No. 684,241. Patented Oct. 8, 1901.

# G. S. HILL.

## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 1.

FIG. 1.

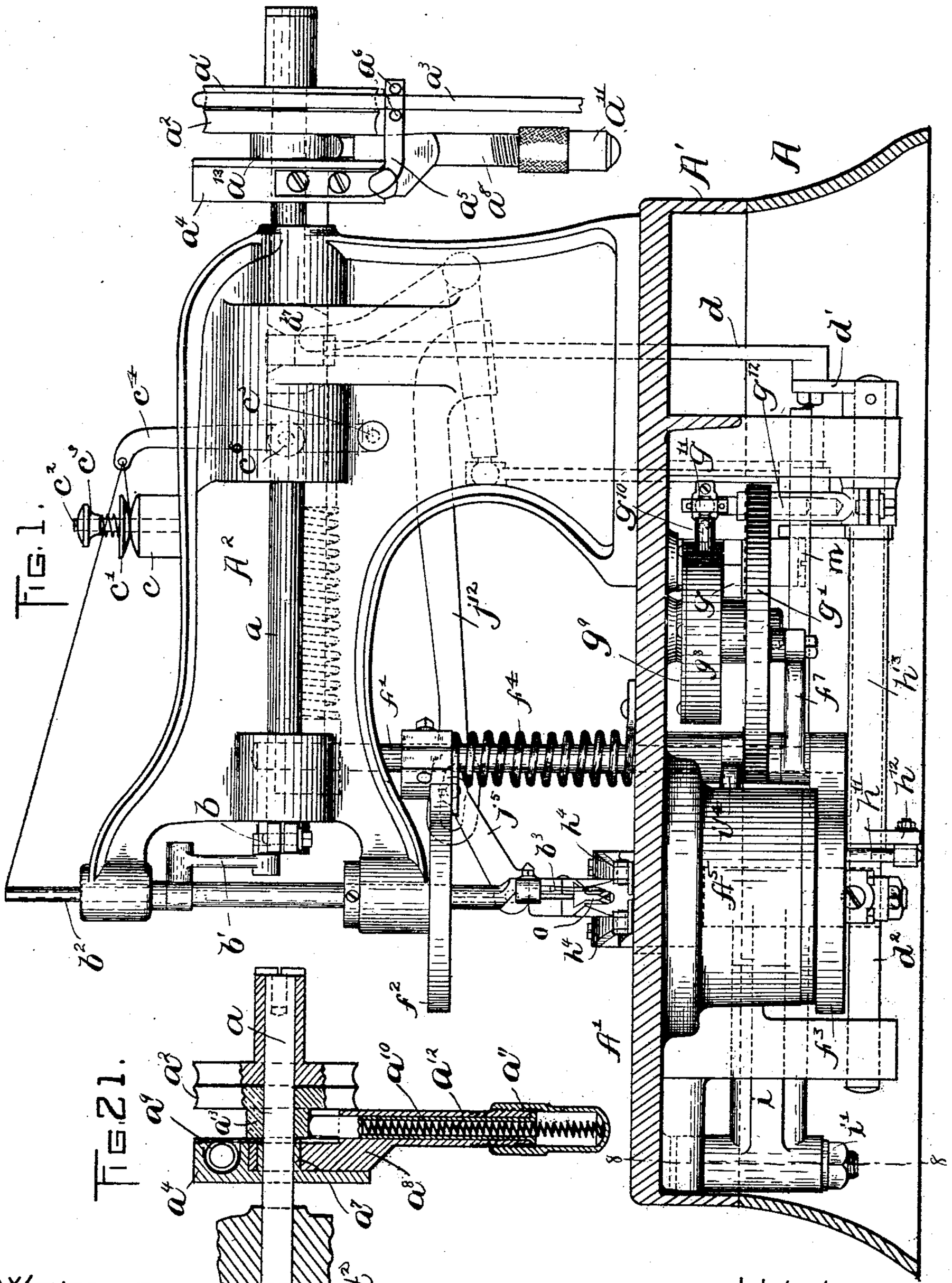

FIG. 21.



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## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 2.

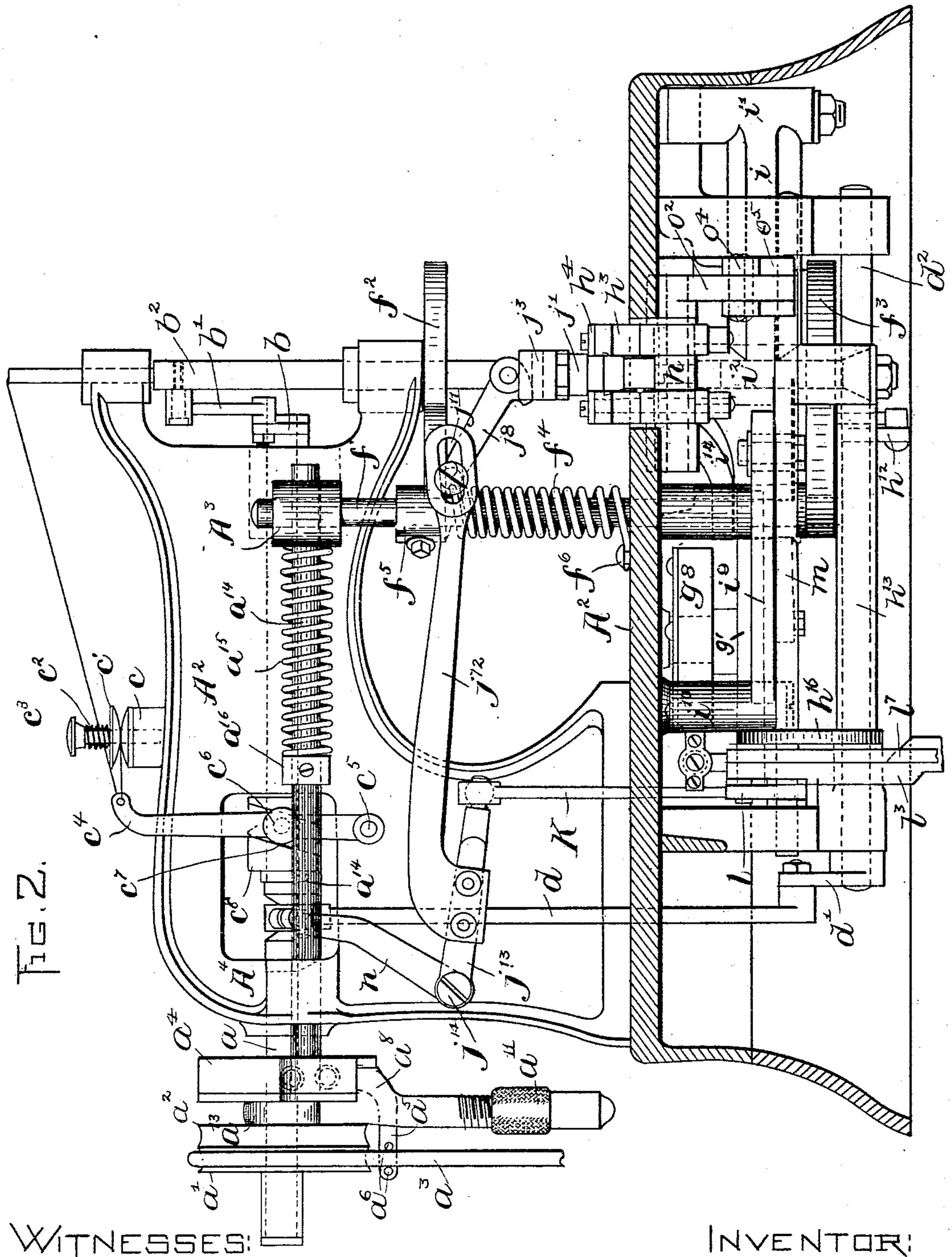

FIG. 2.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 3.

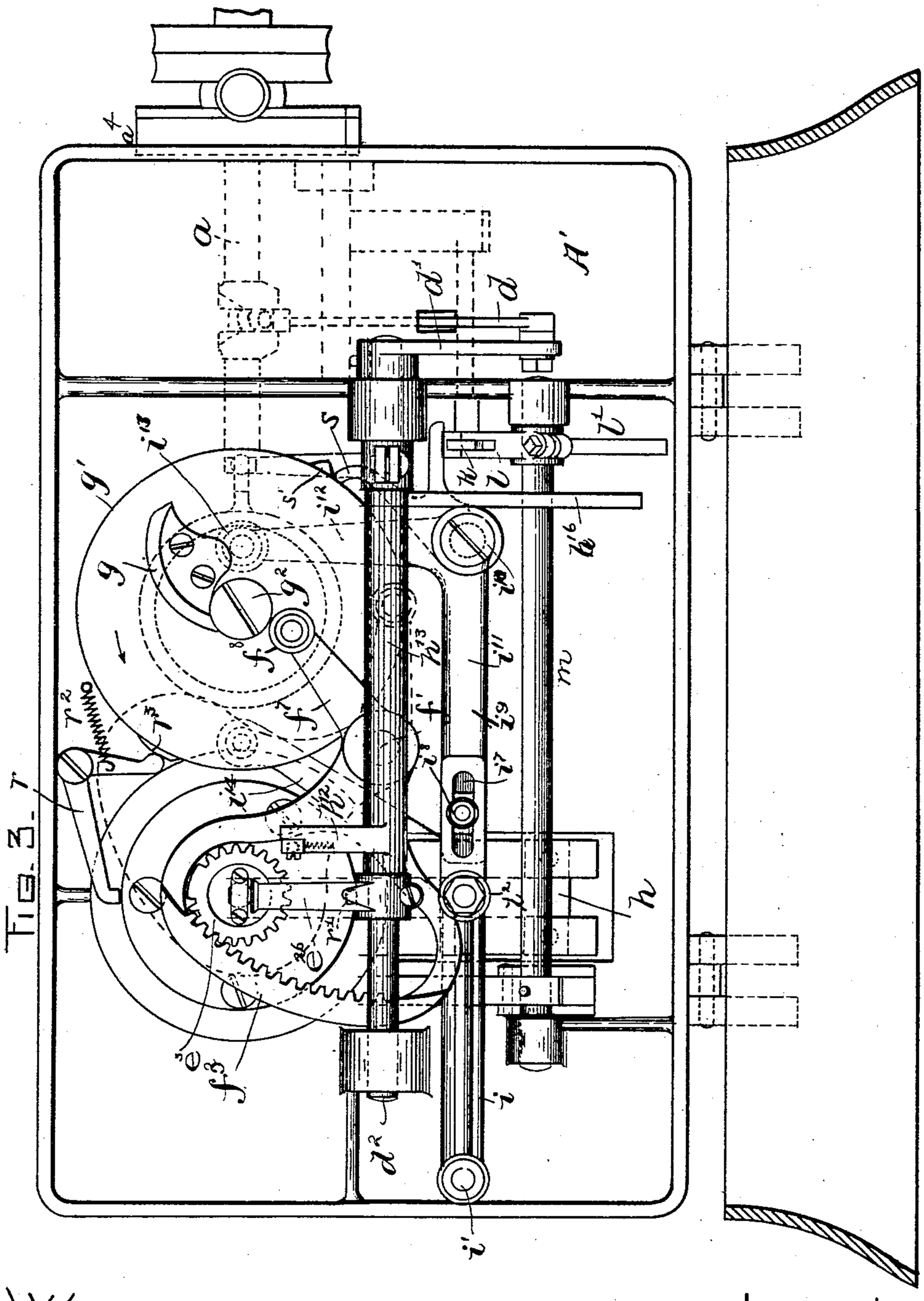

FIG. 3.

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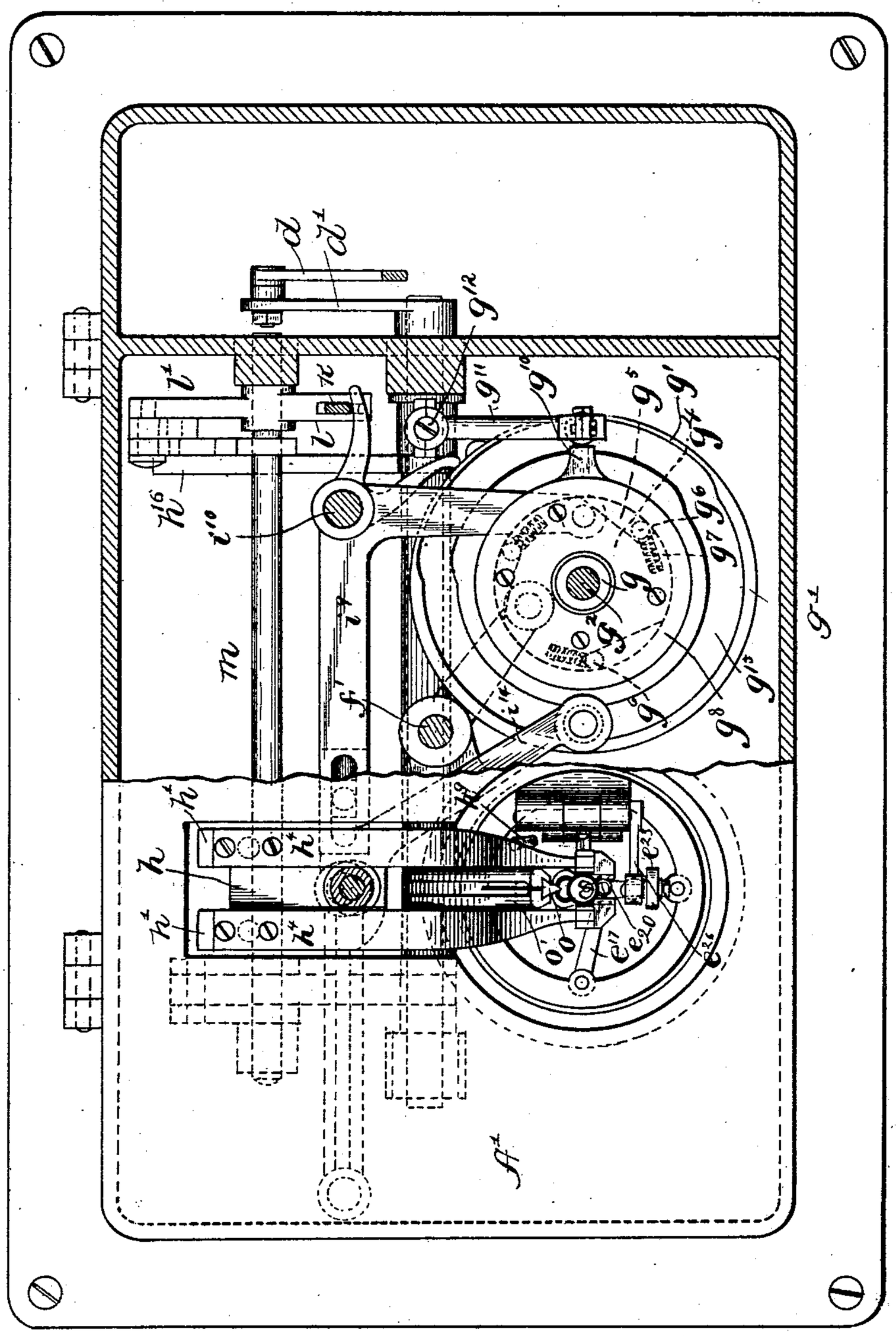
## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 4.

FIG. 4.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 5.

FIG. 22.

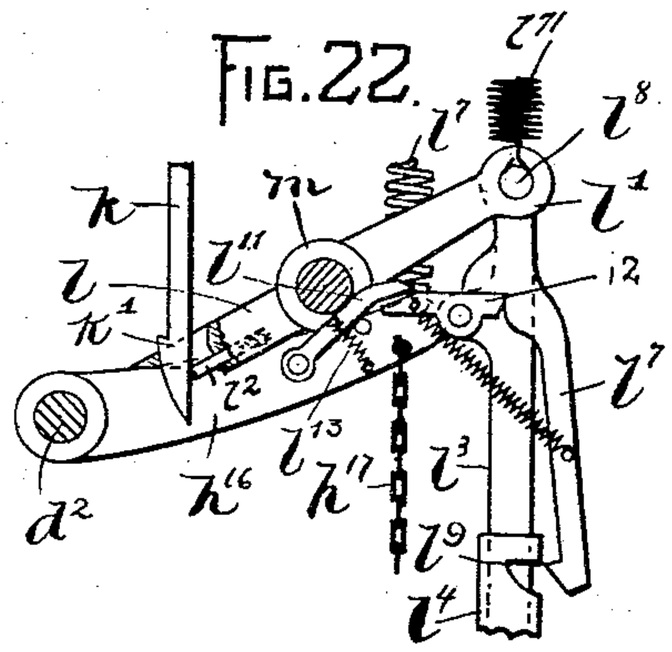


FIG. 5.

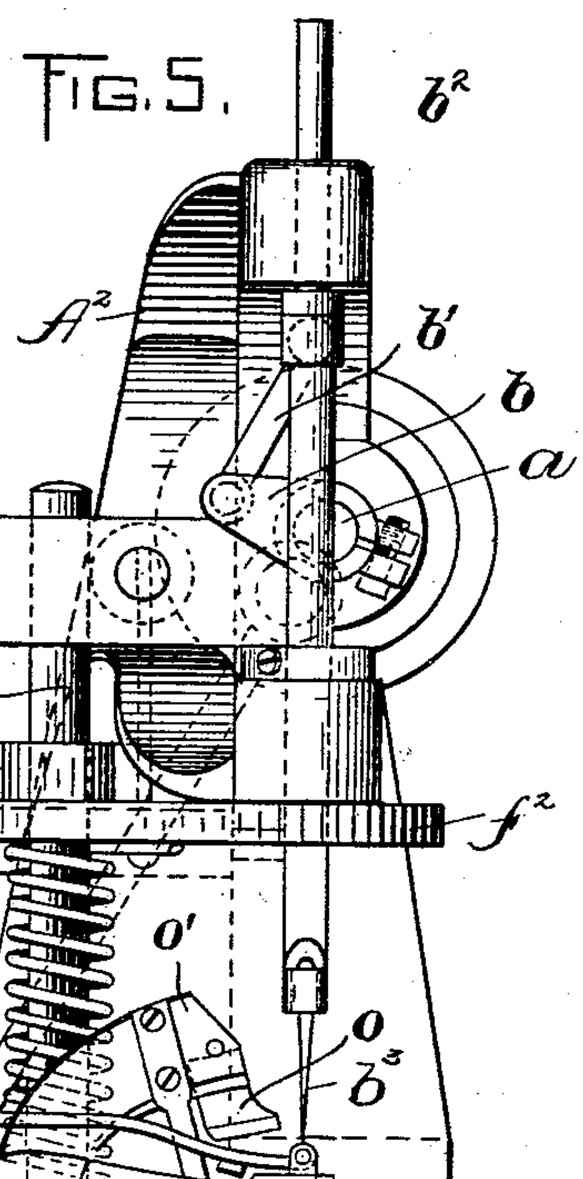


FIG. 6.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 6.

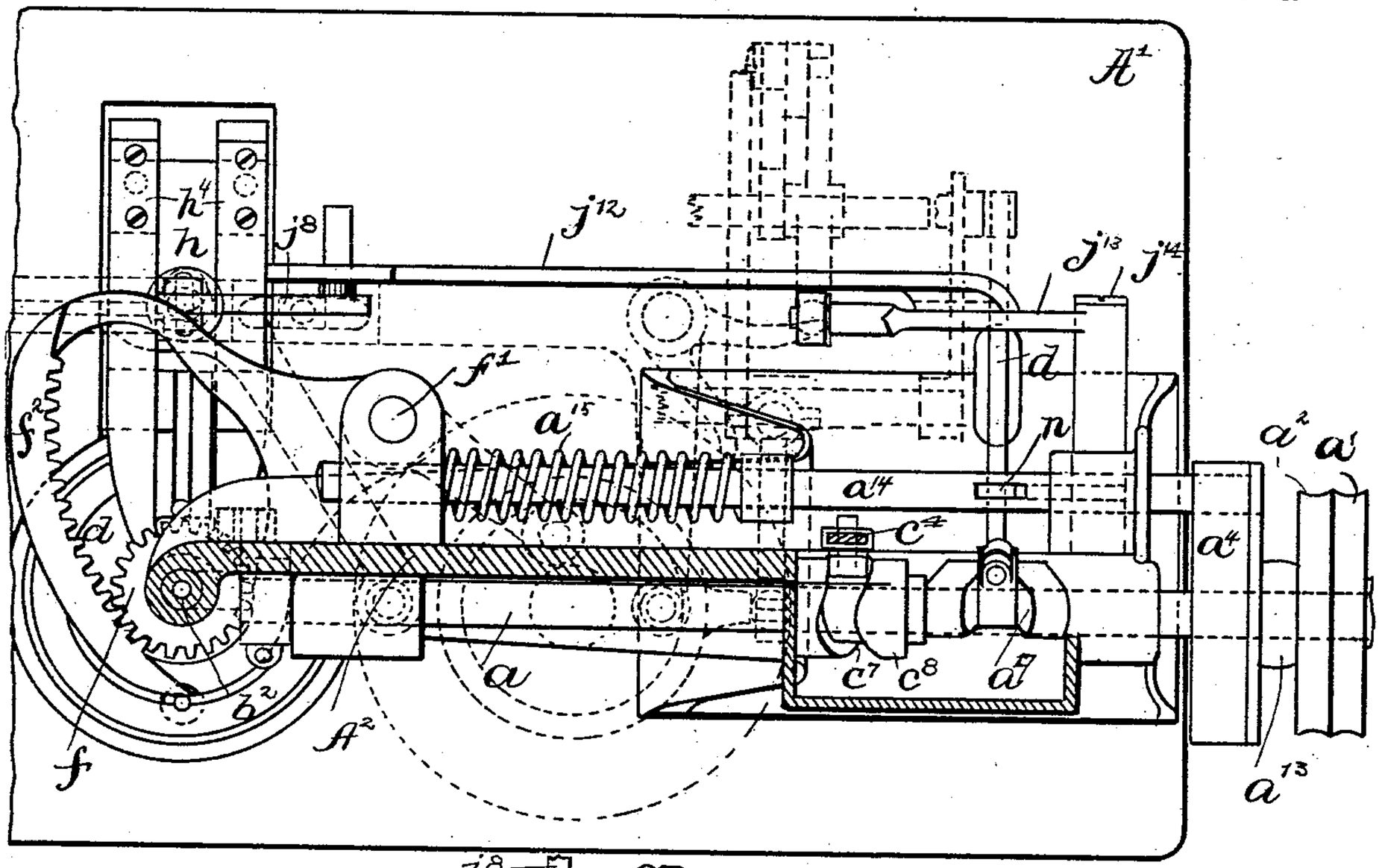



FIG. 7.

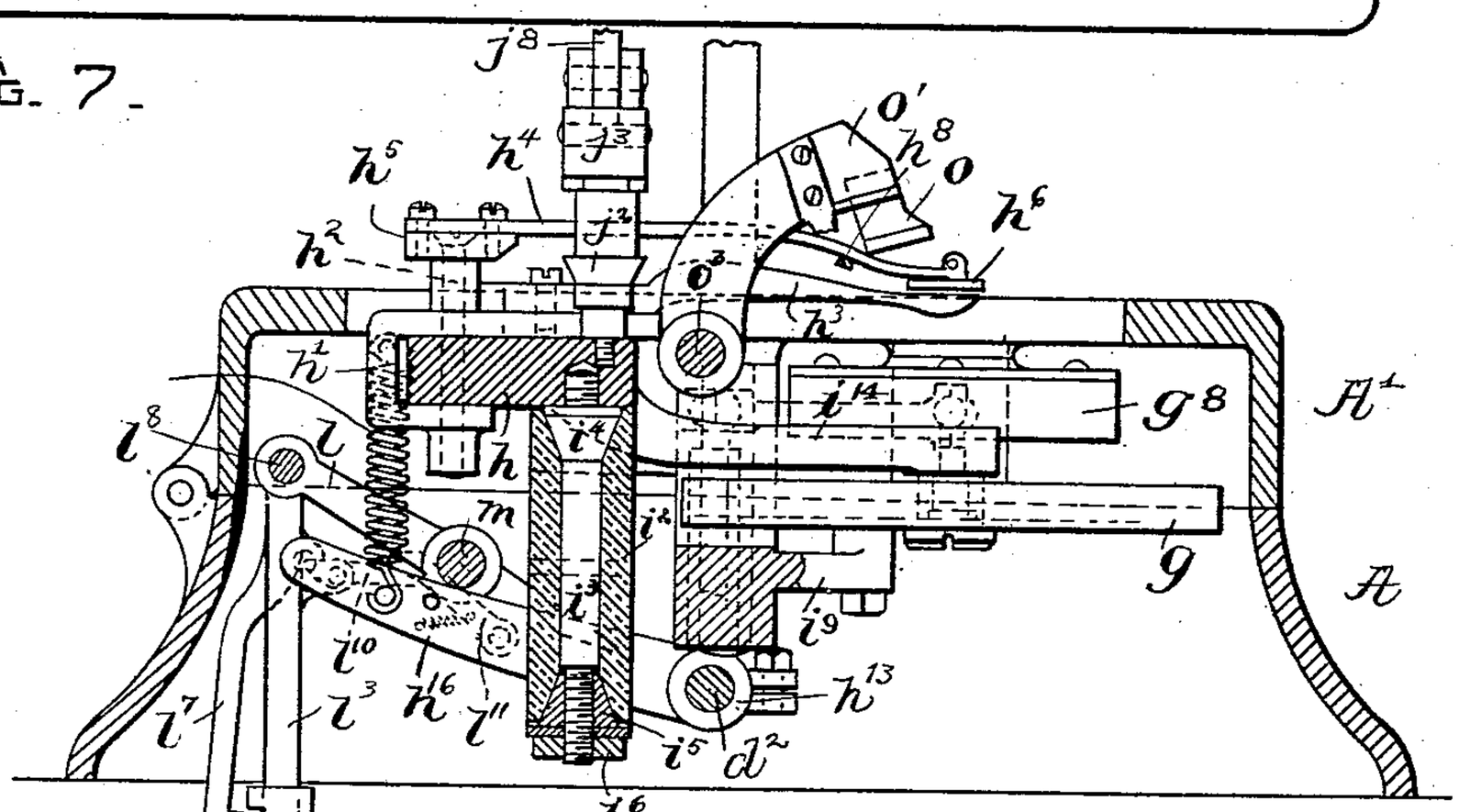
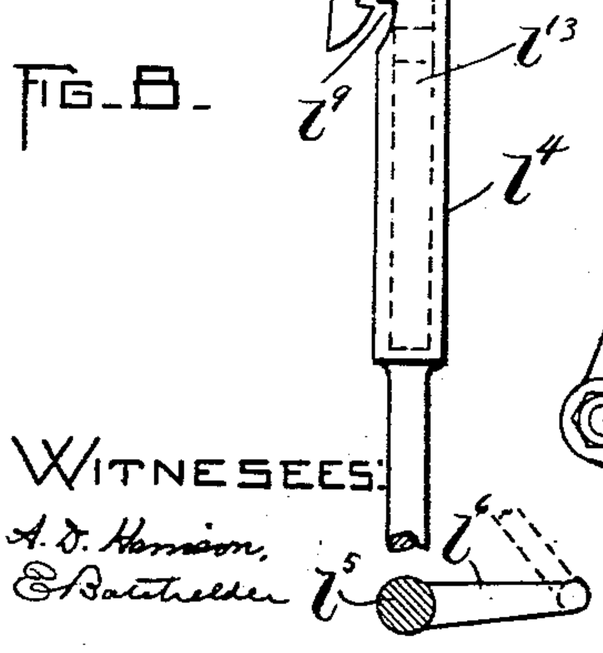



FIG. 8.



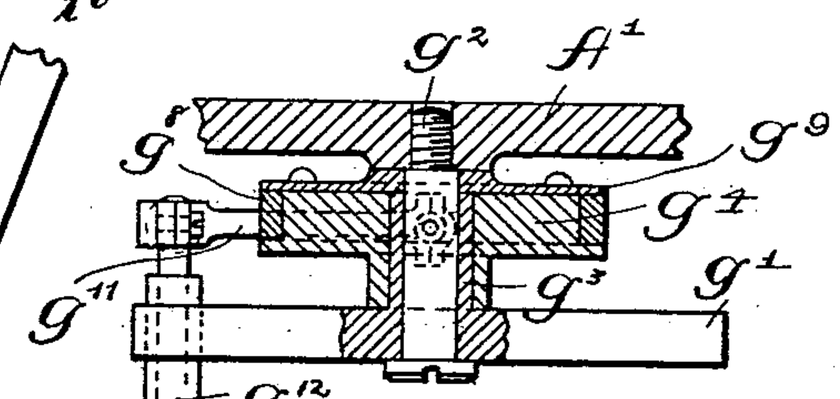




FIG. 9.

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No. 684,241. Patented Oct. 8, 1901.

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## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 7.

FIG. 10.

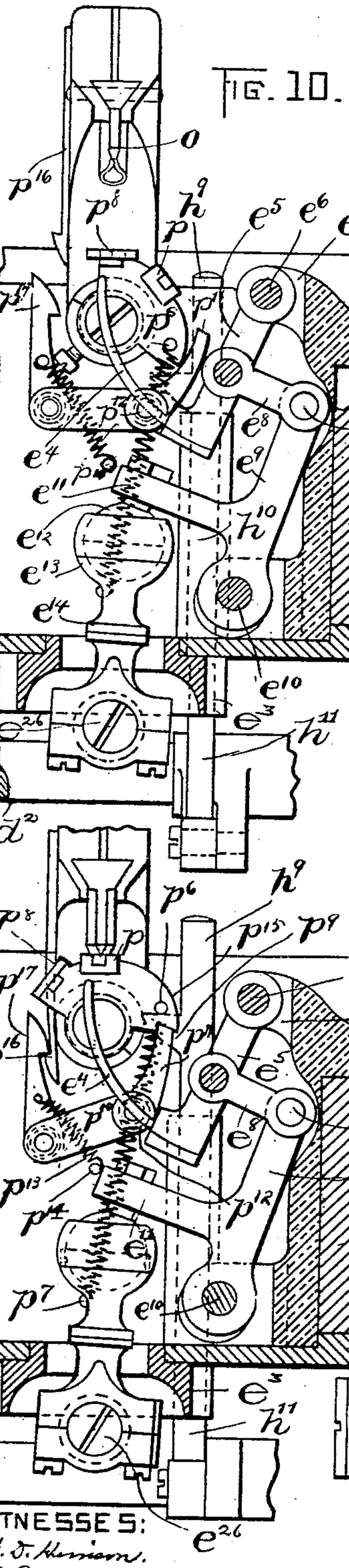


FIG. 12.

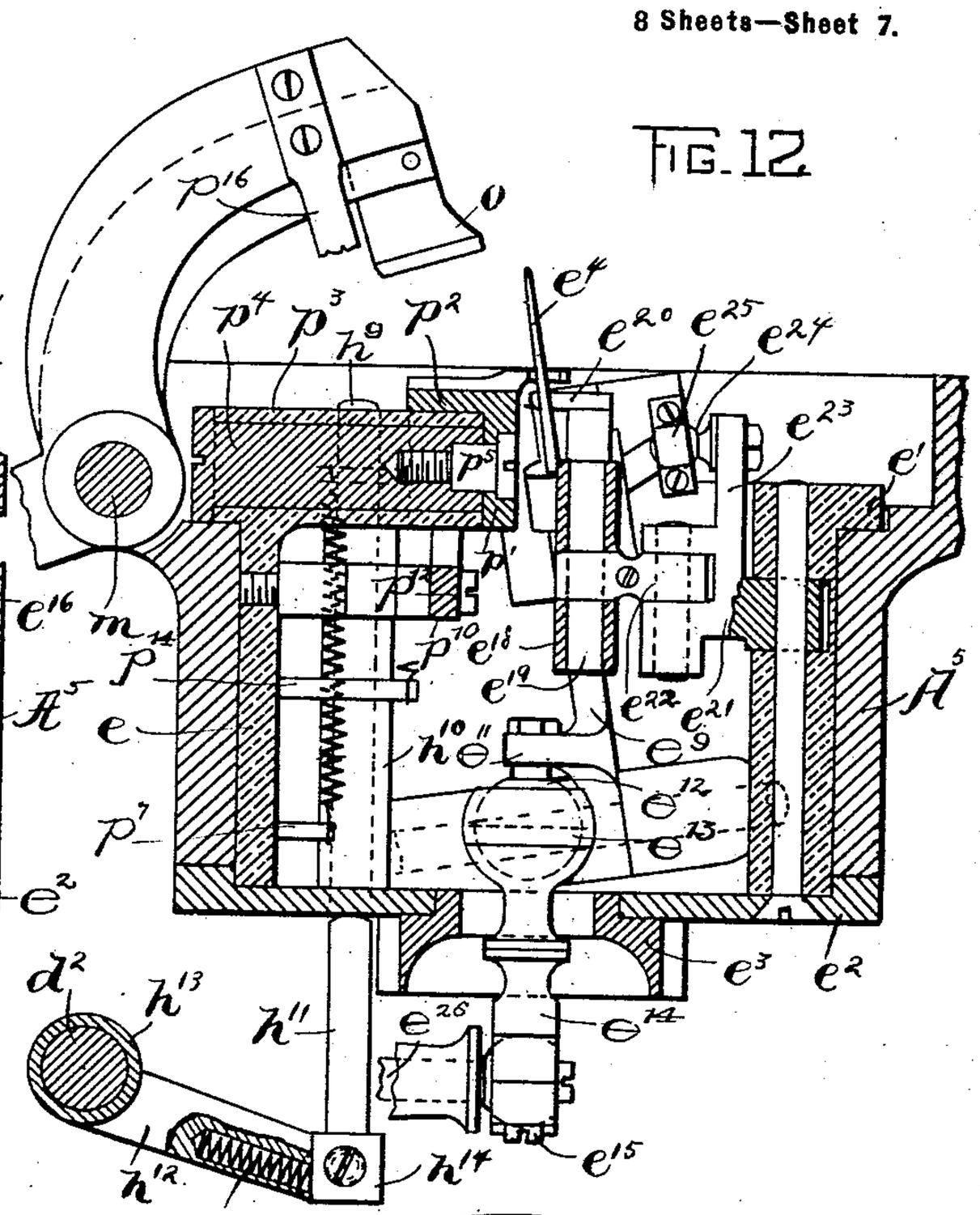


FIG. 11.



FIG. 13.

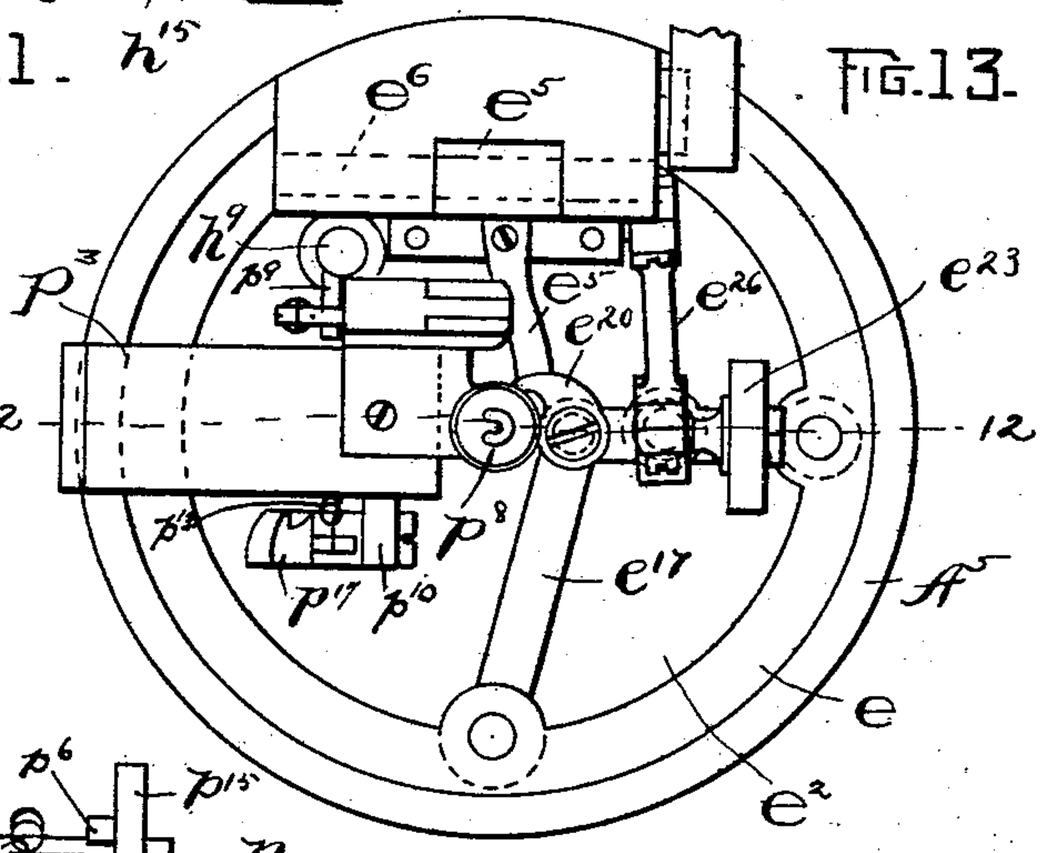
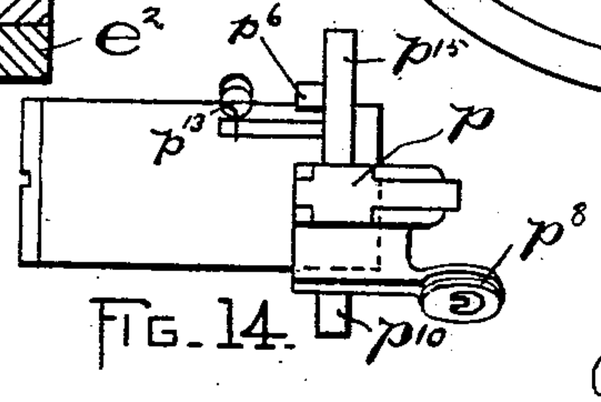


FIG. 14.



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# G. S. HILL.

## BUTTONHOLE SEWING MACHINE.

(Application filed Apr. 11, 1898.)

(No Model.) 8 Sheets—Sheet 8.

FIG. 15.

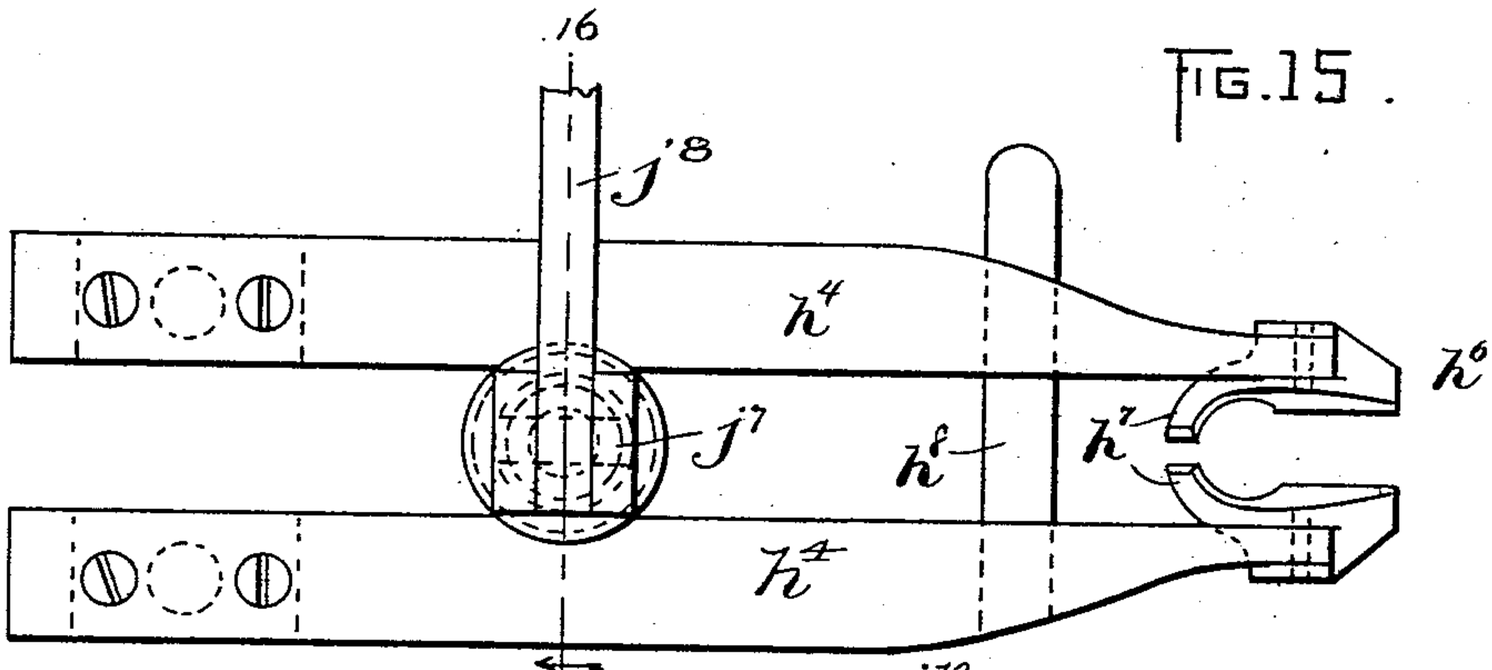
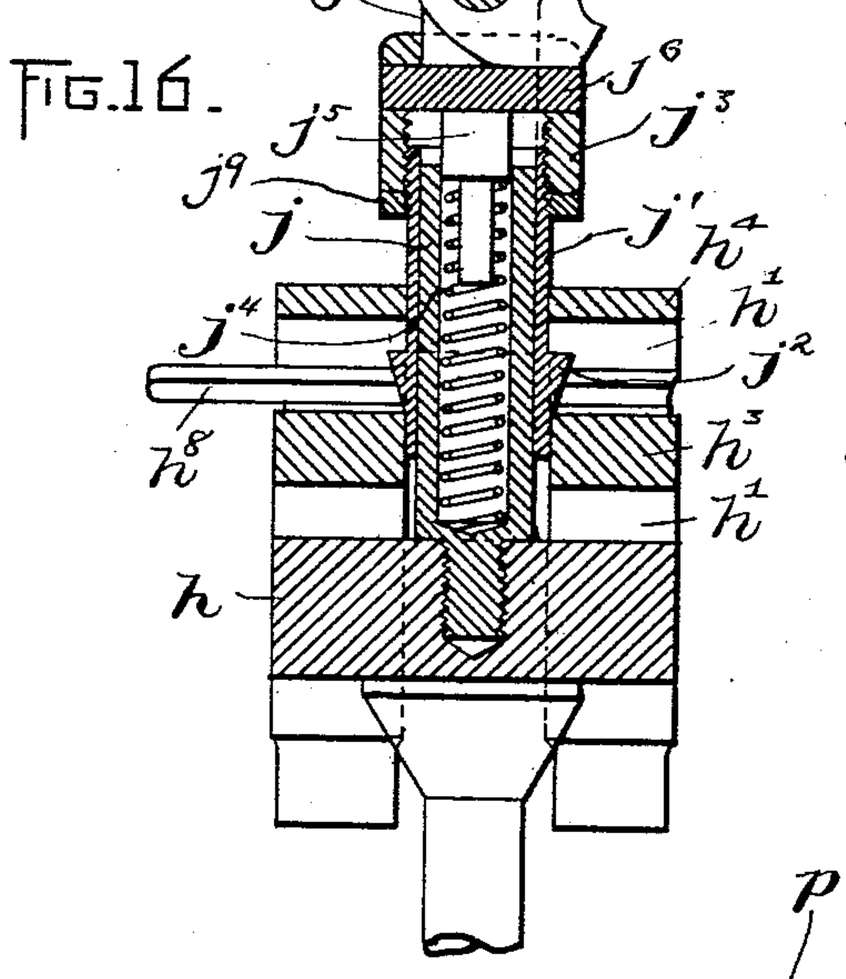



FIG. 16.



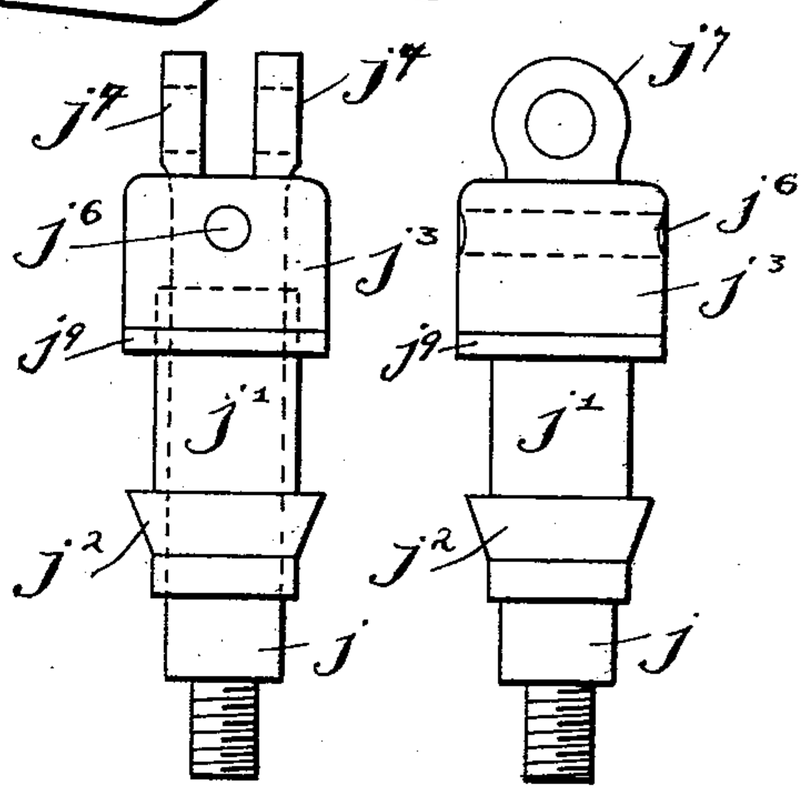




FIG. 17.




FIG. 18.

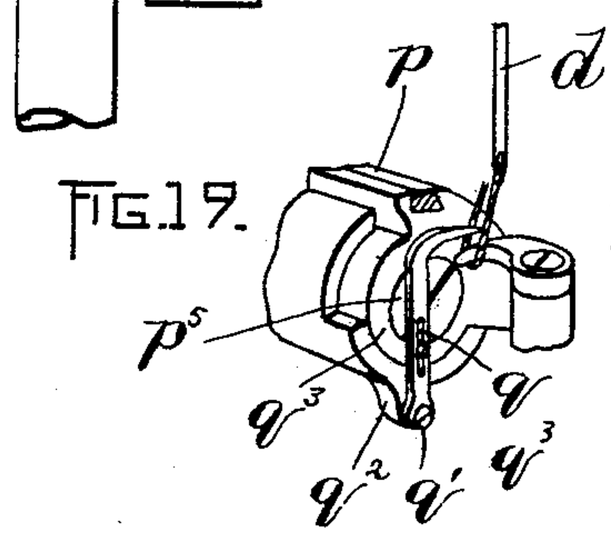



FIG. 19.

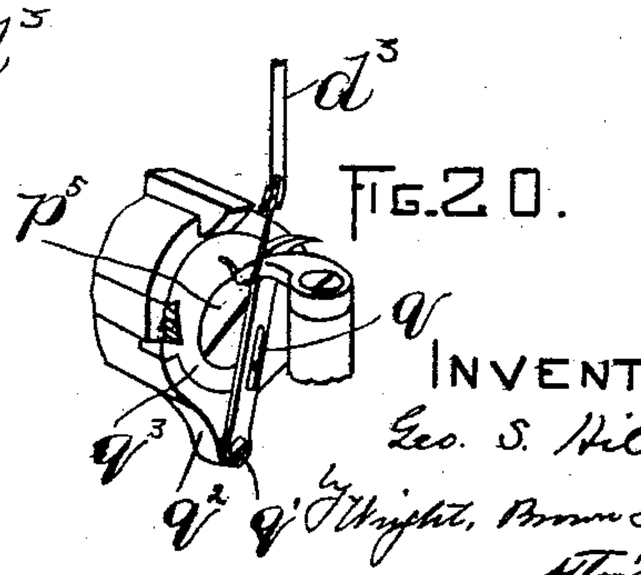



FIG. 20.

WITNESSES:

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Attys.

# UNITED STATES PATENT OFFICE.

GEORGE S. HILL, OF HAVERHILL, MASSACHUSETTS, ASSIGNOR TO JOHN J. SULLIVAN, OF IPSWICH, MASSACHUSETTS.

## BUTTONHOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 684,241, dated October 8, 1901.

Application filed April 11, 1898. Serial No. 677,151. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE S. HILL, of Haverhill, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Buttonhole-Sewing Machines, of which the following is a specification.

This invention relates to machines for sewing buttonholes, and has for its object to provide certain improvements in the same whereby machines of this class are greatly simplified in construction and rendered more highly efficient in operation.

To these ends the invention consists of a buttonhole-sewing machine possessing certain features of construction and relative arrangement of parts, all as hereinafter described in connection with the embodiment of the invention illustrated upon the drawings, the particular features of novelty being pointed out in the claims hereunto annexed.

Reference is to be had to the accompanying drawings, and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Of the drawings, Figure 1 represents in full elevation a buttonhole-sewing machine embodying the invention, the bed and bed-plate being broken away to show the parts beneath the said plate. Fig. 2 represents a rear elevation of the same, the bed and bed-plate being likewise broken away in this view. Fig. 3 represents a front elevation with the bed-plate raised into vertical position to show the parts mounted therebeneath. Fig. 4 represents a machine partially in plan view and partially in section. In this view the bed-plate is broken away to the right of the turret, so as to show the mechanism for transmitting movement to the clamp-carrier and to the mechanism for partially rotating or oscillating the upper and the under needle. Fig. 5 represents an end view of the machine, partially in section. Fig. 6 represents a section through the turret. Fig. 7 represents a horizontal section through the hanging arm. Fig. 8 represents a transverse section through the machine on the line 8 8 of Fig. 1. Fig. 9 represents in sectional view the power transmitter and the devices which intermittently rotate the same. Fig. 10 represents in sectional view the turret, the under needle and the mechanism for operating the same being shown in side elevation. Fig. 11 is a similar view of the same parts, but showing the anvil or cutter-block in position to receive the cutter which is depressed. Fig. 12 is a sectional view on the line 12 12 of Fig. 13. Fig. 13 represents a plan view of the turret and the parts therein mounted. Fig. 14 represents in detail the anvil or cutter-block and the throat-plate, together with the parts upon which they are mounted. Fig. 15 represents in plan view the clamps. Fig. 16 represents in section the clamps and the device for spreading them, being a section on the line 16 16 of Fig. 15. Figs. 17 and 18 represent the device for spreading the clamps. Figs. 19 and 20 represent in perspective view the cutter for cutting the needle-thread after the last stitch has been taken. Fig. 21, on Sheet 1 of the drawings, represents in sectional detail the automatic stop. Fig. 22 shows the hooked link which controls the automatic stop.

Referring to the drawings, in the embodiment of the invention therein shown and selected for the purpose of illustration the base A, the bed-plate A′, hinged thereto, and the overhanging arm $A^2$ may be of any preferred construction, my invention not relating to these parts, but to the mechanism which I shall subsequently describe as being supported thereby.

Mounted in suitable bearings in the overhanging arm $A^2$ is the main shaft $a$, from which power is imparted to the upper and the under needles and mechanism for partially rotating or oscillating the same. Upon the rear end of the shaft is mounted a loose pulley $a'$ and a fast pulley $a^2$, with either of which the belt $a^3$ may be engaged. Loosely mounted upon the shaft between the pulleys and the arm $A^2$ is an automatic stop comprising the box $a^4$, to which is attached a laterally-projecting arm $a^5$, with guide-pins $a^6$ lying on either side of the belt $a^3$, whereby when the box is shifted longitudinally of the shaft the belt is moved from one of the pulleys to the other one. The said box is provided with a hub $a^7$, which projects into an aperture in an

arm $a^8$, depending from the shaft and which is movable in one direction relatively to the box $a^4$. A coiled spring $a^9$, arranged in a circular groove in the box $a^4$, is interposed between the said box and the depending arm $a^8$, whereby the arm may be swung rearwardly in Figs. 1 and 21 against the pressure of the spring.

Arranged in an aperture extending longitudinally through the arm $a^8$ is a tubular bolt or pin $a^{10}$, having on its lower end a flange abutting against the end of the arm $a^8$ and having its upper end projected from the aperture in the said arm. A cap $a^{11}$ is threaded upon the end of the arm $a^8$, and within the bolt $a^{10}$ is a spring $a^{12}$, bearing against said cap $a^{11}$. The fast pulley $a^2$ is provided with a cam $a^{13}$, having a socket to receive the end of the bolt $a^{10}$. The box $a^4$ is secured to the end of a bar $a^{14}$, mounted to slide in bearings $A^3$ $A^4$ in the overhanging arm. A coiled spring $a^{15}$ is placed around the bar, its one end abutting against the bearing $A^3$ and its other end abutting against a block $a^{16}$, secured upon the bar, whereby the bar is held under a spring-pressure, as shown in Fig. 2, with the bolt $a^{10}$ in position to enter the socket in the cam $a^{13}$ of the fast pulley $a^2$. When the bar $a^{14}$ is withdrawn to disengage the bolt from the fast pulley, the belt $a^3$ is shifted from the loose pulley to the fast pulley $a^2$ and the shaft $a$ is rotated; but when the bar $a^{14}$ is moved in the opposite direction the belt $a^3$ is shifted to the loose pulley $a'$ and the bolt $a^{10}$ is brought into the position to enter the socket of the cam $a^{13}$ and stop the rotation of the shaft $a$. The spring $a^9$, interposed between the arm $a^8$ and the box $a^4$, cushions the shaft $a$ in its stoppage, so as to prevent danger to the parts by a sudden jar.

In order to operate the belt-shifting device and the automatic stop, I provide means which I shall hereinafter describe.

On its front end the shaft $a$ is provided with a crank $b$, connected by a pitman $b'$ to the needle-bar $b^2$, which reciprocates in bearings on the end of the overhanging arm $A^2$. This bar is hollow, as is ordinarily the case, and is provided with an offset-needle, which I term the "upper needle" $b^3$. The thread passes through the needle-bar to the needle $b^3$ and is carried through the work at a short distance from the edge of the buttonhole-slit, as I shall subsequently explain. The thread is drawn from a spool, (not shown,) mounted at any convenient place, and is passed through a tension device consisting of a stationary abutment $c$, a spring-pressed disk $c'$, mounted upon a stud $c^2$, having a knob $c^3$ on its upper end and passed down into the abutment $c$. From thence the thread passes through the take-up arm or lever $c^4$, from which it passes directly to the needle-bar $b^2$. The take-up lever $c^4$ is pivoted at $c^5$ to the rear side of the overhanging arm $a^2$ and is provided with a stud $c^6$, projecting into the groove $c^7$ in a cam $c^8$, secured upon the main shaft $a$. The said main shaft $a$ is provided with a crank $a^{17}$, from which a connecting-rod $d$ extends to a crank-arm $d'$ upon the end of the lower needle-driving shaft $d^2$. As the shaft $a$ rotates it imparts an oscillatory or rocking movement to the shaft $d^2$, as will be readily understood. From this shaft power is transmitted to the various parts of the machine which accomplish the operation of the under needle and the looper and the movement of the clamp-carriage.

The under needle and the looper are mounted in the turret $e$, supported in an annular bearing or bracket $A^5$, depending from the bed-plate. It is provided with a flange $e'$ at its upper end, resting upon the walls of the bearing, and to its lower end is secured a plate $e^2$, having attached to its central portion a hollow pinion $e^3$, as shown in Figs. 10, 11, and 12, for a purpose to be subsequently set forth. The under needle $e^4$, which is arranged to project through the slit in the buttonhole, is mounted in a needle-carrier $e^5$, consisting of an arm swinging upon a pin $e^6$, supported in bearings $e^7$, afforded by the turret. The axis of the pin $e^6$ is inclined relatively to the top plane of the turret, as shown in Fig. 12, whereby the needle $e^4$ is inclined from the vertical and moves in a plane which intersects the line of movement of the upper needle at a point a very short distance above the throat-plate.

The needle-carrier is oscillated by toggle-levers $e^8$ $e^9$, the free end of the toggle-lever $e^8$ being pivoted to the needle-carrier $e^5$, and the corresponding end of the toggle-lever $e^9$ being pivoted upon an inclined stud $e^{10}$, supported in bearings in the turret. Projecting out from the lever $e^9$ is an arm $e^{11}$, to which is secured the ball member $e^{12}$ of a ball-and-socket connection, the socket $e^{13}$ being upon the end of a link $e^{14}$, secured to an arm $e^{26}$ upon the end of the shaft $d^2$. The connection between the link $e^{14}$ and the arm $e^{26}$ is likewise a ball and socket.

Now it will be seen from the description thus far given that if the shaft $d^2$ be rocked or oscillated its movement will be communicated to the needle $e^4$ through the medium of the arm $e^{26}$, the link $e^{14}$, the toggle-levers $e^8$ $e^9$, and the needle-carrier $e^5$. Of course, inasmuch as the needle $e^4$ is inclined from the vertical, the toggle-levers $e^8$ $e^9$ are likewise inclined, and the pivot-studs $e^6$ and $e^{10}$ are correspondingly inclined from the horizontal. As previously stated, the bell-crank lever, composed of the lever $e^9$, having the arm $e^{11}$, constitutes, together with the link $e^8$, a toggle, so that when this toggle is straight the needle $e^4$ will be at its highest point. These parts are thus constructed in order to carry the knuckle or joint $e^{16}$ still farther to the left, to a position corresponding to the position it occupies to the right in Fig. 10 after after it has passed a straight line. Supposing the toggle to be straight, then as the knuckle moves to the left the needle $e^4$ will

drop or dip, thereby loosening its thread to form a loop through which the upper needle $e^3$ may pass. The knuckle then returns to its straight position and carries the needle to its highest point, and as the knuckle continues its movement it brings the needle to its lowest point. It will thus be seen that the lower needle is not only carried through the buttonhole-slit, but is also given a dip for the purpose stated.

$e^{17}$ indicates an arm pivoted at one end to the turret. The free end of this arm (see Figs. 12 and 13) is formed as a bearing $e^{18}$, in which is loosely arranged the spindle $e^{19}$, to the upper end of which is secured a looper $e^{20}$.

$e^{21}$ indicates an arm pivoted at one end to the turret, and $e^{22}$ indicates a link pivoted at one end in ears in the arm $e^{21}$ and at its other end is secured to the spindle $e^{19}$.

$e^{23}$ indicates a vertical lip rising from the arm $e^{21}$, to which is secured a ball $e^{24}$, secured in a socket $e^{25}$ in the end of a link $e^{26}$, connecting the lip $e^{23}$ with the needle-carrier $e^5$. By this construction it will be seen that the looper is given a movement of oscillation, and likewise a movement of rotation.

When the upper and under needle actuating mechanisms are operated, the under needle projects through the slit of the buttonhole and drops or dips to form a loop through which the upper needle descends. Then the under needle is withdrawn, and the looper engages the loop of the upper needle and opens it, so that when the under needle again rises it enters the loop of the upper needle, after which the upper needle rises and again descends through the loop of the under thread. The upper needle penetrates the work at a short distance from the slit, while, as stated, the under needle projects through the slit. The needle-bar $b^2$ and the turret $e$ are both arranged to turn in suitable bearings, and the needle $b^3$ is offset or deflected from a right line, as previously stated, in order that when the needle-bar is rotated or oscillated it may assume the proper relation with respect to the other members, as hereinbefore described; but even though the upper and lower sewing mechanisms are rotated the needles remain at an inclination to each other and are so arranged that they may pass through the fabric in a line intersecting the slit, at a right angle thereto, whereby when the sewing is stopped the upper and the lower threads are substantially opposite each other. In other words, the plane of the path of movement of the under needle intersects the line of movement of the upper needle at the plane of the work.

To accomplish the partial rotation of the upper and the under needle, I provide the following devices: As I have previously stated, the turret is provided with a pinion $e^3$, and by examining Fig. 7 it will be seen that upon the needle-bar $b^2$ is secured a similar pinion $f$. A vertical shaft $f'$ is projected through the bed-plate A', being supported in bearings afforded by the bed-plate and by the overhanging arm, as shown in Fig. 5, and upon this shaft are secured two internally-toothed segments $f^2$ $f^3$, of the configuration illustrated in Fig. 3. The segment $f^2$ intermeshes with the pinion $f$ on the needle-bar, and the segment $f^3$ intermeshes with and drives the pinion $e^3$ on the turret $e$. A strong spring $f^4$ is coiled about the shaft $f'$, one end being secured thereto through the collar $f^5$, and the other end being attached by the stud $f^6$ to the bed-plate A'.

Under normal conditions the spiral spring holds the parts in the positions illustrated in Figs. 3 and 4; but when the sewing has progressed far enough for the needles to be partially rotated the shaft $f'$ is rocked to swing the segments $f^2$ $f^3$ about their axes and accomplish the rotation of the said needles.

Secured upon the shaft $f'$, below the bed-plate, is an arm $f^7$, having on its end a roller $f^8$, with which a wiper $g$ on a cam-wheel $g'$ may engage, these parts being best shown in Fig. 3. The wiper $g$ is arranged eccentrically of the cam $g'$, so that the rotatory movement of the needles is properly timed, and when that movement is completed an L-shaped latch $r$, pivoted upon a stud on the under side of the bed-plate and under the pressure of a spring $r^2$, enters a notch $r'$ in the turret and holds it against the action of the spring $f^4$ until it is tripped.

The cam-wheel $g'$ is secured upon a stud-shaft $g^2$, depending from the bed-plate A', and secured upon its hub $g^3$ is a disk $g^4$. (Shown in dotted lines in Figs. 4 and 9.) This disk $g^4$ is provided with a series of notches or sockets $g^5$, in which are placed loose rolls $g^6$, bearing against springs $g^7$, placed in said sockets. A ring $g^8$ surrounds the periphery of the disk $g^4$ and rests on a flange thereon, being provided with a top plate $g^9$, as shown in Fig. 1, to hold the rolls $g^6$ in place. The ring $g^8$, the disk $g^4$, and the rolls $g^6$ constitute friction-clutch mechanism for imparting a step-by-step movement to the cam, this being accomplished by oscillating the member $g^8$. The said member or ring $g^8$ has an outwardly-projecting arm $g^{10}$, connected by a ball-and-socket joint with a link $g^{11}$, having its rear end connected to an arm $g^{12}$, extending upwardly from the shaft $d^2$.

When the machine is set in motion, power is imparted from the main driving-shaft to the shaft $d^2$, and as the latter is oscillated or rocked the cam-wheel $g'$ is rotated with a step-by-step movement to effect the partial rotation of the upper and under needles at the proper time. From this cam-wheel $g'$ power is transmitted to various parts of the machine to accomplish various functions, it being provided with a cam projection $r^3$ to engage the end of the latch $r$ to release the turret when the stitching is completed. One of the offices performed by the cam is the movement of the clamping device, which I shall now proceed to describe.

The clamp-carrier consists of a block $h$, as shown in Fig. 4, to which are secured brackets $h'$ $h'$, which are pivoted upon the said block and to which the upper and lower members of each clamp are secured. A stud $h^2$ passes through each bracket and forms the pivot around which it may swing. The members of each clamp comprise an under clamping-bar $h^3$, secured to the bracket $h'$, and upper clamping-bar $h^4$, secured upon a boss or lug $h^5$, arising from the said bracket. On its end each upper clamp-bar $h^4$ is provided with a pivotal presser-foot $h^6$, having an inwardly-curved heel $h^7$, the heels of the two presser-feet being almost contiguous, as shown in Fig. 15. The upper clamp-bars $h^4$ are made of spring metal, whereby by their own resiliency they clamp the work against the lower clamping-bars. One of the upper clamping-bars $h^4$ is provided with a cross-bar $h^8$, which projects under the top cross-bar $h^4$ of the other clamp and causes it to rise therewith when it is lifted. To raise the upper bars of the clamps, a pin $h^9$ is passed through the turret, being supported in a sleeve $h^{10}$, having its lower end secured in the plate $e^2$, before referred to, these parts being shown in Fig. 12. When the turret is in the proper position, the pin $h^9$ is below the cross-bar $h^8$ and also registers with a pin $h^{11}$, mounted upon the end of an arm $h^{12}$, secured to a sleeve $h^{13}$, loosely mounted on the shaft $d^2$. The pin $h^{11}$ is on a block $h^{14}$, pivoted in an ear in the arm $h^{12}$, and a spring $h^{15}$ in a socket in the said arm bears against the block $h^{14}$, so as to hold the pin $h^{11}$ in its proper position, although the latter is free to swing relatively to the arm when the arm is raised and the pin enters the aperture in the sleeve $h^{10}$ as it forces the pin $h^9$ upwardly. The sleeve $h^{13}$ is provided with a rearwardly-extending arm $h^{16}$, connected by a link $h^{17}$ with a treadle, (not shown,) so that upon depressing the treadle the sleeve is rocked and the pin $h^9$ is lifted to raise the upper bars of the clamp and permit the work to be moved. The sleeve may be rocked, however, by any other mechanism that may be desired.

To effect the movement of the clamp-carrier, I employ the following devices: The arm $i$ is pivoted to a stud $i'$, projecting downwardly from the bed-plate at the left end thereof in the rear of the shaft $d^2$. It is formed near its free end into a cylindrical bearing-bracket $i^2$ to receive a pintle $i^3$, having a frusto-conical or flaring upper end $i^4$, from which the threaded portion projects into an aperture in the clamp carrier or block $h$. The lower end of the pintle is reduced and threaded to receive a conical bearing-sleeve $i^5$ and a lock-nut $i^6$. The ends of the bracket $i^2$ are flared to receive the said cones, whereby I provide for the taking up of wear of any of the parts through the adjustment of the cones. The arm $i$ is projected a short distance beyond the bearing-bracket $i^2$ and is slotted, as at $i^7$, to receive a stud $i^8$, passed through the slotted end of a bell-crank lever $i^9$, fulcrumed upon a stud $i^{10}$, depending from the bed-plate A'. By reason of the levers being connected by the stud passed through the socket the throw of the lever $i$, and consequently of the clamp-carrier, may be varied to suit the length of the buttonhole-slit. The arm $i$ and the arm $i^9$ of the bell-crank lever are substantially in alinement with each other, as seen in plan, Fig. 3. The other arm $i^{12}$ on the bell-crank $i^9$ is provided with a trundle $i^{13}$, lying in a cam-slot in the cam-wheel $g'$, whereby as the cam rotates the bell-crank lever is oscillated to swing the arm $i$ about its axis and effect the forward-and-backward movement of the clamp-carrier. This clamp-carrier being secured to the pintle $i^3$ is thus pivotally supported upon the end of the arm $i$ and is free to swing about the axis of the same. Therefore in order to effect sidewise movement of the front ends of the clamps the block $h$ is provided with an arm $i^{14}$, having on its end a trundle projecting into a cam-slot $g^{15}$ in the cam-wheel $g'$. The parts are so timed that the forward ends of the clamps are moved in a path almost similar in shape to the edges of the buttonhole-slit.

The spreading of the clamps is effected by means of the devices illustrated more particularly in Figs. 16, 17, and 18. Secured to the carrier or block $h$ is a post $j$, which is hollow, as shown, and surrounding the post is a sleeve $j'$, which is conical near its lower end, as at $j^2$. The upper end of the sleeve is threaded to receive an internally-threaded cap $j^3$, held upward by a spring $j^4$, inside the hollow post, having its upper end abutting against a stud $j^5$, pressed against a pin $j^6$, inserted crosswise through the cap. The post $j$ is provided at its upper end with ears or lugs $j^7$ $j^7$, between which is pivoted a cam-lever $j^8$, extending through a slot in the cap and resting upon the pin $j^6$. When the end of the cam-lever is raised, as shown in Fig. 16, the spring $j^4$ forces the cap upward and raises the spreading-sleeve $j'$; but when the end of the lever $j^8$ is depressed the cap is forced down and the conical portion $j^2$ of the sleeve wedges between the lower clamp-bars $h^3$ and swings each pair of clamp-bars about its pivot to spread their outer ends. The spreading-sleeve may be adjusted to vary the spread of the clamp-bars, after which it is locked by a nut $j^9$.

To accomplish the spreading of the clamp-bars automatically, the lever $j^8$ is provided with a pin $j^{10}$, projecting into a slot $j^{11}$ in the end of a bell-crank lever $j^{12}$ $n$, secured to an arm $j^{13}$, pivoted at $j^{14}$ to the side of the overhanging arm $a^2$, the arm $n$ projecting into a slot in the bar $a^{14}$. Connected to the end of the arm $j^{13}$ by a ball-and-socket joint is a link $k$, which projects downward through the bed-plate $a'$ and is provided on its end with a barb or hook $k'$. This hooked link $k$ projects through a slot in the end of a two-armed

lever $ll'$, pivoted between its ends upon a shaft $m$, arranged parallel to the cutter-shaft $d^2$ in the rear thereof. The lever is provided with a hub fast upon the shaft $m$, so that when it is rocked or tilted the shaft is rocked to accomplish a function to be subsequently set forth. Arranged longitudinally in the arm $l'$ is a socket to receive a spring-pressed stud $l^2$, Fig. 22, which tends to throw the link $k$ forward, so that its barb or hook will engage the end of the lever $l$. Pivoted to the opposite end $l$ of the lever is a rod $l^3$, which hangs loosely into a socket in the end of a reciprocating bar $l^4$, driven by the usual transmitter-shaft, (not shown,) from which movement is transmitted to the main driving-shaft of the machine through the belt before described. This transmitter-shaft is indicated at $l^5$, and it reciprocates the tubular bar $l^4$ through the medium of a crank $l^6$, eccentric, or any other device that may be desirable. Normally the bar $l^4$ reciprocates without effecting any movement of the bar $l^3$ and the lever $l\,l'$, the rear end of the latter being normally raised by a strong spring $l^{71}$, as shown in Figs. 6 and 22. In order to temporarily connect the reciprocating part $l^4$ and the bar $l^3$, a latch $l^7$ is pivoted to the pintle $l^8$, (which connects the bar $l^3$ with the end of the lever $l$,) and the hooked end of the latch is adapted to enter a notch $l^9$ in the tubular bar $l^4$ when the latter is in its highest position, as shown in Fig. 8. Normally the latch $l^7$ is held out of the notch by a dog $l^{10}$, pivoted in an ear on the bar $l^3$. A dog $l^{11}$ is pivoted upon the lever $h^{16}$ and is held against a stud $l^{12}$, projecting out from the side thereof, by a spring $l^{13}$, also resting against the shaft $m$. When the main treadle is depressed to draw the lever $h^{16}$ downward, the pawl $l^{11}$ slides by the end of the dog $l^{10}$; but when the lever $h^{16}$ is raised by the spring upon removing the foot from the treadle the dog or pawl $l^{11}$ engages the end of the dog $l^{10}$ and tilts it, throwing it out of the way of the latch $l^7$, which upon the next reciprocation of the bar $l^4$ immediately enters the notch $l^9$, and a single reciprocation is imparted to the lever $l$ by the bar $l^4$. As the bar $l^3$ rises after having been once depressed the end of the dog $l^{10}$ strikes against the end of the pawl $l^{11}$ and is thrown back into its normal position to disengage the latch $l^7$ from the notch $l^9$, the dog $l^{11}$ being held from vertical movement by reason of its pressing against the shaft $m$, as shown in Fig. 8. When the front end of the lever $l\,l'$ was raised, the lower end of the link $k$ entered the aperture therein, so that when the front end of the said lever $l\,l'$ is again depressed it draws down with it the hooked link $k$ and swings the arm $j^9$ about its stud $j^{10}$ to depress the arm $j^8$ and spread the clamp, it continuing to hold the link depressed until a tripping device, consisting of a bell-crank lever $s$, pivoted on the stud $i^{10}$, is actuated by a projection $s'$ on the cam $g'$ to disengage the link from the catch or lever $l$. The downward movement of the arm $j^9$ causes the starting of the machine, for secured to the arm $j^9$ is the arm $n$, the upper end of which was previously described as projecting into a slot in the bar $a^{14}$, whereby when the arm $j^8$ is drawn downward to spread the clamps the automatic stop is thrown out of engagement with the cam $a^{13}$ and the belt is shifted from the loose pulley $a'$ to the fast pulley $a^2$. When the lever $l$ is drawn downward by the bar $l^4$, so as to rock the shaft $m$ to cut a buttonhole-slit, the cutter is actuated, as I shall now proceed to describe.

The cutter for cutting the buttonhole-slit consists of a knife $o$, mounted upon the end of a two-armed lever $o'\,o^2$, pivoted by a pintle $o^3$ between two ears extending downward from the bed of the machine, the arm $o'$ projecting through an aperture in the bed-plate. The end of the arm $o^2$ is connected by a link $o^4$ with an arm $o^5$, secured upon the shaft $m$, before referred to. Hence when the shaft $m$ is rocked through the medium of the lever $l$ the arm $o^5$ and the link $o^4$ operate as a toggle to lift the end of the arm $o^2$ and throw the knife downward against the cutter-block or anvil $p$. This anvil or cutter-block $p$ is secured to or formed upon a disk $p'$, which has a semicylindrical sleeve-like portion $p^2$ surrounding a tubular bracket $p^3$, formed on the turret $e$. A shaft $p^4$ is journaled in the bracket, and the disk $p'$ is secured to its end by a screw $p^5$. A spring having one end connected to a pin $p^6$, extending out from the disk $p'$, and having its other end connected to a pin $p^7$, projecting inward from the turret, tends to normally hold the anvil out of the path of the knife and to hold a throat-plate $p^8$ in the position shown in Fig. 10, this throat-plate being likewise attached to the disk $p'$ and the shaft $p^4$. In order, therefore, to partially rotate the shaft $p^4$, so as to throw the throat-plate out of position and bring the anvil into its operative position, I form the pin $h^9$ (which was previously described as operating to move the top bars of the work-clamp) with an offset cam or projection $p^9$, which when the pin $h^9$ is raised engages the stud $p^6$ and rocks the shaft $p^4$ into the position shown in Fig. 11. To hold the shaft in this position when the pin $h^9$ descends, I provide the two-armed pawl $p^{10}\,p^{11}$, which is pivoted upon a stud $p^{12}$, projecting from the inner wall of the turret. Upon the end of the arm $p^{10}$ is a dog $p^{17}$, and connected thereto is a spring $p^{13}$, having its other end secured to a stud $p^{14}$, projecting inward from the turret. This spring operates to draw the pawl or dog $p^{17}$ inward and also to throw the end of the arm $p^{11}$ toward the shaft $p^4$, so as to slip under the end of a rib $p^{15}$, projecting out from the disk $p'$. Consequently when the pin $h^9$ is raised and the shaft $p^4$ is rocked the arm $p^{11}$ of the two-armed pawl slips under the end of the rib $p^{15}$ and holds the anvil in operative position. As soon as the cutter has descended and has cut a buttonhole-slit in the work a hook $p^{16}$, which is secured thereto, engages

the hooked end of the pawl or dog, and consequently when the cutter rises the hook $p^{16}$ draws the pawl $p^{12}$ upwardly and swings the end of the arm $p^{11}$ out from engagement with the rib $p^{15}$, whereupon the spring $p^5$ immediately returns the anvil to its inoperative position and carries the throat-plate into proper position.

The throat-plate remains uppermost during all of the time that the stitching operation is being performed, and when the machine is stopped and the foot-treadle is depressed to open the work-clamp and to throw the anvil into position for the next cutting operation a thread-cutter is actuated to cut the loop of the upper needle-thread, which at this time remains upon the looper. The thread-cutter consists of a blade $q$, having its lower end pivoted upon a stud $q'$, projecting out from a lug $q^2$ on the stationary bracket in which the shaft $p^4$ is mounted. It is curved, as shown, at its free end, so that if it be swung to the right the said end will enter the loop and the latter will be severed. To accomplish this movement of the blade, it is slotted, as shown at $q^3$, and a pin is passed through the slot into the disk $p'$.

When the treadle is depressed and the shaft $p^4$ is rocked to throw the anvil into position, the cutting-blade is swung upon its pivot into the loop to cut the same. Then when the anvil is returned to its normal inoperative position the cutter-blade is swung back out of the way of the needle while the next stitching operation takes place.

The operation of the machine is as follows: Assuming that a buttonhole has been cut and the stitching operation has just been completed and the machine has stopped automatically and that the transmitter-shaft is being rotated and the belt $a^3$ is upon the fast pulley, the first thing that the operator does is to depress the treadle (not shown) and draw downward upon the chain or link $h^{17}$ and swing the lever $h^{16}$ about the shaft $d^2$. This movement of the lever $h^{16}$ forces the pin $h^9$ upwardly from the sleeve $h^{10}$ in the turret and lifts the top bars $h^4$ of the work-clamps. The cam or projection $p^9$ on the pin $h^9$ engages the stud $p^6$ of the disk $p'$ and throws the anvil into position to receive the buttonhole-cutter. As soon as the anvil reaches its proper position the pawl $p^{11}$ slips under the end of the rib $p^{15}$, as previously described. As the anvil swings into position the thread-cutter $q$ is operated to enter the loop of the last needle-stitch of the previous buttonhole, which is held open by the looper, and sever the same. While the clamp-bars are raised the operator moves the work along underneath the clamp to place it in position for the next buttonhole, and as he removes his foot from the treadle and permits the bar $h^{16}$ to swing upwardly the dog $l^{11}$ engages the dog $l^{12}$ and throwing it out of its normal position permits the latch $l^7$ to drop into the notch $l^9$ in the reciprocating bar $l^4$ the next time it rises. Immediately upon the engagement of the latch with the bar $l^4$ the lever $l$ is rocked, so that its free end engages the hooked link $k'$. As the shaft $m$ is being rocked the toggle $o^4$ $o^5$ swings the cutter-bar about the stud $o^3$ to force the knife downwardly against the anvil. As the cutter-bar moves downwardly the hook $p^{16}$ engages the dog or latch $p^{17}$. Then as the bar $l^4$ rises it forces the bar $l^3$ upward to lift the rear end of the lever $l$. This returns the cutter to its original normal position, and as the cutter rises the hook $p^{16}$ draws upon the pawl $p^{17}$ to permit the shaft $p^4$ to rotate and swing the throat-plate into its normal position, as shown in Fig. 10. The movement of the lever $l$ also draws the link $k$ downward and swings the bell-crank $j^9$ $n$ about its stud $j^{10}$. This causes two things to happen: first, the arm $j^8$ is forced downward to cause the spreading of the work-clamps, which immediately closed upon the work when the foot was raised from the treadle and the pin $h^9$ in the turret returned to its normal position, and, second, it throws the automatic stop out of engagement with the fast pulley and shifts the belt $a^3$ thereto from the loose pulley. The rear end of the lever is held in its raised position by a strong spring, as previously described, so that the sewing operation immediately takes place and continues until the link $k$ is released from the lever. The shifting of the belt from the loose to the fast pulley causes the rotation of the main shaft A and the consequent reciprocation of the needles and the looper. As the sewing progresses the clamp-carrier moves backwardly and slightly laterally until the stitching is complete almost the length of one edge of the buttonhole-slit. Then the wiper $g$ upon the cam $g'$ engages the roll $f^8$ upon the lever $f^7$, and the bar $f'$ is rocked to swing the segments $f^2$ $f^3$ and cause a partial rotation of the turret and the upper needle, whereby the needles sew around the enlarged end of the buttonhole-slit, making one-half of a revolution. Then the movement of the clamp-carrier is reversed, and the sewing is completed upon the opposite edge of the buttonhole-slit. In order to prevent the return of the turret and the upper needle after having been partially rotated, a latch-bar is pivoted upon the under side of the base-plate and enters a notch in the turret. When the last stitch is almost completed, the cam projection $s'$ on the cam-wheel engages a bell-crank lever $s$, pivoted upon the stud $i^9$, and swings it sufficiently to cause it to engage the hooked end $k'$ of the link $k$ and disengage it from the lever $l$. The link immediately rises, and the automatic stop is forced by the spring $a^{15}$ into position to stop the rotation of the needle-shaft at the same time the lever $j^5$ is raised, and the clamps are permitted to approach each other. After a moment of time a cam $r'$ on the cam-wheel $g'$ engages the latch $r$ and forces it from engagement with the turret, whereupon

the turret and the upper needle are returned to their original positions. This completes one entire cycle of operations of the machine.

Having thus explained the nature of the invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. A buttonhole-sewing machine comprising stitch-forming mechanism; a cutter for severing the thread; a movable throat-plate; means for moving the throat-plate into and out of operative position; and mediate connections between the throat-plate and the cutter, whereby the cutter is actuated to cut the thread as the throat-plate is moved out of operative position.

2. A buttonhole-sewing machine comprising stitch-forming mechanism; a cutter for severing the thread; a movable throat-plate; a carrier for the throat-plate; means for moving the throat-plate into and out of operative position, and connections between said carrier and said cutter whereby the latter is actuated by the former.

3. A buttonhole-sewing machine comprising stitch-forming mechanism, a cutter for severing the thread, a buttonhole-cutter, an anvil, a carrier therefor, means for moving said anvil into and out of operative position, and mediate connections between said thread-cutter and said carrier, whereby the former is actuated by the latter.

4. A buttonhole-sewing machine comprising stitch-forming mechanism, a cutter for severing the thread, a buttonhole-cutter, an anvil, means for moving said anvil into and out of operative position, including a carrier on which said anvil is mounted, and a pin-and-slot connection between said thread-cutter and said carrier whereby one is actuated by the other.

5. A buttonhole-sewing machine comprising stitch-forming mechanism, a cutter for severing the thread, a buttonhole-cutter, an anvil, a throat-plate, a carrier for said anvil and throat-plate, means for actuating said carrier to move either said throat-plate or said anvil into operative position, and connections between said carrier and said thread-cutter, for causing the operation of the thread-cutter.

6. A buttonhole-sewing machine, comprising stitch-forming mechanism including a movable throat-plate, a turret on which a portion of said stitch-forming mechanism is mounted, a cutter for severing a thread supported by said turret, a carrier for the throat-plate mechanism for moving said carrier and thereby the throat-plate for the purpose described, and mediate connections between said throat-plate and said cutter, whereby said cutter is actuated by said throat-plate.

7. A buttonhole-sewing machine, comprising stitch-forming mechanism, a turret on which a portion of said mechanism is mounted, a cutter pivotally mounted on the turret for severing the thread, and means including a pin carried by said turret for swinging said cutter about its fulcrum or pivot to cause it to sever the thread.

8. A buttonhole-sewing machine including a lower needle, and complemental stitch-forming mechanism including an upper needle, a turret held against bodily lateral movement, means for imparting a rotatory movement to said upper needle and said turret, and a carrier for said lower needle pivotally mounted on said turret and movable in a plane intersecting the path of the upper needle.

9. A buttonhole-sewing machine comprising an upper needle, mechanism for actuating it, a lower needle, a turret, means for imparting a rotatory movement to said upper needle and said turret, a pivoted carrier for said lower needle, and a toggle mounted on said turret for actuating said carrier, said carrier, toggle and lower needle being inclined with respect to said upper needle.

10. A buttonhole-sewing machine comprising stitch-forming mechanism including a turret, means for actuating said turret to cause the formation of stitches around the end of a buttonhole, a work-clamp, and means of which a part is carried by the turret for opening said clamp.

11. A buttonhole-sewing machine comprising stitch-forming mechanism including a turret, means for actuating said turret to cause the formation of stitches around the end of a buttonhole, a work-clamp, a device carried by said turret for opening said clamp, and manually-operated mechanism for actuating said device.

12. A buttonhole-sewing machine comprising stitch-forming mechanism including a turret, means for actuating said turret to cause the formation of stitches around the end of a buttonhole, a work-clamp comprising two normally spring-closed jaws, means for separating said jaws, and means carried by said turret for opening said jaws.

13. A buttonhole-sewing machine comprising stitch-forming mechanism, a bed-plate, a buttonhole-cutter, a work-clamp, a continuously-rotating shaft, journaled independently of the bed-plate, a rock-shaft journaled upon said bed-plate, toggle connections between said rock-shaft and said rotating shaft, and means for intermittingly connecting said shafts to cause the simultaneous operation of the cutter and the clamps.

14. A buttonhole-sewing machine comprising stitching mechanism including a rotary turret, a buttonhole-cutter, an anvil or cutter-block journaled upon the turret and lying normally in an inoperative position, manually-operated means for moving said anvil into operative position, and automatically-actuated mechanism for operating said cutter.

15. A buttonhole-sewing machine comprising stitching mechanism including a rotary turret, a buttonhole-cutter, an anvil or cutter-block journaled upon the turret and lying

normally in an inoperative position, manually-operated means for moving said anvil into operative position and mechanism operated automatically to actuate the cutter and return the anvil to its inoperative position.

16. A buttonhole-sewing machine comprising stitch-forming mechanism including a turret and means for rotating said turret, a buttonhole-cutter, a spring-held anvil pivotally mounted on said turret and lying normally in an inoperative position, manually-operated means for moving the anvil into operative position, devices for latching said anvil in the last-said position, and means carried by the cutter for causing the anvil to be returned to inoperative position.

17. A buttonhole-sewing machine comprising stitch-forming mechanism including a turret, a buttonhole-cutter, automatic devices for actuating the cutter, an anvil or cutter-block pivotally supported on said turret and lying normally in an inoperative position, and manually-operated means for causing the movement of said anvil into operative position.

18. A buttonhole-sewing machine, comprising stitch-forming mechanism including a turret, a cutter, an anvil pivotally mounted on said turret, a continuously-rotating shaft, manually-controlled devices for moving said anvil into and out of operative position, cutter-actuating devices, and mechanism automatically controlled by said manually-controlled devices, for connecting said cutter-actuating devices with said shaft, whereby the anvil is first moved into position and the cutter is then actuated.

19. A buttonhole-sewing machine comprising stitching mechanism including a rotary turret, a throat-plate, an anvil, a spring-tensioned rock-shaft on said turret for supporting said plate and said anvil, and means whereby said shaft may be moved manually in one direction.

20. A buttonhole-sewing machine comprising a turret, a throat-plate, an anvil, a manually-actuated device supporting said plate and said anvil and mounted pivotally on said turret, and mechanism for rocking said device to move the anvil into operative position.

21. A buttonhole-sewing machine comprising a throat-plate, an anvil, a rocking device supporting said plate and said anvil, and a spring for holding said device with the throat-plate in position, and manually-operated mechanism for rocking said device to move the anvil into operative position.

22. A buttonhole-sewing machine comprising a throat-plate, an anvil, a rocking device supporting said plate and said anvil, a spring for holding said device with the throat-plate in position, manually-operated mechanism for rocking said device to move the anvil into operative position, a lock to hold the said device in the last-said position, and automatically-acting means for disengaging the lock from the rocking device to permit the spring to return the throat-plate to operative position.

23. A buttonhole-sewing machine comprising a stitch-forming mechanism, including an upper needle and an under needle, a main rotary shaft for reciprocating said needles, and mechanism for oscillating said needles, driven from said main rotary shaft, said means for oscillating said needles including pinions connected to said needles, internally-toothed gears meshing with said pinions, a rock-shaft to which said gears are secured, mechanism operated automatically to turn the shaft in one direction, a latch to lock said shaft, a spring to turn the shaft in the opposite direction, and an automatically-operated means for disengaging the latch from the shaft, and permitting the spring to turn said shaft.

24. A buttonhole-sewing machine comprising stitch-forming mechanism, including an upper needle and an under needle, a rotary shaft for reciprocating the upper needle, a rock-shaft for reciprocating said under needle, and mechanism operated from said rock-shaft for oscillating said needles.

25. A buttonhole-sewing machine comprising stitch-forming mechanism including an upper needle and an under needle, a rotary shaft for reciprocating the upper needle, a rock-shaft for reciprocating said under needle, and mechanism operated from said rock-shaft for oscillating said needles, said mechanism including pinions connected to said needles, a second rock-shaft having gears intermeshing with said pinions, and a rotary cam which is actuated by the first-said rock-shaft for imparting a rocking movement to the second-said rock-shaft.

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

GEORGE S. HILL.

Witnesses:
M. B. MAY,
C. F. BROWN.