

No. 679,184.

Patented July 23, 1901.

F. W. OSTROM.
BUTTONHOLE SEWING MACHINE.

(No Model.)

(Application filed Nov. 18, 1899.)

6 Sheets—Sheet 2.

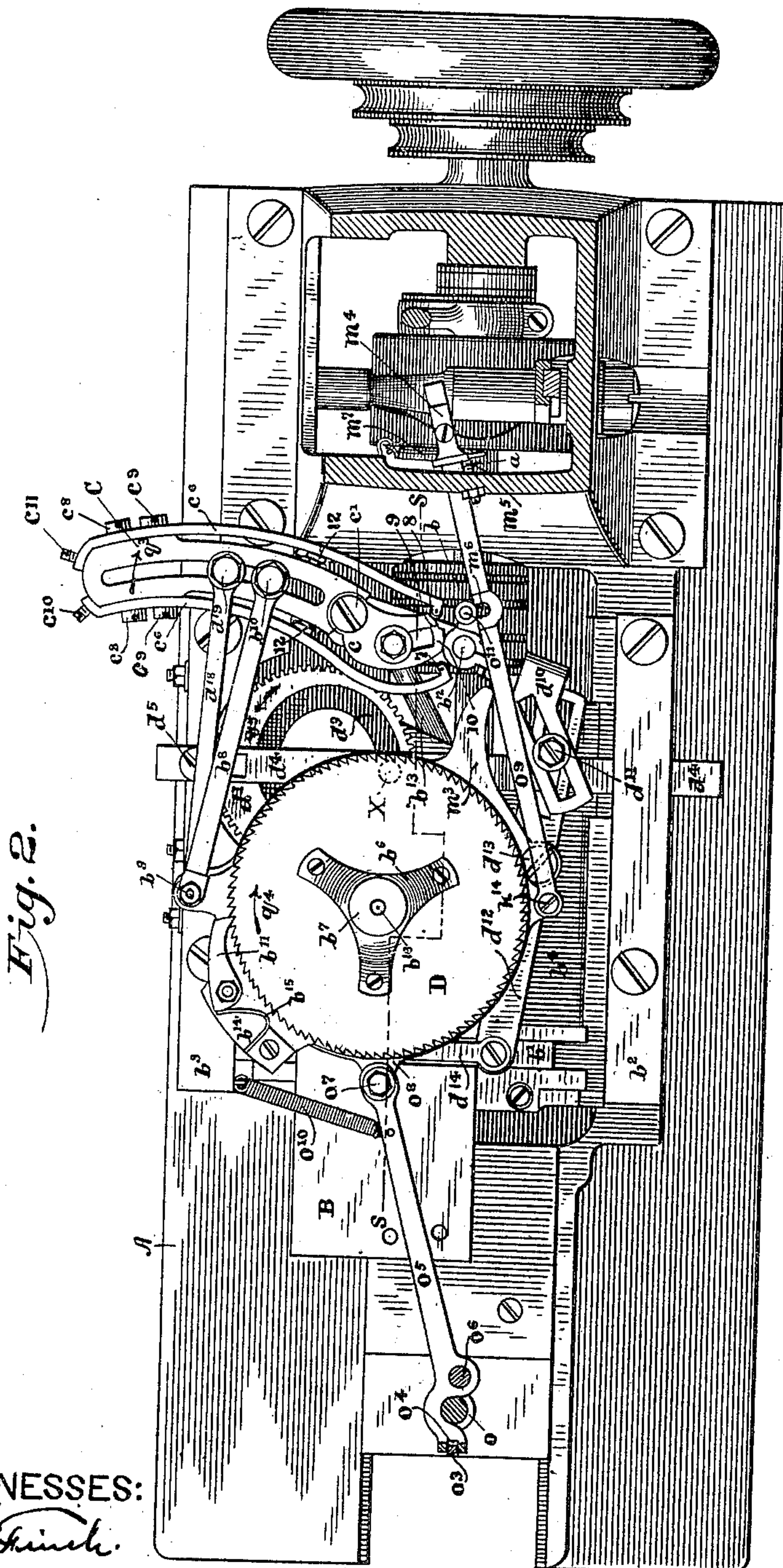


Fig. 2.

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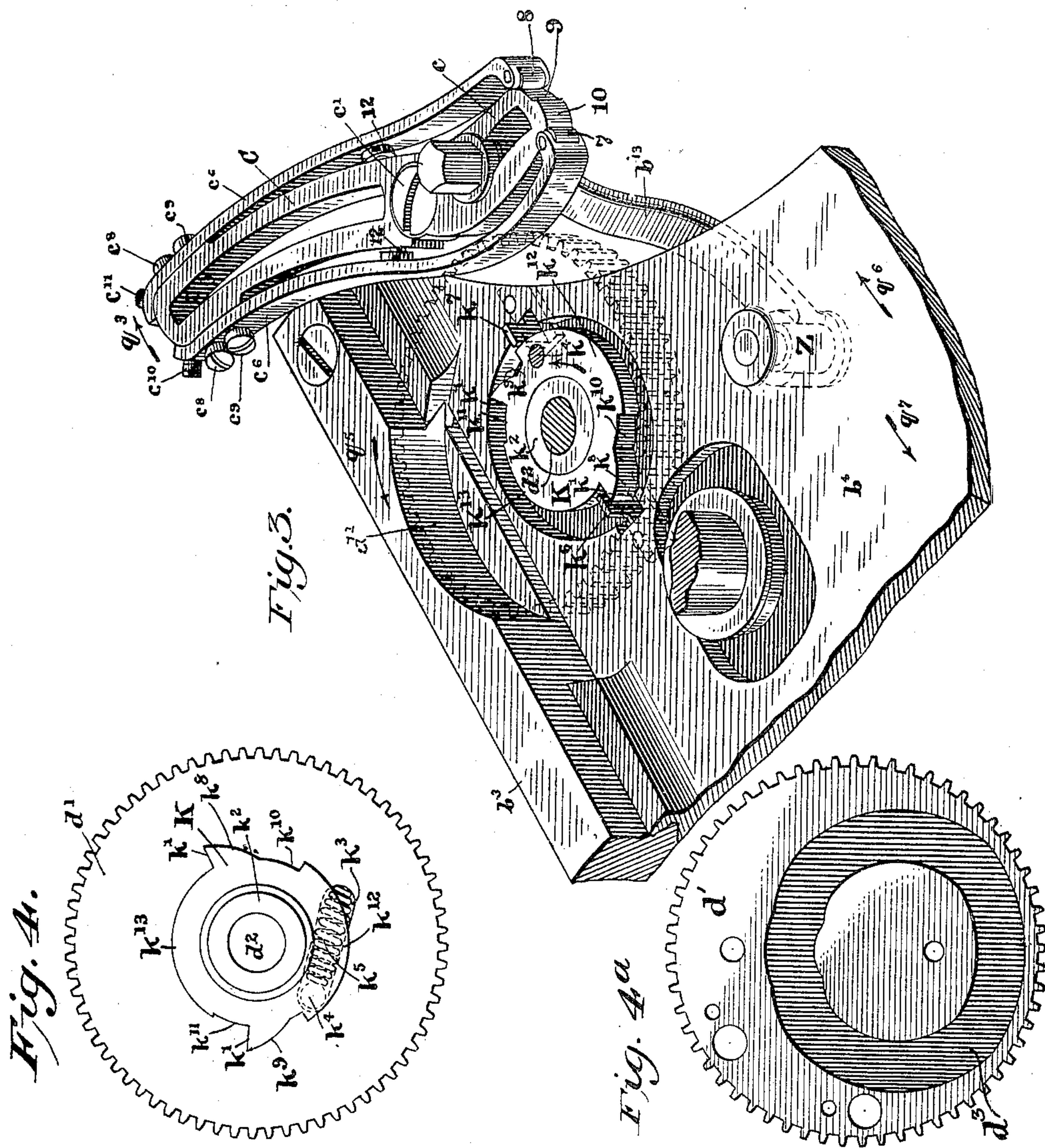
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6 Sheets—Sheet 3.



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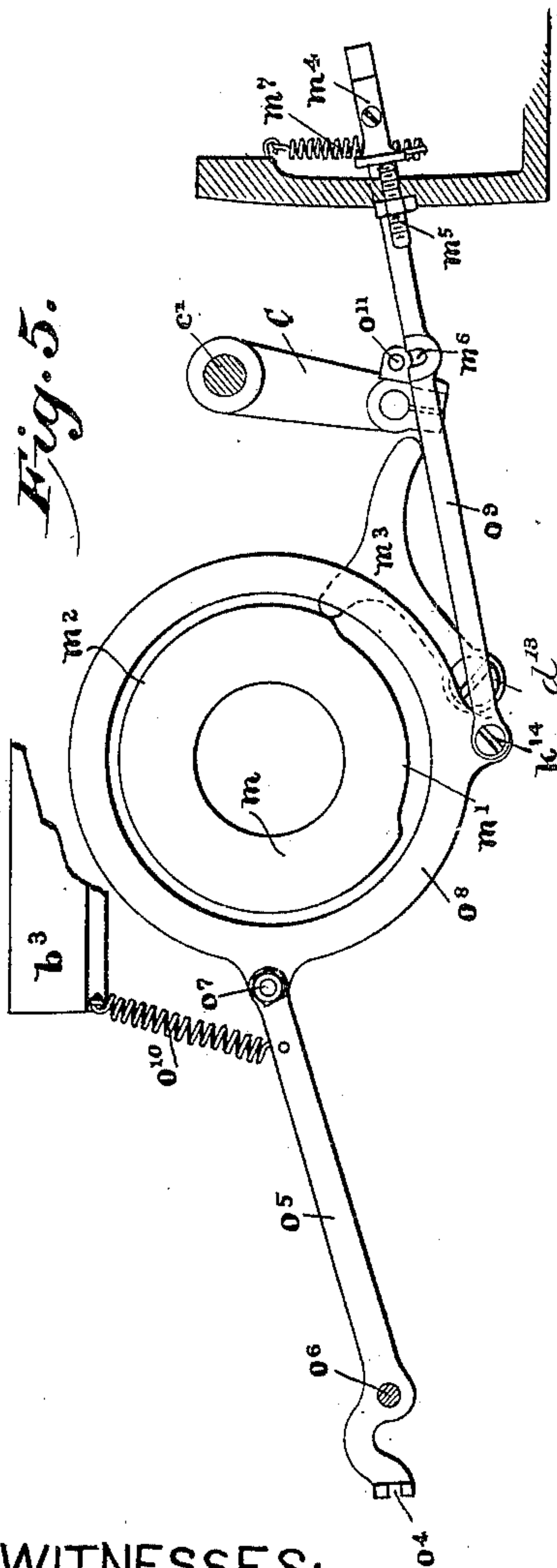
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Fig. 5.



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Fig. 7.

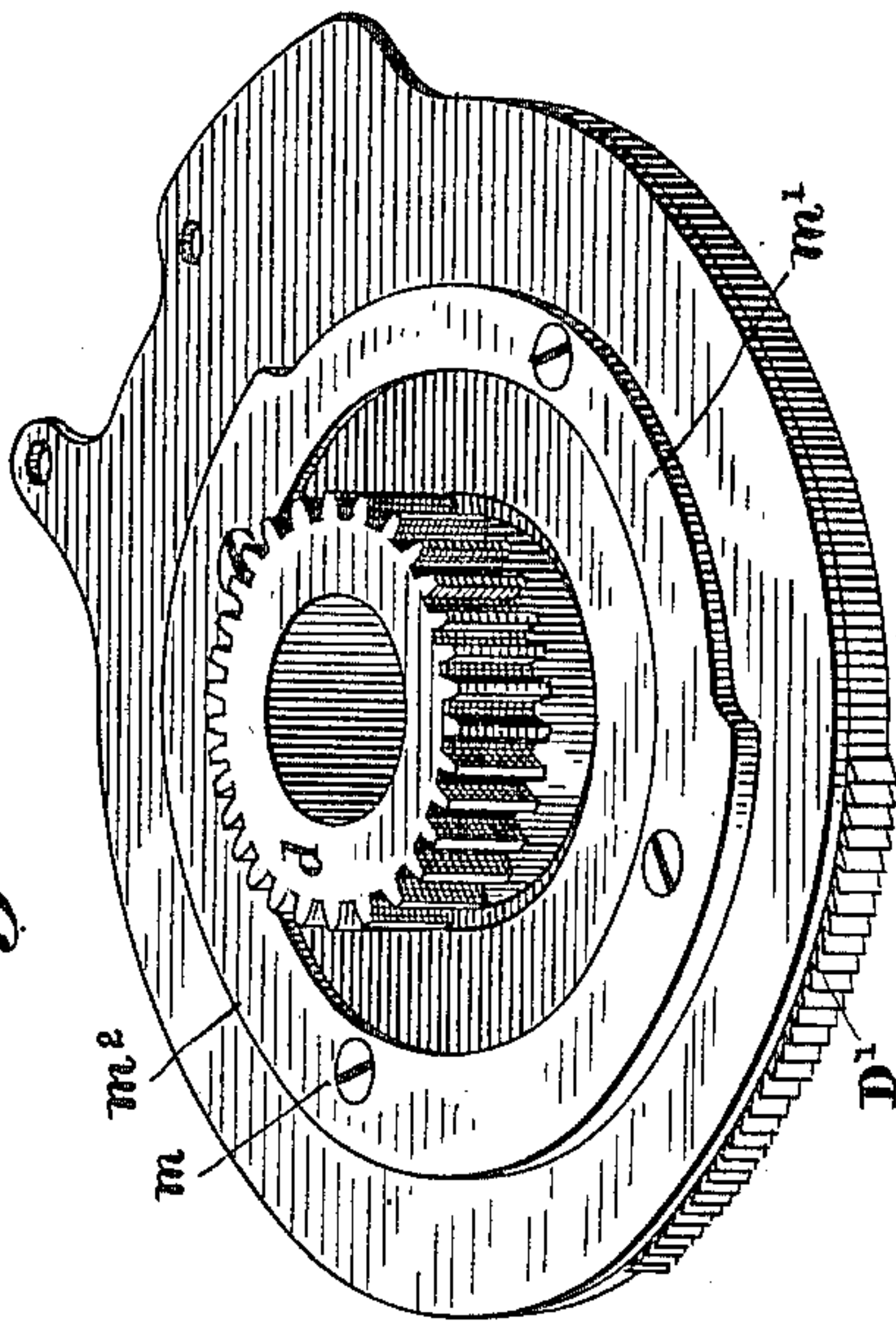
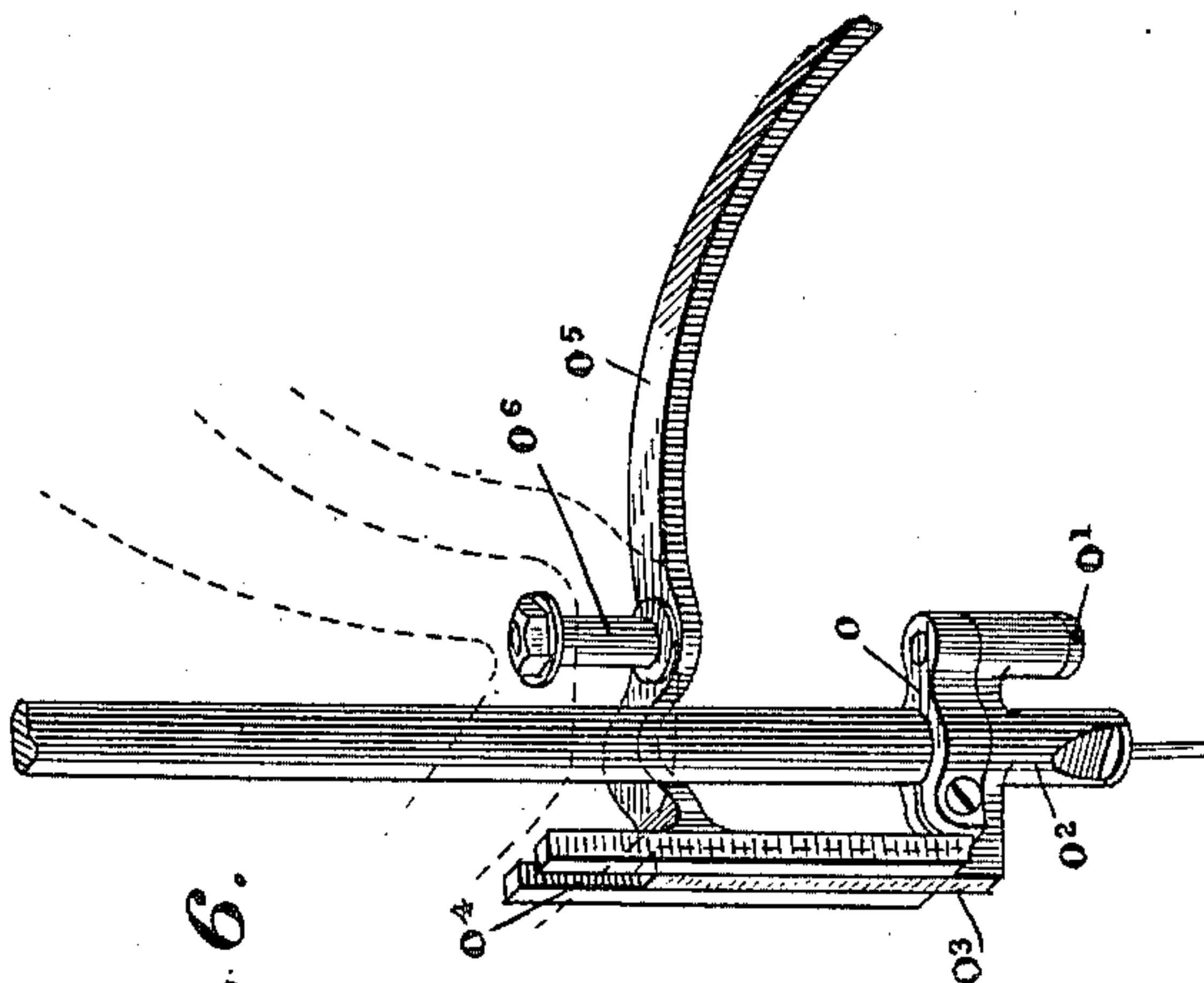


Fig. 6.



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6 Sheets—Sheet 5.

Fig. 10.

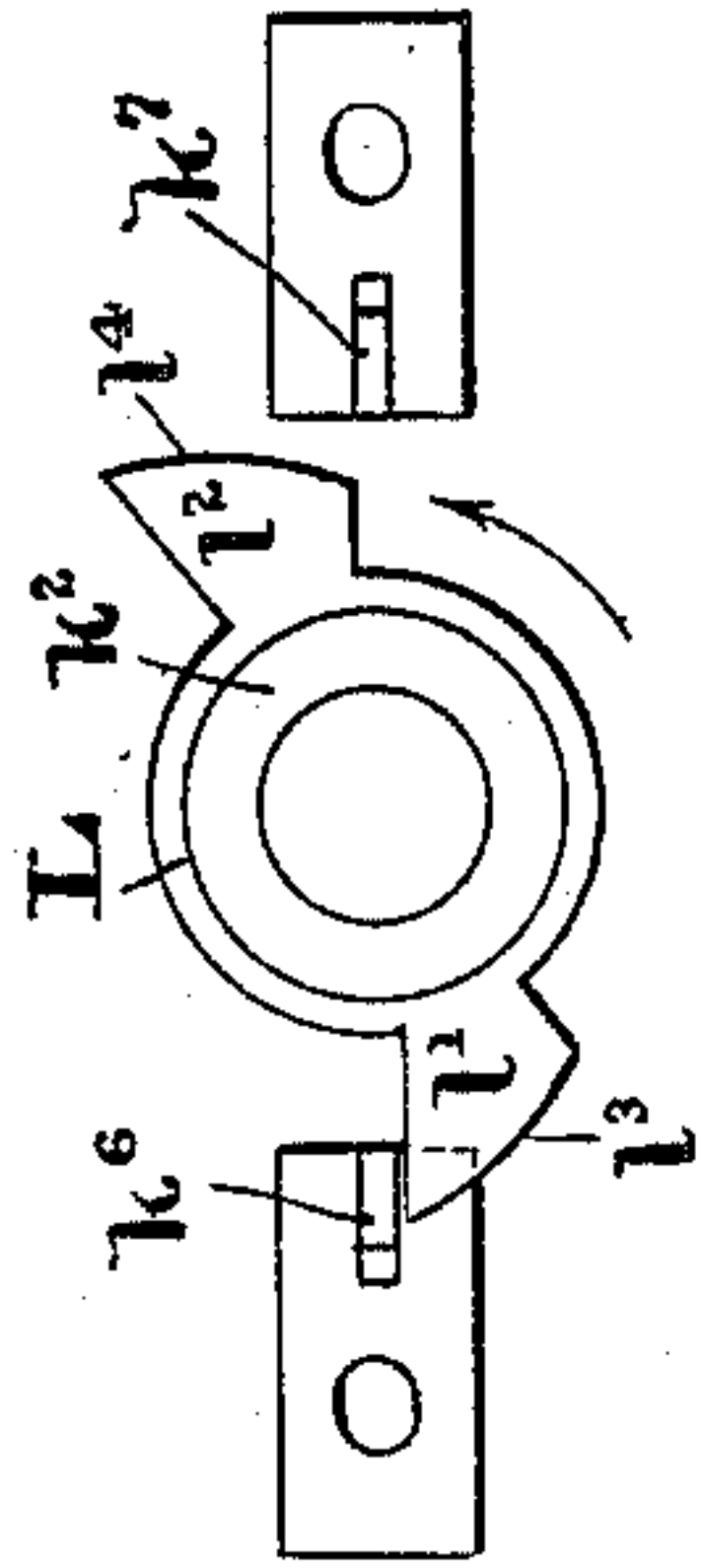


Fig. 9.

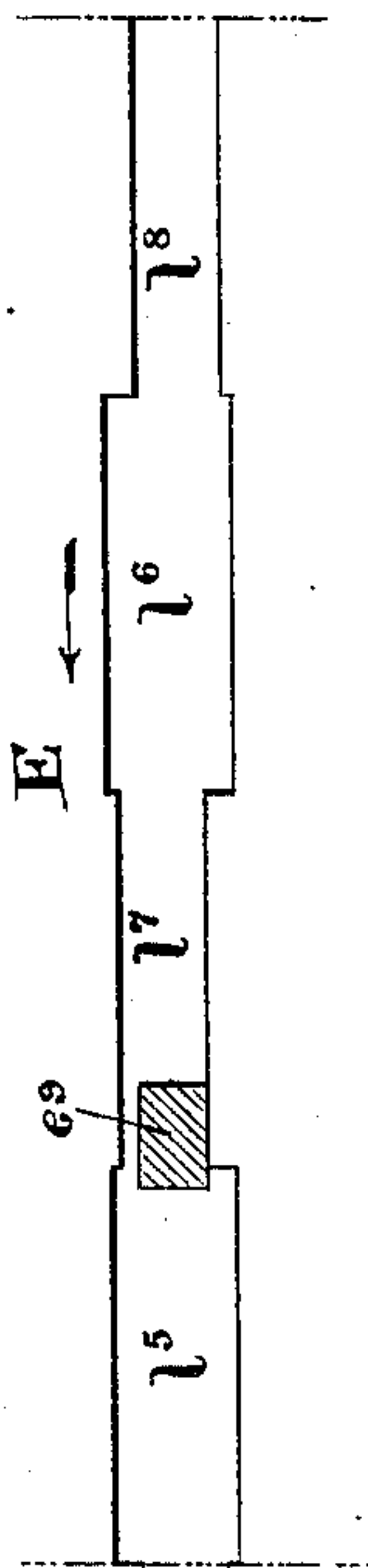
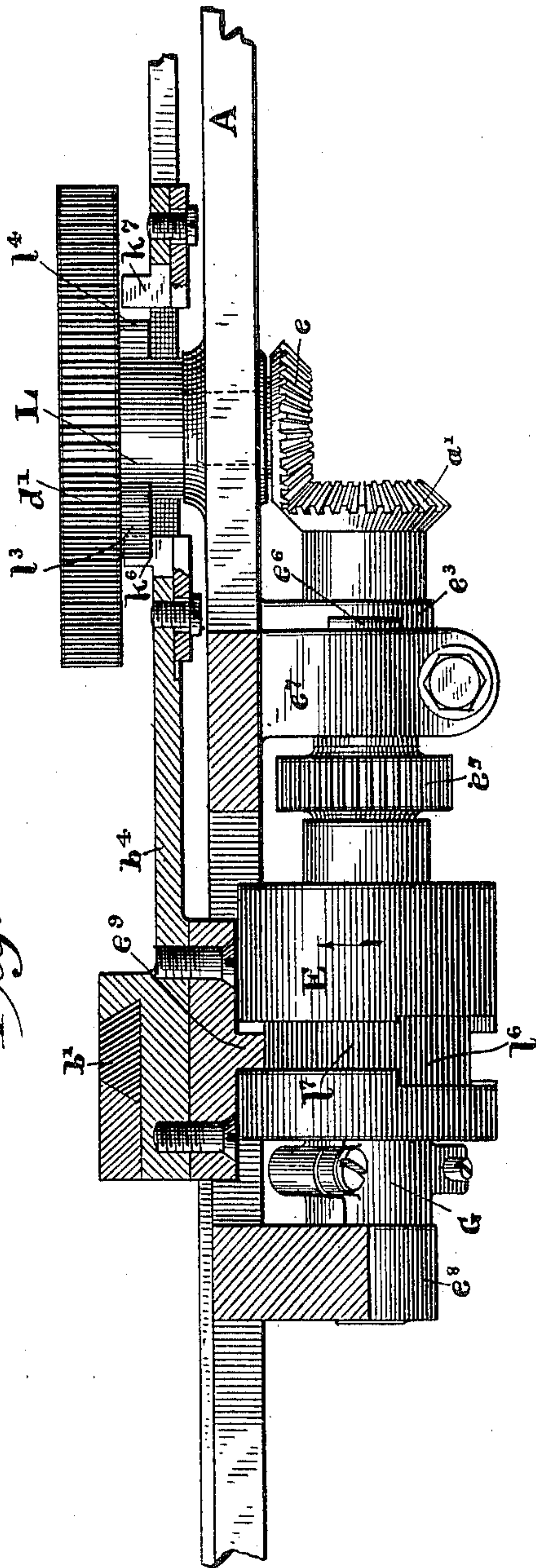


Fig. 8.



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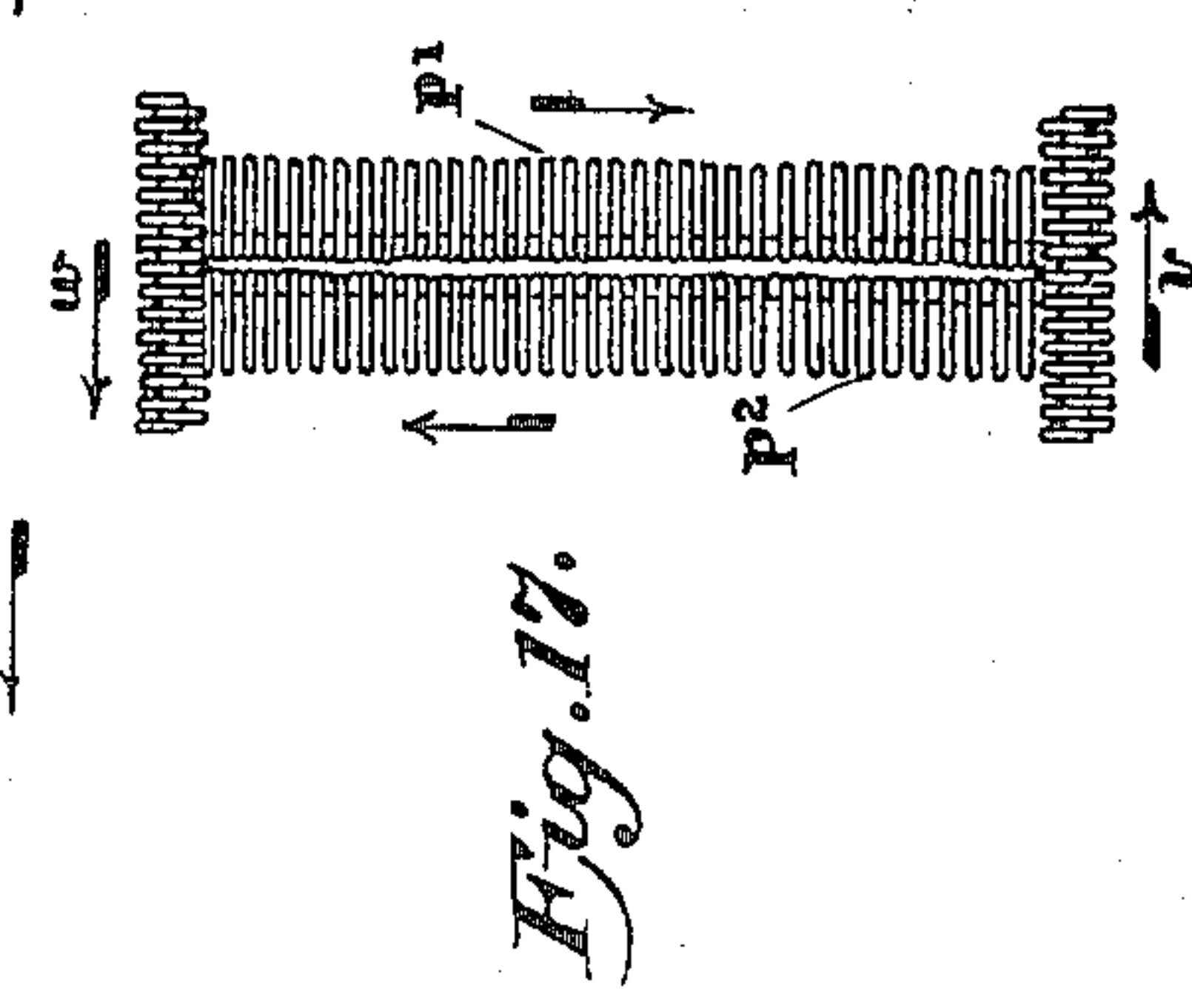
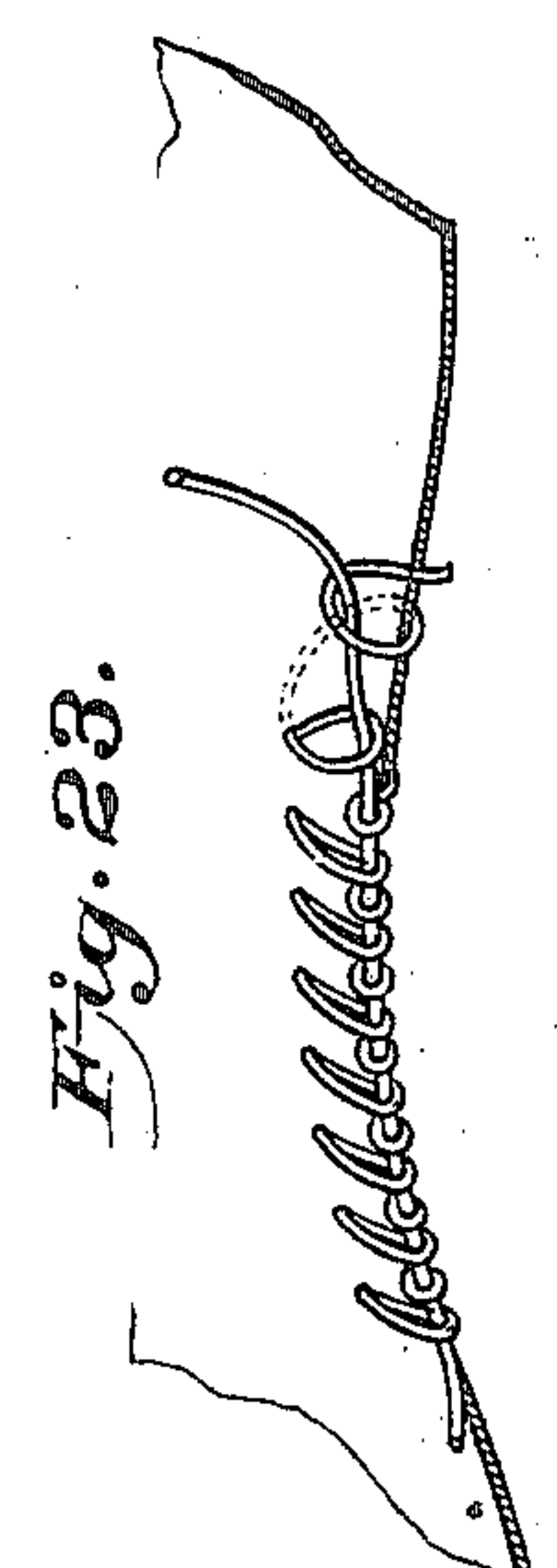
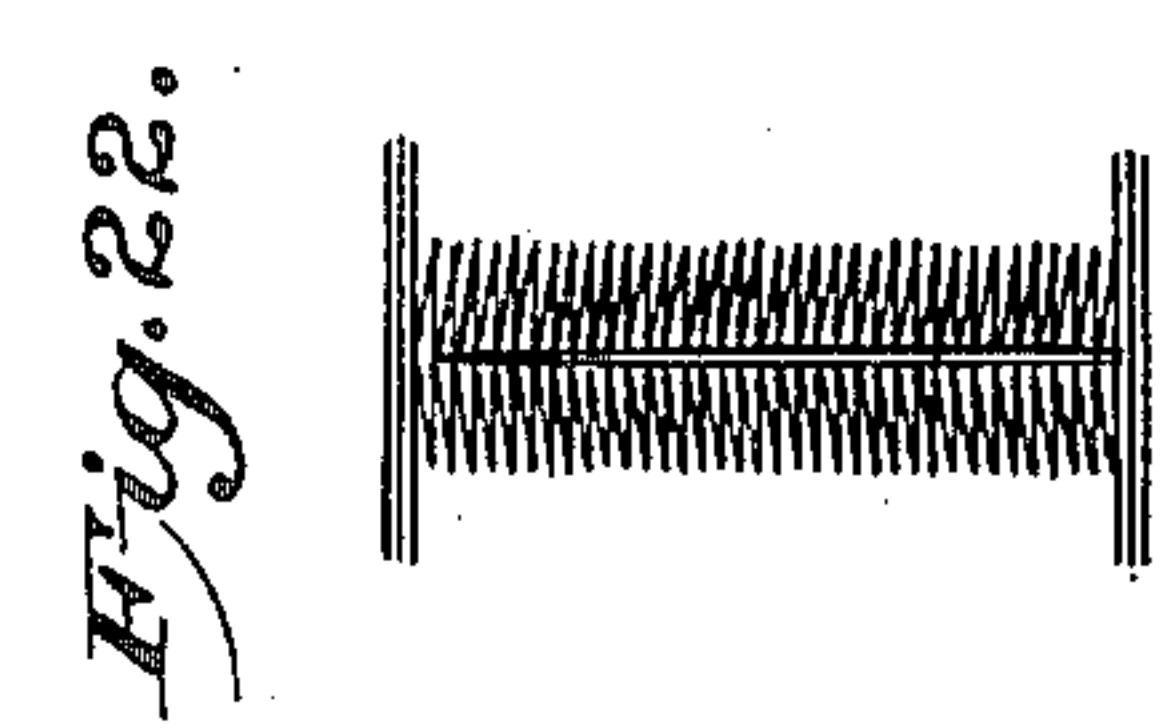
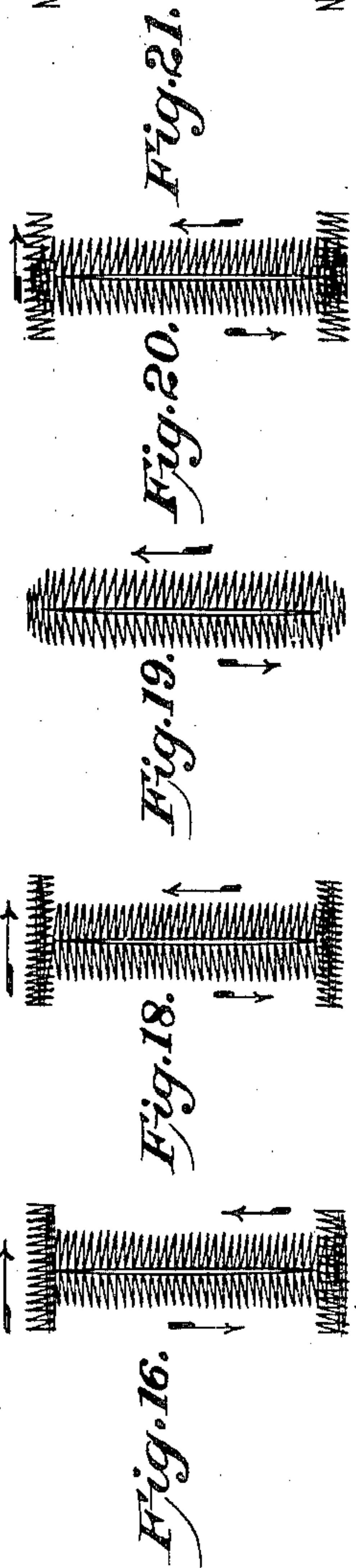
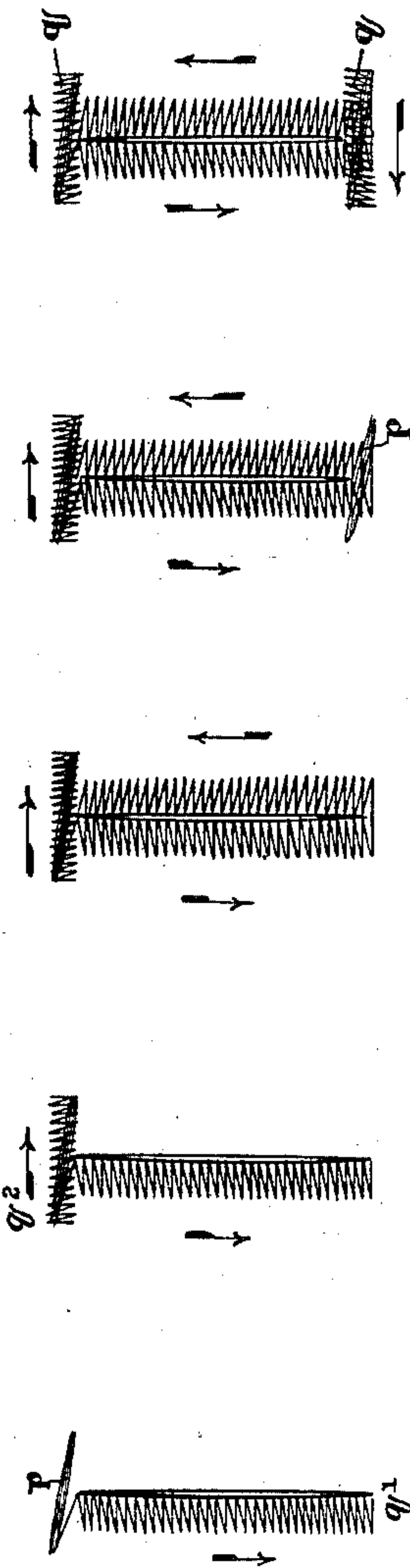
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Fig. 11. Fig. 12. Fig. 13. Fig. 14. Fig. 15.



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UNITED STATES PATENT OFFICE.

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BUTTONHOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 679,184, dated July 23, 1901.

Application filed November 18, 1899. Serial No. 737,517. (No model.)

To all whom it may concern:

Be it known that I, FREELAND W. OSTROM, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Buttonhole-Sewing Machines, of which the following is a full, clear, and exact description.

My invention relates to improvements in buttonhole-sewing machines, and has for its object the automatic overseaming of buttonholes having substantially like barred ends.

Broadly stated, the invention embraces, first, the barring of each end of the buttonhole with bar-stitches placed substantially at right angles or at an oblique angle to the buttonhole-slit, and, second, overseaming such bar-stitches with bar-binding stitches laid substantially at right angles to the side overseam-stitches.

Manufacturers of cotton, linen, and knitted garments employ generally one of three methods for the barring of the ends of what are commercially known as "straight buttonholes." These methods consist of, first, bar-stitches in length substantially the distance from edge to depth stitch of the side overseam-stitch and laid at or substantially at right angles to the buttonhole-slit, but distributed by the feed of the material in a somewhat semicircular form around the end of the buttonhole, and such production is commercially termed "round bar-end buttonhole." The term "round bar-end buttonhole" as here employed has no reference to the machine-overseamed buttonholes commonly termed "eyelet end," which latter form of hole is more commonly employed in the manufacture of outer garments, such as cloaks, coats, shoes, &c. The second method of barring consists of bar-stitches laid substantially in a transverse line relatively to the buttonhole-slit and equal to or somewhat longer than the distance from depth to depth stitch comprising the two sides of overseaming, and this method of barring produces what is termed "square bar-end buttonholes." The third method consists of over-stitches laid at or substantially at right angles to the side overseam-stitches, and this produces what is termed "overstitched bar-

end buttonholes," and this latter method of barring is desirable, owing to its hand-finished appearance; but the strength of the bar is not sufficient to properly protect the material from tearing in the line of the buttonhole-slit, and owing to this principally the first and second mentioned methods are more generally employed. All of these methods of barring will be more fully described herein-after. In addition to these methods of buttonhole-barring many of the manufacturers of superior and extensively-advertised brands of collars, cuffs, and shirts overseam the two sides of the buttonhole with some one of the well-known buttonhole-overseaming machines and afterward hand-bar their opposite ends in a manner substantially as is automatically accomplished by my present invention, with the exception that the hand production is liable to imperfect finish, owing to the failure of the hand-operated needle to pierce all of the plies comprising the material buttonholed, leaving one or more of the under or inner plies improperly barred. It is customary also for extensive manufacturers to employ for their special grades some one of the well-known automatic buttonhole-sewing machines for the overseaming of straight buttonholes in connection with a machine commercially known as a "barring-machine." This latter machine is employed to rebar the ends of the buttonhole first with long bar-stitches equal in length to or a trifle longer than the distance from depth to depth stitch of the stitches comprising the two sides of binding, then overseaming such long bar-stitches by overstitches laid at substantially right angles to the long bar-stitches, and while this latter machine is incapable of overseaming a buttonhole (its primary purpose relegating it to an entirely different art) its application to the barring of the two ends of a buttonhole gives to the production an appearance substantially of hand finish, making the combined use of such barring and buttonhole-sewing machines desirable as to finish, but materially increasing the cost of production, and, moreover, to insure uniformity of work extreme care is demanded on the part of the operator when reclamping the material under the needle for the barring of

first one end and then its opposite end, such method necessitating a loose end of needle and bobbin thread at each end of each bar, making liable the raveling of the bar-binding stitches to an extent detrimental both to the durability and to the finish of the production.

It is the principal object of my invention to combine in one automatic construction advantages superior to the durability and finish derived from the employment of the two independently-operated devices just referred to, and I believe myself to be the first to introduce into the art of machine buttonhole-overseaming a machine which gives to the production a perfection of finish and degree of durability equal to if not exceeding the durability and finish of hand production.

Important to my invention is the automatic overseaming and barring of buttonholes having overstitched bar-stitches by a combination of mechanism which permits the necessary relative action of stitch-forming mechanism and cloth-holding clamp without in any manner disconnecting or reconnecting any of the parts comprised in the cloth-actuating mechanism. The overseaming of the two sides and the barring of the two ends of a buttonhole having overstitched bar-stitches require that both the material and needle shall at some stage in the cycle of feed movement of the material partake of vibratory movements. During a portion of the overseaming of the buttonhole the needle must move continuously in a fixed vertical line, as in ordinary sewing-machines, and at other times the needle must move alternately in one and the other of two vertical lines, as in the common form of zigzag sewing-machines. The mechanism for controlling the movements of the material must be capable of feeding the material in opposite directions lengthwise of the buttonhole and in opposite directions at right angles to such feed movements and capable of vibrating the material in connection with one or the other of its feed movements. Giving to the cloth-holding clamp its feeding and vibratory movements without disconnecting and reconnecting any of its controlling elements of construction insures that practical accuracy of feed alinement and positive locating of the overseam-stitches so essential to a uniform and satisfactory production.

In carrying out my invention I control the movements of the material as to time, extent, duration, and direction by the employment of a yieldingly-vibrated cloth-holding clamp controlled as to the above movements by interposing between the clamp and yielding vibrator a suitable controller-cam, which co-operates with the yieldingly-vibrated clamp to direct the material through the cycle of feed movements necessary for the overseaming of the two sides and the barring of the two ends of the buttonhole without the material deviating from its predetermined line of feed movements and effect the necessary

changes in the cycle of feed movements during substantially a half-revolution of the main shaft or while the needle is out of the material in the formation of one lock-stitch, thus preventing the misplacing of such overseam-stitches as are formed coincidently with the changes in the feed movements of the material, as is the result if the changes in feed movements occupy more time than is necessary for the movements of the needle, as above stated.

The machine-overseaming of buttonholes having barred ends consisting of overstitched bar-stitches calls for a novel and peculiar form of construction and mode of operation to insure that all of such bar-stitches shall be bound under their subsequent over stitches. To insure such result, I have so arranged the relative action of cloth-holding clamp and needle movement that the bar-stitches may be laid at an oblique angle relatively to the length of the buttonhole, and such angle is governed by the length of vibratory movement given the needle while over stitching the bar-stitches.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a front side elevation. Fig. 2 is a plan view of the sewing-machine frame and parts carried by it, including a sectional view of the overhanging arm in the line *tt*, Fig. 1, and the needle-controlling mechanism in the line *yy*, Fig. 1; Fig. 3, a detail in perspective, showing in full lines and mounted underneath the feed-cam the controller-cam for controlling the movements of the cloth-clamp transverse to its lengthwise feed movements, the cam-groove for controlling the feed of the material lengthwise of the buttonhole being omitted in the feed-cam to better illustrate the relative action of the feed-cam and the controller-cam and the followers carried by the slide-frame, the slide-frame shown in section and operatively connected to the vibrating lever for giving to the cloth-clamp its vibratory movements transverse to its lengthwise feed movements; Fig. 4, an under side view of the feed-cam and the controller-cam, illustrating the interposing of a spring to permit yield between the two cams. Fig. 4^a is a plan view of the feed-cam. Fig. 5 is a plan view of the needle-vibrating mechanism. Fig. 6 is a perspective view of the needle-holder and part of its actuating and controlling mechanism. Fig. 7 is a perspective view of the needle-vibrating cam-ring. Fig. 8 is a sectional view in elevation on lines *ss*, Fig. 2, illustrating a modified construction for effecting the vibratory movements of the cloth-clamp and the feed movements of the clamp transverse to its lengthwise feed movements; Fig. 9, a development of the cam, Fig. 8, mounted beneath the bed-plate for controlling the vibratory movements of the feed-clamp, including that portion of its cam-follower that traverses the cam-groove; Fig. 10, a detail of the transverse

feed-cam, Fig. 8, for controlling the feed of the cloth-clamp transverse to its lengthwise feed movement. Figs. 11, 12, 13, 14, 15, 16, and 17 show the overseaming of the two sides and the barring of the opposite ends of a buttonhole as accomplished by the herein illustrated and described invention. Figs. 18, 19, 20, 21, and 22 illustrate the methods of overseaming and barring buttonholes previously referred to and commonly practiced. Fig. 23 illustrates the laying of the purl-stitch adjacent to the cut edge of the material.

Referring to Figs. 1, 2, 3, 4, and 7, the bed-plate A, the main driving-shaft a , the cloth-clamp B, (shown in elevation in Fig. 1 and in partial plan view in Fig. 2,) the switch-cam b , the cross-slide b' , to which the cloth-clamp B is attached, the stationary guideway b^2 and the adjustable guideway b^3 for the cloth-clamp slide-frame b^4 , the latter provided with followers, to be hereinafter described, the ratchet-wheel friction-spring b^6 and its adjusting-nut b^7 , the feed-links b^8 and d^{18} and their connections b^9 , b^{10} , and d^{19} , the pawls b^{11} and d^{16} , (the latter not shown,) the switch-cam follower b^{12} , the connecting-link b^{13} for connecting the slide-frame b^4 with the auxiliary vibrating lever c , the feed-ring b^{14} , the pawl-springs b^{15} and d^{17} , (the latter not shown,) the ratchet-wheel stud b^{16} , the vibrating lever C, the auxiliary vibrating lever c , the vibrating lever-stud c' , the vibrating lever-springs c^6 c^6 and their screws c^8 c^8 , c^9 c^9 , and c^{10} c^{11} , the ratchet-wheels D and D', the gear-pinion d , secured to the ratchet-wheel D', the feed-cam d' with its groove d^3 and its spindle d^2 , the slide-bar d^4 and its screw d^5 , the pivoted lever d^{10} with its shaft d^9 , the adjusting-stud d^{11} for controlling the extent of the feed of the material lengthwise of the buttonhole, the feed-lever d^{12} and its pivot-screw d^{13} , the link d^{14} for connecting the feed-lever d^{12} with the cross-slide b' , the screw X for the feed-cam roller, the point Z at which the connecting-link b^{13} is attached to the slide-frame b^4 , the eccentric surfaces 9 and 10 of the auxiliary vibrating lever c , the vibrating-lever spring-rolls 7 and 8, and the adjusting-screws 12 12 are in construction and operation substantially the same as the like-designated parts illustrated and described in my United States Patent No. 626,189, with the exception that the bed-plate A, Fig. 1, is not provided on its under side with the bearings e^3 , e^7 , and e^8 , as is illustrated in Fig. 3 of said patent, and the feed-cam d' is provided on its under side with a spring-pocket, (see Fig. 4,) which changes in construction will be fully explained hereinafter.

Before enumerating and pointing out the construction and functions of the parts employed in connection with the parts previously referred to as common to both my present construction and the construction illustrated and described in said Patent No. 626,189 to show their operative combinations for effecting the results claimed I will ex-

plain certain details of control common to both constructions. In both constructions there is employed what is termed a "multiple feed" for controlling the number of over-edge overseam-stitches independent of the number of bar-stitches, and while such manner of control is important for a superior production it in no way affects the present invention except in so far as such construction is demanded to give movement to the cloth-feeding clamp, and might consist of a single ratchet-and-pawl feed without in any way affecting my present invention, and likewise as to the means employed for yieldingly vibrating the cloth-holding clamp some other detail of construction might answer equally well, provided the cam-followers acting in conjunction with the transverse feed and controller cam were mounted upon some part of the clamp-actuating mechanism which is yieldingly vibrated.

The feed-cam d' is constructed with a cam-shaft d^2 , Figs. 3 and 4, which passes through a suitable bearing in the machine bed-plate A, and at its lower end it is provided with a collar k (see Fig. 1) to hold said feed-cam d' and its shaft d^2 against vertical movement. The bearing for the feed-cam shaft d' consists of a bushing k^2 , (see Figs. 3 and 4,) secured in the machine bed-plate A, and such bushing k^2 is extended above the bed-plate sufficiently to act as a fulcrum for the controller-cam K. (See Fig. 3.)

The under side of the feed-cam d' is provided with a spring-pocket k^3 and the upper side of the controller-cam K with a stud k^4 , which when the cams d' and K are in their operative positions enters one end of the spring-pocket k^3 and is acted upon by the spring k^5 to hold the controller-cam in registered position relatively to the cam-groove d^3 in the feed-cam d' . From this it will be understood that the feed-cam d' through the spring k^5 rotates the controller-cam synchronously with its own rotation unless the controller-cam meets with resistance sufficient to overcome the power exerted by the spring k^5 , which is likely to occur through the extended walls $k' k'$ of the controller-cam coming in contact with one or the other of the cam-followers $k^6 k^7$, carried by the slide-frame b^4 , as will be more fully explained.

Referring to Fig. 3, the cam-groove d^3 in the feed-cam d' , as previously stated, is omitted, as is also the spring k^5 , (see Fig. 4,) to more clearly demonstrate the control of the material in its cycle of feed movements. Referring to the last-named views, the cam K is provided with inclines $k^8 k^9$ for giving to the material its feed movements transverse to its lengthwise feed movements, as is indicated by the arrows $w v$, Fig. 17, so as to permit the hereinafter-described vibration of the needle to overstretch the long barring-stitches p (see Figs. 11 and 14) previously made with the short overseam-stitches q , Fig. 15, laid substantially at right angles to the side over-

stitches. The concentric portions k^{10} k^{11} of the cam K control the extent of vibration of the material for the placing of the long barring-stitches p , Figs. 11 and 14, and the concentric portions k^{12} k^{13} control the extent of the vibration of the material for the placing of the side overseam-stitches p' p^2 , Fig. 17, and also the two sides of overseaming relative to the buttonhole-slit.

From the foregoing it will be understood that the cloth-holding clamp B is given its vibratory movements through the vibrating lever C; its springs c^6 c^6 , auxiliary vibrating lever c , connection b^{13} , and slide-frame b^4 , and that the extent of such vibratory movements is controlled by the followers k^6 k^7 , carried by the slide-frame b^4 , successively contacting with the concentric portions k^{10} k^{11} and k^{12} k^{13} , and that the material is given its feed movements transverse to its lengthwise feed movements by the followers k^6 k^7 , riding the inclines k^8 k^9 of the cam K, and that the material is given its feed movements lengthwise of the buttonhole through the actuating of the connections d^4 d^{10} d^{12} b' and the cloth-holding clamp by the heart-shaped cam-groove d^3 (see Fig. 4^a) in the feed-cam d' . To control the two sides of overseaming relative to the buttonhole-slit, the concentric portions k^{12} and k^{13} of the cam K are of different radii, and such differences are determined by the length of side overseam-stitch required and are substantially equal to the distance required from edge to depth stitch.

Having described the control of the material under the needle, I will now proceed to describe the control of the needle relative to the movements of the material.

As will be understood from the foregoing, it is necessary that the needle during a portion of the overseaming of the buttonhole shall move continuously in a fixed vertical line, as in ordinary sewing-machines, and at other times the needle must move alternately in one and the other of two vertical lines, as in the common form of zigzag machines. To accomplish this manner of control, referring to Figs. 1 and 5, the usual needle-carrying bar is provided at its lower end with a collar o , and pivotally attached to said collar by a stud-screw o' is a needle-carrier o^2 , which is constructed with a guiding-tongue o^3 , which works in a groove o^4 in a vibrating lever o^5 , the latter fulcrumed to the overhanging arm of the sewing-machine by the stud-bolt o^6 and its rear end pivotally attached by the stud o^7 to a suitable ring o^8 , mounted on the upper side of the feed-wheel D' and fulcrumed on an extended portion of the feed-wheel D in like manner as the feed-ring b^{14} , and pivotally attached to the ring o^8 by a stud-screw k^{14} is a connection o^9 , the latter provided with a notch m^6 , which at a predetermined time coacts with the pin o^{11} , fast in the vibrating lever C, to give vibratory movements to the parts o^9 o^8 o^2 , and consequently to the needle. The duration of the vibratory movements of the needle is gov-

erned by a cam m , (see Figs. 5 and 7,) fast to the under side of the feed-wheel D' and having two concentric portions m' m^2 , which alternately act upon the lever m^3 , fulcrumed on the stud d^{13} . When the lever m^3 is actuated by the concentric portion m^2 of the cam m , the connection o^9 is held, in opposition to the spring m^7 , out of engagement with the pin o^{11} , permitting the needle to move continuously in a fixed vertical line, and when the lever m^3 is in operative relation to the concentric portion m' of the cam m the spring m^7 is permitted to force the connection o^9 in operative relation to the pin o^{11} , when the needle for a predetermined time is caused to alternately move in one and the other of two vertical lines. The stop m^4 , secured to the rear end of the connection o^9 , in conjunction with the adjustable stud-screw m^5 , acts to properly register the needle relatively to the material during such times as the needle is actuated continuously for a predetermined time in a fixed vertical line, and the needle is held in such registered position by the force exerted by the spring o^{10} , which is secured between the connection o^5 and the adjustable way b^3 .

From the foregoing it will be understood that the cam m controls the movements of the needle for a predetermined time in a fixed vertical line, as when overseaming the two sides of the buttonhole, and permits the needle to be moved alternately for a predetermined time in one and the other of two vertical lines for placing the long bar-stitches and over stitching the same with overstitches laid substantially at right angles to the side overseam-stitches.

Figs. 8, 9, and 10 illustrate a modified construction. Referring to Fig. 8, beneath the bed-plate A is provided the shaft-bearings e^3 , e^7 , and e^8 , miter-gears e and a' , pinion e^5 , which meshes in a pinion carried by an auxiliary shaft mounted in the bearing e^3 , a driving pinch-collar G, mounted upon the pattern-cam shaft e^6 , and a pattern-cam E. Above the bed-plate A is provided the slide-frame b^4 , carrying a follower e^9 , and d' is the feed-cam, all of which parts are constructed and combined to operate in like manner to similarly-designated parts in Patent No. 626,189, with the exception that the pattern-cam E and follower e^9 are of solid construction and not capable of adjustment, as in said patent. Fulcrumed on the bearing k^2 and mounted directly beneath the feed-cam d' is a transverse feed-cam L, constructed with extended portions l' l^2 , having inclines l^3 l^4 , the latter arranged to coact with the followers k^6 k^7 on the slide-frame b^4 for effecting the feed of the material transversely to its lengthwise feed movements in the manner hereinbefore described as governing the transverse feed of the material by the coaction of the inclines k^8 k^9 and followers k^6 k^7 of Fig. 3, and during such time the cam-follower e^9 is being gradually fed across one or the other of the wide portions l^5 l^6 of

the groove encircling the pattern - cam E. During the barring of the buttonhole the cam-follower e^9 is traversing one or the other of the sections $l^5 l^6$ of the pattern-cam groove, and after the follower e^9 has entered one or the other of these sections the cloth-holding clamp is vibrated through the yielding vibrator C to lay the long bar-stitches p . (See Fig. 11.) As soon as the follower e^9 has traversed one or the other of the sections $l^5 l^6$ sufficiently for the placing of the required number of long bar-stitches the inclines $l^3 l^4$ of the transverse feed-cam L coact with the followers $k^6 k^7$ to feed the material under the now vibrated needle for the placing of the bar binding-stitches p^3 . (See Fig. 17.)

From the foregoing it will be understood that during the barring operation the follower e^9 is traversing the wide sections of the pattern-cam groove and that the width of such sections $l^5 l^6$ decides the length of the long bar-stitches p , (see Fig. 11,) and as soon as the required number of long bar-stitches have been placed the transverse feed-cam L feeds the slide-frame b^4 , the cloth-holding clamp B, and consequently the material, transversely to the feed movements lengthwise of the buttonhole, such feed movements causing the follower e^9 to be fed from one to the opposite wall of the wide section of the pattern-cam, and it will be seen, further, that the transverse feed-cam performs no function except to feed the material for the over stitching of the long bar-stitches and that its duration of control must be during such time as the follower e^9 is traversing a portion of the wide portion of the pattern-cam groove. The narrow sections $l^7 l^8$ of the pattern-cam groove are employed to control the overseaming of the two sides of the buttonhole in the same manner as it is accomplished by the coöperation of the cam-follower e^9 and cam-groove sections $h^9 h^{10}$ of the Patent No. 626,189 referred to and as particularly mentioned on page 6, lines 50 to 64.

Figs. 11 to 22, inclusive, illustrate the various methods of barring herein previously referred to. Figs. 11 to 15, inclusive, illustrate the overseaming of the two sides and the barring of the two ends as accomplished by my present invention. Fig. 11 illustrates the overseaming of the first side and the placing of the long barring-stitches at one end of the buttonhole. Fig. 12 illustrates the step of over stitching the long bar-stitches first placed; Fig. 13, the additional overseaming of the second side; Fig. 14, the addition of the long bar-stitches at the finished end of the buttonhole; Fig. 15, the addition of the over stitching of the long bar-stitches last placed and the completion of the cycle of feed movements necessary for the overseaming of the two sides and the barring of the two ends of the buttonhole-slits. Fig. 16 illustrates the long bar-stitches placed at right angles to the buttonhole-slit, and while this might be an admissible method I prefer the placing of

the long bar-stitches obliquely to the buttonhole-slit, as illustrated by Figs. 11 to 15, inclusive, and Fig. 17. Figs. 19, 22, and 21 illustrate, respectively, the first, second, and third old methods of finishing the ends of buttonholes previously referred to. Fig. 20 illustrates the automatic overseaming of a buttonhole, as is illustrated by Fig. 19, and after independently barring its opposite ends by hand or by the employment of one of the numerous and well-known zigzag-sewing machines. Fig. 18 illustrates the automatic overseaming of the two sides and the subsequent independent barring of the two ends by the employment of a barring-machine. Fig. 17 is an enlarged view of a finished buttonhole-slit as accomplished by my present invention. Fig. 23 illustrates the manner of forming the purl-stitch.

Referring to Figs. 1 to 7, the operation of the machine for the automatic overseaming of the two sides and the barring of the opposite ends of a buttonhole, assuming that the overseaming is commenced at q' , Fig. 11, is as follows: As the machine commences to overseam the first or left-hand side of the buttonhole (see Fig. 11) the cam-followers $k^6 k^7$ (see Fig. 3) are commencing to coact with the concentric portions $k^{12} k^{13}$ of the cam K, and during such time as the cam-followers are in operative relation to the concentric portions $k^{12} k^{13}$ of the cam K to control the extent of the vibration of the material the cloth-holding clamp is given its step-by-step feed movements lengthwise of the buttonhole through the cam-groove d^3 in the feed-cam d' , acting upon a cam-roller mounted on a stud-screw carried by the slide-bar d^4 , and other suitable connections, such as set forth in the Patent No. 626,189, previously referred to, and the extent of such step-by-step feed-control for the overseaming of the first or left-hand side corresponds to the control of the vibratory movements of the material by the concentric portions $k^{12} k^{13}$ of the controller-cam K, and during the control of the vibratory and feed movements of the material for the overseaming of the first side of the buttonhole the concentric portion m^2 of the cam m through the lever m^3 (see Figs. 5 and 7) holds the connection o^9 out of engagement with the pin o^{11} , secured in the vibrating lever C, permitting the needle to be moved continuously in a fixed vertical line. At the completion of the overseaming of the first or left-hand side the cam-roller acting in the cam-groove d^3 in the feed-cam d' has passed the eccentric or feed contour of the cam-groove and entered the concentric or dead portion nearest the center of the feed-cam, the followers $k^6 k^7$ having entered the concentric portions $k^{10} k^{11}$ of the cam K, permitting an increased vibration of the material sufficient for the placing of the long bar-stitches and coincident with the cam-roller entering the concentric portion of the feed-cam groove d^3 and the followers $k^6 k^7$ entering

the concentric portions k^{10} k^{11} of the cam K. One arm of the cam m^3 (see Fig. 5) rides the concentric portion m' of the cam m , permitting the connection o^9 to be forced, through the spring m^7 , into operative relation with the pin o^{11} , secured in the vibrating lever C, causing the needle to move alternately for a predetermined time in one and the other of two vertical lines, the effect of which is to place the long bar-stitches at an oblique angle to the length of the buttonhole, as is illustrated at p , Fig. 11. At the completion of the formation of the long bar-stitches the rotation of the cam K may bring the wall k' into contact with the adjacent follower; but the yield of the spring k^5 would prevent any injury to the machine due to the consequent arresting of the rotation of the cam, and this contact is relieved as soon as the movement of the slide-frame shifts the followers. As the followers k^6 k^7 ride the inclines k^8 k^9 , which comprises the next step in the automatic operation, the material is caused to be fed transversely to its lengthwise feed movements and in the direction indicated by the arrow q^2 , Fig. 12, and during such coaction of the followers k^6 k^7 and inclines k^8 k^9 for the transverse feeding of the material the vertical movements of the needle in one and the other of two vertical lines is continued until the completion of the over stitching of the long bar-stitches previously made. (See Fig. 12.) Having completed the overseaming of the first side and the barring of the one end of the buttonhole, the cam-roller enters the second section of the eccentric or feed portion of the feed-cam groove d^3 and the followers k^6 k^7 commence coacting with the concentric portions k^{12} k^{13} of the cam K; but the portion k^{12} , which has the greater radius, coacts with the follower k^6 instead of the follower k^7 , causing the material to be moved under the needle transversely to its lengthwise feed movements, so as to properly present the material to the needle for the overseaming of the second or right-hand side, and coincidentally with the cam-roller entering the eccentric portion of the cam-groove d^3 and the coaction of the followers k^6 k^7 with the concentric portions k^{12} k^{13} the concentric portion m^2 of the cam m acts to force the connection o^9 , through the lever m^3 , (see Fig. 5,) out of engagement with the pin o^{11} , permitting the needle to be moved continuously for a predetermined time in a fixed vertical line, as when operated for the overseaming of the sides of the buttonhole. The second side having been completed, as illustrated by Fig. 13, the cam-roller enters the concentric or dead portion of the cam-groove d^3 farthest from the cam-center, (see Fig. 4^a,) the followers k^6 k^7 again enter the concentric portions k^{10} k^{11} of the cam K, but in changed relation, the follower k^6 coacting with the concentric portion k^{10} instead of the concentric portion k^{11} and the follower k^7 with the con-

centric portion k^{11} instead of the concentric portion k^{10} , as when placing the long bar-stitches at the opposite or first end barred the concentric portion m' of the cam m , permitting the reengagement of the connection o^9 and pin o^{11} for the placing of the oblique long bar-stitches, (see Fig. 14,) followed, as in the barring of the first or opposite end, by a transverse feed of the material for the over stitching of the long bar-stitches, (see Fig. 15,) but in a direction opposite to the transverse feed for over stitching the long bar-stitches placed in the opposite end or end first barred. The completion of the over stitching of the long bar-stitches in the finished end of the buttonhole completes the cycle of feed movements and cycle of overseaming for the production of a buttonhole having the over stitched bar ends of the present invention.

From the foregoing it will be understood that the transverse feed of the material for the over stitching of the long bar-stitches is commenced at the end of the bar farthest from the side last overseamed.

Important to the successful operation of my machine is the means devised for feeding the material for the over stitching of the long bar-stitches. It would be impracticable, if not impossible, for either incline k^8 or k^9 by direct rotation of the cam K to force the slide-frame b^4 through the followers k^6 or k^7 in opposition to the force exerted by either of the vibrator-springs c^6 c^6 , and in the operation of the machine no such labor of the inclines k^8 or k^9 is attempted, as might appear without specifically describing the method of operation for giving to the material its feed movements transverse to its lengthwise feed. Referring to Fig. 2, it is to be seen that a movement of the vibrating lever C in the direction indicated by the arrow q^3 causes one or the other of the feed-pawls, through its operative connection with the vibrating lever C, to rotate the feed-wheels in the direction indicated by the arrow q^4 , and the feed-cam d' in the direction indicated by the arrow q^5 , and the controller-cam K, through the spring k^5 , (see Fig. 4,) in the same direction as the feed-cam d' , and by the same movement of the vibrating lever C, through the vibrating-lever spring c^6 , located at the right of the vibrating lever, the auxiliary vibrating lever c , connection b^{13} , slide-frame b^4 , and consequently the cloth-holding clamp, are caused to move in the direction indicated by the arrow q^7 , (see Fig. 3,) effecting a coaction of the follower k^7 and some one of the walls of the cam K, dependent upon the advanced condition of the over stitching. A movement of the vibrating lever C in a direction opposite to that indicated by the arrow q^3 causes the feed-pawls to be positioned for effecting the feed movement next subsequent and through the vibrating-lever spring c^6 , located at the left of the vibrating lever C, moves the cloth-holding clamp B, slide-frame b^4 , connection b^{13} , and auxiliary vibrating lever c in the

direction indicated by the arrow q^6 , thereby causing the follower k^6 to coact with some one of the opposite walls of the cam K.

Referring to Figs. 3 and 4, it will be understood that when the followers k^6 and k^7 are riding inclines k^8 and k^9 a movement of the vibrating lever C in the direction indicated by the arrow q^3 would tend, through the action of the follower k^7 and incline k^8 , to rotate the cam K backward or in a direction opposite to that indicated by the arrow and that a movement of the vibrating lever C in a direction opposite to that indicated by the arrow q^3 tends, through the coaction of the follower k^6 and incline k^9 , to rotate the cam K forward or in the direction indicated by the arrow, which is the operative relation of the above parts when actuated to effect the transverse feed for the over stitching of the first placed long bar-stitches. Let it be understood, however, that the springs c^6 of the vibrating lever C enter into the operation to control these movements by reason of the fact that one of these springs does not lose its control until the other is ready to assume control, and thus one of the followers during one portion of the movement of the vibrating lever impels movement of the cam K, while the other resists during the time the vibrating lever completes the same movement, and hence there is a step-by-step progressive rotation of said cam K in one direction. Now owing to the relative timing of the feed-pawls the cam d' , the vibrating lever, and the cam K it happens that a portion of the rotation of the cam K occurs during the next subsequent vibration of the vibrating lever in the direction opposite to that indicated by the arrow q^3 , resulting in a transverse feed of the material during the time that the feed-pawls are being positioned for a subsequent feed. When the long bar-stitches in the opposite or finished end of the buttonhole are to be over stitched, the follower k^7 is in operative relation to incline k^9 and follower k^6 with incline k^8 , which change in relation of parts causes follower k^7 to coact with incline k^9 , tending to rotate cam K in the direction indicated by the arrow and follower k^6 and incline k^8 in an opposite direction.

From the foregoing it will be understood that when the rotation of the cam K is resisted by the action of either of the followers the spring k^5 permits the said cam to remain inactive relatively to the rotation of the feed-cam d' until the movement of the vibrating lever C brings the opposite follower into active conjunction with the incline k^8 or the incline k^9 , whichever may be in opposition, and by its pressure thereon advances the said cam to its normal position relative to the feed-cam d' , effecting a step-by-step riding of the inclines by the followers instead of the inclines acting by direct rotation to force the slide-frame b^4 in opposition to the power exerted by the vibrating-lever springs c^6 c^6 .

What I claim is—

1. In a buttonhole-sewing machine, a stitch-forming mechanism, means for placing bar-stitches and side overseam-stitches, comprising a switch-cam and a yieldingly-rotated controller-cam, combined with yieldingly-vibrated cam-followers, the latter actuated through the vibratory movements transmitted from the switch-cam, said followers operating alternately to resist and compel rotation of the controller-cam while placing bar-binding stitches at substantially right angles to the barring-stitches, and complementary means for producing bar-binding stitches, substantially as described. 70 75 80

2. In a buttonhole-sewing machine, stitch-forming mechanism, means for placing bar-stitches and side overseam-stitches comprising a switch-cam and a feed-cam, and complementary means for producing bar-binding stitches, combined with a controller-cam, a yieldingly-vibrated cam-follower device actuated through the vibratory movements transmitted from the switch-cam alternately to resist and compel rotation of the controller-cam while placing bar-binding stitches at substantially right angles to the side overseam-stitches, substantially as described. 85 90 95

3. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, means including a yielding vibrator and a feed-cam for actuating said clamp, a controller-cam interposed between said vibrator and clamp and adapted to control the transverse feed movement of the material while placing the bar-binding stitches, and to limit the vibration of the material in the formation of two independent series of stitches, combined with complementary means for producing bar-binding stitches, substantially as described. 100 105

4. In a buttonhole-sewing machine, stitch-forming mechanism, and feed mechanism comprising a grooved cam for giving lengthwise feed to the material, a peripheral cam for controlling the transverse feed of the material, and opposing followers yieldingly vibrated and intermittently resisted by the walls of the peripheral cam, in combination with means whereby the grooved cam and walls of the peripheral cam may temporarily adjust their relative action to the movements of the cam-followers, substantially as described. 110 115 120

5. In a buttonhole-sewing machine, a stitch-forming mechanism, and a feed mechanism, including a feed-cam and a slide-frame capable of reciprocating motion transversely to the line of feed, a yielding vibrator for imparting motion to the slide-frame, cam-followers fixed to said slide-frame, and a cam yieldingly connected with said feed-cam and rotated in the path of movement of the cam-followers, said yielding cam during its control of the feed of the material transverse to the lengthwise feed movements being alternately resisted and compelled by the action of the cam-followers, substantially as described. 125 130

6. In a buttonhole-sewing machine, a stitch-forming mechanism, and a feed mechanism, including a slide-frame capable of a reciprocating motion transversely to the line of feed
5 and having cam-followers mounted thereupon, means to reciprocate said slide-frame, a feed-cam, and a controller-cam operated by the feed-cam and having a series of concentric surfaces which are successively inter-
10 posed in the path of movement of the cam-followers to vary the length of throw of the slide-frame, substantially as described.

7. In a buttonhole-sewing machine, stitch-forming and cloth-feeding mechanism, includ-
15 ing means for placing bar-stitches, bar-binding stitches and side overseam-stitches, comprising a cloth-holding clamp and mechanism to change the relative position of the cloth-holding clamp and stitch-forming mechanism,
20 combined with a yielding-rotated controller-cam actuated to give to the cloth-holding clamp a transverse step-by-step feed movement when placing bar-binding stitches at substantially right angles to the side over-
25 seam-stitches, substantially as described.

8. In a buttonhole-sewing machine, a stitch-forming mechanism, and a feed mechanism, including a slide-frame capable of a reciprocating motion transversely to the line of feed
30 and having cam-followers mounted thereupon, a feed-cam, and a controller-cam operated by the feed-cam and having a series of eccentric surfaces which are successively interposed in the path of movement of the cam-
35 followers to change the relative positions of the cloth-clamp and stitch-forming mechanism, the eccentric surfaces being engaged at intervals in the cycle of movement by the cam-followers to advance the cam, substan-
40 tially as described.

9. In a buttonhole-sewing machine, a stitch-forming mechanism, and a feed mechanism including a slide-frame capable of a reciprocating motion transversely to the line of feed,
45 and having cam-followers mounted thereupon, a feed-cam, a controller-cam operated by the feed-cam and having a series of eccentric surfaces which are successively interposed in the path of movement of the cam-
50 followers to change the relative positions of the cloth-clamp and stitch-forming mechanism, and a yielding connecting medium interposed between the feed-cam and the controller-cam, substantially as described.

10. In a buttonhole-sewing machine, stitch-forming mechanism including means to control the movements of the needle alternately in one and the other of two vertical lines at definite intervals, means to feed and vibrate
60 the material to produce two independent series of stitches, and means for effecting a transverse step-by-step feed movement of the material for the over stitching of one of the two independent series of stitches, substan-
65 tially as described.

11. In a buttonhole-sewing machine, stitch-forming mechanism, including means for

forming overseam-stitches, and means for transverse feeding of the material, combined with means for controlling the movements of
70 the material in the formation of side stitches on one side of the buttonhole-slit, long bar-stitches crosswise of one end of such slit and bar-binding stitches crosswise over such long
75 stitches, and duplicating the said several stitches at the other side and end of said slit to complete the buttonhole in a single automatic cycle of movements, substantially as described.

12. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, mechanism for vibrating and feeding said clamp, including a switch-cam and a feed-cam, a controller-cam interposed between said clamp and its vibrating mechanism and adapted to
85 control the transverse feed movements of the material and to control the limit of vibration of the material in the formation of two independent series of stitches, and complemental means for placing the bar-binding stitches,
90 substantially as described.

13. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, mechanism for actuating said clamp and means for controlling the stitch-forming mechanism
95 and the clamp-actuating mechanism to effect the stitching of the sides of the buttonhole and the formation of long bar-stitches at the ends of the buttonhole-slit obliquely to the direction of the length of the buttonhole-slit,
100 substantially as described.

14. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, mechanism for actuating said clamp and means for controlling the stitch-forming mechanism and
105 the clamp-actuating mechanism to effect the stitching of the sides of the buttonhole and the formation of long bar-stitches at the ends of the buttonhole-slit obliquely to the direction of the length of the buttonhole-slit, and
110 to over stitch the said long bar-stitches with bar-binding stitches placed substantially at right angles to the side stitches, substantially as described.

15. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp mechanism for changing the relative position of the cloth-clamp and stitch-forming mechanism, including devices for automatically controlling the movements of the cloth-clamp for
115 the cycle of feed and vibratory movements necessary to the overseaming of the two sides of a buttonhole and the barring of its opposite ends by over stitched bar-stitches, in combination with mechanism for effecting verti-
125 cal movements of the needle in a fixed vertical line for a portion of the stitching, and also alternate vertical movements in one and the other of two vertical lines for another portion of the stitching, substantially as de-
130 scribed.

16. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, actuating mechanism therefor including a yielding vi-

brator, and a controller-cam and feed-cam, said cams constructed and arranged to control the feed and vibratory movements of the material through the predetermined movements necessary for the automatic overseaming of the two sides of a buttonhole and the barring of its opposite ends by overstitched bar-stitches, without disconnecting the cloth-clamp from its actuating mechanism, in combination with suitable needle-actuating mechanism for binding the bar-stitches with over-stitches laid substantially at right angles to the side overseam-stitches, substantially as described.

17. In a buttonhole-sewing machine, for overseaming buttonholes having like bar ends consisting of bar-stitches bound under subsequently-placed overstitches, the following instrumentalities in combination: a rotating feed-disk, a yielding-vibrated cloth-clamp, mechanism for controlling the vibration of the cloth-clamp for the placing of the subsequently-overstitched bar-stitches, stitch-forming mechanism including an eye-pointed needle capable of lateral movements, and mechanism to control said needle movements for the over stitching of the previously-placed bar-stitches, substantially as described.

18. In a buttonhole-sewing machine, for overseaming buttonholes having bar ends consisting of overstitched bar-stitches, the following instrumentalities in combination: a rotating feed-disk, a controller-cam, a cloth-clamp, vibrating mechanism therefor including a switch-cam, mechanism for controlling the vibration of said clamp, stitch-forming mechanism including an eye-pointed needle, means for effecting lateral movements of said needle, and mechanism for controlling said needle movements for the placing and over stitching of the long bar-stitches, substantially as described.

19. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, a laterally-vibrated needle and means for vibrating said needle laterally for the over stitching of the bar-stitches, in combination with feed-actuating mechanism for controlling the feed of the material lengthwise of the buttonhole, and mechanism for limiting the movements of the cloth-clamp transverse to its lengthwise feed movements, said feed-actuating mechanism and mechanism for limiting the clamp's transverse movements capable of changing their positions relatively to each other, substantially as described.

20. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, a needle and mechanism for moving the needle laterally for the over stitching of the bar-stitches, in combination with means, including a feed-cam, for controlling the feed of the cloth-clamp lengthwise of the buttonhole, and means for controlling the movements of the cloth-clamp transversely to its lengthwise feed movements, said feed-actuating mechanism and mechanism for limiting the clamp's

transverse movements having a yielding connection to permit a relative change of positions, substantially as described.

21. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative position of the cloth-clamp and stitch-forming mechanism for the automatic overseaming of the two sides and the barring of the two ends of a buttonhole, including mechanism, for effecting predetermined transverse feed movements of the cloth-clamp and to limit the vibratory movements of the cloth-clamp at right angles to its lengthwise feed movements for the placing of the long bar-stitches, thereby to effect first the placing of the side overseam-stitches and subsequently the placing of the long bar-stitches, in combination with suitable needle-actuating mechanism for binding the bar-stitches with overstitches laid substantially at right angles to the side overseam-stitches, substantially as described.

22. In a buttonhole-sewing machine, a stitch-forming mechanism, a cloth-clamp, and mechanism for changing the relative position of the cloth-clamp and stitch-forming mechanism for the automatic overseaming of the two sides and the barring of the two ends of a buttonhole, including mechanism, for effecting the predetermined feed movements of the cloth-clamp lengthwise of the buttonhole, and to limit the vibratory movements of the cloth-clamp at right angles to its lengthwise feed movements for the placing of the long bar-stitches, thereby to effect the placing of the side overseam-stitches and thereafter produce movements equal to or slightly longer than the distance from depth-to-depth stitch of the two sides of overseaming for the placing of the long bar-stitches, in combination with suitable needle-actuating mechanism for binding the long bar-stitches with overseam-stitches laid substantially at right angles to the side overseam-stitches, substantially as described.

23. In a buttonhole-sewing machine, a cloth-clamp, actuating mechanism therefor including a controller-cam for controlling the extent of the vibratory movements of the cloth-clamp for the placing of the side overseam-stitches and the long barring-stitches, a stitch-forming mechanism including a needle-holder capable of movements alternately in one and the other of two vertical lines, a needle-holder carrier mounted in bearings in the overhanging arm, said carrier capable of vertical movements in a fixed line, and connections between said needle-holder and clamp-actuating mechanism, including a rotating cam-disk to control the movement of said needle-holder laterally at predetermined intervals, in combination, substantially as described.

24. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp and mechanism for giving to the cloth-clamp first, a progressive feed movement lengthwise of the

buttonhole and simultaneously therewith vibratory movement substantially at right angles to the length of the buttonhole for the placing of the side overseam-stitches; second, 5 extended vibratory movements, for the placing of long bar-stitches, and third, a feed movement substantially transverse to the feed movement lengthwise of the buttonhole for the over stitching of the long bar-stitches, 10 followed by transverse feed movements and like vibratory movements for overseaming the second side and barring the other end in like manner to the first, substantially as described.

15 25. In a buttonhole-sewing machine, stitch-forming mechanism, a cloth-clamp, and actuating mechanism therefor, including a yielding vibrator for giving to the cloth-clamp, first, a progressive feed movement lengthwise 20 of the buttonhole and simultaneously therewith vibratory movements substantially at right angles to the length of the buttonhole for the placing of the side overseam-stitches, second, extended or progressive vibratory 25 movements substantially parallel to the vibratory movements for the side overseaming, for the placing of the bar-stitches, third, a feed movement substantially transverse to the lengthwise feed movement, for the over 30 stitching of the bar-stitches, followed by transverse feed movements and like vibratory movements for overseaming the second side in like manner to the first and barring the finish end of the buttonhole in the same man- 35 ner as its opposite end, in combination with mechanism for controlling the movements of the needle in a fixed vertical line for a portion of the overseaming and at other times

alternately in one and the other of two vertical lines, substantially as described. 40

26. In a buttonhole-sewing machine, in combination, stitch-forming mechanism, a cloth-clamp, actuating mechanism therefor including a yielding vibrator, mechanism for controlling the movement of the needle laterally, and mechanism constructed and arranged for giving to the material, first, a progressive feed movement lengthwise of the buttonhole and simultaneously therewith vibratory movements substantially transverse 50 to its lengthwise feed movement, and to the needle vertical movements in a fixed line for the placing of the side overseam-stitches; second extended vibratory movements to the material and simultaneously therewith vertical movements to the needle; and third, to 55 the material a feed movement transverse to its lengthwise feed movement and simultaneously therewith alternate vertical movement of the needle in one and the other of two vertical lines, for the over stitching of the bar-stitches, followed by transverse feed movements, like vibratory movements, and like control of the movements of the needle laterally for overseaming the second side in like 65 manner to the first, and barring the finish end of the buttonhole in the same manner as its opposite end, substantially as described.

In testimony whereof I have hereunto set my hand this 17th day of November, A. D. 70 1899.

FREELAND W. OSTROM.

Witnesses:

NATHAN POOR,
E. I. VAN HORN.