(No Model.)

2 Sheets—Sheet 1.

# H. R. HEYL.

## STAPLING MACHINE.

No. 389,148. Patented Sept. 4, 1888.

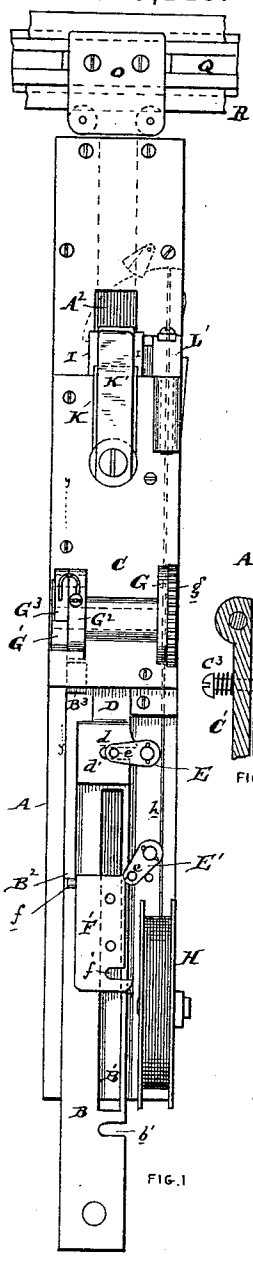

FIG. 1

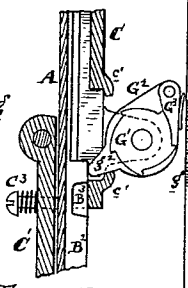

FIG. 5

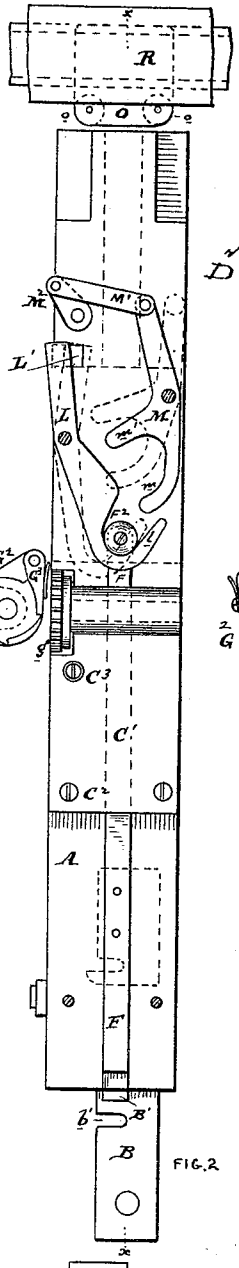

FIG. 2

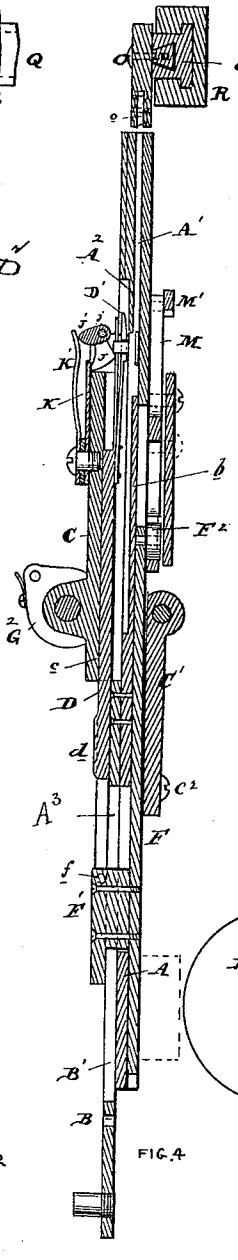

FIG. 4

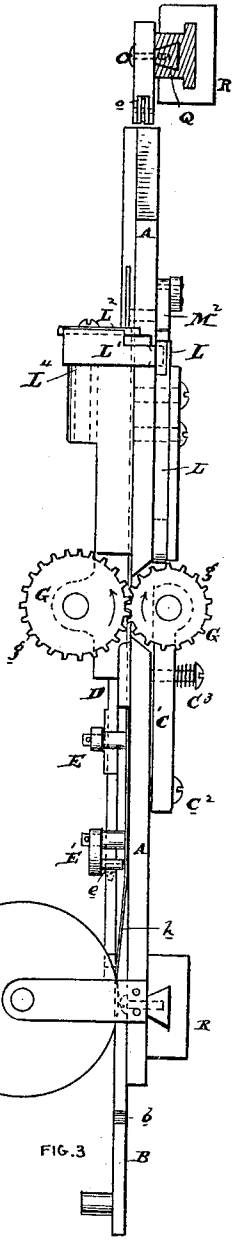

FIG. 3

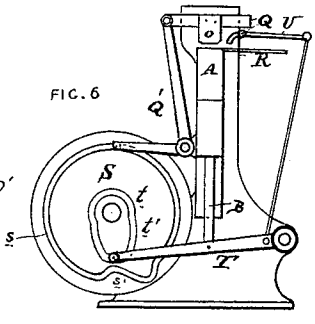

FIG. 6

Attest,

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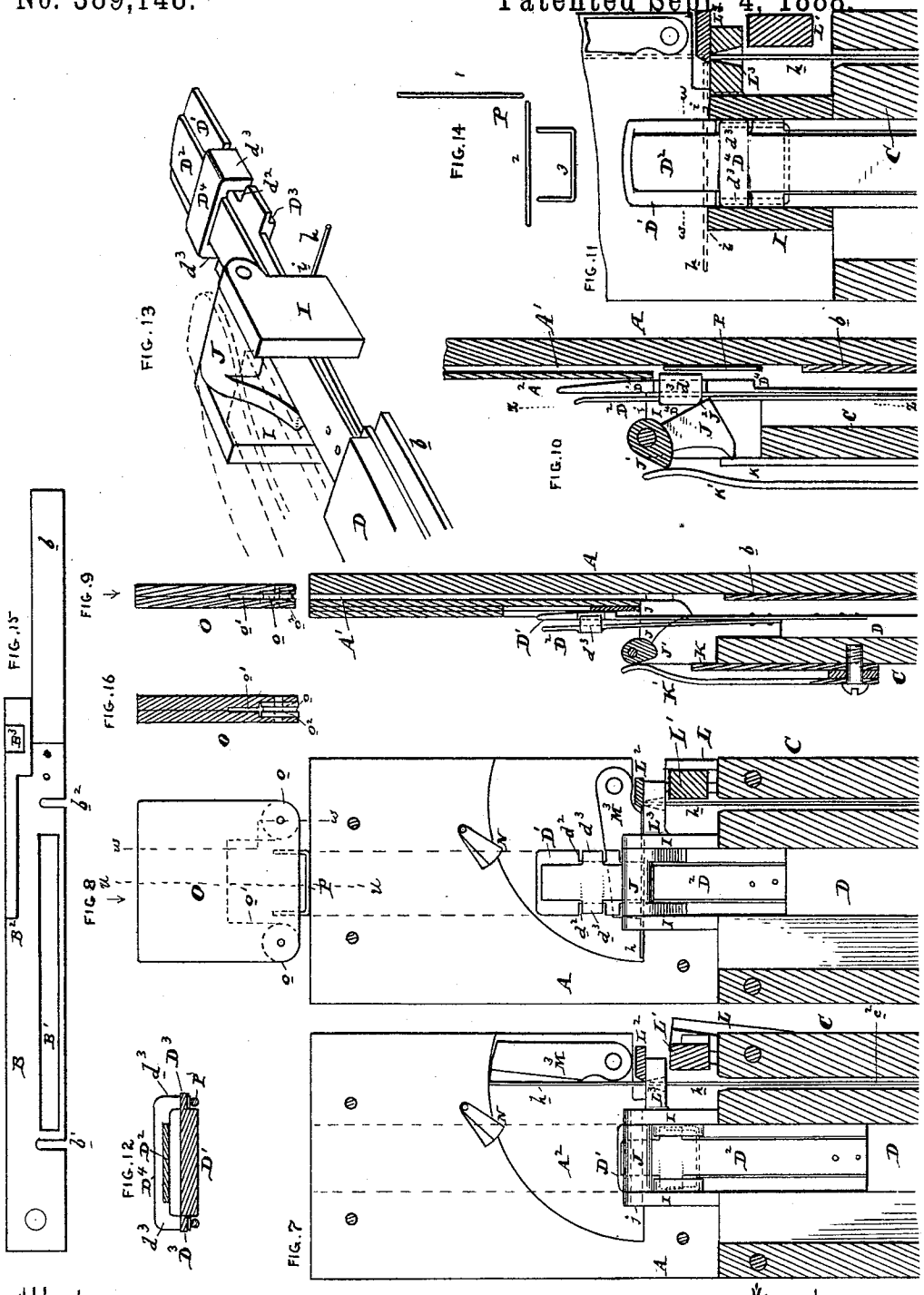
F. P. Lehmer.

(No Model.) 2 Sheets—Sheet 2.

# H. R. HEYL.

## STAPLING MACHINE.

No. 389,148. Patented Sept. 4, 1888.



Attest,
E. W. Breckinridge
H. A. Herr

Inventor,
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By his atty.
Thos. Hutchinson

# UNITED STATES PATENT OFFICE.

HENRY R. HEYL, OF PHILADELPHIA, PENNSYLVANIA.

## STAPLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 389,148, dated September 4, 1888.

Application filed June 10, 1887. Serial No. 240,884. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY R. HEYL, of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Stapling-Machines, of which the following is a specification.

My invention relates to mechanism for forming, inserting, and clinching wire staples in various articles that it may be desirable to thus hold together; and it consists in a new form of construction of the staple forming and driving devices and of the staple-clinching devices, for the purpose of simplifying the same and making them more compact and better applicable for many purposes than the other forms hitherto made and commonly known and used.

The complete machine consists of the usual elements—viz., a wire-feeding device, a wire-cutter, a staple-bending device, a driving-hammer, and a staple-clincher—which combination of parts may be so constructed and adapted to other machinery as to perform similar work upon a great variety of materials and in many different ways and positions. I will therefore describe my invention in its simplest form, without reference to any special product that it may be employed in making, so that skilled mechanics may be enabled to use it in conjunction with other machinery adapted to their wants.

In the drawings, Figure 1 is a front elevation of my improved stapling-machine. Fig. 2 is a rear elevation of same. Fig. 3 is a side elevation of same. Fig. 4 is a sectional elevation of same on line *x x* of Fig. 2. Fig. 5 is a sectional elevation of part of Fig. 1 on line *y y*. Fig. 6 is a front elevation showing connecting mechanism between the staple forming and driving mechanism and the staple-clinching device. Fig. 7 is a sectional plan view of the upper part of the staple forming and driving mechanism before the wire to form a staple is cut off. Fig. 8 is a similar view after the wire has been cut off and turned around in position to be formed into a staple. Fig. 9 is a sectional elevation of Fig. 8 on line *u u*. Fig. 10 is a similar view of a portion of same, on a slightly-enlarged scale, showing parts after the staple is formed and forced down into the hammer-groove. Fig. 11 is a sectional plan view of Fig. 10 on line *z z*. Fig. 12 is a cross-section of part of Fig. 11 on line *w w*. Fig. 13 is a perspective view of the wire-bending devices. Fig. 14 is a diagram showing the various positions and shapes assumed by the wire in being formed into a staple. Fig. 15 is a plan view of the hammer-slide, and Fig. 16 is a cross-section of the clincher on line *w w* of Fig. 8.

In the drawings I represent the staple-forming devices as contained within a long narrow casing standing vertically, as shown in Figs. 1, 2, 3, and 4, the whole mechanism being contained within a width of two inches, so that a series of any desired number of stapling devices may be set side by side to drive staples in a line as close together as two inches. For convenience I shall hereinafter refer to the complete set of staple-forming and staple-driving devices as combined in one case, as shown in the above-named figures, as a "stapler," and the parts that bend down or clinch the staple-legs 0, Figs. 1, 2, 3, and 4, as "clinchers."

Each stapler is provided with a spool of wire, H, a pair of wire-feeding rollers, G, a pair of cutters, $L^2$ $L^3$, staple-bending devices D′, and staple-driver *b*, which elements, when properly operated by power, form a complete staple forming and driving machine. In this device each part receives its motion consecutively by the reciprocating movements of the driver-bar B, one movement of which, both in and out, performing all the operations of making and delivering a staple.

In all other forms of staplers within my knowledge the wire is fed into the staple-forming parts in a direction at right angles to the line of motion of the staple-driver, which necessitates a complicated system of wire-guides across intervening staplers, where a series of them are used side by side; but in my improved form I lead the wire parallel with the driver, and after a length is cut off throw it around at right angles to bring it into position to be bent into staple form and to be driven. (See Fig. 14.) This improvement makes each stapler strictly independent without regard to position or number employed at once.

As a foundation for the construction of the staplers, I use a flat metal plate, A, of about the proportion of two inches in width, fourteen inches long, and one-fourth inch thick, upon which is mounted a grooved cap-piece, C, which serves as a guide for the reciprocating driver-bar B and bender-bar D, and also

as bearings for the shafts of feed-rollers G and swinging cutter $L^2$. On the reverse side of plate A is secured a cap, C', which guides the sliding bar F, and also furnishes the bearing for the shaft of the other feed-roller G.

As previously stated, the movement of all the staple-forming parts is derived through the long reciprocating motion of the driver-bar B, and for this reason the latter is longer than the foundation-plate A, in order that it may be attached to the device from which it gets its motion. At the lower end of plate A, I place the spool of wire H, from which the wire is led through suitable guides to the feed-rollers G. These rollers are pressed together by an adjustable spring, $C^3$, to pinch the wire sufficiently to draw it from the spool and force it along through the passage to the cutters. Motion is imparted to the one feed-roller G through the ratchet G' and pawl $G^3$ from lugs formed by the depression $B^3$ on the driver B, which oscillates the pawl-lever $G^2$ by its projections $g^2$. The length of wire fed at each movement is governed by the diameter of feed-wheel G. In this case the length fed is one-fifth of the circumference of the said feed-wheel, or about one inch. The two feed-wheels are geared together by teeth $g$ to insure their uniform rotation. The feeding of wire is the first step in the formation of a staple, and is accomplished by the first part of the upward movement of driver-bar B acting through the lug $B^2$ upon the pawl-lever $G^2$. The projection or tooth $g^2$, meshing into the slot $B^3$, causes the pawl to rotate only while said depression is acting upon it, and when the slot passes up beyond the reach of the said tooth the pawl rests until the return motion of the depression $B^3$ again restores the pawl to its first position. As soon as a full length of wire is fed, it is to be cut off by the shearing motion of the cutters $L^2$ $L^3$, Fig. 11, $L^2$ being a flat cutter moving across the face of an annular cutter, $L^3$, the latter being fixed and the former movable by reason of its being secured to a rock-lever, L', actuated by a cam-lever, L, which latter derives its motion from a roller, $F^2$, on a slide-bar, F, reciprocating in a lengthwise groove in the reverse side of the plate A. This bar F begins to move up just when the feed-pawl ceases to move the wire, and it is likewise moved by a part of the upward motion of the driver-bar B in the following manner: Through a long slot, B', in bar B and a shorter slot, $A^3$, in plate A connection is made between sliding bar F and a plate, F', lying on top of driver-bar B. As bar B moves up and the end of the slot B' reaches the connecting-piece between plate F' and bar F, the bar F must move up with bar B, thereby causing roller $F^2$ to act on cam-lever L, which in turn moves the cutter $L^2$ and shears off the wire $h$, leaving cutter $L^2$ in the position as shown in Fig. 11. As the bar F continues its upward movement, the roller $F^2$ engages with another cam-lever, M, which in turn is connected by link M' to rock-lever $M^2$, and thence to a lever, $M^3$, (shown in Figs. 7 and 8,) which latter lever is used to carry the cut wire around at right angles to the driver B in position to be bent into the form of a staple. By the time the lever $M^3$ has reached the position shown in Fig. 8 the driver-bar B has completed its upward movement, and the previously-made staple has been forced up through hole A' and out of the stapler by the driver-blade $b$, as seen in Fig. 8. As the cutter $L^2$ presses against the wire to shear it off, the upper or free end of the wire is naturally bent around until it passes the latch N and touches the bender D'. In this position the wire is cut off and is kept from springing away by the latch N at the top, and rests against the bender D' on the opposite side and the cutter $L^2$ at its lower end. In this position the wire is carried around by the lever $M^3$ under the bender D', which latter, being mounted on a flat metal support and slightly beveled under the front end, springs up to allow the wire and lever $M^3$ to pass under it. The space in which the lever $M^3$ moves to change the position of the cut wire is a shallow recess of a depth but little greater than the wire thickness, and is covered by a cap-plate, except in that space in which the bender D' reciprocates, so that the wire is confined and guided absolutely. (See Fig. 1.)

When the driver B is up its entire distance, as last described, the staple-bender D' is also entirely up, as shown in Fig. 8. The movements of the staple-bender D' are also controlled by the driver B in the following manner: The staple-bender is attached to a sliding bar, D, which is guided within the cap-plate C, and lies directly on the driver B. As the plate F' is carried upward, its upper edge comes in contact with the lower end of bar D and forces it up with it. The staple-bender D' is a square plate of metal of a width equal to the inside length of the staple-head, and is secured to the bar D by the flexible blade before described. The object of the bender is to catch the wire and draw it down between two side plates, I I, which latter are fixed and stand apart a distance equal to the outside length of the staple-head, and thus the wire is bent into staple form with its two legs pointing upward. Directly over the staple-bender D' and secured to another thin blade of metal, $D^2$, is a forked piece of metal, $D^4$, which I shall call a "stripper." It has two downward-projecting ends, $d^3$, working within recesses in either side of the bender D', which, being pressed down upon the legs of the staple at the proper time, push the staple off from the bender. While the staple is being bent, this stripper stands up out of the way, and only crosses the wire-space when pushed down by force.

Another device forming a part of the staple-forming mechanism is the swinging piece or rocking lever J. This is also bifurcated and reaches down on either side of the bender-blade $D^2$ to a line even with the top face of the driver-bar $b$. It swings on a pivot, and its movement in one direction is caused by the

downward pulling of the bender D′, and in the other direction by the spring K′ pressing on the cam J′. Its offices are threefold, viz: It lies against the outside of the staple-head with some pressure, which keeps the staple-head well against the bender during the bending operation, and thus secures a square-angled staple. When thus swung around until it strikes a stop, K, it then acts to push down the stripper $D^4$, to push the completed staple from the bender. Then on its return motion, through the action of the spring K′, it forces the staple down to a lower plane, even with the driver-blade *b*, and in position to enter the channel A′ when the driver-blade *b* strikes it. In this way the staple is made on one plane and afterward shifted to another, so that while one set of operations in the process of making a staple is going on the finished staple may be driven through lower planes, past the staple-forming devices, and out at the end of the stapler. On the reverse or downward motion of the driver-bar B the lever $M^3$ is the first to return to its first position. Then the feed-pawl is reversed to grasp the next tooth in the ratchet preparatory to feeding another wire-length. Next the bender D′ is set in motion and drawn down to draw the wire between side plates, I I, and form the staple, the swinging piece J moving with it, and simultaneously the roller $F^2$ is brought entirely down, reversing the lever L, which carries back the cutter $L^2$ and opens the channel for the wire. In order to insure a positive action of the slide-bars D and F, which each move intermittently and for shorter distances than the bar B, which gives them their motion, I employ the levers E and E′, swinging freely on studs fixed into the frame-plate A. These levers stand up high enough to pass freely over the plates *d* and F′, and have studs *e e* projecting downward to almost touch the plate A. In the body of the driver-bar B are two slots, *b*′ and $b^2$, (see Figs. 1 and 15,) which correspond in size with similar slots, *d* and *f*′, in plates *d*′ and F′. In the position shown in Figs. 1 and 3 the two slots $b^2$ and *d* are in line, and the pin *e* of lever E′ is standing downward through both slots, practically uniting the two bars B and D. Now, if bar B be moved up, bar D must also move with it until the pin *e* swings out of the slot $b^2$, when bar D may stand still, while bar B goes on. Then, as plate F′ comes in contact with the end of the slot B′ in bar B, they move up together. At the same time the slots *b*′ and *f*′ are brought into line, and when opposite the pin *e* on lever E′ the projection from the lower side of slot *f*′ carries the pin *e* around into the two slots, and thus the bar B and plate F′ become united, and they continue to move in unison a little farther until the lever E stands at right angles to bar B.

The pin *e* of lever E′ is not of service on the upstroke of bar B; but its use will be seen on the downward motion, as it insures the downward movement of plate F′ at once with the similar movement of bar B, and, after traveling a short distance until pin *e* of lever E′ comes out of slot *b*′, the plate F′ may rest while bar B still proceeds, until the lug $B^2$ strikes the projection *f* on plate F′, causing the latter to resume its downward motion with bar B. I thus secure motion to the sliding bars of different lengths and at varying intervals in a simple, positive, and efficient manner.

There remains to be described the device that completes the stapling operation by clinching down the legs of the staple after it has been driven through the materials to be thus secured together. This clincher consists of a block, O, having a narrow slot across its under face, *o*′, which is enlarged at $o^2$ to form a wire-guide that will direct the staple-legs up into the slot *o*′. Within this block O are located two rollers, *o*, which have slight grooves in their faces in line with the slots *o*′. These rollers are set apart just enough to allow the staple-legs to stand up between them, as in Fig. 8, and should also project a very little below the lower face of block O. The proper position for the clincher is directly over the end of the stapler, so adjusted that there is just space enough between the clincher and stapler to admit of the insertion of the materials to be stapled, and also so adjusted that the staples will be directed into the slot in the clincher and between the rollers *o*. The instant that the staple has been driven by the driver-blade *b* a sidewise movement of the clincher-block O causes one roller to roll down the staple-leg nearest to it. Then by the reverse motion of the block O the other staple-leg is likewise rolled down in line toward the first one; and if we make the second movement of the clincher longer than the first the last roller will pass over both staple-legs and more completely flatten them down to the surface of the stapled material. Then the clincher returns to its original position to repeat its operations upon the next staple. To effect the movements of the clincher it is necessary that it should be mounted upon a bar, Q, having the required horizontal motions—viz., first, a short distance in one direction, then a longer distance in the opposite direction, and a return motion to its first position. At the same time this bar Q should have up-and-down adjustment to enable it to be placed at proper distance from the staplers to accommodate materials of different thicknesses that it may be desired to staple. The movements of the bar Q should be so timed that they will take place while the driver *b* is at rest at its highest position, supporting the head of the staple while the clinching is being done. This may be accomplished in various ways, one of which is shown in Fig. 6, wherein two cams are employed to work the parts in harmony with each other to accomplish the complete result.

An unlimited number of staplers constructed as herein described, and an equal number of clinchers, may be arranged side by side in one machine to drive a series of staples all in line at one operation, and such machine, by very

simple methods, may be thoroughly adjustable, so that the distance between the staplers may be varied at pleasure. To this end the bar Q should have a lengthwise slot, preferably V-shaped, to receive nuts, to which the clinchers can be clamped with one or two screws. The act of fastening the clinchers to these nuts will also clamp the nuts to the sides of the slot and hold the clinchers in firm position. In a similar manner the staplers should be mounted on a horizontal bar, so that they may be adjusted at pleasure. If it shall be found desirable in working upon some materials to automatically hold the materials from moving sidewise by the action of the clinchers, presser-feet U, Fig. 6, may be employed to bear upon the upper surface of the material and hold it firmly down on the machine-table while the clinchers are operating.

While I prefer the construction shown, it is to be understood that I do not limit myself to the details, as they may be modified in various ways without departing from my invention.

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

1. In a stapler, the combination of staple forming and driving devices with a staple-driver bar, and connecting devices between said parts, whereby said staple forming and driving devices derive all of their movements from the motion of the driver-bar.

2. In a stapler, the combination of staple forming and driving devices with a wire-feed and wire guide arranged parallel to the line of motion of the staple-driving devices.

3. In a stapler, the combination of staple forming and driving devices, a wire-feed and wire-guide to feed the wire parallel to the line of motion of the staple driving devices, and means, substantially as described, to turn the wire from which a staple is to be formed from the position in which it is fed to a position at right angles thereto or across the line of motion of the staple-driving devices.

4. In a stapler, the combination of staple-forming devices and staple-driving devices arranged side by side but in different planes, and means, substantially as set out, for transferring the formed staple from the plane in which it was formed to the plane in which it is to be driven.

5. In a stapler, the combination of staple-forming devices and staple-driving devices arranged side by side but in different planes, means, substantially as set out, for transferring the formed staple from the plane in which it was formed to the plane in which it is to be driven, and a reciprocating bar to actuate the staple-forming devices to form a staple when moved in one direction and drive the finished staple when moved in the other direction.

6. In a staple forming and driving device, the combination of the staple-former D′, the staple-stripper $D^4$, the fixed benders I I, and the bifurcated rocking lever J, operating to form a staple within the fixed benders I I and to transfer the made staple to a lower plane, to be thence driven out in a direction the reverse of that of its formation, substantially as described.

7. The bifurcated rocking lever J, in combination with the reciprocating staple-bender D′, operating to produce a square-angled staple, substantially as described.

8. In a stapler having the staple-forming devices in one plane and the staple-driving devices in another parallel plane, the combination of the driving-channel, the driver-bar, rocking lever adapted to force the completed staple from the staple-forming devices into the driving-channel, having its lower edge in line with the driving-channel to form a guide for the staple, substantially as and for the purpose specified.

9. In a stapler, the combination of the staple-bender head D′, the stripper $D^4$, operating to discharge a staple from the bender, the bifurcated rocking-lever J, a stop, K, therefor, and a spring to return the lever to its normal position, substantially as and for the purpose specified.

10. The combination of the fixed benders I I, the reciprocating bender D′, the stripper $D^4$, moving therewith, and suitable means to press said stripper to or from the bender to discharge the bent staple, substantially as and for the purpose specified.

11. In a stapling-machine, the combination of a rigid surface upon which the staple is formed, stationary or fixed benders, and a movable bender made flexible to or from the rigid surface, and means to force the wire from which the staple is to be formed under the movable bender, substantially as and for the purpose specified.

12. In a stapler, the combination of the surface $A^2$, the rigid benders I, the movable bender D′, the wire-cutters $L^2$ $L^3$, and lever $M^3$, to force the wire under the bender D′, substantially as and for the purpose specified.

13. In a stapler, the combination of the surface $A^2$, the rigid benders I, the movable bender D′, the wire-cutters $L^2$ $L^3$, and lever $M^3$, to force the wire under the bender D′, and latch N, to prevent the wire moving backward while being forced under the bender, substantially as and for the purpose specified.

14. In a staple-forming device, a staple bender and stripper, combined with a reciprocating bar, whereby they maintain the same relation at all times, substantially as and for the purpose specified.

15. In a stapler, the combination of stationary benders, a reciprocating bender, a stripper moving with said bender, means to reciprocate said bender and stripper, and a stop or projection to force down the stripper just as the movable bender completes its movement, whereby the staple is first formed and then discharged before the bender has begun to reverse its motion.

16. The staple-clincher consisting of two

rollers journaled within a slotted block in such relation to each other that the legs of a staple protruding into said slot may be rolled down toward each other by alternate action of the rollers moving across the legs, substantially as described.

17. The staple-clinching rollers *o o*, journaled in line with each other and grooved to guide the staple-legs in line toward each other when being rolled down, substantially as described.

18. A staple-clincher consisting of a laterally-reciprocating frame, and a roller secured to said frame, in combination with fixed staple forming and driving devices arranged below the clincher, substantially as and for the purpose specified.

19. The combination of fixed staple forming and driving devices with a laterally-reciprocating clincher to bend down the staple-legs.

20. The combination of fixed staple forming and driving devices with a laterally-reciprocating clincher to bend down the staple-legs, and connecting mechanism to reciprocate the clincher after the staple has been driven home, substantially as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

HENRY R. HEYL.

Witnesses:
R. M. HUNTER,
GEO. W. REED.