No. 734,794. PATENTED JULY 28, 1903.

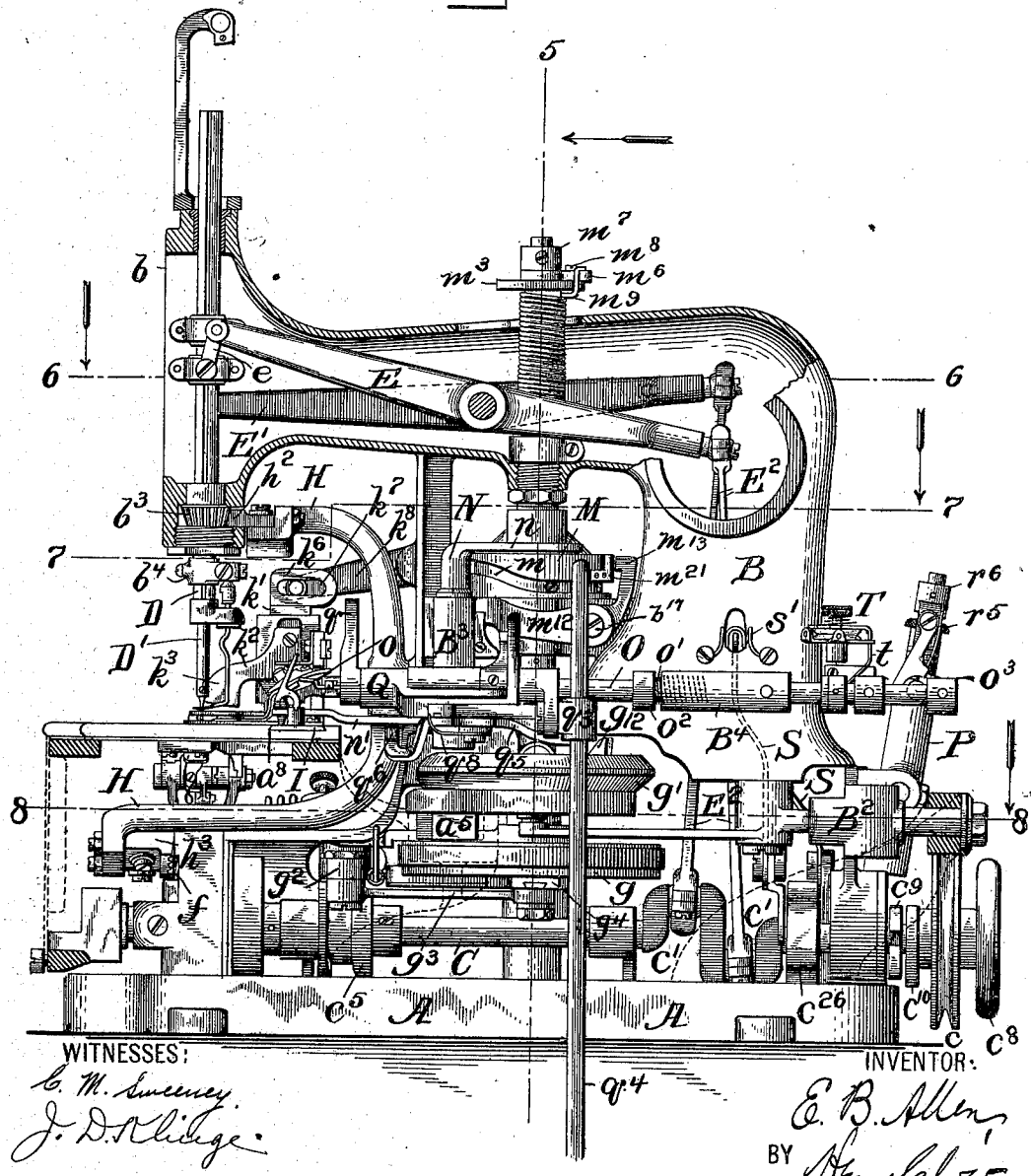
E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 1.

Fig. 1.



THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

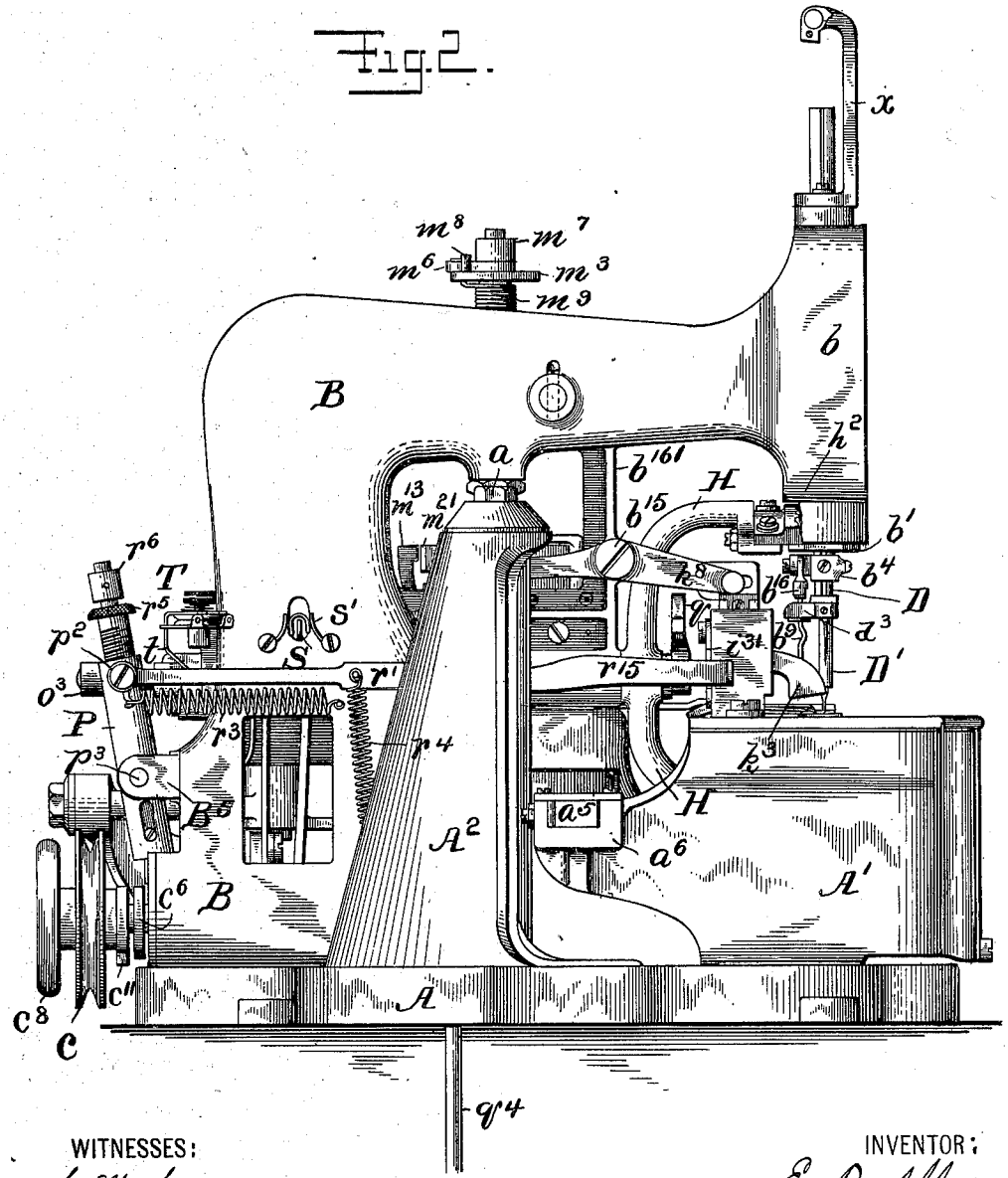
E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

C. M. Sweeney.

J. D. Klinge.

INVENTOR:

E. B. Allen.

BY Munn & Co.

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

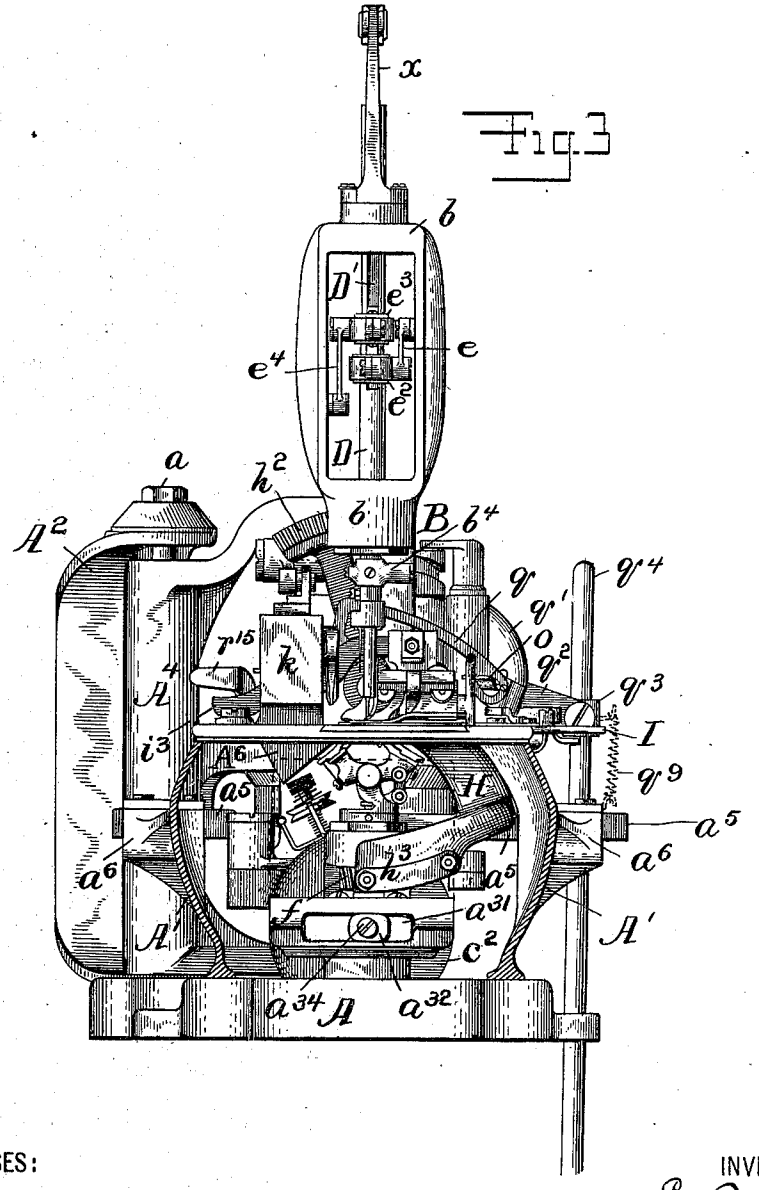
E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 3.

Fig. 3



WITNESSES:

C. M. Sweeney

J. D. Aldridge

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

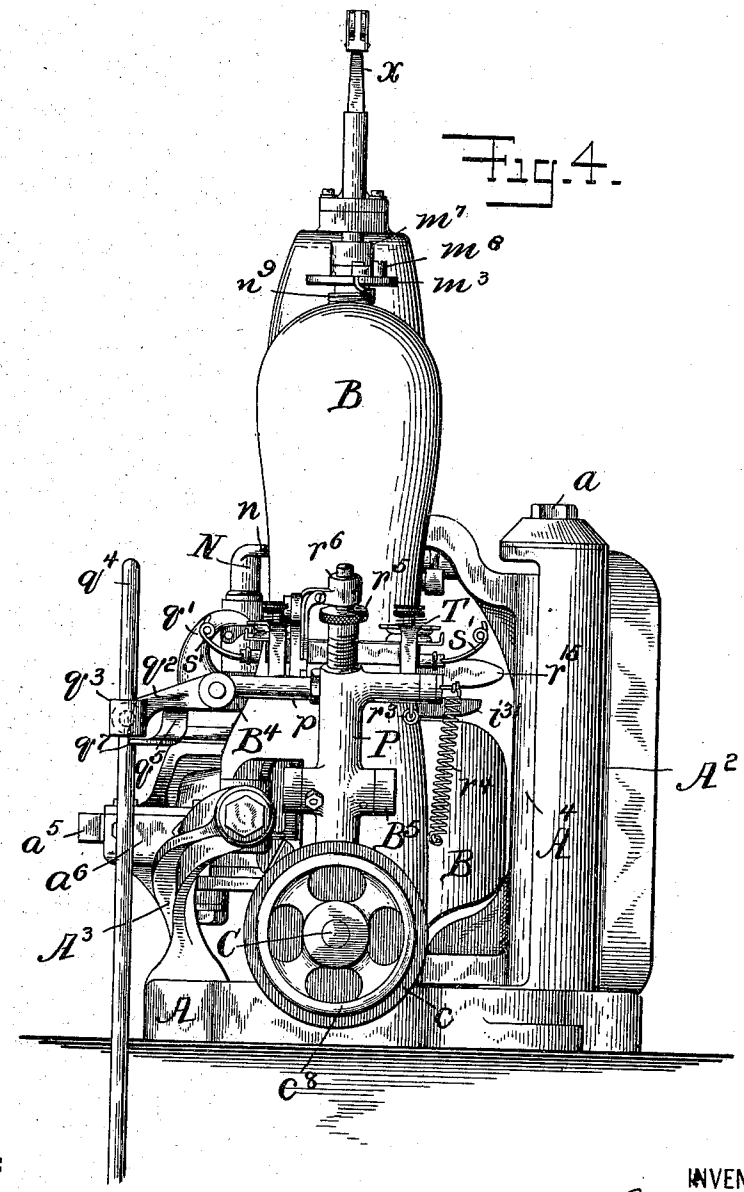
E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 4.

Fig. 4.



WITNESSES:

C. M. Sweeney

J. D. Kilduff

INVENTOR,

E. B. Allen

BY Henry Calver

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

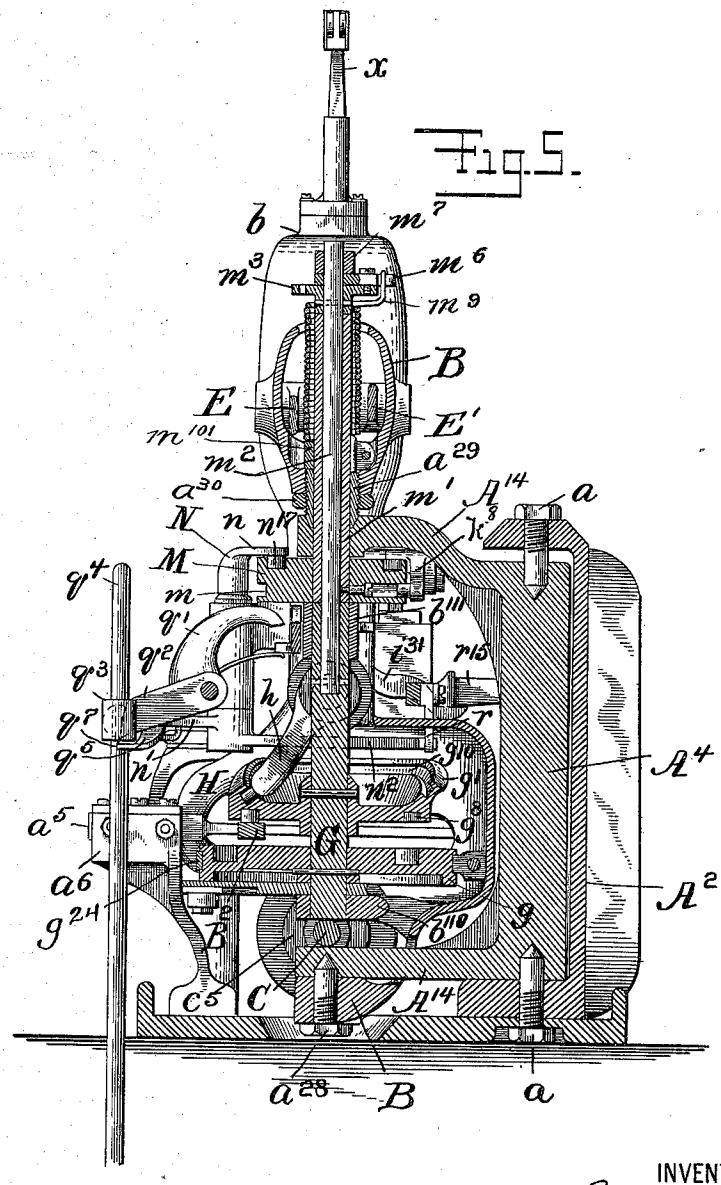
E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 5.

Fig. 5.



WITNESSES:

E. M. Sweeney

J. D. Whitney

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 6.

Fig. 6.

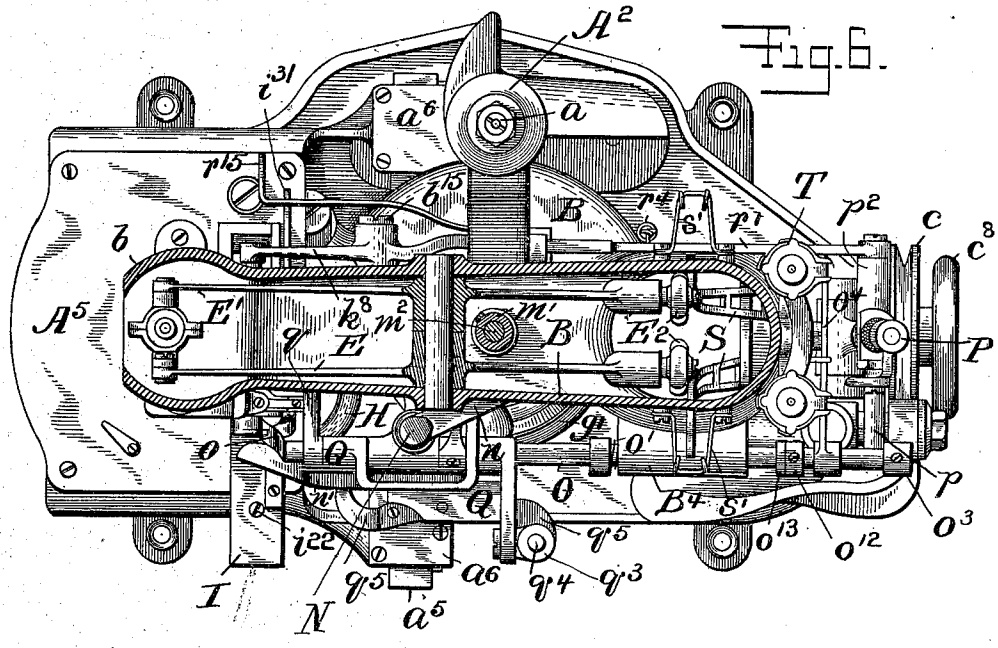
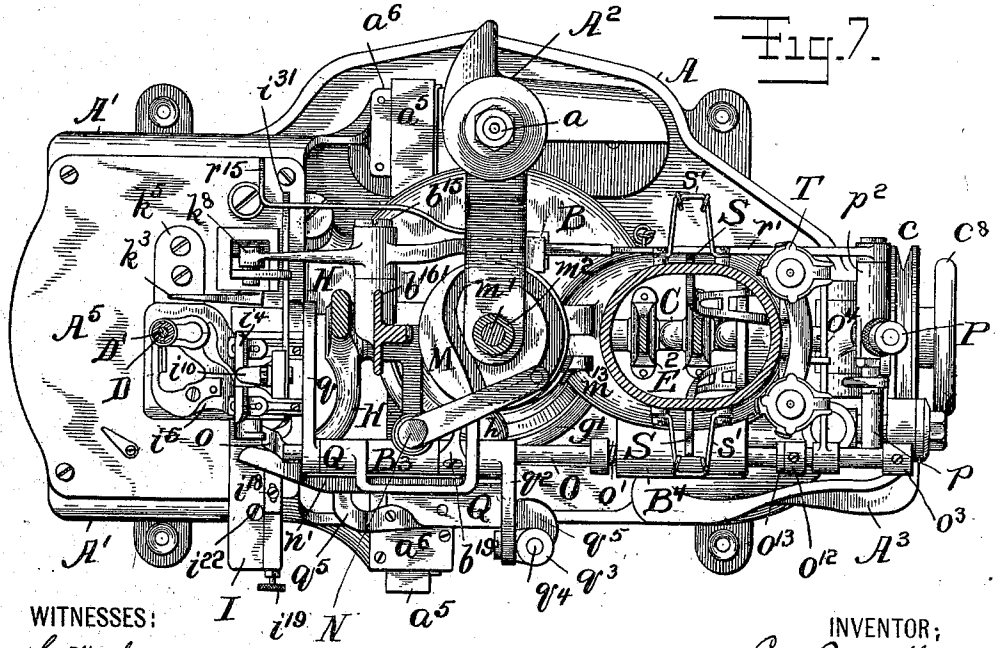


Fig. 7.



WITNESSES:

C. M. Sweeney

J. D. Wellington

INVENTOR;

E. B. Allen

BY Kenyon & Kenyon

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 7.

Fig. 8.

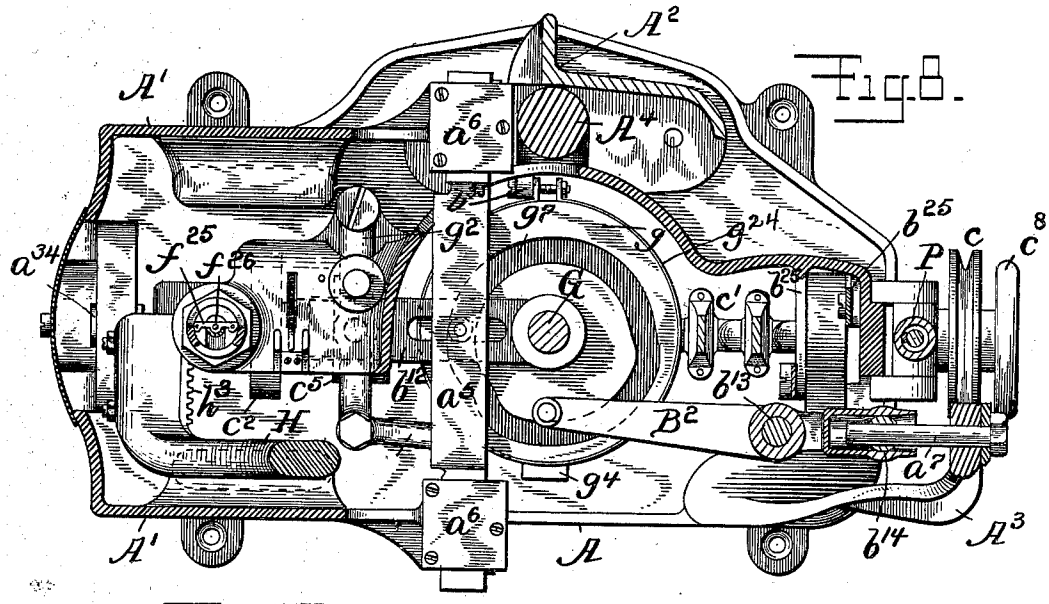


Fig. 47.

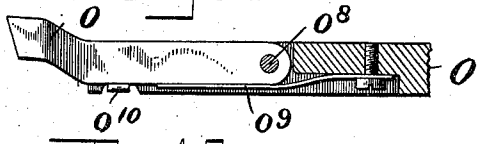
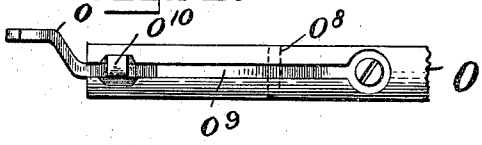


Fig. 48.



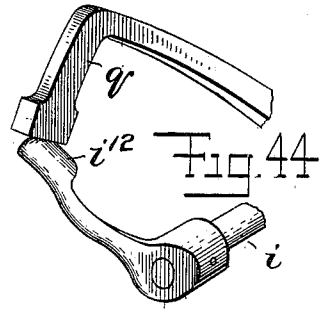
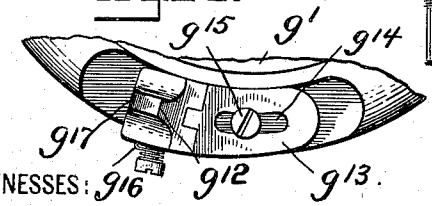


Fig. 44.

Fig. 50.



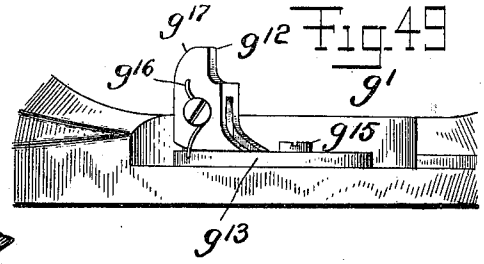


Fig. 49.

WITNESSES:

C. M. Sweeney.

J. D. Aldridge.

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 8.

Fig. 9.

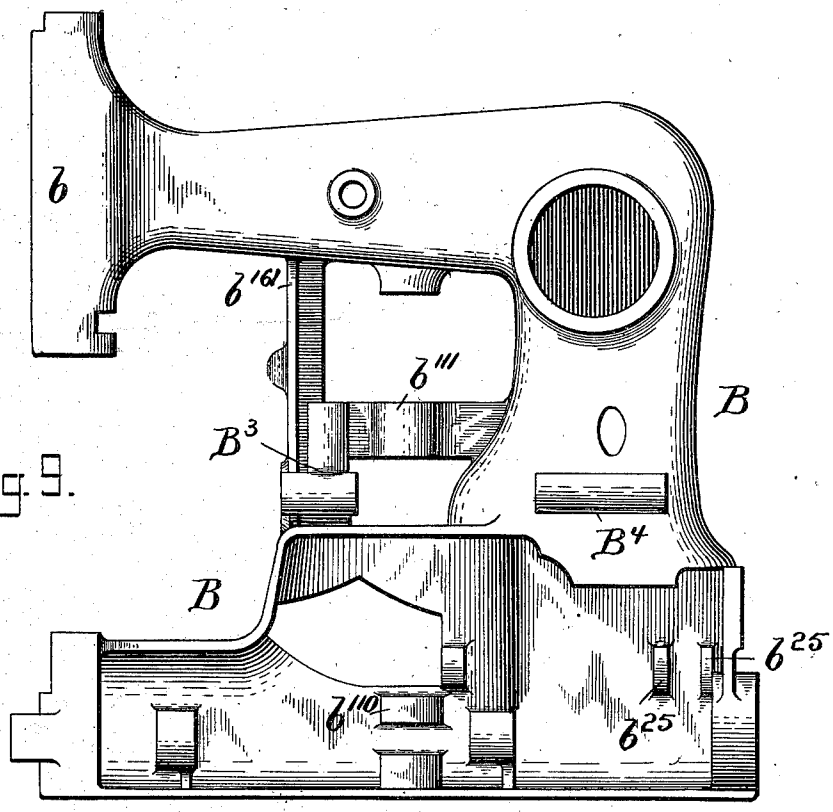


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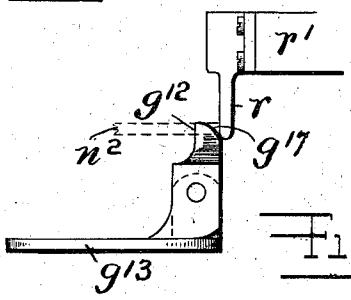


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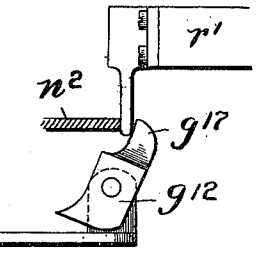
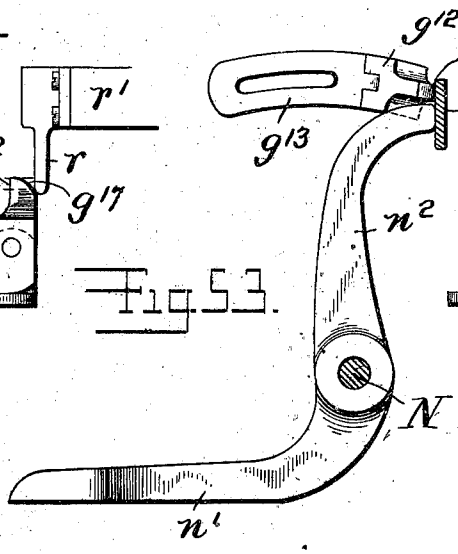


Fig. 53.



WITNESSES:

C. M. Sweeney

J. D. Aldridge

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 9.

Fig. 10.

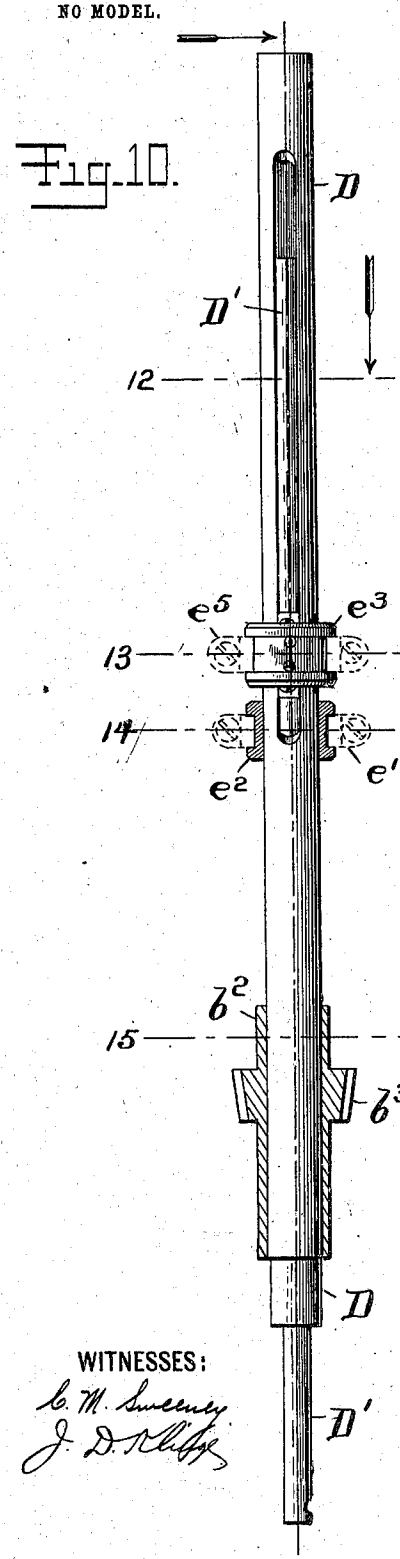


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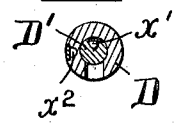


Fig. 13.

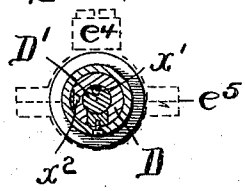


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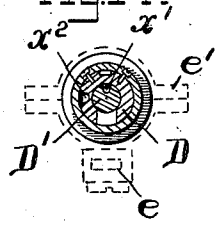


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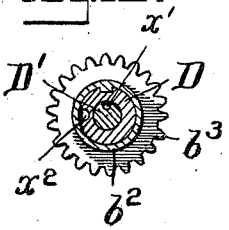


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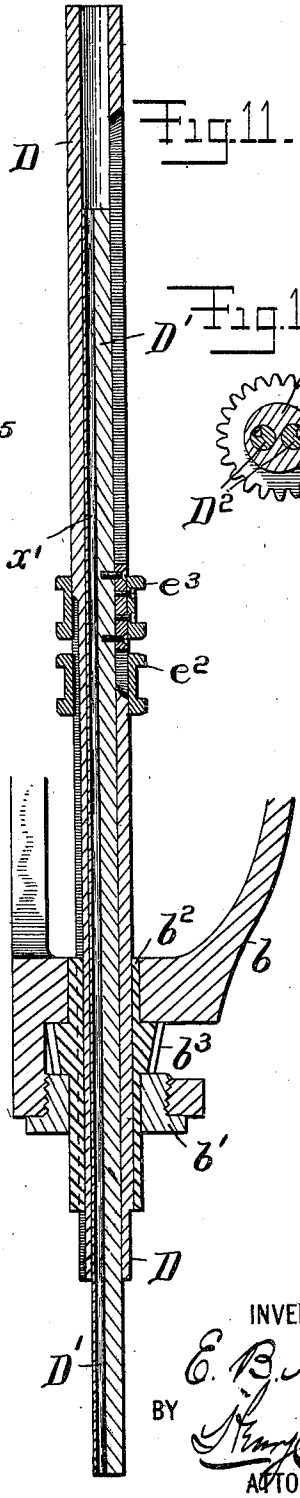


Fig. 16.

WITNESSES:

C. M. Sweeney

J. D. Phillips

INVENTOR:

E. B. Allen,

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 10.

Fig. 17.

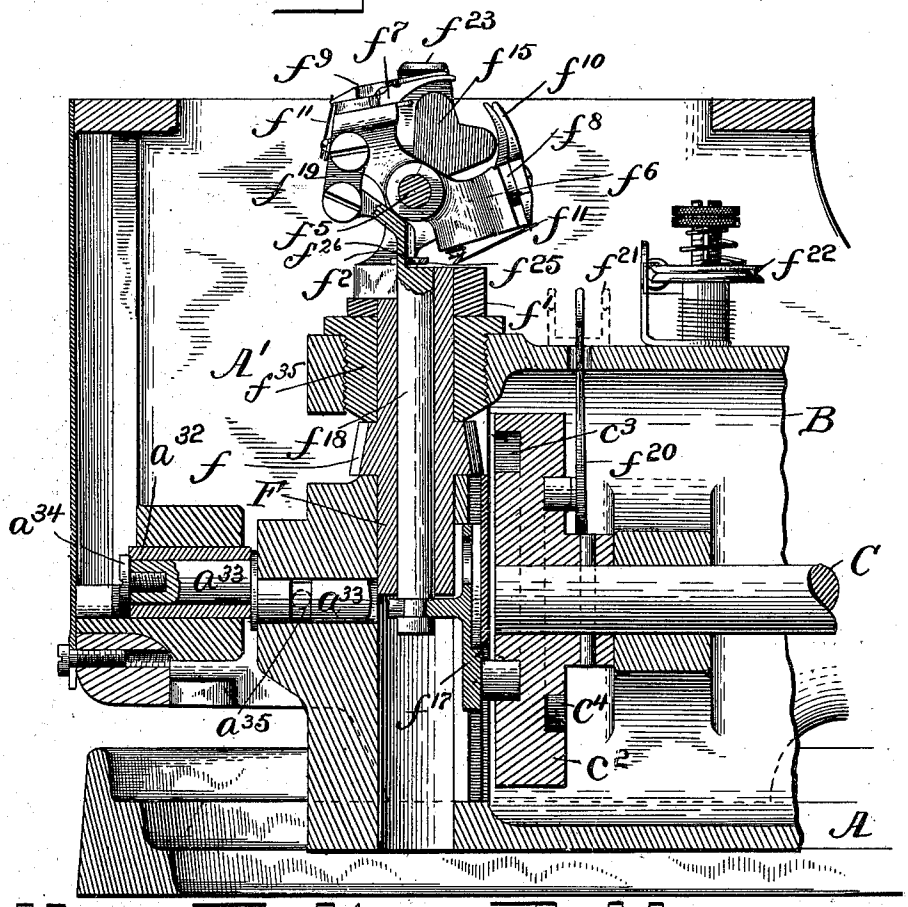


Fig. 60.

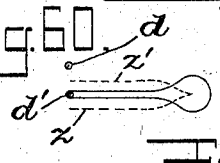


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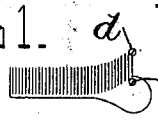


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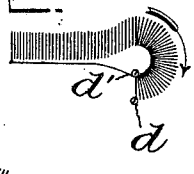


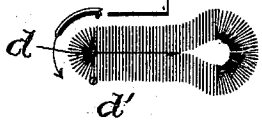
Fig. 63.



Fig. 64.



Fig. 65.



WITNESSES:

C. M. Sweeney

J. D. Kleffner

INVENTOR:

E. B. Allen,

BY Henry Calvert,

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 11.

Fig. 18.

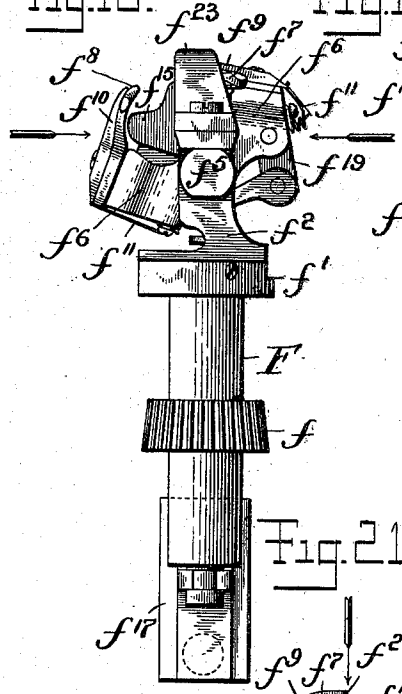


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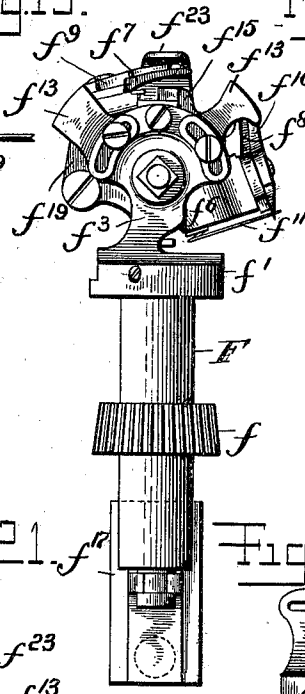


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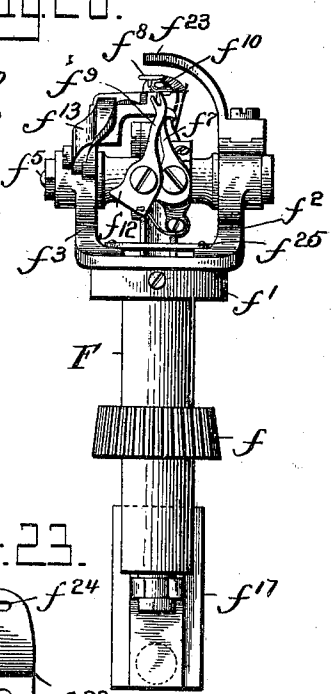


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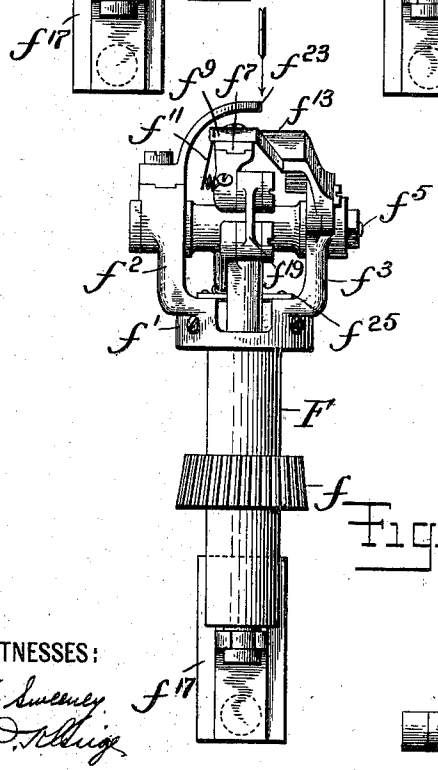


Fig. 23.

Fig. 22.

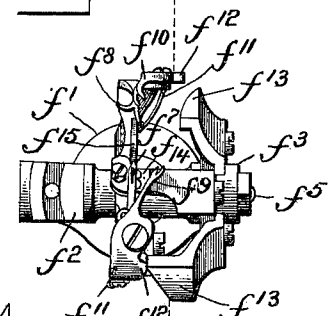
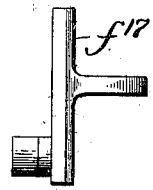


Fig. 24.



WITNESSES:

C. M. Sweeney

J. D. Skillings

INVENTOR:

E. B. Allen

BY Munn & Co.

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 12.

Fig. 25.

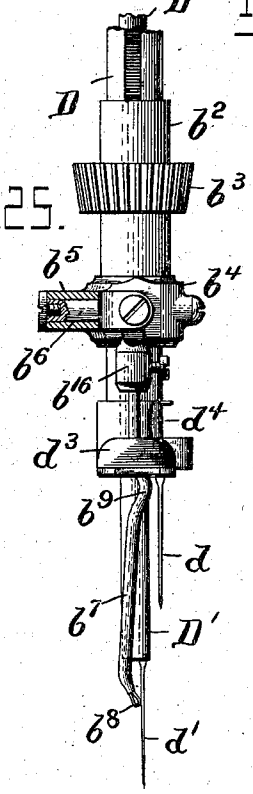


Fig. 26.

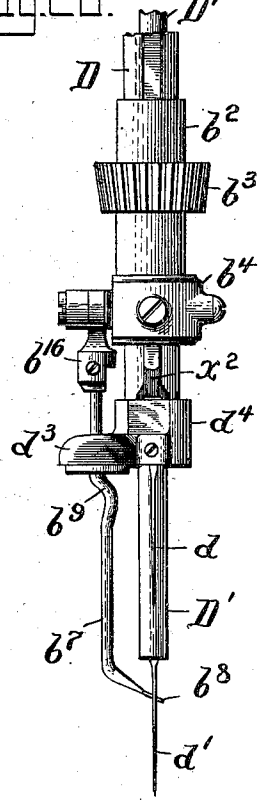


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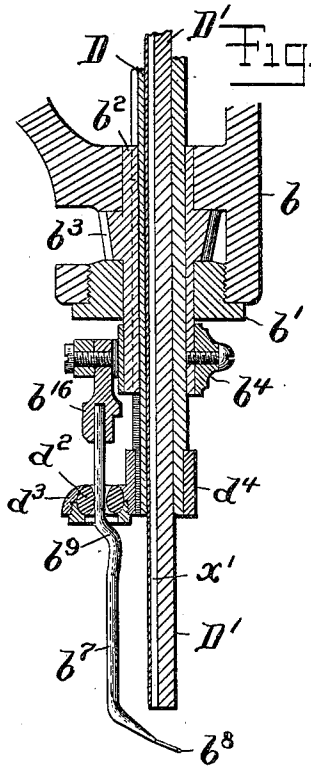


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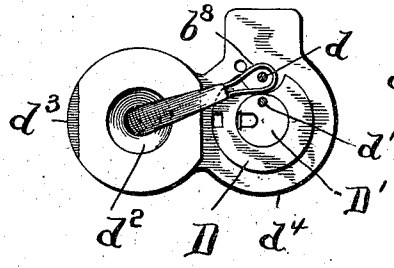
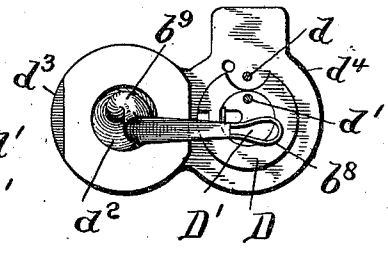


Fig. 29.



WITNESSES:

C. M. Sweeney

J. D. Slingluff.

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 13.

Fig. 30.

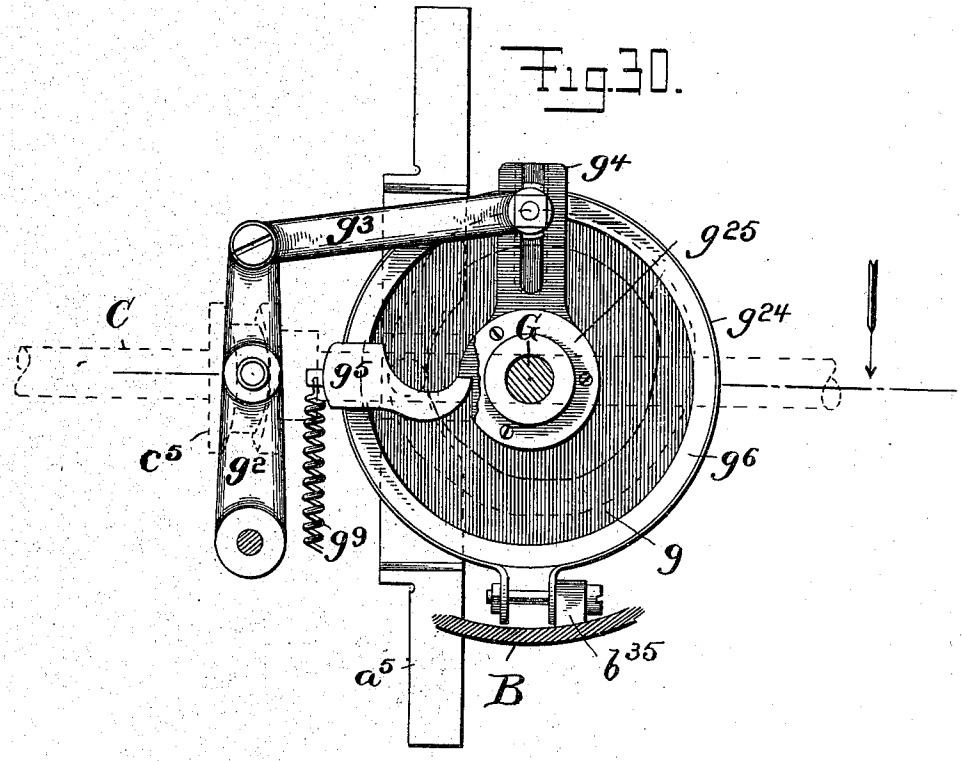
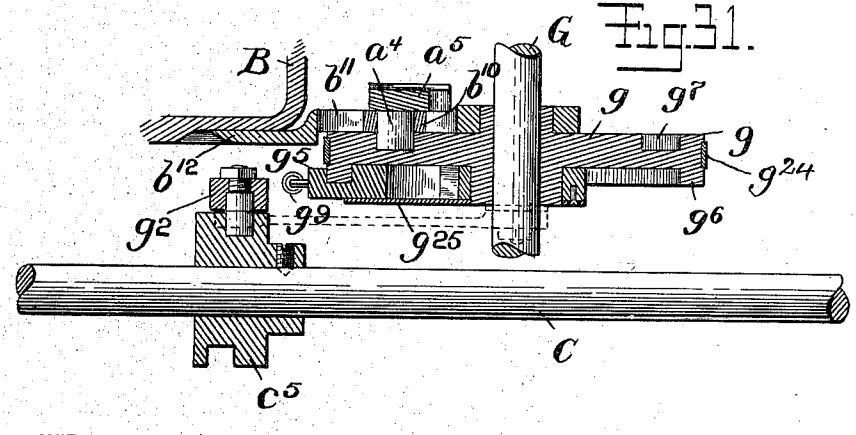


Fig. 31.



WITNESSES:

C. M. Sweeney

J. D. Kludge

INVENTOR:

E. B. Allen,

BY Henry Calvert,

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 14.

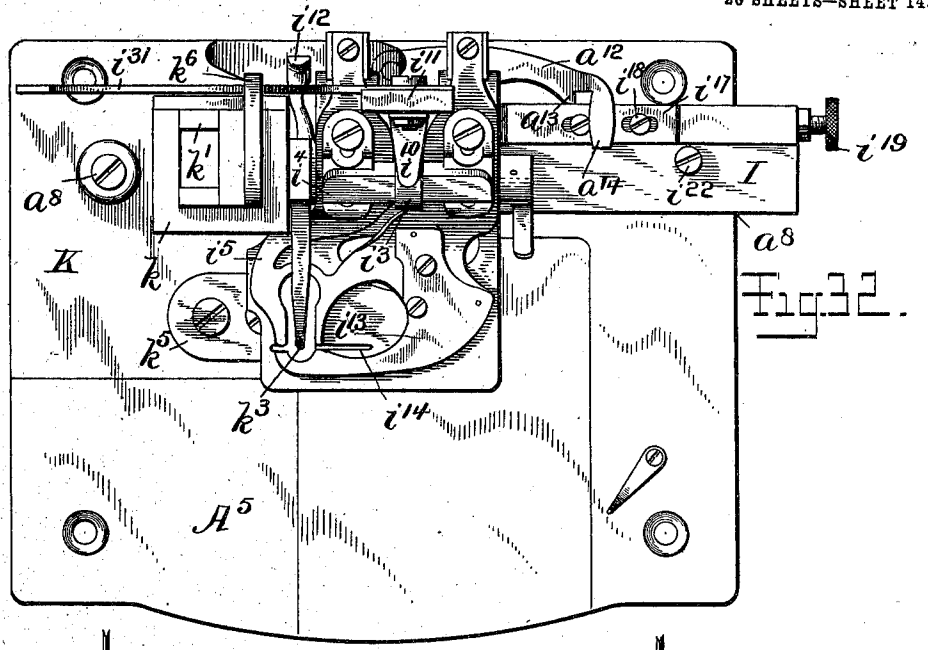


Fig. 32.

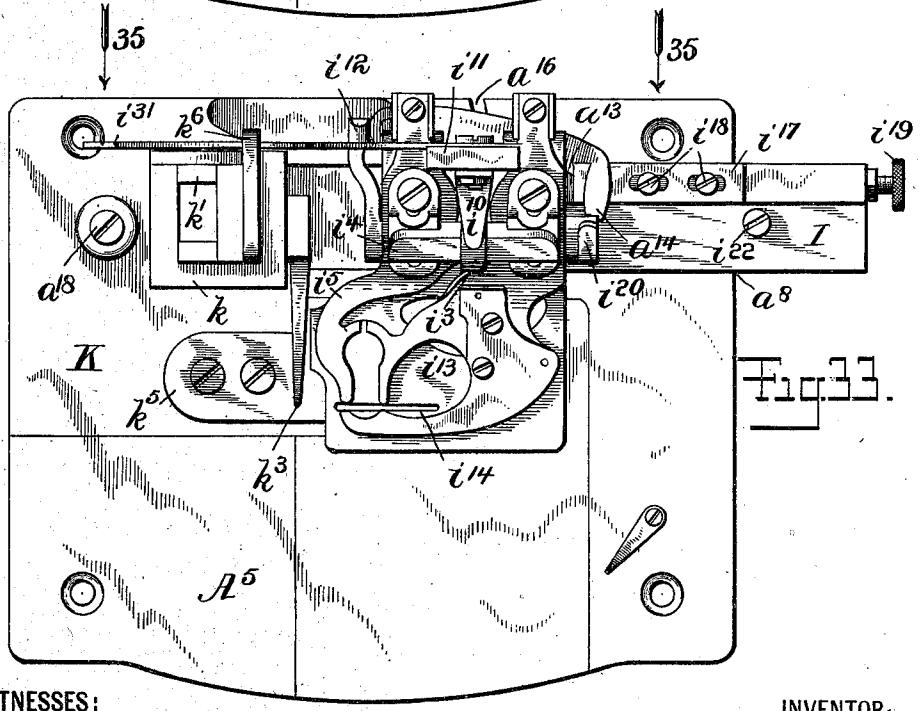


Fig. 33.

WITNESSES:

C. M. Sweeney

J. D. Aldridge

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 15.

Fig. 34.

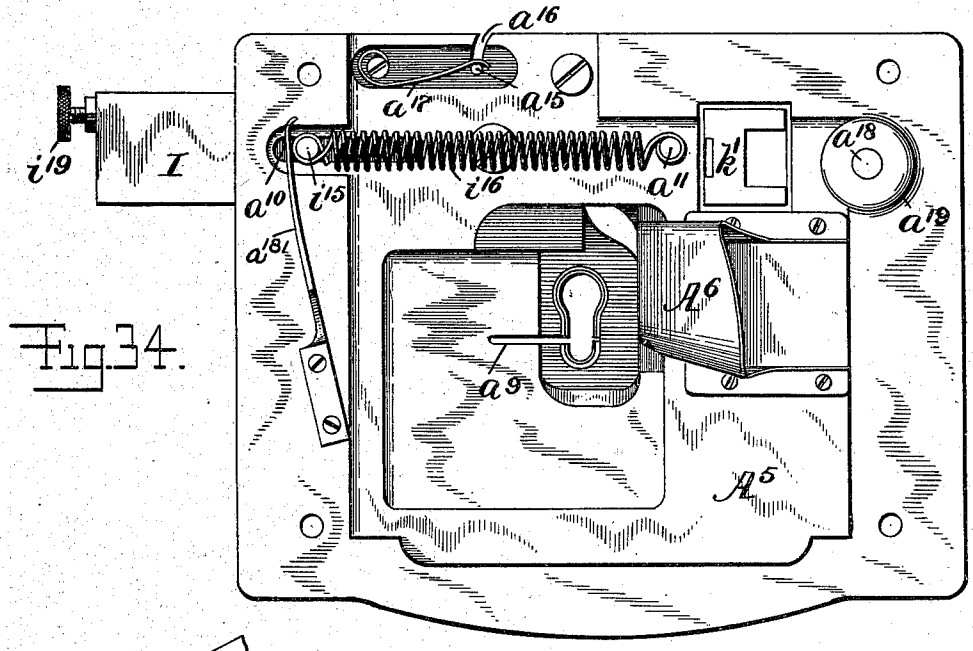


Fig. 36.

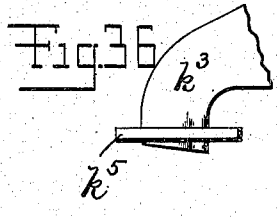


Fig. 37.

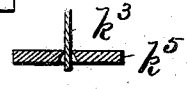


Fig. 35.

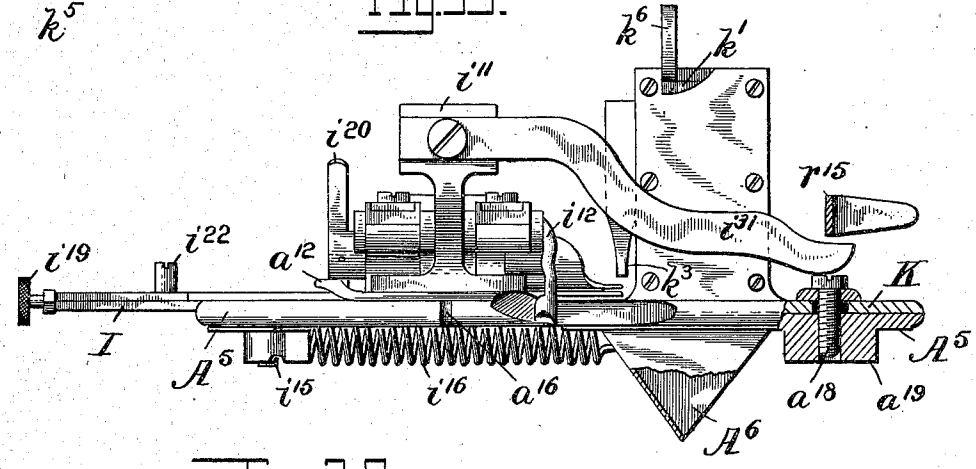


Fig. 38.

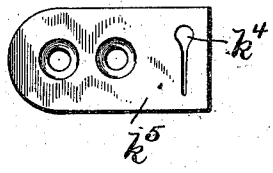
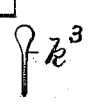


Fig. 39.



WITNESSES:

C. M. Sweeney

J. D. Albright.

INVENTOR:

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BY Henry Calvert,

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 16.

Fig. 40.

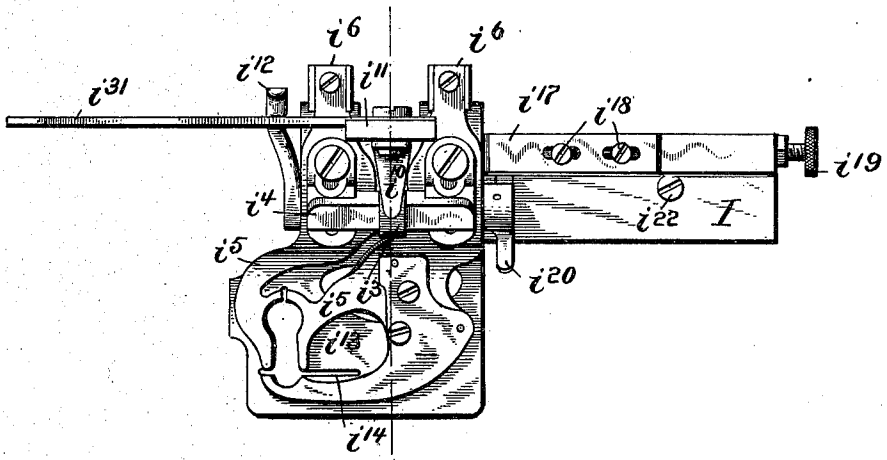


Fig. 41.

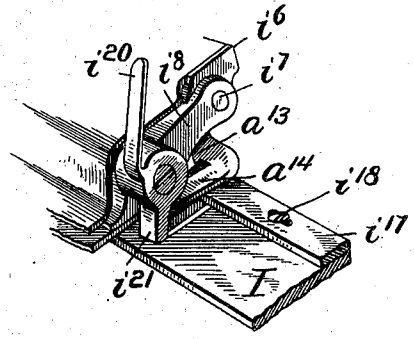


Fig. 42.

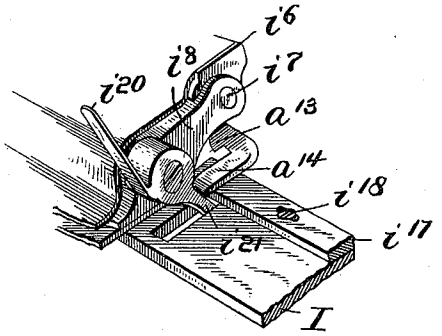
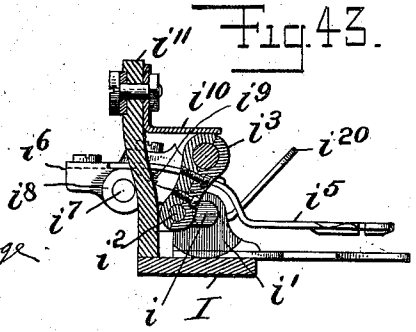


Fig. 43.



WITNESSES:

L. M. Sweeney

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No. 734,794. PATENTED JULY 28, 1903.

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BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 17.

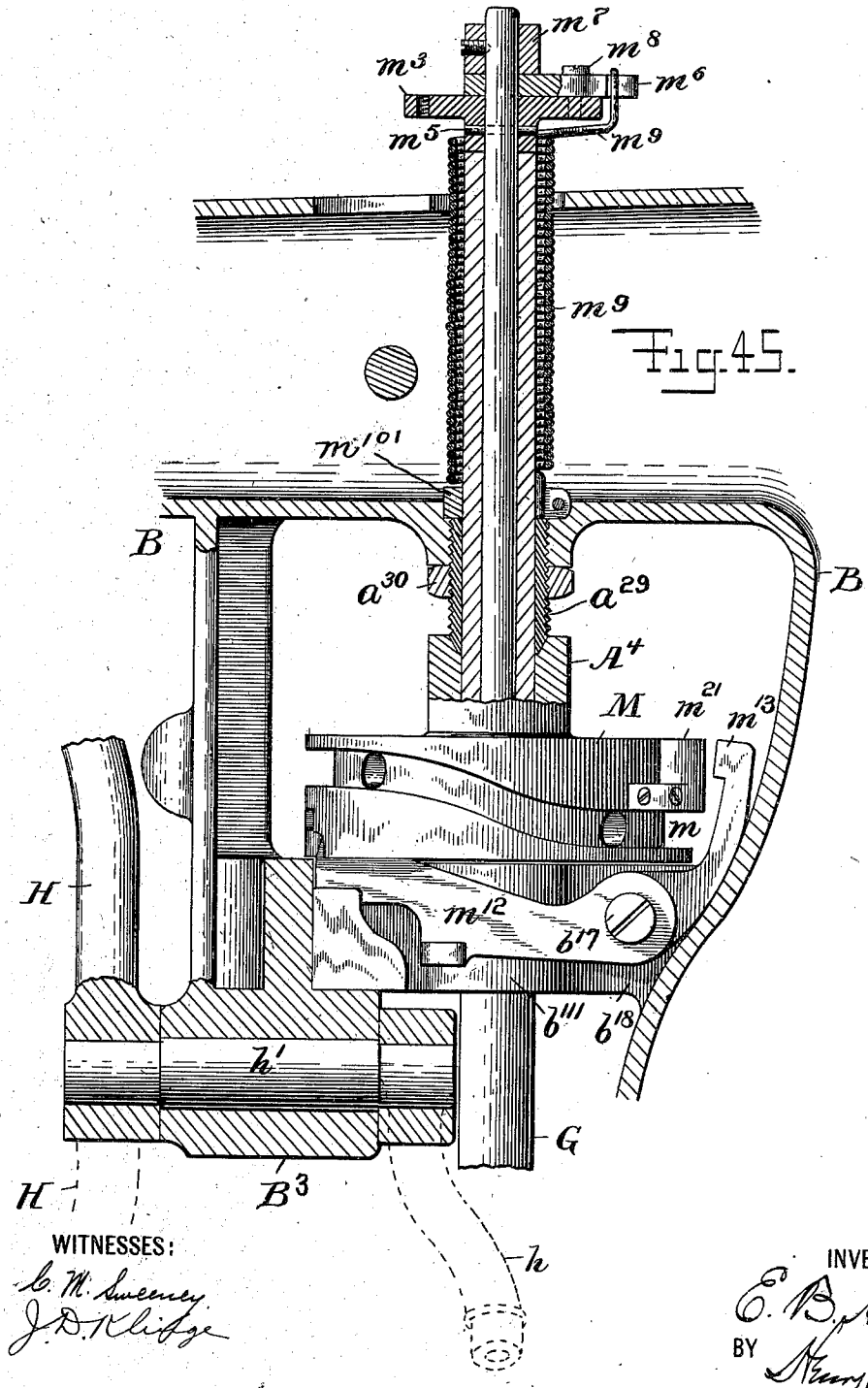


Fig. 45.

WITNESSES:

C. W. Sweeney

J. D. Kliefoth

INVENTOR:

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

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BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 18.

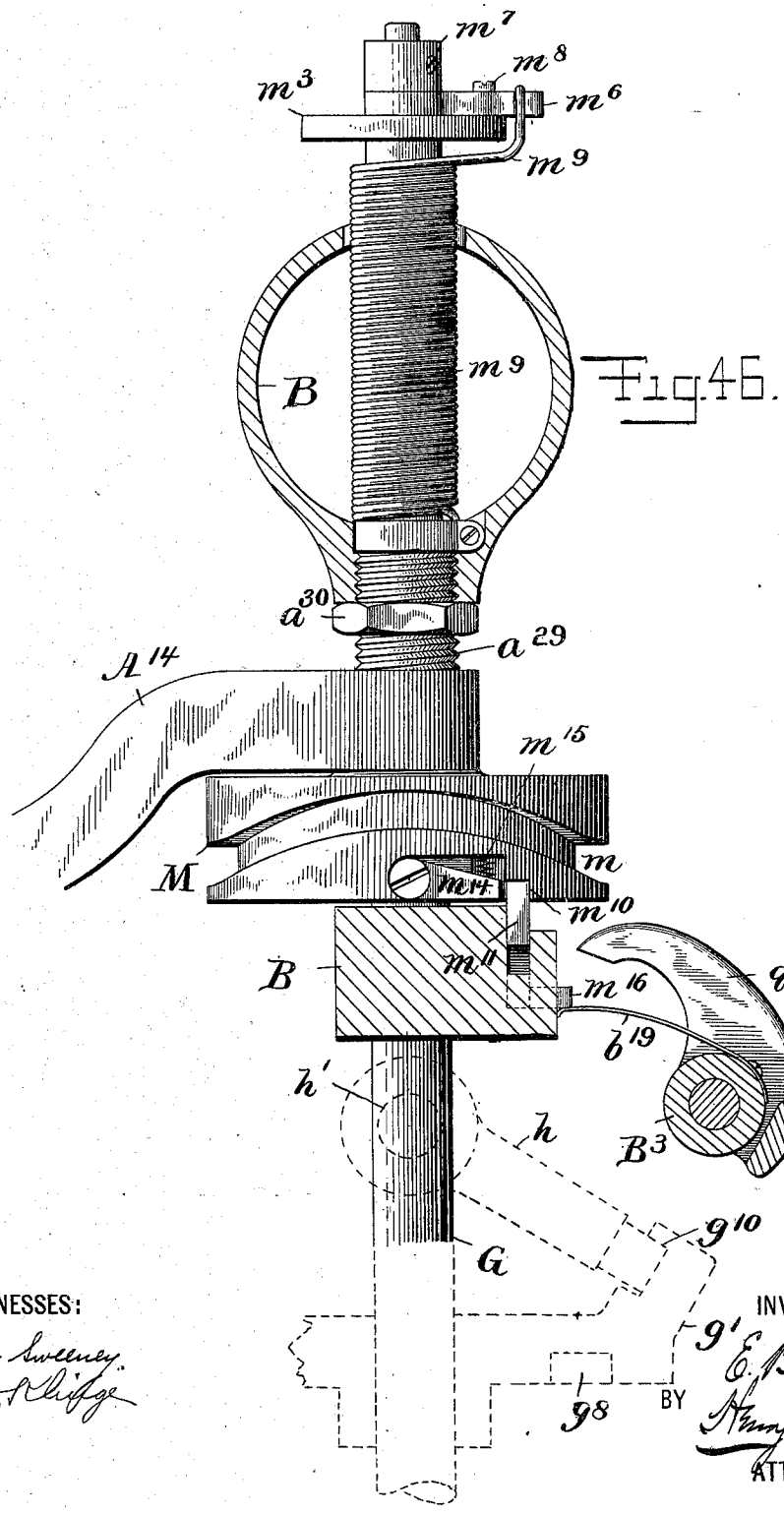


Fig. 46.

WITNESSES:

C. M. Sweeney.

J. D. Whipple.

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No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 19.

Fig. 54.

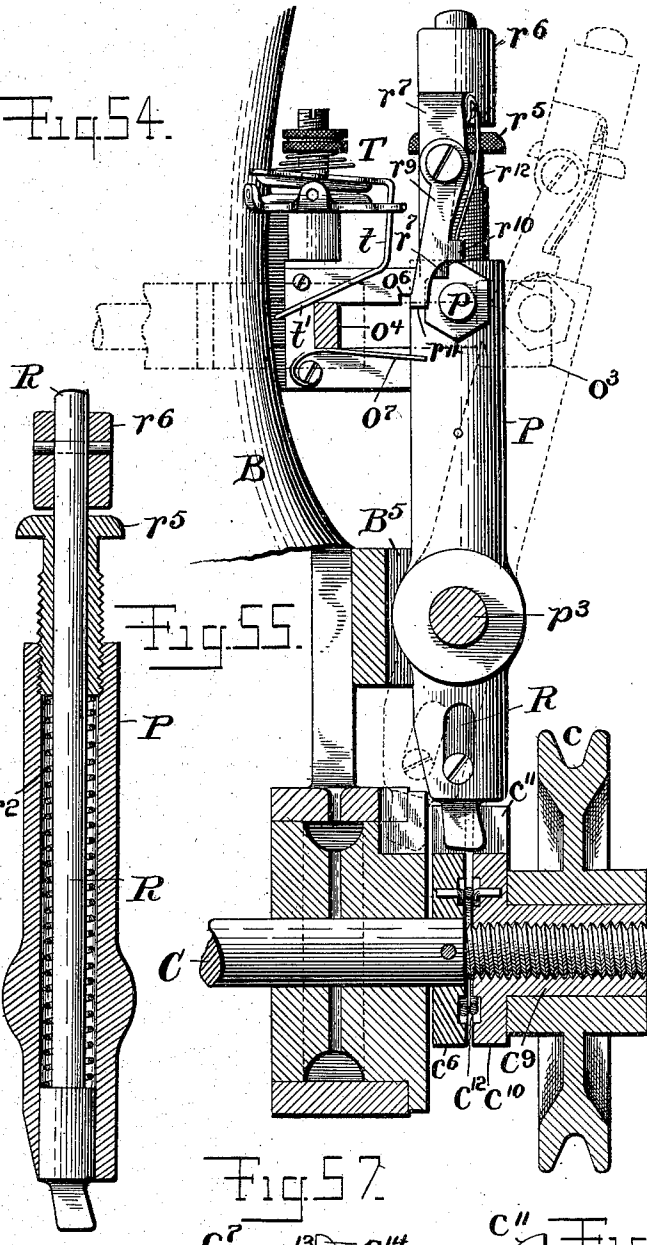


Fig. 56.

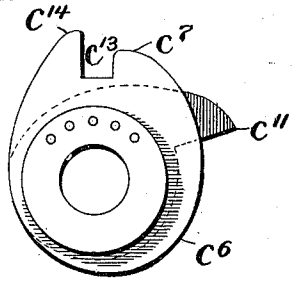
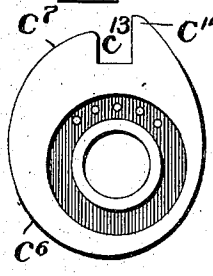
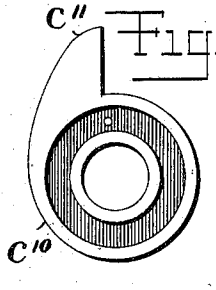


Fig. 57.



C11 Fig. 58.



WITNESSES:

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J. D. Kludge.

INVENTOR:

E. B. Allen

BY Henry Galvert

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. PATENTED JULY 28, 1903.

E. B. ALLEN.

BUTTONHOLE SEWING MACHINE.

APPLICATION FILED JULY 24, 1900.

NO MODEL. 20 SHEETS—SHEET 20.

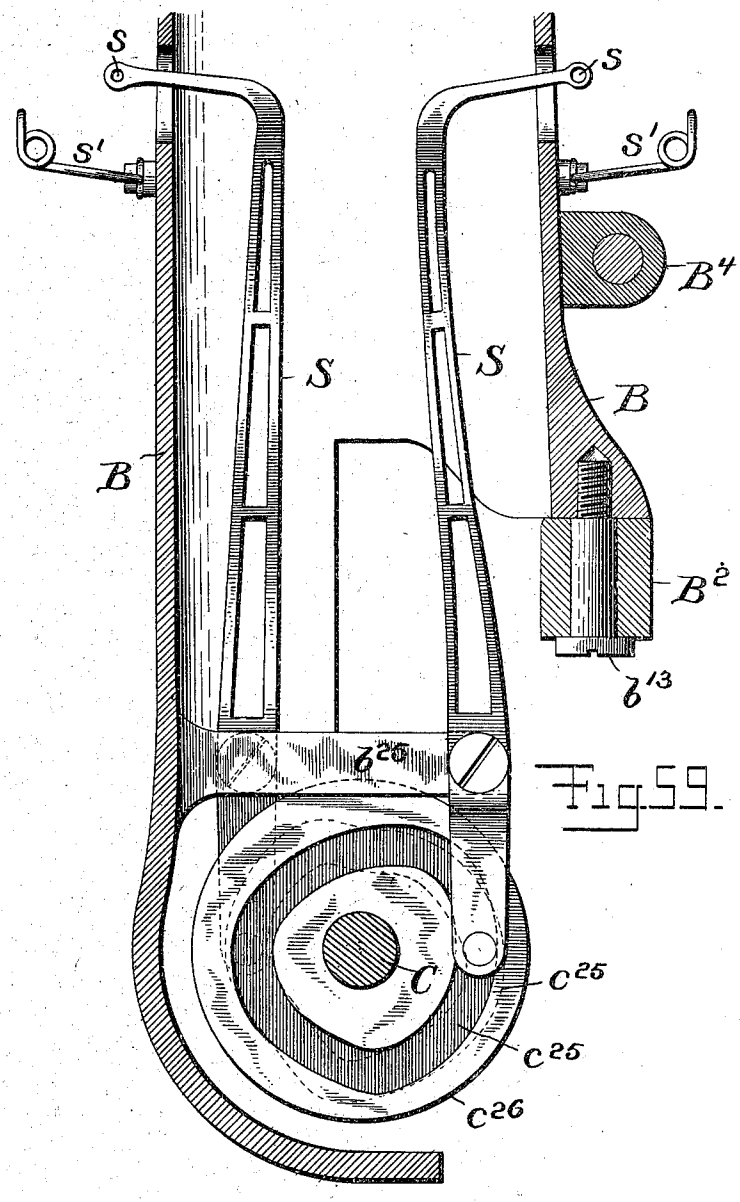


Fig. 59.

WITNESSES:

C. M. Sweeney

J. D. Klinigs

INVENTOR:

E. B. Allen

BY Henry Calvert

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,794. Patented July 28, 1903.

UNITED STATES PATENT OFFICE.

EDWARD B. ALLEN, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE SINGER MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

BUTTONHOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 734,794, dated July 28, 1903.

Application filed July 24, 1900. Serial No. 24,679. (No model.)

To all whom it may concern:

Be it known that I, EDWARD B. ALLEN, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Buttonhole-Sewing Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates generally to that class of buttonhole-sewing machines in which the work remains stationary during the stitching of a buttonhole and in which the stitch-forming devices are fed or caused to travel about the buttonhole to properly lay or dispose the stitches; and the invention has for its object to provide a comparatively simple machine of the class referred to which will preferably comprise an automatic buttonhole-cutter, automatic mechanism for feeding or advancing the work from cutting position to stitching position and from one buttonhole-stitching position to another, automatic mechanism for barring each buttonhole by a barring operation which is a continuation of the stitching operation, automatic mechanism for stopping the machine at the completion of each buttonhole, automatic mechanism for opening the work-clamp when the machine is stopped, and automatic means for moving the clamp while open from stitching position to cutting position, the work remaining stationary during this last-named operation.

The improved machine preferably comprises a fixed work support or frame on which the work-clamp and buttonhole-cutter are mounted, and which for convenience may be termed the "work-frame," and a movable frame on which the stitch-forming and feeding devices and their operating mechanisms are mounted, and which movable frame may be termed the "stitching-frame." The stitching-frame is preferably pivotally mounted near its middle on two arms of a swinging crane or bracket which is in turn pivotally mounted on the fixed or stationary work-frame, the said stitching-frame being thus adapted to be swung back and forth bodily lengthwise of a buttonhole to space the stitches along the edges of the said buttonhole, and said stitching-frame being also capable of being swung sidewise on its central pivotal mounting on the arms of said swinging crane or bracket, as is necessary in stitching around the eye portion of an eyed buttonhole and in providing for barring the buttonhole when the stitching thereof has been otherwise completed. This pivotal mounting of the stitching-frame enables the same to be freely moved in any desired direction with a minimum expenditure of power.

In the improved machine the work-clamp is preferably slidingly mounted on the stationary work-frame, so as to be movable in a direction transverse to the length of the buttonholes, and is closed upon the work by a pedal-operated device, the continued movement of which after the clamp has been closed releases a catch or latch which restrains the movements of a cam wheel or cylinder actuated by the stored-up power of a torsional spring, the said cam-wheel serving through suitable connections to operate the buttonhole-cutter and to transfer the sliding work-clamp from cutting position to stitching position, as also to start the stitching mechanism. Thus when the said latch is released by the said pedal-operated device the said cam-wheel first causes the cutter to be actuated to cut a buttonhole-slit, the continued movement of said cam-wheel to complete its revolution and before its movement is arrested by said catch or latch causing the said work-clamp to be transferred from cutting position to sewing position and also releasing the stop-motion devices and setting the stitch-forming and feeding mechanisms into action to stitch and bar a buttonhole. The rotation of the cam-wheel referred to by its torsional actuating-spring is instantaneous, so that the three operations mentioned—to wit, cutting the buttonhole-slit, transferring the work from cutting position to sewing position, and setting the stitching and feeding mechanisms into action—are all, although effected successively, performed in a fractional part of a second.

The torsional spring, by which the cam-wheel referred to is actuated, is connected with a rotating shaft forming part of the stitch-forming and feeding mechanism of the

machine, so that during the stitching of a buttonhole the said spring is again wound up by the stitching mechanism and power is thus stored for the next operation of the said cam-wheel.

When a buttonhole has been stitched and barred, the stop-motion device is automatically operated to unclutch the driving-pulley and stop the machine, the stop-motion-controlling lever or a part connected therewith being utilized to release a latch restraining the movement of a spring-pressed sliding bar, which when liberated automatically opens the work-clamp.

The sliding base-plate of the work-clamp is connected with a spring which is under tension when the said work-clamp is in stitching position, and when the said clamp is opened an extension or tailpiece on the arm of the clamping-shaft thereof releases a latch which holds the clamp in stitching position, permitting the said spring to transfer the opened clamp to cutting position, the released work meanwhile being held stationary by the tension of the threads with or without the assistance of the attendant. Thus owing to the fact that the work-clamp is automatically shifted backward, or from stitching position to cutting position, when opened or disengaged from the work, and also owing to the fact that said clamp is automatically shifted or fed forward, or from cutting position to stitching position, when closed or engaged with the work, the said work-clamp is utilized as a clamp-feed to advance the work from one buttonhole-stitching position to another, the transfer of the closed clamp from cutting position to stitching position moving the stitched buttonhole away from the stitch-forming devices and bringing the unstitched buttonhole-slit beneath the needle or needles. In thus shifting the work from the cutter to the needle or needles in this improved machine the movement of the work is transverse to or crosswise of the buttonholes, whereas in prior buttonhole-machines in which the work or cutter has been moved the one relatively to the other the shifting or traveling movements of the work or cutter have been lengthwise of the buttonholes. It will therefore be understood that this shifting movement of the work in the present machine in a direction transverse to or crosswise of the buttonhole is essential in order that the automatic feeding of the work from cutting position to stitching position will also effect an automatic feeding or advancement of the work from one buttonhole-stitching position to another.

The stitch-forming mechanism preferably employed in this improved machine comprises two out-of-time eye-pointed needles above the work, a thread-carrying and a non-thread-carrying looper below the work, a loop-spreader coöperating with each of said loopers, and an upper looper. In stitching eyed buttonholes the stitch-forming devices, mounted on the traveling stitching-frame, are given periodical rotary movements, a half-rotation of these devices being required in stitching around the eye of a buttonhole and the return half-rotation thereof to bring said devices to starting position being utilized after the stitching of the buttonhole has been otherwise completed to bar the straight end of the buttonhole by radiating stitches. In working the sides and eye of a buttonhole one of the eye-pointed needles, which may be termed the "edge" or "slit" needle, passes down in the buttonhole-slit, and the other of said needles, which may be termed the "depth-stitch" needle, penetrates the goods back from the edge of the slit, and the upper looper at each stitch carries a loop of the depth-stitch-needle thread around the edge or slit needle for the purpose of forming an upper purl along the edge of the buttonhole in making the double-purled buttonhole or overedge seam shown and described in my United States Patent granted September 3, 1901, No. 681,670, the lower purl being formed by the concatenation of the needle and lower looper-threads. When the stitching of the last side of a buttonhole has been completed and just prior to the reverse turning movements of the stitching devices to bring them back to their first or starting positions, the stitching-frame is shifted laterally slightly on its pivotal supports to bring the depth-stitch needle into register with the end of the buttonhole-slit and the edge or slit needle into register with the goods back from the slit, so that during the return rotary movements of the stitching devices a bar consisting of a series of radiating stitches is formed at the end of the buttonhole. During the formation of this bar the depth-stitch needle proper temporarily becomes the edge or slit needle and the edge or slit needle proper temporarily becomes the depth-stitch needle. Thus the reverse turning movements of the stitching devices instead of being performed idly, as heretofore, are utilized in the present machine to bar the buttonholes, and no special barring devices are therefore necessary. After a bar has been completed the stitching-frame is given a reverse shifting lateral movement to again bring the depth-stitch needle to its depth-stitch position in readiness for the next stitching operation.

In the accompanying drawings, Figure 1 is a front side elevation, with parts of the frames broken away, of the improved machine. Fig. 2 is a rear side elevation of the same. Fig. 3 is a front end view of the same with the work-support of the stationary frame partly broken away. Fig. 4 is a rear end view of the machine. Fig. 5 is a central vertical transverse section on line 5 5, Fig. 1. Fig. 6 is a plan view of the machine, with the arm of the movable stitching-frame in section on line 6 6, Fig. 1. Fig. 7 is a horizontal section on line 7 7, Fig. 1; and Fig. 8 a horizontal section on line 8 8, Fig. 1. Fig. 9 is a detail front side elevation of the movable stitching-frame.

Figs. 10 to 15, inclusive, are detail views of the rotary needle-bars and their mountings, the section-lines in Fig. 10 denoting the positions where the cross-sectional views, Figs. 12, 13, 14, and 15, are taken. Fig. 16 is a detail sectional view illustrating a slightly-modified mounting for the rotary needle-bars. Fig. 17 is a longitudinal section of the front portion of the machine, more particularly illustrative of the lower looper mechanism. Figs. 18 to 24, inclusive, are detail views of the lower looper mechanism. Figs. 25 to 29, inclusive, are detail views illustrative of the upper looper mechanism, Figs. 28 and 29 being enlarged views with the parts in different positions looking up from beneath Fig. 26. Figs. 30 and 31 are detail views to illustrate the feeding mechanism for the movable stitching-frame. Figs. 32 and 33 are detail plan views, with the parts in different positions, of the work-plate, the work-clamp, and cutting device. Fig. 34 is a bottom view of the work-plate. Fig. 35 is an elevation, as seen looking in the direction denoted by the arrows 35, Fig. 33, of the work-plate, work-clamp, and cutting devices, a portion of the work-plate being in section. Figs. 36, 37, 38, and 39 are detail views of the cutter and its throat-plate, Fig. 39 being a bottom face view of the cutter. Figs. 40 to 43, inclusive, are detail views of the work-clamp. Fig. 44 is a detail view illustrative of the means for closing the clamp. Figs. 45 and 46 are detail views showing the means for storing up power and partly illustrating the devices for utilizing the same in cutting, shifting the clamp, and starting the machine. Fig. 47 is a detail horizontal section of the front end of the clamp-opening device, and Fig. 48 a detail side view thereof. Figs. 49 to 53, inclusive, are detail views of the tripping device. Figs. 54 to 58, inclusive, are detail views mostly illustrative of the clutch stop-motion device. Fig. 59 is a detail view showing the take-up and pull-off mechanism; and Figs. 60 to 65, inclusive, are diagrammatic views to illustrate the method of stitching and barring the buttonholes.

Referring to the drawings, A denotes the base-plate, rigid with which is a work-support A', a standard A^2, and an upwardly-projecting arm A^3, these parts constituting the stationary work support or frame of the machine, the said base-plate in the practical use of the machine being suitably fixed to a work bench or table. Pivotally mounted on the standard A^2, as by center screws a, is a swinging crane or bracket A^4, having upper and lower arms A^{14}, on which the movable stitching-frame B, carrying the stitch-forming, feeding, and cutter-operating mechanisms, is pivotally supported at or near its center, the said bracket A^4 swinging freely on its pivotal supports a to move the stitching-frame B and the parts carried thereby bodily back and forth lengthwise of the buttonholes, and the said stitching-frame being adapted for sidewise swinging or turning movements on its central pivotal mounting on the arms of the said swinging bracket to provide for suitable lateral movements of the stitching devices in working the eye portions of the buttonholes and for barring said holes. This double pivotal mounting of the movable stitching-frame, the weight of which and of the parts carried thereby is very considerable, permits the said frame to be easily moved in any desired direction owing to the fact that the said double pivotal mounting affords a universal-joint connection between the stitching-frame and the work-frame, thus effecting a great saving of power compared with what would be required to move this heavy stitching-frame if the same were slidingly mounted on the stationary work-frame.

The stitching-frame B is pivotally mounted on the arms A^{14} of the swinging bracket by means of the center screw a^{28} (threaded in the base of the said stitching-frame and entering the lower side of the lower arm of said swinging bracket) and the bushing-screw a^{29}, tapped in the lower part of the horizontal arm portion of the stitching-frame and having a tapering or conical lower end fitting in a suitable seat in the upper side of the upper arm of said swinging bracket. This center-screw and bushing-screw mounting of the stitching-frame on the arms of the said swinging bracket affords a convenient means for a limited vertical adjustment of the movable stitching-frame relative to the stationary work-frame in assembling the machine to bring the loopers to a proper height relative to the work-plate of the machine, as also convenient means for taking up wear or looseness should such occur, this adjustment to take up wear or looseness being preferably effected by means of the bushing-screw a^{29}, which is held in place (after adjustment) by a set-nut a^{30}.

To steady or prevent vibration of the movable stitching-frame on the work-frame and as a resistance to the downward pull of the driving-belt on the rear end of said stitching-frame, the work-support is provided with a slot a^{31}, in which a block a^{32} loosely fits, so as to have a free sliding movement in any horizontal direction, the said block a^{32} being entered by one end of a pin a^{33}, on which said block is held by the head of a screw a^{34}, tapped in said pin, the other end of said pin fitting closely in a hole or socket formed for its reception in the front end of the lower portion of the stitching-frame B. The part of the said pin which enters the block a^{32} is slightly eccentric to the part thereof which is received in the hole or socket in the stitching-frame, so that by turning said pin more or less (by means of a screw-driver inserted in the nick of the head of the screw a^{34}) the steadying-block a^{32} may be raised or lowered to bring it into a proper position of vertical adjustment, so that it will not bind in its slot in the stitching-frame. The pin a^{33} is fixed in any

desired position of axial adjustment by a set-screw a^{35}.

C is the driving-shaft, journaled in the lower portion of the stitching-frame B, said shaft being provided with a loose driving-pulley c, having a suitable clutch connection (to be hereinafter described) with the said shaft. Fixed in the lower portion of the head b of the upper part of the stitching-frame B is a bushing b', which supports a rotary sleeve or bushing b^2, provided with a pinion b^3, in which the independently-movable needle-bars D and D′ reciprocate vertically, said needle-bars carrying the eye-pointed needles d and d'. The fixed bushing b' is preferably screw-threaded into the lower end of the head b of the stitching-frame and its upper end fits snugly against the lower face of the pinion b^3, fixed to the rotary sleeve or bushing b^2, said pinion having a close working fit vertically between said fixed screw-bushing and a shoulder at the bottom of the bearing portion in the said head b for the upper end of said rotary sleeve or bushing b^2, so that the latter can have no vertical looseness or play when the fixed pinion thereon is turned by its operating-rack, to be hereinafter described. In the construction herein shown the needle-bar D, having a splined connection with the rotary sleeve or bushing b^2, is tubular, and the needle-bar D′ is mounted to reciprocate within the said bar D; but in practice two small bars D^2, mounted to reciprocate side by side in said rotary sleeve or bushing, as shown in Fig. 16, may be employed. In either of these constructions, however, the slit or edge needle d' is mounted eccentric to or at one side of the vertical axis of its rotation when turned about the eye of a buttonhole, and of course the depth-needle d is still farther to one side of or eccentric to said axis, the amount of eccentricity of the said slit-needle to the said turning axis being just equal to the transverse radius of the buttonhole-eye or equal to half the transverse diameter of the said eye. (See diagram Fig. 60, in which the dotted line z denotes the path of travel of the axis of rotation of the needles and loopers while working the first side of the buttonhole, as in Fig. 61, and the dotted line z' denotes the path of travel of the axis of the stitch-forming devices while working the other or second side of the buttonhole.) This arrangement of the needles relative to their axis of rotation enables the working of an eyed buttonhole with evenly-radiating stitches all around the end portion of the eye, a result not heretofore effected by any machine having turning stitching devices. In this improved machine the stitching-frame remains perfectly stationary while the end portion of a buttonhole-eye is being stitched, while in prior machines employing turning stitch-forming devices either the stitching-frame or the work was moved laterally while the end portions of the buttonhole-eye were being worked, these lateral movements of the stitching devices or the work being necessary in stitching a cut-out eyed buttonhole, owing to the fact that the slit needles were located at the axes of rotation of the stitching devices. I do not, however, herein claim this eccentric arrangement of the edge or slit needle of an overedge stitch-forming mechanism constructed for periodical rotation with relation to the axis of rotation of said stitch-forming mechanism, as this feature is claimed broadly in my application, Serial No. 101,191, filed April 3, 1902, as a division of the present application.

Pivotally mounted in the upper portion of the stitching-frame B are two needle-operating levers E E′, the lever E being connected by a pitman e to a strap e', fitting in an annular groove in a collar e^2, fixed to the needle-bar D, and the lever E′ being connected with the grooved collar e^3, attached to the needle-bar D′ through the pitman e^4 and strap e^5. The collars e^2 and e^3 rotate within their encircling straps e' and e^5 when the needle-bars are turned by the rotary bushing b'. The needle-operating levers E and E′ are in the construction herein shown actuated from cranks c' on the driving-shaft C through pitmen E^2; but any other suitable mechanism may be employed for actuating these levers. The cranks c' are nearly diametrically opposite each other on the shaft C, so that out-of-time and, in fact, nearly opposite movements are imparted to the needle-bars and the needles carried thereby for a purpose which will be hereinafter explained, the relative timing of these needle-bars being, however, capable of considerable variation.

In the construction herein shown the needle-bar D′ is bored longitudinally to afford a passage x' for the thread running from the thread-guide x to the needle d' and a vertical thread-passage x^2 for the thread running to the needle d is formed in the outer needle-bar D, both of these thread-passages being thus within the collars and straps surrounding the said needle-bars. (See Figs. 11 to 15.) These inside thread-passages are, however, merely a convenience in the present construction and are not essential, as the threads may be led to the needles outside of the needle-bars in the usual manner, if desired.

Rotatively mounted on the forward end of the lower portion of the stitching-frame B is a short shaft or spindle F, provided with a pinion f, and rigid with the said shaft or spindle is a looper-supporting bracket comprising a circular head or part f' and two upwardly-projecting arms f^2 and f^3, between which on a pin f^5 is mounted the rocking looper-carrier f^6, to one arm of which is fixed the eyed thread-carrying looper f^7, and the other arm of which carries the non-thread-carrying looper f^8. The shaft or spindle F and the pinion f, fixed thereto, are held from vertical movement and any vertical play or looseness thereof prevented by the screw-bushing f^{35},

in which said shaft has its upper bearing and which is tapped in the stitching-frame and abuts against the upper face of the said pinion, the lower face of the latter having a close running contact with a shoulder on said frame above the lower bearing for the said shaft or spindle. This mounting of the rotary shaft or spindle F for turning the looping devices is thus essentially the same as the mounting of the rotary sleeve or bushing b^2 for turning the needle-bar and needles. Coöperating with the loopers f^7 f^8 are two loop-spreaders f^9 f^{10}, pivotally mounted on the arms of the looper-carrier and retained in their normal or inactive positions against suitable stops or abutments f^{13} by springs f^{11}, each of said spreaders having a tailpiece or projection f^{12}. The stops or abutments f^{13} are adjustably secured on the arm f^3 of the looper-supporting bracket and are arranged to be engaged at proper intervals by the projections f^{12} of the spreaders to swing the latter in opposition to the stress of the springs f^{11}, and thus move the acting arms of said spreaders sidewise away from the points of the loopers to spread the loops.

Fixed to the arm f^3 of the looper-supporting bracket is a needle-guard f^{14}, and secured to the rocking looper-carrier f^6 is a second needle-guard f^{15}, the needles descending into suitable spaces between said guards and being prevented thereby from being bent or deflected out of position relative to the loopers. To the arm f^2 of the looper-supporting bracket is secured a curved arm or extension f^{23}, provided with a slot f^{24} for the passage of the needles, said arm or extension thus serving as a throat-plate. Said looper-supporting bracket is also preferably provided with a small bridge-piece f^{25}, having a hole f^{26} at the axis of rotation of the looping devices and up through which the looper-thread runs and which hole thus serves as a looper-thread guide. (See Fig. 17.)

The driving-shaft C is provided near its forward end with a cam-disk c^2, having a groove c^3 for the reception of a roller-stud fixed to a vertically-movable slide f^{17}, guided in a suitable way on the stitching-frame, and f^{18} is a rod having a swiveled connection at its lower end with said slide and connected at its upper end by a link or pitman f^{19} with the rocking looper-carrier f^6 to operate the latter. The cam-disk c^2 has in its rear face a second cam-groove c^4, entered by a roller-stud on the pull-off lever f^{20}, which in cooperation with thread-guides f^{21}, fixed to the stitching-frame B, serves to draw at each stitch a suitable quantity of looper-thread through the tension device f^{22}. This looper-thread pull-off, although not positively necessary, is found to be desirable in that by its aid a better purl is formed on the lower side of the buttonhole-seam.

Attached to the lower end of the rotary sleeve b^2 is a collar b^4, having a socketed ear b^5, in which is pivotally mounted a short arm b^6, to which in turn is pivoted a vibrating arm b^{16}, socketed for the reception of the upper end of the looper-carrier b^7, provided at its lower end with the looper b^8, which serves at each stitch to carry a loop of thread from the depth-stitch needle d around the edge or slit needle d'. The connection of the looper-carrier b^7 with its supporting-collar b^4 by the two pivots referred to and which are at right angles to each other practically affords a universal joint, so that a circular or elliptical movement may be imparted to the lower end of said carrier, at which said looper is mounted. To effect this movement of the said looper, the carrier-shank has an irregular spiral portion b^9, and the said shank passes through a hole in the ball d^2, carried in a socket formed for its reception in a projection d^3 of a collar d^4, attached to the needle-bar D, so that as the said needle-bar reciprocates vertically the said looper b^8 will be caused to travel around the edge or slit needle d' for the purpose stated.

Journaled in suitable bearings at b^{110} b^{111} on the stitching-frame B is a vertical shaft G, having attached thereto the cam wheels or disks g and g'. An intermittent rotary movement is imparted to said shaft from the grooved cam c^5 on the driving-shaft C through the lever g^2, (having a roller-stud entering the groove of said cam,) the link or pitman g^3, the lever g^4, pivoted on a hub of the feeding disk or wheel g, and the clutch-dog g^5, biting on a flange g^6 of the said disk or wheel when moving in one direction and releasing its grip when moving in the opposite direction, as is common in devices of this character. The loose clutch-dog g^5 rests on a supporting-plate g^{25}, attached to the lever g^4. The return or idle movements of the said clutch-dog are effected by the spring g^9, which also takes up any looseness or lost motion between said clutch-dog and its operating feed-lever g^4, so that the said lever will cause said clutch-dog to grip or bite the flange g^6 the instant said lever commences its feeding movement. The link or pitman g^3 is adjustably connected with the lever g^4 for the purpose of varying the intermittent rotary or feeding movements of the shaft G.

Surrounding the feeding cam wheel or disk g is a friction-band g^{24}, attached to a lug b^{35} on the stitching-frame, said friction-band preventing any overthrow in feeding and also preventing any backward turning motion of said wheel or disk by the torsional spring m^9, to be hereinafter referred to, and which is connected, through the shafts G and M, with said wheel or disk g.

The disk g is provided in its upper face with a cam-groove g^7, entered by a pin or stud a^4 on a cross-bar a^5, supported by arms a^6 of the fixed work-support A′ and reacting on the cam disk or wheel g, mounted on the movable stitching-frame to impart an endwise traveling movement to said frame to move the stitch-forming mechanism carried

thereby lengthwise of a buttonhole being stitched.

The cross-bar a^5 is slidingly mounted on the fixed or stationary work-support A′, so as to be fitted for transverse movement on said frame when the stitching-frame is turned or swung sidewise on its central pivotal support, and the pin or stud a^4 passes through a sliding block b^{10}, fitted for movement in a slot b^{11} of a bar b^{12}, rigid with the movable stitching-frame B, said bar thus serving to steady and guide the traveling stitching-frame in its endwise movements. The said traveling stitching frame is also guided and steadied at its rear end by a pin or stud a^7, rigidly fixed in the arm A^3 of the stationary work-frame, said pin or stud a^7 entering the hollow rear end of a lever B^2, pivotally attached by a screw b^{13} to the traveling stitching-frame B.

The cam wheel or disk g' is provided in its under side with a cam-groove g^8, entered by a roller-stud at the forward end of the lever B^2, said lever being fulcrumed at its rear end on a vertical pin b^{14}, bored for the passage of the guiding pin or stud a^7. Thus as the said cam wheel or disk rotates the cam-groove g^8 will at the proper intervals impart a swinging motion to the lever B^2 to turn the stitching-frame sidewise on its central pivotal supports, consisting of the center screw a^{28} and bushing-screw a^{29}, to move the stitching devices laterally, as is necessary in working the eye portions of the buttonholes. In this operation of swinging the stitching-frame laterally the lever B^2 acts as a lever of the second order, the power being applied by the cam and the said lever acting on the weight at the screw b^{13} and which is between the power and the fulcrum-pin b^{14} of said lever.

The periodical rotary movements of the stitching devices are imparted thereto from the cam-wheel g', having in its upper side a cam-groove g^{10}, which is entered by a roller-stud on the end of an arm h at the rear end of a short rock-shaft h', journaled in a suitable bearing in the stitching-frame and provided at its forward end with the double arm or lever H, carrying at its top the rack h^2, meshing with the pinion b^3 to rotate the needles and having at its bottom the rack h^3, meshing with the pinion f to rotate the loopers. The racks h^2 and h^3, mounted on the oppositely-moving arms of the lever H, (for which the shaft h' serves as a horizontal fulcrum or pivot,) engage the pinions b^3 and f on opposite sides, so that the needles and loopers will be turned in the same direction in unison.

Attached to the stationary work-support A′ is the work-plate A^5, provided with a groove or slideway a^8, in which fits the sliding base-plate I of the work-clamp. This clamp is or may be essentially the same in its work-clamping construction as the clamp shown and described in United States Patent No. 319,700, dated June 9, 1885, in that it comprises a small shaft i, journaled in blocks or supports i', attached to the clamp base-plate and provided with a crank i^2, connected by a link or pitman i^3 to a cross-bar i^4 for depressing the spring-metal clamping-arms i^5, attached to blocks i^6, pivoted at i^7 to arms or extensions i^8 of the block i', said clamping-arms i^5 being lifted when released by coil-springs i^9, placed beneath them. The crank i^2 passes slightly over the center in clamping, so that the arms i^5 are retained in clamping position by a toggle action of the link i^3 and the crank i^2. The shaft i is provided with an arm or handle i^{20}, by which it may be turned, the said arm or handle having below said shaft the finger or extension i^{21}. In the present construction the upward movements of the clamping-arms, due to the lifting action of the springs i^9, are limited by a fixed stop i^{10}, against which the upper end of the link i^3 abuts, said stop being attached to a standard i^{11}, fixed to the base-plate I.

The shaft i, as herein shown, is provided with an arm i^{12}, to be acted on in closing the clamp. The plate i^{13}, serving as the lower member of the clamp, is formed with a slot i^{14}, extending from one side of the buttonhole-opening, and the work-plate A^5 has a slot a^9, registering at times with the said slot i^{14}, the said slots receiving the sewing-threads extending beneath the said work-plate when the work is advanced from one buttonhole-stitching position to another.

The clamp base-plate I is provided with a screw or pin i^{15}, extending through a slot a^{10} in the work-plate A^5. A spiral spring i^{16}, connected at one end to a screw or pin a^{11}, attached to the work-plate, is connected at its other end to the said screw or pin i^{15} on the clamp base-plate. Pivotally mounted on the work-plate A^5 is a latch a^{12}, having a tooth or projection a^{13} and an extension or finger a^{14}, said finger being when the clamp is in stitching position opposite the finger or extension i^{21} of the arm or handle i^{20}, fixed to the shaft i. Said latch a^{12} is also provided with pin a^{15}, extending through a slot a^{16} in the work-plate and engaged by the free end of a spring a^{17}, attached to the lower side of said work-plate. The clamp base-plate is provided with a catch to be engaged by the tooth or projection a^{13} on the latch a^{12} to retain the clamp in stitching position on the work-plate, said catch, as herein shown, consisting of a plate i^{17}, adjustably secured to the said clamp base-plate for the purpose of regulating the position of the slit in the work, held in the clamp, relative to the needles. The tooth or projection a^{13} of the latch a^{12} snaps in behind the end of the catch-plate i^{17} by the action of the spring a^{17} when the sliding clamp is moved to stitching position, as will be hereinafter described. The catch-plate i^{17} is adjustably secured to the plate I by screws i^{18} passing through slots in the said catch-plate i^{17}, and the position of the said catch-plate on the said plate I may be nicely regulated when said screws

are loosened by an adjusting-screw i^{19}, tapped in the said plate I and abutting against or having a swiveled connection with said catch-plate.

Rigidly attached to the work-plate A^5 is a base-plate K, supporting an upwardly-projecting hollow standard k, preferably formed integral with said plate by making these parts from a one-piece forging. To afford a proper hold for the set-screw a^{18}, by which the plate K is secured to the work-plate A^5, the latter is provided with a boss or thickened portion a^{19}, tapped for the reception of said screw, the hole in the plate K, through which said screw passes, being elongated or formed sufficiently large to permit of a slight adjustment of the said plate K toward or from the work-clamp. The base-plate K serves as a stop for the sliding base-plate I of the buttonhole-clamp as the said clamp is moved to cutting position by the spring i^{16}, and by making said base-plate adjustable on the work-plate A^5 a variation in the distance apart of the buttonholes is provided for.

Having a close sliding fit within the hollow standard k is a cutter-carrier k', with which the shank k^2 of the knife or buttonhole-cutter k^3 is rigidly connected. The knife or cutter for leather-work is preferably formed with a blunt slit-forming portion, which, in coöperation with a throat or die k^4 of corresponding shape, formed in the cutter throat-plate k^5, attached to the plate K, serves to remove a narrow piece of material from the slit portion of the buttonhole when the eye portion of said hole is punched out by the cutter, so that no spreading of the buttonholes for the stitching operation will be required. The three-thread double-purled overedge seam formed by the stitching mechanism herein shown and described builds out the edges of the buttonhole somewhat, so that the punched-out slit portion of a buttonhole is when completed practically filled up by the stitching. The cutter or die k^4 is preferably formed with a lower end or cutting portion, which is inclined relative to the throat-plate or die-plate k^5, so as to act with a shear cut, the eye-forming part of this inclined cutter being preferably lowest, so as to act first.

The work-plate A^5 is provided on its under side beneath the die k^4 with a shield or chute A^6, which inclines downward and outward away from the looping devices. This shield or chute receives the chips or cuttings punched out by the die-cutter k^3 and conveys them away from the said looping devices, so that they will not injure or clog the latter or become entangled with the stitching-threads, and thus drawn into the overseam to the injury of the stitched buttonholes. In buttonhole-machines at present in use and provided with buttonhole-cutters the punchings in cutting out the eyes of the buttonholes come altogether above the work-plates or are liable to get above said work-plates, and thus get into and injure or spoil the buttonhole-stitching; but this difficulty is entirely avoided in the present construction, in which the cuttings are positively forced downward below the work-plate by the die-cutter and are then directed or carried away from the stitching mechanism below said work-plate by the shield or chute A^6, which thus shields or guards the lower stitching mechanism from the cuttings or punchings.

The vertically-sliding cutter-carrier k' is provided at its top with an ear k^6, which is rigidly attached to or formed integral with said carrier, said ear having a slot k^7, which receives a roller-stud at the forward end of a cutter-operating lever k^8, pivoted on a screw b^{15}, tapped in a web portion b^{161} of the movable stitching-frame B, said lever k^8 having at its rear end a second roller-stud entering a cam-groove m in the circumferential face of a cam-wheel M, rigidly secured to a sleeve m', adapted to turn loosely on a bearing-spindle m^2, pinned to the rotating feed-shaft G. The spindle m^2 is provided near its top with a disk m^3, having a hub m^4, through which and the said spindle passes a pin m^5 to rigidly secure said disk to said spindle. Loosely pivoted on the spindle m^2, above the disk m^3, is an arm m^6, held in place by a collar m^7, fixed to the top of said spindle. The disk m^3 is provided with a series of holes, preferably tapped, for the reception of a screw-pin m^8, which engages the swinging arm m^6. Coiled around the sleeve m' is a torsional spring m^9, attached at its lower end to the said sleeve, as by means of a clamping-collar m^{101}, and connected at its upper end with the swinging arm m^6. The torsional spring m^9 may be wound up or put under tension when the pin m^8 is removed from the disk m^3 either by swinging the arm m^6 around on its pivotal support on the spindle m^2 while the sleeve m' and cam-wheel M are held stationary or by turning the sleeve m' by means of the cam-wheel M or otherwise, said sleeve being adapted for rotation independently of the spindle m^2, fixed to and rotating with the shaft G. When the said torsional spring m^9 has been thus wound up or put under tension, the pin m^8 is inserted in any one of the holes in the disk m^3 to connect said spring with the shaft G through said disk and also through the spindle m^2, a series of said holes being preferably employed, so that the regulation of the stress of the said spring may be properly provided for.

The cam-wheel M is recessed in its lower face to form a shoulder m^{10} to be engaged by a finger m^{11} on a latch-lever m^{12}, pivoted on a screw b^{17}, tapped in a portion b^{18} of the stitching-frame B, said latch-lever being normally lifted to hold said finger m^{11} in front of the shoulder m^{10} by a spring b^{19}, attached to a bearing-bracket B^3, forming part of the said stitching-frame. The latch-lever m^{12} is provided with an upwardly-extending arm m^{13}, arranged to be engaged by an incline or cam m^{21} on the periphery of the cam-wheel M to lift the said latch-lever positively after it has

been depressed to remove its holding-finger m^{11} from engagement with the shoulder m^{10} on said cam-wheel should the spring b^{19} fail to act with sufficient quickness.

The cam-wheel M carries in a suitable recess in its periphery a pivoted latch m^{14}, upon which presses a coil-spring m^{15} to force the free end of said latch downward behind the finger m^{11} of the latch-lever m^{12} after said latch has in the rotation of said cam-wheel passed over said finger, said latch m^{14} thus serving to prevent any accidental backward movement of said cam-wheel. The said latch-lever is provided on its front side with a horizontally-projecting lug m^{16} for a purpose which will presently appear.

Journaled in the bearing-bracket B^3 is a vertical rock-shaft N, having at its top an arm n, provided with a roller-stud, extending into a cam-groove m^{17} in the upper side of the cam-wheel M, said rock-shaft carrying at its lower end the arms n' and n^2, rigid with each other and with said rock-shaft and arranged nearly at right angles to each other. The arm n' extends forward to a proper position to engage a pin i^{22} on the sliding clamp base-plate I, so that said arm may at the proper times slide or move the clamp from cutting position to stitching position in opposition to the stress of the spring i^{16}, and which spring serves when the latch a^{12} is released, as will be hereinafter described, to return the clamp from stitching position to cutting position. The movements of the clamp by the swinging arm n' are limited to prevent overthrow and are also cushioned in stopping by a stiff-spring stop-arm a^{181}, attached to the lower side of the work-plate A^5.

O is a sliding clamp-opening rod fitted for longitudinal movements in the bearing-bracket B^3 and also in a guiding projection B^4, extending laterally from the vertical part of the arm portion of the movable stitching-frame B, said sliding rod having at its forward end a clamp-opener o, opposite to or in line with which opener the arm i^{20} on the clamp opening and closing shaft i will be when the clamp is in stitching position, so that when after a buttonhole has been stitched and barred and the said rod has been released and forced forward (by the action of a coil-spring o', partly housed in the guiding projection B^4 and acting on a collar o^2, fixed to said rod) the said opener will engage the said arm i^{20} and turn the shaft i to open the clamp.

The sliding rod O is retracted by an arm p on the clutch-controlling lever P to the position which said rod is to occupy during the time a buttonhole is being stitched, said arm engaging a collar o^3 on said sliding rod to move the latter rearward or in opposition to the stress of the spring o'. The said rod O is capable of slight turning movements in its sliding bearings, and to retain it in its retracted position it is provided with a rigidly-attached arm o^4 for engagement with a stop or catch o^6 on the stitching-frame, said arm o^4 being lifted and said shaft slightly rocked in one direction by the action of a spring o^7, also on the said stitching-frame. As the sliding rod O is not in the present construction retracted until after the clamp has been shifted from cutting position to stitching position, the clamp-opener is yieldingly mounted in a slot in the forward end of said rod by means of a pivot-screw o^8 at the rear end of the shank of said opener, a spring o^9 pressing against said shank to hold the opener in its normal position relative to said rod and said shank having a small upturned stop or lip o^{10}, which abuts against a notched portion of said rod to limit the movement of said opener by said spring.

When the work-clamp is moved from cutting position to stitching position, the forward part of the clamp-opener will be in the path of lateral movement of the arm i^{20} on the clamp, and when said arm comes into contact with said opener the latter will yield, so as not to interfere with the movement of the clamp; but the instant the latter has reached its stitching position the movement of the clutch-controlling lever to set the machine in motion will retract the sliding bar O, and thus permit the clamp-opener o to snap back into position opposite to or in line with the said arm i^{20} to be in readiness for the next clamp-opening operation. When the arm i^{20} is engaged by the clamp-opener and is turned to open the clamp, the extension i^{21} of said arm engages the finger a^{14} of the latch a^{12} and moves said latch in opposition to its holding-spring a^{17} to release the tooth or projection a^{13} on said latch from its holding engagement with the catch-plate i^{17}, thus leaving the opened clamp free to be automatically shifted from stitching position to cutting position by the spring i^{16}, the work during this shifting of the clamp to cutting position being held stationary by the tension of the sewing-threads, assisted, if necessary, by the attendant.

Pivotally mounted on the sliding rod O is a rocker Q, having at its forward end an inwardly-extending arm q, the depending end portion of which is arranged to engage the arm i^{12} to turn the clamp-shaft i and close the clamp. The said rocker Q has near its rear end a second inwardly-extending arm q', arranged to engage the lug m^{16} on the latch-lever m^{12}, this engagement of said arm q' with said lug depressing said latch-lever to release its finger m^{11} from holding contact with the shoulder m^{10} on the cam-wheel M, thereby leaving said cam-wheel free to be rotated by the stored-up power of the compressed or wound-up torsional spring m^9, communicated to said cam-wheel through the sleeve m', to which said cam-wheel is attached.

The rocker Q is provided at its extreme rear end with an outwardly-extending arm q^2, carrying a swiveled sleeve q^3, through which loosely extends a treadle-operated rod

q^4, recessed on one side to form a shoulder q^7 to engage the rear end of a horizontal latch-lever q^5, pivoted to the under side of said rocker and extending beneath the said swiveled sleeve. The latch-lever q^5 is provided at its forward end with an upturned lug q^6, which is brought into the horizontal path of movement of the clamp-feeding arm n' when the rocker Q is tilted to depress its inwardly-extending arms q and q' to close the clamp and release the latch-lever m^{12}, as above described. The rear end of the latch-lever q^5 is pressed toward the treadle-rod q^4 by a spring q^8.

The rocker Q is disengaged from the treadle-rod q during the time the clamp is being fed or advanced from cutting position to stitching position by the engagement of the clamp-shifting arm n' with the lug q^6 on the latch-lever q^5, the rear end of said latch-lever being thus withdrawn from the shoulder q^7 on said rod, this movement of said latch-lever being in opposition to the stress of its spring q^8. When the machine is at rest or after a buttonhole has been stitched and barred and the machine has been automatically stopped, the attendant raises the treadle-operated rod q^4 to cause the shoulder q^7 thereon to engage the rear end of the latch-lever q^5, after which a continued upward movement of said rod will tilt the rocker Q, causing the arm q thereof to close the clamp, and after the clamp has been closed a further movement of the rocker will cause the arm q' to release the latch-lever m^{12}, which restrains the movement of the cam-wheel M under the influence of its operating-spring m^9. As soon as the said cam-wheel is freed from the restraint of its holding latch-lever it performs an instantaneous rotation, first depressing the cutter to form a buttonhole-slit, then through the operation of the arm n' of the rock-shaft N feeding the clamp from cutting position to stitching position, and then through the arm n^2 of said rock-shaft and by means of devices to be described presently setting the stitching mechanism into operation. The tilting of the rocker Q by the upward movement of the treadle-rod q^4, as described, lifts the lug q^6 of the latch-lever q^5 into the path of movement of the clamp-feeding arm n', which during the feeding or shifting movement of the clamp strikes the said lug and moves the said latch-lever q^5 in opposition to the stress of the spring q^8, thus withdrawing said latch-lever from its engagement with the shoulder q^7 of the treadle-rod q^4, as above described. The said rocker Q is now free to be tilted back to its normal or inoperative position by gravity with or without the assistance of a spring, as q^9, and in this normal or inoperative position of said rocker the arms q and q' thereof will be raised and the arm q^3 lowered.

After the rock-shaft N, operated from the cam-wheel M, has caused the arm n' to advance the clamp to stitching position, as described, the continued movement of said cam-wheel to complete its rotation reverses the movement of the said rock-shaft and the arms n' and n^2 back to position for another clamp feeding or advancing operation and causing the said arm n^2 to engage a depending projection r of an arm r', pivoted at its rear end to a transverse arm p^2 of the start and stop motion or clutch controlling lever P, the latter having its fulcrum at p^3 in a bracket B^5 at the rear end of the traveling stitching-frame B. When the machine is running, the depending projection r of the arm r' is held by the springs r^3 r^4 against the end of the arm n^2.

The tripping device g^{12} is preferably pivotally mounted on a plate g^{13}, provided with a slot g^{14} to adapt it to be adjustably secured by a screw g^{15} to the cam-wheel g', said pivoted tripping device being held in its normal position by a spring g^{16} and said device yielding in one direction only. The part of the said tripping device which is to engage the projection r of the pivoted arm r' to release said projection from the arm n^2 is preferably rounded, as at g^{17}. Thus when in the rotation of the cam-wheel g' the said tripping device engages the projection r said projection will be lifted above the arm n^2, thereby permitting the spring r^3 to draw the arm r' backward to move the clutch-lever P from the position shown in full lines to the position shown in dotted lines in Fig. 54 to stop the machine, the projection r at this time resting on the arm n^2, but said arm moving away from beneath said projection when the arm n' is operated to shift the clamp from cutting position to stitching position. When the arm n^2 next operates to start the machine, it strikes the projection r and moves it against the tripping device g^{12}, which now yields, as denoted in Fig. 53, to permit the projection r to be advanced to its proper stopping position, the said tripping device g^{12} moving away from the said projection r as soon as the machine starts, thus allowing the spring g^{16} to return the said tripping device to its normal position on the plate g^{13}, as shown in Fig. 53.

It will be understood that any desired automatic start and stop motion mechanism for connecting the driving-pulley with or disconnecting it from the driving-shaft of the machine may be employed in connection with this improved machine; but an approved mechanism for this purpose, which is shown in the accompanying drawings, will now be described.

Pinned to the driving-shaft C is a disk c^6, having cam portion c^7, a notch c^{13}, and a peripheral stop projection c^{14} beyond or at the rear side of said notch. Fixedly secured to the rear end of the shaft C is a hand-wheel or disk c^8, which serves as a collar or abutment, and mounted on said shaft between the said disk c^6 and hand-wheel c^8 is a threaded sleeve c^9, engaging a threaded portion of the shaft and provided with a flange c^{10}, having a tappet c^{11}. A torsional spring c^{12} connects

the sleeve c^9 with the disk c^6, the stress of said spring being in a direction to have a tendency to turn the said sleeve so as to screw it toward the fixed hand-wheel or abutment c^8. The driving-pulley c is loosely mounted on the sleeve c^9 between the collar or abutment afforded by the hand-wheel c^8 and the flange c^{10} of the said sleeve, so that a slight turning movement of said sleeve by the torsional spring c^{12} will, owing to the screw-threaded connection of the said sleeve with the shaft, cause the loose driving-pulley c to be clamped between the flange c^{10} and the fixed hand-wheel or abutment, and the said pulley will thus be operatively connected with the said shaft. The direction of rotation of the driving-pulley will be such as to have a tendency to tighten the clamping-flange c^{10} against said pulley, so that only a comparatively light torsional spring c^{12} will be required to effect the initial clamping or clutching operation. The clutch-operating lever P is formed hollow, and mounted therein is a sliding rod or plunger R, encircled by a spiral spring r^2, confined between a shoulder at the lower part of said plunger and a hollow screw r^5, tapped in the upper part of the said clutch-operating lever, and by which screw the stress of said spring may be regulated.

When the arm n^2 of the rock-shaft N is moved rearward at the return movement of the said rock-shaft after the clamp has been fed or advanced from cutting position to stitching position, as hereinbefore described, the engagement of said arm with the depending projection r of the arm r' forces said arm r' rearward in opposition to the stress of the spring r^3, thus swinging the lower end of the clutch-operating lever P inward to shift the lower end of the plunger R inward out of holding engagement with the tappet c^{11} on the flange c^{10} of the sleeve c^9 and also out of the notch c^{13} of the disk c^6, fixed to the shaft C. As soon as the tappet c^{11} is free of the plunger R the torsional spring c^{12} imparts a partial rotation to the sleeve c^9, and thus causes the driving-pulley c to be clamped between the flange c^{10} and the hand-wheel c^8 to set the driving-shaft in motion. When a buttonhole has been stitched and barred, an upwardly-extending tripping device or projection g^{12} on the cam-disk g', rotating with the feed-shaft G, engages the depending projection r of the pivoted arm r', thus lifting said arm against the stress of the spring r^4 above the arm n^2 to free said projection r from engagement with the said arm n^2, which had meanwhile through the said arm r' been holding the clutch-operating lever P in the start motion and running position of the machine. The spring r^3 now draws the upper end of the clutch-controlling lever inward, and thus moves the lower end of the said lever outward to bring the lower end of the plunger or stop R into register with the disk c^6 and the tappet c^{11}, the latter in its rotation being in advance of the cam c^7 on the said disk c^6. As soon as the tappet c^{11} strikes the plunger or stop R the rotation of the sleeve c^9 with the shaft C is arrested, and said sleeve now being held stationary by the said plunger or stop against the stress of the torsional spring c^{12} the continued rotation of the shaft unscrews the flange c^{10} from clamping or clutching engagement with the driving-pulley c, which is now free to run loose on the sleeve c^9. As soon as the driving-pulley c is thus unclutched the cam c^7 on the disk c^6, fixed to the driving-shaft, comes beneath the plunger R and lifts the latter against the stress of its pressure-spring r^2, which forces said plunger downward against the periphery of said cam sufficiently hard to cause it to serve as a brake to arrest or retard the rotation of the driving-shaft, so that by the time the notch c^{13} comes beneath the plunger or stop and the stop projection on the disk c^6 comes into positive contact with the said plunger or stop the rotation of said shaft has almost ceased, and thus any straining jar or shock in stopping the machine is avoided. The stress of the pressure-spring r^2 may be adjusted to a nicety by the regulating-screw r^5 to provide for stopping the machine when running at different speeds without jar or shock, said pressure-spring being preferably so adjusted that when running at any desired speed the cam c^7 will just pass the lower end of the stop or plunger R to bring the notch c^{13} beneath the same.

When the cam-wheel M is rotated and the arm n' is swung in a direction to advance the clamp from cutting position to stitching position, the arm n^2 is at the clamp-advancing operation moved away from beneath the depending projection r on the arm r', so that the spring r^4 then draws said arm downward to bring said projection r into the path of movement of the arm n^2, and thus when said arm n^2 is returned (which occurs before the cam-wheel M has quite completed its rotation) it strikes the said projection r to set the machine in motion, as hereinbefore described.

The stored-up power of the spring m^9, expended each time the cam-wheel M is rotated by said spring after said cam-wheel has been released by the attendant to permit it to operate the cutter, feed or advance the clamp from cutting position to stitching position, and start the stitching mechanism, is restored during the operation of stitching the next buttonhole, the rotation of the shaft G, forming part of the feeding and stitch-forming mechanism of the machine, serving to wind up said spring to the extent to which it is unwound at each rotation of the cam-wheel M by reason of the connections hereinbefore described of said shaft with said cam-wheel.

The plunger R of the clutch-controlling lever P is provided near its top with a fixed collar r^6, having a depending arm r^7, to which is pivoted a lever r^9, having a side stop lug or projection r^{10} and at its lower end a finger r^{11}. A spring r^{12} normally presses said stop

lug or projection against the arm r^7, which thus limits the movement of said lever under the action of said spring. When the lever P is moved to unclutching position, the finger r^{11} is moved into yielding contact with the arm o^4 of the sliding clamp-opening rod O. Thus when the plunger R is lifted by the cam c^7 on the disk c^6 the lever r^9 will be lifted above the said arm o^4, and as soon as the finger r^{11} clears the said arm as said finger moves upward the spring r^{12} swings said finger to a position directly above said arm, so that when the said plunger next descends into the notch c^{13} of the disk c^6 to stop the driving-shaft the said finger r^{11} will strike the arm o^4 and release it from its stop or catch o^6 to permit the coil-spring o' to force said rod forward to open the clamp, as has been described. It will thus be understood that the clamp-opening rod O, which is movable independently of the stop-motion lever P and of the stopping-plunger R, mounted in said lever, will not be released from its holding-catch o^6 until after the driving-shaft of the machine has come to a full stop and after the last stitch of the buttonhole has been fully completed and tightened into the work. This is important, for the reason that if the clamp were to be opened and the work released before the final stitch has been set such final stitch would never be properly completed or tightened at all, but would be left loose, which would be a serious objection. The forward sliding movement of the rod O by the spring o' is limited by the guiding projection B^4, through which said rod slides, in coöperation with a collar o^{12}, fixed to said rod, a buffer-washer o^{13}, of leather or similar yielding material, being preferably interposed between said collar and guiding projection to avoid striking metallic contact between these parts.

The tension devices T for the needle-threads are located at the rear end of the stitching-frame B and are preferably provided with tension-releasing levers or devices t to tilt the upper tension-disks to release the threads, these tension-releasing levers t having depending inclined arms t' arranged to be engaged by the arm o^4 of the clamp-opening rod when said rod slides forward to open the clamp, the tensions remaining released during the shifting of the clamp from cutting position to stitching position and the tension devices being restored to action when the clutch-controlling lever is moved to set the stitching mechanism into operation, and at which time the sliding rod O is retracted by said lever, as has been described.

The needle-thread take-up and pull-off levers S are pivoted to rigid parts b^{25} of the stitching-frame B and are actuated for proper coöperation with the out-of-time needles by grooved cams c^{25}, formed in the opposite faces of a cam-disk c^{26}, fixed to the driving-shaft C. The said take-up and pull-off levers are provided with bent upper ends extending outward through openings in the vertical portion of the hollow arm of the stitching-frame and are provided near their ends with thread-eyes s, coöperating with suitable thread-guides s', attached to said arm.

The starting and stopping arm r' is provided with a forwardly-projecting rigid extension or handle r^{15}, conveniently accessible to the attendant and by which the machine may at any time be started or stopped. To avoid any possible accidental starting of the machine excepting when the work-clamp is in stitching position or to stop the machine should said clamp accidentally get out of stitching position while the machine is running, the standard i^{11} is provided with a rigid guard-arm i^{31}, extending beneath the said extension or handle r^{15} and having an incline on its upper side or edge, adapted to lift the said extension or handle when the clamp is moved to cutting position should said extension or handle and the arm r' (of which it is a rigid part) be down in its running or starting position. This guard-arm i^{31} is desirable owing to the fact that should the stitching mechanism be started when the clamp is not in stitching position a portion of the metallic clamping jaws or members of said clamp would be beneath the needles or in the path of movement of the upper looper, and these parts would thus be liable to be broken.

The general operation of the machine will be readily understood from the foregoing description, in which the operations of the different parts or mechanisms have been set forth. When the attendant after locating the work in position to be clamped and cut lifts the treadle-operated rod q^4, the clamp is first closed, and the latch-lever, restraining the movement of the spring-actuated cam-wheel M, is then released to permit the said cam-wheel to operate the cutter, feed or advance the clamp from cutting position to stitching position, and start the machine, these three operations, resulting from a single rotation of said cam-wheel, being successively performed in the order stated, but all occurring in an instant or fractional part of a second of time. During the traveling movements of the stitching devices lengthwise of a buttonhole in working the same the crane or bracket A^4, supporting the stitching-frame B, swings on its pivotal supports a, while during the lateral movements of the stitching devices in working the first and last portions of the eye of the buttonhole and in barring the said stitching-frame swings on its central pivotal supports on said crane or bracket. When the stitching of the last side of a buttonhole has been completed, as denoted by Fig. 63, the stitching-frame is shifted laterally during the formation of one or more stitches to bring the depth-stitch needle d into register with the buttonhole-slit, as indicated by Fig. 64, and the return partial rotation of the stitch-forming devices then occurs to form the radiating barring-stitches, (illustrated diagram-

matically in Fig. 65,) and after the completion of these barring-stitches the stitching-frame is reversely shifted laterally to bring both needles to their initial side-stitching positions, as denoted in Fig. 60. When the buttonhole has been stitched and barred, the machine is automatically stopped, and after the machine has ceased running the work-clamp is automatically opened, the tensions automatically released, and the opened clamp automatically shifted from stitching position to cutting position in readiness for another operation. On automatically shifting the clamp from cutting position to stitching position in repeating the cycle of operations just briefly referred to the stitched buttonhole is advanced or moved forward away from the needles in bringing the unstitched buttonhole-slit beneath the latter, so that this operation of shifting the work-clamp and work from cutting position to stitching position also advances or feeds the work from one buttonhole-stitching position to another.

In the operation of the novel stitch-forming mechanism hereinbefore shown and described, and comprising two out-of-time thread-carrying needles above the work and a looping mechanism below the work, and in which novel stitch-forming mechanism the non-synchronously-moving needles both reciprocate once at each complete stitch or at each rotation of the driving-shaft, the slit or edge needle d' first descends, and as it does so the upper looper b^8 carries a loop of depth-stitch-needle thread around said edge-needle and its thread and also through a lower loop of depth-stitch thread held by the non-thread-carrying looper f^8, and as said edge-needle rises its loop is entered by the thread-carrying looper f^7, which carries its own loop into the needle-loop. During the continued upward movement of the said edge-needle the said looper f^7 continues its forward movement, and at this time the acting part of the loop-spreader f^9 moves laterally away from the said thread-carrying looper, spreading or expanding the looper-loop horizontally as said looper-loop is carried beneath the depth-stitch needle d, which now descends into said looper-loop and passes a loop of depth-stitch-needle thread through said looper-loop. The depth-stitch needle now rises, and as it does so its loop is taken by the now advancing non-thread-carrying looper f^8 and expanded by the loop-spreader f^{10} as it is carried by said looper and spreader beneath the edge-needle d', so that said edge-needle may at its next descent pass its loop through the said lower depth-stitch-needle loop and also through an upper loop of depth-stitch thread formed, as above stated, by the upper looper b^8. As hereinbefore stated, the reverse turning movements of the stitch-forming devices or of the needles or loopers are utilized to effect the barring of the buttonholes instead of being performed idly, as heretofore in this class of machines. This barring operation will be understood from Figs. 63, 64, and 65. When the stitching of the last side of a buttonhole has been completed, the needles and work occupy the relative positions diagrammatically represented by Fig. 63, and to effect the barring the stitching-frame is shifted laterally on its pivotal supports from the cam-groove g^8, acting through the lever B^2 to change the positions of the needles relative to the work, as will be understood from Fig. 64, which represents the edge or slit needle d' as being temporarily the penetrating or depth-stitch needle and the penetrating or depth-stitch needle d as being temporarily the edge-stitch needle. If the stitching-frame be shifted quickly between two stitches, the changed relative positions of the needles and the work from the last overseaming-stitch to the first barring-stitch would be correctly represented by Figs. 63 and 64; but if this change or lateral shifting of the work be effected during the formation of, say, two or three stitches and without turning the needles such two or three stitches would be disposed straight across the end of the buttonhole as barring-stitches in addition to the radiating barring-stitches. In either case when the needles and the work are caused to occupy the relative positions illustrated by Fig. 64 the needles and loopers immediately performed their reversed turning movements to bring them back to starting position, and during such reverse turning movements if the work remain stationary a series of radiating barring-stitches (see Fig. 65) will be formed about the end of the buttonhole to finish the same. With the radiating barring-stitches disposed as in Fig. 65 a curved or semicircular purl will join their outer ends, such purl being due to the concatenation of the threads of the two needles by the upper looper b^8, as hereinbefore described. If, however, it be desired to dispose the purl of the barring-stitches straight across the end of the buttonhole, a slight longitudinal feeding movement will be imparted to the stitching-frame from the feeding-cam during the time when the radiating barring-stitches are being formed. The improved buttonhole barred in the manner just described is not herein claimed, as it constitutes the subject-matter of my application Serial No. 124,425, filed September 22, 1902.

In the present machine the work is fed or advanced for the next stitch while the depth-stitch needle is rising and the edge-needle descending; but this is not essential, as the work may be fed twice to each complete stitch, or the feed of the work might occur at any time during the cycle of operations required for the formation of a complete stitch, the feed of the work in overedge or buttonhole stitching being so very short that even if the needle or needles be in the work when the latter is being fed the said needle or needles can spring or bend slightly after their loops have been taken by the loopers with no serious detriment. In the present machine the

out-of-time needles reciprocate reversely, so that only one is in or below the work at once and so that both may be above the work when the latter is fed but this is not essential, for the reason just indicated. The improved stitch-forming mechanism herein shown and described and comprising two out-of-time needles, each reciprocating once to each rotation of the driving-shaft or once during the formation of each complete overseaming-stitch, is therefore not to be understood as being limited to any particular relative timing of the independently-moving needles or to the particular looping mechanism herein shown and described, as two non-thread-carrying loopers may be employed in connection with two independently moving out-of-time needles in making the two-thread-stitch seam shown and described in my application Serial No. 668,617, filed January 31, 1898, as will be understood.

The term "out of time" as herein employed in connection with the independently-moving needles will be understood to mean two independently-operating and non-synchronously-moving needles, both of which perform a reciprocation to each rotation of the driving-shaft of the machine.

The present invention is not to be understood as being limited to the details of the mechanism herein shown and described, as these may be varied widely without departing from the essential features of the invention. It will also be understood that many of the novel features of the machine herein shown and described may be used in machines which do not embody the other novel features thereof. For example, the feature of the pivotally-connected work support or frame and stitching-frame, either one of which is movable relative to the other, might be embodied in a buttonhole-stitching machine having stitch-forming, feeding, or cutting mechanisms different from those herein shown and described; also a different mechanism than that shown and described for storing up power during the stitching of a buttonhole to be utilized for operating the cutter, feeding the clamp, and starting the machine or for performing any one or more of these operations might be employed; also the feature of utilizing the return movements of the turning stitching devices in barring the buttonholes might be embodied in a buttonhole-machine quite different in many other features from the present machine; also the improved stitch-forming mechanism, comprising two out-of-time needles and coöperating looping devices, might be used in any overedge or overseaming machine in which this mechanism may be desirable, and so, also, with many other features of this improved machine.

The clutch and brake device herein shown and described and constituting a portion of the start and stop motion mechanism of this machine is not of itself claimed, the same being embraced by my United States Patent No. 673,353, granted April 30, 1901.

When the arm n^2, operated from the cam-wheel M and acting through the depending projection r and the arm or lever r', moves the start and stop motion or clutch controlling lever P from the position shown in full lines in Fig. 54 to the clutching position (shown in dotted lines in said figure and in full lines in Figs. 1 and 2,) the arm p of said clutch-controlling lever engaging the collar o^3 on the sliding clamp-opening rod O and moves said rod rearward in opposition to the stress of the spring o', as has been hereinbefore indicated. It will thus be understood that the stored-up power of the spring m^9 utilized in operating the cam-wheel M is also utilized to compress the spring o', thereby storing up power by the compression of the said last-named spring for operating the sliding clamp-opening rod O, as has been hereinbefore described. Thus the power of the spring m^9 stored up during the operation of stitching a buttonhole is not only utilized to cut the buttonholes, shift the clamp from cutting position to stitching position, and start the machine, but is also utilized indirectly by compressing the said spring o' to open the clamp when the arm o^4 of said clamp-opening rod O is released from its retaining shoulder or catch o^6 by the means hereinbefore described.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of a work support or frame and a stitching-frame having a double pivotal connection, so that one may swing in any desired direction relatively to the other, and automatic means for causing the movable frame to swing or travel relative to the stationary frame.

2. In a buttonhole-stitching machine, the combination with a stationary work support or frame and work-holding devices thereon, of a movable stitching-frame having a universal-joint connection with said stationary frame, so as to be adapted to swing in any desired direction, stitch-forming devices carried by said stitching-frame, and automatic means for causing said stitching-frame to swing in any desired direction relative to said work support or frame.

3. In a buttonhole-stitching machine, the combination with a stationary work support or frame and work-holding devices thereon, of a swinging bracket pivotally mounted on said work support or frame, a stitching-frame pivotally mounted on said swinging bracket, stitch-forming mechanism carried by said swinging stitching-frame, and automatic means for moving said stitching-frame in any desired direction relative to said work support or frame.

4. In a buttonhole-stitching machine, the

combination with a stationary work-frame comprising a base and a standard, of work-holding devices on said frame, a swinging bracket pivotally mounted on said standard and having two arms, a stitching-frame centrally and pivotally supported by the arms of said bracket, stitch-forming devices carried by said swinging stitching-frame, and automatic means for moving said stitching-frame in any horizontal direction.

5. In a buttonhole-stitching machine, the combination with a stationary work-frame, and a work-clamp and a buttonhole-cutter both mounted on said frame, of a movable stitching-frame having a double pivotal connection with said work-frame, stitch-forming devices mounted on said stitching-frame, and means for feeding or causing said stitching-frame to travel relative to said stationary work-frame.

6. In a buttonhole-stitching machine, the combination with a stationary work-frame, of a work-clamp and a buttonhole-cutter both mounted on said frame, a movable stitching-frame having a double pivotal connection with said work-frame, stitch-forming devices mounted on said stitching-frame and adapted for rotary movements, means for feeding or causing said stitching-frame to travel relative to said stationary work-frame, and means for imparting periodical rotary movements to said stitch-forming devices.

7. In a buttonhole-stitching machine, the combination with a stationary work-frame, of a work-clamp and a buttonhole-cutter both mounted on said frame, a movable stitching-frame, stitch-forming devices mounted on said stitching-frame, automatic mechanism for operating said buttonhole-cutter also mounted on said stitching-frame, and means for feeding or causing said stitching-frame to travel relative to said stationary work-frame.

8. In a buttonhole-stitching machine, the combination with a stationary work-frame, of a buttonhole-cutting device mounted on said work-frame, a work-clamp also mounted on said frame and horizontally movable thereon into and out of cutting and stitching positions, automatic means for moving said work-clamp on said work-frame from stitching position to cutting position, and vice versa, a movable stitching-frame, stitch-forming devices mounted on said stitching-frame, automatic mechanism, also mounted on said stitching-frame, for causing the cutter to perform its cutting operation, and means for feeding or causing the said stitching-frame to travel relative to said stationary work-frame.

9. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic cutter, means for operating the same to cut the buttonholes and for lifting or returning the said automatic cutter after its cutting stroke, and automatic means for storing up power, during the operation of stitching a buttonhole, utilized to actuate said cutter at both its cuting and return strokes.

10. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic work-advancing mechanism, and automatic means for storing up power, during the operation of stitching a buttonhole, to be utilized to advance the work from one buttonhole-stitching position to another.

11. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic cutter arranged to cut the buttonholes out of stitching position, means for operating the same to cut the buttonholes, an automatic clamp-advancing mechanism by which the clamp is moved in a direction transverse to the length of the buttonholes, to advance or feed the work from one buttonhole-stitching position to another, and automatic means for storing up power, during the operation of stitching a buttonhole, to be utililized to actuate said cutter and said clamp-advancing mechanism to cut a buttonhole and then feed or advance the clamp from cutting position to stitching position.

12. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic cutter arranged to cut the buttonholes out of stitching position, means for operating said cutter, an automatic clamp-advancing mechanism by which the clamp is moved in a direction transverse to the length of the buttonholes to advance or feed the work from one buttonhole-stitching position to another, an automatic start and stop motion mechanism, and automatic means for storing up power, during the stitching of a buttonhole, to be utilized to actuate said cutter, feed or advance the clamp from cutting position to stitching position, and then release the start and stop motion mechanism to set the said stitch-forming devices into action.

13. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic mechanism for advancing the work from one buttonhole-stitching position to another, an automatic start and stop motion device, and automatic means for storing up power, during the stitching of a buttonhole, to be utilized to feed or advance the work from one buttonhole-stitching position to another and to set the said stitch-forming devices into operation when the work has thus been advanced.

14. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic buttonhole-cutter located laterally or at one side of the buttonhole-slit when the latter is in stitching position, and automatic means for shifting or feeding the work from the said cutter to the said stitch-forming devices in a direction transverse to the length of the buttonhole-slit.

15. In a buttonhole-stitching machine, the combination with stitch-forming devices, of an automatic buttonhole-cutter, a work-clamp movable relative to said cutter and said stitch-forming devices, automatic means for moving the said clamp, in a direction sidewise of the buttonholes, from cutting position to stitching position and from stitching position to cutting position, means for closing the clamp in cutting position and automatic means for opening said clamp in stitching position.

16. In a buttonhole-stitching device, the combination with work-holding and stitch-forming devices, of an automatic buttonhole-cutter, an automatic mechanism for feeding or advancing the work from cutting position to stitching position and which movement from cutting position to stitching position also transfers the work from one buttonhole-stitching position to another, and an automatic stop-motion mechanism for stopping the machine when the stitching of a buttonhole has been completed.

17. In a buttonhole-stitching machine, the combination with work-holding and stitch-forming devices, of an automatic buttonhole-cutter, an automatic mechanism for feeding or advancing the work from cutting position to stitching position and from one buttonhole-stitching position to another, an automatic stop-motion mechanism for stopping the machine when the stitching of a buttonhole has been completed, and an automatic clamp-opening device actuated from said stop-motion mechanism and serving to open the clamp when the machine is stopped.

18. In a buttonhole-stitching machine, the combination with work-holding devices, of a buttonhole-cutting device constructed to punch out or remove a narrow section of material from the slit portion of a buttonhole, and a stitch-forming mechanism for producing an overedge-seam which builds out the edges of the buttonhole-slit and practically fills up the space formed by removing the material from the slit portion of the buttonhole.

19. In a buttonhole-stitching machine, the combination with a stationary frame or support and a frame which is universally movable horizontally, of stitch-forming devices mounted on one of said frames, a work-holding device mounted on the other of said frames, and mechanism for advancing the work from one buttonhole-stitching position to another.

20. In a buttonhole-stitching machine, the combination with a stationary frame or support and a frame which is universally movable horizontally, of stitch-forming devices mounted on one of said frames, an automatic buttonhole-cutter and a work-holding device both mounted on the other of said frames, and mechanism for advancing the work from one buttonhole-stitching position to another.

21. In a buttonhole-stitching machine, the combination with a stationary frame or support and a frame which is universally movable horizontally, of stitch-forming devices mounted on one of said frames, a work-holding device mounted on the other of said frames, means for imparting periodical rotary movements to said stitch-forming devices, and mechanism for advancing the work from one buttonhole-stitching position to another.

22. In a buttonhole-stitching machine, the combination with a stationary frame or support and a frame which is universally movable horizontally, of stitch-forming devices mounted on one of said frames, a work-holding device mounted on the other of said frames, means for imparting periodical rotary movements to said stitch-forming devices, an automatic buttonhole-cutter, and mechanism for advancing the work from one buttonhole-stitching position to another.

23. In a buttonhole-stitching machine, the combination with a stationary work support or frame, and a work-clamp mounted thereon, of a stitching-frame which is universally movable horizontally, stitch-forming devices mounted on said stitching-frame, and mechanism for advancing the work from one buttonhole-stitching position to another.

24. In a buttonhole-stitching machine, the combination with a stationary work support or frame, and a work-clamp mounted thereon, of a stitching-frame which is universally movable horizontally, stitch-forming devices mounted on said stitching-frame, an automatic buttonhole-cutter, and mechanism for advancing the work from one buttonhole-stitching position to another.

25. In a buttonhole-stitching machine, the combination with a stationary work support or frame and a work-clamp mounted thereon, of a stitching-frame which is universally movable horizontally, stitch-forming devices mounted on said stitching-frame, means for imparting periodical rotary movements to said stitch-forming devices, and automatic mechanism for advancing the work from one buttonhole-stitching position to another.

26. In a buttonhole-stitching machine, the combination with a stationary work support or frame, and a work-clamp mounted thereon, of a stitching-frame which is universally movable horizontally, stitch-forming devices mounted on said stitching-frame, means for imparting periodical rotary movements to said stitch-forming devices, an automatic buttonhole-cutter, and automatic mechanism for advancing the work from one buttonhole-stitching position to another.

27. In a buttonhole-stitching machine, the combination with stitch-forming devices, of a work-clamp, an automatic stop-motion mechanism for stopping the machine when the stitching of a buttonhole has been completed, and an automatic clamp-opening device controlled by said stop-motion mechanism, but movable independently thereof, and acting to open the clamp after the driving-shaft of

the machine has come to a full stop; the machine thereby completing the final stitch of a buttonhole before the work is released.

28. In a buttonhole-stitching machine, the combination with stitch-forming devices, of a work-clamp, an automatic buttonhole-cutter, an automatic stop-motion mechanism for stopping the machine when the stitching of a buttonhole has been completed, and an automatic clamp-opening device controlled by said stop-motion mechanism but movable independently thereof, and acting to open the clamp after a buttonhole has been cut and stitched and after the driving-shaft of the machine has come to a full stop; the machine thereby completing the final stitch of a buttonhole before the work is released.

29. In a buttonhole-stitching machine, the combination with stitch-forming devices, of a work-clamp, an automatic buttonhole-cutter, an automatic mechanism for advancing the work from one buttonhole-stitching position to another, an automatic stop-motion mechanism for stopping the machine when the stitching of a buttonhole has been completed, and an automatic clamp-opening device actuated from said stop-motion mechanism so as to open the clamp after the driving-shaft of the machine has come to a full stop.

30. In a buttonhole-stitching machine, the combination with work-holding devices and feeding mechanism for changing the relative positions of the work and the needles, of a stitch-forming mechanism comprising a slit or edge stitch needle, a depth-stitch needle and coöperating loop-taking means, mechanism for imparting a partial rotation to said stitch-forming devices in working one end of a buttonhole, means for bringing the depth-stitch needle into register with the buttonhole-slit when the last side of said buttonhole has been worked, and means for imparting a return partial rotation to the said stitch-forming devices while they are still running so as to form a bar at the other end of the buttonhole during the return partial rotation of the said stitch-forming devices necessary to bring them to their initial positions.

31. In a buttonhole-stitching machine, the combination with work-holding devices and feeding mechanism for changing the relative positions of the work and the needles, of a stitch-forming mechanism comprising a slit or edge stitch needle, a depth-stitch needle and coöperating loop-taking means, mechanism for imparting a partial rotation to said stitch-forming devices in working one end of a buttonhole, means for shifting the stitch-forming devices laterally to bring the depth-stitch needle into register with the buttonhole-slit when the last side of said buttonhole has been worked, and means for imparting a return partial rotation to the said stitch-forming devices while they are still running so as to form a bar at the other end of the buttonhole during the return partial rotation of the said stitch-forming devices necessary to bring them to their initial positions.

32. In a buttonhole-sewing machine, the combination with a work-frame and a stitching-frame having a double pivotal connection so that one of said frames may be moved in any desired direction relative to the other, of a work-clamp mounted on one of said frames, a stitch-forming mechanism mounted on the other of said frames and comprising two out-of-time needles and suitable loop-taking devices, and automatic feeding mechanism for changing the position of one of said frames relative to the other.

33. In an overedge stitching-machine, the combination with a suitable feeding mechanism, of two out-of-time eye-pointed needles above the work-plate, means for imparting non-synchronous reciprocations to said needles and so that each performs one reciprocation to each rotation of the driving-shaft of the machine, and two loopers below the work-plate coöperating with said needles, each of said loopers taking the thread of a different needle and each of said loopers reciprocating once at each rotation of said driving-shaft.

34. In a buttonhole-stitching machine, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time eye-pointed needles above the work-plate, means for reciprocating said needles non-sychronously and so that each performs one reciprocation to each rotation of the driving-shaft, a thread-carrying looper and a non-thread-carrying looper below the work-plate and each taking the thread of a different one of said needles and each of said loopers performing one reciprocation to each rotation of said driving-shaft, and a loop-spreader coöperating with each of said loopers.

35. In a buttonhole-stitching machine, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices cooperating with said needles, and means for imparting periodical rotary movements to said needles and looping devices.

36. In a buttonhole-stitching machine, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices cooperating with said needles, and an automatic buttonhole-cutter.

37. In a buttonhole-stitching machine, the combination with a work-clamp and suitable

feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices cooperating with said needles, and automatic mechanism for advancing the work from one buttonhole-stitching position to another.

38. In a buttonhole-stitching machine, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices cooperating with said needles, means for imparting periodical rotary movements to said needles and looping devices, an automatic buttonhole-cutter, and automatic mechanism for advancing the work from one buttonhole-stitching position to another.

39. In a buttonhole-stitching mechanism, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices coöperating with said needles, means for imparting periodical rotary movements to said needles and looping devices, an automatic buttonhole-cutter, automatic mechanism for advancing the work from one buttonhole-stitching position to another, and an automatic stop-motion mechanism.

40. In a buttonhole-stitching mechanism, the combination with a work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices coöperating with said needles, means for imparting periodical rotary movements to said needles, and looping devices, an automatic buttonhole-cutter, automatic mechanism for advancing the work from one buttonhole-stitching position to another, an automatic stop-motion mechanism and an automatic mechanism for opening the work-clamp after the machine has been stopped.

41. In a buttonhole-stitching mechanism, the combination with the work-clamp and suitable feeding mechanism for changing the relative positions of the work and the needles, of two out-of-time needles, means for reciprocating said needles non-synchronously and so that each performs one reciprocation to each rotation of the driving-shaft, looping devices coöperating with said needles, means for imparting periodical rotary movements to said needles and looping devices, an automatic buttonhole-cutter, automatic mechanism for advancing the work from one buttonhole-stitching position to another, an automatic stop-motion mechanism, an automatic mechanism for opening the work-clamp after the machine has been stopped, and automatic means for shifting the said work-clamp from stitching position to cutting position.

42. In a buttonhole-stitching machine, the combination with suitable stitch-forming and feeding devices, of an automatic cutter, a work-clamp movable relative to said cutter and said stitch-forming devices in a direction transverse to the length of the buttonholes, means for shifting the said clamp from cutting position to stitching position, a latchment device for retaining said clamp in stitching position, means for opening the clamp, means for releasing said latchment device when the clamp is opened, and automatic means for shifting the said clamp from stitching position to cutting position.

43. In a buttonhole-stitching machine, the combination with suitable stitch-forming and feeding devices, of an automatic cutter, a work-clamp movable relative to said cutter and said stitch-forming devices in a direction transverse to the length of the buttonholes, means for shifting the said clamp from cutting position to stitching position, a latchment device for retaining said clamp in stitching position, automatic means for opening the clamp, means for releasing said latchment device when the clamp is opened, and automatic means for shifting the said clamp from stitching position to cutting position.

44. In a buttonhole-stitching machine, the combination with suitable stitch-forming and feeding devices, of an automatic cutter, a work-clamp movable relative to said cutter and said stitch-forming devices in a direction transverse to the length of the buttonholes, means for closing the said clamp in cutting position, means for shifting the said clamp from cutting position to stitching position, a latchment device for retaining said clamp in stitching position, automatic means for opening the clamp, means for releasing said latchment device when the clamp is opened, and automatic means for shifting the said clamp from stitching position to cutting position.

45. In a buttonhole-stitching machine, the combination with suitable stitch-forming and feeding devices, of an automatic cutter, a work-clamp movable relative to said cutter and said stitch-forming devices in a direction transverse to the length of the buttonholes, means for shifting the said clamp from cutting position to stitching position, a latchment device for retaining said clamp in stitching position, automatic means for opening the clamp in stitching position, automatic means for releasing said latchment device when the clamp is opened, and automatic means for shifting the opened clamp from stitching position to cutting position.

46. In a buttonhole-stitching machine, the combination with a stationary work support

or frame, of a work-clamp movably mounted thereon, a movable stitching-frame, stitch-forming devices mounted on said stitching-frame, means for feeding or causing said stitching-frame to travel relative to said work support or frame, a buttonhole-cutter mounted on said stationary work support or frame, automatic means on said stitching-frame for operating said cutter, and automatic means for shifting said clamp on said stationary work support or frame from cutting position to stitching position and from stitching position to cutting position in a direction sidewise of the buttonholes.

47. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a work-clamp movably mounted thereon, a movable stitching-frame, stitch-forming devices mounted on said stitching-frame, means for imparting periodical rotary movements to said stitch-forming devices, means for feeding or causing said stitching-frame to travel relative to said work support or frame, a buttonhole-cutter mounted on said stationary work support or frame, automatic means on said stitching-frame for operating said cutter and automatic means for shifting said clamp on said stationary work support or frame from cutting position to stitching position and from stitching position to cutting position in a direction sidewise of the buttonholes.

48. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a work-clamp movably mounted thereon, a movable stitching-frame, stitch-forming devices mounted on said stitching-frame, means for feeding or causing said stitching-frame to travel relative to said work support or frame, a buttonhole-cutter mounted on said stationary work support or frame, automatic means on said stitching-frame for operating said cutter, automatic means for shifting said clamp on said stationary work support or frame from cutting position to stitching position and from stitching position to cutting position, means for closing said clamp in cutting position and automatic means for opening said clamp in stitching position.

49. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, stitch-forming devices mounted on one of said frames, and an automatic buttonhole-cutter and a work-clamp both mounted on the other of said frames, said clamp being movable on its frame or support toward and from said cutter in a direction sidewise of the buttonholes.

50. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, stitch-forming devices mounted on one of said frames, an automatic buttonhole-cutter and a work-clamp both mounted on the other of said frames, said clamp being movable on its frame or support toward and from said cutter in a direction sidewise of the buttonholes, and means for imparting periodical rotary movements to said stitch-forming devices.

51. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, a buttonhole-cutting device and a work-clamp device both mounted on one of said frames, one of said devices being movable on its frame, sidewise of the buttonholes, toward and from the other of said devices, and stitch-forming devices and automatic means for operating said cutter mounted on the other of said frames.

52. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, a buttonhole-cutter and a work-clamp both mounted on one of said frames, said clamp being movable on its frame toward and from said cutter in a direction sidewise of the buttonholes, stitch-forming devices and automatic means for operating said cutter mounted on the other of said frames, and automatic mechanism for shifting said clamp from said cutter to said stitch-forming devices, and for returning said clamp to said cutter.

53. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, a buttonhole-cutter and a work-clamp both mounted on one of said frames, said clamp being movable on its frame toward and from said cutter, stitch-forming devices and automatic means for operating said cutter mounted on the other of said frames, automatic mechanism for shifting said clamp from said cutter to said stitch-forming devices and for returning said clamp to said cutter, means for closing said clamp in cutting position and automatic means for opening said clamp in stitching position.

54. In a buttonhole-stitching machine, the combination with a work support or frame and a stitching-frame, one of which is movable relative to the other, of means for feeding or causing the movable frame to travel relative to the stationary frame, a buttonhole-cutter and a work-clamp both mounted on one of said frames, said clamp being movable on its frame toward and from said cutter, stitch-forming devices and automatic means for operating said cutter mounted on the other of said frames, automatic mechan-

ism for shifting said clamp in a direction sidewise of the buttonholes from said cutter to said stitch-forming devices and for returning said clamp to said cutter, an automatic stop-motion mechanism, a clamp-opening device operated by said stop-motion mechanism and serving to open the clamp when the latter is in stitching position, and means for automatically shifting the opened clamp from stitching position to cutting position.

55. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a stitching-frame movably mounted relative to said work-frame, stitch-forming devices mounted on said movable frame, a buttonhole-cutter and a work-clamp mounted on said work-frame, said clamp being movable on said work-frame toward and from said cutter in a direction sidewise of the buttonholes, automatic mechanism, on said stitching-frame, for operating said cutter, means for feeding or causing said stitching-frame to travel relative to said work-frame, and automatic means for shifting said clamp from cutting position to stitching position.

56. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a stitching-frame movably mounted relative to said work-frame, stitch-forming devices mounted on said movable frame, a buttonhole-cutter and a work-clamp mounted on said work-frame, said clamp being movable on said work-frame toward and from said cutter, automatic mechanism, on said stitching-frame, for operating said cutter, means for feeding or causing said stitching-frame to travel relative to said work-frame, automatic means for shifting said clamp from cutting position to stitching position and from stitching position to cutting position, means for closing the said clamp in cutting position and automatic means for opening said clamp in stitching position.

57. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a stitching-frame movably mounted relative to said work-frame, stitch-forming devices mounted on said movable frame, a buttonhole-cutter and a work-clamp mounted on said work-frame, said clamp being movable on said work-frame toward and from said cutter, automatic mechanism on said stitching-frame, for operating said cutter, means for feeding or causing said stitching-frame to travel relative to said work-frame, automatic means for shifting said clamp from cutting position to stitching position, a start and stop motion mechanism, means for closing the said clamp in cutting position, and automatic means, operated by said start and stop motion mechanism, for opening said clamp in stitching position.

58. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of a buttonhole-cutter, a cam device operatively connected with said cutter to actuate the same, a spring connected with said cam device and with said stitch-forming mechanism, means for holding said cam device stationary and for winding up or compressing said spring while the stitch-forming mechanism is in operation, and means for releasing said cam device to enable the latter to actuate the cutter when desired.

59. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of mechanism for feeding or advancing the work from one buttonhole-stitching position to another, a cam device to actuate said work-advancing mechanism, a spring connected with said cam device and with said stitch-forming mechanism, means for holding said cam device stationary and for winding up or compressing said spring when the said stitch-forming mechanism is in operation, and means for releasing said cam device to enable the latter to feed or advance the work, when desired.

60. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of a start and stop motion device, a cam device operatively connected with said start and stop motion device and with said stitch-forming mechanism, a spring connected with said cam device, means for holding said cam device stationary and for winding up or compressing said spring when the said stitch-forming mechanism is in operation, and means for releasing said cam device to enable the latter to start the machine, when desired.

61. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of a buttonhole-cutter and a work-shifting device, a cam device operatively connected with said cutter and work-shifting device, a spring connected with said cam device and with said stitch-forming mechanism, means for holding said cam device stationary and for winding up said spring when the said stitch-forming mechanism is running, and means for releasing said cam device to enable the latter to operate said cutter and said work-shifting device, when desired.

62. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of a buttonhole-cutter and a start and stop motion mechanism, of a cam device operatively connected with said cutter and also connected with said start and stop motion mechanism, a spring connected with said cam device and with said stitch-forming mechanism, means for holding said cam device stationary and for winding up or compressing said spring when the said stitch-forming mechanism is running, and means for releasing said cam device to enable the latter to actuate the said cutter, and to start the machine, when desired.

63. In a buttonhole-stitching machine, the

combination with a work-holding device and stitch-forming and feeding mechanisms, of a mechanism for feeding or advancing the work from one buttonhole-stitching position to another, a start and stop motion mechanism, a cam device to actuate the work-advancing mechanism, said cam device being also connected to said start and stop motion mechanism, a spring connected with said cam device and with said stitch-forming mechanism, means for holding said cam device stationary and for winding up or compressing said spring when the said stitch-forming mechanism is running, and means for releasing said cam device to enable the latter to advance the work and start the machine.

64. In a buttonhole-stitching machine, the combination with a work-holding device and stitch-forming and feeding mechanisms, of a buttonhole-cutter, a work shifting and advancing mechanism, a start and stop motion mechanism, a cam device operatively connected with said cutter and with said work shifting and advancing and start and stop motion mechanisms, a spring connected with said cam device and said stitch-forming mechanism, means for holding said cam device stationary and for winding up or compressing said spring when the said stitch-forming mechanism is running, and means for releasing said cam device to enable it to operate the said cutter, shift or advance the work and start the machine, when desired.

65. In a buttonhole-stitching machine, the combination with two needle-bars and their needles, of a work-clamp, a feeding mechanism, a rotary bearing in which both of said needle-bars are mounted, a rotary looper-support, a rocking looper-carrier on said support, two alternately-acting loopers and suitable loop-spreaders all mounted on said carrier, means for operating said needle-bars and looper-carrier, and means for imparting periodical rotary movements to said rotary bearings.

66. In a buttonhole-stitching machine, the combination with two needle-bars and their needles, of a work-clamp, a feeding mechanism, a rotary bearing in which said needle-bars are mounted, a rotary looper-support, a rocking looper-carrier on said support, two alternately-acting loopers on said carrier, a rocking or oscillating needle-guard on said looper-carrier, a needle-guard fixed to said looper-support, means for operating said needle-bars and looper-carrier, and means for imparting periodical rotary movements to said rotary bearings.

67. In a buttonhole-stitching machine, the combination with two needle-bars and their needles, of a work-clamp, a feeding mechanism, a rotary bearing in which said needle-bars are mounted, a rotary looper-support, a rocking looper-carrier on said support, two alternately-acting loopers and suitable loop-spreaders all mounted on said carrier, means for operating said needle-bars and looper-carrier, and means for imparting periodical rotary movements to said rotary bearings, said rotary looper-support being provided, below said loopers, with a thread-guide eye coincident with its axis of rotation, or approximately so.

68. In a buttonhole-stitching machine, the combination with a work-clamp, a feeding mechanism, upper and lower stitch-forming devices and upper and lower rotary members provided with pinions by means of which said members may be rotated, of a two-armed lever swinging on a horizontal pivot and having oppositely-moving upper and lower racks meshing with said pinions, and means for vibrating said two-armed lever.

69. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a swinging crane or bracket pivotally mounted on said frame and having two arms, a stitching-frame, pivot-screws forming a jointed connection between said stitching-frame and said arms, one of said pivot-screws being a bushing-screw tapped in the upper arm of said swinging bracket and adjustable to vary or accommodate the vertical position of said stitching-frame, a set-nut to retain said bushing-screw in any desired position of adjustment, stitch-forming devices carried by said stitching-frame, and automatic means for moving said stitching-frame in any desired direction.

70. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a movable stitching-frame having a double pivotal connection with said work support or frame, driving, feeding and stitch-forming mechanisms carried by said stitching-frame, and means connecting said frames, and independent of the pivotal connections, for steadying said stitching-frame on the said supporting work-frame.

71. In a buttonhole-stitching machine comprising rotary stitch-forming devices, a work-clamp and a feeding mechanism, the combination with the rotary parts by which the stitch-forming devices are turned and which rotary parts are provided with fixed pinions, of threaded bushings abutting against said pinions, a stitching-frame in which said threaded bushings are tapped so as to hold the said pinions, and the rotary parts to which said pinions are fixed, securely in place.

72. In a buttonhole-stitching machine, the combination with the stitching-frame B having the head b, of a work-clamp, a feeding mechanism, the rotary sleeve or bushing b^2 for turning the needle-bars, the pinion b^3 fixed to said sleeve, and the bushing b' tapped in said head and serving as a bearing for said bushing b^2, said bushing b' abutting against said pinion to secure the latter and the said bushing b^2 in place.

73. In a buttonhole-stitching machine, the combination with the stitching-frame B, a work-clamp and a feeding mechanism, of the rotary shaft or spindle F, provided with the

fixed pinion f, the looping devices supported by and turning with said shaft or spindle, and the bushing f^{35} in which the said shaft or spindle turns and which abuts against the said pinion to hold the latter and the said shaft or spindle in place.

74. In a buttonhole-stitching machine, the combination with the upper and lower stitch-forming devices and the work-plate, of a buttonhole cutter or die constructed to remove a portion of the material from the eye and slit parts of a buttonhole and means for operating said cutter or die to cause it to positively force the removed cuttings or chips below the said work-plate, and a chute or shield below said work-plate to carry the said cuttings or chips away from the lower stitch-forming devices.

75. In a buttonhole-stitching machine, the combination with the upper and lower stitch-forming devices and the work-plate, of a buttonhole cutter or die constructed to remove a portion of the material from the eye and slit parts of a buttonhole, and means for operating said cutter or die to cause it to positively force the removed cuttings or chips below the said work-plate, said cutter or die having an inclined cutting portion to give a shear cut.

76. In a buttonhole-stitching machine, the combination with the upper and lower stitch-forming devices and the work-plate, of a buttonhole cutter or die constructed to remove a portion of the material from the eye and slit parts of a buttonhole, and means for operating said cutter or die to cause it to positively force the removed cuttings or chips below the said work-plate, said cutter or die having an inclined cutting portion to give a shear cut, the eye-forming part of said cutter being lowest so as to act first.

77. In a buttonhole-stitching-machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp, and automatic means, acting during the stitching of a buttonhole, for storing up power to be utilized for opening said clamp after the stitching of a buttonhole has been completed.

78. In a buttonhole-stitching-machine, the combination with stitch-forming and feeding mechanisms and a work-clamp, of a sliding clamp-opening rod, a spring for moving said rod forward to open the clamp, a catch device for holding said spring compressed at proper times, a power-spring which is compressed during the stitching of a buttonhole so as to store up power therein, and connections whereby the stored-up power of said power-spring is utilized to compress said first-named spring so that the latter may operate said clamp-opening rod to open the clamp when the said catch device is released.

79. In a buttonhole-stitching machine, the combination with a work-clamp, a feeding mechanism, two out-of-time needles and two loopers coöperating therewith below the work-plate, of mechanism for operating said needles and loopers, a looper above the work-plate serving to hold the thread of one of said needles in position for the other of said needles to enter a loop of the thread of the first-named needle, and mechanism for operating the said last-named looper.

80. In a buttonhole-stitching machine, the combination with a work-clamp, a feeding mechanism and two needle-bars provided with eye-pointed needles, of mechanism for reciprocating said needle-bars non-synchronously, a looper above the work-plate for carrying loops of the thread of one of said needles in position for the other of said needles to enter said loops, a support for said looper with which the shank of the latter has a universal-joint connection, and means on one of said needle-bars for operating said looper, two lower loopers coöperating with said needles, and means for operating said lower loopers.

81. In a buttonhole-stitching machine, the combination with a work-clamp, a feeding mechanism, two needle-bars and their operating mechanisms, of the looper b^8 above the work-plate carried by a shank b^7 having the crooked or spirally-formed portion b^9, a support with which the said looper-shank has a universal-joint connection, a ball device, as d^2, provided with a central opening through which the said looper-shank passes, and means, connected with one of said needle-bars, for supporting the said ball device so that as the latter is reciprocated by the needle-bar a circular movement will be imparted to the said looper.

82. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp having, above the work-plate, a clamp-operating shaft provided with an arm, said clamp-operating shaft having a positive connection with the clamping arms or jaws, and a rocking treadle-operated device having an arm to engage the arm of said clamp-shaft to close the said clamp; the construction and arrangement of the parts being such that while the clamp is positively closed by the treadle connection it is free to be opened independently of the treadle.

83. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp, a buttonhole-cutting device, automatic means for storing up power during the stitching of a buttonhole, and a treadle-operated device whereby the work-clamp is closed and the stored-up power released to operate said cutting device to cut a buttonhole.

84. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp, a buttonhole-cutting device, a clamp-shifting device, automatic means for storing up power during the stitching of a buttonhole, and a treadle-operated device whereby the said work-clamp is closed and the stored-up power released so

that it can, through suitable connections, operate the said cutting and clamp-shifting devices.

85. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp, a buttonhole-cutting device, a clamp-shifting device, a start and stop motion mechanism, automatic means for storing up power during the stitching of a buttonhole, and a treadle-operated device whereby the said work-clamp is closed and the stored-up power is released, and means, operated by said stored-up power, whereby the said cutting and clamp-shifting devices are successively operated and the start and stop motion mechanism released to set the machine in operation.

86. In a buttonhole-stitching machine, the combination with a stitch-forming mechanism, of a feeding mechanism comprising a rotating feeding-wheel, a torsional spring so connected with said feeding-wheel as to be wound up, to store up power therein, during the stitching of a buttonhole, a cam device rotating independently of said feeding-wheel, and with which said spring is connected, a buttonhole-cutting device operatively connected with said cam device, means for holding said cam device stationary while the feeding-wheel is in rotation, and means for releasing the said cam device when it is desired to utilize the stored-up power of said spring for operating the cutting device to cut a buttonhole.

87. In a buttonhole-stitching machine, the combination with a stitch-forming mechanism, of a feeding mechanism comprising a rotating feeding-wheel, a torsional spring so connected with said feeding-wheel as to be wound up, to store up power therein, during the stitching of a buttonhole, a cam device rotating independently of said feeding-wheel and with which said spring is connected, a clamp-shifting device operatively connected with said cam device, means for holding said cam device stationary while the feeding-wheel is in rotation, and means for releasing the said cam device when it is desired to utilize the stored-up power of said spring for shifting the clamp.

88. In a buttonhole-stitching machine, the combination with a stitch-forming mechanism, of a feeding mechanism comprising a rotating feeding-wheel, a torsional spring so connected with said feeding-wheel as to be wound up, to store up power therein, during the stitching of a buttonhole, a cam device rotating independently of said feeding-wheel and with which said spring is connected, a start-motion device operatively connected with said cam device, means for holding said cam device stationary while the feeding-wheel is in rotation, and means for releasing the said cam device when it is desired to utilize the stored-up power of said spring for starting the machine.

89. In a buttonhole-stitching machine, the combination with a stitch-forming mechanism, of a feeding mechanism comprising a rotating feeding-wheel, a torsional spring so connected with said feeding-wheel as to be wound up, to store up power therein, during the stitching of a buttonhole, a cam device rotating independently of said feeding-wheel and with which said spring is connected, a buttonhole-cutting device and a clamp-shifting device both operatively connected with said cam device, means for holding said cam device stationary while the feeding-wheel is in rotation, and means for releasing the said cam device when it is desired to utilize the stored-up power of said spring for operating the cutting device to cut a buttonhole and for shifting the clamp.

90. In a buttonhole-stitching machine, the combination with a stitch-forming mechanism, of a feeding mechanism comprising a rotating feeding-wheel, a torsional spring so connected with said feeding-wheel as to be wound up, to store up power therein, during the stitching of a buttonhole, a cam device rotating independently of said feeding-wheel and with which said spring is connected, a buttonhole-cutting device, a clamp-shifting device and start-motion device all operatively connected with said cam device, means for holding said cam device stationary while the feeding-wheel is in rotation, and means for releasing the said cam device when it is desired to utilize the stored-up power of said spring for operating the cutting device, shifting the clamp and starting the machine.

91. In a buttonhole-stitching machine, the combination with stitch-forming mechanism, of a feeding mechanism comprising the shaft G and the feeding-wheel g fixed to said shaft, the spindle m^2 connected with said shaft to rotate therewith, the sleeve m' adapted to rotate loosely on said spindle, the cam-wheel M fixed to said sleeve, means for holding said cam-wheel stationary while the said shaft G is in rotation, the torsional spring m^2 connected with the said sleeve m' and with the said spindle m^9, a buttonhole-cutting device operatively connected with said cam-wheel M, and means for releasing the holding device of said cam-wheel to permit the latter to be rotated by the stored-up power of the said spring when it is desired to operate the said cutting device.

92. In a buttonhole-stitching machine, the combination with stitch-forming mechanism, of a feeding mechanism comprising the shaft G and the feeding-wheel g fixed to said shaft, the spindle m^2 connected with said shaft to rotate therewith, the sleeve m' adapted to rotate loosely on said spindle, the cam-wheel M fixed to said sleeve, means for holding said cam-wheel stationary while the said shaft G is in rotation, the torsional spring m^9 connected with the said sleeve m' and with the said spindle m^2, a clamp-shifting device operatively connected with said cam-wheel M, and means for releasing the holding device

of said cam-wheel to permit the latter to be rotated by the stored-up power of the said spring when it is desired to operate the said clamp-shifting device.

93. In a buttonhole-stitching machine, the combination with stitch-forming mechanism, of a feeding mechanism comprising the shaft G and the feeding-wheel g fixed to said shaft, the spindle m^2 connected with said shaft to rotate therewith, the sleeve m' adapted to rotate loosely on said spindle, the cam-wheel M fixed to said sleeve, means for holding said cam-wheel stationary while the said shaft G is in rotation, the torsional spring m^9 connected with the said sleeve m' and with the said spindle m^2, a start-motion device operatively connected with said cam-wheel M, and means for releasing the holding device of said cam-wheel to permit the latter to be rotated by the stored-up power of the said spring when it is desired to start the machine.

94. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a movable stitching-frame, a feeding cam-wheel g mounted on said stitching-frame, means for rotating said cam-wheel, the bar a^5 slidingly mounted on said work support or frame so as to move transversely of the latter but held from movement in a direction longitudinal of said frame, said bar being provided with a pin or roller stud entering a groove of said feeding cam-wheel, whereby when the feeding cam-wheel is rotated the stitching-frame will be moved lengthwise of a buttonhole, and means for steadying and guiding said stitching-frame in its longitudinal movement relative to said work support or frame.

95. In a buttonhole-stitching machine, the combination with a stationary work support or frame, of a movable stitching-frame, stitch-forming devices carried by said stitching-frame, a feeding cam-wheel g mounted on said stitching-frame, means for rotating said cam-wheel, the bar a^5 slidingly mounted on said work support or frame so as to move transversely of the latter but held from movement in a direction longitudinal of said frame, said bar being provided with a pin or roller stud entering a groove of said feeding cam-wheel, whereby when the feeding cam-wheel is rotated the stitching-frame will be moved lengthwise of a buttonhole, means for steadying and guiding said stitching-frame in its longitudinal movement relative to said work support or frame, the cam-wheel g' fixed to the said shaft G, the lever B^2 pivotally mounted on the said work support or frame, and having a pivotal connection with said stitching-frame, said lever being provided with a pin or roller stud entering a groove in the said cam-wheel g' so that the latter may swing the stitching-frame sidewise at proper intervals.

96. In a buttonhole-stitching machine, the combination with a work-clamp, a feeding mechanism, and a stitch-forming mechanism comprising two out-of-time needles above the work-plate and a thread-carrying looper and a non-thread-carrying looper beneath the work-plate, of a positively-operated pull-off lever to draw thread from the thread-spool for the said thread-carrying looper.

97. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-plate, a buttonhole-clamp slidingly mounted on said work-plate, a buttonhole-cutter also mounted on said work-plate, means for shifting the said clamp from stitching position to cutting position, a start and stop motion mechanism which is to be operated to start the machine when the said work-clamp is in cutting position, an arm or lever by which the said start and stop motion mechanism is controlled, and a guard device mounted on the said work-clamp and arranged to engage the said arm or lever to prevent the latter from being operated to start the machine excepting when the said work-clamp is in stitching position.

98. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a work-clamp comprising a shaft which is to be turned in opening or closing said clamp, a buttonhole-cutter arranged to cut a buttonhole when the work-clamp is out of stitching position, automatic means for moving said work-clamp from cutting position to stitching position, a latchment device for retaining said work-clamp in stitching position, means for shifting the clamp from stitching position to cutting position, means on said shaft for releasing the said latchment device when the clamp is opened, and an automatic clamp-opening device for turning said shaft to unclamp the work and release the said latchment device.

99. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of the cam-wheel M, means for holding said cam-wheel stationary when the said stitch-forming and feeding mechanisms are in operation, a torsional spring connected with said cam-wheel and with said feeding mechanism, a work-clamp provided with a pin or projection, a work-plate on which said work-clamp is slidingly mounted, the shaft N operatively connected with the said cam-wheel M and provided with the arm n' adapted to engage said pin or projection on said work-clamp to shift the latter from cutting position to stitching position, and means for releasing said cam-wheel when the clamp is to be shifted.

100. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of the cam-wheel M, means for holding the said cam-wheel stationary when the said stitch-forming and feeding mechanisms are in operation, a torsional spring connected with said cam-wheel and with said feeding mechanism, the shaft N operatively connected with said cam-wheel M and pro-

vided with the arm n^2, a start-motion mechanism to be operated by said arm n^2 to set the machine running, and means for releasing the said cam-wheel to permit it to be rotated by the said torsional spring when the machine is to be started.

101. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of the cam-wheel M, means for holding the said cam-wheel stationary when the said stitch-forming and feeding mechanisms are in operation, a torsional spring connected with said cam-wheel and with said feeding mechanism, the shaft N operatively connected with said cam-wheel M and provided with the arms n' and n^2, a work-clamp provided with a pin or projection to be engaged by the said arm n' to shift the said clamp, a start-motion device to be operated by the said arm n^2 to set the machine running, and means for releasing said cam-wheel to enable it to be rotated by said torsional spring when the clamp is to be shifted and the machine started.

102. In a buttonhole-stitching machine, the combination with stitch-forming and feeding mechanisms, of a cutting mechanism comprising a lower die-plate having an eyelet-opening and an open slit communicating therewith, and an upper cutting device consisting of a die closely fitting the opening in the said lower die-plate and thereby adapted, in cutting a buttonhole, to punch out a section of material corresponding in shape to the eye portion of the buttonhole and the open slit portion of said die-plate and force the same down through the said lower die-plate, and means for operating the said upper cutter or die to cause it to positively force the removed cuttings or chips down below the work-plate of the machine.

103. In a buttonhole-stitching machine, the combination with work-holding devices and feeding mechanism for changing the relative positions of the work and the needles, of a stitch-forming mechanism comprising a slit or edge stitch needle, a depth-stitch needle and coöperating loop-taking means, mechanism for imparting partial rotations to said stitch-forming devices in stitching the opposite ends of a buttonhole, and means for bringing the depth-stitch needle into register with the buttonhole-slit before a partial rotation of said stitch-forming devices, for the formation of a bar, and for returning said needle to its depth-stitch position after the bar has been formed.

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

EDWARD B. ALLEN.

Witnesses:
HENRY CALVER,
HENRY J. MILLER.