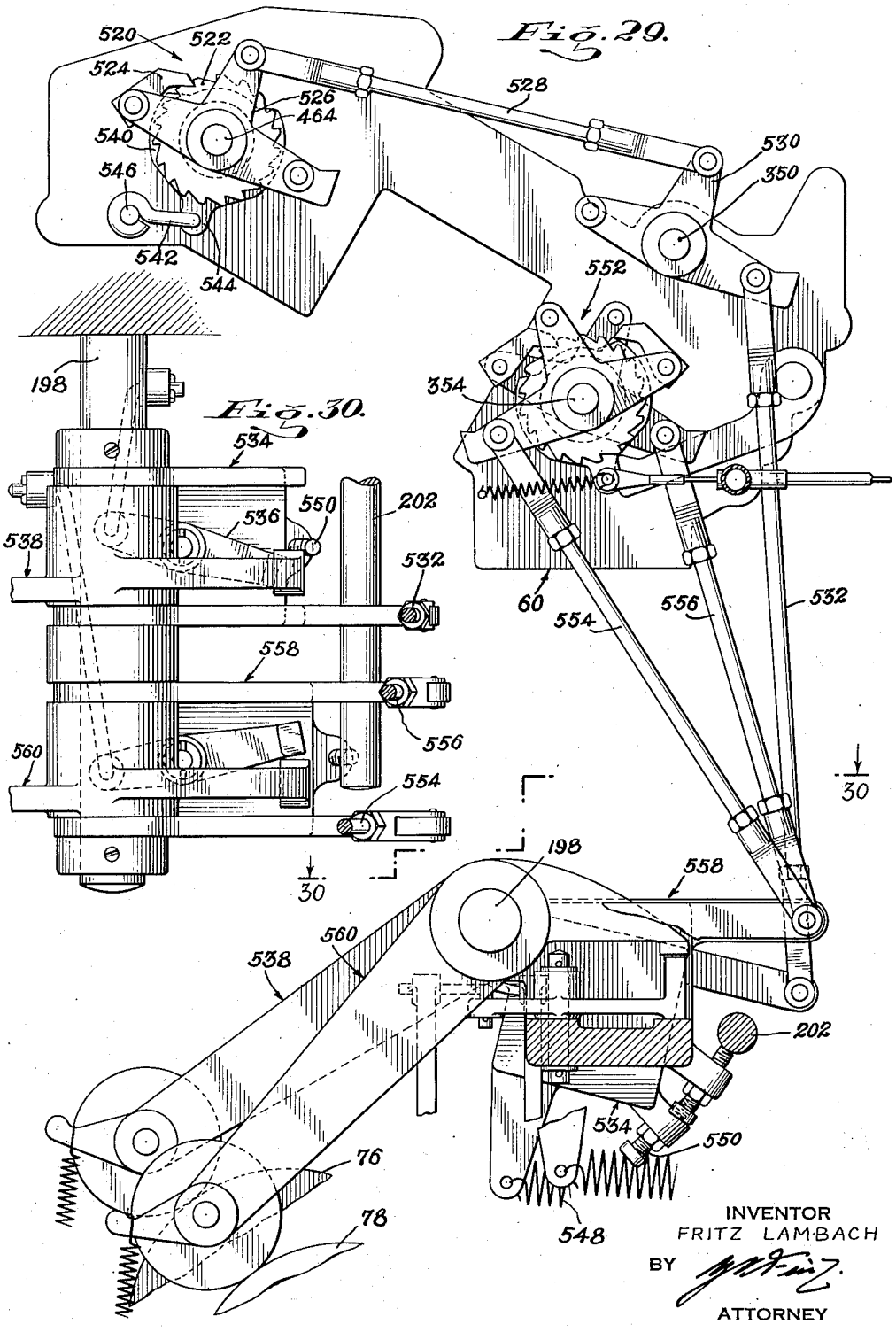


Fig. 30.

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Fig. 31.

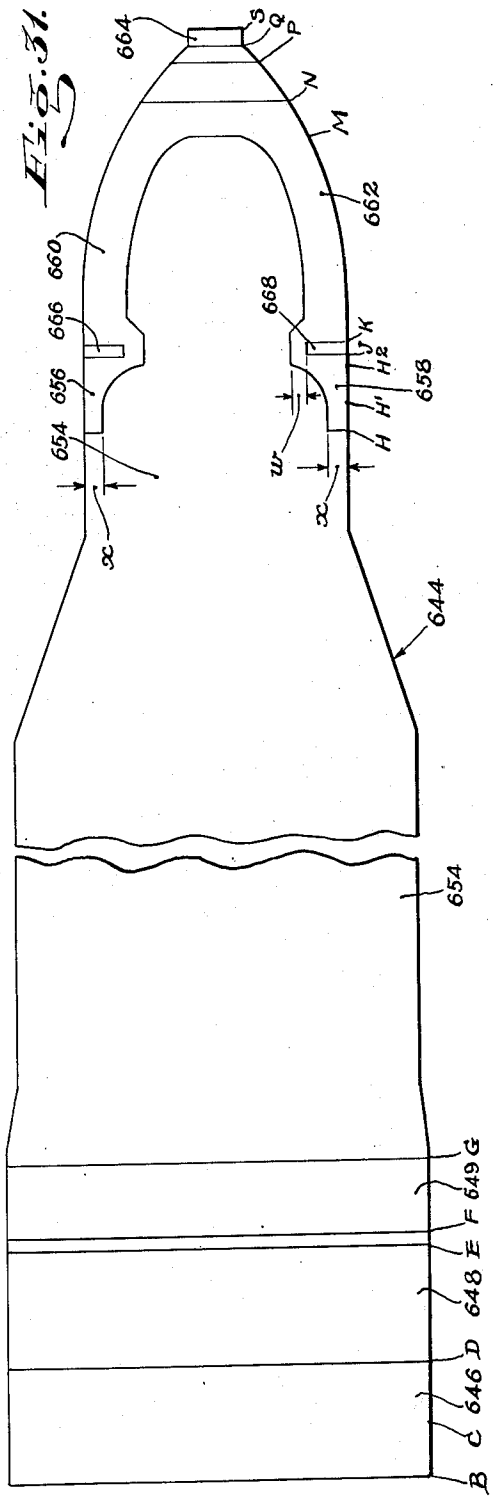
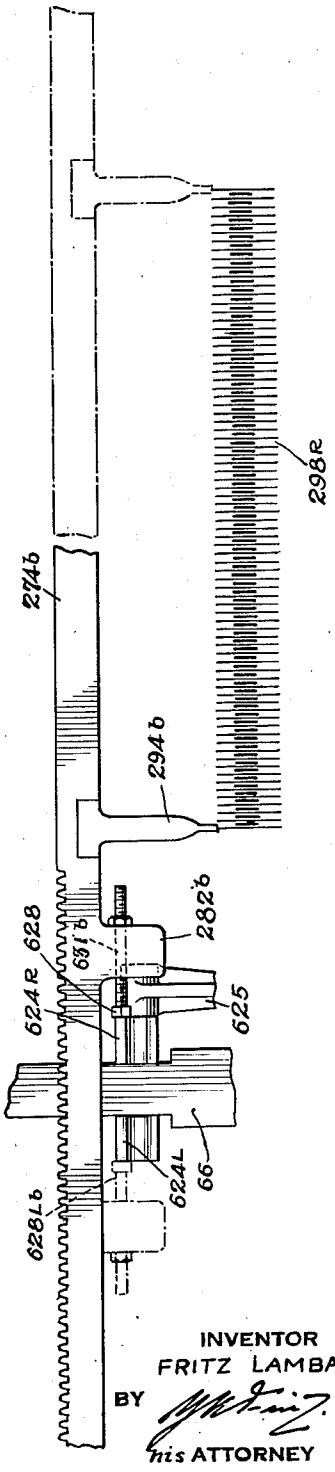



Fig. 34.

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Nov. 13, 1951 F. LAMBACH 2,574,487

STRAIGHT BAR KNITTING MACHINE

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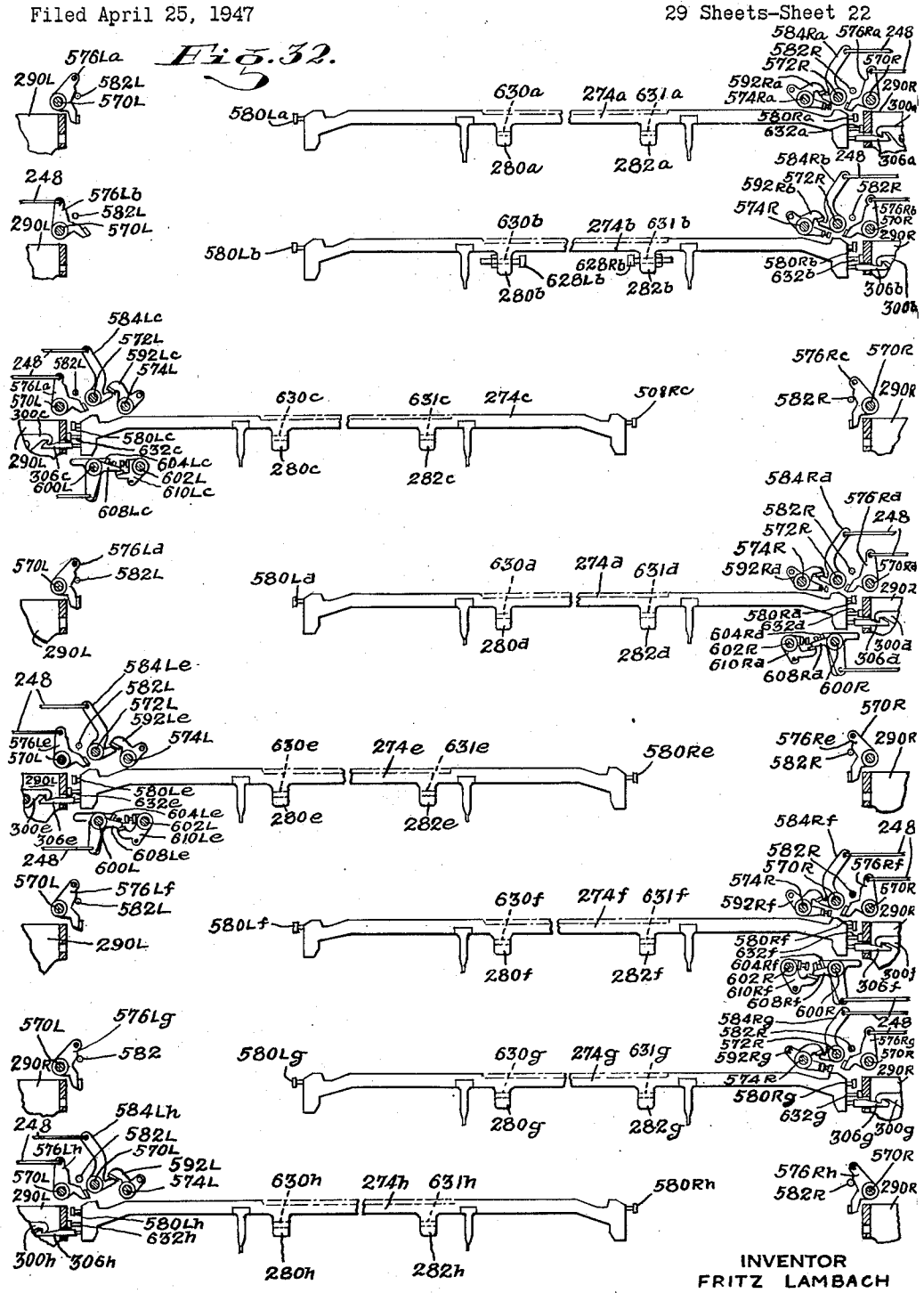
Fig. 32.

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BY

his ATTORNEY

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STRAIGHT BAR KNITTING MACHINE

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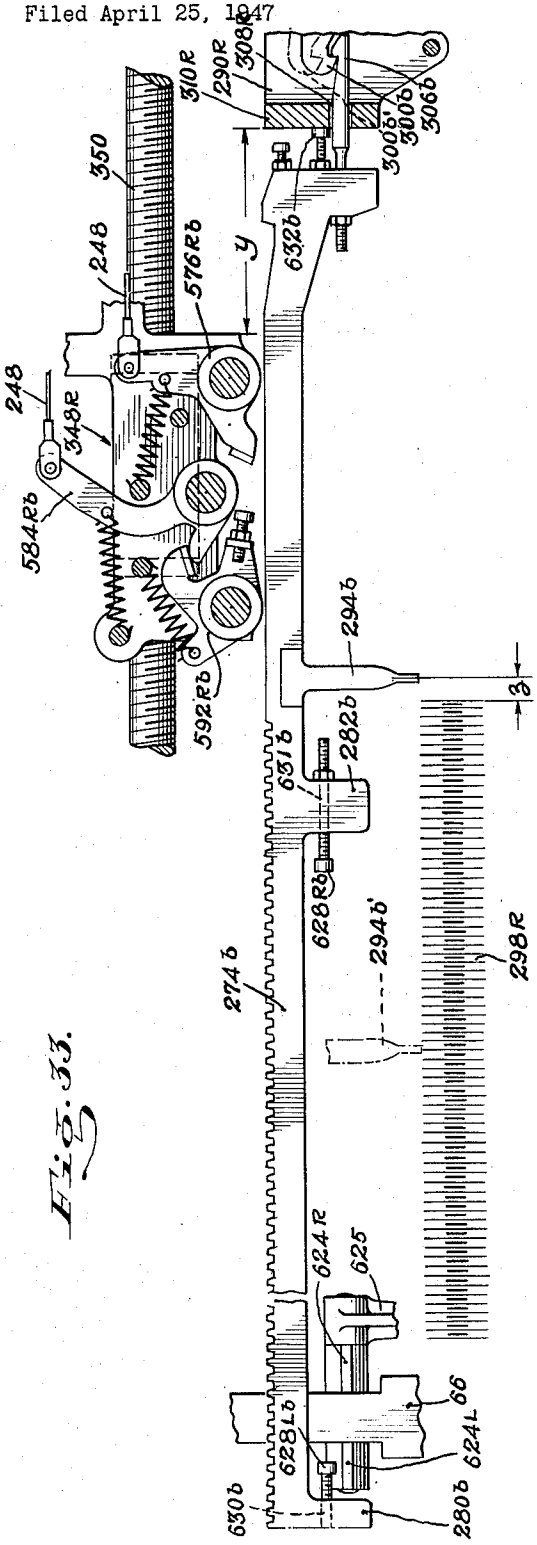



Fig. 33.

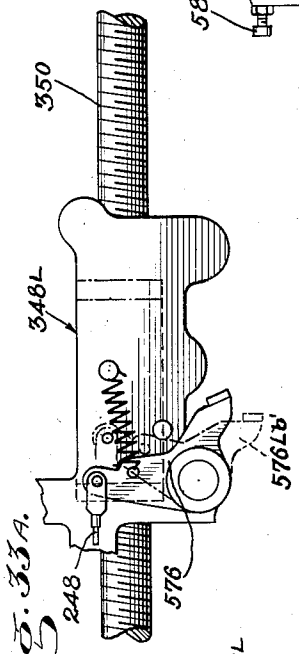
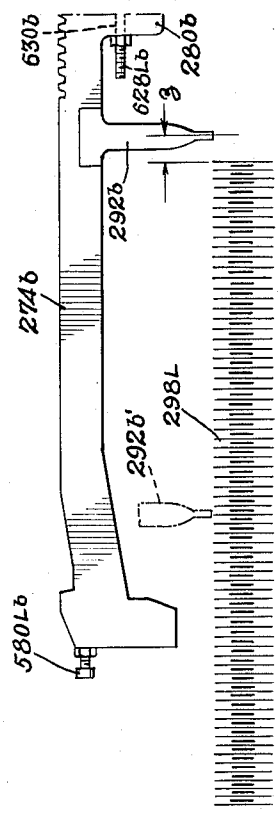
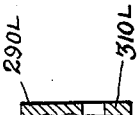



Fig. 33A.

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STRAIGHT BAR KNITTING MACHINE

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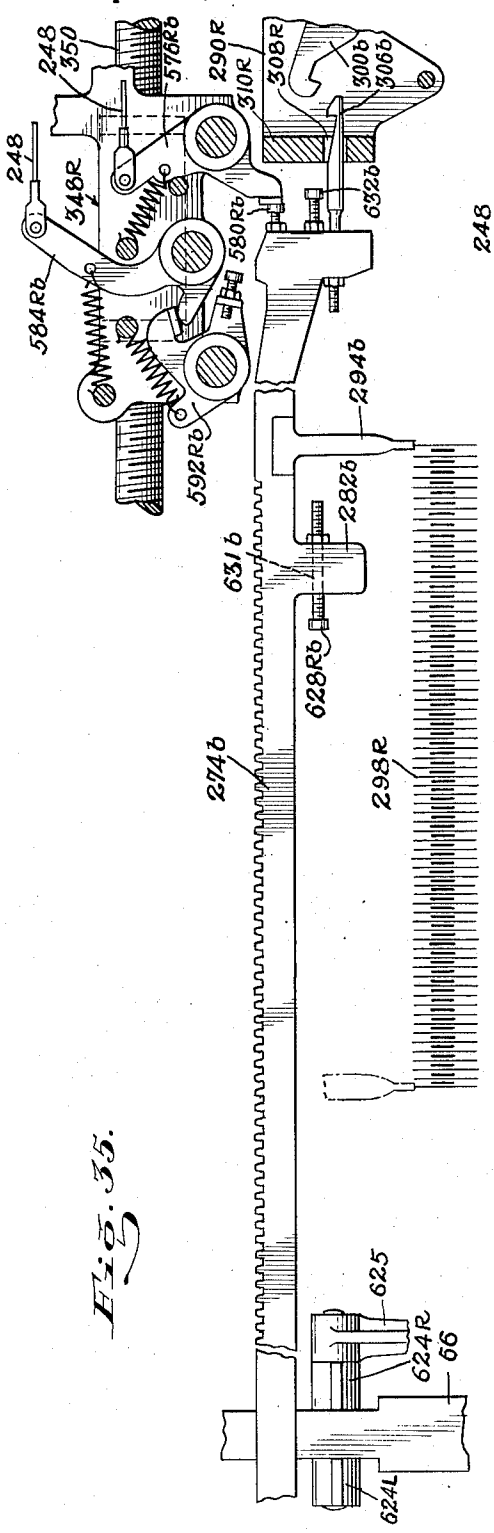


Fig. 35.

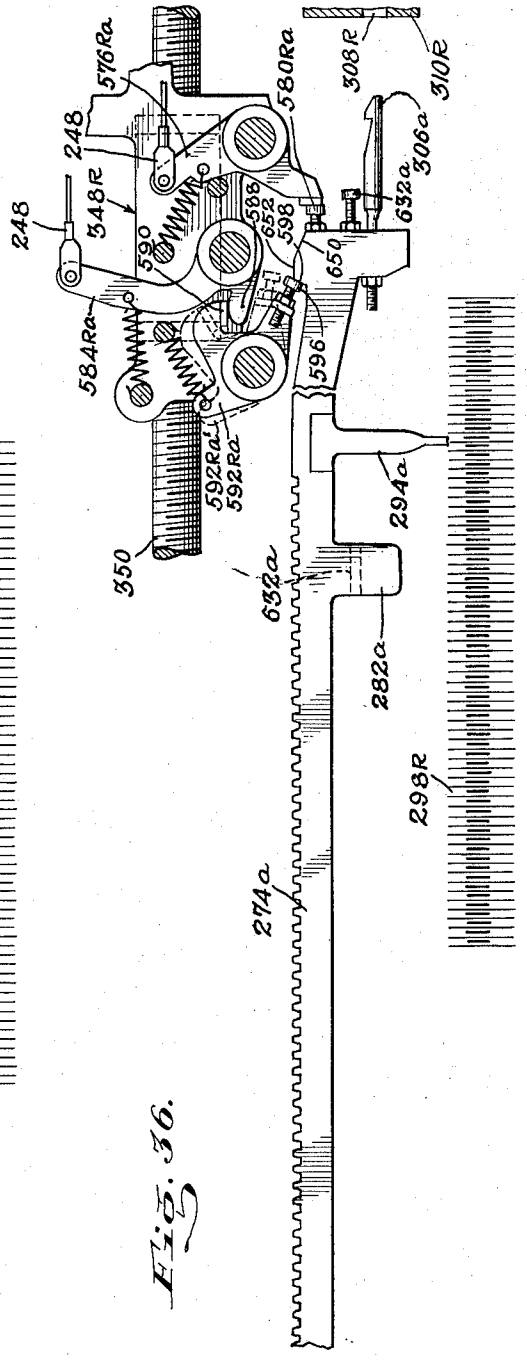


Fig. 36.

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STRAIGHT BAR KNITTING MACHINE

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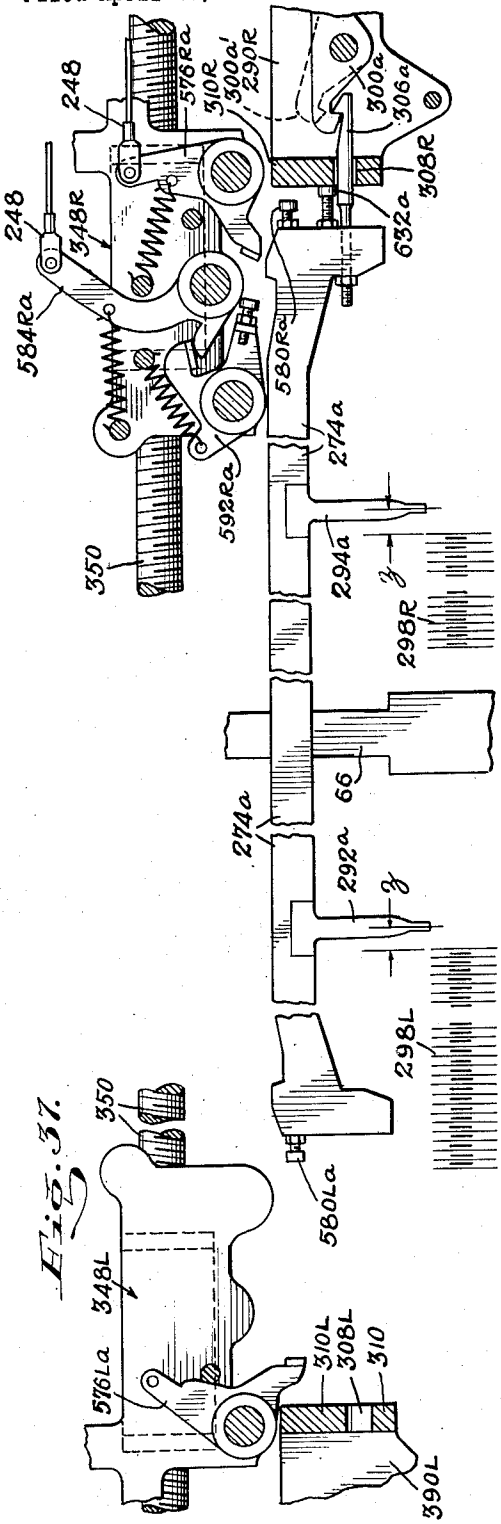


Fig. 37.

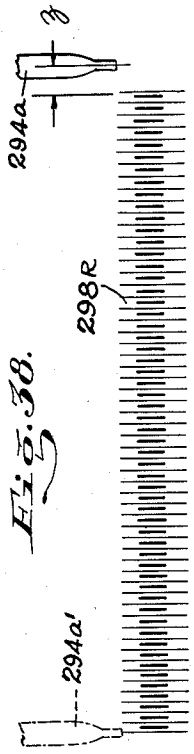


Fig. 38.

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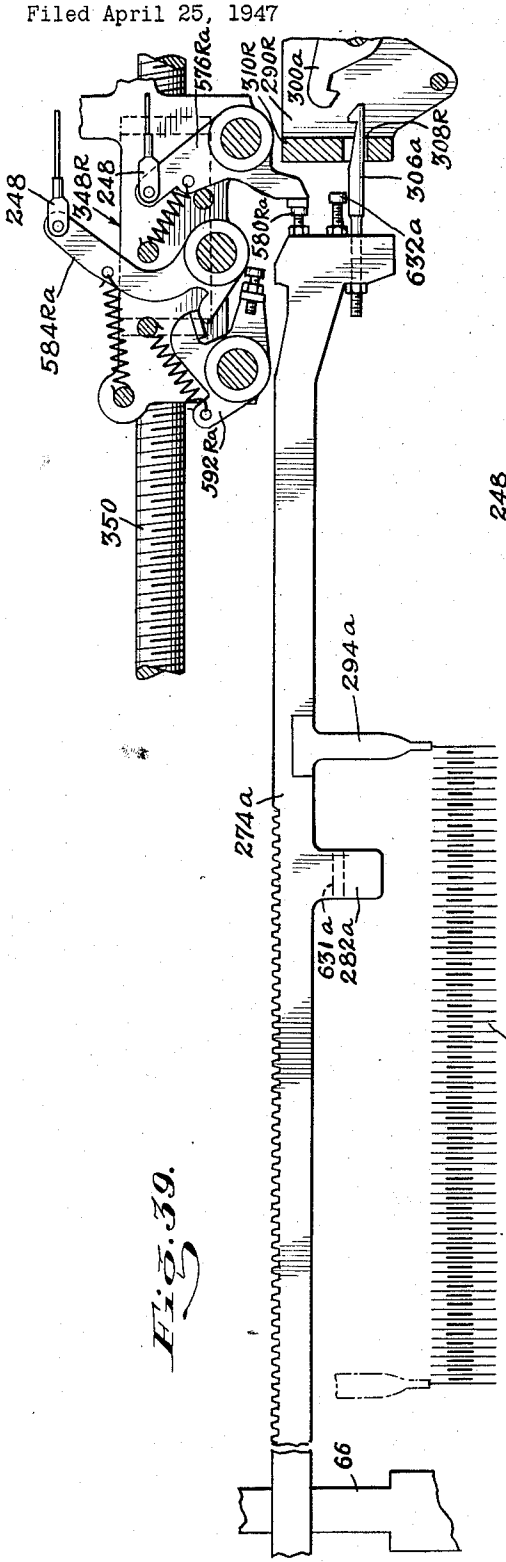


Fig. 39.

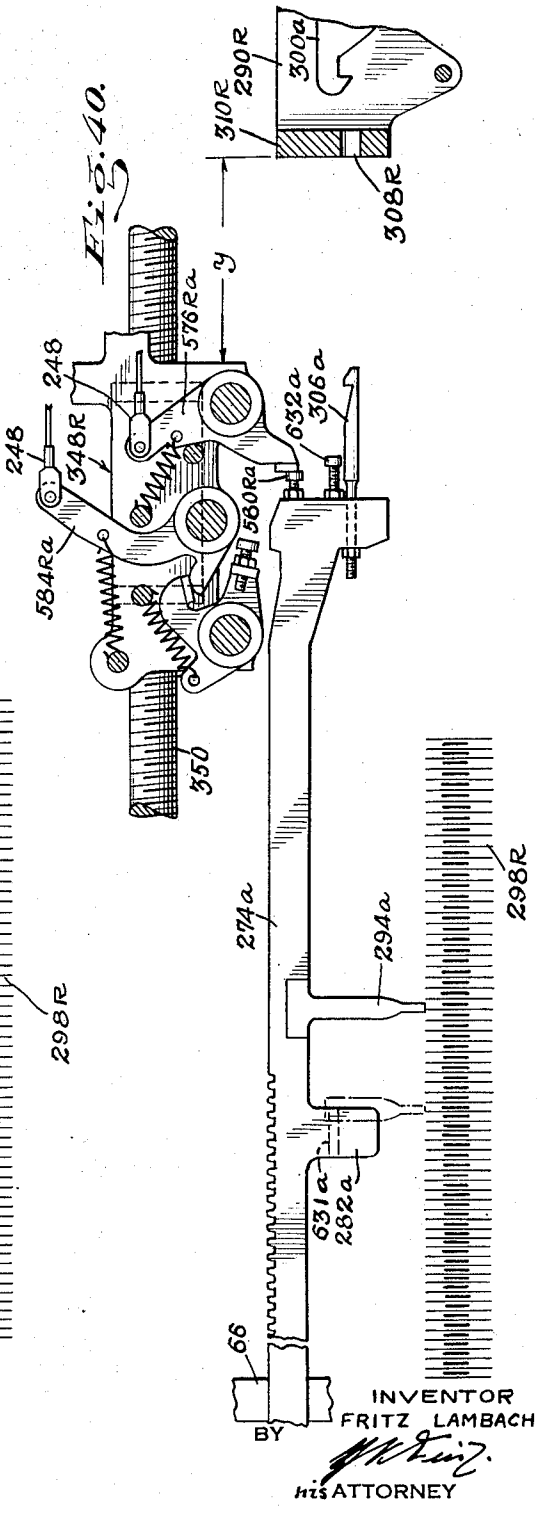


Fig. 40.

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STRAIGHT BAR KNITTING MACHINE

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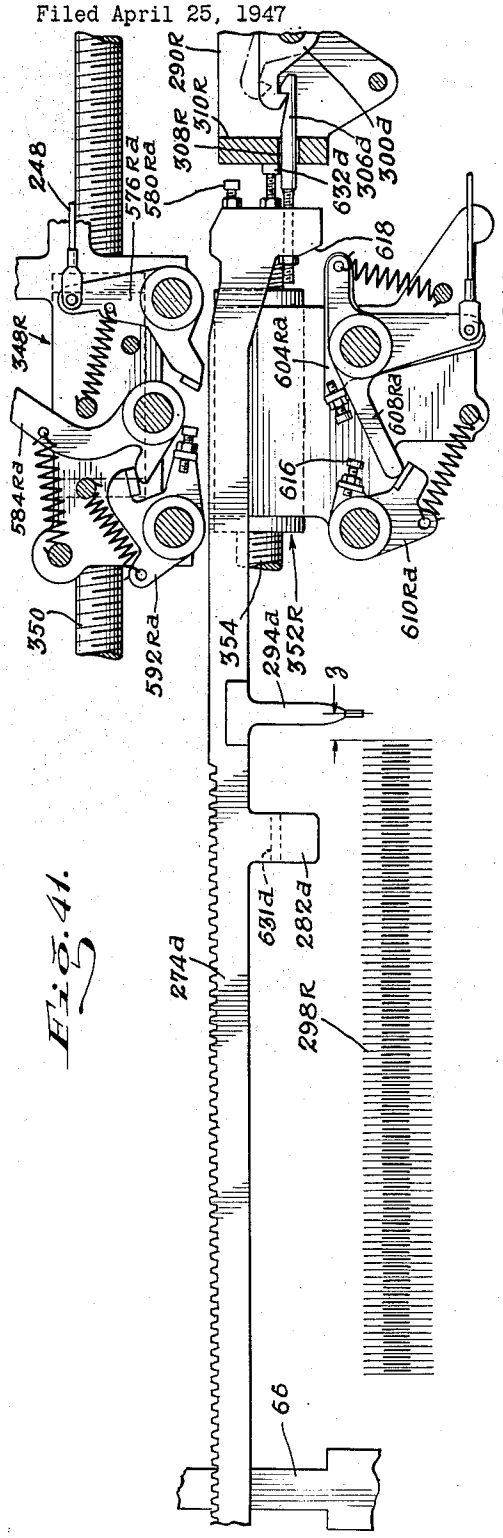


Fig. 41.

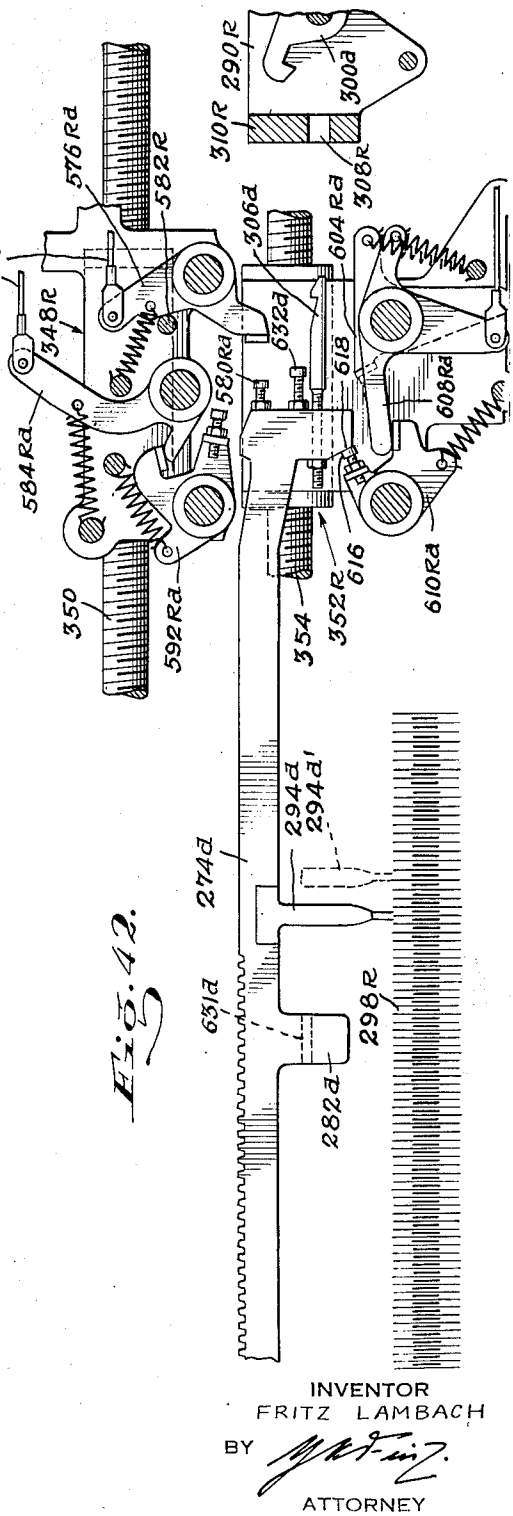


Fig. 42.

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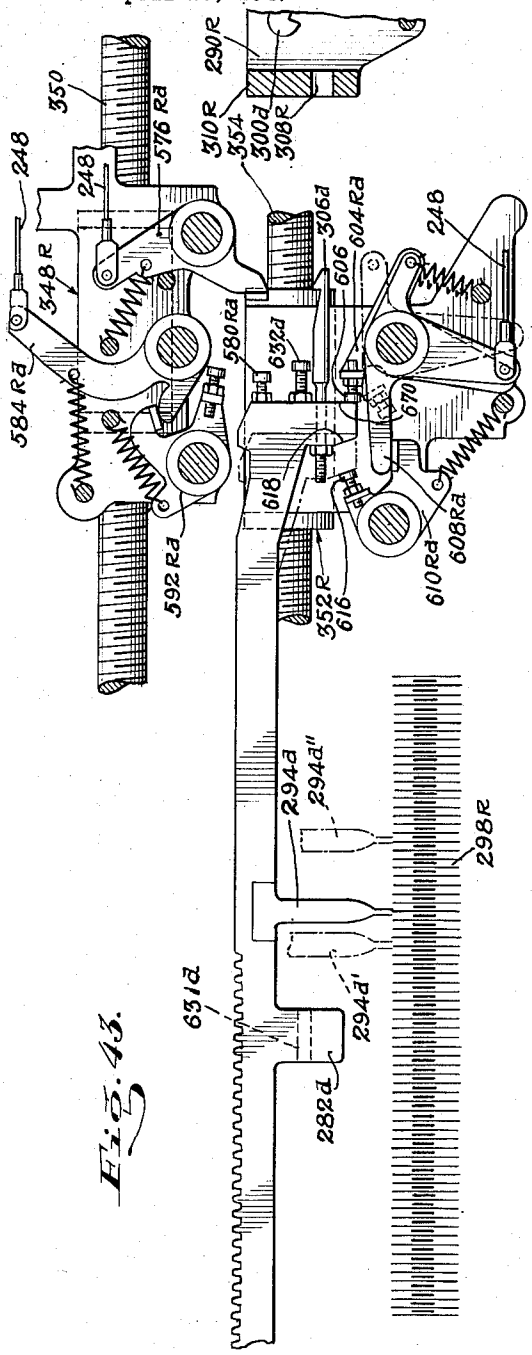


Fig. 43.

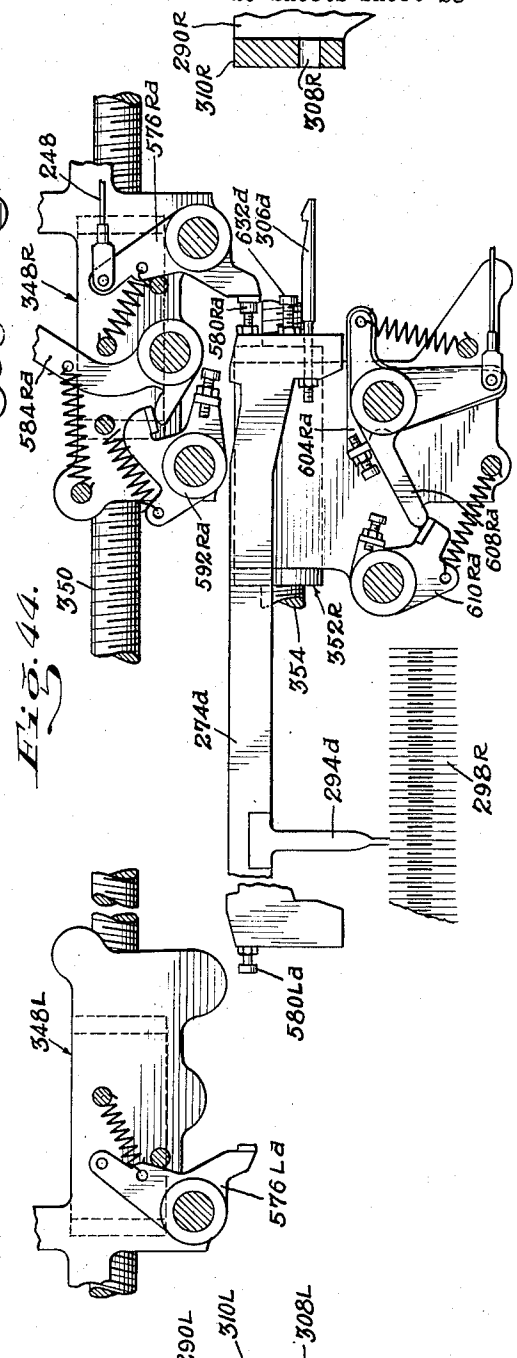


Fig. 44.

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STRAIGHT BAR KNITTING MACHINE

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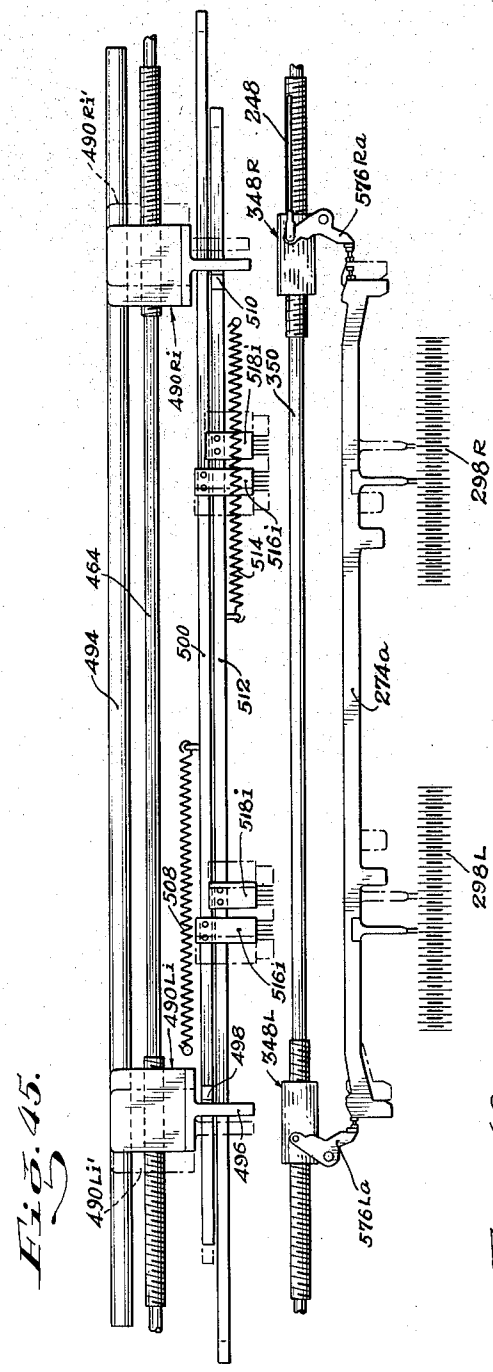


Fig. 45.

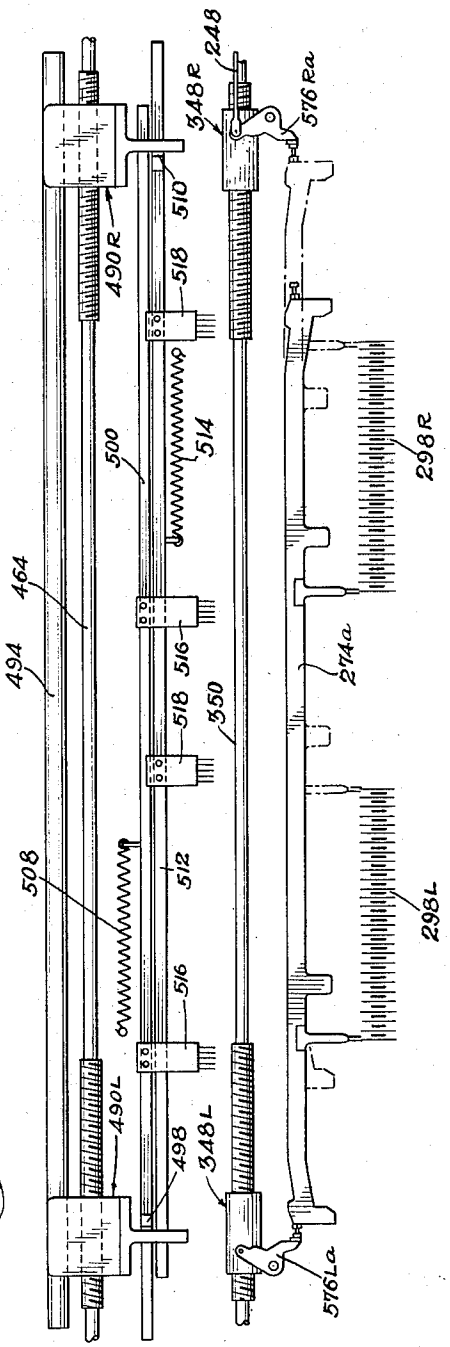


Fig. 46.

INVENTOR
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his ATTORNEY

Patented Nov. 13, 1951

2,574,487

# UNITED STATES PATENT OFFICE

2,574,487

## STRAIGHT BAR KNITTING MACHINE

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

Application April 25, 1947, Serial No. 743,938

26 Claims. (Cl. 66—127)

1

This invention relates to textile machines, and more particularly to straight bar knitting machines.

An object of the present invention is to provide a straight bar knitting machine equipped with efficient means for the automatic control of the yarn feeding mechanism.

A further object of the present invention is to provide a yarn feeding mechanism for a straight bar knitting machine of such a construction, that its carrier rods may be selected in a most flexible manner for any one of the various operations to be performed by carrier rods in a straight bar knitting machine.

Another object of the present invention is to provide a yarn feeding mechanism for a straight bar knitting machine of such a design, that its carrier rods and many of its controlling elements may be manufactured in mass production at low costs.

A further object of the present invention is to provide a straight bar knitting machine of compact design.

Another object of the present invention is to provide a straight bar knitting machine, wherein the masses to be accelerated during the reciprocating movements of the carrier rods are reduced to a minimum.

Still another object of the present invention is to provide a straight bar knitting machine, by means of which fabrics may be knitted at a high rate within a certain period of time, so that a high output of the straight bar knitting machine is obtained.

A further object of the present invention is to improve upon the construction of straight bar knitting machines as now ordinarily made.

Further objects and advantages of the invention will be apparent from the following disclosure of embodiments thereof. In the accompanying drawings:

Fig. 1 is a fragmentary front elevational view of a two-section straight bar knitting machine, some parts being broken away, some parts being omitted for a better illustration of the invention,

Fig. 2 is a fragmentary side elevational view of the straight bar knitting machine shown in Fig. 1, some parts being omitted and some parts being broken away for a better illustration of the invention,

Fig. 3 is an elevational view illustrating the connection of the motor with the main cam shaft and the coulier cam,

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Fig. 4 is an elevational view, partly in section, illustrating the actuating drive for the slur cocks and the carrier rods,

Fig. 5 is a top plan view illustrating a slur cock box,

Fig. 6 is a sectional view taken approximately along line 6—6 of Fig. 1, illustrating the drive for advancing the pattern chain,

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6,

Fig. 8 is an elevational view, partly in section, illustrating the drives for actuating the carrier spindle and for actuating the control shaft,

Fig. 9 is a top plan view of the drives shown in Fig. 8,

Fig. 10 is a side elevational view illustrating the mechanism for intermittently advancing the control shaft with the controlling cams mounted thereon,

Fig. 11 is a fragmentary rear elevational view illustrating the control shaft with a series of controlling cams mounted thereon,

Fig. 12 is a top plan view of the friction-clutches arranged between the actuating drive for reciprocating carrier rods and said carrier rods, some parts being broken away, some parts being shown in section,

Fig. 13 is a sectional view of a frictional-slip clutch taken on line 13—13 of Fig. 12,

Fig. 14 is a sectional view taken on line 14—14 of Fig. 13,

Fig. 15 is a sectional view taken on line 15—15 of Fig. 13,

Fig. 16 is a sectional view taken approximately on line 16—16 of Fig. 12,

Fig. 17 is a fragmentary sectional view illustrating a different embodiment of a friction-slip clutch,

Fig. 18 is a top plan view of the left-hand end of the carrier rods and the mechanisms for controlling the stroke thereof, some parts being broken away,

Fig. 19 is a top plan view of the right-hand end of the carrier rods and the mechanisms for controlling the stroke thereof, some parts being broken away,

Figs. 20, 20A, 20B, 20C when placed end to end from left to right in the order given make up a sectional view taken on line 20—20 shown in Figs. 18 and 19,

Fig. 21 is a fragmentary sectional view taken on line 21—21 of Fig. 20,

Fig. 22 is a front elevational view of the left-hand end of the narrowing mechanism and the

narrowing spindle with the mechanism for controlling the position of the narrowing fingers,

Fig. 23 is a front elevational view of the right-hand end of the narrowing mechanism and the narrowing spindle with the mechanism for controlling the position of the narrowing fingers,

Fig. 24 is a side elevational view illustrating the actuating mechanism for normal forward-racking or back-racking of the carrier spindle and narrowing spindle,

Figs. 25 and 26 illustrate the same actuating mechanism as Fig. 24, the controlling discs of said mechanism being, however, in different positions,

Fig. 27 is a sectional view taken on line 27—27 of Fig. 24,

Fig. 28 is an elevational view of a controlling disc of the actuating mechanism shown in Fig. 24,

Fig. 29 is an elevational view of the actuating mechanism for the normal forward-racking and back-racking of the pointex spindle and for the single needle back-racking of the narrowing spindle,

Fig. 30 is a sectional view taken on line 30—30 of Fig. 29,

Fig. 31 is a diagrammatical illustration of a stocking blank,

Fig. 32 is a somewhat diagrammatical illustration indicating the various idle positions of the various carrier rods of the knitting machine,

Figs. 33 and 33A when placed end to end from right to left in the order given, Figs. 34 and 35 are somewhat diagrammatical illustrations indicating various positions of the welt-carrier rod during its operations and its controlling elements during the operation thereof,

Figs. 36, 37, 38, 39 and 40 are somewhat diagrammatical illustrations indicating various positions of the main carrier rod and its controlling elements during the operation thereof,

Figs. 41, 42, 43 and 44 are somewhat diagrammatical illustrations indicating various positions of the pointex carrier rod and its controlling elements during the operation thereof,

Figs. 45 and 46 are somewhat diagrammatical illustrations indicating various positions of the carrier spindle nuts and narrowing spindle nuts during the operation of the machine.

The drawings illustrate only those parts of a straight bar knitting machine, which are necessary for the understanding of the invention.

Referring now to Figs. 1, 2 and 3, 60 generally indicates the frame of a two-section straight bar knitting machine having side frames 62, 64 and a center frame 66 connected with each other in any suitable manner. A main cam shaft 68 is rotatably arranged in suitable bearings of the frame 60. A series of driving cams is secured to said main cam shaft 68. Fig. 1 illustrates only the carrier spindle cam 70, the control shaft cam 72, the pattern chain cam 74, the single needle back-racking cam 76 and the pointex spindle cam 78. The drives actuated by said cams will be described hereinafter.

As best shown in Figs. 2 and 3, a two-speed motor 80 mounted on a bracket attached to the frame of the machine is operatively connected with the main cam shaft 68 for rotating same through the medium of the motor shaft pinion 82 in mesh with a rotatable gear 84 rigidly connected with a pinion 86 in mesh with a gear 88 keyed to the main cam shaft 68.

As best shown in Fig. 3, the rotatable gear 84 driven by the pinion 82 of the motor 80 is secured to a shaft 90 rotatably arranged in suitable bearings of the side frame 64. A pinion 92 in mesh with a gear 94 is secured to said shaft 90. Said gear 94 is rotatably mounted on a bushing 96 secured to the main cam shaft 68. Said gear 94 is placed between two flanges of said bushing 96 so that it cannot be displaced axially relative to said bushing, that it participates, however, in an axial movement of said bushing 96. The clutch member 98 of the coulier cam clutch generally indicated by 100 is rigidly connected with said bushing 96. The clutch member 102 of said coulier cam clutch 100 is rigidly connected with the coulier cam 104 rotatably but axially immovably mounted on the main cam shaft 68. The ratio of the gears described above is such, that the coulier cam 104 performs half a revolution during a full revolution of the main cam shaft 68, when, during the performance of knitting operations, the clutch members 98 and 102 of the coulier cam clutch 100 are engaged with each other as shown in Fig. 3. In a manner customary in the art of straight bar knitting machines, the main cam shaft 68 is automatically shifted in the direction of the arrow A during the performance of narrowing operations, whereby the clutch members 98 and 102 are disengaged from each other with the result, that the coulier cam 104 coming under the action of a brake-band 106 is arrested, while the main cam shaft 68 continues to rotate. Of course, after the performance of narrowing operations, the main cam shaft 68 is returned in a direction opposite to the direction A, whereby the clutch members 98, 102 of the coulier cam clutch are reengaged, so that upon the release of the brake acting on the coulier cam 104 the latter is rotated again at half the speed of the main cam shaft 68.



According to Figs. 3 and 4, the roller 108 carried by a lever 110 swingably mounted on a stud 112 secured to the side frame 64 of the machine is in engagement with a cam path 114 of the coulier cam 104, whereby said lever 110 is swung upwardly and downwardly during a rotation of the coulier cam 104. One end of a connecting link 116 is pivoted at 118 to the lever 110, the other end of said connecting link 116 is pivoted at 120 to a lug 122 rigidly secured to a vertical coulier cam rack 124 slidably mounted in suitable bearings 126 of the machine. Said coulier cam rack 124 is in mesh with a pinion 128 secured to a shaft 130 rotatably arranged in bearings 132. A pinion 134 secured to the right-hand end (as viewed in Fig. 4) of said shaft 130 is in mesh with a reciprocable slur cock rack 136 carrying the slur cock boxes 138 (only one being shown in the drawings) slidably arranged on the slur cockbar 140. Each slur cock box 138 carries a slur cock 142 (Figs. 2, 4 and 5) for advancing the sinkers 144 through the medium of jacks 146 in a manner customary in the art of straight bar knitting machines. Apparently, the slur cocks 142 are reciprocated along the sinker jacks by a reciprocation of the coulier cam rack 124 caused by the rocking of the lever 110 controlled by the coulier cam 104.

According to Fig. 1, a pattern chain generally indicated by 148 is trained around a rotatable pattern chain drum 150 and a plurality of rotatable guiding rollers 152. As best shown in Figs. 6 and 7, several rows of buttons 154 are secured to said pattern chain 148. Each row of buttons cooperates with a spring-loaded swingable jack 156*a*, 156*b*, 156*c* . . . 156*m*, 156*n*, which, in turn, is connected through a wire 158*a*, 158*b* . . . 158*m*, 158*n* with a controlling mechanism for

controlling a certain operation of a certain drive of the machine.

The pattern chain 148 may be intermittently advanced by the following pattern chain drive: the pattern chain cam 74 keyed to the main cam shaft 68 is in operative engagement with a roller 160 carrier by a spring-loaded follower 162 swingably mounted at 164. The arm 166 of said follower 162 is in loose contact with a screw 168 adjustably mounted on a spring-loaded member 170 swingably and axially immovably mounted on a shaft 172. Said member 170 carries a spring-loaded pawl 174 capable of operative engagement with a ratchet wheel 176 rigidly connected with the pattern chain drum 150 likewise rotatably mounted on the shaft or rod 172. The ratchet wheel 176, the pattern chain drum 150 and the pattern chain 148 may be held in their position by a spring-loaded detent 178 capable of engagement with a tooth of the ratchet wheel 176. Apparently, each time when the follower 162 is rocked by a raise of the pattern chain cam 74, the spring-loaded member 170 is likewise rocked for advancing the pattern chain 148 one step by means of the pawl 174 cooperating with a tooth of the ratchet wheel 176. Furthermore, it is apparent, that each time when a button 154 comes into engagement with a projection of one of the jacks 156*a*, 156*b* . . . 156*n*, such a jack is swung about the shaft 180 against the action of the spring associated with such a jack. The swinging of a jack about the shaft 180, in turn, causes an actuation of a controlling mechanism connected with the jack through a wire 158*a*, 158*b* . . . 158*n*.

For example, as best shown in Figs. 1 and 2, the wire 158*c* leading from the jack 156*c* is connected with the lower end of a lever 182, the upper end of which is secured to one end of a rod 184 journalled in bearings of brackets 185 secured to the side wall 62 of the frame 60. The other end of said rod 184 is rigidly connected with the lower end of a lever 186. As best shown in Figs. 1, 8 and 9, the upper end of said lever 186 is connected by a wire 188 with one arm 190 of a controlling element 192 swingably mounted on a pivot 194 projecting upwardly from the base 195 of a block 196 being substantially of U-shaped cross-section. Said block 196 swingably mounted on a shaft 198 carries an adjustable stop screw 200 capable of cooperation with a shaft or rod 202 of the machine. A spring 204 stretched between a downward extension 206 of said block 196 and a stationary point of the machine tends to urge said stop screw 200 against said shaft 202, whereby the block 196 is held in a substantially horizontal position. Furthermore, a double arm spring-loaded follower 208 carrying a roller 210 cooperating with the control shaft cam 72 is swingably mounted on the shaft 198 between the side walls 197 of the U-shaped block 196. During the operation of the machine, the arm 212 of the follower 208 may freely rock within the U-shaped block 196, held in its position by the spring 204, in accordance with the shape of the control shaft cam 72 engaged with the roller 210 of the follower 208, as long as the controlling element 192 is in the inactive position 192' shown in dash and dot lines in Fig. 9. As soon as, however, said controlling element 192 is brought in response to an actuation of the jack 156*c* by a button on the pattern chain 148 through the medium of the wires and levers 158*c*, 182, 184, 186, 188 into the active position shown in full lines in Fig. 9, an upward extension 214 of the controlling element 192 is brought below an abutment 216 arranged on the arm 212 of the follower 208, whereby the next downward rocking of the arm 212 of the follower 208 caused by a raise on the control shaft cam 72 causes a swinging of the block 196 against the action of the spring 204 into the position shown in Fig. 8. Now the block 196 follows the rocking movements of the arm 212 of the follower 208 as long as the controlling element 192 remains in the active position shown in full lines in Fig. 9. As soon as the jack 156*c* controlled by the pattern chain 148 causes a return of the controlling element 192 into the inactive position 192' shown in Fig. 9 through the medium of its wire and lever connection, the arm 212 of the follower 208 will again rock freely within the block 196 held in its inactive horizontal position by the spring 204 without causing a rocking of said block 196.

As best shown in Figs. 2 and 8, one end of a connecting rod 218 is pivoted at 220 to the downward extension 206 of the block 196 rockable by the follower 208 when the controlling element 192 is in its active position as described above. According to Figs. 2, 10 and 11 the other end of said connecting rod 218 is pivoted at 222 to an arm 224 of a double arm lever 226 rotatably and axially immovably mounted on a control shaft 228 rotatably arranged in suitable bearings of the frame 60 of the machine. The other arm 230 of said double arm lever 226 carries a spring-loaded pawl 232 arranged for cooperation with a ratchet wheel 234 keyed to the rotatable control shaft 228. Apparently, each time the block 196 (Figs. 2, 8, 9) is rocked by the follower 208 upon a movement of the controlling element 192 into the active position in response to the control by a button on the pattern chain, the ratchet wheel 234 (Figs. 2, 10, 11) and the control shaft 228 connected therewith is advanced one step by the pawl 232. The control shaft 228 is held in its position by means of a spring-loaded detent 236 swingably mounted on a shaft 238 for cooperation with an index disc 240 keyed to the control shaft 228.

The control shaft 228 extending from one end of the machine to the other carries a series of controlling cams 242 keyed to and axially immovably held on the control shaft 228 wherever needed. Each controlling cam 242 cooperates with a spring-loaded follower 244 or 246 swingably and axially immovably arranged on the shaft 238. Each follower 244 is connected with one end of a flexible Bowden wire 248, the other end of which is connected with an element on the machine for the performance of a certain control as will be described hereinafter. Each of the followers 246 is connected with one end of a controlling rod 250 the other end of which is in operative engagement with a controlling element of the machine for the performance of a certain control as will be described hereinafter. During the intermittent rotation of the control shaft 228 and the controlling cams 242 mounted thereon, the followers 244 and 246 associated with the controlling cams 242 are swung about the shaft 238 for the performance of a control through the medium of a Bowden wire 248 or a rod 250 in dependence on the shape of the associated controlling cam 242.

As described above, the coulier cam rack 124 (Fig. 4) reciprocated by the coulier cam 104 causes a reciprocating movement of the slur cocks 142 through the medium of a pinion 128 arranged on a rotatable shaft 130. The left-

hand end of this shaft 130 (as viewed in Fig. 4) carries a pinion 252 in mesh with a rack 254 carried by an actuating rack 256 slidably arranged in guides 258 for reciprocating movements in the longitudinal direction of the machine. Apparently, said actuating rack 256 is reciprocated by the coulier cam 104 through the medium of the coulier rack 124, the pinions 128, 252 and the rack 254.

As best shown in Figs. 12 and 16, said actuating rack 256 arranged within a container 260 capable of receiving a lubricant is in mesh with eight pinions 262*a*, 262*b* . . . 262*g*, 262*h*, each of which represents a clutch member of a friction slip clutch generally indicated by 264*a*, 264*b*, . . . 264*g*, 264*h*. Each friction clutch 264*a*, 264*b* . . . 264*h* is in operative engagement with a driving rod 266*a*, 266*b* . . . 266*g*, 266*h* rotatably and axially immovably arranged in bearings of stationary brackets 268, 270. Each driving rod 266*a*, 266*b* . . . carries a pinion 272*a*, 272*b* . . . 272*g*, 272*h* rigidly connected therewith, which is in mesh with a toothed portion of a carrier rod 274*a*, 274*b* . . . 274*g*, 274*h*. Preferably, each carrier rod is made of a material light in weight, such as a light metal or a plastic, and the teeth of the toothed portion of the carrier rod are cut into the material of the carrier rod.

As best shown in Figs. 16, 20, 20A, 20B, 20C and 21 each carrier rod 274*a*, 274*b* . . . is provided with end extensions 276*a*, 276*b* . . . 276*h* and 278*a*, 278*b* . . . 278*h* and with two intermediate lugs 280*a*, 280*b* . . . and 282*a*, 282*b* . . . Each of said end extensions and intermediate lugs is provided with bores slidably engaged with guiding rods 284*a*, 284*b* . . . and 286*a*, 286*b* . . . which are stretched between and rigidly secured to brackets 290L and 290R attached to the frame of the machine. Thus, the carrier rods 274*a*, 274*b* . . . may be reciprocated along the guiding rods 284*a*, 284*b* . . . , 286*a*, 286*b* . . .

Two yarn carriers 292*a*, 292*b* . . . and 294*a*, 294*b* . . . are rigidly secured to each carrier rod 274*a*, 274*b* . . . Each of said yarn carriers 292*a*, 292*b* . . . 294*a*, 294*b* . . . serves to feed yarn (coming from a source not shown) along the needles 296 and sinkers 146 of each section of the two-section machine during a reciprocation of a carrier rod to which they are attached.

The carrier rods 274*a*, 274*b* . . . may be held in an idle position with the yarn carriers 292*a*, 292*b* . . . 294*a*, 294*b* . . . at the distance *z* outside the knitting fields 298L and 298R (Figs. 20A, 20B) by means of automatically controlled spring-loaded end arresters 300*a*, 300*b* . . . swingably mounted on rods 302L and 302R respectively carried by the brackets 290L and 290R respectively (see Figs. 20, 20C and 32). As best shown in Figs. 18, 19 and 32, the end arresters 300*a*, 300*b*, 300*d*, 300*f* and 300*g* spaced from each other by suitable spacers 301 are arranged on the bracket 290R at the right-hand side of the machine, while the end arresters 300*c*, 300*e* and 300*h* spaced from each other by suitable spacers (not shown in Fig. 18) are arranged on the bracket 290L at the left-hand side of the machine. Each of said end arresters 300*a*, 300*b* . . . is associated with one of the carrier rods 274*a*, 274*b* . . . Accordingly, each of said carrier rods 274*a*, 274*b* . . . has at one of its ends a hook 306*a*, 306*b* . . . which may pass through a slot 308L or 308R respectively in the wall 310L or 310R of the bracket 290L or 290R and may be engaged by the hook on the end arresters 300*a*, 300*b* . . . as best shown in Figs. 20, 20C, and 32. In the embodiment shown in the drawings, the end arresters 300*a*, 300*b* . . . are arranged in such a manner, that the carrier rods 274*a*, 274*b*, 274*d*, 274*f* and 274*g* are held on the right side of the machine in the idle position, while the carrier rods 274*c*, 274*e* and 274*h* are held on the left side of the machine in the idle position.

Each end arrester 300*a*, 300*b* . . . has an extension 314*a*, 314*b* . . . (see Figs. 20 and 22) capable of engagement with the wall of the frame under the action of the spring 316*a*, 316*b* . . . stretched between the end arrester and a stationary point on the bracket 290L or 290R, whereby the end arrester is held in its active position. Furthermore, each end arrester is connected by means of a wire 318*a*, 318*b* . . . (see Figs. 1, 2, 18, 19, 20 and 20C) with one arm of individual double-armed swingable levers 320 (Figs. 1 and 2); the other arm of each swingable lever 320 is connected by one of above mentioned rods 250 with one follower 246 of the series of followers 246 associated with controlling cams 242 mounted on the control shaft 228. Thus, each end arrester 300*a*, 300*b* . . . may be individually swung into an inactive releasing position (see for example the dash and dot line position 300*d'* in Fig. 41) by means of an actuation of a follower 246 by a controlling cam 242 on the control shaft 228.

As mentioned above, a friction-slip clutch 264*a*, 264*b* . . . (Figs. 12–16) is arranged between the reciprocable actuating rack 256 and each driving rod 266*a*, 266*b* . . . positively connected through a pinion 272*a*, 272*b* . . . with a carrier rod 274*a*, 274*b* . . . All of said friction slip clutches 264*a*, 264*b* . . . are of the same construction, so that it is sufficient to describe the friction-slip clutch 264*h* in connection with Figs. 13–15. The cylindrical clutch member 322*h* having a flange 324*h* carrying an annular friction lining or facing 326*h* of suitable material is rigidly connected with the driving rod 266*h* by means of a set screw 328*h*. Said cylindrical clutch member 322*h* has diametrically opposite recesses 330*h* slidably receiving lugs 332*h* of a ring 334*h* carrying a friction lining 336*h*. Thus, the ring 334*h* with its lining 336*h* is axially movable relative to the cylindrical clutch member 322*h*, but cannot be rotated relative thereto. The pinion clutch member 262*h* being in mesh with the actuating rack 256 is rotatably arranged on the clutch member 322*h*, rigidly connected with the driving rod 266*h*, between the friction linings 326*h* and 336*h*. The clutch members 322*h*, 326*h*, 336*h* and 262*h* are held in frictional engagement with each other by means of a spring 338*h* arranged between the ring 334*h* and an adjusting nut 340*h* threaded on the threaded end of the clutch member 322*h*. Apparently, the friction slip clutch may be adjusted by means of an adjustment of said adjusting nut 340*h* on the clutch member 322*h* causing a change in the tension of the spring 338*h*. The adjusting nut 340*h* may be held in its position by means of a resilient wire 342*h* partially embracing a groove 344*h* of the nut 340*h* and having one of its ends inserted into a recess 330*h* of the clutch member 322*h*.

During the operation of the knitting machine, the clutch members of all friction-slip clutches 264*a*, 264*b* . . . are permanently in frictional engagement with each other. As long as a carrier rod 274*a*, 274*b* . . . is held in its position, for example by above mentioned end arrester 300*a*, 300*b* . . . or by other controlling means

to be described hereinafter, the clutch member 322*a*, 322*b* . . . rigidly connected with the driving rod 266*a*, 266*b* . . . positively connected with the arrested or stopped carrier rod 274*a*, 274*b* . . . is likewise held in its position; a reciprocation of the actuating rack 256 during the operation of the machine then will cause a rotation of the pinion clutch member 262*h* on the clutch member 322*h* relative to the friction linings 326*h*, 336*h*. As soon as a carrier rod 274*a*, 274*b* . . . is released, for example by an automatic movement of above mentioned end arrester 300*a*, 300*b* . . . into above mentioned releasing position or by other controlling means to be described hereinafter, a rotation of the pinion clutch member 262*a*, 262*b* . . . by a reciprocating movement of the actuating rack 256 causes a rotation of the now released clutch member 322*h* through the friction between the side walls of the pinion 262*a*, 262*b* . . . and the friction linings 326*a*, 326*b* . . . 336*a*, 336*b* . . . , so that the carrier rod 274*a*, 274*b* associated with the friction clutch 264*a*, 264*b* . . . is immediately moved by means of the driving rod 266*a*, 266*b* . . . positively connected with the clutch member 322*a*, 322*b* . . . and the carrier rod 274*a*, 274*b* . . .

As best shown in Fig. 16, the actuating rack 256 and at least a portion of the friction-slip clutches 264*a*, 264*b* . . . are arranged within the oil contained in the tank 260 for a better operation of the mechanisms. If desired, additional oil may be splashed onto said mechanisms by means of a sprayer 346 connected with an oil pump or the like.

Fig. 17 illustrates a different embodiment of a friction slip clutch 2640, which may be substituted for the friction-slip clutch shown in Fig. 13. According to Fig. 17, three pinion clutch members 2620 are rotatably arranged on the cylindrical clutch member 3220 secured to the driving rod. Two friction rings 3340 having an annular friction lining on both sides and having lugs engaged with the recesses 3300 of the cylindrical clutch member 3220 are arranged between the pinions 2620. The spring 3380 holds the clutch members in frictional engagement with each other.

The length of strokes and temporary stoppages of carrier rods released by end arresters and reciprocated by the actuating rack through the medium of friction-slip clutches are controlled by controlling means to be described hereinafter, which are carried by threaded nuts 348L and 348R operatively engaged with threaded portions of a carrier spindle 350 and by threaded nuts 352L and 352R operatively engaged with threaded portions of a pointex spindle 354 (see Figs. 2, 18, 19, 20, 20A, 20B, 20C and 21). The carrier spindle 350 and the pointex spindle 354 rotatably arranged in suitable bearings of the frame of the machine have a left hand thread on their left end and have a right hand thread on their right end. The nuts 348L and 352L are engaged with the left hand threads of the carrier spindle 350 and pointex spindle 354 respectively, and the nuts 348R and 352R are engaged with the right hand threads of said carrier spindle 350 and pointex spindle 354 respectively. Furthermore, the nuts 348L and 348R have a recess 356 slidably engaged with a guide shaft 358 secured to the frame of the machine; likewise, the nuts 352L and 352R have a recess 360 slidably engaged with a guide shaft 362 secured to the frame of the machine (see Figs. 18, 19 and 21). Thus, the nuts 348L, 348R, 352L, 352R are prevented from rotation when the carrier spindle 350 or the pointex spindle 354 are rotated. When said spindles will be rotated in clockwise direction (as viewed in Fig. 21), a forward-racking or inward movement of the nuts 348L and 348R or 352L and 352R towards the center frame 66 and towards each other takes place; when the carrier spindle 350 or pointex spindle 354 are rotated in counter-clockwise direction, the nuts 358L and 348R or 352L and 352R are backracked or moved outwardly away from each other.

The rotations of the carrier spindle 350 and pointex spindle 354 for such a forward-racking or back-racking are automatically carried out by the following mechanisms.

The carrier spindle drive 455 for forward-racking and back-racking is best shown in Figs. 1, 2, 8, 9, 18, 20 and 24–28. As mentioned above, a carrier spindle cam 70 is keyed to the left-hand end of the main cam shaft 68. Said carrier spindle cam 70 is in operative engagement with a roller 364 carried by a spring-loaded follower 366 (Figs. 2, 8 and 9) swingably mounted on the shaft 198. The hub 368 of said follower 366 is arranged between the walls 370 and 371 of a substantially U-shaped block 372 swingably mounted on the shaft 198. Said block 372 carries an adjustable stop screw 374; a spring 376 (Fig. 8) stretched between a downward extension 378 and stationary point of the machine tends to urge the stop screw 374 of the block 372 against the rod 202, whereby said block 372 is held in substantially horizontal position. One arm 380 of a controlling element 382 swingably mounted on a pivot 384 carried by the bottom 386 of the block 372 is connected through a wire 388 with the upper end of a lever 390. The lower end of said lever 390 is secured to a rotatable rod 392 (Figs. 1 and 2) connected with the upper end of a lever 394, the lower end of which is connected by the wire 158*n* with a jack controlled by the pattern chain 148. As long as the controlling element 382 is in the inactive position shown in Fig. 9, the arm 396 of the follower 366 may rock freely within the block 372 in dependence on the shape of the rotating carrier spindle cam 70. As soon as, however, upon an actuation of the associated jack by a button on the pattern chain, the controlling element 382 is automatically swung about the pivot 384 into such a position that the nose 398 on its arm 400 is below and in register with an abutment 402 on the arm 386 of the follower 366, the block 372 participates in the rocking movement or movements of the follower 366.

The lower end of a forward-racking connecting rod 404 is pivotally connected with an extension 406 of the wall 370 of the block 372 at 408. The upper end of said forward-racking connecting rod 404 is pivotally connected at 410 with a three-arm lever 412 swingably but axially immovably mounted on the carrier spindle 350 as best shown in Figs. 2, 18, 20, and 24–27. According to Figs. 8 and 9, the lower end of a back-racking connecting rod 414 is pivotally connected at 416 with an extension 418 of the wall 371 of the swingable block 372. According to Figs. 2, 18, 20 and 24–27, the upper end of said back-racking connecting rod 414 is pivotally connected at 420 with a three-arm lever 422 swingable but axially immovably mounted on the carrier spindle 350.

The arm 424 of the three-arm lever 412 actuated by the forward-racking connecting rod 404 carries a spring-loaded pawl 426, which may cooperate with a ratchet wheel 428 rigidly connected with a cylindrical element 430 secured to

the carrier spindle 350 by a set screw 432 (see Figs. 24 and 27). A controlling disc 434 substantially of the shape shown in Fig. 28 is rotatably arranged on a shoulder of the element 430. Said control disc 434 has a recess 436. Furthermore, the control disc 434 has a lug 438 connected with one end of a Bowden wire 248, the other end of which is connected with one of the followers 244 (Fig. 10) controlled by a controlling cam 242 arranged on the control shaft 228. When the control disc 434 is in the position shown in Figs. 24 and 28, the surface 440 of the control disc 434 is in engagement with the pawl 426 lifting same out of the path of the teeth of the ratchet wheel 434, so that the pawl 426 cannot rotate the ratchet wheel and the spindle 350. If, however, the control disc 434 is brought into the position shown in Fig. 25 upon an actuation of a follower 244 by a controlling cam 242 of the control shaft 228, the recessed portion 442 of the control disc 434 is adjacent the pawl 426, so that the latter may drop into engagement with a tooth of the ratchet wheel 428, so that the ratchet wheel 428 may be advanced in clockwise direction two steps for a normal two-needle forward-racking of the carrier spindle 350 when the lever 412 is reciprocated by a reciprocating movement of the forward-racking connecting rod 404 in response to a reciprocation of the block 372 (Figs. 8 and 9) after a movement of the controlling element 382 into an active position. A spring 444 stretched between the lug 438 of the control disc and a stationary point of the machine assists in above mentioned movement of the control disc from the position shown in Fig. 24 into the position shown in Fig. 25. After the performance of one or more of such normal forward-rackings of the spindle 350, the control disc 434 is automatically returned by the Bowden wire control 248 in response to the shape of a controlling cam on the control shaft into the position shown in Fig. 24 wherein it neutralizes again the pawl 426.

In a similar manner, a spring-loaded pawl 446 arranged on the arm 448 may be neutralized by a control disc 450 connected with a Bowden wire 248 controlled by a controlling cam 242 on the control shaft 228 when the control disc 450 is in the position shown in Fig. 26. When, however, the control disc 450 is in a position corresponding to the position of the control disc 434 shown in Fig. 24, the pawl 446 may come into engagement with a ratchet wheel 452 secured to the member 430 secured to the carrier spindle 350, so that upon an actuation of the back-racking connecting rod 414 the ratchet wheel 452 is advanced in counter-clockwise direction two steps for a normal two-needle back-racking of the carrier spindle 350.

The carrier spindle 350 may be held in its position by means of a spring-loaded detent 451 cooperating with an index disc 453 secured to the carrier spindle as shown in Figs. 18, 20 and 27.

Accordingly, when the control discs 434 and 450 are in alignment with each other in the position shown in Fig. 24, the carrier spindle control is set for a back-racking of the carrier spindle 350 by the back-racking connecting rod 414 and its pawl 446. When, however, the discs 434 and 450 being in alignment with each other are in the position shown in Fig. 25, the carrier spindle control is set for a forward-racking of the carrier spindle 350 by the forward-racking connecting rod 404 and its pawl 426. Furthermore, it will be apparent that in the position of the control discs 434 and 450 shown in Fig. 26 the above described carrier spindle control is set for a neutral position, wherein neither the forward-racking connecting rod 404 nor the back-racking connecting rod 414 may cause a movement of the carrier spindle 350. This neutralization of said carrier spindle drive is necessary for a purpose to be described hereinafter.

As best shown in Figs. 2, 18, 20, 22 and 24–27 one end of a forward-racking connecting link 454 is pivoted at 456 to the arm 458 of the three-arm lever 412; the other end of said forward-racking connecting link is pivoted at 460 to a lever 462 swingably and axially immovably arranged on a narrowing spindle 464 rotatably arranged in suitable bearings of the frame. Said arm 462 carries a spring-loaded pawl 466 arranged for cooperation with a ratchet wheel 468 rigidly connected with the narrowing spindle 464. The pawl 466 may be controlled by a control disc 469 of the type described above in connection with Figs. 24–28, which in turn is controlled by a controlling cam 242 on the control shaft 228 through a Bowden wire 248. Furthermore, one end of a back-racking controlling link 470 is pivoted at 472 to an arm 474 of the three-arm lever 422 swingably arranged on the carrier spindle 350. The other end of said back-racking connecting link is pivoted at 476 to a lever 478, which carries a spring-loaded pawl 480 for cooperation with a ratchet wheel 482 positively connected with the narrowing spindle 464. Said pawl 480 may be controlled by a control disc 484 which in turn is controlled by a controlling cam 242 on the control shaft 228 through a Bowden wire 248. The pawl-ratchet wheel mechanisms 466, 468, 469, 480, 482, 484 of the normal forward- and back-racking drive (generally indicated by 481) of the narrowing spindle 464 operate in the same manner as the pawl-ratchet wheel mechanisms described above in connection with Figs. 24–27 illustrating the normal forward- and back-racking drive (generally indicated by 455) of the carrier spindle 350. Therefore, it becomes apparent that an actuation of the forward-racking connecting rod 404 (Fig. 24) also causes an actuation of the forward-racking connecting link 454, which results in a normal two-needle forward-racking of the narrowing spindle 464, when the control disc 469 is set for an actuation of the ratchet wheel 468 by the pawl 466. Likewise, an actuation of the back-racking connecting rod 414 causes an actuation of the back-racking connecting link 470 which results in a normal two-needle back-racking of the narrowing spindle 464 when the control disc 484 is set for an actuation of the ratchet wheel 482 by the pawl 480.

The narrowing spindle 464 may be held in its position by means of a spring-loaded detent 486 cooperating with an index disc 488 secured to the narrowing spindle 464 as shown in Fig. 22.

During the operation of the knitting machine it might be necessary that either only the narrowing spindle 464 or only the carrier spindle 350 is advanced at a certain interval. If this is the case, the control discs either of the carrier spindle or of the narrowing spindle are automatically set into the neutralizing position shown in Fig. 26.

As best shown in Figs. 1, 22 and 23, the narrowing spindle 464 journalled in suitable bearings of the frame of the machine has a left-hand thread portion at its left end and a right-hand thread portion at its right end. A nut 490L is

threaded on the left-hand thread portion of the narrowing spindle 464, and a nut 490R is threaded on the right-hand thread portion of the narrowing spindle 464. Each nut 490L and 490R has a recess 492 (see Figs. 21–23) slidably engaged with a guiding shaft 494 secured to the frame of the machine. Thus, the nuts 490L and 490R are prevented from rotation when the narrowing spindle 464 is rotated. Apparently, a rotation of the narrowing spindle 464 in clockwise direction as viewed in Figs. 2 and 21 causes an inward movement or forward-racking of the nuts 490L and 490R for example from the position shown in full lines in Figs. 22 and 23 into the position 490L¹ and 490R¹ shown in dash and dot lines in Figs. 22 and 23. On the other hand, a rotation of the narrowing spindle 464 in counterclockwise direction as viewed in Figs. 2 and 21 causes an outward movement or back-racking of said nuts from an inner position to an outer position farther away from each other.

Each nut 490L and 490R is provided with a downward extension 496. The downward extension 496 of the nut 490L cooperates with an abutment 498 secured to an upper rail 500 slidably arranged in apertures of arms 502 secured to a horizontal tube 504 carried by arms 506 of the narrowing machine swingably mounted on the frame of the knitting machine in a manner known per se. A spring 508 stretched between the left outer arm 502 and said upper rail 500 tends to hold said abutment 498 against the downward extension 496 of the left-hand nut 490L. In a similar manner, the downward extension 496 of the right-hand nut 490R (see Fig. 23) is in engagement with an abutment 510 secured to a lower rail 512 slidably arranged in apertures of said arms 502 of the narrowing machine. A spring 514 stretched between the right outer arm 502 and the lower rail 512 tends to urge the abutment 510 against the downward extension 496 of the right-hand nut 490R.

As best shown in Figs. 2, 23 and 46, the upper slidable rail 500 of the narrowing machine carries the narrowing fingers 516 while the lower rail 512 of the narrowing machine carries the narrowing fingers 518. Therefore, a forward-racking of the nuts 490L and 490R from the position shown in full lines of Figs. 22 and 23 into the position 490L¹ and 490R¹ shown in said figures in dash and dot lines causes a shifting of the upper rail 500 towards the right and of the lower rail 512 towards the left, so that the narrowing fingers 516 and 518 approach each other in each knitting field and finally reach the position shown in full lines in Fig. 45. On the other hand, a back-racking of the narrowing spindle nuts from the position shown in full lines in Fig. 45 into the position shown in full lines in Figs. 22, 23 and 46 causes a movement of the narrowing fingers 516 and 518 away from each other under the action of the springs 508 and 514 causing the abutments 498 and 510 to follow the outward movement or back-racking of the downward extensions 496 of the nuts.

Of course, during the performance of a narrowing operation, the narrowing machine carrying the narrowing fingers 516 and 518 is automatically lowered and lifted by a mechanism controlled by the pattern chain in a manner known per se.

As best shown in Figs. 23 and 29, the right-hand end of the narrowing spindle 464 is connected with a single-needle back-racking drive generally indicated by 520. Said single-needle back-racking drive 520 comprises one ratchet wheel 522 rigidly connected with the narrowing spindle 464 and arranged for cooperation with a spring-loaded pawl 524 mounted on a lever 526 swingably mounted on the narrowing spindle 464 and actuated by a connecting link 528, which connects said lever 526 with another lever 530 swingably mounted on an extension of the carrier spindle 350. Said last mentioned lever 530 may be actuated by a connecting rod 532, the lower end of which is connected with a block generally indicated by 534. Said block 534 being of substantially the same construction as the block 196 shown in Figs. 8 and 9 is swingably mounted on the right-hand end of the shaft 198 (see Figs. 1, 29 and 30). The block 534 may be rocked at predetermined intervals, controlled by the position of a controlling element 536 controlled by a button on the pattern chain 148, by a spring-loaded follower 538, which is in operative engagement with the single-needle back-racking cam 76 arranged on the main cam shaft 68. According to Figs. 23 and 29, a stationary control disc 540 substantially of the shape shown in Fig. 28 is arranged on the narrowing spindle 464. Said control disc 540 is held in its position by means of a hook 542 engaged with the lug 544 of the control disc 540 and a stud 546 secured to the frame of the machine. The control disc 540 is arranged in such a position that it permits the pawl 524 to rotate the ratchet wheel 522 and the narrowing spindle 464 connected therewith only through one step; as the pawl 524 rotates the ratchet wheel 522 in clockwise direction as viewed in Fig. 29, such a rotation of the ratchet wheel 522 will cause a single-needle back-racking of the narrowing spindle 464. When the pattern chain controlling element 536 (Fig. 30) is in such a position that the follower 538 cannot swing the block 534, the latter is held by means of a spring 548 and a stop screw 550 cooperating with the shaft 202 in a substantially horizontal position, whereby the end of the pawl 524 is brought into engagement with the high portion of the control disc 540 so that the ratchet wheel 522 connected with the narrowing spindle 464 may be freely rotated in one direction or the other when the normal two-needle forward- and back-racking drive 431 arranged at the other end of the narrowing spindle 464 (see Figs. 2 and 22) is rendered active.

As best shown in Figs. 19, 20C and 29 a forward- and back-racking drive generally indicated by 552 is arranged at the right-hand end of the pointex spindle 354. Said forward- and back-racking drive 552 of this pointex spindle 354 substantially corresponds to the forward- and back-racking drive 455 of the carrier spindle and does not need to be described in detail. It may be mentioned that the forward-racking connecting rod 554 and the back-racking connecting rod 556 of said forward- and back-racking drive 552 are connected with a block 558 swingably mounted on the shaft 198 which is actuated by a follower 560 engaged with the pointex spindle cam 78 in dependence on a control by the pattern chain.

The pointex spindle 354 may be held in its position by means of a spring-loaded detent 562 cooperating with an index disc 564 secured to the pointex spindle 354 as shown in Figs. 19 and 20C.

As best shown in Figs 18, 19, 20, 20C and 21, the carrier spindle nuts 348L and 348R, which may be moved inwardly and outwardly by above

described forward-racking drive and back-racking drive **455** of the carrier spindle **350** carry plates **566L** and **566R** respectively, which in turn carry a plurality of controlling means for controlling the stroke and temporary stoppings of the carrier rods **274***a*, **274***b* . . . during the operation thereof after their automatic release by an end arrester **300***a*, **300***b* . . . Likewise, the pointex spindle nuts **352L** and **352R**, which may be moved inwardly and outwardly by above described forward-racking drive and back-racking drive **552** of the pointex spindle **354**, carry plates **568L** and **568R** which in turn carry controlling means for controlling the stroke of certain carrier rods during certain reinforcing or splicing operations thereof.

Referring now to the carrier spindle nuts **348L**, **348R** and their plates **566L**, **566R**: each plate **566L**, **566R** carries a bolt **570L**, **570R**, a bolt **572L**, **572R** and a bolt **574L**, **574R**, respectively.

A series of stop latches **576L***a*, **576L***b*, **576L***c* . . . **576L***h* is swingably mounted on the bolt **570L** of the plate **566L**; the individual stop latches of said series of stop latches **576L***a*, **576L***b* . . . are held at the proper distance from each other by means of ring-like spacers **578** arranged on the bolt **570L** (see Figs. 18, 20 and 20C). Likewise, a series of stop latches **576R***a*, **576R***b*, **576R***c* . . . **576R***h* is swingably mounted on the bolt **570R** of the plate **566R**; the individual stop latches of said series of stop latches **576R***a*, **576R***b* . . . are held at the proper distance from each other by means of ring-like spacers **578** arranged on the bolt **570R**. Each carrier rod **274***a*, **274***b* . . . **274***h* has at its left-hand end an adjustable stop screw **580L***a*, **580L***b* . . . and at its right-hand end an adjustable stop screw **580R***a*, **580R***b* . . . respectively. Each stop latch of the left-hand series of stop latches **576L***a*, **576L***b* . . . has a laterally extending projection arranged for cooperation with the stop screw **580L***a*, **580L***b* . . . of the associated carrier rod **274***a*, **274***b* . . . ; likewise, each stop latch of the right-hand series of stop latches **576R***a*, **576R***b* . . . is arranged for cooperation with a stop screw **580R***a*, **580R***b* . . . of an associated carrier rod **274***a*, **274***b* . . . In the exemplatory arrangement of the various stop latches shown in the drawings, the stop latches **576L***b*, **576L***c*, **576L***e* and **576L***h* of the left-hand series of swingable stop latches as well as the stop latches **576R***a*, **576R***b*, **576R***d*, **576R***f* and **576R***g* of the right-hand series of swingable stop latches are selectively connected with a Bowden wire control **248**, which in turn is controlled by a controlling cam **242** on the control shaft **228**. Therefore, said latches may be automatically brought at predetermined intervals in response to a control by a controlling cam from an inactive position out of the path of the associated carrier rod as shown in Fig. 32 into an active position, wherein the lower end of the stop latch is in the path of the stop screw of the associated rod as shown, for example, in dash and dot lines in Fig. 33A. Said active position is limited by a stopping bolt **582L** or **582R** respectively, which is attached to the plate **566L** or **566R** respectively. Of course, upon an actuation by an associated controlling cam **242**, arranged on the control shaft **228**, said stop latches **576R***a*, **576R***b*, **576L***b*, **576L***c* . . . may be automatically returned from an active position into an inactive position through the medium of a Bowden wire. Furthermore, according to the embodiment shown in the drawings, the stop latches **576L***a*, **576L***d*, **576L***f* and **576L***g* of the left-hand series of stop latches as well as the stop latches **576R***c*, **576R***e* and **576R***h* of the right-hand series of stop latches are selected for use as stationary stop latches which are permanently in the path of the associated carrier rods during the operation of the machine; therefore, said stationary stop latches are not connected with a Bowden wire control and are held in their active position by means of the spring acting on said stop latches.

Moreover, as shown in Figs. 18, 20, 20C, 21 and 32, a series of spring-loaded, Bowden wire controlled actuating levers **584L***c*, **584L***e* and **584L***h* are swingably mounted on the bolt **572L** of the plate **566L**, and a series of spring-loaded Bowden wire controlled actuating levers **584R***a*, **584R***b*, **584R***d*, **584R***f*, **584R***g* are swingably mounted on the bolt **572R** of the plate **566R**. Said spring-loaded actuating levers are held at the proper distance from each other by means of ringlike spacers **586** arranged on the bolt carrying said actuating levers. As best shown in Figs. 20 and 20C, each of said spring-loaded actuating levers has an abutting arm **588** in loose contact with an abutting projection **590** on an arm of a spring-loaded holding latch. As shown in Figs. 18, 20, 20C and 32 a series of such spring-loaded holding latches **592L***c*, **592L***e*, **592L***h* is swingably mounted on the bolt **574L** of the plate **566L**, and a series of such spring-loaded holding latches **592R***a*, **592R***b*, **592R***d*, **592R***f* and **592R***g* is swingably mounted on the bolt **574R** of the plate **566R**. The holding latches are spaced from each other by ring-like spacers **594** arranged on the bolt **574L** or **574R** respectively. The holding latches are arranged in such a way that the holding latch **592L***c* is associated with the actuating lever **584L***c*, the holding latch **592L***e* is associated with the actuating lever **584L***e*, the holding latch **592L***h* is associated with the actuating lever **584L***h*, the holding latch **592R***a* is associated with the actuating lever **584R***a*, the holding latch **592R***b* is associated with the actuating lever **584R***b*, the holding latch **592R***d* is associated with the actuating lever **584R***d*, the holding latch **592R***f* is associated with the actuating lever **584R***f* and the holding latch **592R***g* is associated with the actuating lever **584R***g*. In each case, the spring acting on the holding latch tends to hold its abutting projection **590** in engagement with the abutting arm **588** of the associated actuating lever. Each spring-loaded holding latch **592R***a*, **592R***b*, **592L***c* . . . carries an adjustable stop screw **596** for cooperation with an abutting surface **598** on the associated carrier rod **274***a*, **274***b* . . . (see Figs. 20 and 20C). As best shown in Fig. 32, the swingable holding latch **592R***a*, is associated with the carrier rod **274***a*, the holding latch **592R***b* is associated with the carrier rod **274***b*, the holding latch **592L***c* is associated with the carrier rod **274***c*, the holding latch **592R***d* is associated with the carrier rod **274***d*, the holding latch **592L***e* is associated with the carrier rod **274***e*, the holding latch **592R***f* is associated with the carrier rod **274***f*, the holding latch **592R***g* is associated with the carrier rod **274***g* and the holding latch **592L***h* is associated with the carrier rod **274***h*. Said holding latches are normally held by means of the Bowden wire **248** connected with the actuating lever associated with such a holding latch in an inactive position out of the path of the carrier rod as shown in Figs. 20, 20C and 32. Upon an actuation of such a Bowden wire control by a controlling cam **242** mounted on the control shaft **228**, such an actuating lever **584R***a*, **584R***b*, **584L***c* . . . may be swung about its

bolt 572R or 572L at a predetermined interval, so that the spring-loaded associated holding latch 592R*a*, 592R*b*, 592L*c* . . . may follow the movement of such an actuating lever into an active position, wherein the stop screw 596 of such a holding latch is in the path of the abutting surface 598 of a carrier rod as shown in full lines in Fig. 36. Of course, upon an automatic actuation by an associated controlling cam 242 on the control shaft 228, the actuating lever and the associated holding latch may be returned into their inactive position against the action of the springs acting thereon.

Referring now to the pointex spindle nuts 352L and 352R and their plates 568L and 568R: each plate 568L, 568R carries a bolt 600L, 600R, and a bolt 602L, 602R respectively as shown in Figs. 19, 20, 20C and 32, for example.

As best shown in Figs. 20, 21 and 32, a spring-loaded stop latch 604L*c* and a spring-loaded stop latch 604L*e* are swingably mounted on the bolt 600L of the plate 568L. As best shown in Figs. 19, 20C and 37, likewise a spring-loaded stop latch 604R*d* and a spring-loaded stop latch 604R*f* are swingably mounted on the bolt 600R of the plate 568R. The stop latch 604L*c* is associated with the carrier rod 274*c*, the stop latch 604R*d* is associated with the carrier rod 274*d*, the stop latch 604L*e* is associated with the carrier rod 274*e*, and the stop latch 604R*f* is associated with the carrier rod 274*f*. Each of said stop latches 604L*c*, 604R*d*, 604L*e*, and 604R*f* carries an adjustable stop screw 606 for cooperation with an end surface of the associated carrier rod. Each of said spring-loaded swingable stop latches is controlled by an associated controlling cam 242 on the control shaft 228 through a Bowden wire 248. Said stop latches are normally in an inactive position out of the path of the associated carrier rod as shown in Figs. 20 and 20C, for example. Upon an actuation by the automatic controlling cam control, each of said stop latches may be brought at a predetermined interval into an active position as shown in full lines in Fig. 43, wherein it is in the path of the carrier rod; of course, said controlling cam control may return automatically such a stop latch from the active position into its inactive position at a predetermined interval.

Furthermore, as best shown in Figs. 20, 21, and 32, a spring-loaded actuating lever 608L*c* and a spring-loaded actuating lever 608L*e* are swingably mounted next to said spring-loaded stop latches 604L*c* and 604L*e* respectively on the bolt 600L of the plate 568L. Likewise, as shown in Figs. 19, 20*c* and 32, a spring-loaded actuating lever 608R*d* and a spring-loaded actuating lever 609R*f* are swingably mounted next to the stop latch 604R*d* and 604R*f* respectively on the bolt 600R of the plate 568R. The bolt 602L of the plate 568L carries two swingable spring-loaded stop latches 610L*c* and 610L*e*: likewise, the bolt 602R of the plate 568R carries two swingable spring-loaded stop latches 610R*d* and 610R*f*. The stop latch 610L*c* is associated with the actuating lever 608L*c* and the carrier rod 274*c*, the stop latch 610L*e* is associated with the actuating lever 608L*c* and the carrier rod 274*c*, the stop latch 610L*e* is associated with the actuating lever 608L*e* and the carrier rod 274*e*, the stop latch 610R*d* is associated with the actuating lever 608R*d* and the carrier rod 274*d* and the stop latch 610R*f* is associated with the actuating lever 608*f* and carrier rod 274*f*. Each of said stop latches 610L*c*, 610R*d*, 610L*e*, and 610R*f* has a lateral abutting projection 612, which is held in loose abutting engagement with an arm 614 of the associated actuating lever by a spring acting on such a stop latch. Furthermore, each stop latch carries an adjustable stop screw 616 arranged for cooperation with an abutting surface 618 on the associated carrier rod as shown in Figs. 20 and 20C. Said stop latches 610L*c*, 610R*d*, 610L*e*, 610R*f* are normally in an inactive position out of the path of said abutting surface 618 of the associated carrier rod. However, upon a controlling cam control through a Bowden wire 248 connected with an associated actuating lever 608L*c*, 608R*d* . . . the latter may be swung about its bolt into such a position, that the spring-loaded associated stop latch following said actuating lever comes into an active position in the path of the abutting edge 618 of the associated carrier rod as shown in Fig. 42, for example. Of course, the stop latch may be returned into its inactive position by an automatic controlling cam control through the medium of a Bowden wire and the associated actuating lever.

Ring-like spacers 620 are arranged on the bolts 600L and 600R for holding the stop latches 604L*c*, 604R*d* . . . and actuating levers 608L*c*, 608R*d* . . . in proper position. Likewise, ring-like spacers 622 are arranged on the bolts 602L and 602R for holding the stop latches 610L*c*, 610R*d* . . . in proper position.

As mentioned above, the stop latches 576L*a*, 576L*b* . . . 576R*a*, 576R*b* . . . may limit an outer end position of an associated reciprocable carrier rod by cooperation with a stop screw 580L*a*, 580L*b* . . . 580R*a*, 580R*b* . . . arranged on the carrier rods. Furthermore, as mentioned above, said stop latches 576L*a*, 576L*b* . . . 576R*a*, 576R*b* . . . are arranged on the plates 566L, 566R of the carrier spindle nuts 348L, 348R, which during the knitting of a stocking blank are moved inwardly. When said carrier spindle nuts 348L and 348R are at the end of a knitting cycle in their innermost position, the stop latches 576L*a*, 576L*b* . . . 576R*a*, 576R*b* . . . mounted thereon cannot be used for stopping a carrier rod in such an outer end position as would be necessary at the beginning of the next knitting cycle for the knitting of the welt of the stocking blank. In order to eliminate a back-racking of the carrier spindle nuts 348L and 348R into their starting position prior to the start of a new knitting cycle, auxiliary stopping means are provided, which are automatically rendered active at the beginning of a new knitting cycle, so that such a new knitting cycle may immediately follow a previous knitting cycle without necessity of back-racking the carrier spindle nuts prior to the start of a new knitting cycle. The carrier spindle nuts may be back-racked at the beginning of a new knitting cycle during the knitting of the welt, and the auxiliary stopping means are automatically rendered active until the carrier spindle nuts are restored into their starting position, wherein the stop latches 576L*a*, 576L*b* . . . 576R*a*, 576R*b* . . . may be used. Said auxiliary stopping means comprise the following elements:

According to Figs. 16, 20A and 20B, auxiliary stop levers 624L and 624R arranged on each side of the center frame 66 are rigidly connected with a pivot 626 swingably mounted in suitable bearings of the center frame 66. A spring-loaded actuating lever 625 keyed to the pivot 626 is operatively connected with a controlling cam 242 on the control shaft 228 by means of a Bowden wire 248. Thus, the position of the auxiliary stop

levers 624L and 624R may be controlled by an associated controlling cam on the control shaft. Said auxiliary stop levers 624L, 624R are normally in the inactive position shown in Figs. 16, 20A, and 20B, wherein they are out of the path of a stop screw 628L*b* and 628R*b* threaded into a threaded bore 630*b* and 631*b* of the lugs 280*b* and 282*b* respectively of the carrier rod 274*b*. At predetermined intervals, said auxiliary stop levers 624L and 624R may be automatically lifted into an active position as shown for example in Fig. 34 by means of the actuating lever 625 and the Bowden wire 248 in response to a control by a controlling cam 242 on the control shaft 228; when the auxiliary stop levers 624L and 624R are in said active position, they are in the path of the stop screws 628L*b* and 628R*b* for limiting the outer end position of the carrier rod 274*b*. When the auxiliary stop levers 624L and 624R are no longer needed, they are automatically returned into their inactive position shown in Figs. 16, 20A, 20B and 35 by means of the actuating lever 625 and the Bowden wire 248 in response to a control by a controlling cam on the control shaft.

In the arrangement of the parts shown in the drawings, the stop screws 628L*b* and 628R*b* are arranged only in the lugs 280*b* and 282*b* of the carrier rod 274*b*. However, as best shown in Figs. 16, 20A, 20B and 32, each lug 280*a*, 280*b*, 280*c* . . . and 282*a*, 282*b*, 282*c* . . . of each carrier rod 274*a*, 274*b*, 274*c* . . . is provided with a threaded bore 630*a*, 630*b*, 630*c* . . . and 631*a*, 631*b*, 631*c* . . . respectively, so that the stop screws 628L*b* and 628R*b* and other stop screws, if so desired, may be selectively threaded into such bores of the lugs of any carrier rod as may be necessary for the selected operation thereof. The auxiliary stop levers 624L and 624R are arranged in such a manner, that they are in the path of any stop screw threaded into any bore of the lugs of the carrier rods when said auxiliary stop levers are in their active position; in their inactive position they are out of the path of such stop screws.

As mentioned above, and as shown in Fig. 32, the carrier rods 274*a*, 274*b*, 274*d*, 274*f* and 274*g* are arrested at the right-hand end of the machine by the end arresters 300*a*, 300*b*, 300*d*, 300*f*, and 300*g* in their idle position; the carrier rods 274*c*, 274*e*, and 274*h* are arrested on the left-hand side of the machine by the end arresters 300*c*, 300*e*, and 300*h* in their idle position. As best shown in said Fig. 32 and in Figs. 20 and 20C, each carrier rod 274*a*, 274*b* . . . has an adjustable safety screw 632*a*, 632*b*, 632*c* . . . at its end, where it is arrested in its idle position. Said safety screw 632*a*, 632*b* . . . abuts the wall 310L or 310R of the bracket 290R or 290L when the carrier rod runs into its idle position at the end of an operation thereof, so that the hook 306*a*, 306*b* . . . may safely come into engagement with the end arrester 300*a*, 300*b* . . .

As best shown in Figs. 45 and 46, a carrier rod of above described knitting machine is of symmetrical construction. As best shown in Figs. 20 and 20B, a carrier rod of the knitting machine has at its left-hand end three threaded bores 634L, 636L, 638L and at its right-hand end three threaded bores 634R, 636R, 638R, so that the stop screws 580 and 632 as well as the hook 306 may be selectively threaded into said bores on either end of the carrier rod. As best shown in Figs. 12 and 32, all carrier rods 274*a*, 274*b* . . . of the machine are of the same construction. As best shown in Fig. 19, the stop latches 604, 610 and actuating levers 608 arranged on the bolts 606 and 602 of the pointex spindle nuts 352 are held in their position by spacers 620 and 622 and removable cotter pins 640, 642. Apparently, after removal of the cotter pins 640, 642, the stop latches 604, 610 and actuating levers 608 of the pointex spindle nuts 352 may be readily rearranged, so that they will be associated with different carrier rods; of course, the stop latches and actuating levers of the pointex spindle nuts will be held in their new position by suitable spacers of suitable length, which may be substituted for the spacers shown in the drawing. Furthermore, if so desired, one or more additional sets of stop latches and actuating levers could be arranged on the bolts 620 and 622 of the pointex spindle nuts 352 for cooperation with carrier rods, for example for cooperation with the carrier rods 274*g* and 274*h*. Such additional sets of stop latches and actuating levers, of course would be connected through a Bodwen wire with additional controlling cams on the control shaft 228. Likewise, as best shown in Fig. 18, the actuating levers 584 and holding latches 592 as well as the spacers 586 and 594 are removably and exchangeably arranged on the bolts 572 and 574 of the carrier spindle nuts 348, so that they may be selectively associated with any one of the carrier rods 274*a*, 274*b* . . . Moreover, any one of the stop latches 576 of the carrier spindle nuts 348 may be selectively made adjustable by connecting same through a Bowden wire with a controlling cam on the control shaft 228 or may be made stationary by disconnecting same from the Bowden wire control and subjecting same only to the action of the spring connected therewith. Likewise, as best shown in Fig. 19, the end arresters 300 and spacers 301 arranged on the bolt 302 of the bracket 290 could be rearranged on both sides of the machine for cooperation with different carrier rods, so that the carrier rods could be held in their idle position on a different side of the machine, if so desired.

As will be readily understood from above, all controls of all carrier rods cooperate directly with said carrier rods and may be interchanged or replaced in any way desired, so that each carrier rod may be used for any selected operation, for example for the operation as a so-called "main carrier rod" or for the operation as a so-called "welt-carrier rod" or for the operation as a so-called "pointex carrier rod" or for the operation as a so-called "splicing carrier rod," etc.

In the embodiment shown in the drawings, the selection of the various controlling means has been made as follows, as best shown in Fig. 32:

*Carrier rod 274.*—The end arrester 300*a* for arresting the carrier rod in its idle position is on the right-hand side of the machine; the stop latch 576R*a* on the right-hand carrier spindle nut is adjustable; the stop latch 576L*a* on the left-hand carrier spindle nut is stationary; the adjustable holding latch 592R*a* is on the right-hand carrier spindle nut. For the theoretical example of knitting a stocking blank 644 as shown diagrammatically in Fig. 31, said carrier rod 274*a* is selected for use as a main carrier rod.

*Carrier rod 274b.*—The end arrester 300*b* for arresting the carrier rod in its idle position is on the right-hand side of the machine; the stop latch 576R*b* on the right-hand carrier spindle nut is adjustable; the stop latch 576L*b* on the left-hand carrier spindle nut is likewise adjustable; the adjustable holding latch 592R*b* is on the right-hand carrier spindle nut. For the the-

oretical example of knitting the stocking blank 644, said carrier rod 274b is selected for use as a welt carrier rod.

*Carrier rod 274c.*—The end arrester 300c for arresting the carrier rod in its idle position is on the left-hand side of the machine; the stop latch 576Lc on the left-hand carrier spindle nut is adjustable; the stop latch 576Rc on the right-hand carrier spindle nut is stationary; the adjustable holding latch 592Lc is on the left-hand carrier spindle nut; the adjustable stop latches 604Lc and 610Lc are on the left-hand pointex spindle nut. For the theoretical example of knitting the stocking blank 644, said carrier rod 274c is selected for use as a left-hand pointex carrier rod.

*Carrier rod 274d.*—The end arrester 300d for arresting the carrier rod in its idle position is on the right-hand side of the machine; the stop latch 576Rd on the right-hand carrier spindle nut is adjustable; the stop latch 576Ld on the left-hand carrier spindle nut is stationary; the adjustable holding latch 592Rd is on the right-hand carrier spindle nut; the adjustable stop latches 604Rd and 610Rd are on the right-hand pointex spindle nut. For the theoretical example of knitting the stocking blank 644 said carrier rod 274d is selected for use as a right-hand pointex carrier rod.

*Carrier rod 274e.*—The end arrester 300e for arresting the carrier rod in its idle position is on the left-hand side of the machine; the stop latch 576Le on the left-hand carrier spindle nut is adjustable; the stop latch 576Re on the right-hand carrier spindle nut is stationary; the adjustable holding latch 592Le is on the left-hand carrier spindle nut; the adjustable stop latches 604Le and 610Le are on the left-hand pointex spindle nut. For the theoretical example of knitting the stocking blank 644 said carrier rod 274e is selected for use as a left-hand splicing carrier rod.

*Carrier rod 274f.*—The end arrester 300f for arresting the carrier rod in its idle position is on the right-hand side of the machine; the stop latch 576Rf on the right-hand carrier spindle nut is adjustable; the stop latch 576Lf on the left-hand carrier spindle nut is stationary; the adjustable holding latch 592Rf is on the right-hand carrier spindle nut; the adjustable stop latches 604Rf and 610Rf are on the right-hand pointex spindle nut. For the theoretical example of knitting the stocking blank 644 said carrier rod 274f is selected for use as a right-hand splicing carrier rod.

*Carrier rod 274g.*—The end arrester 300g for arresting the carrier rod in its idle position is on the right-hand side of the machine; the stop latch 576Rg on the right-hand carrier spindle nut is adjustable; the stop latch 576Lg on the left-hand carrier spindle nut is stationary; the adjustable holding latch 592Rg is on the right-hand carrier spindle nut. This carrier rod 274g is not selected for use for the knitting of the stocking blank 644 shown in Fig. 31 and may be considered as an optional carrier rod which could be used for a suitable operation, if a different type of stocking blank should be knitted on the machine.

*Carrier rod 274h.*—The end arrester 300h for arresting the carrier rod in its idle position is on the left-hand side of the machine; the stop latch 576Lh on the left-hand carrier spindle nut is adjustable; the stop latch 576Rh on the right-hand carrier spindle nut is stationary; the adjustable holding latch 592Lh is on the left-hand carrier spindle nut. This carrier rod 274h is not selected for use for the knitting of the stocking blank 644 shown in Fig. 31 and may be considered as an optional carrier rod, which could be used for a suitable operation, if a different type of stocking blank should be knitted on the machine.

It is understood, that the buttons 154 on the pattern chain 148 and the controlling cams 242 on the control shaft 228 are set as required for the various operations to knit a certain stocking blank.

Assume now, that a knitting cycle for knitting a stocking blank has been completed, and that a new knitting cycle for knitting another stocking blank 644 (Fig. 31) is to be started:

All carrier rods 274a, 274b . . . are arrested by the associated end arresters 300a, 300b . . . in their idle positions. As will be described hereinafter, the carrier spindle nuts 348L and 348R are still in their innermost position as shown in Figs. 33, 33A and 45, which they occupy at the end of the previous knitting cycle.

The knitting of the stocking blank 644 shown in Fig. 31 starts with the knitting of the first welt portion 646 by means of the welt carrier rod 274b.

Figs. 33 and 33A illustrate the welt carrier rod 274b in its right-hand idle position arrested by the end arrester 300b. The yarn carriers 292b and 294b are at the distance z from the knitting fields 298L and 298R respectively. The stop latch 576Rb and the holding latch 592Rb on the right-hand carrier spindle nut 348R are in their inactive position and cannot be brought at this time into their active position as, as mentioned above, the right-hand carrier spindle nut 348R is still in its innermost position and, consequently, the welt carrier rod 274b is in the path of said stop latch 576Rb and holding latch 592Rb, if they should be brought into their active position. Likewise, the stop latch 576Lb on the left-hand carrier spindle nut 348L is in its inactive position as shown in full lines. Said stop latch 576Lb also cannot be brought into the active position 576Lb' (shown in dash lines) at this time as—owing to the inward position of the carrier spindle nut 348L—the stop latch 576Lb' would stop the carrier rod 274b in this position at a time when the yarn carriers 292b and 294b would have reached only the positions 292b' and 294b' as shown in dash and dot lines in Figs. 33 and 33A. Therefore, the controlling cams on the control shaft of the knitting machine are set in such a way, that at this time the latches on the carrier spindle nuts 348L and 348R remain in their inactive position as shown in full lines in Figs. 33 and 33A.

However, the controlling cam associated with the auxiliary stop levers 624L and 624R is set and shaped in such a way, that shortly after the end arrester 300b is brought by an associated controlling cam into the releasing position 300b' (Fig. 33) for a release of the welt carrier rod 274b, the auxiliary stop levers 624L and 624R are lifted from their inactive position shown in Fig. 33 into their active position shown in Fig. 34. Therefore, as soon as the welt carrier rod 274b is released by the end arrester 300b and is driven by the actuating rack 256 (Fig. 12) through the medium of the friction slip clutch 264b in left-hand direction as viewed in Figs. 33 and 34, said movement of the welt carrier rod 274b continues until the stop screw 628Rb abuts against the auxiliary stop lever 624R as shown in Fig. 34. In this position

of the welt carrier rod 274b, the yarn carriers (only the yarn carrier 294b is shown in Fig. 34) are at the left-hand end of the knitting fields. Said stopping of the welt carrier rod 274b by the auxiliary stop lever 624R in the path of the stop screw 628Rb causes the clutch members of the friction slip clutch 264b to slide relative to each other, when the coulier-motion mechanism continues to drive the actuating rack 256 in the same direction. As soon as the coulier-motion mechanism reverses the movement of the actuating rack, the latter drives through the medium of the friction-slip clutch 264b the welt-carrier rod 274b in right-hand direction as viewed in Fig. 34. Said movement to the right continues until it is stopped by an abutment of the stop screw 628Lb against the auxiliary stop lever 624L. Now, the yarn carriers 292b and 294b are at the right-hand end of the knitting fields as indicated for the yarn carrier 294b in dash lines in Fig. 34.

Above described reciprocating movement of the welt carrier rod 274b, the stroke of which is limited by the auxiliary stop levers 624L and 624R is repeated several times during the knitting of the first courses of the first welt portion 646 between the points B and C (see Fig. 31). During said knitting of the first courses of the welt, the back-racking of the carrier spindle nuts 348L and 348R from their innermost position shown in Fig. 45 into their starting position shown in Fig. 46 takes place by means of above described carrier spindle forward- and back-racking device 455 set for a back-racking operation. When the carrier spindle nuts 348L and 348R reach their outer starting position shown in Figs. 35 and 46, the stop latch 576Rb on the right-hand carrier spindle nut 348R is automatically brought into the active position shown in said Fig. 35 by a controlling cam on the control shaft. At the same time, the stop latch 576Lb on the left-hand carrier spindle nut 348L is brought from the full line inactive position shown in Fig. 33A into the dash and dot line active position 576Lb'. It may be recalled that now both carrier spindle nuts 348L and 348R are in their outer position so that now the stroke of the welt carrier rod 274b may be controlled by said stop latches 576Lb and 576Rb cooperating with the stop screws 580Lb and 580Rb as shown in Fig. 35. The auxiliary stop levers 624L and 624R are automatically returned into their inactive position shown in Fig. 35. The yarn carriers 292b and 294b are reciprocated from one end of the knitting field 298L or 298R respectively to the other end of said knitting field as indicated in Fig. 35; as mentioned above, the end positions of the yarn carriers during said reciprocating movements are now controlled by the stop latches 576Lb and 576Rb on the carrier spindle nuts 348L and 348R.

After the knitting of several courses of the welt portion 646 (Fig. 31) from the point C to the point D by the welt carrier rod 274b controlled by the stop latches 576Lb and 576Rb, the Picot is made in a manner known per se. Thereafter, the second welt portion 648 is knitted by the welt carrier rod 274b controlled by the stop latches 576Lb and 576Rb on the carrier spindle nuts 348L and 348R as indicated by Fig. 35. At the point E the welt is turned in a manner known per se. Thereafter, again several courses are knitted by the welt carrier rod 274b controlled by the stop latches 576Lb and 576Rb until the point F (see Fig. 31) is reached. At this point, the main carrier rod 274a is to be brought into the knitting field for knitting together with the welt carrier rod 274b the so-called reinforced "shadow-welt" 649.

Before the main carrier rod 274a is brought into the knitting field, the main carrier rod 274a is arrested in its right-hand end position by the end arrester 300a as shown in Fig. 37. The stationary stop latch 576La on the left-hand carrier spindle nut 348L is in its active position in the path of the stop screw 580La of the main carrier rod 274a. Immediately upon an automatic movement of the end arrester 300a into the releasing position 300a', the main carrier rod 274a is moved to the left by its actuating drive. As soon as the stop screw 580La hits the stop latch 576La, the main carrier rod 274a is stopped in its left-hand end position, wherein the yarn carriers 292a and 294a are at the left-hand ends of the knitting fields 298L and 298R; Fig. 38 indicates said end position 294a' for the yarn carrier 294a in dash and dot lines. In the meantime, the stop latch 576Ra on the right-hand carrier spindle nut 348R is automatically brought from the inactive position shown in Fig. 37 into the active position shown in Fig. 39. Therefore, upon a subsequent movement of the main carrier rod 274a to the right, the stroke thereof is limited by an abutment of its stop screw 580Ra against the stop latch 576Ra. When the main carrier rod 274a is thus stopped by the stop latch 576Ra on the right-hand carrier spindle nut 348R, the yarn carriers 292a and 294a are at the right-hand end of the knitting fields 298L and 298R. The main carrier rod 274a and the welt carrier rod 274b are simultaneously reciprocated during the knitting of the courses of the reinforced "shadow-welt" 649 between the points F and G (Fig. 31). After the completion of the reinforced "shadow-welt," the welt carrier rod 274b is automatically arrested by the end arrester 300b which, at a suitable interval has been brought automatically into the arresting position shown in Fig. 33. Of course, shortly before the arresting of the welt carrier rod 274b by the end arrester 300b takes place, the stop latch 576Rb on the right-hand carrier spindle nut 348R is automatically lifted into its inactive position, so that it is out of the path of the stop screw 580Rb and the welt carrier rod 274b may run towards the right until its stop screw 632b hits the wall 310R of the bracket 290R. Preferably, the stop latch 576Lb on the left-hand carrier spindle nut 348L is automatically returned into its inactive position simultaneously with the afore-mentioned return of the stop latch 576Rb on the right-hand carrier spindle nut 348R into its inactive position.

The reciprocation of the main carrier rod 274a for the knitting of the leg portion 654, the high heel portions 656, 658, the sole portions 660, 662 and the ravel courses 664 continues from the point Q up to the point S. During said reciprocation of the main carrier rod 274a, its stroke is always controlled by the stop latch 576La on the left-hand carrier spindle nut 348L and the stop latch 576Ra on the right-hand carrier spindle nut 348R. As is customary in the art of knitting stocking blanks, narrowing operations are performed at suitable intervals during the knitting of the stocking blank from the point G to the point Q at the start of the ravel courses. In accordance with said narrowing operations, the carrier spindle nuts 348L and 348R are intermittently moved forwardly towards each other by means of above described carrier spindle forward- and back-racking drive 455 set for a forward-racking

operation. Obviously, said forward-racking of the carrier spindle nuts 348L and 348R causes a reduction of the length of the strokes of the main carrier rod 274*a* controlled by the stop latches 576L*a* and 576R*a*. When the point Q at the start of the ravel courses 664 is reached, the carrier spindle nuts 348L and 348R are in their innermost position shown in Figs. 40 and 45. There are no more narrowing operations during the knitting of the ravel courses 664. The position of the carrier spindle nut 348R shown in Fig. 40 at the distance *y* from the bracket 290R is identical with the position of the carrier spindle nut 348R at the distance *y* from the bracket 290R shown in Fig. 33. Therefore, after the pressing off of the stocking blank at the end of a knitting cycle, a new knitting cycle for the knitting of a new stocking blank may be immediately started, without returning at first the carrier spindle nuts 348L and 348R into their starting position, as in view of above described automatic control of the welt carrier rod 274*b* by the auxiliary stop levers 624L and 624R, the welt carrier rod 274*b* may be operated for the knitting of a series of courses of the welt at the beginning of the new knitting cycle and the carrier spindle nuts may be back-racked into their starting position during the knitting of said first courses of the welt.

Between the points H and J (see Fig. 31) the high heel portions 656 and 658 are knitted. Said high heel portions are reinforced by the use of additional yarn fed by the left-hand pointex carrier rod 274*c* for the high heel portion 656 and by the right-hand pointex carrier rod 274*d* for the high heel portion 658. While the main carrier rod 274*a* is reciprocated over the entire width of the stocking blank at the point H and, consequently, may be controlled by the stop latches 576L*a* and 576R*a* on the carrier spindle nuts 348L and 348R as described above, each of said pointex carrier rods 274*c* and 274*d* may be reciprocated only through a distance *x* (see Fig. 31). This feature may be obtained in the following manner:

As the operations of the left-hand and right-hand pointex carrier rods and the control thereof are identical, it is sufficient to describe only the operation and control of the right-hand pointex carrier rod 274*d*.

Fig. 41 illustrates the right-hand pointex carrier rod 274*d* in its idle position arrested by the end arrester 300*d*. The right-hand carrier spindle nut 348R and the right-hand pointex spindle nut 352R are in a somewhat inward position corresponding to the reduced width of the stocking blank at the point H. All latches on the carrier spindle nut 348R and on the pointex spindle nut 352R associated with the right-hand pointex carrier rod 274*d* are in their inactive position.

Shortly before the release of the pointex carrier rod 274*d* by an automatically controlled movement of the end arrester 300*d* into the releasing position 300*d'*, the actuating lever 608R*d* on the pointex spindle nut 352R is automatically swung in clockwise direction, so that the stop latch 610 R*d* may follow said swinging movement of the actuating lever 608R*d* in counterclockwise direction from the position shown in Fig. 41 into the position shown in Fig. 42. Therefore, when the right-hand pointex carrier rod 274*d* is released, its movement in left-hand direction is limited by an abutment of its abutting surface 618 against the stop screw 616 on the holding latch 610R*d* being now in an active position as shown in Fig. 42. When the right-hand pointex carrier rod 274*d* is thus stopped by the stop screw 616 of the stop latch 610R*d*, the yarn carrier 294*d* is in the position shown in full lines in Fig. 42. At an appropriate interval, the stop latch 576R*d* on the right-hand carrier spindle nut 348R is automatically lowered into the active position shown in Fig. 42, so that upon a return movement of the right-hand pointex carrier rod 274*d* to the right, the pointex carrier rod is stopped by an abutment of its stop screw 580R*d* against the abutting projection on the stop latch 576 R*d*. When such a stoppage of the pointex carrier rod 274*d* occurs, the yarn carrier 294*d* is in the position 294*d'* shown in dash and dot lines in Fig. 42. In other words, the stroke of the pointex carrier rod 274*d* is limited by the stop latch 610R*d* on the pointex spindle nut 352R and by the stop latch 576R*d* on the carrier spindle nut 348R, the stop latch 610R*d* controlling the inner end position of the carrier rod and the stop latch 576R*d* controlling the outer end position of the pointex carrier rod. In order to obtain the widening of the high heel portion 658 (Fig. 31) between the points $H^1$ and $H^2$, the pointex spindle nut 352R is intermittently moved inwardly by the forward-racking drive 552 described above, whereby the stroke limited by the stop latch 610R*d* on the pointex spindle nut and the stop latch 576R*d* on the carrier spindle nut is increased.

Fig. 31 illustrates a stocking blank for a stocking wherein in a subsequent knitting operation on a so-called "heeler" heel portions are knitted onto the high heel portions and are interknitted with the sole portions. Such a stocking blank comprises so-called "separating courses" 666 and 668 which are cut after the knitting of the stocking blank and prior to afore-mentioned knitting of the heel portion. Said separating courses 666 and 668 are not reinforced. Therefore, during the knitting of said separating courses, the right-hand pointex carrier rod 274*d* should lay yarn only over the length *w* from J to K.

In order to obtain this feature, the stop latch 604R*d* on the pointex spindle nut 352R is automatically moved at a predetermined interval from the inactive position shown in Fig. 42 into the active position shown in Fig. 43, wherein its stop screw 606 is in the path of the right-hand end surface 670 of the right-hand pointex carrier rod 274*d*. Now the strokes of the reciprocating movements of the right-hand pointex carrier rod 274*d* are limited by the stop screw 606 of the stop latch 604R*d* and the stop screw 616 of the stop latch 610R*d*, the former cooperating with the end surface 670 of the pointex carrier rod 274*d*, the latter cooperating with the abutting surface 618 of the pointex carrier rod 274*d*. When the pointex carrier rod 274*d* hits against the stop screw 606 its yarn carrier 294*d* is in the position shown in full lines in Fig. 43, which corresponds to the right-hand end of the distance *w* shown in Fig. 31. When the pointex carrier rod 274*d* hits against the stop screw 616, the yarn carrier 294*d* is in the position 294*d'* shown in dash and dot lines in Fig. 43, which corresponds to the left-hand end of the distance *w* in Fig. 31.

As soon as the knitting of the courses (preferably two) between the points J and K has been completed, the stop latch 604R*d* of the pointex spindle nut 352R is automatically returned from its active position shown in full lines in Fig. 43 into its inactive position shown in dash and

dot lines in said Fig. 43, wherein the stop screw 606 is out of the path of the end surface 670 of the pointex carrier rod 274*d*, so that from now on the right-hand outer end position of the pointex carrier rod 274*d* is again limited by the stop latch 576R*d* on the carrier spindle nut 348R. In other words, the yarn carrier 294*d* of the pointex carrier rod 274*d* now is reciprocated between the positions 294*d'* and 294*d''* shown in dash lines in Fig. 43.

During the knitting of courses between the points K and M, the carrier spindle nuts 348L and 348R and the pointex spindle nuts 352L and 352R are displaced in accordance with the shape and the structure fo the stocking blank to be knitted for controlling the strokes of the left-hand pointex carrier rod 274*c* by the stop latch 576L*c* of the left-hand carrier spindle nut and the stop latch 610L*c* of the left-hand pointex spindle nut and for controlling the strokes of the right-hand pointex carrier rod 274*d* by the stop latch 576R*d* of the right-hand carrier spindle nut and the stop latch 610R*d* of the right-hand pointex spindle nut.

Shortly before the point M is reached, the stop latch 576L*c* is automatically returned into inactive position, so that the left-hand pointex carrier rod 274*c* may run into its idle position wherein it is arrested by the end arrester 300*c* previously automatically set for arresting position. Preferably, the stop latch 610L*c* on the left-hand pointex spindle nut is also automatically returned into inactive position at this time.

Furthermore, the stop latch 610R*d* of the right-hand pointex spindle nut 352R is automatically returned from its active position shown in Fig. 43 into its inactive position shown in Fig. 44, so that from now on the strokes of the right-hand pointex carrier rod 274*d* are limited by the stop latches 576R*d* and 576L*d* of the carrier spindle nuts 348R and 348L as shown in Fig. 44 and, accordingly, the right-hand pointex rod 274*d* lays yarn along the same length as the main carrier rod 274*a* controlled by the latches 576R*a* and 576L*a* on the carrier spindle nuts 348R and 348L.

At the point N the left-hand splicing carrier rod 274*e* is brought into the knitting field for feeding additional reinforcing yarn, and at the point P the right-hand splicing carrier rod 274*f* is brought into the knitting field for feeding further reinforcing yarn. The strokes of said splicing carrier rods 274*e* and 274*f* are controlled by the stop latches 576L*e* and 576R*e* and 576L*f* and 576R*f* of the carrier spindle nuts 348L and 348R in the same manner as described above for the right-hand pointex carrier rod 274*d* in connection with Fig. 44.

During the knitting of a stocking blank, it may become necessary to make a so-called "idle course" at a certain interval before an additional carrier rod is brought into the knitting field. During such an "idle course," the needles are inactive and the carrier rod or carrier rods, which are in operation prior to the "idle course," must be temporarily stopped during such an "idle course" in an end position with the yarn carriers within or at the end of the knitting fields. This feature may be accomplished by the following automatic gripping means which are described hereinafter with reference to the main carrier rod 274*a* in connection with Fig. 36. Before the main carrier rod 274*a* is moved to the right (as viewed in Fig. 36) towards the active stop latch 576R*a* during the last movement prior to such an idle course, the actuating lever 584R*a* is automatically swung in counter-clockwise direction in response to a control by a control cam on the controlling shaft, so that the spring-loaded latch 592R*a* may follow in clockwise direction from the position shown for example in Fig. 39 into the position shown in full lines in Fig. 36. Now, when the inclined edge 650 of the main carrier rod 274*a* during its movement from the left to the right into the position shown in Fig. 36 hits the stop screw 596 on the holding latch 592R*a*, the holding latch is rocked into the intermediate position 592R*a'* (shown in dash and dot lines) against the action of its spring. During said rocking of the holding latch 592R*a* into said intermediate position 592R*a'*, its abutting projection 590 is disengaged from the abutting arm 588 of the actuating lever 584R*a*. As soon as the surface 652 of the main carrier rod 274*a* is past the stop screw 596 of the holding latch 592R*a*, the latter is automatically returned into the active position shown in Fig. 36 in full lines by means of the spring acting on the holding latch 592R*a*. Thus, the stop screw 596 of the holding latch 592R*a* comes into engagement with the abutting surface 598 of the main carrier rod 274*a*, so that the latter is temporarily prevented from a return movement in left-hand direction. As may be gathered from Fig. 36, now the main carrier rod 274*a* is gripped between the stop screw 596 of the holding latch 592R*a* and the lateral extension of the stop latch 576R*a* cooperating with the screw 580R*a* on the main carrier rod 274*a*; the yarn carriers 292*a* and 294*a* are in the knitting fields 298L and 298R respectively. After the performance of the idle course, the actuating lever 584R*a* is automatically swung in clockwise direction for turning the holding latch 592R*a* in counter-clockwise direction for disengaging same from the main carrier rod 274*a*, whereupon the latter may be again reciprocated by its actuating drive, the length of its strokes being controlled by the stop latches 576L*a* and 576R*a* on the carrier spindle nuts 348L and 348R.

It is understood that each of the carrier rods may be gripped by an associated holding latch 592 and stop latch 576 with its yarn carriers in the knitting fields during the performance of an "idle course," whenever such an "idle course" is necessary prior to the bringing in of an additional carrier rod.

Furthermore, it is understood that at the end of a yarn feeding operation of a carrier rod the adjustable stop latch of the carrier spindle nut associated with such a carrier rod is automatically brought into an inactive position, so that the respective carrier rod may run into its idle position wherein it is arrested by the associated end arrester previously automatically set for arresting position.

As will be apparent from above, the carrier rods 274*a*, 274*b* . . . of a straight-bar knitting machine according to the invention may be selected in a most flexible manner for any operation. As set forth above, the various controlling means controlling the stoppages and strokes of the carrier rods may be arranged or interchanged in any desired manner.

For example, if so desired, the stop latch 576L*a* (see Fig. 32) associated with the carrier rod 274*a* could be made adjustable by connecting same with a controlling cam on the control shaft 228, the stop latch 576L*b* associated with the carrier rod 274*b* could be made stationary by disconnecting same from a controlling cam on the

control shaft **228** and the stop screws **628L***b* and **628R***b* could be removed from the carrier rod **274***b* and arranged on the carrier rod **274***a*. In such a case, the carrier rod **274***a* could be used as a welt carrier rod and the carrier rod **274***b* could be used as a main carrier rod.

Furthermore, for example, the stop latches **604L***c*, **610L***c* on the left-hand pointex spindle nut could be associated with the carrier rod **274***h* instead of with the carrier rod **274***c* and the stop latches **604R***d* and **610R***d* of the right-hand pointex spindle nut could be associated with the carrier rod **274***g* instead of the carrier rod **274***d*, so that the carrier rods **274***g* and **274***h* could be used as pointex carrier rods, if so desired.

Above mentioned changes in the association of controlling means with carrier rods are only given by way of examples, and it is understood, that many other changes in the associations are possible.

Apparently, a great number of different designs of stocking blanks may be manufactured by the knitting machine according to the invention. If, for example, a stocking blank shall be made without separating courses, the setting of the controlling means shown in Fig. 43 is not needed, and the stop latch **604R***d* remains in its inactive position during the entire knitting cycle.

Moreover, it becomes obvious from above, that, owing to the identical construction of the carrier rods **274** and of the stop latches **576**, the stop latches **592** and of other similar controlling means described above, said carrier rods and controlling means may be manufactured in mass production at low costs.

Furthermore, above described reciprocable arrangement of the carrier rods **274** on guiding rods **284** and **286** permits a reduction of the length of the movable carrier rods, if compared with hitherto customary knitting machines, wherein the carrier rods are guided in bearings. Said reduction in the length of the carrier rods results in a reduction of the masses to be accelerated, and furthermore in a reduction of the width of the machine, so that the latter may be made of compact design.

Furthermore, above mentioned manufacture of the carrier rods of a material light in weight and the cutting of the teeth into the material of the carrier rods results in a reduction of the masses to be accelerated.

As mentioned above, the carrier spindle nuts **348L** and **348R** as well as the narrowing spindle nuts **490L** and **490R** are in their innermost position shown in Fig. 45, when the point Q (see Fig. 31) is reached near the end of a knitting cycle for knitting a stocking blank. According to the invention, the automatic controls of the straight-bar knitting machine may be set in such a way, that, during the knitting of the ravel courses **664** between the points Q and S the single needle narrowing spindle back-racking drive **520** (see Figs. 23 and 29) causes an automatic single needle back-racking of the narrowing spindle nuts **490L** and **490R** from their innermost position **490L***i*, **490R***i* shown in full lines in Fig. 45 into an intermediate inner position **490L***i'*, **490R***i'* shown in dash and dot lines in said Fig. 45. During said single needle back-racking of the narrowing spindle nuts **490L**, **490R** the carrier spindle nuts **348L**, **348R** remain in their position shown in Fig. 45. After the pressing off of the stocking blank at the end of a knitting cycle, the next knitting cycle may be started immediately, and at the beginning of said next knitting cycle, a normal simultaneous two-needle back-racking of the narrowing spindle nuts from their intermediate inner position **490L***i'*, **490R***i'* shown in dash and dot lines in Fig. 45 and of the carrier spindle nuts **348L**, **348R** from their innermost position shown in said Fig. 45 in full lines into their starting positions shown in Fig. 46 is caused by the automatic controls of the knitting machine through the normal back-racking drives **455** and **481** (see Figs. 2, 20 and 22).

Apparently, the elimination of a back-racking of the narrowing spindle nuts **490L**, **490R** and of the carrier spindle nuts **348L**, **348R** into their starting position after the pressing off of a stocking blank and prior to the start of a new cycle increases the output of stocking blanks knitted by a knitting machine according to the invention, as there is no extra time needed for the back-racking of the narrowing spindle nuts and carrier spindle nuts, which may be partially or entirely back-racking during the performance of knitting operations either shortly before the end of a knitting cycle or at the beginning of the next knitting cycle.

It is understood, that the controls of the knitting machine may also be set in such a way, that both the single needle back-racking of the narrowing spindle nuts and the subsequent simultaneous two-needle back-racking of the narrowing spindle nuts and carrier spindle nuts takes place at the beginning of a knitting cycle during the knitting of the first courses of the welt. Moreover, the controls could be set in such a way, that a portion of the normal two-needle back-racking of the narrowing spindle nuts **490L**, **490R** takes place already before the end of a knitting cycle during the knitting of the ravel courses, and that the remainder of the normal two-needle back-racking of the narrowing spindle nuts takes place at the beginning of a new knitting cycle during the knitting of the first courses of the welt. Furthermore, of course, the controls of the knitting machine may be set in such a way, that at least a portion of the two-needle back-racking of the narrowing spindle nuts **490L**, **490R** takes place at a different time than the two-needle back-racking of the carrier spindle nuts **348L**, **348R**. As will be readily understood, there are many possibilities for setting the automatic back-racking of the narrowing spindle nuts and carrier spindle nuts during the performance of knitting operations.

I have described preferred embodiments of my invention, but it is understood that numerous changes and omissions may be made without departing from the spirit and scope of the appended claims. For example, the invention may also be applied to a straight-bar knitting machine having more than two sections.

What I claim is:

1. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, an actuating drive for reciprocating said carrier rods, a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position and releasing same at predetermined intervals.

2. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, an actuating drive for reciprocating said

carrier rods, a plurality of friction-slip clutches, each friction-slip clutch including permanently frictionally engaged clutch members and being interposed between a carrier rod and said actuating drive, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position and releasing same at predetermined intervals.

3. In a straight bar knitting machine, the combination of: a knitting mechanism including sinkers, a plurality of reciprocable carrier rods, a reciprocable actuating element, a coulier-motion mechanism for operating said sinkers and said actuating element, a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating element, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position and releasing same at predetermined intervals.

4. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, an actuating drive for reciprocating said carrier rods, a plurality of rotatable driving rods, each of said driving rods being operatively engaged with a reciprocable carrier rod, a plurality of friction-slip clutches including frictionally engaged clutch members, one clutch member of each friction-slip clutch being positively connected with a driving rod, the other clutch member of each friction-slip clutch being positively connected with said actuating drive, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position and releasing same at predetermined intervals.

5. In a straight bar knitting machine, the combination of: a knitting mechanism including sinkers, a plurality of reciprocable carrier rods, a reciprocable actuating rack, a coulier-motion mechanism for operating said sinkers and said actuating rack, a plurality of rotatable driving rods, each of said driving rods being operatively engaged with a reciprocable carrier rod, a plurality of friction-slip clutches including frictionally engaged clutch members, one clutch member of each friction-slip clutch being positively connected with a driving rod, the other clutch member of each friction-slip clutch being in the shape of a pinion and being in mesh with said actuating rack, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position and releasing same at predetermined intervals.

6. In a straight bar knitting machine as claimed in claim 5, said friction-slip clutch comprising: a cylindrical member secured to a driving rod, a series of friction members arranged on and positively connected with said cylindrical member for rotation therewith, at least one pinion in mesh with said actuating rack being rotatably arranged on said cylindrical member between adjacent friction members, and resilient means associated with said friction members and said pinion for holding same in frictional engagement with each other.

7. In a straight bar knitting machine as claimed in claim 5, said friction-slip clutch comprising: a cylindrical member secured to a driving rod, a series of friction members arranged on and positively connected with said cylindrical member for rotation therewith, at least one pinion in mesh with said actuating rack being rotatably arranged on said cylindrical member between adjacent friction members, adjustable resilient means associated with said friction members and said pinion for holding same in frictional engagement with each other, and means for adjusting said adjustable resilient means.

8. In a straight bar knitting machine as claimed in claim 5, a container having a sump capable of receiving a lubricant, at least a portion of said actuating rack and of said friction-slip clutches being arranged within said sump.

9. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, a plurality of movable arresting means, each movable arresting means being capable of engagement with an associated reciprocable carrier rod for arresting same in its idle position and being capable of disengagement from such an associated reciprocable carrier rod for releasing same, automatic controlling means associated with said movable arresting means for selectively arresting and releasing predetermined carrier rods by said movable arresting means at predetermined intervals, an actuating drive, and a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive whereby the latter may reciprocate carrier rods selectively released by an associated arresting means.

10. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, each reciprocable carrier rod including coupling means, a plurality of swingable hook-like arresting means, each swingable arresting means being capable of engagement with the coupling means of an associated reciprocable carrier rod for arresting the latter in its idle position and being capable of disengagement from the coupling means of such an associated reciprocable carrier rod for releasing same, automatic controlling means associated with said swingable arresting means for selectively arresting and releasing predetermined carrier rods by said swingable arresting means at predetermined intervals, an actuating drive, and a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive whereby the latter may reciprocate carrier rods selectively released by an associated arresting means.

11. In a straight bar knitting machine, the combination of: a knitting mechanism including sinkers, a plurality of reciprocable carrier rods, a plurality of movable arresting means, each movable arresting means being capable of engagement with an associated reciprocable carrier rod for arresting same in its idle position and being capable of disengagement from such an associated reciprocable carrier rod for releasing same, automatic controlling means associated with said movable arresting means for selectively arresting and releasing predetermined carrier rods by said movable arresting means at predetermined intervals, a reciprocable actuating element, a coulier-motion mechanism for operating said sinkers and said actuating element, and a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said reciprocable actuating element whereby the latter may reciprocate carrier rods selectively released by an associated arresting means.

12. In a straight bar knitting machine, the combination of: a reciprocable carrier rod, an actuating drive including a friction-slip clutch having permanently frictionally engaged clutch

members for reciprocating said carrier rod, a rotatable threaded spindle, threaded supporting means engaged with said threaded spindle, means for rotating said spindle so as to displace said supporting means, gripping means adjustably mounted on said supporting means for assuming inactive and active positions, and automatic controlling means associated with said gripping means for bringing same at predetermined intervals into an active position for engagement with said reciprocable carrier rod so as to hold same in a predetermined position.

13. In a straight bar knitting machine, the combination of: a reciprocable carrier rod, an actuating drive including a clutch for reciprocating said carrier rod, a rotatable threaded spindle, threaded supporting means engaged with said threaded spindle, means for rotating said spindle so as to displace said supporting means, limiting means adjustably mounted on said supporting means for assuming inactive and active positions, said limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting an end position thereof, holding means adjustably mounted on said supporting means for assuming inactive and active positions, said holding means being capable of engagement in its active position with the reciprocable carrier rod for holding same in an end position limited by said limiting means, and individual automatic controlling means associated with each of said limiting means and holding means for selectively bringing same into an active position at predetermined intervals.

14. In a straight bar knitting machine as claimed in claim 13, said holding means comprising a swingable actuating lever and a swingable spring-loaded holding latch having cooperating abutting surfaces loosely abutting against each other, said actuating lever being operatively connected with the automatic controlling means, and said spring-loaded holding latch being arranged for a temporary resilient yielding from its active position upon an abutment of the carrier rod against said holding latch during a movement of the former towards said limiting means.

15. In a straight bar knitting machine, the combination of: a reciprocable carrier rod, an actuating drive including a clutch for reciprocating said carrier rod, a rotatable threaded spindle, threaded supporting means engaged with said threaded spindle, means for rotating said spindle so as to displace said supporting means, limiting means adjustably mounted on said supporting means for assuming inactive and active positions, said limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting an end position thereof, auxiliary stopping means adjustably mounted on a stationary part of the machine for assuming inactive and active positions, said auxiliary stopping means being arranged for engagement in its active position with the reciprocable carrier rod for limiting an end position thereof where the supporting means is not in the proper position for a limitation of the stroke of the carrier rod by its limiting means, and individual automatic controlling means associated with each of said limiting means and auxiliary stopping means for selectively bringing same into an active position at predetermined intervals.

16. In a straight bar knitting machine as claimed in claim 15, holding means adjustably mounted on said supporting means for assuming inactive and active positions, said holding means being capable of engagement in its active position with the reciprocable carrier rod for holding same in an end position limited by said limiting means, and an automatic control associated with said holding means for bringing same into an active position at predetermined intervals.

17. In a straight bar knitting machine, the combination of: a reciprocable carrier rod, an actuating drive including a clutch for reciprocating said carrier rod, a first rotatable threaded spindle, first threaded supporting means engaged with said first threaded spindle, means for rotating said first spindle so as to displace said first supporting means, first limiting means adjustablly mounted on said first supporting means for assuming inactive and active positions, said first limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting an outer end position thereof, a second rotatable threaded spindle, second threaded supporting means engaged with said second threaded spindle, means for rotating said second spindle so as to displace said second supporting means, second limiting means adjustably mounted on said second supporting means for assuming inactive and active positions, said second limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting an inner end position theerof, and individual automatic controlling means associated with each of said first and second limiting means for selectively bringing same into an active position at predetermined intervals.

18. In a straight bar knitting machine as claimed in claim 17, holding means adjustably mounted on said first supporting means for assuming inactive and active positions, said holding means being capable of engagement in its active position with the reciprocable carrier rod for holding same in an end position limited by said first limiting means, and an automatic control associated with said holding means for bringing same into an active position at predetermined intervals.

19. In a straight bar knitting machine, the combination of: a reciprocable carrier rod, an actuating drive including a clutch for reciprocating said carrier rod, a first rotatable threaded spindle, first threaded supporting means engaged with said first threaded spindle, means for rotating said first spindle so as to displace said first supporting means, first limiting means adjustably mounted on said first supporting means for assuming inactive and active positions, said first limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting a first outer end position thereof, a second rotatable threaded spindle, second threaded supporting means engaged with said second threaded spindle, means for rotating said second spindle so as to displace said second supporting means, second limiting means adjustably mounted on said second supporting means for assuming inactive and active positions, said second limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting an inner end position thereof, third limiting means adjustably mounted on said second supporting means for assuming inactive and active positions, said third limiting means being capable of engagement in its active position with the reciprocable carrier rod for limiting a second outer end position thereof, and individual automatic controlling means associated with each of said first, second and third limiting

means for selectively bringing same into an active position at predetermined intervals.

20. In a straight bar knitting machine as claimed in claim 19, holding means adjustably mounted on said first supporting means for assuming inactive and active positions, said holding means being capable of engagement in its active position with the reciprocable carrier rod for holding same in an end position limited by said first limiting means, and an automatic control associated with said holding means for bringing same into an active position at predetermined intervals.

21. In a straight bar knitting machine the combination of: a plurality of reciprocable carrier rods, an actuating drive for reciprocating said carrier rods, a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive, and a plurality of automatic controlling means associated with said carrier rods for selectively holding same in a predetermined position, releasing same and controlling the stroke thereof.

22. In a straight bar knitting machine, the combination of: a plurality of reciprocable carrier rods, an actuating drive for reciprocating said carrier rods, a plurality of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive, a plurality of movable arresting means, each movable arresting means being capable of engagement with an associated reciprocable carrier rod for arresting same in its idle position and being capable of disengagement from such an associated reciprocable carrier rod for releasing same, automatic controlling means associated with said movable arresting means for selectively arresting and releasing predetermined carrier rods by said movable arresting means at predetermined intervals, a rotatable threaded spindle, threaded supporting means engaged with said threaded spindle, means for rotating said spindle so as to displace said supporting means, limiting means mounted on said supporting means for cooperation with said carrier rods so as to limit the stroke of released carrier rods, a predetermined number of said limiting means being movable, said movable limiting means being normally in an inactive position, and automatic controlling means associated with said movable limiting means for selectively bringing same into an active position at predetermined intervals.

23. In a straight bar knitting machine as claimed in claim 22, holding means movably mounted on said supporting means for cooperation with the carrier rods so as to hold same in a predetermined position, said holding means being normally in an inactive position, and automatic controlling means associated with said holding means for selectively bringing same into an active position at predetermined intervals.

24. In a straight bar knitting machine as claimed in claim 22, an additional rotatable threaded spindle, additional threaded supporting means engaged with said additional threaded spindle, means for rotating said additional spindle so as to displace said additional supporting means, additional limiting means movably mounted on said additional supporting means for cooperation with carrier rods so as to limit the stroke of released carrier rods, said additional limiting means being normally in an inactive position, and automatic controlling means associated with said additional movable limiting means for selectively bringing same into an active position at predetermined intervals.

25. In a straight bar knitting machine, the combination of: a set of reciprocable carrier rods, an actuating drive including coupling means for reciprocating said carrier rods, a set of friction-slip clutches, each friction-slip clutch being interposed between a carrier rod and said actuating drive, a set of adjustable arresting means arranged on the machine for individually arresting and releasing carriers, a set of automatic controlling means individually associated with such arresting means for selectively adjusting same in arresting and releasing positions, at least one rotatable threaded spindle, threaded supporting means operatively engaged with such a threaded spindle, means for rotating such a spindle so as to displace said supporting means, sets of stroke-controlling means arranged on said supporting means for individually controlling the stroke of carriers, a predetermined number of said stroke-controlling means being adjustable in inactive and active positions, and a plurality of automatic controlling means individually associated with such adjustable stroke-controlling means for selectively adjusting same in inactive and active positions, the stroke-controlling means of the various sets being interchangeable.

26. In a straight bar knitting machine, the combination of: a set of reciprocable carrier rods, an actuating drive including coupling means for reciprocating said carrier rods, at least one rotatable threaded spindle, threaded supporting means operatively engaged with such a threaded spindle, means for rotating such a spindle so as to displace said supporting means, sets of adjustable limiting means arranged on said supporting means for controlling the stroke of carriers, a pattern chain, a drive for actuating said pattern chain, a rotatable control shaft, a set of controlling cams mounted on said control shaft, a mechanism controlled by said pattern chain for rotating said control shaft, and sets of flexible means operatively connecting individual controlling cams with individual adjustable limiting means on said supporting means.

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