(Model.) 3 Sheets—Sheet 1.

A. C. CAMPBELL.

BUTTON HOLE SEWING MACHINE.

No. 303,557. Patented Aug. 12, 1884.

Figure 1

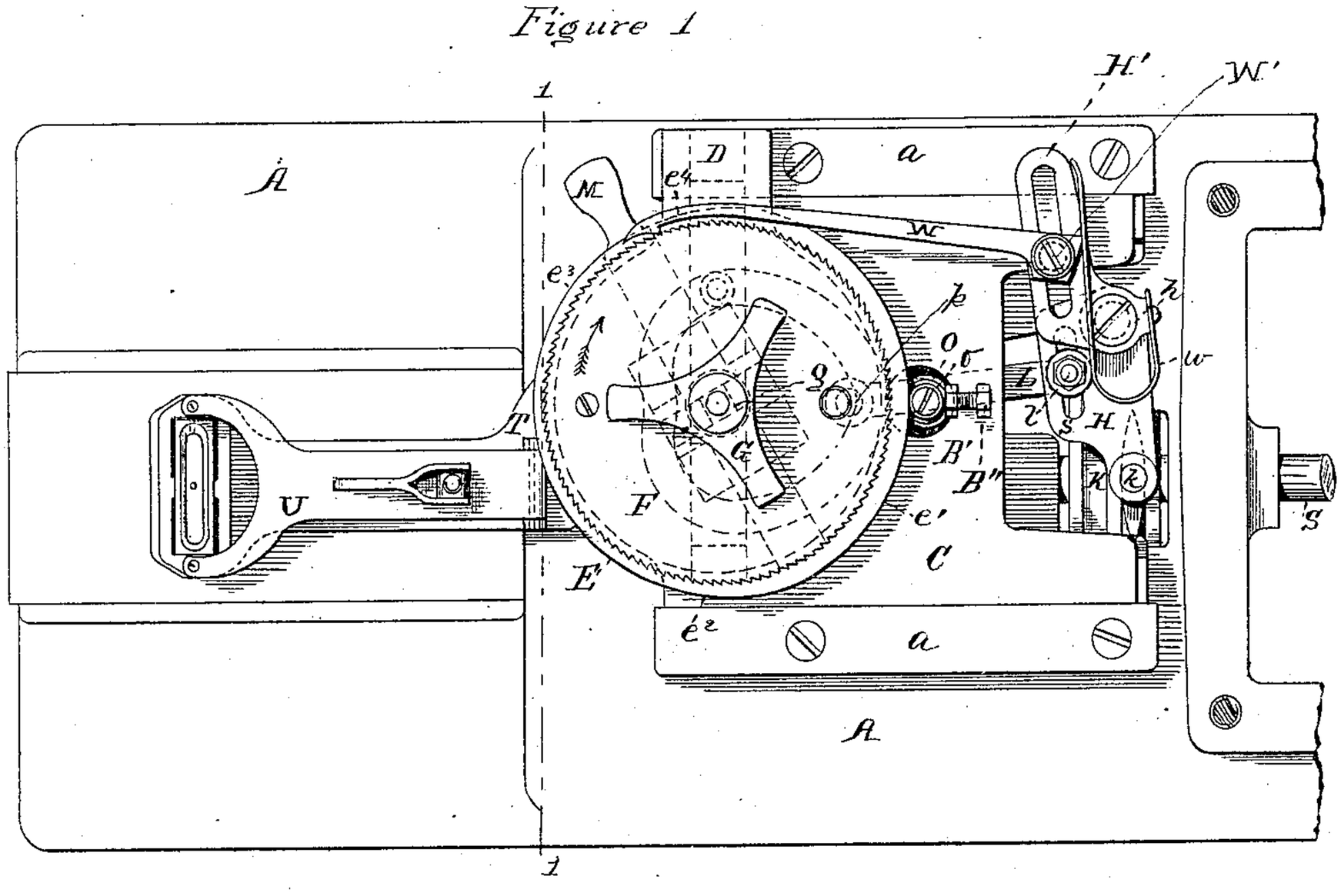


Figure 2

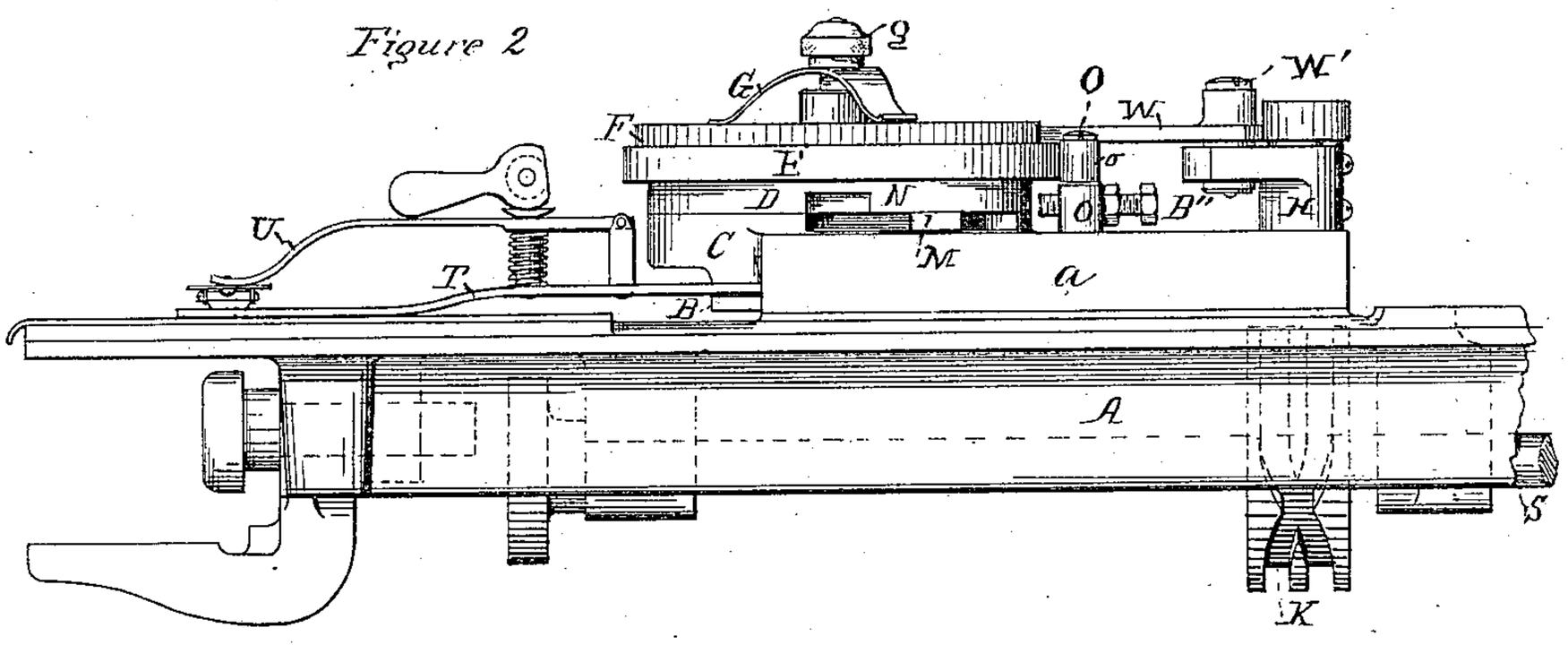
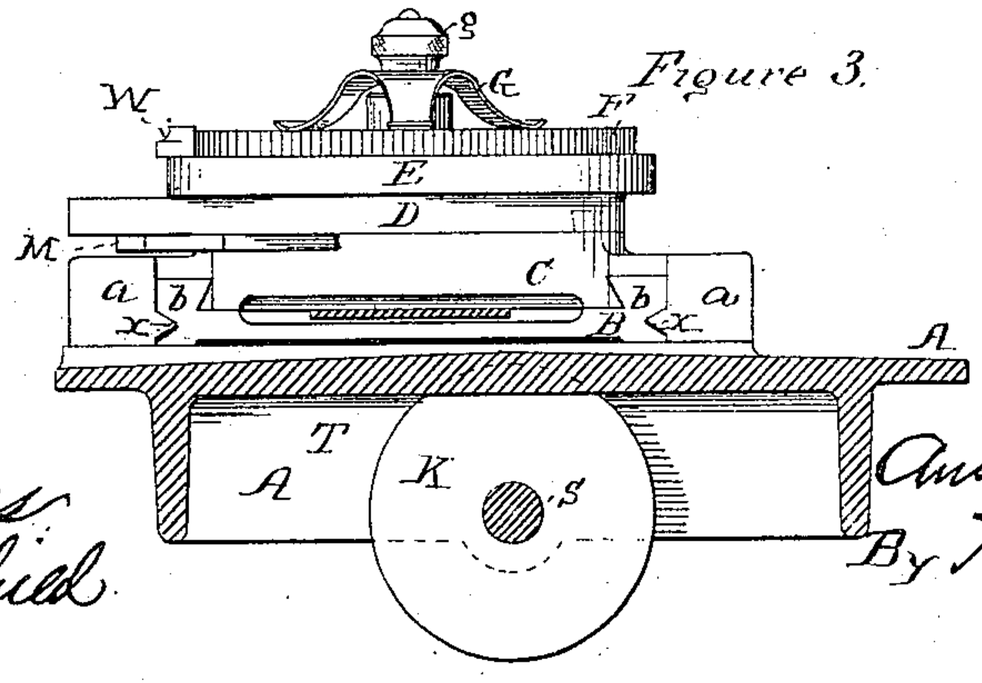


Figure 3.



Witnesses
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A. B. Fairchild

Inventor
Andrew C. Campbell
By A. M. Wooster
Atty.

(Model.) 3 Sheets—Sheet 2.

A. C. CAMPBELL.

BUTTON HOLE SEWING MACHINE.

No. 303,557. Patented Aug. 12, 1884.

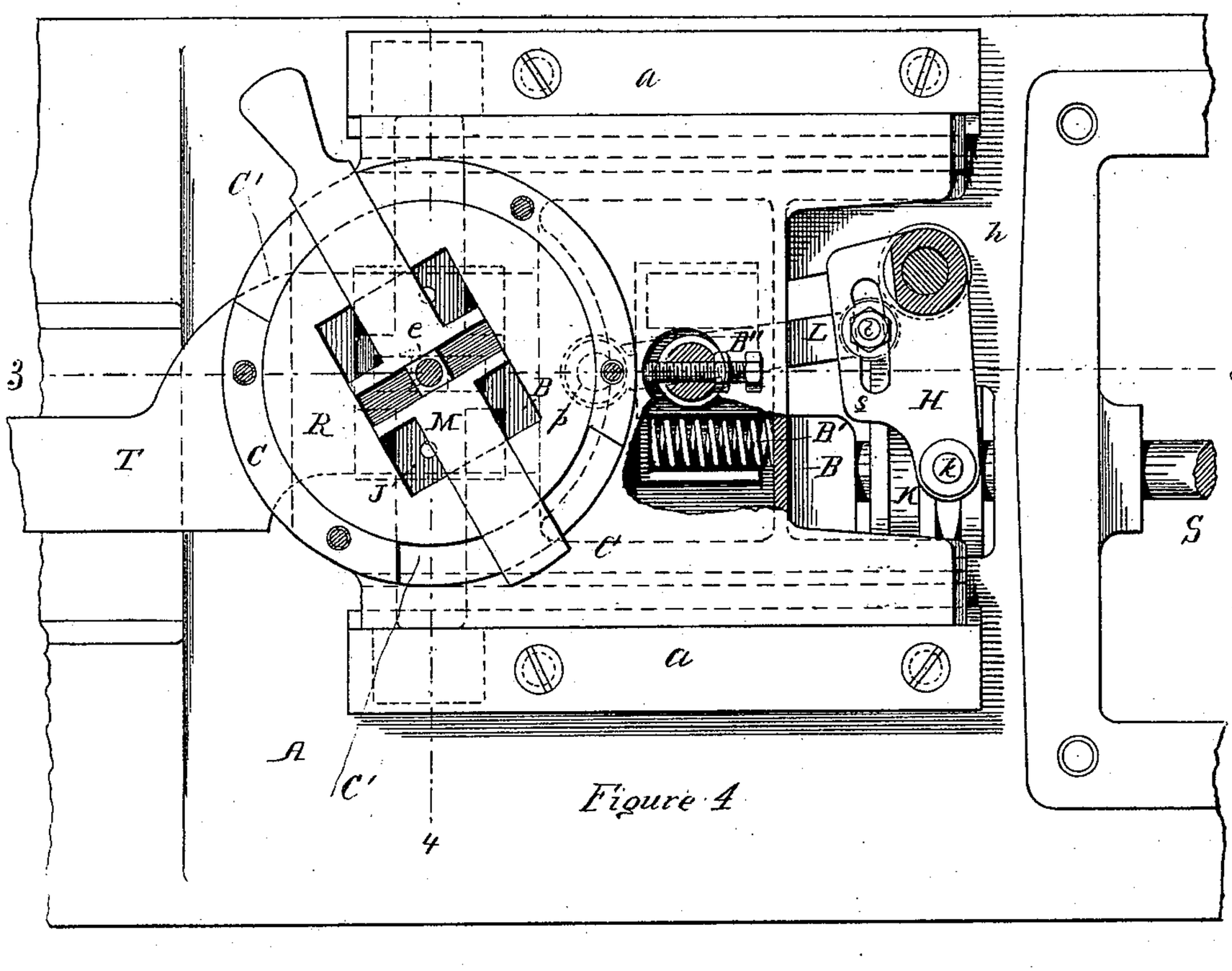

Figure 4

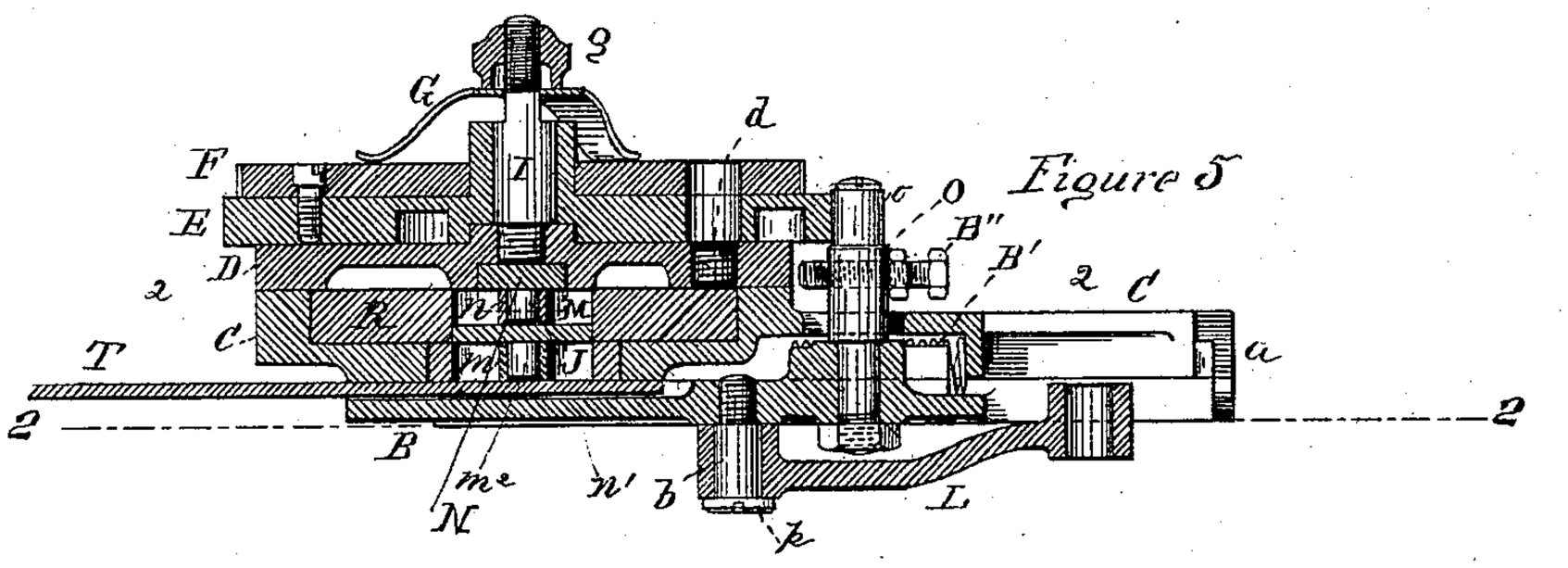

Figure 5

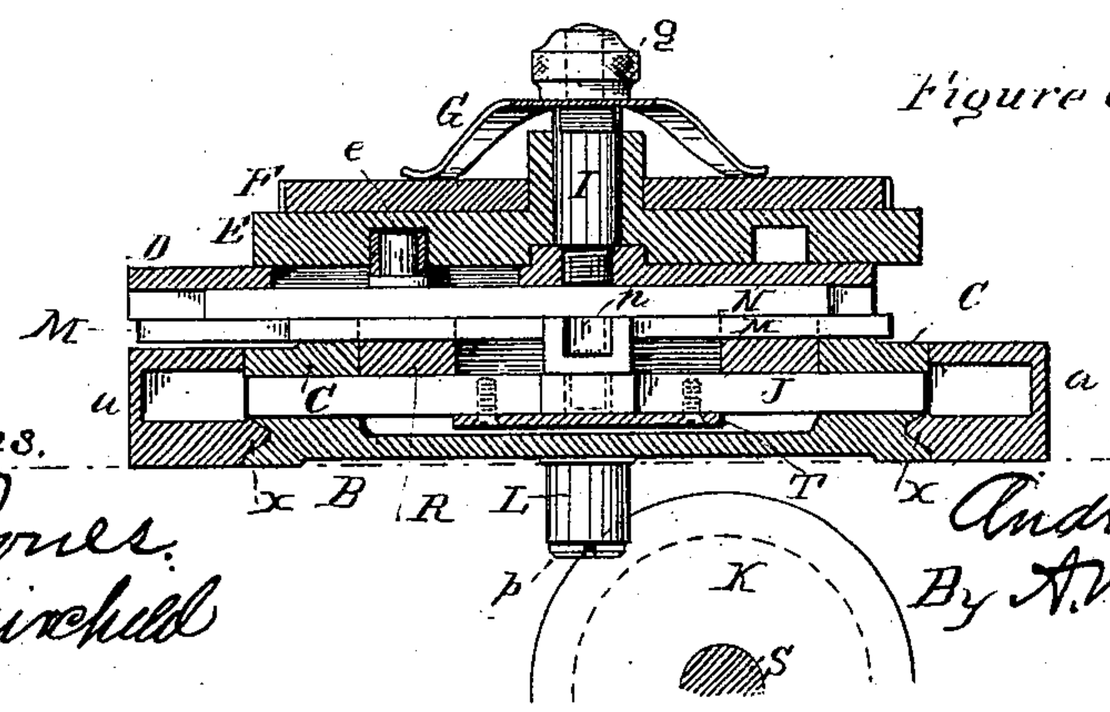

Figure 6

Witnesses.
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(Model.) 3 Sheets—Sheet 3.

A. C. CAMPBELL.

BUTTON HOLE SEWING MACHINE.

No. 303,557. Patented Aug. 12, 1884.

Fig. 7.

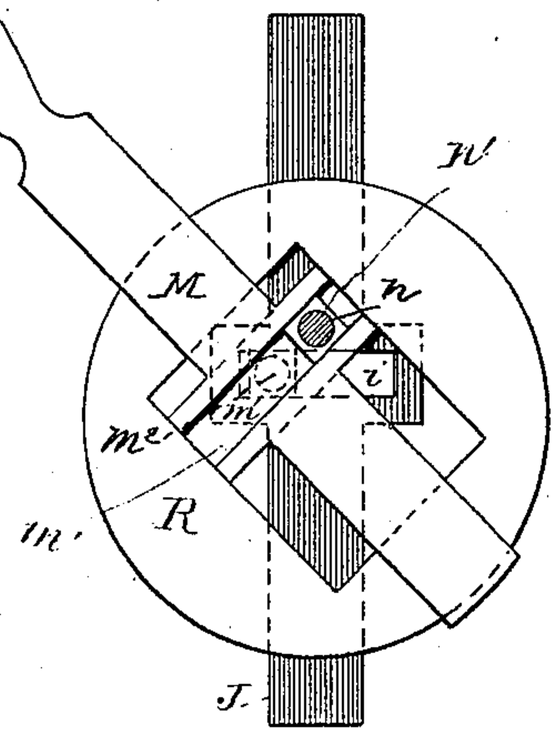


Fig. 8.

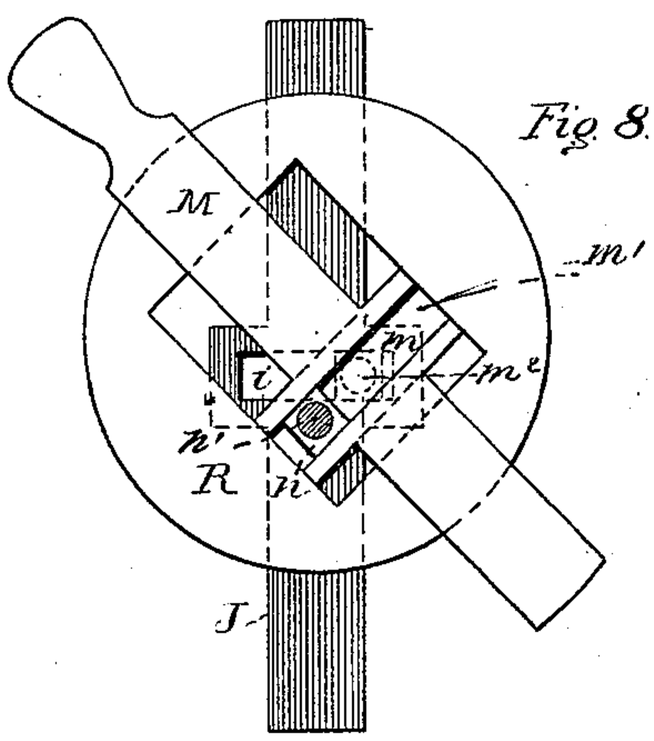


Fig. 9

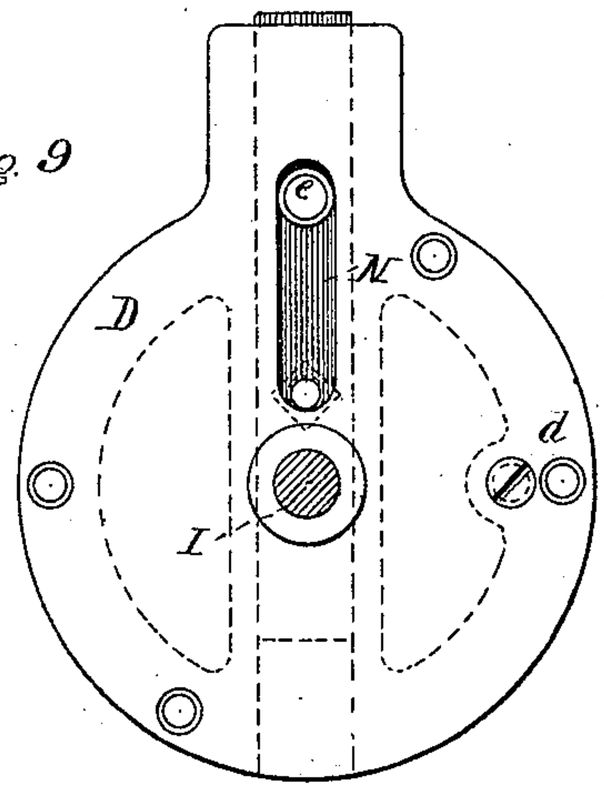


Fig. 10

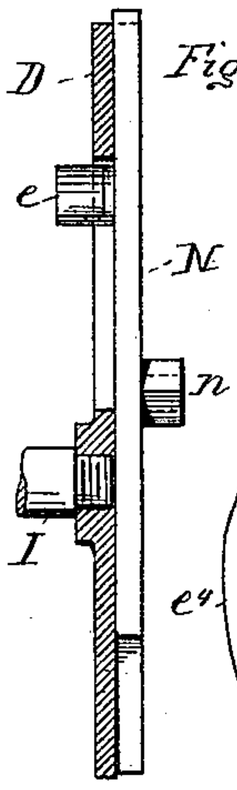


Fig. 11.

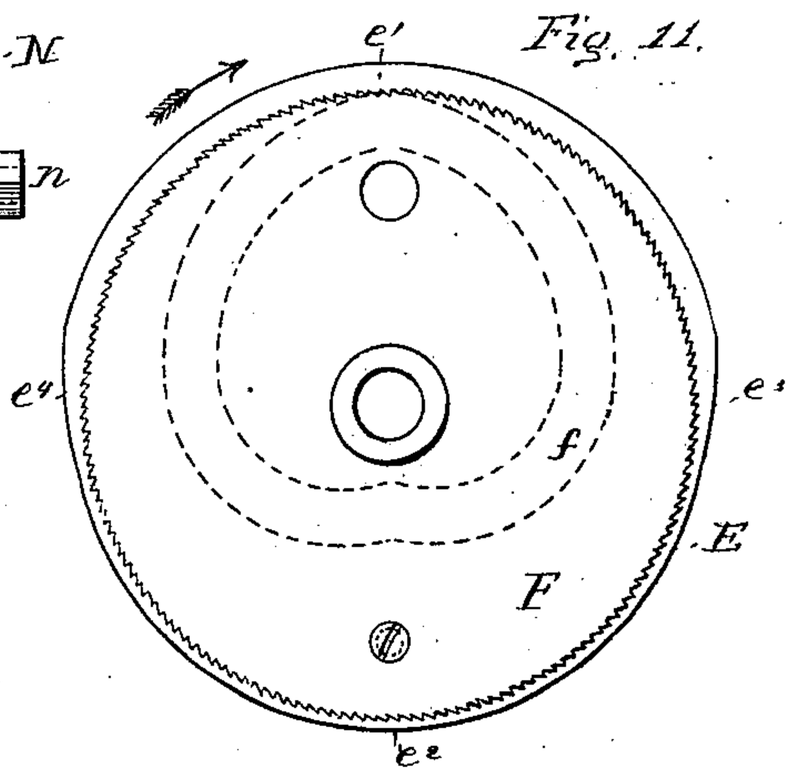
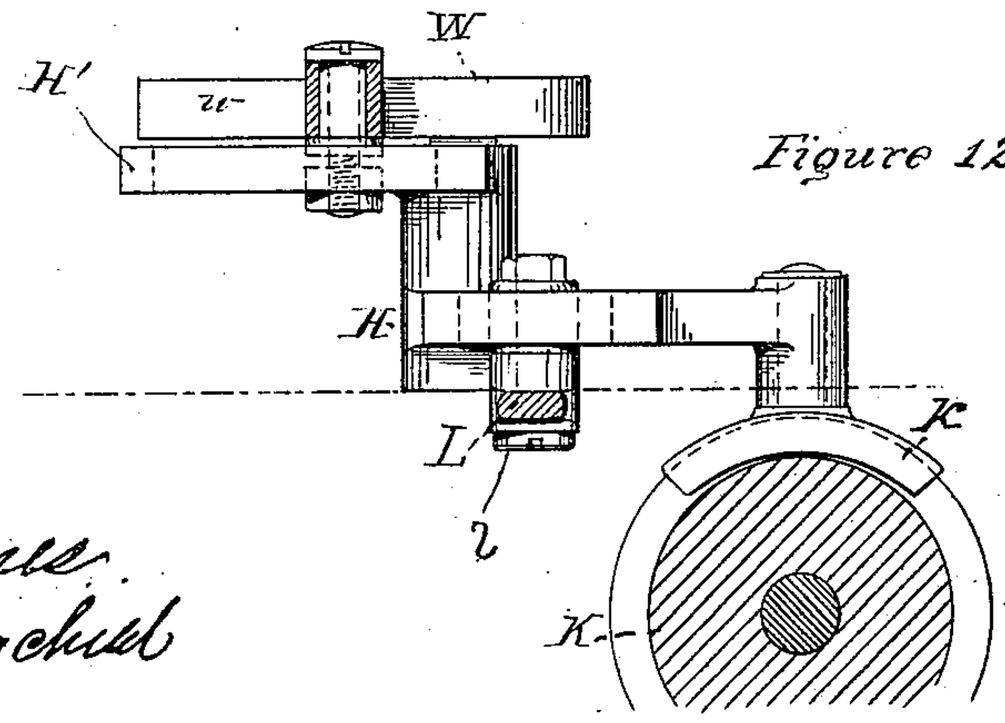


Figure 12



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UNITED STATES PATENT OFFICE.

ANDREW C. CAMPBELL, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO THE WHEELER & WILSON MANUFACTURING COMPANY, OF SAME PLACE.

BUTTON-HOLE SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 303,557, dated August 12, 1884.

Application filed January 7, 1884. (Model.)

To all whom it may concern:

Be it known that I, ANDREW C. CAMPBELL, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Button-Hole Sewing-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to button-hole sewing-machines, and has for its object the production of mechanism whereby the machine may be readily adjusted to stitch any sized button-hole, or, having been adjusted to a certain sized button-hole, may be instantly changed to any other size without the substitution or removal of any of the operative parts, and also to so proportion and adjust the parts as to render the cloth-clamp self-adjusting, so that at every alternate descent the needle punctures at the center line of the button-hole which is being operated upon without regard to the depth of the stitch to which the machine may be adjusted—that is to say, the bight upon the goods.

With these ends in view my invention consists in the construction and combination of elements hereinafter fully described, and then pointed out in the claims.

In order that others may understand and use my improved mechanism, I will proceed to describe the same, referring by letters to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of a sewing-machine bed-plate with my improvements applied. Fig. 2 is a front elevation. Fig. 3 is a cross-section on the line 1 1 of Fig. 1. Fig. 4 is an enlarged plan view, partly in section, of those parts of the mechanism which lie below the line 2 2 in Fig. 5. Fig. 5 is a central longitudinal section generally on the line 3 3 of Fig. 4, but showing the entire mechanism, and also showing slide M at right angles to the line 3 3, instead of the position shown in Fig. 4. Fig. 6 is a cross section on the line 4 4 of Fig. 4, but showing the complete mechanism, and with slide M in position as in Fig. 5. Fig. 7 is a detail view showing the mechanism for adjusting the throw of the lower slide, to which the cloth-clamp is attached, at one extremity of its motion. Fig. 8 shows the same mechanism at the opposite extremity of its motion. Fig. 9 is a plan of the cover-plate in which the upper slide-bar is fitted, said parts forming a cover to inclose the mechanism shown in Figs. 7 and 8, and occupying the position next above said parts. (See Figs. 4, 7, and 8.) Fig. 10 is a section of the cover-plate, showing the upper slide not in section. Fig. 11 is a plan view of the heart-cam and ratchet, which rest upon the upper surface of cover-plate. Fig. 12 shows the vibrating lever and a cross-section of the switch-cam with its follower therein. In this view is also shown a section of the adjustable end of the connecting-link and of the ratchet-pawl.

Similar letters indicate like parts in all the figures of the drawings.

A is the bed-plate of the machine, and B is a plate arranged to slide longitudinally thereon between ways *a a*. (See Figs. 3, 5, and 6.) I ordinarily provide the ways with splines X X and the plate with corresponding grooves, to insure smoothness of operation. Motion is imparted to this plate by means of a link, L, one end of which is pivoted to a stud, *p*, which projects downward from about the center of the plate, the other end being provided with a stud, *l*, which engages in a slot, *s*, in the vibrating lever H. This lever is secured to the bed-plate by pivot *h*, upon which it turns freely. In the opposite end of lever H follower *k* is journaled. This follower is of ordinary construction and travels in a switch-cam also of ordinary construction, which is secured to rotating shaft S below the bed-plate. The switch-cam is so constructed as to cause the follower, and with it the free end of lever H, to move from right to left, or vice versa, at each revolution. The amount of vibration imparted to plate B determines the bight of the thread—*i. e.*, the depth of the stitch in the goods. When it is desired that the stitch shall take deeper hold in the goods, the necessary adjustment is obtained by loosening the nut upon stud *l*, and moving said

stud in slot *s* away from pivot *h*. Should it be desired to lessen the depth of the stitch, stud *l* is moved nearer to pivot *h*.

Above plate B is a plate, C, which is arranged to have independent motion on dovetail guides *b b*, for a purpose presently to be explained. The general contour of this plate is similar to plate B.

In the under side of plate C is a recess running at right angles to shaft S, in which and above plate B a bar, J, is arranged to slide. To the under side of this slide-bar the cloth-clamp plate T is secured, the upper surface of the inner end of which rests firmly against the under side of plate C, as shown in Figs. 2 and 5. This clamp-plate T extends to and its overhanging extremity surrounds the needle-hole of the machine just above the throat-plate.

The cloth-clamping device U is attached to plate T, and is operated in connection therewith to retain the fabric firmly in position while the machine is stitching the button-hole. (See Figs. 1 and 2.) The slide-bar J and cloth-clamp T thus arranged are free to be moved to and from the operator a distance equal to the extreme length of the largest button-hole required to be worked.

Heretofore in this class of machines when the operator desired to change from one sized button-hole to another it has usually been necessary to change the heart-cam which controls the motion of the cloth-clamp. My improved mechanism, however, which I will now proceed to describe, enables me to change instantly from one sized button-hole to another without the removal or substitution of any parts. In the center of slide-bar J, and at right angles to its length, is a slot, *i*. Immediately above said slide-bar is an angularly-adjustable cross-slide, M, which also has a slot, *m'*, across its center at right angles to its length. On the under side of this cross-slide, and directly below the center of the slot aforesaid, is a downwardly-projecting pin, m^2, on which is pivoted a rectangular block, *m*. This block is of just sufficient size to slide freely in the cross-slot of slide-bar J. Cross-slide M is fitted to slide centrally in a groove in a circular plate, R, which in turn is capable of rotary motion in a recess in the top of plate C. It will of course be understood that the blocks are not an essential feature of my invention, as the pins alone, or pins with anti-friction rollers, will work in the slots and accomplish the same results. The ledge or annular ring around the recess in plate C is cut away on opposite sides, as at C' C' in Fig. 4, to accommodate the ends of cross-slide M, the shoulders at the ends of said cut-away portion serving as stops to limit the angular motion of cross-slide M. It will thus be seen that while slide M is free to be moved in the direction of its length its angular position relative to slide-bar J may be changed by turning plate R (which carries it) about its axis. (See Figs. 4 and 5.) Above cross-slide M and plate R is the cover-plate D, (see Figs. 2, 3, 5, 6, 9, and 10,) into whose under surface is fitted the upper slide-bar, N. This latter slide-bar lies directly above slide-bar J, already described, and reciprocates in the same direction. The cover-plate is secured to the annular ring of plate C by screws near its edge. Slide-bar N on its lower side is provided with a downwardly-projecting pin, *n'*, on which is pivoted a rectangular block, *n*, which is adapted to slide freely in the slot across the center of cross-slide M, the construction being the same as that referred to above with reference to slide-bar J.

Projecting from the upper surface of slide-bar N is a pin carrying a roller, *e*, which passes through a slot in the cover-plate and projects above it. (See Figs. 9 and 10.)

I is a stud which projects upward from the center of the cover-plate, (and exactly above the center of the circular plate R,) and forms the pivot upon which are journaled the cam E and ratchet feed-wheel F. (See Fig. 11.) The heart-shaped groove in the under surface of cam E engages with roller *e* upon slide-bar N, and imparts to said slide-bar the required longitudinal motion, the cam and feed-wheel being secured together by screws, as shown in Fig. 5, or in any simple manner. The groove in the under surface of cam E is of such form that any part of a revolution of said cam will move slide-bar N in the direction of its length a proportionate distance, so that if the cam be advanced through certain uniform arcs the slide-bar N will be moved through uniform spaces in the direction of its length, the shape of the cam only deviating from this principle near its major and minor radii.

Having determined the motion to be given to slide-bar N and shaped cam E thereto, suppose that it is desired to give an equal amount of motion to the lower slide-bar, J, which carries the cloth-clamp. To do this the circular plate R is so turned in plate C that cross-slide M shall lie directly below slide-bar N and above slide-bar J. If, now, the circular plate be secured in this position by set-screw *d*, or in any convenient manner, cross-slide M and slide-bar J will move as one piece with slide-bar N, owing to their connection with each other, through the rectangular blocks and slots heretofore described.

In Fig. 4 I have shown plate R and cross-slide M as moved (by means of the handle at the end of slide M) so that the center line of cross-slide M is at an angle with slide-bars N and J. This is more clearly illustrated in Figs. 7 and 8, the first of which shows the stud and rectangular block *n* of the upper slide-bar at the farthest extreme of its throw—that is to say, away from the operator—the cam E having forced the roller *e* of said upper slide-bar to its limit away from stud I. This position of the upper slide-bar is also illustrated in Figs. 9 and 10.

In Fig. 8 I have shown the stud and rectangular block *n* of slide-bar N at the other extreme of its throw—that is to say, toward the operator—at which time the machine is operating on the farther end of the button-hole.

Referring to Figs. 7 and 8, it will be seen that the angular position of adjustable cross-slide M has so turned the cross-slot thereof, in which the block *n* of slide-bar N slides, that said block, in passing from the position shown in Fig. 7 to that shown in Fig. 8, passes across said slot from one side of the center line of cross-slide M to the other, so that cross-slide M moves through a lesser distance in the direction of its length than the slide-bar J, which operates it. The endwise motion of cross-slide M decreases as its angle with the slide-bars increases, until it lies at a right angle thereto, in which position the groove in cross-slide M, in which block *n* travels, is parallel with the line of motion of the slide-bars. Consequently block *n* moves freely across in said groove without affecting the position of cross-slide M, the block merely serving to hold the cross-slide centrally with the circular plate R, should the set-screw for holding said plate be loosened. The motion of cross-slide M is transferred to slide-bar J by means of the pin and rectangular block *n* on the under side of cross-slide M, which engage in cross-slot *i* at the center of slide-bar J, (see Figs. 7 and 8,) as already described, the relative amount of motion given to slide-bar J by cross-slide M being the same as that given to cross-slide M by slide-bar N.

In Figs. 7 and 8 cross-slide M is shown as adjusted at an angle of forty-five degrees to the two slide-bars, in which position the longitudinal motion imparted to slide-bar J by the cross-slide is equal to but one-half of the longitudinal motion of slide-bar N, which actuates the cross-slide. When cross-slide M is adjusted at an angle of sixty degrees to the two slide-bars, the lower slide-bar will move but one-fourth of the distance through which the upper slide-bar travels in the same length of time, or when the cross-slide is adjusted at an angle of thirty degrees to the slide-bars the lower slide-bar will move three-fourths of the distance that the upper slide-bar moves at each revolution of the switch-cam. It will be apparent, therefore, that by this device any form may be given to the cam E, which operates the upper slide-bar, and the motion of the said bar exactly reproduced by the lower slide-bar on the same or a different scale.

As a means for revolving cam E, I use a ratchet feed-wheel, F, whose teeth are engaged by the hooked end of feed-pawl W, (shown in Figs. 1 and 2,) said feed-pawl being vibrated in the direction of its length by an arm, H′, on the back of vibrating lever H. The pawl is adjustably pivoted in a slot in said arm, for a purpose presently to be explained, the arm being raised above the lever and projecting from the top of the pivotal stud *h*. As stated above, feed-pawl W is adjustably pivoted in a slot in arm H′, and when it is desired to vary the motion of the ratchet feed-wheel it is only necessary to loosen screw W′ and move the feed-pawl nearer to or farther from the pivot-stud of lever H, and then tighten the screw, when the desired adjustment is secured. The spring *w*, which is secured to the arm H′, acts on the heel of feed-pawl W in such a manner as to insure constant contact between the hooked end of the pawl and the face of the feed-wheel. Should it be desired to operate the cloth-clamp by hand, pawl W may be lifted out of contact with the feed-wheel, and will be held in such position by spring *w*, which will then press against the back of said pawl. It will of course be understood that the feed-wheel makes a complete revolution during the stitching of each button-hole, and that each actuation thereof is accompanied by a descent of the needle-bar. If the button-hole to be stitched is a large one, or it is desired that the stitching should be fine, the feed-pawl is adjusted close to the pivot-stud of lever H and arm H′, so that at each actuation the pawl will pass over but two or three teeth on the face of the feed-wheel. On the other hand, if the button-hole is a small one, or it is desired that the stitching be more or less coarse, pawl W may be adjusted to a greater distance from the pivot-stud of the lever and arm, so that at each actuation the pawl will pass over five or six, or, if need be, more teeth on the face of the feed-wheel, in order to maintain a uniformity of motion, so that the feed-wheel and cam E will be under perfect control when working at a high rate of speed.

I produce a frictional resistance against the feed-wheel by means of a cup-shaped spring, G, which is placed over the upper end of stud I, and is tightened up to adjust the pressure of the spring on the feed-wheel by a nut, *g*, which turns on the top of stud I.

In order to obtain the requisite cross-feed which is necessary to form the ends of the button-hole, and to start the straight-line feed, already described, in its reverse direction, it is necessary to change the relative position of plate C with reference to the lower plate, B. To accomplish this I form the periphery of cam E with a segment thereof, amounting to nearly one-half of its circumference, of greater radius than the opposite portion, the difference between the two radii being equal to the greatest amount of endwise motion which it is intended that plate C shall have upon the lower plate, B.

Projecting upward from a hub on the lower plate, B, is a stud, O, which passes freely through a clearance-hole in the upper plate, C, and is provided at its upper end with a roller, *o*, against which the periphery of cam E rests. (See Figs. 2 and 5.) The cam is kept in contact with roller *o* by means of coiled springs B′, which are arranged in pockets in the lower plate, B, and act against a lip on

the upper plate, C, to press said plate and the parts carried thereby away from the needle-hole, or toward the right in Figs. 1, 2, 4, and 5, so that in the revolution of cam E, when the part having the longest radius e' is against roller *o*, the center of the cam and of the roller-stud are farthest removed from each other; but as the rotation of the cam is continued in the direction indicated by the arrow in Figs. 1 and 11 the incline e^4 thereof, in passing the roller, allows the center of the cam to approach the stud under the action of springs B', as above described. This action begins when the cloth-clamp has almost reached its extreme position toward the operator, and the needle is acting at that end of the button-hole which is farthest from the operator. The combined action of the heart-cam E and the incline e^4 in the periphery thereof gives a rounded shape to that end of the button-hole farthest from the operator, after which the cloth-clamp moves in the direction away from the operator, the roller *o* resting at that time firmly against the periphery of the cam at that portion having the smallest radius, (indicated in the drawings by e^2.) The other end of the button-hole is finished by the combined action of the heart-cam and the incline e^3. Should it be desired to reduce the motion of plate C upon plate B, the set-screw B'', which passes through the stud O below the roller *o*, is so adjusted that its point comes in contact with the edge of the cover-plate D as the roller *o* follows down the incline e^4 on the periphery of cam E. The amount of movement of plate C upon plate B would then be equal to the distance between the point of set-screw B'' and the edge of cover-plate D when the part having the longest radius e' of cam E is in contact with the roller *o*, as shown in Figs. 1, 2, 4, and 5, the effect of this adjustment being to give the second line of stitching—*i. e.*, on the opposite side of the button-hole—its proper position relative to the first line of stitching. For instance, if the bight has been increased, the screw is turned out to prevent the two lines of stitching from overlapping. If the bight has been decreased, the screw is turned in to bring the second line of stitching nearer to the first.

I will now describe another very valuable feature of my invention. It will be seen upon reference to Fig. 1 that the needle-hole occupies a position exactly central with the opening in cloth-clamp U; also, that the vibrating lever H is at its extreme of motion to the right, and that roller *o* is in contact with the part having the largest radius e' of cam E, so that as the end of the vibrating lever H shifts from right to left during the next revolution of switch-cam K the whole of the sliding mechanism would be forced toward the needle-hole, and the needle would descend near to the side of the opening in the cloth-clamp which is toward cam E. The succeeding revolution of the switch-cam would return the lever H to the position shown in Figs. 1 and 4. When the parts are in this position, if it is desired to change the amount of vibration of plate B, stud *l* is moved in slot *s* to or from the switch-cam, as already described.

It will be noticed in Figs. 1 and 4 that the adjustment-slot in the vibrating lever is so located with reference to the pivot-stud *p* of link L that stud *l* of the link may be moved in said slot without imparting movement to the lower plate, B, for the reason that slot *s*, when the parts are in the position shown, is, in fact, a perfect arc, of which the link is a radius in any position in which it may be placed. By this construction the "bight" or depth of the stitch may be varied within the capacity of the machine without its being necessary to recenter the cloth-clamp, as it will be self-centering no matter what may be the adjustment of plate B with relation to the vibrating lever. It will of course be understood that the parts return to this position every second revolution of the switch-cam.

I am aware that button-hole sewing-machines have heretofore been made in which a ratchet feed-wheel, a heart-cam, and a peripheral cam, substantially as herein shown, were operated by a vibrating lever and switch-cam, and I make no claim thereto.

I claim—

1. In a button-hole sewing-machine, the combination, with a cloth-clamp, a slide-bar to which the cloth-clamp is attached, an operating-cam, and a slide-bar driven thereby, of an intermediate angularly-adjustable cross-slide and intermediate mechanism for connecting said cross-slide and slide-bars, whereby the motion of the driven slide-bar is reproduced in the lower slide-bar on the same or a different scale.

2. A cloth-clamp, a slide-bar to which the cloth-clamp is attached, and which is provided with a cross-slot, and an adjustable cross-slide lying above it, which is provided with a cross-slot in its upper side and a downwardly-projecting pin on its lower side, in combination with a slide-bar above the cross-slide, having a downwardly-projecting pin on its lower side, and mechanism—for example, a cam—for operating said slide, all combined and arranged substantially as and for the purpose set forth.

3. A cloth-clamp, slide-bar J, to which the cloth-clamp is attached, and which is provided with cross-slot *i* and block *m*, sliding therein, and adjustable cross-slide M, having slot m', block *n*, sliding therein, and pin m^2, in combination with slide-bar N, having pin n', and cam E, for imparting motion thereto, substantially as described.

4. Slide-bar J, carrying a cloth-clamp and having a cross-slot and a block sliding therein, and an adjustable cross-slide having a pin in its lower side and a cross-slot and block in its upper side, in combination with a plate which carries said cross-slide, a slide-bar car-

rying a pin which engages the block in the cross-slide, and an operating-cam for imparting motion thereto.

5. Slide-bars N and J and adjustable cross-slide M, in combination with plate R, the cloth-clamp, and operating and connecting mechanism.

6. In a button-hole sewing-machine, the cloth-clamp, the slides J and N, the angularly-adjustable cross-slide M, and plate R, in combination with the operating cam-plates B and C, adapted to have independent reciprocation, and operating and connecting mechanism, whereby the cloth-clamp is operated and the size of the button-hole may be regulated without removal or substitution of parts.

7. In a button-hole sewing-machine, the combination, with the cloth-clamp, the plate B, and intermediate connecting mechanism, of the link L, pivoted to said plate, and having at its opposite end a stud, suitable mechanism for operating said link, lever H, having a slot, *s*, which is curved to conform to the arc of a circle described from the pivotal point of said link on said plate, whereby the length of the movements of the plate B may be varied without changing its adjustment relative to the cloth-clamp, substantially as set forth.

8. In a button-hole sewing-machine, the combination, with the plate B, having the stud O, of the movable plate C, the feed-wheel, and cam E, carried by said plate C, and thus adapted to reciprocate independently of the plate B, springs for holding said cam in contact with said stud, the cloth-clamp, and the operating-slide by which said clamp is carried, substantially as set forth.

9. Plate C, slide-bar J, carrying the cloth-clamp, and cross-slide M, carried by plate R, in combination with cover-plate D, having slide-bar N recessed therein, and operating and connecting mechanism.

10. In a button-hole sewing-machine, the combination, with the cloth-clamp and its operating mechanism, of mechanism for varying the stroke of the cloth-clamp without changing cams, the same consisting of an angularly-adjustable cross-slide interposed between the driven slide-bar and the slide-bar to which the cloth-clamp is attached, the cross-slide having a slot at right angles to its length, which is engaged by a pin on the upper slide-bar, and a pin on its lower side engaging a cross-slot in the lower slide-bar, as described, and for the purpose set forth.

11. In a button-hole sewing-machine, the combination, with plate B, provided with stud O, having roller *o*, springs B′, movable plate C, the feed-wheel, and cam E, having inclines e^3 e^4, of the cloth-clamp and mechanism for connecting the said clamp with the plate B, substantially as set forth.

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

ANDREW C. CAMPBELL.

Witnesses:
A. M. WOOSTER,
A. B. FAIRCHILD.