No. 705,257. Patented July 22, 1902.

# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 1.

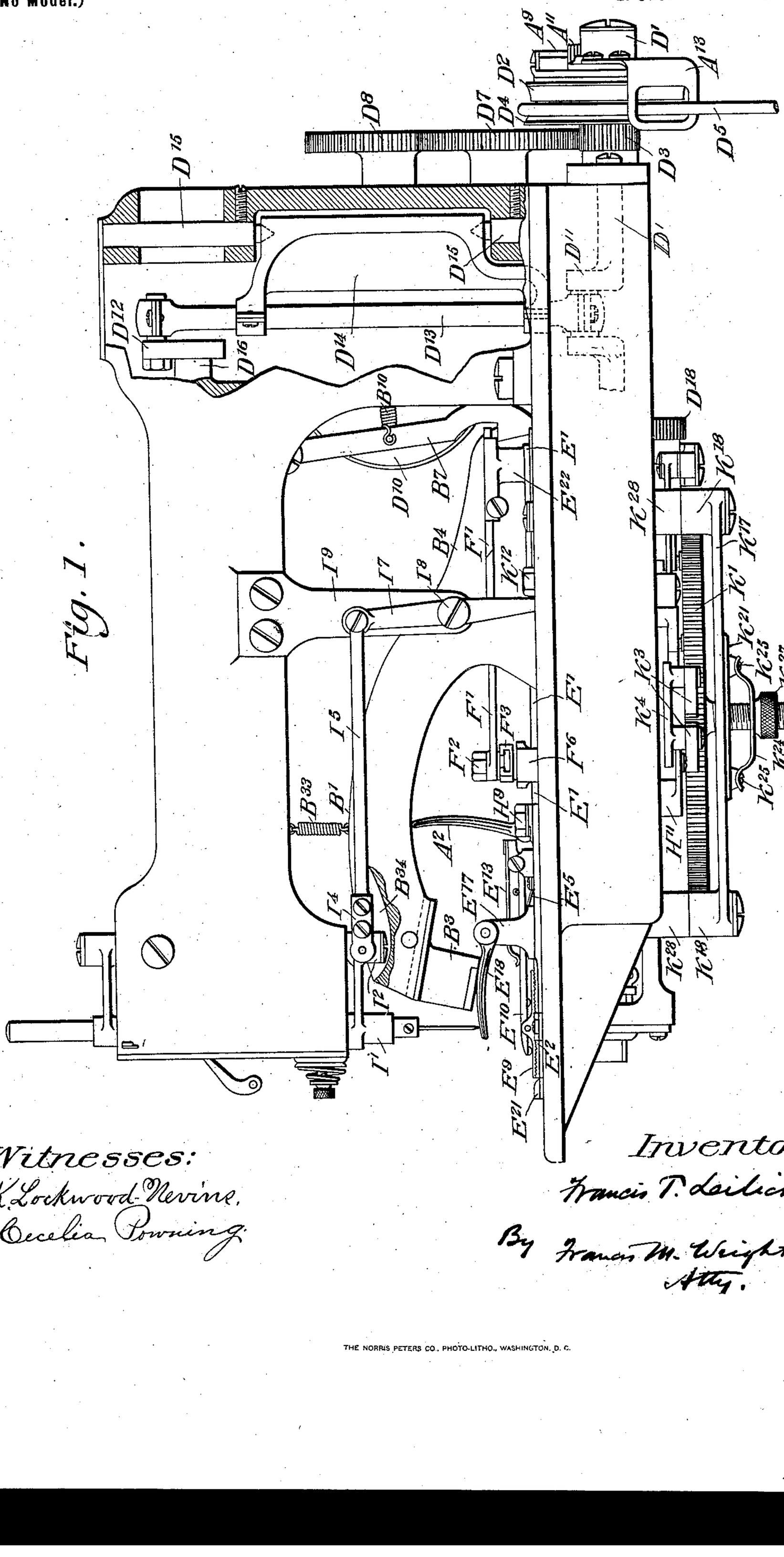


Fig. 1.

Witnesses:
K. Lockwood-Nevins.
Cecelia Powning.

Inventor:
Francis T. Leilich
By Francis M. Wright
Atty.

No. 705,257. Patented July 22, 1902.

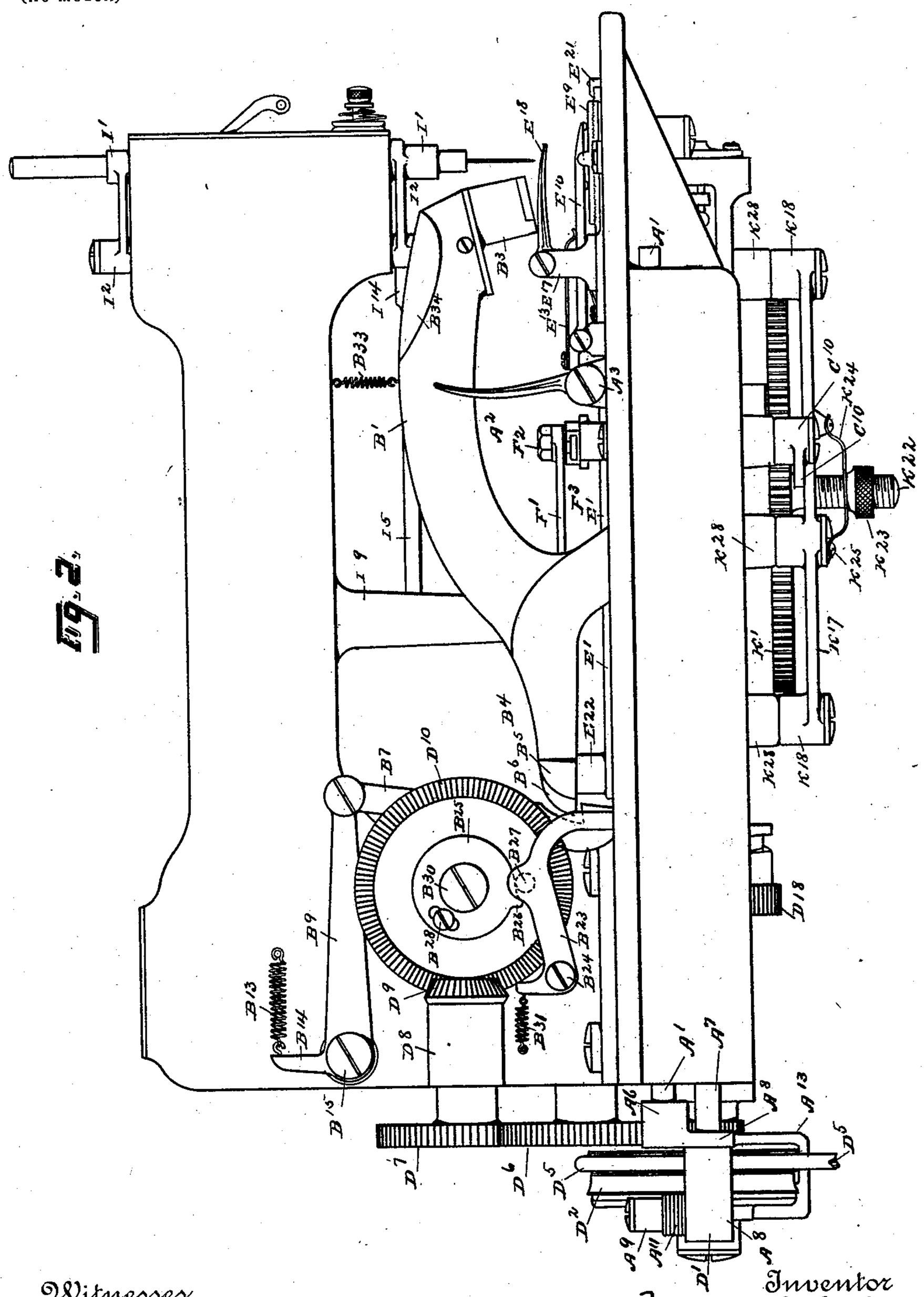
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 2.

Fig. 2.




Witnesses
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No. 705,257. Patented July 22, 1902.

# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 3.

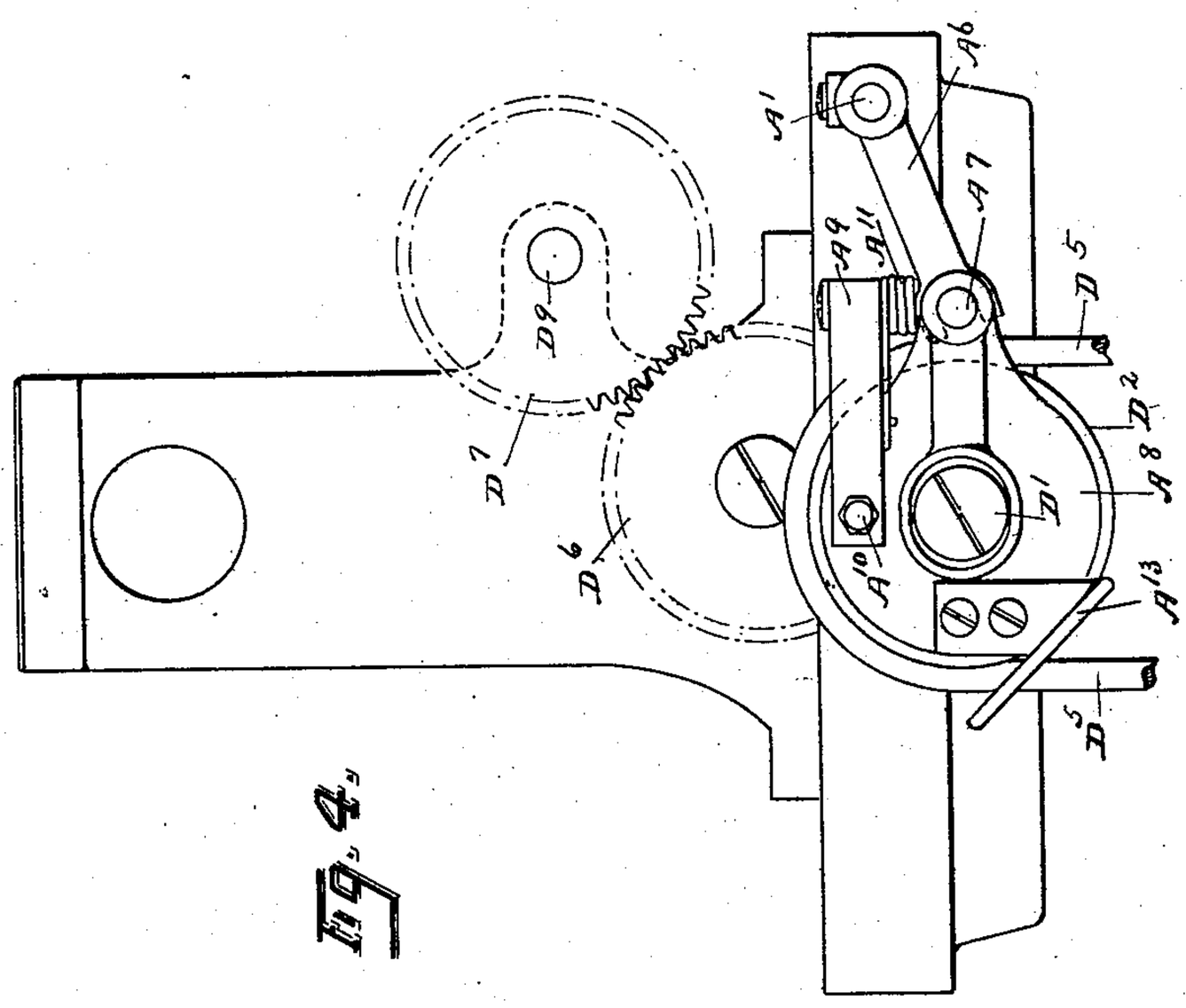


Fig. 4.

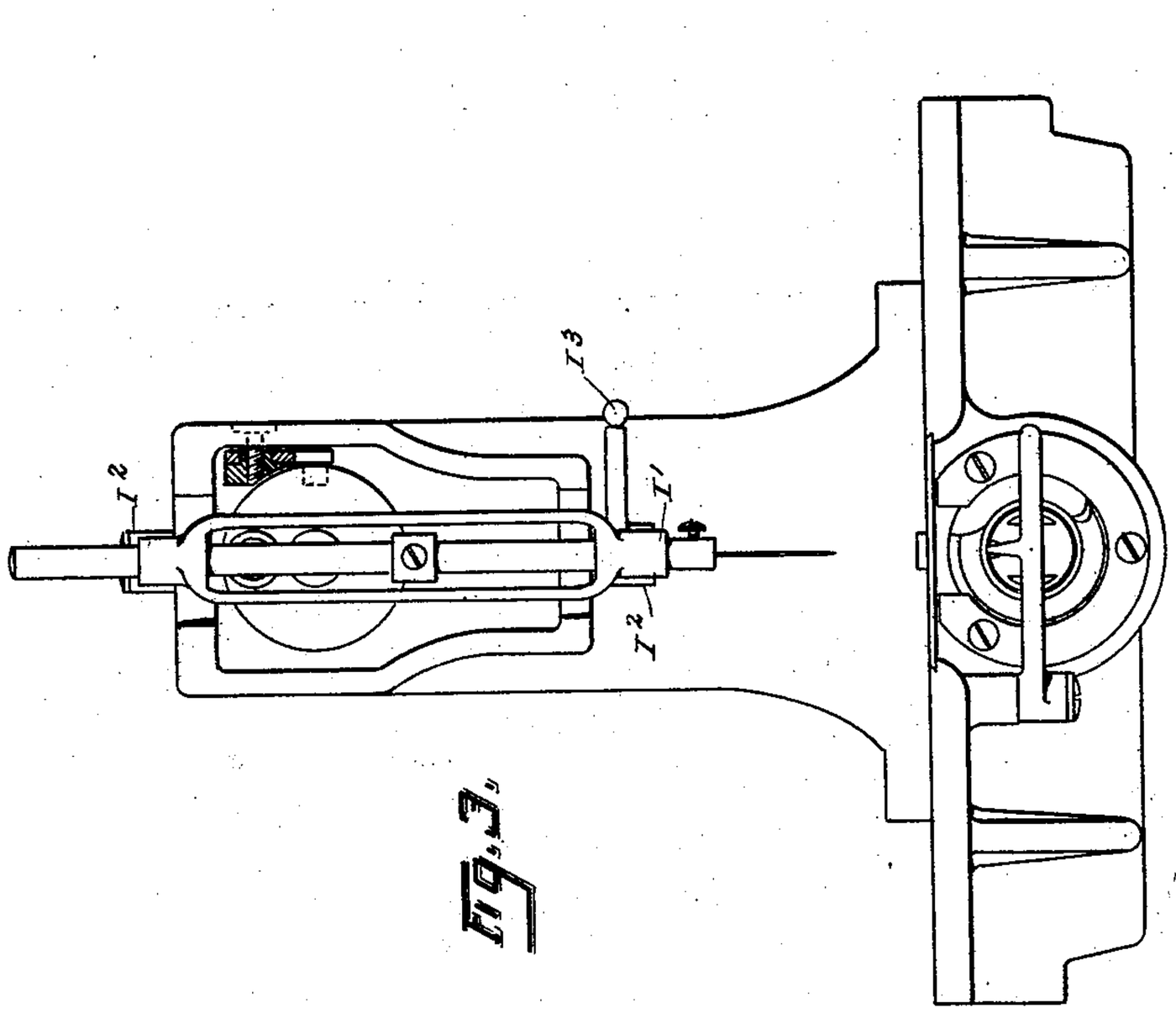


Fig. 3.

Witnesses
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W. W. Whitman

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No. 705,257. Patented July 22, 1902.

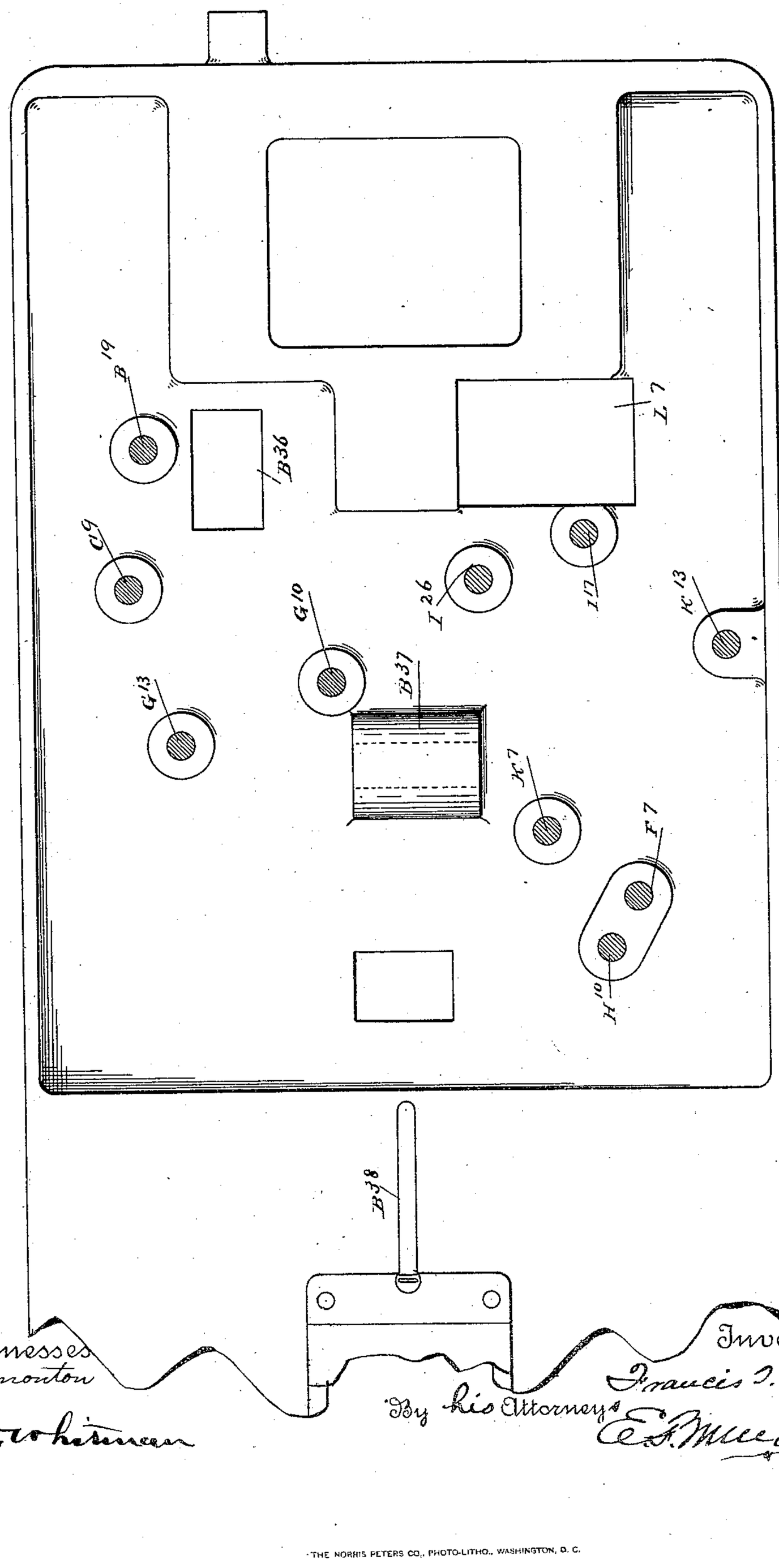
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 4.

Fig. 5.




Witnesses
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No. 705,257. Patented July 22, 1902.

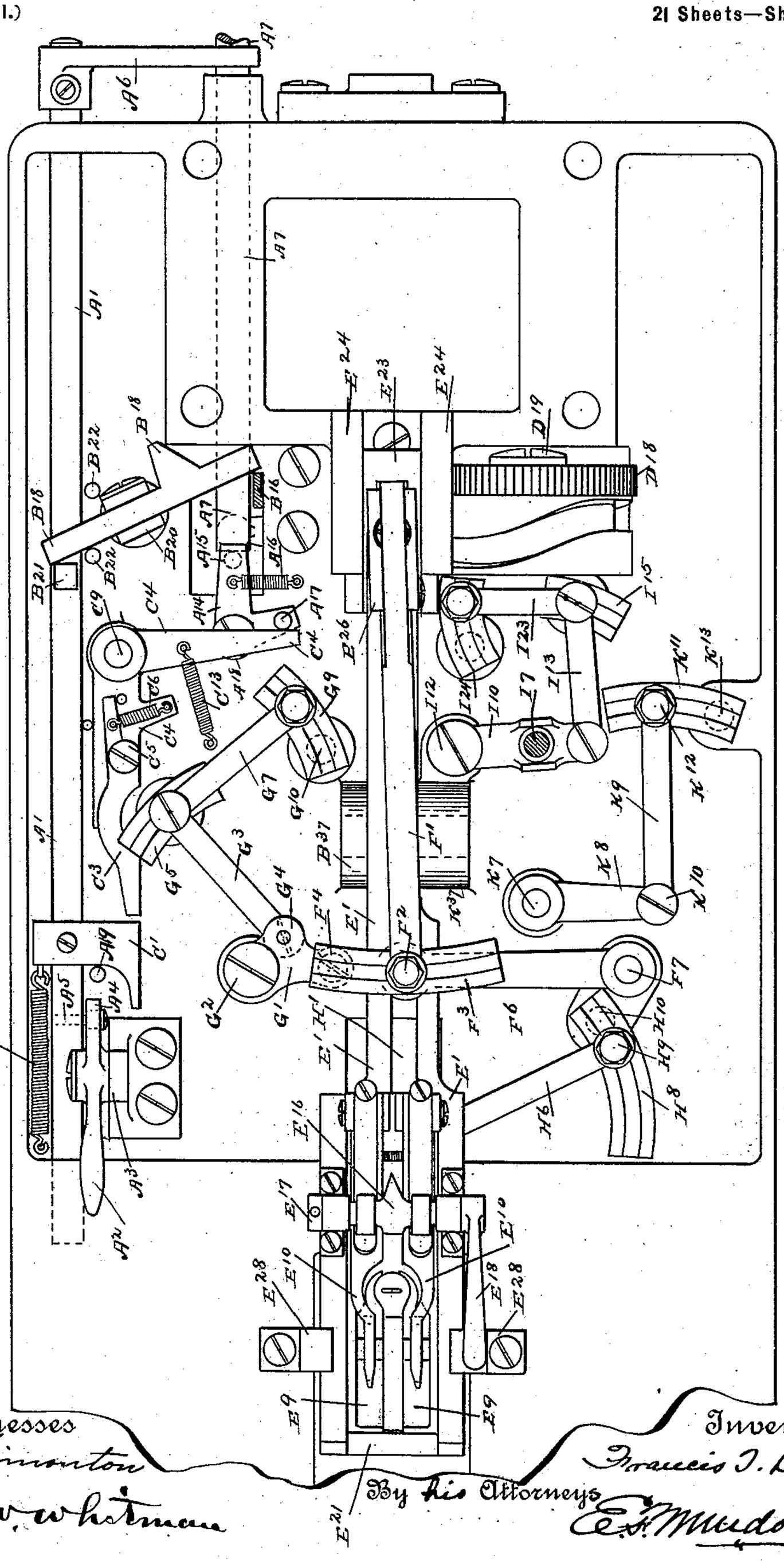
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 5.

Fig. 6.



Witnesses
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No. 705,257. Patented July 22, 1902.

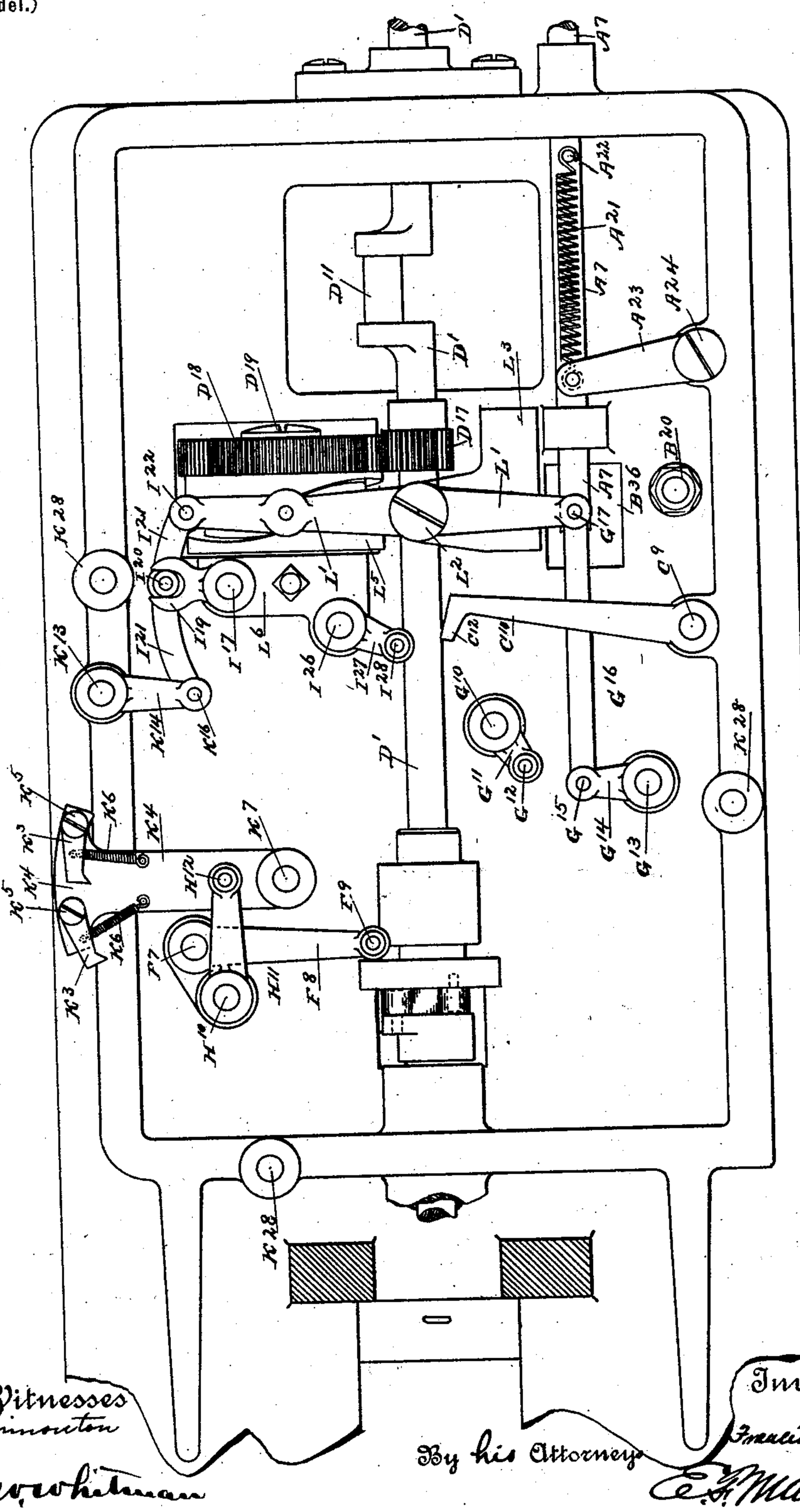
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 6.

Fig. 7.



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No. 705,257. Patented July 22, 1902.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

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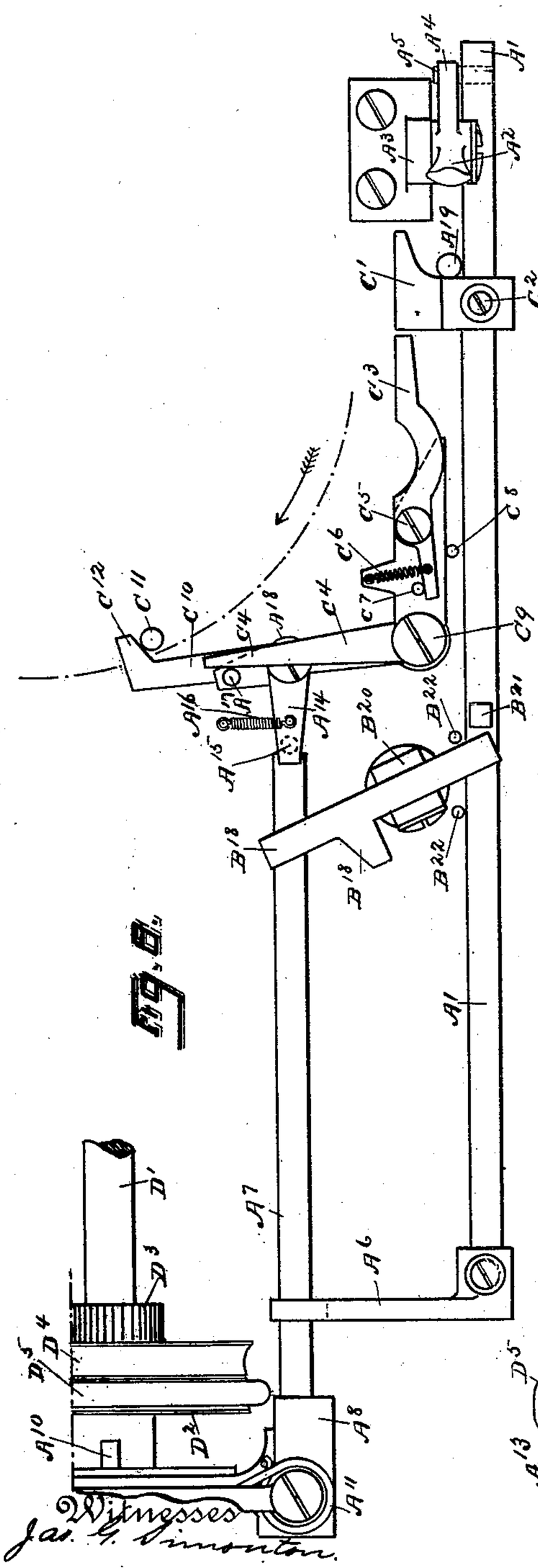

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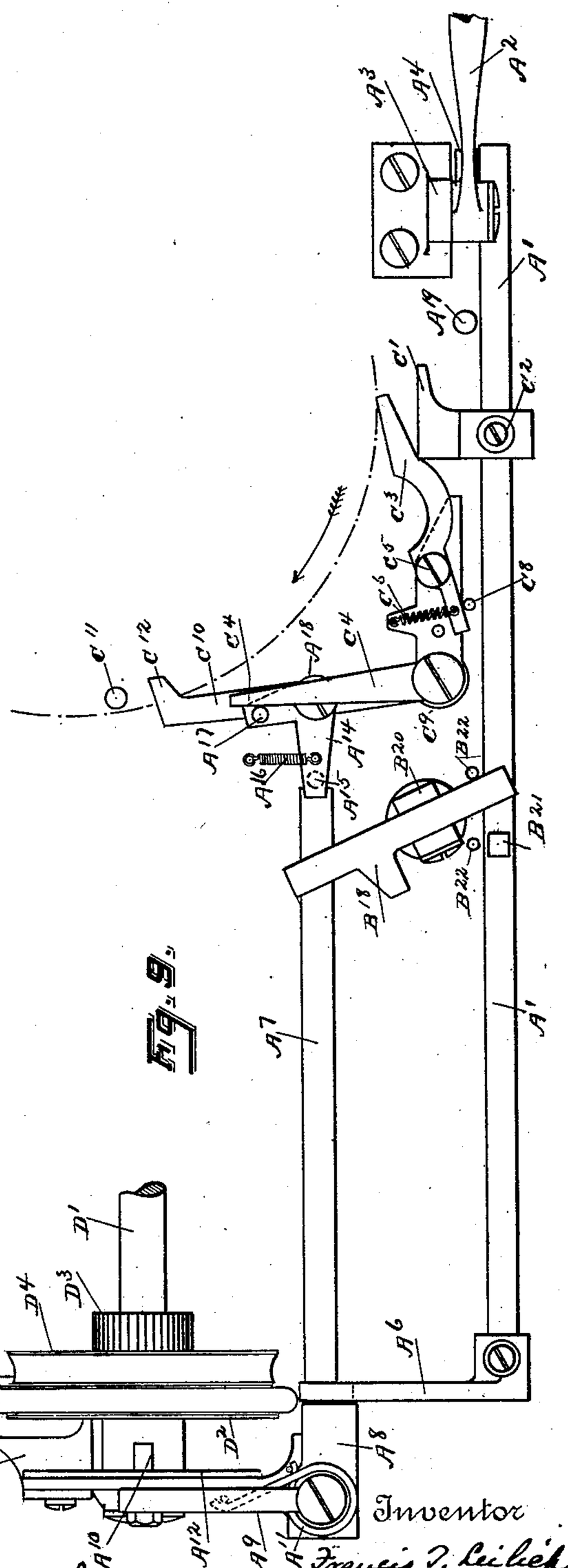

Fig. 9.

Witnesses
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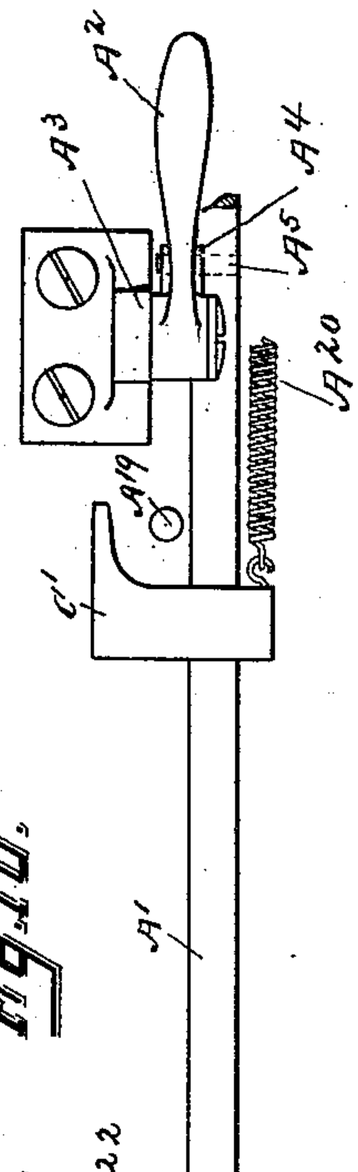
## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 8.

Fig. 10.

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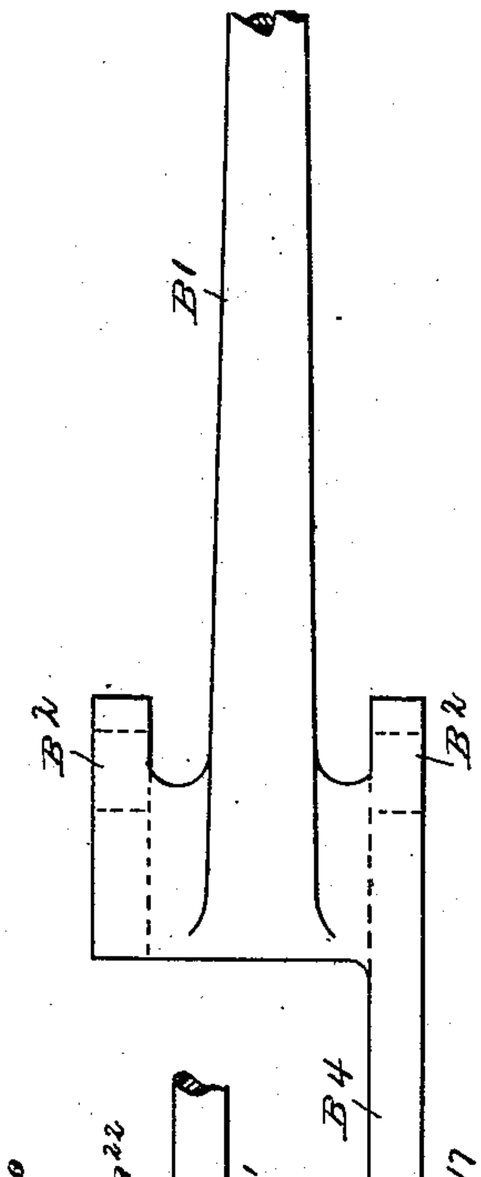


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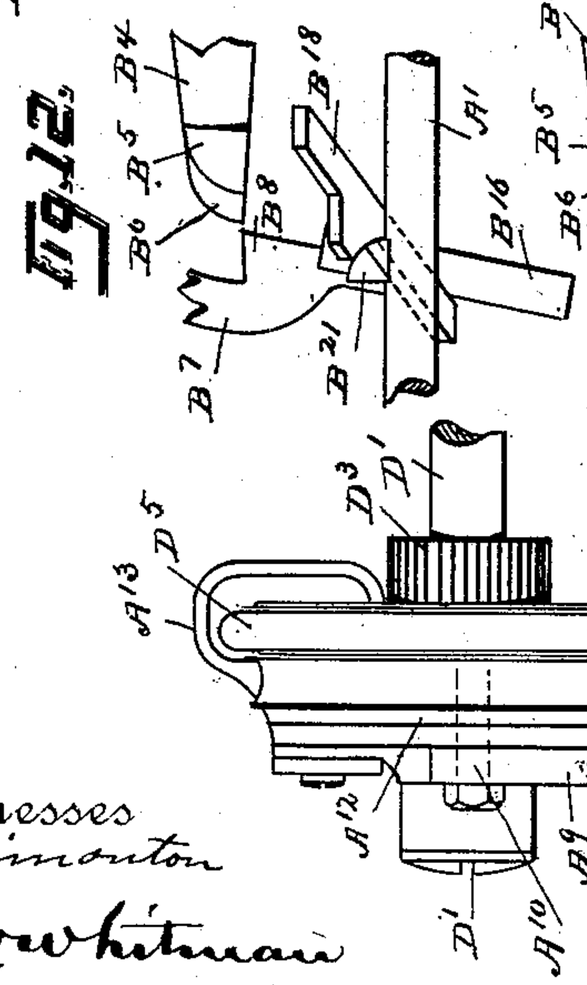


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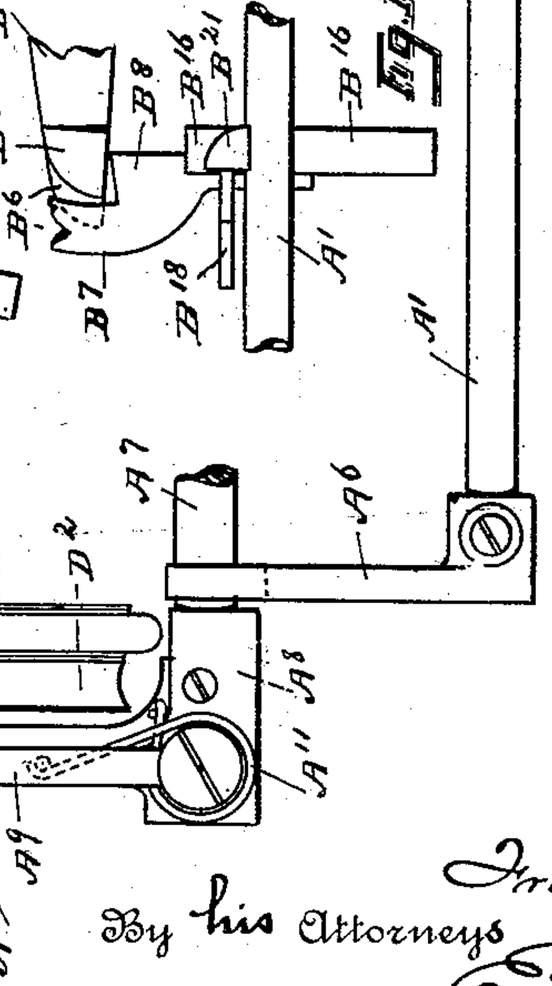


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No. 705,257. Patented July 22, 1902.

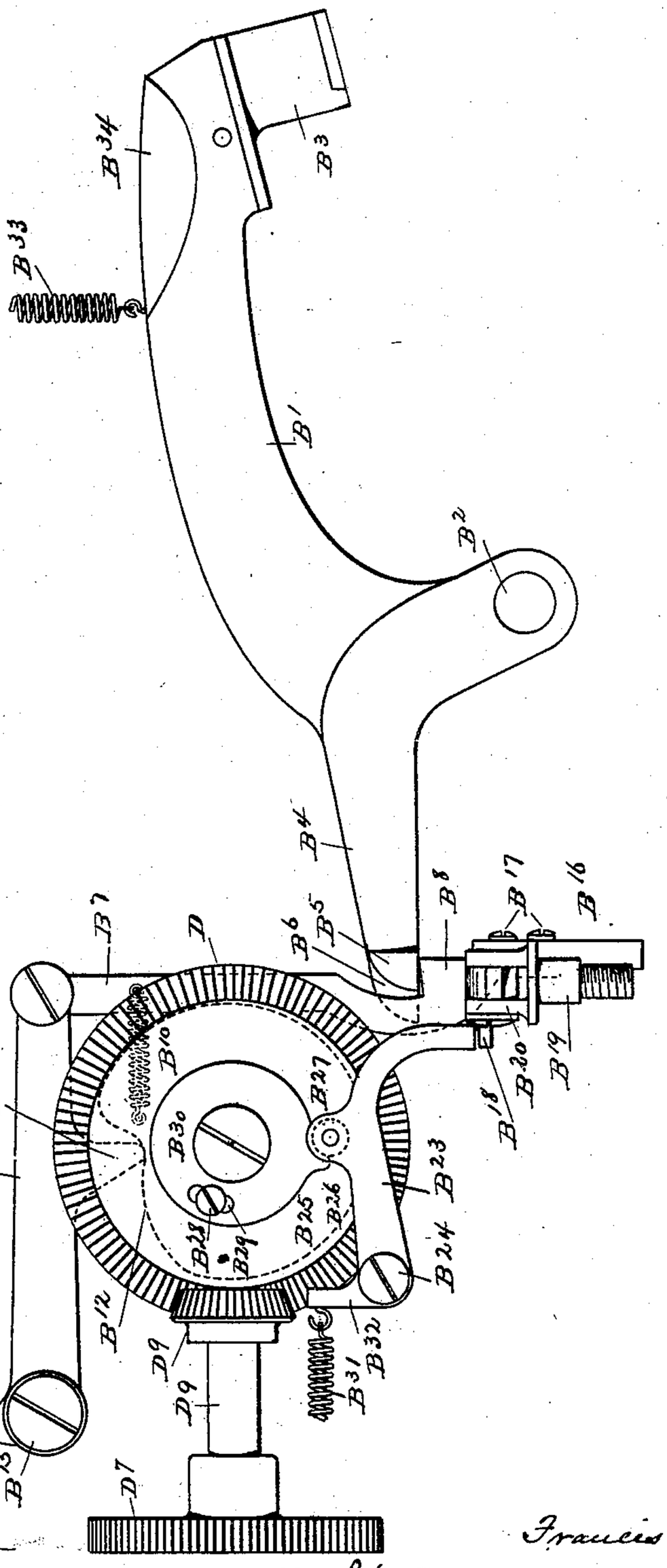
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 9.

Fig. 14.

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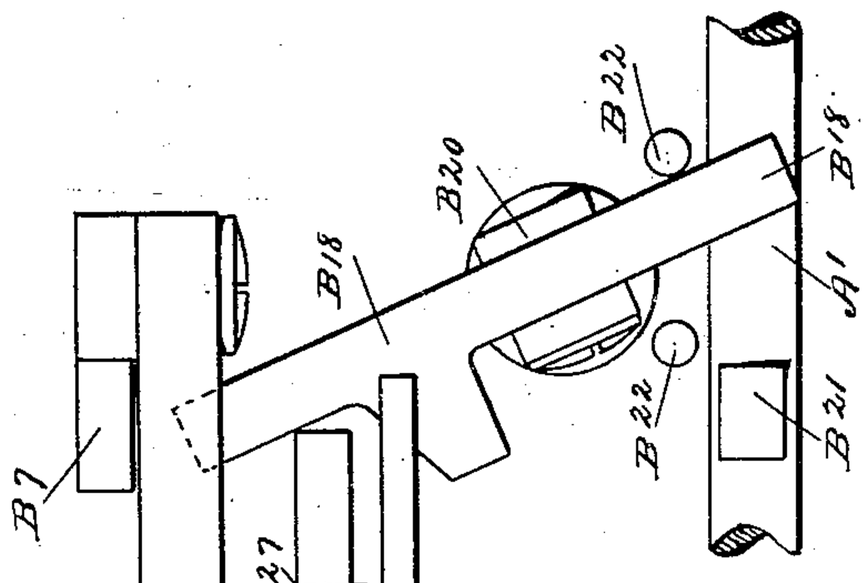
## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 10.

Fig. 17.

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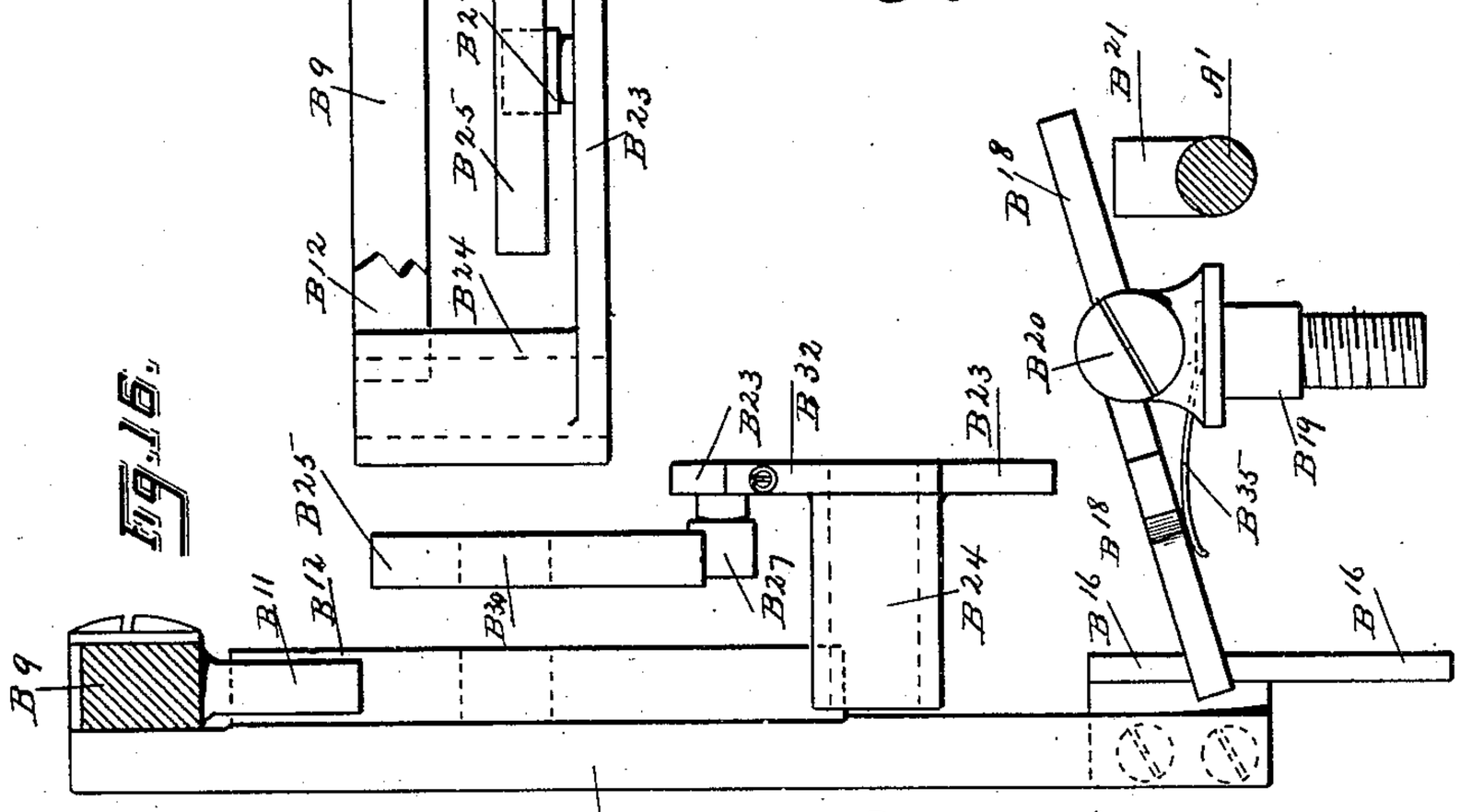


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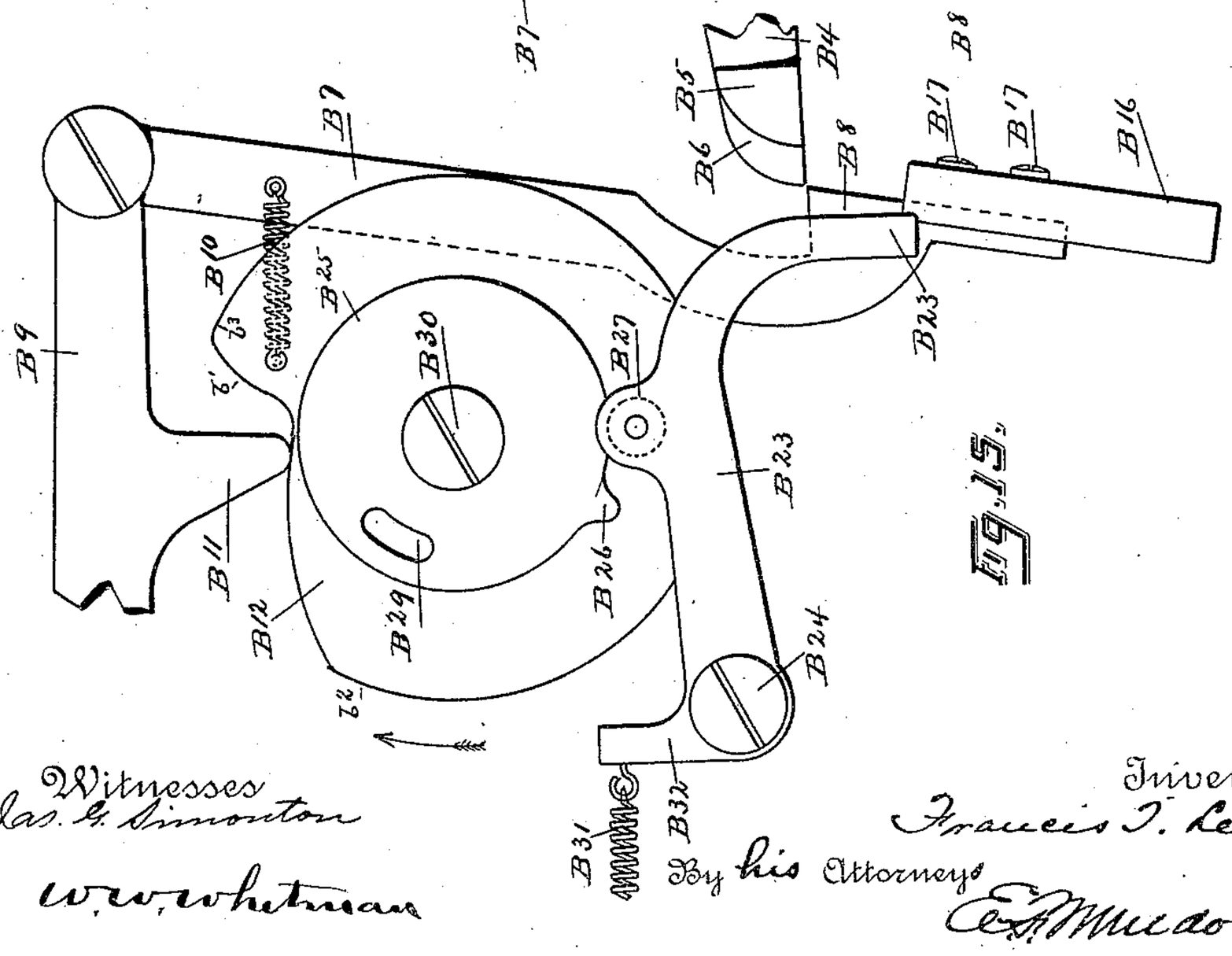


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## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 11.

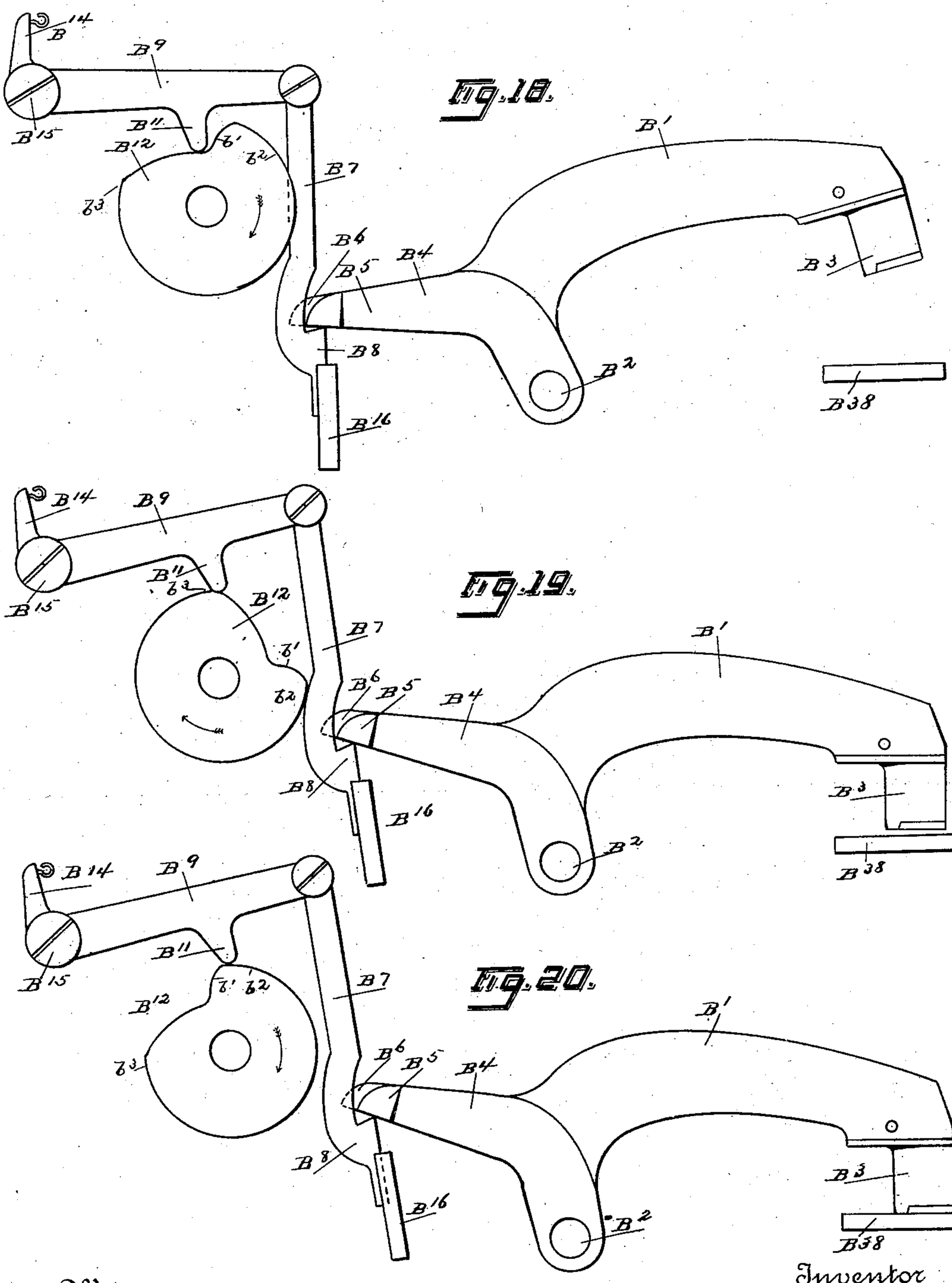


Fig. 18.

Fig. 19.

Fig. 20.

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## BUTTONHOLE SEWING MACHINE.

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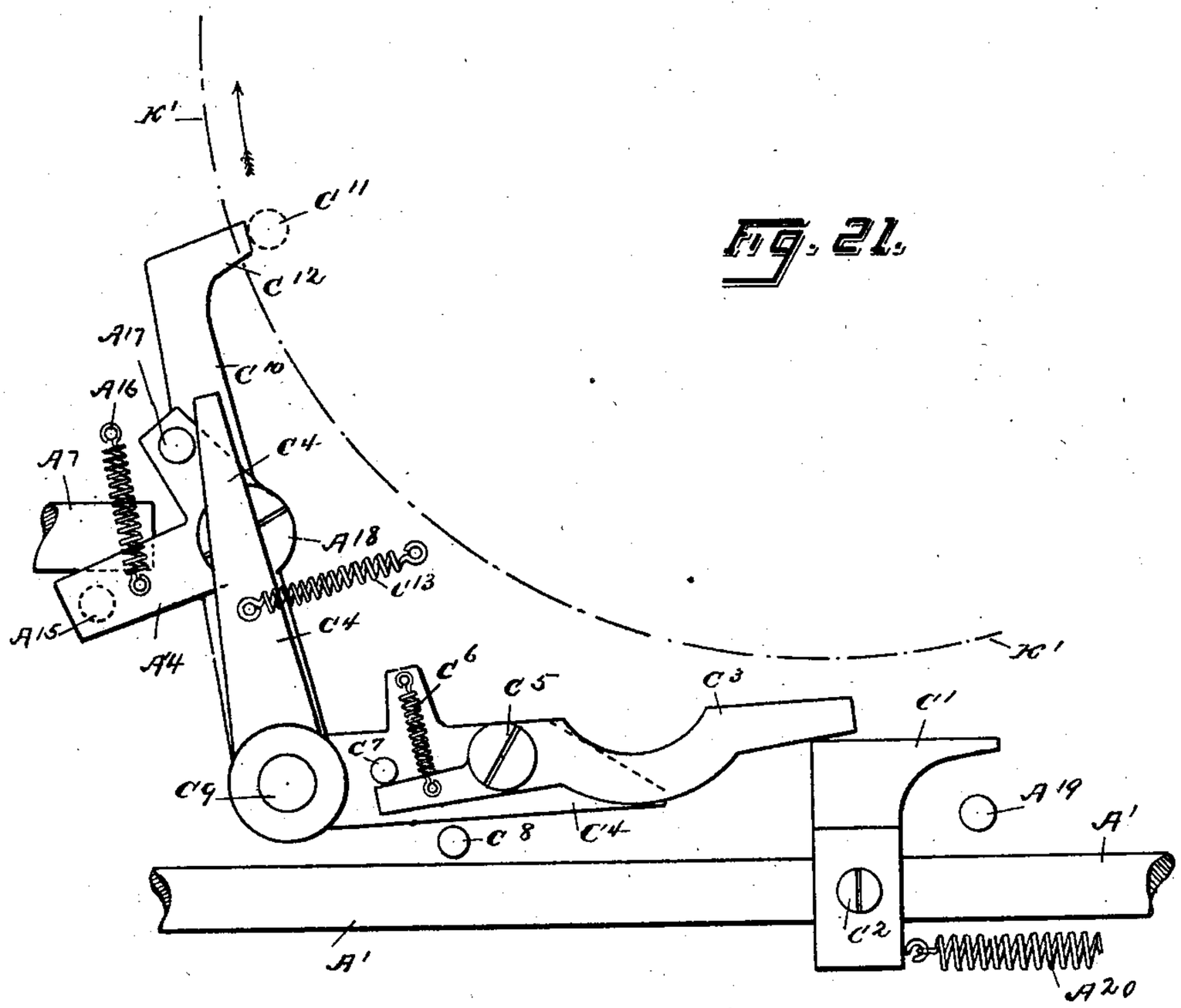


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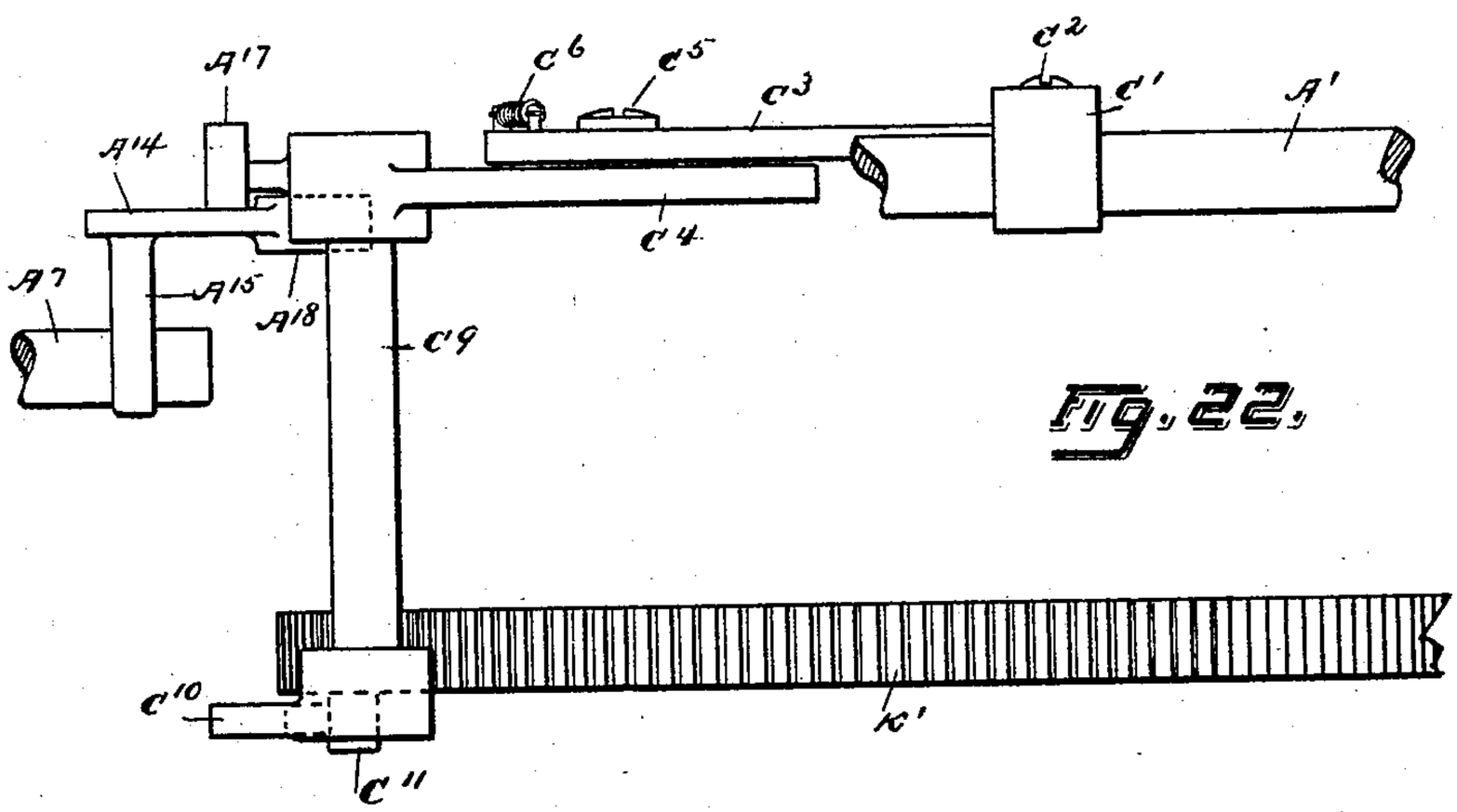


Fig. 22.

Witnesses
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No. 705,257. Patented July 22, 1902.

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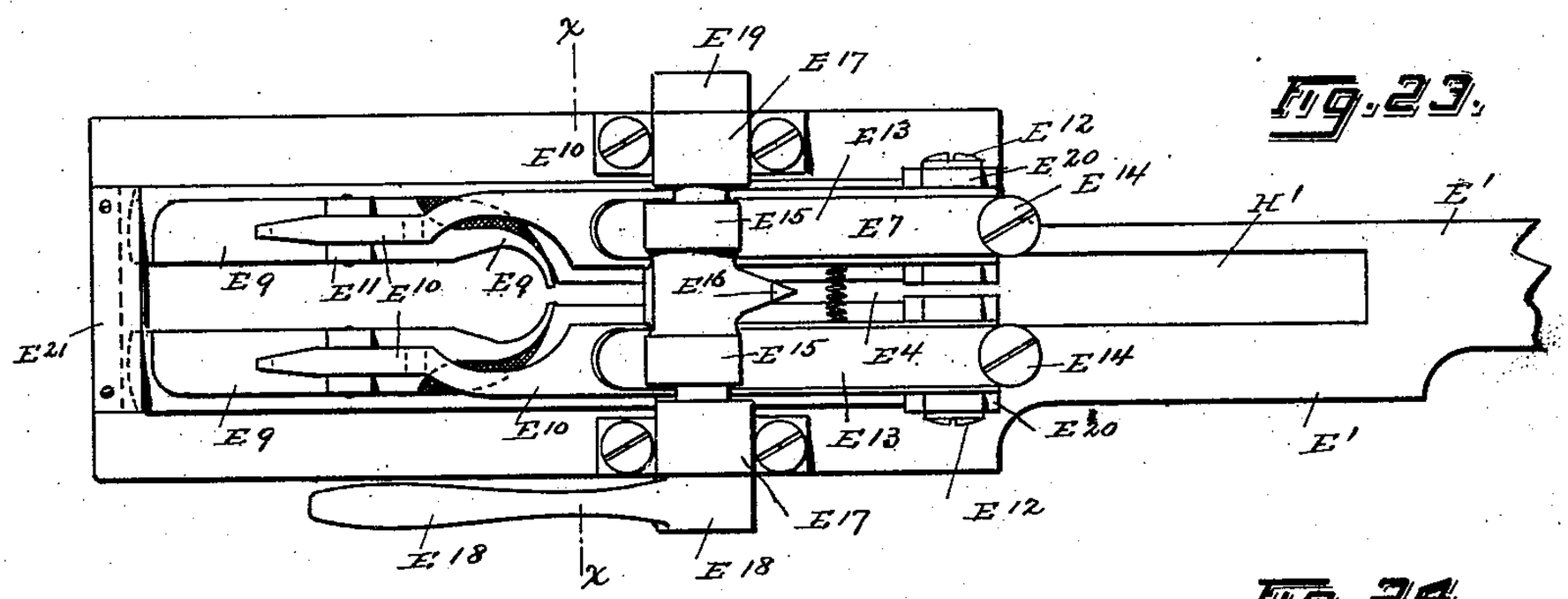
## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 13.

Fig. 23.

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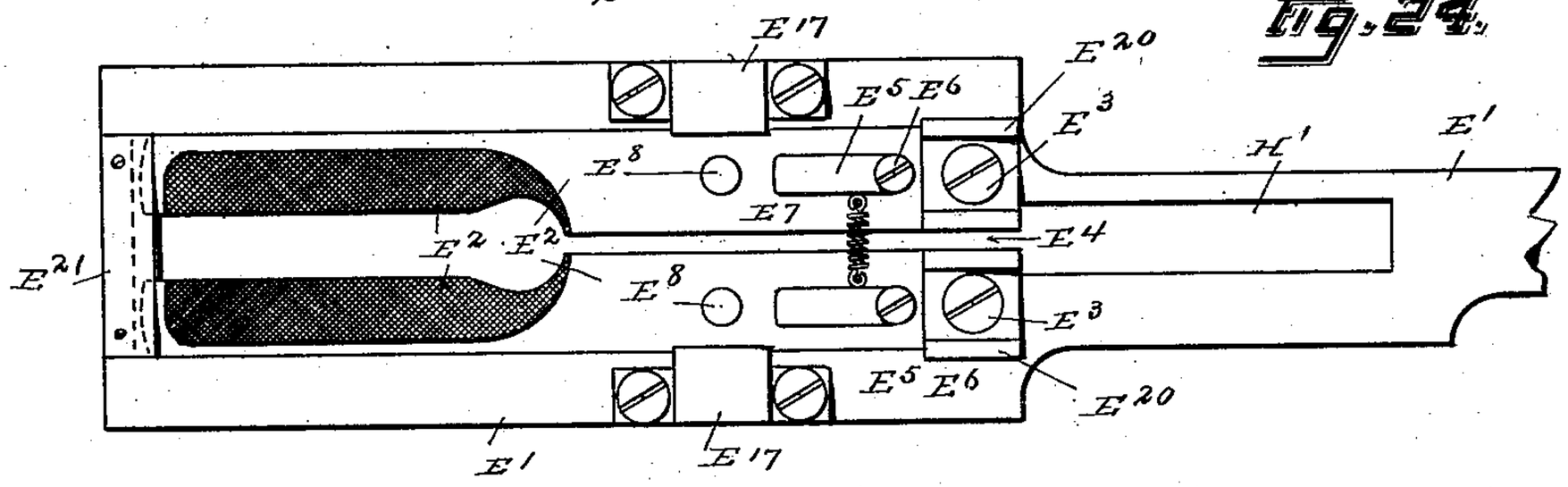


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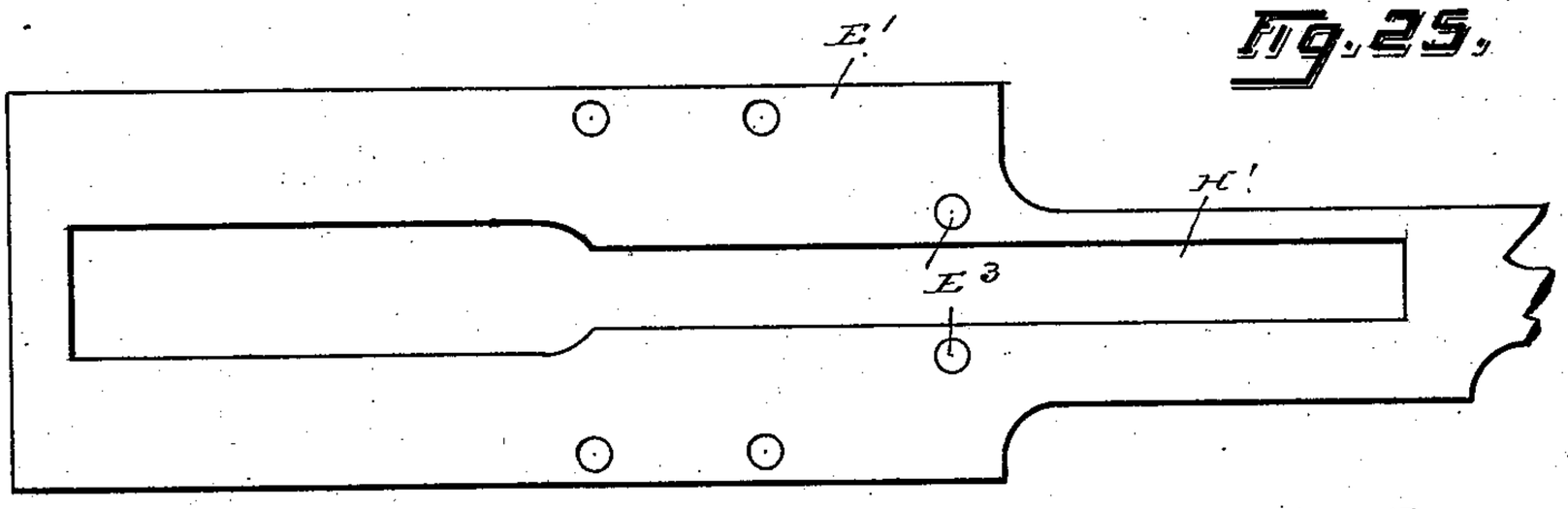


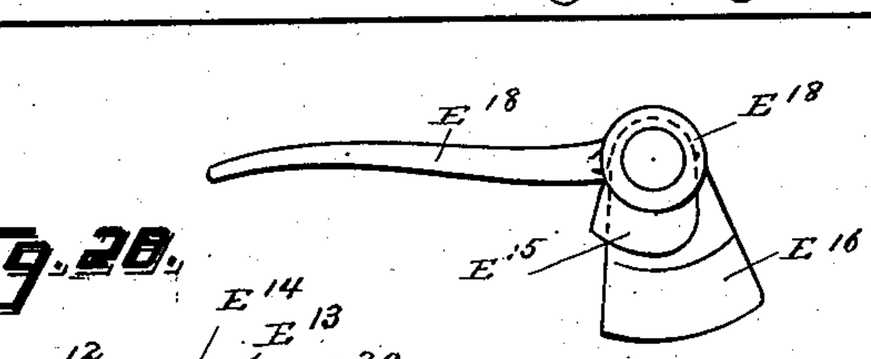


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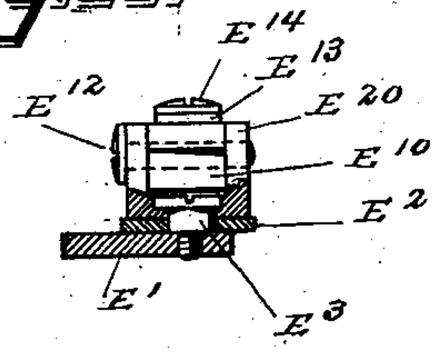


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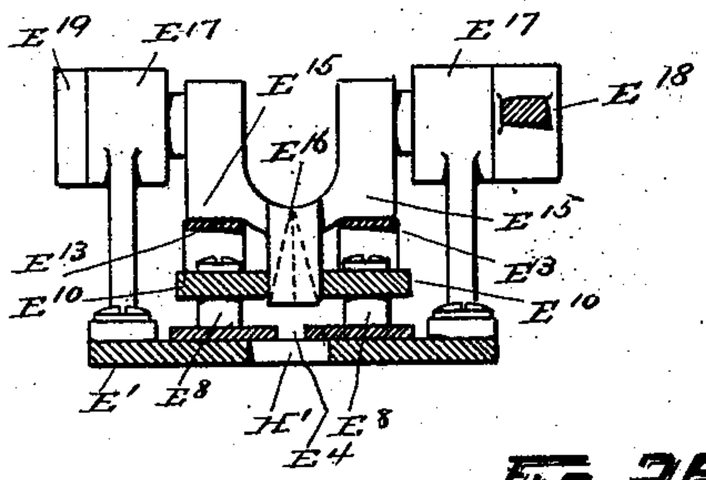


Fig. 26.

Witnesses
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No. 705,257. Patented July 22, 1902.

# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

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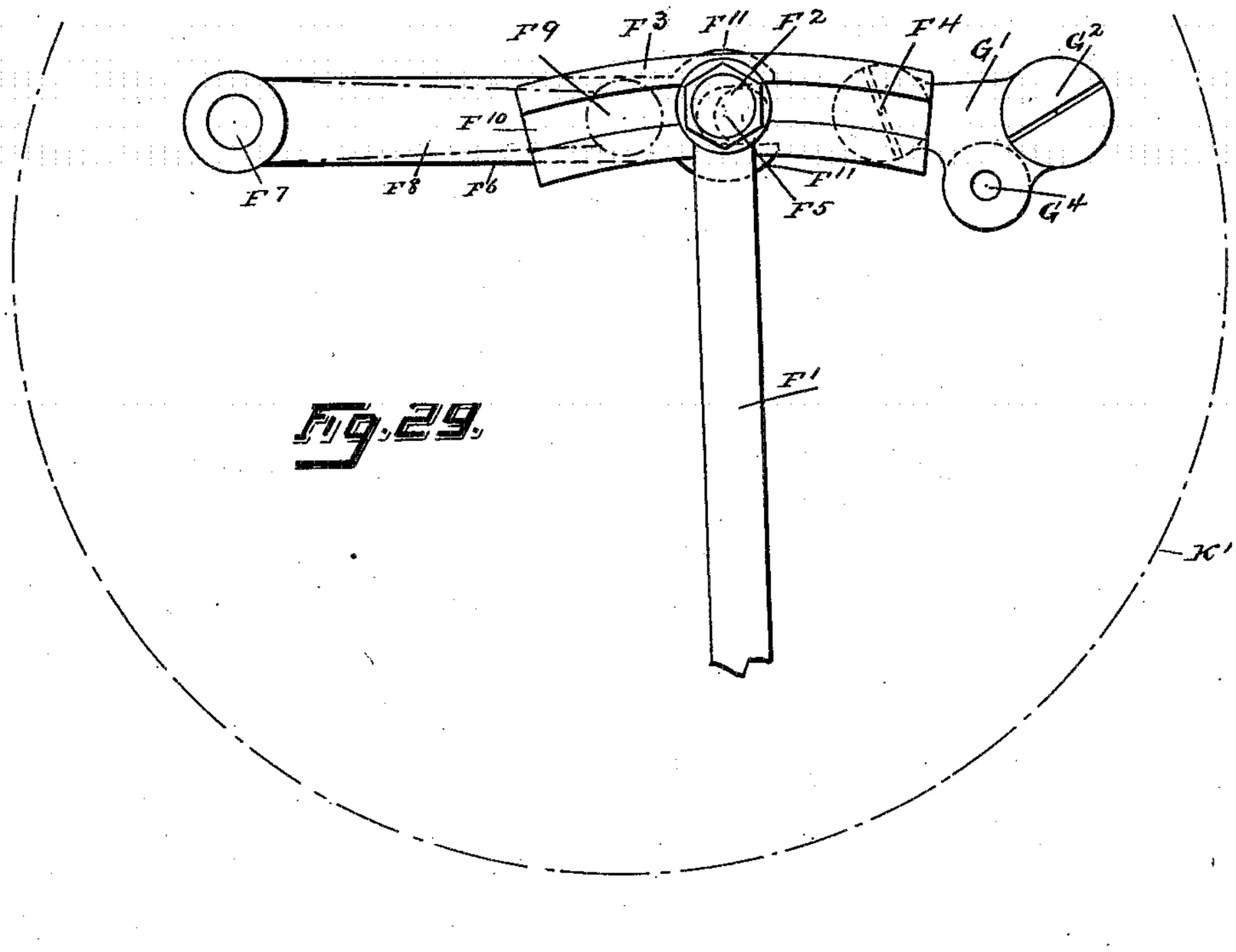


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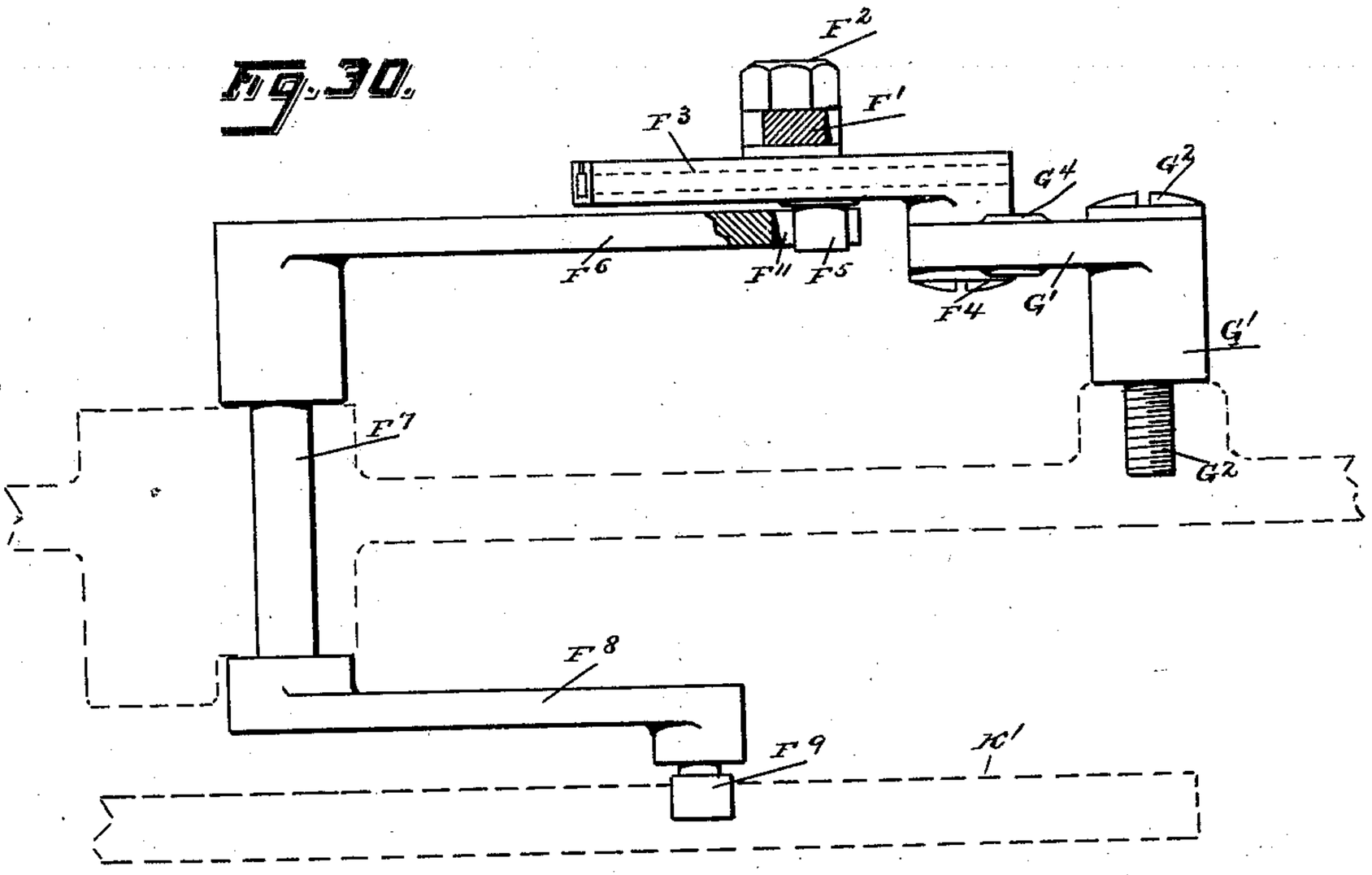


Fig. 30.

Witnesses
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No. 705,257. Patented July 22, 1902.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 15.

Fig. 31.

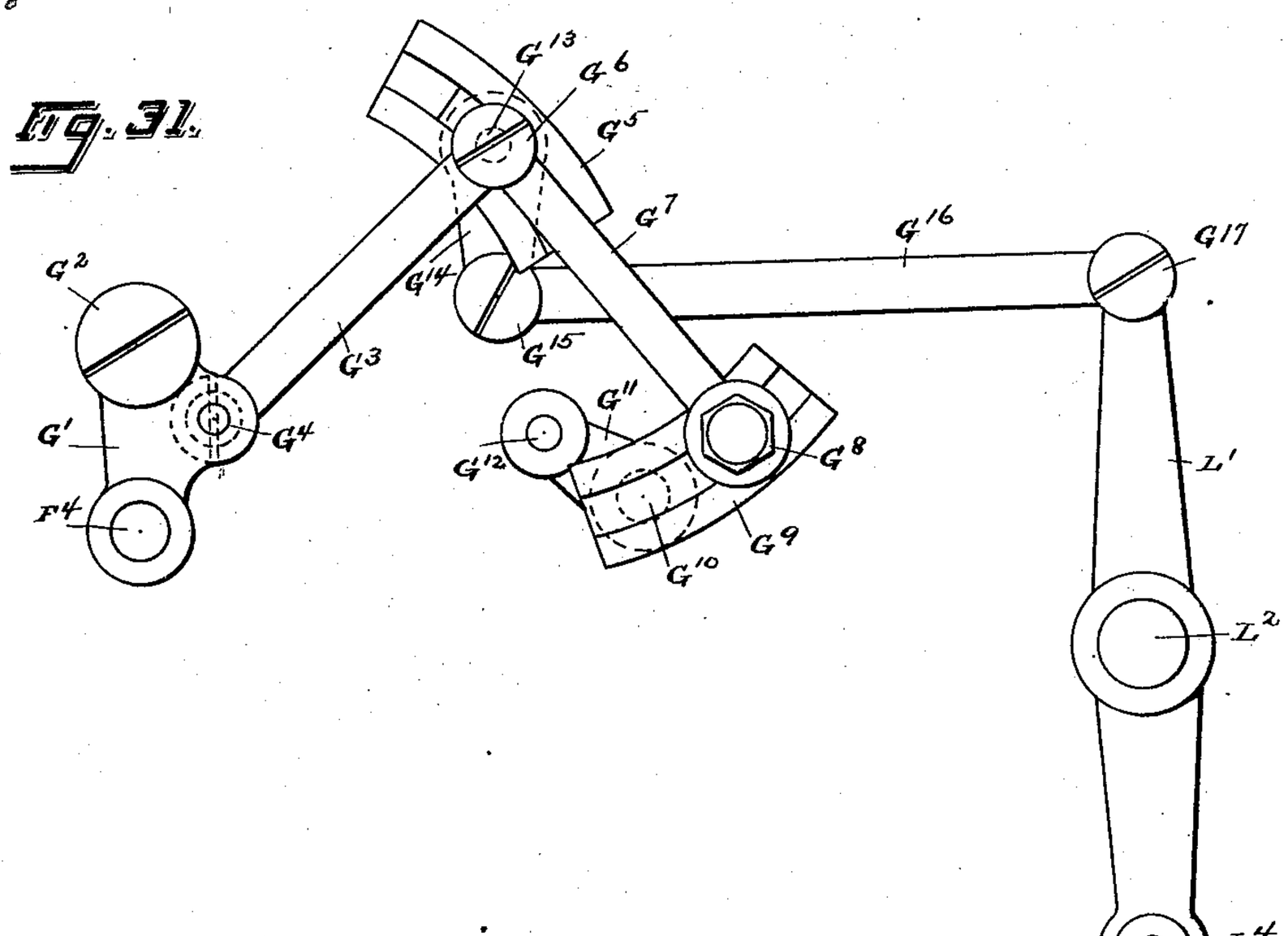
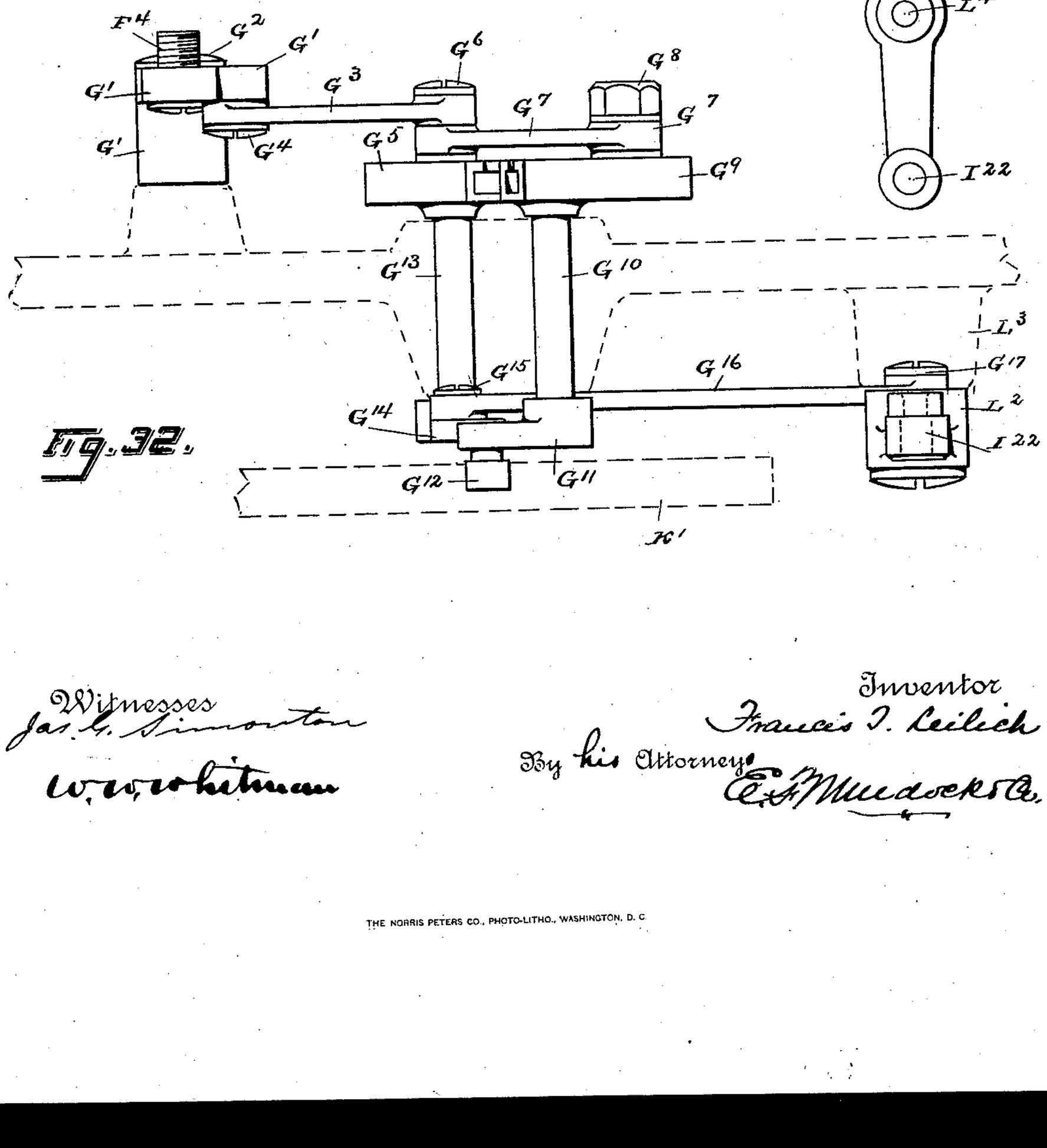



Fig. 32.




Witnesses
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No. 705,257. Patented July 22, 1902.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 16.

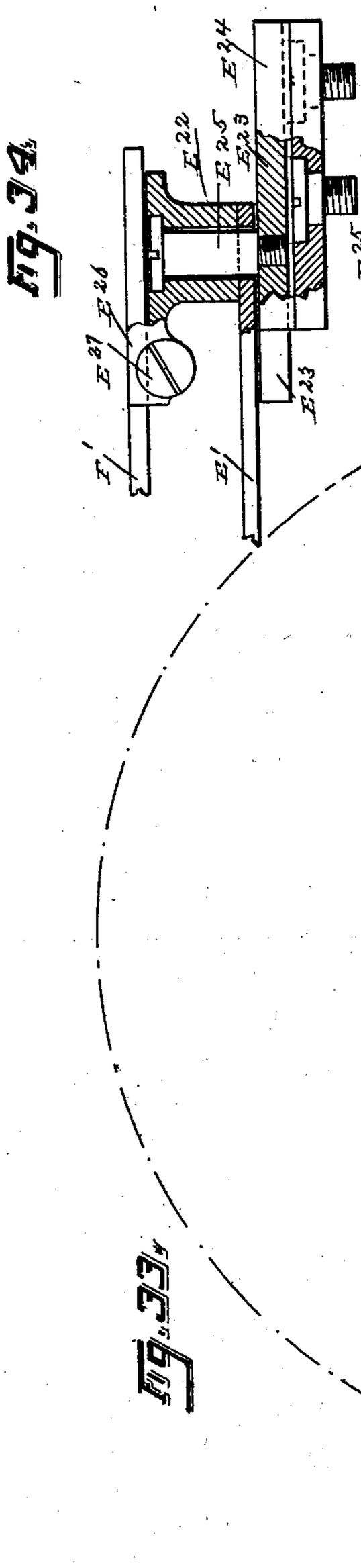


Fig. 34.

Fig. 35.

Fig. 36.

Witnesses
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## BUTTONHOLE SEWING MACHINE.

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(No Model.) 21 Sheets—Sheet 17.

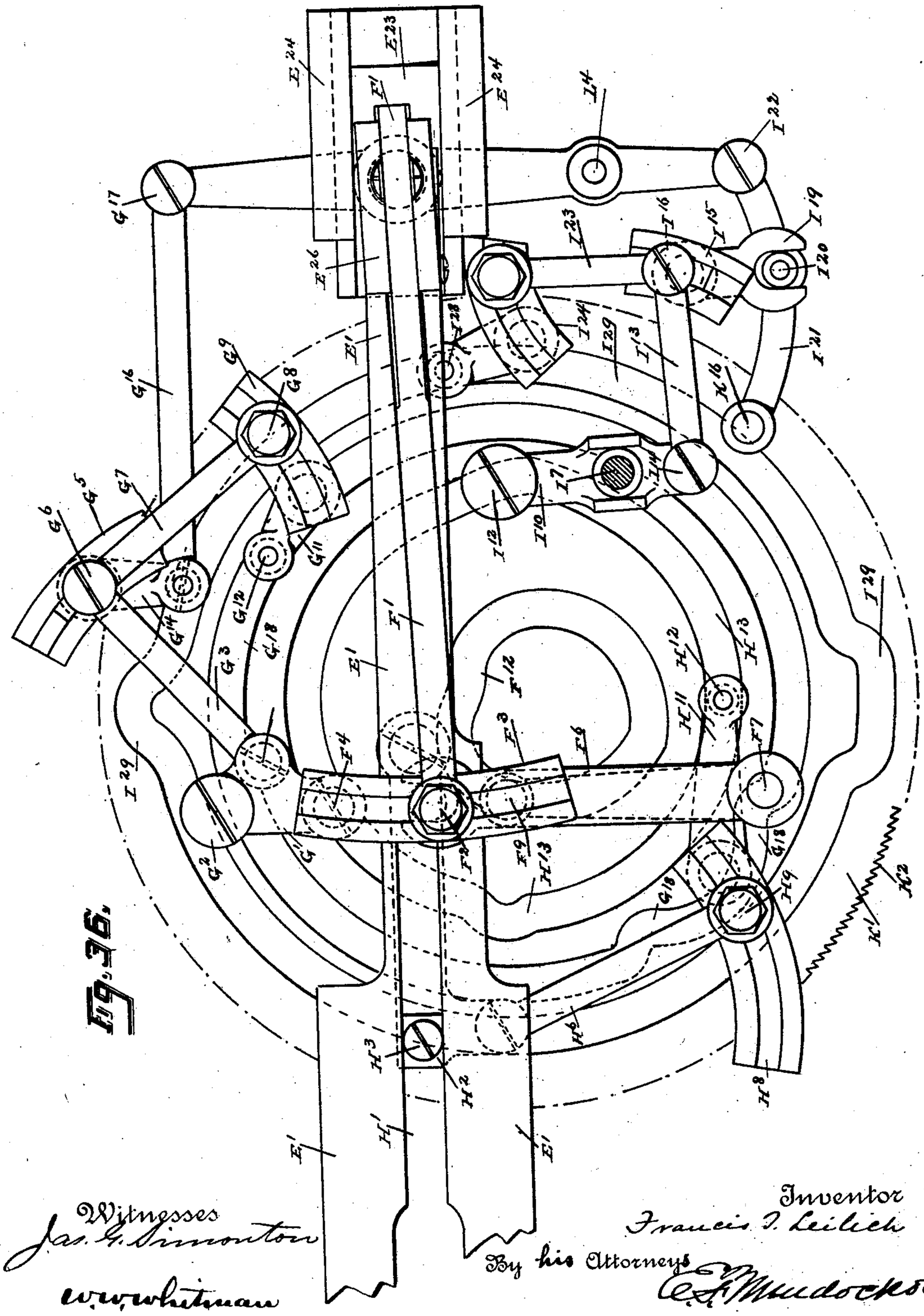

Fig. 36.

Witnesses
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# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 18.

Fig. 36.

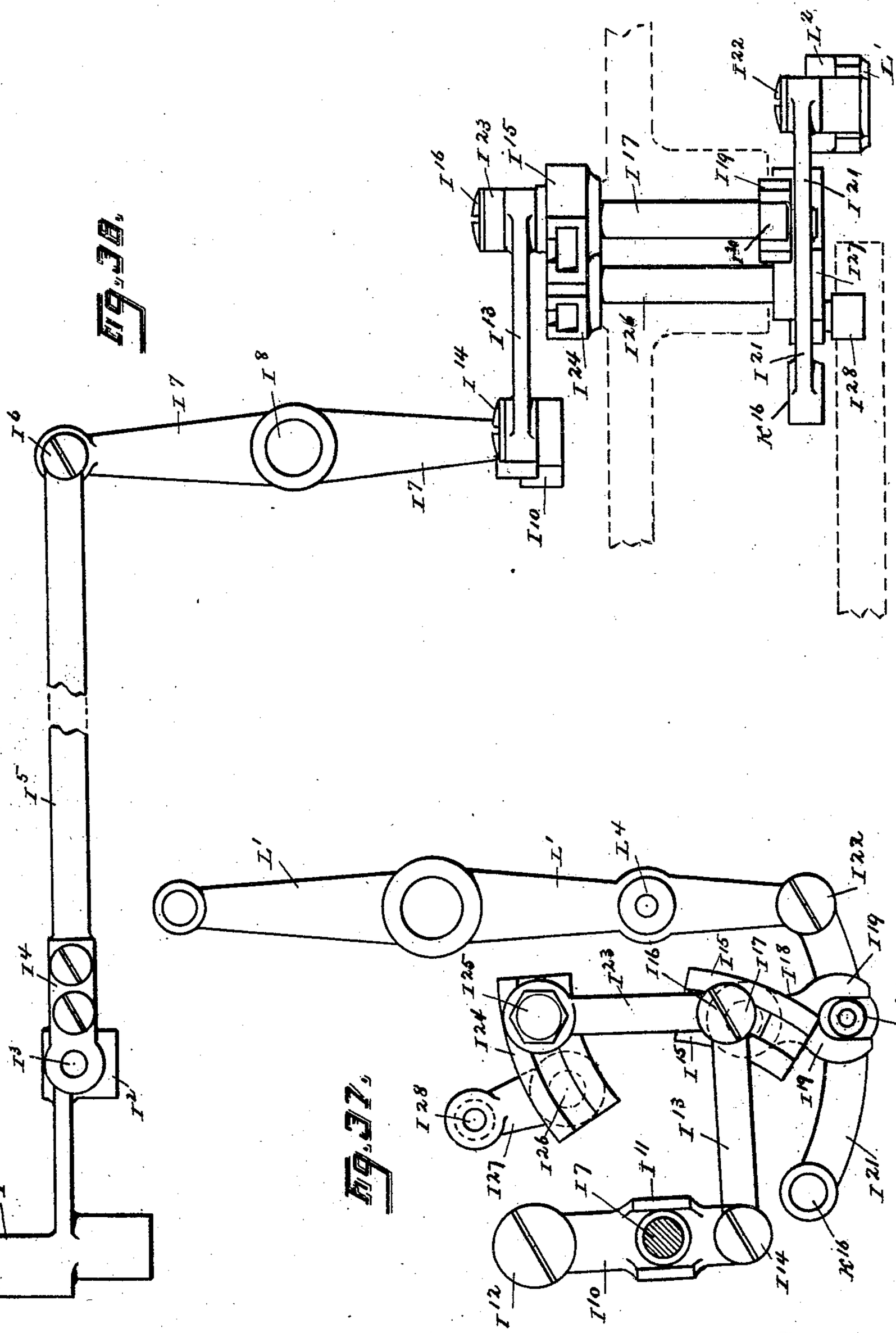


Fig. 37.




Witnesses
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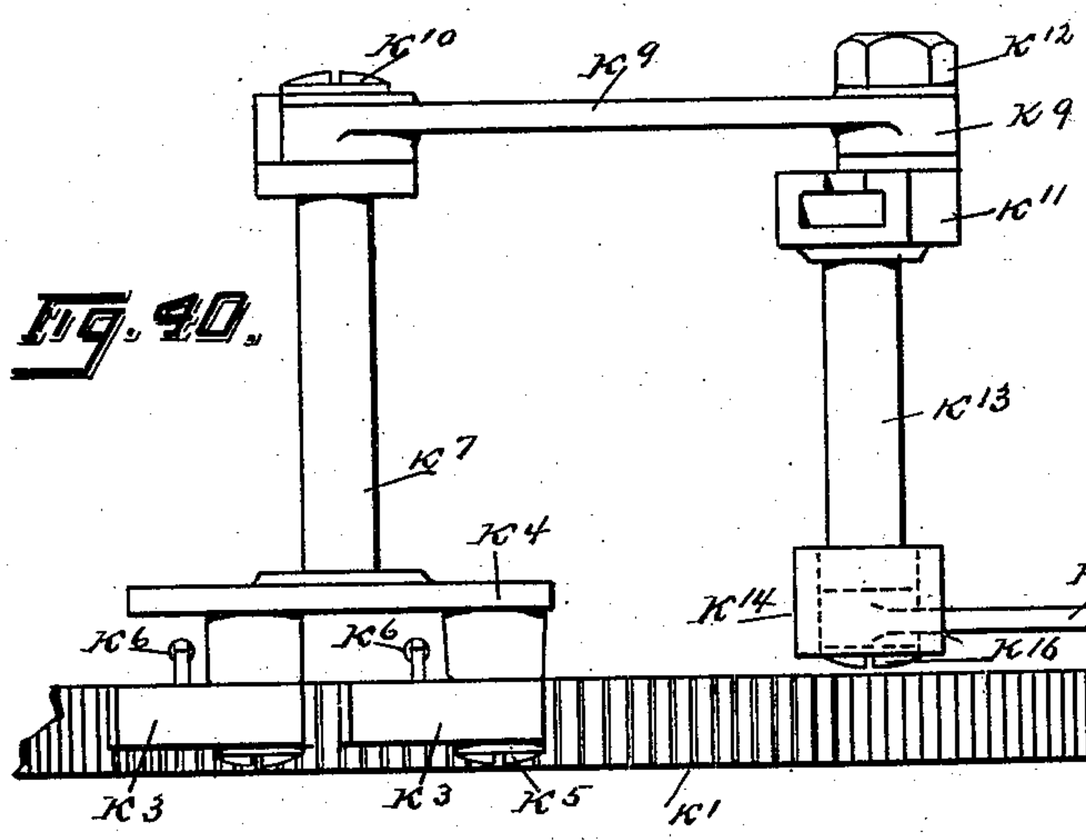
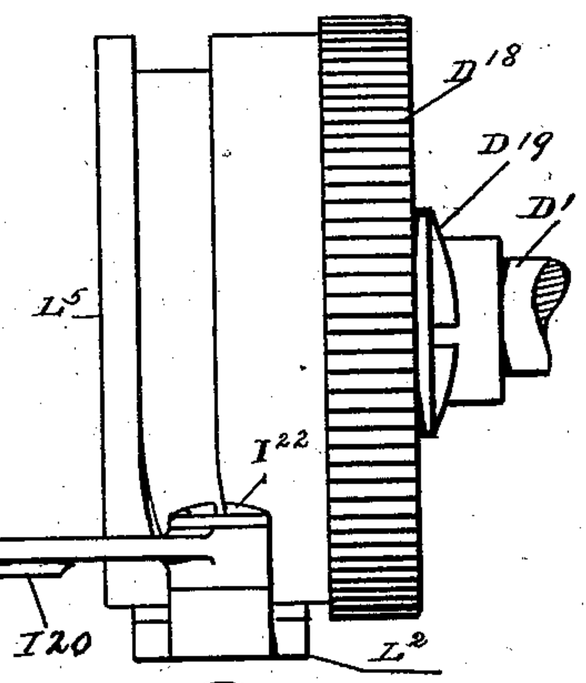
## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 19.

Fig. 40.



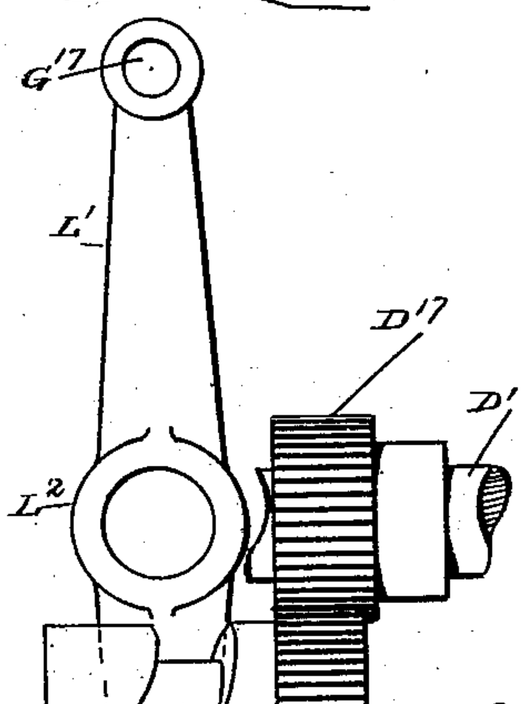
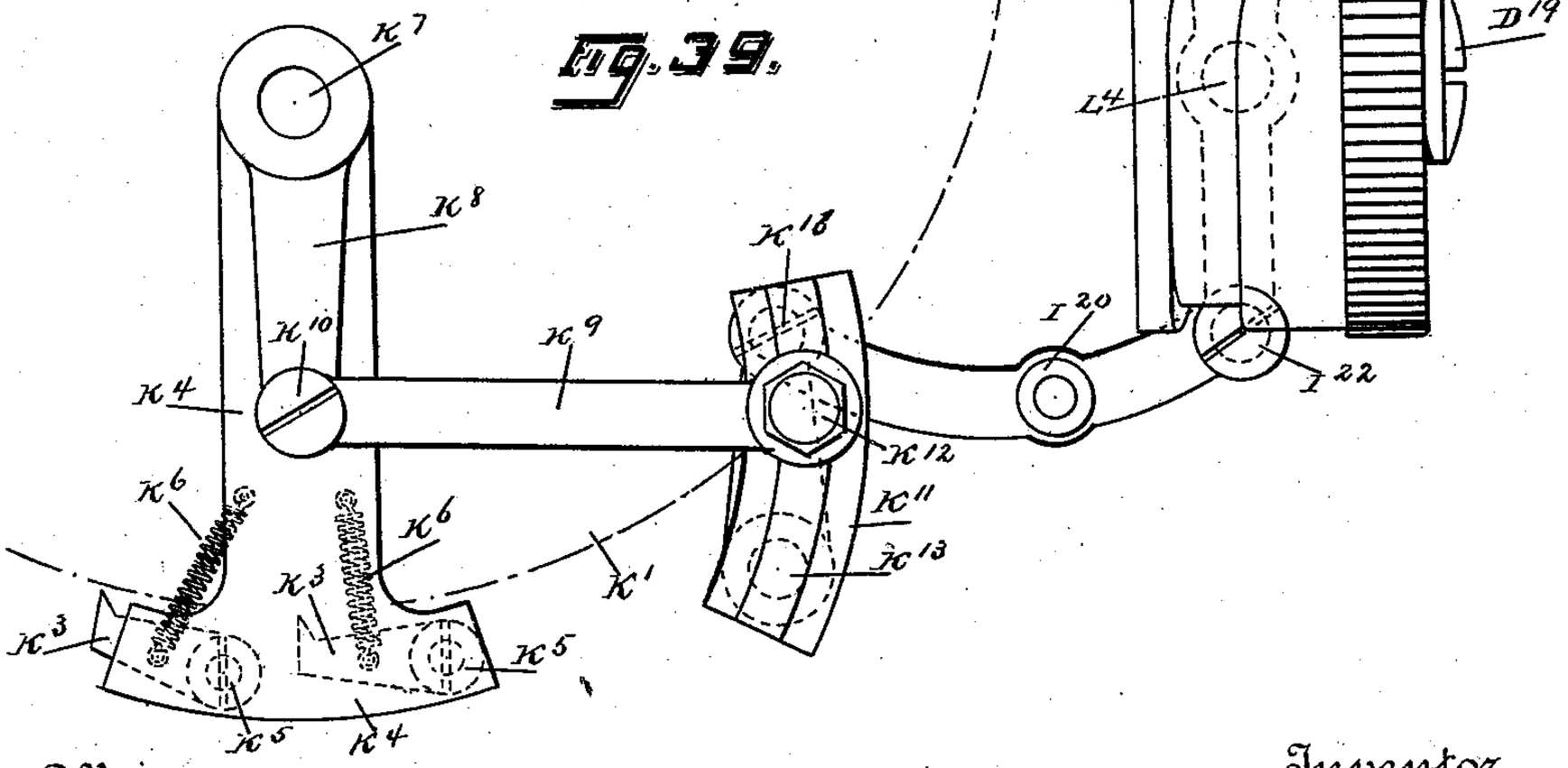




Fig. 39.




Witnesses
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No. 705,257. Patented July 22, 1902.

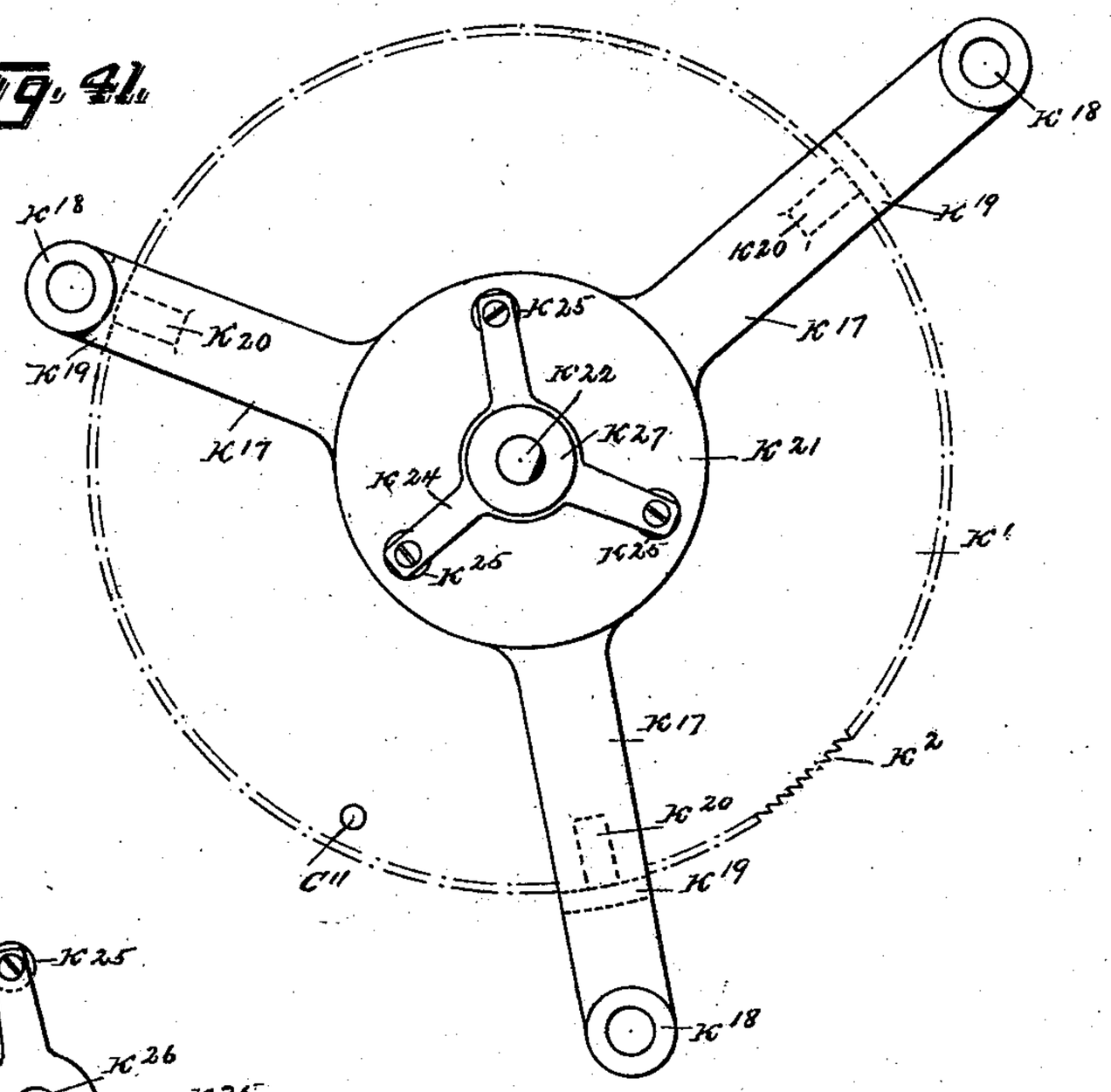
# F. T. LEILICH.

## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 20.

Fig. 41.

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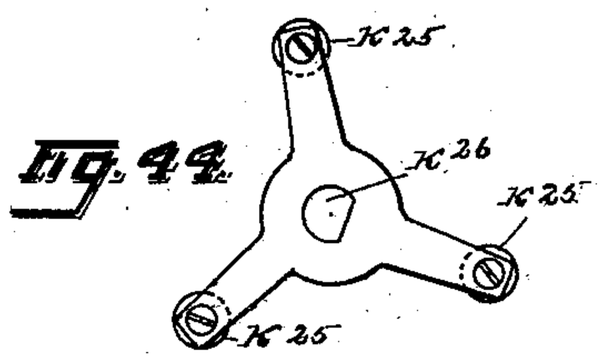


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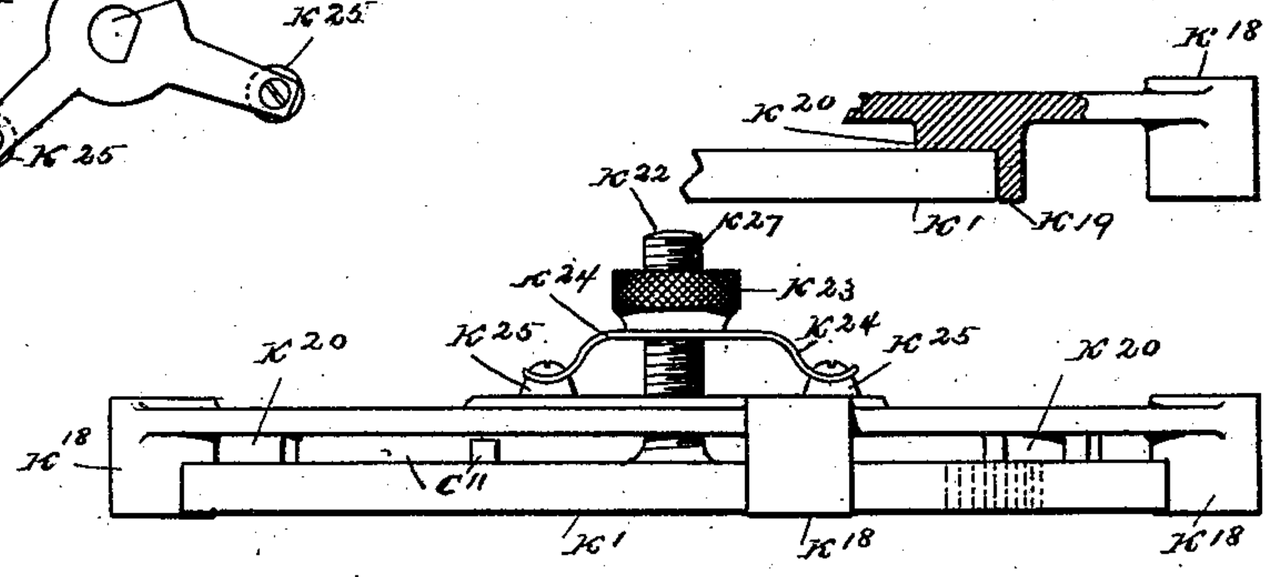


Fig. 42.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Sept. 14, 1898.)

(No Model.) 21 Sheets—Sheet 21.

Fig. 45

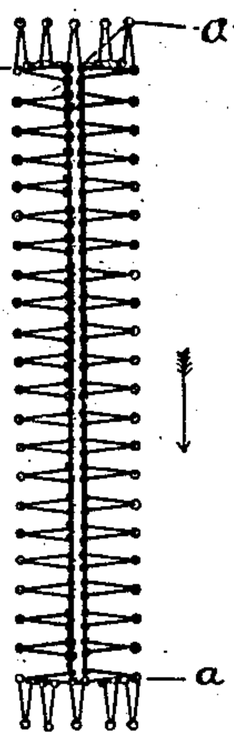


Fig. 46.

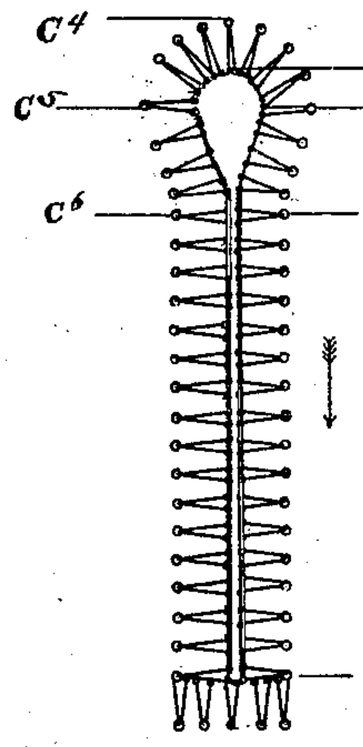


Fig. 47

Fig. 48

Fig. 49.

Fig. 50.

Fig. 51.

Fig. 52.

Fig. 53.

Witnesses
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W. W. Whitman

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# UNITED STATES PATENT OFFICE.

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## BUTTONHOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 705,257, dated July 22, 1902.

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*To all whom it may concern:*

Be it known that I, FRANCIS T. LEILICH, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Buttonhole-Sewing Machines; and I do hereby declare the following to be a full, clear, and exact description of said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

This invention relates to that class of buttonhole-machines in which the material is held in a clamp, the buttonholes cut and then automatically stitched around their cut edges.

The objects of this invention are to provide an organized and complete machine by means of which a variety of different kinds of buttonholes, either straight or with eyelets, and barred at the ends according to different methods may be produced, and which, while capable of making buttonholes in any kind of fabric, has been designed with more particular reference to making a fine class of buttonholes in shirts, collars, and cuffs, of a character closely resembling the best hand-made buttonholes in appearance, while being superior in regularity; to provide means for starting the machine, especially as regards the operation of the clamping device and the starting of the cutting device; to provide a cutting mechanism to act prior to the sewing mechanism and to move very quickly through the ineffective period of its path of movement and which during the effective or cutting period of its movement shall be driven continuously with the full power of the driving mechanism; to provide an improved arrangement of the parts of the machine permitting easy and rapid adjustments of the working parts; to provide means for holding and securing the pattern-cam with respect to the connected mechanism, whereby the pattern-cam can be easily and quickly removed and another substituted to change the style or kind of buttonhole; to provide an improved mechanism for stitching buttonholes either with an eye or barred at the ends and with a purl on the edges of the cut and around the eye or on the edge of the bar, as the case may be.

My invention also resides in the novel construction, combination, and arrangement of parts hereinafter fully specified, and particularly pointed out in the claims.

In the drawings, Figure 1 is a front side elevation of the machine of the character specified constructed in accordance with this invention. The arm is partly broken away to show the manner of connecting the upper and lower driving-shafts. The lower end of the connecting member and the lower driving-shaft and crank are shown in dotted lines. Fig. 2 is a rear side elevation of the same. Fig. 3 is a front end elevation. In this figure the attachments upon the bed-plate and the rear end of the arm are omitted. Fig. 4 is a rear end elevation. The attachments connected with the arm forward of the members herein shown are omitted. Fig. 5 is a plan view of the upper side of the bed-plate. All of the attachments are omitted, and the shafts of the various members which extend through the plate are shown in section. The cutting-block upon which the buttonhole is cut prior to stitching is also shown in this figure. Fig. 6 is a plan view of the bed-plate from the same side, the various attachments connected to and operated upon the bed-plate being shown. In this view the arm and driving mechanism are omitted. Fig. 7 is a plan view of the under side of the bed-plate, showing the extensions of the various attachments connected with shafts shown in Fig. 5. Part of the starting and stopping mechanism and the driving mechanism have been omitted. Fig. 8 is a detail view in plan of the starting, stopping, and locking mechanisms. The driving-pulleys, brake-shoe, and stopping-arm and the driving-shaft are partly broken away. In this view the parts are illustrated as in the position assumed just prior to the completion of the operation of stitching the buttonhole and in which they have remained just subsequent to the starting of the sewing mechanism. Fig. 9 is a similar view of the same parts, showing their position immediately after the sewing mechanism has been thrown into operation and prior to the release of the starting-rod to permit the same to return to the position shown in Fig. 8. Fig. 10 is a detail view in plan of the starting and stopping mechanism

and a portion of the cutting mechanism, showing the first step in the operation of cutting the buttonhole. Figs. 11, 12, and 13 are detail views furnished to illustrate the action of the parts of the mechanism shown in Fig. 10 to show the connection between the parts of the starting mechanism and the cutting mechanism. Fig. 11 is a side elevation of the end of the cutting-lever, cutter-lever hook, of the tilting lever, and a segment of the starting-rod, showing the parts as engaged and as shown in plan in Fig. 10. Fig. 12 is a side elevation of the same parts, showing in perspective the tilting lever in its tilted position, having released the starting-rod and the lever-hook. Fig. 13 is a plan view of the parts as shown in Fig. 12. Fig. 14 is a detail view, in side elevation, of the cutting mechanism, showing that portion of the driving mechanism which operates directly upon it. Fig. 15 is a detail view, in side elevation, enlarged, of the cams for operating the lever-hook and its attachments, with the end of the cutting-lever. Fig. 16 is an end elevation of the parts shown in Fig. 15 looking from the rear end, the tilting lever and its mounting, the starting-rod, and its lug being shown in connection with this figure. Fig. 17 is a plan view of the parts shown in Fig. 16. Figs. 18, 19, and 20 are detail views in diagram, showing the operation of the cutting mechanism as influenced by the cutting-lever cam through its various points of movement. The arrows in these figures show the direction of the movement of the cam. Fig. 21 is a detail view in plan of the locking mechanism, showing the position of the various parts of this mechanism and the parts of the stopping and starting mechanism shown in connection therewith in the positions assumed by the parts in throwing the cutting mechanism into operation. Fig. 22 is a side elevation of the same, the starting-rod being cut away to show the mounting of the locking-lever. Figs. 23, 24, and 25 are detail views in plan of the clamp. Fig. 23 shows the parts fully assembled. Fig. 24 shows the bottom plate of the clamp, the upper clamp-arms, the clamping-lever, and spreading-cam being removed. Fig. 25 is a view of the forward end of the clamp feed-slide, the lower clamp-plates shown in Fig. 24 having been removed. Fig. 26 is a cross-section taken through the lines X X in Fig. 23. Fig. 27 is a detail view, in side elevation, of the clamp-cams, the spreader, and clamp-lever. Fig. 28 is a detail view from the rear of the construction of the pivot-bearing of the clamp-arms. The lower part is partly cut away back to the central pivot-line to show the pivot-screw which permits the lateral movement of the clamp arms and plates. Fig. 29 is a detail view in plan of the clamp feed-levers in producing the constant feed of the clamp. Fig. 30 is a side elevation of the same, the end of the forked lever being cut away to show the connecting-pin with which it is engaged. In this view the shape of the bed-plate is shown in dotted lines. Fig. 31 is a detail view in plan of the controlling mechanism for the clamp-feed. Fig. 32 is a side elevation of the same. The bed-plate is here likewise indicated by dotted lines. Fig. 33 is a detail view in plan of the clamp-feed plate, together with the guiding mechanism for shifting the clamp laterally and the rear end of the clamp-feed mechanism. Fig. 34 is a detail view in section, showing the connection between the clamp-feed plate and the clamp-feed mechanism and guide-block. Fig. 35 is a detail view, in cross-section, of the guide-block, feed-plate, the connecting-rod of the clamp-feeding mechanism, and the pivotal connection between the same. Fig. 36 is a plan view of the clamp feeding mechanism, the feed-controlling mechanism, the guiding mechanism, the needle-vibrating mechanism, the needle-vibrating-controlling mechanism, together with the pattern cam-wheel, and the oscillating driving-lever by means of which it is operated. Fig. 37 is a detail view in plan of the needle vibrating and controlling mechanism, showing the parts connected with the oscillating lever and the connection with the vibrating lever extending above the bed-plate. Fig. 38 is a side elevation of the parts shown in Fig. 37, together with the vibrating lever extending above the bed-plate, the needle-bar carrier, and the connecting-rod between the same and the vibrating lever. Fig. 39 is a detail view in plan of the driving mechanism for the pattern-cam. Fig. 40 is a side elevation of the same. Fig. 41 is a plan view from the under side of the pattern-cam, showing the mountings for the same. Fig. 42 is a side elevation of the same inverted. Fig. 43 is a segment of the view shown in Fig. 42, partly in section, to show the method of supporting and guiding the pattern-cam. Fig. 44 is a detail view in plan of the friction-spring and the friction-shoes with which it is provided. Fig. 45 is a diagrammatic view showing the arrangement of the stitches as placed by a machine of this construction when making a straight buttonhole barred at the ends with stitches at right angles to those on the sides to imitate a hand-made buttonhole. Fig. 46 is a similar view illustrating the same arrangement when making an eyelet-end hole, with one end barred with stitches at right angles to those on the sides to likewise imitate a hand-worked buttonhole. Fig. 47 illustrates an eyelet-end buttonhole with what is known as a "soft bar," in working which the barring-stitches exceed in length those upon the sides of the buttonhole. Fig. 48 illustrates an eyelet-end buttonhole, illustrating what is called a "taper bar," the stitching of the sides being converged to the center at the end of the slit. Fig. 49 shows an eyelet-end hole constructed with what is called a "hard bar," in which the barring-stitches, like those in Fig. 47, exceed in length those on the side of the buttonhole, but which are in addition

overstitched by a series of stitches at right angles to those on the sides. Fig. 50 shows a straight buttonhole barred at each end with the soft bar, as shown in Fig. 47. Fig. 51 shows a straight buttonhole barred at each end with the hard bar, as in Fig. 49. Fig. 52 shows a straight buttonhole with a radially-stitched end illustrated as barred like the buttonhole in Fig. 51. Fig. 53 shows a straight buttonhole with rounded ends.

To facilitate the description of the present invention with reference to the drawings, I have separated the machine into groups of elements or mechanisms. The groups I have distinguished by letters, as follows: The starting and stopping mechanism I will distinguish by the letter A, the cutting mechanism by the letter B, the locking mechanism by means of which the cutting mechanism is prevented from being thrown into operation until the buttonhole is completed by the letter C, the driving mechanism by the letter D, the clamp for holding the material in which the buttonhole is constructed by the letter E, the clamp-feeding mechanism by the letter F, the controlling mechanism for supplementing and increasing or diminishing the operation of the clamp feed mechanism by the letter G, the guiding mechanism for controlling the path of the operation of the clamp and for laterally vibrating the same by the letter H, the needle-vibrating mechanism and its controlling devices by the letter I, the pattern-cam and the connections for operating it by the letter K, and the driving-cam and the oscillatory lever for transmitting the motion therefrom by the letter L. The details or elements of the several groups are distinguished by numerals used in connection with the letter of the group to which it belongs.

To start the mechanism, I have provided the starting-rod A′, which is mounted in suitable bearings in the bed-plate and extends from near the forward end of the frame to the rear of the same. It is operated by means of the hand-lever $A^2$ and the spring $A^{20}$. By means of the former it is thrown toward the rear end of the machine and by the latter returned toward the forward end. The lever $A^2$ is provided with an extension $A^4$, which engages the pin $A^5$, set in the side of the rod. At the rear end the rod is provided with an arm $A^6$, having a forked end to engage the stop-motion shaft $A^7$. The stop-motion shaft is mounted in suitable bearings under the bed-plate and is provided at the rear end, beyond the arm $A^6$, with the brake-shoe and stopping mechanism, more fully described by me in an application filed February 17, 1898, bearing Serial No. 670,679. At the forward end of the stop-motion shaft $A^7$ it is extended into the path of an arm of a trigger $A^{14}$. The trigger $A^{14}$ is pivotally mounted at $A^{18}$ and consists in two arms extended at right angles to each other, upon the ends of each of which are set pins $A^{15}$ and $A^{17}$. The pin $A^{15}$ is extended downwardly through the opening in the bed-plate $B^{36}$ and is adapted to rest in the path of the stop-motion shaft $A^7$ and operates to prevent the shaft moving to its forward position and setting the brake-shoe and stopping mechanism. The pin $A^{17}$ extends upward into the path of an arm $C^4$ of the locking mechanism, by means of which the trigger is thrown out of engagement with the shaft $A^7$. The trigger $A^{14}$ is thrown into engagement to present the pins $A^{15}$ in the path of the shaft $A^7$ by the spring $A^{16}$. By means of this trigger $A^{14}$ the brake-shoe and stopping mechanism are held out of engagement with the driving mechanism while the starting-rod A′ is returned to its normal position, from which it was moved in starting the mechanism. This return of the starting-rod is effected by means of the spring $A^{20}$. The first part of the action of the starting-rod has the effect of throwing into operation the cutting mechanism. This is accomplished by means of the lug $B^{21}$, which is mounted upon the upper part of the rod A′ and extends into the path of the outward end of the tilting lever $B^{18}$. The tilting lever $B^{18}$ is pivoted to move in a vertical direction in the swivel-block $B^{20}$. The swivel-block $B^{20}$ is pivotally mounted in the bed-plate of the machine and carries a spring $B^{35}$, which rests under the inner end of the tilting lever $B^{18}$ to lift it to a horizontal position normally and in which position it rests in the path of the operation of the lug $B^{21}$. The inner extension of the tilting lever rests against an extension $B^{16}$ of the cutter-lever hook $B^7$, to which it is secured by means of the screws $B^{17}$. It is by throwing the lever-hook $B^7$ forward that the cutting-lever B′ is engaged and compelled to operate.

The cutting-lever B′ is pivotally mounted on wings $B^2$ in a bearing $B^{37}$ in the bed-plate. In the forward end is set a cutter $B^3$ of any desired shape. In its operation the cutting-lever descends until the cutter $B^3$ is brought down upon the cutting-block $B^{38}$. This action is effected by means of what has hereinbefore been termed the "cutting mechanism." To the rear of the pivotal mounting $B^2$ of the cutting-lever it is provided with an extension $B^4$, and the end of the extension is provided with a lug $B^5$, extending from the side of the same. The extreme end of the extension $B^4$ forms a guide $B^6$, against which the hook end $B^8$ of the lever rests normally. When the action which has just been described occurs, whereby the tilting lever $B^{18}$ is engaged by the lug $B^{21}$ of the starting-rod A′, the pressure applied upon the starting-rod is transferred to the extension $B^{16}$ of the lever-hook $B^7$. The effect of this is to advance the hook $B^8$ when the same reaches its downward stroke under the lug $B^5$ on the side of the extension $B^4$ of the cutting-lever. From this point the lever-hook $B^7$ is raised by means of the lever $B^9$, with which it is pivotally connected, and which has an extension $B^{11}$, that is provided to ride upon the surface of the

cam $B^{12}$. The cam $B^{12}$ is mounted upon a bearing $B^{30}$, on which is mounted the beveled gear $D^{10}$ of the driving mechanism. To this gear the cams $B^{11}$ and $B^{25}$ are rigidly connected. The cam $B^{12}$ is rotated in the direction of the arrow shown in Figs. 18, 19, and 20 of drawings, and through the first part of its stroke after the hook $B^8$ has been extended under the lug $B^5$ it raises the lever $B^9$ and the hook-lever $B^7$ rapidly, as shown in Fig. 19, until the extension $B^{11}$ rests upon the part of the cam-surface designated by $b^3$. This occupies a small portion of the revolution of the cam-wheel and moves the cutter through the greater part of its movement until it rests upon or close to the material to be cut. From this point to the point marked $b^2$ is the major portion of the travel of the cam, while the rise is gradual, being just sufficient to raise the levers $B^9$ and $B^7$ to force the cutter $B^3$ firmly against the block $B^{38}$. In other words, the action of the cutting mechanism throws the cutting-lever $B'$ and the cutter $B^3$ over the necessary travel between its normal position and operative position rapidly, and slowly and with great power over the remaining or operative part of the stroke. While this operation of the cutting mechanism has been occurring the lug $B^{21}$ on the starting-rod has rested against the outer end of the tilting lever $B^{18}$, while the forward end of the lever $B^{18}$ has rested behind and against the extension $B^{16}$ of the hook-lever $B^7$ and maintained the same in position. It will be observed that while in this position the extension $A^6$ of the starting-rod has rested near or against the shoulder of the brake-shoe $A^8$ and has been prevented from engaging or moving the same. This is accomplished by the rear stop $B^{22}$ stopping the further backward movement of the forward end of the lever $B^{18}$, and therefore, also, of the rod A. A similar stop $B^{22}$ limits the forward movement of said forward end. The result of this has been that the cutting mechanism has been permitted to act and return without starting the sewing mechanism. This is necessary, as the cutter $B^3$ must strike upon the material directly in the path of and under the needle-bar of the sewing mechanism.

To release the starting-rod and the cutting mechanism simultaneously, the lever $B^{23}$ is provided. This is a curved lever pivotally mounted on the frame of the machine at $B^{24}$ and the forward end of which rests over the tilting lever $B^{18}$ in all of its positions. The lever $B^{23}$ is normally raised by means of the spring $B^{31}$ to the end $B^{32}$, to which it is connected. The action of this spring is to raise the roller $B^{27}$, which is mounted upon the lever $B^{23}$, against the surface of the adjustable release-cam $B^{25}$. This cam $B^{25}$ is provided with the sharp incline $B^{26}$, the remainder of its surface being concentric. Its adjustment is effected by means of a set-screw $B^{28}$, which extends through an elongated slot $B^{29}$ and engages the beveled gear $D^{10}$. To this gear it is stationarily secured in its various positions. It will be understood that this construction may be substituted by a pin or other various devices set out from the surface of the beveled gear to answer this purpose without departing from this invention. In the position in which the cutting mechanism has completed its operation, as shown in Figs. 10 and 20 of drawings, the end of the lever $B^{23}$ rests over the tilting lever $B^{18}$.

From that portion of the cam $B^{12}$ marked $b^2$ the cam is cut away suddenly at $b'$, the effect of which is to lower rapidly the levers $B^9$ and $B^7$ and permit the cutting-lever $B'$ to rise. It will be observed in Fig. 15 this part $b'$ and the sharp incline $B^{26}$ are about in line. The effect of this is to depress the lever $B^{23}$ upon the tilting lever $B^{18}$ as the levers $B^9$ and $B^7$ are brought to their lowest position. By depressing the inner end of the tilting lever $B^{18}$ it is moved upon its pivotal center in the swivel-block $B^{20}$ until the outer end is raised out of engagement with the lug $B^{21}$ on the starting-rod A'. Immediately the pressure is relieved from the outer end the spring $B^{10}$ on the lever-hook $B^7$ is permitted to return it to its normal position out of engagement with the lug $B^5$ of the cutting-lever $B'$. The effect of this is to swing the tilted lever on the pivotal bearing of the swivel-block $B^{20}$ until it assumes the position shown in Figs. 13 and 17. This is accomplished through the extension $B^{16}$, these two parts $B^{16}$ and $B^{18}$ being always in contact. The instant the lug $B^{21}$ is disengaged the starting-rod A' is permitted to move backward and releases the brake and, by means of the guide $A^{13}$, to shift the belt $D^5$ from the loose pulley $D^1$ to the driving-pulley $D^2$ of the driving mechanism, and thereby start the sewing mechanism. The sewing mechanism having been started, the operator releases the lever $A^2$, and the starting-rod A' is returned to its normal position by the spring $A^{20}$. In its return the lug $B^{21}$, which is inclined on its reversed side, clears the tilting lever $B^{18}$, which has assumed its horizontal position. When the starting-rod A' is thus returned, it is important that it should not be again advanced until the operation of sewing the buttonhole has been completed, for the reason that with its advance it would throw the cutting mechanism into operation at a time in which the sewing mechanism is operating and cause the cutter to descend upon the clamp, which would at that time be in the path of the cutter. It is to prevent this that I have devised what is hereinbefore termed the "locking" mechanism. This consists of the stop C', which is secured on the starting-rod A' by means of a set-screw $C^2$. The lever $C^3$ is pivotally mounted at $C^5$ upon the arm $C^4$ and is actuated by a spring $C^6$. The arm $C^4$, upon which the locking-lever $C^3$ is mounted, forms a part of the same construction with the shaft $C^9$ and the lever $C^{10}$. The arm $C^4$ has two extensions—that upon which the lever $C^3$ is mounted and that which

is extended behind the pin $A^{17}$ on the trigger $A^{14}$. These two extensions are above the bed-plate and are connected with the long arm $C^{10}$, below the bed-plate, through the shaft $C^9$. The arm $C^{10}$ extends inward and under the pattern-cam K'. The end $C^{12}$ of this arm is designed to extend into the path of a pin $C^{11}$, set in the under surface of the pattern-cam K'. This pin may be adjusted, though not so shown. These arms are moved with the shaft $C^9$ by means of the spring $C^{13}$ to throw the end $C^{12}$ toward the center of the pattern-cam. The extent of this movement is limited by a stop-pin $C^8$. When the operation of forming the buttonhole is completed, the machine is brought to rest with the pin $C^{11}$ under the end $C^{12}$ of the lever $C^{10}$, as shown in Fig. 21. In this position the locking-lever $C^3$ is drawn out of engagement with the stop C' and the starting-rod is free to be advanced to repeat the operations for which it is designed. With the starting of the sewing mechanism the pattern-cam K' is moved in the direction shown by the arrow in Fig. 21, and the pin $C^{11}$ clears the end $C^{12}$ of the arm $C^{10}$ and permits the spring $C^{13}$ to throw the arms into the position shown in Fig. 9 of drawings. At this time if the rod A' be advanced the lever $B^3$ strikes upon the side of the stop C' and is thrown in the position as shown in Fig. 9. When, however, the lever $A^2$ is released and the rod A' returned, the spring $C^6$ immediately swings the lever $C^3$ so as to interpose it in the path of the stop C'. This locking mechanism remains in this position until the pin $C^{11}$ on the pattern-cam K' has been carried one nearly-complete revolution of the pattern-cam and returns to the position shown in Fig. 8, when it begins to operate upon the end $C^{12}$ of the arm $C^{10}$ to throw the same outward and to rotate the arms $C^{10}$ and $C^4$ on their shaft $C^9$. The effect of this rotation is to place the parts in the position shown in Fig. 21 or unlock the starting-rod. This, however, only occurs after the operation of sewing the buttonhole has been completely performed. The driving mechanism by means of which these operations are accomplished consists of two parts—the driving mechanism by means of which the cutting mechanism is operated and the driving mechanism by means of which the sewing mechanism is operated. The driving mechanism by means of which the cutting mechanism is operated is driven from the "loose pulley" $D^4$, as it is called. This loose pulley $D^4$ is provided with a small pinion $D^3$ and is connected to the beveled gear $D^{10}$, to which the cams $B^{12}$ and $B^{25}$ are attached by means of the train of gears $D^7$, $D^8$, and $D^9$. The effect of this arrangement is that when the belt $D^5$ is thrown onto the loose pulley and when the machine is out of operation this train of gears is continually operating, rotating the cams $B^{12}$ and $B^{25}$ and raising and lowering the levers $B^9$ and $B^7$. By means of this arrangement the operation of the cutting mechanism is accomplished with the same force and power that is exerted upon the driving mechanism for the sewing mechanism, but at a distinct time and through a distinct driving mechanism. While this arrangement is preferred by me, it is obvious that I may separate the pulley $D^4$ from the pinion $D^3$ to provide a bearing for a third absolute idle pulley and so connect the belt-shifter as to cause the movement of the belt to run over the third pulley. The first part of the operation of the belt after leaving the idle pulley would be upon the present pulley $D^4$, and I do not wish to be understood as limiting myself to the present construction. The driving mechanism for the sewing mechanism starts from the pulley $D^2$, which is fixed rigidly upon the shaft D'. The shaft D' is extended along the under side of the bed-plate, in which it is suitably mounted, and is provided with a crank $D^{11}$, which is connected to the crank-disk $D^{12}$ of the shaft $D^{16}$ by means of the connecting-rod $D^{13}$. This connecting-rod is a straight rod and is guided in bearings in a swinging frame $D^{14}$. This swinging frame is vertically mounted between pivots $D^{15}$ $D^{15}$. The upper shaft drives the stitch-forming mechanism located in the arm. The whole stitch-forming mechanism may be any of the preferred forms. The lower shaft, as far as this invention is concerned, from the crank $D^{11}$ is extended forward and is provided with the pinion $D^{17}$, which engages the pinion $D^{18}$, mounted upon a suitable bearing $D^{19}$, (shown in the present drawings as a stud mounted in the boss $L^6$,) let down from the underside of the bed-plate. (Shown in Fig. 7.) Rigidly attached to the gear $D^{18}$ is a cylindrical cam $L^5$, through which all of the mechanisms hereinafter described are driven.

The clamp in which the material is held while being cut and sewed is mounted upon the clamp feed-plate E'. (Shown in Fig. 25 of drawings.) Upon this clamp feed-plate is mounted the clamp. This consists of two pairs of jaws, the lower being marked $E^2$ in the drawings and roughened, as shown in Fig. 24. They are pivoted on the screws $E^3$ and under the blocks $E^{20}$ and have lateral movement only. They are held down and guided in their lateral movement by the plate $E^{21}$, which extends over the ends of the plates $E^2$. They are provided on the surface with pins $E^8$ $E^8$, that extend upward and engage the upper arms $E^{10}$ $E^{10}$, perforations or slots being formed in the arms $E^{10}$ to receive them. The arms $E^{10}$ $E^{10}$ are mounted pivotally in the blocks $E^{20}$ upon screws $E^{12}$. This pivotal mounting permits of the vertical lifting of the arms $E^{10}$ $E^{10}$, and the blocks $E^{20}$ are pivoted upon the screws $E^3$ $E^3$ to permit them to move laterally. (See Figs. 24 and 28 of drawings.) The arms $E^{10}$ $E^{10}$ have an extension behind the blocks $E^{20}$ to receive the screws $E^{14}$ $E^{14}$, by means of which the leaf-springs $E^{13}$ $E^{13}$ are secured. The springs $E^{13}$ are provided as a yielding connection between the surface of the arms $E^{10}$ and the cams $E^{15}$, which are formed

integrally with the spreading-cam $E^{16}$ and the shaft which extends between and is mounted in journals $E^{17}$ $E^{17}$. The spreader $E^{16}$ is wedge shape, and the shaft is provided at the one end with a set-collar $E^{19}$ and on the other end with a collar and lever $E^{18}$, by means of which the shaft-cams and spreader are operated. At the forward end of the arms $E^{10}$ $E^{10}$ they are pivotally connected to the jaws $E^9$ $E^9$. These jaws are roughened on the under side to correspond with the jaws $E^2$ and are shaped to correspond therewith. The lower jaws $E^2$ and the upper jaws $E^9$ are connected and controlled in their lateral movement by the pins $E^8$ and are drawn by the spring $E^7$ against the side of the spreader $E^{16}$, which in all positions is extended between the arms $E^{10}$ $E^{10}$. Mounted between the upper and lower plates are springs $E^5$ $E^5$ to lift the upper jaws when the lever $E^{18}$ is raised to the vertical position. When the material is placed between the upper and lower jaws, the lever $E^{18}$ is depressed, bringing down the cams $E^{15}$ upon the springs $E^{13}$ and clamping the upper arms $E^{10}$, carrying the upper jaws $E^9$, upon the material. The cams $E^{15}$ and the spreader $E^{16}$ are so constructed relatively that the first part of the movement of the lever $E^{18}$ sets the jaws $E^9$ firmly upon the material. At this time the cutting mechanism is started and the cutter descends upon the material and cuts the hole, after which a further pressure upon the lever $E^{18}$ extends the spreader $E^{16}$ between the arms $E^{10}$ $E^{10}$ and causes by means of the pins $E^8$, connecting them, the jaws, both upper and lower, to spread, thereby spreading the slit formed by the cutter. In this position the clamp is retained until the buttonhole is sewed. The clamp feed-plate at the rear is pivoted upon a guide-block $E^{23}$, to which it is secured by a screw $E^{25}$. The guide-block $E^{23}$ is guided in a plate $E^{24}$, secured to the bed-plate of the machine. By means of this pivotal connection the clamp feed-plate E′ is permitted to shift its lateral position. In feeding it is controlled and guided in a straight line at the rear by the guide-block $E^{23}$. It is connected to the feeding mechanism by a connection F′, which at this end is adjustably secured in a slot in the top of a block $E^{22}$. The block $E^{22}$ is pivotally mounted upon the screw $E^{25}$ over the feed-plate E′. (See Figs. 33, 34, and 35.) The connection F′ is connected at the forward end by means of a stud and nut $F^2$ within an undercut slot formed in a grooved lever $F^3$. The grooved lever $F^3$ is pivotally mounted at $F^4$ upon a second lever G′, forming the connection between this lever and the clamp feed-controlling mechanism. By means of the stud and nut $F^2$ the connection F′ may be joined to the lever $F^3$ in various positions remote or near its pivot $F^4$ and its movement and the feed of the feed-plate E′ increased or diminished for the construction of various lengths of buttonholes.

Extending down from the under side of the lever $F^3$ is a pin $F^5$, which is engaged by a fork $F^{11}$, formed in the end of the arm $F^6$. The arm $F^6$ is mounted upon the shaft $F^7$, at the lower end of which is provided an arm $F^8$. The shaft $F^7$ extends through the bed-plate. In the end of the arm $F^8$ is mounted a stud and roller $F^9$, that enters the cam-slot $F^{12}$ in the pattern-cam K′. This cam-slot is cut to approximately the form shown in Fig. 36 of drawings, and the "constant feed," as I have termed it, of the clamp is obtained thereby. The term "constant feed" I have used to distinguish from what I have termed the "controlling-feed." The controlling mechanism for the feed-clamp is marked by the common letter G and is shown in detail in Fig. 31. This controlling mechanism is designed to impart a to-and-fro motion to the clamp when in position at the ends of the buttonholes for barring the ends thereof with bars, such as are shown in Figs. 45, 46, 49, 51, and 52, or when stitching the ends of the buttonhole and during the time when the clamp is being moved laterally. During the time the barring, as aforesaid, is being done the constant feed is stationary by reason of dwells in the cam F, and the pin $F^5$ becomes the fulcrum of the curved lever $F^3$ instead of the screw $F^4$ used in the constant feed. The lever G′ is pivoted at $G^2$ and is connected at $G^4$ by means of the connection $G^3$ with a sliding block carrying the screw $G^6$ and sliding in the curved rocking lever $G^5$, and the slide-block is movably secured in an undercut slot in the said rocking lever. The rocking lever is mounted centrally on a shaft $G^{13}$, which is extended downward through the bed-plate and is provided with an arm $G^{14}$. The arm $G^{14}$ is pivotally connected at $G^{15}$ by the connection $G^{16}$ to the end of the oscillating driving-lever L′ at $G^{17}$. The oscillating driving-lever L′, as hereinafter described, has a constant movement throughout the operation of the driving mechanism of the sewing mechanism. This through its connections produces in the rocking lever $G^5$ a constant rock about its center—the shaft $G^{13}$. By means of the connection between the lever G′ with the slide-block mounted in the undercut slot in the rocking lever the said lever G′ is given a greater or lesser movement as the slide-block is moved to and from the center of the rocking lever—the shaft $G^{13}$. Also the direction of the timed movements of vibration imparted through the lever G′ to the feed-clamp are varied according to the location of the slide-block upon the one side of the center of the rocking lever $G^5$ or the other. As will hereinafter be described, the vibrations imparted by the lever L′, and through it to the rocking lever $G^5$, are timed with the needle-bar-reciprocating mechanism to produce one complete vibration or to-and-fro motion of the clamp-controlling feed once in every three reciprocations of the needle. This will be better understood when the stitch made by this machine is understood. It consists in placing in the material one interlocked stitch and in

the cut two vertical superimposed locked stitches. The effect of this, as will hereinafter be more fully described, is to produce a heavy purl on the edge of the cut.

The mechanism herein termed the "feed-controlling" mechanism vibrates the clamp-feed mechanism when the bar across the ends of the buttonhole or the eye is being formed. Therefore it is necessary to regulate the vibration of the clamp-feed with reference to the stitches to bring the double superimposed stitch of the stitch-forming mechanism on the inside of the buttonhole at both the opposite ends. The regulation as to which side of the center $G^{13}$ of the rocking lever the sliding block is placed is controlled by the pattern cam-wheel K′ through the stud and roller $G^{12}$, moved by the cam $G^{10}$. The stud and roller $G^{12}$ is connected to the sliding block in the rocking lever $G^5$ through the shaft $G^{10}$, the curved lever $G^9$, and the connection $G^7$, to which the curved lever $G^9$ is connected by means of the stud and nut $G^8$. This connection by means of the stud $G^8$ admits of adjustment which controls the depth or width of the stitch which is formed on the bar or around the eye. This adjustment, it is obvious, is caused by the fact that the arm $G^{11}$ and the curved lever $G^9$ are pivoted on the shaft $G^{10}$, and the extent of the throw of the connection $G^7$ is dependent upon the distance the stud and nut $G^8$ is moved from the center of the shaft $G^{10}$. By properly shaping the cam-slot $G^{10}$ it will be observed that the extent or direction of the vibration of the lever G′ may be automatically controlled to produce any desired effect, and, further, by the adjustment of the connection $G^7$ with the curved lever $G^9$ the depth or width of the stitching of the eye or of a bar, as in Fig. 45, may be governed.

As before stated, the operation of the mechanism here described occurs when the machine is forming the stitching around the eye of the buttonhole or at the ends thereof, which is at a time when the constant clamp-feed F is at rest or during, as in the case of the eye, its differential movement. Also, as stated, the operation of the feed-control mechanism G occurs simultaneously with the shifting of the clamp in a lateral direction. This shifting is produced by what has been herein termed the "guiding mechanism" H. The guiding mechanism consists of a guide-block $H^2$, which is pivotally mounted at $H^3$ upon the lever $H^4$, which is pivotally mounted at $H^5$ upon the bed-plate of the machine. The lever $H^4$ is pivotally connected at $H^7$ to a connection $H^6$, which is pivotally secured by means of a stud and nut $H^9$ in an undercut slot in the curved lever $H^8$, by means of which the lateral movement of the clamp is adjusted. The end of the curved lever $H^8$ is provided with a shaft $H^{10}$, that extends through the bed-plate and is provided on the under side thereof with the arm $H^{11}$, upon which is mounted a stud and roller $H^{12}$. The stud and roller $H^{12}$ moves in the cam-groove $H^{13}$, formed in the face of the pattern cam-wheel K′, and according to the shape of the contour of the cam-groove $H^{13}$ the arm $H^{11}$ and curved lever $H^8$ are vibrated about the shaft $H^{10}$, and through the connection $H^6$ the end of the lever $H^4$ carrying the block $H^2$ is moved across the path of the clamp-feed. The clamp feed-plate E′ is provided with a slot H′ to receive the guide-block $H^2$. The cam-grooves G and $H^{13}$ are so formed with relation to the studs and rollers $G^{12}$ and $H^{12}$ that the lateral movement produced by the guiding mechanism H is simultaneous with the vibrations of the clamp-controlling feed, which produce, in combination with the controlled needle-bar-vibrating mechanism and the complemental stitch-forming mechanism, the end cross-stitching of the buttonholes, as in Fig. 46. This guiding mechanism also controls the path of the constant-feed mechanism in its relation with the vibrating needle, guiding the feed up one side of the buttonhole and down the other, and determines the length of the bar at the end of the buttonhole and, conjointly with the other coacting elements, the shape of the eye of the buttonhole.

The needle-vibrating mechanism is shown in the drawings at Figs. 37, 38, and 36. The needle-bar is reciprocated in the carrier I′, which is pivotally mounted on the arm of the machine at $I^2$ and is provided with an arm $I^3$, extending from the side, upon the end of which is formed a ball to receive a socket connection formed by the plate $I^4$ and the end of the connection $I^5$. The connection $I^5$ is pivotally attached at $I^6$ to the vibrating lever $I^7$, which is mounted at $I^8$ to the bracket $I^9$, which is secured to the arm of the machine, as shown in Figs. 1 and 2 of drawings. The lower end of the vibrating lever $I^7$ is provided with a ball which extends between flanges $I^{11}$, set up from the lever $I^{10}$. The lever $I^{10}$ is pivoted to the frame of the machine at $I^{12}$ at one end and connected movably by a screw at $I^{14}$ to the connection $I^{13}$, which is movably secured to the stud and block $I^{16}$, sliding in a curved rocking lever $I^{15}$. The stud and block $I^{16}$ is pivotally mounted in the undercut slot in the curved lever $I^{15}$. The curved lever $I^{15}$ is centrally provided with a shaft $I^{17}$, which extends downward through the bed-plate and is provided at the lower end of the short arm $I^{18}$ with the fork $I^{19}$. The fork $I^{19}$ embraces a roll and stud $I^{20}$, mounted upon the connection $I^{21}$. The connection $I^{21}$ is pivotally attached at $I^{22}$ to the end of the oscillating lever L′. As before mentioned, the oscillating lever L′ is constantly operated by the cam $L^5$ to produce one complete vibration or oscillation of the lever L′ or two lateral movements of the end thereof to each revolution of the cam $L^5$ and through its connections to operate the elements with which it is connected. Its influence upon the present mechanism I, through its connections with the rocking le-

ver $I^{15}$, produces a rock of the said lever simultaneously with its own movement. The needle-vibrating lever $I^{7}$ receives its own movement from the curved lever $I^{15}$ by means of the intermediate connections. In proportion as the sliding block and stud $I^{16}$ is moved to and from the center of the rocking lever $I^{15}$ (the shaft $I^{17}$) the vibrating lever $I^{7}$ is given greater or less movement. When the sliding block is directly over the center of the shaft $I^{17}$, there is no movement. The side of the rocking lever $I^{15}$ to which the sliding block is moved will determine at which end of the vibration of the needle-vibrating lever $I^{7}$ the two reciprocations of the needle-bar shall occur. This will produce on opposite sides of the vibration, so to speak, a pause in the vibration while the double superimposed stitch is forming by the sewing mechanism. The sliding block and stud $I^{16}$ are connected to the curved lever $I^{24}$ by the connection $I^{23}$, which is secured in an undercut slot in the curved lever $I^{24}$ by the stud and nut $I^{25}$. This connection is adjustable, and through it the movement which is imparted by the cam-groove $I^{29}$ to the curved lever $I^{24}$ is diminished or increased in its effect upon the sliding block and stud $I^{16}$, which in turn increases or diminishes the vibration of the lever $I^{7}$, through the connection $I^{13}$ and lever $I^{10}$, and also determines the position of the double reciprocation of the needle-bar. The cam-groove $I^{29}$ is formed relatively to the cam-grooves $H^{13}$ and $G^{10}$ with the design to place the sliding block and stud $I^{13}$ over the shaft $I^{17}$ during the operation of the clamp-feed-guiding mechanism and the clamp-feed-controlling mechanism when making a bar such as shown in Fig. 45. During the time that the bar is being produced across the end of the buttonhole by the coöperation of the guiding mechanism and the feed-controlling mechanism and the stitch-forming mechanism it will be observed that the needle-vibrating mechanism is stationary. As later described, when the round eye is being formed the sliding block and stud $I^{16}$ are gradually moved toward and across the center of the shaft $I^{17}$. This produces a graduated width of the vibration of the needle-bar simultaneously with the movement produced in the clamp-feed by the controlling mechanism G and the guiding mechanism H. It will be shown as the resultant of the simultaneous movement of these three elements or mechanisms that the radial stitching about the eye of the buttonhole is produced.

The clamp feed mechanism F, the controlling mechanism G, the guiding mechanism H, the vibrating mechanism I are each operated from or controlled by cam-grooves formed in the surface of the pattern cam-wheel K′. This pattern cam-wheel K′ is provided on its periphery with the ratchet-teeth $K^{2}$ and is rotated by means of the lever $K^{4}$, upon which, pivotally mounted at $K^{5}$, is one or more pawls $K^{3}$. The pawls $K^{3}$ are arranged over spaces of the teeth $K^{2}$, so that the adjustment of the throw of the pattern cam-wheel may be regulated more closely. The pawls $K^{3}$ are held in contact with the teeth by the springs $K^{6}$, which are secured on the lever $K^{4}$. The lever $K^{4}$ is mounted upon the lower end of the shaft $K^{7}$, that is extended upward through the bed-plate and is provided upon the upper end with an arm $K^{8}$. The arm $K^{8}$ is pivotally connected at $K^{10}$ to the connection $K^{9}$, which is secured at its end by means of an adjustable stud and nut $K^{12}$ within an undercut slot formed in a curved lever $K^{11}$. The curved lever $K^{11}$ is mounted on the end of a shaft $K^{13}$, that is extended downward through the bed-plate and is provided at the lower end with an arm $K^{14}$ beneath the bed-plate. The end of the arm $K^{14}$ is pivotally connected at $K^{16}$ with the connection $I^{21}$, by means of which it is connected to the end of the oscillating lever L′. By means of the adjustable stud and nut $K^{12}$ the end of the connection $K^{9}$ may be moved to and from the center of the curved lever $K^{11}$ and the shaft $K^{13}$, and the throw of the said lever $K^{4}$ and the pawl engagement between it and the pattern cam-wheel increased or diminished thereby. It is thus that the desired number of stitches in a buttonhole may be regulated.

The pattern cam-wheel K′ is mounted in bearings on the bracket $K^{17}$, which is here shown in a tripod form. It is centrally provided with a stud $K^{22}$, which is threaded to receive a milled nut $K^{23}$. A friction-spring $K^{24}$, shown in Figs. 41 and 42 as having three extensions on the end of which are mounted friction-surfaces $K^{25}$, rests upon a surface $K^{21}$, formed on the bracket $K^{17}$. The stud $K^{22}$ is slabbed on one side at $K^{27}$ and the spring $K^{26}$ is correspondingly shaped, so as to be compelled to move with the stud and pattern cam-wheel. By adjusting the milled nut $K^{23}$ the friction-tension upon the pattern cam-wheel may be regulated and controlled. The pattern cam-wheel is supported and guided in its action by the lugs $K^{20}$ and the shoulders $K^{19}$. The bracket $K^{17}$, preferably made in the tripod form, is mounted upon bosses $K^{28}$, set down from the under side of the bed-plate, to which they are secured by screws. By means of this construction the pattern-cam may be readily and rapidly unshipped and replaced, all that is necessary being to remove the three screws extending through the hubs $K^{18}$ of the bracket $K^{17}$. By this method various pattern cam-wheels may be rapidly and easily substituted for the construction of various kinds of buttonholes.

The pattern cam-wheel, the needle-vibrating mechanism, and the clamp-feed-controlling mechanism are all operated by the oscillating lever L′. This lever is pivotally mounted at $L^{2}$ by means of a screw set into a bracket $L^{3}$. It is provided with a stud and roller $L^{4}$, which is extended into the groove in the cam $L^{5}$. This groove is formed to produce one complete vibration of the lever L′ in one revo-

lution of the cam. The cam, as before stated, is securely attached to the gear-wheel $D^{18}$, which is driven by the pinion $D^{17}$ on the main shaft of the driving mechanism. The gear-wheels $D^{17}$ and $D^{18}$ are formed of a size to produce one revolution of the wheel $D^{18}$ to three revolutions of the pinion $D^{17}$. The result of this gearing is to produce one complete vibration of the lever L′ or two lateral movements to three revolutions of the driving-shaft D′ and the stitch-forming mechanism which is driven by it. (See Figs. 39 and 40.)

While I have herein shown and described the driving mechanism as operating upon the various mechanisms through the oscillated lever L′, cam $L^5$, gear $D^{18}$, and pinion $D^{17}$ with a period of one to three revolutions of the driving-shaft D′, other periods and more than one lever, as L′, can be used, and thus distinct and various movements of the different mechanisms operated from the driving-shaft may be produced.

In Figs. 45 and 46 I have undertaken to show by diagrams the operation of the present machine in stitching a buttonhole. In Fig. 45 I have illustrated the stitching as produced by this machine in the style of buttonholes known as "square-barred" buttonholes, in imitation of a hand-made bar. There has been before mentioned the nature of the stitch and the manner of forming the same produced by this mechanism. All that is now necessary to mention in regard to it is that the action of the machine produces one stitch in the material and two vertically-superimposed stitches or a double stitch on the edge of the buttonhole and that this is produced by the pause at one end of the complete vibration of the needle-bar carrier to receive two reciprocations of the needle in that position and pausing at the other extremity of the vibration to receive but one. Attention is here called to the fact that the side of the vibration of the needle-bar upon which the carrier is paused to receive the double reciprocation is governed by the position of the sliding block and stud $I^{16}$ to the one side or the other of the pivotal center of the rocking block $I^{15}$—that is to say, when the sliding block and stud are on the one side of the pivotal center the double stitch will be produced at the one extremity of the vibration of the needle-bar, and when the block and stud are on the opposite side of the pivotal center the double stitch will be produced at the other extremity of the vibration of the needle-bar. Attention is also called to the same construction which is used in the feed-controlling mechanism, whereby the feed is regulated in the same manner for the same purpose to place the double stitch along the side of the work next to the cut in the material. Referring first to Fig. 45, the arrow in this figure is used to show the direction of the movements of the buttonhole and clamp under the needle. I start the operation at *a*. It will be remembered that this is the position in which the material has been held in the clamp while operated upon by the cutting mechanism and in which, subsequent to being cut, the clamp has slightly spread the edges of the buttonhole apart. The needle enters in the material back from the cut edge, where it forms, in combination with the complemental stitch-forming mechanism, one interlocked stitch, after which the vibrating mechanism immediately shifts the needle-bar laterally over the cut edge, where it is held to form two interlocked superimposed stitches. Between the double stitch and the single stitch the feeding mechanism F advances the clamp in its regular feed. At this point the needle is reciprocated once only, when the vibrating mechanism I again moves it over the cut, and so on up the straight side of the buttonhole until the point *a*′ is reached. At this point the stud and roller $F^9$ reaches a concentric portion of the contour of the cam-groove $F^{12}$, and the feeding mechanism remains in a fixed position for the time. Simultaneously the sliding block and stud $I^{16}$ is thrown directly over the pivotal center of the curved lever $I^{15}$ and ceases to operate the needle-vibrating mechanism. The sliding block and stud $G^6$, which has up to this time remained directly over the pivotal center of the curved lever $G^5$, is now moved to one side of the center and the controlling mechanism G begins to operate. The guiding mechanism H now operates to throw the clamp yet farther from the side of the cut the needle has been stitching to bring the medium line of the needle operation in line with the single outside stitches. From this position the action of the machine is the resultant of the cooperation of the non-vibrated reciprocating needle and the other coöperating stitch-forming elements, the controlling mechanism G operating to vibrate the clamp parallel with the cut of the buttonhole and the guiding mechanism H, which slowly moves the clamp transversely across the line of the vibration of the controlling mechanism until the position indicated by $a^2$ is reached. It will be observed that the vibratory action of the controlling mechanism G is similar to the vibratory action of the needle-vibrating mechanism I, in that it has produced the same effect of a single outside stitch and the double inside stitch, the effect of which is to produce the purl along the inside of the bar in imitation of a hand-made bar. From the point marked $a^2$ the controlling mechanism G is thrown out of operation by the sliding block $G^6$, being thrown directly over the center of the rocking lever $G^5$, while the guiding mechanism H has slightly advanced to fix the medium line of the needle vibration for the constant-feed mechanism F in the operation of sewing the remaining side of the buttonhole. This side of the buttonhole and the remaining bar are constructed in the same manner as the other side and bar, which has just been described. It will, however, be observed that

in returning the needle-vibrating mechanism I in operation the sliding block and stud $I^{16}$ have been moved to the side of the pivotal center of the rocking lever $I^{15}$ opposite from that which it previously occupied. The result has been that the pause in the needle vibration to permit the double stitch is now on the opposite extremity of the vibration or on the opposite edge of the buttonhole-cut, and when the second bar is constructed a similar action transpires in the controlling mechanism G, by which the sliding block and stud $G^6$ is likewise carried to the opposite side of the pivotal center of the rocking lever $G^5$ to produce the pause in its vibration to receive the double stitch on the edge opposite from that produced in the former bar. Attention is called to the fact that the driving mechanism is brought to a definitive stop by the stopping mechanism A when the last stitch of the bar is put in and when the parts cooperating to construct the bar have been returned to their normal positions.

In Fig. 46 is illustrated the arrangement of the stitches in constructing an eyelet end buttonhole. This operation, as far as the two sides and the square bar on the end are concerned, is the same as above described. The variation begins at the point marked $c'$. From this point to the point marked $c^2$ the feed mechanism F is operating in its constant feed. From the point $c^2$ to the point $c^3$ the feed mechanism F is gradually diminished to a pause and is then returned with gradually-increased speed to $c^5$. At the stitch following the point marked $c'$ the controlling mechanism G is thrown into operation, the sliding block $G^6$ being thrown to that side of the pivotal center of the rocking lever $G^5$, by which the feeding mechanism is moved backward. This produces the result that the single stitch is placed in a position slightly in front of the double stitch, by which the stitches along the inclined side of the eye are placed at substantially right angles to the cut. This sliding block and stud $G^6$ remains in this position during the continuation of the feed along the inclined side of the eye to the point opposite $c^2$, where it is returned to the center of the rocking lever $G^5$ and is immediately moved to the opposite side of the center, the result of which is to increase the feed of the controlling mechanism in excess of the now gradually diminishing controlling-feed of the feeding mechanism F. From the point $c^2$ the sliding block and stud $c^6$ is being gradually thrown toward the end of the lever $G^5$ away from the center until at $c^4$ it reaches its maximum feed-stroke at the point when the direct feed F has ceased. From this point around the other side of the circular part of the eye to the line $c^5$ the feed of the controlling mechanism G is being gradually decreased and the feed of the clamp feeding mechanism F gradually increased. At $c^5$ the sliding block and stud $G^6$ again passes the pivotal center to the other extension of the rocking lever $G^5$, where it remains while the sewing mechanism is stitching the inclined side of the buttonhole until the point $c^6$ is reached. Here the slide-block and stud $G^6$ is again returned over the pivotal center of the rocking lever and remains there during the stitching of the last side of the cut. During the stitching of the first straight side until the point $c'$ is reached the guiding mechanism H has remained in its constant position. From this point it begins to gradually shift to maintain the medium line of the vibration of the needle parallel to the inclined side of the eye until the point $c^2$ is reached. From this point the guiding mechanism and the guiding-block $H^2$ are returned gradually while the feeding mechanism F and the controlling mechanism G are performing their separate functions until the point $c^5$ is reached, when the direction of the movement of the guiding mechanism changes to maintain the medium line of the needle vibration down the inclined side of the buttonhole until the point $c^6$ is reached, when the guiding mechanism H remains in a stationary position for the stitching of the last straight side of the buttonhole-cut. The result of the three movements of the feeding mechanism F, the controlling mechanism G, and the guiding mechanism H is to produce the two inclined sides and the round end of the eye. (Shown in Fig. 46.) During the operation thus far described the needle-vibrating mechanism has been operating constantly up the first straight side and the inclined side until the point $c^2$ is reached. From this point to the point $c^4$ the sliding block and stud $I^{16}$ is gradually moved over the pivotal center of the rocking lever $I^{15}$, which it reaches during the formation of the stitch or stitches parallel with the straight cut of the buttonhole and during the maximum throw of the controlling mechanism G. From this point the sliding block and stud $I^{16}$ is continued in its movement from the pivotal center to the opposite side of the rocking lever $L^{15}$, which gradually increases the amplitude of the vibration of the needle-bar and, it will be remembered, changes the pause of the needle vibration to the opposite extremity of the vibration. In other words, it causes the double stitch to be placed at the opposite end of the needle vibration upon the opposite edge of the buttonhole. This increasing of the needle vibration continues until the point $c^5$ is reached, where the maximum vibration begins and continues down the inclined and straight side of the buttonhole. The square bar at the end is produced as before described.

While I have shown in the accompanying drawings the pattern-cam in which the grooves are formed to produce an eyelet-hole, such as shown in Fig. 46, it will be understood that the grooves may be changed indefinitely to produce various and independent acts on the parts of the various mechanisms, the effect of which will be to form many and various forms of buttonholes. To illustrate, I have shown in Figs. 47 to 53, inclusive, various

forms of buttonholes which may be constructed by this machine by forming the cam-grooves to correspond.

As to the best of my knowledge and belief I am the first to devise means whereby a buttonhole may be stitched with a series of stitches placed substantially at right angles to each other with respect to the sides and bar at the ends thereof, I claim such mechanism and its equivalent broadly.

Having thus described this invention, what is claimed is—

1. In a buttonhole-sewing machine, the combination of a cutter, a cam for operating the cutter, a stitch-forming mechanism, a power device transmitting motion alternately to said cam and mechanism, a device for clamping the work, a starting device, operated independently of the clamping device, and which, when moved in one direction, brings the cam into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, a stop limiting the further movement, in the first direction, of said starting device, and means, operated by said cam at a predetermined point in its effective movement, for removing said stop, said starting device then, in its further movement, shifting said power device to operate the stitching mechanism, substantially as described.

2. In a buttonhole-sewing machine, the combination of a cutter, a cam for operating the cutter, a stitch-forming mechanism, a power device transmitting motion alternately to said cam and mechanism, a starting device, which, when moved in one direction, brings the cam into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, a stop limiting the further movement, in the first direction, of said starting device, and means, operated by said cam at a predetermined point in its effective movement, for removing said stop, said starting device then, in its further movement, shifting said power device to operate the stitching mechanism, substantially as described.

3. In a buttonhole-sewing machine, the combination of a cutter, a cutter-operating mechanism, a stitch-forming mechanism, a power device transmitting motion to said mechanisms alternately, a device for clamping the work, a starting device, operated independently of the clamping device, and which, when moved in one direction, brings the cutter-operating mechanism into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, a stop limiting the further movement, in the first direction, of said starting device, and means, operated by said cutter-operating mechanism at a predetermined point in its effective movement, for removing said stop, said starting device then, in its further movement, shifting said power device to operate the stitching mechanism, substantially as described.

4. In a buttonhole-sewing machine, the combination of a cutter, a cutter-operating mechanism, a stitch-forming mechanism, a power device transmitting motion to said mechanism alternately, a starting device, which, when moved in one direction, brings the cutter-operating mechanism into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, a stop limiting the further movement, in the first direction, of said starting device, and means, operated by said cutter-operating mechanism at a predetermined point in its effective movement, for removing said stop, said starting device then, in its further movement, shifting said power device to operate the stitching mechanism, substantially as described.

5. In a buttonhole-sewing machine, the combination of a cutter, a cutter-operating mechanism, a stitch-forming mechanism, a device for clamping the work, a starting device, operated independently of the clamping device, and which is reciprocated to render the cutter-operating mechanism effective or ineffective on the cutter, said starting device, in its further movement in the first direction of its reciprocation, bringing into operation the stitch-forming mechanisms, the first part of its movement in said direction being controlled by the position of the stitch-forming mechanism, and the said further movement being controlled by the position of the cutter-operating mechanism, substantially as described.

6. In a buttonhole-sewing machine, the combination of a cutter, a cutter-operating mechanism, a stitch-forming mechanism, a starting device which is reciprocated to render the cutter-operating mechanism effective or ineffective on the cutter, said starting device, in its further movement in the first direction of its reciprocation, bringing into operation the stitch-forming mechanism, the first part of its movement in said direction being controlled by the position of the stitch-forming mechanism, and the said further movement being controlled by the position of the cutter-operating mechanism, substantially as described.

7. In a buttonhole-sewing machine the combination of a cutter, a cam for operating the cutter, a stitch-forming mechanism, a power device, a reciprocating starting device, which, when moved in one direction, brings the cam into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, an obstruction limiting the further movement in the first direction of said starting device, a lever for removing said obstruction, means, adjustably carried by said cam for operating said lever, and a belt-shifter moved by said starting device in its further move-

ment, to shift the belt to operate the stitching mechanism, substantially as described.

8. In a buttonhole-sewing machine the combination of a cutter, a cam for operating the cutter, a stitch-forming mechanism, a power device, a reciprocating starting device, which, when moved in one direction, brings the cam into operative relation with the cutter, means whereby the reverse movement of said starting device interrupts said operative relation, an obstruction limiting the further movement in the first direction of said starting device, a lever for removing said obstruction, means, carried by said cam for operating said lever, and a belt-shifter moved by said starting device in its further movement, to shift the belt to operate the stitching mechanism, substantially as described.

9. In a buttonhole-sewing machine, the combination of a cutter, a cam for operating the cutter, a stitch-forming mechanism, a power device transmitting motion alternately to said cam and mechanism, a reciprocating rod, a tilting lever swung by said rod, a hook, operated by said cam, and shifted by said lever into engagement with said rod, and means, operated with the movement of said cam, for tilting said lever and thereby freeing said rod from further movement said rod being connected with said power device to thereupon by said further movement shift the latter from the cam to the mechanism, substantially as described.

10. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse vibration to the needle, means for imparting a longitudinal reciprocation to the clamp, a bed-plate, four vertical rock-shafts pivotally mounted in said bed-plate, each carrying an arm above and an arm below said bed-plate, rollers on said lower arms, a horizontal rotating cam-wheel mounted below said bed-plate having in its upper surface four cam-grooves in which said rollers ride, and links extending from the upper arms, of which two are operatively connected with the clamp to reciprocate the same longitudinally and transversely respectively, and the other two are connected respectively with the aforesaid means, to control their operation, substantially as described.

11. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse reciprocation to one of said elements relatively to the other, means for imparting a longitudinal reciprocation to one of said elements relatively to the other, a bed-plate, four vertical rock-shafts pivotally mounted in said bed-plate, each carrying an arm above and an arm below said bed-plate, rollers on said lower arms, a horizontal rotating cam-wheel mounted below said bed-plate having in its upper surface four cam-grooves in which said rollers ride, and links extending from the upper arms, of which two are operatively connected with the clamp to reciprocate the same longitudinally and transversely respectively, and the other two are connected respectively with the aforesaid means, to control their operation, substantially as described.

12. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse vibration to the needle, means for imparting a longitudinal reciprocation to the clamp, a bed-plate, four vertical rock-shafts pivotally mounted in said bed-plate, each carrying an arm above and an arm below said bed-plate, rollers on said lower arms, a horizontal rotating cam-wheel mounted below said bed-plate having in its upper surface four cam-grooves in which said rollers ride, and links extending from the upper arms, and independently adjustable thereon, of which two are operatively connected with the clamp to reciprocate the same longitudinally and transversely respectively, and the other two are connected respectively with the aforesaid means, to control their operation, substantially as described.

13. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse reciprocation to one of said elements relatively to the other, means for imparting a longitudinal reciprocation to one of said elements relative to the other, a bed-plate, four vertical rock-shafts pivotally mounted in said bed-plate, each carrying an arm above and an arm below said bed-plate, rollers on said lower arms, a horizontal rotating cam-wheel mounted below said bed-plate having in its upper surface four cam-grooves in which said rollers ride, and links extending from the upper arms, and independently adjustable thereon, of which two are operatively connected with the clamp to reciprocate the same longitudinally and transversely respectively, and the other two are connected respectively with the aforesaid means, to control their operation, substantially as described.

14. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle-bar, a bracket having arms removably secured to the under side of the bed-plate of the machine, a suitably-driven horizontal cam-wheel revolubly supported on said bracket and having cam-grooves in its upper surface, mechanism operated thereby, extending through said bed-plate, for controlling the relative movements of the needle-bar and clamp, and means, carried by said arms, for accurately centering the cam-wheel in its revolution, substantially as described.

15. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse reciprocation to one of said elements relatively to the other, means for imparting a longitudinal reciprocation to one of said elements relatively to the other, a bracket having arms removably secured to the under side

of the bed-plate of the machine, a suitably-driven horizontal cam-wheel revolubly supported on said bracket and having cam-grooves in its upper surface, mechanism operated thereby, extending through said bed-plate, for controlling the relative movements of the needle-bar and clamp, and means carried by said arms, for accurately centering the cam-wheel in its revolution, substantially as described.

16. In a sewing-machine, the combination, with the stitching mechanism, of a work-holding clamp, a clamp feed-plate, a lever operatively connected to said plate, whereby the rocking of the lever reciprocates the plate, said lever having two movable fulcra, a train of mechanism from the main driving-shaft to rock one of said fulcra synchronously with a predetermined number of stitches of the stitching mechanism to impart a short rapid reciprocation to said clamp, and a rotary cam-wheel having two cams, whereof one controls the action of said train of mechanism to increase or diminish the rocking of said fulcrum rocked thereby, and the other rocks the other fulcrum, to impart a longer slow reciprocation to said clamp, substantially as described.

17. In a sewing-machine, the combination, with the stitching mechanism, of a work-holding clamp, a clamp feed-plate extending from front to rear of the machine, a link pivotally connected at its rear end with the clamp feed-plate, a lever to which the front end of said link is adjustably connected, said lever having two movable fulcra, a train of mechanism from the main driving-shaft to rock one of said fulcra synchronously with a predetermined plurality of stitches of the stitching mechanism to impart a short rapid reciprocation to said clamp, and a rotary cam-wheel having two cams, whereof one controls the action of said train of mechanism to increase or diminish the rocking of said fulcrum rocked thereby, and the other rocks the other fulcrum, to impart a longer slow reciprocation to said clamp, substantially as described.

18. In a sewing-machine, the combination with the stitching mechanism, of a work-holding clamp, a clamp feed-plate extending from front to rear of the machine, a reciprocating guide-block to which the rear end of said plate is pivotally connected, a link pivotally connected and longitudinally adjustably connected at its rear end with the rear end of the clamp feed-plate, a lever to which the forward end of the link is adjustably connected, means for rocking said lever whereby a longitudinal reciprocation is imparted to the clamp, and independent means for transversely reciprocating said clamp, substantially as described.

19. In a buttonhole-sewing machine, the combination of a work-holding clamp, a vertically-reciprocating needle-bar, a link connected to one of said elements to rock the same transversely relatively to the other, a link connected to one of said elements to rock the same longitudinally relatively to the other, a lever for reciprocating said links arranged to make a complete reciprocation during three complete vertical reciprocations of the needle-bar, being at one end of its reciprocation during two of the complete reciprocations of the needle-bar, and at the other end during one, whereby two stitches are formed in the cut of the buttonhole and one stitch in the work during each complete reciprocation of said lever, and a cam driven step by step by said lever in its reciprocations, and having grooves controlling the action of said links, substantially as described.

20. In a buttonhole-sewing machine, the combination of a work-holding clamp, a vertically-reciprocating needle-bar, a link connected to one of said elements to rock the same transversely relatively to the other, a link connected to one of said elements to rock the same longitudinally relatively to the other, a cam for reciprocating said links arranged to make a complete revolution during three complete vertical reciprocations of the needle-bar, holding said links in one position of their reciprocation during two of the complete reciprocations of the needle-bar, and in the other position during one, whereby two stitches are formed in the cut of the buttonhole and one stitch in the work during each complete reciprocation of said lever, and a second cam driven step by step by said first cam in its revolutions and having grooves controlling the action of said links, substantially as described.

21. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle, means for imparting a transverse vibration to the needle, means for imparting a longitudinal reciprocation to the clamp, a rotary cam-plate having four cam-grooves in its face, rock-shafts having arms rocked by said cam-grooves, links reciprocated by the respective other arms of said shafts, and independent means for varying the extent of the reciprocations so produced, two of said links being connected with the work-holding clamp to feed the same longitudinally and transversely respectively, and the other two being connected, respectively, with the means for vibrating the needle and for reciprocating the clamp, to control the operation of said means, substantially as described.

22. In a sewing-machine, the combination of a reciprocating needle-bar and needle, a work-holding clamp, a cam making a complete revolution during a plurality of reciprocations of the needle-bar, a train of mechanism from said cam to the needle-bar to impart a transverse vibration thereto, a train of mechanism from the cam to the clamp to impart a longitudinal reciprocation thereto, a second cam, and controlling devices therefrom to the trains to render the latter operative or inoperative as desired at predetermined points in the revolution of the latter

cam, said controlling devices comprising elements adjustably secured to each other, whereby the bite of the stitches formed by the vibration of the needle and the reciprocation of the clamp may be varied at pleasure, and suitable feed mechanism for advancing the work, substantially as described.

23. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle-bar, a rotary cam-plate, a vibrating lever, trains of mechanism from said lever to the needle-bar, the clamp, and the cam-plate to vibrate the needle-bar, reciprocate the clamp, and intermittently feed the cam-plate, all synchronously, rock-shaft arms rocked by cam-grooves in the face of the cam-plate, and links reciprocated by the respective other arms of said shafts, and connected to the trains of mechanisms to the needle-bar and clamp to control their movement, substantially as described.

24. In a sewing-machine, the combination of a work-holding clamp, a vertically-reciprocating needle-bar, a rotary cam-plate, a cam, trains of mechanisms from said cam to the needle-bar, the clamp, and the cam-plate to vibrate the needle-bar, reciprocate the clamp, and intermittently feed the cam-plate, all synchronously, rock-shafts having arms rocked by cam-grooves in the face of the cam-plate, and links reciprocated by the respective other arms of said shafts, and connected to the trains of mechanisms to the needle-bar and clamp to control their movement, substantially as described.

25. In a buttonhole-sewing machine, in combination with a stitch-forming mechanism comprising a laterally-vibrated needle; a clamp to hold the material in which the buttonhole is formed; a feeding mechanism to move the said clamp transversely across the vibratory path of the needle; a guiding mechanism for the movement of the said clamp adapted to shift the same at the ends of the buttonhole to present the material on the opposite sides of the buttonhole to the operation of the needle, and to vibrate the said clamp parallel with the vibration of the needle at the end of the buttonhole to produce a bar across the buttonhole; said feeding and guiding mechanism being operated by cams, a controlling mechanism for said feeding mechanism, also operated by a cam, all of said cams being on a pattern-plate revolubly below the bed of the table, substantially as described.

26. In a buttonhole-sewing machine, in combination with a stitch-forming mechanism comprising a laterally-vibrated needle; a driving mechanism; a clamp adapted to hold the material in which the buttonhole is formed; a feeding mechanism for the said clamp mechanism adapted to move the said clamp parallel with the cut of the buttonhole; a controlling mechanism adapted to supplement and modify the extent of the movement of the clamp by the feeding mechanism and to vibrate the clamp parallel to the cut of the buttonhole under the path of the needle; and a guiding mechanism adapted to control the path of the said clamp while being operated on by the said feeding and controlling mechanisms and to vibrate the clamp transversely across the path of the operation of the said feeding mechanism and controlling mechanism; and a connecting mechanism for the said feeding mechanism and said driving mechanisms, said feeding, controlling, guiding and connecting mechanisms being all operated by cams on a common revoluble plate, substantially as described.

27. In a buttonhole-sewing machine, in combination with a stitch-forming mechanism; a driving mechanism; a needle-vibrating mechanism adapted to laterally vibrate the needle; a connecting mechanism between the said needle-vibrating mechanism and the driving mechanism comprising means for producing two movements of the vibrating mechanism to three reciprocations of the needle, and an interposed rocking member connected to the vibrating mechanism by means of a movable connection; and a controlling mechanism comprising a pattern-cam, and adapted to move the said movable connection on the said rocking member over, and to both sides of the rocking center, substantially as described, whereby there is produced a buttonhole-stitch consisting in a single stitch at one end of the lateral vibration of the needle and a double superimposed stitch at the other end of the lateral vibration and means for reversing the positions of the single and double superimposed stitches.

28. In a buttonhole-sewing machine, in combination with a stitch-forming mechanism; a driving mechanism; a clamp adapted to hold the material in which the buttonhole is to be formed; a feeding mechanism adapted to vibrate the clamp across the path of the needle parallel with the buttonhole cut; a connecting mechanism between the said feeding mechanism and driving mechanism adapted to produce two movements of the feeding mechanism to every three reciprocations of the needle, and comprising a rocking member; a connection between the said feeding mechanism movably secured to the said rocking member; and a controlling mechanism comprising a pattern-cam and adapted to move the said connection over the rocking center of the rocking member and to both sides thereof, substantially as described, whereby the said clamp may be brought to rest during two reciprocations of the needle at either end of the throw of the said feeding mechanism.

In testimony whereof I have hereunto set my hand this 1st day of September, 1898.

FRANCIS T. LEILICH.

Witnesses:
E. F. MURDOCK,
M. H. HARMS.