A. H. DE VOE.

SEWING MACHINE.

APPLICATION FILED DEC. 5, 1916.

1,416,002.

Patented May 16, 1922.

5 SHEETS—SHEET 1.

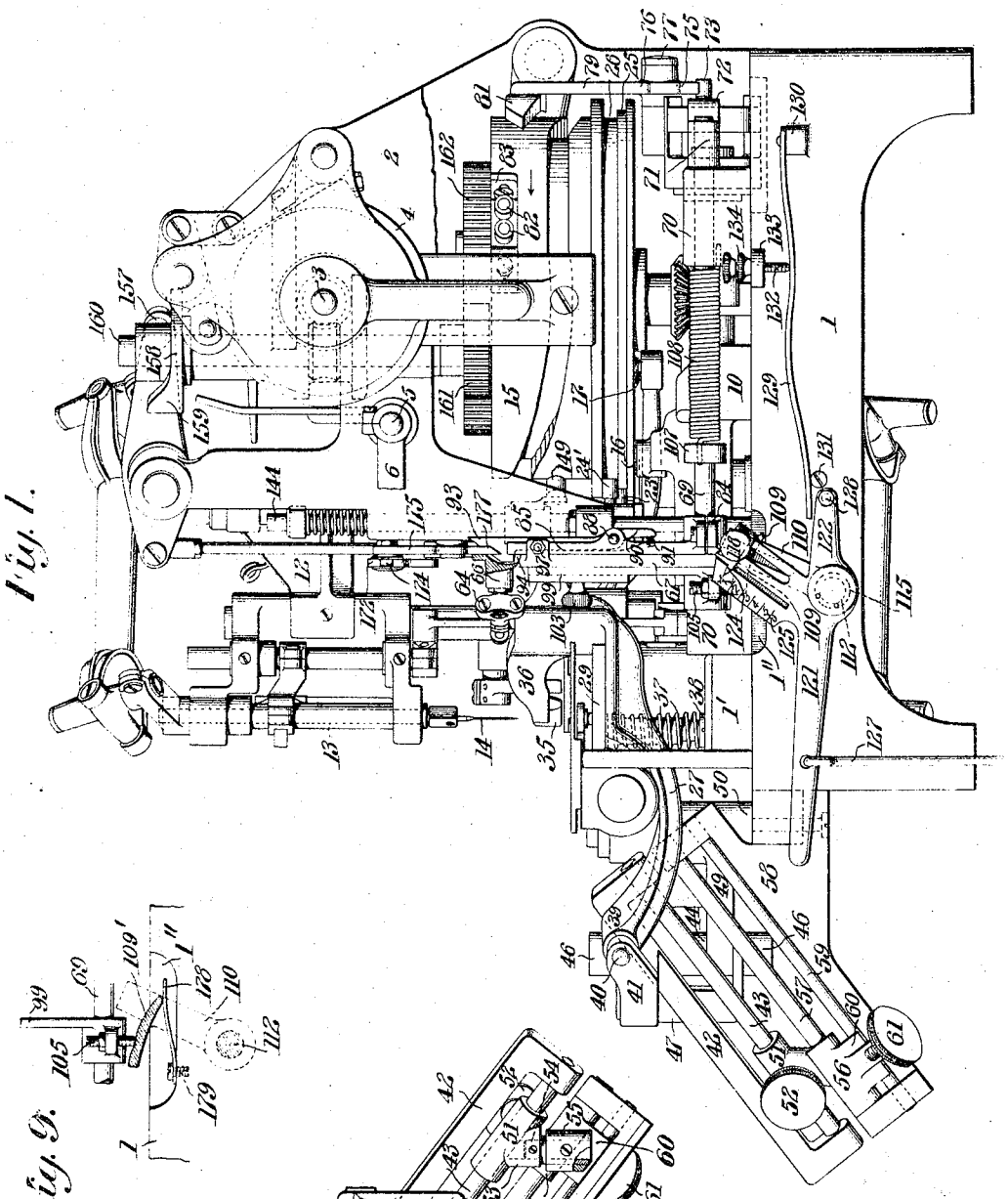


Fig. 1.

Fig. 9.

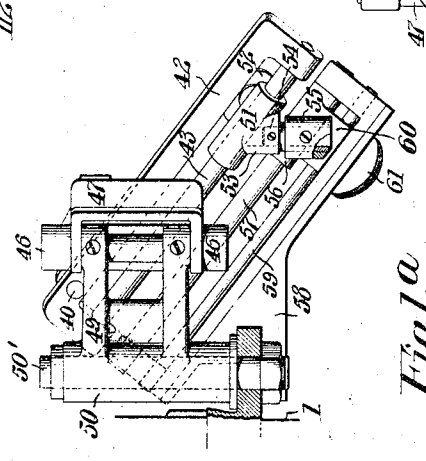


Fig. 10.

WITNESS

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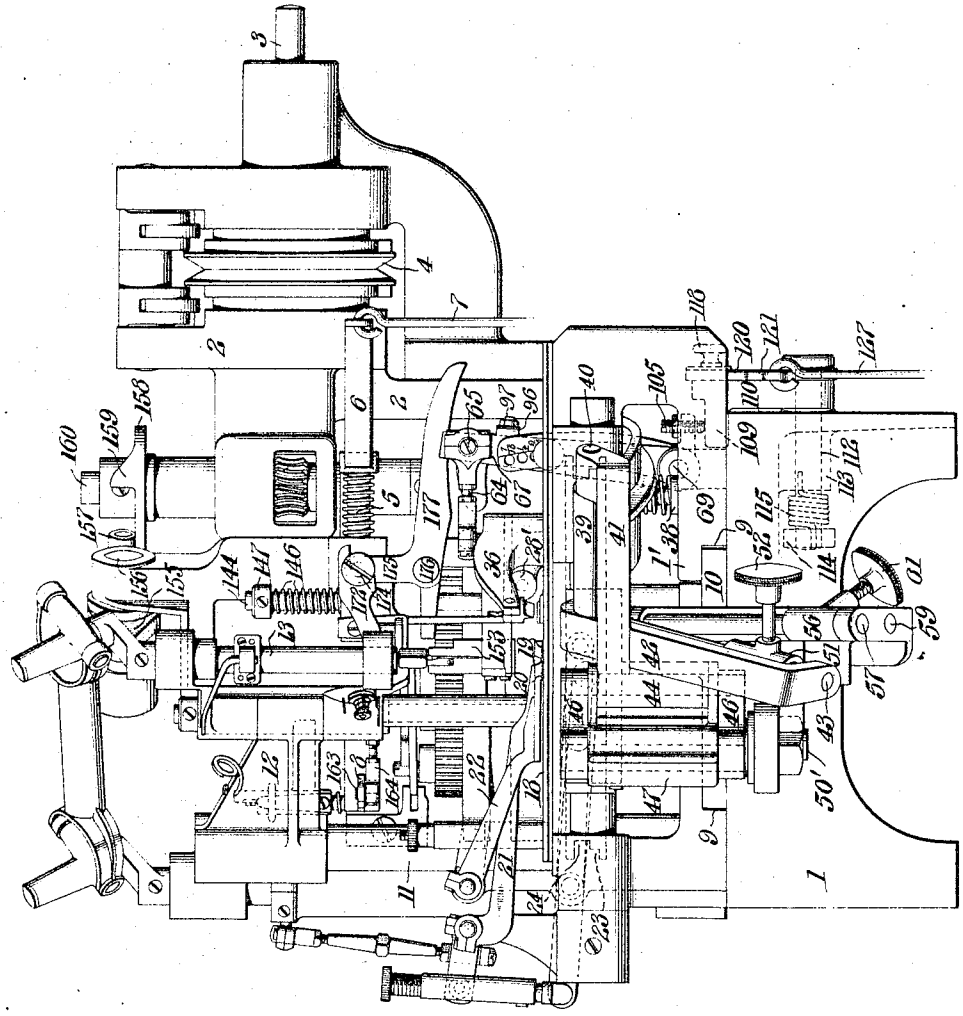


Fig. 2.

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5 SHEETS—SHEET 3.

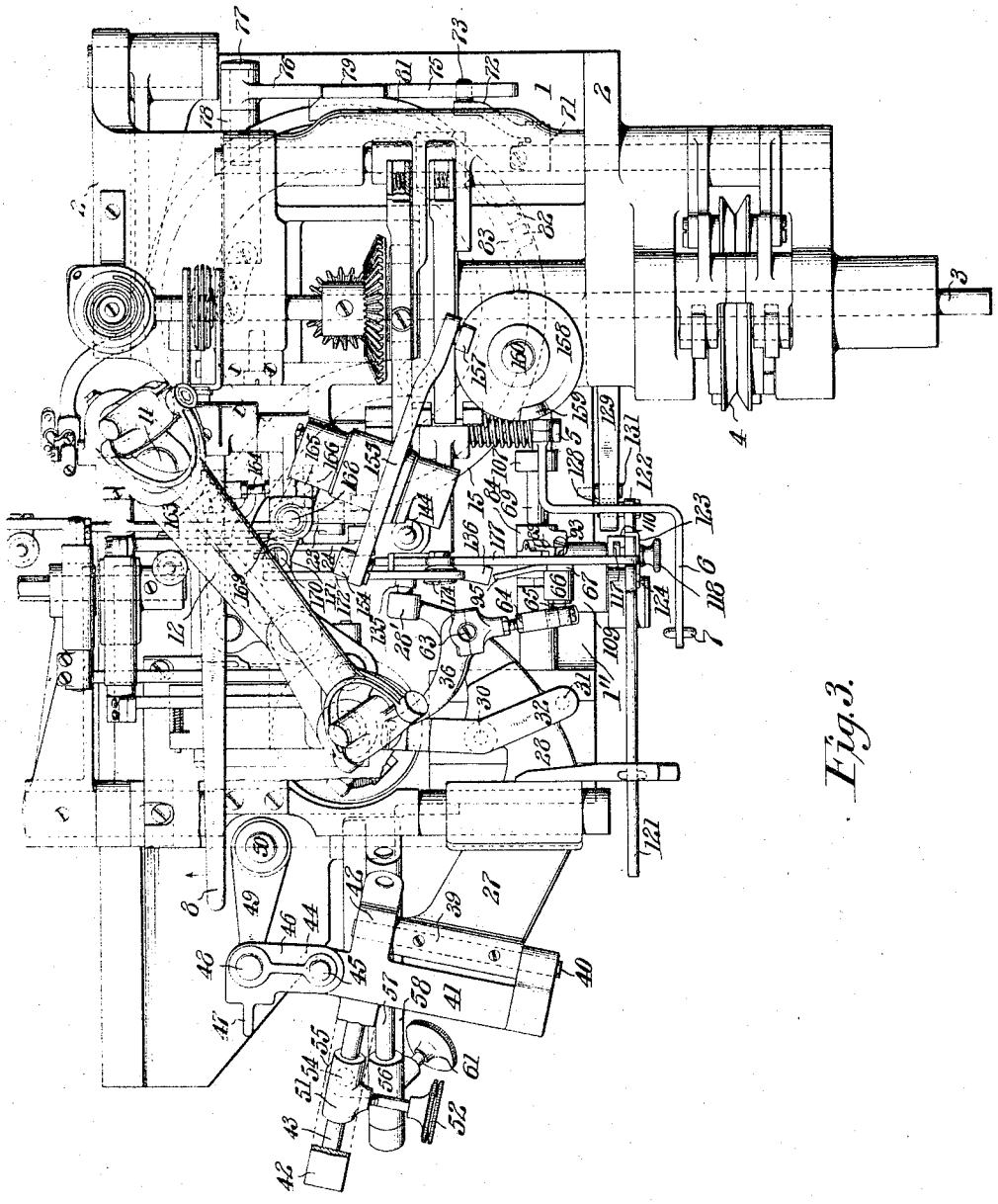


Fig. 3.

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5 SHEETS—SHEET 4.

Fig. 5.

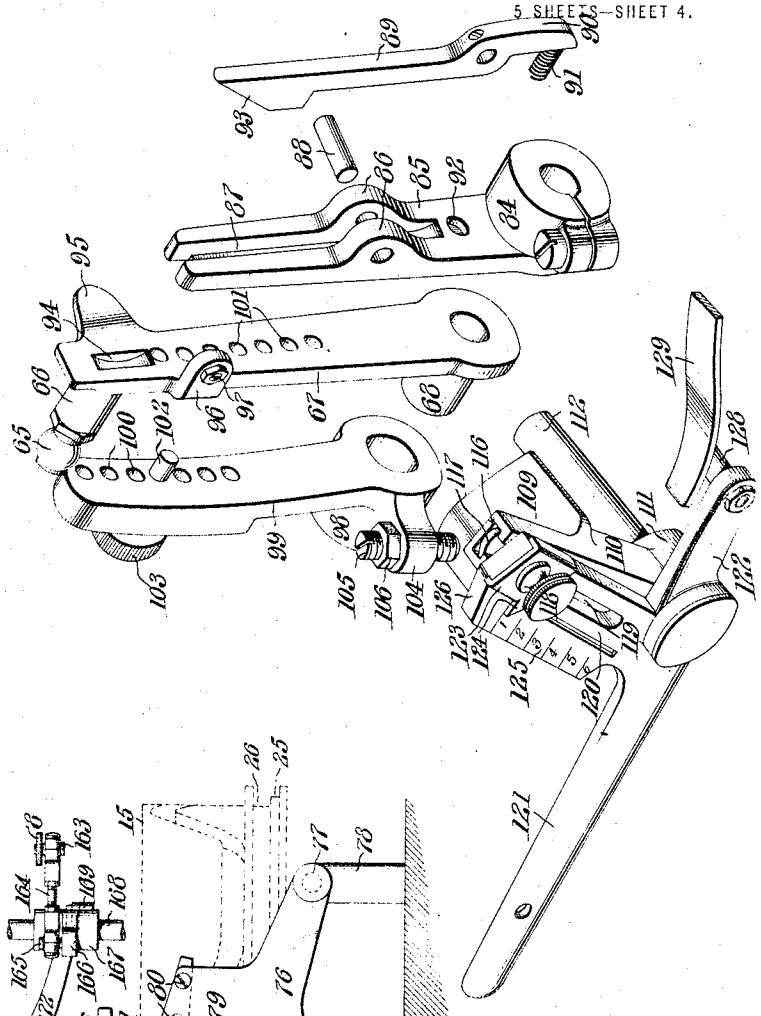
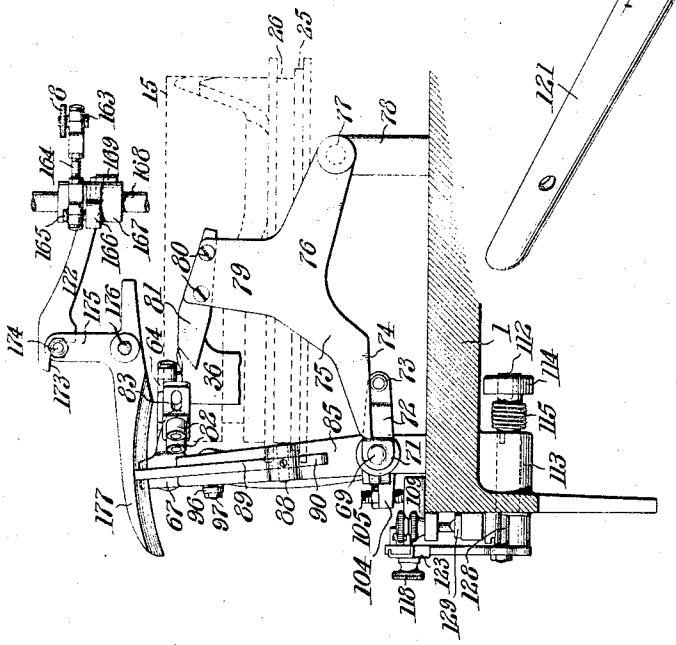


Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 6.

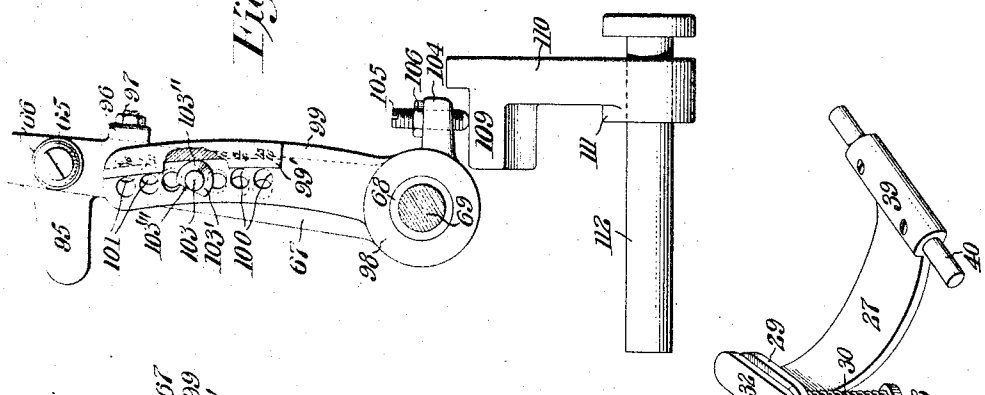
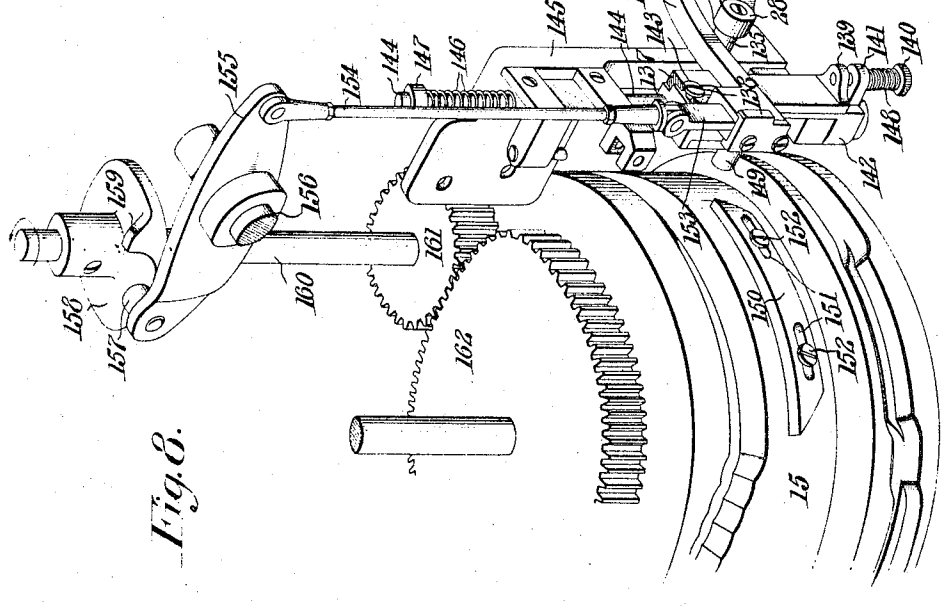


Fig. 7.



Fig. 8.



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UNITED STATES PATENT OFFICE.

ALBERT H. DE VOE, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE SINGER MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

SEWING MACHINE.

1,416,002. Specification of Letters Patent. Patented May 16, 1922.

Application filed December 5, 1916. Serial No. 135,154.

To all whom it may concern:

Be it known that I, ALBERT H. DE VOE, a citizen of the United States, residing at Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Sewing Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates more particularly to that class of devices in sewing machines having a certain normal operation which it is desired under certain conditions to modify either in predetermined degree or to an extent which may be arbitrary on the part of the operator, as in the case of machines employing means for imparting lateral jogging movements to a reciprocating needle, or feeding or ruffling mechanisms for special classes of work. It is designed more particularly for employment in connection with means for shifting the work relatively to the work-holder of a buttonhole sewing machine to space the buttonholes apart.

The invention has for one of its objects to provide, in mechanisms including a driving element and a driven element connected therewith and deriving operative movements therefrom, manually controlled means whereby the normal movements of the driven element may be varied at pleasure either in a predetermined degree or in a degree which is arbitrary on the part of the operator. It has for a more specific object to provide in a buttonhole sewing machine means whereby the work may be shifted preparatory to each buttonhole stitching operation so as to correctly space apart a succession of buttonholes in a piece of material, such spacing being either uniform or varied in fixed or arbitrary degree.

In its preferred embodiment, the present improvement is applied to a buttonhole sewing machine containing suitable stitch-forming mechanism and a work-holder with feeding mechanism for producing relative stitch-spacing movements between them. Cooperating with the stitch-forming and feeding mechanisms is a travelling cutting device having opposed cutting elements adapted in the retracted position of the cutting device to be closed in nipping relation upon the work and in its other extreme or advance position adjacent the stitch-forming mechanism to perform its normal slit-cutting action.

The travelling movements are imparted to the cutting device preferably from a rock-shaft having an arm lying in the path of movement of a projection of the feed-cam, a second arm of said rock-shaft being operatively connected with the cutting device. A third arm or projection of the rock-shaft is normally spring-pressed into contact relation with a stop-plate sustained by a manually operated rock-lever having an arm which is adapted to contact with a yielding stop-spring beyond the normal position of which it may be forced when desired.

The engagement of the said third arm or projection of the rock-shaft with the stop-plate determines the normal retracted position of the cutting device from which it advances toward the stitch-forming mechanism a distance corresponding with the normal spacing apart of the buttonholes. The stop-plate is so formed that, upon manual movement of the rock-lever until arrested by encounter with the stop-spring, the relation of the operative portion of the stop-plate to said arm or projection is changed to a predetermined degree so as to locate the retracted position of the cutting device accordingly preparatory to its performing an advance movement of corresponding length to the stitching point. The travel of the cutting device may obviously be further modified by forcing the rock-lever carrying the stop-plate into any arbitrary position beyond the point of contact with the stop-spring which latter is adapted to yield under the abnormal impulse required to overcome its resistance. It is evident that the operative face of the stop-plate may be so shaped that the movement of the rock-lever beyond the initial point of resistance offered by the stop-spring will cause it to so determine the retracted position of the cutting device as to effect either the lengthening or shortening of its range of movement to work-presenting position.

As represented in the drawings, the present improvement is embodied in the buttonhole cutting and stitching machine forming

the subject of my pending application Serial No. 69,644, filed December 31, 1915, and the several groups of mechanism not directly involving features of the present invention are, or may be, constructed in accordance with said application.

In the accompanying drawings, Fig. 1 is a side elevation of a buttonhole sewing machine embodying the present improvements, and Fig. 1ª a similar elevation taken from the opposite side, representing a portion of the cutting mechanism. Fig. 2 is a front and elevation, and Fig. 3 a plan of the machine. Fig. 4 is an elevation, viewed from the end opposite that represented in Fig. 2, showing the mechanism for producing the travelling or work-shifting movements of the cutting device, and Fig. 5 is a perspective view, upon a larger scale, of a portion of such mechanism, showing certain of its component parts detached for purposes of illustration. Fig. 6 is an elevation of a portion of the mechanism represented in Fig. 5, and Fig. 7 is a transverse section of the same through the coupling pin by means of which the adjustment of the normal traverse of the cutting device is effected. Fig. 8 is a perspective view representing that part of the cutting mechanism which imparts to the opposed cutting elements the work-nipping and cutting movements. Fig. 9 is a detail sectional elevation representing a modification of the stop-plate and its positioning means.

As shown in the drawings, the machine is constructed with a frame comprising the base 1 from which rises the standards 2 sustaining in coaxial relation the main-shaft 3 and the constantly running driving pulley 4 imparting, through suitable clutch devices and other connections, operative movements to the several trains of mechanism.

The clutch devices are controlled to set in motion successively the cutting and stitch-forming and feeding mechanisms by means of an endwise movable rock-shaft 5 carrying at one end the bent crank-arm 6 to which is attached the treadle rod 7. The rock-shaft may be actuated to start the machine either by drawing down the treadle rod 7 or by pressing down the hand-lever 8 pivotally connected with the opposite end of the rock-shaft.

Slidingly mounted upon the base 1 and confined within ways 9 thereon is the bed-plate 10 of the travelling stitch-frame sustaining the upright post 11 carrying the lateral bracket member 12 which sustains bearings in which is journaled the reciprocating needle-bar 13 carrying a needle 14 co-operating in practice with loop-taking elements sustained by the bed-plate 10. These stitch-forming elements are suitably mounted in their respective supports to perform a partial rotation in a buttonhole stitching cycle through an operative connection with the feed-can 15 which derives its operative movements from connections with the main-shaft 3.

The longitudinal feeding or stitch-spacing movements and the lateral side-shift movements are imparted to the stitch-frame by connections with the feed-cam including roller-studs 16 and 17, respectively, entering suitable cam-grooves in the lower face of the feed-cam cylinder 15.

The non-travelling work-holder of the present machine comprises a workplate 18, preferably in relatively movable sections and serving as the lower clamping member, and the feet 19 and 20 constituting the sectional upper clamping member of the work-holder, these feet being carried respectively by the independently mounted arms 21 and 22 adapted to be differentially lowered and lifted to clamp and release the work by automatically operated means including levers 23 and 24 carrying roller-studs 23′ and 24′ entering peripheral cam-tracks 25 and 26 in the feed-cam-cylinder.

As described in my said pending application, the travelling cutting device comprises a vertically and horizontally movable cutter-lever formed in two rigidly connected sections 27 and 28 with an intermediate raised seat 29 apertured to receive and guide a stud 30 and a steady pin 31 depending from a plate 32 having an upwardly offset lateral extension 33. Secured upon the extension 33 is the cutter-block or plate 34 disposed beneath and in operative relation with the relatively movable upper cutting knife 35 sustained by the overhanging member 36 of the cutter-lever or frame. The upper and lower cutting elements 34 and 35 are maintained normally separated by means of a spring 37 surrounding the stud 30 and interposed between the head of a screw 38 tapped therein and the lower face of the part 29 of the cutter-lever.

The lever-arm 27 is formed with a transverse boss 39 in which is secured the pivotal pin 40 which is journaled in the spaced members of a transverse yoke 41 of a swinging frame 42 carrying the guide-rod 43. The frame 42 is formed with a depending boss 44 embraced between and pivotally connected by means of the pin 45 with the spaced arms 46 of a link member which are rigidly connected together by the tie piece 47. The arms 46 embrace between them and are pivotally connected by the pin 48 with the spaced lateral arms 49 of a swinging bracket having a tubular hub 50 journaled upon the fulcrum-stud 50′ which is sustained by the base 1.

By the means described, the swinging frame 42 is supported for movement in any direction horizontally around the pivotal pins 45, 48 and 50′ and is restrained against movement in other directions. The cutter-

lever, while having a pivotal connection with said frame transverse to the pins upon which it moves, is sustained horizontally by the screw 38 resting upon the top of the base member 1.

Slidingly mounted upon the guide-rod 43 is a sleeve 51 adapted to be secured thereon in the desired position of adjustment by means of the clamp-screw 52 and provided with a laterally extending and apertured boss 53 in which is secured the fulcrum-pin 54 entering a socket 55 of the sliding sleeve 56. This sleeve is fitted upon a rod 57 of the rigid bracket 58 provided with a parallel rod 59 embraced by the wings 60 of the sleeve 56 to restrain the latter against turning, a clamp-screw 61 being applied to said sleeve to secure it in the desired position of adjustment.

The bracket 58 is shown secured to the front end of the base 1 with the parallel rods 57 and 59 inclined to the vertical pivotal pins 45, 48 and 50', the rod 43 being so sustained by its swinging frame 42, that it assumes a position in parallelism with the rods 57 and 59 when directly above them corresponding with the cutting position of the cutting elements.

The vertically arranged pin 54 obviously affords a fulcrum upon which the swinging frame 42 and the connected cutter-lever move to confine the bodily travel of the cutting elements to a circular path with a degree of curvature determined by the distance of the fulcrum-pin from cutting position by which it is maintained in alinement in its adjustment along the fixed guide-rod 57. By simultaneous adjustment of the sleeves 51 and 56 lengthwise of their respective supporting rods, the radius of curvature of the travelling movements of the cutting elements may be correspondingly varied.

The cutter-lever arm 28 is shown provided with an upwardly extending boss 62 carrying a ball-stud 63 which is embraced by a strap at one end of a link 64 having at its opposite end a similar strap embracing the ball-shaped extremity 65 of the stud 66 projecting laterally from one face of the rock-arm 67 which is formed with the tubular hub 68. The hub 68 of the rock-arm 67 is loosely fitted upon the rock-shaft 69 which is mounted in bearings 70 projecting from the top of the bed 1.

Fixed upon the rearward end of the rock-shaft 69 is the hub 71 of a lateral crank-arm 72 carrying the roller-stud 73 disposed within the range of movement of the straight lower edge 74 of one branch 75 of a forked lever 76 fulcrumed at 77 upon the post 78 rising from the base 1, said lever having an upwardly extending arm 79 to one face of which is secured by screws 80 the forwardly extending tappet-member 81.

The angular upper edge of the tappet-member 81 lies within the path of circular movement of the roller-studs 82 adjustably mounted by means of the bracket-plate 83 upon the periphery of the cam-wheel 15. The shape of the upper edge of the tappet-member is such that the encounter of its downwardly inclined forward edge with the first roller 82 causes its depression until the roller reaches the adjacent straight portion which in the extreme lower position thus assumed is parallel with the path of movement of the actuating roller-studs so as to produce a dwell of the forked lever in such depressed position until the rollers 82 reach a third downwardly inclined portion of the edge which permits the lever to rise to initial position.

Adjacent the rock-arm 67 upon the rock-shaft 69 is secured the split hub 84 of an overlying arm 85 provided upon its opposite face with the spaced and apertured ears 86 between which it is formed with a longitudinal groove 87. Mounted upon a pivotal pin 88 passing through said ears 86 is a latch-lever 89 with an outwardly offset tail 90 pressed outwardly by means of a spring 91 interposed between the same and the bottom of a cavity 92 in the arm 85. The latch-lever 89 is normally maintained by its spring within the groove 87 of the arm 85 with its projecting portion 93 extending beyond the opposite face of said arm and into a notch 94 in the adjacent face of the rock-arm 67, whereby said arms are normally locked together for movement in unison.

The rock-arm 67 is provided at its rearward edge with the inclined guide wing 95 to insure the correct relative positioning of the arms 67 and 85 in assuming interlocking position, and is provided upon its opposite edge with an angularly disposed lug 96 carrying the stop-screw 97 adapted to engage the corresponding edge of the arm 85.

Loosely mounted upon the hub 68 of the rock-arm 67 is the hub 98 of an upwardly extending arm 99 formed with a longitudinal series of transverse holes 100 disposed at an angle with a similar series of holes 101 of the rock-arm 67 and entered by the coupling pin 102 having the knurled head 103 and adapted to pass through corresponding holes of the respective arms to lock them together in different positions of relative angular adjustment. The head of the pin 102 has a conical eccentric flange 103' formed with an eccentric cam-portion 103'' which is flattened upon one side at 103''', the outer portion of the flange being adapted to enter a space beneath the inwardly beveled overhanging lip 99' of the arm 99 against the overhanging wall of which it may be jammed by turning to secure the pin against working loose in the operation of the machine. The pin may be removed by turning the same to bring the flatted side of its

flange into register with the edge of said lip and then withdrawing the same for insertion into a different pair of holes. The hub 98 of the arm 99 has a lateral lug 104 through which is tapped the contact stud-screw 105 provided with the jam-nut 106 for retaining it in the proper adjustment.

The rock-shaft 69 has secured thereon the collar 107 between which and one of the bearings 70 it is embraced by the spring 108 having one end secured in said bearing and the other end attached to the collar 107. This spring acts upon the rock-shaft 69 to cause the point of the contact stud-screw 105 to normally rest upon the upper warped surface of the stop-plate 109 sustained by an upwardly extending arm 110 whose hub 111 is fixed upon the fulcrum-pin 112 journaled within a suitable bearing boss 113 of the base 1. The fulcrum-pin 112 has fixed upon its inner end the collar 114 between which and the bearing 113 it is provided with the spring 115 having its opposite ends connected with said parts to insure the normal contact of one edge of the stop-plate with the bottom of a recess 1'' formed therefore in the upper face of the base.

The outer face of the arm 110 is shown formed with an undercut longitudinal groove 116 in which is fitted a similarly shaped nut 117 entered by a clamp-screw 118 passing through a slot 119 of an overlying arm 120 of a plural-armed operating lever loosely journaled upon the fulcrum-pin 112 and having oppositely extending lateral arms 121 and 122. Fitted upon the arm 120 is a sliding cap 123 entered by and movable with the screw 118 in its various positions of lengthwise adjustment and provided with a lateral projection in the form of a pointer 124 overlying a scale 125 provided upon a lateral extension or wing 126 of the arm 120.

The outer portion of the arm 121 is apertured to receive the eyed end of a rod 127 affording a connection with a knee-lever or treadle beneath the machine.

The backwardly extending arm 122 carries at its extremity a lateral stud-pin 128 having a range of movement about the fulcrum-pin 112 crossing the outer extremity of the stop-spring 129 secured at its opposite end upon the lug 130 sustained by the base 1 and normally resting upon the stud-screw 131 of the base 1 under the action of the thrust-screw 132 passing through a lug 133 upon the base 1 and locked in the required position of adjustment by means of the jam-nut 134. The stud-screw 131 may be considered as a stop for predetermining a certain definite operative position of the spring 129.

The section 28 of the cutter-lever is formed with a boss 28' carrying the roller-stud 135 adapted for engagement by the lower face of the transverse rail 136 sustained by the vertical slide-bar 137 which has in its upper portion the slot 138 and at its lower end the lateral ear 139 carrying the depending stud-screw 140 which passes through the apertured lug 141 of the block 142 to which the bar 137 is slidingly fitted. The slot 138 is entered by the shank of the guide-screw 143 tapped into the block 142.

The block 142 is secured upon the vertically sliding rod 144 which is journaled within the rigid bracket 145 forming a part of the machine frame and is normally maintained in initial upper position by means of the surrounding spring 146 interposed between the bracket 145 and a collar 147 fixed upon the upper end of the rod 144. The slide-bar 137 is yieldingly maintained in its lower position, in which it rests upon a shoulder afforded by the block 142, by means of a spring 148 interposed between the head of the stud-screw 140 and the lug 141.

The block 142 has upon its inner face the lateral roller-stud 149 adapted to engage the lower edge of the cam-rib 150 upon the periphery of the cam-wheel 15, this cam-rib being provided with downwardly and convergently inclined opposite ends and is in the form of a plate having slots 151 extending lengthwise thereof and entered by the fastening screws 152 by which it is adjustably secured to the cam-cylinder 15. In the rotation of the cam-wheel the encounter of the roller-stud by the inclined advance end of the cam-rib causes the depression of the block 142 in opposition to the spring 146, the slide-bar 137 being at such time prevented from full downward movement, under which condition the spring 148 is compressed.

The spring 146 obviously serves to normally maintain the block 142, and with it the slide-bar 137, raised to permit the separating of the cutter elements under the action of the spring 37; but when the block 142 is forced downwardly in opposition to the spring 146 by encounter of the roller-stud 149 with the cam-rib 150, the spring 148, acting as a yielding connection between the parts 137 and 142, serves as a cushion so as to impose merely a light pulling action upon the bar 137 which carries with it the rail 136 exerting a yielding engagement with the roller-stud 135 and thus depresses the cutter-carrying lever with sufficient force in opposition to the spring 37 to produce a mere nipping action of the opposed cutting elements upon the work preparatory to its travelling or work-shifting movement toward the stitching point.

The relative timing of the clamp-operating cam elements 25 and 26 and the work-nipping cam-element 150 is preferably such that the clamp remains closed upon the work at the completion of a buttonhole

producing period, the initial downwardly inclined end of the cam-rib 150 being at such time closely adjacent to or in contact with the roller-stud 149 and in readiness to perform its work-nipping action at the beginning of the next buttonhole-producing cycle immediately before the opening of the work-holder, so that the work is free to be shifted between the now open work-clamping members to position the succeeding buttonhole from that just completed.

The rail 136 has at its end nearest the stitch-forming mechanism a guiding socket entered by the plunger-bar 153 suitably attached at its upper end to the connecting rod 154 which is in turn connected with one arm of a rock-lever 155 mounted upon a fixed fulcrum 156 and having an oppositely extending arm provided with a lateral stud 157. The stud 157 normally rests upon the cam-disk 158 provided at one point of its periphery with the actuating projection 159 by means of which the rock-lever 155 is tilted to reciprocate the plunger-bar 153.

The cam-disk is secured upon the vertical shaft 160 which is geared to rotate synchronously with the cam-wheel 15 by means of the intermeshing gears 161 and 162. While the relation of these gears is such that the plunger 153 performs repeated reciprocations while the feed-wheel is making a single rotation, all such reciprocations are idle excepting when the cutting device assumes its advance or work-presenting position adjacent the stitch-forming mechanism, wherein the roller-stud 135 comes into register with the range of movement of the plunger-bar.

In this position of the cutting device the descent of the plunger-bar and its consequent engagement with the roller-stud 135 causes the forcible depression of the cutter-lever so as to effect the second stage of its work-engaging movement wherein the cutting elements are closed together and the buttonhole slit is cut in the fabric. The rise of the plunger-bar 153 and the subsequent disengagement of the cam-rib 150 from the stud 149 obviously permits the separation of the cutting elements under the action of the spring 37 for disengagement of the cutting elements from the work preparatory to the retraction of the cutting device to initial position.

The actuating means for imparting work-shifting movements to the cutting device is preferably such that, regardless of the initial position in which it begins such movement, it completes said movement invariably within the range of action of the stitch-forming mechanism, the separable pairs of work-clamping members comprising the work-holder being so manipulated as to accommodate this movement while remaining open sufficiently to permit the shift of the work, as is fully set forth in my pending application above referred to.

The hand-actuated starting lever 8 is shown provided near its connection to the rock-shaft 5 with a depending ball-stud 163 embraced by a strap at one end of the link 164 having at its opposite end a strap embracing a ball-stud 165 upon a lateral arm 166 of a collar 167 upon the vertically disposed rock-shaft 168. This rock-shaft has an oppositely extending arm 169 carrying a stud-screw 170 which is loosely embraced by an aperture in the lateral ear 171 upon one end of the push-rod 172 which has the lower edge of its opposite end formed with a notch 173 having a straight upper edge. The upper wall of the notch 173 rests upon a lateral stud-pin 174 upon the upwardly extending arm 175 of an angular trip-lever mounted upon a fixed fulcrum-pin 176 and having a lateral arm 177 formed with a lower beveled edge preferably of segmental form concentric with a center of curvature coincident with the axis of the rock-shaft 69 when in normal position.

The beveled edge of the trip-lever normally rests in the throat formed by the inclined upper edge of the latch element 93 and the adjacent face of the rock-arm 67. When the starting lever 8 performs its initial lateral movement at the beginning of a button-hole-producing cycle, the consequent rocking of the shaft 168 will produce a slight idle retractive movement of the push-rod 172 without effecting a consequent movement of the trip-lever 175, 177; but in case it is desired to prevent the work-shifting movement of the cutting device and its consequent cutting action upon the work, the abnormal movement of the starting lever in the direction of the arrow, Fig. 3, will turn the rock-shaft 168 in the opposite direction, thereby causing the operative shoulder of the notched push-rod 172 to forcibly engage the stud 174 and force the beveled arm 177 downwardly so as to retract the latch element 93 from its recess 94 of the rock-arm 67, thereby uncoupling the actuating arm 85 from the actuated arm 67, so that the actuation of the rock-shaft 69 will have no effect upon the cutting device. The release of the starting lever obviously permits the retraction of the connected parts and the recoupling of the arms 85 and 67 by the latch-lever 89 under the action of the spring 91.

In the use of the machine, the stitch-forming and feeding mechanisms are of course initially at rest with the needle retracted from the work. As before stated, the work-holder still grips the work and the cutting device is open and in retracted position.

When the machine is at rest, the contact stud 105 rests normally upon the stop-plate

109, as represented in Fig. 5, and, the coupling pin 102 having been withdrawn, the rock-arm 67 is set in the required relation to the arm 99 with corresponding holes in the respective arms in alinement, and the coupling pin reinserted. This determines the normal retracted position of the ball-stud 65, and hence of the travelling cutting device having the described link connection therewith, and insures a normal length of traverse of the cutting device into stitching position.

The coupling screw-stud 118 may be loosened and shifted within the slot 119 to adjust the relation of the overlying arms 110 and 120 and at the same time set the stud 128 at the required normal distance from the stop-spring 129 so as to fix the extent of predetermined increase of throw of the rock-arm 67 under the action of its actuating cam, but varying the initial retracted position of such rock-arm through a manual shift of the stop-plate 109.

The machine is started by rocking the shaft 5, either by drawing down the treadle-rod 7 or pressing down the hand-lever 8, whereby the feed-cam is set in motion and acts through the described connections to first effect the nipping of the work by the cutting elements and then open the work-holder preparatory to the advance of the cutting device toward the stitch-forming mechanism under the action of the studs or actuating elements 82 upon the tappet-arm or follower 81, so as to advance the work through the work-holder a distance equivalent to the spacing apart of buttonholes for which the machine has been previously adjusted. The upper cutting element or knife 35 is now depressed through the work to cut the butttonhole slit and permitted to rise and the separately operable pairs of clamping elements composing the work-holder are successively closed upon the work while the cutting device retires to retracted position. The stitch-forming mechanism is now thrown into action and the stitching of the buttonhole is performed, after which, through the usual action of the stop-motion device, the machine comes to rest in the initial position above described.

In the normal operation of the machine in producing uniformly spaced buttonholes in an article such as a shoe upper, the cutting and working of the buttonholes and the shift of the work to space them apart is effected automatically without any special attention to the cutting device on the part of the operator. However, it sometimes happens that in different parts of a series of buttonholes it is desirable to vary an initial spacing by a fixed or predetermined amount, such amount being determined by the relative adjustment of the arms 110 and 120 as before described. This change of spacing may be readily effected in the present machine by drawing down the arm 121 preparatory to a buttonhole-producing cycle to such extent as to bring the stud 128 into contact with the stop-spring 129, thereby shifting the stop-plate 109 to the left, as viewed in Fig. 5, the contact stud 105 thus being caused under the action of the spring 108 to assume a new predetermined position upon the stop-plate 109, and the initial retracted position of the cutting device being changed accordingly. In the subsequent advance of the cutting device to its uniform advance position adjacent the stitch-forming mechanism, it now performs a traverse of different extent from the normal and imparts to the work a corresponding advance movement. In case a further change from the normal work-shifting movement is desired, this may be effected by moving the lever-arm 121 to move the stud 128 beyond the normal stopping position of the spring 129, thereby thrusting the same backward to such extent as may be desired so as to give the stop-plate 109 a movement of an amplitude arbitrarily determined by the operator, with a corresponding change in the initial retracted position of the cutting device.

It is evident that the form and relation of the stop-plate 109 to the swinging arm 99 and the contact-stud 105 carried thereby will be determined according to the nature of the desired changes to be effected in the normal shift of the work to space the buttonholes; and in the present instance the operative face of the stop-plate is arranged eccentrically to the fulcrum-pin 112 in such manner that the manual shift of the arm 110 from initial position would effect a retirement of the cutting device from normal retracted position in a direction opposite to the stitching point. It is however evident that the effect of such movement of the contact-plate may be determined by the form of its operative face.

In Fig. 9 is represented a modification in which the extremity of the stop-plate 109′ rests upon a stiff flat spring 178 secured within the recess 1″ of the machine base by means of a screw 179. In this case the opposite end of the stop-plate is shown extended beyond that of the preceding figures and suitably shaped. With this construction, the depression of the treadle-rod 127 acts as in the preceding figures to effect an increase in the spacing apart of the buttonholes; but by an upward pressure upon the treadle rod, the end of the stop-plate forcibly displaces the spring 178 toward the bottom of the recess 1″ to present the opposite extremity of the stop-plate to the contact-stud 105, thereby having the effect of shifting the initial position of the cutting device toward the stitching point and reducing the spacing apart of the buttonholes.

From the foregoing description, it is evident that in its broadest aspect, the present invention is susceptible of embodiment in different types and classes of sewing machines involving the manual variation of the normal throw of a reciprocating element either to a predetermined degree or to an arbitrary degree beyond the same.

In the buttonhole machine herein represented, the shifting of the work to space the groups of stitches of the successive buttonholes is effected by means of the travelling cutting device with its two-stage closing actions of which the first involves the nipping of the work and the second the cutting of the buttonhole slit; and it is evident that the closing of the cutting elements may be effected by a single stage movement preparatory to the travel from retracted to stitching position. It is also evident that this feature of shifting the work to space successive groups of stitches thereon may be embodied in machines not provided with travelling cutting devices by employment of special travelling work-shifting means with provision for gripping the work preparatory to their work-advancing movements.

It is equally obvious that in its several aspects the present improvement is not limited, in other respects than those above noted, to the specific construction and arrangement of its component parts, in accordance with the present disclosure, but it is susceptible of modification in very large degree within the scope of the present invention.

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

1. In a sewing machine, in combination, a driven element, a driving element with means acting through the same for normally imparting to the driven element uniform movements, and means for selectively varying the amplitude of said movements either to a predetermined limit or beyond said limit, said means including a manually shiftable element and coacting devices for arresting movement of said element at a predetermined position under a normal impulse, one of said devices including means which shifts under an abnormal impulse to permit further movement of said manually shiftable element.

2. In a sewing machine, in combination, a driven element, a driving element with means acting through the same for normally imparting to the driven element uniform movements, and means including a shiftable element for selectively varying the amplitude of said movements either to a predetermined limit or beyond said limit, said last-mentioned means including a resistance device interposed in the path of movement of said element and a stop for determining a certain definite operative position of said resistance device.

3. In a sewing machine, in combination, a driven element, a driving element with means acting through the same for normally imparting to the driven element uniform movements, and means including a shiftable element for selectively varying the amplitude of said movements either to a predetermined limit or beyond said limit, said last-mentioned means including a resistance device which, when displaced by said element, will automatically return to initial position.

4. In a sewing machine, in combination, a driven element, a driving element with means acting through the same for normally imparting to the driven element uniform movements, means for selectively varying at will the amplitude of said movements either to a predetermined limit or beyond said limit, and independent means for adjusting the predetermined limit of variation of said movements.

5. In a sewing machine, in combination, a driven element, a driving element with means acting through the same for normally imparting to the driven element movements of predetermined amplitude, means including a reciprocatory member for varying at will the amplitude of said movements in a predetermined degree, and means including a yielding resistance disposed intermediate the limits of movement of said reciprocatory member and serving optionally to arrest the latter or to permit its continued movement.

6. In a sewing machine, driving and driven elements with a connection between them for producing normal movements of the driven element, and controlling means applied to said connection for effecting variations in the extent of said movements and comprising a reciprocatory member with means for applying thereto a yielding resistance at a definite point between the extremes of its range of movement.

7. In a sewing machine, driving and driven elements with a connection between them for producing normal movements of the driven element, and controlling means applied to said connection for effecting variations in the extent of said movements and comprising a reciprocatory member and a yielding stop therefor disposed at a definite point between the extremes of its range of movement.

8. In a sewing machine, in combination, a driving element, a driven element mounted for to-and-fro movement, a variable operative connection between said elements for producing a variable throw of the driven element, a shiftable device for adjusting said connection, and means for limiting the throw-varying movement of said shiftable device under a normal impulse, said means being constructed to permit a further movement of said shiftable device under an abnormal impulse and to return automatically

to initial limiting position prior to the execution of a subsequent normal impulse.

9. In a sewing machine, in combination, stitch-forming mechanism, feeding mechanism for producing relative stitch-spacing movements between the stitch-forming mechanism and the work, work-shifting means for advancing the work in a curved path transversely of the stitch-spacing movements produced by said feeding mechanism, and adjusting means operable while the machine is in operation to vary the extent of the work-advancing movements.

10. In a sewing machine, in combination, stitch-forming mechanism, feeding mechanism for producing relative stitch-spacing movements between the stitch-forming mechanism and the work, work-shifting means for advancing the work in a different direction from the stitch-spacing movements produced by said feeding mechanism, and manually controlled means for varying at will the extent of the work-advancing movements of said work-shifting means without stopping the machine.

11. In a sewing machine, in combination, stitch-forming mechanism, feeding mechanism for producing relative stitch-spacing movements between the stitch-forming mechanism and the work, work-shifting means for advancing the work to said feeding mechanism, and manually actuated means including a reciprocatory member and a yielding resistance therefor adapted to come into action upon said member intermediate its limits of movement whereby the extent of the normal work-advancing movements may, at will, be varied to or beyond a predetermined limit.

12. In a sewing machine, in combination, stitch-forming mechanism, feeding mechanism for producing relative stitch-spacing movements between the stitch-forming mechanism and the work, work-shifting means for advancing the work to said feeding mechanism, manually actuated means including a reciprocatory member and a yielding resistance intermediate its extreme positions whereby the extent of the normal work-advancing movements may be varied up to or beyond a predetermined limit, and means for adjusting the position of said yielding resistance relative to the extreme positions of said reciprocatory member.

13. In a sewing machine, in combination, stitch-forming mechanism, feeding mechanism for producing relative stitch-spacing movements between the stitch-forming mechanism and the work, work-shifting means for advancing the work to said feeding mechanism, means for adjusting the length of the normal work-advancing movements, and manually actuated means including a reciprocatory member and a yielding resistance interposed at a predetermined point intermediate the limits of movement of said reciprocatory member whereby the extent of the normal work-advancing movements may be varied up to or beyond a predetermined limit.

14. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, work-shifting means including a reciprocatory work-engaging element for advancing the work to said work-holder between sewing periods, and means for varying the length of travel of said work-engaging element to vary the spacing of the buttonholes.

15. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, work-shifting means including a to-and-fro moving work-engaging element for advancing the work to said work-holder, means connected with and actuated by a moving part of the machine for imparting a normal to-and-fro travel to said work-engaging element, and means for varying the length of travel of said work-engaging element.

16. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, means for producing relative bodily traveling movements between the stitch-forming mechanism and the work-holder to sew around a buttonhole, work-shifting means out of engagement with the work during the sewing and adapted to engage and advance the work to said work-holder between sewing periods, and manually controlled means for rendering the work-shifting means ineffective without affecting the operation of the stitch-forming mechanism and the work-holder.

17. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for producing relative bodily traveling movements between the stitch-forming mechanism and the work-holder, work-shifting means for presenting the work to the work-holder, and manually controlled means operable without stopping the machine for varying the normal action of said work-shifting means.

18. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, means for advancing the work to the work-holder between sewing peroids, said means including a work-engaging element movable in opposite directions toward and away from sewing position, a stop for limiting its movement in one direction, and means for shift-

ing said stop to vary the spacing of the buttonholes.

19. In a buttonhole sewing machine, in combination, stitch-forming mechanism, work-shifting means for presenting the work to the stitch-forming mechanism including a moving element and a stop for limiting its movement, manually controlled means including a reciprocatory member for shifting said stop into different operative relations with said element, and means acting upon said reciprocatory member optionally to limit its movement to a predetermined point or to permit such movement beyond said point.

20. In a buttonhole sewing machine, in combination, stitch-forming mechanism, work-shifting means for presenting the work to the stitch-forming mechanism, said means including a work-engaging element movable in opposite directions toward and away from the stitch-forming mechanism, a stop for limiting the retrograde movement of said element away from the stitch-forming mechanism, means for adjusting the initial position of said stop, and manually controlled means operable at will for shifting said stop into different operative relations with said element.

21. In a buttonhole sewing machine, in combination, stitch-forming mechanism, work-shifting means for presenting the work to the stitch-forming mechanism including a moving element and a stop for limiting its movement, manually controlled means including a reciprocatory member for shifting said stop into different operative relations with said element, and means acting at a predetermined point in the range of movement of said member for forcibly resisting its movement beyond the same while permitting its movement throughout the entire range of movement.

22. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a traveling buttonhole cutting device, means for shifting it toward and from the stitch-forming mechanism, and means for varying the length of travel of said cutting device.

23. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a buttonhole cutting device, means for shifting it from retracted position toward and from the stitch-forming mechanism, means for closing it and maintaining it closed upon the work while in retracted position and during its travel therefrom, respectively, and means for varying the length of travel of said cutting device.

24. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a travelling buttonhole cutting device, means for shifting it toward and from the stitch-forming mechanism, and manually controlled means for varying the length of travel of said cutting device.

25. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device including opposed work-gripping elements, movable toward and from the stitch-forming mechanism, means for closing said gripping elements upon the work, and means for imparting travelling movements to said elements and comprising an actuating element and a follower therefor with provision for shifting of the follower to different positions within the range of movement of said actuating element.

26. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device movable toward and from the same, means for closing said gripping device upon the work, and means for imparting travelling movements to said device and comprising an actuating element and a follower therefor, normally acting means for setting the follower at a predetermined position within the range of action of said actuating element, and manually controlled means for shifting at will said position without disturbing said normally acting positioning means.

27. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, a travelling work-gripping device movable toward and from the work-holder, means for closing said gripping device upon the work, and means for imparting travelling movements to said device and comprising a spring-pressed reciprocatory member connected therewith, actuating means therefor, and a shifting stop element for determining the initial position of said reciprocatory member.

28. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device movable toward and from the same, means for closing said gripping device upon the work, and means for imparting travelling movements to said device and comprising a spring-pressed reciprocatory member connected therewith, actuating means therefor, a movable stop element for determining the initial position of said reciprocatory member, means for shifting said stop element into different relations with said reciprocatory member, and a yielding stop into contact with and beyond which said stop element shifting means may be moved.

29. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device movable toward and from the same, means for closing said grip-

ping device upon the work, and means for imparting travelling movements to said device and comprising a spring-pressed reciprocatory member connected therewith, actuating means therefor, a movable stop element for determining the initial position of said reciprocatory member, means for shifting said stop element into different relations with said reciprocatory member, a stop-spring within the range of action of the stop element shifting means, and a fixed abutment normally receiving the thrust of said stop-spring upon the side thereof engaged by said shifting means.

30. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device movable toward and from the same, means for closing said gripping device upon the work, and means for imparting travelling movements to said device and comprising a spring-pressed reciprocatory member connected therewith, actuating means therefor, a movable stop element for determining the initial position of said reciprocatory member, means for shifting said stop element into different relations with said reciprocatory member, a stop-spring within the range of action of the stop element shifting means, a fixed abutment normally receiving the thrust of said stop-spring upon the side thereof engaged by said shifting means, and means for adjusting the initial position of said shifting means relatively to said stop-spring.

31. In a sewing machine, in combination, stitch-forming mechanism, a travelling work-gripping device movable toward and from the same, means for closing said gripping device upon the work, and means for imparting travelling movements to said device and comprising an actuating element, a spring-pressed reciprocatory member connected with said device and carrying a follower disposed within the range of action of said actuating element, adjusting means for varying the initial position of said follower relative to the range of movement of said actuating element, and a shifting stop element-carrier operatively connected with said spring-pressed member with manually controlled means acting thereon for further controlling the position of said follower.

32. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, a travelling work-nipping device for shifting the work relatively to the work-holder between buttonhole stitching operations, means for closing the work-nipping device upon the work preparatory to a travelling movement, and means for varying the length of travel of said nipping device.

33. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, a travelling work-nipping device for shifting the work relatively to the work-holder between buttonhole stitching operations, means for closing the work-nipping device upon the work preparatory to a travelling movement, manually shiftable means for varying the length of travel of said nipping device, and means for rendering said device ineffective.

34. In a buttonhole sewing machine, in combination, stitch-forming mechanism, a work-holder, feeding mechanism for relatively moving the stitch-forming mechanism and work-holder to sew around a buttonhole, a travelling work-nipping device for shifting the work relative to the work-holder between buttonhole stitching operations, travel-producing means therefor, means for closing said work-nipping device upon the work preparatory to a travelling movement, and means for rendering said travel-producing means ineffective.

35. A buttonhole sewing machine having, in combination, stitching devices and a work-clamp relatively movable to sew about a buttonhole, a work-feeder, mechanism for advancing the feeder, for the purpose of spacing the buttonholes, while the clamp is opened and for returning it to initial position before the completion of the succeeding buttonhole making cycle, and means for varying the spacing stroke of the feeder.

36. A buttonhole sewing machine, having, in combination, stitch-forming mechanism, a work-clamp, mechanism for relatively moving them to sew about a buttonhole, a work spacer, mechanism for advancing the spacer to space the work while the clamp is opened and for returning it to initial position before the completion of the succeeding buttonhole making cycle, and means for varying the spacing stroke of the spacer.

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

ALBERT H. DE VOE.