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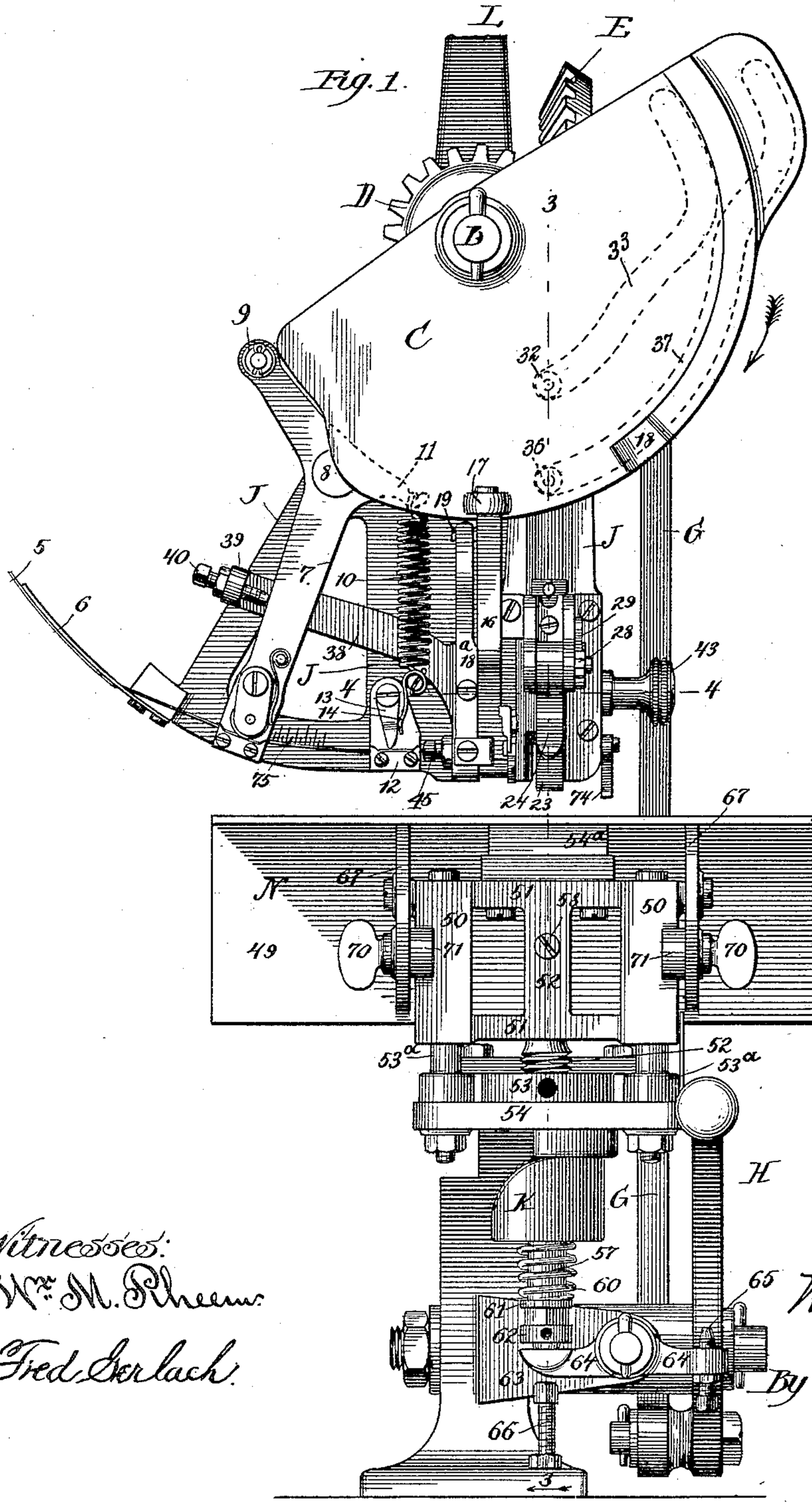
W. E. HARPER.

WIRE STAPLING MACHINE.

No. 445,140. Patented Jan. 20, 1891.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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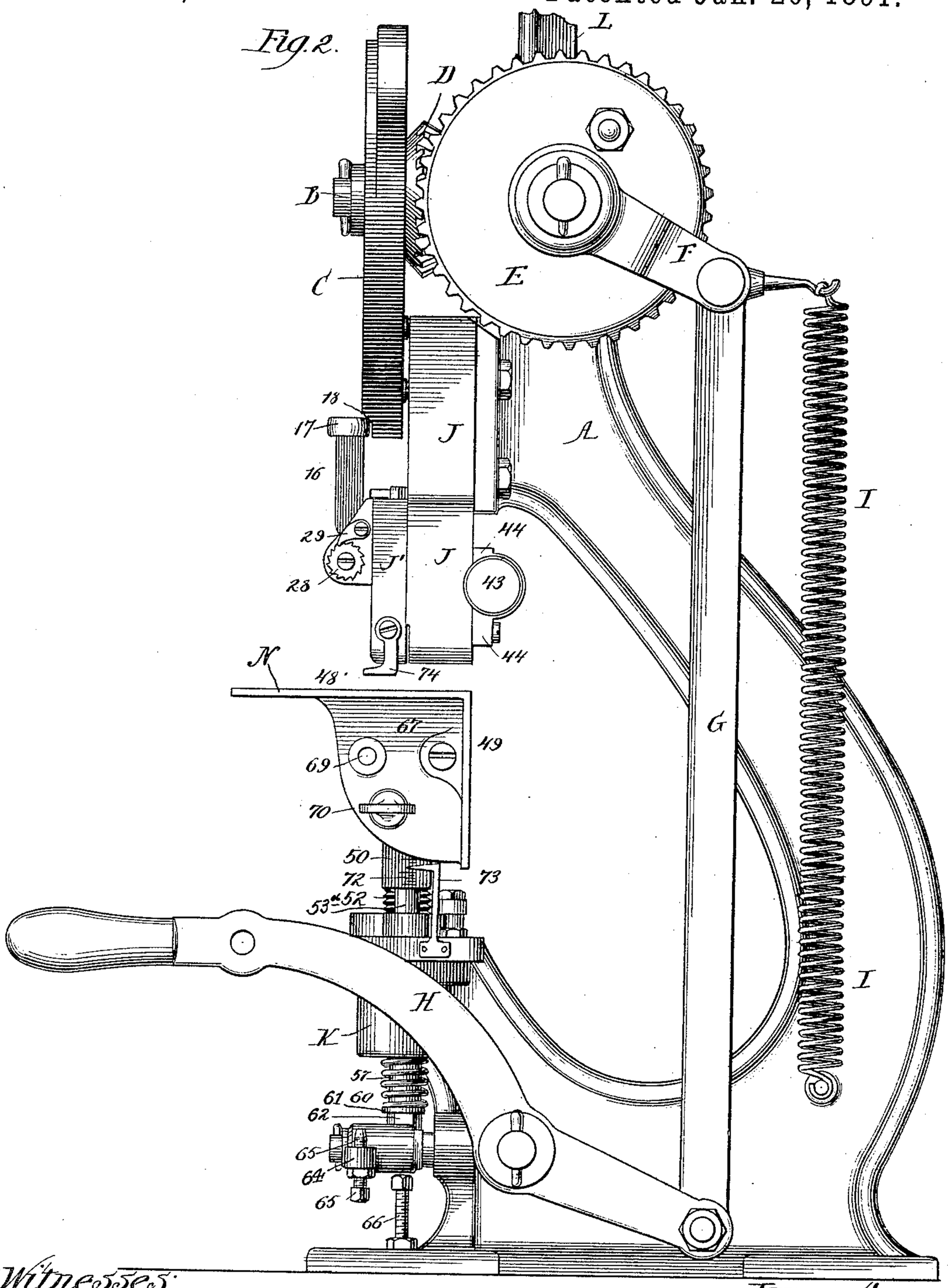
Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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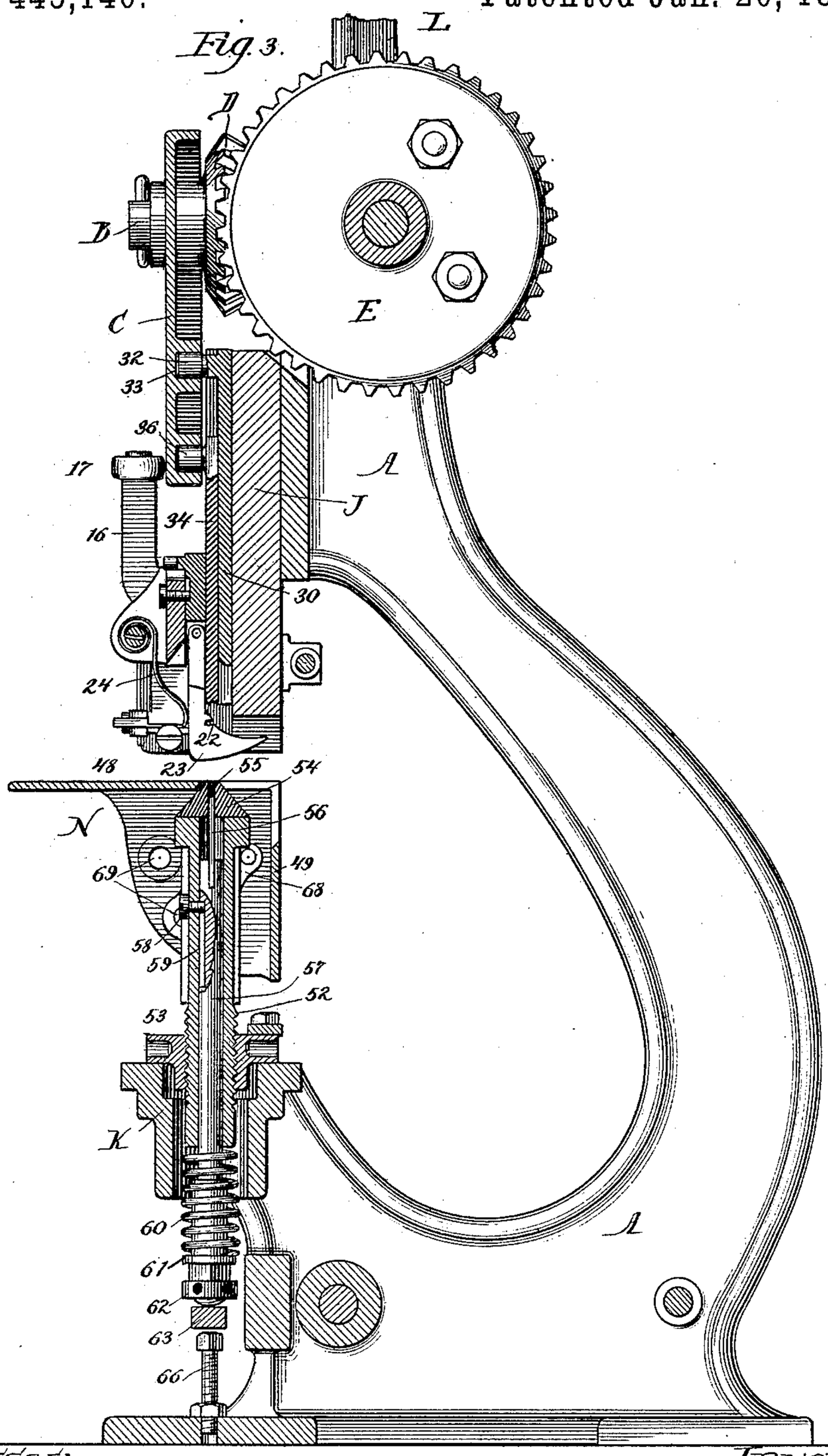
Fig. 3.



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WIRE STAPLING MACHINE.

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Fig. 4.

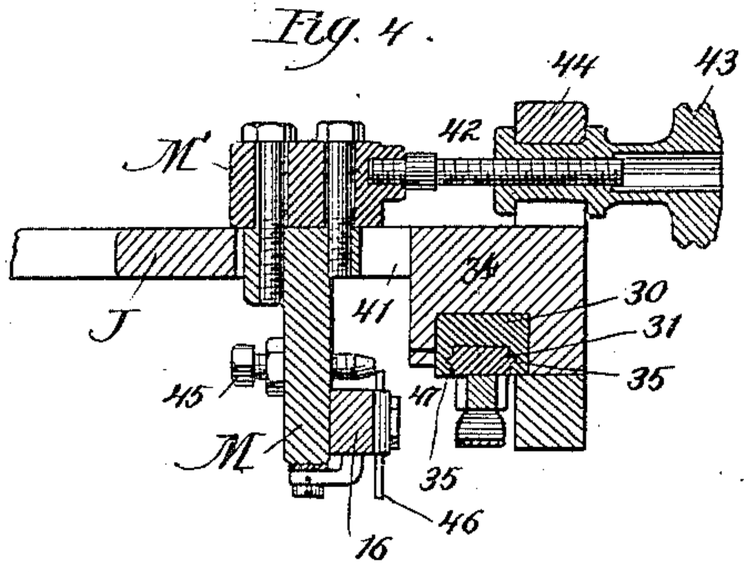


Fig. 6.

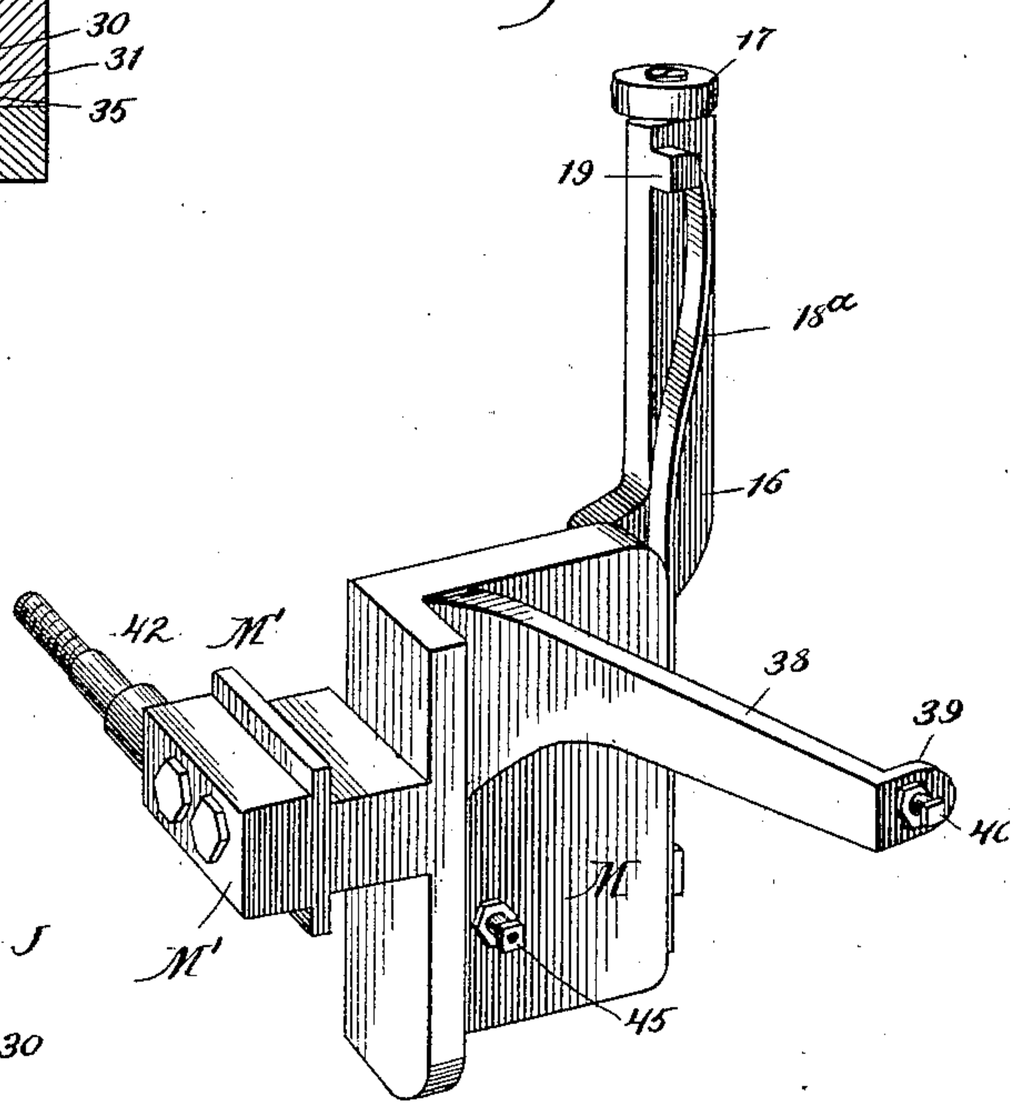
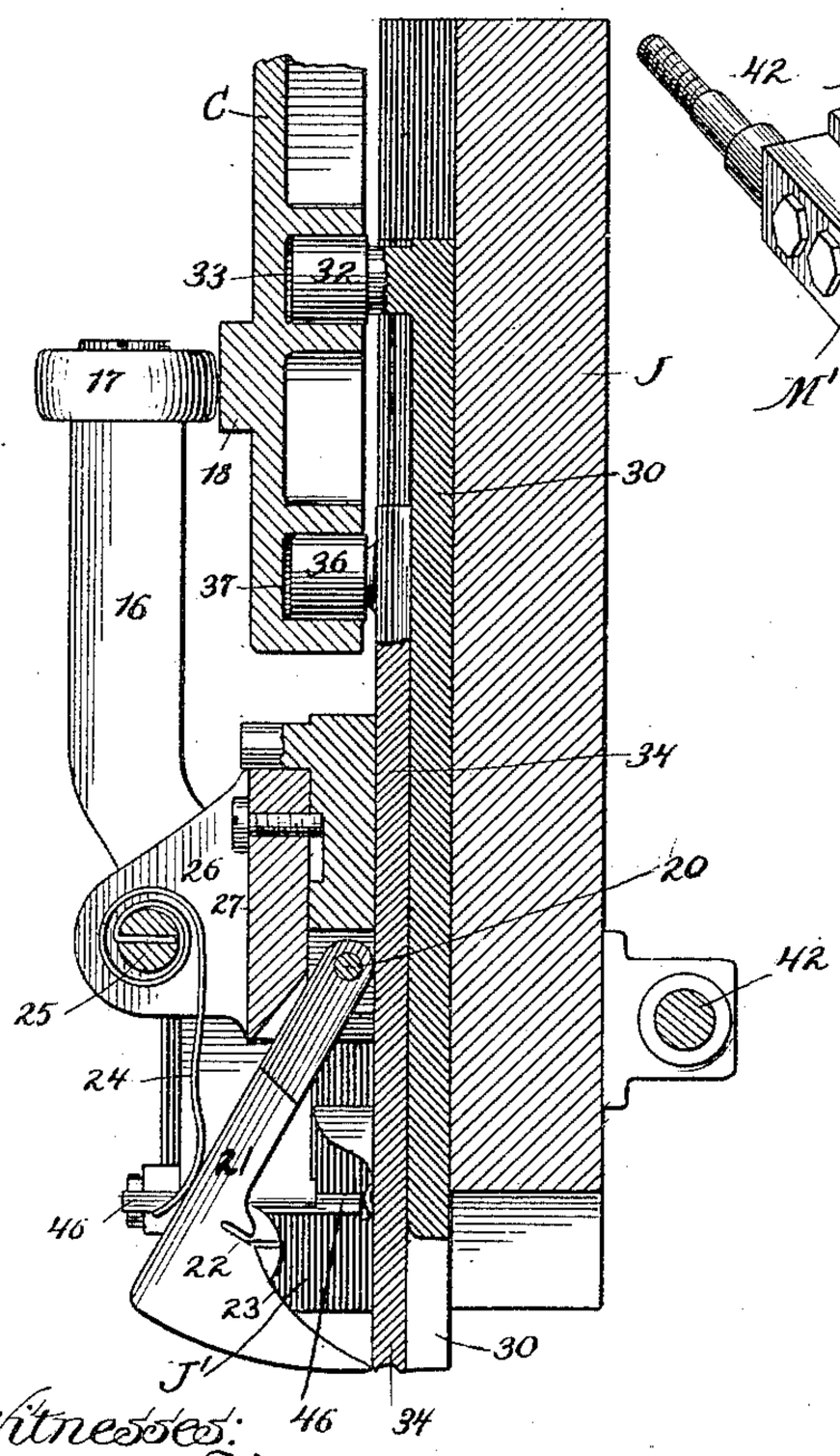


Fig. 5



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(No Model.)

5 Sheets—Sheet 5.

W. E. HARPER.

WIRE STAPLING MACHINE.

No. 445,140. Patented Jan. 20, 1891.

Fig. 7.

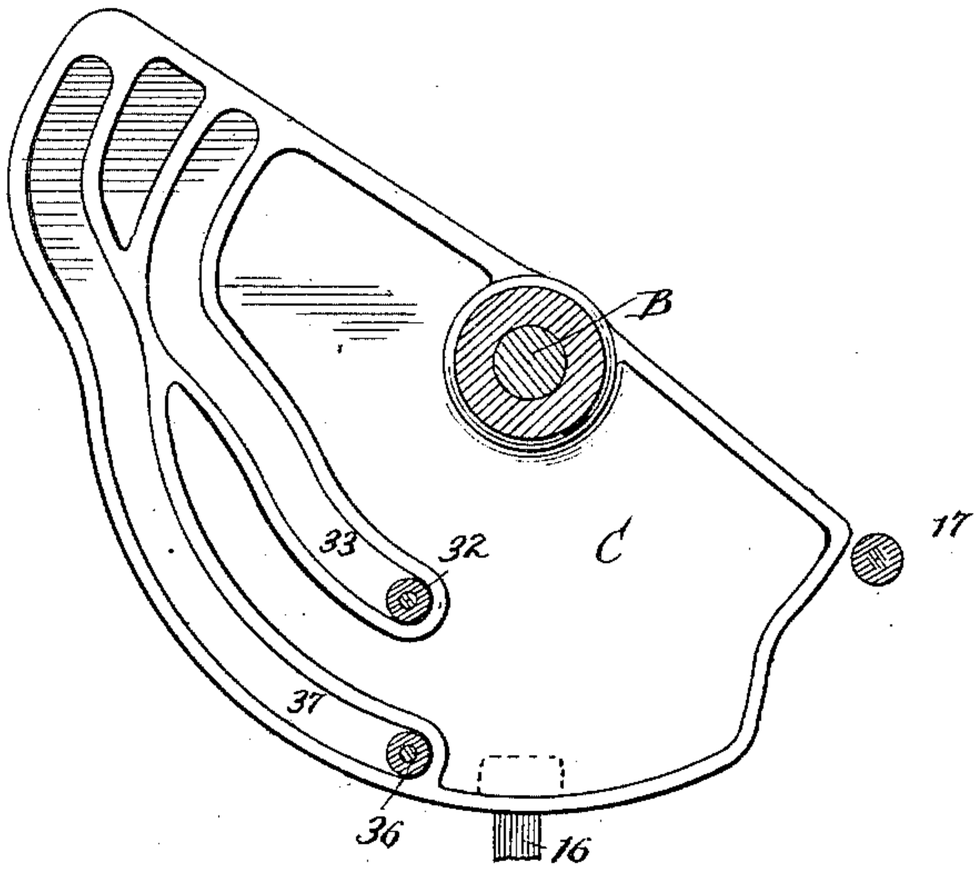


Fig. 8.

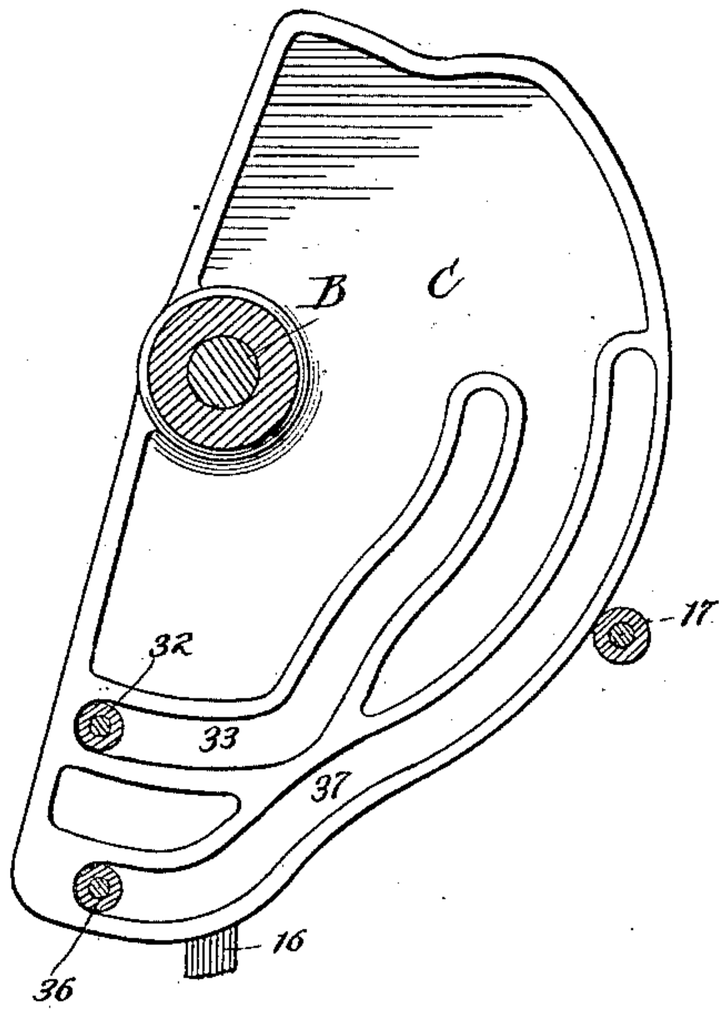


Fig. 9.

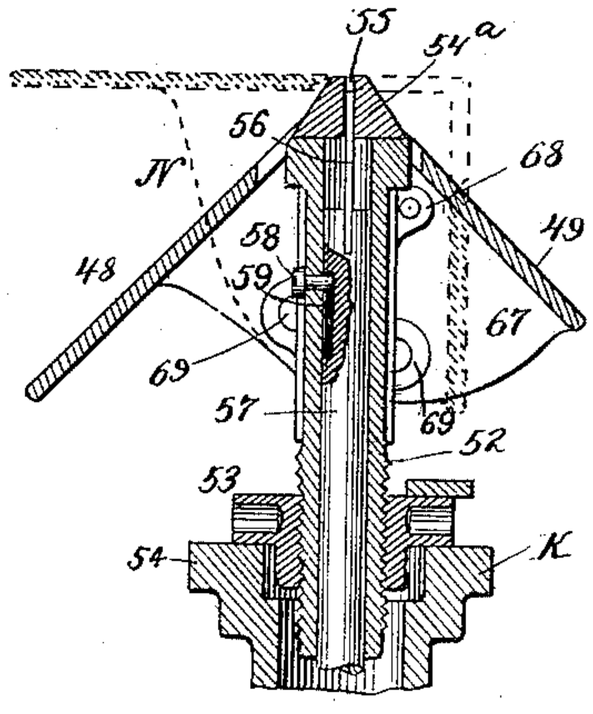
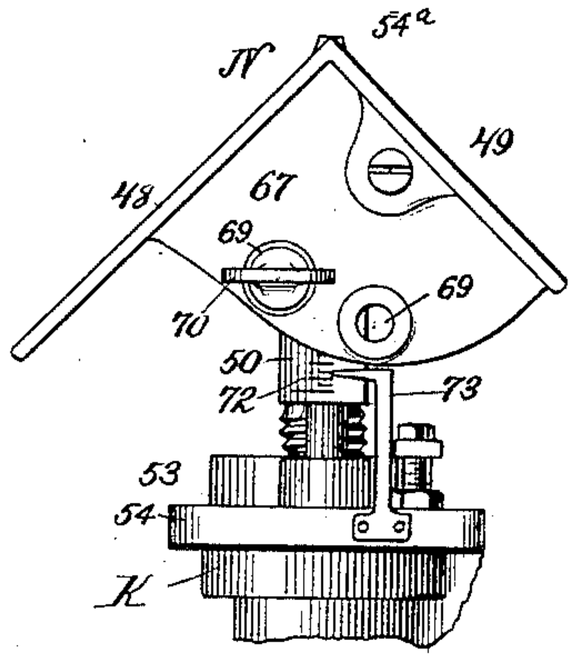


Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM E. HARPER, OF CHICAGO, ILLINOIS.

WIRE-STAPLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 445,140, dated January 20, 1891.

Application filed January 30, 1890. Serial No. 338,559. (No model.) Patented in Germany May 18, 1887, No. 42,280.

To all whom it may concern:

Be it known that I, WILLIAM E. HARPER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Wire-Stapling Machines for Books and Pamphlets, (for which I have obtained a patent in Germany, No. 42,280, bearing date May 18, 1887,) of which the following is a specification.

This invention relates to improvements in wire-stapling machines especially designed for use in the binding of books and pamphlets, and in which wire fed from a spool is automatically and successively separated into lengths, formed into a staple, driven through the materials to be stapled, and at the same time sustained against any possibility of its legs crippling during the driving operation, and finally clinched upon the under side of the book or pamphlet.

More specifically stated, this invention relates to improvements in a hand-power machine of the above-described general character, although containing, as hereinafter described, novel features equally well adapted to power-machines.

One object of this invention is the actuation of the devices for feeding the wire through the machine, for severing the wire into proper lengths, for forming the staple, for supporting the staple-legs against crippling while being driven, and for driving the staple by means of a single cam, whereby a machine of this character is reduced to the simplest possible cheap and durable form, and the proper timing of its parts when once accomplished cannot be accidentally changed.

A further object of this invention is to dispense with the usual gripping-jaws and to have such a connection between the vibrating feed-lever and the cutter that both of these parts may be simultaneously adjusted and in such a manner that both legs of a staple, of whatever length they may be, are invariably of the same length.

Another object is to have a work-supporting table of such a character that it may be adjusted so as to form a single horizontal support for the work below the machine, or, if desired, form a table having two inclined sides with its apex directly between the staple forming and driving devices and the clinching mechanism, and yet all sides of said table be in rigid connection with each other.

A further object is to have such a connection between the power for actuating the wire-feeding, wire-severing, staple forming and driving devices, and the clinching devices that the lever actuating the machine will at the proper time also actuate the clinchers, although having no direct connection therewith.

A further object is to have such a construction of the adjusting devices for the work-supporting table that a scale thereon will with certainty indicate the size of staple required to staple a book of any thickness when placed in its operative position between said table and the stapling devices, and also to have such an adjustment of the feed-lever for differing sizes of staples that said lever may operate as a pointer for and be quickly and readily adjusted to a scale on the supporting-frame of the machine, indicating differing sizes of staples, and, finally, to have a compact and durable machine throughout, by reason of certain parts and arrangement of parts hereinafter described, and shown in the accompanying drawings, in which—

Figure 1 represents a front elevation of a wire-stapling machine for books and pamphlets embodying my invention; Fig. 2, a side elevation of the same; Fig. 3, a vertical longitudinal section on the line 3 3 of Fig. 1; Fig. 4, a transverse section on the line 4 4 of Fig. 1; Fig. 5, an enlarged vertical section taken on a line at one side of the combined anvil and supporter, showing the position of said parts and of the driver at the end of the stroke of the latter; Fig. 6, a detail perspective of the sliding block supporting and connecting the cutter with the feed-lever; Fig. 7, a rear elevation of the cam-plate, indicating its position and the position of the several parts it actuates when the same are at rest; Fig. 8, a similar view of the cam-plate and its position, together with the several parts it operates, at the end of its movement after the staple is driven; Fig. 9, a central vertical section through the work-supporting table and its supporting devices, the dotted lines indicating the change of the table from a double inclined to a horizontal table; and Fig. 10, a side elevation of the same.

Similar letters and figures of reference indicate the same parts in the several figures of the drawings.

The working parts of my machine are preferably supported by, and at the ends of a yoke-shaped frame A, in the upper end or arm of which is journaled a shaft B, on the end of which is mounted a cam-plate C, of such form as to actuate all of the operating devices above the table.

On the shaft B is a beveled pinion D, meshing with a beveled gear E, journaled on a pintle or shaft likewise projecting from the upper end of the frame, from which gear projects a crank-arm F, connected by a pitman G with a hand-lever H, fulcrumed on one side of the base of the frame, a spring I, extending from a projection on the upper end of the pitman downwardly toward the base of the frame, where its other end is secured, serving to retract or lift the lever H and depress the crank-arm F after the lever has been depressed and actuated, all and the several operating devices of the machine, as hereinafter described.

Below or otherwise secured to and depending from the upper end of the yoke-frame is a face-plate J, which carries all of the wire-feeding, staple-forming, staple-supporting, and staple-driving devices, including the further devices for adjusting these several parts, and likewise secured to, or, as shown, preferably cast upon, the lower end of the yoke-frame is a tubular projection K, supporting the work-table and clinching mechanisms. The frame is further provided with a vertical standard or arm L (but partly shown, though of the usual construction) for suspending the spooled wire above the machine conveniently thereto and for the operator. The wire 5 supplied from this reel is directed over a tension device which in the present construction is shown to be a spring-arm 6, secured to the head or plate J, over which arm the wire passes, and thence through a perforation therein through and between the usual jaws of a vibrating feed-lever 7, which in making its forward movement grips the wire and pushes it forward through a gripper, thence through a tubular guide, past the cutter, and across the face of the anvil, in position for severing and forming into a staple, the feed-lever for this purpose being a bell-crank lever pivoted to the head-block at 8 and provided at its free end with a friction-wheel 9, engaging with the edge of the cam C, which has the proper conformation to give the feed-lever its desired stroke, the feed-lever being maintained in contact with the cam and forced to retreat, after making its forward movement, by means of a spring 10, secured to an arm 11, projecting inwardly from the feed-lever and secured at its other end to the face-plate of the machine, as shown in Fig. 1.

The gripper consists of a fixed jaw 12 and a pivoted jaw 13, actuated by a spring 14 and so arranged relative to the fixed jaw that the wire may freely pass forwardly under it, but is rigidly clamped against a backward movement, so that after the wire is carried forward by the feed-lever it cannot be retreated by the latter when making its backward movement or by any other means.

The tubular guide is of the usual construction and secured in the usual manner to the face-plate J, the inner end of said guide forming a surface across which the wire is severed by a cutter 16, pivoted to the face-plate J and having on its upper end a friction-roller 17, adapted to engage a cam 18 on the cam C, which cam 18 is of such construction that at the proper moment the feed-lever is swung on its pivot so as to sever the wire with a shear cut, a spring 18ª, secured to the face-plate J and having its free end engaging a stud 19, projecting from the upper end of the vibrating cutter, serving to maintain the cutter at all times against the face of its cam and therefore to retreat it after the cutter has severed the wire.

The face-plate is provided with a forward extension J′, to which is pivoted at 20 (see Fig. 5) the leg 21 of a combined anvil 22 and supporter 23, which two combined parts in side elevation form a substantially triangular piece of metal of a width which practically corresponds with the distance between the staple-legs, while its greatest depth or height from the bottom of the supporter to the anvil is preferably about equal to the longest staples designed to be made, the face of the anvil being formed by a transverse slot in said piece at a point below the leg thereof when flat wire is used, which is generally of a greater width than depth or thickness. The depth of this slot, although greater than the thickness of the wire, is less than its width, whereby the wire may freely pass through it, but without any possibility of turning or twisting therein; but when for round wire the slot may be of the usual form.

The combined anvil and supporter are maintained in their operative position underneath the bender and driver (presently described, and as shown in Fig. 3) by a spring 24, coiled about and secured to an adjustable pintle 25, confined between lugs 26, projecting from a plate 27, secured to the forward extension J′ of the face-plate, the adjustment of the tension-spring being secured by means of a ratchet-wheel 28 on the pintle 25 and a pawl 29, pivoted to one of said lugs and engaging the ratchet.

The bender 30, for forming the staple over the anvil, is of the usual form and provided with the usual vertical and parallel internal grooves 31, (see Fig. 4,) and has projecting therefrom an anti-friction roller 32, (see Fig. 5,) engaging the camway 33, (see Figs. 7 and 8,) whereby it is given its vertical movement.

The driver 34 is arranged within the legs of the bender in the usual manner, but is provided with splines 35, (see Fig. 4,) projecting into the grooves of the bender, one

purpose of which splines is to guide and insure movement of the driver; but the main object of these splines is to extend the operating-face of the driver the full width of the staple, whereby the force of the driver is in a direct line through and not at an angle to the legs of the staple, as would be the case if the splines were omitted, as will be understood by remembering that the legs of the staple lie in the grooves of the bender. The driver toward its upper end has projecting from it an anti-friction roller 36, engaging the camway 37 (see Figs. 5, 7, and 8) in the cam C for actuating the driver.

Prior to my invention the adjustment of these machines for staples varying in length has required the independent manipulation of the stroke of the feed-lever and of the cutter with reference to the anvil, and as a result considerable manipulation back and forth of these adjusting devices has been necessary and required considerable skill before such adjustment of the stroke of the feed-lever and the cutter could be secured as to produce a staple having legs of uniform length or of such uniformity that the force of the driver was the same or substantially the same on both legs of the staple, as is necessary, particularly in fine-wire staples, to prevent a twisting of a staple during the driving operation, or in any event to have a uniformity in length and finish of the clinched ends of the staple.

In an application executed and filed of even date herewith, Serial No. 338,558, I have provided for a simultaneous and uniform adjustment of the stroke of the feed-lever and of the cutter by means of a stop-connection between a gripping-lever and the feed-lever and a link-connection between said gripping-lever and a sliding block supporting the cutter and manipulated through the medium of a single thumb-screw. My present invention, however, simplifies that construction by eliminating the pivoted gripping-lever and having a rigid connection between the feed-lever and the sliding block M, carrying the cutter. To this end the cutter 16 is pivoted to a sliding block M, (see Figs. 4 and 6,) provided with a projection M′, cast therewith or preferably bolted thereto, as shown in Fig. 4, from which block projects an arm 38, having a right-angular bend 39 at its free end, through which bend passes a set-screw 40, the said arm extending beyond the feed-lever 7 and in such a position that the set-screw 40 operates as an adjustable stop for the arm and as a take-up for any lost motion, as will be presently explained. The projection M′ has its bearing in a slot 41 (see Fig. 4) in the face-plate J, and working in the projection M′ is one end of a right and left hand screw 42, the other end of which works in a thumb-nut 43, free to turn, but otherwise fixed, in an ear 44, projecting rearwardly from the face-plate, so that by turning said female thumb-nut the sliding block is advanced and retreated, carrying with it the cutter and the feed-lever, the connection of the arm 38 with the feed-lever being at such a point that the gripper thereof will move twice as far as the sliding block and the cutter, the arm 38 to that end engaging the feed-lever at a point midway between the pivot of the feed-lever and the gripper-jaws carried thereby. By this relative arrangement it will be understood that when it is desired to increase the length of each staple-leg, for example, one-sixteenth of an inch the feed-lever, by having its stroke increased two-sixteenths of an inch, will carry the wire two-sixteenths of an inch farther and increase the length of the severed piece one-sixteenth of an inch on each side of the anvil. While the feed-lever is moving two-sixteenths of an inch farther than its original stroke, the cutter will be moved away from the anvil one-sixteenth of an inch, and thereby sever the wire, so that it will have one-sixteenth of an inch greater length on the side of the anvil next the cutter. So, on the other hand, in shortening the staple the feed-lever carries the wire beyond the anvil a corresponding distance, and the cutter, moving one-half that distance, will sever the wire on the other side of the anvil at such a point that the ends of the wire projecting beyond the anvil and forming staple-legs will be of precisely the same length. In feeding the wire to the anvil it is passed through a tubular guide 45 in the sliding block M, which tubular guide is screw-threaded to be adjustable with reference to the cutting-edge of the cutter, against the inner end of which guide said cutter severs the wire, the cutter itself preferably consisting of a removable blade 46, held in a slot in the cutting-lever by means of a set-screw 47 in such a manner that it may be adjusted lengthwise for wear and also for timing its contact with the wire, so as to sever the wire at the proper moment.

In operation, after the parts so far described are adjusted for the desired length of staple, and with the cam C in the position shown in Fig. 1, the starting of the cam to the left, as indicated by the arrow in said figure, will cause the feed-lever to make its forward stroke and push the wire forward past the gripper 12, through the tubular guide, and across the face of the anvil. By the time the feed lever has reached the limit of its forward stroke the roller 17 of the cutter will engage the cam 18 and swing the cutting-edge inwardly, severing the wire close off against the edge of the inner end of the tubular guide, the gripping-jaw 13 in the meantime preventing the wire from making a backward movement. By the time the wire is severed the cam 33 actuates the bender, which then descends, bending the wire over the anvil and forming the staple and continuing in its descent until it comes in contact with the work to be stapled. The driver is then actuated through the cam 37, and, descending in contact with the incline above the face of the

anvil, forcibly swings the anvil backwardly out of the staple, the crown of which is then above the face of the supporter, and the driver, continuing its descent, forces the staple through the book or pamphlet, and in so doing as gradually recedes the supporter from the staple to the position shown in Fig. 5, by which time the staple is through or practically through the book or pamphlet, and is then tightened therein by the further stroke of the driver down to the face of the work, after which, as will now be described, the clinching devices are actuated and the stapling completed. As soon as the staple is finally clinched the releasing of the hand-lever H permits the force of the spring I to return all of the parts to their first-described position preparatory to the formation and driving of another staple.

The book, pamphlet, or other work to be stapled is supported on a work-supporting table N, having two surfaces 48 and 49 joined at a right angle to each other and supported from parallel hollow standards 50 50, joined at each end by bars 51 51, the frame thereby formed being vertically adjustable, and with it the work-support table, by means of a hollow post 52, externally screw-threaded, as shown in Figs. 1 and 3, and having working thereon a nut 53, bearing on the tubular projection K of the machine-frame, the tubular projection K, in fact, being the base-support for the table and the clinching devices heretofore described, and the hollow posts 50, by reason of their being sleeved on rods 53^a, rigidly secured to a projecting flange 54 of the tubular projection, serving simply as guides, preventing an axial rotation of the table, but permitting its vertical adjustment.

The hollow central post 52 has secured to or formed therewith at its upper end an elongated cap 54^a, triangular in cross-section and provided with an elongated slit 55, in which works a clinching-blade 56, secured to a rod 57, working in the hollow post 52, (see Fig. 9,) the vertical movement of which rod, together with the clinching-blade, being limited by a set-screw 58, projected through the post 52 into a recess 59 in the rod 57, a coiled spring 60 on the rod bearing at one end against a collar 61 at the free end of the rod and at its other end against the end of the hollow post 52, serving to actuate the rod to the limit of its downward stroke and withdraw the clinching-blade within the cap 54^a, the tension of said spring being adjustable by means of a nut 62 on the rod below the spring.

Pivoted to a lug 63, projecting from near the base of the frame A, is a lever 64, one end of which projects under and engages the nut of the rod 57, and the other end projects under and is adapted to be engaged by the hand-lever H during the latter part of its downward stroke, the movement of the lever 64, and consequently of the clinching-blade, being accurately adjusted and determined by means of a set-screw 65 in the end of the lever 64, projecting into the path of movement of, so as to be engaged by, the hand-lever during the latter part of its stroke. The length of stroke of the rod 57 is also made adjustable by a set-screw 66 in the base of the machine, which subserves the further purpose of a stop for both the lever 64 and the rod 57. The table N is slotted at the juncture of its right-angular faces directly over the cap 54 and is provided with internal flanges or ears 67 67 and is pivoted to lugs 68 68, (see Fig. 3,) projecting from the post 50. The flanges 67 67 are provided with two or more perforations 69 69, through which are passed thumb-screws 70 70, adapted to work in screw-threaded perforations or lugs 71 71 in the standards 50 and lock the table in its adjusted position—as, for example, in the horizontal position shown in Fig. 3 or in the inclined position shown in Fig. 9—it being understood that it is sometimes desirable to use a flat table and at other times to straddle a book or pamphlet over a triangular table for stapling purposes, and that the form, slotting, and pivoting of this work-supporting table permit of its adjustment to either of these positions. The prior tables capable of these forms have heretofore required the use of a hinged leaf; but it is obvious that by my construction a greater and desirable rigidity of the table is secured, and at the same it may be rigidly and with certainty secured with either of its adjustments. The face of the cap 54, next the ends of the slot, is provided with the usual incline (not shown) for directing the ends of the staple toward each other as they are forced downwardly below the work, so that the clinching-blade in coming in contact with these ends may press them directly against the under side of the work. The slot itself may have a width greater than the thickness of the wire of the staple, so that the ends projected below the face of the slot may be forced upwardly between them against the work; but this width in the slot is not absolutely necessary, providing the face of the cap is properly inclined and the clinching-blade properly timed, as may be by the adjustment of the screw 65.

In operation, after adjusting the table to the desired position by the manipulation of the nut 53 and with the clinching-blade at the limit of its lower stroke, as shown in Fig. 3, the staple, when forced downwardly by the driver, will have its ends strike the inclines of the cap 54 and bend inwardly, and the moment the staple is fully driven the hand-lever H comes in contact with the pivoted lever 64, and, lifting the clinching-blade against the action of the spring 60, forces and flattens the ends of the staple inwardly toward each other against the work, the clinching-blade being retreated by the action of the spring 60 as soon as the hand-lever is released from the rocking lever 64, which then retreats against the stop-screw 66, supporting the clinching-blade against further retreat.

So far as my invention includes a pivoted and swinging angular table, it would not be a departure therefrom to pivot said table or to lock it in its several adjustments by means other than are shown, and so also a direct connection may be made between the hand-lever H and the clinching-blade other than by the employment of the rocking lever, for my invention in this regard includes, broadly, a clinching-blade actuated by or through a mechanism employed for actuating the operative devices of the machine that are above the table and in consonance therewith.

Another important feature of my invention, not before referred to, and rendered possible by the combination and arrangement of the several parts of this machine, is the indication of the size of staple desirable for any given thickness of work, and in such a manner that all parts of the work may, without the exercise of any particular skill, be accurately adjusted to that end. To this end (see Fig. 2) one of the hollow and vertically-adjustable posts 50 is provided with a scale 72, and rigidly secured to the tubular projection is a pointer 73, which, as the tubular posts are raised or lowered, and with them the work-table, will indicate the the vertical movement in inches and fractional inches of the table toward and from the operating device above the table. On one side of the forward extension J′ is pivoted a toe-piece 74, the under face of which is in a plane with the face ends of the bender 30 when at the limit of its downward stroke, and therefore the distance between this toe-piece and the table will represent the thickness of the work when the table is properly adjusted—that is to say, so that the work will be to a limited extent clamped between the bender and the table, as it should be while being stapled. Now, on the face-plate J in the same arc of a circle or line of travel of the wire between the feed-lever and the anvil is a similar scale 75, for which the feed-lever is the pointer, which scale corresponds with the scale 72. Now, suppose the work to be a half of an inch thick and the work-table properly adjusted thereto, the pointer 73 will indicate that thickness plus the desired increased length of the staple for clinching purposes—for example, a staple with legs three-fourths of an inch in length. With this indication the operator has only to turn the thumb-nut 43 until the feed-lever has reached the corresponding mark on its scale, with the result that he simultaneously adjusts without calculation or experiment both the feed-lever and the cutter for the particular work then on the table, and thereby not only saves much valuable time, but avoids much annoying and tedious manipulation of the parts at the present time required in machines of this particular class.

While the machine herein described is particularly adapted for hand purposes, it would of course be no departure from my invention to operate it by power for the operation and the co-operation of these several parts, and the result secured thereby would be identically the same.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a wire-stapling machine, the combination, with a single moving cam-piece, of a wire-feed, a cutter, an anvil, a bender, and a driver having direct connection with and actuated by said single cam-piece, substantially as described.

2. In a wire-stapling machine, the combination of a single vibrating cam, means for actuating the same, a wire-feed, a cutter, a bender, an anvil, and a supporter directly engaging and actuated by said vibrating cam, substantially as described.

3. In a wire-stapling machine, the combination of an adjustable feed-lever, an adjustable cutter, an arm between and connecting said cutter and lever, and means for actuating said arm, whereby the feed-lever and cutter are simultaneously and uniformly adjusted for staples varying in length, substantially as described.

4. In a wire-stapling machine, the combination of an adjustable feed, an adjustable cutter, a sliding block supporting said cutter, and an arm connecting said block and feed, and means for actuating said block, substantially as and for the purpose described.

5. In a wire-stapling machine, the combination of a wire-feed, a sliding block, a cutter pivoted to said block, and an arm connecting the cutter-support with the wire-feed, a screw, and a thumb-nut journaled in the machine-frame and actuating said screw, substantially as described.

6. In a wire-stapling machine, the combination of a vibrating feed-lever, a cutter, and a wire-gripper between the feed-lever and cutter, substantially as described.

7. In a wire-stapling machine, the combination of a vibrating feed-lever, a cutter, and a stationary gripper between said lever and cutter, substantially as described.

8. In a wire-stapling machine, the combination of a work-supporting table, a frame or support therefor, and a pivot-connection between said table and support, whereby the table may be bodily adjusted, substantially as described.

9. In a wire-stapling machine, a work-table having two faces at a right angle to each other, a support for said table, and a pivot-connection between said table and support, whereby the table may be swung so as to present either a flat surface or inclined surface for the work, substantially as described.

10. In a wire-stapling machine, the combination of a work-supporting table having rigidly-jointed angular faces and a support upon which said table is pivotally adjustable, which said support is also vertically adjustable, substantially as described.

11. In a wire-stapling machine, the combination of a work-supporting table having angular faces rigidly joined and slotted, a support for said table, a pivot-connection between said support and table, and clinching devices projecting through said slot, substantially as described.

12. In clinching devices for a wire-stapling machine, the combination of a hollow post provided at its upper end with an opening and a reciprocating clinching-blade working in said post and adapted to be projected through said opening, substantially as described.

13. In a wire-stapling machine, the combination, with a reciprocating clinching-blade, of a hand-lever connected with and adapted to actuate said blade, substantially as described.

14. In a wire-stapling machine, the combination of a reciprocating clinching-blade, a hand-lever, and a rocking lever adapted to be actuated by the hand-lever so as to operate the clinching-blade, substantially as described.

15. In a wire-stapling machine, the combination, with a reciprocating clinching-blade, of an adjustable stop engaging and regulating the stroke of said blade, substantially as described.

16. In a wire-stapling machine, the combination of a reciprocating clinching-blade, a rocking lever engaging and actuating said blade, and an adjustable stop below said rocking lever and engaging therewith, substantially as described.

17. In a wire-stapling machine, the combination of a tubular post, a reciprocating clinching-blade therein, an adjustable nut on the end of said clincher, and a spring confined between said nut and tubular post, whereby the clincher is maintained at the limit of its downward stroke and the tension of said spring may be adjusted, substantially as described.

18. In a wire-stapling machine, the combination of a work-supporting table, an adjustable support therefor, a gage on said support, a pointer for said gage, a face-plate provided with a corresponding gage, and an adjustable vibrating feed-lever in the path of said gage and operating as a pointer therefor, substantially as and for the purpose described.

19. In a wire-stapling machine, the combination of an adjustable work-supporting table, a gage therefor, an adjustable vibrating feed-lever, and a gage therefor, and a toe-piece secured to said face-plate above the work-table, substantially as and for the purpose described.

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Witnesses:
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