

J. E. FEFEL.  
BLINDSTITCHING SEWING MACHINE.

APPLICATION FILED MAR. 9, 1906.

5 SHEETS—SHEET 1.

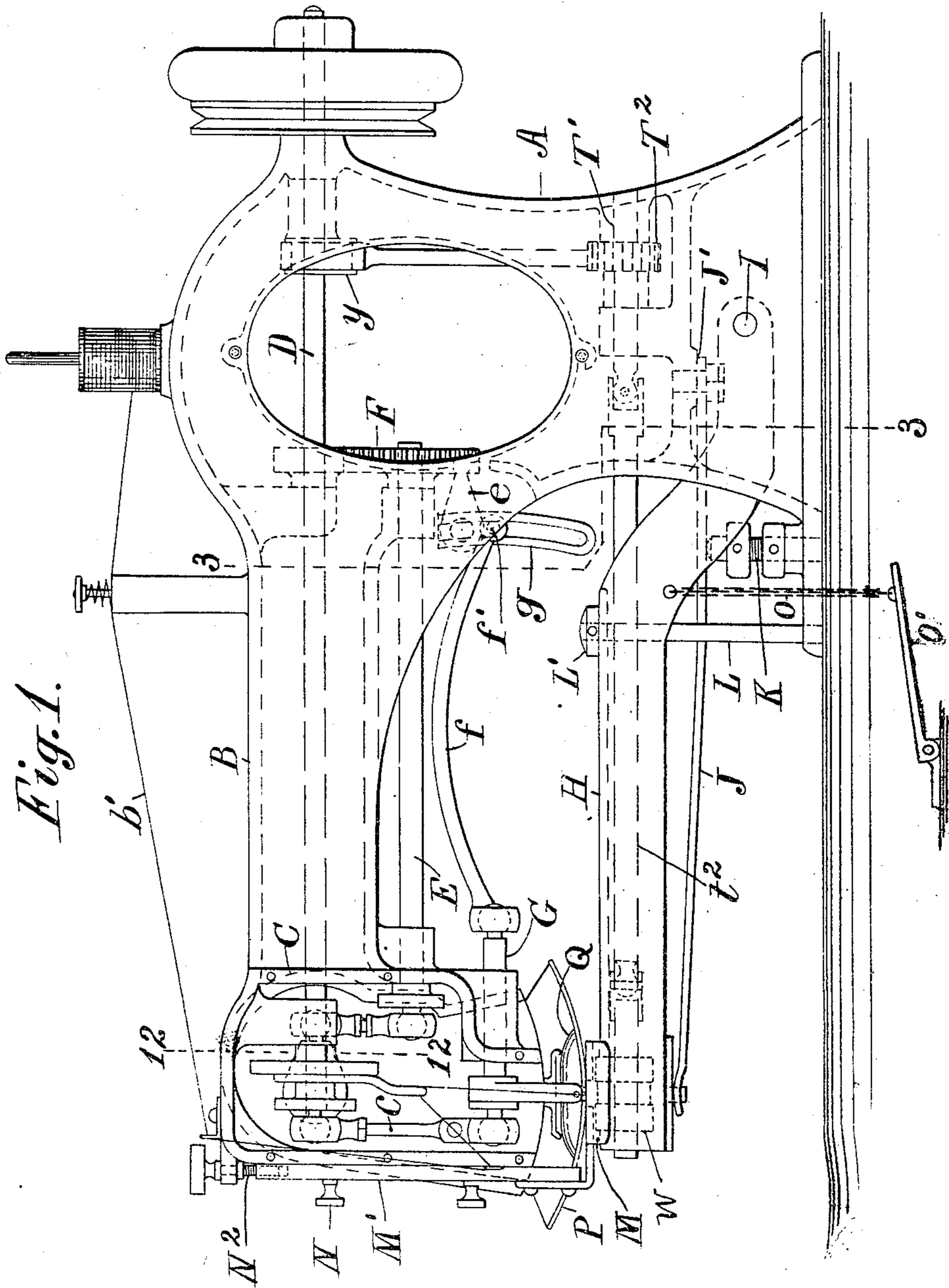


Fig. 1.

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John E. Fefel, per  
Thomas S. Crane, Atty.

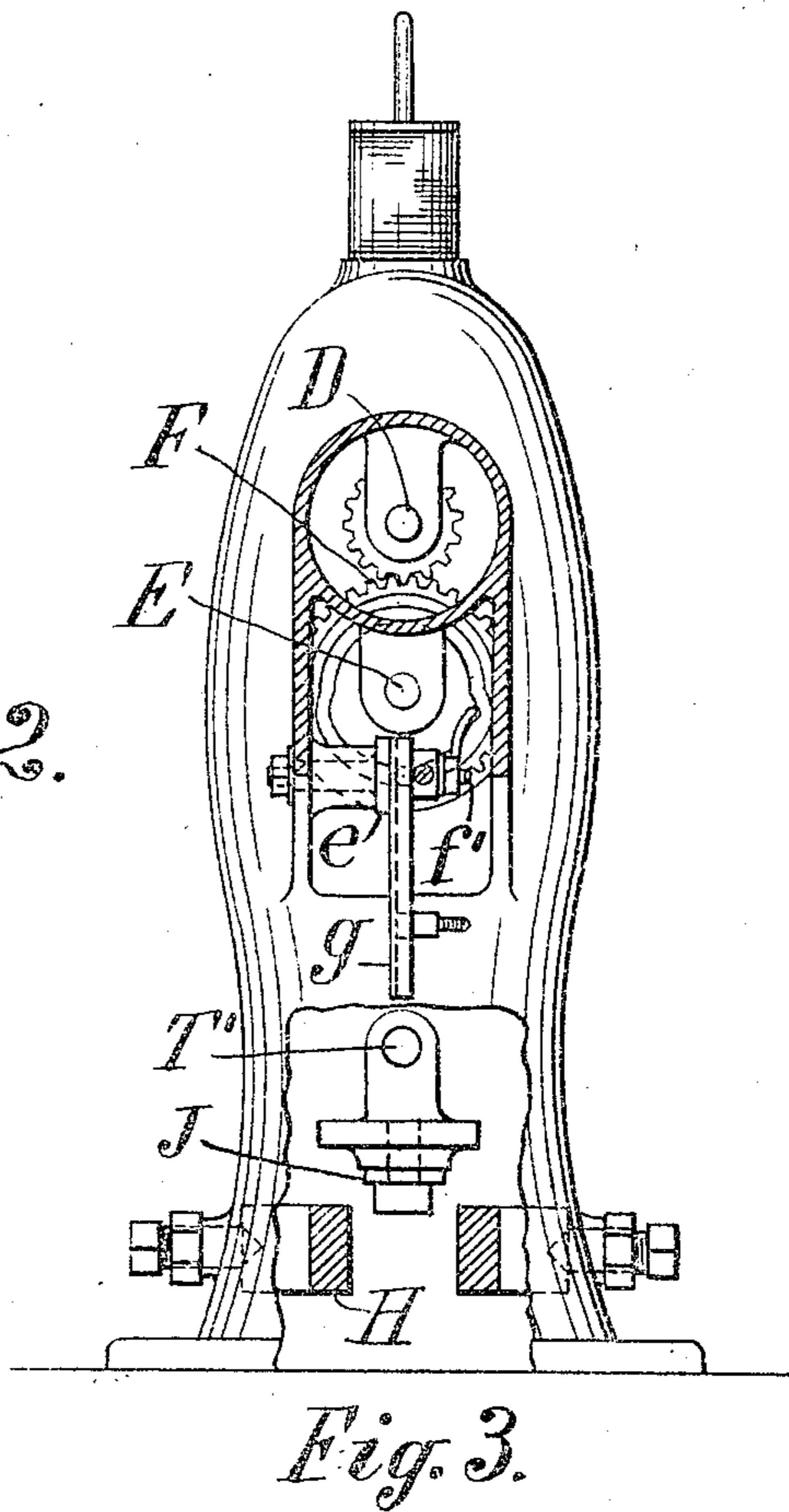
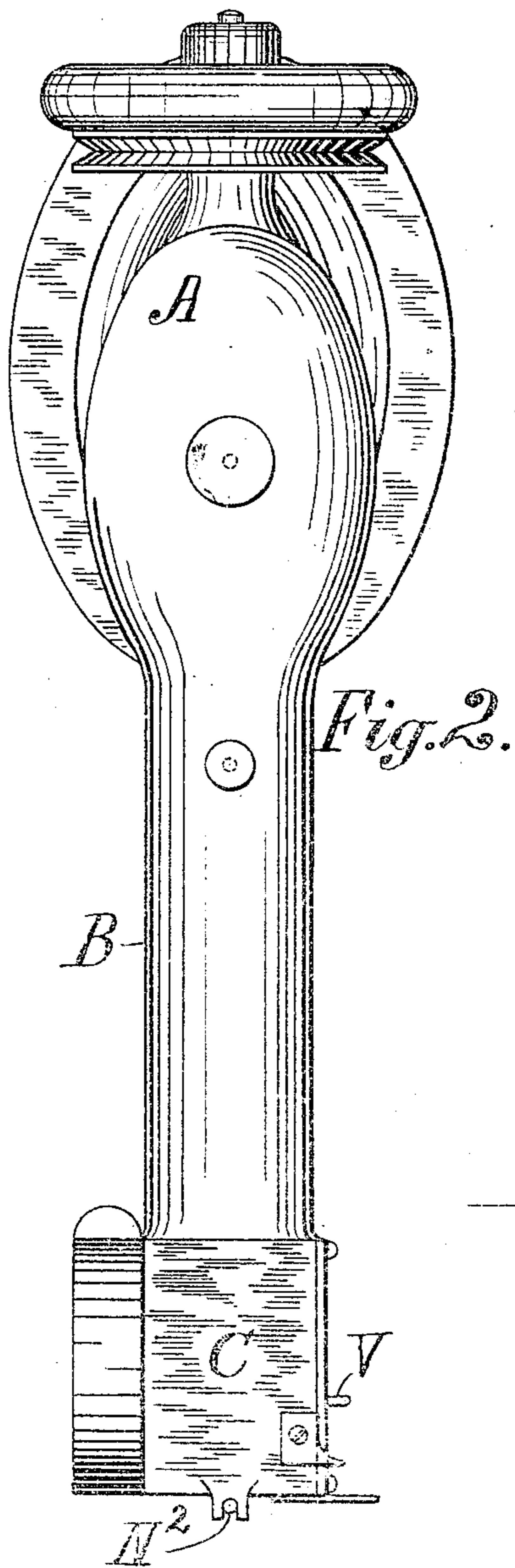
No. 859,376.

PATENTED JULY 9, 1907.

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5 SHEETS—SHEET 2.



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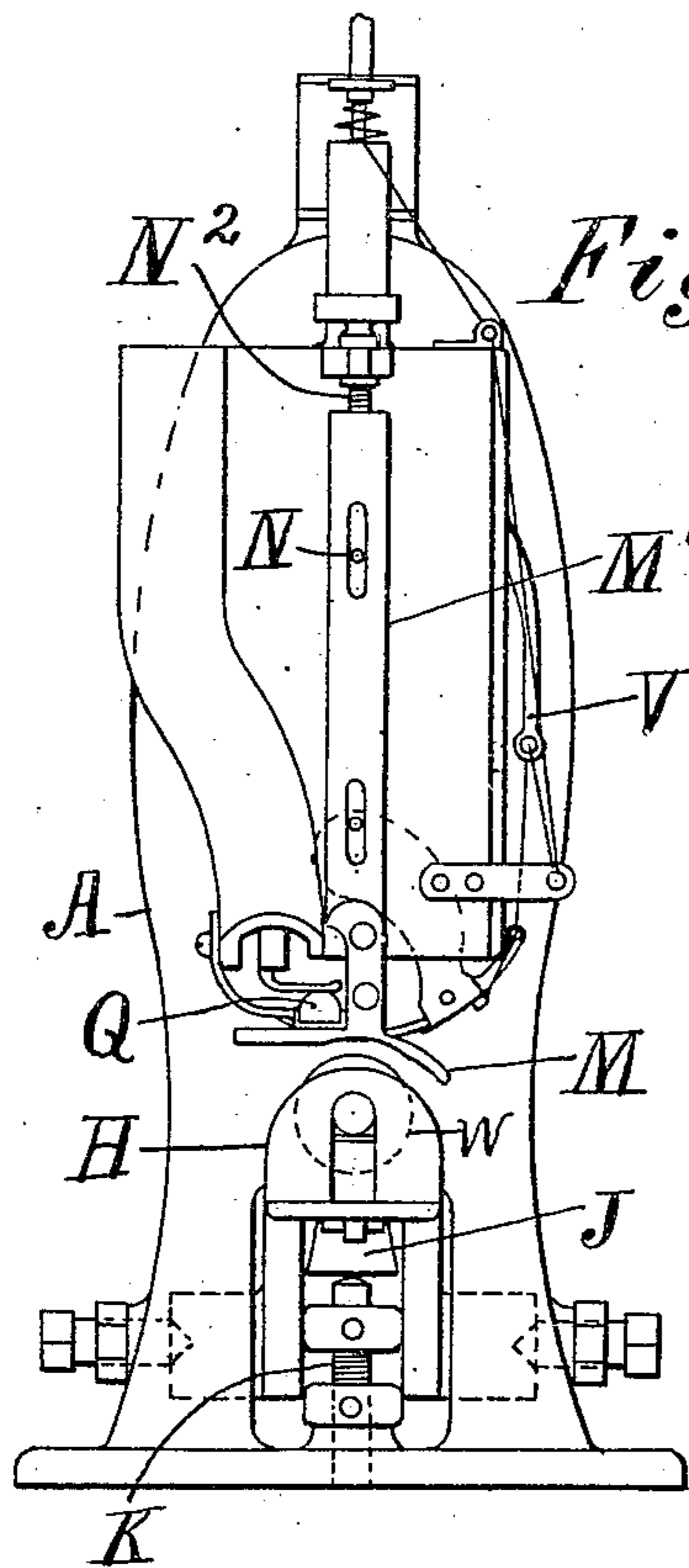


Fig. 4.

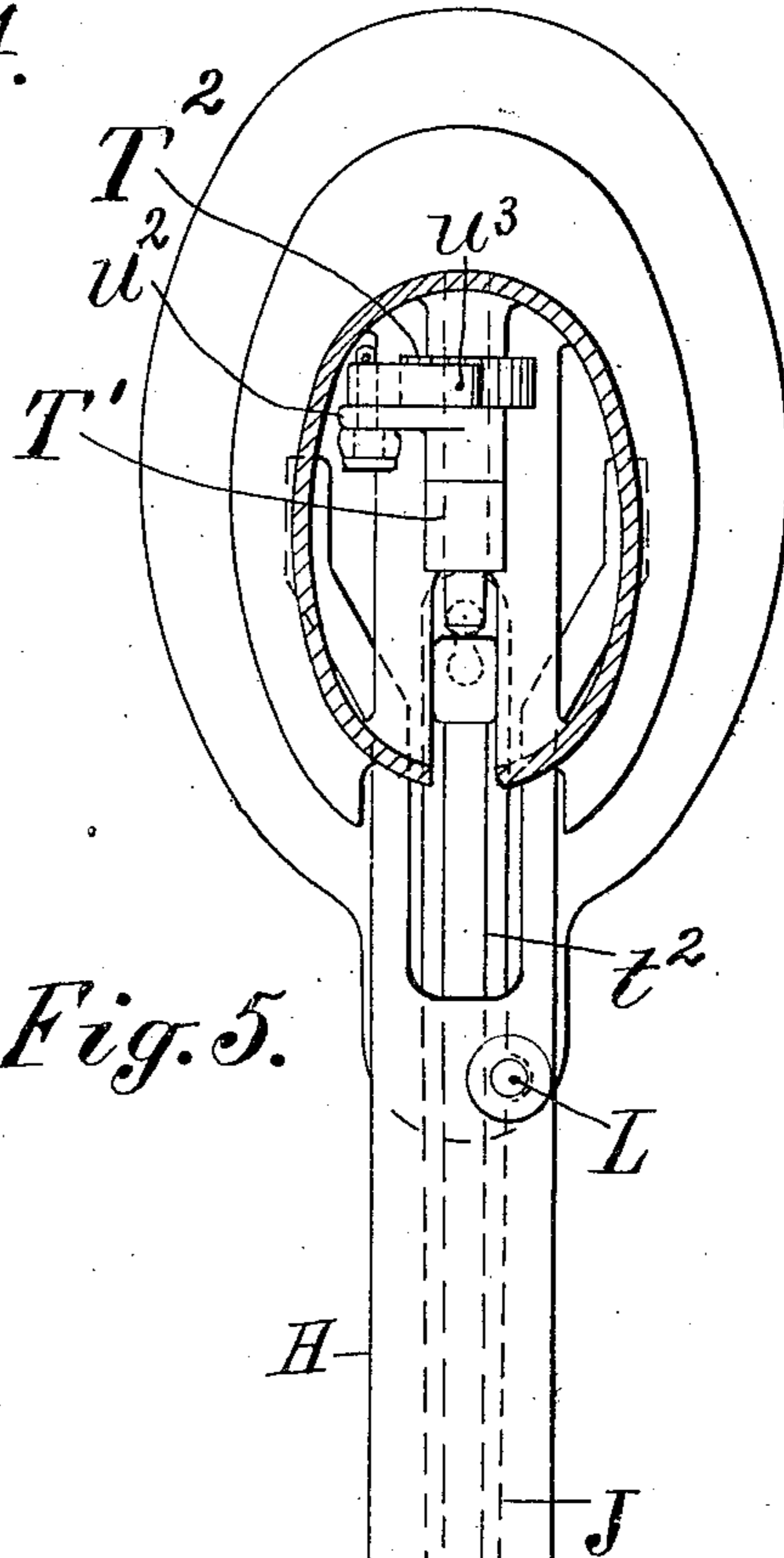


Fig. 5.

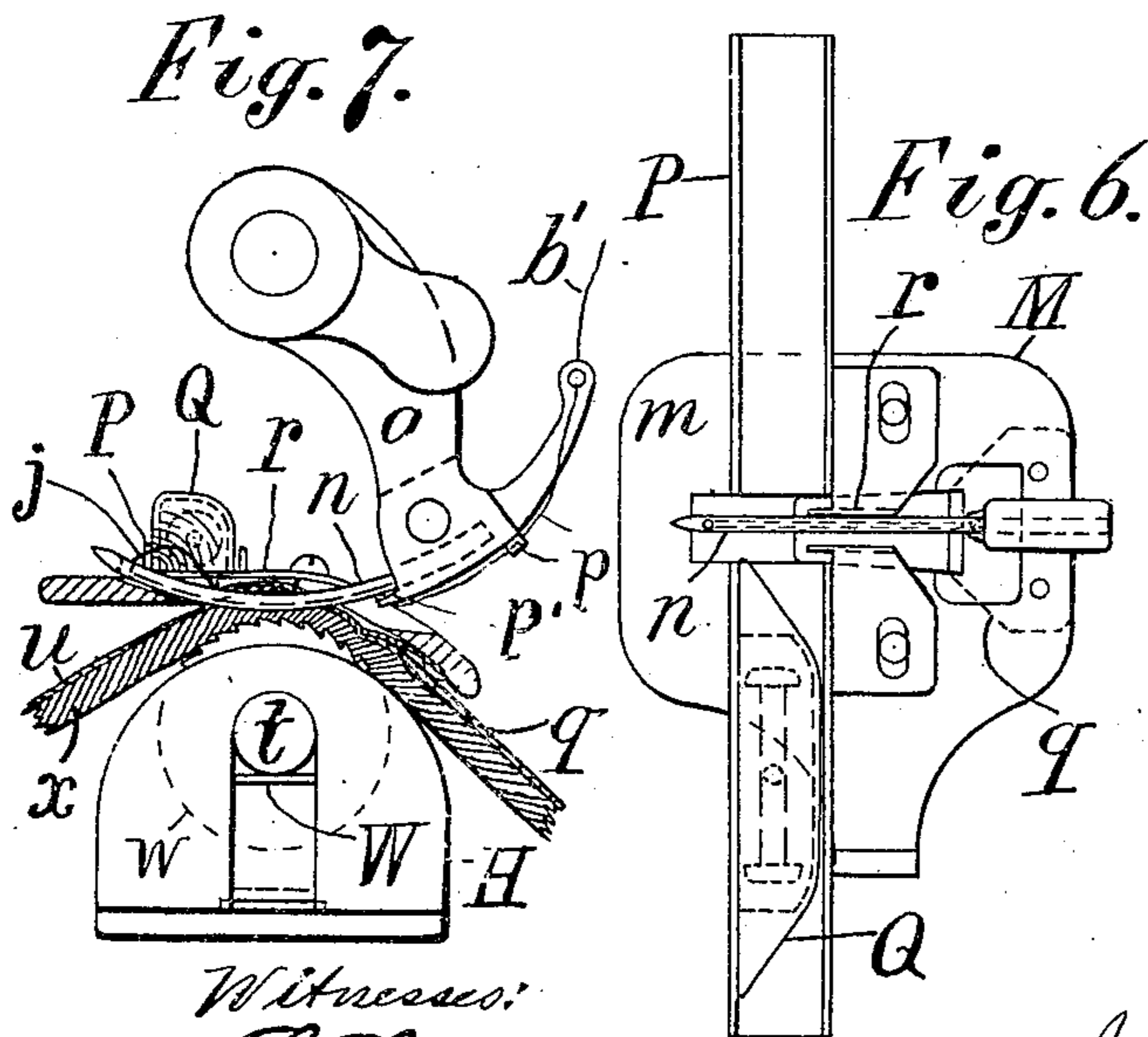


Fig. 6.

Fig. 7.

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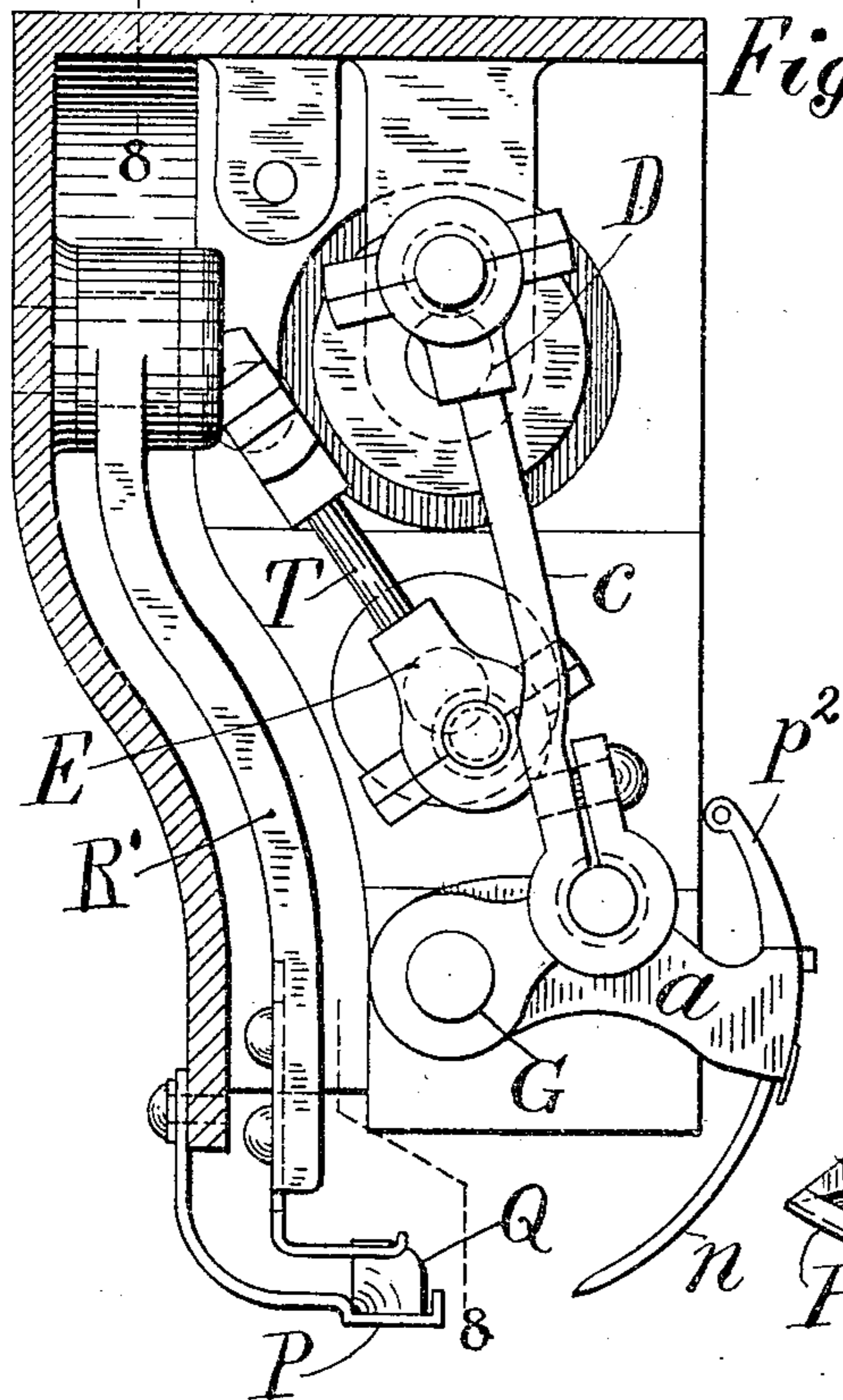


Fig. 8.

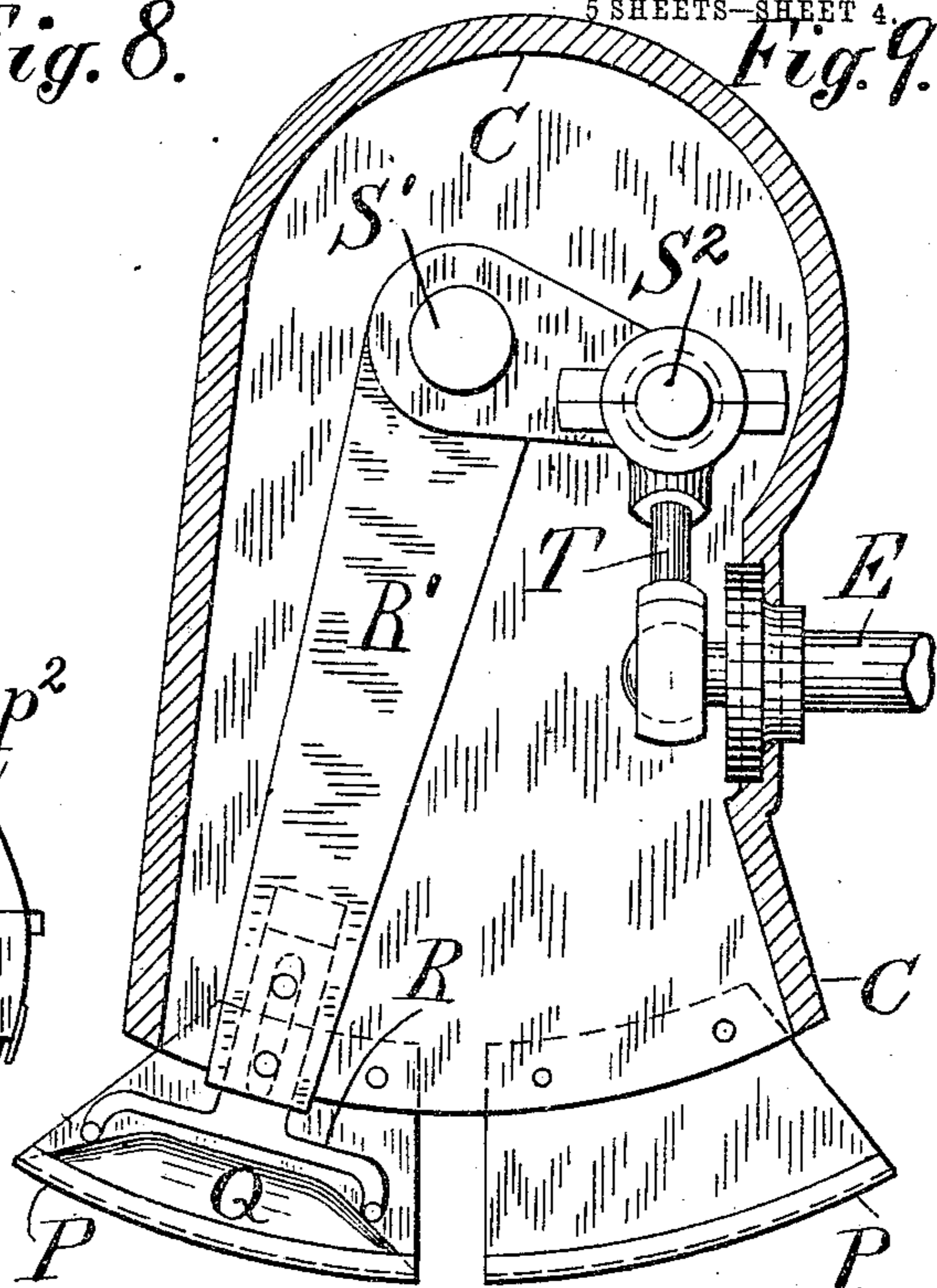


Fig. 9.

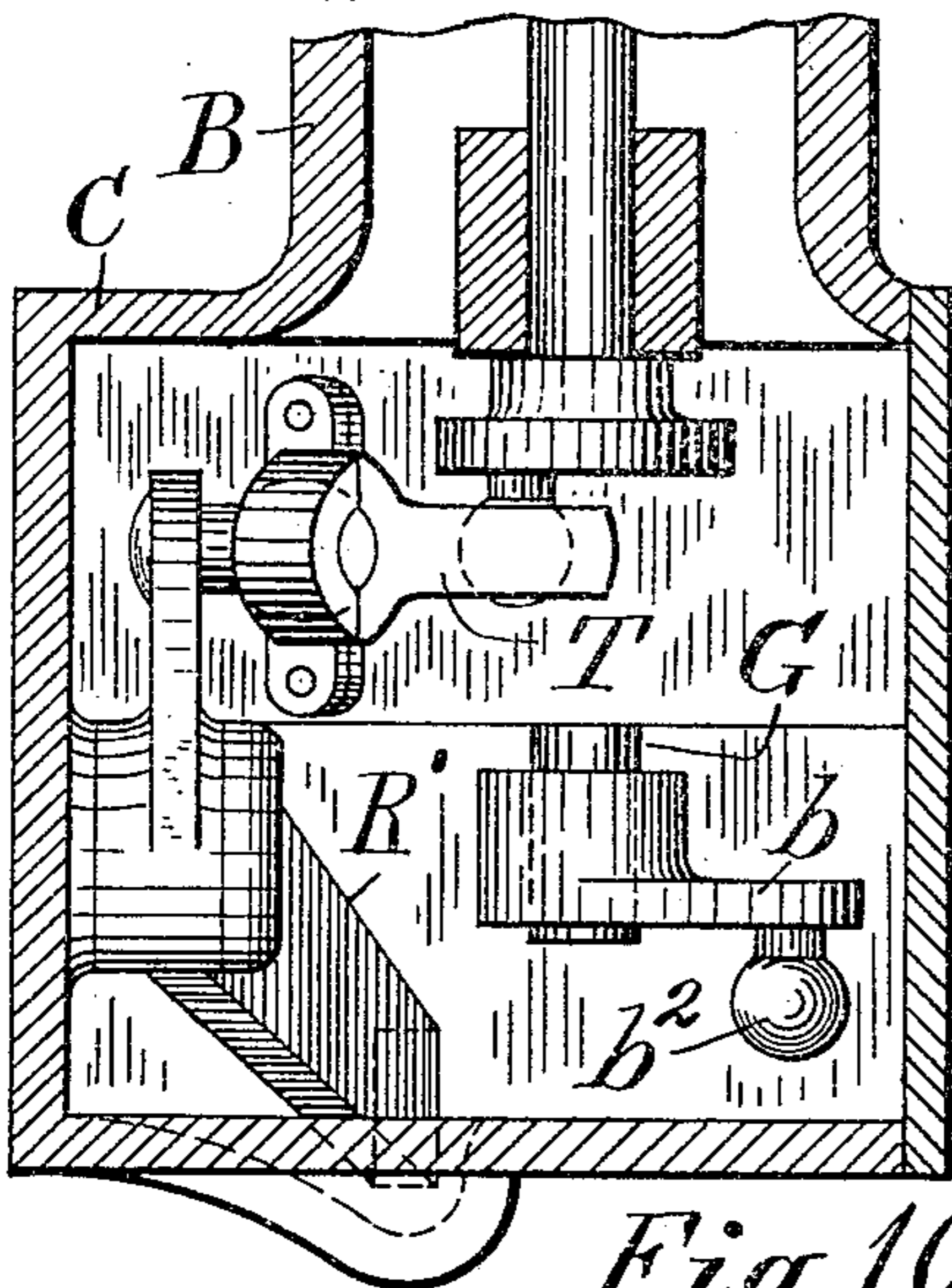


Fig. 10.

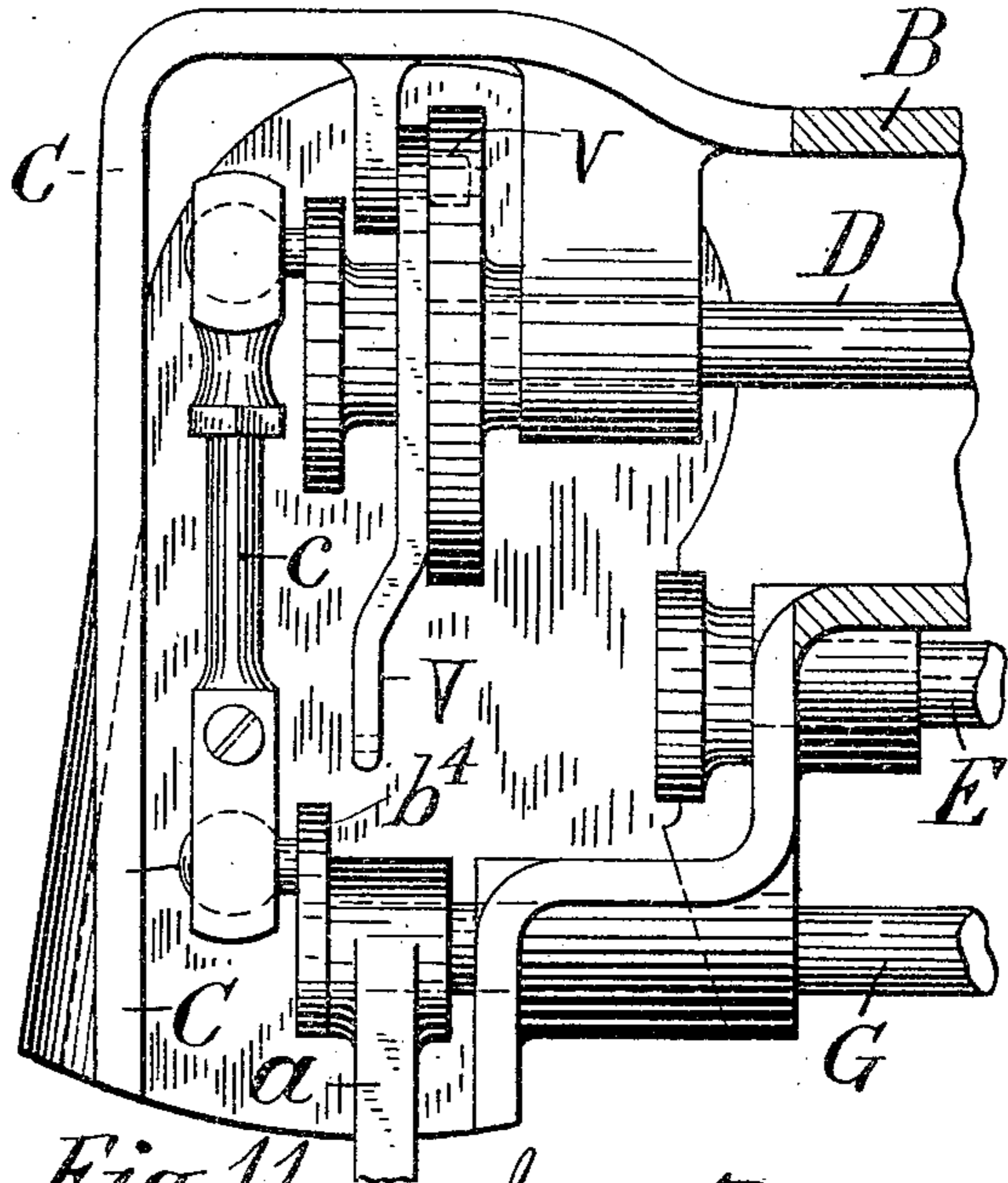


Fig. 11.

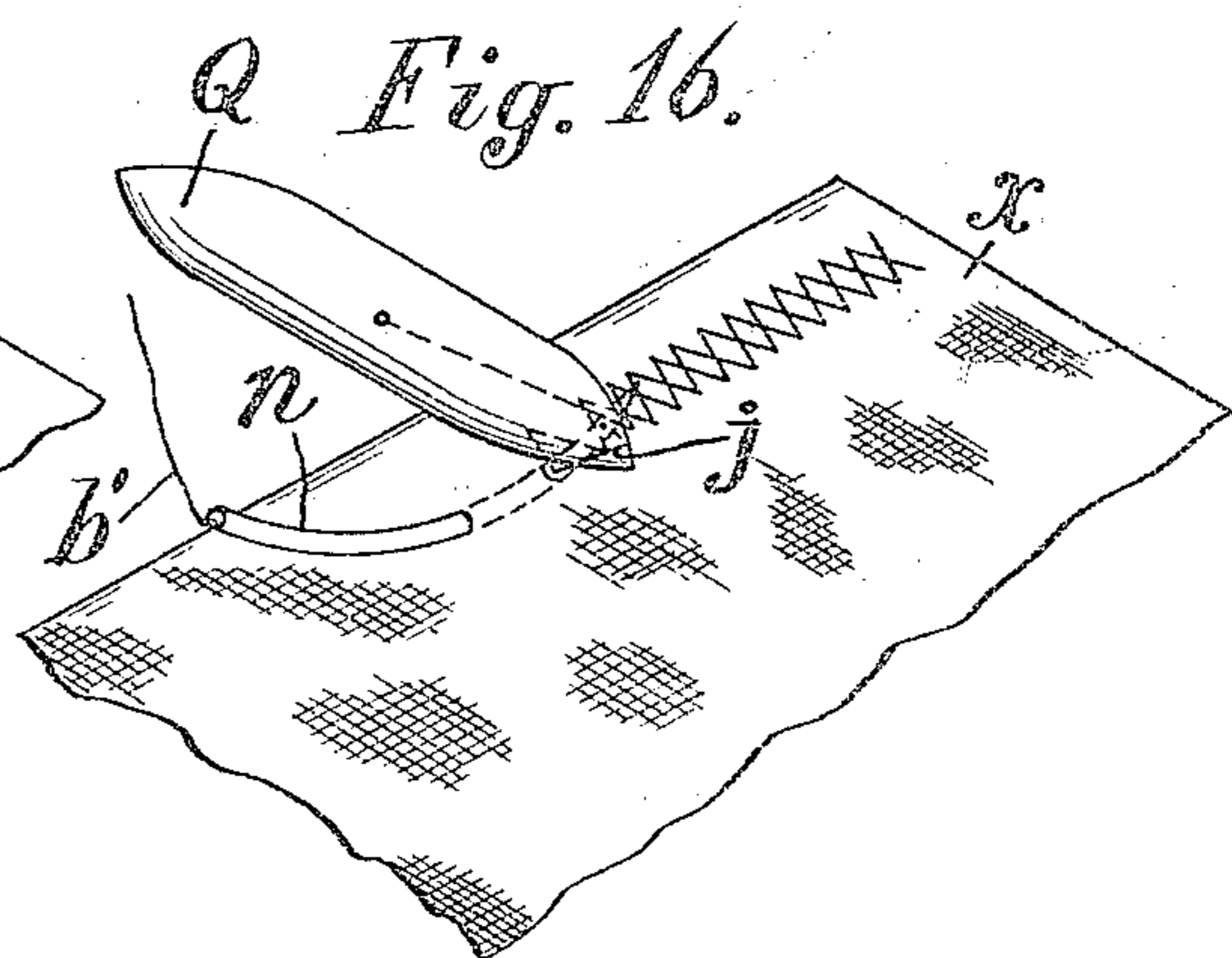
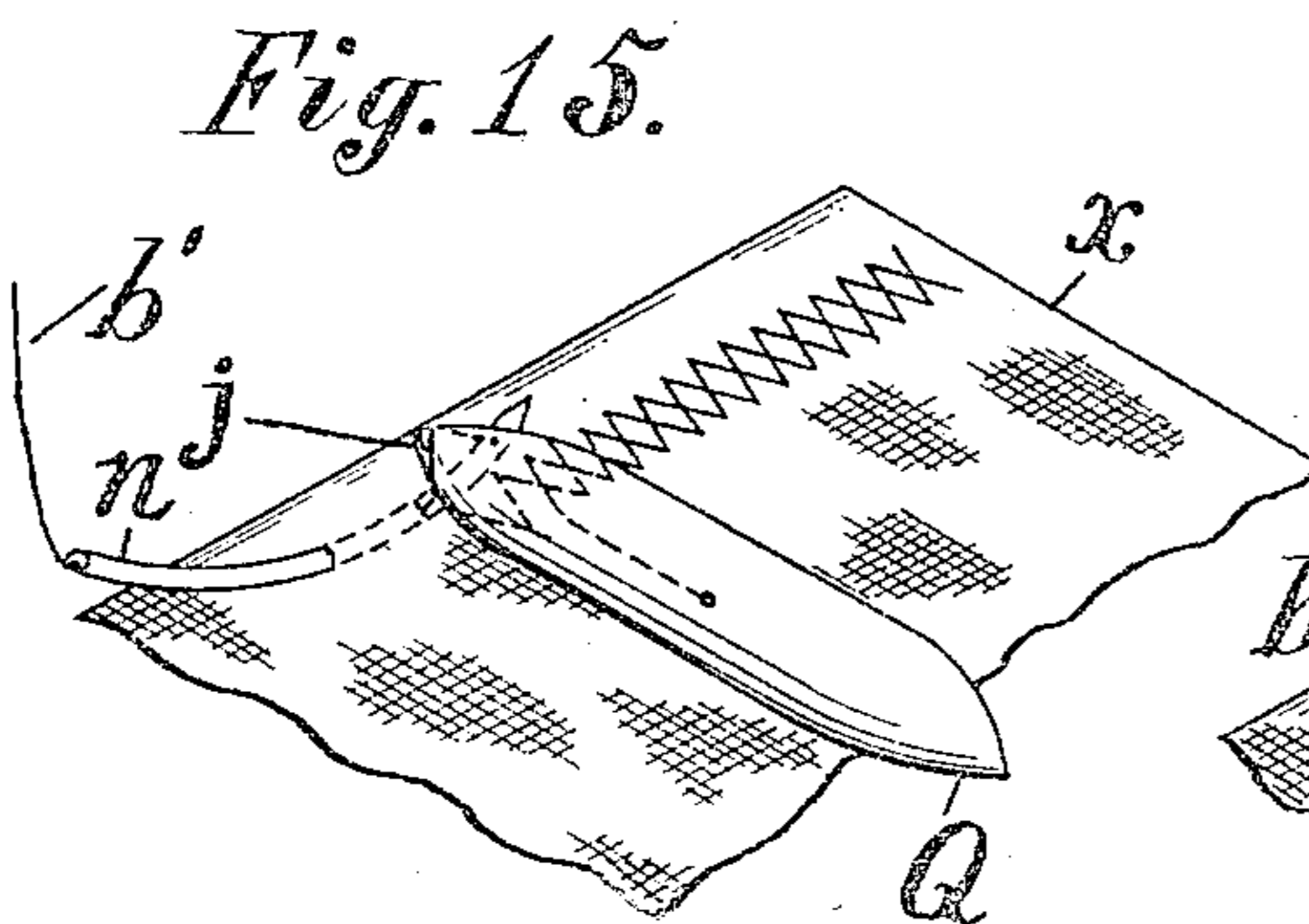
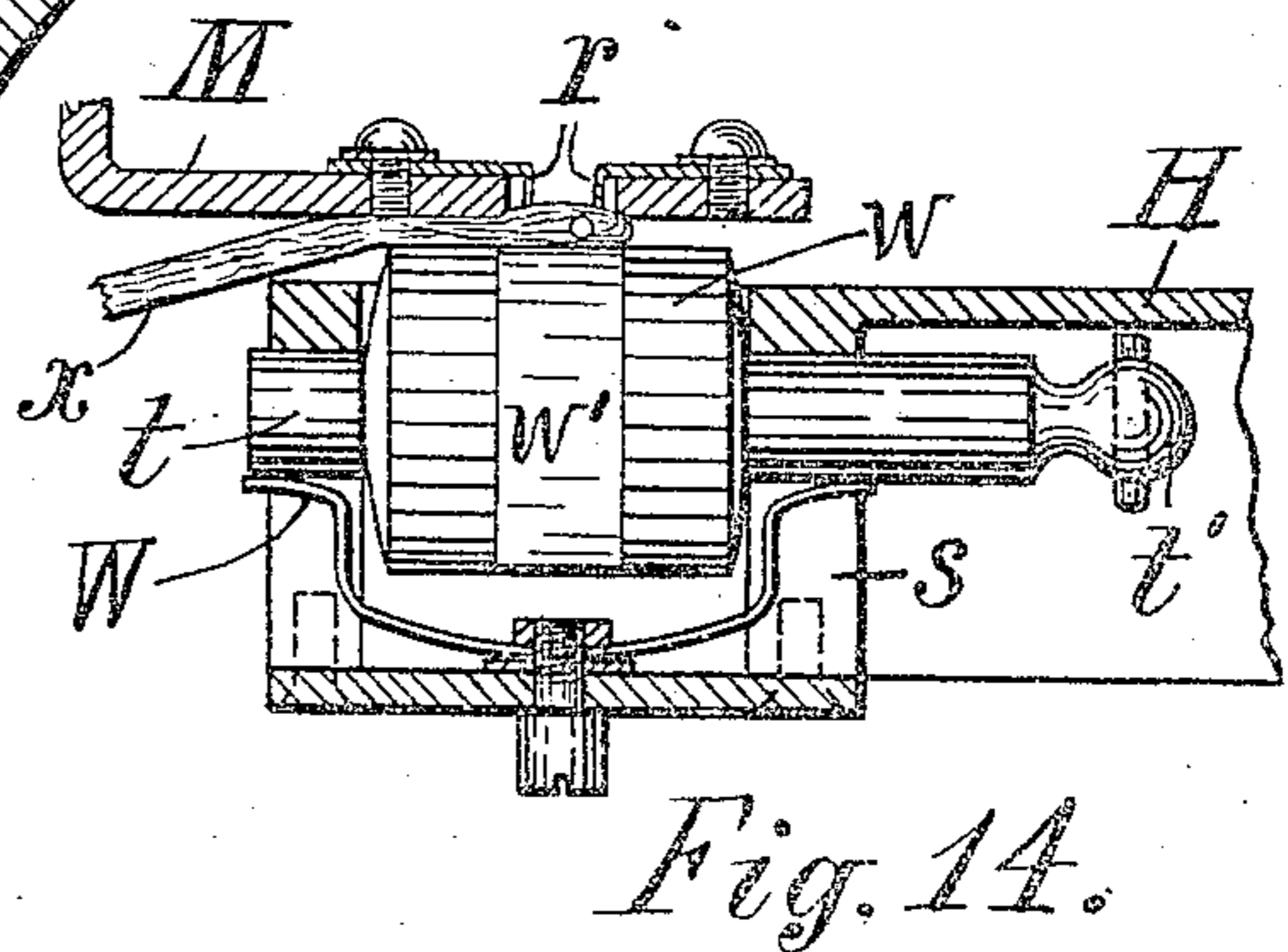
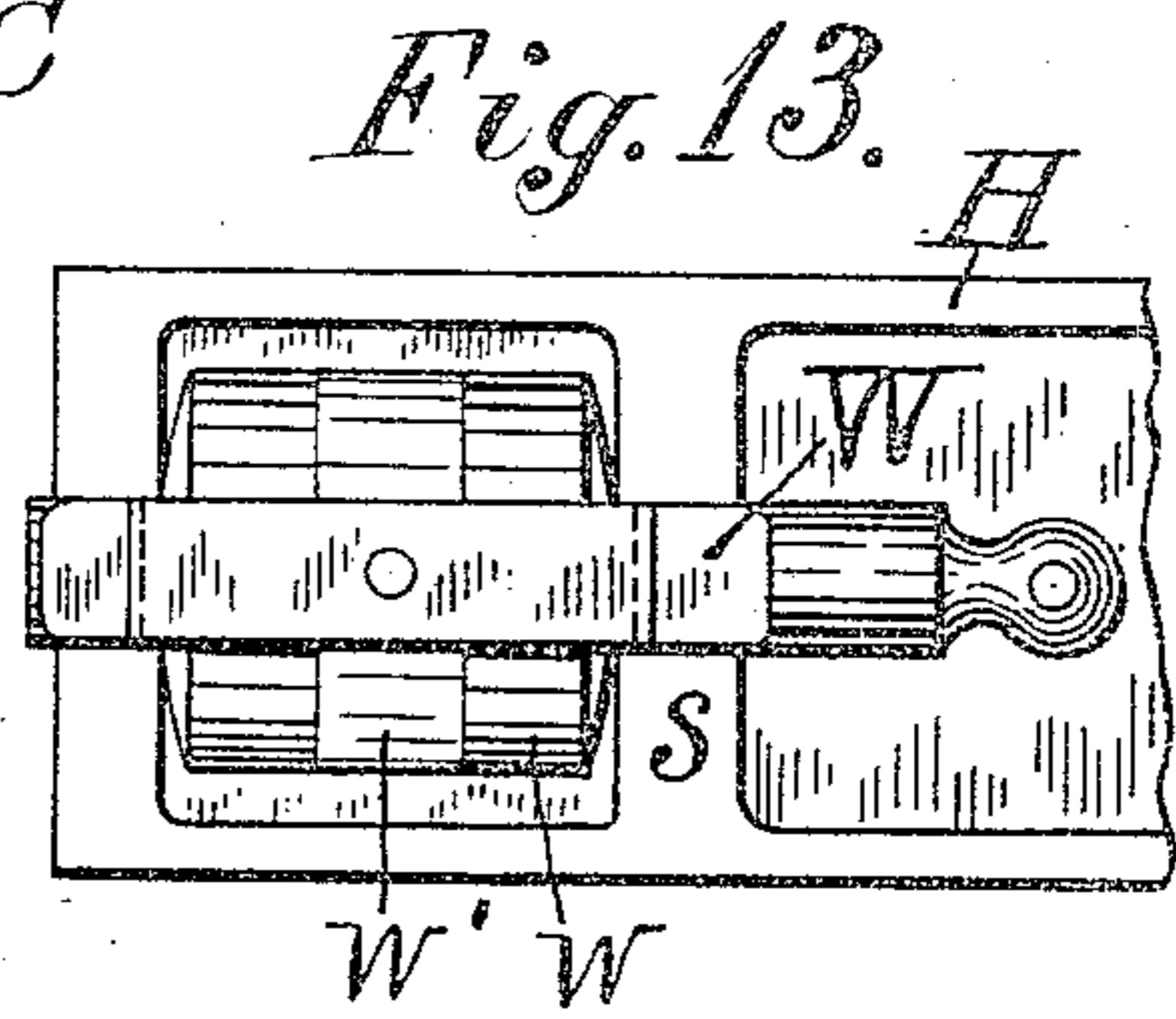
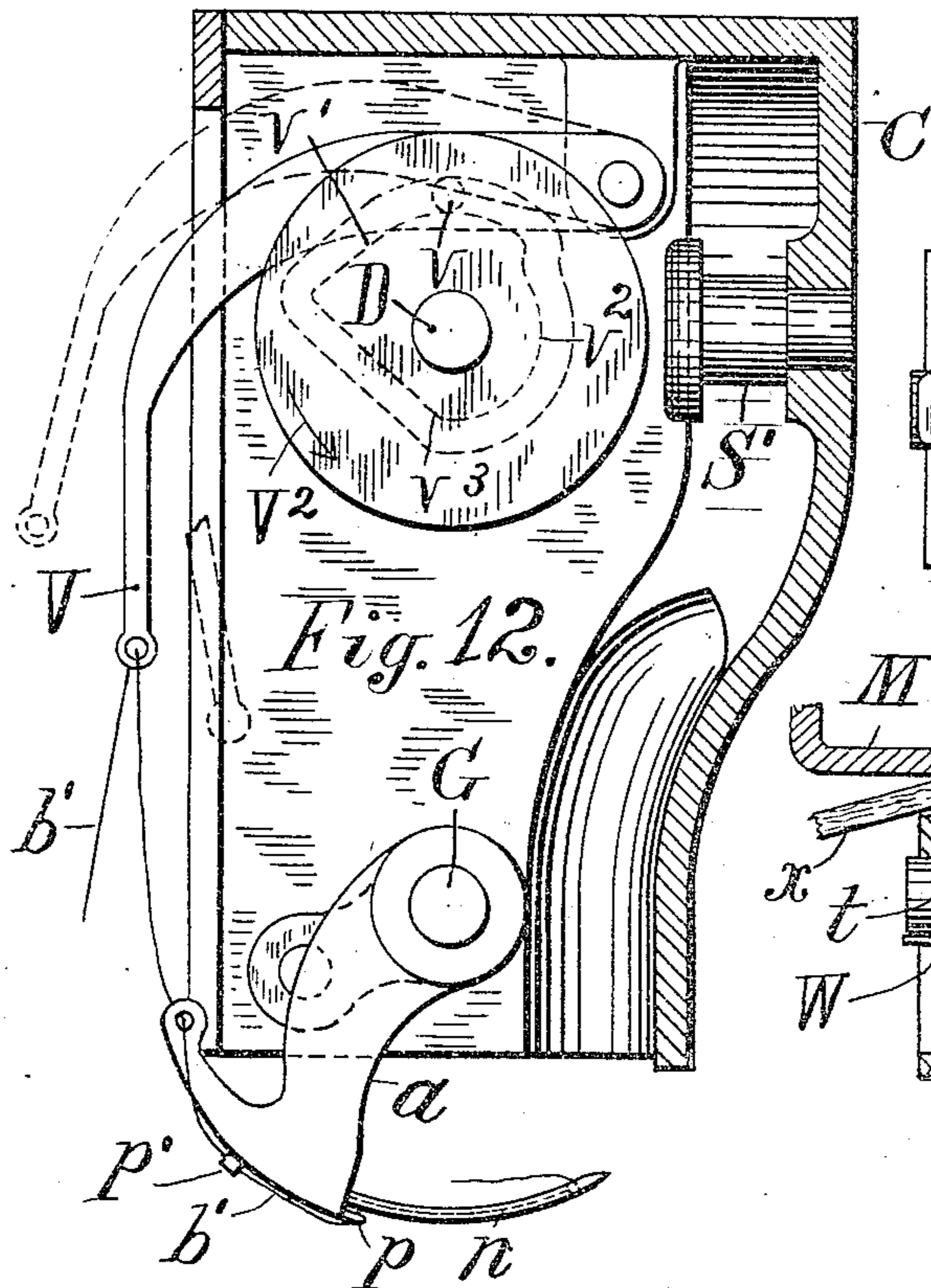
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BLINDSTITCHING SEWING MACHINE.

APPLICATION FILED MAR. 9, 1906.

5 SHEETS—SHEET 5.



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# UNITED STATES PATENT OFFICE.

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## BLINDSTITCHING SEWING-MACHINE.

No. 859,376.

Specification of Letters Patent.

Patented July 9, 1907.

Application filed March 9, 1906. Serial No. 305,033.

To all whom it may concern:

Be it known that I, JOHN E. FEFEL, a citizen of the United States, residing at 240 South Ninth street, Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Blindstitching Sewing-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 The present invention relates to that class of sewing machines which is employed in "felling" or making "blind stitches" upon one side of a fabric, for attaching a lining, binding, or facing thereto; and in which a curved needle operates wholly upon one side of the fabric.

15 In the present machine, the cloth or work-piece to be sewed is laid directly upon the feed-arm, and a foot provided with an aperture rests upon the fabric and a needle is oscillated across the aperture in alignment with the seam, engaging the portion of the fabric which is exposed in the aperture. A raceway in the form of an open trough is supported above the foot transverse to the path of the needle and also transverse to the line of the seam, with a gap or notch in the middle to facilitate the passage of the needle, and a reciprocating shuttle is laid in this open raceway and reciprocated by the shuttle-carrier to take a loop from the needle just as it is being retracted from the fabric. A shuttle pointed at both ends is preferable, as it is adapted to engage a loop upon the needle when crossing the path of the latter in either direction, and such a shuttle needs to be oscillated only half as frequently as the needle. The arrangement of an open-trough raceway above the foot renders the shuttle very accessible, and permits it to be placed in and removed from the raceway with the utmost facility.

20 The machine is provided with a frame, a goose-neck, and a head upon the outer end of the goose-neck, carrying the stitch-forming mechanism; a driving-shaft being extended into the head as usual, to operate such mechanism. The foot is preferably held stationary upon the head, and the feed-arm hinged upon the frame to move to and from the foot, and pressed elastically thereto to clamp the fabric or cloth during the sewing operation.

25 The raceway for the shuttle is preferably secured upon the head in a fixed relation to the path of the needle, and the foot is adjustable upon the head so as to vary the exposure of the fabric to the point of the needle. As the needle travels in a curve, it intersects one corner of the raceway, and the point of the shuttle is therefore formed to lie in such corner of the raceway, and not in the middle of the raceway, as is common. A corner of the shuttle can travel close to the needle. A feed-wheel is employed in the feed-

arm, and is preferably made with a central smooth space between marginal rows of teeth, so that it may press the fabric close to the needle without danger of the needle's engaging the teeth. The smooth central space is preferably made level with the tops of the teeth, so as to hold the fabric up as close as possible to the path of the needle.

30 The feed-wheel is preferably formed with a short journal upon each end and connected by a universal joint with a feed-arbor in the post of the frame, such construction permitting a spring to be inserted under each of the journals to press them elastically toward the fabric, and thus permitting either end of the wheel to yield independently of the other, as is often required in stitching close to the edge of a garment, in which case the pressure and the feeding are thrown chiefly upon one end of the wheel.

35 The curved needle is carried by a vibrating arm, and the holder for the needle upon the arm provided with a thread-guide which delivers the thread directly into a groove upon the under side of the needle; a vertical eye near the point of the needle permitting the thread to pass upward so that the loop is formed directly on top of the needle, where the transversely moving shuttle can readily engage it.

40 A take-up lever is provided, and operated by a cam which permits the thread to follow the extreme forward movement of the needle and then to slacken the thread suddenly to form a loop; and afterward restore the tension, to tighten the needle-thread upon the shuttle-thread.

One embodiment of the invention is shown in the annexed drawing, in which

45 Figure 1 is a side elevation of the machine; Fig. 2 is a plan of the same; Fig. 3 is a section on line 3-3 in Fig. 1; Fig. 4 is a front elevation; Fig. 5 is a plan in section just above the level of the foot M; Fig. 6 is a plan of the foot and raceway with needle across the raceway; Fig. 7 is an end view of the feed-arm and needle-arm with the foot, the raceway, and a piece of fabric in section; Fig. 8 is a front view of the head with the casing cut away to show the interior, and Fig. 9 is a section of the head, looking toward the rear side of the head, and showing the connection for driving the shuttle-arm and Fig. 10 is a plan of the head in section, where hatched, at the center of the driving-shaft. Fig. 11 is a vertical section of the head adjacent to the outer end of the head, with the connections for the needle-arm only; Fig. 12 is a section of the head on line 12-12 in Fig. 1, showing the take-up lever and its cam; Fig. 13 shows the under side of the feed-wheel and front end of the feed-arm; Fig. 14 is a section, where hatched, at the center line of the foot, with the outer end of the feed-arm; Fig. 15 is a diagram showing the operation of the double-pointed shuttle, with its left-hand end engag-

ing a loop of the needle-thread; Fig. 16 is a similar diagram with the right-hand end of the shuttle engaging a loop.

The machine is shown with a frame having a hollow post A, goose-neck B, and head C, with a driving-shaft D extended into the head. A shuttle-shaft E is arranged directly below the driving-shaft and connected thereto by gears F, and a rock-shaft G for the needle-arm *a* is shown mounted to turn, and also to reciprocate, in a bearing directly below the shuttle-shaft.

*Arrangement of feed-arm.*—A feed-arm H has forked feet fitted within the post A and jointed upon pivots I, and it is extended beneath the head to carry a feed-wheel beneath the needle-arm *a*. A leaf-spring J is secured to a seat J' within the post and projected outwardly between the feet of the fork to the front end of the feed-arm, and an adjusting screw K is arranged beneath the spring to produce an upward elastic pressure upon the feed-arm. The upward movement of the feed-arm under such pressure is limited by a screw L having an adjustable nut L'. The foot M is mounted adjustably upon the head by a bar M' and clamp-screws N, a screw N<sup>2</sup> (having a bearing upon the head) being fitted to the upper end of such bar to adjust the foot vertically. A treadle *o*' and chain *o* are shown diagrammatically in Fig. 1 to depress the feed-arm, when it is requisite to insert the garment or fabric to be sewed beneath the foot.

*Shuttle connections.*—The raceway P has a division or gap in the path of the needle, and attached to the rear edge of the head (Figs. 8 and 9), and a double-pointed shuttle Q is vibrated in the raceway by shuttle-carrier R and a shuttle-arm R', having pivot S' at one side of the driving-shaft transverse to the same, and provided with spherical crank-pin S<sup>2</sup>. A crank upon the shuttle-shaft E is also provided with a spherical crank-pin, and a connecting-rod T has spherical bearings fitted to the said crank-pins to oscillate the shuttle-arm as the shuttle-shaft revolves. With this arrangement the raceway lies wholly above the foot and is curved in a vertical plane, concentric with the pivot S'. The shuttle-arm R' also moves in a vertical plane as its pivot is horizontal. The shuttle-arm R' moves in a vertical plane, and as its lower end traverses a curve, the raceway is correspondingly curved in a vertical plane, but its bottom is flat transversely. The bottom of the shuttle is therefore flat transversely and curved longitudinally to fit the open trough of the raceway, from which it can be readily lifted when required. With a double-pointed shuttle, the gearing F revolves the shuttle-shaft at half the speed of the driving-shaft, thus permitting the needle to make two oscillations for each oscillation for the shuttle, and enabling the opposite ends of the shuttle to engage the loop of the needle-thread when crossing the path of the needle in either direction, as shown in Figs. 15 and 16.

*Construction for zigzag sewing.*—The general construction of the machine adapts it for sewing zigzag stitches or a straight seam, the zigzag stitches requiring the moving of the needle laterally intermediate to its oscillations, so as to intersect the cloth or fabric in two different lines, as shown in Figs. 15 and 16. In the present invention, such lateral movement of the needle is made in parallel planes, and is effected by mounting the needle-arm *a* upon a rock-shaft G which

can be reciprocated lengthwise at the same time that it is oscillating to propel the needle. To oscillate the rock-shaft, a crank *b* with spherical crank-pin *b*<sup>4</sup> is attached to the needle-arm (Figs. 10 and 11), and oscillated by a link *c* which is connected to a spherical crank-pin *d* rotated by the end of the shaft D. The rock-shaft is reciprocated by a connecting-rod *f* having one end adjustable in a segment *g*, which is vibrated by a crank *e* and a needle-cam *e*' upon one of the gear-wheels F. This connecting-rod is shown arched upwardly to afford more room for the cloth or work-piece upon the feed-arm. The segment is grooved or slotted to receive the connecting-pin *f*' of the rod *f*, and such groove is extended past the axis of the crank *e*, so that pin *f*' may remain stationary when set at that point, as required when the needle is to oscillate always in the same path, for sewing a straight seam. The connecting-rod *f* is attached to the pivot-shaft G by a universal joint so as to permit the oscillation of the shaft and the movement of the rod *f* to different inclinations, as the pin *f*' is adjusted in the segment. The segment *g* being actuated by the shuttle-shaft, is vibrated only half as often as the needle oscillates, and it consequently operates intermediate to the oscillations of the needle to shift it into the two positions required for zigzag sewing. The adjustment of the pin *f*' varies the breadth of the stitches in zigzag sewing. Fig. 7 shows a thick piece of cloth *x* stretched over the feed-wheel upon the outer end of the feed-arm, with a piece of thin facing or lining *u* upon its upper side in contact with the bottom of the foot M. Fig. 6 shows a recess with sloping side in the upper side of the foot, with aperture *m* through the bottom of the recess, of a width equal to the space between the sections of the raceway, and suitable for the lateral play or movement of the needle in sewing zigzag stitches. A beveled recess *m*' is also shown at the end of the aperture from which the needle advances, to accommodate the needle-carrier marked *a*, and Fig. 7 shows the needle *n* engaged with a portion of the cloth *x* and the facing *u* to form a stitch, and retracted partially from its extreme forward position to loosen the thread and form a loop *j* with which the point of the shuttle Q is shown engaged, the same as in Figs. 15 and 16. As the needle moves through or along the aperture of the foot in order to penetrate the cloth, it necessarily moves tangentially to the feed-wheel; as it does not pass through the cloth in forming the stitches, but enters and emerges at adjacent points, as clearly shown in Fig. 7.

*Thread guide and take-up.*—The needle is shown with a vertical eye *l* (Figs. 6 and 7) and grooves *l*' upon the under side, and the thread is led into such groove by a thread-guide *p* attached to the needle-arm or carrier close to the shank of the needle. An ear *p*' upon the opposite end of the needle-carrier receives the thread from a guide-arm *p*<sup>2</sup> which extends from the needle-arm upwardly to receive the thread from a take-up lever V. This lever, as shown in Fig. 12, is actuated by a cam having a groove with three different seats for the lever-pin *v*. The cam, as shown in Figs. 1 and 12, is mounted upon the driving-shaft, and the take-up lever is pivoted at one side of the shaft and extended across the grooved face of the cam and downwardly toward the needle-arm to deliver the thread thereto. In Figs. 1 and 4, the machine is shown with spool A', tension

device B', and thread-guides C' upon the head which deliver the thread b' to the take-up lever. The lever V is shown in Fig. 12 in full lines in the position, just before the needle is retracted to form a loop, and it is shown in dotted lines at opposite sides of such position. The cam revolves per arrow V<sup>2</sup>, and the lever-pin v is shown engaging the seat v' of the groove, which is sufficiently eccentric to let the take-up lever move from its highest position gradually downward as the needle enters the cloth. The groove then makes a sudden drop to the seat v<sup>2</sup>, which slackens the thread and permits the formation of the loop j upon the needle as the shuttle engages the same, and the seat v<sup>3</sup> which connects the portions v<sup>2</sup> and v' inclines outwardly from the axis of the cam so as to raise the take-up lever to its highest position, and tighten the needle-thread upon the shuttle-thread to finish the stitch after the shuttle has cleared the loop.

*Attachments to the foot.*—I have found that the needle cannot engage the fabric uniformly, to make uniform stitches, with a mere foot having an aperture or throat through which the cloth can project to engage a needle oscillated wholly above the foot, but provision is required to keep the cloth from dragging forwardly with the needle, and for holding the two parts of the material down when one material, as the edge of a facing, is secured to the inside of a coat, and such edge does not extend across the opening in the foot. To keep the cloth from dragging forward, I attach an elastic leaf-spring detent q to the under side of the foot at the rear edge of the aperture m, and curve the free corner of the same downwardly sufficiently to press upon the cloth elastically and prevent the same from movement, except when carried forward by the feed-wheel. To hold the edge of a facing down upon the cloth at either side of the needle, I provide fingers r attached adjustably to the top of the foot, so that they may be set at varying distances apart as may be required to admit the lateral movement of the needle in zigzag sewing. Each finger has a straight rib which projects downwardly through the aperture m to the top of the cloth, as shown in Fig. 14, and they prevent the edge of the fabric from lifting in the aperture, on one side or the other, when the stitches are made (as along the tops of trousers' bands) so close to the edge of the fabric that this edge rests upon only one side of the feed-wheel, and does not extend across the aperture. These fingers can be adjusted so as to hold the fabric down, no matter how close the sewing is done to the edge of the fabric.

*Feeding devices.*—Figs. 7, 13 and 14 show the outer end of the feed-arm, which is provided with two cross-bars s having each a vertical slot s' to form bearings for the journals t of the feed-wheel. The wheel has marginal rows of teeth w and an intermediate smooth space w', which is preferably made flush with the tops of the teeth, to press the cloth z upwardly, as shown in Fig. 14. One of the journals t is provided with a universal joint t' connecting it with a feed-shaft t<sup>2</sup> which is extended into the feed-arm from the post A of the machine, where it is coupled to a feed-arbor T' having a ratchet-wheel T<sup>2</sup> thereon, as shown in Figs. 1 and 5. An eccentric y on the feed-shaft oscillates the feed-crank u<sup>2</sup> having the pawl u<sup>3</sup> to turn the feed-wheel.

The feed-crank u<sup>2</sup> is shown as an arm pivoted upon the feed-arbor T', so that as it is oscillated by the eccen-

tric y, the pawl u<sup>3</sup> moves back and forth over the teeth of the ratchet-wheel T<sup>2</sup> intermittingly, and drives the feed-wheel in the required manner.

The ratchet mechanism for turning the feed-arbor is in practice made variable so as to vary the feed; but the construction of the ratchet mechanism is immaterial to the present invention.

The journals t of the feed-wheel are pressed upwardly by the opposite ends of a leaf-spring W, and its periphery projects above the top of the feed-arm, through an opening formed in the same, such projection and the spring-support W enabling the feed-wheel to yield during the operation of sewing, when material of greater or lesser thickness is passed beneath the foot.

The connection of the feed-shaft t<sup>2</sup> with the feed-wheel and the feed-arbor T' by universal couplings, permits the feed-wheel to yield readily when pressed downward by the cloth, and allows one end of the wheel to be depressed independently of the other where the sewing is done close to the edge of the cloth, and the latter therefore presses upon only one end of the feed-wheel. The ends of the wheel are rounded, as shown in Fig. 14, to permit it to tip between the partitions s which form its bearings.

The yielding support of the feed-arm permits the latter also to yield, if the variations in the thickness of the material exceed the projection of the feed-wheel from the arm.

From the above description it will be understood that the raceway and the needle are arranged in fixed relations to one another, so that the needle may always pass beneath the corner of the shuttle. The foot is arranged between the raceway and the feed-arm, and is preferably held stationary, as shown in the drawing, and the feed-arm made to yield for introducing the fabric or work-piece.

In Fig. 7, I have shown the top of the feed-arm curved in cross section, and the bottom of the foot correspondingly curved at one side; but no ridge is required to bend the cloth for sewing in the present invention, nor is it necessary to bend the foot in conformity to such a ridge. The foot is shown bent downward at one side in Fig. 7, to clear the end of the carrier which supports and moves the needle; but the foot may be made flat and the needle-bar or table may be made flat, as shown and claimed in the co-pending application just referred to herein.

In the drawing, the reciprocation of the needle is transverse to the feed-arm, and as the raceway is necessarily transverse to the needle it reciprocates in a plane parallel to the line of the feed arm, with this arrangement; but the relation of these parts to the feed-arm may be varied without departing from the invention.

Where the rock-shaft for the needle-arm has an adjustable longitudinal movement to form zigzag stitches and to vary their breadth, it necessitates the use of universal couplings upon the connecting-rod which oscillates this shaft, and the movement of the shuttle-arm at right angles to the oscillation of the needle necessitates the use of universal joints upon its connection with the shuttle-shaft, which is made parallel with the driving-shaft.

The machine may be operated for felling the folds of seams, for joining the edge of a facing to the edge of a piece of cloth, as at the top of a trousers waistband, and

in quilting the crinoline or stiffening in the lining of collars, or for any other purpose to which a blind stitching machine is adapted, and can, while engaged in making zigzag stitches, be readily changed for sewing a straight seam or single line of stitches, by merely shifting the pin *f'* to the center of oscillation of the segment *g*; the needle with whatever kind of stitching always reciprocating in the line of the seam and not transverse to the same, and taking positions in two parallel planes alternately, when making zigzag stitches. The width of a zigzag seam with this construction is governed solely by the reciprocation of the rock-shaft *G* and thus differs widely from those in which the needle operates transverse to the line of the seam and in which the width of the seam is produced and governed by the penetration of the needle into the cloth.

With a transverse movement of the needle, such as has commonly been employed, a greater width of seam can only be secured by penetrating the cloth to a greater depth which is of course prohibited in sewing thin materials, whereas, the present construction can form a zigzag seam of any width upon material of any thickness. A wide zigzag seam can therefore be made upon thin materials, where it is desired to ornament the surface and display colored threads thereon, or a very narrow zigzag seam can be made upon thick material, and unite the layers together, which is impossible with thin materials if the needle operates transverse to the seam.

So far as I am aware, my present invention is the first in which a reciprocating shuttle has been used in forming zigzag stitches, and as a reciprocating shuttle clears the needle-thread in a different manner from a rotary shuttle, it enables me to operate twice as fast as if a rotary shuttle were employed to form the stitch.

Having thus set forth the nature of the invention what is claimed herein is:

1. In a blind stitching machine, the combination, with the frame of the machine having a post, a goose-neck and a head carried thereby of a feed-arm pivoted upon the post and projected beneath the head and rounded or sloped toward the opposite sides beneath the head, with an aperture having a toothed feed-wheel projecting therethrough, a foot held stationary upon the head with aperture over the feed-wheel, means for pressing the feed-arm toward the foot, a needle-bar upon the head carrying a curved needle, means for oscillating the needle transversely to the feed-arm and tangentially to the feed-wheel so as to enter and emerge from the cloth upon the same side, the raceway *P* curved in a vertical plane and supported upon the head above the foot contiguous to the path of the needle and transverse to the same, a shuttle movable in the raceway with point adjacent to the path of the needle, and means for reciprocating the shuttle, all of such parts excepting the feed-arm and feed-wheel being sustained upon the head in a working relation to one another.

2. In a blind stitching sewing machine, the combination, with the head of the machine, a feed-arm below the same with feed-wheel having a central smooth space between marginal rows of teeth, means for rotating the feed-wheel and a needle-bar with needle oscillated above the arm, tangentially to the periphery of the feed-wheel of a shuttle and raceway supported upon the head transverse to the path of the needle, a foot arranged between the raceway and the feed-arm, and having an aperture for the tangential movement of the needle through the fabric, and fingers secured adjustably upon the foot with flanges projected through the aperture toward the feed-arm, to hold the fabric downward close to the path of the needle.

3. In a blind stitching sewing machine, the combination, with the head of the machine, a feed-arm below the same

with feed-wheel having a central clearance space between marginal rows of teeth, and a needle-bar with needle oscillated transversely above the arm, of a shuttle and raceway supported upon the head transverse to the path of the needle, a foot arranged between the raceway and the feed-arm, and having an aperture for the tangential movement of the needle through the goods, pressers secured adjustably upon the foot with flanges projected through the aperture toward the feed-arm, and a leaf-spring detent upon the under side of the foot projected toward the pressers to hold the fabric elastically upon the feed-arm.

4. In a blind stitching sewing machine, the combination, with the head of the machine, a feed-arm below the same and a needle-bar with curved needle oscillated transversely above the arm, of a raceway divided at the middle and arranged above the path of the needle with one corner contiguous to such path, and a shuttle fitted to the raceway and tapered at both ends toward such corner, whereby it is adapted to engage a loop of the needle-thread at such corner when moved in either direction.

5. In a blind stitching machine, the combination, with the head of the machine and a feed-arm below the same, of a needle-bar upon the head with means for oscillating it transverse to the feed-arm, a foot held stationary upon the head between the path of the needle and the arm, a raceway supported upon the head above the foot contiguous to the path of the needle and transverse to the same, a double pointed shuttle movable in the raceway with point adjacent to the path of the needle, and means for reciprocating the shuttle in the raceway half as often as the needle-bar.

6. In a blind stitching machine, the combination, with the head of the machine and a feed-arm below the same, of a needle-bar upon the head with means for oscillating it transverse to the feed-arm, a foot held stationary upon the head between the path of the needle and the arm, an open channel raceway curved in a vertical plane and supported upon the head above the foot contiguous to the path of the needle and transverse to the same, a double pointed shuttle movable in the raceway with corner adjacent to the path of the needle, a shuttle-arm movable in a vertical plane and pivoted upon the head concentric with the curve of the raceway and provided with a shuttle-carrier adapted to embrace the opposite ends of the shuttle, and means for vibrating the shuttle-arm half as often as the needle-bar.

7. In a blind-stitching machine, the combination, with the frame, goose-neck, head, and a driving-shaft extended into the head, of a feed-arm jointed to the frame and projected below the head, a feed-device carried by the feed-arm a foot sustained upon the head with aperture for the tangential movement of the needle, a raceway sustained upon the head above the foot with shuttle movable therein in parallel to the feed-arm, an oscillating needle-bar carrying a needle through the foot-aperture transverse to the raceway, and tangentially to the feed-device and having a pivot-shaft parallel with the feed-arm, connections from the driving-shaft to the pivot-shaft to oscillate the needle-arm, and a cam rotated by the driving-shaft with connections for reciprocating the pivot-shaft longitudinally intermediate to the movements of the shuttle to form zigzag stitches with the needle.

8. In a blind stitching machine, the combination, with the frame, goose-neck, head, and a driving-shaft extended into the head, of a feed-arm jointed to the frame and projected below the head, a feed-device carried by the feed-arm a foot sustained upon the head with aperture for the tangential movement of the needle, a raceway sustained upon the head above the foot with a shuttle therein movable in a plane parallel to the feed-arm, an oscillating needle-bar carrying a needle through the foot-aperture transverse to the raceway, and tangentially to the feed-device and having a pivot-shaft parallel with the feed-arm, connections from the driving-shaft to oscillate and reciprocate the pivot-shaft of the needle-bar for making zigzag stitches, a vibrating-arm for reciprocating the shuttle, and a shuttle-shaft geared to the driving-shaft to rotate at one-half its speed and connected to the shuttle-arm to oscillate the shuttle.

9. In a blind stitching machine, the combination, with the frame, goose-neck, head, and a driving-shaft extended into the head, of a feed-arm jointed to the frame and projected below the head, a feed-device carried by the feed-arm, a foot sustained upon the head with aperture for the tangential movement of the needle, a raceway sustained upon the head above the foot with a shuttle therein movable in a plane parallel to the feed-arm, a shuttle-arm pivoted in the head, a shuttle-shaft geared to the driving-shaft to rotate at one-half its speed and connected to the shuttle-arm to vibrate the same, an oscillating needle-bar carrying a needle through the foot-aperture transverse to the raceway, and tangentially to the feed-device and having a pivot-shaft parallel with the feed-arm, a cam rotated with the shuttle-shaft with connections to the pivot-shaft to reciprocate the same to vary the path of the needle in making zigzag stitches, and connections from the driving-shaft to the pivot-shaft to oscillate the same and reciprocate the needle.

10. In a blind stitching machine, the combination, with the frame, goose-neck, head, and driving-shaft extended into the head, of a feed-arm jointed to the frame and projected below the head, a feeding device carried by the feed-arm, a foot sustained upon the head with aperture for the tangential movement of the needle, a raceway sustained upon the head above the foot with shuttle movable in a plane parallel to the feed-arm, an oscillating needle-bar carrying a needle through the foot-aperture transverse to the raceway and tangential to the feeding device with connections to the driving-shaft to oscillate the needle-bar, a shuttle-arm with means for vibrating the same to reciprocate the shuttle, a cam upon the driving-shaft above the needle-bar, a take-up lever pivoted upon the cam and extended over the same and downward toward the needle-bar, a thread-guide upon the head to receive the thread from the spool and deliver it to the take-up arm, and an ear upon the needle-bar with hole to receive the thread from the take-up lever and deliver it to the needle.

11. In a blind stitching machine, the combination, with the frame, goose-neck, head, and a driving-shaft extended into the head, of a feed-arm below the head, an oscillating needle-arm carrying a needle contiguous to the raceway and having a pivot-shaft parallel with the feed-arm, means for forming a stitch with the needle, connections to the driving-shaft to oscillate the pivot-shaft, and a grooved segment with connection to the driving shaft to be oscillated thereby, a pin adjustable in the segment, and a link connecting the pin with the pivot-shaft to reciprocate the same for making zigzag stitches.

12. In a blind stitching sewing machine, the combination, with the frame, goose-neck, head, and a driving-shaft extended into the head, of a feed-arm below the head, an oscillating needle-arm carrying a needle contiguous to the raceway and having a pivot-shaft parallel with the feed-arm, means for forming a stitch with the needle, connections to the driving-shaft to oscillate the pivot-shaft, and a segment with groove extended transverse to its axis, and having a connection with the driving shaft to be oscillated thereby a pin adjustable in the segment from the axis of the same to any outer point, and a link connecting the pin with the pivot-shaft, whereby the pivot-shaft may be reciprocated for making zigzag stitches, or held stationary longitudinally for sewing in a straight line.

13. In a blind stitching sewing machine, the combination, with a feed-arm and a curved needle movable tan-

gentially above the same, of bearings in the feed-arm and a feed-wheel journaled movably in the bearings below the needle, and having marginal rows of teeth with smooth intermediate space flush with the teeth, to support the fabric close to the path of the needle.

14. In a blind stitching sewing machine, the combination, with the frame, goose-neck, head and driving-shaft extended into the head, of a feed-arm, a foot, raceway and shuttle, an oscillating needle-arm carrying a needle transverse to the raceway and having a pivot-shaft parallel with the feed-arm, a cam with connections for reciprocating the pivot-shaft to form zigzag stitches with the needle, a crank upon the driving-shaft with spherical crank-pin, a crank upon the needle-arm with spherical crank-pin, and a connecting-rod having spherical bearings fitted to said crank-pins for oscillating the needle-arm in different positions of the pivot-shaft.

15. In a blind stitching sewing machine, the combination, with the frame, goose-neck, head and a driving-shaft extended into the head, of a feed-arm, a foot, raceway and shuttle, a needle-arm carrying a needle transverse to the raceway with connection to the driving-shaft for oscillating it, a shuttle-arm with pivot at one side of the driving-shaft transverse to the same with carrier upon its end to reciprocate the shuttle, a shuttle-shaft below the driving-shaft and geared thereto, cranks upon the shuttle-shaft and upon the shuttle-arm with crank-pins which stand at right angles to one another, and a rod and universal joints connecting the same to such crank-pins, as and for the purpose set forth.

16. In a blind stitching sewing machine, the combination, with the frame, goose-neck, head and a driving-shaft extended into the head, of a feed-arm, a foot, raceway and double-pointed shuttle, a needle-arm carrying a needle transverse to the raceway with connection to the driving-shaft for oscillating it, a shuttle-arm pivoted to vibrate at one side of the driving-shaft, a shuttle-shaft below the driving-shaft, gearing to rotate the same at one-half the speed of the driving-shaft, and connections from the shuttle-shaft to the shuttle-arm to oscillate the same and the shuttle.

17. In a blind-stitching machine, the combination, with the frame, goose-neck and head, of a foot supported adjustably upon the head, a needle with means for oscillating the same above the foot, a feed-arm movable to and from the foot with aperture for a feed-wheel below the foot, a feed-wheel projected through such aperture and having marginal rows of teeth with a central smooth space flush with the tops of the teeth, and means for rotating the wheel within the aperture.

18. In a blind stitching machine, the combination, with the frame, goose-neck and head, of a foot supported adjustably upon the head with aperture for the engagement of the needle with the cloth, a needle with means for oscillating the same, a feed-arm with feed-wheel movable to and from the aperture in the foot, and fingers secured upon the foot with flanges projected through the aperture toward the feed-arm, and adjustable close to the path of the needle to hold the fabric downward in said path.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN E. FEFEL.

Witnesses:

L. LEE,

THOMAS S. CRANE.