(No Model.)

4 Sheets--Sheet 1.

J. LAIRD.

BUTTONHOLE SEWING MACHINE.

No. 562,003. Patented June 16, 1896.

Fig. 1.

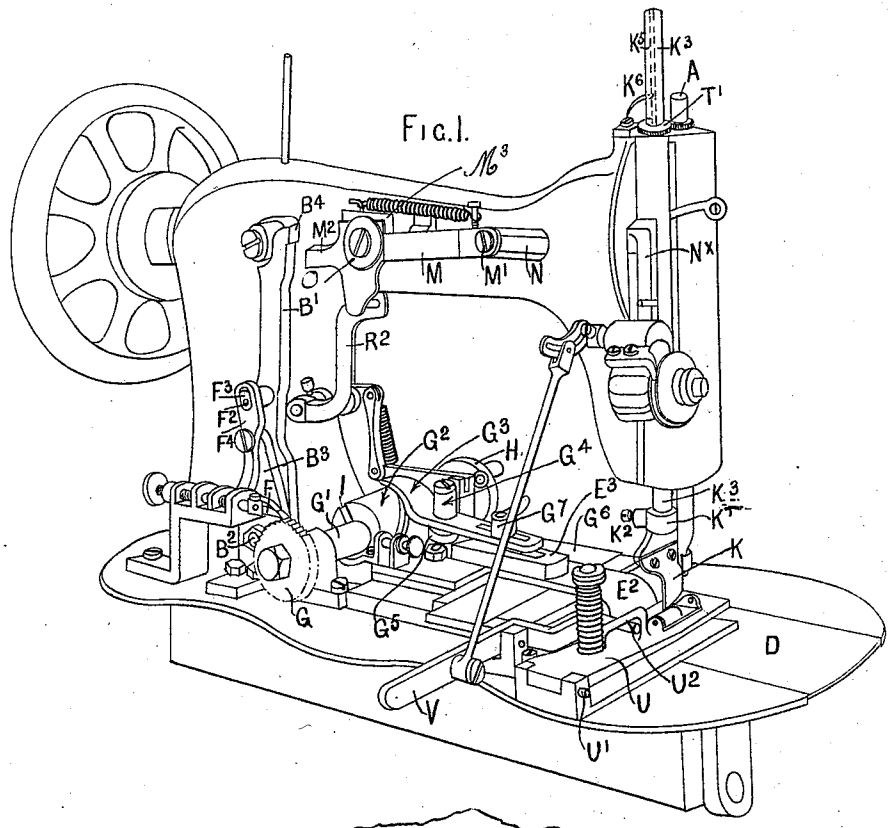
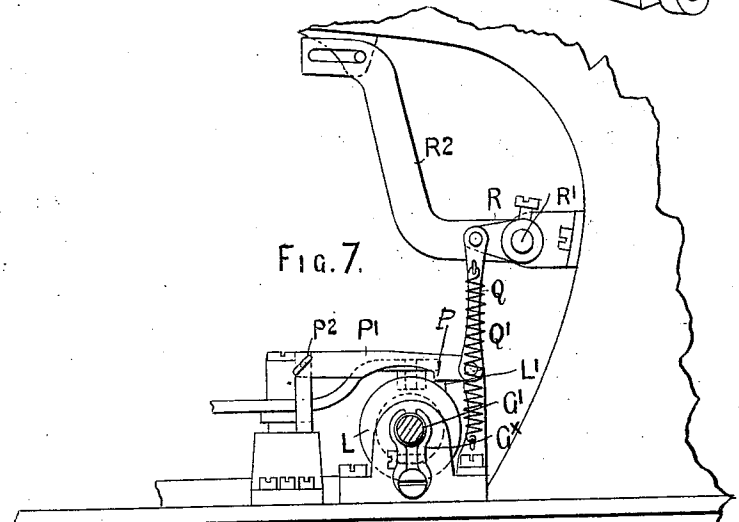


Fig. 7.



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(No Model.) 4 Sheets—Sheet 2.

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BUTTONHOLE SEWING MACHINE.

No. 562,003. Patented June 16, 1896.

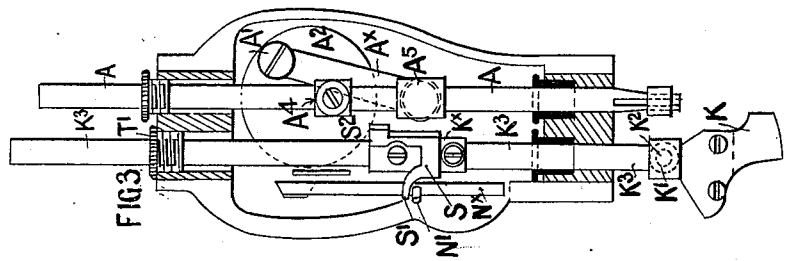

FIG.3

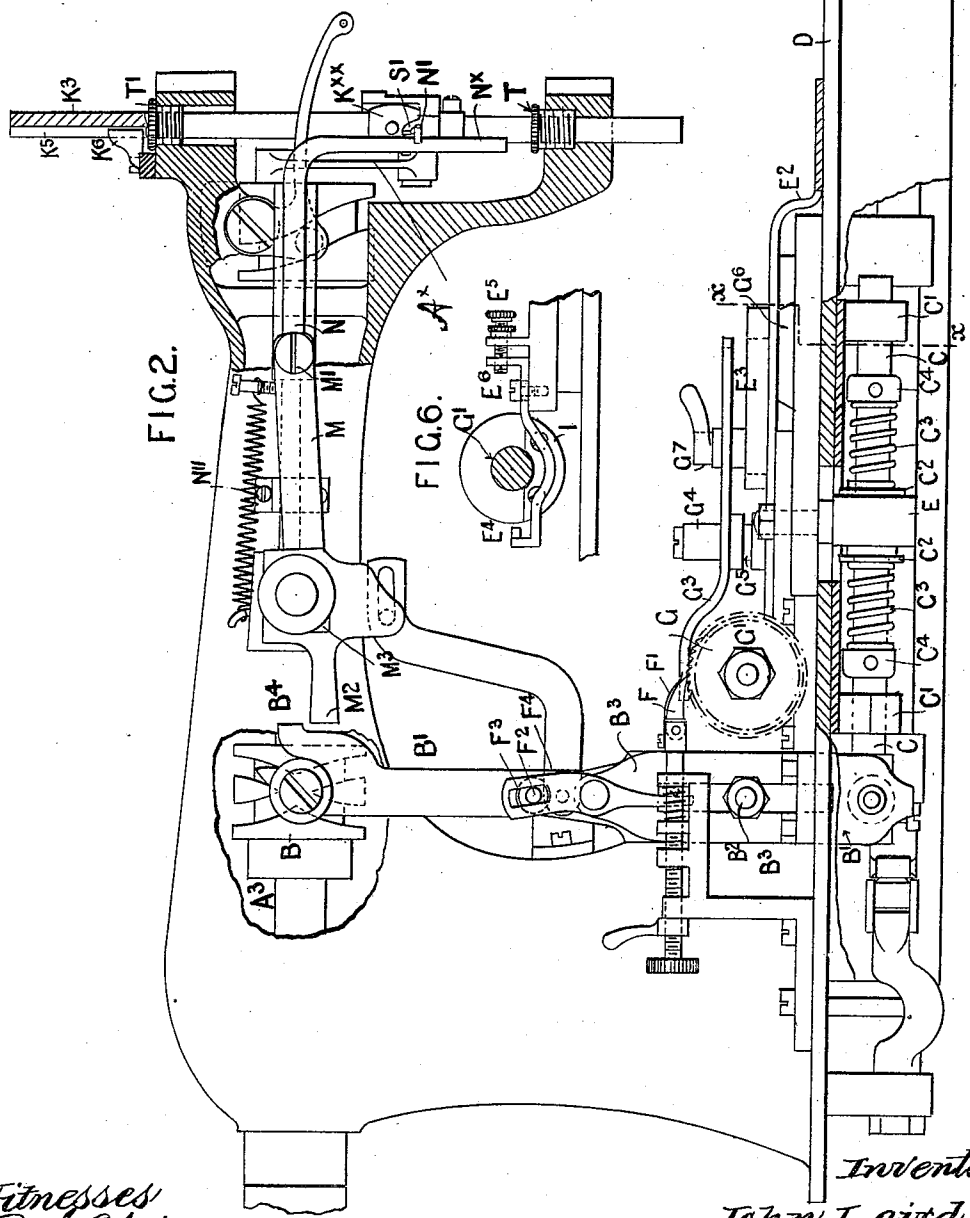

FIG.2.

FIG.6.

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BUTTONHOLE SEWING MACHINE.

No. 562,003. Patented June 16, 1896.

FIG. 4.

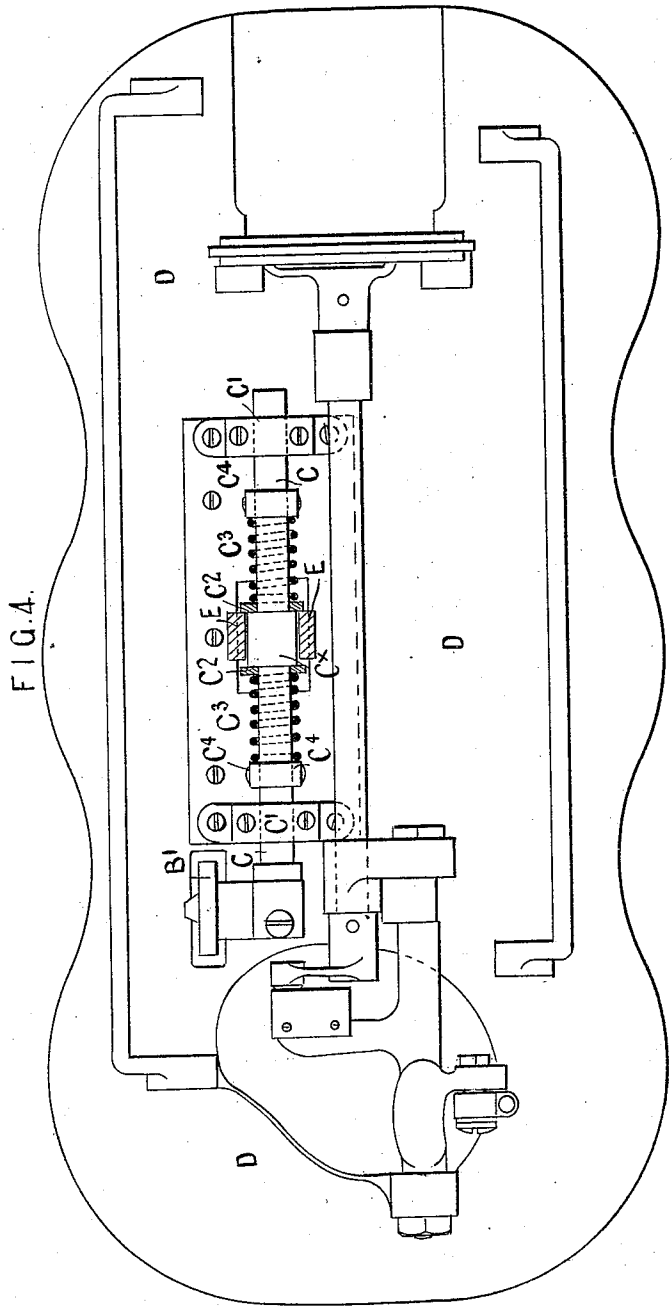
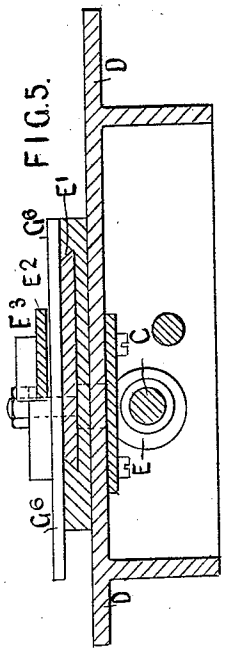


FIG. 5.



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(No Model.) 4 Sheets—Sheet 4

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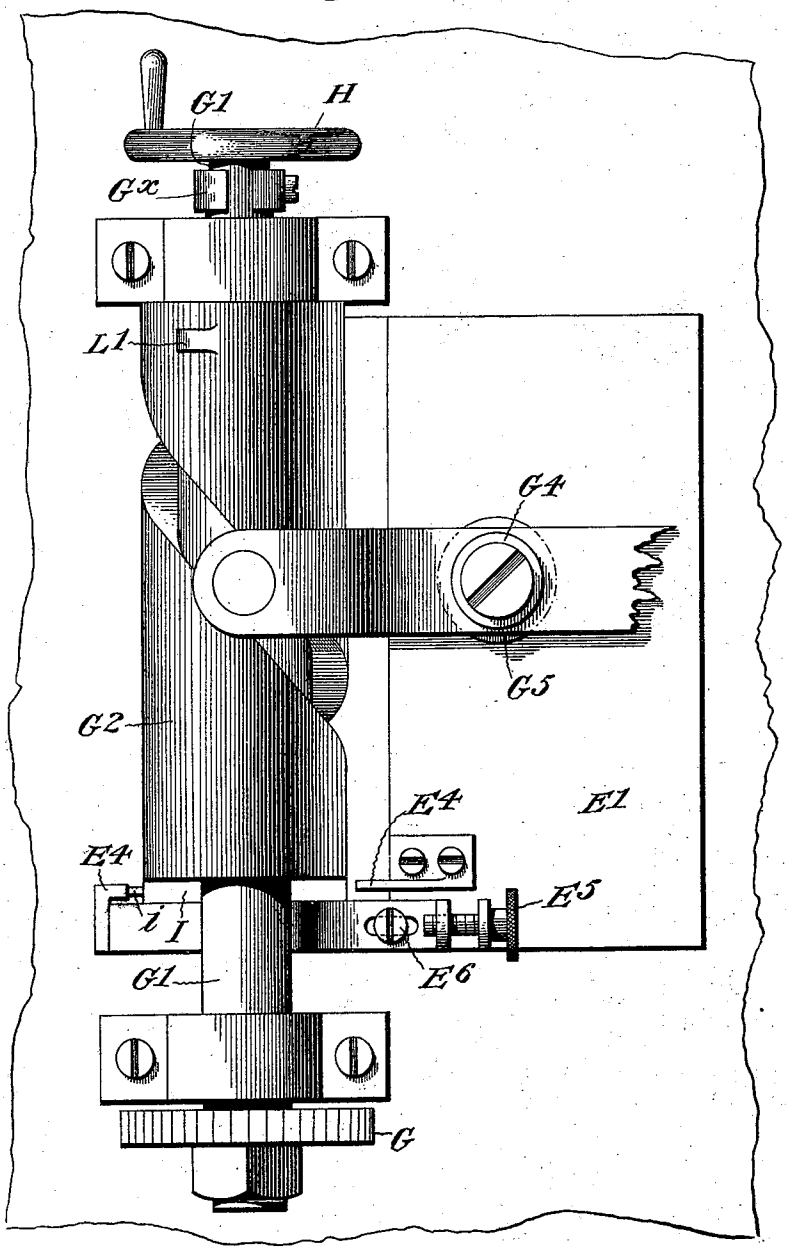
BUTTONHOLE SEWING MACHINE.

No. 562,003. Patented June 16, 1896.

Fig. 6.a



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UNITED STATES PATENT OFFICE.

JOHN LAIRD, OF BELFAST, IRELAND, ASSIGNOR OF TWO-THIRDS TO THE HOPE STREET FACTORY, LIMITED, OF SAME PLACE.

BUTTONHOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 562,003, dated June 16, 1896.

Application filed November 5, 1894. Serial No. 527,895. (No model.) Patented in England June 19, 1894, No. 11,876; in France October 25, 1894, No. 242,385; in Belgium October 25, 1894, No. 112,429; in Germany October 27, 1894, No. 86,084; in Austria January 5, 1895, No. 57, and in Canada January 23, 1895, No. 47,988.

To all whom it may concern:

Be it known that I, JOHN LAIRD, engineer, a subject of the Queen of Great Britain, residing at Belfast, in the county of Antrim, Ireland, have invented certain new and useful Improvements in Buttonhole-Sewing Machines, (for which I have obtained Letters Patent in Great Britain, No. 11,876, dated June 19, 1894; in France, No. 242,385, dated October 25, 1894; in Belgium, No. 112,429, dated October 25, 1894; in Germany, No. 86,084, dated October 27, 1894; in Austria, No. 57, dated January 5, 1895, and in Canada, No. 47,988, dated January 23, 1895;) 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this application.

These improvements are specially applicable in connection with the lock-stitch machines, and have for their object to simplify the construction and to improve the work, so as to produce a good buttonhole with straight crossover-bar at each end by automatic means.

In the accompanying drawings is shown a machine constructed according to this invention adapted to run at a very high speed, while working regularly and producing accurate work. This machine also automatically and while running cuts the slit for the buttonhole.

Figure 1 is a perspective view of said machine; Fig. 2, a sectional side elevation; Fig. 3, a front elevation with the cover removed, and Fig. 4 a plan of under side. Fig. 5 is a vertical cross-section on the line $x\,x$, Fig. 2; Fig. 6, a detail view of parts for effecting the travel of the cloth-plate; Fig. 6^a, a plan view of same, and Fig. 7 a detail view of parts for actuating the cutter-bar.

The needle-bar A is operated in any ordinary and suitable manner—such as, for instance, by a connecting-rod $A^\times$ from a crank A′ on a crank-disk A^2, which is fixed on the shaft A^3 in the arm of the machine. On this shaft is also fixed a switch-cam B, with a groove of two convolutions, whereby it operates a lever B′ once back and forth for every two revolutions of the shaft. This lever, which may be called the "main lever," is adjustable for altering the stroke of a sliding bar C under the bed-plate D of the machine, according to the required length of the stitch, said bar being operated by the lower arm of the main double-armed lever B′, that has its fulcrum on the pin B^2, which is adjustable up and down in a slot in the bracket B^3, fixed or cast on the bed-plate D.

The sliding bar C is guided in bearings C′ and passes freely through a lug E on the under side of the side slide E′, which latter works on the top of the bed-plate and serves to give the cloth-plate E^2 on the side slide E′ the side motion—that is to say, for the length of stitch along the two sides of the buttonhole. From the main lever B′ is also, by means of a pin F^2 with block F^3 in a slot in one arm of a double-armed lever F^4, which pivots on the bracket B^3, operated an adjustable pawl F with spring F′, which acts upon a pawl-wheel G on a feed-spindle G′, so as to give it one revolution during each buttonhole-sewing operation.

On the feed-spindle is fixed a groove-cam G^2, which, by a lever G^3, having its fulcrum at G^4 on a bracket G^5, fixed or cast on the bed-plate, operates the cross-slide G^6, forming part of the cloth-plate E^2 for moving it the length of the buttonhole. The cross-slide G^6 works between dovetail guide-pieces on the side slide E′. By an adjusting-pin G^7, which can be fixed anywhere in a slot in the lever G^3 and in a slot in the upper part E^3 of the cloth-plate E^2, the length of the travel is regulated in accordance with the length of the buttonhole. The feed-spindle G′ is provided with a hand-wheel H and has also a spring-clip brake $G^\times$, Figs. 6^a and 7, for holding it in the intervals when the pawl F is not active.

On the feed-spindle G′, and it may be against the cam G^2, as shown in Figs. 6 and 6^a, I fix a stop-piece I, Fig. 6, the edge i of which alternately comes in contact with one of the lugs E^4 on the side slide E′, except during the times that the barring operation is ef-

fected at each end of the buttonhole. As shown in Fig. 6, one of the lugs or stops E^4 on the side slide E′ is adjustable by means of a regulating-screw E^5 when the screw E^6 for fixing the said lug has been loosened, slots being provided for the said screw. This adjustment is effected according to the space which is to be left between the two rows of stitches.

The aforesaid sliding bar C is in the middle, where it passes through the lug E on the under side of the side slide E′, of enlarged diameter, as shown at $C^\times$, Fig. 4, and the bar is on each side of the enlargement $C^\times$ provided with a washer C^2, which, by a helical spring C^3, is pressed against the one side or the other of the enlarged part $C^\times$. C^4 C^4 are collars with set-screws for adjusting the tension of these springs.

The barring-stitches at each end of the buttonhole are made when the stop-piece I is in the position shown in Fig. 6. The said stop-piece I on the feed-spindle G′ works alternately together with one or other of the two lugs E^4, and thus alternately shortens the whole length of the stroke of the sliding bar C in the one direction or the other to the extent of half the stroke, so that the side slide E′ then only moves to the extent of the other half-stroke; but during the intervals between the actions of the stop-piece I, or when the latter is in the position shown in Fig. 6, the lugs E^4 pass freely back and forth over said stop-piece I, so that the sliding bar C gives the side slide E′ its full stroke—that is to say, performs the barring-stitches at each end of the buttonhole. When, however, the side slide E′ is held fast by one of the lugs E^4, the sliding bar C can slide in the lug or eye E. The one washer C^2 comes against one end of the enlarged middle part $C^\times$ of the sliding bar C, while the other washer C^2 moves a little distance away from the other end of the middle part $C^\times$, such distance being equal to the half-stroke of the sliding bar C during the barring, the last-named washer C^2 coming against the lug or eye E; but when the stop-piece I is not acting—that is, when the side slide E′ can follow the sliding bar C unhindered—then the washers C^2 are pressed equally against the lug or eye E, and the latter, along with the side slide E′, have the same motions as the sliding bar C. The actions of the washers C^2 are reversed according to the side of the buttonhole which is being sewed.

By the described positive driving of the cloth-clamp in the length direction and cross direction without the application of tooth-wheel gear the advantage is gained that the machine can be driven at a great speed; but in order to avoid all stoppages and consequent loss of time I provide it with a cutter for making the buttonhole-slit automatically and in the right moment. Moreover, the cutter is raised without the use of a spring, and the slit is cut while the machine runs at full speed, and yet accurately and at right angles to the cloth-clamp movement, and so that the cutter cannot be moved except the machine is running.

The cutter or knife K for cutting the hole is fixed detachably by screws to a shoe-piece K′, which, by a set-screw K^2, is fixed to the knife-bar K^3 on the front end of the "arm" of the machine by the side of the needle-bar A, and is operated by the following means: On the feed-spindle G′, as shown in Fig. 7, is fixed a small disk L with lift-cam L′, which, at the proper moment by the intervention of a connection from the main lever B′, operates the knife-bar K^3, or rather puts it into gear with the needle-bar A, so that the latter carries the knife-bar down with it and forces it through the cloth and thereupon raises it again. The projection B^4 on the main lever B′ operates against the end M^2 of a bar M when the part M^2 is raised fair with the projection B^4. The bar M has its fulcrum-pin M′ on a bar N, which can slide in guides on the side of the arm of the machine at the head end. The pin O, fixed in the arm of the machine and passing through a square slot M^3 in the bar M, guides the latter somewhat in its movements, but with a little play in both directions. When the projection B^4 on the main lever B′ comes against the end M^2 of the sliding bar M, the latter and the sliding bar N are by the cam B pushed to the front of the machine.

To raise the end M^2 of the bar M into the position for being operated by the cam B, the lift-cam L′, once in every revolution of the feed-spindle G′—that is to say, every time a buttonhole has been all but finished—comes against a projection P on the end of a lever P′, having its fulcrum at P^2. The lever P′ is by a link Q connected to the lever R on a shaft R′, which also carries a lever R^2. The latter is by slot and pin connected to the bar M. The spring Q′ is connected to the link Q and to the bed-plate, and serves to keep the lever P′ against the lift-cam L′.

The sliding bar N is continued in front into a downwardly-extending bar $N^\times$, which engages with a fork S′ on the socket S, that can turn freely between a collar $K^\times$ and a collar $K^{\times\times}$ on the cutter-bar K^3, Fig. 3, and turns the said socket around so far that the lug S^2 comes under the block A^4 and above the block A^5. These blocks are fixed on the needle-bar A, so that in the descent of the latter the block A^4 comes against the lug S^2 and carries the cutter-bar K^3 down, and the cutter K cuts the buttonhole-slit in the material. In the return or up stroke of the needle-bar A the block A^5 on it comes in contact with the lug S^2 and carries the cutter-bar up to its former or starting position, wherein it is held by the fork S′, resting on the pin N′ in the bar $N^\times$, until the next cutting operation takes place. The spring N′ returns the sliding bar N into its normal position. The cutter-bar K^3 is guided vertically at the lower end in the socket T and at the upper end in the socket

T′. The upper end of the cutter-bar K is provided with a longitudinal feather-way K^5, with which engages the feather K^6 on the head of the machine for guiding the cutter K accurately while cutting.

The presser-foot U is hinged at one end at U′ and can be raised by means of a treadle connected by a rod to the one end of the lever V, the other end of which takes under a staple U^2 on the presser-foot U.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a buttonhole-sewing machine, a switch-cam on the needle-bar-driving spindle which rotates in the upper part of the machine, in combination with a main lever the upper end of which engages with the switch-cam, a feed-spindle, a pawl-wheel thereon, a pawl operated from the main lever for propelling the pawl-wheel, frictional means for holding the latter during the return stroke of the pawl, a groove-cam on the feed-spindle, a lever engaging therewith, the cloth-clamp reciprocated laterally thereby, a sliding bar arranged under the bed-plate and reciprocated by the lower part of the main lever, the side slide, and elastic connections between the sliding bar and the side slide for the purpose of effecting the feed of the latter at about half the length of stitch along the sides of the buttonhole and the full length of stitch for barring at the ends, substantially as set forth.

2. In a buttonhole-sewing machine, a switch-cam on the needle-bar-driving spindle, and a main lever B engaging with the cam and provided with adjustable or shifting fulcrum for altering the length of stitch, in combination with the sliding bar C with enlarged part $C^\times$, the washers C^2 C^2, springs C^3 C^3, and abutments C^4 C^4, the side slide E′ with lug E between the washers C^2 and with stops E^4 E^4, the feed-spindle G′, the pawl-wheel G thereon, a pawl gearing with said wheel and operated from the main lever, a friction-brake for holding the pawl-wheel and spindle G′ during the return stroke of the pawl, and the lug I on the feed-spindle, which lug while the barring-stitches are being made is free of the stops E^4 and allows the side slide E′ to have its full stroke but which comes with its edge against the said stops and limits the stroke of the said slide and thus shortens the stitches made along the sides of the buttonhole, substantially as set forth.

3. The combination with the side slide E′ provided with stops E^4, of the spindle G′ having a step-by-step movement and provided with a lug I of such shape that said stops E^4 alternately butt against said lug and pass by the same, whereby in the first case the stroke of the side slide is limited in the formation of the stitches along the edges of the buttonhole, while in the latter case the said slide makes its full stroke during the formation of the barring-stitches, substantially as described.

4. The combination of the side slide E′ provided with an eye E, the sliding bar C passing through said eye, and the springs C^3 C^3 on the bar bearing on opposite sides of the aforesaid eye, whereby said bar C is enabled to carry along the side slide so long as the motion of the latter is not positively stopped, while said bar is enabled to move freely through the eye as soon as the motion of said slide is stopped, thereby compressing one of the springs, substantially as and for the purpose set forth.

5. The combination of the side slide E′ provided with an eye E, the sliding bar C having central enlarged portion $C^\times$ fitting said eye, the loose washers C^2 C^2 on opposite sides of such enlarged portion and the spiral springs C^3 C^3 on said bar C, having bearing on said washers, said parts arranged and operating substantially as and for the purpose set forth.

6. In a buttonhole-sewing machine, the feed-spindle G′ with means for stepwise rotating it and a brake for holding it in the intervals, in combination with a lift-cam L L′ on the feed-spindle, a lever P′, a link Q connected thereto, a lever R connected to said link, a lever R^2, a shaft R′ which carries said two levers, a bar M, the end M^2 of which, once after each buttonhole-sewing operation, is raised by the lift-cam, the main lever B′ with the projection B^4, the switch-cam B with which the main lever B′ engages, the sliding bar N connected to the bar M, the spring N′ connected to the bar N and to the arm of the machine, the cutter-bar K^3 with swiveling-socket S and collars $K^\times$ and $K^{\times\times}$, and the needle-bar A with collars A^4 and A^5 all so arranged that when the part S^2 of the socket is, by the lift-cam L L′, and the aforesaid connections between it and the socket turned in under the collar A^4, the cutter-bar is caused to be depressed so that the cutter pierces a hole in the material, whereupon the cutter-bar is raised again by the collar A^5 coming against the part S^2 of the socket S and the latter is turned back and the cutter-bar held in the raised position, substantially as set forth.

7. A buttonhole-sewing machine consisting of the following main operating parts which are arranged in connection with a bed-plate and an arm-framing thereon viz. a driving-spindle rotating in the arm-framing, the needle-bar driven thereby, a spindle below the bed-plate also driven thereby and fitted with switch-forming devices operating with the needle, suitable tension devices, needle-plate and presser-foot, a switch-cam on the driving-spindle, a main lever engaging therewith, a sliding bar arranged below the bed-plate and reciprocated by the main lever, a cloth-plate with side slide elastic connections between the sliding bar and the side slide, a feed-spindle driven by pawl-gear from the main lever, a cam thereon and fixed stops for varying the stroke of the cloth-plate while the stitches are made along each side of the buttonhole, a groove-cam on the feed-spindle, a

cross-slide on the cloth-plate, a lever mounted on adjustable fulcrum and meshing with said groove-cam and connected to the cross-slide for operating it and feeding the cloth along the length of a buttonhole and back, a lift-cam on the feed-spindle, a lever on the arm-framing operated thereby once in every buttonhole-sewing operation so as to raise it into contact with the main lever, a bar connected to the said lever and adapted to slide along the arm-framing and provided with a prolongation going down on the head of the arm-framing, a cutter-bar on the head adapted to work parallel with the needle-bar, a socket swiveling on the cutter-bar between an upper and a lower collar thereon and provided with a fork which engages with the aforesaid downgoing prolongation of the sliding bar on the arm-framing, an upper and a lower collar on the needle-bar between which said socket when turned is made to engage, whereby the needle-bar depresses the cutter-bar and the cutter thereon cuts the buttonhole-slit and then raises it, and a pin on the prolongation of the sliding bar for the fork of the socket to rest on, substantially as described.

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