(No Model.) 8 Sheets—Sheet 1.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

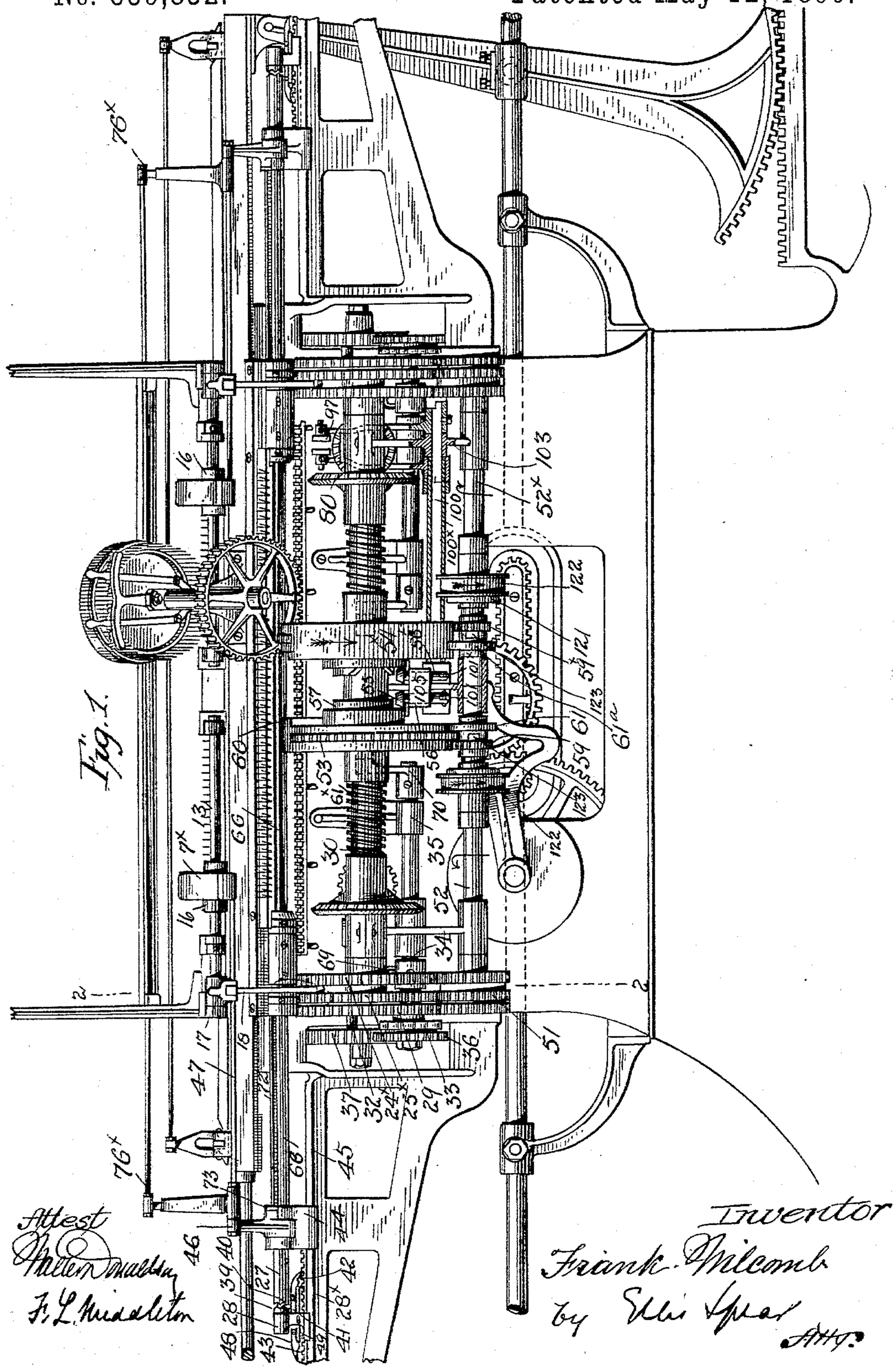



Fig. 1.

Attest
Thelen Middleton
F. L. Middleton

Inventor
Frank. Wilcomb
by Ellis Spear
Atty.

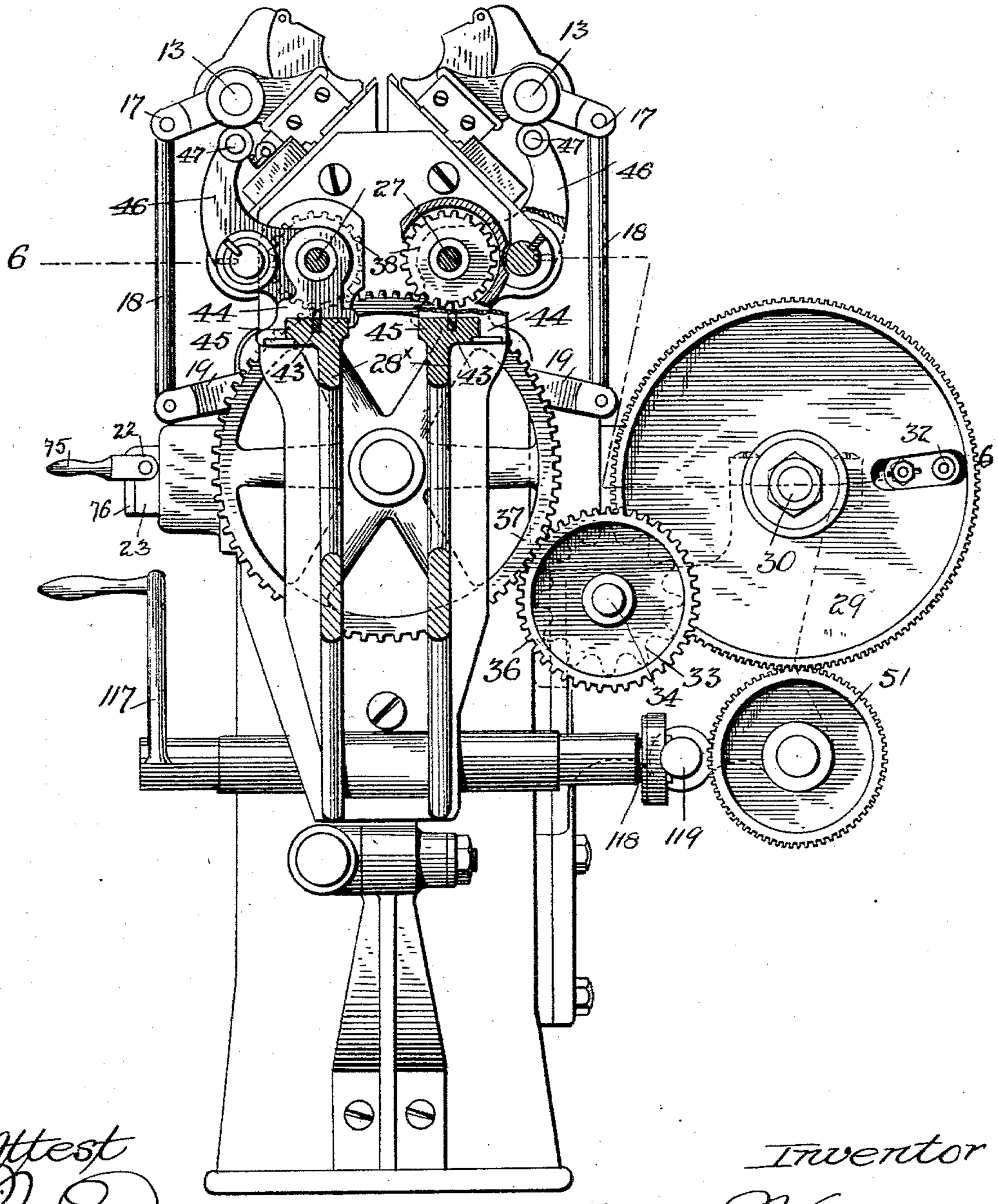
(No Model.) 8 Sheets—Sheet 2.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

Fig 1.a




Attest
Walter Donaldson
F. L. Middleton

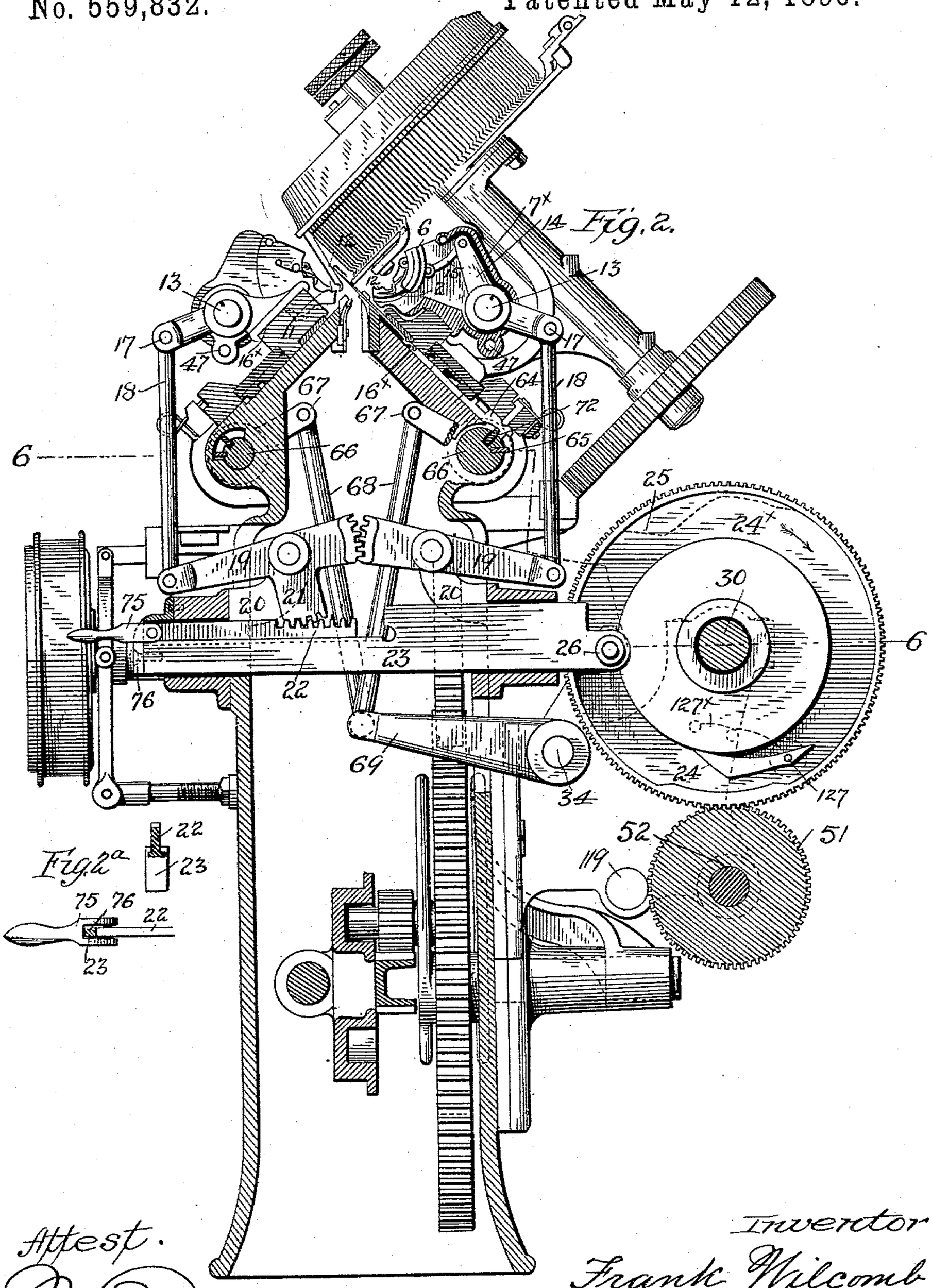
Inventor
Frank Wilcomb
by Ellis Spear
Atty.

(No Model.) 8 Sheets—Sheet 3.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.




Attest.
Walter Donaldson
F. L. Middleton

Inventor
Frank Wilcomb
by Ellis Spear.
Att'y.

(No Model.) 8 Sheets—Sheet 4.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

Fig. 3.

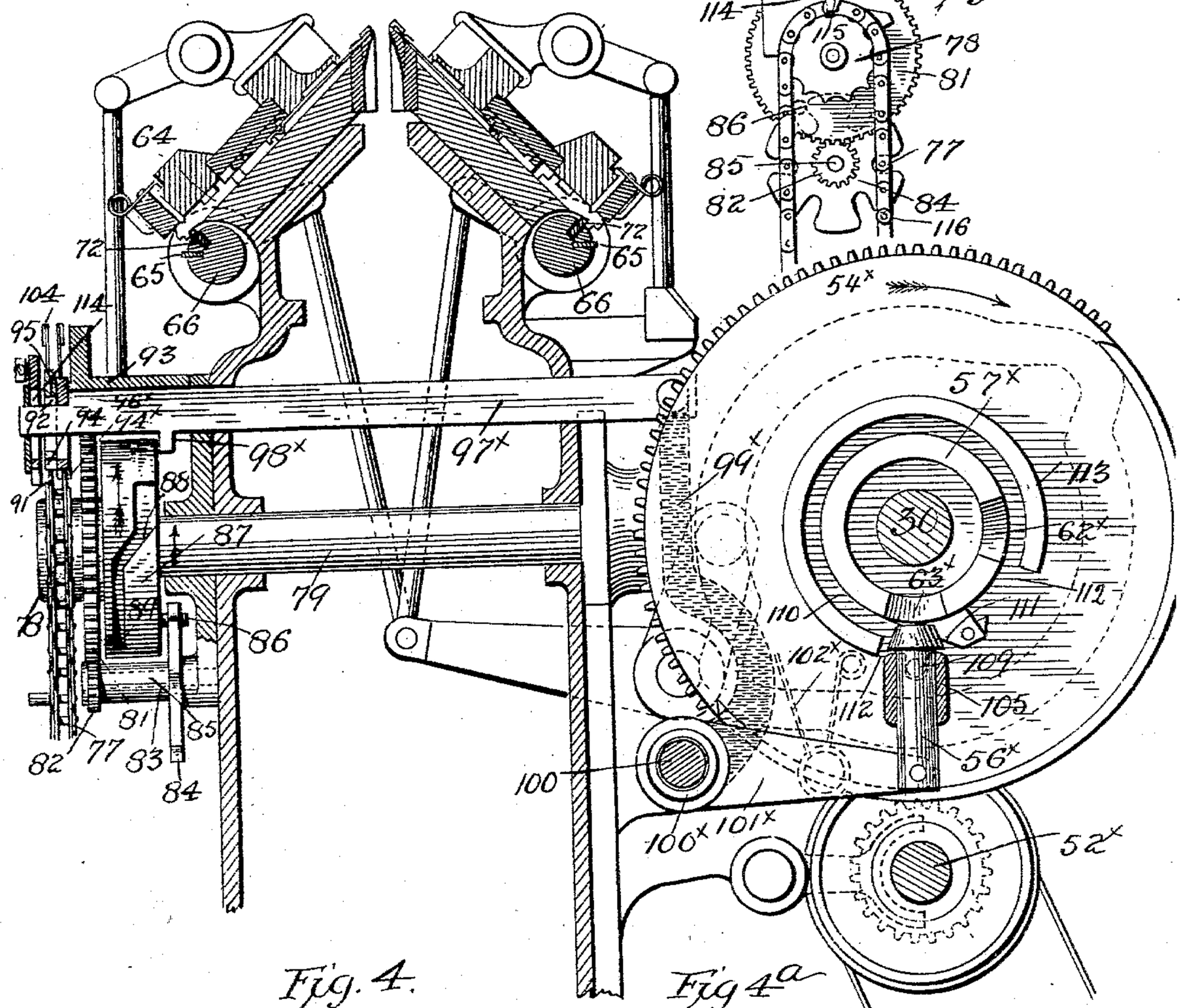



Fig. 4c

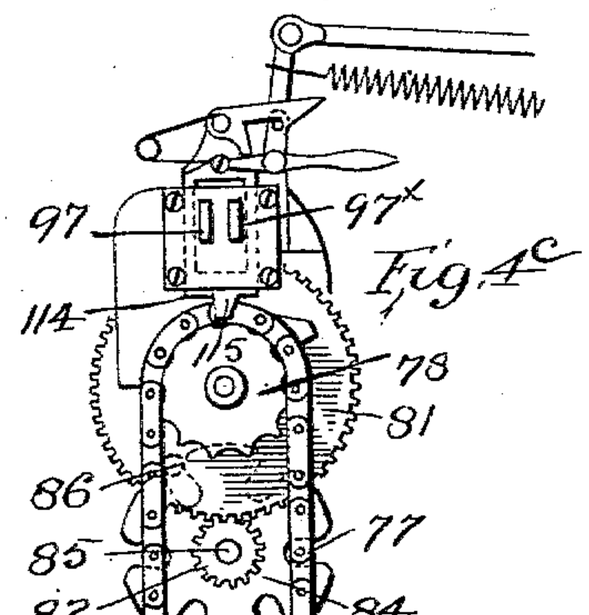



Fig. 4.

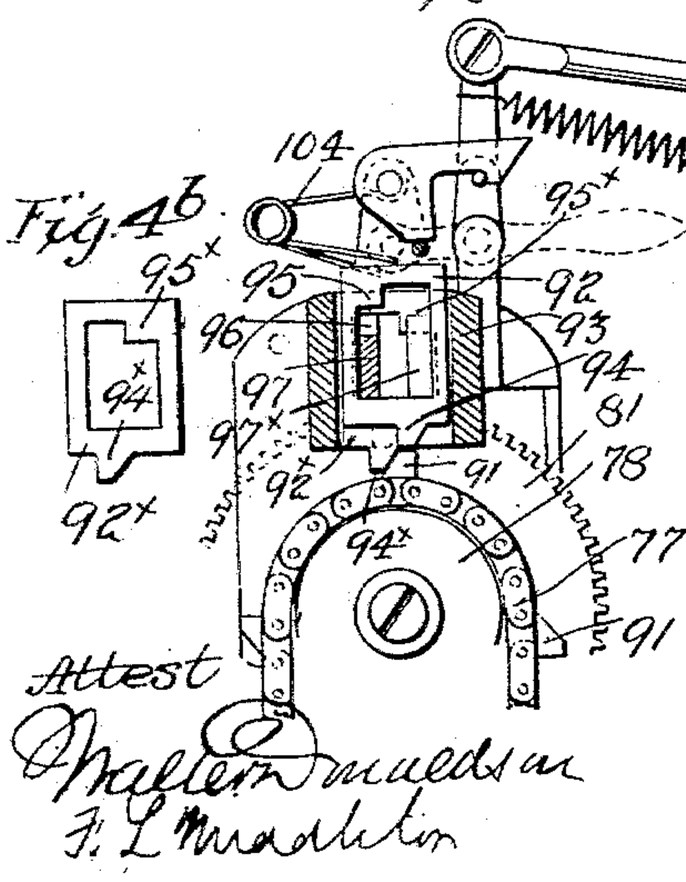
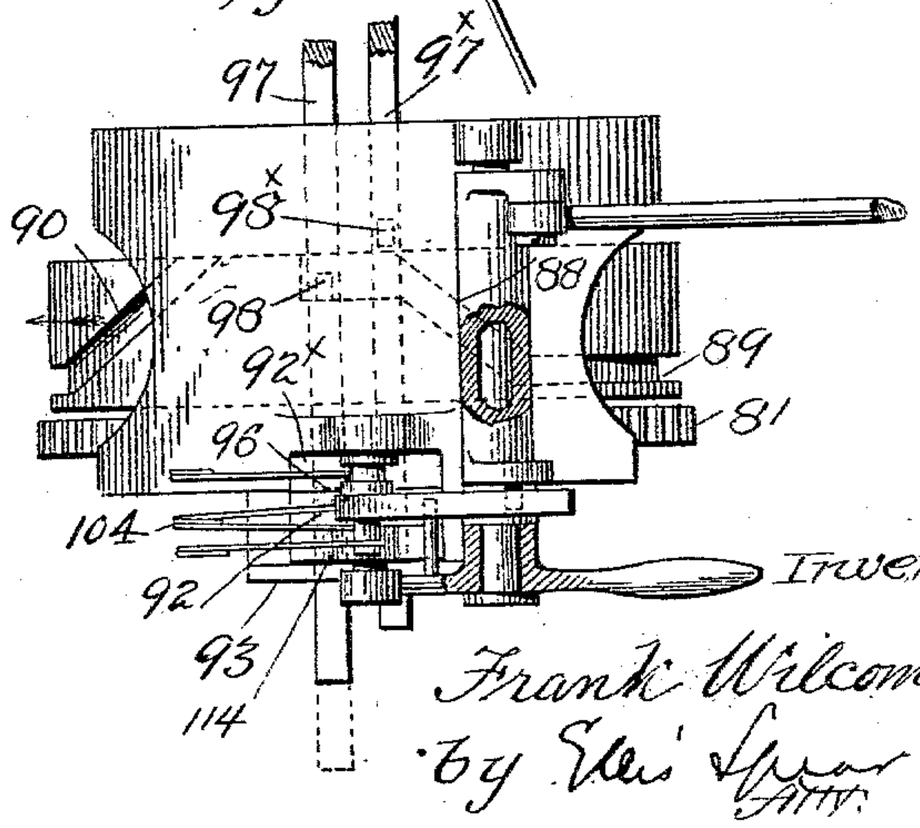



Fig. 4b




Fig. 4a



(No Model.) 8 Sheets—Sheet 5.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

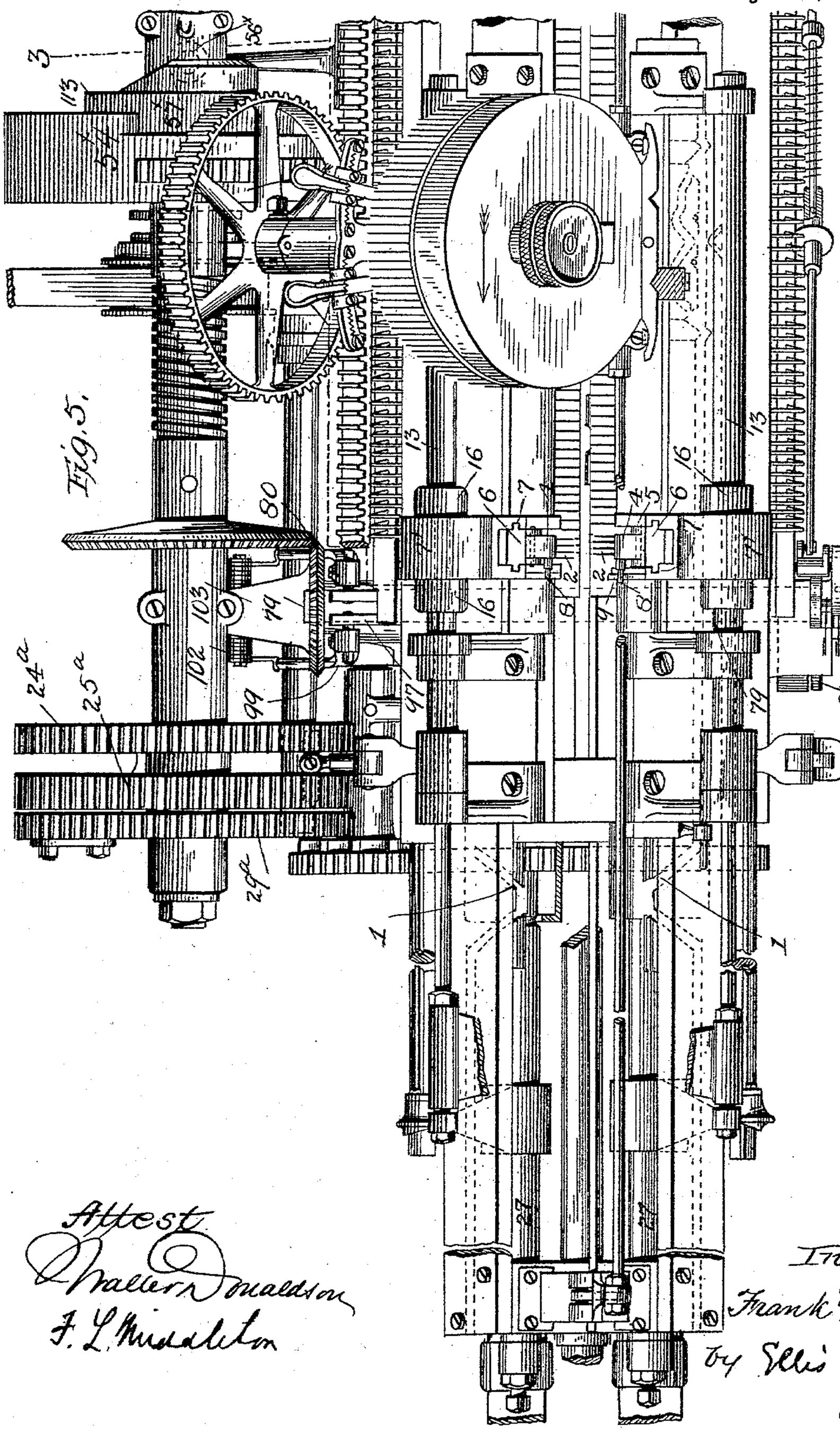



Fig. 5.

Attest.
Wallace Donaldson
F. L. Middleton

Inventor
Frank Wilcomb
by Ellis Spear
Atty.

(No Model.) 8 Sheets—Sheet 6.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

Fig. 9.

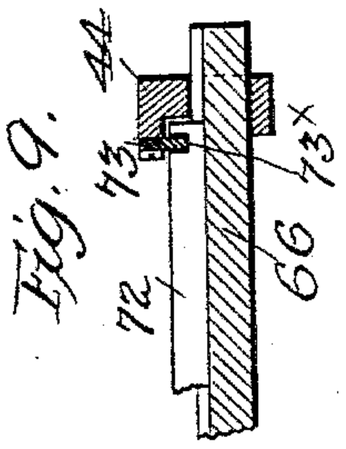


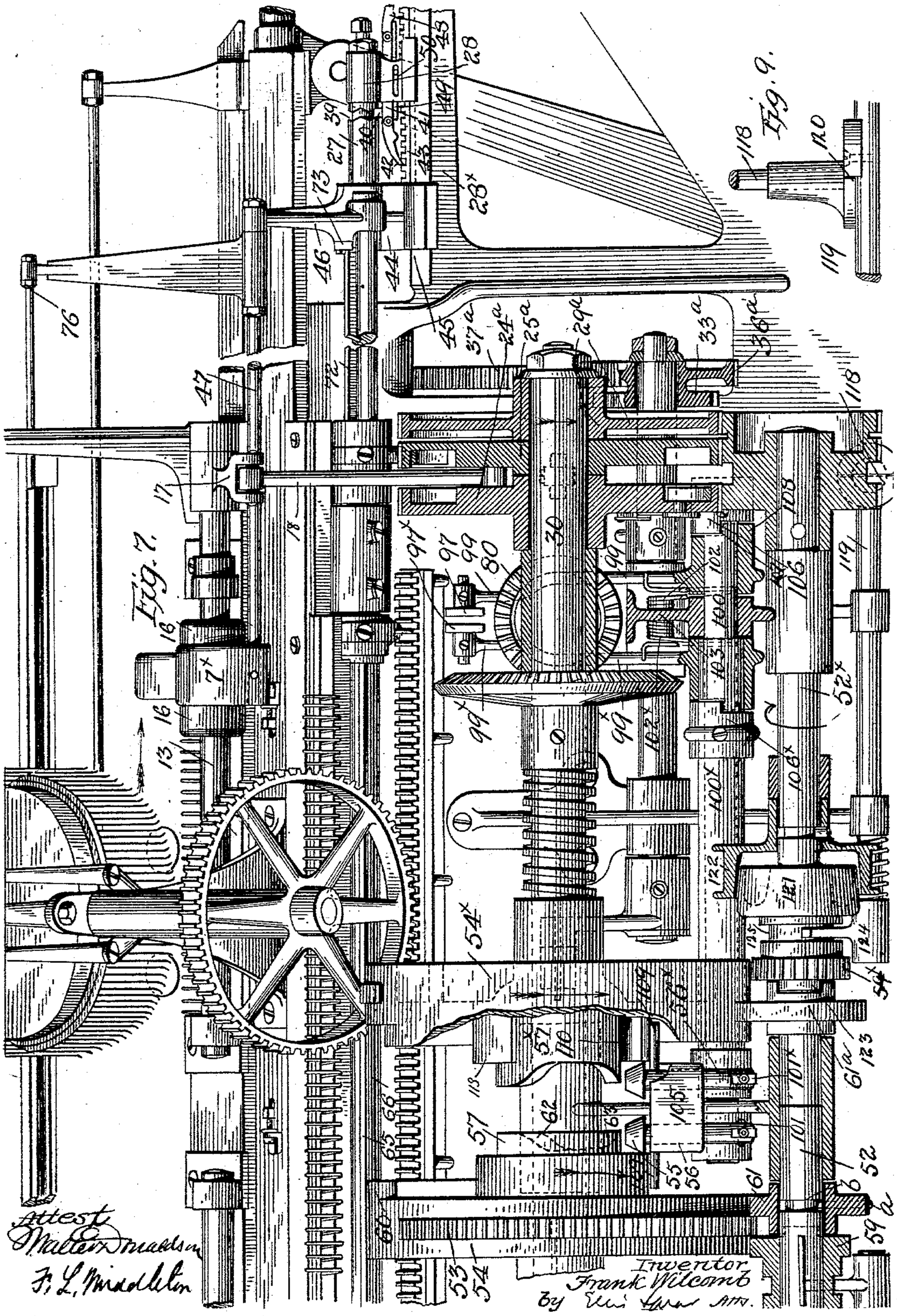

Fig. 6.

(No Model.) 8 Sheets—Sheet 7.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.



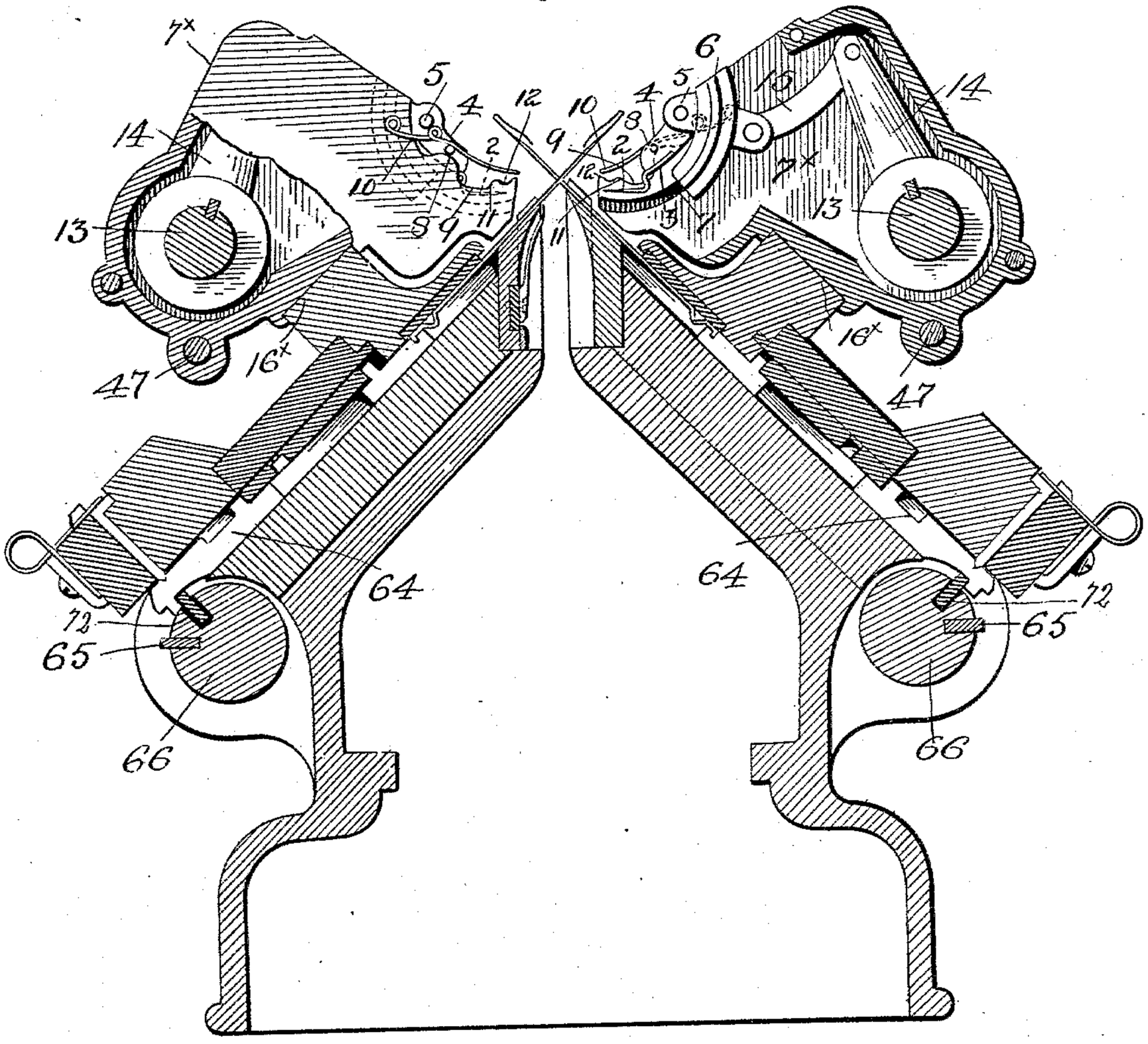
(No Model.) 8 Sheets—Sheet 8.

# F. WILCOMB.

## FASHIONING MECHANISM FOR KNITTING MACHINES.

No. 559,832. Patented May 12, 1896.

Fig. 8.




Attest
Walter Dwelly
F. L. Middleton

Inventor
Frank Wilcomb
by Edw. Gear
Atty

# UNITED STATES PATENT OFFICE.

FRANK WILCOMB, OF PAWTUCKET, RHODE ISLAND, ASSIGNOR TO THE NARRAGANSETT KNITTING COMPANY, OF SAME PLACE.

## FASHIONING MECHANISM FOR KNITTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 559,832, dated May 12, 1896.

Application filed December 24, 1894. Serial No. 532,814. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK WILCOMB, a citizen of the United States of America, residing at Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Fashioning Mechanism for Knitting-Machines, of which the following is a specification.

My invention relates to knitting-machines of the spring-needle type, and particularly to fashioning devices and mechanism for operating the same. Though I show the invention as applied to a spring-needle machine, many features thereof are applicable to the latch-needle type, and I do not therefore limit myself in this respect, and while I show the invention in connection with two rows of needles to produce a ribbed fabric its application is not limited to this, and it may be used in producing a plain-fashioned fabric, if desired.

My invention includes the special form of narrowing-prong block and holder movable thereon, of mechanism for shifting the block longitudinally of the machine from needle to needle, combined with special mechanism to operate the prongs to engage and disengage the stitches later and earlier alternately at each narrowing action, so that the prongs will act always in the same relation to the transfer-cam of the cam-bars and when the needles are properly advanced. It includes also a pattern mechanism and controlling mechanism operated thereby for determining the times of the fashioning actions and causing them to occur first at one end of the machine and then at the other in succession, and in various details of construction hereinafter pointed out.

In the drawings, Figure 1 is a rear view of the entire machine. Fig. 1ª is an elevation of the right-hand end of the machine with parts in section. Fig. 2 is a transverse section of the machine on line 2 2 of Fig. 6, looking from the right, the rear needle-bed and adjacent parts being shown in section for convenience of illustration. Fig. 2ª shows detail views of the rack-bar 22 shown in Fig. 2. Fig. 3 is a section on line 3 3 of Fig. 5. Figs. 4, 4ª, 4ᵇ, and 4ᶜ are views of the pattern mechanism for controlling the fashioning. Fig. 5 is a plan view of the left-hand half of the machine, the thread-carrier being removed. Fig. 6 is a sectional plan view of the right-hand half of the machine on lines 6 6 of Figs. 1ª and 2. Fig. 7 is a rear view of the right-hand half of the machine with parts broken away. Fig. 8 is a detail sectional view through the needle-beds and the prong-block. Fig. 9 is a view of a detail.

The knitting is preferably carried on with the devices described and claimed in applications filed by me in the United States Patent Office of even date herewith, serially numbered 532,812 and 532,813; but I do not wish to limit myself in this respect, as the fashioning devices may be used on other styles of machines. The needles are operated independently of each other and the forming and casting off of the stitches goes on continuously and in rapid succession. The fashioning devices act with the independently-operated needles and simultaneously with the knitting operation.

As the knitting devices are fully described in the application referred to, no detail description of them need be given herein. Each set of transfer-cams is substantially V-shaped, as at 1, Fig. 5, comprising a lifting-cam and a retracting-cam. These cams advance the needles independently of each other as the cam-bars approach the limit of their stroke, and in the fashioning action the needles are advanced so that the old loops are on their stems below the beards. The prongs then move along the stems, enter the loops, and lift them high enough to let the beards pass through the loops when the needles are withdrawn, leaving the loops hanging upon the prongs. The prongs are then shifted along the needle-row the distance of one needle and remain stationary until the needles are again advanced in the next stroke of the cam-bars, the hooks of the needles passing through the loops hanging upon the prongs, whereupon the prongs recede, leaving the loops hanging upon the stems of the needles. The transfer-prongs 2, Figs. 2 and 8, are carried by their bent shanks 3 in holders 4, pivoted at 5 to the blocks 6, which are movable in curved ways 7 of the shifting block 7ˣ, the curve of the ways being on the arc of a circle, so that the prongs will move down to take the loops from

the needles and then lift the same. The pivoted prong-holder 4 is allowed a falling motion in relation to the sliding prong-block 6, so that the prongs will engage properly with the needles to take the loops therefrom and then be slightly elevated to avoid a long frictional engagement with the needles and therefore saving wear on the same. To control this falling and rising movement, the prong-holder has a pin 8, moving over a camway 9 on the side of the shifting block $7^{\times}$, the pin being pressed thereon by the spring 10. As the sliding block 6 moves forward along its curved way the prongs will receive this curved movement; but in addition they will fall to take the loops and then the pin riding up the incline 11 they will raise the loops from the needles to allow the beards to retract and will remain in this position, the pin engaging the seat 12 at the end of the camway.

The sliding blocks are operated from the rock-shafts 13, extending lengthwise of the machine, journaled in bearings on the frame, and having arms 14 splined thereto and connected by the links 15 with the sliding blocks, the said arms being each inclosed by the prong shifter or block $7^{\times}$ and its splined bearings working in the bosses or journals 16, projecting laterally from the shifter sides and through which the rock-shafts pass. The shifter moves on the ways $16^{\times}$, Figs. 2 and 8, on the main frame. The shaft is rocked to move the prongs to and from the needles by the arms 17, Figs. 1, 2, and 7, the links 18, the levers 19, pivoted to brackets 20, Fig. 2, within the frame, said levers having toothed segments engaging each other, and a segment 21 on one lever engaging a rack-bar 22, carried by a transverse slide 23, operated toward the left of Fig. 2 by the cam 24 engaging its roller 26 to move the prongs toward the needles and operated toward the right by the cam 25 to move the prongs from the needles for depositing the transferred stitches thereon. For shifting the prong-shifter longitudinally of the row of needles rotary shafts 27 are used, one end of each shaft being journaled in the end frames of the machine and the other end in bearings 28, secured to the brackets $28^{\times}$, projecting from the ends of the machine.

The shafts are rotated from the gear 29, loose on the main shaft 30, which also carries loosely the cam-wheels having the cams 24 25 thereon. This gear-wheel has an adjustable pin 32 on its side which at each revolution of the gear engages a spur-wheel 33, loose on the rock-shaft 34, journaled in bearings 35 on the rear of the machine, the said spur-wheel having fixed thereto a pinion 36, meshing with a gear 37, Figs. 1, $1^{a}$, and 6, journaled on a pin on the end frame of the machine and engaging pinions 38 on the shafts 27, there being a shaft for the front prong-shifter and one for the rear. This mechanism rotates the shafts in unison step by step. They have zigzag cam-grooves 39, engaging the pins 40 on the pawl-slides 41, splined in the bearings 28. Pawls 42, carried by the slides, engage the toothed bars 43 of the blocks 44, adapted to be moved step by step along the ways 45 of the brackets. These blocks have standards 46, from which rods 47 extend to the prong-shifters, and each time the grooved shafts are given a forward movement the pawls will move the toothed bars and through the blocks and rods the prong-shifters to shift the prongs to the next needles, each movement of the shaft operating the pawl 42 forward and backward. The pawl-carrier has also a retracting-pawl 48 for returning the toothed bar and block to normal position to begin a new fabric, and either one pawl or the other may be held out of engagement with the toothed bar by the shifting-rod 49, movable in the bearing-bracket and having a finger-piece passing through the slot 50 to operate the same. The cams 24 25 are carried, respectively, on the adjacent faces of the gears $24^{\times}$ $25^{\times}$, and the three gears 29 $24^{\times}$ $25^{\times}$, all being loose on the main shaft 30, (see a similar arrangement of loose gears at the right of Fig. 7,) are operated by the wide gear 51, fixed on the supplemental shaft 52, which is rotated only when the fashioning is to be performed by the segmental rack 53 on the rack-wheel 54, which is splined at 58 to the main shaft and is shifted laterally by a conical roller 55 on the switch-pin 56, when said pin is lifted through the pattern mechanism hereinafter described into line with the boss 57 on the wheel, which boss has an incline 62, Figs. 6 and 7, to shift the wheel laterally when engaged by the pin. The shifting of the wheel brings its segmental rack into line with the pinion 59 on the supplemental shaft, and the revolution of the wheel rotates the shaft 52 and through the gear 51 the three loose gears on the main shaft. The main shaft, with its rack-wheel 54, makes one revolution to each reciprocation of the cam-bars, and the rack engages the pinion when the machine is near the middle stroke, and as the stroke is being completed and the transfer-cams are passing the transfer-prongs the revolution of the gear $24^{\times}$, carrying the advancing-cam 24, will operate the transfer-prongs toward the needles to take the loops from the advanced needles. At the end of the stroke the pin on the gear-wheel 29 moves the described connections one step to shift the transfer-prongs to the next needles to transfer the loops, and as the cam-bars near the middle of their return stroke and the transfer-cams are passing the transfer-prongs the retracting-cam 25 (dotted lines in Fig. 2) acts to return the prongs and deposit the loops onto the needles which have advanced through them. Thus the three loose gears are operated to start the transferring action as the machine is a little past middle stroke in one direction (the transferring following the knitting action) and completes the transferring near the middle return stroke in advance of the knitting, the three loose gears thus mak-

ing one revolution from the middle of the stroke one way to the middle of the return stroke, the segmental rack on the rack-wheel being only long enough to effect this result. As the rack leaves the pinion a plane segment 60 of the rack-wheel engages a cutaway disk 61 on the supplemental shaft and connected with the pinion, and the pinion and the transfer mechanism are thus locked inactive until the next transferring action is to be performed. The rack-wheel is returned to position by the spring $61^{\times}$ with its rack out of line with the pinion when the second incline 63 comes opposite the conical shifting pin, and the connections are still held locked by the continuous plane part of the periphery of the rack-wheel engaging the locking-disk.

It will be noticed that as the transfer-prongs are shifted along the needle-row from one needle to the next their relation to the stroke of the machine and of the transfer-cam is changed, and as they must act always in the same relation to the needles—that is, when the needles are advanced—it is necessary to provide means whereby they will advance one needle later each time, so that the V-shaped cam will be directly opposite them when they operate. By referring to Fig. 5, for instance, in which the transfer-cams are shown at the left of the transfer-prongs, the advancing of the prongs to take the stitches from the needles takes place as the transfer-cams are passing the prongs from left to right, and the retraction of the prongs to deposit the loops on the needles takes place as the transfer-cams are on their return stroke from right to left. The shifting of the prongs one needle inward or to the right of Fig. 5 takes place after they have advanced and when the transfer-cams are at the end of their stroke from left to right, and this shifting brings the prongs one needle nearer to the transfer-cams at the right of the prongs, and as the transfer-cams move toward the left they will arrive opposite the prongs one needle earlier in the stroke, and consequently the retraction of the prongs must take place earlier in the stroke. The prongs remaining in their shifted position toward the right and the transfer-cams having returned to the left of Fig. 5, the parts are ready for another transferring action, and on the stroke from left to right the transfer-cams will arrive opposite the shifted prongs one needle later, and consequently the advance of the prongs must take place later in relation to the stroke. This is effected by making the gear $24^{\times}$ with one tooth more than the gear 29, so that while the gear 29 shifts the carrier at exactly the same time and point in the stroke the gear $24^{\times}$ will operate the prongs later on each stroke corresponding with the interval between the movements of the needles, or, in other words, the prongs will advance one needle later at each action.

Supposing there are three hundred and thirty-six needles in the stroke, the gear 29 would have three hundred and thirty-six teeth, while the gear $24^{\times}$ would have three hundred and thirty-seven. On the return stroke it will be clear that the prongs must be returned one needle earlier in the stroke each time to deposit the loops on only those needles which have fully advanced, and therefore the gear $25^{\times}$ carrying the retracting-cam has three hundred and thirty-five teeth to secure this earlier returning movement of the prongs.

As before stated, I use the same knitting-cams and devices as are described in the application above referred to, comprising the needles, the call-jacks 64, and the call-cams shown in the said application, the jacks being thrown into action by the call-bars 65 in the rock-shafts 66, operated through the arms 67, fixed thereon, the links 68, the arms 69, the rock-shaft 34, and the arm 70 on the rock-shaft having a roller engaging a cam-groove 71 in the rack-wheel 54. The rock-shafts 66 are operated at the end of each stroke to throw all the call-jacks into operation; but the call-jacks of those needles which are to remain inactive in fashioning the fabric are immediately returned to position out of line with their call-cams by the jack racking bar 72, carried in a slideway of the rock-shaft. This bar is adjusted step by step lengthwise of the machine to follow the shifting movements of the transfer-prongs and is operated by the sliding block 44, to which the bars are connected by the clips 73, Figs. 7 and 9, on the blocks engaging notches $73^{\times}$ in the bars, so that the bars may oscillate without breaking the connection. The lengthwise adjustment of the racking bars takes place at the end of the stroke, when the rock-shaft is turned inwardly and the racking bar is at its highest point of movement, and thus in position to be moved in front of the nibs of the jacks. The rack-bar 22, Figs. 2 and $2^{a}$, is detachably connected with its transverse slide 23 by the latch 75, having a forked end pivoted to the rack-bar and embracing a stud 76 on the transverse slide. By throwing the latch up the connection will be detached and the transfer-prongs may be manipulated, if desired, by hand.

The stops of the thread-carrier described in the application above referred to may also be operated from the sliding block 44 through the standard thereon and the standard and rod $76^{\times}$, Fig. 1.

The pattern mechanism comprises a chain 77, a chain-wheel 78, loose on the rotating shaft 79, journaled in the frame and driven from the main shaft through bevel-gears 80, and the gear 81, connected with the chain-wheel and meshing with a pinion 82 on the pin 83, projecting from the machine-frame, which pinion is driven step by step through the slotted wheel 84, having a sleeve 85, connected to the pinion, said wheel being operated by a pin 86 on the side of the grooved cam-wheel 87, fixed to the rotating shaft and mak-

ing one revolution for each stroke of the machine to move the pattern-chain one step forward. The cam-wheel has an inclined groove 88 opening laterally of the wheel and connecting with a straight peripheral groove 89, ending in a reversely-inclined groove 90, Fig. 4ª, also opening laterally of the wheel.

In describing the connections from the pattern mechanism for controlling the fashioning mechanisms at the right and left hand ends of the machine, I will refer first to the connections for controlling the fashioning mechanism at the right hand of the machine. The two sets of devices are similar in all respects, and as the details are more fully shown in connection with the second set reference may be had to them also to illustrate the description of the first set of connections. When a dog 91 of the pattern-chain lifts the catch-plate 92, moving in ways of the box 93, by engaging with its incline projection 94, the catch-plate will lift its catch-shoulder 95 from the shoulder 96, Fig. 4, of the bar 97, which is movable through bearings transversely of the machine, Fig. 3, and as this release takes place just before the mouth of the inclined groove 88 comes opposite the pin 98, Fig. 4ª, on the bar 97 the said bar will be free to be forced forward, so that the pin will engage the inclined cam-groove and then the bar will be operated forward by the cam-groove positively. The rear end of the bar is connected to the lever 99, connected with the rock-shaft 100, turning in suitable bearings at the rear of the machine, and this rock-shaft carries an arm 101, Figs. 6 and 7, connected by a pivot at its end with the switch-pin 56, carrying the conical roller. This pin is arranged to slide in a stationary bearing 105, Fig. 7, and it will thus be seen that when the bar 97 is operated by the cam the switch-pin will be raised to engage the incline 62 of the boss 57 on the rack-wheel to shift it laterally for the fashioning, it being understood that the parts are so timed that the cut-away part of the boss will be opposite the pin when the same is lifted. For throwing the bar 97 into the inclined groove of the pattern-cam when said bar is released by the lifting-plate a spring 102 is used, Figs. 3 and 7, connected with the lever 99 and with the bearing-bracket 103. The lifting-plate, Fig. 4, is in the form of an open frame, having the shoulder 95 at one side, and through this frame the bar 97 is free to move forward. The bar is returned to normal position by the reversely-inclined groove 90, and the pin then lies alongside the cam-wheel ready for the next action, when the inclined groove 88 comes around again after the release of the bar. The lifting catch-plate is pressed downward by a spring 104.

I have thus far described fashioning devices for one end of the machine, the pattern connections described being for the fashioning devices at the right of the machine. All the mechanism is duplicated for fashioning at the other end of the machine, the pattern connections, however, being combined and arranged together and in a novel manner. The supplemental shaft $52^{\times}$, Figs. 1 and 7, of the fashioning mechanism at the left of the machine is arranged end to end with the shaft 52, described as in Figs. 1 and 7. The switch-pin $56^{\times}$ for the left-hand mechanism and designed to act with the rack-wheel $54^{\times}$ passes through the bearing 105 and is pivotally connected with the arm $101^{\times}$ on the hollow rock-shaft $100^{\times}$, through which passes the rock-shaft 100, and having a lever $99^{\times}$ connected thereto, which is connected to a second transverse sliding bar $97^{\times}$, arranged alongside the bar 97, above described.

The bar is pressed by the spring $102^{\times}$, and has a pin $98^{\times}$, lying normally alongside the cam-wheel 87. A second open-frame catch-plate $92^{\times}$, Fig. 4ᵇ, having a catch-shoulder $95^{\times}$, located in line with the shoulder $96^{\times}$ on the second bar, moves vertically in ways in the box 93, when its inclined projection $94^{\times}$ is engaged by a dog 91 of the pattern-chain on the next stroke of the machine. This projection is to one side of the projection 94 on the first lifting-plate and is lifted when the pattern-chain makes its next stop. This occurs immediately after the first bar has been returned to normal position by the reversely-inclined groove 90 in the cam and just before the inclined groove 88 comes around. The second bar is released and is thrown into connection with the cam-groove 88 as the cam begins its second revolution with the beginning of the stroke of the machine in the opposite direction. By this arrangement the narrowing at one end of the machine follows that at the other end on the same reciprocation of the machine, the second fashioning action being completed on the next stroke.

In order to hold the narrowing mechanism first operated in operation after the first sliding bar 97 has been returned to normal position, so that the fashioning on one side can be completed while the switching mechanism for the other end of the machine is being thrown in, a loose or clutch connection is provided in the operating connections leading to the switch-pins, so that the pin may remain in its operated position, while the bar 97 may be reset. This consists simply of a clutch-piece 106, Fig. 7, secured to the shaft 100 and having a jaw 107, engaging a corresponding jaw on the bearing 108 of the lever 99, so that after having operated the shaft 100 through this clutch the lever may return to normal position to be held by its catch-plate. The switch-pin is held up while the bar 97 is reset, and as both pins are held up by similar means it will be only necessary to describe the means in connection with the switch-pin $56^{\times}$, as this is better illustrated. The switch-pin is held up by the pin 109 thereon engaging the groove 110 between the flange 113, Figs. 3 and 7, and the boss $57^{\times}$, and is depressed by the incline 111 on the rack-wheel engaging the pin 109 and forcing the switch-pin down when the rack-

wheel is to be shifted laterally to normal position by its spring and when the open part of the boss $57^{\times}$ comes around, as in Figs. 3 and 7. The flange 113 is open at 112 to allow the pin 109 to be disengaged. The lever $99^{\times}$ has a similar clutch connection $106^{\times}$ with its shaft $100^{\times}$. This mechanism is not limited to the combination of two sets of fashioning mechanisms, as the clutch and means for holding the switch-pin in action may be used with one set, as the pattern mechanism can thus be reset while the switch-pin remains in action.

The stop-motion may be the same as that described in the above-mentioned application, the lifting-piece 114 therefor being in the form of an open frame to allow the bars 97 $97^{\times}$ to slide through and having an inclined projection 115, Fig. $4^{c}$, to be operated by a lateral stud 116 on the chain. This piece may operate any suitable shipper connections, such as those shown in the said application. In order to return all the parts to normal position for a new fabric after the machine is stopped, the handles 117 at each end of the machine are turned, operating the transverse rock-shafts 118 and the shipper-rods 119, operated through the half-disks at 120 to throw the clutches 121 on the supplemental shafts into connection with the pulleys 122, which are constantly operated in the opposite direction from that of the supplemental shafts in operating the fashioning mechanisms to fashion the garment. One half-disk is secured to the rod 119 and the other to the rock-shaft, as in Fig. 9, their straight faces being in contact. These clutches 121 are splined to the supplemental shaft and connected with the pinions 59 $59^{\times}$, also splined to said shafts, and when shifted laterally they withdraw the clutch-teeth 123 of the pinion out of connection with the locking-disks 61 $61^{a}$ loose on the supplemental shafts, so that the revolution of the pulleys with the clutches will rotate the supplemental shafts backward and through the loose gear 29 return the transfer-prongs to normal position, the clutch being thrown out by the operator when the prongs have been returned with the racking-bars and thread-carrier stops. The two loose gears carrying the advancing and retracting cams will also return to their normal positions with the cams in the proper relation to each other, said cams having changed their relative positions at each fashioning operation. The three loose gears for the second set of fashioning mechanism I have shown in section on the right of Fig. 7 and marked $29^{a}$, $24^{a}$, and $25^{a}$, corresponding to the gears 29 $24^{\times}$ $25^{\times}$, before described. The loose spur-wheel and gear operated from the gear $29^{a}$ is also shown at the right of Fig. 7 at $36^{a}$ and $33^{a}$, the former meshing with the step-by-step gear $37^{a}$, corresponding to the gear 37 at the other end of the machine.

The locking-disks 61 and $61^{a}$ are held against lateral displacement on the supplemental shafts by pins $a$ entering grooves $b$ in the shafts, Fig. 7. The clutch-rods are connected with the clutches 121 by the forks 124 engaging the groove 125 in the clutches. For convenience of illustration I have shown the clutch-rods 119 in Fig. 7 as in a lower plane than the supplemental shafts. In practice, however, these clutch-rods are in the same horizontal plane with the supplemental shafts, as in Figs. $1^{a}$ and 2.

The cam-piece 24 for moving the prongs toward the needles is pivoted at 127, Fig. 2. This pivot extends through the wheel and has a disk on it engaged by a spring $127^{\times}$ for holding the cam-piece in normal position and also for allowing it to turn and pass the roller on the rack-slide when the wheel $24^{\times}$ is rotated backward.

While I have shown the narrowing-prongs as combined with mechanism for operating the same earlier and later in the stroke, it will be understood that I do not limit myself to the particular fashioning devices shown, as the said operating mechanism may be used in connection with other fashioning means adapted to be operated later and earlier in the stroke.

I claim—

1. In combination with the spring-needles and transfer-cams, the transfer-prongs, means for operating them substantially in the arc of a circle and means for giving them a falling-and-rising movement in addition thereto, substantially as described.

2. In combination with the spring-needles and transfer-cams, the transfer-prongs, means for operating them through the loops along the stems of the needles toward the hooks and for lifting them, means for shifting them laterally when the needles have been retracted from beneath them, and means for retracting the narrowing-prongs along the stems of the needles from the hooks when the needles are advanced beneath them, substantially as described.

3. In combination with the spring-needles, the transfer-prongs arranged over the needle-stems, means for advancing and retracting the needles, means for operating the prongs along the stems of the needles toward and from their hooks and for making contact between the prongs and needles, substantially as described.

4. In combination with the spring-needles, and transfer-cams, the transfer-prongs, the sliding block, the prong-holder carried thereby and movable in relation thereto, the prong-shifter having curved ways for the sliding block and the stationary cam-path on the prong-shifter for controlling the movement of the prong-holder, substantially as described.

5. In combination, the needles, transfer-cams, the transfer-prongs, the shifting block the means for operating the transfer-prongs and the means for shifting the block compris-

ing the push-block, a connection therefrom to the shifting block, and means for operating the push-block, substantially as described.

6. In combination, the needles, transfer-cams, the transfer-prongs, the shifting block, means for operating the transfer device, the push-block, a connection therefrom to the shifting block, the rotary shaft, a connection therefrom to the push-block and means for rotating the shaft step by step, substantially as described.

7. In combination, the needles, transfer-cams, the transfer-prongs, means for operating the same, the shifting block therefor, the push-block, a connection therefrom to the shifting block, the grooved rotary shaft, means for operating it step by step, the sliding pawl operated thereby and the rack-bar connected to the push-block, substantially as described.

8. In combination, the needles, transfer-cams, the transfer-prongs, means for operating the same, the shifting block therefor, the push-block at the end of the machine connected to the shifting block, the rotary shaft and means to operate the block therefrom, the pinion on the shaft, the gear meshing therewith and means for operating the gear step by step, substantially as described.

9. In combination in a knitting-machine, the transfer-prongs and means for advancing and retracting the same consisting of rotary cams connections between the same and the transfer-prongs and means for changing the relation between the cams at each successive narrowing movement, substantially as described.

10. In combination in a knitting-machine, the transfer-prongs devices for advancing the said prongs and devices for retracting the same means for actuating the said devices and changing their relation at each successive narrowing action and connections between the said devices and prongs, substantially as described.

11. In combination in a knitting-machine, the transfer-prongs means for advancing the said prongs and for retracting the same including the two gears moving at different rates of speed and means for operating the gears, substantially as described.

12. In combination, the needles, transfer-cams, the transfer-prongs for the loops, means for shifting the same along the needles, a cam for advancing the transfer-prongs, a cam for retracting the same, connections to the transfer-prongs and means for driving the cams at different speeds, substantially as described.

13. In combination, the needles, transfer-cams, the transfer-prongs for the loops, means for shifting the same along the needles, a cam for advancing the transfer-prongs, a cam for retracting the same gearing for operating the cams having different numbers of teeth and connections between the cams and the transfer-prongs, substantially as described.

14. In combination, the needles, transfer-cams, the transfer-prongs, means for shifting the same, the cam for advancing the transfer-prongs, the cam for retracting the same, the gears carrying the cams, said gears being operated at different rates of speed and connections between the cams and the transfer-prongs for operating the same, substantially as described.

15. In combination, the needles, transfer-cams, the transfer-prongs for the loops, means for shifting the same along the needles, the cams for advancing and retracting the transfer-prongs and the connections therefrom comprising the sliding rack, the lever having a segment engaging the same, the rock-shaft and the connection from the lever to the rock-shaft, substantially as described.

16. In combination, the two rows of needles, transfer-cams, the transfer-prongs, the sliding rack with means for operating the same, the two pivoted levers having segments, the connections from the levers to the transfer-prongs and a segment on one lever engaging the rack, substantially as described.

17. In combination, the needles, transfer-cams, the transfer-prongs, the rack, the slide carrying the same, means for operating the slide, the connections from the rack to the transfer-prongs, and the detachable connection between the rack and slide, substantially as described.

18. In combination, the needles, transfer-cams, the transfer-prongs, the shifting block therefor, connections for shifting the block, connections for advancing and retracting the transfer-prongs, the gear carrying the advancing-cam, the gear carrying the retracting-cam and the third gear for operating the shifting connections, the said advancing-gear moving slower and the retracting-gear faster than the shifting-gear and means for operating the gears, substantially as described.

19. In combination, the needles, transfer-cams, the transfer-prongs, means for advancing and retracting the same means for shifting the prongs lengthwise of the needle-row comprising the step-by-step gear and intermediate devices, the pinion meshing therewith, the toothed wheel connected to the pinion and the gear having the pin for engaging the toothed wheel with operating mechanism for the gear, substantially as described.

20. In combination, the needles, the transfer-prongs, operating connections thereto for advancing and retracting the prongs and for shifting the same along the needle-row, the main shaft, the laterally-shifting rack-wheel on the shaft having the incline, the switch-pin to act thereon, the pinion arranged to be operated by the rack-wheel and to operate the said connections to the transfer-prongs and pattern mechanism for controlling the switch-pin, substantially as described.

21. In combination the call-bar extending lengthwise of the needle-row, the racking bar also extending lengthwise thereof, pattern mechanism for operating the racking bar lon-

gitudinally of the needle-row and means for operating the call-bar and racking bar at each stroke of the machine and in a direction laterally of the machine, substantially as described.

22. In combination, the needles, the transfer-prongs, the main shaft, the shifting-rack wheel thereon, means for shifting the same, the supplemental shaft, the pinion thereon, the gearing loose on the main driving-shaft, geared to the supplemental shaft and connections to the transfer-prongs operated by said gearing for advancing and retracting the prongs and for shifting the same along the needle-row, substantially as described.

23. In combination, the needles, their cams, means for rendering the needles inactive comprising a racking bar, means for reciprocating the bar laterally of the machine, the sliding block having a loose connection therewith to permit it to move laterally and means for adjusting the sliding block, substantially as described.

24. In combination, the transfer-prongs, driving mechanism therefor for advancing and retracting the prongs and for shifting the same along the needle-row and the pattern mechanism including a pattern device, means for moving the same, the rotary cam-wheel with operating means therefor, the sliding bar adapted to engage the cam-wheel, the catch-plate arranged to hold the bar out of engagement with the cam, said catch-plate being adapted to be operated by the pattern device to release the bar and connections from the bar to the driving mechanism to control the times of operation thereof, substantially as described.

25. In combination, the transfer-prongs, driving mechanism therefor for advancing and retracting the prongs and for shifting the same along the needle-row, and the pattern mechanism comprising the pattern device with operating means, the cam-wheel, the sliding bar adapted to engage the same, the connections from the slide to the driving means for the transfer-prongs to control the times of operation thereof, and the open frame-latch to hold the slide-bar out of engagement with the cam and arranged to be lifted by the pattern device, substantially as described.

26. In combination, the transfer-prongs, driving mechanism therefor including the shifting-wheel for advancing and retracting the prongs and for shifting them along the needle-row, the switch-pin for operating the same laterally, the pattern mechanism with connections for operating the switch-pin and the flange on the shifting-wheel for holding the switch-pin in its moved position, substantially as described.

27. In combination, the transfer-prongs, driving mechanism therefor, including the shifting-wheel for advancing and retracting the prongs and for shifting them along the needle-row, the switch-pin, means for operating the same, the pin on the switch-pin, the flange on the shifting-wheel and the incline for returning the switch-pin to position, substantially as described.

28. In combination, the transfer-prongs, driving mechanism for advancing and retracting the prongs and for shifting them along the needle-row, the sliding bar with connections to the driving mechanism to control the times of operation thereof, the grooved cam having reversely-inclined portions, the pattern device and means controlled thereby for throwing the bar into connection with the grooved cam, substantially as described.

29. In combination, the two sets of transfer-prongs, the two sets of driving mechanisms therefor for advancing and retracting the said prongs and for shifting them along the needle-rows, two slide-bars with connections to the driving mechanisms to control the times of operation of the driving mechanisms, the cam for operating the bars when in contact therewith, the latches for controlling the engagement of the bars with the cam-wheel and the pattern device arranged to operate the latches in succession, said cam having reverse inclines to reset the bar first operated before the second bar is operated, substantially as described.

30. In combination, the two sets of transfer-prongs, the two sets of driving mechanisms for advancing and retracting the transfer-prongs and for shifting the same along the needle-rows, said driving mechanism including the shifting-wheels, two slide-bars arranged side by side, the levers connected thereto, the hollow shaft connected to one lever, the shaft connected to the other lever and passing through the hollow shaft, means operated by the shafts for controlling the two sets of driving mechanisms by engaging the shifting-wheels and pattern mechanism for controlling the slide-bars, substantially as described.

31. In combination, the transfer-prongs, the driving mechanism for advancing and retracting the prongs and for shifting the same along the needle-rows, said mechanism including the main shaft the shifting-wheel thereon having the rack, the supplemental shaft having the pinion splined thereon, and connections from the supplemental shaft to the transfer-prongs, the revolving pulley loose on the supplemental shaft, the locking-disk on the supplemental shaft having a clutch connection with the pinion and the clutch connected with the pinion, with means for shifting it to engage the revolving pulley and to be released from the locking-disk, substantially as described.

32. In combination, transfer-prongs, driving mechanism for advancing and retracting the prongs and for shifting the same along the needle-row, said mechanism including the main shaft, the shifting rack-wheel thereon, the supplemental shaft having the pinion to engage the rack, and connections from the supplemental shaft to the transfer-prongs,

the revolving pulley on the supplemental shaft and the clutch to connect the same with the shaft to return the parts to normal position, substantially as described.

33. In combination, the transfer-prongs, driving mechanism for the same for advancing and retracting them and for shifting them along the needle-row, including the main and supplemental shafts with a clutch connection between them, and connections from the supplemental shaft to the transfer-prongs and means for rotating the clutch connections backward, substantially as described.

34. In combination, fashioning-prongs, a main shaft, devices between the main shaft and the prongs for advancing and retracting the latter and shifting the same along the needle-row, said devices including a clutch portion, together with means to operate said devices backward when disconnected from the main shaft, substantially as described.

35. In combination, fashioning mechanism including the transfer-prongs, the main shaft, operating means therefrom to the fashioning mechanism including the loose gears, for advancing and retracting the prongs and shifting them along the needle-row, and a clutch connection and means for turning the gears backward when the clutch connection is disengaged, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK WILCOMB.

Witnesses:

GEORGE O. EVERETT,

DANIEL MCNIVEN.