(No Model.)

3 Sheets—Sheet 1

A. B. SMITH.

STAPLING MACHINE.

No. 335,154. Patented Feb. 2, 1886.

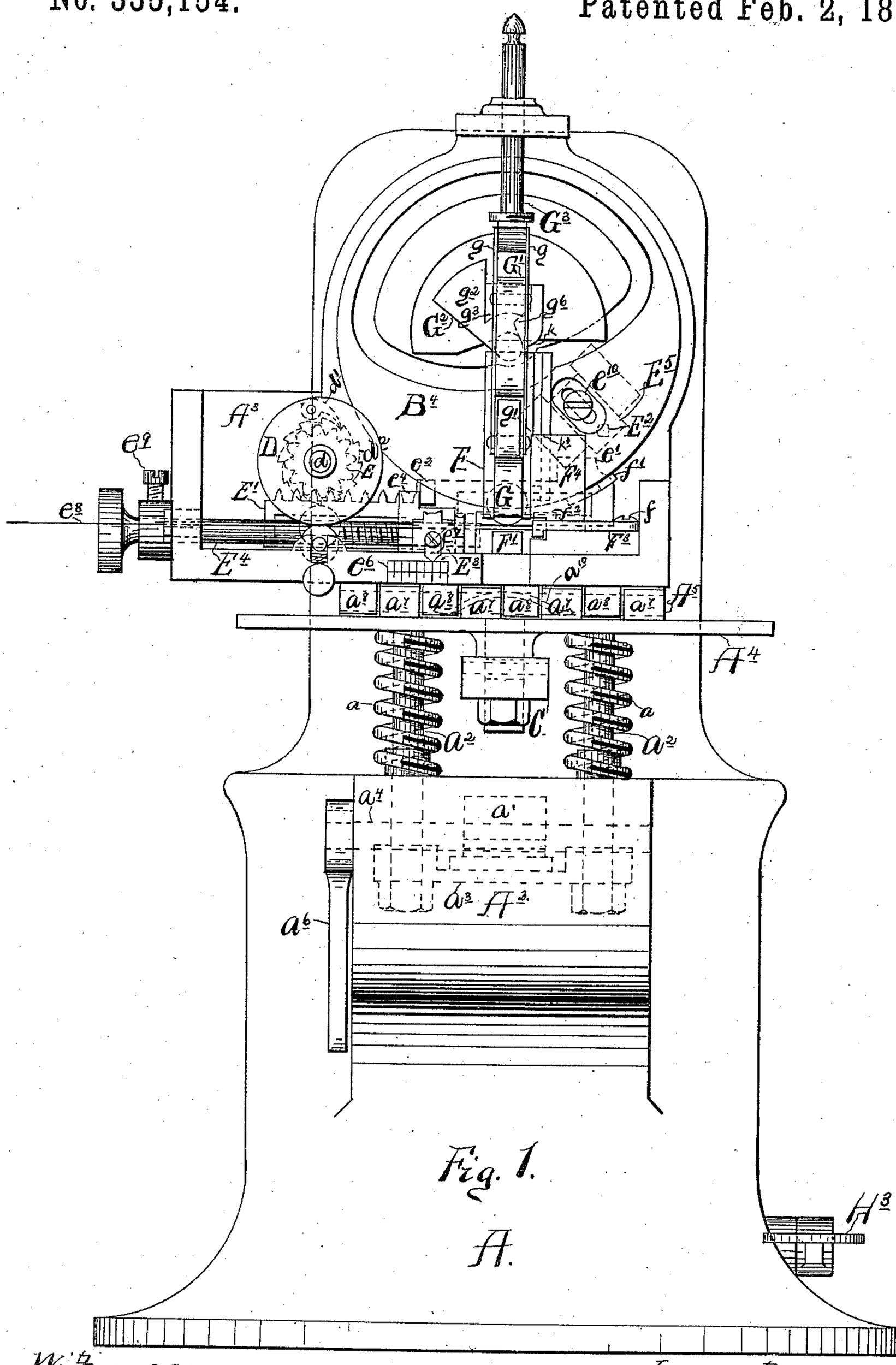

Fig. 1.

Witnesses
W. E. Krammo
W. G. Smith

Inventor
A. B. Smith

(No Model.)

3 Sheets—Sheet 2.

A. B. SMITH.

STAPLING MACHINE.

No. 335,154. Patented Feb. 2, 1886.

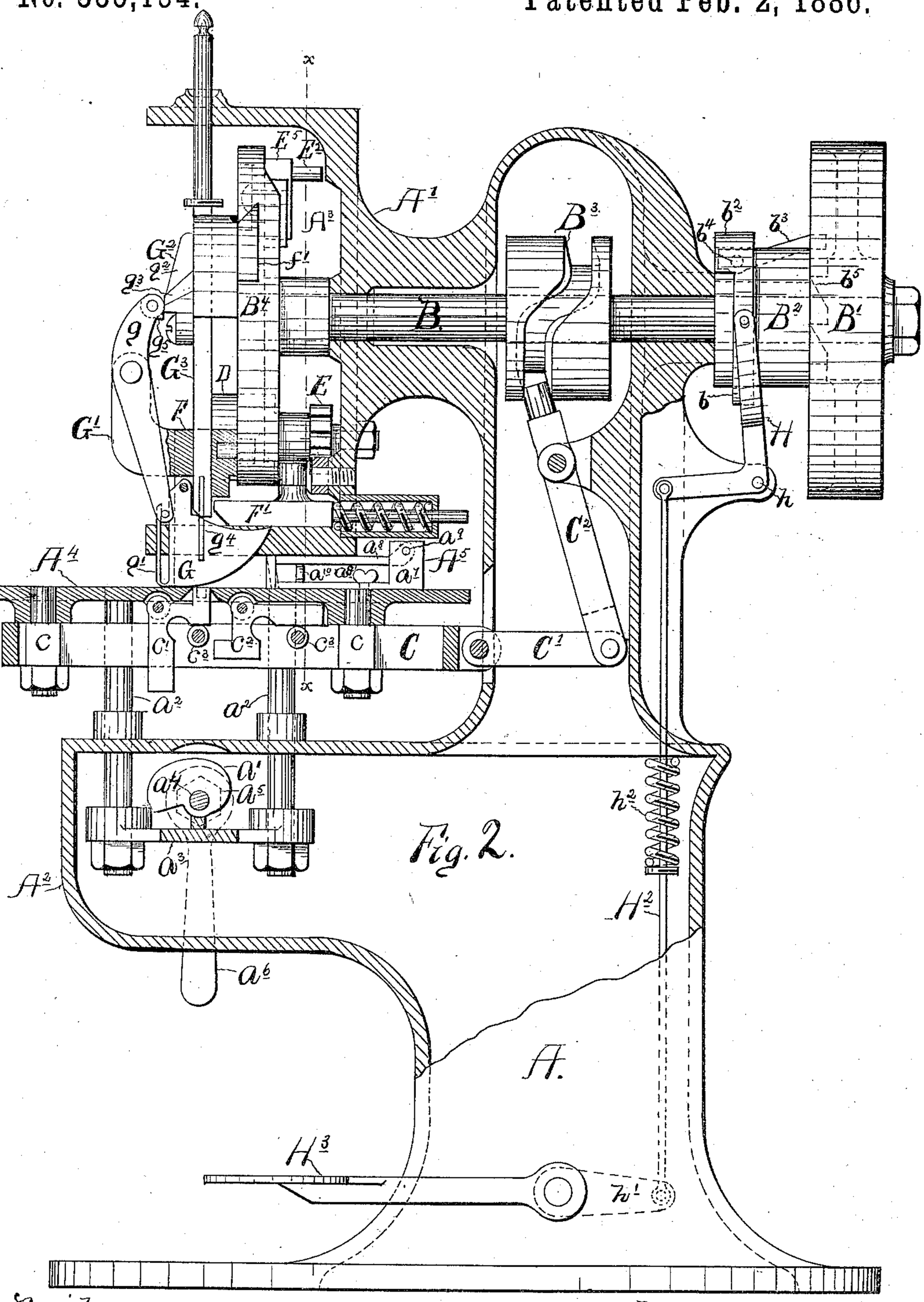

Fig. 2.

Witnesses.

W. E. Krauss

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Inventor.

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(No Model.) 3 Sheets—Sheet 3.

A. B. SMITH.

STAPLING MACHINE.

No. 335,154. Patented Feb. 2, 1886.

Fig. 7.

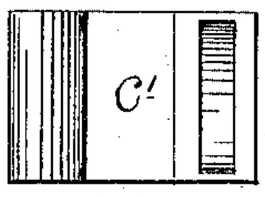
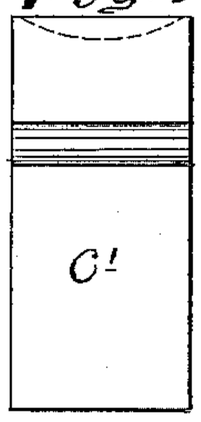


Fig. 10.



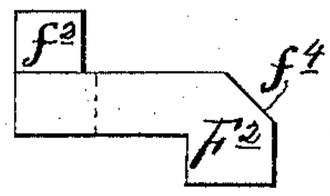


Fig. 6.

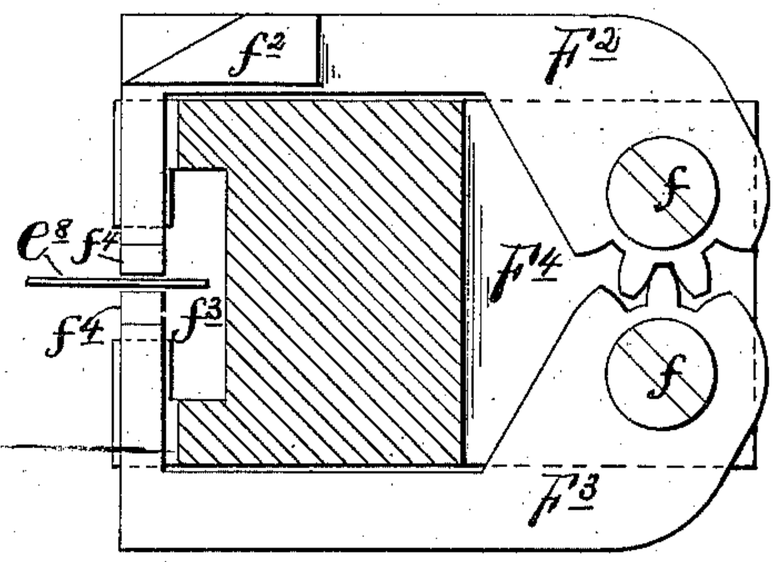


Fig. 8.

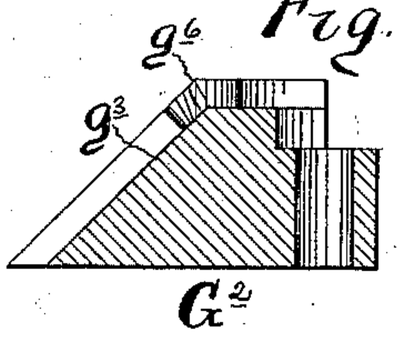
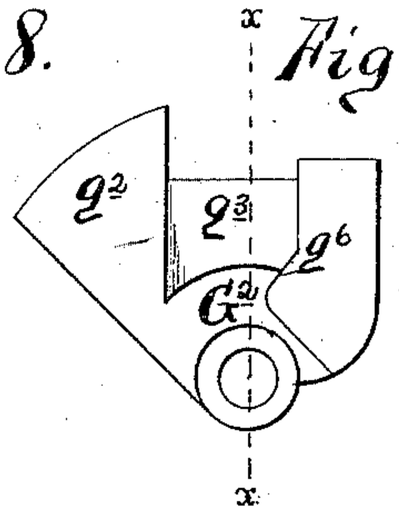


Fig. 9.



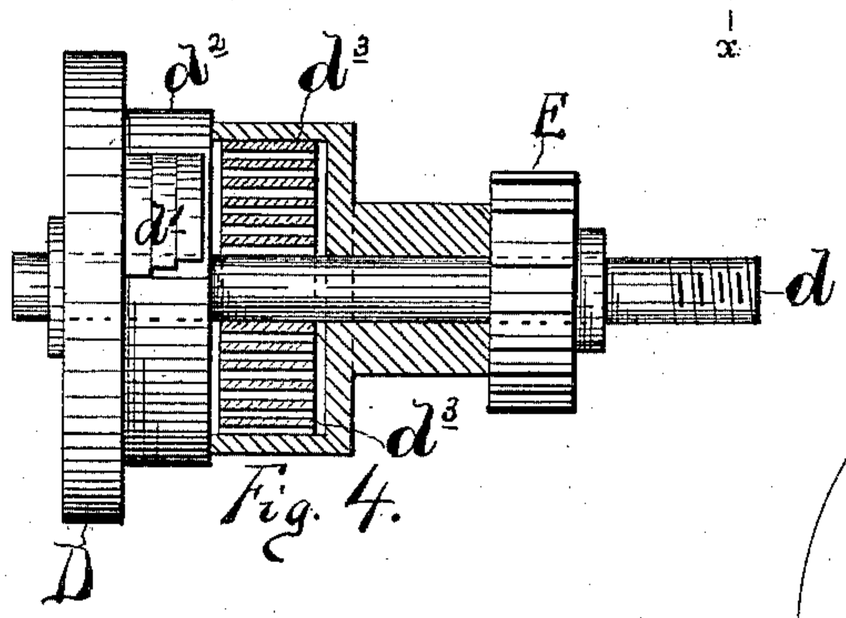


Fig. 4.

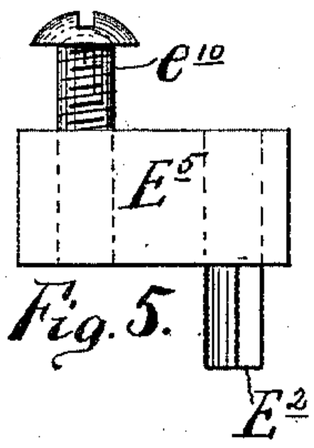
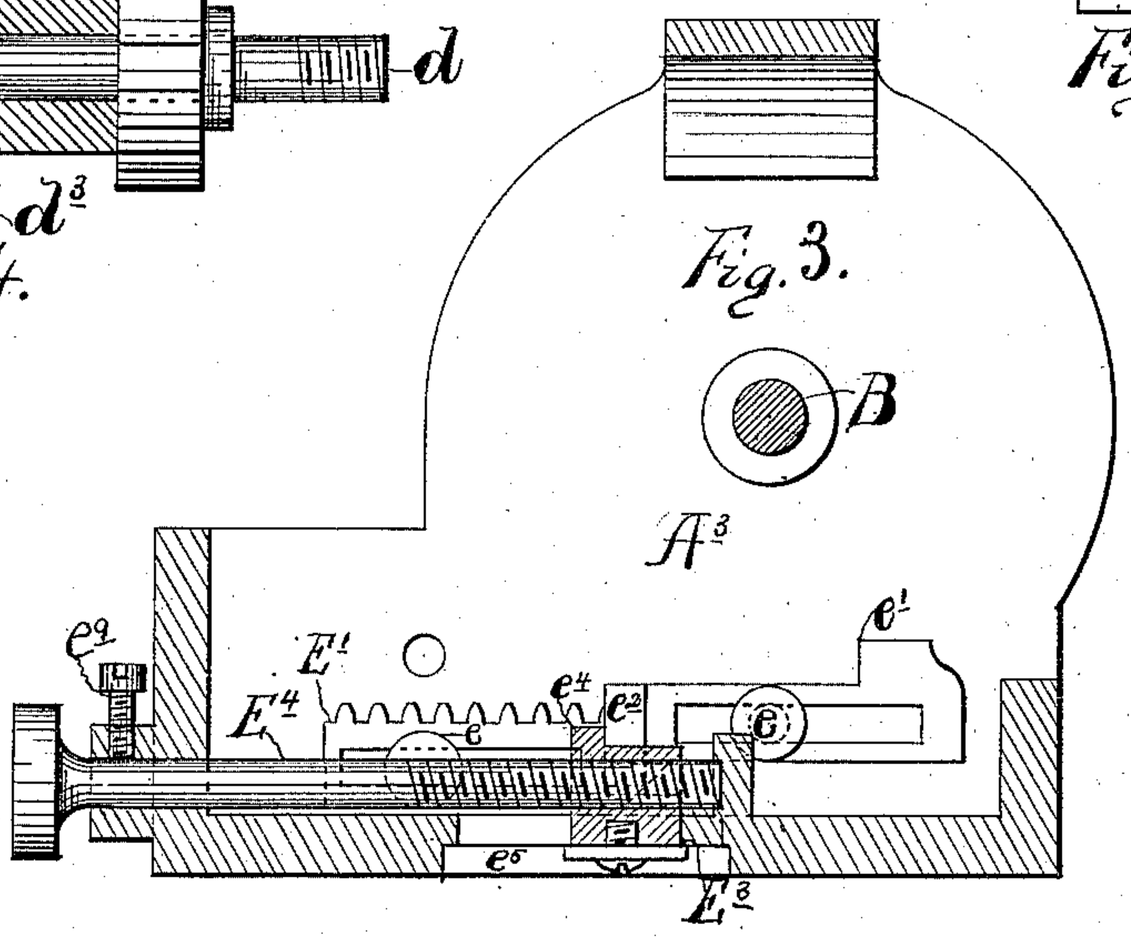


Fig. 5.

Fig. 3.



Witnesses

M. E. Kramm

W. G. Smith

Inventor

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UNITED STATES PATENT OFFICE.

A. BEVERLY SMITH, OF PHILADELPHIA, PENNSYLVANIA.

STAPLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 335,154, dated February 2, 1886.

Application filed May 7, 1885. Serial No. 164,683. (No model.)

To all whom it may concern:

Be it known that I, A. BEVERLY SMITH, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Machinery for Binding Paper and other Materials by the Means of Staples Formed from Wire, of which the following is a specification.

My invention relates to improvements in that class of staple-machines in which the staple is formed from a continuous wire, and inserted and clinched in the work by a single movement of the machine, and has direct reference to improvements in staple-machines as shown and described in application for Letters Patent of J. D. Wilber and A. B. Smith, Serial No. 58,487, filed April 17, 1882.

My invention consists in certain novel construction and combinations of parts, as hereinafter fully shown and described and claimed; and the objects of my improvements are, first, to provide an accurate feeding device; second, to simplify the adjustment to varying lengths of staple and thickness of work; third, to provide for the certain entering of the wire into the grooves of the staple-former; fourth, to afford positive support to the staple while being driven; fifth, to support all thickness of work by a suitable self-adjusting gage; sixth, to provide a positively-moving clinching device; seventh, to provide for an improved adjustment of the work-table. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents a front view of the machine. Fig. 2 represents a side view of the machine, partly sectional, on a line through the center. Fig. 3 represents a sectional view of the head on the line *x x*, Fig. 2, and shows in detail part of the feeding devices. Fig. 4 represents a part of the feeding devices removed from the machine. Fig. 5 represents the feed pin and block. Fig. 6 is a sectional view of the former-guide, showing the wire-fingers in position. Fig. 7 is a plan view of part of the clinching device, and Fig. 10 a side view of the same. Fig. 9 is a plan view of the swinging cam, and Fig. 8 a sectional view of same on line *x x*.

Similar letters and figures refer to similar parts throughout the several views.

The base A of the machine carries two arms, A′ and A². The arm A′ has running through it and resting in suitable journals at each end the shaft B, carrying the loose pulley B′, the clutch B², and cams B³ and B⁴, and enlarges at its free end into the head A³, containing the staple forming and driving mechanism. The arm A² carries the work-table A⁴, supported upon the coiled springs *a*, and connected with the cam *a′* by the rods a^2 and brace a^3. The shaft a^4 of the cam *a′* is connected by the hexagonal head a^5 with the lever a^6. The table A⁴ carries on its under side the clincher-slide C, which reciprocates on the bearings *c c*, and actuates the clinching-block *c′* and hammer c^2 through the rollers c^3. The slide C receives its motion through the connection C′ from the lever C², which engages in the cam B³.

In order to guide the work properly and insure the position of the staples, the table A⁴ bears on its upper side the gage or guide A⁵.

It is important in this class of machinery that the work-guide should extend above the table as high as possible, in order to prevent the upper sheets of a heavy work-pack slipping over the top of the guide, and thus disarranging the pack before a staple can be inserted. It is manifestly an advantage, therefore, to have the work-guide so constructed as to entirely fill the space between the table and the head of the machine, thus obviating the disarrangement of the pack. As in this class of machines the distance between the head and the table is constantly variable, being greater for thick work than for thin, it is evident that the guide must adjust itself to this variation in order to always fill the space. I prefer to accomplish this by making the guide A⁵ in two parts, a^7 and a^8, pivoted together at a^9, and supported in position by the spring a^{10}. The part a^7 fits upon the table and is secured thereto by suitable screws, and that portion forming the guiding-face for the work is serrated or cut into sections like teeth. The part a^8 is also toothed on the front portion in such manner that it fits into and down upon a^7, the two forming alternate sections of the complete guiding-face, as shown in Fig. 1.

It will be seen that by the action of the spring a^{10} the part a^8 is constantly pressed upward against the bottom of the head A³, and

follows it in all the changes of position of the table. The pivot a^9 is so placed in relation to the other parts that as the part a^8 rises out of a^7 it also projects farther to the front, thus always keeping the guiding-face nearly or quite perpendicular. It is obvious that this guide might be constructed in other ways, yet practically the same, to accomplish this result. A screw or similar device, worked by the hand, may be substituted for the spring a^{10}, or a slide may be used instead of the pivot a^9. I prefer, however, the construction shown, as being more simple and self-adjusting.

The head A^3 carries the staple feeding, forming, and driving mechanism, which consists of a device for feeding and cutting the wire into suitable lengths, and a device for bending the same into the form of a staple and afterward driving it into and through the work, which latter device is fully set forth and shown in the application for Letters Patent of Wilber and Smith, before cited, and forms no part of this application.

The feed-wheel D is mounted loosely on the shaft d, which shaft is screwed into the back of the head A^3 and does not turn. The wheel D carries three pawls, d', which engage in the teeth of the ratchet d^2. These pawls are of different lengths, and are so adjusted as to give three equal divisions of each tooth of the ratchet d^2, so that a movement at any time of the wheel D equal to one-third the space of a tooth of the ratchet d^2 will cause one or other of the pawls to engage another tooth and hold it. The ratchet d^2 is hollow, and contains the coiled spring d^3, the inner end of which is fastened to the shaft d, and the outer end to the ratchet d^2. This spring by its stress causes the ratchet to return to its normal position after the release of the feed-rack, as hereinafter shown. The other end of the hollow ratchet enlarges into the gear wheel or pinion E, which gears into the toothed rack E′. The rack E′ reciprocates on the bearings e e, and has the lug e' on the end. This lug lies in such a position back of the cam B^4 that the feed-pin E^2 engages with it at each revolution of the cam, causing it to move a certain distance and impart motion through the pinion E and ratchet d^2 to the feed-wheel D. The rack E′ also has a lug, e^2, on its side, which lug engages with a similar lug, e^4, on the block E^3, which carries the cutting mechanism. The pin E^2 in its revolution on the cam B^4 engages with the lug e', and carries the rack E′ a certain fixed distance to the right and against the stress of the coiled spring d^3. As the pin E^2 rises it disengages the rack E′, and the spring d^3 then causes the rack to move in the opposite direction—*i. e.*, to the left—until its further progress is stopped by the lug e^2 engaging with the lug e^4 on the knife-block E^3. It is evident, then, that if the block E^3 be moved farther to the left the stroke of the rack E′ will be increased in length to the extent of such movement, and will therefore cause a greater movement in the feed-wheel D, and necessarily a greater length of wire to be fed for each staple. In this way I obtain the adjustment of the feeding and cutting mechanism by a single motion.

The block E^3 slides in ways e^5 in the bottom of the head A^3, and is moved in these ways by the screw E^4, which projects through the side of the machine, and has a milled head for convenience of handling. By the motion of this screw the block E^3 can be moved closer to the staple-forming mechanism for a short staple, and farther from it for a long one, and as it so moves the stroke of the rack E′ is shortened or lengthened to exactly the same amount.

The amount of variation in the length of wire to form a staple being required to be exactly twice that of the variation in the position of the cutting mechanism, as is well known in the art, the relative sizes of the wheels D and E are made in this proportion, the pinion E being exactly half the size of the wheel D. Thus if the stroke of the rack E′ be shortened or lengthened—say one-quarter of an inch—the movement of the outer edge of the wheel D will be varied just twice that much, and the wire e^8, which stands in the same relative position to the wheel D that the rack E′ bears to the pinion E, will be fed forward one-half inch more or one-half inch less.

A set-screw, e^9, on the journal of the screw E^4 enables it to be secured in position when the machine is adjusted correctly for the work in hand. A graduated scale, e^6, on the front of the machine, with a pointer, e^7, on the block E^3, enables the operator to set the machine for different lengths of staple very quickly.

The feed-pin block E^5 is adjustable in ways in the cam B^4, and is held in position by the screw e^{10}. This construction allows all wear of the various parts of the feed mechanism to be taken up and compensated.

The wire e^8 passes through a straightening device, (not shown,) which removes the tendency to curl which it has received from passing around the spool or bobbin on which it is usually wound; but it has also a tendency to bend or curl sidewise, which tendency often causes it to bend so far to the right or left after passing beyond the guiding-groove in the block E^3 that it will not readily enter the grooves in the bending fork or former F, but lies over the top of the mandrel F′ in a diagonal direction. To obviate this and bring the end of the staple-blank back to its place, the two nippers or fingers F^2 F^3 are so placed in relation to the feeding and forming mechanism that the end of the wire passes between them. These fingers are pivoted at f and geared together, so that motion imparted to one will be communicated to the other.

The finger F^2 has on its upper side the lug f^2, which engages with a corresponding lug, f', on the cam B^4, and causes the fingers F^2 F^3 to close together upon the wire e^8, as shown in Fig. 6, thus bringing the wire directly under the grooves in the bending-fork F. As the bending-fork F descends through the guide F^4, traveling in the groove f^3, the lower end of it

strikes the inclined ends f^4 of the fingers F^2 F^3 and forces them apart, ready for the next staple.

It is highly important that the staple should be supported on all sides while it is being driven, as, if it is not, it is apt to bend under the necessary pressure in hard work. To accomplish this, I use the curved supporter G. I prefer this form, as it enables me to more easily give it a positive motion into and out of the staple, as hereinafter described. This curved supporter enters the staple after it is formed, as is hereinafter shown, passing between the legs of the staple as it lies in the guiding-grooves of the bending-fork F and completely filling the space between the sides of the fork. The staple-legs are thus practically incased in tubes of solid metal, and the top of the staple is rigidly held by the bottom of the driver resting on the supporter. The staple being thus held, it is impossible for it to bend or cockle while being driven, but it will enter the work true and straight. The curved shape of the supporter allows it to still fill the remaining space of the staple as it gets nearer and nearer to the work in being driven, the staple sliding over the supporter to its point as the supporter swings out until it is so driven nearly or quite through the work.

The bending-fork F, to which the supporter G is pivoted, carries an arm, G′, to which is pivoted the double lever g, the lower end of which lever rests against the supporter G, and is loosely confined to it by the strap g'. The upper end of the lever g rests on and engages with the swinging cam G^2, pivoted on the driving rod G^3. The cam G^2 has two faces, g^2 g^3, which are alternately presented to the lever g, and through the lever g forces the supporter G into the interior of the staple g^4, or allows it to recede as the driving-rod G^3 descends. A tooth or lug, g^5, on the lever g engages with the raised cam-face g^6 on the cam G^2 and causes it to swing on its pivot, as hereinafter shown.

The clutch-wheel B^2 is tight upon the shaft B, and is encircled by the ring b, which has a shoulder, b^2, extending about one-eighth of the circumference. The clutch-bolt b^3 is pivoted at b^4 to the wheel B^2, and lies partly inside of it, the end of the bolt b^3 extending enough beyond the wheel B^2 to engage at the proper time with the teeth b^5 on the loose pulley B′. The bell-crank lever H clasps the ring b, to which it is connected, and is pivoted at h. To the lever H is connected the rod H^2, which, at its lower end, is connected through the lever and shaft h' with the treadle H^3.

The operation of the machine is as follows: By means of the screw E^4 the knife-block E^3 is moved until the pointer e^7 rests upon the appropriate figure on the scale e^6 for the thickness of the work to be done. This operation at the same time automatically adjusts the length of feed of the wire to correspond, as hereinbefore shown. The lever a^6 is then turned until the cam a', operating upon the table A^4 through the brace a^3 and legs a^2, forces it down against the stress of the springs a until it stands just far enough below the bottom of the forming and driving mechanism to leave a sufficient pressure to hold the work firmly when the bending-fork descends upon it. Power is then applied to the pulley B′. The treadle H^3 is depressed, causing the rod H^2 to rise, and thrusting the ring b along the wheel B^2. As the ring b passes over the wheel B^2 it causes the bolt b^3 to tip downward on its pivot, and the end to engage with the teeth b^5 on the pulley B′, thus causing the shaft to move with it. As the shaft revolves the pin E^2 on the cam B^4 engages with the lug e' on the rack E′ and causes the rack to move forward. As the rack E′ moves it operates the pinion E, and through the ratchet d^2 and pawls d' causes the wheel D to feed the wire e^8 forward and under the bending-fork F. At this instant the lug f' on the cam B^4 engages with the lug f^2 on the finger F^2, and causes the fingers F^2 F^3 to close upon the wire, bringing it directly under the grooves in the bending-fork. At this instant the pin E^2 rises far enough to disengage the lug e', and the rack E′ is carried back to its former position by the stress of the coiled spring d^3, the wheel D remaining stationary, as the pawls d' do not engage the ratchet d^2 when moving in this direction. The bending-fork then descends, forming the staple over the mandrel F′, and as it descends opens the fingers F^2 F^3 by impinging upon the inclined faces f^4. As the bending-fork descends the driver remains stationary, as is fully described in the application for Letters Patent of Wilber and Smith, before cited. The upper end of the lever g as the bending-fork descends is carried down the face g^3 of the cam G^2, and by its action causes the supporter G to enter the staple g^4, assuming the position shown in Fig. 2. As the lever g passes down the cam G^2 the lug g^5 engages the raised edge g^6 of the cam G^2 and causes the cam to swing upon its pivot, until as the lever g reaches its lowest point the cam is swung far enough to bring the face g^2 in the same relative position to the path of the upper end of the lever g as the face g^3 first occupied. The driver G^3 then descends, carrying the cam G^2 with it, and as its lower end reaches the supporter G the upper end of the lever g begins its travel over the face g^2 of the cam G^2, and the curved supporter G swings out of the bending-fork as the driver descends, allowing the staple to slide over it to its point, which is reached by the staple just at the moment when it is nearly or quite driven through the work. The face g^2 of the cam G^2 is at such an angle that the lever g, controlled by it, keeps the supporter G tightly pressed against the lower end of the driver G^3 during its whole downward motion, thus affording support to the staple until it is nearly or quite driven. As the supporter is held positively against the

driving-rod G^3 and cannot move any faster than the driver G^3 descends, the staple g^4 can in no way bend or "cockle," which is not the case with the well-known devices where the supporter is held against the driving-rod by the stress of a spring or similar device. As the driver G^3 continues its descent, and just as it has nearly finished same, the part k of the cam G^2 impinges upon the top k' of the former-guide F^4, causing it to swing back through its arc until at the moment the driver G^3 has ended its stroke the cam G^2 has assumed its first position. As the staple g^4 is forced through the work the ends, projecting through a slot in the table A^4, meet the rounded depression in the top of the clinching-block c' and are bent together. At this moment, the driver G^3 having ended its stroke, the cam B^3 engages the lever C^2, and through the connection C' forces the slide C forward. As the rollers c^3 pass along the clinching-block c' and hammer c^2 they cause the clinching-block c' to drop down from its position and the hammer c^2 to rise into the slot in the table A^4 previously occupied by the clinching-block c'. The solid head of the hammer c^2 presses the ends of the staple g^4 flat upon the under side of the work in the manner well known in the art. At this moment the bending-fork and driver rise, the cam B^3 causes the slide C to reverse its motion, bringing the clinching-block c' up to its former position ready for another staple, and the operations of the machine, as described, are repeated. If the treadle H^3 is released, the spring h^2 causes the lever H to bring the ring b back on the wheel B^2, when the shoulder b^2 engages the back end of the bolt b^3, causing it to rise out of clutch with the teeth b^5, and the machine comes to a rest.

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

1. The combination, with a staple forming and driving mechanism substantially as described, of a feeding mechanism consisting substantially of a feed-wheel and pawls, a hollow ratchet-wheel containing a spring by which it is actuated in one direction, a fixed shaft, and a rack and pinion, all arranged substantially as and for the purpose set forth and shown.

2. In a wire-stapling machine, the combination of a feeding mechanism consisting of a feed-wheel, a ratchet and pawls, a fixed shaft, and a rack and pinion, with a pin, E^2, and wheel B^4, all arranged substantially as shown, and for the purpose specified.

3. In a machine for making and inserting wire staples, the combination of a feeding mechanism substantially as described, lugs e^2 e^4, and an adjustable knife-carrier, all arranged as and for the purpose set forth and shown.

4. In a machine for making and inserting wire staples, the combination of a feeding mechanism substantially as described, an adjustable knife-carrier connected therewith and controlling said feeding mechanism, and means, substantially as described, whereby they both may be adjustable by a single movement, all arranged substantially as and for the purpose set forth and shown.

5. The combination, with a staple forming and driving mechanism substantially as described, of geared centering-fingers constructed and arranged substantially as described to positively grasp the loose end of the wire so that it is guided and held in position to enter the grooves in the bending-fork after passing through the staple-forming mechanism, substantially as shown and specified.

6. The combination, with a staple forming and driving mechanism, of geared centering-fingers carrying a lug, and a cam engaging therewith, operating substantially as shown, and for the purpose specified.

7. The combination, with a staple forming and driving mechanism substantially as described, of a curved staple-supporter so arranged as to support and sustain the legs of the staple while being driven, substantially as shown and described.

8. In a machine for forming and inserting wire staples, the combination of a bending-fork carrying a curved staple-supporter with a driving-rod working within and in connection with same, substantially as shown, and for the purpose described.

9. In a wire-stapling machine, the combination of a staple-supporter with a lever and swinging cam, arranged substantially as and for the purpose set forth and shown.

10. In a machine for forming and inserting wire staples, the combination of a staple-former, a driving-rod, and a swinging cam with a lever and a curved staple-supporter, arranged substantially as shown, and for the purpose specified.

11. The combination, with a staple forming and driving mechanism substantially as described, of a curved staple-supporting device, substantially as described, so arranged as to support and sustain the legs of the staple while being driven, and means whereby a positive motion is imparted to same, substantially as and for the purpose set forth and shown.

12. The combination, with a staple forming and driving mechanism substantially as described, and an adjustable work-table, of an expanding and compressible work-guide, arranged substantially as shown and described.

13. The combination, with a staple forming and driving mechanism substantially as described, of a table supported by springs, a cam and lever to actuate said table, and an expanding and compressible work-guide, all arranged substantially as shown, and for the purpose specified.

14. The combination, with a staple forming and driving mechanism substantially as described, of a clinching device consisting of a clinching-block and hammer, substantially as shown and described.

15. In a wire-stapling machine, the combination of a clinching-block and hammer with a reciprocating slide and rollers, arranged substantially as shown and described.

16. In a wire-stapling machine, the combination of a clinching-block, a hammer, and a reciprocating slide actuating the same, with means, substantially as described, whereby the proper motion is imparted to said slide, all arranged substantially as and for the purpose set forth and shown.

A. BEVERLY SMITH.

Witnesses:
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JAMES R. MOYER.