Nov. 21, 1944. F. LAMBACH 2,363,008

ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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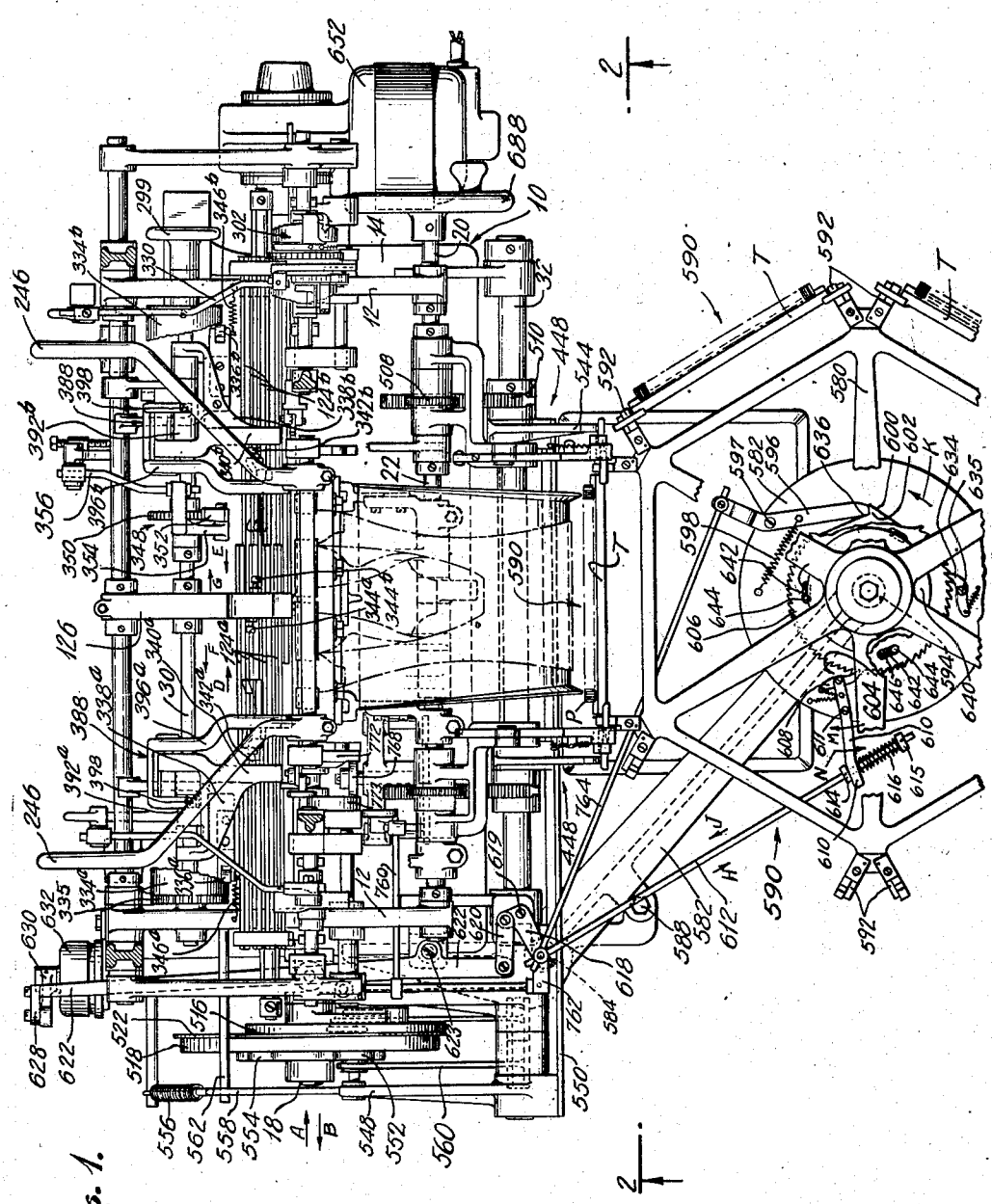


Fig. 1.

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Nov. 21, 1944. F. LAMBACH 2,363,008

ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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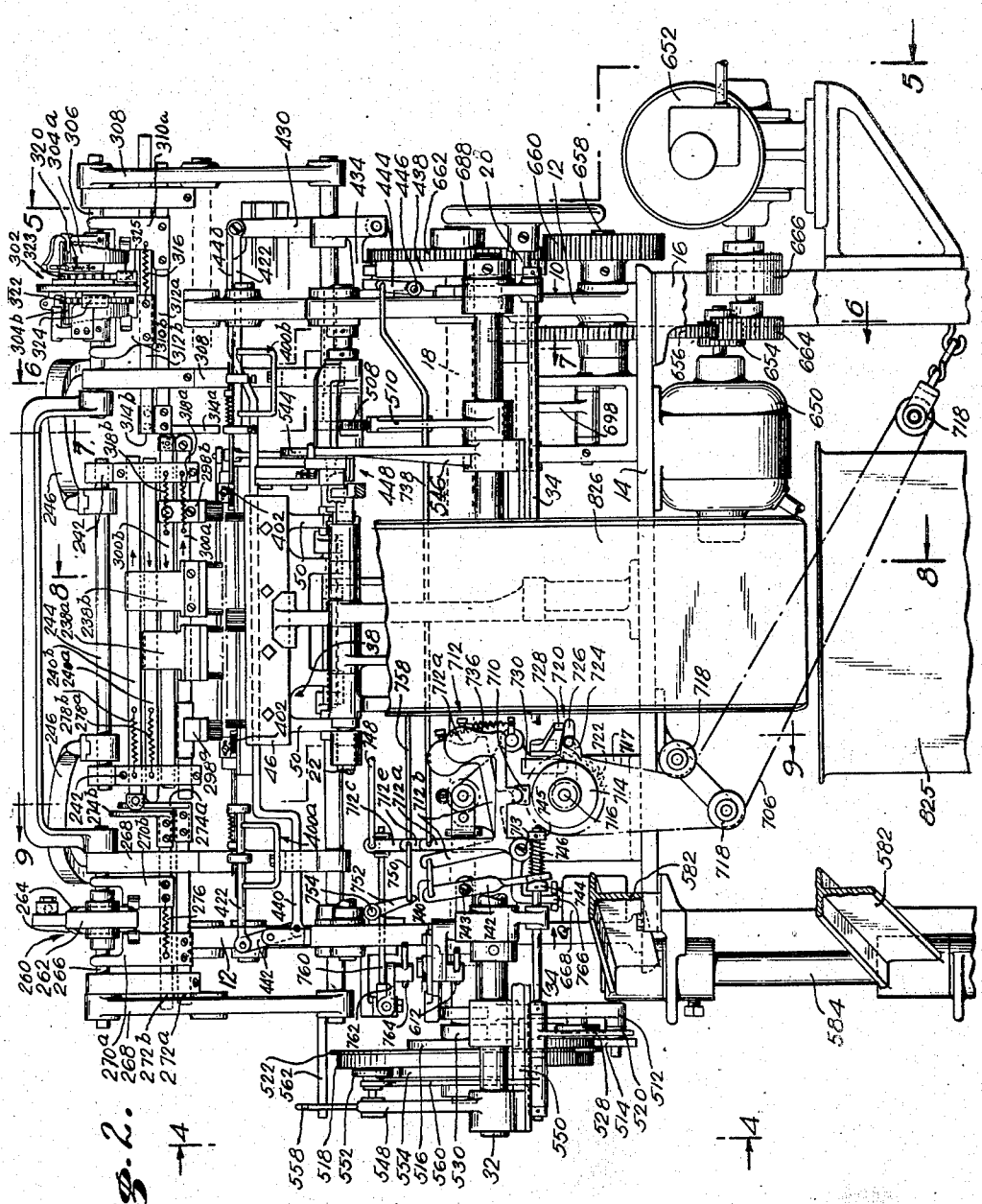


Fig. 2.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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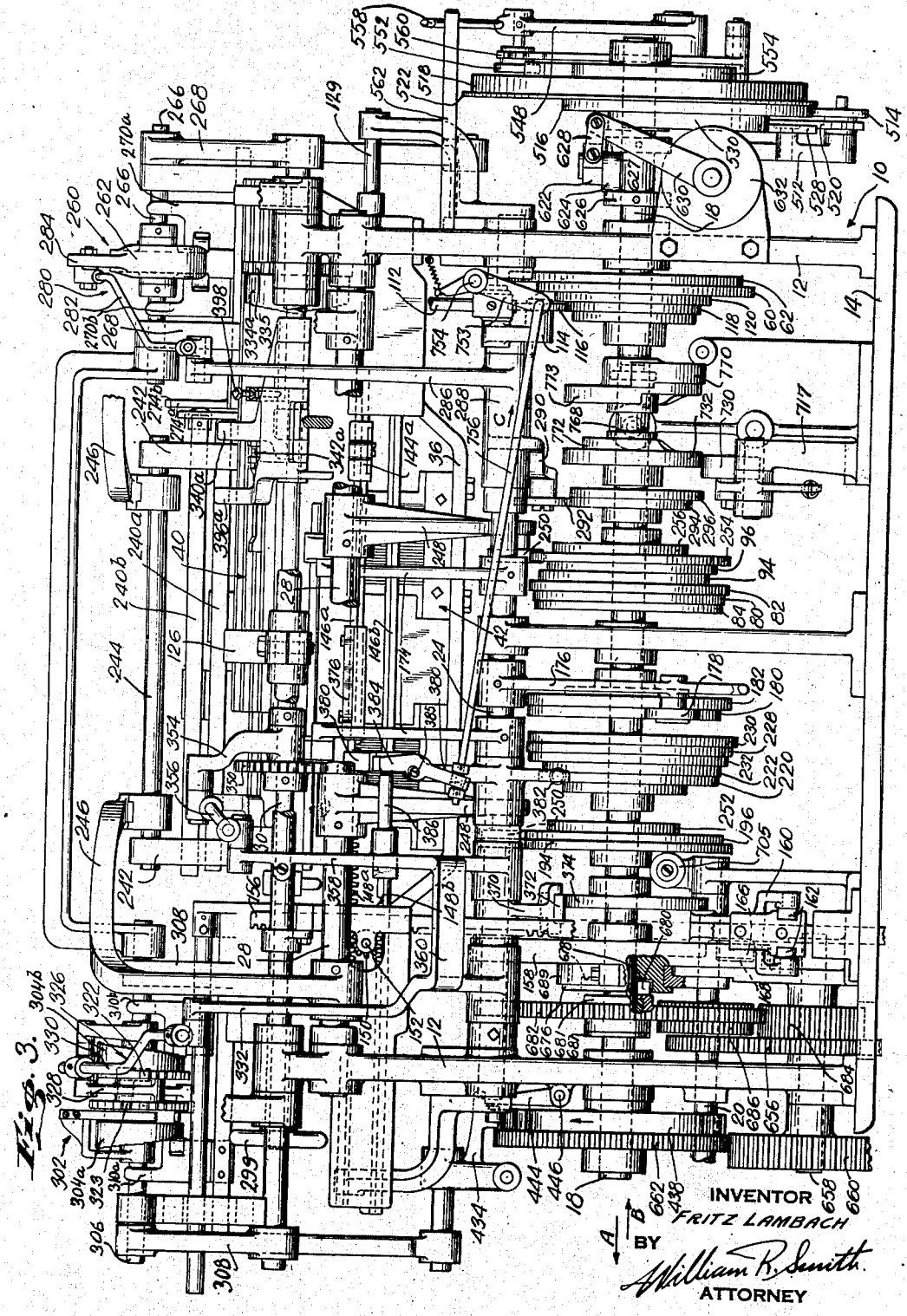


Fig. 3.

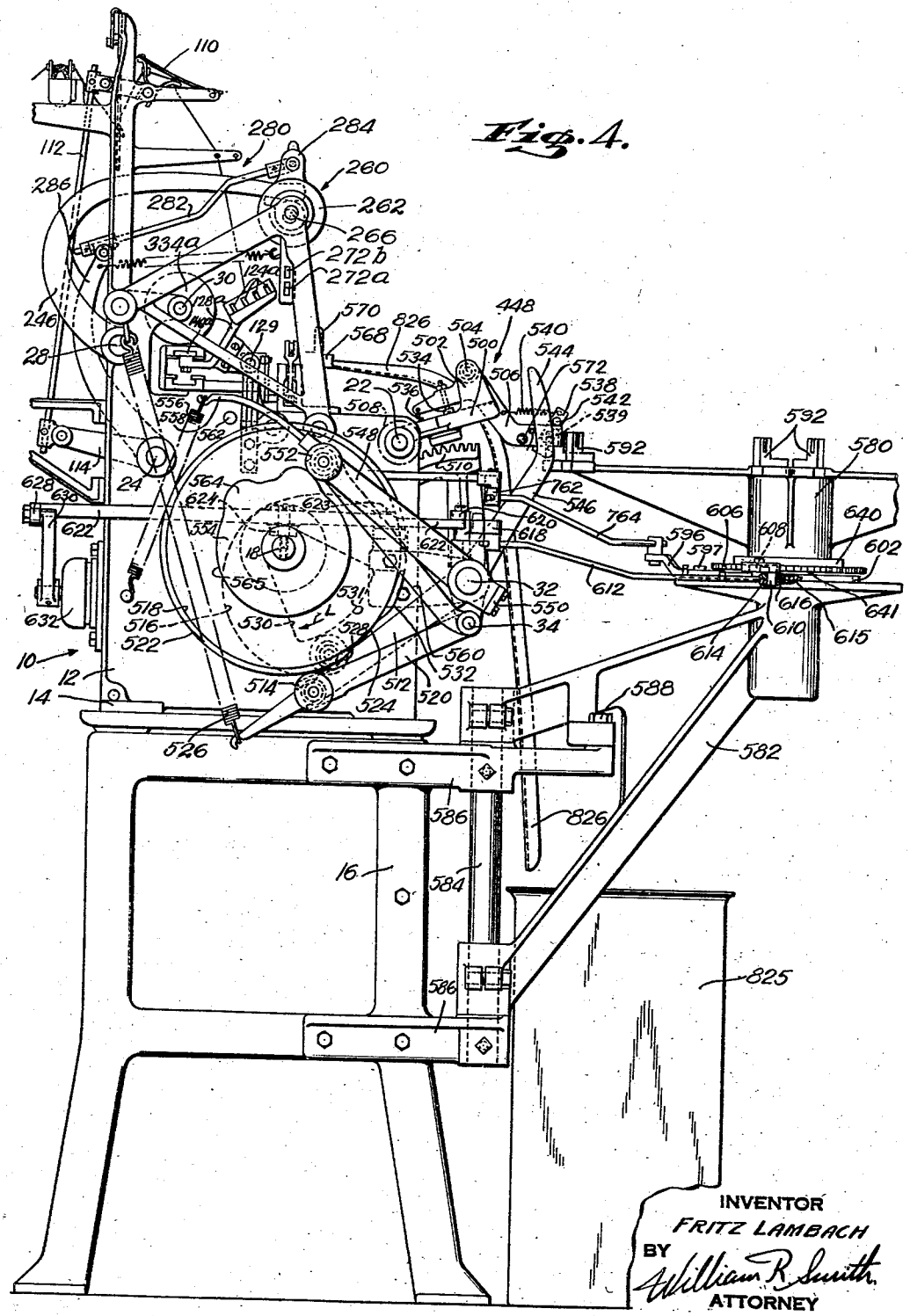
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Nov. 21, 1944. F. LAMBACH 2,363,008

ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 4.

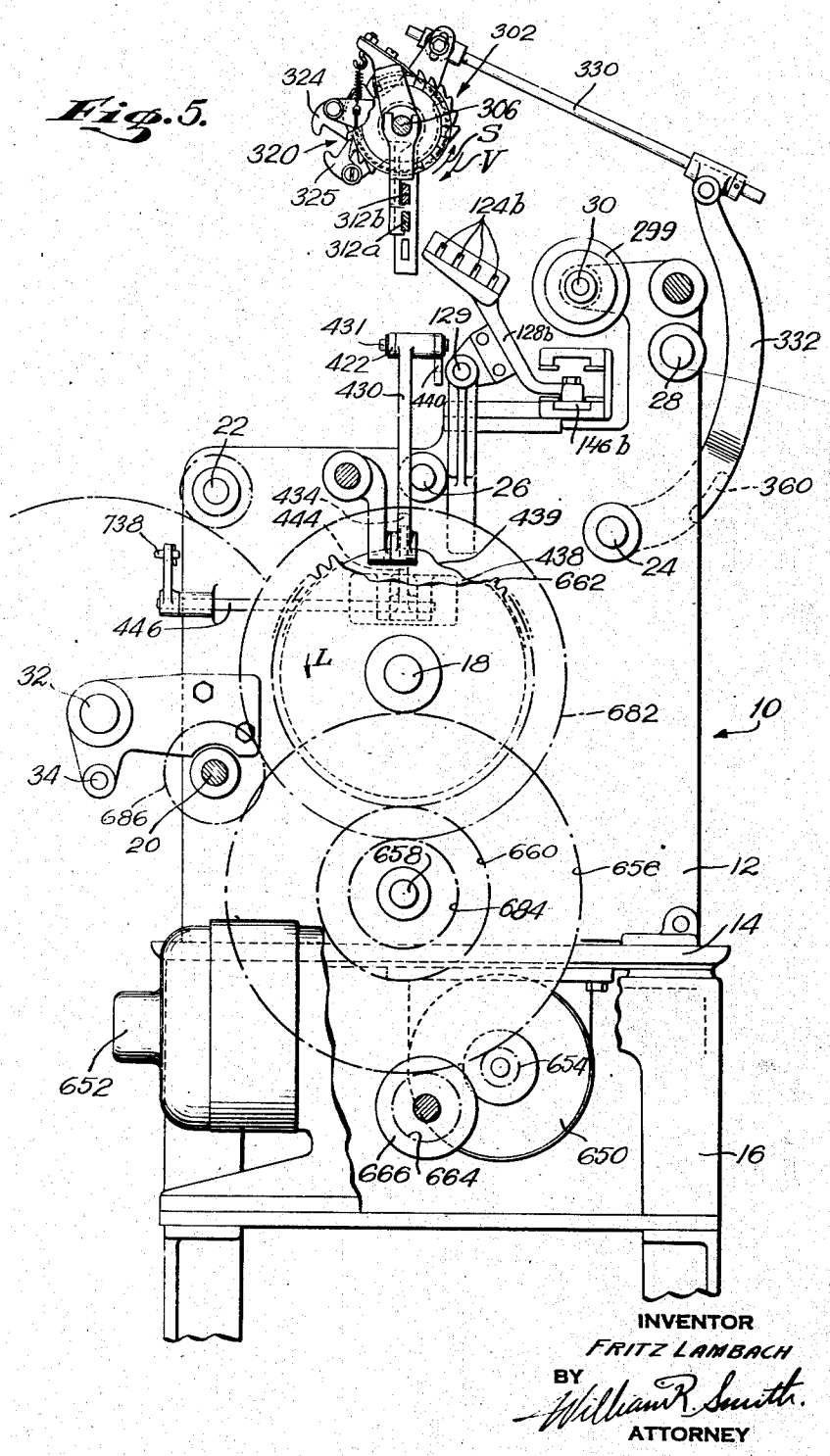


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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 5.



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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 15.

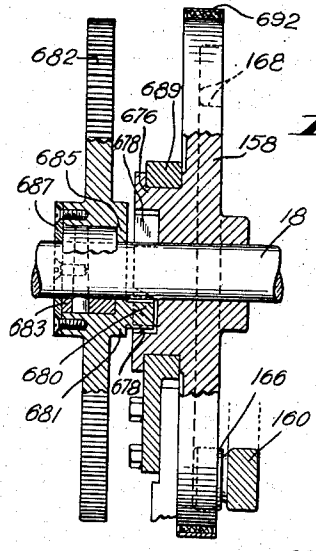


Fig. 6.

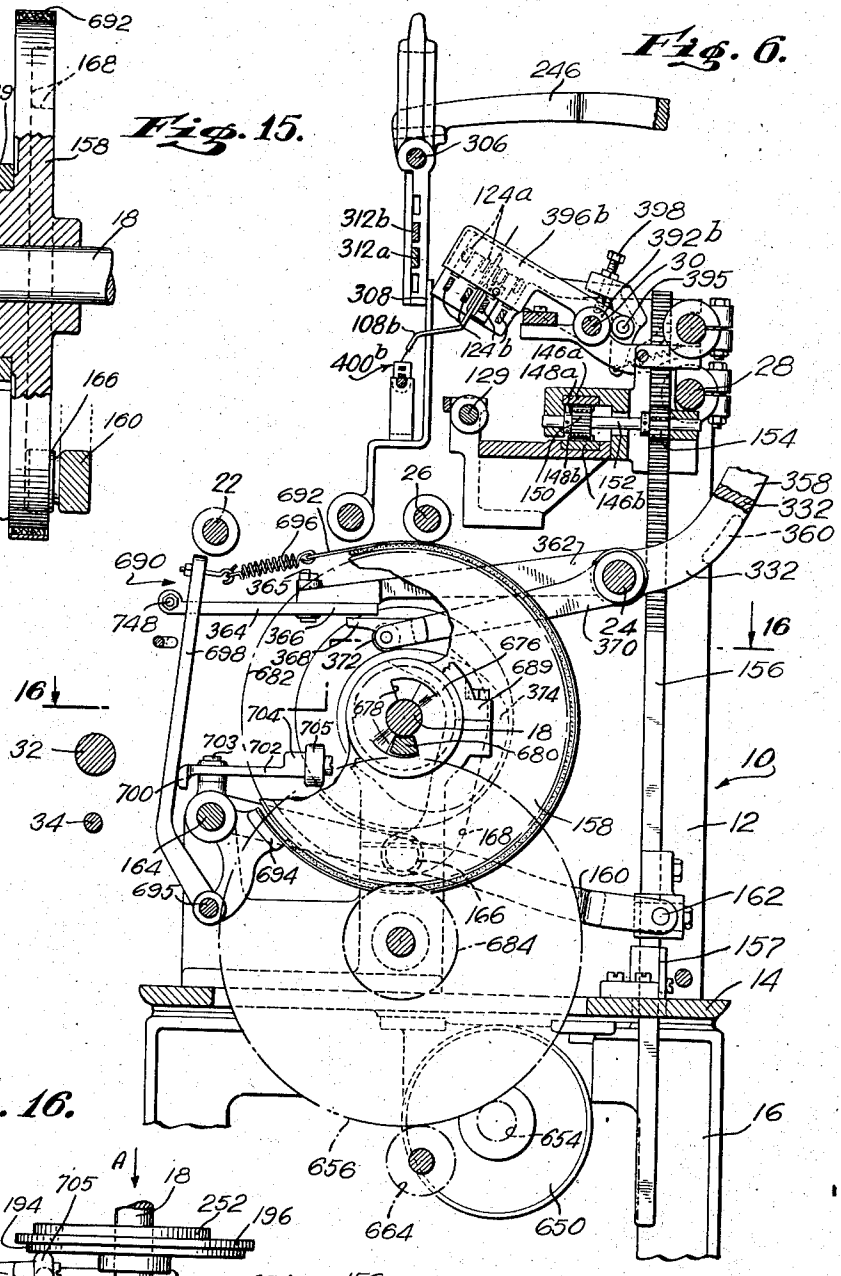
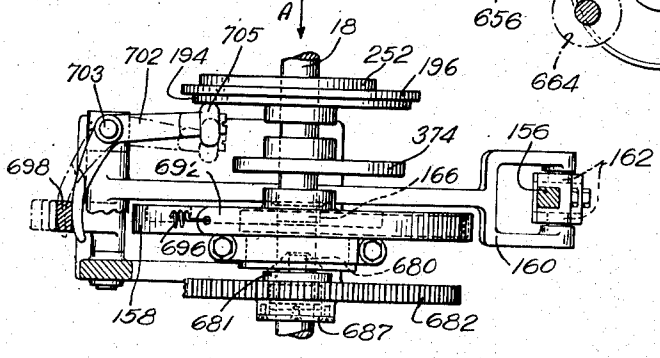


Fig. 16.



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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 7.

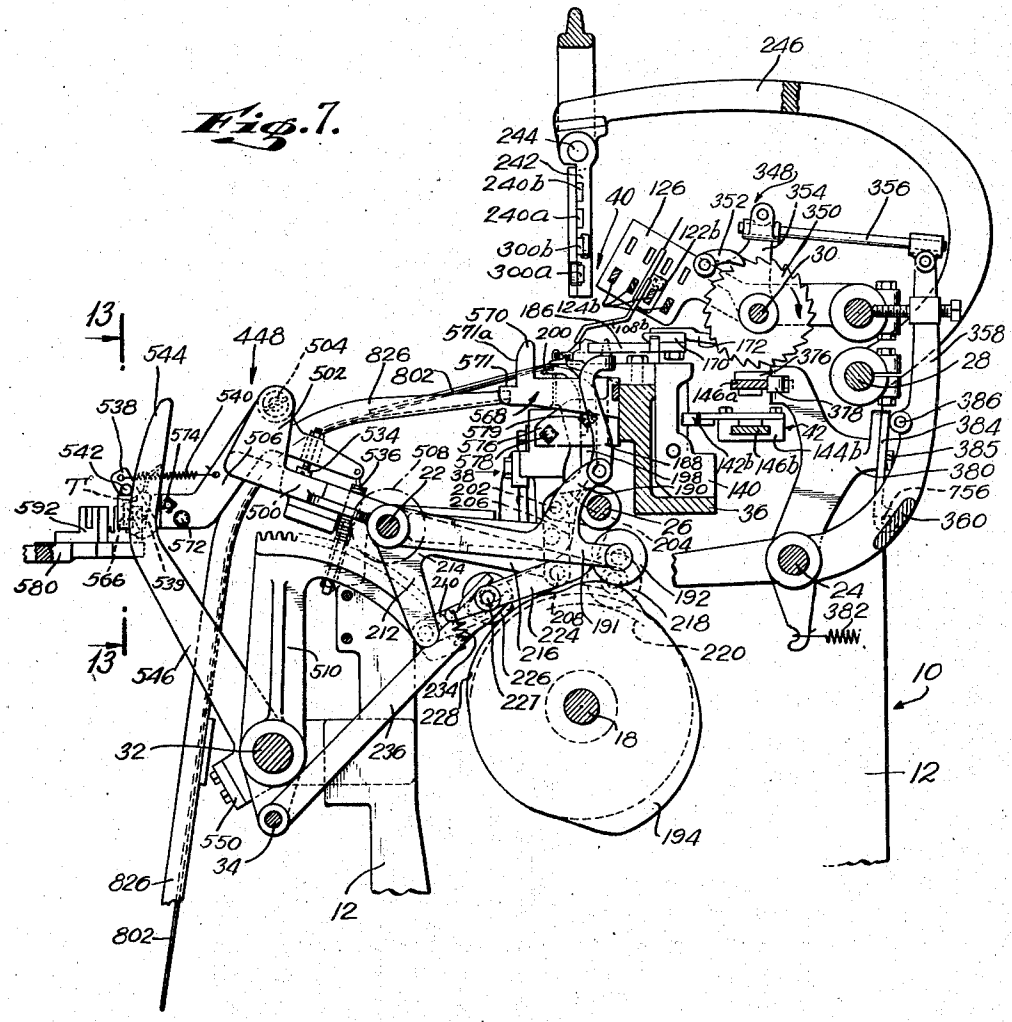
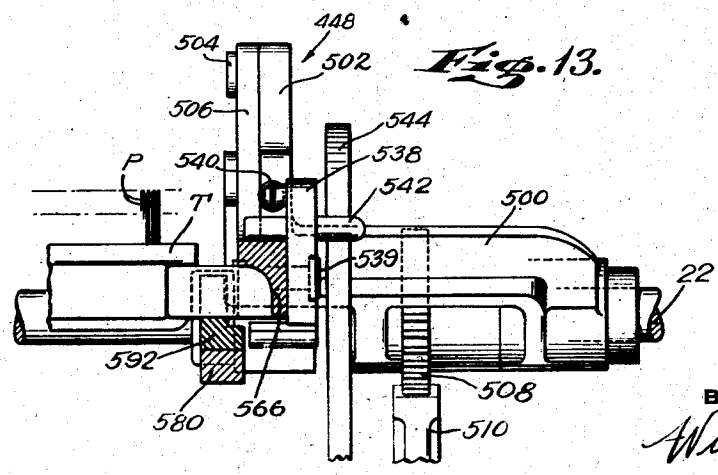


Fig. 13.



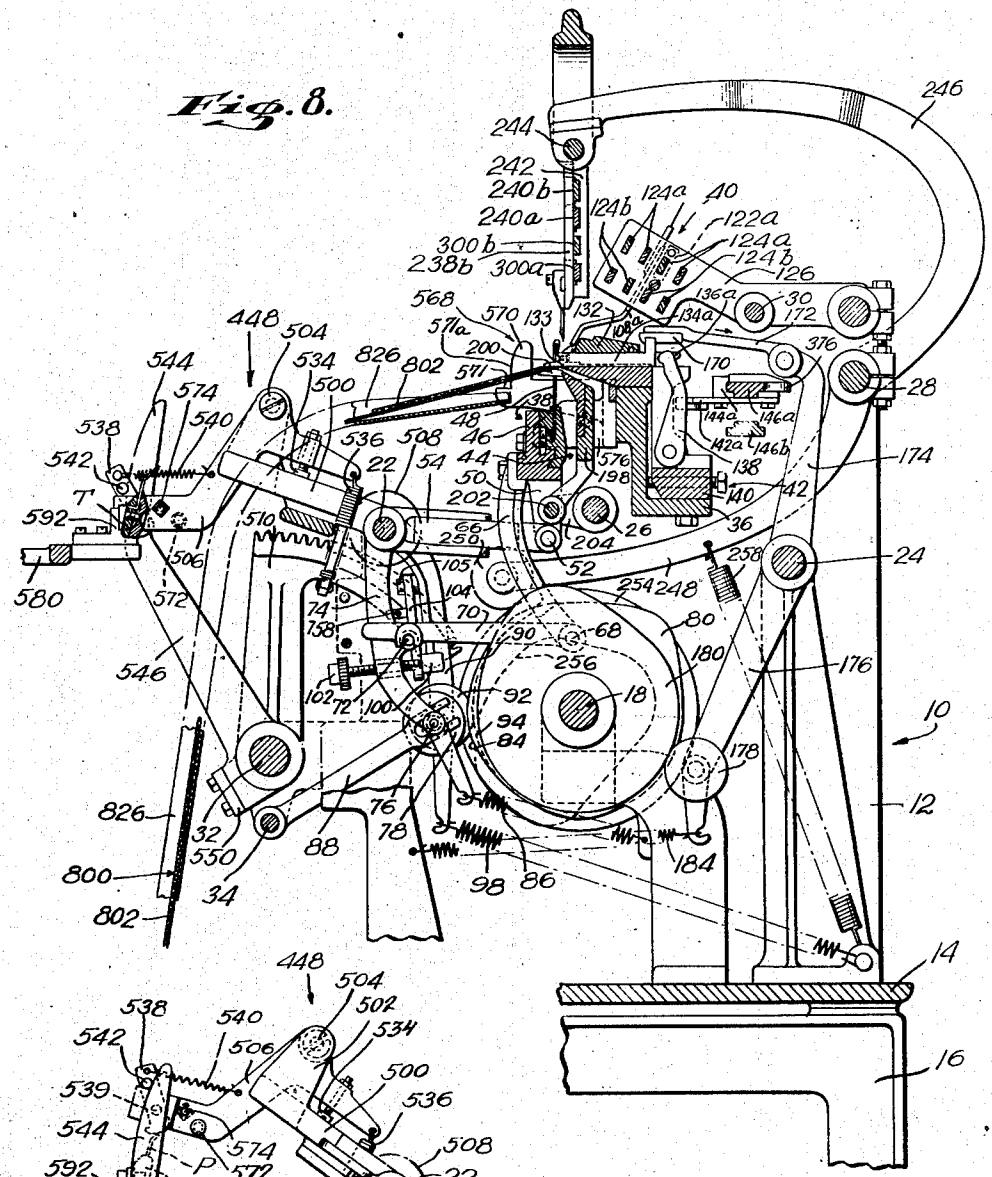
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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 8.



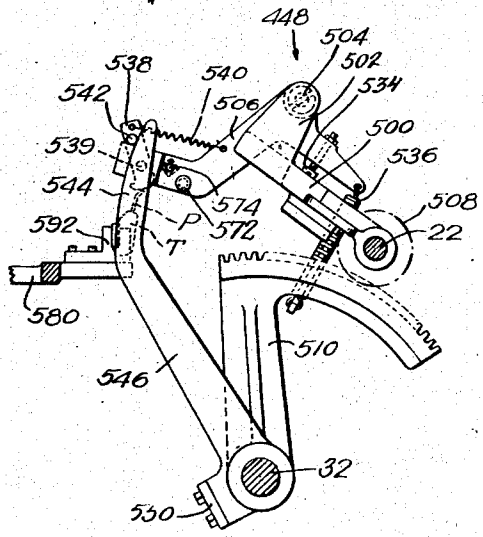


Fig. 12.

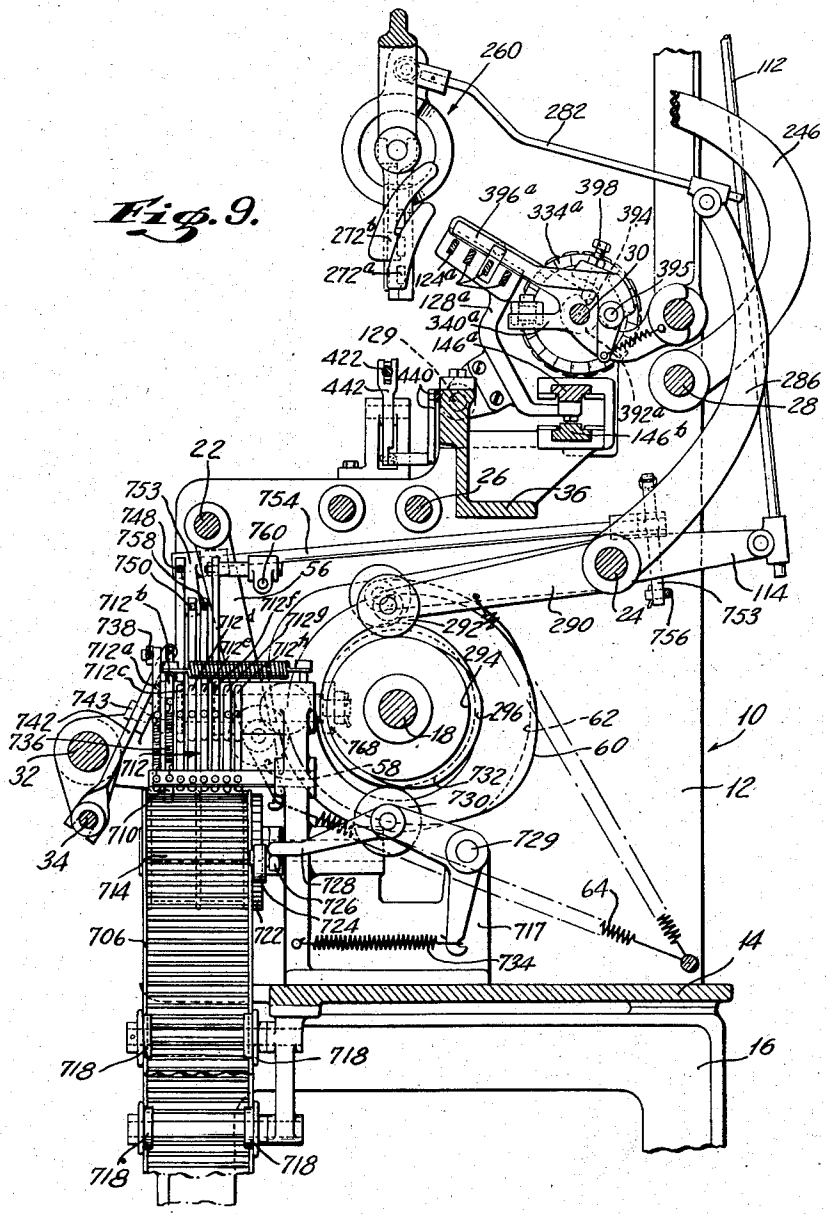
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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 9.



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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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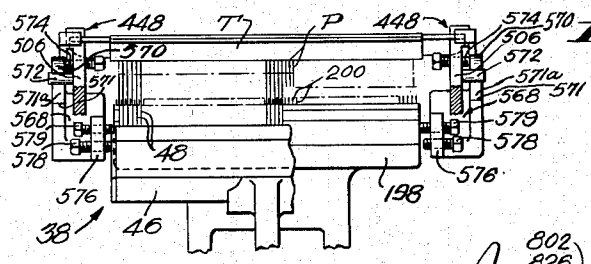


Fig. 14.

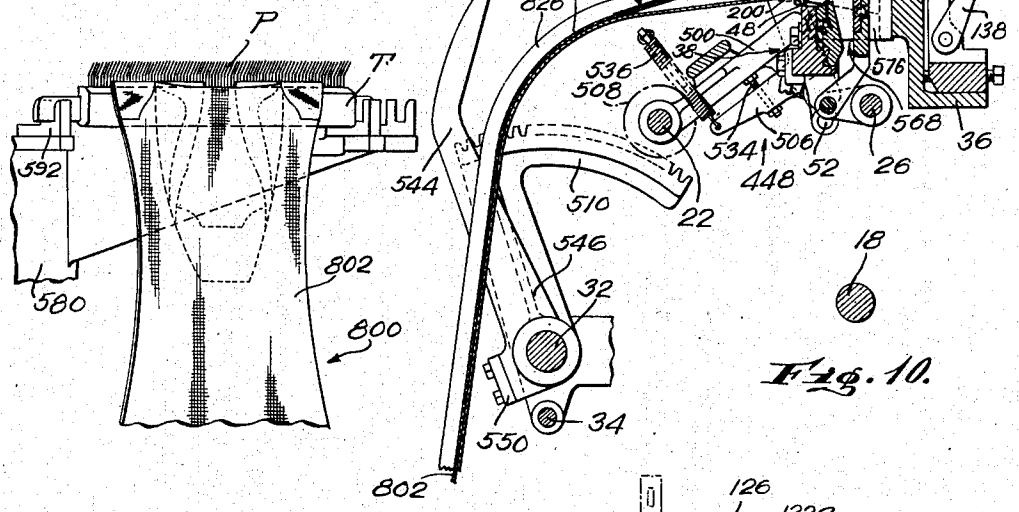


Fig. 10.

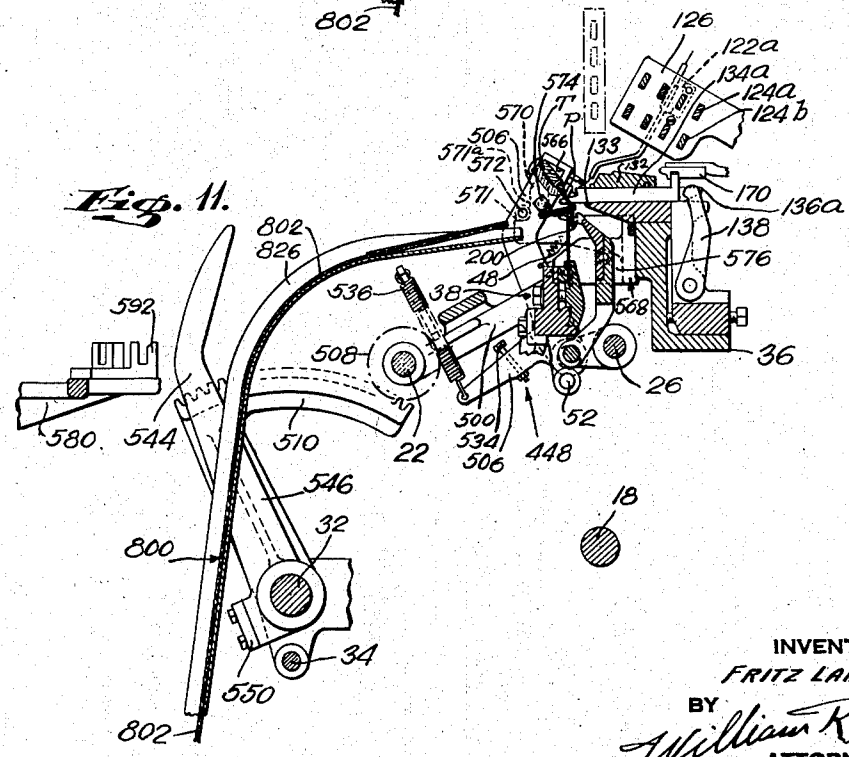


Fig. 11.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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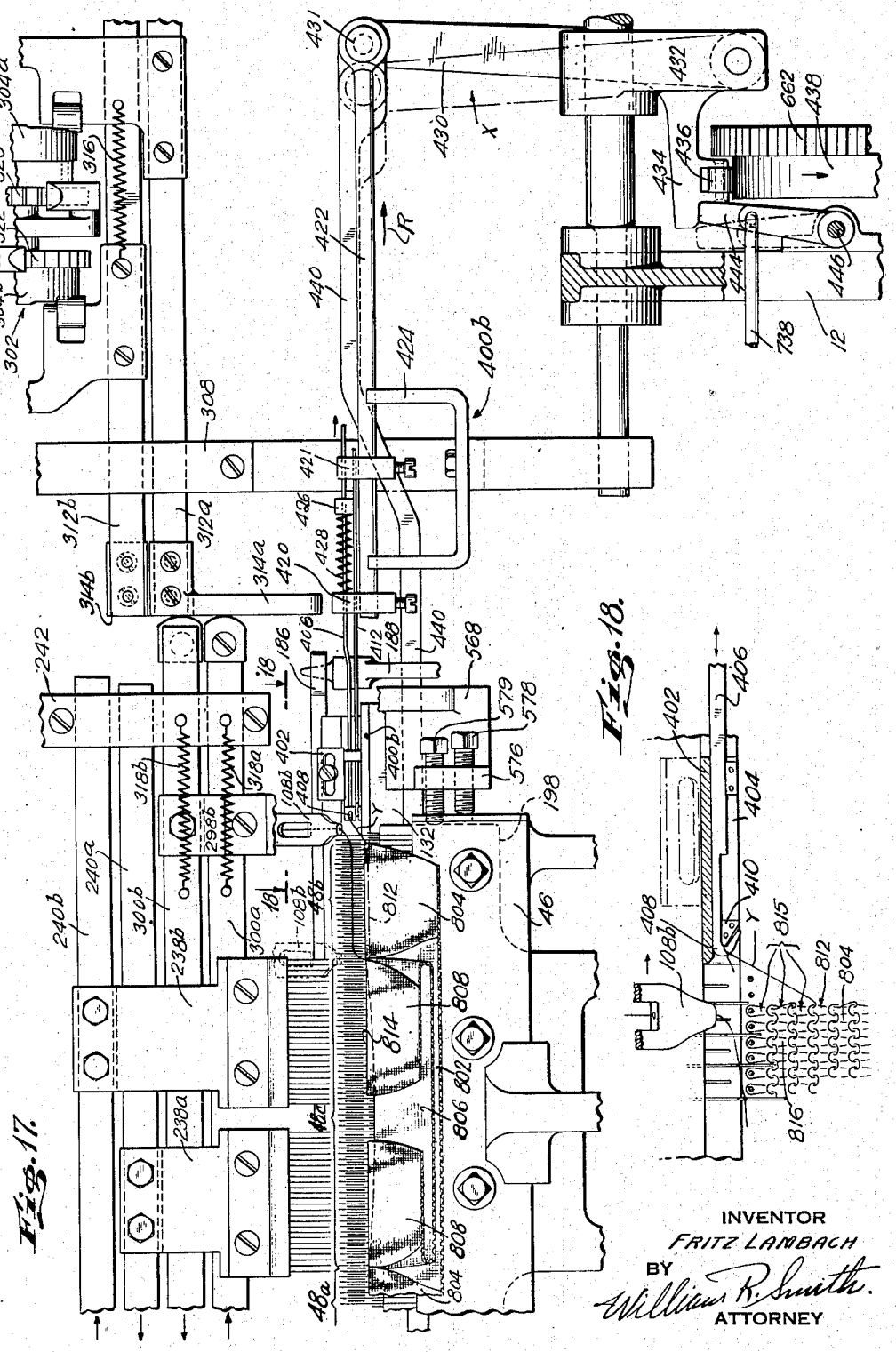


Fig. 17.

Fig. 18.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 24.

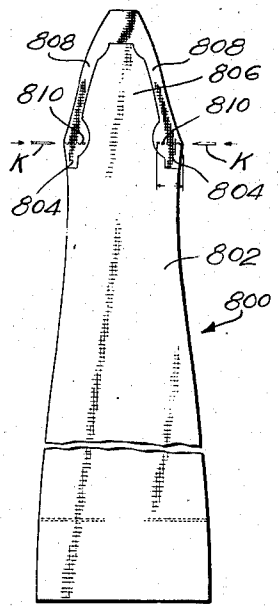


Fig. 25.

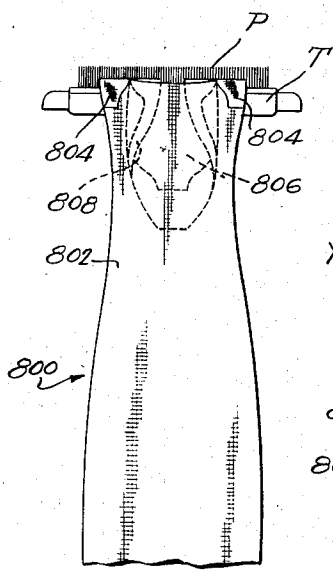


Fig. 26.

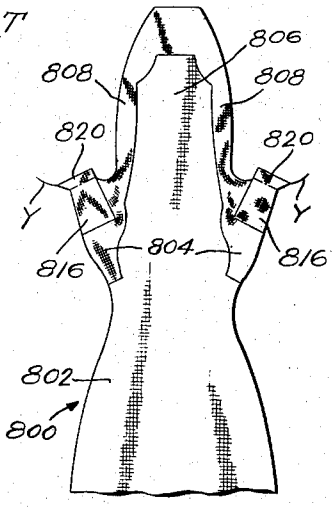


Fig. 19.

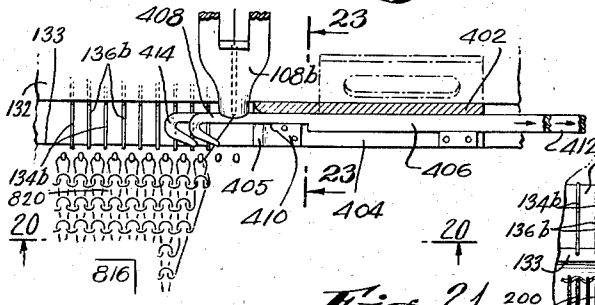


Fig. 20.

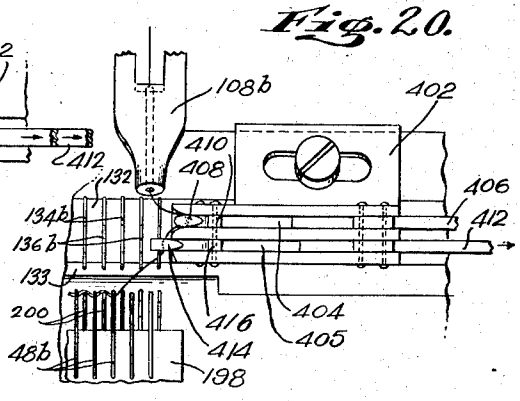


Fig. 21.

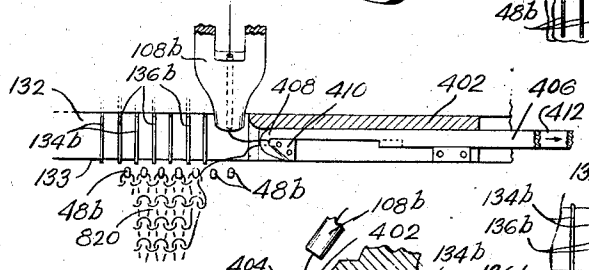


Fig. 22.

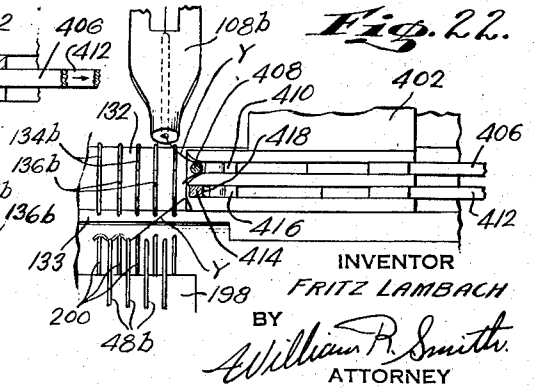
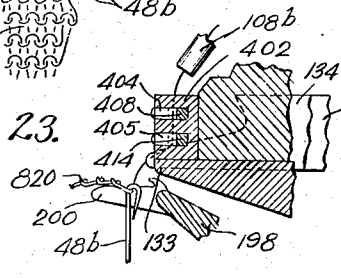


Fig. 23.



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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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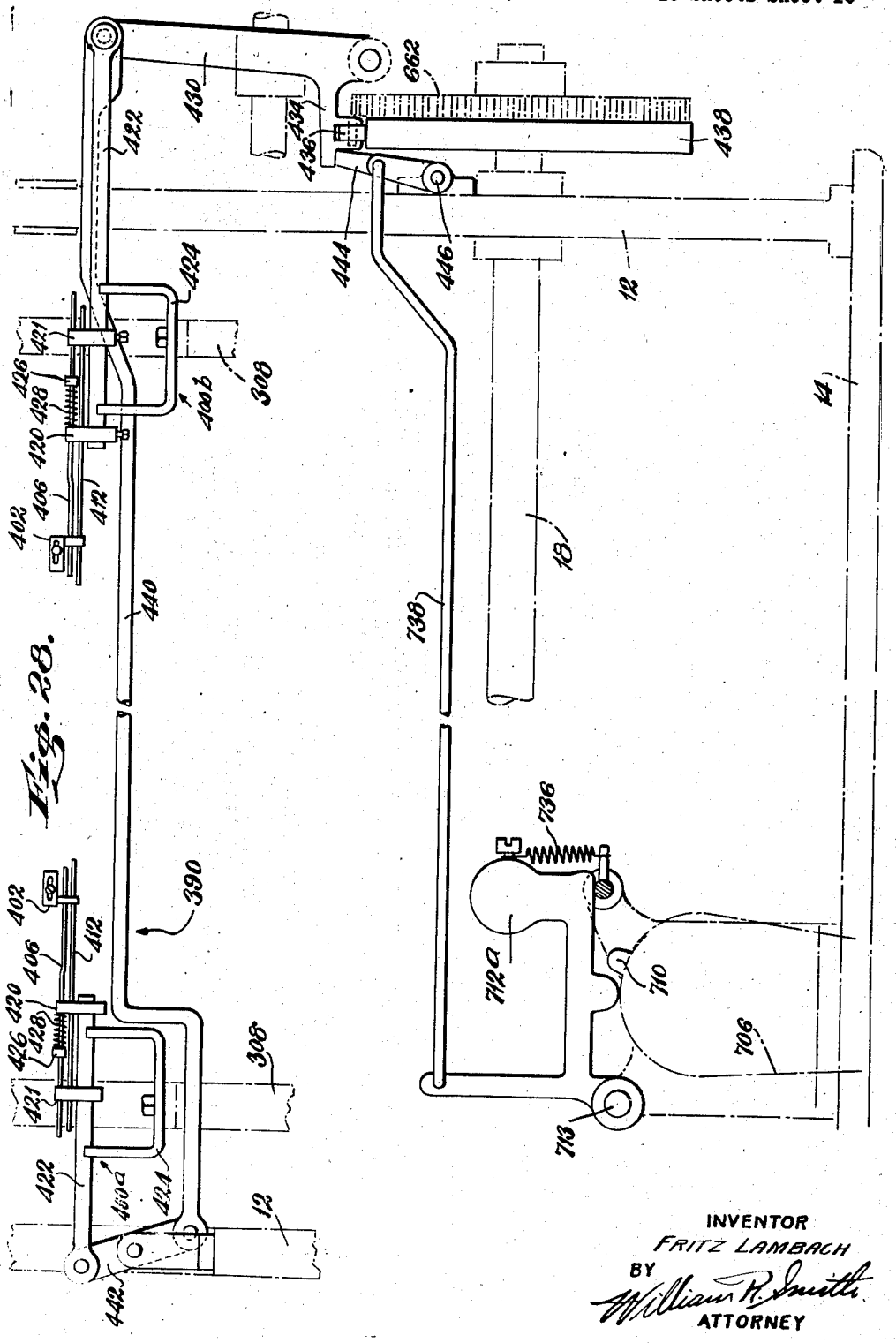


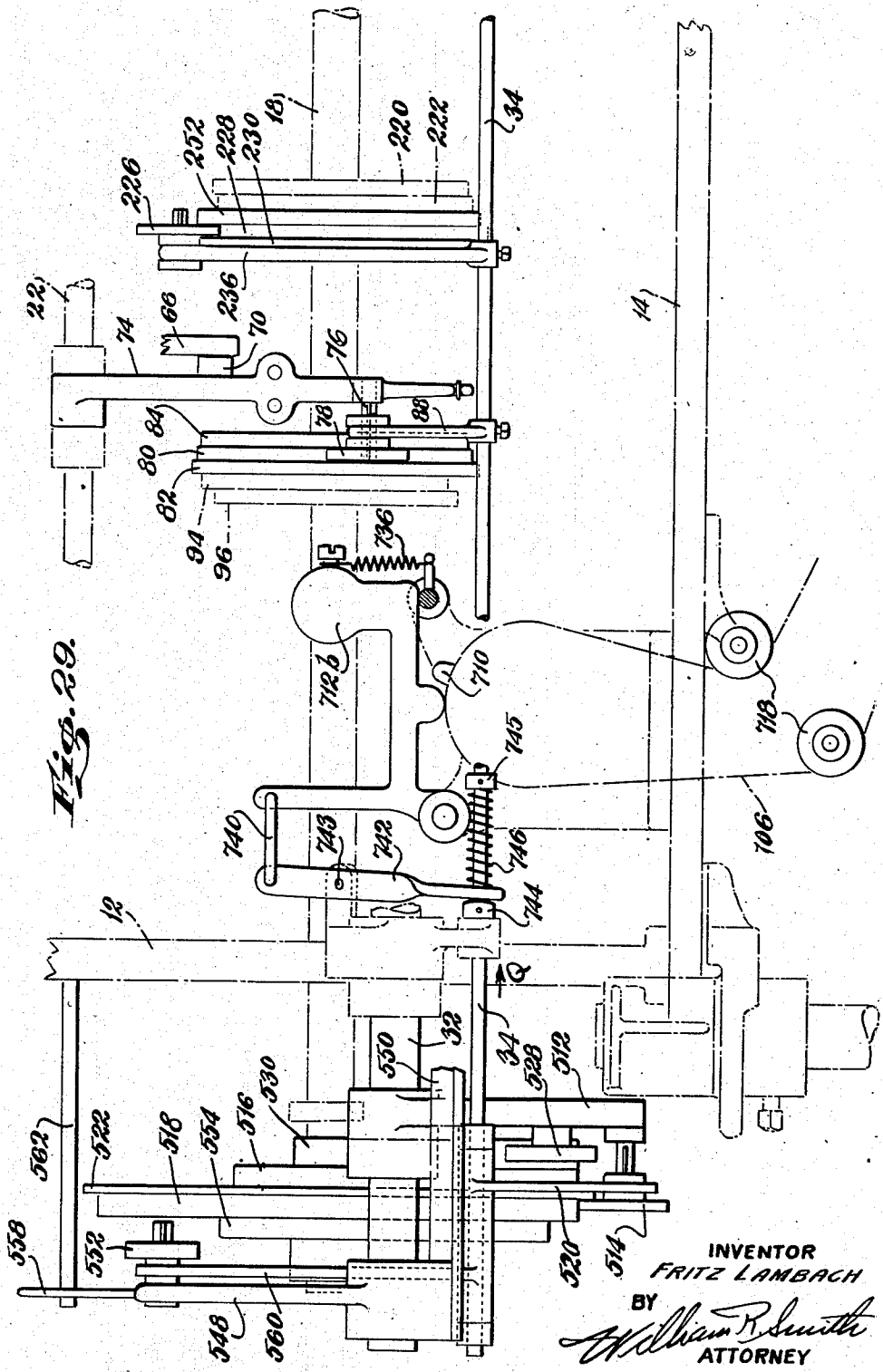
Fig. 28.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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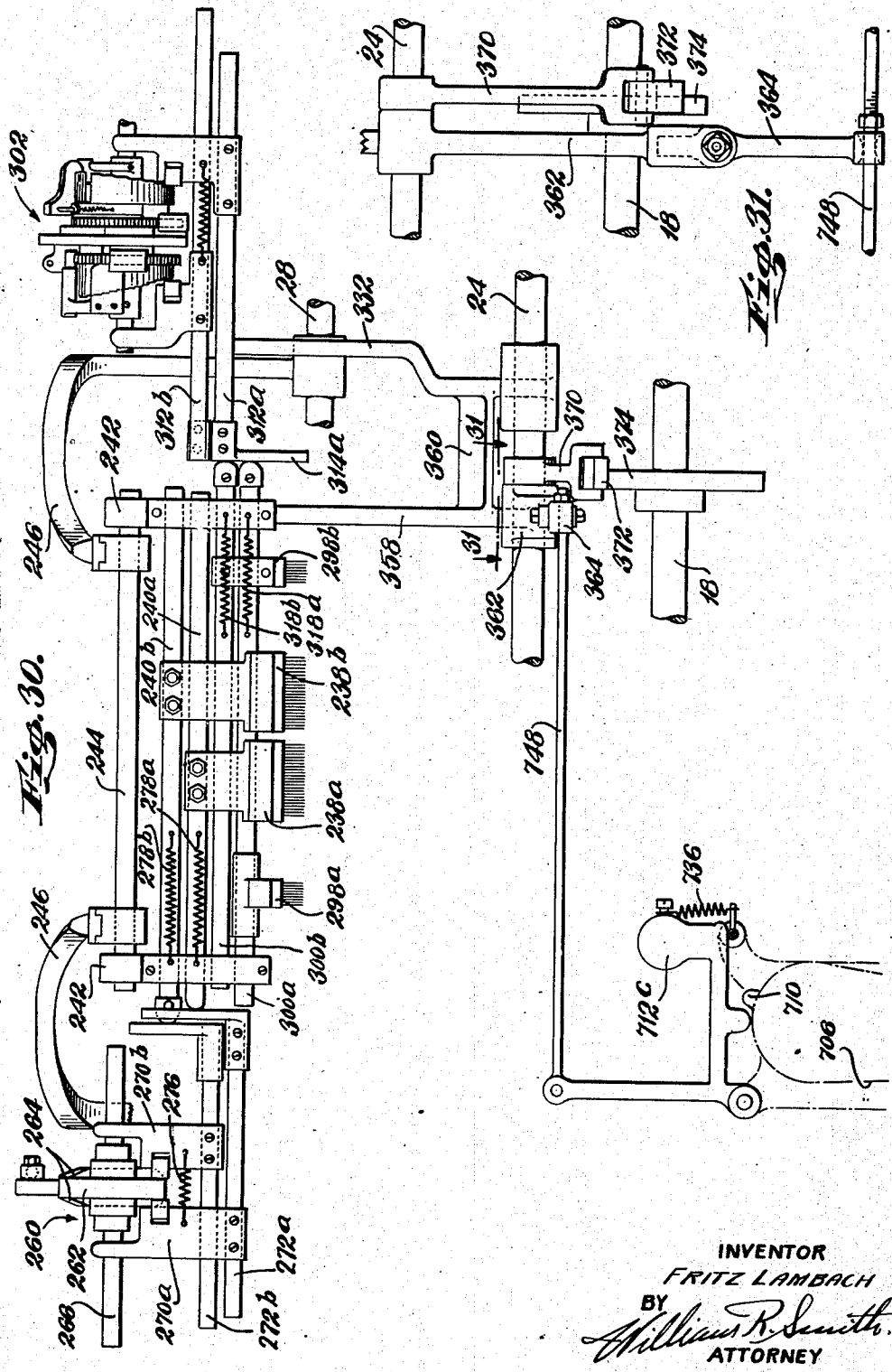


Fig. 30.

Fig. 31.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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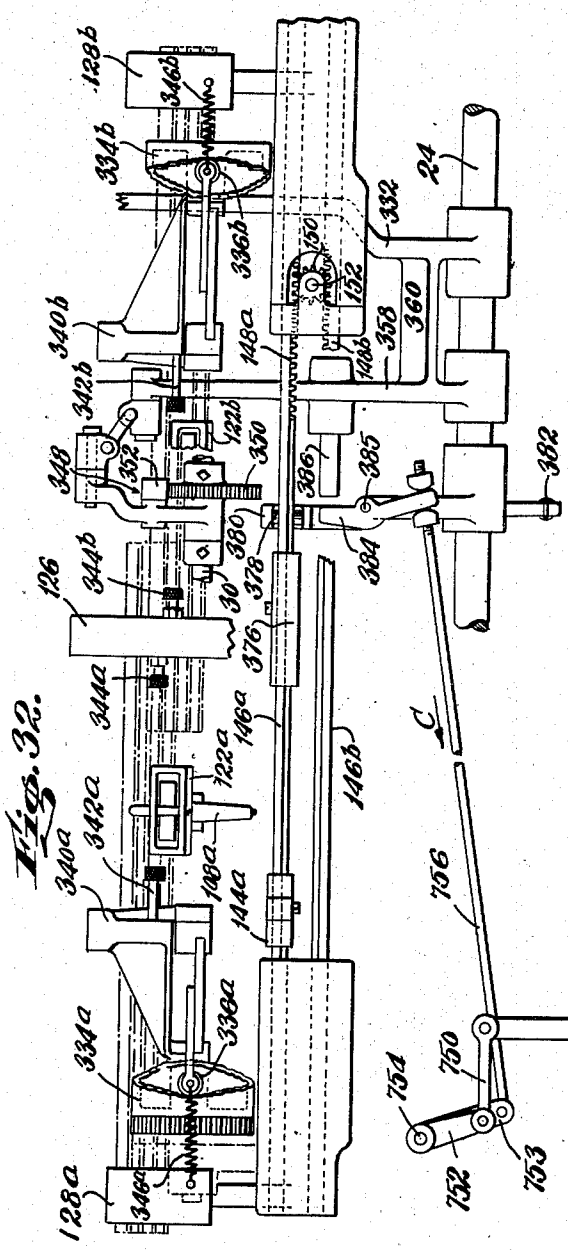


Fig. 32.

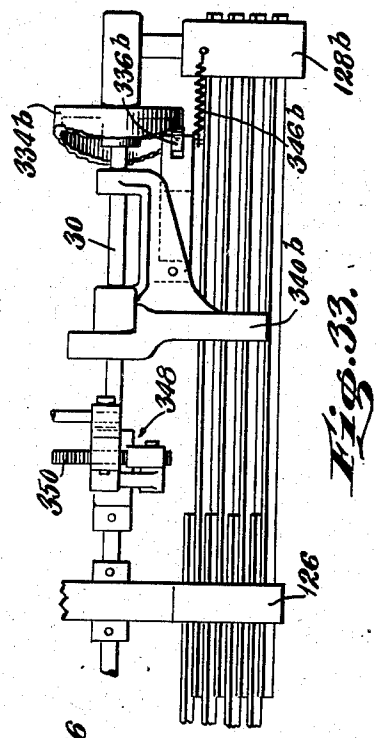


Fig. 33.

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ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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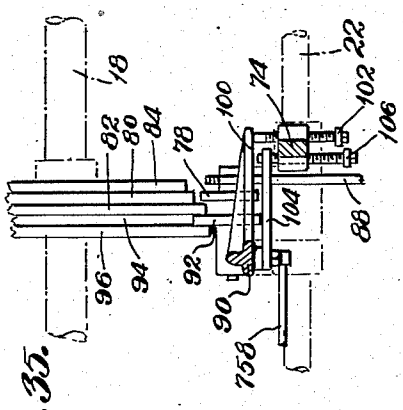


Fig. 35.

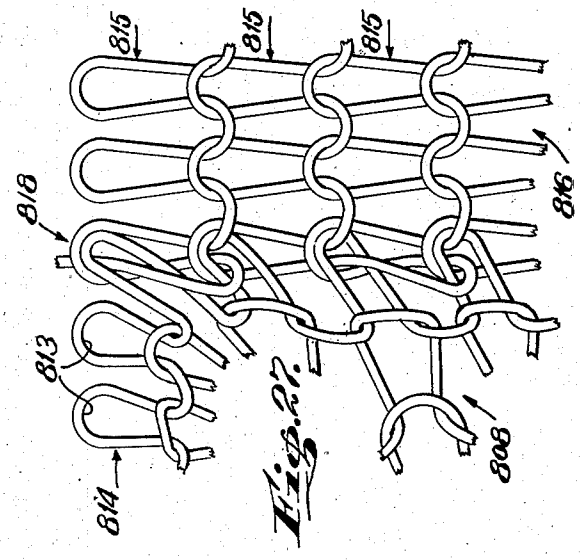


Fig. 27.

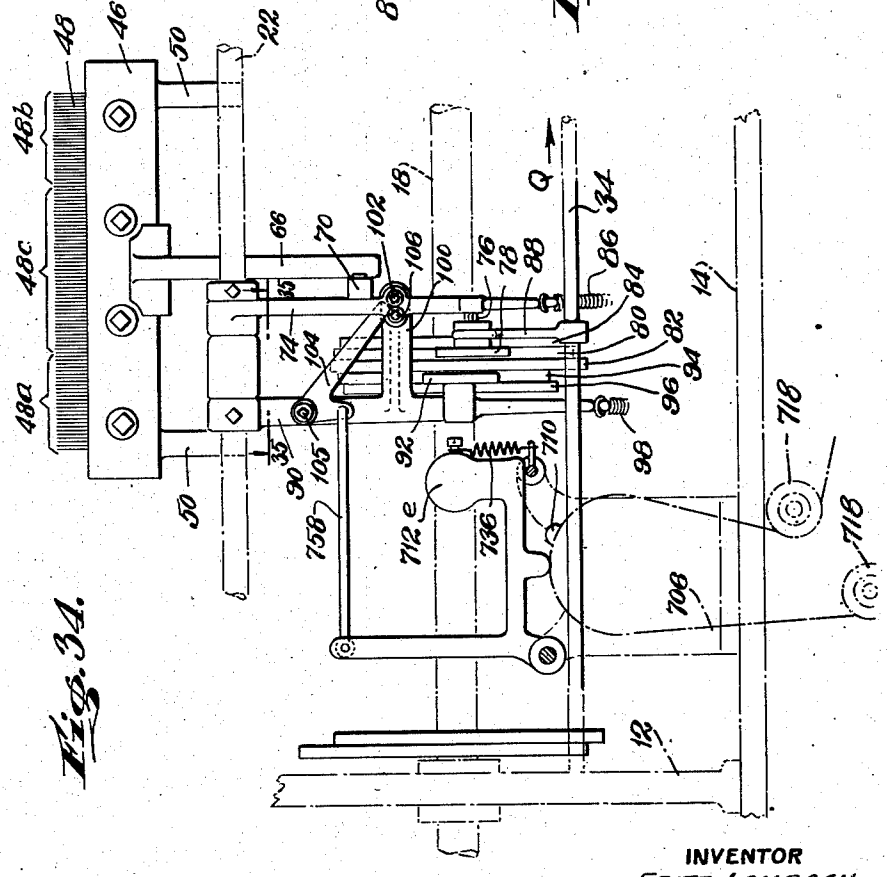


Fig. 34.

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Nov. 21, 1944. F. LAMBACH 2,363,008

ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 37.

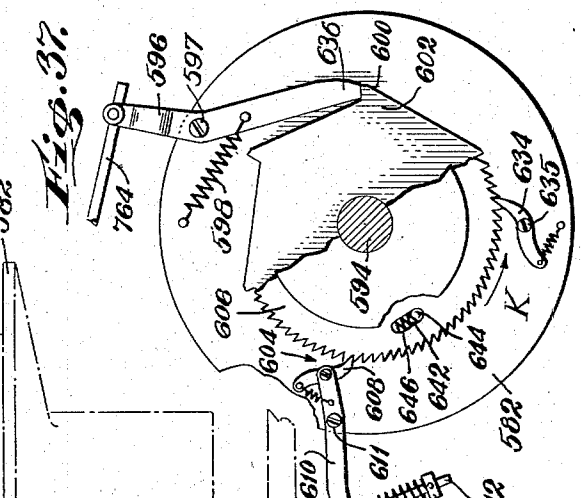


Fig. 36.

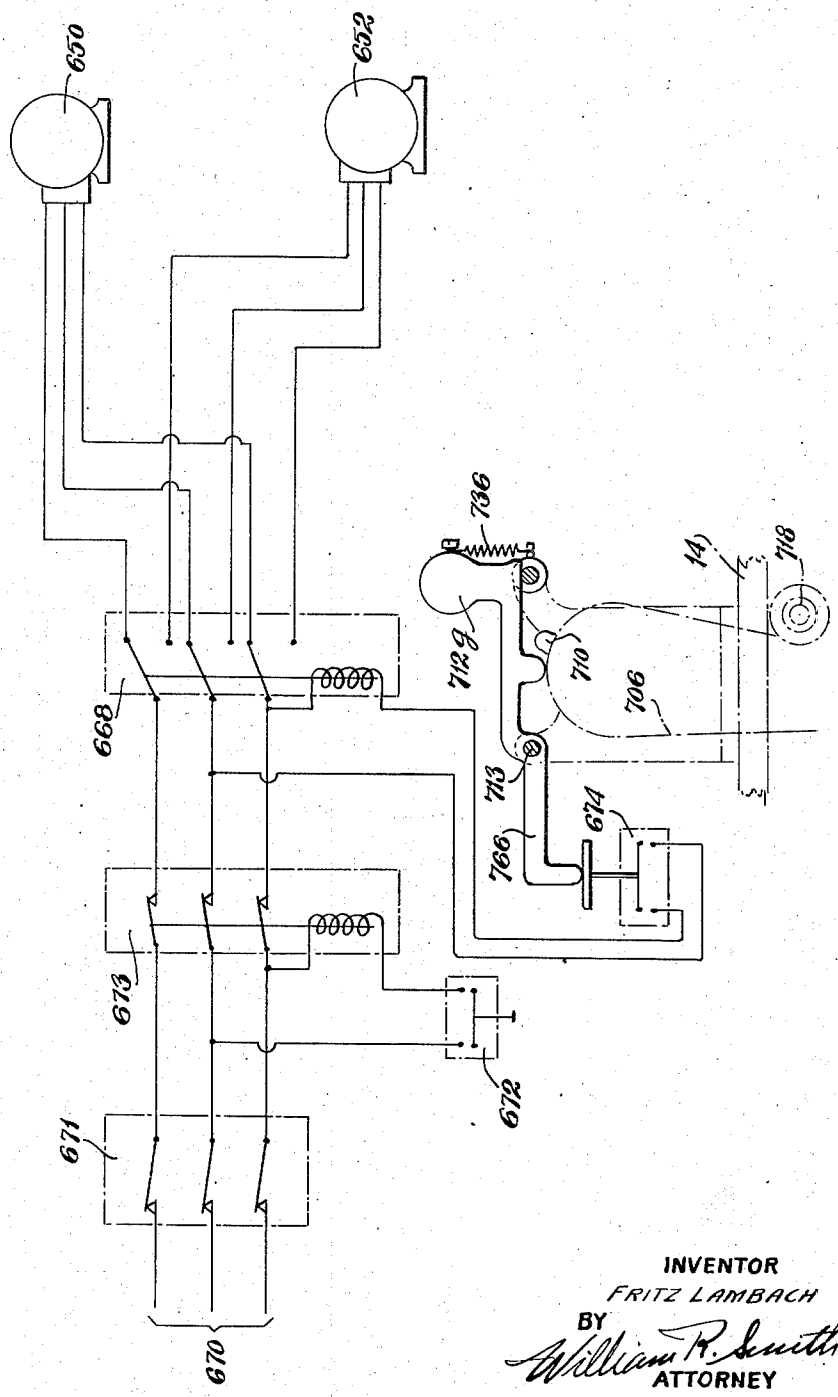
INVENTOR
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ATTORNEY

Nov. 21, 1944. F. LAMBACH 2,363,008

ART OF KNITTING FABRIC INTO PREFABRICATED FABRIC BLANKS

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Fig. 38.



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Patented Nov. 21, 1944 2,363,008

UNITED STATES PATENT OFFICE

2,363,008

ART OF KNITTING FABRIC ONTO PREFABRICATED FABRIC BLANKS

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

Application October 4, 1939, Serial No. 297,829
In Germany March 6, 1939

65 Claims. (Cl. 66—82)

The present invention generally relates to the manufacture of fabric articles, and to the machine therefor, and particularly applies to the art of knitting additional fabric onto pre-fabricated fabric blanks. The invention, although not restricted to the hosiery field, offers special advantages in the manufacture of full-fashioned stocking wherein certain portions thereof are to be knitted onto other previously made portions.

For instance, according to the usual procedure followed in manufacturing full-fashioned stockings, it is necessary to transfer the leg portion from one machine called the "legger" onto another machine known as the "footer" in order to knit the foot portion onto said leg portion.

Also, in the manufacture of that type of stocking wherein the body thereof is knitted as a continuation of a special welt, it is necessary to transfer said welt made on a special machine onto the stocking knitting machine so that the body of the stocking may be knitted onto the welt.

Likewise, according to a more recently developed method of manufacturing stockings wherein heel tabs are knitted directly onto, and as continuations of, the high heel portions of a combination leg and foot blank, and the sole portions of said blank are interknitted with said heel tabs as the knitting thereof progresses, it is necessary to transfer the combination leg and foot blank onto a knitting machine which has become known in the trade as a "heeler."

The transfer of pre-fabricated fabric has heretofore been generally accomplished by manual operation, which consumes considerable time and involves technical procedure. Moreover, in order to effect the transfer operation in accordance with the common practice, it is necessary to stop the knitting machine after each press-off operation so that the yarn may be pulled out, broken, and hung into a clamping device, after which the machine is again started.

It is, therefore, the primary purpose of the invention to provide a fully automatic knitting machine, that is, a knitting machine which, once set into operation, will continue to work repeatedly without interruption to feed prefabricated blanks, transfer such blanks, knit additional fabrics, and press off the finished product.

It is also an important object of the invention to provide a knitting machine with mechanisms, such as a knitting mechanism, a loop transfer mechanism, a fabric narrowing mechanism, a press-off mechanism, a fabric blank transfer mechanism, a fabric blank feeding mechanism, a drive mechanism, and a pattern control mechanism, all of which are relatively associated and co-function to render the knitting machine fully automatic in that no manual operation is needed after the machine has once been set into operation to knit additional fabric onto a plurality of pre-fabricated blanks and to automatically feed and transfer said blanks in successive order on the needles of said knitting machine.

The accompanying drawings illustrate the application of the invention to a so-called "heeler" or heeling machine intended to knit heel tabs as continuations of the high heel portions of a combination leg and foot full-fashioned stocking blank, and to interknit said blank with the heel tabs. It is, however, to be understood that the invention is in no way limited to such a heeler or heeling machine.

In these drawings:

Figure 1 is a top plan of the knitting machine with certain parts removed for the sake of clarity;

Figure 2 is a section taken on line 2—2 of Figure 1;

Figure 3 is an enlarged rear elevation of the knitting machine with certain parts removed for the sake of clarity;

Figure 4 is an end elevation of the machine looking in the direction of arrow 4—4 of Figure 2;

Figure 5 is a section taken on line 5—5 of Figure 2;

Figure 6 is a section taken on line 6—6 of Figure 2;

Figure 7 is a section taken on line 7—7 of Figure 2;

Figure 8 is a section taken on line 8—8 of Figure 2;

Figure 9 is a section taken on line 9—9 of Figure 2;

Figure 10 is a detail showing parts of Figure 8 in one operative position;

Figure 11 is a view similar to Figure 10 with the parts in another operative position;

Figure 12 is a side elevation of the transfer device showing the parts in neutral inoperative position;

Figure 13 is a section taken on line 13—13 of Figure 7;

Figure 14 is a detail in front elevation illustrating the guiding means for the needle bar, knock-over comb, and transfer device;

Figure 15 is an enlarged detail of the Coulier cam and associated elements;

Figure 16 is a section taken on line 16—16 of Figure 6;

Figure 17 is an enlarged detail of a part of the knitting section of the knitting machine;

Figure 18 is a section taken on line 18—18 of Figure 17;

Figure 19 is a view similar to Figure 18 with the parts in another position;

Figure 20 is a face elevation of the parts shown in Figure 19 in the direction of line 20—20;

Figure 21 is a view similar to Figures 18 and 19 with the parts in still another position;

Figure 22 is a view similar to Figure 20 with certain parts in section to illustrate a construction thereof;

Figure 23 is a section taken on line 23—23 of Figure 19;

Figure 24 is a diagrammatic illustration of a combination leg and foot blank;

Figure 25 is a diagrammatic illustration of the stocking fabric in topped position on the welt bar;

Figure 26 is a diagrammatic illustration of the stocking blank with the heel tabs knitted therein;

Figure 27 is an enlarged diagrammatic illustration of the connection between the heel tab and sole of the stocking;

Figure 28 is an enlarged detail of the yarn clamping and cutting mechanism;

Figure 29 is an enlarged detail of the shifting mechanism;

Figure 30 is an enlarged detail of the fabric narrowing and loop transfer mechanism;

Figure 31 is a section taken on line 31—31 of Figure 30;

Figure 32 is an enlarged detail of the automatic re-setting mechanism for the fabric narrowing mechanism;

Figure 33 is a top plan of a portion of the mechanism illustrated in Figure 32;

Figure 34 is an enlarged detail of the loose course control mechanism;

Figure 35 is a section taken on line 35—35 of Figure 34;

Figure 36 is a diagrammatic illustration of the turn-table locking control mechanism;

Figure 37 is a detail in top plan of a portion of the mechanism illustrated in Figure 36, with certain parts broken out;

Figure 38 is a diagrammatic illustration of the speed control mechanism.

The machine frame is designated by the reference character 10, and includes relatively spaced upright end frames 12 rigid with a base 14 preferably mounted upon a stand 16. The machine frame is provided with the necessary bearings to support a rotatable longitudinally shiftable main cam shaft 18, a rotatable hand wheel shaft 20, a rockable needle bar shaft 22, a rockable catch bar shaft 24, a rockable knockover bit shaft 26, a rockable narrowing lifting shaft 28, a rotatable carrier narrowing spindle 30, a transfer device shaft 32, and a longitudinally slidable shifting rod 34.

The various shafts are co-related, to either actuate or support the several cooperating mechanisms of the machine, which may be stated to comprise:

I. A knitting mechanism
II. A loop transfer mechanism
III. A fabric narrowing mechanism
IV. A press-off mechanism
V. A fabric blank transfer mechanism
VI. A fabric blank feeding mechanism
VII. A drive mechanism
VIII. A pattern control mechanism.

For clarity and convenience herein, the several mechanisms will first be described separately in the order given, and then a statement of the operation of the whole machine will follow, clearly setting forth the cooperative function and association of said mechanisms.

I. Knitting Mechanism

Spanning the end frames 12 and conveniently fixed thereon is a beam 36 serving as a center bed about which is located the knitting section, which essentially comprises a needle device 38, a yarn feeding device 40, a yarn sinking device 42, and a knockover bit device 44.

Needle device

According to the invention, and as illustrated in the drawings, the needle device 38 comprises a needle bar 46 carrying needles 48 divided into three groups, that is, two end groups 48*a* and 48*b*, and an intermediate group 48*c*.

The needles in the end groups 48*a* and 48*b* are adapted to receive yarn from the feeding device 40, and act to knit fabric, whereas the needles in the intermediate group 48*c* are non-knitting needles and serve only to retain loops of a previously knitted fabric for the purpose to be explained in detail hereinafter.

As is customary in the straight needle bar type of knitting machine, the needle bar 46 is capable of both vertical and horizontal movements, the horizontal movement being controlled to vary the length of the stitch.

For the purpose of imparting to the needle bar its vertical movement, said needle bar is provided with extension arms 50 pivoted, as at 52, to a link 54 in rigid engagement with the needle bar shaft 22. A lever 56, also rigid with the needle bar shaft 22, carries a roller 58 adapted for riding engagement with either a needle bar knitting cam 60 or a needle bar narrowing cam 62, depending upon the shifted position of the main cam shaft 18. Constant contact of the roller 58 is assured by means of a spring 64 having one of its ends attached to the lever 56, and the other of its ends attached to the machine frame.

From the foregoing, it will be understood that whenever the roller 58 contacts the knitting cam 60, the same will cause the needle bar shaft 22 to oscillate, thereby moving the needle bar up and down for its knitting motion during a revolution of the main cam shaft 18 in the course of a knitting cycle, wherein said cam shaft is in its normal knitting position, but that whenever the roller 58 contacts the narrowing cam 62, the needle bar will be moved up and down for its narrowing motion during a revolution of said main cam shaft in the course of a narrowing cycle wherein the main cam shaft is in its shifted narrowing position.

For the purpose of imparting to the needle bar 46 its horizontal movement, an arm 66 is fastened to said needle bar and pivoted, as at 68, to a link 70 detachably engageable with a pin 72 arranged upon a lever 74 freely suspended from the needle bar shaft 22 and carrying a stud 76 on which a roller 78 is mounted for riding engagement with a normal knitting presser cam 80 or with a narrowing presser cam 82, or with an auxiliary presser cam 84.

The roller 78 is urged into proper riding engagement with cams 80, 82, or 84 by means of a spring 86 having one of its ends attached to the roller carrying lever 74, and the other of its ends

attached to the machine frame. The roller 78 may be shifted to various positions for engagement with said cams 80, 82, or 84 independently of the shifting of the main cam shaft 18 by means of a forked arm 88 fastened to the shifting rod 34. It will, therefore, be understood that engagement of the roller 78 with the cams 80, 82, or 84 will cause the lever 74 to swing, thus moving the needle bar 46 in and out during a revolution of the main cam shaft 18 by means of the link 70 and arm 66.

The movement of the needle bar 46 in its out direction may be controlled in order to vary the length of the stitch. For that purpose, there is provided a regulating lever 90 loosely mounted on the needle bar shaft 22 and carrying a roller 92 adapted for riding engagement with either a knitting presser regulating cam 94, or a narrowing presser regulating cam 96, depending upon the shifted position of the main cam shaft 18.

The roller 92 is normally pulled towards the cams 94 and 96 by the action of a spring 98 connected to the lever 90 and to the machine frame.

The regulating lever 90 is formed with an abutment 100 disposed for engagement with the end of a regulating screw 102 carried by the presser lever 74. Thus it will be appreciated that by adjusting the regulating screw 102, the position of the lever 74 will be changed in relation to the lever 90 accordingly changing the motion of said lever 90 and, therefore, the length of the loops.

Moreover, in accordance with the invention, the machine is provided with means to change the length of the loops for the formation of one or more loose courses in the fabric. This feature may be had by mounting on the regulating lever 90 a latch 104 pivoted as at 105 and adapted to be brought into and out of contact with a second adjustable screw 106 carried by the presser lever 74. Thus it will be understood that when the latch 104 is out of contact with the adjustable screw 106, the lever 74 remains in its normal adjusted position with respect to the lever 90 so that the machine knits loops of normal length, but when said latch is brought into contact with the adjustable screw 106, the position of lever 74 is changed in relation to lever 90, causing the machine to knit loops of increased length.

Yarn feeding device

In accordance with the invention, and as shown in the drawings, the yarn feeding device 40 includes yarn carriers 108*a* and 108*b*, at least one carrier being provided for each end group of knitting needles. The yarn fed to the carriers passes through the usual well known tension device or snapper 110 operated by means of a rod 112 connected to a lever 114 pivoted on the catch bar shaft 24 and provided with a roller 116 disposed for riding engagement either with the active cam 118 or the neutral cam 120 on the main cam shaft 18, depending upon the shifted position of said main cam shaft.

The yarn carriers 108*a* and 108*b* associated with the knitting needle groups 48*a* and 48*b* are frictionally engaged by means of friction boxes 122*a* and 122*b* with separate carrier bars 124*a* and 124*b*, preferably arranged in superposed relationship, as more clearly illustrated in Figures 10 and 11, and adapted to reciprocate with respect to each other in a fixed supporting bracket 126. The carrier bar 124*a* carrying the carrier 108*a* associated with one knitting needle group 48*a* is secured to a slidable bracket 128*a* rigidly connected to one slur cock bar 146*a* (Figure 9) for movement therewith, whereas the carrier bar 124*b* carrying the carrier 108*b* associated with the remaining knitting needle group 48*b*, is secured to a slidable bracket 128*b* rigidly connected to another slur cock bar 146*b* (Figure 5). The brackets 128*a* and 128*b* are slidable on guide rods 129 carried by convenient supports on the machine frame.

Yarn sinking device

As shown in the drawings, the yarn sinking device 42 comprises a sinker and divider head 132 fixed upon the center bed beam and having a portion constituting the presser edge 133. Said head 132 is provided with two sets of sinkers 134*a* and 134*b* and two sets of dividers 136*a* and 136*b*, one set of sinkers 134*a* and dividers 136*a* respectively being disposed for cooperation with one knitting needle group 48*a*, and the other set of sinkers 134*b* and dividers 136*b* respectively being disposed for cooperation with the other knitting needle group 48*b*.

The sets of sinkers 134*a* and 134*b* associated with the knitting needle groups 48*a* and 48*b* are actuated by means of jacks 138 pivoted in a jack bed 140 also fixed upon the center bed beam 36. The jacks intended to actuate the sets of sinkers associated with the knitting needle groups 48*a* and 48*b* are advanced in successive order by separate slur cams 142*a* and 142*b* respectively carried by the slur cock boxes 144*a* and 145*b* individually connected to the slur cock bars 146*a* and 146*b*. The slur cock bars 146*a* and 146*b* are each provided with a rack, as indicated at 148*a* and 148*b*. Between the racks 148*a* and 148*b* is positioned a pinion 150 secured upon one end of a stub shaft 152 carrying at its other end portion a second pinion 154 enmeshed with a rack bar 156 guided for vertical reciprocating movements in a guide member 157 on the machine base 14. The rack bar 156 is adapted to be reciprocated through a Coulier cam 158 on the main cam shaft 18 by means of a rocking lever 160 having one end pivotally connected to said rack bar, as at 162, and the other end pivotally connected to the machine frame, as at 164, and having at its intermediate portion a roller 166 received within a camming groove 168 cut in the Coulier cam 158 so that the rotation of said Coulier cam is translated into the vertical rocking motion of the lever 160.

The dividers 136*a* and 136*b* in both sets are advanced in unison by means of a catch bar 170 when moved in its forward stroke, said catch bar being connected through links 172 connected to catch bar arms 174 fixed on the catch bar shaft 24. Also fixed on the catch bar shaft is a lever 176 carrying a roller 178 disposed for riding engagement with either a knitting catch bar cam 180 or a narrowing catch bar cam 182 depending upon the shifted position of the main cam shaft 18. The roller 178 is urged towards the cams 180 and 182 by means of a spring 184 connected to the lever 176 and to the machine frame.

All the sinkers and dividers in both sets are retracted in unison by means of the catch bar 170 in the usual manner, while said catch bar moves in its backward stroke, that is, in the direction of the arrow in Figure 8. The catch bar 170 is also adapted to be lifted slightly in order to clear the sinkers for their actuation by the jacks 138. For that purpose, the catch bar 170 is provided with a connecting piece 186 engaged with a lifting arm 188 pivotally connected to a lever 190

arranged for oscillating movement on the needle bar shaft 22 and provided with an extension 191 carrying a roller 192 disposed for engagement with either a catch bar lifting cam 194 or an idling cam 196, depending upon the shifted position of the main cam shaft.

Attention is called to the fact that, with actuation of the Coulier cam 158, the slur cam 142*a* and the yarn carrier 108*a* associated with the knitting needle group 48*a* and the slur cam 142*b* and yarn carrier 108*b* associated with the knitting needle group 48*b* are caused to move in unison towards and away from each other as indicated in Figure 1 by the arrows D, E, F, and G, thus laying the yarns and actuating the sinkers 134*a* and 134*b* simultaneously in opposite directions during a knitting cycle of the machine.

Knockover bit device

As illustrated in the drawings, the knockover bit device 44 includes a knockover bit bar 198 carrying knockover bits 200 and pivotally connected to a stub shaft 202 supported by lever arms 204 fixedly attached to the knockover bit shaft 26. The stub shaft 202 is also in engagement with a link 206 pivoted, as at 208, to another link 210 which, in turn, is pivoted to one arm 212 of a bell crank lever 214 rotatably engaging the needle bar shaft 22. The other arm 216 of the bell crank lever 214 carries a roller 218 disposed for riding engagement with either a knitting forward knockover cam 220 or a narrowing forward knockover cam 222, depending upon the shifted position of the main cam shaft 18, for the purpose of imparting to the knockover bits 200 their horizontal reciprocating motion.

For the purpose of imparting to the knockover bits 200 their vertical reciprocating motion, there is rockingly mounted upon the knockover bit shaft 26 a lever 224 carrying a shiftable roller 226 mounted on a stud 227 and disposed for engagement with the knitting knockover lifting cam 228 or with the narrowing knockover lifting cam 230, or with the auxiliary knockover lifting cam 232. Proper engagement of the roller 226 with cams 228, 230, or 232 is assured by means of a spring 234 connected to the free end of the lever 224 and to a suitable part of the machine frame. The roller 226 may be shifted by means of a forked arm 236 secured to the shifting rod 34.

II. Loop Transfer Mechanism

Arranged for coaction with the non-knitting needle group 48*c* are two relatively wide loop transfer combs 238*a* and 238*b* respectively secured to separate narrowing bars 240*a* and 240*b* slidably mounted in brackets 242 disposed on a connecting shaft 244, suspended from dipping arms 246 rigidly connected to the rockable narrowing lifting shaft 28.

Also rigidly connected to said shaft 28 are relatively spaced levers 248 carrying rollers 250. The roller carried by one of said levers 248 is disposed for engagement with either the idling cam 196 or with an active cam 252, whereas the roller carried by the other of said levers is disposed for engagement with either an idling cam 254 or an active cam 256, identical in shape to cams 196 and 252 respectively. The rollers 250 are normally urged towards said cams by means of springs 258 attached to the levers 248 and to suitable portions of the machine frame. Thus it will be understood that when the active cams 252 and 256 are in engagement with the rollers 250, the shaft 28 will be rocked, accordingly imparting a dipping motion to arms 246 and associated parts, but that when the idling cams 196 and 254 are in engagement with the rollers 250, said shaft 28, arms 246, and associated parts remain stationary.

Sliding movement is imparted to the narrowing bars 240*a* and 240*b* by means of a transfer motion device 260. This transfer motion device comprises a cam disc 262 having camming faces 264 on both of its sides and mounted for oscillation on a shaft 266 supported in suitable bearing brackets 268 conveniently arranged on the machine frame.

Disposed for riding engagement with the camming faces 264 of the cam disc 262 is a pair of roller carrying plates 270*a* and 270*b* respectively connected to slidable support bars 272*a* and 272*b*. One bar 272*a* is provided with a finger 274*a* adapted for contact with one end of the narrowing bar 240*a* carrying the loop transfer comb 238*a*, while the other bar 272*b* is provided with a finger 274*b* adapted for contact with one end of the narrowing bar 240*b* carrying the loop transfer comb 238*b*.

The plates 270*a* and 270*b* may be urged in constant engagement with the cam disc 262 by means of a spring 276 between said plates, whereas the narrowing bars 240*a* and 240*b* may be urged in constant contact with the fingers 274*a* and 274*b* by means of springs 278*a* and 278*b* connected to said bars and to parts of the supporting structure, such as one of the brackets 242.

The cam disc 262 is actuated by means of a link arrangement 280 consisting of a rod 282 connected at one end to an extension 284 formed with said disc 262 and at the other end to an arm 286 of a sleeve 288 rotatable on the catch bar shaft 24. The sleeve 288 is provided with a second arm 290 carrying a roller 292 disposed for riding engagement with either an idling cam 294 or an active cam 296 on the main cam shaft 18, depending upon the shifted position of said main cam shaft. Because of this construction, it will be understood that whenever the active cam 296 is in engagement with the roller 292, the cam disc 262 will be oscillated and that the oscillation of said cam disc will cause the narrowing bars 240*a* and 240*b* to move in opposite directions, indicated by the arrows in Figure 2.

III. Fabric Narrowing Mechanism

Disposed for cooperation with a predetermined number of needles in the knitting needle groups 48*a* and 48*b* at the opposite ends of the needle bar are two relatively small narrowing combs 298*a* and 298*b* respectively fixed in separate narrowing bars 300*a* and 300*b* longitudinally slidably mounted in brackets 242. The narrowing combs 298*a* and 298*b* are intended to slide independently of the sliding movement of the loop transfer combs 238*a* and 238*b*. At this point, it is to be noted that, whereas the loop transfer combs 238*a* and 238*b* are intended to have a constant uniform back and forth motion over the same series of needles, the narrowing combs 298*a* and 298*b* are adapted to have a progressive inward motion over different series of needles. For that purpose, there is provided a progressive narrowing motion device 302 which comprises a pair of integral stepped cylinders 304*a* and 304*b* rotatably mounted upon a shaft 306 supported in suitable bearing brackets 308 conveniently arranged on the machine frame.

Disposed for riding engagement with the stepped surfaces of the cylinders 304a and 304b is a pair of roller carrying plates 310a and 310b respectively connected to slidable support bars 312a and 312b. One bar 312a is provided with a finger 314a adapted for contact with one end of the narrowing bar 300a carrying the narrowing comb 298a, and the other bar 312b is provided with a finger 314b adapted for contact with one end of the narrowing bar 300b carrying the narrowing comb 298b.

The plates 310a and 310b may be urged in constant engagement with the stepped cylinders 304a and 304b by means of a spring 316 between said plates, and the narrowing bars 300a and 300b may be urged in constant contact with the fingers 314a and 314b by means of springs 318a and 318b connected to said bars and to parts of their support, such as one of the brackets 242.

The integral cylinders 304a and 304b are adapted to be rotated clockwise or anti-clockwise and, for that purpose, are provided with a suitable pawl and ratchet arrangement 320 which, in the embodiment shown, consists of two ratchet wheels 322 and 323 respectively having their teeth directed in opposite directions, and of two pawls 324 and 325, one pawl 324 cooperating with the ratchet wheel 322 to cause rotation of the cylinders in the direction of arrow S, the other pawl 325 cooperating with the remaining ratchet wheel 323 to cause rotation of the cylinders in the direction of the arrow V in Figure 5. The pawls 324 and 325 are actuated by means of a link arrangement 326 consisting of an appropriately shaped lever 328 connected to one end of a rod 330 having its other end connected to an arm 332 rockingly mounted on the catch bar shaft 24.

It will be understood that, as the narrowing combs 298a and 298b are progressively moved inwardly to narrow the fabric, it is also necessary to arrest the carrier bars 124a and 124b at points gradually moving inwardly. For that purpose, a pair of stepped disc 334a and 334b are fixed upon the rotatable carrier narrowing spindle 30, one disc 334a being positioned at one end portion of said spindle, and the other disc 334b being positioned at the other end portion of said spindle. Accidental rotation of the narrowing spindle 30 may be prevented and the desired positioning of the stepped discs 334a and 334b may be had by providing an index mechanism 335.

Disposed for riding engagement with the stepped discs 334a and 334b are rollers 336a and 336b carried by brackets 338a and 338b mounted for sliding movement on said narrowing spindle 30 and having arms 340a and 340b projecting over the carrier bars 124a and 124b. The arm 340a is provided with an adjustable stop 342a arranged in the path of outward movement of the friction box 122a associated with the carrier 108a for limiting its outward stroke. The arm 340b is likewise provided with an adjustable stop 342b arranged in the path of outward movement of the friction box 122b associated with the carrier 108b to limit its outward stroke. The carriers 108a and 108b are limited in their inward stroke by means of adjustable stops 344a and 344b provided on the fixed carrier bar supporting bracket 126 and disposed in the path of inward movement of the friction boxes 122a and 122b.

The rollers 336a and 336b may constantly be urged in engagement with the stepped discs 334a and 334b by means of springs 346a and 346b. The narrowing spindle 30 is rotated by the function of a pawl and ratchet arrangement 348 comprising a ratchet wheel 350 rigidly fixed to said spindle and acted upon by a pawl 352 carried by a lever 354 connected through a link 356 to a rocking arm 358 rotatably supported on the catch bar shaft 24.

As will appear from the drawings, a cross piece 360 spans and unites the arm 332 and the arm 358 so that, normally, said arms are rocked together for the simultaneous operation of the pawl and ratchet arrangements 320 and 348 to actuate the entire fabric narrowing mechanism in the manner to be presently described.

Rigid with the arm 358 is a lever 362 carrying a pivotal latch 364, one end 366 of which is adapted to be brought into contact with a nose piece 368 of a lever 370 loosely supported on the catch bar shaft. The latch 364 may be pivoted to the lever 362 as indicated at 365. The lever 370 is provided with a roller 372 disposed for riding engagement with a narrow cam 374 on the main cam shaft 18, said roller 372 being much wider than said cam 374 so that the roller engages the cam in either shifted position of the main cam shaft.

From the foregoing, it will be appreciated that whenever the pivotal latch 364 is swung in position to contact the nose piece 368 of lever 370, the cam 374 will cause the lever 362 to oscillate and thus impart a rocking motion to lever 354 and arm 358, accordingly actuating the pawl and ratchet arrangements 320 and 348. However, when the pivotal latch 364 is swung to a position to clear the nose piece 368 of the lever 370, then the oscillation of the latter through the cam 374 has no action on the lever 362 so that the pawl and ratchet arrangement 320 and 348 remain inactive and, accordingly, the entire fabric narrowing mechanism remains idle.

At certain times during the operation of the machine for the purpose to be specified hereinafter, the pawl and ratchet arrangements 320 and 348 are adapted to be actuated to return the narrowing combs 298a and 298b and the yarn carriers 108a and 108b to their original extreme outer positions. This is accomplished after the narrowing of the fabric has been completed and, in accordance with the present invention, as ravelling courses are being knitted. For that purpose, there is provided a cam block 376 on one slur bar 146a or 146b, which cam block is disposed to engage a roller 378 carried by a lever 380 pivoted on the catch bar shaft 24 and normally urged towards said slur bar by means of a spring 382. Thus it will be understood that, with every reciprocation of the slur bar, the lever 380 is given an oscillatory motion through the cam block 376 acting on the roller 378. The lever 380 is provided with a latch 384 pivoted as at 385 and adapted to be brought into engagement with an extension 386 on the arm 358.

Because of this arrangement, it will be appreciated that whenever the latch 384 is swung out of engagement with the extension 386, the oscillatory motion of the lever 380 has no effect on the machine, but when said latch is swung into engagement with said extension, the oscillatory motion of the lever 380 is transmitted through the interconnected arms 332 and 358 and, accordingly, actuate the pawl and ratchet arrangements 320 and 348 to cause rotation of the stepped cylinders 304a and 304b and the stepped discs 334a and 334b for permitting the step-by-step return of the narrowing combs 298a and 298b and yarn carriers 108a and 108b to their original position.

IV. Press-Off Mechanism

According to the invention, the machine is adapted to press off the fabric after the knitting thereof is completed. Of course, for the actual pressing off, it is necessary that the main cam shaft **18** undergo a revolution to actuate the needles **48** so that the same may disengage the loops of the last fabric course. However, it will be understood that, during the pressing off operation, it is also necessary that the yarn carriers **108***a* and **108***b* be stopped and held stationary to prevent the feeding of the yarn and that the yarn be cut to permit the complete press off, and clamped in position for the formation of the initial course of the fabric to be knitted by the machine in the normal operation thereof following the press off. Therefore in accordance with the invention, there are provided a carrier locking device **388** and a yarn clamping and cutting device **390**.

Carrier locking device

The carrier locking device **388** comprises a pair of sleeves **392***a* and **392***b* mounted on the carrier narrowing spindle **30** for longitudinal sliding movement thereon, but held against rotating movement in relation thereto, each sleeve being provided with a depression **394** at one point of its periphery for the purpose to be later specified.

The sleeve **392***a* is associated with the carrier narrowing bracket **338***a* while the sleeve **392***b* is associated with the carrier narrowing bracket **388***b* so that said sleeves follow the inward and outward movements of said carrier narrowing brackets.

Cooperatively associated with the sleeves **392***a* and **392***b* are locking levers **396***a* and **396***b* suitably mounted in pivots **395** for transversal pivotal movement, but stationary with respect to the longitudinal sliding movement of said sleeves. Each locking lever is provided with an adjustable pin **398** adapted to glide on the peripheral surface of the associated sleeve in alignment with the depression **394** thereof during the sliding movement of said sleeve through operation of the carrier narrowing brackets **338***a* and **338***b*.

The pins **398** are adapted to normally hold the locking levers **396***a* and **396***b* at a level above the carriers **108***a* and **108***b* and thus allow for the free reciprocation of the latter in their yarn laying function. With the sliding movement of the sleeves **392***a* and **392***b*, the depressions **394** thereof are brought in registration with the pins **398** whereupon said pins fall into the depressions, thus permitting the locking levers **396***a* and **396***b* to drop and engage the carriers **108***a* and **108***b* for locking the same against reciprocation. It is to be noted that the location of the depressions **394** on the sleeves is predetermined so that the actuation of the locking levers takes place at the precise moment when press of is to occur. These locking levers **396***a* and **396***b* are caused to release the carriers **108***a* and **108***b* when, in the sequence of operation of the knitting machine as will be set forth hereinafter, the narrowing spindle **30** is rotated, thereby sliding the sleeves **392***a* and **392***b*, thus moving the depressions **394** out of registration with the pins **398**, accordingly returning said levers **396***a* and **396***b* to their level above the carriers **108***a* and and **108***b* for the free reciprocation thereof.

Yarn clamping and cutting device

The yarn clamping and cutting device **390** consists of two yarn clamp and cutter assemblies **400***a* and **400***b*, one arranged on each side of the knitting section. Each assembly comprises a guide block **402** adjustably supported on the sinker head **132** and formed with a pair of guideways **404** and **405** disposed in paralleling superposed relationship. Mounted for sliding movement in one guideway **404** is a movable bar **406** having a yarn engaging hook end **408**. Fixed within said guideway **404** is a stationary block **410** shaped to fit within the hook end **408** of the bar **406** and to cooperate therewith to clamp the yarn therebetween. Also mounted for sliding movement in the other guideway **405** is a second movable bar **412** likewise having a yarn engaging hook end **414**. Fixed in said guideway **405** is a stationary block **416** shaped to fit within the hook end **414** of the bar **412** and to cooperate therewith to cut the yarn. For that purpose, the hook end **414** is formed with cutting edges **418**.

The straight end portion of the cutter bar **412** is fixed in relatively spaced holders **420** and **421** adjustable on a rod **422** slidably supported in a U-shaped bracket **424** attached on the machine frame. The straight end portion of the clamp bar **406** freely engages the holders **420** and **421** so that said bar **406** may slide in relation to the cutter bar **412**.

In order to assure the proper clamping of the yarn *y* before the cutting thereof, the hook end **414** of the cutter bar **412** is adapted to project at a greater distance than the hook end **408** of the clamp bar **406** so that the latter may engage the yarn and clamp the same prior to the actuation of the cutter bar. This feature may be accomplished by providing a body **426** fixedly arranged upon the slidable clamp bar **406** between the holders **420** and **421** and positioning an extension spring **428** between said body and the innermost holder **420**. Because of this construction, it will be understood that when the rod **422** is moved outwardly, that is, in the direction of arrow R in Figure 17, the clamp bar end **408** in engagement with the yarn will come in contact with the clamp block **410**, thereby securely clamping the yarn *y* due to the tension of said spring **428** which then permits the rod **422** to continue its outward movement to bring the cutter bar end **414** engaging the yarn *y* in cooperative position with the cutter block **416** to sever the yarn.

The rod **422** receives its sliding motion through an arm **430** pivoted to said rod **422**, as indicated at **431**, and to a support **432** on the machine frame and provided with an extension **434** carrying a roller **436** disposed for contact with a cam **438** arranged on the main cam shaft **18** and positioned at one end of the machine. The arm **430** transmits simultaneous movement to the clamp and cutter assemblies **400***a* and **400***b* by means of a link **440** and lever **442**. The arm **430** may be rendered inactive by the function of a latch **444** pivoted to the machine frame, as indicated at **446**, said latch being adapted for engagement with the underside of the arm extension **434** thus holding the arm in the position represented in full lines in Figure 17 and consequently preventing its actuation by the cam **438**. It will be noted that the cam **438** is provided with a relatively short active camming portion **439** so that arm **430** is normally swung in the direction of arrow X thus normally maintaining the hook ends of the clamp bar **406** and cut-

ter bar 412 out of the way of the knitting instrumentalities.

V. Fabric Blank Transfer Mechanism

According to the invention, previously knitted fabric blanks are to be transferred automatically onto the needles 48 of the knitting machine and, for that purpose, there is provided a fabric blank transfer mechanism 446 which, as represented in the drawings, comprises a pair of supporting brackets 500 swingably mounted on the needle bar shaft 22 of the knitting machine, one bracket being disposed on one side of the knitting section, and the other bracket being disposed on the other side of said knitting section. Each bracket is formed with an extension 502 pivotally carrying, as shown at 504, an angular lever 506 adapted for swinging movement with its associated bracket. Swinging movements may be imparted to the brackets 500 by means of a pair of gears 508 respectively fixed to each of said brackets and enmeshed with toothed segments 510 keyed, or otherwise suitably secured, upon the transfer device shaft 32. Also suitably secured upon the transfer device shaft 32 is a lever 512 carrying a shiftable roller 514 disposed for engagement with either an active cam 516 or an idling cam 518 on the main cam shaft 18, independently of the shifted positions of the latter.

The roller 514 is shifted by the actuation of a forked lever 520 connected to and controlled by the shifting rod 34, in the manner to be fully set forth hereinafter.

As shown in the drawings, the cam 518 is formed with an upstanding flange 522 provided with a recess 524 at that point where the active cam 516 and idling cam 518 are approximately of the same height. Therefore, the roller 514 and, accordingly, the shifting rod 34 are prevented from shifting until the cams 516 and 518 reach the position where the recess 524 registers with the roller 514, for the purpose subsequently to be stated.

The roller 514 is urged towards its associated cams 516 and 518 by means of a spring 526 connected to the lever 512 and to a suitable portion of the knitting machine frame. In order to facilitate the shifting of the roller 514, the lever 512 is provided with a non-shiftable roller 528 disposed for riding engagement with an auxiliary cam 530 on the main cam shaft 18, irrespective of the shifted position thereof, the cam 530 for that purpose being wider than the roller 528.

As will more clearly appear from Figure 4, the auxiliary cam 530 is shaped and positioned so that the camming edge 531 thereof lies in a plane concentrically disposed with respect to the cams 516 and 518 at the point where they are approximately of the same height, that is, at the point where the recess 524 is formed in the flange 522. At that point, the cams 516 and 518 are preferably formed with a slight depression 532 so that the roller 514 temporarily leaves said cams 516 and 518, the lever 512 being maintained in its position by the roller 528 in engagement with the auxiliary cam 530. Thus it will be appreciated that the roller 514, being relieved from pressure against its associated cams 516 and 518, normally existing due to the action of the spring 526, may be readily shifted at the proper moment.

From the foregoing, it will be understood that whenever the roller 514 is shifted to that position wherein it engages the active cam 516, the shaft 32 is caused to oscillate and thus impart a rocking movement to the toothed segments 510 which, in turn, rotates the gears 508, swinging the supporting brackets 500 with their respective angular levers 506 to and from the position shown in Figures 4 and 10, but whenever the roller 514 is shifted to the position wherein it engages the idling cam 518, then the parts mentioned remain stationary, that is, the brackets 500 and their associated elements are in neutral position, as illustrated in Figure 4.

It is to be noted that one arm of each of the angular levers 506 preferably carries an adjusting stop 534 disposed to rest upon a portion of the corresponding bracket 500 and urged thereon by means of a spring 536 so that said levers 506 may assume a definite adjustable position with respect to the brackets 500. The other arm of each of said angular levers 506 carries a transfer bar engaging latch 538 pivoted as at 539 and normally moved and held in transfer bar engaging position by means of a spring 540. The latches 538 are provided with pins 542 positioned for engagement with guide fingers 544 formed with levers 546 mounted for oscillation on the transfer device shaft 32, adjacent the toothed segments 510.

Oscillation of the levers 546 is had through the function of an arm 548 connected to said levers by means of a rigid bar 550 and carrying a roller 552 adapted to be shifted in and out of engagement with a cam 554 on the main cam shaft 18, proper engagement of the roller 552 with said cam 554 being assured by means of a spring 556 connected to an extension 558 on the arm 548 and to a suitable point on the knitting machine frame.

The roller 552 is shifted through the actuation of a forked lever 560 on the shifting rod 34. The shifting of the roller 552 may be accomplished easily by fixing a stop rod 562 to the machine frame at a point where said rod will contact the arm extension 558 when the roller 552 leaves the raised portion 564 of the cam 554 and thus suspend said roller away from the round or inactive portion 565 of said cam, at which time the shifting occurs. Of course, the provision of the rod 562 also acts to support the arm 548 when the roller 552 is shifted out of engagement with the cam 554.

The oscillation of the levers 546 acts to open the latches 538 against the action of the springs 540 and to permit said latches to close under action of said springs. In other words, when the latch carrying levers 506 are in their position for engagement with the transfer bar T and the levers 546 are moved outwardly, the fingers 544 thereof bear against the pins 542 and open the latches 538 so that the same may pass under the extremities of the transfer bar T. With the subsequent inward movement of the levers 546, the fingers 544 thereof leave the pins 542, allowing the latches 538 to be closed by the springs 540 and thus engage the extremities of said transfer bar and lock the same within grooves 566 provided for that purpose in the angular levers 546. In this manner, the transfer bar T is held fixedly by the levers 506, and may be swung with said levers to the position bringing the transfer points P of the transfer mar T in alignment with the needles 48 of the needle bar 46. When the transfer bar T is returned from its registration with the needle bar 46 to its original position, the outward oscillation of the levers 506 again opens the latches 538 freeing the transfer bar.

It will be appreciated that, in order to effect the proper transfer of the fabric from the transfer bar onto the needles in the manner to be fully described hereinafter, it is necessary that the needles, transfer points, and knockover bits be maintained in accurate relationship. For that purpose, there are provided guide plates 568 suitably fixed on the center bed beam 36 on each side of the knitting section, and having outstanding wedge shaped nose pieces 570 provided with angularly disposed faces 571 and 571a adapted for engagement with guide pins 572 preferably in the form of guiding rollers carried by the transfer bar engaging levers 506. Moreover, the levers carry adjustable pins 574 adapted to engage the inner faces of the plates 568.

Rigid with the plates 568 but laterally spaced therefrom are also provided second guide plates 576, each having a pair of adjustable pins 578 and 579, one pin 578 being disposed to bear upon the end of the needle bar, the other pin 579 being disposed to bear upon the end of the knockover bit comb. Because of these various elements, the transfer bar, needle bar, and knockover bit comb are stabilized in relation to one another so that the transfer points P are held in proper alignment with the needles 48 and the knockover bits 200 are held in the required position for their accurate movement between the needles and transfer points aligned therewith.

VI. Fabric Blank Feeding Mechanism

In accordance with the invention, the previously knitted blanks are to be fed automatically to the fabric blank transfer mechanism, and for that purpose, there is provided a fabric blank feeding mechanism which, as shown in the drawings, preferably comprises a turn-table 580 supported for rotation on frame work 582 swingably carried by the machine frame stand 16 by means of a shaft 584 rotatably arranged in brackets 586 on said machine frame stand.

The frame work 582 may be locked in place to support the turn-table 580 in operative position by means of a bolt 588 rigidly interconnecting said frame work to its carrying structure. The bolt 588 may be removed to permit the swinging of the frame work 582 and the turn-table 580 out of their operative position whenever it is desired. The turn-table 580 is divided into a plurality of successive sections 590. Each section is provided with a pair of transfer bar holding members 592 adapted to hold the transfer bar T in position for engagement by the transfer bar engaging levers 506 of the fabric blank transfer mechanism, in order to transfer the blank on said transfer bar onto the needles of the knitting machine in the manner hereinbefore described.

As will more clearly appear from Figure 1, the turn-table 580 is mounted to revolve about an axis 594 fixed to the supporting frame work 582 but is held against rotating movement by means of a holding pawl 596 pivoted as at 597 to the frame work 582 and normally urged by the action of a spring 598 in engagement with any one of a plurality of abutments 600 formed at spaced points on the edge of a disc 602 rigid with said turn-table. It is to be noted that the number of abutments 600 correspond to the number of transfer bar holding sections into which the turn-table 580 is divided, and that the spacing of said abutments is predetermined so that said sections may be successfully maintained in proper relation with respect to the transfer bar engaging levers 506 of the fabric blank transfer mechanism.

The holding pawl 596, as will be described hereinafter, is adapted to be moved to free the turn-table for its rotation. The turn-table is rotated by means of a pawl and ratchet device 604 comprising a ratchet wheel 606 and spring pressed pushing pawl 608. The pawl 608 is suitably mounted on a lever 610 which is pivotally supported at 611 on framework 582 to oscillate thereon, as indicated by the arrows M and N in Figure 1. The lever 610 is resiliently connected to a rod 612 which is provided with spaced collars 614 and 615, the lever 610 being disposed to be engaged by the innermost collar 614, a spring 616 being interposed between said lever and the outermost collar 615.

The free end of the rod 612 is attached to a bell crank lever 618 pivoted to the machine frame, as at 619, and connected by means of a link 620 to an arm 622 pivotally mounted, as at 623, on the machine frame for horizontal rocking motion. The intermediate portion of the arm 622 is provided with a roller 624 disposed to extend between relatively spaced annular discs 626 and 627 rigidly fastened on the main cam shaft 18. Because of this construction, it will be understood that with every shifting motion of the main cam shaft 18, the arm 622 will be oscillated and thus actuate the pushing pawl 608 through the link, lever, and rod connection above described, to operate the ratchet wheel 606 and, accordingly, rotate the turn-table 580 step by step in the direction of arrow K in Figure 1. It is to be noted that the rear end portion of the arm 622 is connected by means of a link 628 and lever 630 to a hydraulic shock absorber 632 of any suitable known construction. In this manner, it is possible to check, in an advantageous way, the back and forth movements of the main cam shaft 18.

The ratchet wheel 606 may be locked in position after each step by step movement by means of a spring actuated locking pawl 634 pivoted as at 635 to the framework 582. During the actuation of the pushing pawl 608 on the ratchet wheel 606 to rotate the turn-table 580, the end 636 of the holding pawl 596 rides on the smooth edge of the disc 602. When the next abutment 600 on said edge is brought in position to contact the end 636 of the holding pawl 596, the corresponding transfer bar section 590 of the turn-table 580 reaches its proper position for cooperation with the fabric blank transfer mechanism.

Upon reaching that position, the turn-table 580 is adapted to be held stationary and, therefore, the action of the pushing pawl 608 must be disrupted. For that purpose, the ratchet wheel 606 is capable of rotating relatively to the turn-table. This feature may be had, as shown in the drawings, by mounting the ratchet wheel 606 freely between spaced flanges 640 and 641 rigid with said turn-table, and by providing slots 642 in the ratchet wheel 606 through which extend pins 644 suitably fixed on the flange 641. Springs 646 are introduced in the slots 642 to bear against the normal rear portion of the pins 644 and corresponding portion of the slots 642. By reason of this construction, when the holding pawl 596 prevents further rotation of the turn-table 580, the pushing pawl 608 will continue to act on the ratchet wheel 606 to advance the same one or more steps, the springs 646 yielding under the resultant force until the

pins 644 reach a point relative to the end of the slots 642 which prevents movement of said ratchet wheel. At that point, the resistance of the spring 616 on the rod 612 is overcome so that the pushing pawl carrying lever 610 becomes inactive. Therefore, any subsequent movement of the rod 612 in the directions indicated by arrows H and J in Figure 1 will have no effect on the pushing pawl lever 610 because of the yielding connection therebetween. This condition persists until the holding pawl 596 is again moved to free the turn-table 580.

It is particularly to be noted that the holding pawl 596 and locking pawl 634 co-function to hold the turn-table fixed so that there is no danger of the transfer bar section 590 becoming displaced with respect to the transfer bar engaging levers 506 of the fabric blank transfer mechanism.

VII. Drive Mechanism

The several motions which the machine must undergo to perform its various functions are imparted through rotation of the main cam shaft 18 which is adapted to be driven at times at a relatively high rate of speed, and at other times at a reduced rate of speed in the general direction indicated by the arrow L in Figs. 4 and 5. For that purpose, there are provided a high speed motor 650 and a low speed motor 652 respectively mounted on suitable portions of the machine. The high speed motor 650 carries a gear 654 enmeshed with a second gear 565 fixed onto a stub shaft 658 supported in suitable bearings on the machine frame.

Also fixed onto the stub shaft 658 is a third gear 660 enmeshed with a fourth gear 662 keyed, or otherwise secured, on the main cam shaft 18. The low speed motor 652 also carries a gear 664 enmeshed with the gear 656 which, of course, imparts rotation to the main cam shaft 18 through gears 660 and 662.

Preferably a free-wheeling clutch 666 is interposed between the gear 664 and low speed motor 652 so that, during the running of the high speed motor 650, the low speed motor shaft remains idle, although the gear 664 revolves.

Electric current is selectively supplied either to the high speed motor 650 or the low speed motor 652 by the function of a double pole magnetic switch 668 arranged on the machine frame and controllable from the pattern control mechanism of the machine, as will later appear.

In Figure 38, there is diagrammatically shown an electrical circuit illustrating a possible way of selectively supplying current to the motors. The current from the feed lines 670 in which a line switch 671 may be interposed, is controlled by means of a manually operable master switch 672 adapted, by the function of a single pole magnetic switch 673 associated therewith, to start and stop the machine.

The line switch 671 and the single pole magnetic switch 673 being closed, the current may then flow to the high speed motor 650, or to the low speed motor 652. The pole may be reversed by actuation of a limit switch 674 under control of the pattern control mechanism.

It is to be noted that all the cams on the main cam shaft 18, with the exception of the Coulier cam 158 which is loosely mounted on said main cam shaft and held against shifting movement therewith, are rotated with, and at the same rate of speed as, said main cam shaft. The Coulier cam 158 is adapted to be rotated through an individual gearing and, for that purpose, is provided with a hub 676 having diametrically opposed recesses 678 formed for engagement with a projection 680 integral with the hub 681 of a gear 682 mounted for free rotation on the main cam shaft 18, but for shifting movement therewith. As will more clearly appear from Figure 15, the hub 681 is hollowed out and fitted over a bushing 683 keyed, or otherwise fixed, to the main cam shaft 18. The gear 682 may be maintained in engagement with the bushing 683 by means of a flange 685 formed with one side of the hub 681 and by means of a ring 687 suitably fixed to the other side of said hub. The Coulier cam 158 is held against shifting movement preferably by means of a split collar 689 freely engaging the hub 676 and secured to a suitable support on the machine frame. The gear 682 engages another gear 684 secured to the stub shaft 658 carrying the driving gears 656 and 660. The Coulier cam gear 682 is also in engagement with a gear 686 carried by the hand wheel shaft 20 so that, upon rotation of the hand wheel 688 on said shaft, the Coulier cam 158 and the cam shaft 18 may be rotated by hand, for the purpose to be subsequently stated.

It is pointed out that the gear 684 is smaller than the gear 660 so the Coulier cam gear 682 is rotated at one-half the speed of the main cam shaft 18. It is moreover pointed out that, since the Coulier cam 158 is held against the shifting movement of the main cam shaft 18, and the gear 682 is adapted to shift with said cam shaft, the Coulier cam will remain stationary whenever the main cam shaft shifts in the direction of the arrow A in Figure 3, because such shifting disengages the projection 680 from the recess 678, thereby temporarily destroying the connection between the gear 682 and the Coulier cam 158.

In order to assure positive arrest of the Coulier cam 158 immediately upon its disengagement with the gear 682 and, further, assure re-engagement of the projection 680 with said Coulier cam, there is provided a brake arrangement 690 consisting of a brake shoe 692 disposed about a portion of the peripherial edge of the Coulier cam 158 and having one end fixed to an arm 694 pivoted to the machine frame, as indicated at 695. The other end of the brake shoe 692 is resiliently connected by means of a spring 696 attached to a lever 698, in turn connected to the arm 694.

Bearing against the lever 698 is the end 700 of a bell crank lever 702 pivoted, as at 703, to the machine frame, the other end 704 of said bell crank lever carrying a roller 705 disposed for contact with the face of a cam on the main cam shaft, for instance, the catch bar lifting cam 194. Thus, as shown in Figure 16, it will be appreciated that, with the shifting of the main cam shaft 18 in the direction of arrow A, the cam 194 urges the bell crank lever 702 to the position shown in dotted lines, accordingly displacing the lever 698 to actuate the brake shoe 692 and, accordingly, holding the Coulier cam 158 against free rotation.

VIII. Pattern Control Mechanism

The various mechanisms of the machine so far referred to are intended to be controlled automatically through the function of the pattern control mechanism which will now be described.

As shown in the drawings, the pattern control

mechanism essentially comprises a pattern chain 706 having sets of buttons 710 arranged thereon according to a definite plan, and disposed to act at precise moments on a set of jacks 712 conveniently pivoted on the machine adjacent said chain, as shown at 713, and individually linked in the manner to be more fully stated hereinafter to said various mechanisms of the knitting machine.

The pattern chain 706 engages a rotatable drum 714 rotatably supported on a shaft 716 mounted in bracket 717 secured on the machine frame. The pattern chain is guided in its movement by means of suitable pulleys 718 arranged at convenient points on the machine frame.

Movement is imparted to the drum 714 by actuation of a pawl and ratchet arrangement 720 consisting of a ratchet wheel 722 rigid with said drum, and a pawl 724 carried by an arm 726 pivoted on the drum supporting shaft 716.

Adapted for contact with the arm 726 is an oscillating lever 728 pivoted on the machine frame, as shown at 729, and carrying a roller 730 disposed for riding engagement with a cam 732 on the main cam shaft 18. Positive engagement between the roller 730 and cam 732 is assured by means of a spring 734 connected to the lever 728 and to the machine frame.

It will be noted that the roller 730 is somewhat wider than the cam 732 so that constant engagement therebetween exists regardless of the shifted position of the main cam shaft 18.

From the preceding description, it will appear that rotation of the cam 732 with the main cam shaft 18 causes oscillation of the lever 728 which, in turn, oscillates the arm 726, thereby actuating the pawl and ratchet arrangement 720 to advance the pattern chain 706 step by step at each revolution of said main cam shaft.

As illustrated in the drawings, and as will more clearly appear from Figure 9, the set of jacks 712 includes eight jacks, respectively designated by the reference characters 712*a* to 712*h* inclusive, each jack being normally urged into its inactive position by means of springs 736.

The jack 712*a* is connected by means of a rod 738 to the latch 444 controlling the function of the yarn clamping and cutting device 390 hereinbefore described, so that whenever a button 710 on the pattern chain 706 is brought in position to move said jack 712*a*, the same exerts a pull on the latch 444 so that the yarn clamping and cutting device is free to function as stated.

The jack 712*b* is connected by means of a link 740 and a lever 742 to the shifting rod 34 to which are affixed the shifting forked levers 520 and 560 of the fabric blank transfer mechanism, the shifting forked arm 88 of the needle device 38, and the shifting forked arm 236 of the knock over device 44. The lever 742 is pivoted as at 743 on a suitable support on the machine frame. It will be noted particularly from Figure 2 that the connection between the jack 712*b* and the shifting rod 34 is yieldable and, for that purpose, there are provided on said rod 34 a pair of spaced collars 744 and 745 between which the lever 742 is slidably engaged, a spring 746 being disposed between the collar 745 and the corresponding face of said lever 742. Therefore, whenever a button 710 on the pattern chain 706 is brought in position, to move the jack 712*b*, the same will pivot the lever 742 compressing the spring 746 which may then act to shift the rod 34 in the direction of arrow Q.

The jack 712*c* is connected by means of a rod 748 to the pivotal latch 364 of the fabric narrowing mechanism in order to actuate the same for its narrowing function, whereas the jack 712*d* is connected by means of a link 750 to pivotal arms 752 and 753 interconnected through a shaft 754, and of a rod 756 to the latch 384 controlling the automatic resetting of said fabric narrowing mechanism.

The jack 712*e* is connected by means of a rod 758 to the latch 104 of the loose course control means to automatically actuate the same.

The jack 712*f* is connected by means of a link 760, of a bell crank lever 762, and of a rod 764 to the turn-table holding pawl 596 to control the same automatically.

The jack 712*g* is provided with an extension 766 disposed to actuate the switch 674 for the purpose of changing the pole of the double pole magnetic switch 668 in order to direct current either to the high speed motor 650 or to the low speed motor 652.

The jack 712*h* is connected by means of the usual rod linking arrangement (not shown) to the cam shaft shifting roller 768 acted upon by the controlling cam 770 and cooperating with the shifting cams 772 and 773 on the main cam shaft 18 for the purpose of shifting said main cam shaft to and from knitting and narrowing or loop transfer positions.

The Sequence of Operation of the Knitting Machine

As hereinbefore stated, the machine herein described is devised to knit heel tabs into a combination full-fashioned leg and foot blank. Such a blank has been shown in Figure 24.

As shown in said Figure 24, the blank 800 comprises a leg 802 having reinforced high heel portions 804, and a foot 806 having reinforced sole portions 808 which are formed by continuous knitting to constitute a combination leg and foot blank. Between the leg and foot portions of the blank, there are provided non-reinforced courses 810 which serve to form a line of demarcation between those portions of the last course of the foot fabric and the first course of the sole fabric into which the heel tabs are subsequently to be knitted.

In accordance with the invention, the last course 812 of the reinforced high heel portions, and the first course 814 of the reinforced sole portions are topped onto a special topping stand, for instance, a topping stand as shown and described in my co-pending application Serial Number 140,004, filed April 30, 1937, now Patent No. 2,267,528, that is, the last course 812 of the reinforced high heel portions 804 and the first course 814 of the reinforced sole portions 808 are first topped in paralleling relationship; then the interposed non-reinforced courses 810 are cut (preferably by means of knives K on the special topping stand); and finally, the topped courses are positioned into straight line relationship so that said courses may be placed onto the points P of the rigid transfer bar T. This topping operation is performed manually by the operator, who may then place the transfer bar T with the topped blank thereon in position on the transfer bar holding members 592 provided on the successive sections 590 of the turn-table 580 on the knitting machine.

Before starting the knitting machine, the same may be adjusted properly, if needed, by manually setting the fabric narrowing mechanism to

its starting position, which may be done readily by rotating the progressively narrowing motion device 302 to bring the stepped cylinders 304a and 304b in position to hold the narrowing combs 298a and 298b in their starting position and by manipulating a hand wheel 299 affixed to the carrier narrowing spindle 30 to bring the stepped discs 334a and 334b in position for locating the carrier bars 124a and 124b to hold the yarn carriers 108a and 108b in their starting position.

If necessary, the pattern control mechanism may also be adjusted to its starting position by means of the hand wheel 688 on the shaft 20 carrying the gear 686 in engagement with the Coulier cam gear 682 operatively associated with the main cam shaft 18 on which is secured the pattern chain working cam 732.

The turn table 580 is moved into a position wherein one section 590 thereof with the filled transfer bar T held thereby, lies in front of the transfer bar engaging members 592 of the blank transfer mechanism 448 on the knitting machine. The knitting machine thus adjusted, the master switch 672 is manually operated to start the machine, the double pole magnetic switch 668 being set so that current will flow to the low speed motor 652 causing the main cam shaft 18 to rotate at reduced speed, accordingly causing the machine to run slowly.

At the start of the knitting machine, the main cam shaft 18 is in its normal knitting position, but the carriers 108a and 108b are held in their extreme outermost positions by means of the locking levers 396a and 396b respectively so that, with the rotation of the main cam shaft, said carriers will be prevented from laying their yarns and, therefore, no knitting will actually take place, although the machine will go through a knitting cycle.

At the initial motion of the main cam shaft 18, a button 710 on the pattern chain 706 lifts the jack 712b for the actuation of the shifting rod 34. With the shifting of said rod 34, the rollers 514 and 552 of the fabric blank transfer mechanism 448 are moved in alignment with their respective active cams 516 and 554; the roller 78 of the needle bar device 38 is moved in alignment with the auxiliary presser cam 84; and the roller 226 of the knockover bit device 44 is moved in alignment with the auxiliary knockover cam 232. Therefore, during the revolution of the main cam shaft 18, the cam 516 causes the angular levers 506 to drop from their neutral position to a position adjacent the end of the transfer bar T.

At the same time, the cam 554 causes the levers 546 first to open and then to close the latches 538 so that said transfer bar becomes rigidly engaged with said latches. The cam 516 then acts to rotate the shaft 32 moving the segments 510 and gears 508 thus imparting rotation to the shaft 22 and, accordingly, swinging the levers 506 to bring the transfer bar T from the turn table 580 to a position where the transfer points P of said transfer bar register with the needles 48 of the knitting machine. At that time, the auxiliary presser cam 84 moves the needles so that the same press against the transfer points and the auxiliary knockover cam 232 moves the knockover bits 298 to a position lower than customary thereby providing clearance for the transfer of the fabric blank 800 from the points of the transfer bar onto the needles of the knitting machine. It is pointed out that during the transfer of the fabric blank from the points of the transfer bar to the needles of the knitting machine the Coulier cam rotates since the main cam shaft is in knitting position. This rotation of the Coulier cam, however, has no effect on the yarn carriers 108a and 108b because they are held against movement by the locking levers 396a and 396b, but does act on the slur cock bars 146a and 146b to cause the sinkers 134a and 134b to advance in position over the fabric as shown in Figure 10 where, in cooperation with the dividers advanced to that same position by actuation of their advancing means in the manner hereinbefore stated, they function to hold down the fabric for its transfer to the needles.

Following the transfer of the fabric, the cam 516 causes the angular levers 506 to return to their position adjacent the turn table 580 whereupon the cam 554 causes the levers 546 to open the latches 538 so that the empty transfer bar is deposited onto the turn table which, during the fabric transfer operation, is held stationary by function of the holding pawl 596. After the depositing of the empty transfer bar, the cam 516 causes the angular levers 506 to be lifted to their neutral position where they remain until the next fabric blank transfer operation is to take place. By the time the angular levers 506 reach their neutral position, the knitting machine operates to rotate the spindle 30 thereby actuating the stepped discs 334a and 334b and accordingly sliding the sleeves 392a and 392b which brings the depressions 394 out of registration with the pins 398 so that the lever 396a and 396b release the yarn carriers 108a and 108b. At substantially the same time the rod 34 is shifted so that the roller 552 leaves the cam 554; the roller 514 engages the idling cam 518; and the rollers 78 and 226 respectively engage their regular normal knitting cams 80 and 228.

As the machine is set for normal knitting, a button on the pattern chain lifts the jack 712g which actuates the switch 674 reversing the pole of the double pole magnetic switch 668 so that current then flows to the high speed motor 650, causing the machine to move at high speed. At approximately the same time, another button on the pattern chain lifts the jack 712f, which actuates the holding pawl 596 and releases the turn table 580. Thus it will be understood that, since the main cam shaft 18 is already in knitting position, the Coulier cam 158 and its driving gear 682 are in engagement, the brake shoe 692 is released, the roller 292 of the loop transfer mechanism rides on the idling cam 294, the dipping rollers 250 ride on their idling cams 196 and 254, the yarn tension roller 116 rides on its active cam 118, the roller 192 of the yarn sinking device 42 rides on the catch bar lifting cam 194, the roller 178 rides on the knitting catch bar cam 180, the roller 218 of the knockover device 44 rides on the knitting forward knockover lifting cam 228, the roller 58 of the needle device 38 rides on the knitting cam 60, the roller 78 rides on the normal knitting presser cam 80, and the roller 92 rides on the presser regulating cam 94. The machine may then knit heel tab courses onto the high heel portions of the blank in engagement with the knitting needle groups 48a and 48b.

In accordance with the preferred form of the invention, the loops 813 of the first course 814 of the sole portions 808 of the blank 800 in engagement with the non-knitting needle group 48c are adapted to be transferred for a predetermined number of needles as the knitting of the

courses 815 of the heel tabs 816 progresses, in order to effect an interknit overlapping connection 818 between said sole portions 808 and heel tabs 816. For that purpose, after the knitting of each course of the heel tabs, a button 710 on the pattern chain 706 which, as already stated, advances one step with each revolution of the cam shaft 18, is brought to raise the jack 712*h*, bringing the shifting roller 768 into cooperative relation with the shifting cam 773 for the shifting of the main cam shaft 18. This shifting of the main cam shaft disrupts the knitting mechanism and sets the loop transfer mechanism for operation, that is to say, the Coulier cam 158 and its driving gear 682 are disconnected. The brake shoe 692 is applied to said Coulier cam in the manner already stated. The roller 292 of the loop transfer mechanism leaves the idling cam 294 and engages the active cam 296; the dipping rollers 250 leave the idling cams 196 and 254 and engage their active cams 252 and 256; the yarn tension roller 116 leaves the active cam 118 and engages its neutral cam 120; the roller 178 leaves the knitting catch bar cam 180 and engages the narrowing catch bar cam 182; the roller 192 leaves the catch bar lifting cam 194 and engages the associated idling cam 196; the roller 218 leaves the knitting forward knockover cam 220 and engages the narrowing forward knockover cam 222; the roller 226 leaves the normal knitting knockover lifting cam 228 and engages the normal narrowing knockover lifting cam 230; the roller 58 leaves the needle bar knitting cam 60 and engages the needle bar narrowing cam 62; the roller 78 leaves the normal knitting presser cam 80 and engages the normal narrowing presser cam 82; the roller 92 leaves the knitting presser regulating cam 94 and engages the narrowing presser regulating cam 96. The roller 514 of the blank feeding device, however, remains in engagement with the idling cam 518 since said cam is relatively wider than said roller.

With the main cam shaft 18 in its shifted narrowing position, it will be appreciated that, during the following rotation of said main cam shaft, the machine operates to pick the loops 813 off the non-knitting needles 48*c* and transfer them for the required number of needles so that certain of said loops are deposited over certain loops on the knitting needles 48*a* and 48*b*. Following the loop transfer operation of the machine, the main cam shaft 18 is returned to its normal knitting position and again functions to knit a course 815 in each heel tab 816, which causes the interknitting of the transferred loops with the heel tab courses.

It is to be noted that the operation of the loop transfer mechanism, as above described, does not cause the operation of the fabric narrowing mechanism, which is intended to operate only when the knitting has reached the point where the heel tabs 816 are to be narrowed in order to shape the same. Upon reaching that point, a button 710 on the pattern chain 706 shifts the jack 712*c* which, through its connecting rod 748, pivots the latch 364 to bring the same in position for the simultaneous function of the narrowing and loop transfer mechanisms in the manner hereinbefore explained.

It is also to be noted that, because of the connection between the turn table 580 of the blank feeding device and the main cam shaft, the repeated shifting of the latter causes, in the manner previously explained, the automatic rotation of said turn table which, as already stated, has been set free by actuation of the jack 712*f* following the fabric transfer operation.

After the required number of courses 815 has been knitted, to constitute the heel tabs 816, a button 710 on the pattern chain 706 lifts the jack 712*e* thus automatically actuating the loose course control means so that one or more loose courses may be knitted at the finishing edge of each heel tab. Following the knitting of the loose courses, the machine continues to knit without any transfer operation so that several ravelling courses 820 are formed as continuations of the heel tabs 816.

During the knitting of the ravelling courses 820, a series of buttons on the pattern chain are brought successively in position to maintain the jack 712*d* in raised position through actuation of the rod 756 in the direction of arrow C (Figure 3), thereby placing the latch 384 in operative position so that with each reciprocation of the slur bar 146*a*, the pawl and ratchet arrangements 320 and 348 of the fabric narrowing mechanism are operated to cause the automatic step by step return of the narrowing combs 298*a* and 298*b* and yarn carriers 108*a* and 108*b* to their original position by the time the several ravelling courses are knitted. At that time, the locking levers 396*a* and 396*b* engage the yarn carriers, holding the same against further yarn laying movement. At approximately the same time, a button 170 on the pattern chain 706 lifts the jack 712*g* which again actuates the switch 674, accordingly reversing the pole of the double pole magnetic switch 668 and, therefore, directing current to the low speed motor 652 so that the machine again runs at a reduced rate of speed. Thereupon, a button 170 on the pattern chain 706 lifts the jack 712*a* which displaces the latch 444, thus freeing the yarn clamping and cutting device 390 for operation by actuation of the cam 438, in the manner hereinbefore described, so that the fabric is pressed off the needles and allowed to drop, for instance, into a suitable receptacle 825, being guided therein by means of a chute 826 conveniently supported on the machine frame.

By the time the press-off operation has taken place, a button 170 on the pattern chain 706 lifts the jack 712*b*, permitting the rod 34 to shift and, therefore, automatically setting the machine for operation of the blank transfer mechanism, which places a new blank 800 on the needles 48 for the repeated knitting of the heel tabs thereonto, in the manner hereinbefore set forth.

What I claim is:

1. In a flat knitting machine: a mechanism operatively associated with the machine to feed prefabricated fabric blanks thereto, and means establishing a driving connection between said mechanism and machine to actuate the former through, and in timed relation with, the latter.

2. In a flat knitting machine: a mechanism operatively associated with the machine to transfer prefabricated fabric blanks thereto for the knitting of additional fabric thereon, and means establishing a driving connection between said mechanism and machine to actuate the former through, and in timed relation with, the latter.

3. In a flat knitting machine: mechanisms operatively associated with the machine to feed and transfer prefabricated fabric blanks thereto for the knitting of additional fabric thereon, and means establishing a driving connection between said mechanism and machine to actuate the former through, and in timed relation with, the latter.

4. In combination with a flat knitting machine intended to knit additional fabric onto prefabricated fabric blanks: a mechanism associated with said machine and operated thereby for automatically feeding the prefabricated fabric blanks thereto.

5. In combination with a flat knitting machine intended to knit additional fabric onto prefabricated fabric blanks: a mechanism associated with said machine and operated thereby for automatically transferring the prefabricated fabric blanks thereto.

6. In combination with a flat knitting machine intended to knit additional fabric onto prefabricated fabric blanks: mechanisms associated with said machine and operated thereby for automatically feeding and transferring the prefabricated fabric blanks thereto.

7. In a flat knitting machine having a bank of needles: a mechanism operatively associated with and operated by the machine to bring prefabricated fabric in position for engagement with said needles; and a mechanism also operatively associated with and operated by the machine to bring prefabricated fabric in position for engagement by the first mentioned mechanism.

8. In a flat knitting machine: a needle bar having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar; and a fabric blank transfer mechanism operatively associated with and operated by the machine and comprising transfer bar engaging means movable into registration with the needle bar.

9. In a knitting machine: a needle bar; a fabric blank transfer mechanism operatively associated with the machine and comprising transfer bar engaging means movable into registration with the needle bar; and a fabric blank feeding mechanism comprising transfer bar holding means movable for presenting a plurality of transfer bars in succession to the transfer bar engaging means of said fabric blank transfer mechanism.

10. In a knitting machine: a mechanism operatively associated with the machine to feed prefabricated fabric blanks thereto, said mechanism comprising a support having a plurality of fabric blank holding sections; and means operable to control said support to bring the sections thereof into position for the feeding of said blanks to the machine.

11. In a knitting machine: a mechanism operatively associated with the machine to feed prefabricated fabric blanks thereto, said mechanism comprising a turn table divided into a plurality of fabric blank holding sections; means connected to a driven part of the machine for operating the turn table to bring said sections thereof, in succession, into position for the feeding of said blanks to the machine; and means functioning for temporarily holding the turn table against operation by said operating means.

12. In a knitting machine: a mechanism operatively associated with the machine to feed prefabricated fabric blanks thereto, said mechanism comprising a turn table divided into a plurality of fabric blank holding sections; means connected to a driven part of the machine for operating the turn table to bring said sections thereof, in succession, into position for the feeding of said blanks to the machine; means functioning for temporarily holding the turn table against operation by said operating means; and means for controlling the function of said holding means.

13. In a knitting machine having a shiftable cam shaft; a mechanism operable to feed prefabricated fabric blanks to said machine, said mechanism comprising a turn table divided into a plurality of fabric blank holding sections; and means connected to said cam shaft and actuated through the shifting thereof for operating the turn table to bring said sections thereof, in succession, into position for the feeding of said blanks to the machine.

14. In a knitting machine having a shiftable cam shaft and a pattern chain: a mechanism operable to feed prefabricated blanks to said machine, said mechanism comprising a turn table divided into a plurality of fabric blank holding sections; means connected to said cam shaft and actuated through the shifting thereof for operating the turn table to bring said sections, in succession, into position for the feeding of said blanks to the machine; means functioning for temporarily holding the turn table against operation by said operating means; and means governed by said pattern chain for controlling the function of said holding means.

15. In a knitting machine having a shiftable cam shaft, a mechanism operable to feed prefabricated fabric blanks to said machine, said mechanism comprising a turn table divided into a plurality of fabric blank holding sections; a rocking arm connected to said cam shaft and actuated through the shifting thereof for operating the turn table to bring said sections, in succession, into position for the feeding of said blanks to the machine; and a shock absorber connected to said rocking arm and operable thereby to check the main cam shaft in its shifting movements.

16. In a knitting machine: a knitting mechanism including a needle bar and a knockover bit comb; a fabric transfer mechanism operatively associated with the machine to transfer prefabricated fabric blanks to said knitting mechanism and including transfer bar engaging means; and guide members disposed on the machine for engagement with said needle bar, knockover bit comb, and transfer bar engaging means for the aligned registration thereof in the transfer of the fabric blanks.

17. In a knitting machine: a mechanism operatively associated with the machine to transfer prefabricated fabric blanks thereto, said mechanism comprising a transfer bar engaging device; a cam for operating said device; and pattern means for controlling the operation of said device by the cam.

18. In a knitting machine having a pattern chain: a mechanism operatively associated with the machine to transfer prefabricated fabric blanks thereto, said mechanism comprising a transfer bar engaging device; a cam for operating said device; and means governed by said pattern chain to control the operation of said device by the cam.

19. In a knitting machine having a main cam shaft and a pattern chain: a mechanism operatively associated with the machine to transfer prefrabricated fabric blanks thereto, said mechanism comprising a transfer bar engaging device; a cam on said main cam shaft for operating said device; and means governed by said pattern chain to control the operation of said device by the cam.

20. In a knitting machine: a knitting mechanism comprising a needle device and a yarn feeding device, said needle device including a needle

bar provided with two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have prefabricated fabric blanks transferred thereon, and said yarn feeding device including yarn carriers for laying yarn simultaneously in opposite directions for the knitting of courses as continuations of said blank portions transferred on the knitting needles; a loop transfer mechanism including a set of transfer combs associated with the non-knitting needles and operable to pick up the loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; a fabric narrowing mechanism including a set of narrowing combs associated with a number of knitting needles for transferring the loops thereon to narrow certain of said courses; a mechanism comprising a carrier locking device and a yarn clamping and cutting device, said carrier locking device including means engageable with said carriers to arrest the same in their yarn laying function, and said yarn clamping and cutting device including yarn engaging means operable to engage the yarn and cut the same while the carriers are arrested by said carrier locking device; a fabric blank transfer mechanism comprising transfer bar engaging means movable into registration with the needle bar for the transfer of said fabric blank onto the needles; a fabric blank feeding mechanism comprising transfer bar holding means movable for presenting a plurality of transfer bars in succession to the transfer bar engaging means of said fabric blank transfer mechanism; a drive mechanism comprising a main cam shaft, and cams on said shaft for imparting movement to said mechanisms; and a pattern mechanism actuated by the main cam shaft for controlling said mechanisms in their actuation by said cams during the continuous operation of the knitting machine.

21. In a knitting machine of the character described, a set of knitting needles and a set of non-knitting needles adapted to have a prefabricated knitted fabric blank topped thereon, means for knitting courses as a continuation of the fabric blank topped on the knitting needles, means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting said loops with certain loops of said courses during the knitting thereof, and mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles.

22. In a knitting machine for producing an insert element in a prefabricated knitted fabric blank by knitting said element to a course portion of the blank, and successively transferring loops of another course portion of the blank to loops of said element as the element is knitted, the combination of loop forming and positioning mechanism comprising transfer point means and a loop manipulating implement structure including a plurality of implement groups, the loops of said first course portion to be topped onto the implements of one of said groups, and the loops of said other course portion to be topped onto the implements of another of said groups, means for actuating and controlling said loop forming and positioning mechanism providing for knitting on said first group and transferring loops from said other group to loops formed on said first group, and mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said implement groups.

23. In a knitting machine for producing an insert element in a prefabricated knitted fabric blank by knitting said element to a course portion of the blank, and successively transferring loops of another course portion of the blank to loops of said element as the element is knitted, the combination of loops manipulating and fashioning mechanism comprising transfer point means, narrowing point means, and a loop manipulating implement structure including a plurality of implement groups, the loops of said first course portion to be topped onto the implements of one of said groups and the loops of said other course portion to be topped onto the implements of another of said groups, means for actuating and controlling said loop manipulating and fashioning mechanism providing for knitting and narrowing on said first group and transferring loops from said other group to loops formed on said first group, and mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said implement groups.

24. In a flat knitting machine having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar: a mechanism operatively associated with the machine and provided with means for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto.

25. In a knitting machine intended to knit additional fabric onto prefabricated fabric blanks: a knitting mechanism including needles and a device for feeding yarn thereto; a mechanism operable for locking said device to prevent the latter from feeding yarn to the needles; a prefabricated fabric blank transfer mechanism for engaging said blanks in succession with the needles of the knitting mechanism; a control mechanism including means for the alternate actuation of said knitting and device locking mechanisms; and means for the actuation of said transfer mechanism between the actuation of the device locking mechanism and the actuation of the needles of the knitting mechanism during the continuous operation of the knitting machine.

26. In a knitting machine intended to knit additional fabric onto prefabricated fabric blanks: a knitting mechanism including needles and a device for feeding yarn thereto; a mechanism operable for locking said device to prevent the latter from feeding yarn to the needles; a prefabricated fabric blank transfer mechanism for engaging said blanks in succession with the needles of the knitting machine; a control mechanism including means for the alternate actuation of said knitting and device locking mechanisms; means for the actuation of said transfer mechanism between the actuation of the device locking mechanism and the actuation of the needles of the knitting mechanism; and a drive mechanism common to said knitting, device locking, transfer, and control mechanisms for the operation thereof during the continuous operation of the machine.

27. In a knitting machine: a knitting mechanism comprising a needle device and a yarn feeding device, said needle device including a needle bar having two sets of needles, and said yarn feeding device including a yarn carrier movable for supplying yarn to one set of needles for the knitting of a fabric thereon, and a yarn carrier movable for supplying yarn to the other set of needles for the knitting of a fabric thereon; a mechanism comprising a carrier locking device

and a yarn clamping and cutting device disposed in relation to each set of needles for cooperation with the associated yarn carrier to lock the same against movement and to clamp and cut the yarn supplied thereby for causing the simultaneous pressing off of both fabrics from said sets of needles; and a control mechanism for the alternate actuate of said mechanisms during the continuous operation of the machine.

28. In a knitting machine: a carrier bar reciprocating in a uniform stroke in opposite directions; a yarn carrier having constant frictional engagement with said bar for normally reciprocating therewith in either direction; means disposed in the path of movement of the yarn carrier for overcoming its frictional engagement with the carrier bar and thus arrest the carrier in the course of its normal stroke in one direction while the carrier bar completes its stroke in said one direction; and means engageable at times with the carrier to overcome its frictional engagement with the carrier bar and thus prevent the carrier from movement with the carrier bar stroke in either direction.

29. In a knitting machine: a yarn carrier bar having a constant uniform reciprocating stroke; a yarn carrier frictionally mounted on said bar for normally moving in a constant uniform reciprocating stroke therewith; stationary means disposed in the path of movement of the yarn carrier for arresting the latter at the same point in the course of its normal stroke in one direction while the yarn carrier bar completes its stroke in that one direction; movable means disposed in the path of movement of the yarn carrier for arresting the latter at various points in the course of its normal stroke in the other direction while the yarn carrier bar completes its stroke in that other direction; and locking means engageable with the yarn carrier to overcome its frictional engagement with the carrier bar and thus prevent the yarn carrier from movement with the carrier bar in either direction.

30. In a knitting machine of the character described, knitting mechanisms including a set of knitting needles and a set of non-knitting needles adapted to have prefabricated knitted fabric blanks topped thereon, means for knitting courses as a continuation of the fabric blank topped on the knitting needles, and means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting said loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft adapted for rotatable longitudinal shiftable movements for operation of said mechanisms, and a Coulier cam on said shaft mounted for rotation independently of the rotatable movement of the shaft and supported fixedly in relation to the longitudinal shiftable movement thereof.

31. In a knitting machine of the character described, knitting mechanism including a set of knitting needles and a set of non-knitting needles adapted to have prefabricated knitted fabric blanks topped thereon, means for knitting courses as a continuation of the fabric blank topped on the knitting needles, and means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting said loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft adapted for rotatable movement, a Coulier cam on said shaft mounted for rotation independently of the rotatable movements of the latter, means for driving said cam shaft at a certain rate of speed, and means for driving said Coulier cam at a rate of speed different from that of the main cam shaft.

32. In a knitting machine of the character described, knitting mechanism including a set of knitting needles and a set of non-knitting needles adapted to have prefabricated knitted fabric blanks topped thereon, means for knitting courses as a continuation of the fabric blank topped on the knitting needles, and means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting said loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft adapted for rotatable longitudinal shiftable movements, a Coulier cam on said shaft mounted for rotation independently of the rotatable movement of the shaft and supported fixedly in relation to the longitudinal shiftable movement thereof, a gearing for driving said cam shaft at a certain rate of speed, and gearing for driving said Coulier cam at a rate of speed different from that of the main cam shaft and having a gear mounted for free rotation on said cam shaft but adapted for longitudinal shiftable movement therewith and provided with means establishing a detachable connection with the Coulier cam for disconnecting said gear from the Coulier cam with the longitudinal shifting of the cam shaft.

33. In a knitting machine: a knitting mechanism comprising a needle device and a yarn feeding device, said needle device including a needle bar provided with two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have prefabricated fabric blanks transferred thereon, and said yarn feeding device including yarn carriers for laying yarns simultaneously in opposite directions for the knitting of courses as continuations of said blank portions transferred on the knitting needles; a loop transfer mechanism including a set of transfer combs associated with the non-knitting needles and operable to pick up the loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; a fabric narrowing mechanism including a set of narrowing combs associated with a number of knitting needles for transferring the loops thereon to narrow certain of said courses; a mechanism comprising a carrier locking device and a yarn clamping and cutting device, said carrier locking device including means engageable with said carriers to arrest the same in their yarn laying function, and said yarn clamping and cutting device including yarn engaging means operable to engage the yarn and cut the same while the carriers are arrested by said carrier locking device, a cam for operating said yarn clamping and cutting device, and pattern means for controlling the operation of said device by the cam.

34. In a knitting machine: a knitting mecha-

nism comprising a needle device and a yarn feeding device, said needle device including a needle bar provided with two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have prefabricated fabric blanks transferred thereon, and said yarn feeding device including yarn carriers for laying yarns simultaneously in opposite directions for the knitting of courses as continuations of said blank portions transferred on the knitting needles; a loop transfer mechanism including a set of transfer combs associated with the non-knitting needles and operable to pick up the loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; a fabric narrowing mechanism including a set of narrowing combs associated with a number of knitting needles for transferring the loops thereon to narrow certain of said courses; a mechanism comprising a carrier locking device and a yarn clamping and cutting device, said carrier locking device including means engageable with said carriers to arrest the same in their yarn laying function, and said yarn clamping and cutting device including yarn engaging means operable to engage the yarn and cut the same while the carriers are arrested by said carrier locking device, means operable for controlling the operation of said device by the cam, and a pattern chain arrangement for governing the operation of said means.

35. In a knitting machine having a main cam shaft and a pattern chain: a knitting mechanism comprising a needle device and a yarn feeding device, said needle device including a needle bar providd with two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have prefabricated fabric blanks transferred thereon, and said yarn feeding device including yarn carriers for laying yarns simultaneously in opposite directions for the knitting of courses as continuations of said blank portions transferred on the knitting needles; a loop transfer mechanism including a set of transfer combs associated with the non-knitting needles and operable to pick up the loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; a fabric narrowing mechanism including a set of narrowing combs associated with a number of knitting needles for transferring the loops thereon to narrow certain of said courses; a mechanism comprising a carrier locking device and a yarn clamping and cutting device, said carrier locking device including means engageable with said carriers to arrest the same in their yarn laying function, and said yarn clamping and cutting device including yarn engaging means operable to engage the yarn and cut the same while the carriers are arrested by said carrier locking device, a cam on the main cam shaft of the knitting machine for operating the yarn clamping and cutting device, and means governed by the pattern chain of the knitting machine to control the operation of the yarn clamping and cutting device by the cam.

36. In a knitting machine of the character described, knitting mechanisms including a set of knitting needles and a set of non-knitting needles adapted to have a prefabricated knitted fabric blank topped thereon; means for knitting courses as a continuation of the fabric blank topped on the knitting needles; means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft shiftable from one position to another for the operation of said mechanisms, a rocking arm extending at substantially right angles to said main cam shaft, means provided on the main cam shaft for engagement with said arm, and a shock absorber connected to said arm whereby to check said main cam shaft in its shifting movements.

37. In a knitting machine of the character described, knitting mechanisms including a set of knitting needles and a set of non-knitting needles adapted to have a prefabricated knitted fabric blank topped thereon; means for knitting courses as a continuation of the fabric blank topped on the knitting needles; means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft shiftable from one position to another for the operation of said mechanisms, a rocking arm pivoted at one end portion and at substantially right angles to said main cam shaft, means provided on the main cam shaft for engagement with the intermediate portion of said arm, and a shock absorber connected to the other end of said arm whereby to check the main cam shaft in its shifting movements.

38. In a knitting machine of the character described, knitting mechanisms including a set of knitting needles and a set of non-knitting needles adapted to have a prefabricated knitted fabric blank topped thereon; means for knitting courses as a continuation of the fabric blank topped on the knitting needles; means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft, a high speed motor, a low speed motor, gearings between said motors and the main cam shaft, and pattern control means operable during the continuous operation of the machine for the alternate operation of the high speed motor to actuate said knitting mechanisms and of the low speed motor to actuate said blank feeding and topping mechanisms.

39. In a knitting machine of the character described, knitting mechanisms including a set of knitting needles and a set of non-knitting needles adapted to have a prefabricated knitted fabric blank topped thereon; means for knitting courses as a continuation of the fabric blank topped on the knitting needles; means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting loops with certain loops of said courses during the knitting thereof; mechanisms operatively associated with the machine to feed prefabricated knitted fabric blanks and top the latter successively onto said needles; and a drive including a main cam shaft, a high speed motor, a low speed motor, gearings between said motors and the main cam shaft, a riding clutch interposed between said

low speed motor and gearings, and pattern control means operable during the continuous operation of the machine for the alternate operation of the high speed motor to actuate said knitting mechanisms and of the low speed motor to actuate said blank feeding and topping mechanisms.

40. In a flat knitting machine having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar, a mechanism for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto; and means for operating in timed relation said needles and mechanism including a rotatable longitudinal shiftable main cam shaft and a Coulier cam on said shaft mounted for rotation independently of the rotatable movement of said shaft and supported fixedly in relation to the longitudinal shiftable movement thereof.

41. In a flat knitting machine having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar, a mechanism for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto; and means for operating in timed relation said needles and mechanism including a rotatable longitudinal shiftable main cam shaft and a Coulier cam on said shaft mounted for rotation independently of the rotatable movement of said shaft and supported fixedly in relation to the longitudinal shiftable movement thereof, means for driving said cam shaft at a certain rate of speed, and means for driving said Coulier cam at a rate of speed different from that of the main cam shaft.

42. In a flat knitting machine having a bank of needles adapted to have prefabricated deposited thereonto by means of a separate transfer bar, a mechanism for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto; and means for operating in timed relation said needles and mechanism including a rotatable longitudinally shiftable main cam shaft and a Coulier cam on said shaft mounted for rotation independently of the rotatable movement of said shaft and supported fixedly in relation to the longitudinal shiftable movement thereof, a gearing for driving said cam shaft at a certain rate of speed, and gearing for driving said Coulier cam at a rate of speed different from that of the main cam shaft and including a gear mounted for free rotation on said cam shaft but adapted for longitudinal shiftable movement therewith and having means establishing a detachable connection with the Coulier cam for disconnecting said gear from the Coulier cam with the shifting of the cam shaft.

43. In a flat knitting machine having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar, a mechanism for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto; and means for operating in timed relation said needles and mechanism including a rotatable longitudinally shiftable main cam shaft, a high speed motor, a low speed motor, gearings between said motors and the main cam shaft, and pattern control means operable during the continuous operation of the knitting machine for the alternate operation of said motors.

44. In a flat knitting machine having a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar, a mechanism for grasping the transfer bar to bring the same in position for engagement with said needles for depositing the prefabricated fabric thereonto; and means for operating in timed relation said needles and mechanism including a rotatable longitudinally shiftable main cam shaft, a high speed motor, a low speed motor, gearings between said motors and the main cam shaft, a riding clutch interposed between said low speed motor and gearings, and pattern control means operable during the continuous operation of the knitting machine for the alternate operation of said motors.

45. In a knitting machine: a pair of carrier bars reciprocating in uniform strokes in opposite directions towards and away from each other; a pair of yarn carriers each having constant frictional engagement with one of said bars for normally reciprocating therewith in either direction for movement into positions towards and away from each other; and locking means engageable with the carriers when moved in positions away from each other to overcome their frictional engagement with the carrier bars and thus prevent the carriers from movement with the carrier bars when reciprocating in directions towards each other.

46. In a knitting machine: a pair of carrier bars reciprocating in uniform strokes in opposite directions towards and away from each other; a pair of yarn carriers each having constant frictional engagement with one of said bars for normally reciprocating therewith in either direction for movement into positions towards and away from each other; locking means engageable with the carriers when moved in positions away from each other to overcome their frictional engagement with the carrier bars and thus prevent the carriers from movement with the carrier bars when reciprocating in directions towards each other; and means for actuating said locking means at certain definite times during the operation of the knitting machine.

47. In a knitting machine of the character described, two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have knitted fabric portions topped thereon; means for laying yarns simultaneously in opposite directions for the knitting of courses as continuations of the fabric portions topped on the knitting needles; means for interknitting the loops of the fabric portions topped on the non-knitting needles with certain loops of said courses during the knitting thereof; and means for automatically and successively topping fabric portions on the needles.

48. In a knitting machine of the character described, two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have knitted fabric portions topped thereon; means for forming courses simultaneously and in opposite directions upon said end sets of knitting needles; sets of transfer combs associated with the non-knitting needles and operable to pick up loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; and means for automatically and successively topping fabric portions on the needles.

49. In a knitting machine of the character de-

scribed, two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have knitted fabric portions topped thereon; means for forming courses simultaneously and in opposite directions upon said end sets of knitting needles; sets of transfer combs associated with the non-knitting needles and operable to pick up the loops from said non-knitting needles and transfer said loops onto certain of the knitting needles; means for controlling the transfer movement of said sets of combs for actuation thereof when said forming means have formed courses in directions away from each other; and means for automatically and successively topping fabric portions on the needles.

50. In a knitting machine of the character described, two end sets of knitting needles and an intermediate set of non-knitting needles adapted to have fabric portions topped thereon; means for laying yarns simultaneously in opposite directions for the knitting of courses as continuations of the fabric portions topped on the knitting needles; means for transferring the loops from the non-knitting needles onto certain of the knitting needles for interknitting said loops with certain loops of said courses during the knitting thereof; means associated with a number of knitting needles for transferring the loops thereon to narrow certain of said courses; and means for automatically and successively topping fabric portions on the needles.

51. In a knitting machine for knitting a pair of heel tabs into a combination leg and foot stocking blank by knitting said tabs to corresponding course portions in the blank and successively transferring loops of other course portions in the blank to loops of said heel tabs as the knitting thereof progresses, the combination of loop forming and positioning mechanism comprising transfer point means and a loop manipulating implement structure including two end sets of knitting needles and an intermediate set of non-knitting needles, the loops of the first mentioned course portions to be topped onto the sets of knitting needles, and the loops of the second mentioned course portions to be topped onto the intermediate set of non-knitting needles; means for automatically and successively topping course portions onto the sets of needles; and means for actuating and controlling said loop forming and positioning mechanism providing for the formation of loops simultaneously and in opposite directions on the end sets of knitting needles, and transferring loops from the intermediate set of non-knitting needles to loops formed on the end sets of knitting needles.

52. In a knitting machine for knitting a pair of heel tabs into a combination leg and foot stocking blank by knitting said heel tabs to corresponding course portions in the blank and successively transferring loops of other course portions in the blank to loops of said heel tabs as the knitting thereof progresses, the combination of loop manipulating and fashioning mechanism comprising transfer point means, narrowing point means, and a loop manipulating implement structure including two end sets of knitting needles and an intermediate set of non-knitting needles, the lops of the first mentioned course portions to be topped onto the sets of knitting needles and the loops of the second mentioned course portions to be topped onto the intermediate set of non-knitting needles; means for automatically and successively topping course portions onto the sets of needles; and means for actuating and controlling said loop manipulating and fashioning mechanism providing for the formation of loops simultaneously and in opposite directions and for narrowing on said end sets of knitting needles and transferring loops from the intermediate set of non-knitting needles to loops formed on the end sets of knitting needles.

53. In a knitting machine having two separated needle banks and their associated knitting elements operable simultaneously for knitting fabric sections into the body portion of a knitted fabric blank, the combination of a yarn carrier associated with each bank of needles, means for supporting the blank for knitting an initial course into an intermediate or connecting course of said blank, means operative during the knitting of said initial course for moving the carriers associated with the two needle banks simultaneously in opposite directions outwardly to feed yarn, and means for automatically and successively topping fabric blanks on the needle banks.

54. In a knitting machine having two separated banks of needles movable as a unit and their associated knitting elements including yarn measuring sinkers operable for knitting fabric sections into the body portion of the knitted fabric blank, the combination of a yarn carrier and sinker slur-cock assembly associated with each of said groups of needles, driving connections for the machine including a cam shaft, connections therefrom for reciprocating said assemblies simultaneously in opposite directions toward and away from each other, means for stopping the machine at the completion of a knitting operation with the active carriers associated with each section at the inside limit of their travel, and means for automatically and successively topping fabric blanks on the needle banks.

55. In a flat knitting machine having needles movable as a unit and yarn measuring sinkers, the combination of two yarn carrier and sinker slur-cock assemblies arranged for laying and sinking yarn simultaneously on different groups of said needles, means for reciprocating said assemblies to lay and sink yarn simultaneously in opposite directions on said groups of needles, and means for automatically and successively topping fabric blanks on the needles.

56. In a flat knitting machine having needles movable as a unit and yarn measuring sinkers, the combination of two yarn carrier and sinker slur-cock assemblies arranged on different groups of needles, a friction driving rod associated with each of said assemblies, driving means including a cam and draw arm actuated thereby, a connection from said draw arm for reciprocating one of said friction rods, a connection between said friction rods for driving one from the other in the opposite direction, and means for automatically and successively topping fabric blanks on the needles.

57. In a flat knitting machine having needles movable as a unit and yarn measuring sinkers, the combination of sinker jacks for advancing the sinkers, two sinker slur-cock assemblies arranged for operation simultaneously against sinker jacks cooperating with different groups of said needles, one of said assemblies including a slur-cock cam for operation at a relatively high level against the jacks, and the other of said assemblies having a slur-cock cam arranged for operation at a relatively low level against the

jacks, means for reciprocating said assemblies to lay and sink yarn simultaneously in opposite directions on said groups of needles, and means for automatically and successively topping fabric blanks on the needles.

58. In a flat knitting machine having needles movable as a unit and yarn measuring sinkers, the combination of sinker jacks for advancing the sinkers, two yarn carrier and sinker slur-cock assemblies arranged for laying and sinking yarn simultaneously on different groups of needles, one of said assemblies including a slur-cock cam for operation at a relatively high level against the jacks, and the other of said assemblies having a slur-cock cam arranged for operation at a relatively low level against the jacks, a friction driving rod associated with each of said assemblies, means for driving said rods simultaneously in opposite directions to produce simultaneous yarn laying and sinking in opposite directions on said groups of needles, and means for automatically and successively topping fabric blanks on the needles.

59. A flat heeling machine having, in combination, two separated groups of spring beard needles all movable as a single unit for knitting the lower heel sections of a full-fashioned stocking blank, said groups being spaced apart less than the width of instep fabric intervening between the heel flaps, yarn measuring sinkers cooperating with each of said groups of needles, a yarn carrier and sinker slur-cock assembly associated with each of said needle groups, means for reciprocating said assemblies to lay and sink yarn simultaneously in opposite directions on said groups of needles, and means for automatically and successively topping fabric blanks on the needles.

60. In combination with a heel knitting machine having spring beard needles adapted to have prefabricated fabric topped thereonto by means of a separate transfer bar, a mechanism associated with the machine and provided with means for grasping the transfer bar to bring the same in position for engagement with said needles for topping the prefabricated fabric thereonto.

61. In combination with a flat knitting machine having beard needles adapted to have prefabricated fabric topped thereonto by means of a separate transfer bar, a mechanism movably supported by the machine for grasping the transfer bar to bring the same into position for engagement with said needles for topping the prefabricated fabric thereonto.

62. In a flat knitting machine, in combination: a bank of needles adapted to have prefabricated fabric topped thereonto by means of a separate transfer bar; a mechanism movably supported by the machine and adapted to support the transfer bar for movement into position to engage the needles and top the prefabricated fabric thereonto; yarn carriers for feeding yarn to the needles; two sets of devices for moving said yarn carriers; and gearing connections between said two sets of devices for their operation simultaneously in opposite directions.

63. In a flat knitting machine, in combination: a bank of needles adapted to have prefabricated fabric deposited thereonto by means of a separate transfer bar; a device movably supported by the machine and adapted to support the transfer bar for movement into and out of operative relationship with the needles for topping the prefabricated fabric thereonto; yarn carriers for feeding yarn to the needles; movable elements supporting the yarn carriers; two sets of devices, each including a friction mechanism for moving said yarn carrier supporting elements; and a rack and gear connection between said two sets of devices for the operation of the friction mechanism simultaneously in opposite directions.

64. In a flat knitting machine, in combination: knitting mechanism including a bank of needles; mechanism for automatically and successively topping prefabricated fabrics upon said bank of needles; a loop transfer mechanism cooperating with said bank of needles; a fabric narrowing mechanism cooperating with said bank of needles; a press-off mechanism operatively associated with said bank of needles; and pattern mechanism timing the relative operation of said knitting mechanism, said prefabricated fabric topping mechanism, said loop transfer mechanism, said narrowing mechanism, and said press-off mechanism.

65. In a flat knitting machine, in combination: a pair of slur cock cams; means for moving said cams towards and away from each other; a pair of yarn carriers; means for moving the yarn carriers towards and away from each other; groups of sinkers operatively associated with said cams; groups of needles operatively associated with said carriers; and means for automatically and successively topping prefabricated fabrics upon said groups of needles.

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