Sept. 6, 1938. L. G. BOWMAN 2,129,402

SEWING MACHINE

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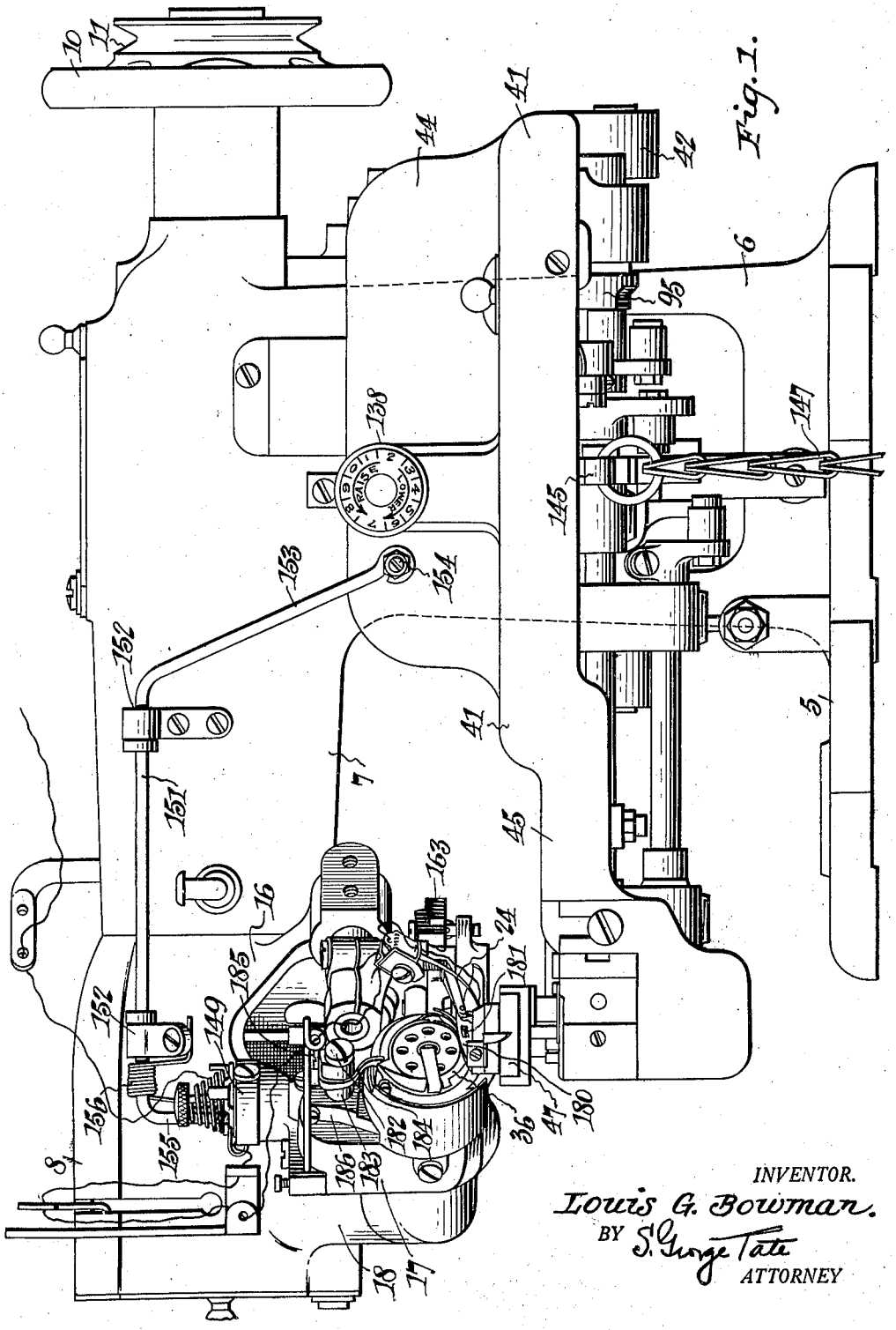


Fig. 1.

INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

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SEWING MACHINE

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Fig. 2.

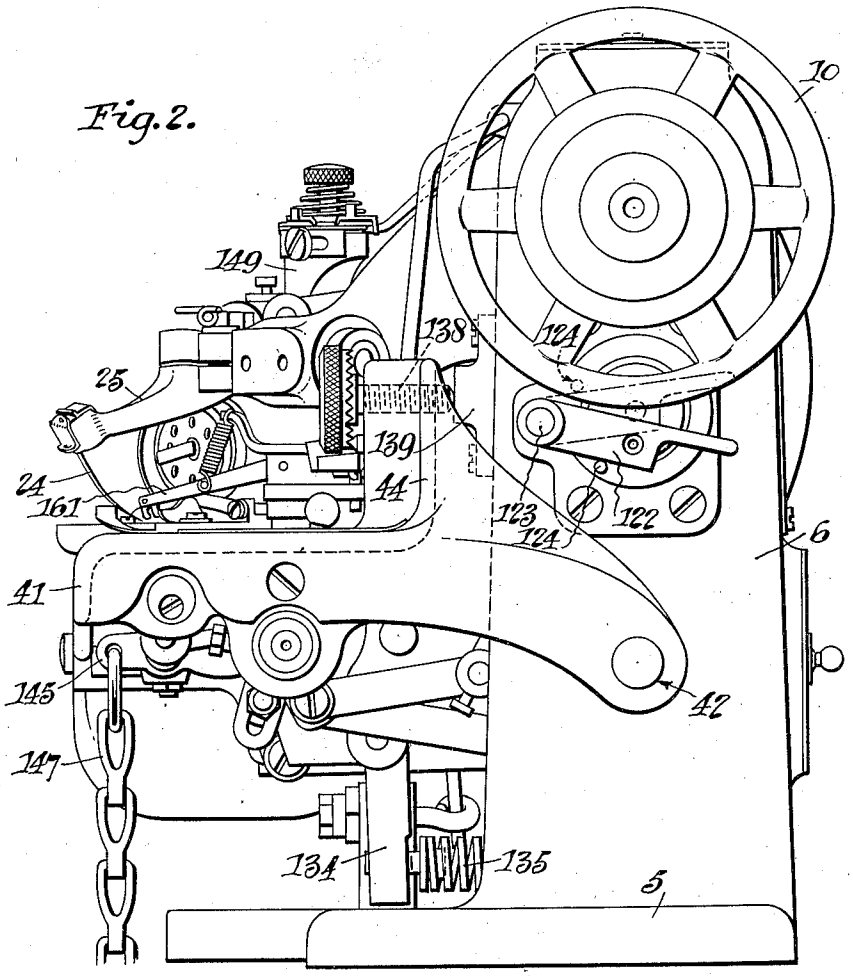
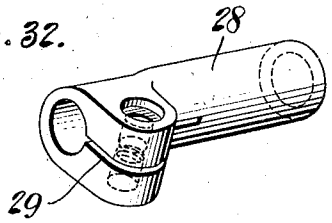


Fig. 32.



INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

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SEWING MACHINE

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Fig. 3

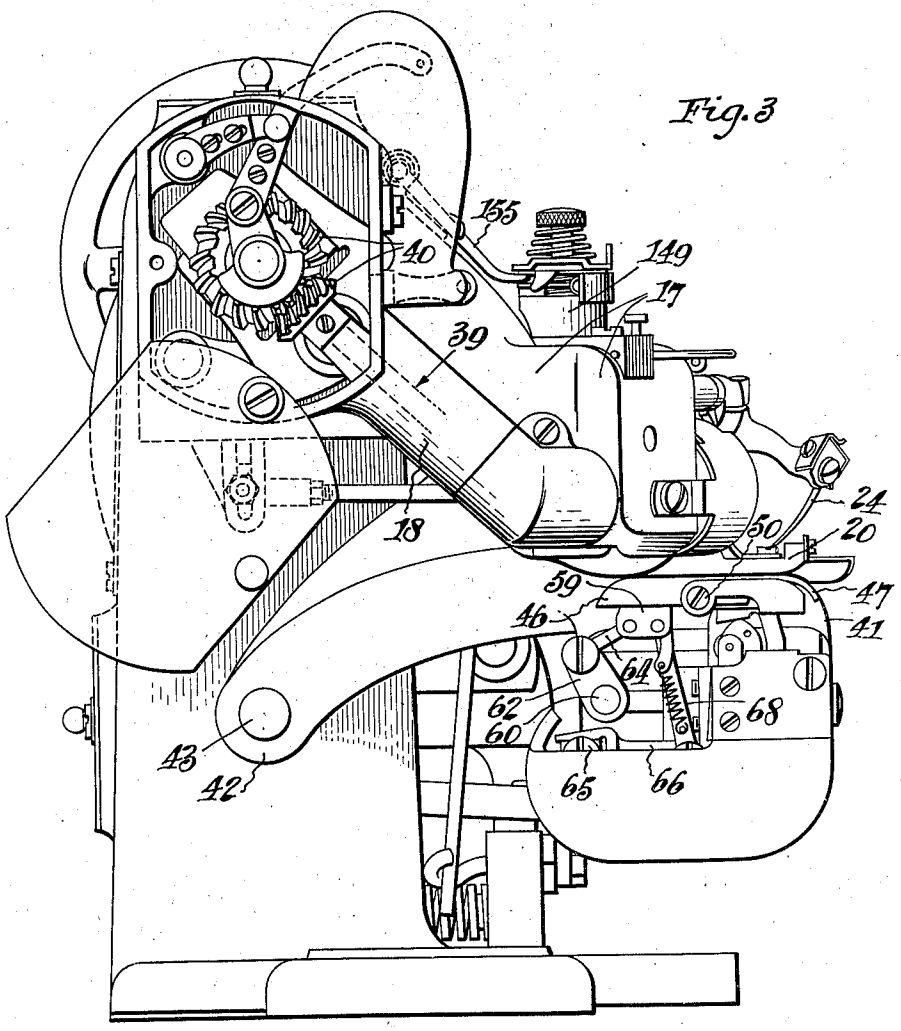
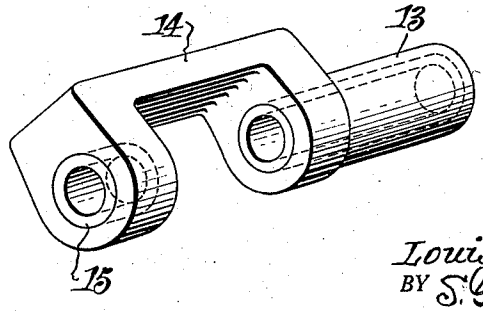


Fig. 33.



INVENTOR.

Louis G. Bowman.

BY S. George Tate

ATTORNEY

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SEWING MACHINE

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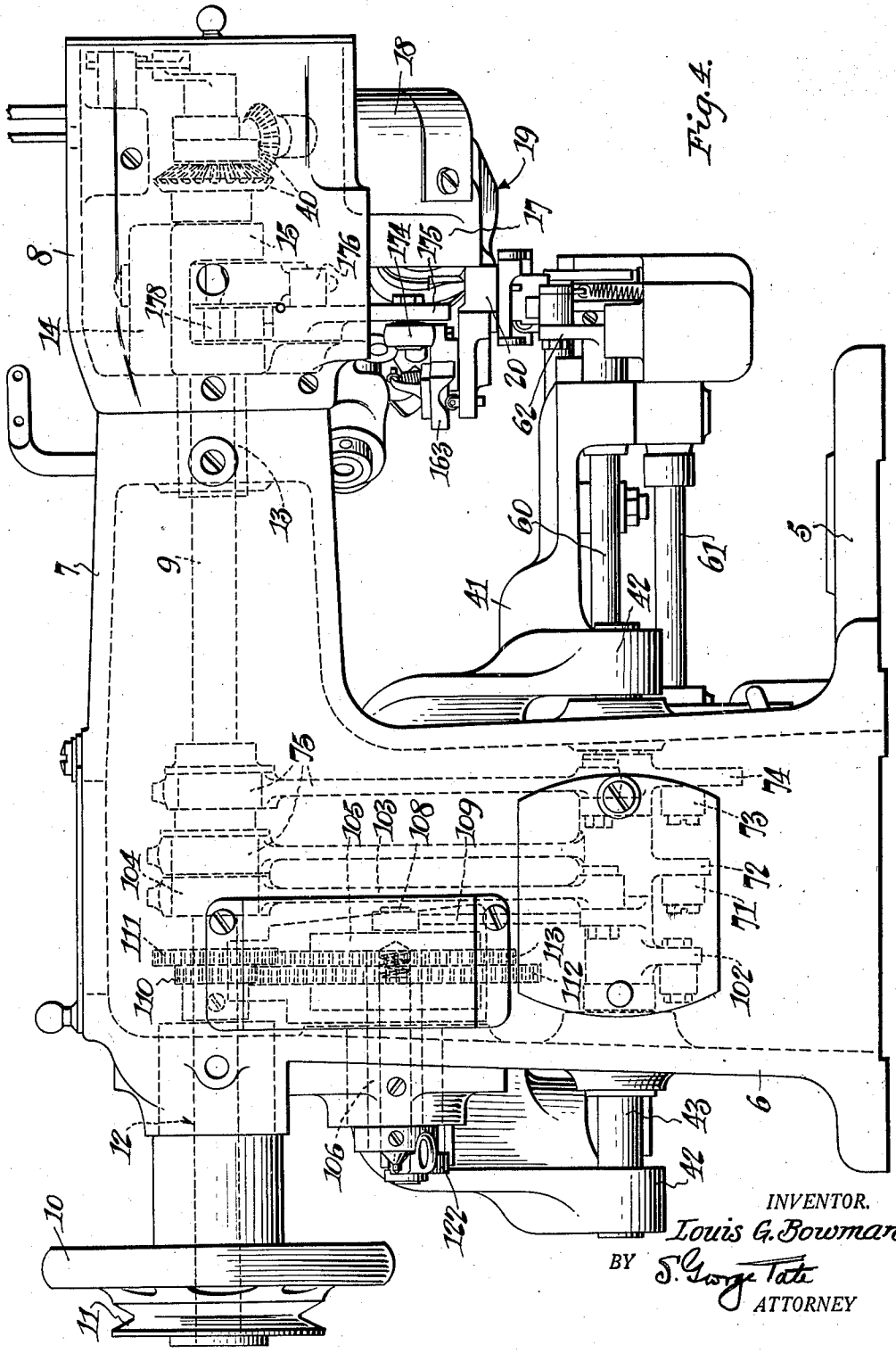


Fig. 4.

INVENTOR.
Louis G. Bowman
BY S. George Tate
ATTORNEY

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SEWING MACHINE

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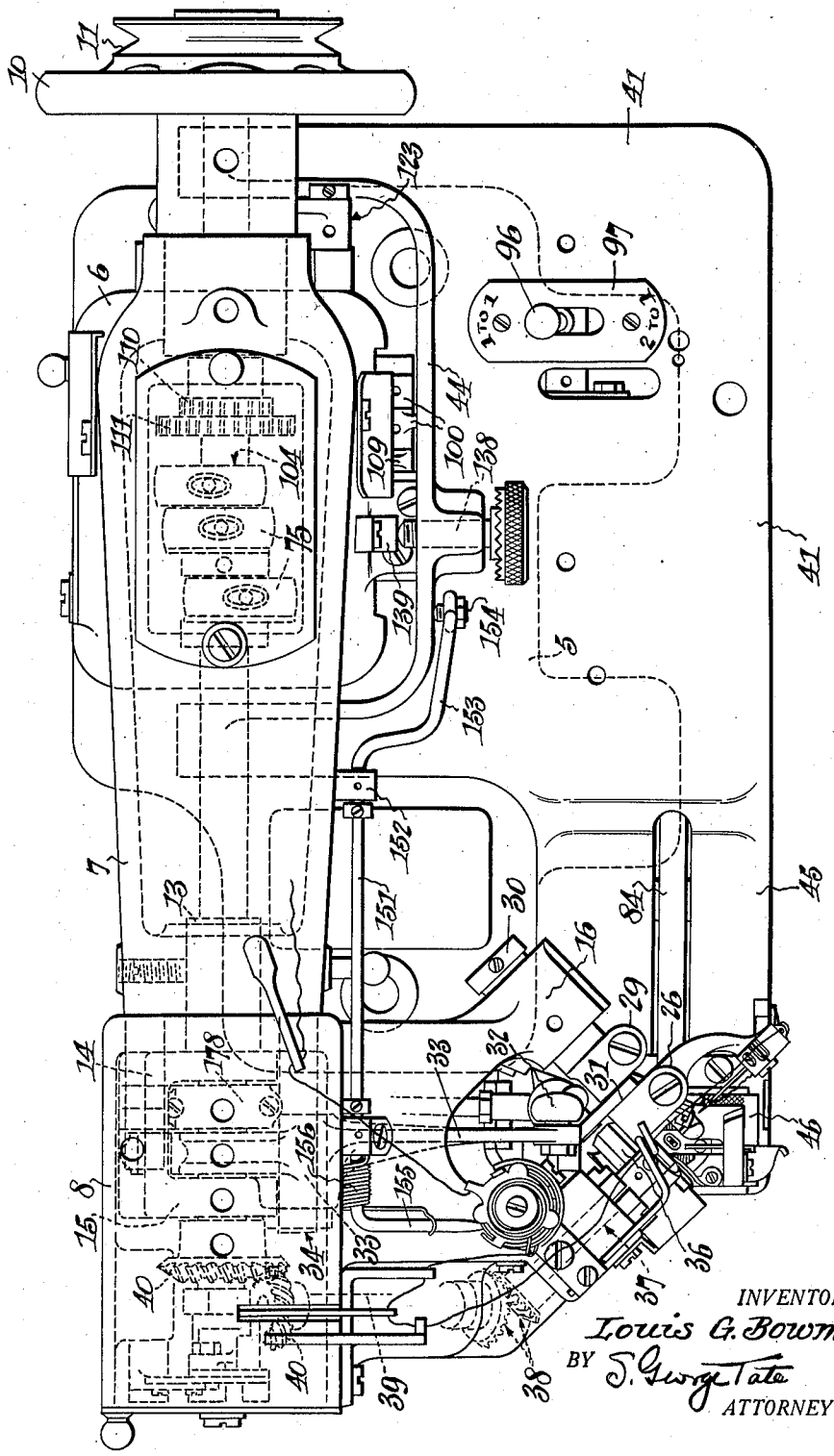


Fig. 5.

INVENTOR.
Louis G. Bowman.
BY J. George Tate
ATTORNEY

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Fig. 6.

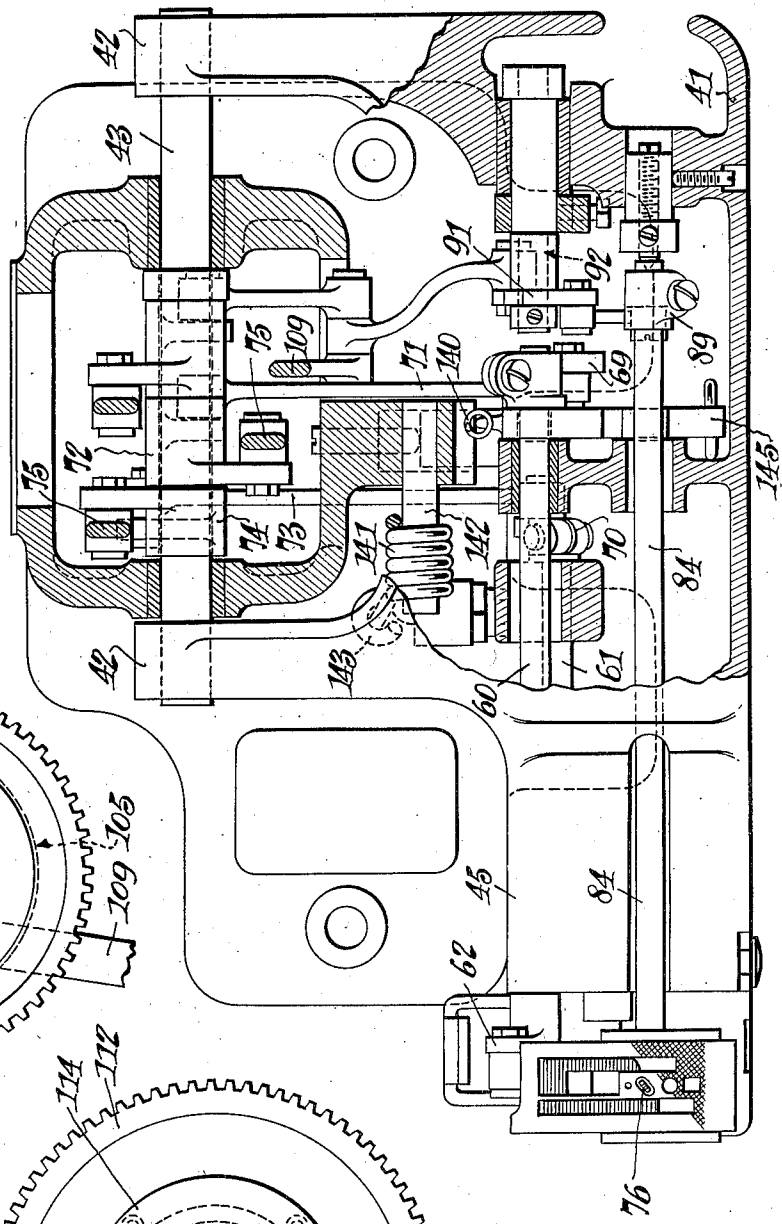


Fig. 7.

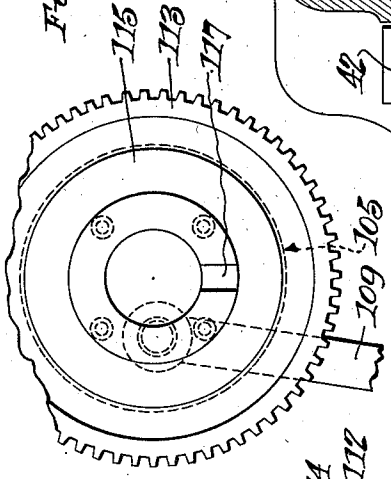
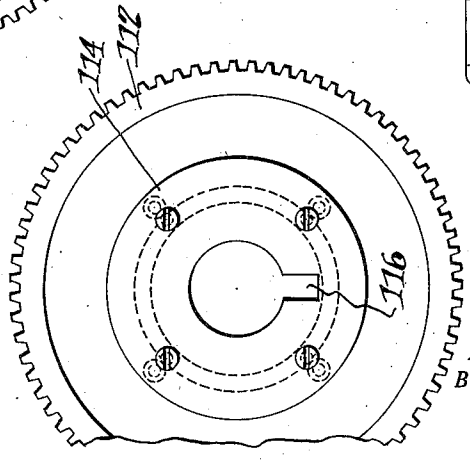


Fig. 8.



INVENTOR.
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ATTORNEY

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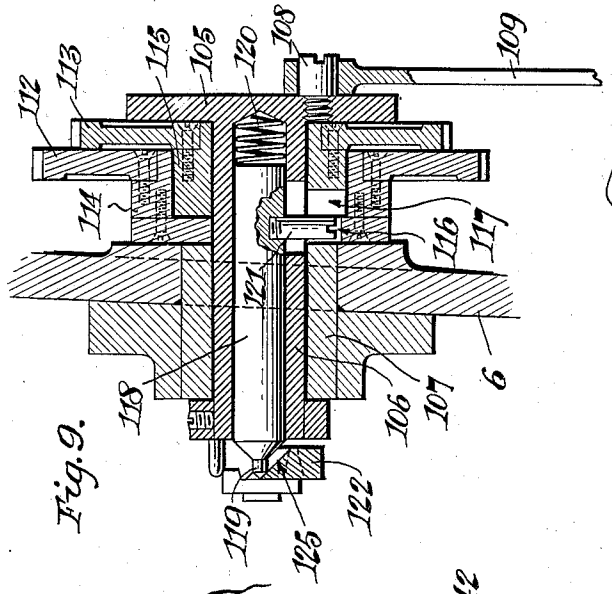


Fig. 9.

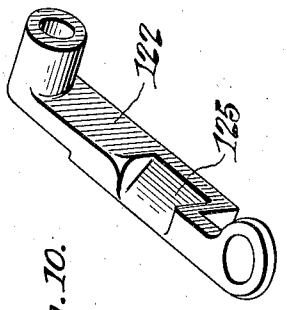


Fig. 10.

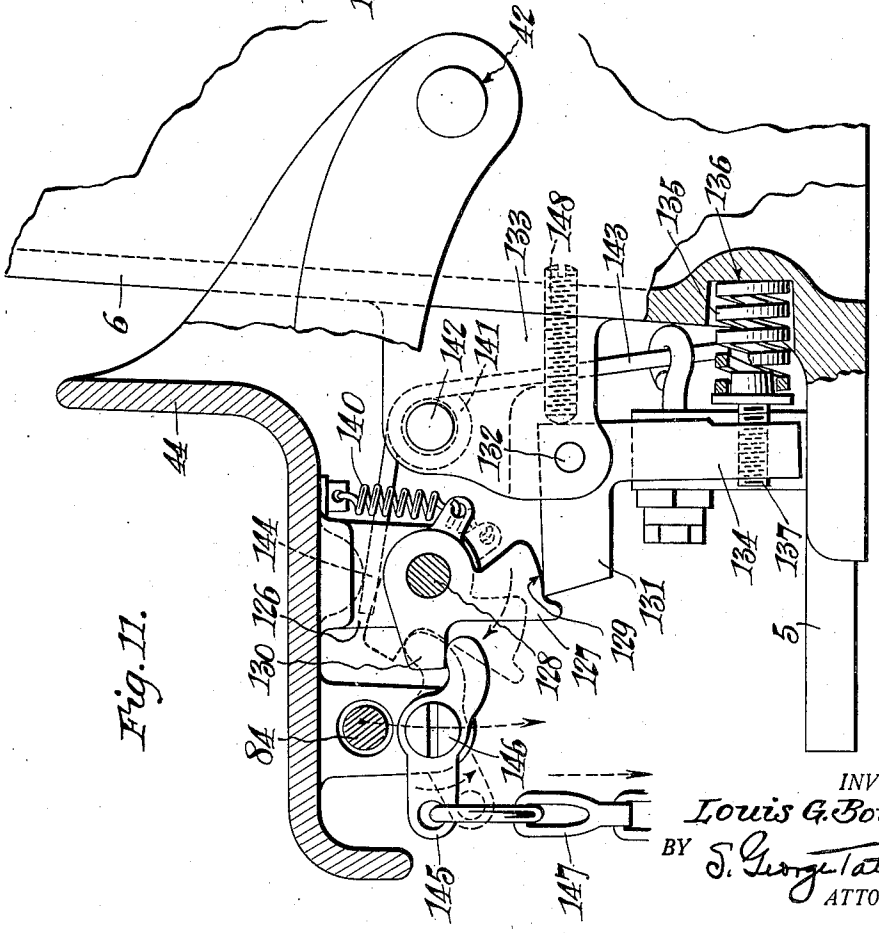


Fig. 11.

INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

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SEWING MACHINE

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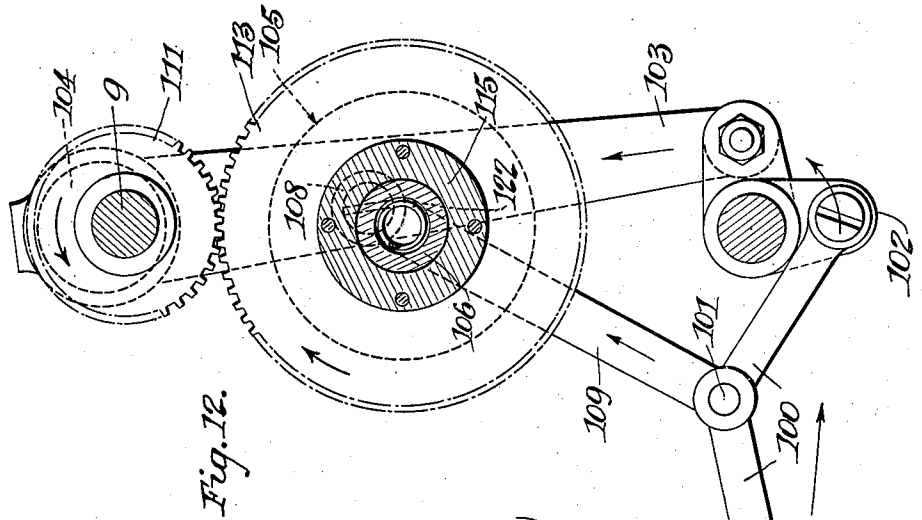
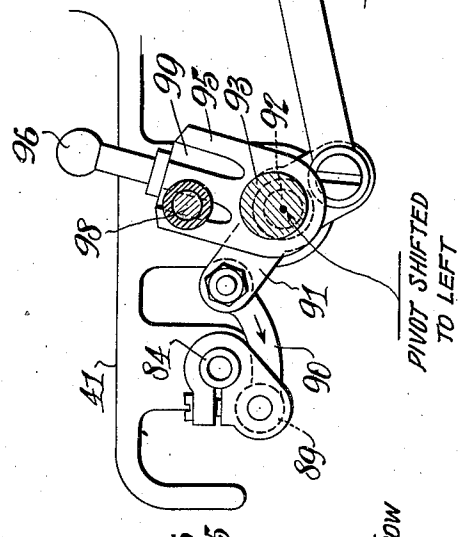


Fig. 12.



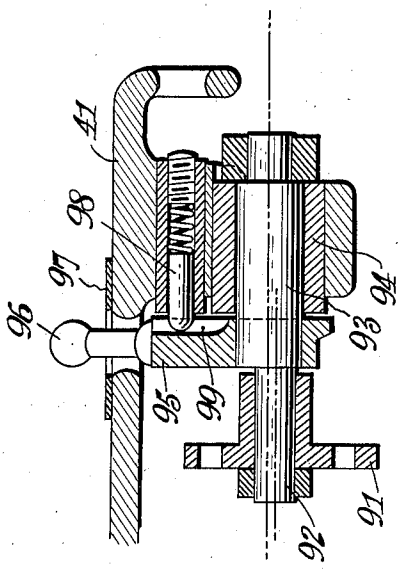


Fig. 14.

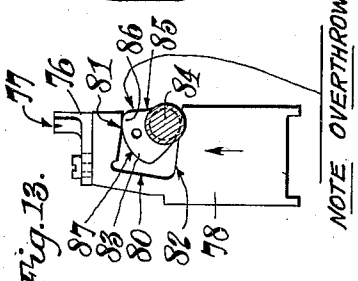


Fig. 13.

INVENTOR.
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BY
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SEWING MACHINE

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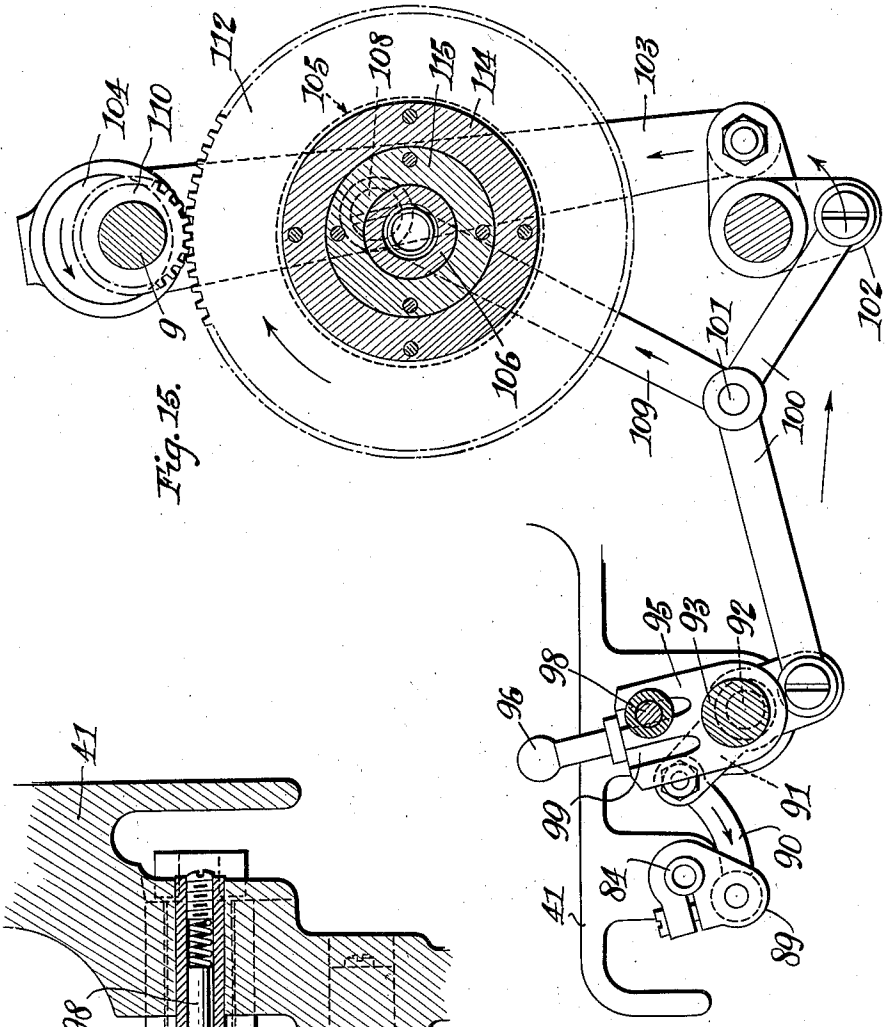


Fig. 15.

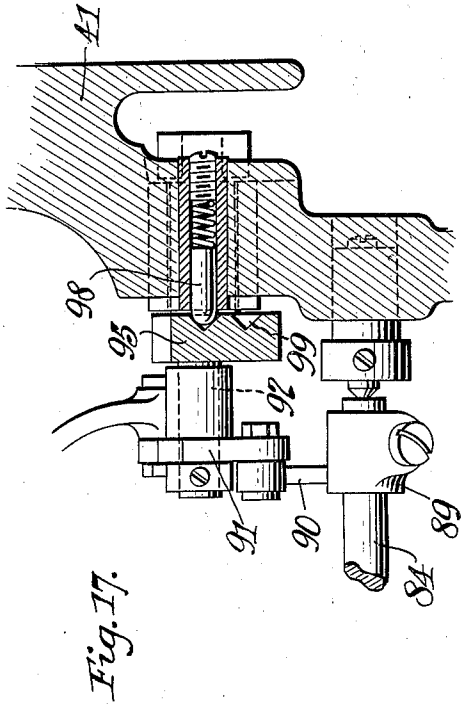


Fig. 17.

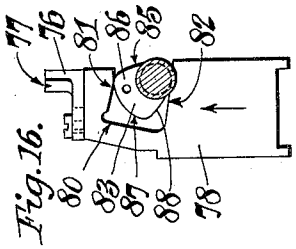


Fig. 16.

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SEWING MACHINE

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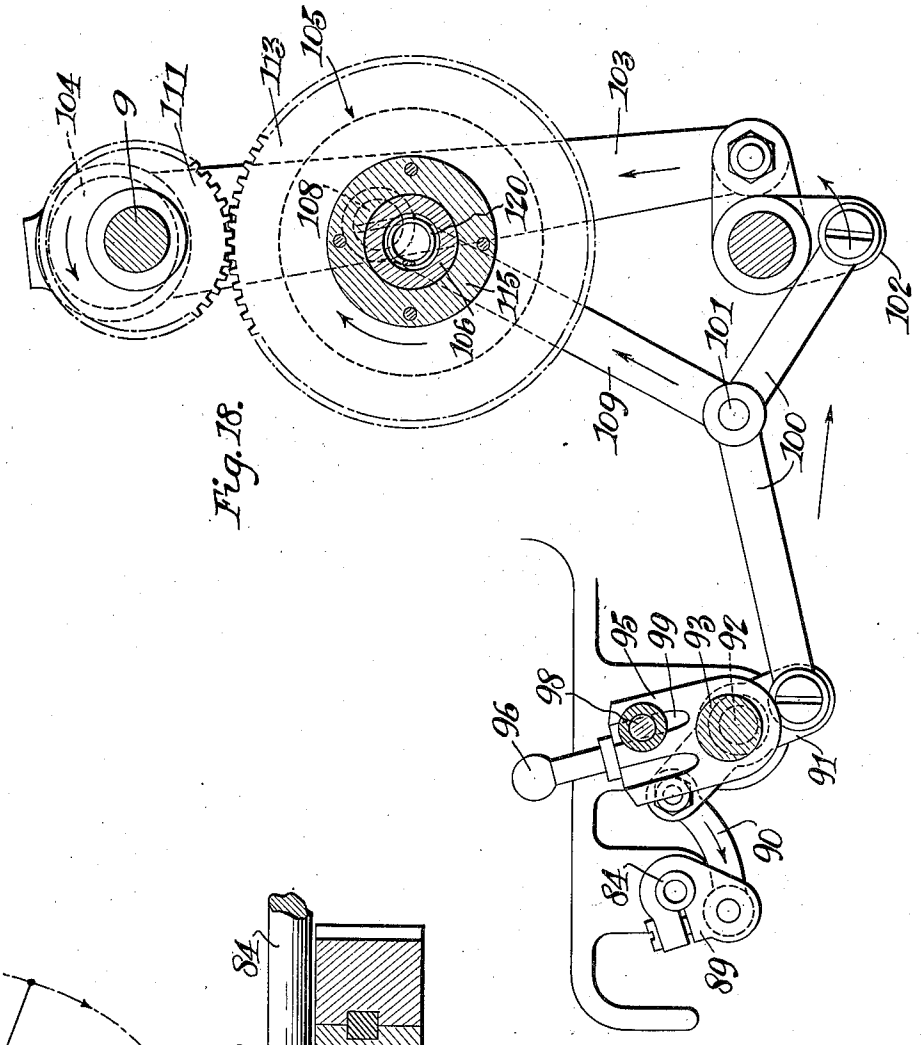


Fig. 18.

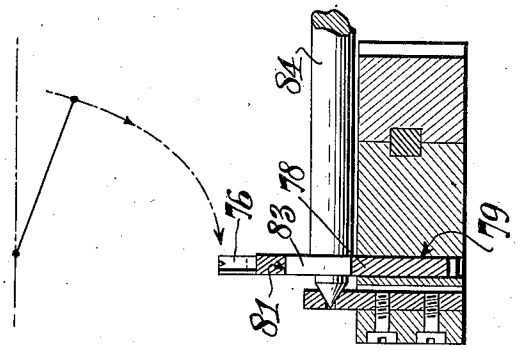


Fig. 20.

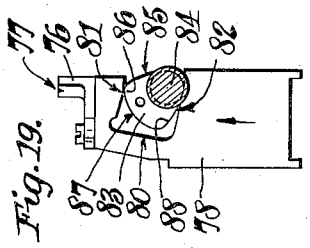


Fig. 19.

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SEWING MACHINE

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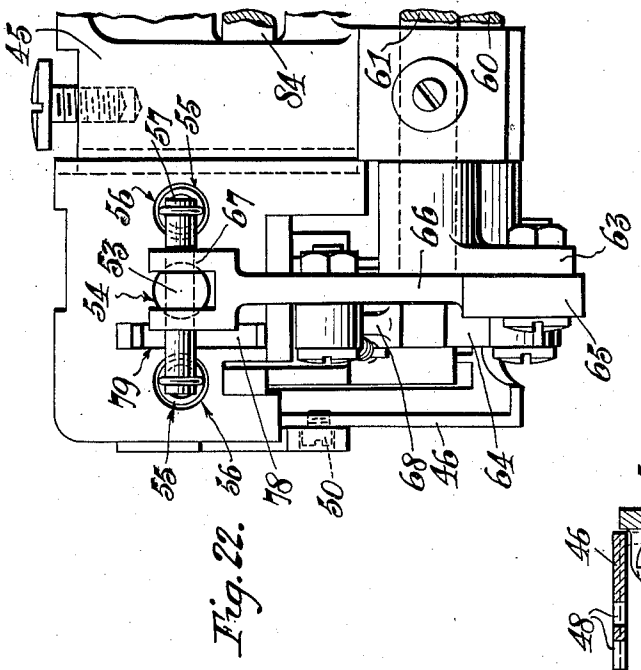


Fig. 22.

Fig. 23.

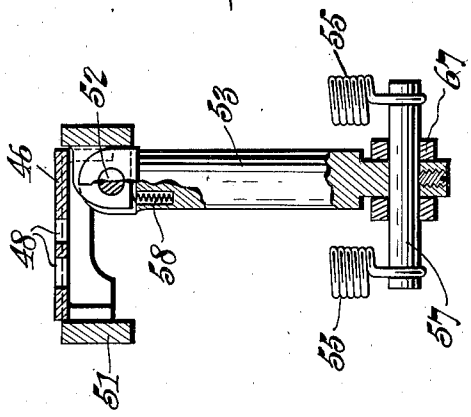
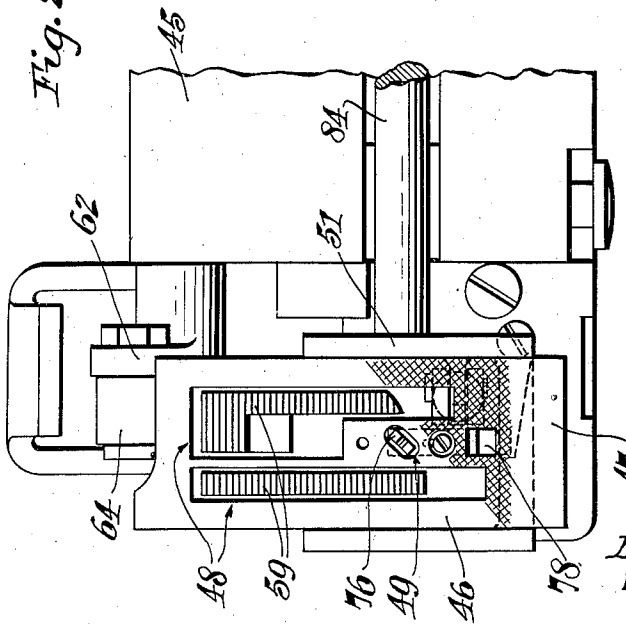


Fig. 21.



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Fig. 24.

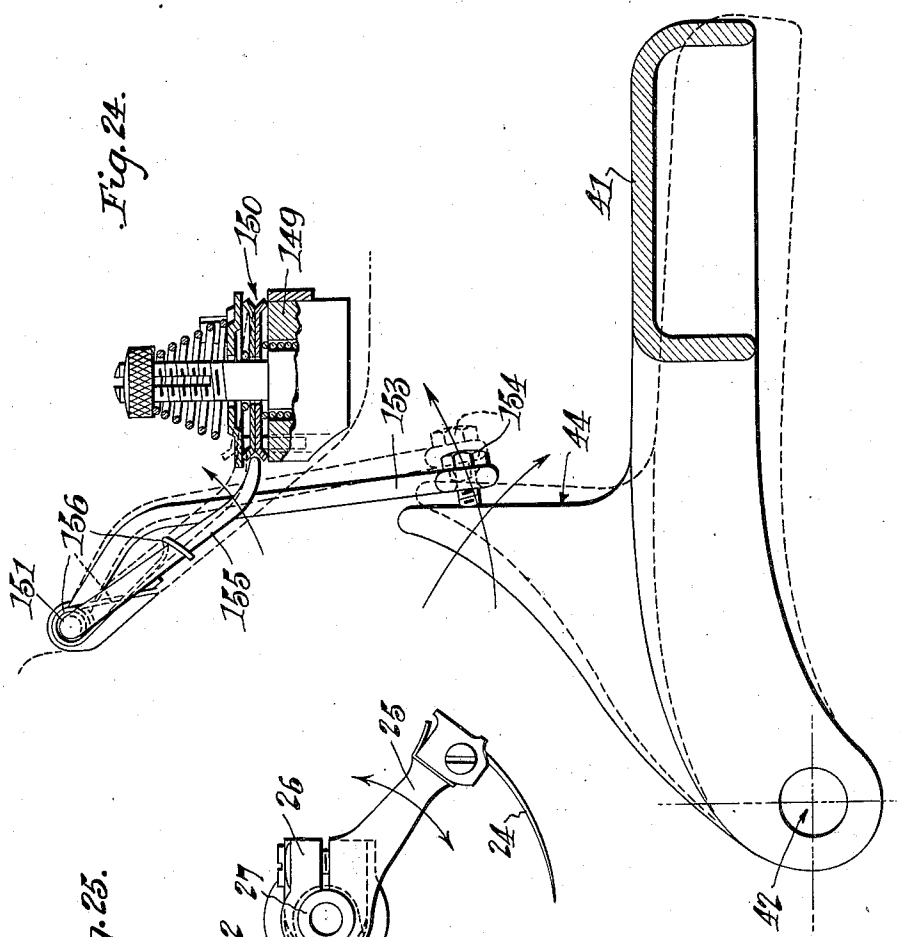
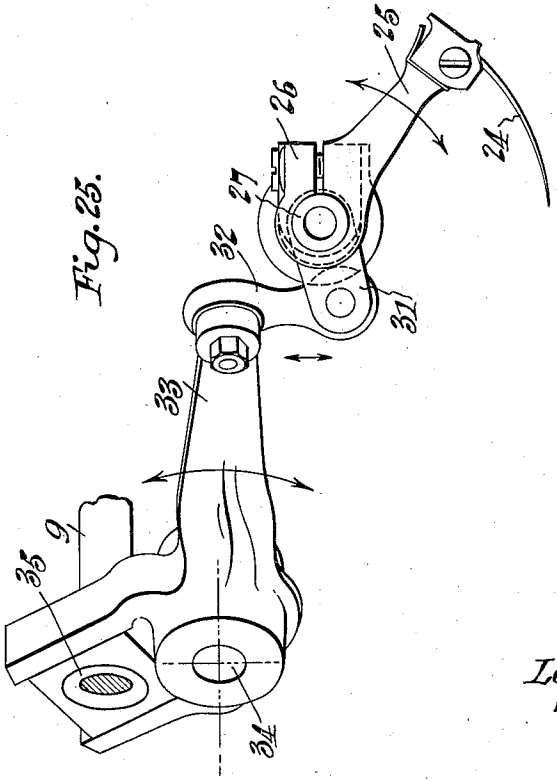


Fig. 25.



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BY S. George Tate
ATTORNEY

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SEWING MACHINE

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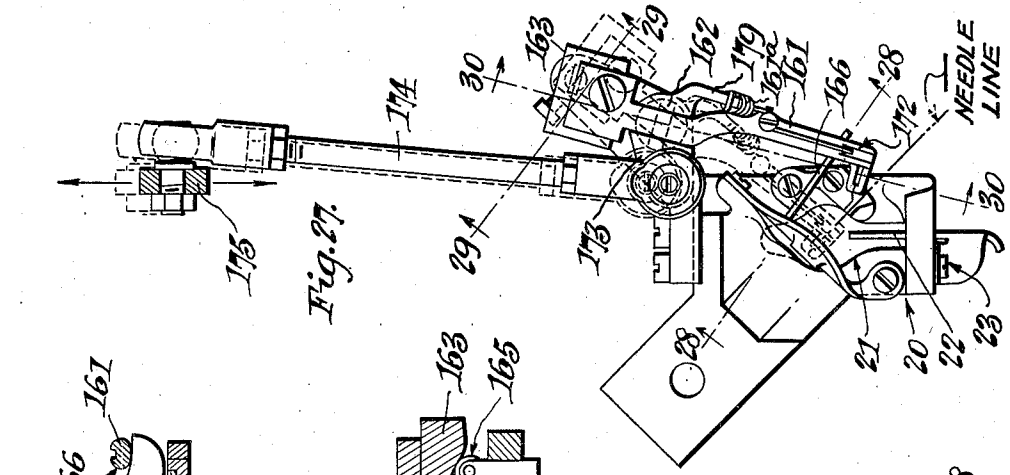


Fig. 27.

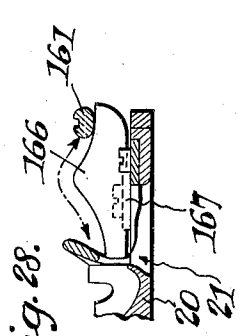


Fig. 28.

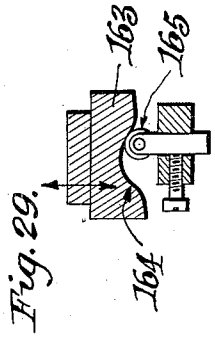


Fig. 29.

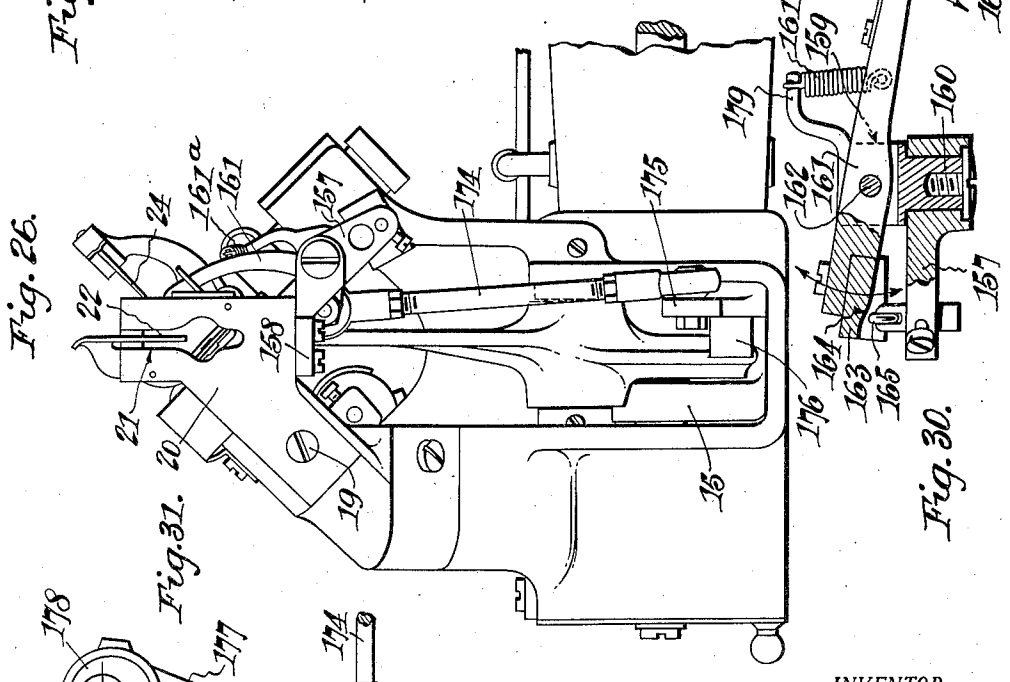


Fig. 26.

Fig. 30.

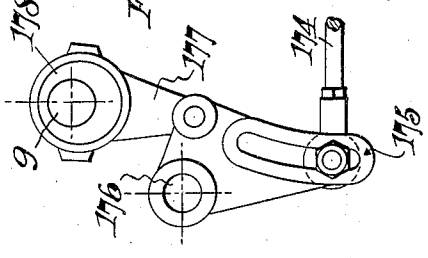


Fig. 31.

INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

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Fig. 34.

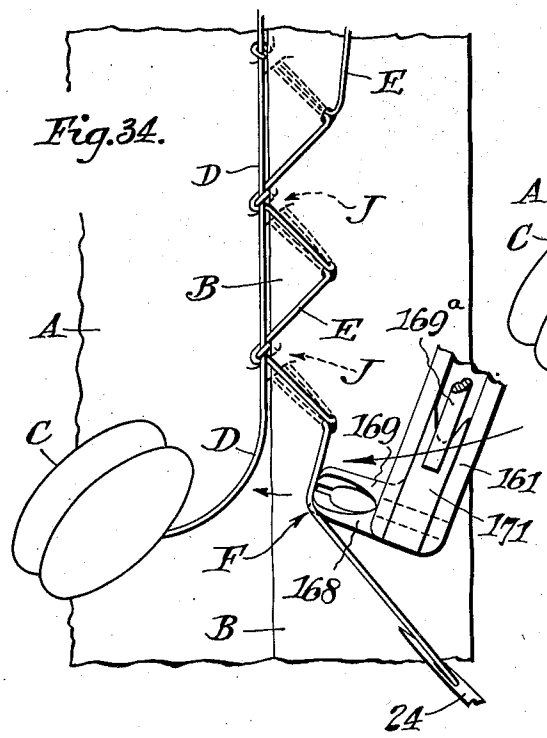


Fig. 35.

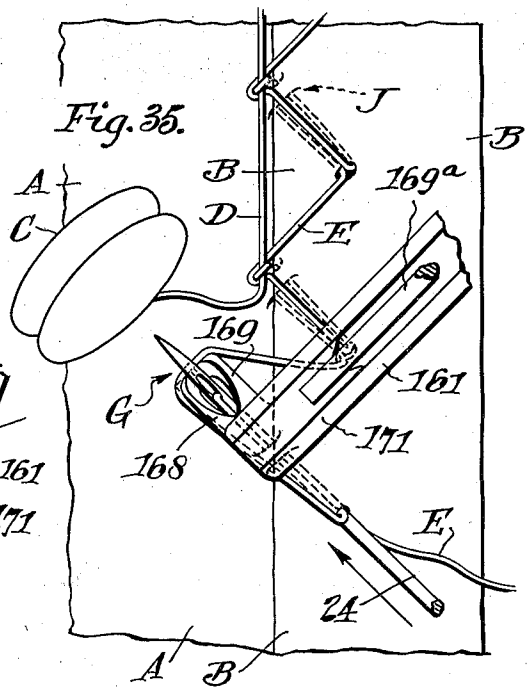
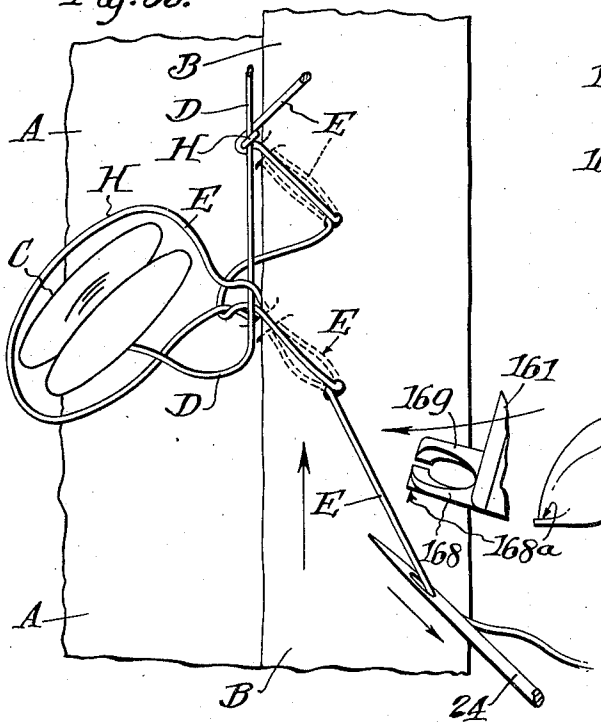


Fig. 36.



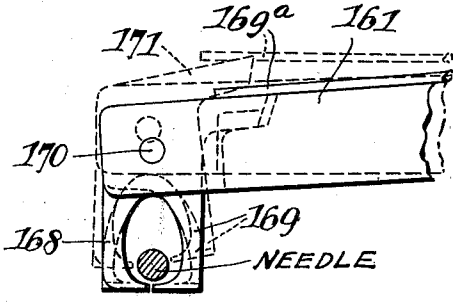


Fig. 37.

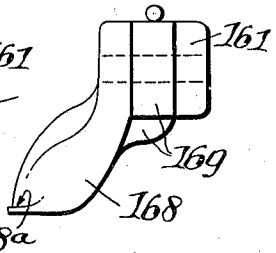


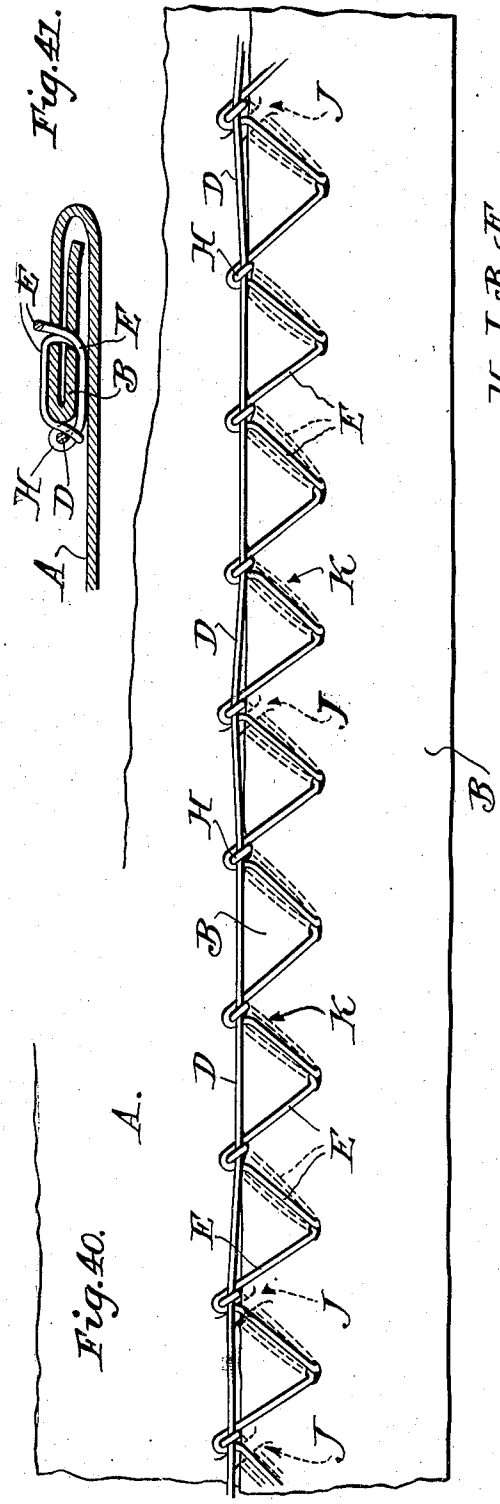
Fig. 38.

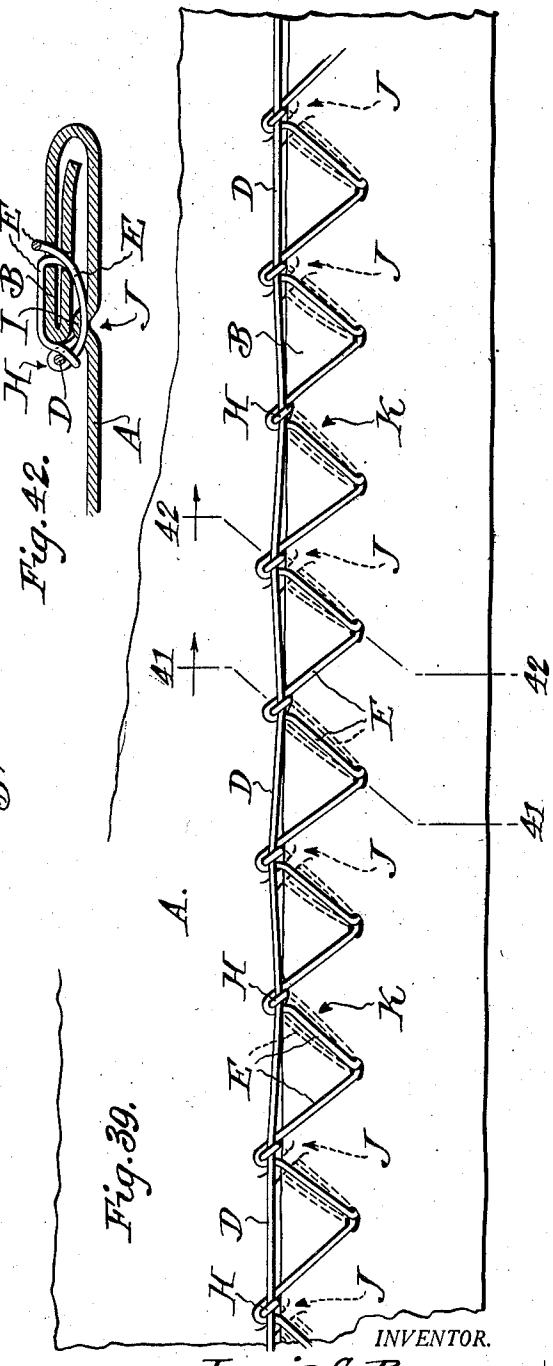
INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

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SEWING MACHINE

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INVENTOR.
Louis G. Bowman.
BY S. George Tate
ATTORNEY

Patented Sept. 6, 1938 2,129,402

UNITED STATES PATENT OFFICE

2,129,402

SEWING MACHINE

Louis G. Bowman, St. Louis, Mo., assignor to Lewis Invisible Stitch Machine Company, St. Louis, Mo., a corporation of Maine

Application September 27, 1935, Serial No. 42,547

31 Claims. (Cl. 112—178)

This invention relates to new and useful improvements in sewing machines generally, although more particularly to those of the blind stitch type.

Sewing machines have heretofore been devised which are capable of forming "anchor" and "skip" stitches in alternation. In the Mueller Patent 2,018,186, Oct. 22, 1935, there is disclosed a machine in which is embodied means for forming blind stitches, means for normally projecting the hem fold and body fabric and then the hem fold only into position for needle penetration whereby alternate "anchor" and "skip" stitches will be formed. There is provided also manually controllable means for causing the formation of successive "anchor" stitches without forming any "skip" stitches.

An object of my invention is to provide novel and improved mechanisms for forming "anchor" and "skip" stitches, there being included adjustable devices by employment of which the operator is enabled to effect the formation of a succession of "anchor" stitches; or alternated "anchor" and "skip" stitches, there being one "skip" stitch intervening each pair of "anchor" stitches; or alternated "anchor" and multiple "skip" stitches, there being a multiple of "skip" stitches intervening each pair of "anchor" stitches.

With this and other objects in view which will more fully appear, the nature of the invention will be more clearly understood by following the description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:—

Figure 1 is a front elevation of the machine.

Figure 2 is a right end elevation.

Figure 3 is a left end elevation.

Figure 4 is a rear elevation.

Figure 5 is a top plan view.

Figure 6 is a horizontal section through the standard at the point of pivot of the work support or table, portions of the latter being shown broken away and in section.

Figure 7 is a face view of the larger gear of the 1-to-2 ratio set of gears.

Figure 8 is a face view of the larger gear of the 1-to-4 ratio set of gears.

Figure 9 is a detail vertical longitudinal section through the axis of the gear ratio selecting mechanism.

Figure 10 is a detail perspective view of the pivoted lever by which the gear ratio selection is made.

Figure 11 is a detail vertical sectional view illustrating the dual spring mounting of the work support or table.

Figure 12 is a somewhat diagrammatic vertical cross sectional view illustrating the ridge forming element shifting devices shifted to position for causing the formation of an "anchor" stitch during each needle operation or main shaft rotation, the 1-to-2 gear ratio being shown as effective.

Figure 13 illustrates the position of the ridge forming element and operating cam effected by the position of the parts as shown in Figure 12.

Figure 14 is a detail vertical longitudinal section taken along the axis of the pivot pin shifting means shown in Figure 12.

Figure 15 is a somewhat diagrammatic vertical cross sectional view illustrating the ridge forming element shifting devices shifted to position for causing the formation of a single "anchor" stitch during each fourth needle operation or main shaft rotation, "skip" stitches alone being formed during intervening needle operations or main shaft rotations, the 1-to-4 gear ratio being shown as effective.

Figure 16 illustrates the position of the ridge forming element and operating cam effected by the position of the parts as shown in Figure 15.

Figure 17 is a detail horizontal section taken along the axis of the spring pin which yieldably retains the adjustment of the pivot pin shifting lever.

Figure 18 is a somewhat diagrammatic vertical cross sectional view illustrating the ridge forming element shifting devices shifted to position for causing the formation of a single "anchor" stitch during every other needle operation or main shaft rotation and "skip" stitches during the intervening alternate needle operations or main shaft rotations, the 1-to-2 gear ratio being shown as effective.

Figure 19 illustrates the position of the ridge forming element and operating cam effected by the position of the parts shown in Figure 18.

Figure 20 is a detail vertical longitudinal section through the ridge forming element support cam plate and its mounting.

Figure 21 is an enlarged detail plan view illustrating the work clamp and the supporting table extension end.

Figure 22 is an inverted plan view of the parts shown in Figure 21, the protective casing member being shown removed.

Figure 23 is a detail sectional view illustrating the transverse pivot mounting and spring support of the work clamp.

Figure 24 is a somewhat diagrammatic sectional view illustrating the feature of automatically releasing thread tension by depression of the work support or table.

Figure 25 is a detail view illustrating the driving connections for the needle.

Figure 26 is a detail inverted plan view of the sewing head and the parts supported thereon.

Figure 27 is a detail plan view of the rigid presser foot and thread looper removed from their support.

Figure 28 is a detail cross section taken on the line 28—28 on Figure 27.

Figure 29 is a detail cross section taken on the line 29—29 on Figure 27.

Figure 30 is a detail longitudinal section taken on the line 30—30 on Figure 27.

Figure 31 is a detail view illustrating the driving connections for the thread looper.

Figure 32 is a detail perspective view of the needle shaft take-up bearing.

Figure 33 is a detail perspective view of the extension bearing for the main shaft.

Figure 34 is a diagrammatic plan view illustrating the formation of a series of "anchor" stitches, the thread arm or looper being shown in the process of laying the needle thread over the edge of the hem fold.

Figure 35 illustrates the completion of the thread laying movement shown in Figure 34, the needle being shown in the process of carrying the needle thread through the loop laid by the thread looper fingers.

Figure 36 illustrates the continuation of the stitch formation shown in Figures 34 and 35, the needle having receded and left a slack needle thread which has been taken up by the hook and is being passed around the bobbin thread, and the thread looper being shown as starting toward formation of its function shown in Figures 34 and 35.

Figure 37 is a detail view of the thread looper end and illustrates the manner in which the yieldable thread looper finger clears the needle in receding from the thread laying function shown in Figure 35.

Figure 38 is a detail end elevation of the thread looper.

Figure 39 is an enlarged somewhat diagrammatic plan view of a portion of a seam showing a plurality of "anchor" stitches at each end and alternate "skip" and "anchor" stitches intermediate said ends.

Figure 40 is a view similar to Figure 39 and illustrates the seam embodying "anchor" stitches at the beginning or left hand end and a single "anchor" stitch spaced by three "skip" stitches or one "anchor" stitch in each four needle operations or main shaft revolutions following said initial "anchor" stitches.

Figure 41 is a detail cross sectional view taken on the line 41—41 on Figure 39.

Figure 42 is a detail cross sectional view taken on the line 42—42 on Figure 39.

Like reference numerals designate corresponding parts throughout the several figures of the drawings.

My improved machine embodies a main frame including a base 5, a standard 6, an overhanging or laterally extending arm 7, and a sewing head 8 which is secured to the free end of said arm.

A main shaft 9 equipped with the usual handwheel 10 and drive pulley 11 is journaled in the arm and sewing head in bearings 12 and 13, the latter being in the nature of a long hub mounted in the abutting walls of the arm and head and having a U-shaped extension 14 providing an auxiliary bearing portion 15 spaced from said hub. See Figures 4, 5 and 33.

Considering the direction of feed of the fabric as being away from the operator, the head 8 is equipped with a forward extension providing a needle shaft bearing support portion 16, a complemental stitch forming mechanism support portion 17 and a drive housing portion 18.

Rigidly secured as at 19 to the under face of and projecting from the support portion 17 is a horizontal presser foot 20 having formed therein a longitudinal opening 21 effective during the sewing operation to receive a ridge of material, and a hem guide 22, the latter being removably secured as at 23 to said foot.

The stitch forming mechanism includes a reciprocatory needle 24 which is oscillatable angularly across the opening 21 as shown in Figures 5 and 27. The needle is attached to a needle arm 25, and the latter is clamped as at 26 to the forward end of an oscillatory needle shaft 27 which is journaled in a bearing sleeve 28 supported in the bearing support portion 16. It will be observed by reference to Figures 1, 5 and 32 that the sleeve 28 has its end formed in the nature of a split clamp which facilitates the taking up of undesirable shaft clearance and thus tends to assure very accurate needle action. It will be understood that bearings with a thrust motion at one end wear unevenly, the wear appearing at the thrust end first. By taking up slightly at the split clamp end of my improved bearing sleeve 28 wear can be compensated for and the life of the bearing materially prolonged. The bearing sleeve 28 being only partially split, the desired wear take-up adjustment may be effected without danger of binding the needle shaft 27. The needle shaft 27 is held against end play by a collar 30.

The crank arm 31 is secured to the needle shaft and is link-connected as at 32 to one end of a forked bell crank lever 33 which is pivoted as at 34 in the sewing head 8, the fork embracing a block and eccentric equipment 35 as shown in Figures 5 and 25 so that the rotary motion of the main shaft 9 will be transmitted in the form of oscillatory motion to the needle.

Cooperating with the needle 24 is a complementary stitch forming mechanism for forming a line of lock stitches and which in this particular disclosure includes a rotary hook 36 carried by a driven shaft 37. The shaft 37 is rotated through the means of bevel gear unit 38 from a driver shaft 39 rotatably supported in the housing portion 18 and which is in turn driven by bevel gear unit 40 with the main shaft 9. It will be observed by reference to Figures 4 and 5 that the hook driving gear unit 40 is disposed in close relation to the extended bearing portion 15, and consequently all tendency toward undesirable flexure or freedom of the main shaft at this point is thus avoided.

A work support or table 41 is pivotally supported at 42 on a horizontal shaft 43 supported in and extending laterally from the frame standard 6 in parallelism with the main shaft 9. The support 41 includes an upstanding guard flange portion 44 and a slightly depressed portion 45 which extends laterally from said support beneath the presser foot 20 as shown in Figure 1.

A vertically yieldable work clamp 46 is carried by the lateral extension 45 and includes a downwardly turned receiving end 47, openings 48 for

accommodating a feed dog, and an opening 49 for permitting vertically reciprocatory movement of a ridge forming element.

The work clamp 46 is pivotally supported as at 50 for fore and aft tilting movement on a carrier 51 which is in turn pivotally supported at 52 for lateral tilting movement on a post 53. The post 53 is vertically reciprocable in a bore 54 formed in the lateral extension 45 and is yieldably pressed upwardly in opposition to the presser foot 20 by retractile springs 55 anchored in bores 56 and connected to the cross pin 57 secured to the lower end of the post. It will be noted that the pivot 52 of the work clamp is off center and a cushioned spring 58 is provided to balance the position of said clamp. See Figures 6, 21, 22 and 23.

The function of the work clamp 46 is to hold the material securely during the sewing operation. When the feed dog has descended, the ridge forming element rising at this time and coming in contact with the material would draw it unevenly if it were not held securely on all sides, causing the needle penetrations to vary. Therefore the work clamp is permitted to rock laterally to take care of uneven thicknesses at the right and left hand sides of the ridge forming element, and also to rock fore and aft to take care of the same conditions in front as well as in back of the ridge forming element, and to allow the seam to feed freely. To further accommodate the conditions stated the work clamp is pivoted off center as shown at 52 in Figure 23. The positioning of the post 53 off-center also avoids the necessity of otherwise placing it too far forward, and the coil spring 58 compensates for tilting tendencies of the clamp by reason of its off-center mounting and tends to hold the clamp level.

A feed dog 59 is of the usual 4-motion type and for effecting this movement I employ a feed travel shaft 60 and a feed lift shaft 61, said shafts being supported beneath the work support 41 in parallelism with each other and with the main shaft 9. The shaft 60 is provided at its left hand end with a crank 62 and the shaft 61 with a similar crank 63, the former being link-connected as at 64 with the feed dog and the latter being connected as at 65 to one end of a lever 66 which is connected at its other end with a lower extremity of the post 53 and intermediately of its ends, by a link 68, with said feed dog. See Figures 3, 6, 22 and 23.

At their right hand ends the shafts 60 and 61 are respectively equipped with cranks 69 and 70, the former being connected by a link 71 with one arm of a bell crank lever 72 and the latter by a link 73 with one arm of a bell crank lever 74 both of said bell crank levers being pivotally supported on the shaft 43. The other arms of the bell crank levers 72 and 74 are connected by pitman and eccentric connections 75 with the main shaft 9.

It will be readily understood that as the cranks 62 and 63 oscillate the usual 4-motion movement will be imparted to the feed dog 59, and that by reason of the connection of the link 68 intermediately of the ends of the lever 66, each time the feed dog is engaged in the feeding of the fabric, the post 53 will be depressed slightly and the work clamp 46 relieved from tight engagement against the fabric and presser foot. The springs 55 associated with the work clamp 46 are independent of the plunger. As the feed dog comes up into contact with the material under the presser foot, the work clamp recedes, allowing the material to be fed through freely. When the feed dog has completed its feed travel and moves down, the springs 55 lift the work clamp against the material to hold it in position with enough pressure to allow the ridge forming element to stretch the material slightly as it rises to the needle penetration receiving position.

A ridge forming element or plunger 76 is vertically reciprocable through the opening 49 in the work clamp and the opening 21 in the foot for projecting a ridge or node of hem and body fabric into needle penetrating position. The element 76 is provided with a needle accommodating notch 77 and is adjustably supported on a cam slide or plunger 78 slide guided as at 79 in the work support extension 45 as shown in Figures 20 and 22.

The slide 78 includes a cam receiving cutout portion 80 defined above by an elevation control shoulder 81 and below by a downward movement effecting shoulder 82. Operable in the cutout 80 is a 3-point wiper cam 83 which is secured at the left hand end of a shaft 84 rockably supported beneath the work support or table 41. The cam 83 includes a lifting surface 85 terminating in a nose 86 merging with a concentric dwell portion 87 and downward movement effecting surface 88. See Figures 3, 13, 16 and 20.

At its other end the shaft 84 is equipped with a crank 89 which is link-connected as at 90 to one end of a lever 91 rockably pivoted intermediate its ends on a shiftable pivot pintle 92. The shiftable pintle is in the nature of a reduced end extending eccentrically from a stud shaft 93 rockably supported at 94 beneath the work support 41 and having a shifter crank or lever 95 secured thereto. The crank 95 includes a handle portion 96 projecting above the work support 41 through a suitable aperture therein and adapted for association with an indicator scale 97 mounted on said support. A spring pin 98 carried by the work support 41 cooperates with notches 99 in the crank 95 for yieldably securing said clamp in its positions of adjustment. See Figures 6, 12, 14, 15 and 17.

The other end of the lever 91 is connected by toggle links 100 pivoted together as at 101 to one arm of a bell crank 102, the other arm of the bell crank being pitman connected as at 103 with an eccentric 104 mounted on the main shaft 9. See Figures 4, 6 and 12.

A crank disc 105 mounted on a sleeve hub 106 is rotatably supported in the frame bearing 107 and has a crank pin 108 projecting therefrom in spaced relation to the axis of rotation thereof. The crank pin is link-connected as at 109 to the pivotal connection 101 of the toggle links 100 so that upon rotation of the disc 105 the toggle links will be alternately broken and straightened out. See Figures 9 and 18.

A small gear 110 and a larger gear 111 are mounted side by side on the main shaft 9 and respectively mesh constantly with the large and smaller gears 112 and 113 secured on the hub sleeves 114 and 115 rotatably nested on the sleeve hub 106 as shown in Figure 9. The ratio of the gears is such that for each two revolutions of the main shaft 9 the sleeve hub 115 will be rotated once and for each four revolutions of said main shaft the sleeve hub 114 will be rotated once.

The sleeve hub 114 is equipped with a locking or clutching notch 116 and the hub 115 is equipped with a locking or clutching notch 117.

In order to provide for effectively coupling one or the other of the hub and gear combinations 112, 114, or 113, 115, I provide a shuttle pin 118 which is equipped with a cam end 119 projecting from the end of the sleeve hub 106, said pin being opposed at its inner end by a spring 120 which constantly tends to project the pin from the sleeve bore in which it is mounted. A clutch pin 121 projects radially from the shuttle pin and a shifter lever 122 shown in detail in Figure 10 is pivoted at 123 to the frame standard between limiting pins 124 and provided with a cam surface 125 for engaging the projecting end of the pin 118 to cooperate with the spring 120 for shifting the clutch pin 121 into locking engagement in one or the other of the notches 116 and 117.

It is my purpose in devising the present machine to enable the making of (1) a succession of "anchor" stitches passing through both the hem and the body fabric being worked upon, or (2) a plurality of such "anchor" stitches at the beginning and end of the formation of the hem with alternate "skip" and "anchor" stitches intervening the end sets of "anchor" stitches, or (3) a plurality of such "anchor" stitches at the beginning and end of the hem operation with intervening "anchor" stitches formed only at each fourth needle operation, there being between each pair of such intervening "anchor" stitches three "skip" stitches which pass through the turned-over or hem fabric only and not through both the hem fabric and the body fabric. These operations are made possible by employment of the shiftable pivot pintle 92 and the toggle link and selective gear ratio equipments illustrated in Figures 9, 12, 15 and 18. Although I have shown and described my invention as being particularly adapted in seaming hems, it will be understood that the machine may be employed in other sewing operations wherein a line of successive "anchor" stitches may be formed, or a line of alternate "anchor" and "skip" stitches may be formed, or a line of spaced "anchor" stitches with three "skip" stitches therebetween may be formed.

It should be understood that each time the cam nose 86 advances far enough to render any portion of the concentric or dwell cam portion 86 effective, the plunger 76 will have been elevated to a point for projecting a ridge of the hem and body fabric through the opening 21 of the foot into needle penetrating position whereby the needle 24 will penetrate the hem fabric and also the body fabric to form a resultant "anchor" stitch. When the plunger 76 is elevated to a lesser degree the needle will penetrate the hem fabric only, to form a resultant "skip" stitch which does not pass through the body fabric. Whenever the lever 95 is shifted to the position shown in Figures 15 and 18 the pivot pintle 92 will have been retracted causing a slight counter-clockwise movement of the shaft 84 as viewed in Figures 15 and 18. The maximum cam advancement movement or lifting of the plunger 76 is accomplished when the toggle links 100 are broken to the maximum degree as illustrated in Figures 12, 15 and 18 and when the cooperating eccentric and strap connections 104, 103 are at the maximum throw position illustrated in these figures, these conditions serving to bring about a maximum of movement of the link 90 toward the left as viewed in Figures 12, 15 and 18.

In other words, the maximum lift of the element 76 necessary in the formation of an "anchor" stitch ordinarily is accomplished only when the maximum throw of the eccentric and strap connection 104, 103 and the maximum lift of the crank pin 108 and link 109 coincide. Thus when the shuttle pin 118 is shifted to the position shown in Figure 9 causing the large gear 112 and smaller gear 110 to be effective, the maximum eccentric throw and link lift illustrated in Figure 15 will occur only once during each four revolutions of the main shaft 9. During the intervening revolutions of the main shaft 9 the plunger 76 will be only partially lifted and will result in the needle penetrating the hem fabric alone and therefore three "skip" stitches will be formed between each spaced pair of "anchor" stitches.

When the shuttle pin 118 is shifted to the right as viewed in Figure 9 so as to render effective the gears 111, 113, the maximum eccentric throw and link lift will coincide once during each two revolutions of the main shaft and consequently maximum lift will be imparted to the plunger 76 at alternate revolutions of the main shaft and during the intervening alternate revolutions the element will be only partially lifted resulting in the formation of alternate "anchor" and "skip" stitches.

Whenever it is desired to form a succession of "anchor" stitches, it is only necessary to shift the lever 95 to the position illustrated in Figure 12 of the drawings at which time the pivot pintle 92 will be projected toward the left causing the link 90 to rotate the shaft 84 a slight bit in the clockwise direction thus slightly advancing the cam 83. In this adjustment regardless of the driving ratio of the gears selected at the moment, the ridge forming element 76 will be lifted the maximum degree at every revolution of the main shaft 9. This is possible because the shifting of the pivot pintle 92 brings about an overthrow of the cam 83 as shown in Figure 13 at the intervals, during which the maximum throw of the eccentric and pitman connection 104, 103 and lift of the link 109, coincide, and during each intervening revolution of the main shaft the movement of the cam 83, while less than the maximum, will still be sufficient to bring the dwell surface 87 into effect causing the necessary maximum lift of the plunger element 76. Thus it should be clear that with the lever 95 adjusted to the position illustrated in Figure 12, the element 76 will be lifted the maximum degree at each revolution of the main shaft 9 regardless of the gear ratio effective at the time thus causing the needle and complemental stitch forming mechanism to form a succession of "anchor" stitches which engage both the hem and the body fabric.

As illustrated in Figure 39 a plurality of "anchor" stitches may be formed at the beginning of the hem and then the lever 95 may be shifted to the position illustrated in Figure 18 and a series of alternate "skip" and "anchor" stitches made, after which the lever may be returned to its initial position and the hem operation concluded by a progression of "anchor" stitches. It will be observed that in the formation of the hem in Figure 39 the 1-to-2 ratio gear unit 111, 113 is employed.

In Figure 40 I have shown a fragment of a hem in which three "skip" stitches are formed intervening each pair of "anchor" stitches. In the formation of this seam, the lever 95 is shifted to the position illustrated in Figure 12 and a plurality of "anchor" stitches formed, after which the lever is shifted to the position shown in Fig-

ure 15 and with the 1-to-4 ratio gear unit 110, 112 in use the operation is continued forming three "skip" stitches in advance of each "anchor" stitch, and at the end of the hem the lever 95 may be shifted back to the original position and without any change of gear ratio the hem may be concluded by the formation of a succession of "anchor" stitches.

A lug 126 depends from the work support 41 and to this lug a latch dog 127 is pivoted as at 128. The dog 127 includes an eccentric lock surface 129 and a release lug extension 130. The lock surface 129 normally rests on one horizontal leg 131 of a bell crank lever pivoted at 132 on the frame lug 133, the remaining leg 134 of the bell crank extending downwardly and engaging a strong cushioned spring 135 seated in a frame socket 136. The contact between the leg 134 and the spring 135 is made by an adjustable abutment screw 137.

By reason of the direct contact between the parts 129, 131, 137, 135 downward movement of the work support 41 is strongly resisted by the spring 135 and the tendency of the spring 135 to force the support upwardly is suitably resisted by an adjustable stop screw 138 threaded through the guard wall 44 and abutting a stop 139 secured on the frame standard. By provision of this equipment a downwardly yieldable work support is provided and yet the spring 135 is much too strong to permit undesirable downward movement thereof.

When it is desired to lower the support 41 to insert or remove the work, the operator should not be subjected to the severe labor and strain necessary to oppose the relatively stronger spring 135 and for this reason I have provided a relatively lighter spring and means whereby the strong spring may be rendered ineffective and the weaker spring brought into play simultaneously with the effort of lowering the support.

It will be observed by reference to Figure 11 that a coil spring 140 connected to the support 41 and the dog 127 serves normally to retain the dog in the position illustrated in Figure 11. The relatively weaker spring above referred to is in the nature of a coil spring 141 coiled about the stud 142 projecting from the frame lug 133 and having one end thereof anchored as at 143 to the frame and the other end 144 engaging under the work support 41 as shown in Figure 11. A trip lever 145 is pivoted intermediate its ends as at 146 to a lug depending from the support 41. One end of the lever projects under the release lug 130 and to the remaining end a pull chain 147 is secured. By pulling downwardly on the chain 147 the dog 127 will be tripped to the position illustrated in dotted lines in Figure 11, thus releasing the support 41 from the influence of the relatively stronger spring 135 and permitting the operator to lower the support by use of the chain 147 resisted only by the relatively weaker spring 141. Upon release of the chain the spring 140 will return the dog 137 to the position illustrated in full lines in Figure 11, the eccentric surface 129 facilitating the return to normal engagement with the bell crank leg 131.

The strong spring 135 is essential to the attainment of even needle penetrations because the needle travels in a fixed path and consequently the same depth of the ridge of material must be always presented to the needle. Thus in the formation of "anchor" stitches it is necessary that the ridge forming element rise to the same high position in relation to the needle, and the work support which carries the element must be substantially rigid when heavy seams are encountered. The resistance to upward movement of the element must not be solid, however, because if the element could not push the material up through the opening in the presser foot something must yield or break. The spring 135 provides the desirable strong yet yieldable resistance.

When the operator desires to insert work, a slight pull on the chain 147 will release the toggle 145, 127. With the parts in this position the light spring 141 alone is effective to hold the work support against depression and only a slight force is necessary to be exerted by the operator to depress the work support 41 sufficiently for inserting the work under the presser foot, or removing work therefrom. In this manner the depression of the work support or table 41 may be said to be opposed by a primary means and a secondary means of varying degree, and that said means may be rendered selectively effective.

A safety stop screw 148 may be provided to supplement the function of the stop screw 138 and assure against the exerting of excessive pressure contact between the work clamp and presser foot at any time.

The usual thread tensioning means is indicated at 149 and includes the usual opposed tensioning plates or discs 150. In order to automatically release the thread tension whenever the work table or support 41 is depressed, I provide a release lever 151 which is pivoted at 152 on the machine frame. The lever includes a crank arm 153 which overlies the guard wall or flange 44 of the support and is equipped with an adjustable abutment screw 154 for engaging said wall. The lever also includes a release arm 155 which projects into position for engaging between the tension plates 150. A coil spring 156 encircles the lever and has its end extended for engagement with the frame release arm 155 for holding the abutment screw 154 in engagement with the support wall 44. Each time the support is depressed as shown in dotted lines in Figure 24 of the drawings, the release arm 155 will effect a separation of the tension plates 150.

It is desirable to seam a hem with the cross stitch formation as shown in Figures 34 to 36, 39 and 40. In order to make this cross stitch, it is necessary to take the thread from a position above the hem on the right hand side and lay it in the form of a loop in a position under the needle point on the left hand side of the hem where the needle point penetrates the loop as shown in Figures 34 to 36. A novel form of thread looper is employed for this purpose. To this end a bracket member 157 is secured as at 158 to the presser foot 20 and a pivot block 159 is pivotally supported as at 160 to swing about a vertical axis on said bracket. The block is cross-grooved to receive a thread looper 161, said looper being pivoted intermediate its ends as at 162 in the groove to swing about a horizontal axis. At one end the looper carries a cam block 163 provided in its under surface with a guiding cam surface 164 adapted during horizontal swinging movements of the looper to ride over a roller 165 journaled on the bracket member 157 and at its other end the looper rides over a stationary ridge cam 166 secured as at 167 on the presser foot 20. At its end beyond the ridge cam 166 the looper 161 terminates in an integral downturned front finger 168 and also carries a cooperating similiarly shaped rear finger 169 yield-

ably pivoted thereto as at 170 and equipped with an integral tailpiece 171 receivable in and projectable from a groove or recess 172 formed in the top surface of the looper 161 and opposed by a spring member 169a as shown in Figures 30 and 37. A crank 173 projects from the pivot block 159 and is connected by a link 174 with a slotted arm 175 of a bell crank lever pivoted at 176 in the sewing head 8. The other arm portion of the bell crank is link and strap connected as at 177 to an eccentric 178 mounted on the main shaft 9 which, like the eccentric equipment 139, is located between the legs of the U-shaped bearing extension 14. The pivot block 159 also includes a finger 179 which overhangs the looper and terminates at a point intermediate the pivot 162 and the cam 166. A coil spring 161a which is connected at its upper end to the finger 179 and at its lower end to the looper at a point between the pivot 162 and the cam 166, functions to balance the looper and maintain the cam block 163 in engagement with the cam roller 165. Because the looper oscillates about its vertical axis at very high speed, there is a tendency for the cam block 163 not to remain in contact with the cam roller 165, but by the provision of the stationary ridge cam 166, such contact will be maintained and the looper fingers 168, 169 will positively follow the path of travel prescribed by the ridge cam. By reference to Figures 4, 5, and 26 to 31 inclusive, it will be observed that as the eccentric 178 is rotated the bell crank lever will be oscillated about its pivot 176 and, through the link connection 174, the crank 173 will be oscillated causing the looper 161 to swing back and forth about its vertical pivot 160 moving the cooperating fingers 168, 169 into and out of the path of travel of the needle 14 and the zone of stitch forming operation. As the looper 161 is swung about its vertical pivot the cam equipments 163, 166 will cause the looper to swing up and down about its horizontal pivot 162 as indicated in Figures 20 and 29. The back and forth motion of the looper 161 takes the needle thread from the right hand side of the hem (see Figure 34) and lays it in the form of a loop at the left hand side of the hem (see Figure 35). The up and down motion of the arm changes the position of the thread from a position above to a position below the path of movement of the needle, completing the stitch. It will be observed by reference to Figures 34 to 38 that the finger 168 includes a thread supporting shelf portion 168a which supports the thread loop during the forward stroke of the looper.

It will also be observed that the needle reciprocates in a straight line, whereas the looper oscillates in an arc which crosses the needle path, and that on the return stroke of the looper, the rear finger 169 will yield by reason of its being contacted by the needle, and thereby allow the needle to recede with freedom from between these fingers 168, 169.

In Figures 34 to 36, I have illustrated diagrammatically the function of the looper 161 in the formation of the cross stitch seam. Completed hem seams are shown in Figures 39 and 40. In these illustrations, A designates the body fabric or material, B the hem fold, C the conventional bobbin, D the bobbin thread, and E the needle thread.

In Figure 34 the material is stationary, following a feed step, and the stitch last made has just been set by movement of the take-up lever in the well known manner. The looper 161 is contacting the needle thread at F for the purpose of taking it from the side at the right of the left hand edge of the hem fold B over said left hand edge where it is laid on the body fabric A in the form of a loop G as shown in Figure 35. During the movement of the looper the thread is supported by the shelf 168a. In Figure 34, the needle 24 is about to start its fabric penetrating movement. In Figure 35 the looper 161 has completed its loop laying function and is perfectly lined up with the now penetrating needle 24 so that the latter can pass freely between the finger 168 and 169 and through and over the loop G.

In Figure 36 the needle 24 is moving away and has been withdrawn from contact with the material. The material has been fed rearwardly a step and the looper 161, having moved away during return movement of the needle, is returning to again contact the needle thread and repeat its loop laying function. As the needle recedes from its penetration of the material the free loop H of needle thread resulting from the recession is caught up by the hook and carried around the bobbin C and its thread D as shown in Figure 36. When the loop is cast from the hook and the take-up lever has functioned to set the stitch, another stitch has been completed with the needle thread overlying the hem fold edge in zig-zag fashion. The now tight needle thread loop H serves to secure the bobbin thread against the body fabric A in parallelism with the hem fold edge. The portions of the zig-zag formation of needle thread extend beyond the hem fold edge and are secured against the body fabric beneath the bobbin thread and around said loops H.

As the looper 161 and the needle 24 recede from the position shown in Figure 35, they travel at different speeds and in different paths, and movement of the yieldably mounted finger 169 enables the clearing of the needle as shown in Figure 37.

In Figures 34 to 36 all "anchor" stitches J are shown, that is, stitches so made that the needle penetrates both the hem fold and the body fabric, securing the former to the latter at each stitch. In Figures 39 and 40, I have illustrated seams in which both "anchor" and "skip" stitches J and K are employed.

It should be understod that whenever the ridge forming plunger 76 rises to maximum height it projects a ridge I of the body fabric A into needle penetrating position. At such times the hem fold is stitched to the body fabric by "anchor" stitches J. See Figure 42. During all lower projections of the plunger 76 the needle will not enter the body fabric, but will pass through the hem fold alone, thus forming "skip" stitches K as shown in Figure 41.

In Figure 39, I have shown a seam including two "anchor" stitches J, J at each end of the seam and alternated "skip" and "anchor" stitches J, K intermediately of said ends. In Figure 40, I have shown a seam including two "anchor" stitches J at the left hand end followed by three "skip" stitches K, then a single "anchor" stitch J, then three "skip" stitches K followed by another "anchor" stitch J.

A novel bobbin case opener is disclosed in Figure 1. The usual retainer bridge 180 includes the rearwardly projecting retainer 181. A shoulder screw 182 is mounted on the head 8 above the hook 36 and journaled on this screw is a sleeve 183 having a seat to which one end of a spring arm 184 is attached by a screw 185. Clamped to the sleeve is the upper end of a fork

186 which is oscillated by an eccentric (not shown) fixed to the hook shaft. The free end of the spring arm 184 is adapted to contact a shoulder 186 on the bobbin case. As the needle recedes, the hook picks up the needle thread loop and carries it around the bobbin case. When the loop is at the top of the bobbin case, the lower part of the front leg of the loop is held by the retainer 181 from passing under the case, and thereby keeps the thread under control in the usual manner. It is, of course, necessary to oscillate the bobbin case so as to free or cast-off the loop from the retainer, and this is accomplished by the spring arm 184 being shifted by the eccentric and fork 186. Heretofore a rigid arm has been employed for oscillating the bobbin case, but this was objectionable because an assembler would frequently set the eccentric either too fast or too slow and if set too fast the arm would engage the bobbin-case and jam the mechanism. By employing the spring arm 184 this objection has been eliminated.

It will also be observed that by locating the pivot for the work support 41 on the shaft 43, a resultant long radius is provided and consequently the ridge forming element 76 will move in a substantially vertical plane when the work support is moved up or down, such as, when crossing seams or when materials of different thicknesses are being sewed, and consequently the needle will always register with the groove in the ridge forming element.

The work support forms the subject matter of my divisional application Serial No. 78,035, filed May 5, 1936.

The tensioning mechanism forms the subject matter of my divisional application Serial No. 74,378, filed Apr. 14, 1936.

The needle driving mechanism forms the subject matter of my divisional application Serial No. 75,484, filed Apr. 20, 1936.

The main shaft bearing forms the subject matter of my divisional application Serial No. 75,483, filed Apr. 20, 1936.

The bobbin case opener forms the subject matter of my divisional application Serial No. 89,833, filed July 9, 1936.

It is of course to be understood that the details of structure and arrangement of parts may be variously changed and modified without departing from the spirit and scope of my invention.

I claim:—

1. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, and means for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of a plurality of "skip" stitches intervening each two adjacent "anchor" stitches.

2. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, and means for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of three "skip" stitches intervening each two adjacent "anchor" stitches.

3. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, and selectively adjustable means for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of either one or a greater number of "skip" stitches intervening each two adjacent "anchor" stitches.

4. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, and means including selective gear couples of different ratios for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of either one or a greater number of "skip" stitches intervening each two adjacent "anchor" stitches.

5. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, control means for normally operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of a plurality of "skip" stitches intervening each two adjacent "anchor" stitches, and manually operable means for altering the normal operation of said control means to enable the formation of a succession of "anchor" stitches at the will of the operator.

6. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, control means for normally operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of a plurality of "skip" stitches intervening each two adjacent "anchor" stitches, and manually operable means for altering the normal operation of said control means to enable the formation of a succession of "anchor" stitches at the will of the operator and for thereafter restoring said control means to normal operation.

7. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of superposed layer or layers only to form

resultant "skip" stitches, selectively adjustable control means for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of either one or a greater number of "skip" stitches intervening each two adjacent "anchor" stitches, and manually operable means for altering the normal operation of said control means to enable the formation of a succession of "anchor" stitches at the will of the operator.

8. In a sewing machine for seaming superposed layers of fabric, the combination of fabric feeding means, stitch forming means including a reciprocatory needle, ridge forming means for at times presenting to the needle a ridge of all layers of fabric to form resultant "anchor" stitches, and for at times presenting to the needle a ridge of the superposed layer or layers only to form resultant "skip" stitches, control means including selective gear couples of different ratios for operating the ridge forming means in timed relation with the needle reciprocations to effect the formation of either one or a greater number of "skip" stitches intervening each two adjacent "anchor" stitches, and manually operable means for altering the normal operation of said control means to enable the formation of a succession of "anchor" stitches at the will of the operator.

9. In a sewing machine, the combination of stitch forming means including a reciprocatory needle, means for presenting superposed layers of fabric for penetration by said needle including a ridge forming element, a power shaft, means for driving the needle from said power shaft, and means to impart variable movement to the ridge forming element from said power shaft in timed relation with said needle movement including selective gear couples of 1-to-2 and 1-to-4 ratios respectively, and means to render said gear couples selectively effective.

10. In a sewing machine; the combination of a reciprocatory needle; means for feeding fabric in superposed layers, a power shaft; means for driving the needle from the power shaft; a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; and means adjustable to effect one maximum element movement in association with each second needle penetration and lesser intervening element movements, or one maximum element movement in association with each fourth needle penetration and lesser intervening element movements.

11. In a sewing machine; the combination of a reciprocatory needle; means for feeding the fabric in superposed layers, a power shaft; means for driving the needle from the power shaft; a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; means adjustable to effect one maximum element movement in association with each second needle penetration and lesser intervening element movements, or one maximum element movement in association with each fourth needle penetration and lesser intervening element movements; and manually operable means to alter the effect of said adjustable means regardless of the particular adjustment thereof to cause the element to move the maximum distance in association with every needle penetration.

12. In a sewing machine; the combination of a reciprocatory needle; means for feeding fabric in superposed layers, a power shaft; means for driving the needle from the power shaft; a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; and means to move said element including a rock shaft, means actuated by said power shaft and including toggle links for imparting a rocking thrust to the rock shaft for each needle penetration, and means actuated by said power shaft for controlling the position of the toggle links to at times minimize the thrust imparted therethrough for effecting a maximum movement of the ridge forming element once only during a plurality of needle penetrations.

13. In a sewing machine; the combination of a reciprocatory needle; means for feeding fabric in superposed layers, a power shaft; means for driving the needle from the power shaft, a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; and means to move said element including a rock shaft, means actuated by said power shaft and including toggle links for imparting a rocking thrust to the rock shaft for each needle penetration, and means actuated by said power shaft for controlling the position of the toggle links to at times minimize the thrust imparted therethrough for effecting a maximum movement of the ridge forming element once only during a plurality of needle penetrations, said last named means including selective gear couples of different ratios for determining the relations of maximum and lesser movements of the ridge forming element.

14. In a sewing machine; the combination of a reciprocatory needle; means for feeding fabric in superposed layers, a power shaft; means for driving the needle from the power shaft; a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; means to move said element including a rock shaft, means actuated by said power shaft and including toggle links for imparting a rocking thrust to the rock shaft for each needle penetration, and means actuated by said power shaft for controlling the position of the toggle links to at times minimize the thrust imparted therethrough for effecting a maximum movement of the ridge forming element once only during a plurality of needle penetrations; and manually operable means to alter the effect of the element moving means to cause all rocking thrusts imparted to the rock shaft to be sufficient to provide for maximum movement of the ridge forming element.

15. In a sewing machine; the combination of a reciprocatory needle; means for feeding fabric in superposed layers, a power shaft; means for driving the needle from the power shaft; a ridge forming element movable a maximum distance to present fabric layers for needle penetration to form "anchor" stitches and a lesser distance to present fabric layers for needle penetration to form "skip" stitches; means to move said element including a rock shaft, means actuated by said power shaft and including toggle links for imparting a rocking thrust to the rock

shaft for each needle penetration, and means actuated by said power shaft for controlling the position of the toggle links to at times minimize the thrust imparted therethrough for effecting a maximum movement of the ridge forming element once only during a plurality of needle penetrations, said last named means including selective gear couples of different ratios for determining the relations of maximum and lesser movements of the ridge forming element; and manually operable means to alter the effect of the element moving means to cause all rocking thrusts imparted to the rock shaft to be sufficient to provide for maximum movement of the ridge forming element regardless of the condition of adjustment of said selective gear couples.

16. In a sewing machine wherein is provided a power shaft and a ridge forming element, means to move said element a maximum distance to aid in the formation of "anchor" stitches and a lesser distance to aid in the formation of "skip" stitches, said means including a rock shaft having movement effecting connection with the element, a small gear on the power shaft, a larger gear driven by the small gear, a crank pin rotatable with the larger gear, a bell crank lever, eccentric and pitman connections for rocking the bell crank from the power shaft, means including toggle links for imparting rocking thrust from the bell crank lever to the rock shaft, and a link connecting the crank pin with the point of connection of the toggle links one with the other.

17. In a sewing machine wherein is provided a power shaft and a ridge forming element, means to move said element a maximum distance to aid in the formation of "achor" stitches and a lesser distance to aid in the formation of "skip" stitches, said means including a rock shaft having movement effecting connection with the element, a rotatable crank disc having a crank pin, selective reduction gear couples of different ratios for driving the crank disc from the power shaft, means including toggle links for imparting rocking thrust from the bell crank lever to the rock shaft, and a link connecting the crank pin with the point of connection of the toggle links one with the other.

18. In a sewing machine wherein is provided a power shaft and a ridge forming element, means to move said element a maximum distance to aid in the formation of "anchor" stitches and a lesser distance to aid in the formation of "skip" stitches, said means including a rock shaft having movement effecting connection with the element, a rotatable crank disc having a crank pin, selective reduction gear couples of different ratios for driving the crank disc from the power shaft, means including toggle links for imparting rocking thrust from the bell crank lever to the rock shaft, a link connecting the crank pin with the point of connection of the toggle links one with the other, and manually operable means to alter the effect of the element moving means to cause all rocking thrusts imparted to the rock shaft to be sufficient to provide for maximum movement of the ridge forming element regardless of the condition of the adjustment of said selective gear couples.

19. In a sewing machine wherein is provided a power shaft and a ridge forming element, thrust imparting means for moving said element varied distances to aid in the formation of "anchor" and "skip" stitches, said means including small gears of different size rotatable with the power shaft, a rotatably supported crank disc having a bearing hub and a crank pin, a thrust link connected to the crank pin, larger gears of different size freely rotatable on said hub and meshing with the small gears, and means to selectively connect the larger gears in driving relation with the hub.

20. In a sewing machine wherein is provided a power shaft and a ridge forming element, thrust imparting means for moving said element varied distances to aid in the formation of "anchor" and "skip" stitches, said means including small gears of different size rotatable with the power shaft, a rotatably supported crank disc having a bearing sleeve hub and a crank pin, a thrust link connected to the crank pin, larger gears of different size freely rotatable on said hub and having selective clutching recesses therein and meshing with the small gears, and a shuttle pin shiftable axially in the sleeve and having a clutch pin projecting through a wall of the sleeve and selectively engageable in the recesses of the larger gears.

21. In a sewing machine wherein is provided a power shaft and a ridge forming element, thrust imparting means for moving said element varied distances to aid in the formation of "anchor" and "skip" stitches, said means including small gears of different size rotatable with the power shaft, a rotatably supported crank disc having a bearing sleeve hub and a crank pin, a thrust link connected to the crank pin, larger gears of different size freely rotatable on said hub and having selective clutching recesses therein and meshing with the small gears, a shuttle pin shiftable axially in the sleeve and having a clutch pin projecting through a wall of the sleeve and selectively engageable in the recesses of the larger gears, a spring to normally urge the shuttle pin in one direction in the sleeve, and means to shift the shuttle pin in the opposite direction in said sleeve.

22. In a sewing machine wherein is provided a frame including a standard, an overhanging arm and a work support; the combination of a power shaft mounted in the arm, a ridge forming element supported on the work support, and means to move said element a maximum distance to aid in the formation of "anchor" stitches and a lesser distance to aid in the formation of "skip" stitches, said means including a rock shaft supported by the work support in parallel relation with and in a plane below the power shaft and having movement effecting connections with the element, a small gear on the power shaft, a larger gear rotatably supported in the standard and meshing with the small gear, a crank pin rotatable with the larger gear, a bell crank lever supported in the standard beneath the larger gear, eccentric and pitman connections for rocking the bell crank from the power shaft, means including toggle links extending laterally from said bell crank lever for imparting rocking thrust from the bell crank lever to the rock shaft, and a link connecting the crank pin with the point of connection of the toggle links one with the other.

23. In a sewing machine, the combination of a presser foot and a work clamp, means to support said foot and clamp permitting them to yield relatively during feeding of fabric including a supporting post, and means to support the work clamp on the post for both fore and aft and lateral tilting movements.

24. In a sewing machine, the combination of a rigidly mounted presser foot, a work clamp, and means for yieldably and tiltably mounting the work clamp to permit it to yield relatively

to the presser foot and to tilt both fore and aft and laterally during feeding of fabric.

25. In a sewing machine, a work clamp and mounting therefor comprising a supporting post, a work clamp member, a member supporting frame, means to pivotally support the member on the frame for fore and aft tilting movements, and means to pivotally support the frame on the post for lateral tilting movement.

26. In a sewing machine, a work clamp and mounting therefor comprising a supporting post, a work clamp member, a member supporting frame, means to pivotally support the member on the frame for fore and aft tilting movements, means to pivotally support the frame on the post at one side of the center of gravity of the frame for lateral tilting movements, and spring means for supporting the unbalanced weight of the frame and member supported thereon.

27. The combination with a needle, of a looper for carrying the needle thread loop into position to be entered by the needle, said looper being fulcrumed to swing about vertical and horizontal axes, means for swinging the looper about said vertical axis, and a cam means cooperating with the looper for imparting the swinging movements thereto about its horizontal axis.

28. The combination with a needle, of a looper having thread-engaging fingers at its forward end for carrying the needle thread loop into position to be entered by the needle, said looper being fulcrumed intermediate its ends to swing about vertical and horizontal axes, means for swinging the looper about its vertical axis, and means for swinging the looper about its horizontal axis comprising a cam block secured to the rear end of the looper and provided with a cam surface on its under side, a stationary cam roller for cooperation with said cam block, and a spring for yieldably maintaining the block in engagement with said roller.

29. The combination with a needle, of a looper having thread-engaging fingers at its forward end for carrying the needle thread loop into position to be entered by the needle, said looper being fulcrumed intermediate its ends to swing about vertical and horizontal axes, means for swinging the looper about its vertical axis, and means for swinging the looper about its horizontal axis comprising a cam block secured to the rear end of the looper and provided with a cam surface on its under side, a stationary cam roller for cooperation with said cam block, and a spring for yieldably maintaining the block in engagement with said roller, and a stationary ridge cam located under the forward end of the looper for cooperation therewith to insure constant engagement between the cam block and the cam roller.

30. The combination with a needle, of a looper having thread-engaging fingers at its forward end for carrying the needle thread loop into position to be entered by the needle, said fingers projecting downwardly and one of said fingers being yieldably mounted to swing outwardly about a horizontal axis, said looper being fulcrumed to swing about vertical and horizontal axes, means for swinging the looper about said vertical axis, and a cam means cooperating with the looper for imparting the swinging movements thereto about its horizontal axis.

31. The combination with a needle, of a looper having thread-engaging fingers at its forward end for carrying the needle thread loop into position to be entered by the needle, said fingers projecting downwardly and conjointly provided with a shelf for supporting the thread loop, said looper being fulcrumed to swing about vertical and horizontal axes, means for swinging the looper about said vertical axis, and a cam means cooperating with the looper for imparting the swinging movements thereto about its horizontal axis.

LOUIS G. BOWMAN.