E. B. ALLEN.

THREAD CUTTING AND NIPPING MECHANISM FOR SEWING MACHINES.

APPLICATION FILED MAR. 19, 1919.

1,404,727.

Patented Jan. 31, 1922.

5 SHEETS—SHEET 1.

Fig. 1

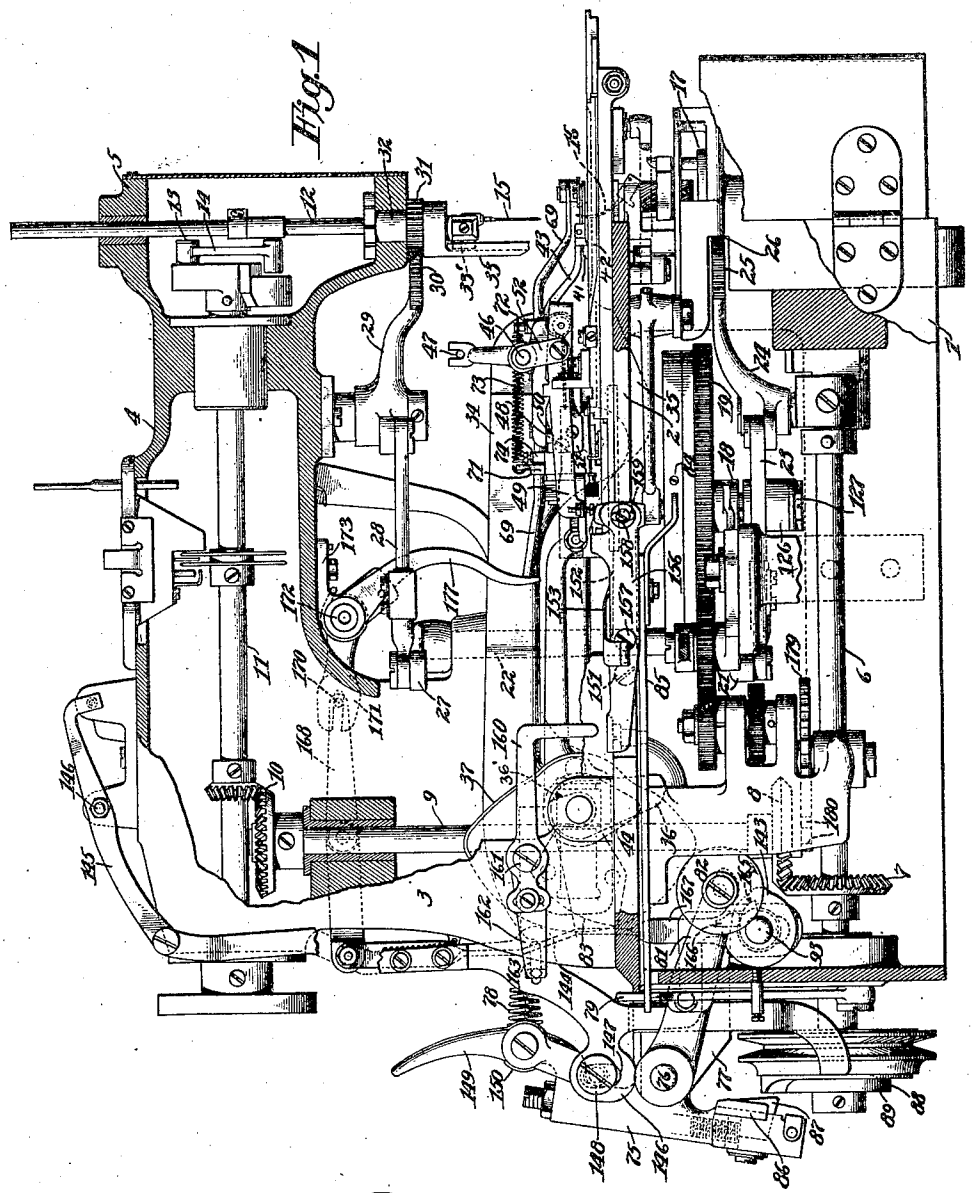
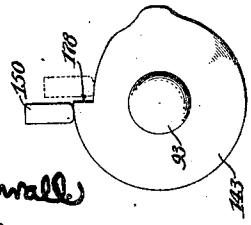


Fig. 10



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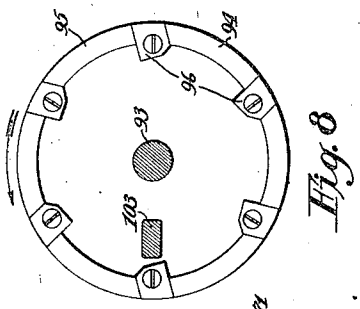

Fig. 8

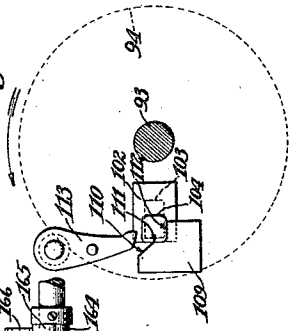

Fig. 9

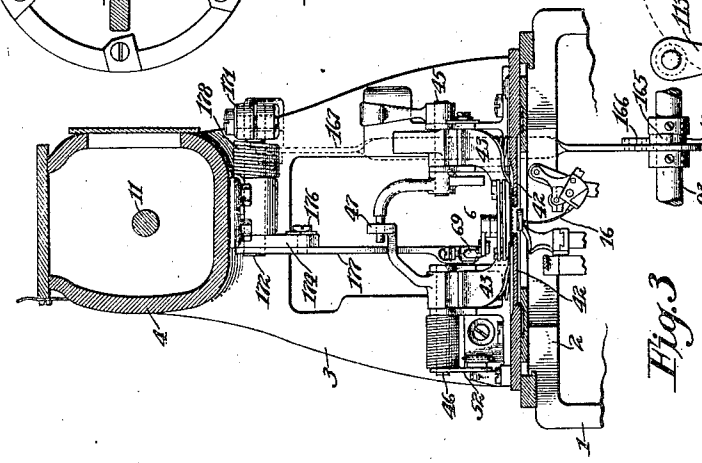

Fig. 3

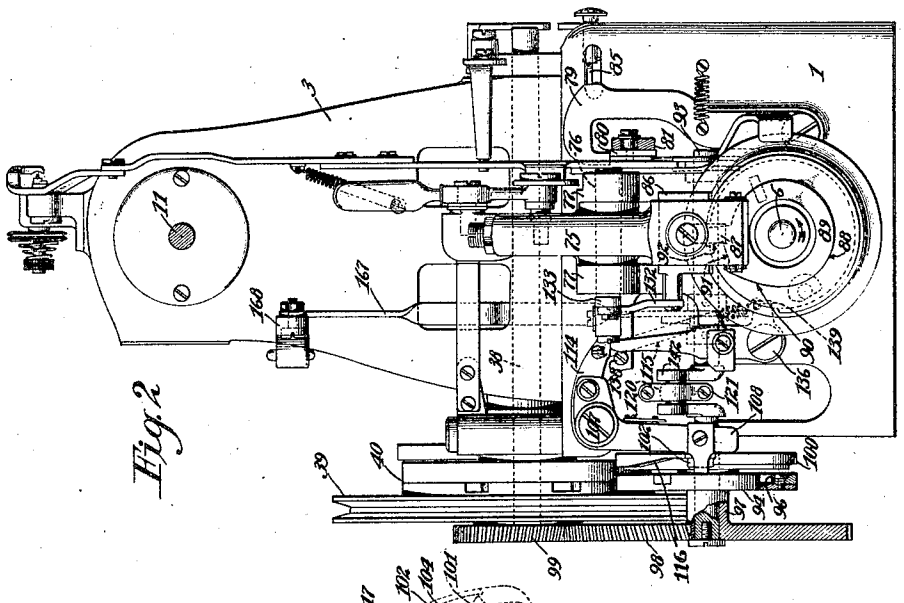

Fig. 2

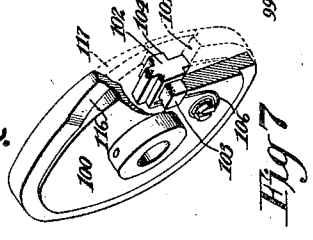

Fig. 7

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5 SHEETS—SHEET 3.

Fig. 12

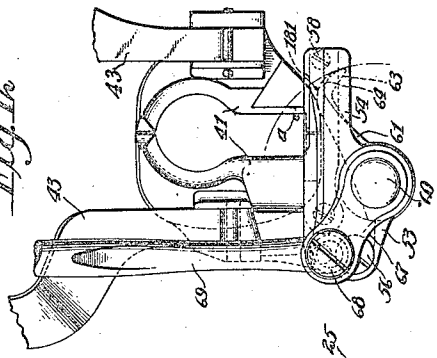


Fig. 13

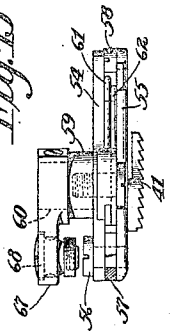


Fig. 4

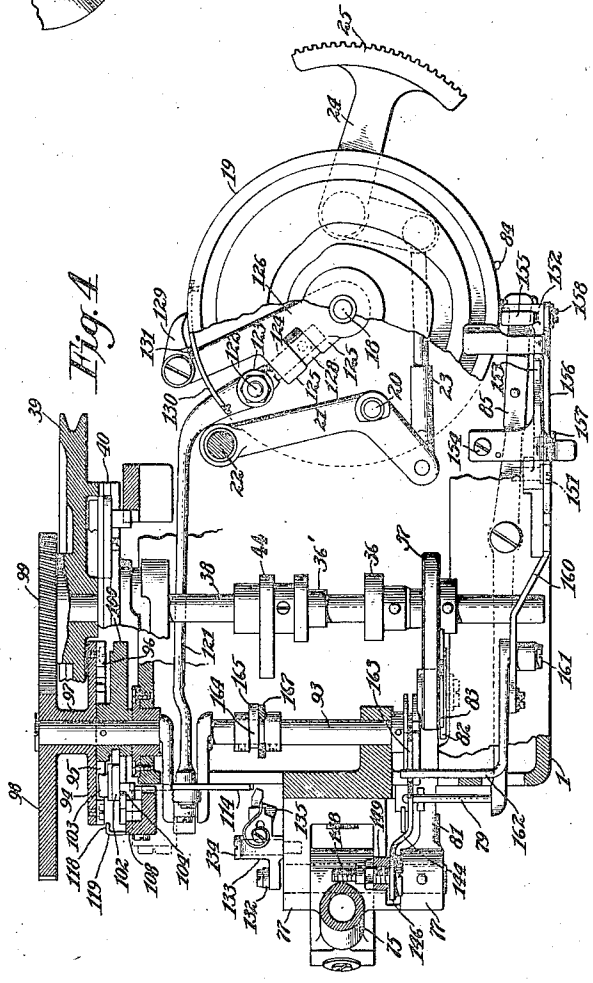
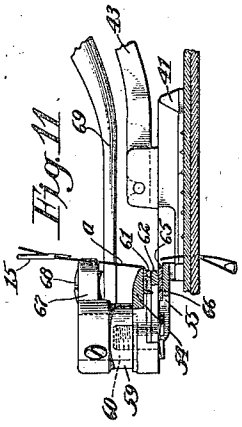


Fig. 14



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5 SHEETS—SHEET 4.

Fig. 6

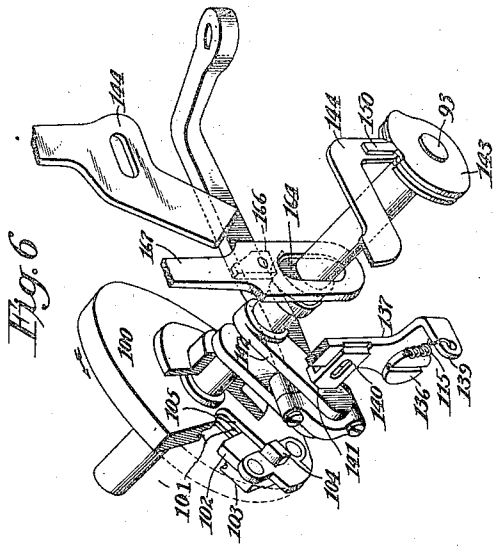
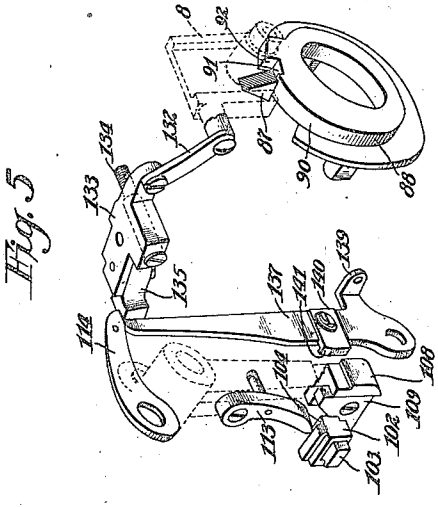


Fig. 5



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5 SHEETS—SHEET 5.

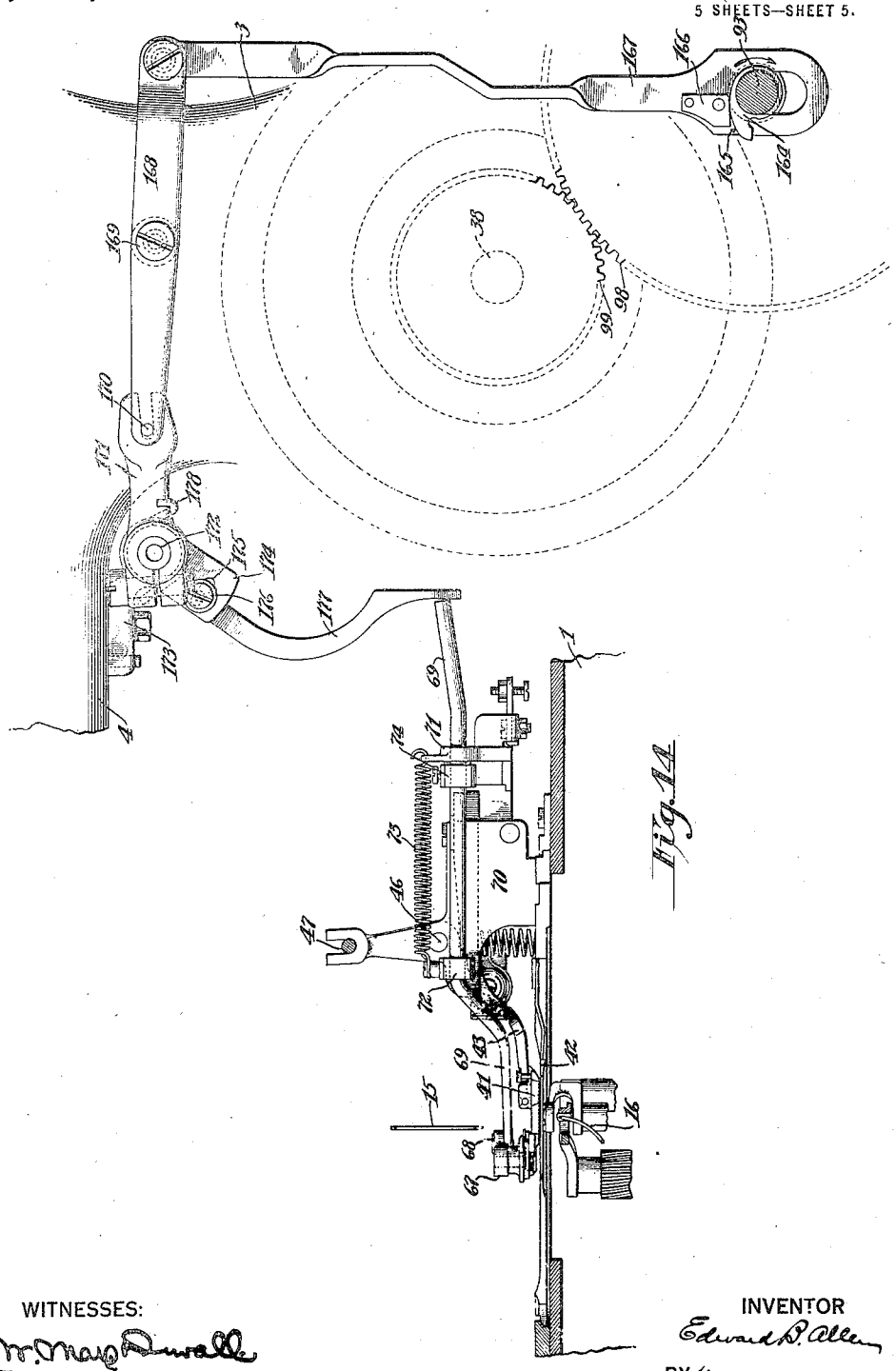

Fig. 14

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THREAD CUTTING AND NIPPING MECHANISM FOR SEWING MACHINES.

1,404,727. Specification of Letters Patent. Patented Jan. 31, 1922.

Application filed March 19, 1919. Serial No. 283,603.

To all whom it may concern:

Be it known that I, EDWARD B. ALLEN, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Thread Cutting and Nipping Mechanism for Sewing Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to thread-cutting and nipping mechanism for sewing machines, more particularly of the type operating automatically to form a group of stitches in a predetermined order or arrangement, and has for an object to provide a thread-cutting and nipping mechanism of simple construction which will be quick, positive and certain in its operation, and which will not be dependent upon power received from parts of the machine moving prior to or during the stitching cycle.

A further object of the invention is to provide thread-cutting and nipping mechanism for sewing machines of the type forming a group of stitches beginning and ending at the same point, which mechanism will hold the beginning end of the needle-thread until after the final stitches have been laid, thereby preventing the beginning end of the thread from bunching up under or interfering with the formation and accurate placing of the final stitches.

Further objects of the invention will appear from the following description and claims.

For convenience, the invention will be described as embodied in an automatic buttonhole cutting and stitching machine constructed substantially in accordance with the disclosure of my Patent No. 1,346,102, dated July 13, 1920. In the machine of said patent there is incorporated an auxiliary shaft which is stationary during the preparatory and stitching stages of the buttonhole producing cycle and performs a single rotation at the completion of the sewing; receiving power from a constantly running pulley-wheel independent of the sewing, feeding and buttonhole cutting mechanisms. In said machine the thread-cutting and nipping blade is actuated from a connection with the needle-driving shaft to release the beginning end of the needle-thread during the formation of the initial stitches, and to set the blade in latched position in readiness for a thread-cutting operation at the end of a stitching cycle. When the stitching of the buttonhole is completed, the latch is tripped by a connection with said auxiliary shaft and the thread-cutting blade is caused to sever the needle-thread.

In sewing buttonholes or the like in certain classes of fabrics, particularly soft fabrics, it is desirable to hold the beginning end of the needle-thread during the tightening of the initial stitches. In the present machine an auxiliary shaft is utilized to time the release of the beginning end of the needle-thread, as well as to time the severance of said needle-thread. In the present embodiment of the invention the auxiliary shaft is timed to operate at the completion of the sewing and is provided with a cam which forcibly actuates the thread-cutting and nipping mechanism to release the beginning end of the needle-thread after the final stitches have been laid. This cam also serves to time or control the thread-cutting operation which immediately follows the release of the beginning end of the needle-thread.

In the accompanying drawings, Fig. 1 is a side elevation of an automatic eyelet-end buttonhole cutting and stitching machine embodying the invention. Fig. 2 is a rear end elevation of the machine. Fig. 3 is a transverse vertical section through the bracket-arm and bed of the machine showing certain parts of the thread-cutter operating mechanism in elevation. Fig. 4 is a plan view partly in section, showing the cutter and auxiliary shafts. Figs. 5, 6 and 7 are detail perspective views of the mechanism for controlling the operation of the auxiliary shaft. Figs. 8 and 9 show, in elevation, certain details of the controlling mechanism for the auxiliary shaft. Fig. 10 is a detail elevation of the cam which operates the tension and work-clamp releasing connections. Figs. 11, 12 and 13 are detail views of the thread-cutting and nipping instrumentalities, and Fig. 14 is a fragmentary elevation of the machine showing the train of connections for operating the thread-cutting and nipping mechanism from the auxiliary shaft.

In the preferred embodiment of the invention, as illustrated, the machine frame comprises the hollow rectangular base 1 formed with a bed-plate 2 from the rear end of which rises the hollow standard 3 carrying

the usual bracket-arm 4 which terminates in the hollow head 5. Extending within and lengthwise of the base 1 is the main-shaft 6 for the stitch-forming mechanism. This shaft carries a bevel-gear 7 which meshes with a companion gear 8 of equal size fixed to the lower end of the vertical shaft 9 journaled within the standard 3. The vertical shaft 9 acts through one-to-two speed multiplying bevel-gears 10 to drive the needle-bar actuating shaft 11 which at its forward end is connected to the reciprocating needle-bar 12 by means of the usual crank 13 and link 14.

The stitch-forming mechanism of the machine may be of any suitable type. In the present instance it is constructed substantially in accordance with the disclosure of my Patent No. 1,162,207 of November 30, 1915 and embodies the reciprocating eye-pointed straight needle 15 carried by the needle-bar 12 and the lower curved needle 16 which is sustained in the turret 17.

Mounted beneath the bed-plate 2 on the screw-pin 18 is the well known feed-wheel 19 which is formed in its under face with a suitable cam-groove (not shown) acting during a partial revolution of the feed-wheel to shift the cam-follower 20, Fig. 4, and, through the usual connections therewith, to turn the stitch-forming mechanism while stitching around the eyelet-end of a buttonhole. At the end of a stitching operation the feed-wheel is given a further turning movement to complete its single rotation and at this time acts to turn the stitch-forming mechanism back to initial position. The cam-follower 20 is sustained by a lever-arm 21 fixed at one end to the vertical fulcrum-shaft 22 and at its opposite end connected by means of the link 23 to the bellcrank-lever 24 which carries the usual toothed sector-gear 25 meshing with a pinion 26, Fig. 1, on the turret 17. The vertical fulcrum-shaft 22 carries a crank-arm 27 which is connected by means of a link 28 to a bellcrank-lever 29 formed with the toothed sector-gear 30 meshing with the pinion 31 connected to the bushing 32 from which depends the guide-arm 33 having a channelway entered by a stud 33′ on a needle-bar, all as more fully described in my said Patent No. 1,162,207.

The buttonhole cutting mechanism of the machine is preferably constructed in substantial accordance with the disclosure of my Patent No. 1,048,786 and comprises the usual upper and lower cutter-levers 34 and 35 which are advanced and closed to cut the buttonhole-slit in stitching position by means of the usual connections with the cutter-closing cams 36, 36′, Fig. 4, and the cutter-advancing and retracting cam 37, all carried by the cutter-shaft 38 which is driven independently of the stitch-forming mechanism from a constantly running pulley 39 through the well-known automatic single-rotation clutch mechanism 40 fully disclosed in my said Patent No. 1,048,786. When the cutter-shaft controlling clutch is tripped into action during the first stage of a buttonhole-producing cycle the constantly running driving pulley 39 imparts a single complete revolution to the cutter-shaft 38 as is well understood.

The work-holder of the present machine is constructed substantially in accordance with the disclosure of my Patent No. 1,331,176, dated February 17, 1920, and comprises upper and lower work-clamping elements 41 and 42 of which the upper are sustained at the forward ends of the clamp-arms 43. The upper clamping members or feet 41 are closed upon the work during the first stage of the buttonhole-producing cycle, preferably by means of the usual clamp closing cam 44 on the cutter-shaft, as disclosed in my copending application Serial No. 872,333, filed November 16, 1914. During the first part of the single revolution of the cutter-shaft, the cam 44 operates through suitable connections to rock the clamp closing rock-shaft 45, Fig. 3, which in turn is connected to the companion shaft 46 through the usual fork-and-pin connection 47. When the clamps are closed upon the work, the tooth 48, Fig. 1, on the latch-lever 49 drops into the notch 50 of the latch-plate 51 and locks the clamps in closed position; the lever 49 being pivoted to the crank-arm 52 which is fixed to the clamp-closing rock-shaft 46. When the latch-lever 49 is shifted upwardly, the tooth 48 is displaced from the notch 50, thereby allowing the clamps to spring open. This mechanism is fully described in my Patent No. 1,369,371, dated February 22, 1921.

During the stitching of a buttonhole the feed-wheel 19 operates through the usual connections to impart both longitudinal and lateral traveling or feeding movements to the work-holder to shift the work in the desired path for the reception of stitches. In the present instance the work-holder is so fed that the initial and final stitches are made at substantially the same point in the work.

The thread-cutting and nipping mechanism with which the present invention is particularly concerned comprises, in the specific embodiment illustrated, thread-cutting and nipping instrumentalities carried by and traveling with the work-holder, and controlling means for said instrumentalities mounted on the frame of the machine independently of the work-holder.

The parts of the thread-cutting and nipping mechanism which are mounted on the work-holder are constructed substantially in accordance with the disclosure of my said Patents Nos. 1,369,371 and 1,346,102. Re-

ferring to Figs. 11, 12 and 13 it will be seen that one of the clamping feet 41 is formed with an extension 53 including the slightly resilient upper and lower bars 54 and 55 which are rigidly secured together by the screw 56 and are held in spaced relation by means of the washer 57 and spacing screw-head 58. Journaled within an upwardly extending bearing boss 59 on the bar 54 is a pin 60 in the recessed lower end-face of which are secured the shanks of the overlapping blade-sections 61 and 62 constituting a compound thread-nipping and cutting blade. The outer end-portion of the blade-section 61 is formed with an edge-portion 63 inclined abruptly outwardly from the adjacent edge-portion to afford an angle for guiding the thread to the nipping point. The edge of the cutting section 62 of the compound thread-nipping and cutting blade is formed beneath the aforesaid angle with the concaved cutting edge 64 which shears the thread against the edge 65 of the ledger-blade 66 let into the upper side of the bar 55. The compound blade is adapted to move within and substantially fill the space between the bars 54 and 55; the nipping blade-section 61 coacting with the lower wall of the upper bar 54 in nipping the thread. To operate the nipping and cutting elements, the pin 60 has secured to its upper end the crank-arm 67, the apertured extremity of which is loosely entered by the screw-pin 68 threaded into the forward end of the cutter-rod 69 which extends rearwardly alongside the clamp-bearing block 70 and passes loosely through the apertured extremity of the supporting arm 71. Surrounding the rod 69 is a collar 72 to which is secured one end of a tension spring 73 the opposite end of which is anchored to said arm 71. A stop-collar 74 secured to the rod 69 is adapted to strike the arm 71 and arrest the rearward or cutter and nipper-closing movement of the rod 69 under the influence of the spring 73.

Unlike the construction disclosed in my said Patent No. 1,346,102, the present mechanism embodies no latch on the work-holder for holding the rod 69 in forward or set position with the spring 73 under tension. In the present case, the cutting and nipping blades occupy closed position (Figs. 12 and 14) throughout the stitching operation, so that the beginning end of the needle-thread will be held clear of the final stitches and will not be free to bunch up under and interfere with the laying of said final stitches.

The main-shaft 6 of the stitch-forming mechanism is controlled by means of a suitable stop-motion device preferably such as disclosed in my said Patent No. 1,048,786. A stop-motion device of this type embodies a tilting starting and stopping lever 75 which is fixed to a fulcrum-pin 76 journaled in the bearing lugs 77. The lever 75 is urged to stopping position by the spring 78 and is held in running position, Fig. 1, by means of the latch 79, the downturned upper extremity of which engages over a wear plate 80 on the arm 81 fixed to and extending forwardly from the fulcrum-pin 76. The arm 81 carries a cam-roll 82 at its free end which is depressed by a cam 83 on the cutter-shaft to start the stitch-forming mechanism during the latter part of the single rotation of the cutter-shaft. At the completion of the stitching operation, a tripping point 84 on the feed-wheel acts through a lever 85 to displace the latch 79 laterally and release the lever-arm 81 thereby permitting the stop-lever 75 to spring to stopping position.

As is well understood by those skilled in the art, stop-motions of the present type embody a downwardly spring-pressed slide-block 86 which is mounted upon the stop-lever 75 and is formed with a tooth 87 which snaps into position over the peripheral surface 88 of the clutch-ring 89 when the stop-lever swings to stopping position. Further turning movement of the main-shaft causes the slide-block 86 to be lifted as the outwardly inclined cam-portion 90 of the clutch ring rides under the tooth 87. Finally, the tooth 87 drops into the stop-notch 91 in the clutch-ring, as the abrupt shoulder 92 forming one side wall of said notch strikes the side face of the tooth 87 and arrests the motion of the main-shaft. This well known upward and downward movement of the slide-block 86 is utilized in the present machine for a purpose to be hereinafter described.

The present machine embodies an auxiliary shaft 93 which is preferably stationary during the preparatory and stitching stages of the buttonhole producing cycle and performs a single rotation after the buttonhole has been stitched. This auxiliary shaft and its controlling devices are preferably constructed substantially in accordance with the disclosure of my said Patent No. 1,346,102. The auxiliary shaft 93, which is journaled within and transversely of the bed 1, in parallelism with the cutter-shaft 38, carries loosely upon its outwardly projecting extremity the constantly running driving disk 94 of an automatic one-revolution clutch-device. One side face of the disk 94 is recessed to form a peripheral flange 95 into which is let a series of peripherally spaced and inwardly directed driving teeth 96. The driving disk 94 is further formed with a hub 97 integral with which is a gear-wheel 98 meshing with a pinion 99 fixed to the well known belt-wheel 39 which turns freely upon the cutter-shaft 38.

Fixed to the auxiliary shaft 93 adjacent the driving disk 94 is a driven disk 100

formed with a radial slideway 101 in which is fitted a slide-block 102 having at one side a clutch-tooth 103 which projects laterally into the recessed portion of the driving disk. At its opposite side the slide-block 102 is formed with a stopping tooth 104 which projects through the slot 105 in the face of the driven disk 100 remote from the driving disk. A spring 106, Fig. 7, mounted on the disk 100 and having its free end bearing against the notched inner end of the clutch-tooth 103 is utilized to urge the slide-block 102 outwardly, thereby projecting the clutch-tooth 103 to a position wherein it will be struck by one of the driving teeth 96, thus coupling the shaft 93 to the source of power.

Fulcrumed on the screw-pin 107 is a clutch-controlling bell crank-lever having a depending arm 108 which at its lower extremity carries an abutment block 109 having an inclined cam face 110, Fig. 9, a detaining shoulder 111 and a stop-shoulder 112. Pivoted to the arm 108 is a spring-pressed latch 113 the lower extremity of which is spaced above the stop-shoulder 112. The other arm 114 of the clutch-controlling bellcrank-lever is pulled downwardly by the coil spring 115 which acts yieldingly to hold the abutment block 109 in a position such that the stopping tooth 104 is detained in its retracted position by the detaining shoulder 111 and is locked against upward or downward displacement by the latch 113 and stop-shoulder 112, respectively.

In the normal stopping position of the parts thus described, the slide-block 102 is at its extreme inner position, Fig. 8, with the clutch-tooth 103 withdrawn from engagement with the clutch-teeth 96 of the driving disk 94. The shifting of the clutch-controlling bell-crank-lever, by means presently to be described, so as to move the arm 108 away from the adjacent face of the driving disk 94, disengages the stop-shoulder 112 and detaining shoulder 111 from the stopping tooth 104 of the slide-block 102, thus permitting the latter to move outwardly under the action of its spring 106 to introduce the clutch-tooth 103 into engagement with one of the driving teeth 96. As the driven disk 100 nears the completion of a single revolution, the clutch-controlling bellcrank-lever has been returned to initial position by the action of both the spring 115 and the more positive action of the inclined face 116 of the cam-rib 117 upon the bent extremity 118, Fig. 4, of a lateral arm 119 secured to the lower end of the clutch-controlling lever-arm 108, thus bringing the inclined cam face 110, Fig. 9, of the abutment block 109 into the path of movement of the stopping tooth 104 by means of which the slide-block 102 is thrust inwardly to disengage its clutch-tooth 103 from the driving teeth 96. As the stopping tooth 104 arrives at initial position, it engages the stop-shoulder 112 and is prevented from rebounding by the extremity of the latch 113 which snaps into operative position as the stopping tooth 104 passes it. By the means thus described the auxiliary shaft 93 is insured a single complete revolution for each clutch-releasing actuation of the controlling bell-crank lever 108, 114.

The auxiliary shaft 93 is formed between its ends with a ball-crank 120, Fig. 2, which is embraced by the strapped end of a pitman 121 the opposite end of which is pivotally connected by a screw-bolt 122 to the headed end 123 of a pin having a cylindrical shank 124 entering alined bearing apertures formed in the spaced laterally projecting portions 125 of a lever-arm 126 which is fulcrumed upon a screw-pin 127, Fig. 1, concentric with and tapped into the head of the screw-pin 18 which carries the feed-wheel. A collar 128 secured to the shank of the pin 124 between the projecting portions 125 of the lever-arm 126 serves to retain the pin in working position. The pins 122 and 124 having their axes arranged substantially at right angles, form a universal connection between the pitman 121 and the lever-arm 126. At its free end the lever-arm 126 carries a spring-pressed pawl 129 the extremity of which bears yieldingly against the smooth cylindrical surface portion of the feed-wheel into which is let a curved plate 130 formed with one or more teeth 131 which are so placed that when the stop-motion lever 75 is released by the action of the tripping point 84 to stop the stitch-forming mechanism, at least one of said teeth 131 has passed under the extremity of the pawl 129 and is in position to be acted upon by said pawl. It will be noted that in the normally stationary position of the auxiliary shaft 93, Figs. 2 and 4, the crank 120 is slightly above its rearward dead-center position.

The slide-block 86 carrying the stopping tooth 87 is connected by a link 132 to the rearwardly extending arm of a lever 133 pivoted to the frame by the screw-pin 134. Pivoted to the forwardly extending arm of the lever 133 is a spring-pressed latch 135 the extremity of which is adapted to snap under the lateral arm 114 of the bellcrank clutch-controlling lever when the slide-block 86 is lifted by the eccentric surface portion 90 of the clutch-ring, as shown in Fig. 5. When the stopping tooth 87 snaps into the stop-notch 91, the slide-block 86, in falling, acts through the link 132, lever 133 and latch 135 to lift the arm 114 and thereby retract the depending arm 108 of the bellcrank clutch-controlling lever and effect the coupling of the auxiliary shaft 93 to the driving disk 94 for a single revolution.

Pivoted to the frame at 136 is an upstand-

ing lever 137 the upper free end of which is yieldingly held against a stop-screw 138, Fig. 2, by the action of the spring 115 which is connected at its lower end to a lateral arm 139 of said lever. The lever 137 carries a laterally projecting cam-block 140 having an inclined face 141 which lies in the path of downward movement of the crank-arm 142 and is deflected to one side as the crank-arm passes it during the first part of its single revolution, as shown in Fig. 6. When the lever 137 is deflected, its upper end strikes the latch 135 and disengages it from the arm 114 of the bellcrank clutch-controlling lever, thereby allowing said lever to immediately return to clutch-disengaging position under the action of the spring 115 or under the more positive action of the cam surface 116 of the clutch wheel 100 upon the bent extremity 118 of the lateral arm 119 fixed to said clutch-controlling lever.

It will be readily understood that the crank on the auxiliary shaft 93 will, during its movement from rearward to forward dead-center position, turn the feed-wheel at one sweep from its position at the end of the stitching operation, to initial position ready to begin a new cycle of operations; this final and rapid movement of the feed-wheel being preferably utilized in the present instance to return the stitch-forming mechanism to initial position through the usual connections hereinbefore referred to.

The auxiliary shaft 93, with which the present machine has been provided, may be utilized in the performance of various operations during the final stage of a buttonhole producing cycle. For example, the shaft 93 has, in the present instance, been provided with a cam-member 143 in the form of a pair of spaced disks of similar shape between which is guided the lower end of a lifting bar 144 the upper end of which is pivotally connected to the rearward end of the usual tension releasing lever 145 fulcrumed to the bracket-arm 4 at 146.

Projecting rearwardly from the lifting bar 144, intermediate the ends of the latter, is an arm 146 having at its free end a vertical slot 147 loosely entered by a screw-pin 148 which is threaded into the lower extremity of the hand-lever 149 pivotally secured to a boss 150 formed at its upper extremity of the stop-motion lever 75. The inner end of the screw-pin 148 projects some distance laterally of the hand-lever 149 and is yieldingly held in engagement with the stop-motion lever 75, Fig. 4, by means of a suitable spring (not shown). The lifting bar 144 is formed at its lower end with a laterally projecting follower lug 150 adapted to bear upon the peripheral portion of one of the cam-disks 143.

Pivotally mounted on the machine bed 151 is the rearward end of the lever-arm 152 which is yieldingly depressed by the forward extension 153 of a leaf-spring screwed to the bed at 154. The upwardly and inwardly extending forward extremity 155 of the lever-arm 152 overhangs the machine bed in a position directly beneath the rearward extremity of the latch-lever 49 which locks the work-clamps in closed position. A lever 156 is adjustably fixed to the lever-arm 152 by means of the pivot-screw 157 and the screw 158 which enters a vertical slot 159 in the forward extremity of said lever 156 and is threaded into the lever-arm 152.

The rearwardly extending arm of the lever 156 is adapted to be depressed to elevate the work-clamp tripping extension 155, by means of the lever 160 which is pivoted to the standard 3 and 161 and the laterally bent rearward arm 162 of which enters the horizontal slot 163, in the lifting bar 144.

When the compound thread-cutting and nipping blade 61, 62 is in closed position, pressure upon the rearward end of the rod 69 will serve to retract said blade and release the beginning end of the needle-thread. When this pressure is relieved, the spring 73 will return the blade to closed position, to cut and nip the thread leading from the last stitch to the needle-eye.

In the present instance, the auxiliary shaft 93 is utilized to actuate the thread-cutting and nipping device at the end of a stitching cycle. Fixed to the shaft 93, Fig. 14, is a cam 164 having a cam rise 165 which acts upon the cam-follower block 166 fixed to the lower end of the upright bar 167 pivotally connected at its upper end to the lever 168. The lower end of the bar 167 is slotted to embrace the shaft 93 and thereby maintain the follower 166 in position to be acted upon by said cam.

The lever 168 is pivoted to the standard 3 at 169 and at its forward end carries a lateral pin 170 which plays in the forked rear end of the arm 171 clamped to the cross-shaft 172 journaled in the bearing bracket 173 fixed to the underside of the bracket-arm 4. Fixed to and depending from the shaft 172 is a short arm 174 having a slot 175 through which passes a screw 176 threaded into the longer depending arm or tappet 177 which at its upper end loosely embraces the shaft 172. By loosening the screw 176, the arm 177 may be adjusted relatively to the arm 174. At its lower end the arm 177 is enlarged and flattened to engage and push forwardly upon the rod 69 when the work-holder is stationary at the end of a sewing operation. A spring 178 coiled about the shaft 172 and anchored at its opposite ends, respectively, to the bearing bracket 173 and arm 171 serves to maintain the follower 166 in engagement with the cam 164.

In the operation of the present machine, which embodies the invention in its pre-

ferred form, the work is placed in position under the raised clamping feet and the machine is started by the usual treadle-device, not shown, which trips the cutter-shaft into action. During the single revolution of the cutter-shaft, the work-clamps are closed, the buttonhole-slit is cut and spread and the stop-lever 75 is tilted to running position, Fig. 1, by the action of the cam 83 on the cam-roll 82 at the free end of the lever-arm 81; the latch 79 snapping over the lever-arm 81 and holding the stop-motion lever in running position. The tension on the needle-thread is restored when the cam-follower lug 150 is pushed over the declivity 178 (Fig. 10) by the tilting of the stop-motion lever.

As the stitching progresses, the feed-wheel 19 receives a relatively slow step-by-step turning motion through the usual gear connections with the star-wheel 179, Fig. 1, with which mesh the diametrically opposed pins 180 carried by the lower end of the vertical shaft 9. In stitching around the eyelet-end of the buttonhole, the stitch-forming mechanism is given a turning movement through the usual connections with the feed-wheel. When the buttonhole is completely stitched, the tripping point 84 strikes the lever 85 and effects the release of the arm 81 from the latch 79, thus permitting the stop-motion lever to spring to stopping position. At this time the teeth 131 on the feed-wheel have moved to a position just in front of the pawl 129.

The upward movement of the slide-block 86 carried by the stop-motion lever, engages the latched extremity 135 of the lever 133 under the lateral arm 114 of the bell crank clutch-controlling lever for the auxiliary shaft 93. As the stopping tooth 87 drops into the notch 92 of the clutch-ring 88 to stop the stitch-forming mechanism, the downwardly moving slide-block 86 retracts the depending arm 108 of the bellcrank-lever, thus tripping the auxiliary shaft 93 into action to perform its single revolution, during the first part of which the upright bar 167 is elevated by the cam 164 thus causing the beginning end of the needle-thread to be released; the rounded edge 181 (Fig. 12) at the extremity of the compound cutting and nipping blade 61, 62, serving, as said blade is moved to open position, to deflect and move past the needle-thread *a* leading from the eye of the needle to the last stitch. When the cam rise 165 passes from under the follower 166, the spring 178 causes the quick retraction of the tappet 177 thus timing the action of the spring 73 upon the rod 69 to draw the latter rearwardly and close the cutting and nipping blades upon the needle-thread *a* (Fig. 11). Thus the power for opening the thread-cutting and nipping blades is derived from the positively rotated auxiliary shaft 93, as is also the power which is stored in the spring 73 preparatory to the immediately following thread-cutting and nipping action.

The active portions of the cams 143 and 164 are so related that at the close of a sewing period the blades 61 and 61 are first opened, the lever 145 is then actuated to release the tension on the needle-thread. The tappet 177 is next retracted to time the thread cutting operation, and finally, the latch lever 49 is elevated to open the work clamps.

While the invention has been described as embodied in a buttonhole sewing machine in which the relative movement between the stitch-forming mechanism and the work-holder is secured by moving the work-holder, it is evident that the invention, in its broader aspects, is not limited in its application to a buttonhole sewing machine, nor to a buttonhole sewing machine having a traveling work-holder.

Having thus set forth the nature of the invention, what I claim herein is:—

1. In a sewing machine for laying a group of stitches in accordance with a predetermined pattern, in combination, stitch-forming mechanism including a reciprocating needle, means for controlling its period of action, a work-holder, means for imparting stitch-positioning movements to the work-holder, a device carried by the work-holder for holding the beginning end of the needle-thread throughout a sewing operation, and means acting at the completion of the sewing operation to impart thread-releasing and thread-nipping movements in opposite directions to said device.

2. In a sewing machine for laying a group of stitches in accordance with a predetermined pattern, in combination, stitch-forming mechanism including an eye-pointed reciprocating needle, means for controlling its period of action, a work-holder, means for imparting stitch-positioning movements to the work-holder, means including a thread-severing and holding blade carried by said work-holder and adapted to cut and nip the needle-thread at the completion of a sewing period and hold the beginning end of the needle-thread at a point close to the work throughout the following stitching period, and means for retracting and advancing said thread-severing and holding blade at the completion of the sewing to effect the release of the beginning end of the needle-thread and to thereafter effect the severance of the needle-thread between the needle-eye and the last stitch.

3. In a sewing machine for laying a group of stitches in accordance with a predetermined pattern, the combination with stitch-forming mechanism, a work-holder, means for cutting the buttonhole prior to stitching

and means for relatively feeding the stitch-forming mechanism and work-holder, of an auxiliary shaft stationary during the buttonhole cutting and sewing operations and performing one rotation after the sewing is completed, devices for severing and holding the sewing thread, and means controlled by said auxiliary shaft for causing said devices to release the thread and to subsequently sever and hold the same.

4. In a sewing machine, in combination stitch-forming mechanism, means for controlling its period of action, a traveling work-holder, a tappet mounted independently of said work-holder for reciprocatory movement, an auxiliary shaft stationary during the sewing and connections therewith for imparting a to-and-fro movement to said tappet at the completion of the sewing, and thread-severing and holding devices moving with said work-holder and adapted to come into position to be actuated by said tappet after the buttonhole has been stitched.

5. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, means for relatively moving the stitch-forming mechanism and work-holder to sew about a buttonhole, buttonhole cutting mechanism including a cutter shaft performing a single rotation to cut the buttonhole preparatory to sewing, thread-cutting and nipping devices stationary relatively to the work-holder throughout the sewing period, an auxiliary shaft performing a single rotation after the buttonhole has been stitched, and connections for operating said devices from said auxiliary shaft.

6. In a buttonhole sewing machine, in combination, sewing mechanism, a work-holder, means for relatively moving the sewing mechanism and work-holder to sew about a buttonhole, buttonhole cutting mechanism including a cutter-shaft performing a single rotation to cut the buttonhole prior to stitching, thread-cutting and nipping devices, an auxiliary shaft performing a single rotation after the buttonhole has been stitched, and connections with said auxiliary shaft for controlling the nipper-opening and cutter-closing movements of said devices.

7. In a sewing machine, in combination, stitch-forming mechanism, means for controlling its period of action, a traveling work-holder, thread-cutting and nipping devices carried by said work-holder and including a horizontally slidable spring actuated rod, and means operating at the completion of the travelling movement of the work-holder to propel said rod horizontally against the action of its spring to release the nipped needle-thread, said means operating subsequently to release said rod for the thread-cutting operation.

8. A buttonhole sewing machine having, in combination, stitch-forming mechanism including a sewing shaft, means for controlling its period of action, a work-holder, means for relatively moving the stitch-forming mechanism and work-holder to sew around the buttonhole, an auxiliary shaft, power means for driving said shaft independently of the sewing shaft, a thread-nipping and cutting device, and connections deriving power from said auxiliary shaft for operating said device to release the beginning end of the needle-thread and to cut and nip the needle-thread at the completion of the sewing.

In testimony whereof, I have signed my name to this specification.

EDWARD B. ALLEN.