

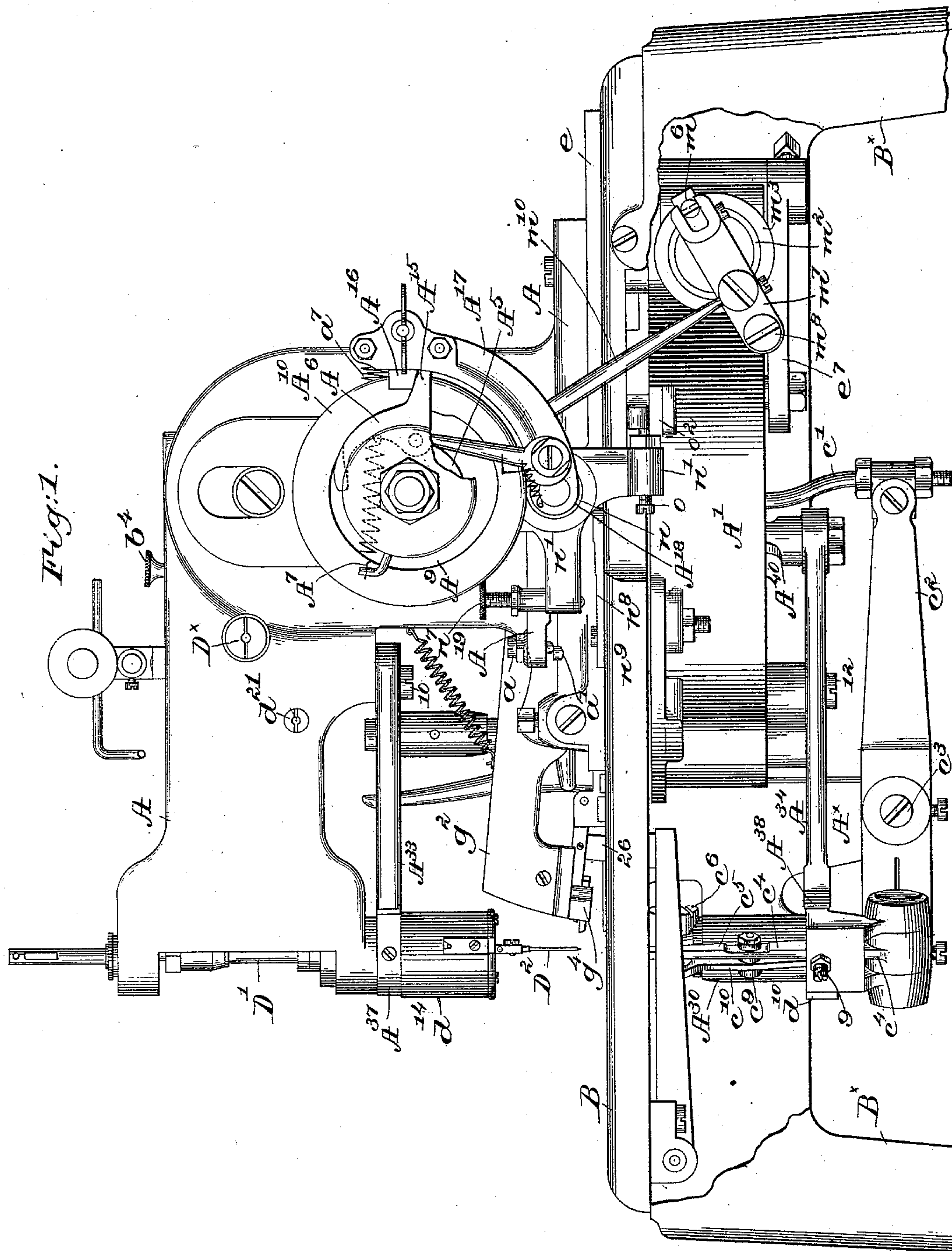
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9 Sheets—Sheet 1.

J. REECE.  
BUTTONHOLE SEWING MACHINE.

No. 488,028.

Patented Dec. 13, 1892.



Witnesses.  
Fred S. Greenleaf  
Louis M. Munnell

Inventor:  
John Reece.  
By Crosby & Gregory  
Attys.

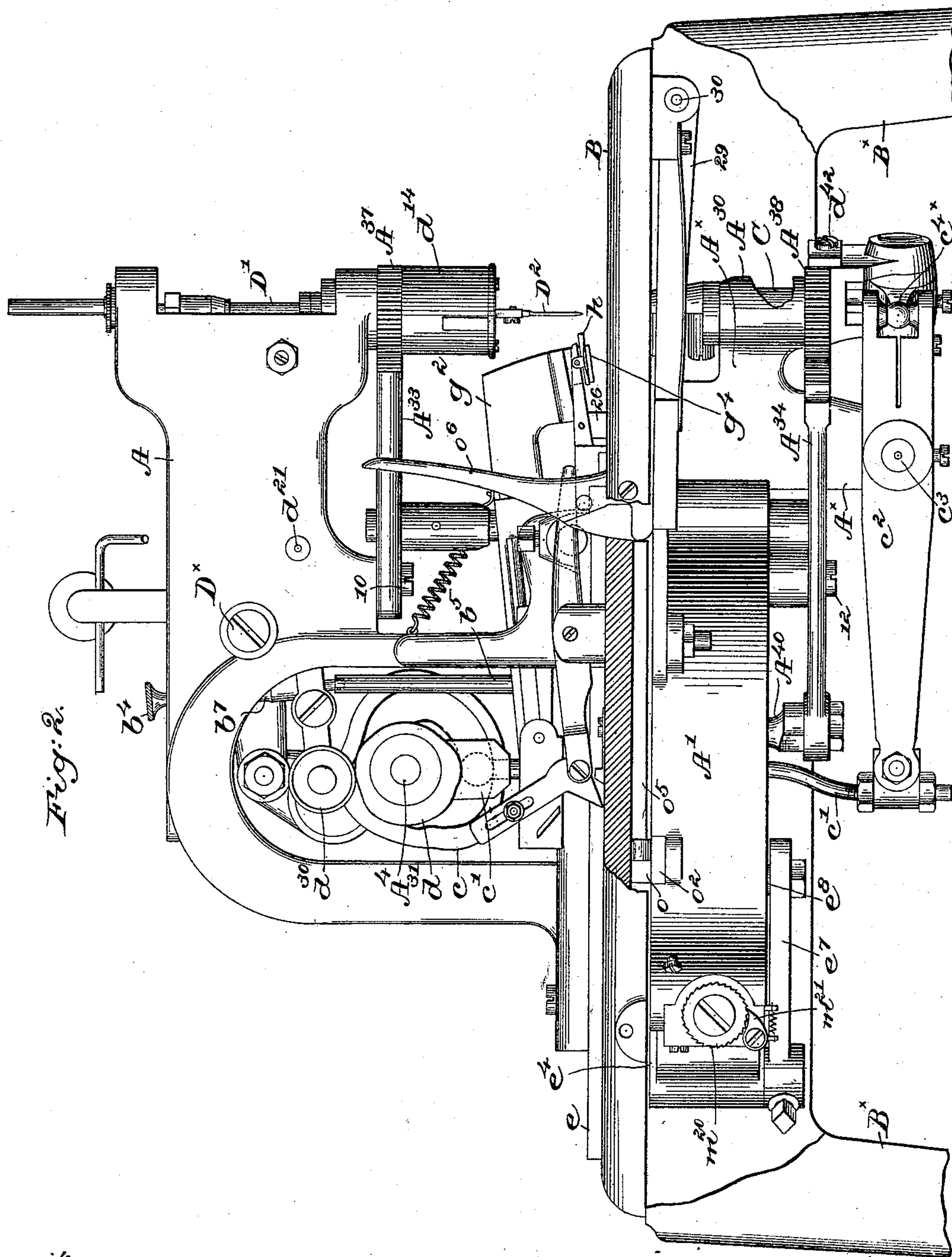
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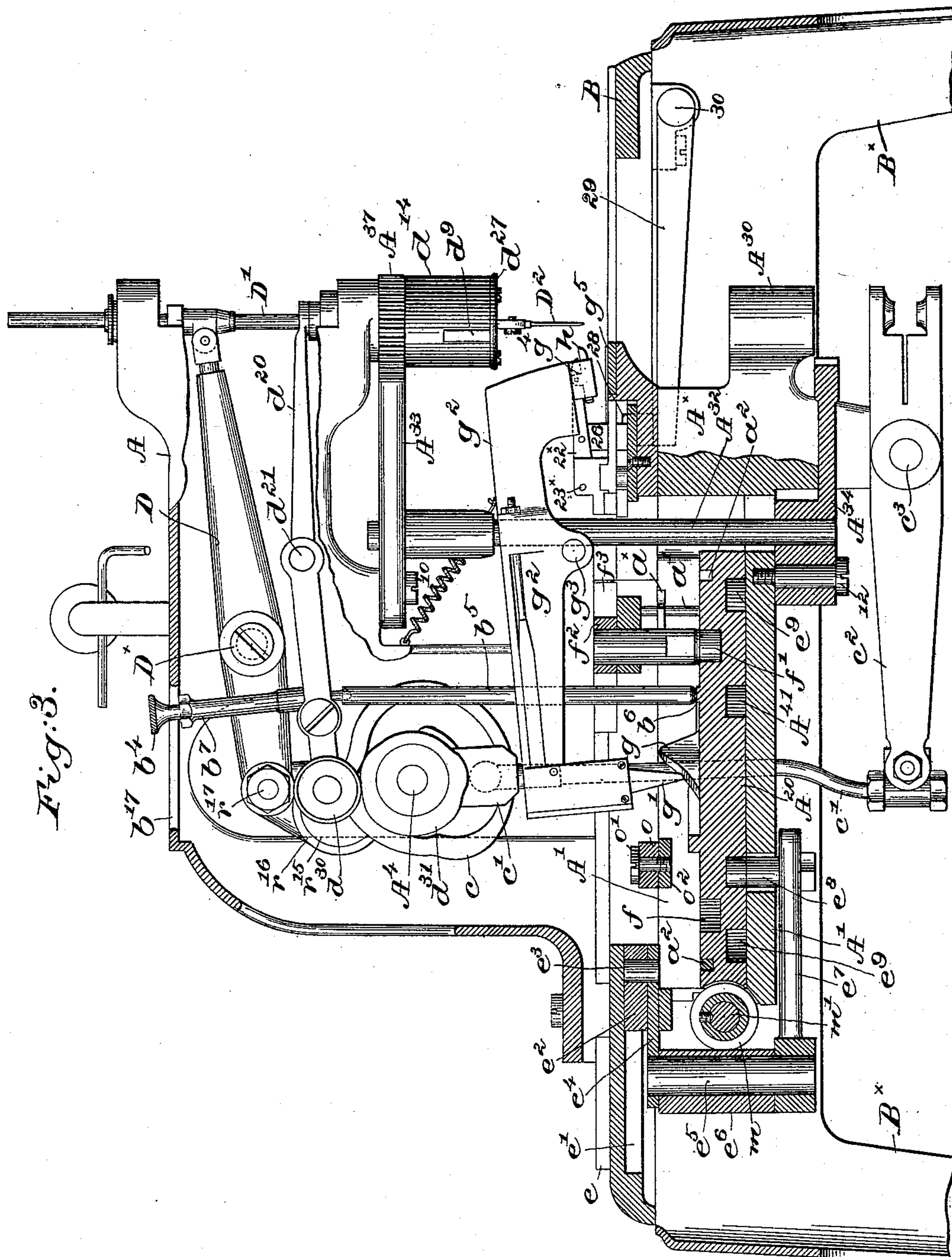


Fig. 3.

Witnesses

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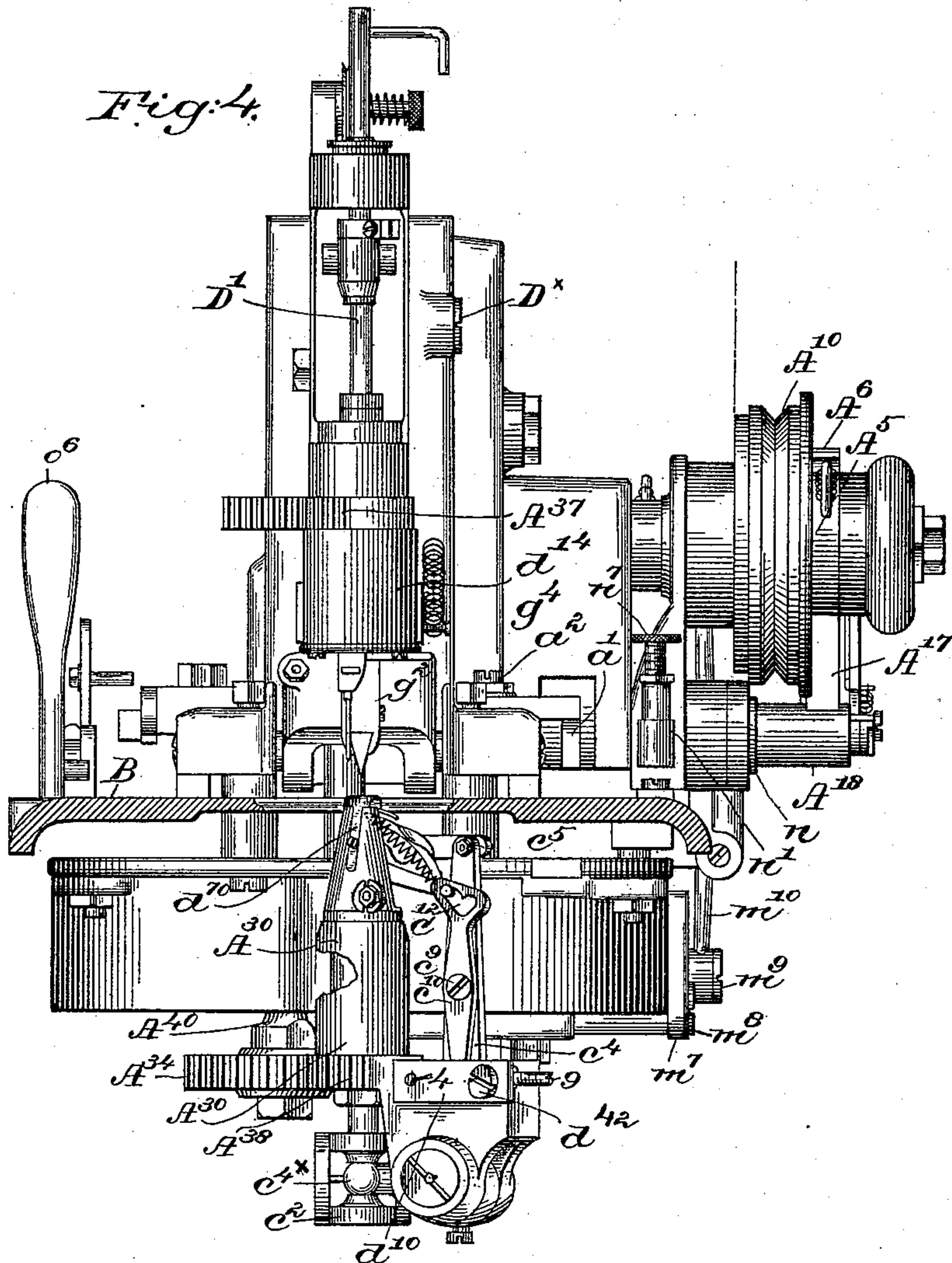
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Witnesses.

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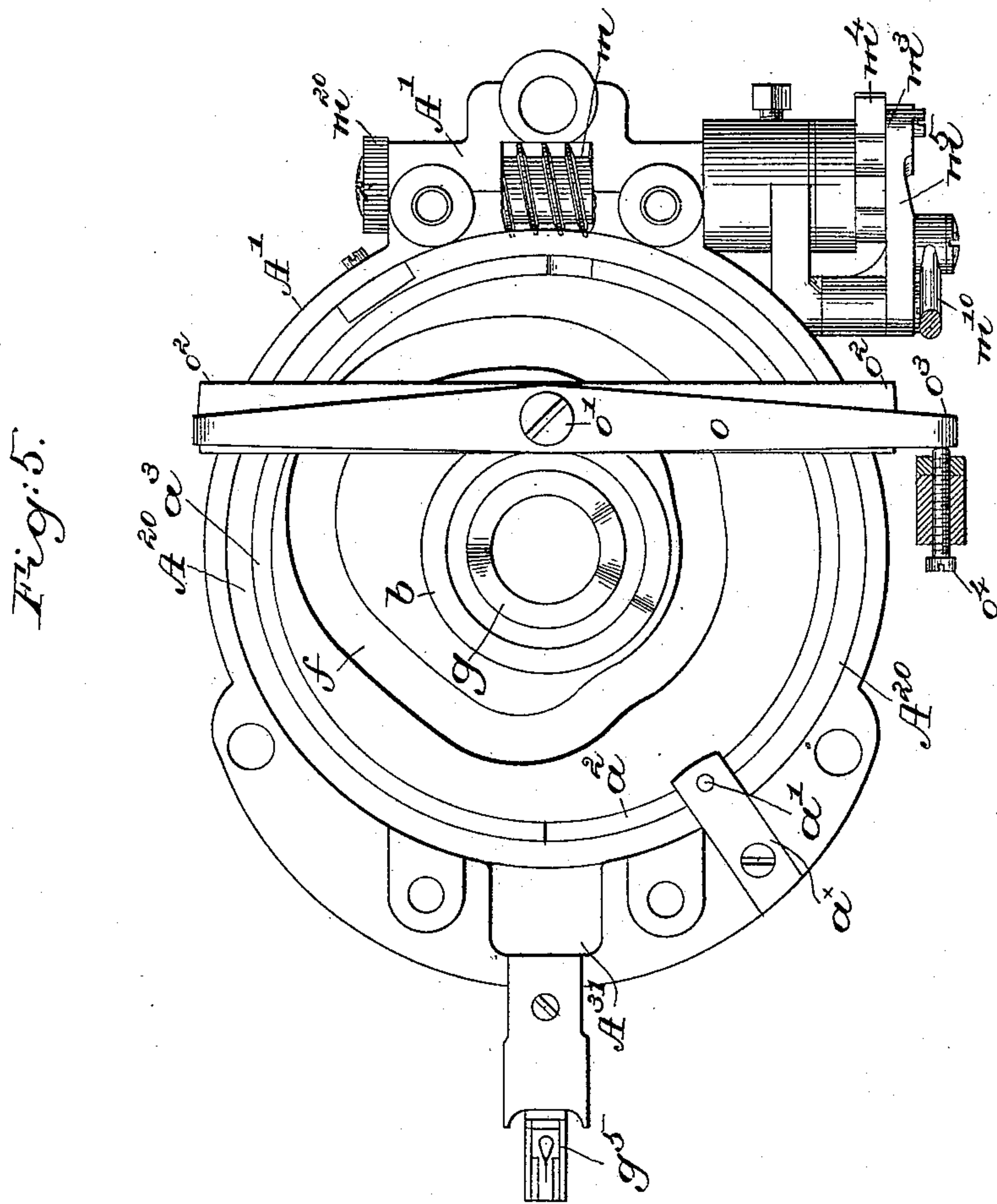
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Witnesses.

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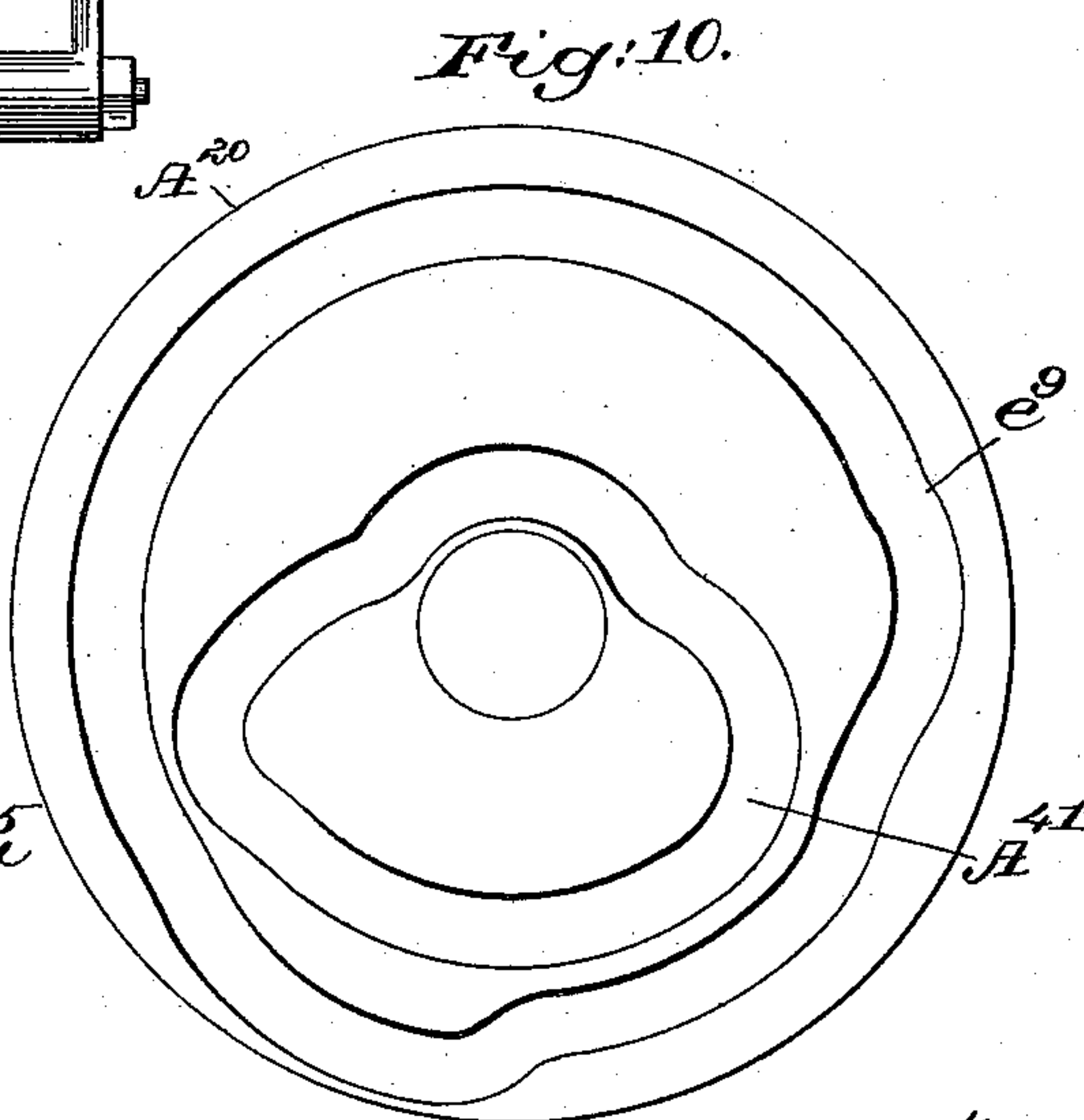
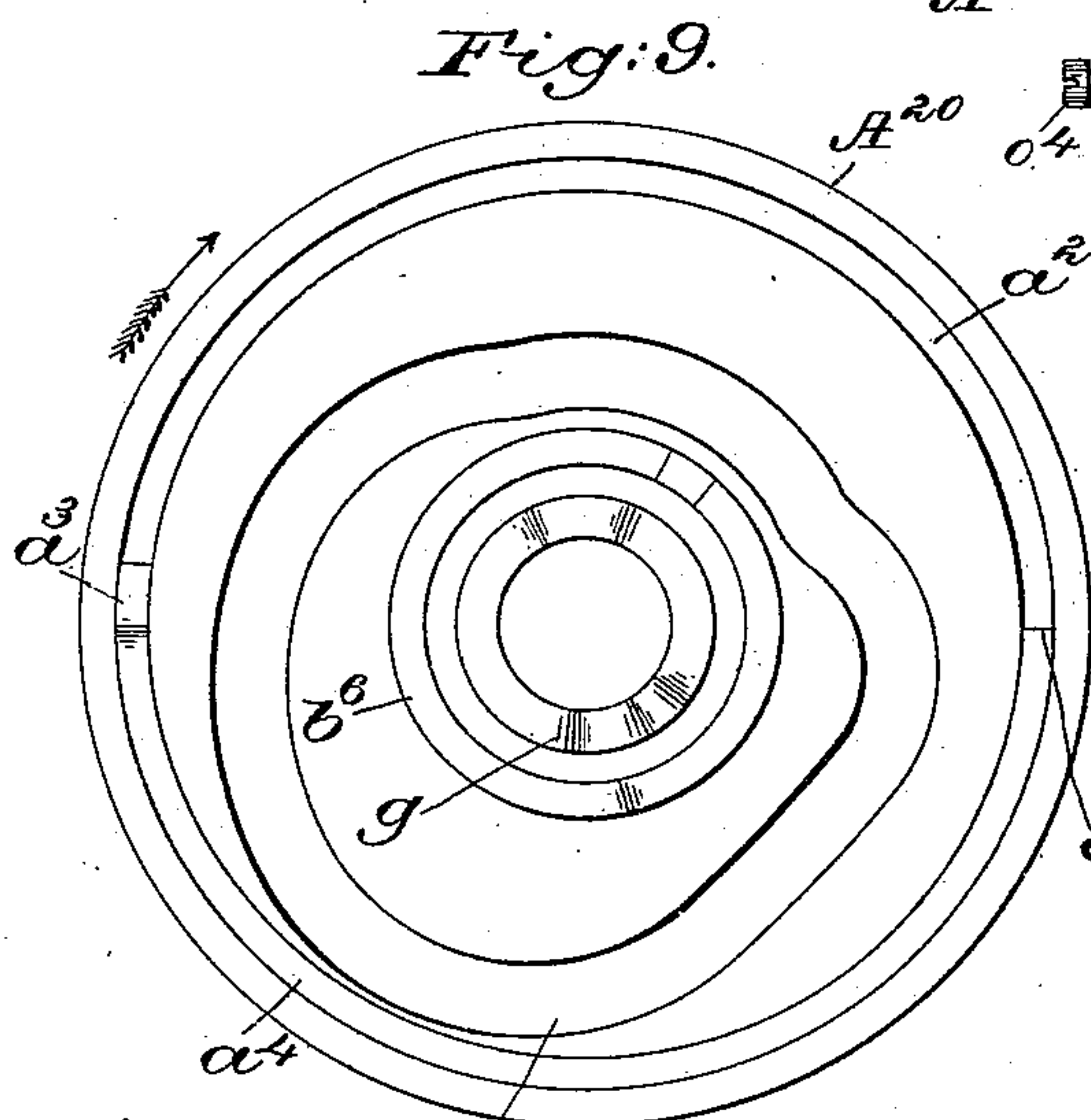
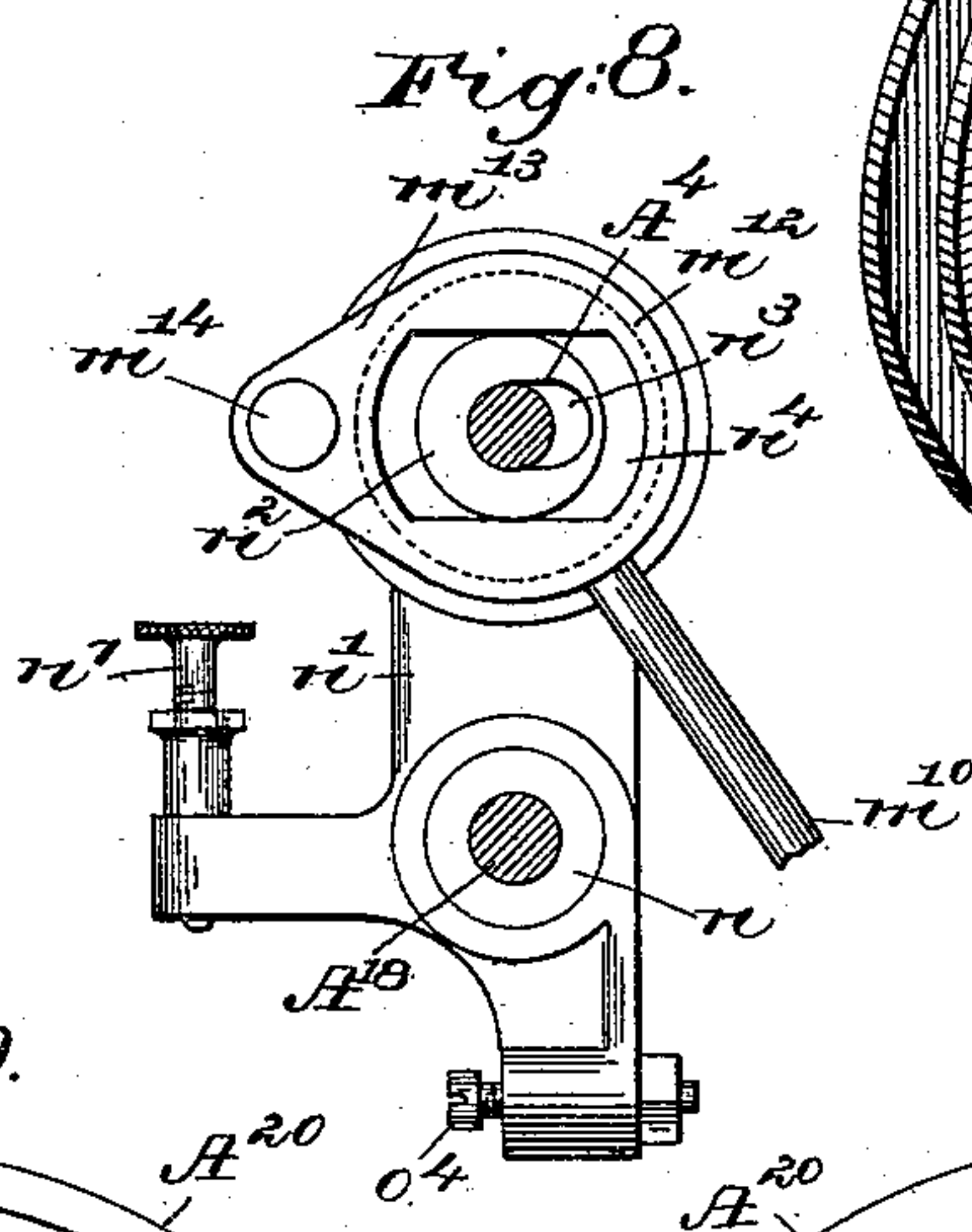
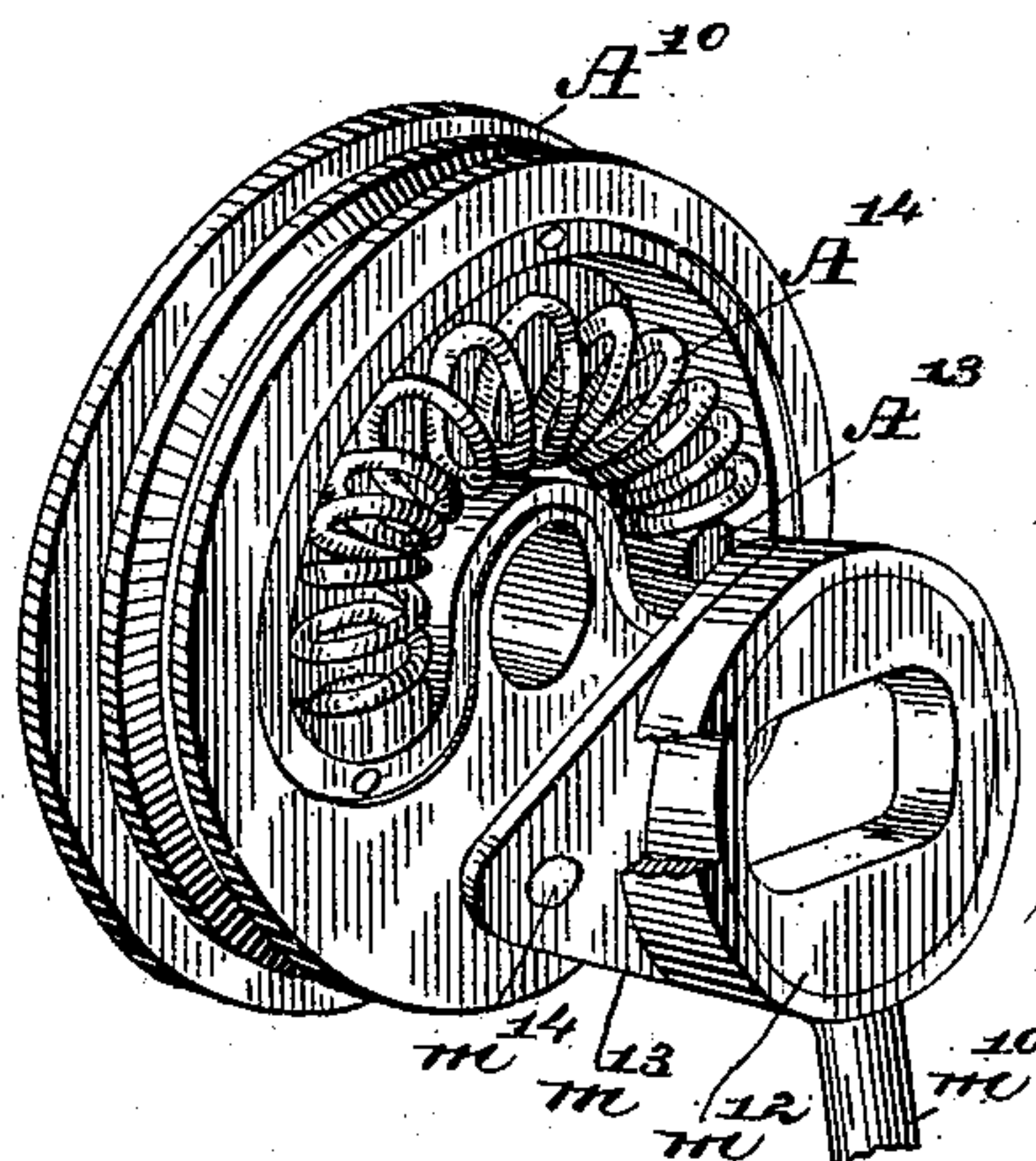
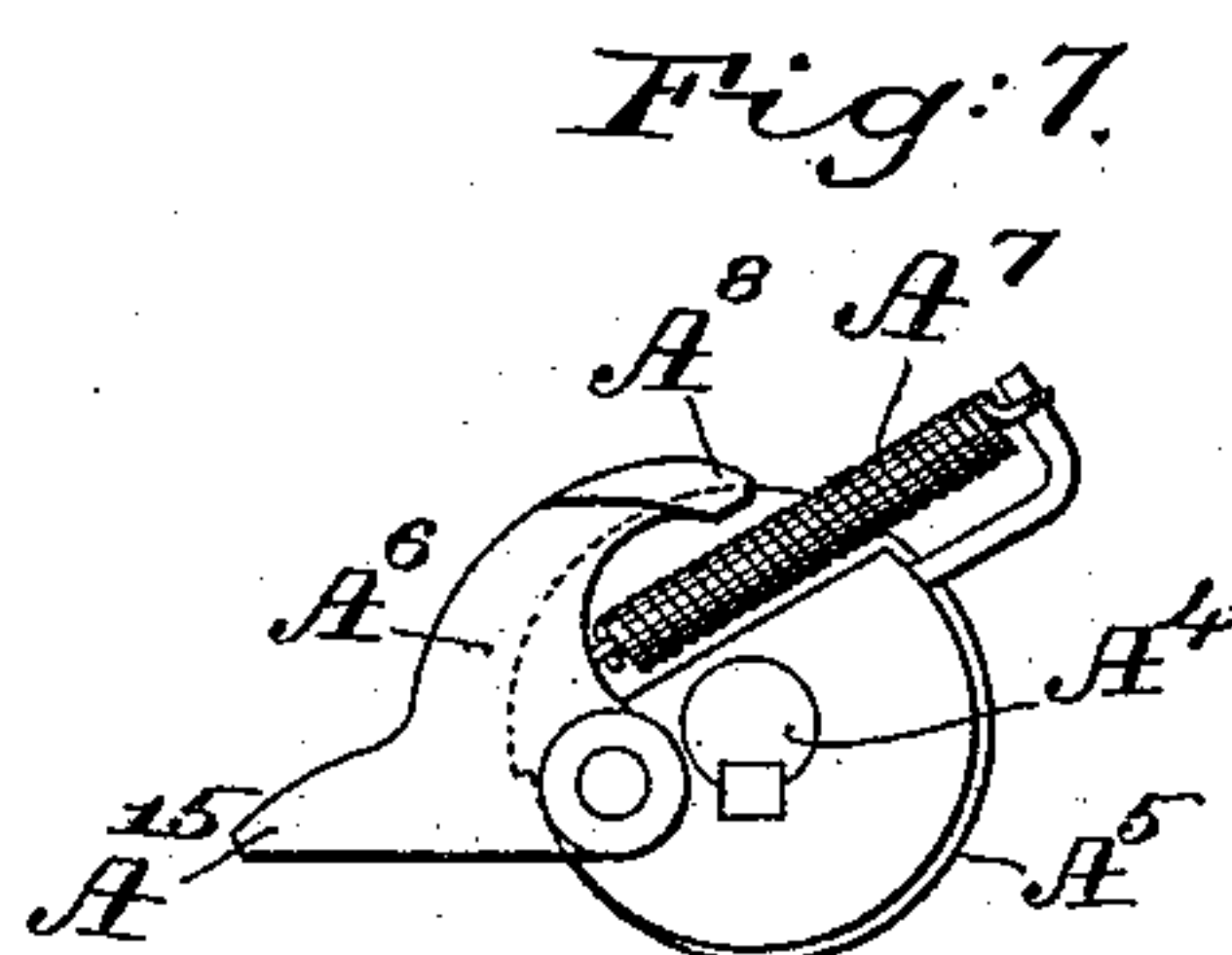
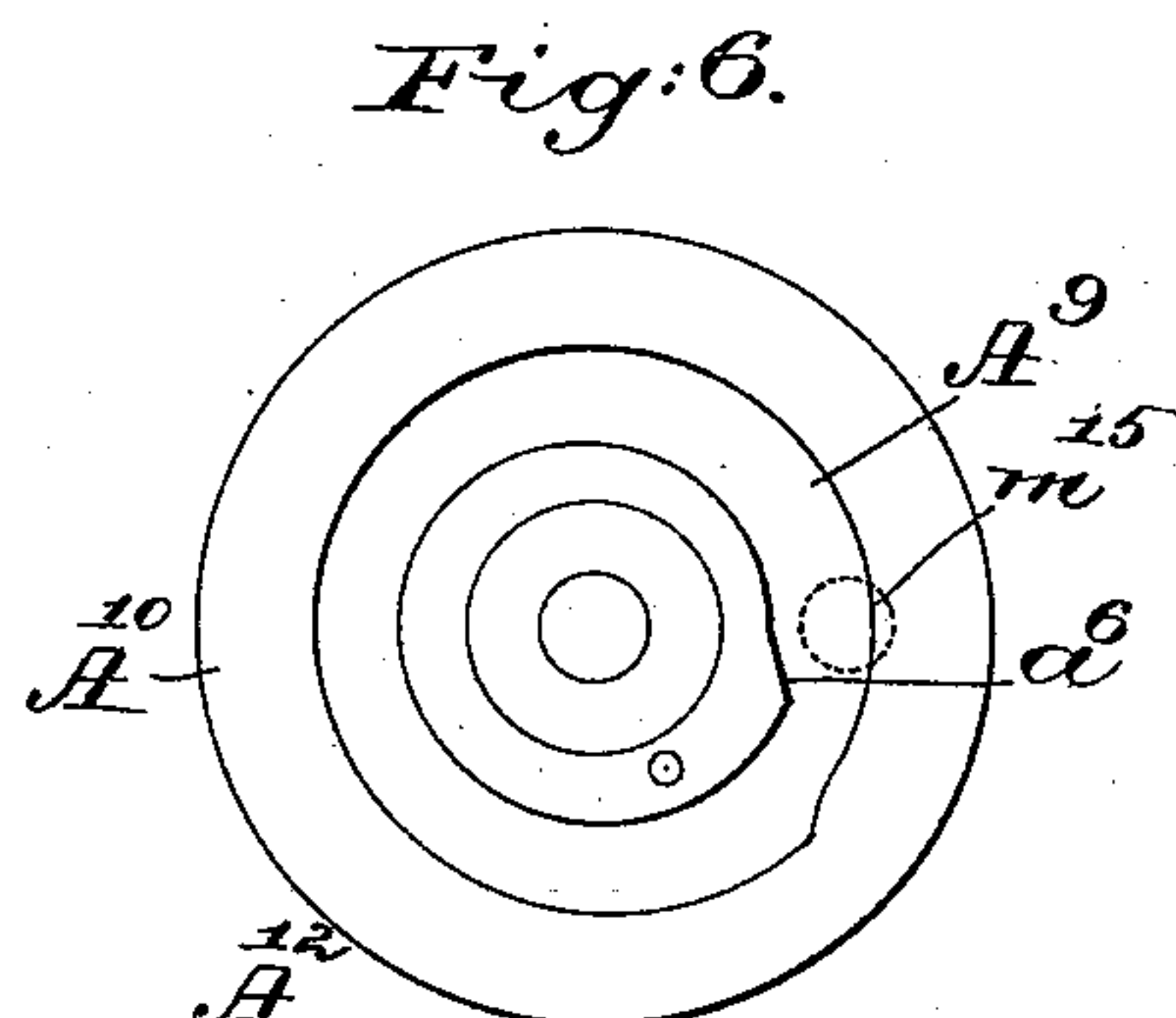
(No Model.)

9 Sheets—Sheet 6.

J. REECE.  
BUTTONHOLE SEWING MACHINE.

No. 488,028.

Patented Dec. 13, 1892.



witnesses, f  
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9 Sheets—Sheet 7.

No. 488,028.

Patented Dec. 13, 1892.



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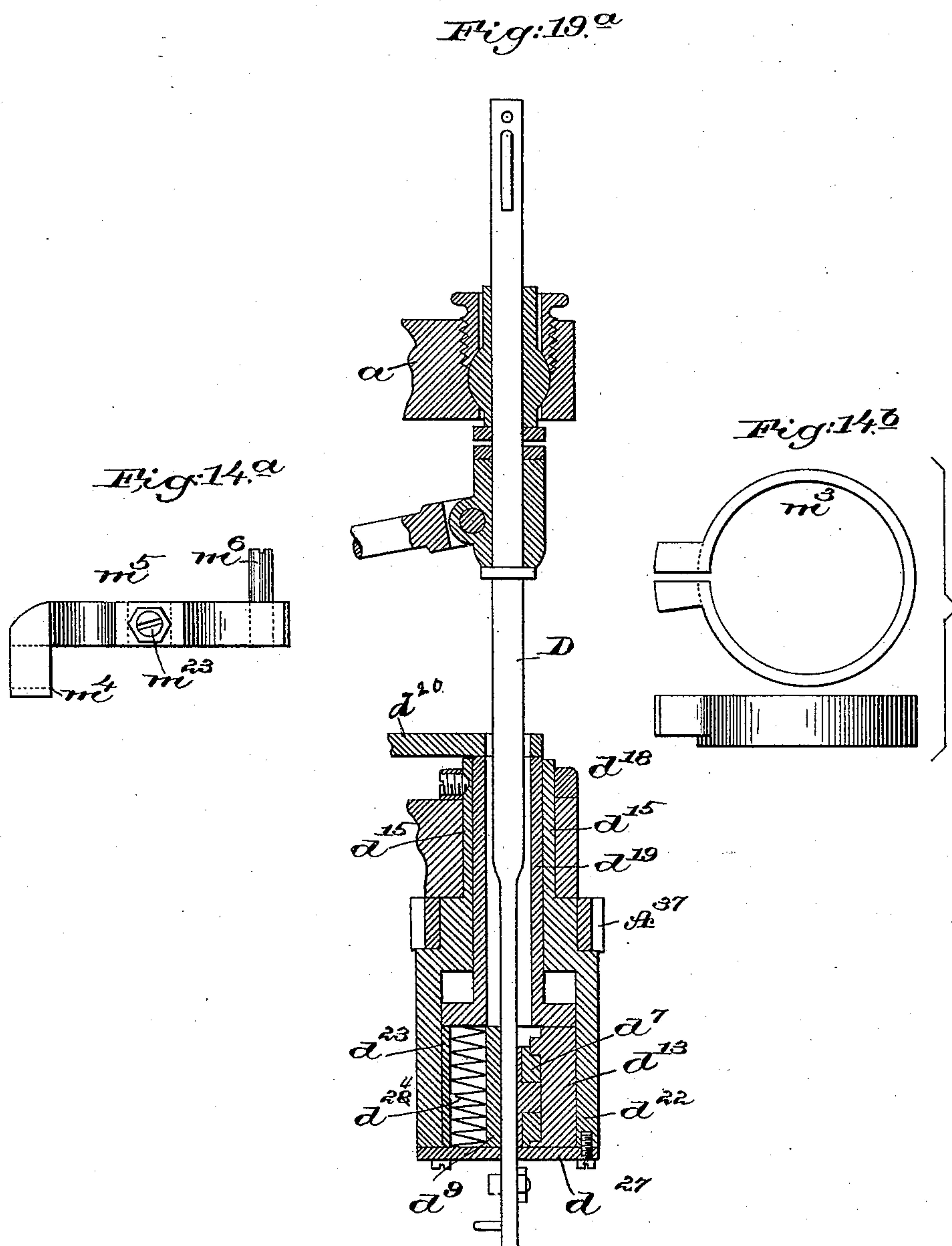
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9 Sheets—Sheet 8.

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No. 488,028.

Patented Dec. 13, 1892.



Witnesses  
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Fred S. Gruntz.

Inventor:  
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(No Model.)

9 Sheets—Sheet 9.

J. REECE.  
BUTTONHOLE SEWING MACHINE.

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Patented Dec. 13, 1892.

Fig: 18.

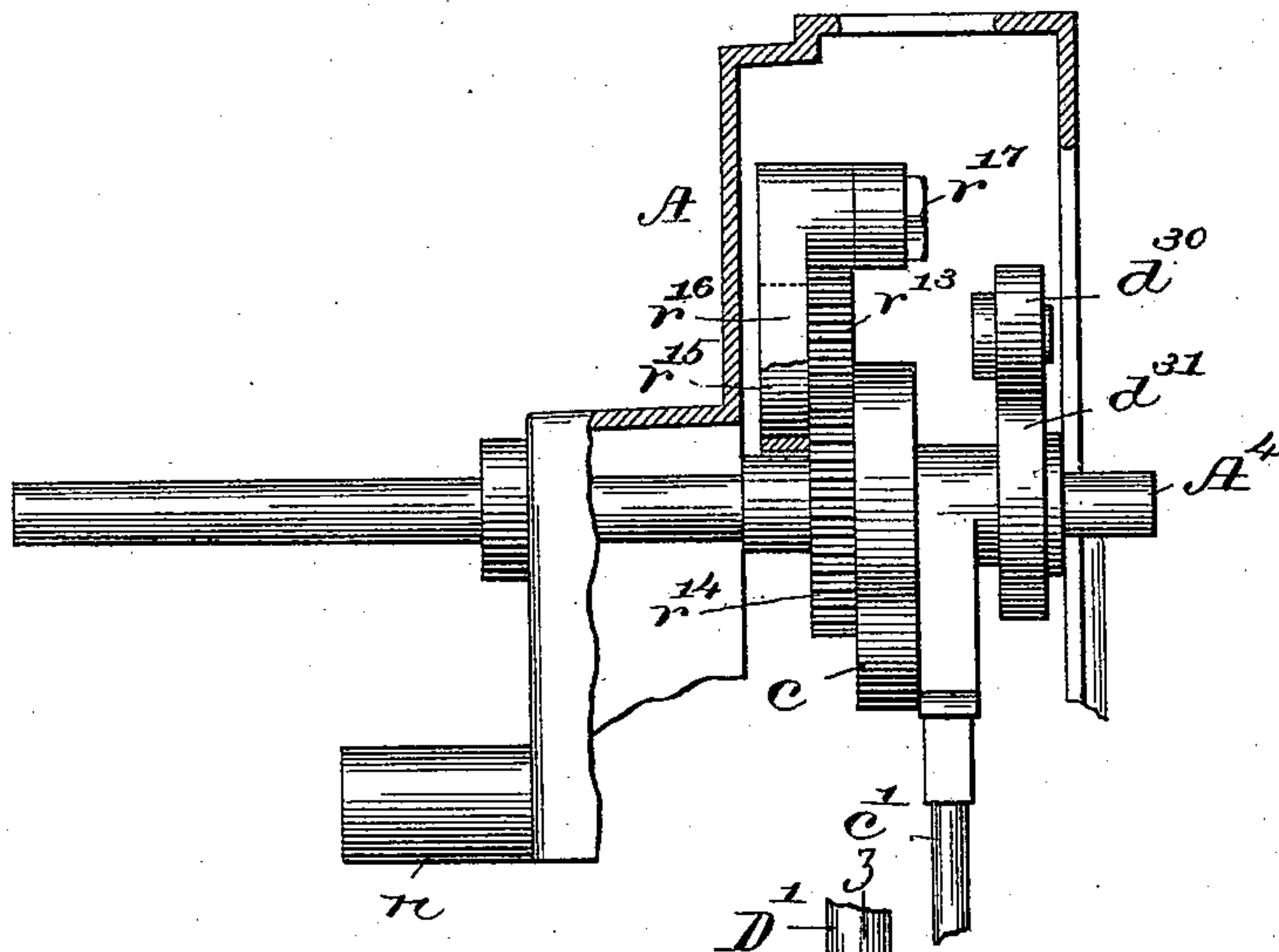
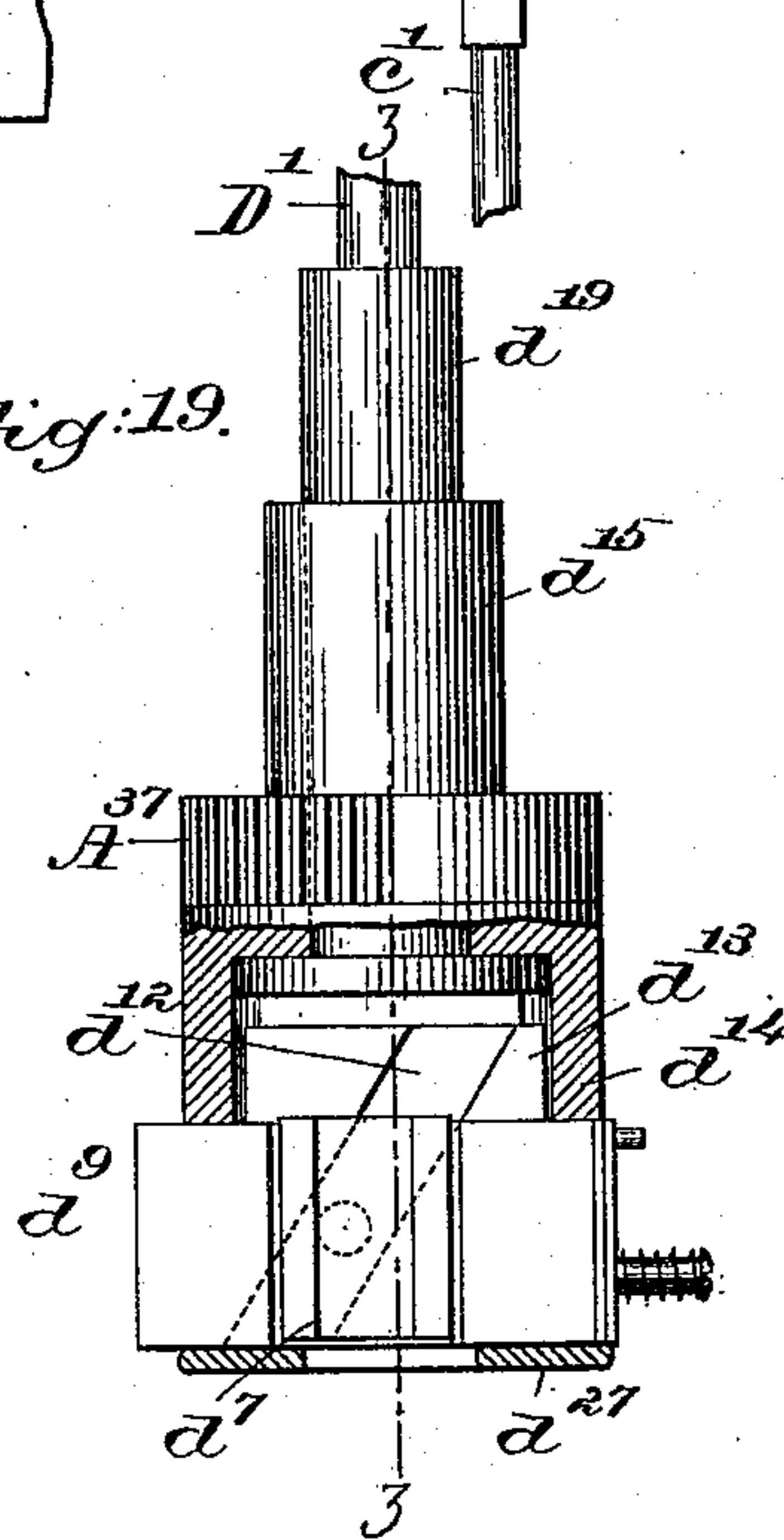


Fig: 19.



*Witnesses*

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# UNITED STATES PATENT OFFICE.

JOHN REECE, OF BOSTON, MASSACHUSETTS.

## BUTTONHOLE SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 488,028, dated December 13, 1892.

Application filed May 31, 1892. Serial No. 434,861. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN REECE, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Buttonhole Sewing-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

10 This invention has for its object to improve and simplify that class of buttonhole sewing-machines wherein the stitch-forming mechanism is rotated partially about a vertical axis during the stitching of the eye of the button-  
15 hole, the stitch-forming mechanism and work-holding clamp at other times having relative movements in a horizontal plane, whereby the stitching is made along the sides of the buttonhole. The machine herein to be described  
20 has buttonhole-cutting mechanism and devices for automatically actuating the same, whereby the material in the clamp is cut while clamped and preparatory to stitching the buttonhole. The machine also has de-  
25 vices whereby the work-holding clamp and the said cutting mechanism are put automatically into and out of operative position with relation each to the other at the proper times, and the machine is also adapted to make a  
30 series of long stitches for barring and thus completing the small end of the buttonhole. In the machine herein shown the change in relative positions of the stitch-forming mechanism and work-holding clamp is effected by  
35 or through rotating cams, and it is a matter of great importance to so construct the actuating mechanism for the said cams that they may be rotated with the least expenditure of power, so that wear of parts and lost motion shall  
40 be reduced to a minimum. In accordance with this invention the cams for controlling the relative positions of the stitch-forming mechanism and the work-holding clamp and also the relative positions of the work-holding  
45 clamp and buttonhole-cutting mechanism are positively actuated by or through a worm-gear and worm, the latter being on a shaft, the rotation of the worm stopping automatically after the buttonhole has been completed, its motion being started by or through the action of  
50 closing the work-holding clamp upon the work. In the machine herein to be described the

feed mechanism for controlling the relative positions of the stitch-forming mechanism and work-holding clamp has moving in uni- 55  
son with it a cam device so constructed and devised that one portion of it at a predetermined time shall enable the rotation of the shaft which in the present instance imparts motion to the stitch-forming mechanism to 60  
be started, the other portion, (the stitch-forming mechanism,) having performed its functions on the buttonhole, serving to effect the stopping of the rotation of said shaft. The worm referred to has imparted to it vari- 65  
able or intermitting movement, and to effect this I have devised peculiar novel devices. The devices referred to consist, essentially, in a lever having a circular hub provided with a slot and embracing the main shaft of 70  
the machine, a rotating pulley having a crank-pin, a slotted plate having a circular projection and having a hole for the reception of the said crank-pin, and a connecting-rod having a strap to embrace the said circular pro- 75  
jection, the said connecting-rod co-operating with and imparting motion to a pawl device to effect the intermitting rotation of the worm-shaft whenever the center of the circular hub carried by the lever referred to is not concentric 80  
with the center of rotation of the main or cam shaft. I have provided means for automatically moving this lever into such position that the said circular slotted hub shall be concentric with the said main shaft about as the 85  
stitching of a buttonhole is completed, and to further utilize this lever and simplify the parts I have made it as the carrier for the part of the regulating device instrumental in determining the spacing of the stitches about 90  
the buttonhole. Herein the cam instrumental in changing the relative positions of the stitch-forming mechanism and the work-holding clamp has combined and running in uni-  
son with it a depth-stitch cam, and this latter 95  
cam has combined with it and with the lever which reciprocates the slide-block instrumental in making the depth-stitch a regulating device, shown as a screw readily accessible, the said regulating device by its movement 100  
effecting the length of the depth-stitch.

Figure 1 in side elevation represents a buttonhole stitching and cutting machine embodying my invention; Fig. 2, an opposite side



elevation partially broken out. Fig. 3 is a view showing the framework and most of the parts below the bed in longitudinal section, the parts above the bed being in elevation, the looper and its co-operating parts shown in Fig. 2 being omitted; Fig. 4, a front end elevation, the bed being in transverse section in the line of the throat-plate, the work-holding clamp being, however, omitted; Fig. 5, a detail showing the cam employed for changing the relative positions of the stitch-forming mechanism and the work-holding clamp and of the devices for rotating the same. Fig. 6 is an under side view of the belt or driving-wheel, it forming part of a clutch mechanism. Fig. 7 is a detail of the other member of the clutch co-operating therewith. Fig. 8 is a detail showing the stitch-spacing lever and some of its co-operating parts. Fig. 9 is a detail showing the upper side of the cam-carrying worm-wheel. Fig. 10 is a detail showing the under side of the said worm-wheel. Fig. 11 is a detail showing the inner side of the clutch-pulley and its attached device, having the circular slotted hub, the strap at the upper end of the connecting-rod being broken out. Fig. 12 is an enlarged detail of the looper, its actuating devices, the throat, and loop-controller. Figs. 14<sup>a</sup> and 14<sup>b</sup> show details of the friction-clamp device shown together in Fig. 14. Fig. 13 is a top or plan view of some of the parts shown in Fig. 12. Fig. 14 is a detail of the friction feed device co-operating with and to operate the worm-shaft intermittingly. Fig. 15 shows lever  $c^{10}$  detached. Fig. 16 shows the loop-controller in perspective. Fig. 17 shows the looper separately. Fig. 18 is a sectional detail showing part of the shaft  $A^4$  and the devices carried by it instrumental in actuating the stitch-forming mechanism. Fig. 19 is an enlarged detail of the needle-bar and some of the devices carried by it to give to the needle its increased lateral movement. Fig. 19<sup>a</sup> is a detail to be referred to in the line  $z$ . Fig. 20 is a detail showing the throat-plate in top view.

The framework of the machine consists, chiefly, of two parts—viz., a stitching-frame composed of an overhanging arm  $A$  and a cam-casing  $A'$ , having a suitable arm  $A^x$ , the other part of the framework, called for brevity the "clamp-frame," being marked  $B$ , and as herein shown the frame  $B$  is sustained on legs  $B^x$ . The stitch-frame carries the stitch-forming mechanism, and the clamp-frame carries the work-holding clamp, both of which will be described, the said frames being movable one with relation to the other to enable the stitching to be carried on about the edges of the buttonhole-slit in the material held in the clamp, and in the particular form in which my invention is herein embodied I have shown the stitch-frame as movable, while the clamp-frame is stationary; but the reverse of this condition may exist and yet all the parts instrumental in forming the buttonhole will operate in just the same man-

ner. The stitch-frame has a main shaft  $A^4$ , near the outer end of which is fastened a hub  $A^5$ , having a pivoted dog  $A^6$ , acted upon by a pulling-spring  $A^7$ , the dog having a toe  $A^8$  (see Fig. 7) to enter a cam-groove  $A^9$  (see Figs. 1 and 6) in a belt-pulley  $A^{10}$ , loose on said shaft, the said pulley at its inner side having a cam-ring  $A^{12}$ , having a pin  $A^{13}$  (see Fig. 11) extended through a curved slot in the belt-pulley and acted upon by a suitable spiral spring  $A^{14}$ , (see Fig. 11,) substantially as in my United States Patent No. 367,063, dated July 26, 1887, the tail  $A^{15}$  (see Fig. 7) of the clutch-dog being acted upon and held, as in Fig. 1, by a block or projection  $A^{16}$  of an arm  $A^{17}$  of a rock-shaft  $A^{18}$ , having an arm  $A^{19}$ , provided with a screw  $a$ , which normally rests on the upper end of a slide-pin  $a'$ , extended down through the base of the frame  $A$  and through a guide  $a^x$ , (see Fig. 5,) said pin resting on a cam  $a^2$  at the face of the worm-wheel  $A^{20}$ . This cam-ring  $a^2$  has a beveled portion  $a^3$ , leading up onto a higher portion  $a^4$  of said ring, and at a distance therefrom of about one hundred and eighty degrees, more or less, according to the length of the buttonhole, the said ring has an abrupt shoulder  $a^5$ . (See Fig. 9.) This ring through the pin  $a'$  actuates the rock-shaft referred to to effect the release of the clutch-dog  $A^6$ , so that its toe may engage the shoulder  $a^6$  of the ring  $A^{12}$ , and thus couple the loose and fixed members of the clutch-pulley device, so that the main shaft will be rotated long enough to complete the stitching of a buttonhole, which done the pin  $a'$  will pass off the shoulder  $a^5$  and enable the spring  $A^7$  to resume control of the rock-shaft referred to and put its block  $A^{16}$  in the path of rotation of the tail of the dog to thus uncouple the clutch members and stop the action of the stitch-forming mechanism. This main shaft has at its inner end a cam  $d^{31}$ , which in the rotation of said shaft strikes a roller or other stud  $d^{30}$  at the inner end of a lever  $d^{20}$ , pivoted at  $d^{21}$ , the forward end of said lever acting upon a spring-supported sleeve  $d^{19}$ , provided at its lower end with a zone-shaped projection  $d^{13}$ , having a diagonal groove  $d^{12}$ , in which enters a projection at the rear side of an auxiliary slide-block  $d^9$ , said slide-block having pivoted on it loosely a swivel-block, in which slides the flattened lower end of the needle-bar, said cam  $d^{31}$  therefore effecting the lateral movements of the needle-bar, the latter being supported at its upper end in a ball-like bearing. The sleeve  $d^{19}$  is contained in a support  $d^{14}$ , slotted for the reception of the block  $d^9$  and provided with teeth, as at  $A^{37}$ , to be engaged and turned about a vertical center when it is desired to stitch about the eye of a buttonhole.

The needle-bar and the devices referred to for imparting lateral movement to the needle are all substantially as in my application, Serial No. 227,269. The lever and slide-block effect, as described in said application, the extent of the lateral thrust of the needle and needle-bar in making the usual depth-stitch,



and to vary the length of the depth-stitch for the particular class of buttonhole being made I have provided said lever  $d^{20}$  with an adjusting device  $b^4$ , shown as a screw inserted into a threaded hole in said lever  $d^{20}$ , the inner end of said screw engaging or co-operating with a slide-pin  $b^5$ , extended through a hole in the part A of the stitch-frame and resting on a cam  $b^6$ , carried by the said worm-wheel. The adjustment of the screw  $b^4$  enables the effective stroke of the lever  $d^{20}$  to be more or less, as required, for in practice the roller  $d^{30}$  is normally pressed toward its actuating-cam  $d^{31}$  by a spring  $d^{24}$ , contained in the zone-shaped bearing-block  $d^{23}$ , (see Fig. 19<sup>a</sup>), and by turning the screw  $b^4$  in more or less, so that its inner end will contact sooner or later with the rod  $b^5$ , the movement of the roller  $d^{30}$  toward its actuating-cam will be arrested sooner or later, and thus vary the effective stroke of the cam and the depth-stitch. I preferably employ with the screw  $b^4$  a set-nut  $b^7$ , and, as shown, the said screw is readily accessible to the operator for manipulation and adjustment through a hole  $b^{17}$  in the stitch-frame. (See Fig. 3.) The main shaft has on it next to the cam  $d^{31}$  a cam-disk  $c$ , provided (see Fig. 3) with a cam-groove, which receives in it a roller or other stud at the upper end of a link  $c'$ , swing-jointed to a lever  $c^2$ , pivoted at  $c^3$  on a depending lug or stand attached to the arm  $A^x$  of the casing  $A'$  of the stitch-frame, the said arm also having a bearing  $A^{30}$ , to be described.

The part  $A'$  of the stitch-frame has a slot  $A^{31}$ , (see Fig. 5,) through which is extended the rod  $A^{32}$ , which connects the two sector-levers  $A^{33}$   $A^{34}$ , pivoted, respectively, at 10 12 and having their sector-like ends engaging, respectively, the gears  $A^{37}$   $A^{38}$  for effecting the rotation of the needle-bar and looping mechanism, as when the stitching is being effected about the round part of the eye of the buttonhole, and for returning the said parts into their normal or starting position. The sector-lever  $A^{34}$  at its inner end (see Fig. 2) has a stud  $A^{40}$ , which enters the cam-groove  $A^{41}$  in or moving in unison with the worm-wheel referred to.

The mechanism for partially rotating the needle-bar and looper-carrying block or frame C is substantially the same as in my application, Serial No. 227,269; but herein the looper  $d$  and loop-controller  $d^2$  are quite different.

Referring to Figs. 12 and 13, showing the looper-carrying frame detached, with its parts,  $c^4$  represents an elbow-lever, the ball-like end  $c^{4x}$  of which is engaged by the short arm of the lever  $c^2$ . The upper end of the lever  $c^4$  has jointed to it a link  $c^5$ , the opposite end of which embraces a stud  $c^6$  at one side of the looper-carrier  $c^7$ , pivoted on the said frame C. The lever  $c^4$  carries an adjustable stud  $c^9$ , which serves as the fulcrum for a cam-lever  $c^{10}$ , having at its upper end a cam-slot  $c^{12}$ , into which enters a pin  $c^{13}$  at the inner end of the loop-controller, the latter having its pivot on the same stud or in line with the pivot of the

looper-carrier. The acting end of the loop-controller (see Fig. 13, where the same is shown enlarged) has an angular finger or point 13, and the upwardly-extended arm of the loop-controller is normally kept by a spring  $d^3$  up against a stop or shoulder  $d^4$ , (see Fig. 13,) forming part of the frame C. The upper end of the frame C supports the slotted throat  $d^5$ , having a gimp-hole  $d^6$ , the shank  $d^{70}$  of the throat entering a groove in the block or frame C and being held in adjusted position therein by a suitable set-screw. (See Fig. 4.) The looper  $d$  has a beak 2 and extended backwardly from it a point 3. When the looper is in its normal backward position, as shown in Fig. 12, a loop of needle-thread extending from the cloth is held one half by the thread-controller and the other half by the looper, and the said loop is spread, so that as the needle next descends over the edge to form a loop said needle will pass through the said spread loop, and as the looper starts forward to the right in Fig. 12 it will pass through the new loop of needle-thread far enough to enable said loop to pass to the rear of the point 3 and enable the loop previously held spread by it and the loop-controller to pass from the point 3, and as the looper is being moved in the direction stated the said loop-controller is moved slightly to the left, viewing Fig. 12, to thus put it into its loop-entering position. This is done by the action of the lower end of the lever  $c^{10}$  against a stop 4, carried by a plate  $d^{10}$ , connected to the frame C by a screw  $d^{42}$ , (see Fig. 4,) the stop arresting the movement of the lower end of said lever, so that its upper end, having the cam, may travel with the lever  $c^4$ , but at a faster speed, so that the cam part of said lever  $d^{10}$  will move the loop-controller backwardly, or away from the shoulder  $d^4$ ; but as soon as the point 5 of the cam for operating the thread-controller  $d^2$  passes the stud  $c^{13}$  the spring  $d^3$  immediately assumes control of the loop-controller and the stud  $d^{13}$  enters the notch or space 6, the loop-controller going nearly back to the said shoulder  $d^4$ . The loop-controller at the end of the movement stated is left with its point in position to catch one side or half of the loop of needle-thread last entered and then held by the looper, and in this position of the looper the needle, having risen, is again caused to descend; but at this descent it penetrates the material for the depth-stitch. Now as the said looper returns its point 2 enters the loop of needle-thread just made through and below the material, and in its movement it takes the said loop with it through the loop previously made through the cloth and yet held by the shank of the looper and the loop-controller. In this way each depth-stitch loop of needle-thread in the material is spread so that the loop formed near the edge is passed through it, and said depth-loop is in turn drawn through each overedge-loop, thus making an edge pearl-stitch from one thread, it



enveloping the usual cord issuing from the throat. The stitch referred to is the same as will be produced by the machine described in my said application, Serial No. 227,269.

5 The block or frame C has a second adjustable stop 9, against which the lower end of the cam-lever  $c^{10}$  strikes as the lever  $c^4$  is completing its backward movement, the cam-lever in this latter movement causing the loop-  
10 controller to be returned into its normal position against the shoulder  $d^4$  and stand there and aid in holding the depth-stitch loops spread for the descent of the thread through it, as stated of the overedge-loop. The cam gives to  
15 the loop-controller two full strokes to each full stroke of the looper. The lever D, pivoted at  $D^x$ , is slip-jointed to the needle-bar  $D'$ , having at its lower end an eye-pointed needle  $D^2$ . This needle-bar is adapted to be reciprocated  
20 in an oscillating block  $d^{14}$ , having a gear  $A^{37}$ , and the blocks  $A^{37}$  and C are adapted to be oscillated from the main shaft, as provided for in my said application.

The stitch-frame, as shown, is adapted to  
25 slide and also to swing on ways  $e$ , forming part of the clamp-frame B. The under side of the bed part of the clamp-frame near the rear end thereof is provided with a groove  $e'$ , in which slides a block  $e^2$ , entered by a pin  $e^3$ ,  
30 extended from an arm  $e^4$  of a shaft  $e^5$ , supported in a bearing  $e^6$ , carried by the part  $A'$  of the stitch-frame, the said shaft having a second arm  $e^7$ , provided with a pin  $e^8$  to enter a cam-groove  $e^9$  at the under side (see Fig. 10)  
35 of the worm-wheel, or a part moving in unison therewith, this cam and rock-shaft serving to impart in the present instance to the stitch-frame the relative lateral movement necessary between the stitch-frame and the clamp-  
40 frame. It will be understood that the relative movement of the stitch-frame and clamp-frame is derived from the rotating cam device  $A^{20}$ , and the stitch-frame or the clamp-frame may be anchored or restrained from  
45 longitudinal movement, and whichever is moved the stitching devices will work just the same. The relative movement of the stitch-frame and clamp-frame to insure the stitching along the sides of a buttonhole is  
50 effected in this instance of my invention by or through the cam-groove  $f$  (see Figs. 3 and 9) in the upper side of the worm-wheel  $A^{20}$  or a part moving in unison therewith, said cam-groove being entered by a roller or other stud  
55  $f'$ , fixed with relation to and depending from the clamp-frame, the upper end of said stud (see Fig. 3) having a block  $f^2$ , which enters a groove  $f^3$  in the stitch-frame. The resultant  
60 motion derived by the employment of the two cams  $e^9$  and  $f$  insures the stitching along the straight sides and about the round end or eye of a buttonhole; but when stitching about the eye part the needle and looper of the stitch-forming mechanism are partially rotated, as  
65 before stated. The two cams last referred to by or due to their peculiar shape (shown in Figs. 9 and 10) serve, also, when the stitching

is taking place at the small end of the buttonhole to give to the stitch-frame such a position with relation to the clamp-frame as to  
70 insure the formation of two or more bar-stitches extended from depth-stitch to depth-stitch. To do this, the stitch-frame is moved laterally to one side and there held while  
75 these bar-stitches are being made; but to get the bar all the way across from depth-stitch to depth-stitch outside it is necessary to give, and I have given, to the needle-bar an increased  
80 lateral movement, this increase taking place as the pin  $b^5$  comes upon the lower level of the cam  $b^6$ , substantially as in my said application.

The worm-wheel  $A^{20}$  has near its center a cam  $g$ , which acts on a toe  $g'$  at the rear end of a cutter-carrying lever  $g^2$ , pivoted at  $g^3$   
85 and provided with a cutter  $g^4$ , adapted to form a slit by one cut, the said cutter co-operating with a cutter-bed  $g^5$ , attached to the arm  $A^x$ .

The cutter mechanism is carried by the stitch-frame and is substantially the same as  
90 in my patent, No. 349,359.

The clamp-frame carries a work-holding clamp for clamping the material, and in practice the said clamp (but partially shown) is  
95 and may be the same as in my said patent.

To enable the worm-gear to give to the various cams described positive motions with minimum expenditure of power and lost motion, I  
100 have provided a worm  $m$ , fast on the shaft  $m'$ , having suitable bearings in the part  $A'$  of the stitch-frame. This shaft at its outer end has fast on it a disk  $m^2$ , which, as shown best in Figs. 1 and 14, is embraced by a clutch-band  
105  $m^3$ , having its ends outwardly turned to form lips, which enter a recess in an ear  $m^4$  of a lever  $m^5$ , having at its opposite end a pin  $m^6$ , which enters a slot in one end of a lever  $m^7$ , pivoted at  $m^8$ , the said lever having a stud-screw  $m^9$ , which is embraced by the lower end of a rod  
110  $m^{10}$ , said rod at its upper end having a strap, which embraces a circular projection  $m^{12}$  (see Figs. 8 and 11) of a slotted plate or link  $m^{13}$ , having a pin  $m^{14}$  extended from one side and entering a hole  $m^{15}$  (see dotted lines, Fig. 6)  
115 in the inner side of the belt-wheel  $A^{10}$ .

The stitch-frame has extended from it (see Figs. 1 and 4) a boss  $n$ , which is bored through for the reception of part of the rock-shaft  $A^{18}$ , and the outside of this boss is turned true to  
120 receive (see Fig. 8) the hub of a stitch-controlling lever  $n'$ , having at its upper end a circular laterally-projecting hub  $n^2$ , having an elongated slot  $n^3$  to allow it to be swung in the slot  $n^4$  of the link  $m^{13}$ . As the belt-pulley  
125  $A^{10}$  is rotated the link  $m^{13}$  is rotated, and with it the projection  $m^{12}$ , and it will be understood that so long as the center of motion of the belt-wheel is concentric with the center of the hub  $n^2$  just so long there will be no  
130 motion transmitted to the rod  $m^{10}$ , and consequently the lever for imparting movement to the worm will not be actuated and the worm and worm-wheel will remain at rest; but as soon as the center of the hub  $n^2$  is at



all eccentric with relation to the center of rotation of the pulley  $A^{10}$  then the lever  $m^7$  will be reciprocated, the extent of its stroke being in proportion to the extent of eccentricity of the said hub  $n^2$ . It will be understood, when the center of the shaft  $A^4$  is concentric with the center of the hub  $n^2$ , that the pin  $m^{14}$ , carried by the belt-pulley, fast on said shaft, and entering the link  $m^{13}$ , provided with the eccentric  $m^{12}$ , will rotate said eccentric in a circle coincident with the center of rotation of the shaft  $A^4$  and with the center of said hub; but if the lever  $n'$  is moved to place the center of the hub  $n^2$  eccentric with relation to the center of the shaft  $A^4$  then the link  $m^{13}$  will in its rotation with the belt-pulley be slid on the hub  $n^2$ , and said link will be vibrated during its rotation, so that in each complete revolution with the belt-pulley the eccentric carried by the said link will be twice concentric and twice eccentric with relation to the center of the shaft  $A^4$ , and consequently four strokes—two up and two down—will be imparted to the connecting-rod  $m^{10}$ . The lever  $m^5$  is slotted at  $m^{22}$  (see Fig. 14) to embrace the outer end of the worm-shaft, and the said lever has a screw  $m^{23}$  to limit the effective length of said slot. The screw  $m^{23}$  by abutting against the worm-shaft forms a sort of fulcrum, so that as the lever  $m^5$  is moved in the direction of the arrow  $n^5$  the part thereof embracing the lips of the spring-ring  $m^3$  moves the said ring easily freely about the periphery of the said disk  $m^2$ ; but when the direction of movement of said lever is reversed then it, acting on the said lips, forces them together, thus clamping the ring  $m^3$  snugly on the said disk and causing the rotation of the worm-shaft.

This invention is not limited to the particular devices actuated by the link  $m^{10}$  to rotate the worm-shaft intermittingly, and I consider as within the scope of this invention any usual suitable friction or ratchet mechanism. The employment of the worm-wheel as an element of the positive mechanism for actuating the various cams referred to necessitates very rapid short strokes for the worm-gear between needle-thrusts, and hence the employment of the link  $m^{13}$  described, by which it is possible to get four strokes of the link  $m^{10}$  to one rotation of the main shaft or belt-wheel employed to drive said link  $m^{13}$ . The lever  $n'$  has a length-stitch regulator, shown as a screw  $n^7$ , the lower end of which acts on a stitch-block  $n^8$ , (see Fig. 1,) attached to the top of the clamp-frame by a screw  $n^9$  and made adjustable thereon, according to the length of the buttonhole, the said stitch-block having its surface made cam-shaped, so that as the said screw rides on or off the said stitch-block the speed of rotation of the worm-wheel will be varied, this being according to the length of stitch desired for any particular part of the buttonhole or to enable the stitch-frame to be reciprocated at a faster speed, so as not to lose time between the completion of

the stitching of one buttonhole and commencing the stitching of the next buttonhole. This screw  $n^7$  by running on the stitch-block will, it will be obvious, alter the eccentricity of the hub  $n^2$ . After the stitching of the buttonhole the reciprocation of the needle-bar is stopped through the rock-shaft  $A^{18}$ , which disengages the belt-pulley from the main shaft; but the rotation of the belt-wheel continues and through slotted link  $m^{13}$  described keeps up the rotation of the worm-shaft and at an increased speed until the stitch-frame has put the cutting mechanism into or nearly into operative position with relation to the work-holding clamp, when the worm, and with it the worm-wheel, is automatically stopped. The first stoppage is effected by the lever  $o$ , pivoted at  $o'$  on a bridge  $o^2$ , fastened to the part  $A'$  of the stitch-frame, said bridge being extended across over the worm-wheel, (see Fig. 5,) one end, as  $o^3$ , of said lever at such time acting against the screw  $o^4$ , carried by the lever  $n'$ , the other end of the said lever being thereby made to engage with a slide-bar  $o^5$ , (see Fig. 2,) fitted into a guideway in the clamp-frame B, pushing said slide-bar against the usual clamp-closing lever  $o^6$ , the latter arresting the movement of the said slide-bar. The movement of the stitch-frame is, however, enough to turn the lever  $o$  sufficiently to cause it, acting on the screw  $o^4$ , to turn the lever  $n'$  far enough to place the hub  $n^2$  thereof concentric with the center of rotation of the said belt-wheel. The blocks C and D<sup>3</sup>, carrying the needle and looper mechanism, are oscillated in unison. The worm-shaft  $m'$  has fast on it at its end most remote from the clutch a ratchet  $m^{20}$ , which is engaged by a spring-controlled pawl  $m^{21}$ , said pawl preventing reverse or back rotation of the said worm-shaft.

The rock-shaft 30 and the arm 29, having the projection 28 engaging the link 26, jointed to the arms 22<sup>x</sup>, pivoted at 23<sup>x</sup>, and carrying one of the pivoted presser-feet of the work-clamp, are and may be as in my United States Patent No. 349,359, dated September 21, 1886, it being understood that the rock-shaft has two arms 29, one for each of two arms 22<sup>x</sup>, and that one of the arms 29 is acted upon by the cam-lever  $o^6$  when it is desired to cause the arms 29 to be depressed and close the work-clamp on the material.

Referring now to Fig. 18, the shaft  $A^4$  has a gear  $r^{14}$ , which engages a small pinion  $r^{13}$ , suitably supported to rotate about a fixed center, said pinion having projecting from one side of it an eccentric  $r^{15}$ , surrounded by an eccentric-strap  $r^{16}$ , partially broken away in said figure to show the eccentric within it, said eccentric-strap being pivoted at  $r^{17}$  to the needle-bar-actuating lever D.

In addition to the needle-bar and needle-actuating mechanism hereinbefore referred to as common to the machine herein described and that forming the subject of my application, Serial No. 227,269, filed February 11, 1887, there are other features common to the



two which are hereby reserved to that earlier application, among which are the following: the mechanisms for automatically stitching the longitudinal edges and the eye of the buttonhole and for barring the end of the buttonhole, the mechanisms for automatically starting and stopping the stitch-forming means, the mechanism for piling the barring and overedge stitches, the mechanism for effecting the relative movements of the throat-plate and needle for effecting the stitching of the buttonhole, the loop-spreader and its operative adjuncts, and the looper and its operative adjuncts, inasmuch as these devices and the various combinations into which they enter form the subjects of claims in said earlier application.

I claim—

1. In a sewing-machine, the following instrumentalities, viz: a stitch-frame, stitch-forming devices having periodic rotation, a clamp-frame having a work-holding clamp connected to it, a cam device, intermediate connections between said cam and said stitch-forming devices to periodically rotate said stitch-forming devices and to effect the relative change of position of said stitch-frame and clamp-frame, a worm-wheel operatively connected with said cam device, a worm, and devices to automatically operate said worm, substantially as described.

2. In a buttonhole-stitching machine, a stitch-frame, contained stitch-forming devices comprehending a reciprocating eye-pointed needle, and complementary stitch-forming mechanism, each supported at opposite sides of the work-holding clamp and adapted to be turned in unison about coincident centers of motion, and a clamp-frame and attached work-holding-clamp, combined with a worm, a worm-wheel actuated thereby, and devices intermediate said worm-wheel and stitch-forming mechanism to both rotate the said stitch-forming mechanism and to effect the relative change of motion between said stitch-frame and clamp-frame whereby the said stitch-forming mechanism is adapted to stitch the two straight sides and the round eye of a buttonhole, substantially as described.

3. A buttonhole-stitching machine containing the following instrumentalities, viz: stitch-forming devices, carrying-blocks therefor adapted to be turned about a center, supports for said blocks, a cam device, connections between it and the said blocks to turn the same about a center coincident with the longitudinal center of the needle-bar, a worm-wheel operatively connected to said cam device, and a worm to rotate said worm-wheel and cam device, to operate substantially as described.

4. In a sewing-machine, the following instrumentalities, viz: stitch-forming devices having periodic rotation, a cam device and suitable intermediate connecting mechanism between it and said stitch-forming devices for periodically rotating the stitch-forming

devices, a worm-wheel operatively connected with said cam device, a worm to engage said worm-wheel, and devices to rotate said worm intermittently, to operate substantially as described.

5. In a sewing-machine, the following instrumentalities, viz: stitch-forming devices, a cam device and suitable intermediate connecting mechanism between it and said stitch-forming devices for turning the latter, a worm-wheel operatively connected with said cam device, a worm to engage said worm-wheel, a friction-clutch, and devices to actuate it to effect the movement of said worm, substantially as described.

6. In a sewing-machine, the following instrumentalities, viz: stitch-forming devices, a cam device and suitable intermediate connecting mechanism between it and said stitch-forming devices for turning the latter, a worm-wheel operatively connected with said cam device, a worm to engage said worm-wheel, a friction-clutch, and worm-actuating devices having as operative elements thereof a link having a circular projection and a rod having a strap to embrace said projection, the said link and rod imparting two movements to the said worm for each rotation of the pulley carrying said link, a shaft, suitable devices set in motion thereby to actuate said stitch-forming devices to make stitches, and a belt-wheel to rotate said shaft, substantially as described.

7. In a sewing-machine for buttonhole-stitching, the following instrumentalities, viz: stitch-forming devices, oscillating blocks to support said stitch-forming devices, a cam device and suitable intermediate mechanism for turning said blocks and stitch-forming devices during the operation of stitching the round part of the eye of a buttonhole, a worm-wheel connected to said cam device, a worm engaging said worm-wheel, a length or spacing stitch lever having a circular hub provided with a slot, a slotted link pivotally connected to said belt-wheel and provided with a circular projection or rim and having its slot entered by the hub of said stitch-lever, a connecting-rod actuated by said link, devices between it and the said worm-shaft to actuate it, and means to actuate said slide-lever, whereby by change of position of the hub with relation to the center of rotation of said belt-pulley more or less throw may be given to the said worm and worm-wheel at each rotation of the said link, substantially as described.

8. In a sewing-machine, the following instrumentalities, viz: stitch-forming mechanism, a work-clamp, and actuating devices co-operating therewith and including two cams to effect a combined longitudinal and lateral movement between said stitch-forming mechanism and work-clamp in the stitching of an eyed buttonhole, combined with a worm-wheel operatively connected with said actuating devices, a worm to engage said worm-



wheel, and devices to rotate said worm, substantially as described.

9. In a sewing-machine for cutting and stitching buttonholes, the following instrumentalities, viz: a stitch-frame, a cutting mechanism, a work-holding clamp, a series of cams for changing the relative positions of said stitch-frame, cutting mechanism, and the said clamp-frame and a cam for causing the said cutting mechanism to cut the material held in said work-holding clamp, a worm-wheel, a worm, and actuating devices for the latter, whereby the said worm is made to actuate said cams, substantially as described.

10. In an overedge-stitching mechanism, a needle, a looper having a beak and a point, a throat-plate, and a loop-controller, combined with a device to actuate said looper and a cam device to actuate said loop-controller, whereby the loop taken by the part of the looper at one descent of the needle is held spread by said part and said loop-controller while another loop is put through it, the beak of the looper entering this second loop and

drawing it below the material, said second loop during the reverse movement of the looper to engage by its point a third loop of needle-thread being engaged by the loop-controller to prevent the point of the looper again catching the loop then on it and previously entered by the beak of the looper, substantially as described.

11. The driving-wheel, the worm-wheel, the worm-shaft, its worms, clutch mechanism on the worm-shaft, the link pivoted on the driving-pulley and having a slotted hub  $m^{12}$ , and the link  $m^{10}$  for actuating the said clutch mechanism, combined with the stitch-regulating lever having a slotted hub and devices to automatically turn said lever, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN REECE.

Witnesses:

GEO. W. GREGORY,  
FRANCES NOBLE.