

1,032.621.

D. NOBLE & J. S. FINCH.
 BUTTONHOLE SEWING MACHINE.
 APPLICATION FILED DEC. 19, 1906.

Patented July 16, 1912.

13 SHEETS-SHEET 1

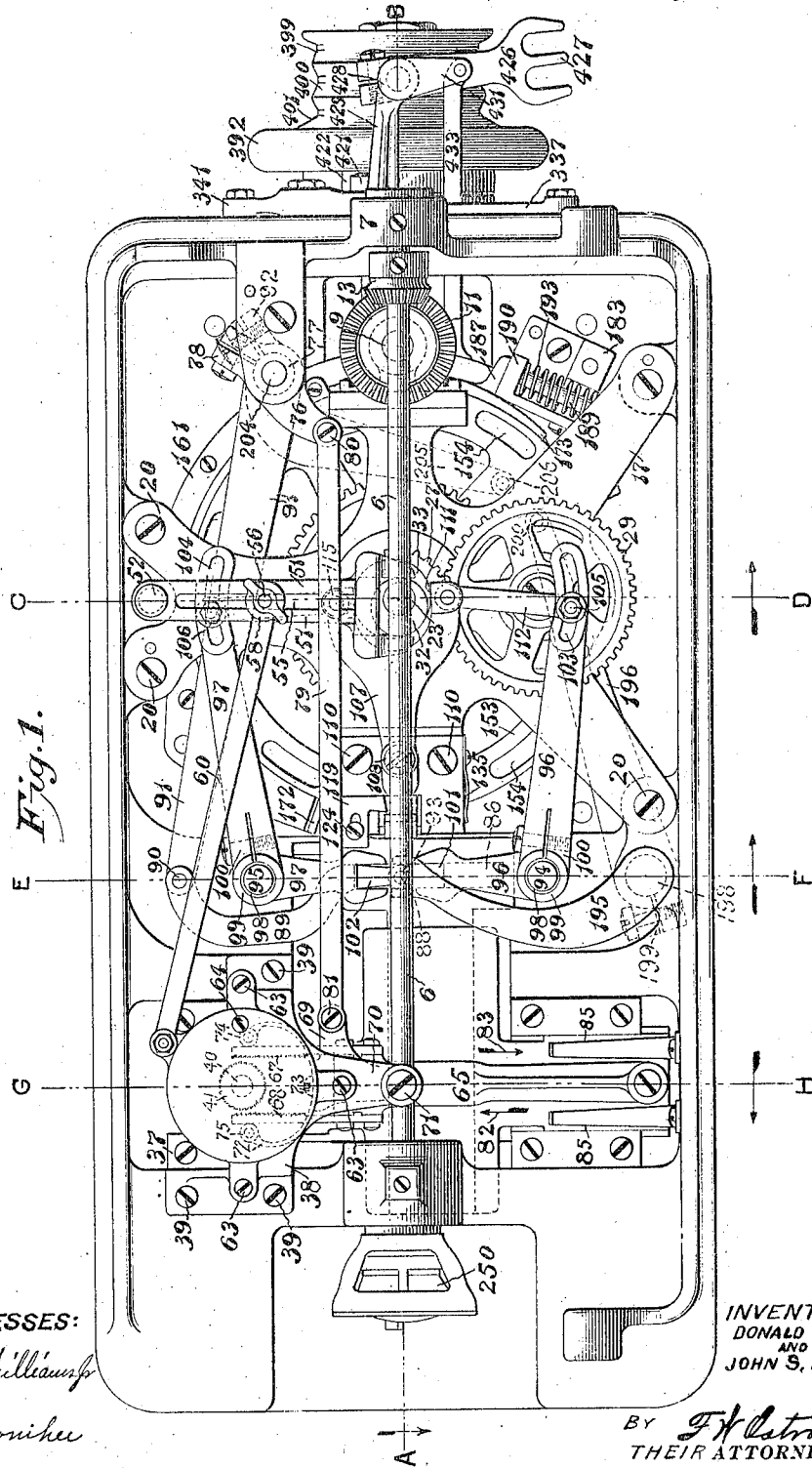


Fig. 1.

WITNESSES:

H. K. Williams

A. D. Oniker

INVENTORS,
 DONALD NOBLE
 AND
 JOHN S. FINCH,

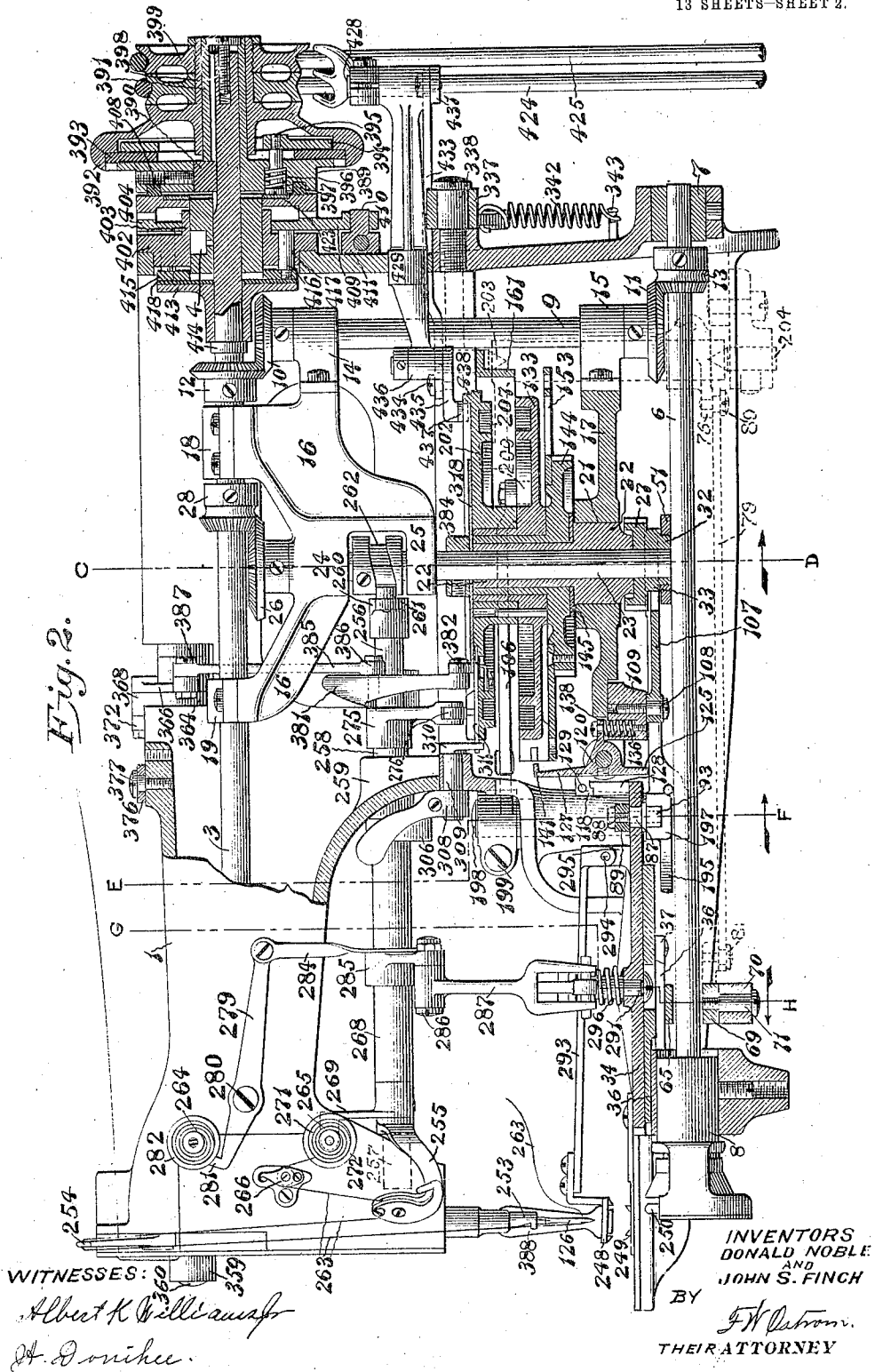
By *F. H. C. Brown*
 THEIR ATTORNEY

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13 SHEETS—SHEET 2.



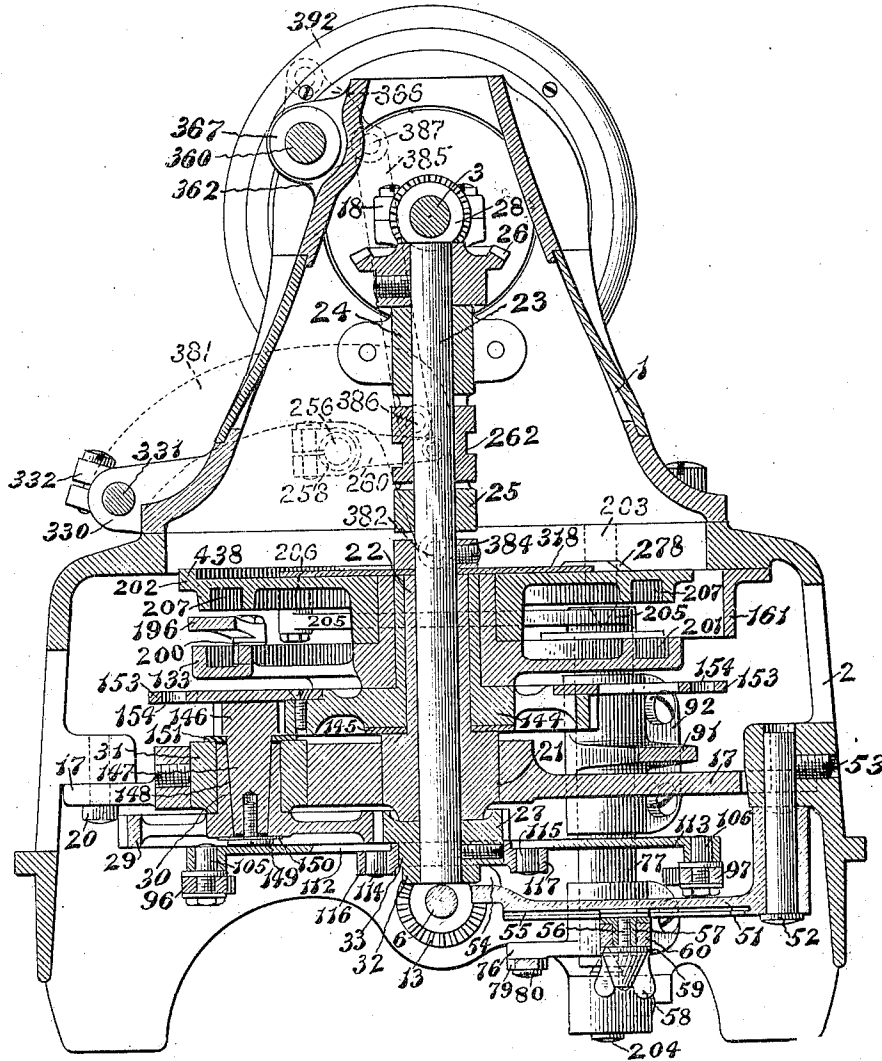
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13 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

Albert H. Williams
 A. Donahoe

INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH

BY

F. W. Peterson
 THEIR ATTORNEY.

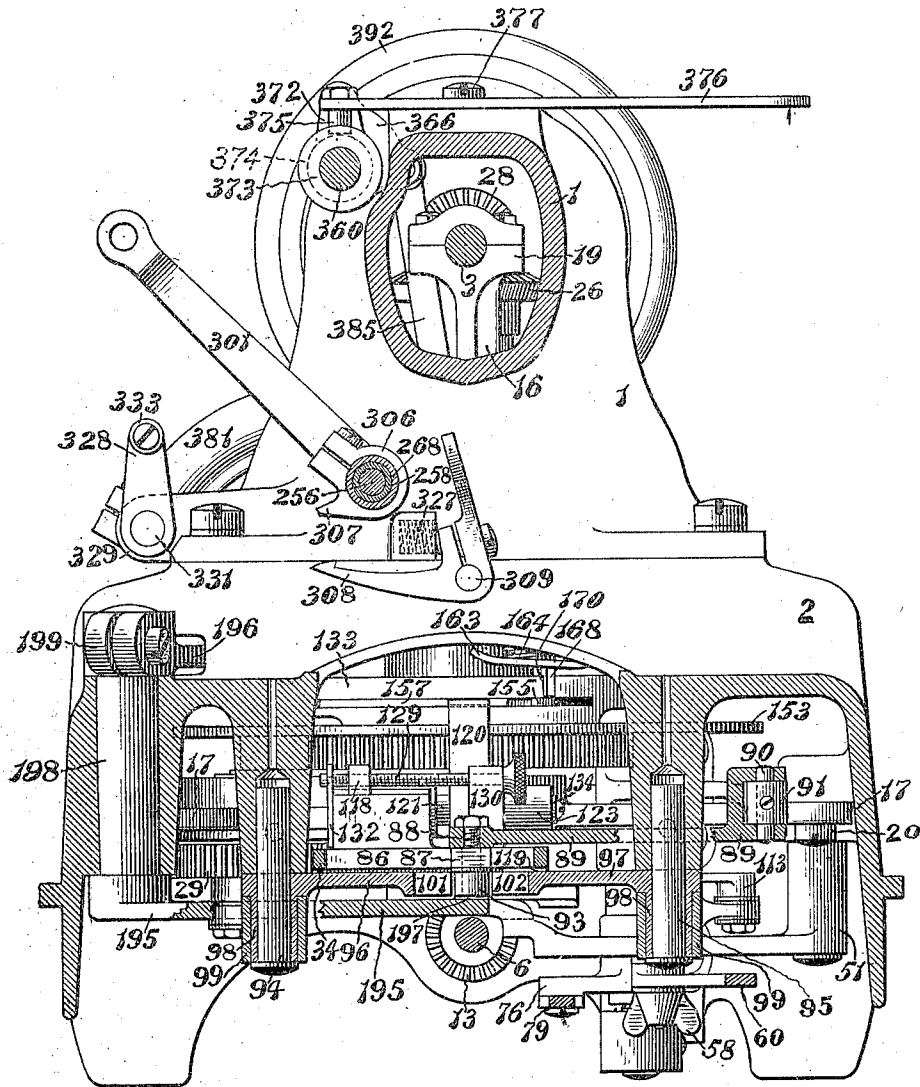
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Patented July 16, 1912.

13 SHEETS—SHEET 4.

Fig. 4.



WITNESSES:

Albert K. Williams

A. Doncher

INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH

BY

F. W. Gibson

THEIR ATTORNEY.

D. NOBLE & J. S. FINCH.
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13 SHEETS-SHEET 5.

Fig. 5.

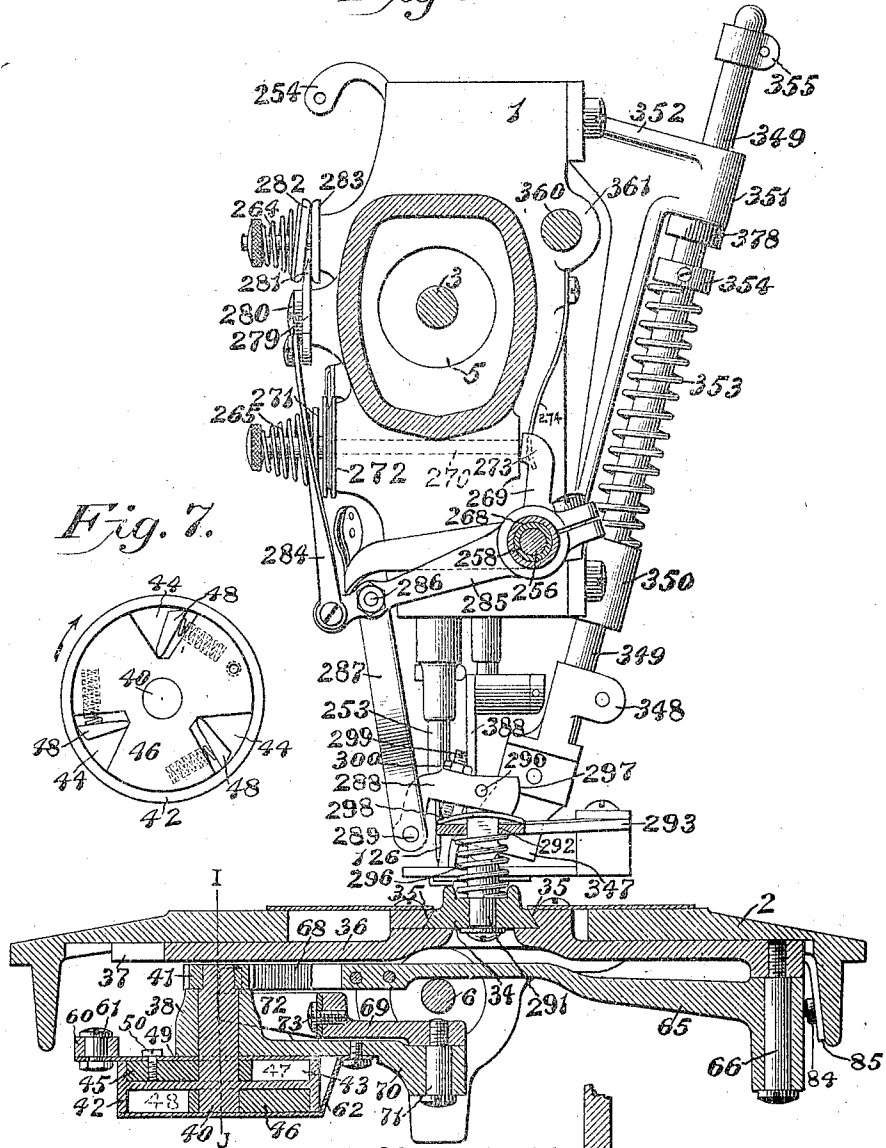


Fig. 7.

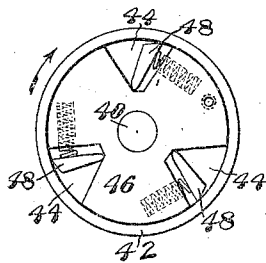
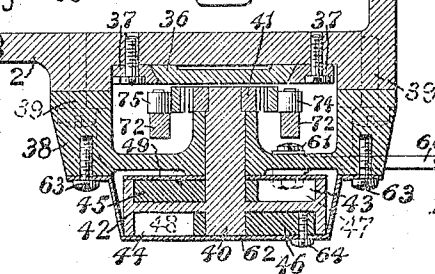


Fig. 6.

WITNESSES:

Albert K. Williams
 A. Doniker.



INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH,

BY *F. W. DeLam.*
 THEIR ATTORNEY.

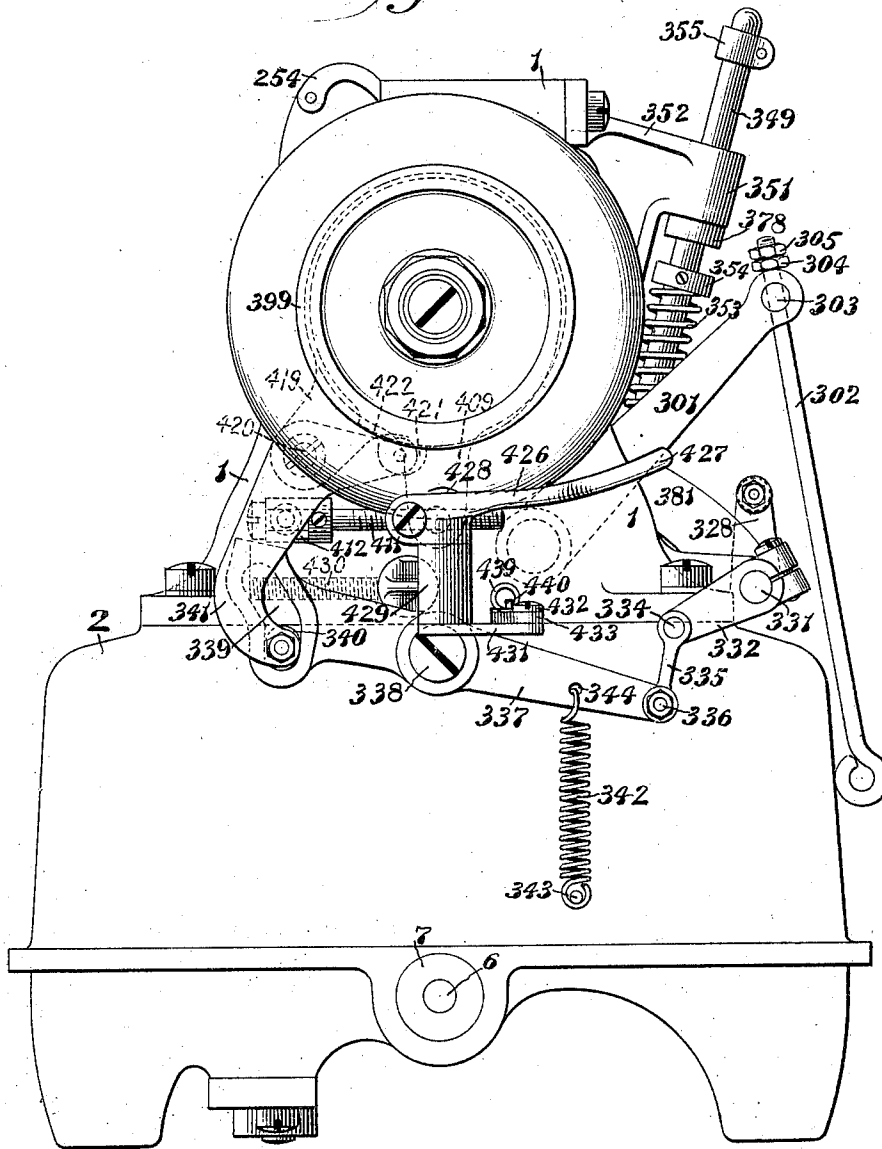
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13 SHEETS-SHEET 6.

Fig. 8.



WITNESSES:

Albert K. Williams, Jr.
 A. Donihue.

INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH

BY

F. W. Watson
 THEIR ATTORNEY.

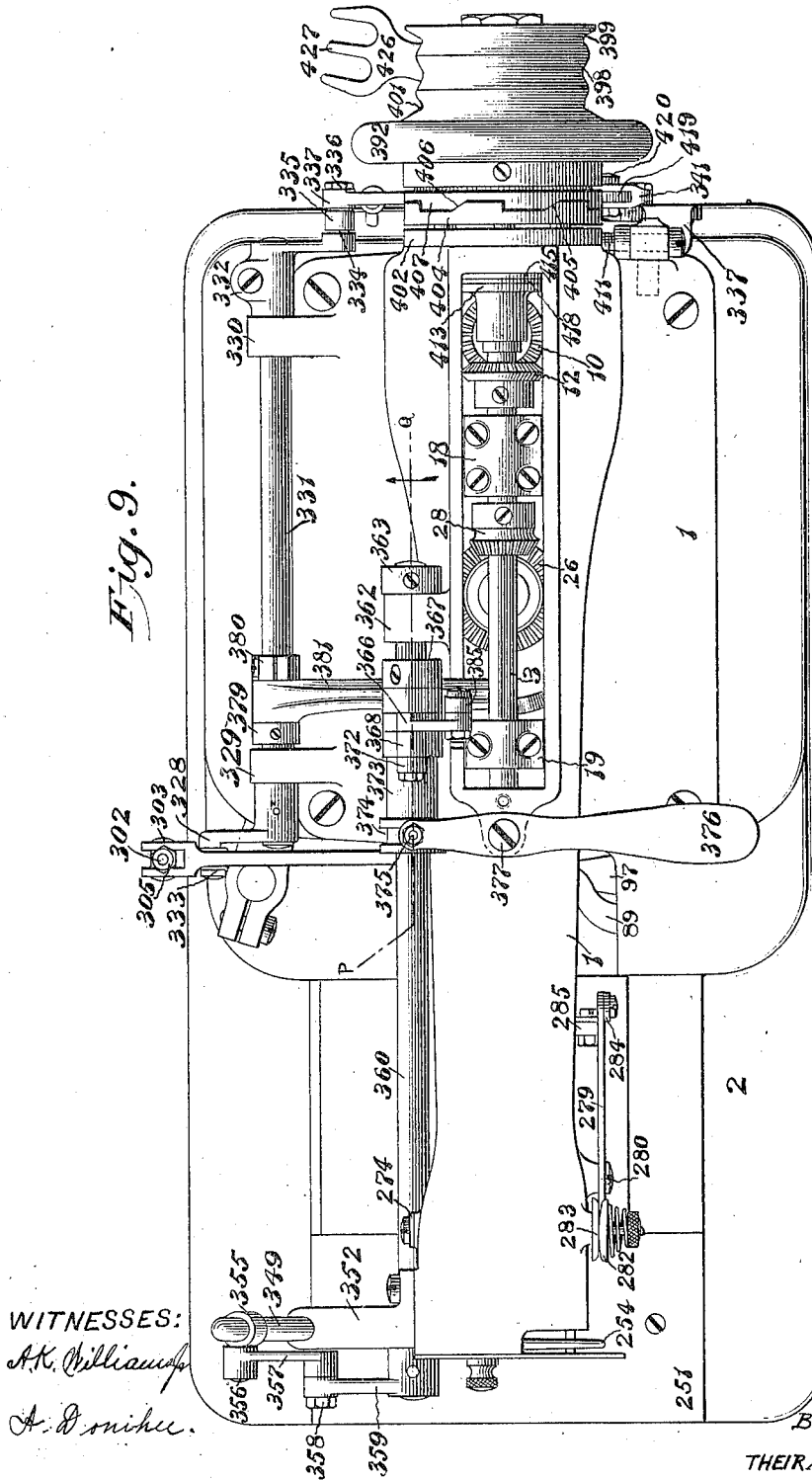
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 APPLICATION FILED DEC. 19, 1906.

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Patented July 16, 1912.

13 SHEETS-SHEET 7.

Fig. 9.



WITNESSES:

A. K. Williams

A. D. Smith

INVENTORS,
 DONALD NOBLE
 AND
 JOHN S. FINCH.

By F. W. Robinson.
 THEIR ATTORNEY.

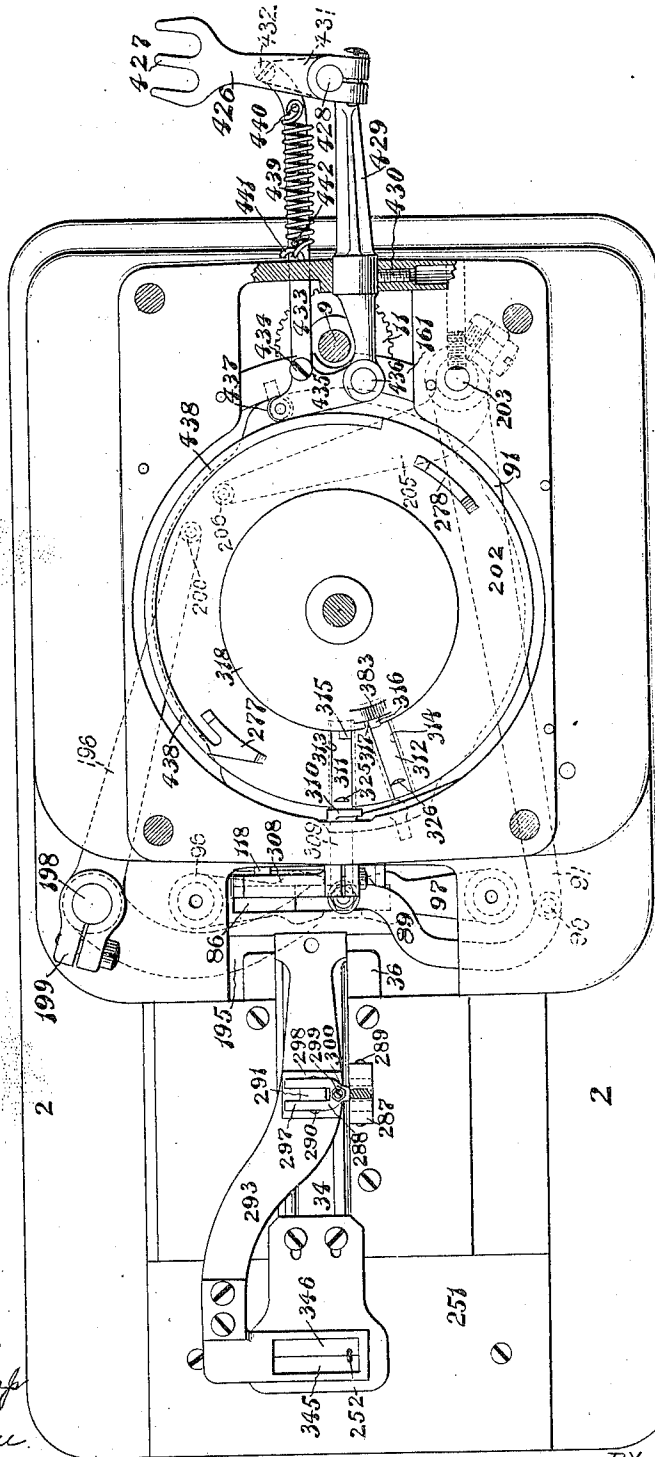
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13 SHEETS—SHEET 8.

1,032,621.

Fig. 10.



WITNESSES:
 A. K. Williams
 A. Koniku

INVENTORS,
 DONALD NOBLE
 AND
 JOHN S. FINCH.

BY *J. H. Brown*
 THEIR ATTORNEY.

D. NOBLE & J. S. FINCH.
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13 SHEETS—SHEET 9.

Fig. 11.

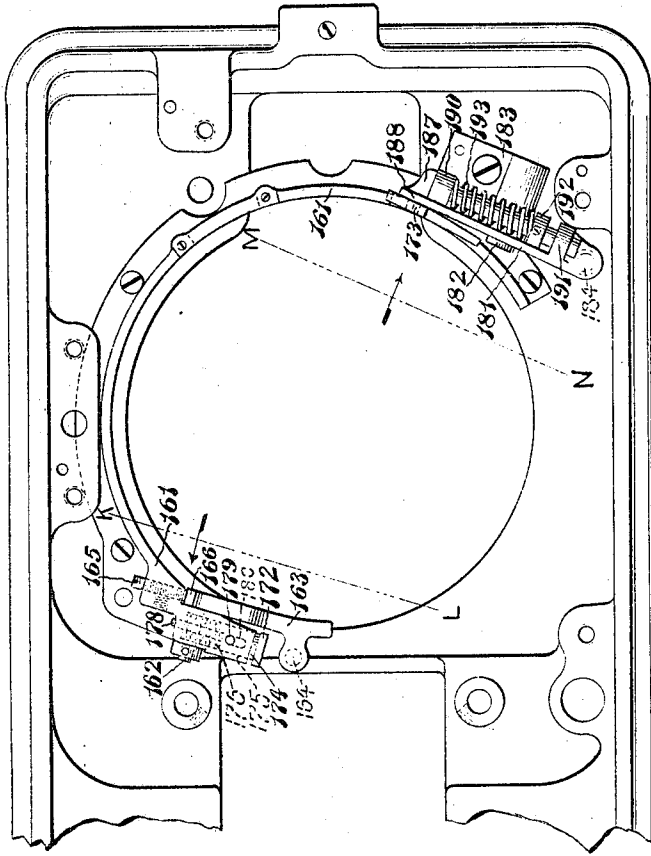


Fig. 12.

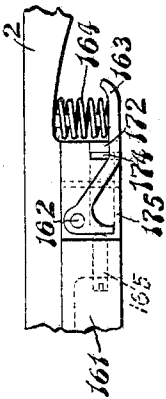


Fig. 13.

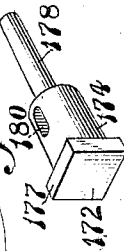
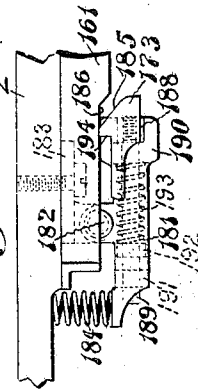


Fig. 14.



WITNESSES:

Albert K. Williams
 A. Donike.

INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH.
 BY
 F. W. Whom
 THEIR ATTORNEY

D. NOBLE & J. S. FINCH.
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13 SHEETS—SHEET 10.

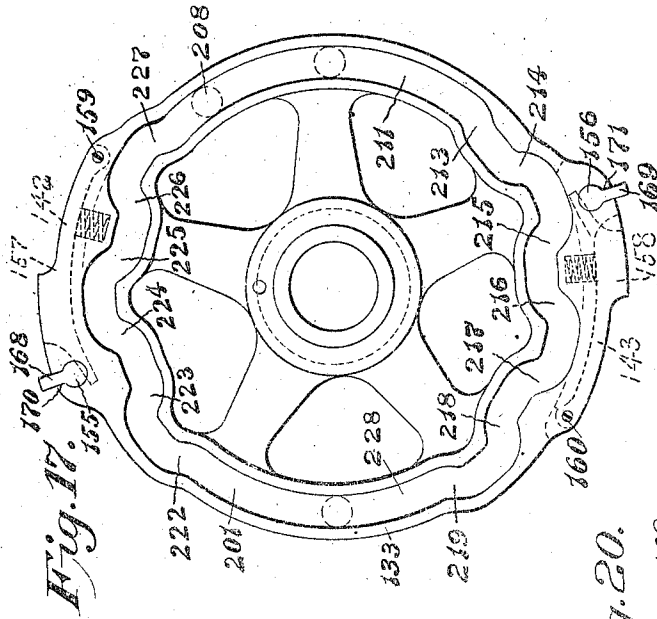


Fig. 17.

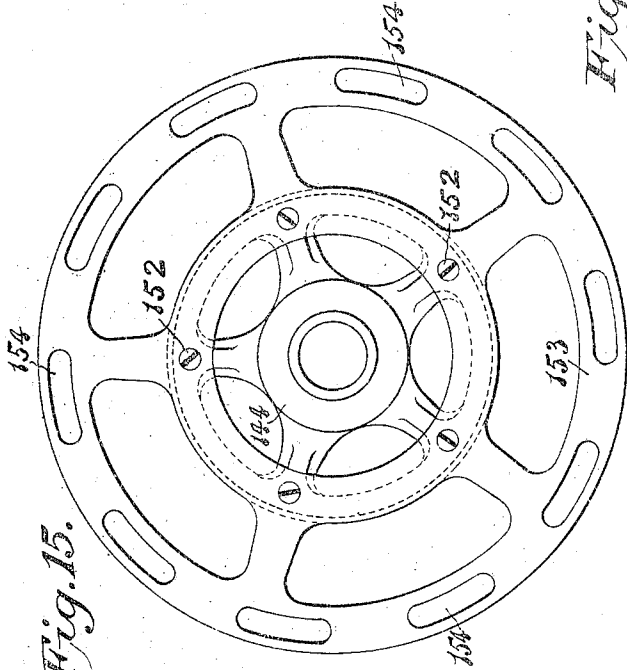


Fig. 15.

WITNESSES:

Albert K. Williams
 J. D. Donihue

Fig. 19.



Fig. 20.



Fig. 18.

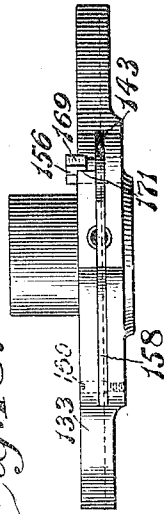
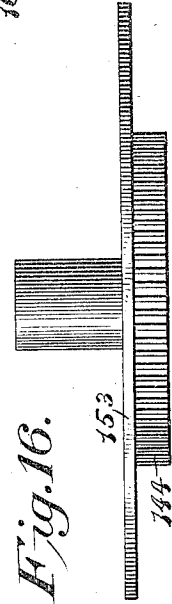


Fig. 16.



INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH
 BY
 F. W. Colburn
 THEIR ATTORNEY.

D. NOBLE & J. S. FINCH.
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Fig. 21.

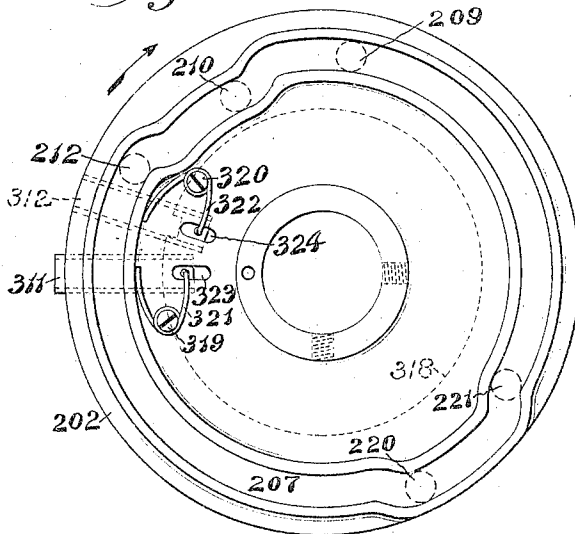


Fig. 22.

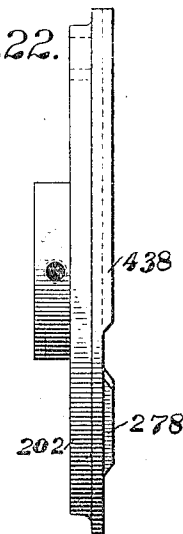


Fig. 23.

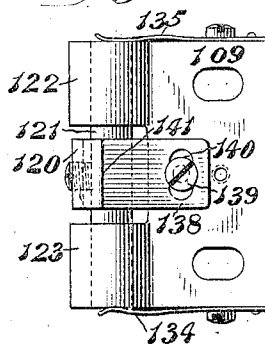


Fig. 26.



Fig. 25.



Fig. 27.

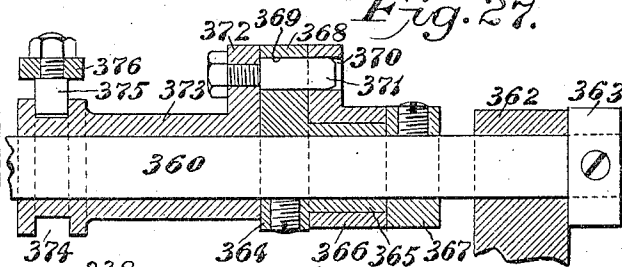


Fig. 24.

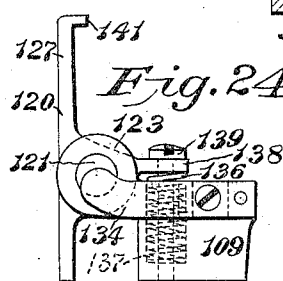
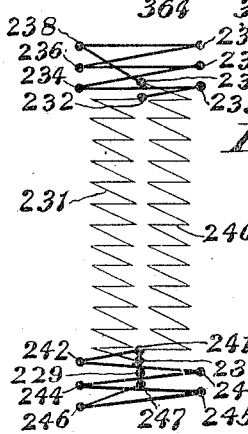


Fig. 28.



WITNESSES:
 Albert K. Williams,
 A. Donike.

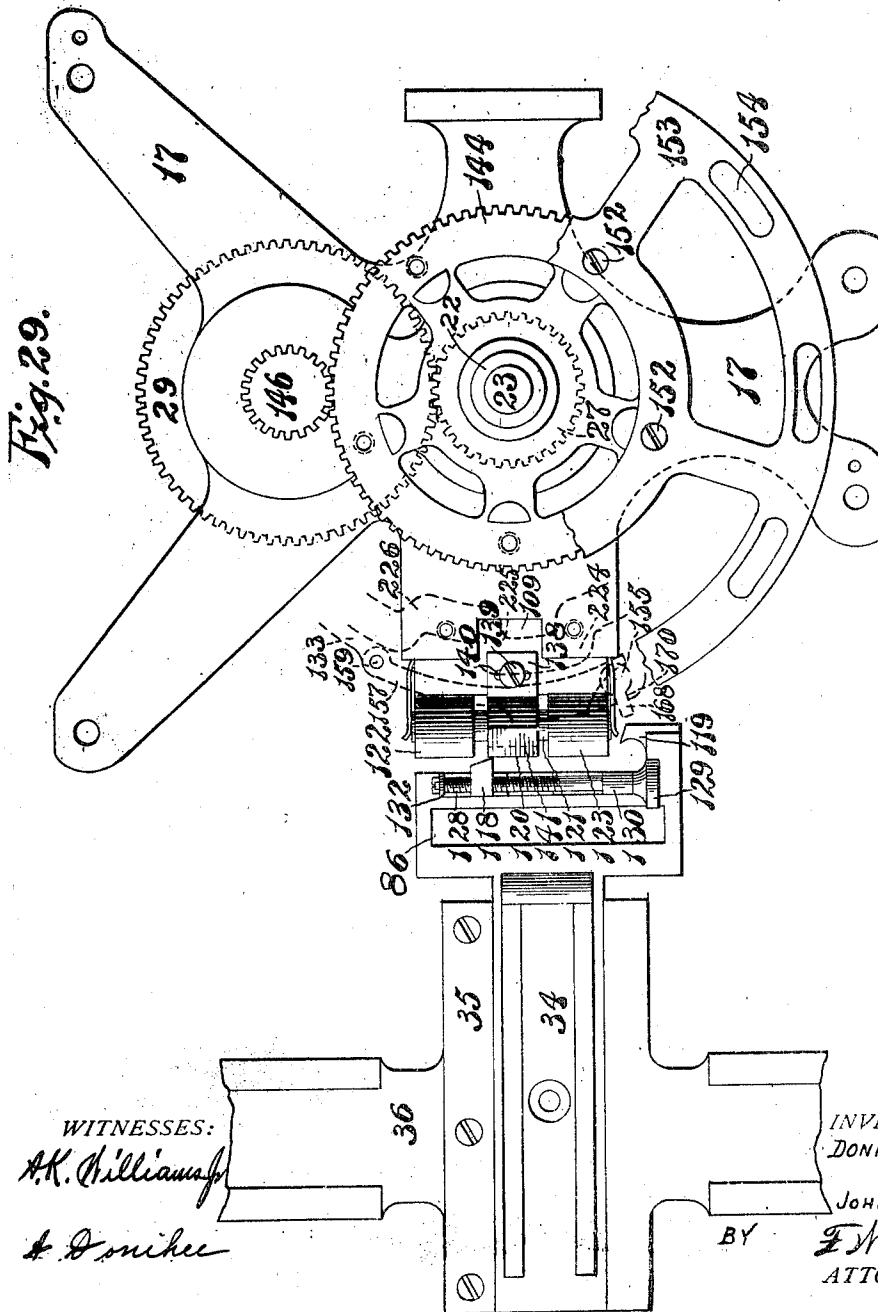
INVENTORS
 DONALD NOBLE
 AND
 JOHN S. FINCH.
 BY
 F. W. Ostrom.
 THEIR ATTORNEY

D. NOBLE & J. S. FINCH.
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13 SHEETS—SHEET 12.

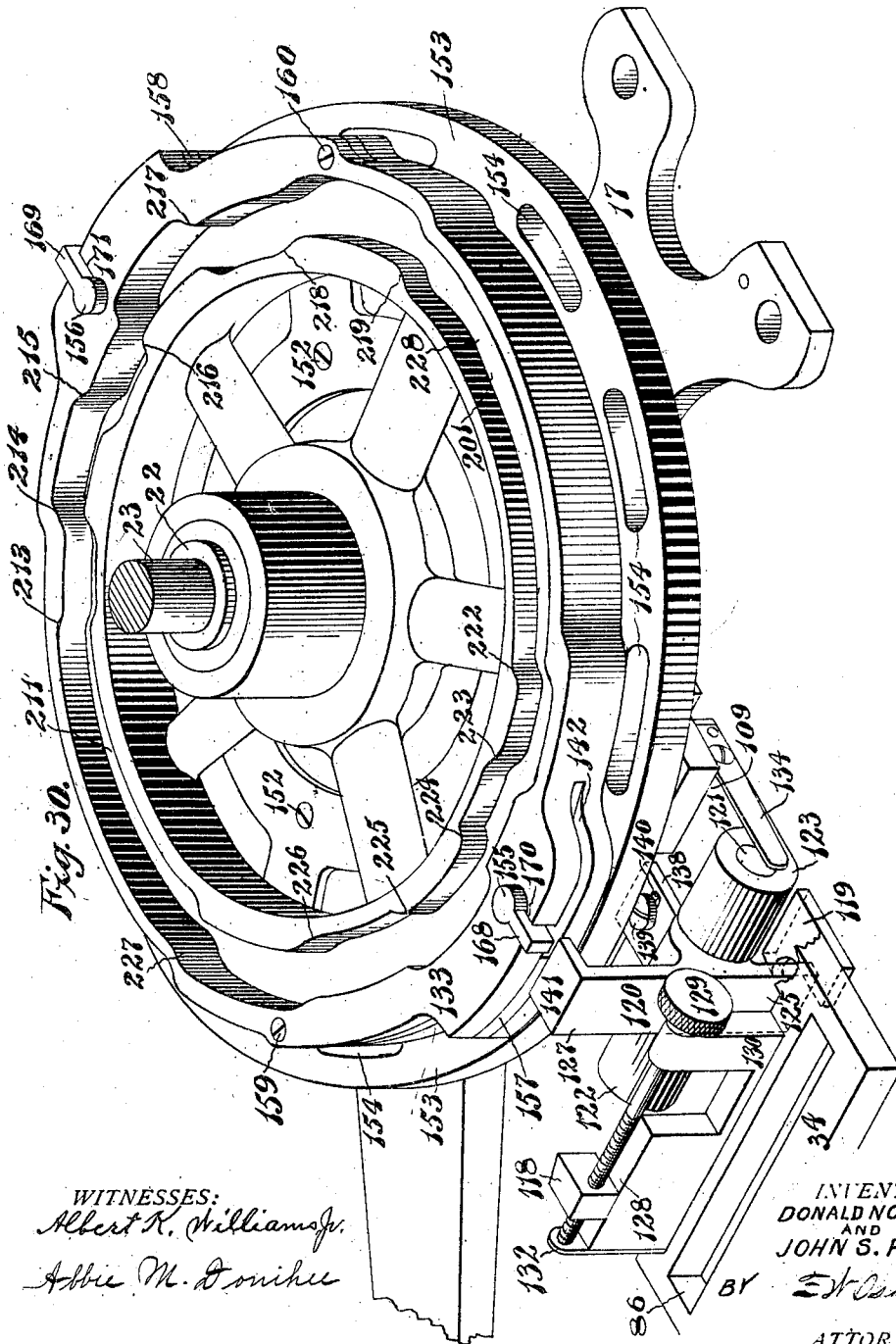


D. NOBLE & J. S. FINCH.
 BUTTONHOLE SEWING MACHINE.
 APPLICATION FILED DEC. 19, 1906.

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13 SHEETS—SHEET 13.



WITNESSES:
 Albert R. Williams
 Abbie M. Donihue

INVENTOR.
 DONALD NOBLE
 AND
 JOHN S. FINCH
 BY *E. W. C. Ham*
 ATTORNEY.

UNITED STATES PATENT OFFICE.

DONALD NOBLE AND JOHN S. FINCH, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS, BY
MESNE ASSIGNMENTS, TO THE SINGER MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

BUTTONHOLE-SEWING MACHINE.

1,032,621.

Specification of Letters Patent.

Patented July 16, 1912.

Application filed December 19, 1906. Serial No. 348,618.

To all whom it may concern:

Be it known that we, DONALD NOBLE, a subject of the King of Great Britain, and JOHN S. FINCH, a citizen of the United States, residents of Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Buttonhole-Sewing Machines, of which the following is a specification.

Our invention relates to buttonhole sewing machines and has for its object to provide a machine of this character capable of high speed and increased utility, thus reducing the cost and increasing the quality of the production.

The particular kind of buttonhole which this machine is designed to produce is commonly known as the "straight, square bar end" as distinguished from the "eyelet end", and the present construction embodies improved means for positioning the locks of the needle and bobbin threads on the inner cut edges of the buttonhole slit, producing what is termed "purl stitch", having the appearance of cambric needle work.

Our invention comprises broadly stitch forming and cloth feeding mechanism; mechanism for giving to the cloth clamp the necessary vibratory movements for the placing of the side overseam and barring stitches; mechanism for automatically opening and closing the cloth clamp; mechanism for maintaining the relative action of the vibratory and feed movements of the cloth clamp; mechanism for suspending the feed of the material during the barring operation; mechanism for controlling the needle thread tension for the barring operation and for releasing the needle thread tension at the completion of the sewing operation; mechanism for producing tying stitches; mechanism for controlling the action of the auxiliary take-up, and mechanism for controlling the actuation of the cutter carrying bar, all of which we shall fully hereinafter describe and explain, reference being had to the accompanying drawings which form a part of this specification and in which,—

Figure 1 is an inverted plan or bottom

view of our machine, Fig. 2, a vertical longitudinal sectional elevation, partly broken, taken in the plane indicated by the line A, B, on Fig. 1, Fig. 3, a vertical cross-sectional elevation, taken in the plane indicated by the line C, D, on Figs. 1 and 2, Fig. 4, a vertical cross-sectional elevation, taken in the plane indicated by the line E, F, on Figs. 1 and 2, Fig. 5, a vertical cross-sectional elevation, taken in the plane indicated by the line G, H, on Figs. 1 and 2, Fig. 6, a vertical sectional elevation, taken in the plane indicated by the line I, J, on Fig. 5, illustrating the clutch mechanism for feeding the cloth-clamp slide, Fig. 7, a detailed bottom view of the feed-clutch with the plate removed, Fig. 8, a rear end elevation of our machine, Fig. 9, a plan or top view of our machine, Fig. 10, a plan view, partially in section, taken on a line intersecting the upper side of the base and the lower side of the rear portion of the overhanging arm, Fig. 11, a bottom view of a portion of the base, all parts being removed except such as are employed to arrest the rotation of the barring cam, as will be hereinafter described, Fig. 12, a detail broken elevation, taken in the plane indicated by the line K, L, on Fig. 11, Fig. 13, a detail perspective view of the barring cam stopping buffer, Fig. 14, a detail sectional elevation, taken in the plane indicated by the line M, N, on Fig. 11, Fig. 15, a detail plan view of the cam driving disk and the gear to which it is attached, Fig. 16, an edge elevation of the structure shown in plan in Fig. 15, Fig. 17, a plan view of the barring cam, Fig. 18, an edge elevation of the barring cam, Fig. 19, a detail plan view of one of the spring actuated latches which engage the coupling-pins carried by the barring cam, Fig. 20, a detail perspective view of one of such coupling-pins, Fig. 21, a detail inverted plan or bottom view of the controller cam for controlling the position of the slide block and kindred parts, for vibrating the clamp, Fig. 22, a side or edge elevation of the controller cam shown in plan in Fig. 21, Fig. 23, a detail plan view of the barring cam starting trigger, Fig. 24, a side elevation of the same, Fig. 25, a detail

view of the adjusting screw for controlling the length of buttonhole, Fig. 26, a detail elevation of the plate which holds said adjusting screw against end play, Fig. 27, a detail sectional elevation taken on the line P, Q, of Fig. 9, and Fig. 28 is a diagram of the side overseaming and barring stitches comprising the buttonhole. Fig. 29 is a plan view, partially in section, and partially in full and partially in dotted lines, of the tripping mechanism and the parts directly connected therewith. Fig. 30 is a view, in perspective, of the tripping mechanism, embodying substantially the same parts as are illustrated in Fig. 29.

1 is the overhanging arm which is mounted upon a suitable base 2.

3 is the upper on needle actuating shaft journaled in bearings 4, 5, in the arm, and connected with the hook-driving shaft 6, journaled in suitable bearings 7, 8, in the base 2, by an intermediate vertical shaft 9, carrying bevel gears 10, 11, fixed thereon, which intermesh, respectively, with bevel gears 12, 13, carried by said upper shaft 3 and hook-driving shaft 6. The proportions of the respective gears, 10, 11, 12, 13, are such that two revolutions will be imparted to the hook-driving shaft 6 for every revolution of the needle actuating shaft 3. The vertical shaft 9 is journaled in suitable bearings 14, 15, supported, respectively, by the hanger 16 and bracket 17. The hanger 16 is provided with bearings 18, 19, which encircle the upper shaft 3, by means of which said hanger is suspended and supported in position, while the bracket 17 is suitably secured to the base 2, as by screws 20.

Suitably secured within a central hole 21, in the bracket 17, in line with the upper and lower shafts 3, 6, is a bushing 22 through which passes a vertical shaft 23, the upper portion of which latter is journaled in bearings 24, 25, formed in the hanger 16, while the lower portion is journaled within said bushing 22. Secured respectively to the upper and lower ends of the shaft 23 are gears 26, 27, which intermesh respectively with gears 28, 29. The gear 28 is tight on the upper shaft 3 and communicates motion from the latter to said vertical shaft 23, the proportions of said gears 28 and 26 being such that the vertical shaft 23 will revolve once for every two revolutions of the upper shaft 3. The gear 29 has a hub 30 which is journaled within a bushing 31, also secured to the bracket 17 (see Fig. 3), said gear forming a part of a train which will be described later on.

The gear 27 has formed thereon a feed eccentric 32 and an overseaming eccentric 33, from which motion is imparted to the cloth clamp through a series of connections presently to be described, for effecting both

the lengthwise feed of the buttonhole and the lateral vibrations for placing the side overseam stitches.

34 is a cloth clamp slide mounted in dovetail ways 35 formed on the feed-slide 36, which latter is similarly mounted in dovetail ways 37 secured to the underside of the base 2, the ways 37 extending at right angles to the ways 35; and the movements of the slide 36, by which the slide 34 is carried bodily, effect the lengthwise movements or feed of the button-hole, while the movements of the slide 34, independent of and at right angles to the movements of said feed-slide 36, effect both the overseaming of the sides of the buttonhole and the barring of the ends.

The mechanism for effecting the feed movements of the slide 36 we will now describe.

38 is a bracket secured to the underside of the base 2 in any suitable manner, as by screws 39, within which is journaled an upright shaft 40, upon the upper end of which is fastened, in any suitable manner, a pinion 41, while upon the lower end is formed a clutch-wheel 42 of any desired or approved construction, but preferably of the form shown in Figs. 5, 6, and 7, wherein said wheel is provided with two separate cylindrical compartments 43, 44, adapted to contain separate friction clutches 45, 46, having spring-actuated clutching pawls 47, 48, adapted to cooperate with the internal peripheries of said clutch-wheel.

49 is a clutch-disk pivoted around the shaft 40 and secured rigidly to the clutch 45 by means of a screw 50 so that said clutch will partake of all movements communicated to said disk.

51 is a feed-lever, one end of which is fulcrumed around a pin 52 secured to the base 2 in any suitable manner, as by screw 53, while the other end is bifurcated as shown at 54, Figs. 1 and 3, and straddles the feed eccentric 32, from which, as the latter revolves, an oscillatory movement is communicated to said lever, as will be readily understood. The feed-lever 51 throughout a greater portion of its length is provided with an undercut groove 55, within which is slidably fitted a T-bolt 56, the threaded end of which passes loosely through a flanged bushing 57 and has run thereon a thumb-nut 58, a washer 59 being interposed between the end of said bushing and said nut.

60 is a link, one end of which is pivoted around the bushing 57, while the other end is pivoted around a shouldered screw 61 secured to the clutch-disk 49, and it will be manifest that as the lever 51 is oscillated by the feed eccentric 32, such motion will be communicated to said disk 49, the extent of such motion being dependent upon the

location of the T-bolt 56 in the undercut groove 55, it being understood that such bolt is readily adjustable farther from or nearer to the fulcrum of said lever, by simply manipulating the thumb-nut 58, whereby the feed movement may be lengthened or shortened.

The oscillatory movement communicated to the clutch-disk 49 is, in turn, converted into an intermittent rotary movement of the clutch-wheel 42 by reason of the action of the clutch 45 which is effective upon said wheel in one direction only, serving to turn the same intermittently in the direction indicated by the arrow, Fig. 7, the return oscillation of said disk and clutch permitting the pawls 47 to slip idly upon the internal periphery of the clutch-wheel 42.

In order to prevent any reverse rotation of the clutch-wheel 42 during the return oscillatory movement of the clutch 45 or in a direction opposite to that indicated by the arrow, we employ the second clutch 46 which is held perfectly stationary and acts as a detent to insure the clutch-wheel 42 being rotated intermittently in one direction only. The means for holding said clutch 46 stationary comprises the cover plate 62, secured to the bracket 38 by screws 63, a screw 64 serving to hold said clutch and plate rigidly together.

65 is a draw-bar pivoted at one end to the underside of the feed-slide 36 by a shouldered screw 66, while to the other end is rigidly secured rack-bars 67, 68, which straddle and are adapted to alternately engage the pinion 41.

69 is a lever pivoted to an extension 70 of the bracket 38 by a shouldered screw 71. 72 is a U-shaped spring secured to said lever by screw 73, and carrying at its free ends pivoted rolls 74, 75, which embrace the outer opposite side walls of the rack-bars 67, 68 and thereby hold the draw-bar 65 and said rack-bars resiliently poised with respect to the pinion 41.

76 is a lever adjustably secured upon a vertical rock-shaft 77 by a pinch-joint 78, and 79 is a link one end of which is pivotally connected by a screw 80 to the end of said lever 76 while the other end is pivoted to the lever 69 by a screw 81. The lever 76 has imparted thereto, by mechanism hereinafter to be described, a series of movements which, through the connecting link 79 and lever 69, positions the rack-bars 67, 68, with respect to the pinion 41 for feeding the slide 36 and parts carried thereby, first in one direction for overseaming one side of the buttonhole, and then in the opposite direction for overseaming the other side of the buttonhole, and in addition thereto causes the feed to be suspended during the barring operation by holding the rack-bars

in such position that neither one is in engagement with the pinion 41, which latter position is clearly shown in Fig. 1.

As shown in Fig. 1, the parts are in the position which they occupy when the machine is automatically stopped after the completion of a buttonhole, and when again started a few barring stitches will be made, as described later on, and the rack-bar 68 will then be brought into engagement with the pinion 41, which will cause the feed-slide 36, and parts carried thereby, to be advanced intermittently throughout the length of the buttonhole in the direction indicated by the arrow 82, whereupon the draw-bar 65 will be shifted so that neither of the rack-bars are in engagement with the pinion, at which point the barring of the second end will occur, as will later be described, after which the draw-bar 65 will again be shifted, bringing the rack-bar 67 into engagement with the pinion 41 and returning the slide, and parts thereon, in the direction of the arrow 83 to the original position, at which point the initial bar is completed, as soon to be described, and the machine again stopped and the work adjusted.

By reason of the manner in which the pinion 41 is actuated, as previously described, it will be observed that the same is revolved intermittently throughout the entire period in which the machine is in motion, and that the engagement of rack-bar 67 on one side and rack-bar 68 on the opposite side of said pinion causes the feeding of the slide 36 to take place in opposite directions.

Secured to the base 2, by screws 84, are springs 85 which press upwardly against the bottom of the slide 36 and exert sufficient friction thereon to prevent the latter from overthrowing when in motion, and also afford sufficient friction to prevent the accidental displacement of said slide during the barring operation, at which time slide 36 is disconnected from the feed.

Formed on the rear end of the cloth clamp slide 34, parallel to the line of movement of the feed-slide 36, is an elongated straight slot 86 within which is slidably mounted a block 87. The block 87 is pivoted around a stud 88 secured on the end of a link 89, the other end of which latter is pivoted at 90 to the end of a lever 91 secured rigidly to the rock-shaft 77 by a pinch joint 92. Also pivoted on the stud 88 beneath the block 87 is a flanged roll 93. Pivoted respectively to studs 94, 95, secured rigidly to the underside of the frame, are bell-crank levers 96, 97. For the purpose of initially adjusting said bell-crank levers, the latter are preferably formed of two sections, one section having an externally turned hub 98 around which the hub 99 of the other section is clamped, by means of the pinch-joints 100.

formed thereon. The juxtaposed ends of the levers 96, 97, are bifurcated, as shown at 101, 102, and adapted to receive and have work therein the roll 93, while the other ends of said levers are provided with arcuate slots 103, 104, within which are secured adjustable studs 105, 106.

107 is an oscillating lever one end of which is pivoted by a shouldered screw 108 to a bracket 109, which latter is secured to the bracket 17 by screws 110. The other end of said oscillating lever 107 is bifurcated as shown at 111, and straddles the overseaming eccentric 33, and it will be plain that as said eccentric is revolved said lever will be oscillated to and fro.

112, 113 are links upon the inner ends of which are formed studs 114, 115, which fit within holes 116, 117, formed in the bifurcated end of the lever 107, and are pivoted respectively at their outer ends to the studs 105, 106, secured in the arcuate slots 103, 104, formed on the outer ends of the levers 96, 97.

The block 87 and roll 93 are at certain times, as will be later described, moved by the link 89 to position the block in the slot 86 of the cloth-clamp slide 34, so that the roll 93 will be in operative engagement within one or the other of the bifurcated ends 101, 102, of the levers 96, 97, said roll occupying the bifurcated end 101 of the lever 96 during the overseaming of the first or left hand side of the buttonhole, and on overseaming the second or right hand side of the buttonhole said roll will be within the bifurcated end 102 of the lever 97; in either of these positions the slide 34 will be reciprocated back and forth by said levers through the link connections 112, 113, with the oscillating lever 107, the extent of such motion being dependent upon the relative positions of the studs 105, 106, in the arcuate slots 103, 104. Thus it will be clear that the width of overseam at the sides of the buttonhole slit is readily increased or diminished by adjusting the studs 105, 106, within the arcuate slots 103, 104, which they respectively occupy.

The adjustment of the levers 96, 97, with respect to each other and a line intersecting the axes of their fulcrums is such that the movement of the lever 96 will be entirely on one side of said line, namely, the right hand side, (which will position the overseam stitches on the left hand side of the buttonhole), while the movement of the lever 97 will be entirely on the left hand side of said line, (which will position the overseam stitches on the right hand side of the buttonhole).

Mounted on the cloth-clamp slide 34 on the upper and lower sides thereof, respectively, are adjustable dogs 118, 119, adapted to cooperate with a trigger 120 secured to a

rock-shaft 121 journaled in bearings 122, 123, formed on the bracket 109. The dog 119 is secured to the underside of the slide 34 by a screw 124, and is adapted to cooperate with the lower portion 125 of the trigger 120 as said slide is moved to the left; while the dog 118 carried on the upper side of said slide is adapted to cooperate with the upper portion 127 of said trigger as the slide 34 is moving in the opposite direction, to the right or away from the needle. The dog 118 is slidably mounted on a ledge 128 formed on the slide 34 and takes upon the threads of an adjusting screw 129 likewise carried by said slide. The adjusting screw 129 is at one end journaled so as to turn freely in a post 130 formed on the slide 34, and at the other end has turned thereon an annular groove 131 over which is fitted a plate 132 secured to the ledge 128, whereby said screw is restrained against motion endwise, and by rotating said screw the dog 118 may be positioned relatively to the trigger 120, whereby the length of the buttonhole may be regulated. Upon the arrival of the cloth-clamp slide 34 at either extremity of the lengthwise feed of the buttonhole, one or the other of the dogs 118, 119, will contact with the trigger 120 and cause the upper end thereof to be thrust in a direction toward the barring cam 133, which, as will be presently described, causes the latter to be set in motion.

By reference to Fig. 1, it will be observed that the motions of the juxtaposed ends of the bell-crank levers 96 will be in directions opposite to each other, by reason of the fact that such ends are disposed in directions diametrically opposite but are driven from the same overseaming eccentric 33, such action having the effect to completely reverse the reciprocatory movements of the slide 34, through the connections between the latter and said levers, when the feed movements are reversed, thereby preserving the same relative conditions between the feed and overseaming movements of the cloth-clamp slide for one side of the buttonhole as for the other, which is a great desideratum.

The timing of the feed movement is such that the latter occurs as the slide 34 moves to the right for the first side of the buttonhole, and to the left for the second side of the buttonhole; and in order that the dogs 118, 119 may not be injured in contacting with the sides of the trigger 120 during such action, as they approach the latter in a direction lengthwise of the buttonhole, the rock-shaft 121 upon which said trigger is carried is slidably journaled in the bearings 122, 123, and is positioned endwise by springs 134, 135, (see Fig. 23) secured to the bracket 109, which bear, respectively, upon the ends of said shaft, so that the latter is yieldingly supported and permits the

trigger 120 to yield to the pressure exerted upon the sides thereof by either of the dogs 118, 119, during such feed movement. After feeding, the next subsequent reciprocatory movement of the slide 34 will withdraw whichever dog has been in contact with said trigger and allow the same, through the action of the springs 134, 135, to resume its normal position, which brings said trigger in position directly in front of the dog ready to be tilted on its pivot by the succeeding reciprocatory movement of said slide 34 (Figs. 1, 2, 4 and 23).

136 is a coil spring housed within a pocket 137 formed in the bracket 109, which bears against an offset 138 formed on said trigger, by means of which the latter is restored to normal position after having been tilted by either of the dogs 118, 119; and 139 is a headed screw which passes through a slot 140 in said offset and is tapped into said bracket. The screw 139 limits the action of the spring 136 and affords an adjusting stop to correctly position the trigger 120 axially of the shaft 121.

Whenever the trigger 120 is rocked or tilted by either of the dogs 118, 119, the upper extremity 141 is thrust within one of the slots 142, 143, formed in the periphery of the barring cam 133, and thereby causes the latter to be put in motion, as will presently be described.

Journaled upon the vertical sleeve 22 which encircles the vertical shaft 23 is a spur gear 144, interposed between which and the annular shoulder formed on said sleeve is a friction washer 145 which supports the weight of said gear and other parts superimposed thereon. Intermeshing with the gear 144 is a pinion 146 formed on the end of a tapered shaft 147 which fits and is adapted to be driven tight within a similarly tapered hole 148 formed in the hub 30 of the gear 29.

149 is a screw tapped in the end of the tapered shaft 147 by means of which said parts are drawn tightly together, a washer 150 being interposed between the head of said screw and the gear 29.

151 is a washer interposed between the pinion 146 and the upper surface of the bushing 31 by means of which said pinion and connected parts are supported.

As previously described, the gear 29 intermeshes with the gear 27, and the proportions of the gears 27, 29, 144 and pinion 146 are such that ten revolutions of the gear 27 and shaft 23 by which it is carried will occur during one revolution of the gear 144; and by reason of the proportions of the gears 26, 28, which drive the vertical shaft 23, twenty revolutions of the upper shaft 3 will take place during one revolution of said gear 144.

Secured concentrically upon the gear 144 by screws 152 is a cam driving disk 153

which has formed in its outer ring a series of elongated holes or slots 154 concentrically disposed and equi-distant from each other. These slots are, in the present instance, ten in number, and by reason of the ratio existing between the gear 144 which carries the disk 153 and the gear 27 on the shaft 23, such number of slots results in preserving the barring mechanism in proper time with respect to the side stitching, as will later on be more fully explained.

Journaled concentrically upon the hub of the gear 144, so as to turn independently thereof, is the barring cam 133 which is provided at diametrically opposite points with vertically sliding bolts 155, 156, upheld from engagement with the disk 153 by spring actuated latches 157, 158, pivoted at 159, 160 within the slots 142, 143, formed in the periphery of said barring cam. When either of said bolts 155, 156, are in alinement with the slots 154 in the disk 153, and the bolt in alinement is depressed, said cam driving disk and barring cam are coupled together and rotated synchronously, as will presently be explained. The means for depressing said bolts within the slots in the disk 153 and for withdrawing the same we will now describe, reference being had particularly to Figs. 1, 11, 12, 13, 14, 15 and 17. Secured to the underside of the base 2, concentrically with the axis of the barring cam, is a circularly disposed guard-rail or ring 161 which has pivoted thereon at 162 a spring-actuated presser-foot 163 which extends directly over the circular path traveled by the bolts 155, 156. 164 is a coil spring interposed between the underside of the base 2 and said presser-foot 163 which acts to thrust the latter downwardly, and 165 is a stop-screw tapped within the guard-rail 161, against which the heel end 166 of said presser-foot 163 abuts so as to limit the downward action thereof, said foot being so adjusted as not to depend beneath the lower edge of the guard-rail 161, as clearly shown in Fig. 12. As each of the bolts 155, 156 come successively beneath the presser-foot 163, the latter will be raised as clearly shown in Fig. 4, causing the pressure of the spring 164 to be exerted to depress said bolts, the latter, however, being upheld by the latches 157, 158, which engage notches 167 cut crosswise in said bolts, will remain in raised position until the trigger 120 has been operated to disengage the latches from the bolts, by having its end 141 thrust within whichever slot is at that time opposite said trigger.

Before proceeding further with a more detailed description of the various other parts connected with the operation of the barring cam 133, we deem it advisable to state that the cam and parts carried thereby are twice set in motion and twice stopped during the operation of forming the buttonhole, one

half of said cam being used in the formation of each bar, and said cam is in each instance stopped in such a position that one of the slide-bolts 155, 156 is directly beneath the spring actuated presser-foot 163, with one of the spring actuated latches 157, 158 directly opposite the starting trigger 120. When the trigger 120 is rocked, by engagement with either of the dogs 118, 119, as previously described, the upper extremity 141 will be thrust within one of the slots 142, 143 in the barring cam 133, in the present instance, as illustrated in Figs. 2 and 4, the slot 142 being opposite said trigger, the latter will be thrust therein causing the latch 157 to release the slide-bolt 155 whereupon the latter will be depressed by the presser-foot 163 into engagement with the cam driving disk 153, (it being understood that the latter is in motion throughout the time the machine is running) and said bolt will be forced within one of the holes 154, thereby coupling the barring cam 133 and disk 153 together and causing said cam 133 to rotate with said disk 153. By reason of the location of the holes 154 in the cam driving disk 153, (being stationed thirty-six degrees apart throughout the circumference) said disk can only be coupled with said cam 133 at alternate descents of the needle, whereby, as previously referred to, the movements of the barring cam 133 and other mechanism controlled thereby are maintained in proper relation to the movements of the levers 96, 97, which effect the movements of the cloth-clamp slide 34 for overseaming the sides of the buttonhole.

The barring cam 133 being put in motion as above described, continues to rotate for a half revolution thereof until arrested by the barring cam stopping mechanism, which we will now describe.

The slide-bolts 155, 156, are provided with fingers 168, 169, which project radially through notches 170, 171, respectively, out beyond the periphery of the barring cam 133 and are adapted to successively engage, at diametrically opposite points on the guard-rail 161, a spring cushioned buffer 172 and a spring actuated bolt shifter or raiser 173. The ends of the fingers 168, 169, of the bolts 155, 156, when depressed and in coupled position, project directly beneath the guard-rail 161 and are thereby prevented from being accidentally uncoupled during the rotation of the barring cam 133; and in raised position, the horizontal plane or path traveled by said fingers is directly within the field of the buffer 172, against which latter said fingers 168, 169, successively abut in bringing said barring cam to rest. The buffer 172 comprises a cylindrical body portion 174 fitted within a pocket 175 formed in one end of the guard-rail 161 and backed up by a coil spring 176, a rectangular end por-

tion 177 serving to receive the impact of said fingers 168, 169, while a stem 178 which passes through a hole made therefor in the bottom of the pocket 175 serves to insure a smooth sliding motion without undue cramping. Secured to the guard-rail 161 is a pin 179 which passes through the buffer 172 and secures the latter within said pocket, an elongated slot 180 being formed in said buffer through which said pin passes so as to permit a limited sliding motion. The bolt shifter 173 is carried upon a rocking frame 181 pivoted at 182 to a bracket 183 secured to the underside of the base 2, and interposed between frame 181 and bracket 183 is a coil spring 184 whose tendency is to press the beveled nose 185 against the offset portion 186 of the guard-rail 161. Said shifter 173 has an offset portion 187 which passes through the bifurcated end 188 of the rocking frame 181 and is attached to the end of a slide 189 having bearings in ears 190, 191, formed on said frame 181. Interposed between the ear 190 and a collar 192 carried on the slide 189 is a coil spring 193, the tendency of which is to keep said slide 189 and offset part of the shifter 173 pressed against the ear 190. The shifter 173 is also provided with a shoulder 194 which snaps in behind the fingers 168, 169, after they have been raised in passing said shifter, and the latter takes any rebounding action of the barring cam 133 which may be caused by the spring buffer 172, such rebounding action being yieldingly received through the cushion offered by the spring 193, as will be readily understood. The operation of this portion of our invention is as follows:—The barring cam 133 having been put in motion, as previously described, by the trigger 120 unlatching whichever of the bolts 155, 156 happens to be opposite thereto, and for the purpose of explanation we shall designate the bolt 155, the latter will be depressed against the cam driving disk 153, and as soon as one of the holes 154 shall come beneath said bolt the latter will be forced therein by the presser-foot 163, thereby coupling barring cam 133 and cam driving disk 153 together. As the barring cam approaches the completion of a half-revolution, the depressed protruding finger 168 will come in contact with the beveled nose 185 of the bolt shifter 173, and said bolt will be thereby withdrawn from the hole 154 in the cam driving disk 153, the distance said bolt is withdrawn being governed by the difference in the height of the offset portion 186 above the remainder of the guard-rail 161. At the same time the spring-actuated latch 157 will reset itself within the notch 167 cut crosswise in said bolt and prevent the same from dropping until again operated upon by the trigger 120 and presser-foot 163. As soon as the bolt 155 has been withdrawn from en-

gagement with the cam driving disk 153, the protruding finger 169 of the other bolt 156 is about ready to contact with the buffer 172 which it shortly does, thereby bringing said barring cam 133 to a standstill.

The second half of the revolution of the barring cam 133 is brought about in a manner precisely similar to that for effecting the first half revolution, and a description thereof would be merely a reiteration of the process described with reference to such first half revolution, except that the bolt 156, having changed places with the bolt 155, would be operated upon in lieu of the latter, and such description is, therefore, omitted.

The movements of the slide 34 for effecting the barring of the ends of the buttonhole are transmitted from the barring cam 133, through a bell-crank lever, which we will now describe.

The barring lever, for the purpose of facility in assembling and initial adjustment in setting up the machine, is preferably made in two sections, 195, 196, respectively; the section 195 having formed in one end, intermediate of the levers 96, 97, and in proper alinement therewith, a grooved extension 197 adapted to receive and contain the roll 93 in similar manner as the latter is contained by said levers, the other end of said section 195 having turned thereon a rock-shaft 198 journaled in the base 2, and having clamped upon its upper extremity by a pinch-joint 199 said section 196, upon the other end of which latter is carried a roll 200 adapted to track within the groove 201 formed in said barring cam 133. Mounted rigidly upon the hub of the barring cam 133 is a controller cam 202 which controls the position of roll 93 relatively to the levers 96, 97 and 195, and also the position of the feed rack-bars 67, 68, with respect to the feed pinion 41, and the means for transmitting movements to said parts we will now describe.

Pivoted between pintles 203, 204, secured to the base 2 in any suitable manner, is a vertical rock-shaft 77 upon the upper end of which is formed a lever 205 having on its end a roll 206 which tracks within the groove 207 formed in the underside of the controller cam 202, and secured upon said rock-shaft 77, as previously described, are the levers 76, 91, which are respectively connected with the rack-bars and roll 93.

When the machine is brought to a standstill at the completion of a buttonhole, the roll 200 on the end of the lever 196 occupies the position illustrated in Fig. 17 at 208, at which time the barring cam 133 is operatively connected with the cam driving disk 153, and the roll 206 on the end of the lever 205 is in the concentric portion of the controller cam groove 207 at the point indicated at 209 in Fig. 21, causing the slide

block 87 to be positioned so that the roll 93 will be in the end 197 of the barring lever 195, the latter, by reason of the shape of the barring cam groove 201 causing the cloth clamp slide 34 to be held stationary at this period midway between its lateral motion limits.

Upon starting the machine, two descents of the needle will occur substantially in line with the buttonhole slit and in the same needle puncture, advancing the barring cam 133 and controller cam 202 thirty-six degrees, whereupon they are brought to rest by the action of the barring cam stopping mechanism, as previously described, and are not again put in motion until the length of the first side of the buttonhole has been stitched. This advancement of the barring cam 133 and controller cam 202 will have caused the roll 206, on the lever 205, to move inwardly to the position indicated at 210, Fig. 21, which will have caused the roll 93 to move out of the grooved end 197 of the lever 195 into the slotted end 101 of the lever 96, where it remains until the first side of the buttonhole has been stitched and the cams 133, 202, again put in motion. When the controller cam and barring cam are again started at the second end of the buttonhole, the controller cam 202 will, during the period the roll 200 is traversing the concentric portion 211 of the cam 133, cause the roll 206 on the end of the lever 205 to move outwardly to the point indicated at 212, Fig. 21, thereby causing the roll 93 to move out of the slotted end 101 of the lever 96 back into the grooved end 197 of the lever 195, where it remains until the completion of the lateral vibrations imparted to the cloth clamp slide 34, by the configurations 213, 214, 215, 216, 217, 218 and 219 of the barring cam 133, for making the barring stitches; and at the conclusion of the latter the controller cam 202 causes the roll 206, on the end of the lever 205, to move farther outwardly to a point indicated at 220, thereby causing the roll 93 to move out of the grooved end 197 of the lever 195 into the slotted end 102 of the lever 97, where it remains until the completion of overseaming the second side of the buttonhole. As soon as the roll 206 has climbed the incline of the cam groove in the controller cam 202 to the point indicated at 220, said cam and barring cam are again brought to a standstill by the barring cam stopping mechanism, as previously described. When the barring cam 133 and controller cam 202 are again put in motion to complete the barring of the first end of the buttonhole, (it being borne in mind that the first two stitches upon starting the machine are placed in the middle of the bar and in the same needle puncture, so as to make a tie of the thread ends at starting) the roll 206 on

the end of the lever 205 will be moved inwardly to the position indicated at 221, Fig. 21, which will cause the roll 93 to move out of the slotted end 102 of the lever 97 back into the grooved end 197 of the lever 195, where it remains throughout the period during which the configurations 222, 223, 224, 225, 226 and 227, of the barring cam 133 are actuating the cloth clamp slide 34 to complete the bar first started by the two centrally disposed tying stitches, and at the completion of this bar the respective rolls 200, 206, will be again positioned at the points 208, 209, which they originally occupied at the starting of the machine, at which point the machine is stopped and the work adjusted.

While we have used Figs. 17 and 21 as diagrams in explaining the movements imparted to the rolls 200, 206, by the respective cams which they engage, it will, of course, be obvious that said rolls do not travel circularly around the axes of said cams through the grooves, but merely move to and from the cam axes as the cams are rotated, as is usual with such elements.

As previously stated, the movements of the side stitching levers 96, 97, are in directions opposite to each other and in fields on opposite sides of a line intersecting their fulcrums, and said levers are so adjusted that at the end of each alternate vibration or oscillation, the slotted ends 101, 102, are in alinement with each other; also the adjustment of the barring lever 195 is such that when the roll 200 is in either of the dwells 211, 228 of the barring cam 133, the grooved end 197 of said lever is positioned midway of its throw and in alinement with said slotted ends 101, 102; and the location of the eccentric portions of the cam groove 207, from which the slide block 87 and stud 88 carrying the same are actuated, is such that said slide block 87 and kindred parts can be moved from the lever 195 to either of the levers 96, 97, or vice versa, only when the latter are in alinement, both the controller cam 202 and barring cam 133 being maintained in proper time-relation to the alternate movements of said levers 96, 97, by the location and number of the holes 154 in the cam driving disk 153, in conjunction with the gearing which rotates the latter, as previously set forth.

In Fig. 28 we have shown a diagram of the stitching, the light lines indicating the side overseaming stitches and the heavy lines indicating the barring stitches; all of the needle punctures in making the bars being indicated by black circles, and while in reality there is no feed movement to produce the staggered effect noticeable in the barring stitches, (the latter being superposed in actual sewing) such a plan has been adopted to show their number, relative

position, and order of making; for in the class of work for which this machine is designed, it is very important that the upper thread should lead correctly in order to insure that the so called purl will be positioned at the edge of the slit. Referring to said Fig. 28, 229 is the first needle puncture and 230 the second needle puncture, which are both made substantially in line with the buttonhole slit and in reality in the same hole. The succeeding stitches 231, indicated by light lines on the left hand edge of the hole, are side overseaming stitches and continue throughout the length of the hole, ending in the first needle puncture 232 upon starting to bar the second end of the buttonhole. The following needle punctures, 233 to 239, both inclusive, are then made in forming the bar at the second end of the hole, at the conclusion of which the second edge is overseamed as indicated at 240, and upon the termination thereof the barring of the first end is resumed and completed in the order indicated by the numbers 241 to 247, both inclusive. As is customary with this type of buttonhole, the stitches which bar the ends are formed with a much lighter tension than is employed for the making of the side stitches, by reason of which fact it is necessary that the upper thread after barring should lead from the side opposite the edge about to be overseamed in order to cause the purl to be drawn to the edge of the slit, and the position of such barring stitches immediately preceding the transition from barring to overseaming, as illustrated in said diagram, insures this result.

Mounted upon the slide 34 are the upper and lower sections 248, 249, respectively, of the cloth clamp, between which the material to be stitched is clamped and presented to the action of the stitch forming mechanism which we will now describe.

250 is the loop-taker of any approved construction and actuated from the lower shaft 6 in any suitable manner. The loop-taker is provided with any suitable bobbin (not shown) around which the upper thread is passed in the usual manner.

251 is the throat-plate provided with the usual needle aperture 252, and 253 is the needle-bar operatively mounted in the end of the overhanging arm 1 in the usual manner and provided with the usual eye-pointed needle 126.

254 is the take-up mounted in the end of the overhanging arm 1 in the usual or any approved manner.

255 is an auxiliary take-up tight on a horizontal shaft 256, one end of which is journaled at 257 in the end of the overhanging arm 1, while the other end is journaled within a tubular shaft 258 which latter is journaled at one end at 259 in the arm 1, while the other end is supported by the

shaft 256 which it incloses. 260 is a lever tight on the inner end of the shaft 256 and provided with a roll 261 adapted to work within the groove of a barrel cam 262 tight on the vertical shaft 23, so that as the latter revolves said auxiliary take-up 255 will be oscillated up and down, the contour of the cam 262 being such that said take-up will be moved once up and once down during a rotation of said cam, the effect of which is to produce alternately long and short take-ups of the upper thread, as will presently appear.

The upper thread 263 passes through two separate tensions 264, 265, thence up over a pulley 266, thence through the end of the auxiliary take-up lever 255, thence through the end of the main take-up lever 254, and thence down through a guide 267 on the needle-bar, to the needle 126. The two take-up levers are so timed with respect to each other that the auxiliary take-up will be actuated only at every second actuation of the main take-up, and it will, therefore, be manifest, without further description, that such action will produce alternately long and short take-ups of the thread.

Journalled around the tubular shaft 258 is a second tubular shaft 268. Interposed between one end of the latter and the hub of the auxiliary take-up lever 255 is a tension controlling lever 269 secured rigidly to said shaft 258. The other end of the outer tubular shaft 268 abuts against the arm 1 and is thereby positioned endwise, by which means the inclosed shafts 256, 258 are also secured against longitudinal movement.

The tension 265 is engaged by the end of a pin 270 slidably mounted in the arm and adapted to engage the tension disk 271 in the usual manner and relieve the thread disk or wheel 272 of pressure, as will be readily understood by reference to Figs. 2 and 5, thereby altering the tension on the thread.

The tension controlling lever 269 has an offset end 273 which bears upon one end of the pin 270, and pressing said lever against said pin is a spring 274. Secured upon the tubular shaft 258 which carries the tension controlling lever 269 is a second lever 275 provided at its end with a roll 276, directly in the pathway of cam-steps 277, 278, formed upon the upper flat surface of the controller cam 202, diametrically opposite each other. Rotation of the controller cam 202 will, therefore, cause the shaft 258, lever 275 and tension controlling lever 269 to be rocked back and forth against the resiliency of the spring 274 twice during one revolution of said cam, the arrangement of the parts being such that when said cam 202 is at a standstill during the formation of side overseam stitches, the roll 276 will be resting upon one or the other of the steps 277, 278, thereby withdrawing the tension controlling lever

269 from contact with the slide pin 270, and permitting the tension pressure upon the thread to be resumed. When the steps 277, 278 and roll 276 are disengaged, the force of the spring 274 will overcome the comparatively slight pressure exerted by the tension spring 265, thereby causing this tension to be removed from the thread, at which time the barring operation takes place, as will be readily understood.

279 is a tension releasing lever pivoted at 280 to the arm 1 and having a beveled nose 281 adapted to enter between the tension disks 282, 283, thereby separating said disks and relieving the thread of all tension. The other end of said lever 279 is pivotally connected by a link 284 to a lever 285 fast on the tubular shaft or sleeve 268. Pivoted to the lever 285 at 286 is a link 287 which depends therefrom and is connected to the clamp-closing lever 288 by a pin 289. The clamp-closing lever 288 is pivoted at 290 to a post 291 rigidly secured to the cloth clamp slide 34 and passing through a hole 292 made therefor in the upper hinged section 293 of the cloth clamp. Said hinged section 293 is, at its heel end, pivoted at 294 to a lug 295 formed on the cloth clamp slide 34. Interposed between the upper face of the cloth clamp slide 34 and the underside of the cloth clamp part 293 is a spring 296 by means of which the section 293 of the clamp is raised. The clamp-closing lever is formed with a cam portion 297 which bears upon a spring washer 298 interposed between the latter and the upper side of the cloth clamp, whereby the latter may be closed yieldingly upon the material.

299 is a stop-screw tapped into the lever 288 and backed up by a jam-nut 300. The stop-screw 299 abuts against the washer 298 and determines the open position of the lever 288, as clearly shown in Fig. 5.

The lower end of the link 287, which is pivoted around the pin 289, is forked and straddles over the end of the lever 288, as shown in Fig. 2, so as to permit the vibratory movements of the cloth clamp slide 34 to take place without vibrating said link, the pin 289 being held fast in the end of the lever 288 and sliding freely through the holes in said forked end of the link.

301 is an operating lever fast on the tubular shaft or sleeve 268 and carrying at its end a rod 302. The rod 302 slides freely through a pivot pin 303, which latter is journalled in the end of said lever 301. 304, 305 are nuts run on the end of said rod by means of which the latter is secured in place. The rod 302 is at its lower end attached to any suitable treadle connection (not shown) by which the same may be operated.

Secured upon the sleeve 268 adjacent to the hub of the lever 301 is a clutch-collar 306, provided with a single tooth 307

adapted to engage a spring-actuated pawl 308, secured upon a short rock-shaft 309 journaled in the upper portion of the base 2. Said rock-shaft 309 has formed upon its inner end an arm 310 which depends within the path of rotation of dogs 311, 312, fitted within undercut or dove-tail radial grooves 313, 314, formed in the upper face of the controller cam 202. Said dogs 311, 312, are each provided with a stop 315, 316, respectively, adapted to enter a notch 317 cut within the periphery of a disk 318 pivoted around the shaft 23 and supported by the controller cam 202 (see Fig. 10).

As will be later explained, the relative position of the notch 317 in the disk 318 with respect to the stops 315, 316, on the dogs 311, 312, determines the time of cutting the buttonhole, whether at the start or finish of the same, (and therefore, the relative position of the controller cam 202 upon stopping the machine). The position shown in Figs. 10 and 21 illustrates the adjustment for cutting after the stitching has been completed. Said adjustment, however, may be readily changed to the "cut before" position, as we shall presently explain.

Secured to the underside of the controller cam 202 by screws 319, 320, are springs 321, 322, which respectively engage the dogs 311, 312, through apertures 323, 324 in the controller cam 202 and exert a tendency to press said dogs in a direction toward the disk 318. Said dogs are provided with nicks 325, 326, whereby they may be withdrawn, against the resiliency of the springs 321, 322, from contact with said disk 318 (see Figs. 10 and 21). As shown in Fig. 10, the stop 316 on the slide 312 is now in engagement with the notch 317, and in order to change from this position (which is the "cut after") to the "cut before" adjustment, all that is necessary is to withdraw the stop 316 out of the notch 317 and rotate the disk 318 around the shaft 23 until said notch is opposite the stop 315, whereupon the latter will be forced, by the spring 321, within said notch, thereby locking said disk in its other adjustment. The somewhat extended reference to the cutting "before" or "after" feature of our machine is made at this time merely in order that a clear understanding may be had of the two different points at which the machine may be stopped for the purpose of removing the finished work.

The operation of the cloth clamp mechanism is as follows:—The material having been placed between the upper and lower gripping sections 248, 249, a downward pressure on the operating lever 301 will, through the intermediate connections 268, 285, 287, 289, cause the lever 288 to close the clamp 293 against the resiliency of the spring 296. The parts are now manually held in this position until the dog 311 moves clear of the

depending arm 310 on the rock-shaft 309, (it being understood that the downward movement of the operating lever 301 also starts the machine) whereupon the spring 327, which actuates the pawl 308 and shaft upon which it is carried, will force said pawl into engagement with the tooth 307 and thereby hold these parts in this position until the dog 311 has completed the circuit through which it travels and again contacts with the depending arm 310. The latter part of the downward motion of the operating lever 301 also causes a lever 328 to be rocked upon its fulcrum, which, in addition to starting the machine, furnishes a resilient pressure by means of which said lever 301 and parts controlled thereby may be returned to normal position, and the clamp thereby automatically opened simultaneously with the release of the latch tooth 307 by the pawl 308.

Journaled in bearings 329, 330, formed on the lower portion of the arm 1 at the rear of the machine, is a rock-shaft 331 which has secured tight on one end the lever 328, while fast upon the other end is a lever 332, (see Figs. 4, 8 and 9). The lever 328 has upon its end a roll 333 which coacts with the under edge of the lever 301, while the lever 332 is provided at its end with a stud 334 upon which is pivoted at one end a link 335, the other end of said link being pivoted around a stud 336 carried on one end of a lever 337 pivoted at 338 to the base 2.

342 is a coil spring, one end of which is attached to the base at 343, while the other end is secured to the lever 337 at 344, the tendency of said spring being to depress the stud end 336 of said lever and to press the lever 328, through the intermediate connections, 336, 335, 334, 332, 331, in a direction toward the lever 301, as will be readily understood by reference to Fig. 8.

The adjustment of the levers 301, 328, with respect to each other and to the clamping lever 288 is such that the lever 301 in its downward movement will contact with the roll 333 on the lever 328 before the clamp is nearly closed, so that the reflex action of the spring 296 will be able to continue the opening movement of said clamp after the lever 301 has passed beyond and away from the lever 328 on its return movement.

The operation of opening the clamp is as follows:—The clamp having been closed, as previously described, by downward pressure upon the lever 301, which may be effected either by hand or through any suitable treadle connection with the rod 302, the spring 296 will have been compressed and the spring 342 distended. The machine having been simultaneously set in motion, the clamp will remain closed until the dog 311, having completed its circuit, again strikes against the depending arm 310, where-

upon the pawl 308 will release the latch tooth 307 and allow the combined pressure exerted by the springs 296, 342 to reset the parts, as shown in Figs. 5 and 8, the spring 342 and its connections accomplishing the first portion of this action, and the spring 296 continuing the return opening movement of the clamp and lever connections 288, 287, 285, 268, 301, to their original open normal positions, as shown in Figs. 4, 5 and 8, or until the stop screw 299 abuts against the washer 298 interposed between the cam end 297 of the lever 288 and top of the clamp. The tension releasing lever 279, by reason of its link connection 284 with the lever 285 will, when the clamp is opened, protrude its beveled nose 281 between the tension disks 282, 283, and thereby remove the barring tension from the thread, leaving the latter perfectly free so that the work may be manipulated without danger of breaking the thread. When the clamp is again closed, however, said tension lever 279 will be withdrawn from the disks 282, 283, thereby restoring the barring tension upon the thread, as will be readily understood.

The employment of the spring 342 in connection with the opening of the clamp is incidental and not essential, as spring 296 could be of sufficient resiliency to operate the several parts connected with the opening of the clamp. The spring 342 is in reality a part of the stop-motion mechanism, but owing to the manner in which it is combined with the mechanism for starting and stopping the machine, it made it convenient to utilize its resiliency to assist the spring 296 to return the several parts connected with the opening and closing of the clamp to the positions which they occupy when the clamp is open.

We will now describe the mechanism for cutting the buttonhole slit.

The iron-plate 251 is provided with any suitable or approved cutter plates 345, 346, adapted to cooperate with a knife 347 carried by the knife holder 348 secured upon the cutter-bar 349 in any suitable or approved manner. The cutter-bar 349 is slidably mounted in bearings 350, 351, formed on a bracket 352 bolted to the rear side of the overhanging arm 1. 353 is a coil spring around the cutter-bar, interposed between a collar 354, fast thereon, and the lower bearing 350, by means of which said bar is returned to normal elevated position, as shown in Fig. 5, after having been depressed to cut the buttonhole slit. 355 is a collar fast upon the upper end of said cutter-bar 349, and provided with a stud 356 around which is pivoted the upper end of a link 357, while the lower end of said link is pivoted around a stud 358 carried on the end of a lever 359 secured on the front end of a rock shaft 360 and journaled in bearings

361, 362, formed on the upper rear portion of the arm 1 (see Figs. 5 and 9). The hub of the lever 359 shoulders against the front face of the bearing 361, while a collar 363 tight on the other end of the shaft 360 shoulders against the rear face of the bearing 362, whereby said shaft is restrained against endwise play.

Tight on the shaft 360, near the end journaled in bearing 362, is a clutch collar 364 around the hub 365 of which is loosely journaled a bell-crank lever 366, which latter is held in place by a collar 367 also tight on said shaft. The clutch collar 364 has a radially extending arm 368 provided with a hole 369 in alinement and registering with a hole 370 in the bell-crank 366, and 371 is a pin carried by an arm 372 extending radially from a sleeve 373 slidably mounted on the shaft 360. The pin 371 is capable of sliding freely through the holes 369, 370, and when in engagement therein, as shown in Fig. 27, serves to lock the bell-crank 366 and clutch-collar 364 together. When, however, the pin 371 is withdrawn from the hole 370, the bell-crank 366 will be free to rotate upon the hub 365 independently of the clutch-collar 364, as will be readily understood. Turned in the sleeve 373 is an annular groove 374 within which depends a stud 375 carried upon the end of a hand lever 376 pivoted at 377 on top of the arm 1, and it will be clear that as this lever is shifted back and forth, the bell-crank 366 will be thereby locked or unlocked relatively to the clutch collar 364.

378 is a collar, tight on the cutter-bar 349, which in the elevated position of the latter, abuts against the underside of the bearing 351, thereby causing the holes 369, 370 in the clutch-collar 364 and bell-crank 366, through the connections between said cutter bar and shaft 360, to register with each other, as will presently more fully appear.

Pivoted at its heel end around the shaft 331 between collars 379, 380, tight thereon, is a lever 381 which carries at its other end a roll 382 adapted to engage the cutter-cam 383 formed on the disk 318, which latter is pivoted around the shaft 23, as previously described, and held in place thereon by a collar 384.

385 is a link, the lower end of which is pivoted at 386 to the lever 381, while the upper end is pivoted at 387 to the bell-crank 366.

The operation of the cutting mechanism is as follows:—As disk 318 is carried around by the controller cam 202 upon which it is mounted, the cutter-cam 383 will, at a certain time, (predetermined by the location of the cutter-cam with respect to the notch 317 and the relation of the latter with the stops, 315, 316 on the dogs 311, 312) cause the lever 381 to be raised, thereby causing the

cutter-bar 349, through the connections between the latter and said lever, to be depressed against the resiliency of the spring 353 and cut the buttonhole slit, as will be readily understood by reference to Figs. 2, 3, 5 and 9, the knife 347 at such time coacting with the cutter-plates 345, 346. As previously pointed out, this action of the cutter-cam 383 may occur either before or after the buttonhole has been overseamed, such action being dependent merely upon the relative adjustment of said cutter-cam with respect to the stops 315, 316. The adjustment of the cutting mechanism is such that when cutter-bar 349 is in elevated position with the collar 378 against the bearing 351, the roll 382 on the end of the cutting lever 381 will be rolling idly upon the flat part of the disk 318, and the holes 369, 370 in the clutch-collar 364 and bell-crank 366, respectively, will be in alinement, registering with each other, so that should the pin 371 be withdrawn from the hole 370, thereby unlocking the bell-crank from the clutch-collar, said pin may be readily pushed back into said hole whenever the parts are in this position, to reunite said clutch-collar and bell-crank. Should the thread break or for any other reason it be desired to omit cutting of the buttonhole slit, all that is necessary is to move the handle of the lever 376 to the right or away from the needle, whereupon the bell-crank 366 will be rocked at the usual time by the cutter-cam 383, but owing to the withdrawal of the pin 371 from the hole 370 in said bell-crank, operative connections between the latter and the cutter-bar will be severed, as will be readily understood, operative connections between these parts to resume cutting being reestablished by moving the handle of said lever 376 to the left.

388 is an auxiliary presser-foot used in connection with the cloth clamp for setting the purl, but as such foot forms the subject matter of a separate application for patent filed by us on even date herewith, a description of the latter is herein omitted. The stop-motion mechanism also forms the subject matter of a separate application for patent, filed by us December 19, 1906, Serial No. 348,619; accordingly, we will describe only so much of its construction and operation as is essential to an understanding of the part which it performs in connection with the automatic operation of the organized construction. The automatic operation of the combined machine does not depend upon the particular construction of stop-motion mechanism herein illustrated and described, as other well-known constructions of stop-motion mechanism might be employed.

To the main driving shaft 3 is secured a

cam disk 389, and upon the hub 391 of the disk 389 is loosely mounted a balance wheel 392 which carries an internal friction ring (leather) 393 located between the disk 389 and a second disk or ring 394, which latter is secured to the disk 389 by screws 395 fitted loosely in the disk 389 and passing through the cut out portion of the ring 393 and threaded into the disk 394. The screws 395 are provided with coil springs 397 seated in pockets 396 and surrounding the screws 395, said springs tending to draw the disks 389, 394 against the opposite sides of the friction ring 393, thus frictionally securing the balance wheel 392 to the driving disk 389.

399 is a belt pulley secured to the outer end of the hub 398 of the balance wheel 392.

400 is a pulley mounted between the pulley 399 and the grooved portion 401 of the balance wheel 392 to turn on the hub 398 independently of said pulley 399 and balance wheel 392.

402 is a bushing secured in the rear end of the arm 1 and into which is supported the bearing 4 of the shaft 3. The bushing 402 is formed with a hub 403 upon which latter is mounted a toothed disk 404 having inclined surfaces 405 and adapted to cooperate with similar inclined surfaces 406 formed on the brake disk 407 interposed between said disk 404 and the cam disk 389.

408 is a friction ring (leather) secured to the cam disk 389 against which the disk 407 presses in the act of stopping the machine.

The disk 404 is provided with an arm 409 which carries a swivel stud 410 into which is threaded an adjusting screw 411 journaled in a swivel 412 secured in the arm 1. To the shaft 3 is rigidly secured a flange 413.

415 is a brake ring into which is threaded screws 416 which extend through holes 417, formed in the bushing 402, and bear against the disk 404, a friction washer 418 (leather) being interposed between the ring 415 and flange 413.

On the brake disk 407 is formed an ear 419, the latter being pivoted at 420 to the releasing lever 341. The releasing lever 341 is provided with a shoe 421 which projects beneath the cam disk 389 to engage, at a predetermined time, the cam-step 422, formed on the periphery of cam disk 389. When in driving position, the block 340 is in the upper portion of the cam slot 341, and the shoe 421 is out of the path of rotation of the cam-step 422, thus releasing the pressure between disks 404 and 407 and causing the cam disk 389, through the springs 397, to back away from the disk 407.

424, 425 are belts run from any suitable driving pulleys, said belts engaging at different times the belt groove 401 and pulleys 399 and 400.

429 is a bracket secured to the arm 1 and into which is journaled a vertical rock-shaft

428 carrying the belt shipper 426, which latter is provided with a forked end 427 engaging the belts 424, 425. The lower end of the vertical shaft 428 carries a crank arm 431 pivoted at 432 to one end of a link 433, the opposite end of link 433 being pivoted at 434 to a lever 435 which, in turn, is pivoted at 436 to the inner end of the bracket 429. The lever 435 carries a roll 437 which, at a predetermined time, engages a cam 438 formed upon the controller cam 202.

439 is a coil spring which holds the roll 437 in the direction of the cam 438.

The link 433 is provided with a pin 442 to limit the movements of the belt shipper toward the arm.

In the automatic operation of the machine, one of the dogs 311, 312, dependent upon the desired adjustment, in its rotation oscillates the depending arm 310, thus releasing the pawl 308 from engagement with the latched tooth 307, permitting, through the connections previously pointed out, the spring 342 to adjust the brake mechanism in position to stop the machine, the reverse action of said step-motion mechanism for starting the machine being accomplished by forcing the lever 301, preferably by connection with a foot treadle, in contact with the roll 333 which, through the connections described, reverses the movements of the brake mechanism, thus permitting the machine to be actuated by its driving mechanism.

We claim:—

1. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form one set of side overseam stitches, independent means for vibrating said clamp for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, and means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means.

2. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form the side overseam stitches for the first side of the buttonhole, independent means for vibrating said clamp in changed relationship with the feed of the material for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches for forming the barring stitches, and means acting on an element

connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means, in combination with needle-thread take-ups one of which is given movements to set each successive stitch, its coacting take-up acting to set only the edge stitches of the oppositely arranged side overseam stitches, substantially as described.

3. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form one set of side overseam stitches, independent means for vibrating said clamp for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, and means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means, in combination with means including rack-bars and pinion for feeding the cloth-clamp longitudinally and means for disconnecting the rock-bar and pinion during the barring operation.

4. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form one set of side overseam stitches, independent means for vibrating said clamp for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, and means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means, in combination with multiple needle-thread take-ups, one of which is given movements to set each successive stitch, its coacting take-up acting to set only the edge stitches of the oppositely arranged side overseam stitches.

5. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, means for feeding said clamp in opposite directions corresponding with the length of the buttonhole, means for changing the relative positions of said stitch-forming mechanism and cloth-clamp for the placing of the side overseam stitches and the barring stitches including an eccentric, clamp-vibrating levers operatively connected with said eccentric, the motions of said levers being in opposite directions, sliding elements operatively connected with the cloth-clamp, means for adjusting said elements in opera-

tive relationship with one of said levers to overseam one side of the buttonhole and in operative relationship with the other of said levers to overseam the opposite side of the buttonhole, a barring cam and a barring lever, one end of the latter being operatively connected with said cam, its opposite end coöperating with said sliding element to vibrate said clamp for the placing of the barring stitches.

6. In a buttonhole sewing machine, a stitch forming mechanism, a cloth clamp, and connections between said stitch forming mechanism and cloth clamp, including a controller cam for controlling the time of the barring operation, vibrating levers which through suitable connections with the stitch forming mechanism, are given vibratory movements in directions opposite to each other, in combination with a slide block which is at all times held in operative relationship with said clamp and by said controller cam adjusted into operative relationship with first one and then the other of said vibrating levers for the placing of the edge and depth stitches comprising the side overseam stitches.

7. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, means for feeding said clamp in opposite directions corresponding with the length of the buttonhole including a rack bar and pinion, means for disconnecting the rack bar and pinion during the barring operation, means for changing the relative positions of said stitch-forming mechanism and cloth clamp for the placing of the side overseam stitches and the barring stitches including an eccentric, clamp-vibrating levers operatively connected with said eccentric, the motions of said levers being in opposite directions, sliding elements operatively connected with the clamp, means for adjusting said elements in operative relationship with one of said levers to overseam one side of the buttonhole and in operative relationship with the other of said levers to overseam the opposite side of the buttonhole, a barring cam and a barring lever, one end of the latter being operatively connected with said cam, its opposite end coöperating with said sliding element to vibrate said clamp for the placing of the barring stitches.

8. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, means for feeding said clamp in opposite directions corresponding with the length of the buttonhole, means for changing the relative positions of said stitch-forming mechanism and cloth-clamp for the placing of the side overseam stitches including an eccentric, clamp-vibrating levers whose motions are in opposite directions operatively connected with said eccentric, sliding elements operatively connected with the cloth-clamp,

means for adjusting said elements in operative relationship with one of said levers to overseam one side of the buttonhole and in operative relationship with the other of said levers to overseam the opposite side of the buttonhole, means for effecting vibrations of different amplitudes of said levers, a barring cam and a barring lever, one end of the latter being operatively connected with said cam, its opposite end coöperating with said sliding element to vibrate said clamp for the placing of the barring stitches.

9. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, means for feeding said cloth-clamp in opposite directions corresponding with the length of the buttonhole including a rack-bar and pinion, means for disconnecting said rack-bar and pinion during the barring operation, means for changing the relative positions of said stitch-forming mechanism and cloth-clamp for the placing of the side overseam stitches including an eccentric, clamp-vibrating levers whose motions are in opposite directions operatively connected with said eccentric, sliding elements operatively connected with the cloth-clamp, means for adjusting said elements in operative relationship with one of said levers to overseam one side of the buttonhole and in operative relationship with the other of said levers to overseam the opposite side of the buttonhole, means for effecting vibrations of different amplitudes of said levers, a barring cam and a barring lever, one end of the latter being operatively connected with said cam, its opposite end coacting with said sliding elements to vibrate said clamp for the placing of the barring stitches.

10. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form one set of side overseam stitches, independent means for vibrating said clamp for the placing of the oppositely arranged side overseam stitches, means for effecting vibrations of unlike amplitudes of said vibrating means, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, and means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means.

11. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form the side overseam stitches for the first side of the buttonhole, independent means for vibrating said clamp

in changed relationship with the feed of the material for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means, and adjustable elements carried by said clamp for determining the extent of its feed movements, in combination with multiple needle-thread take-ups one of which is given movements to set each successive stitch, its coacting take-up being controlled to act upon each edge stitch.

12. In a buttonhole sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative positions of said stitch-forming mechanism and cloth-clamp including means for vibrating said clamp to form one set of side overseam stitches, independent means for vibrating said clamp for the placing of the oppositely arranged side overseam stitches, means, independent of the means for vibrating the clamp for the placing of the respective side overseam stitches, for forming the barring stitches, means acting on an element connected with the cloth-clamp to shift said element into operative relationship with either of said vibrating means, and adjustable elements carried by said clamp for determining the extent of its feed movements.

13. In a buttonhole sewing machine, stitch-forming and cloth-feeding mechanism including a cloth-clamp, means for automatically controlling the movements of said clamp for the cycle of feed and vibratory movements necessary for the overseaming of first one and then the opposite side of the buttonhole and the barring of the opposite ends thereof, an eccentric for giving to said clamp its feed movements lengthwise of the buttonhole, a second eccentric for giving to said clamp its vibratory movements for the placing of the edge and depth stitches, a cam provided with concentric and eccentric portions for effecting the vibratory movements of said clamp for the placing of the barring stitches, and means including an automatically controlled tripping dog for releasing the clamping member of said cloth-clamp coincidently with the completion of the stitching operation, substantially as described.

14. In a buttonhole sewing machine, a stitch forming mechanism including a needle actuating shaft; a vertically mounted shaft carrying a feed eccentric and operatively connected to said needle actuating shaft; a clutch disk and coacting clutch wheel; and connections between said clutch disk and feed eccentric for converting the continuous

rotatory movements of the feed eccentric into the step by step rotatory movements of the clutch wheel; a cloth clamp and connections between said cloth clamp and clutch wheel, including a pinion and rack-bars for converting the step by step rotatory movements of the clutch wheel into the lengthwise step by step feed movements of the cloth clamp.

15. In a buttonhole sewing machine, a stitch forming mechanism, a cloth clamp, a cloth clamp slide, a pinion, connections between said slide and pinion including rack-bars, a clutch disk with its coacting clutch wheel, a feed eccentric, and connections between said clutch disk and eccentric for converting the continuous rotatory movements of the feed eccentric into the step by step rotatory movements of the clutch wheel, in combination with means for operatively connecting said feed eccentric with the stitch forming mechanism.

16. In a buttonhole sewing machine, a stitch forming mechanism, a cloth clamp, and means for placing side overseam and barring stitches, including an overseaming eccentric, a controller cam for controlling the time of the barring operation and a feed eccentric, in combination with means, including a cam step carried by said controller cam, and a tension device for increasing the tension on the needle thread while overseaming the opposite sides of the buttonhole.

17. In a buttonhole sewing machine, a stitch forming mechanism; a cloth clamp and connections between the latter and said stitch forming mechanism, including a slide block operatively connected with said cloth clamp; clamp vibrating levers whose motions are in opposite directions; operative connections intermediate of said levers and said stitch forming mechanism; automatic means for effecting coöperation between first one and then the other of said levers and said block, whereby the cloth clamp is positioned for the overseaming of the opposite sides of the buttonhole.

18. In a buttonhole sewing machine, a stitch forming mechanism, a cloth clamp and connections between the latter and said stitch forming mechanism, including instrumentalities to position said clamp for overseaming the opposite sides of the buttonhole, mechanism for reversing the action of the vibratory and feed movements of the cloth clamp intermediate of overseaming the respective sides of the buttonhole, and means for changing the amplitude of vibration of said cloth clamp for overseaming one side of the buttonhole independent of such movements for the overseaming of the other side of the buttonhole.

19. In a buttonhole sewing machine, a stitch forming mechanism, a cloth clamp, and connections between the latter and said stitch forming mechanism including instru-

mentalties to position said clamp for over-
seaming the opposite sides of the button-
hole, and means for changing the amplitude
of vibration of said cloth clamp for over-
seaming one side of the buttonhole inde-
pendent of such movements for overseaming
the other side of the buttonhole.

20. In a buttonhole sewing machine, a
stitch forming mechanism, a cloth clamp,
and connections between the latter and said
stitch forming mechanism to position said
clamp for overseaming the opposite sides of
the buttonhole, mechanism for reversing the
action of the vibratory and feed movements
of the cloth clamp intermediate of overseam-
ing the opposite sides of the buttonhole, in
combination with a barring cam having
operative connections between the same and
said clamp, and a controller cam having con-
nections between the same and the cloth
clamp, whereby the latter is respectively ac-
tuated by the side overseaming mechanism
and barring mechanism alternately.

21. In a buttonhole sewing machine, a
stitch forming mechanism, a cloth clamp,
means for feeding and vibrating said clamp
to produce side stitching, means for actuating
said clamp to produce barring stitches, mech-
anism for reversing the vibratory and feed
movements of the cloth clamp intermediate
of side stitching the opposite sides of the

buttonhole, in combination with a controller
cam, means actuated thereby to shift an ele-
ment connected to the cloth clamp so that
the latter will be operated alternately by
the side stitching mechanism and the bar-
ring mechanism.

22. In a buttonhole sewing machine,
stitch-forming mechanism, a cloth-clamp
and mechanism for changing the relative
positions of said stitch-forming mechanism
and cloth-clamp including a controller-cam,
connections between said controller-cam and
cloth-clamp for reversing the vibratory
movements of said clamp relatively to its
feed movements when said clamp is shifted
under the needle for the overseaming of the
opposite side of the buttonhole, in combina-
tion with needle-thread take-ups one of
which is given movements to set each suc-
cessive stitch, its coacting take-up acting to
set only the edge stitches of the oppositely
arranged side overseam stitches.

Signed at Bridgeport, in the county of
Fairfield, and State of Connecticut, this 18th
day of December, A. D. 1906.

DONALD NOBLE.
JOHN S. FINCH.

Witnesses:

A. K. WILLIAMS, Jr.,
W. G. MARKS.