March 1, 1938. A. L. ROSENMUND 2,109,910

END STAPLING MACHINE

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Fig. 1.

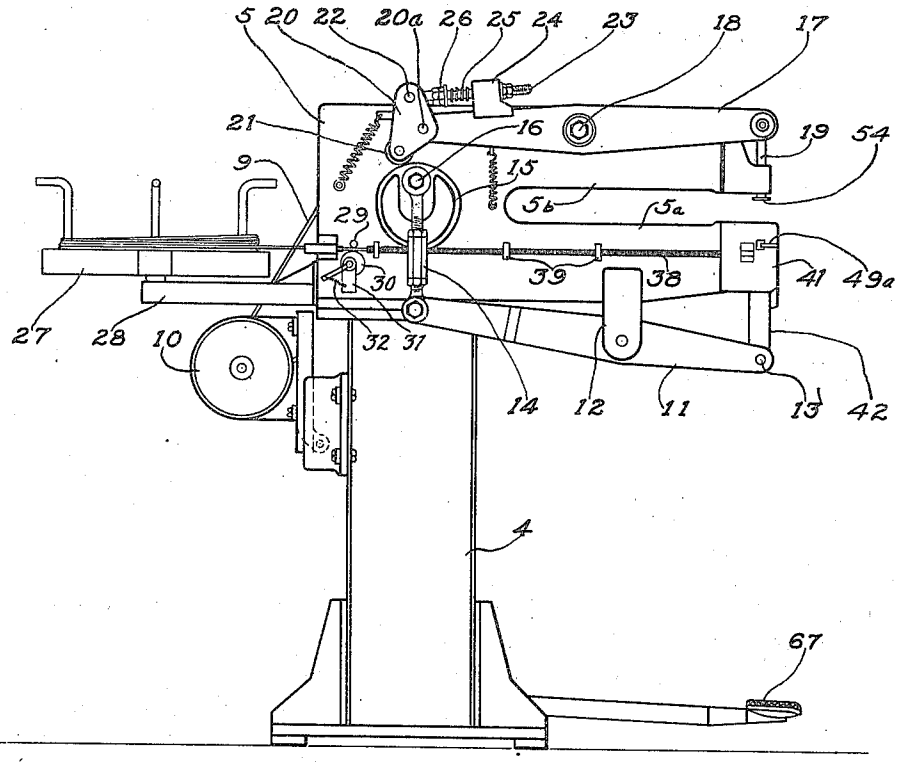
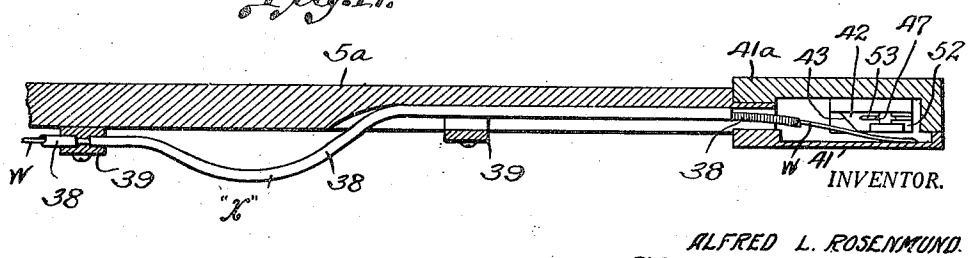


Fig. 1a.



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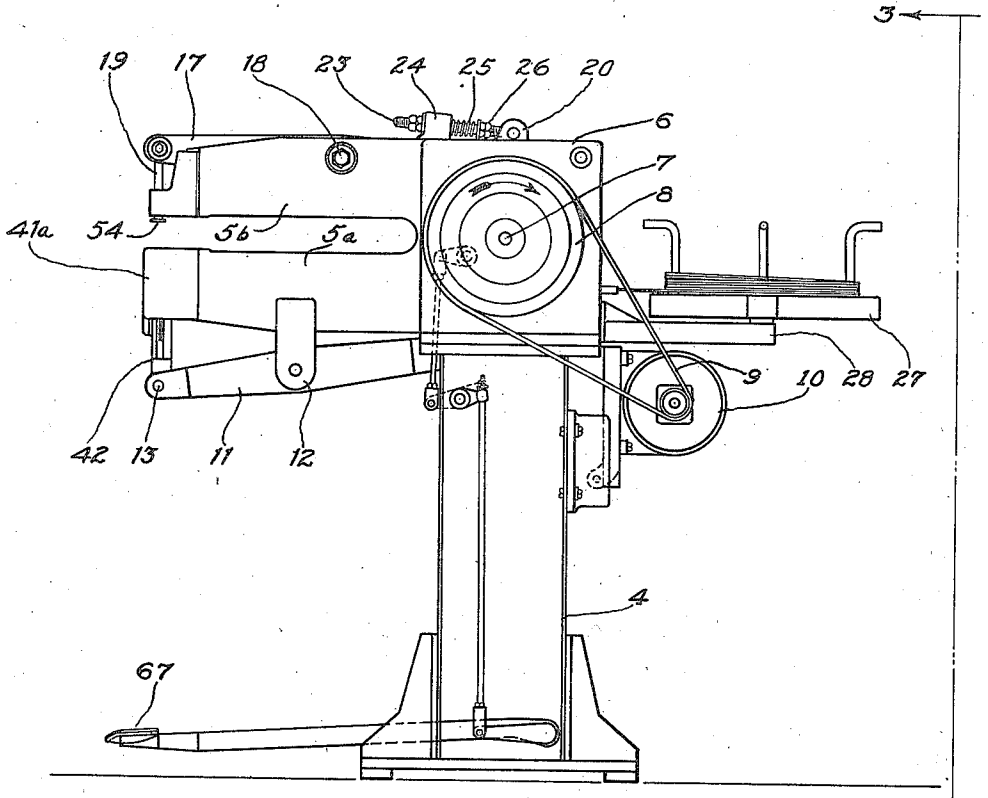
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Fig. 2.



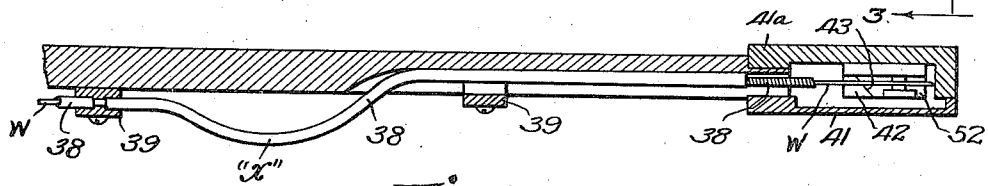


Fig. 1B.

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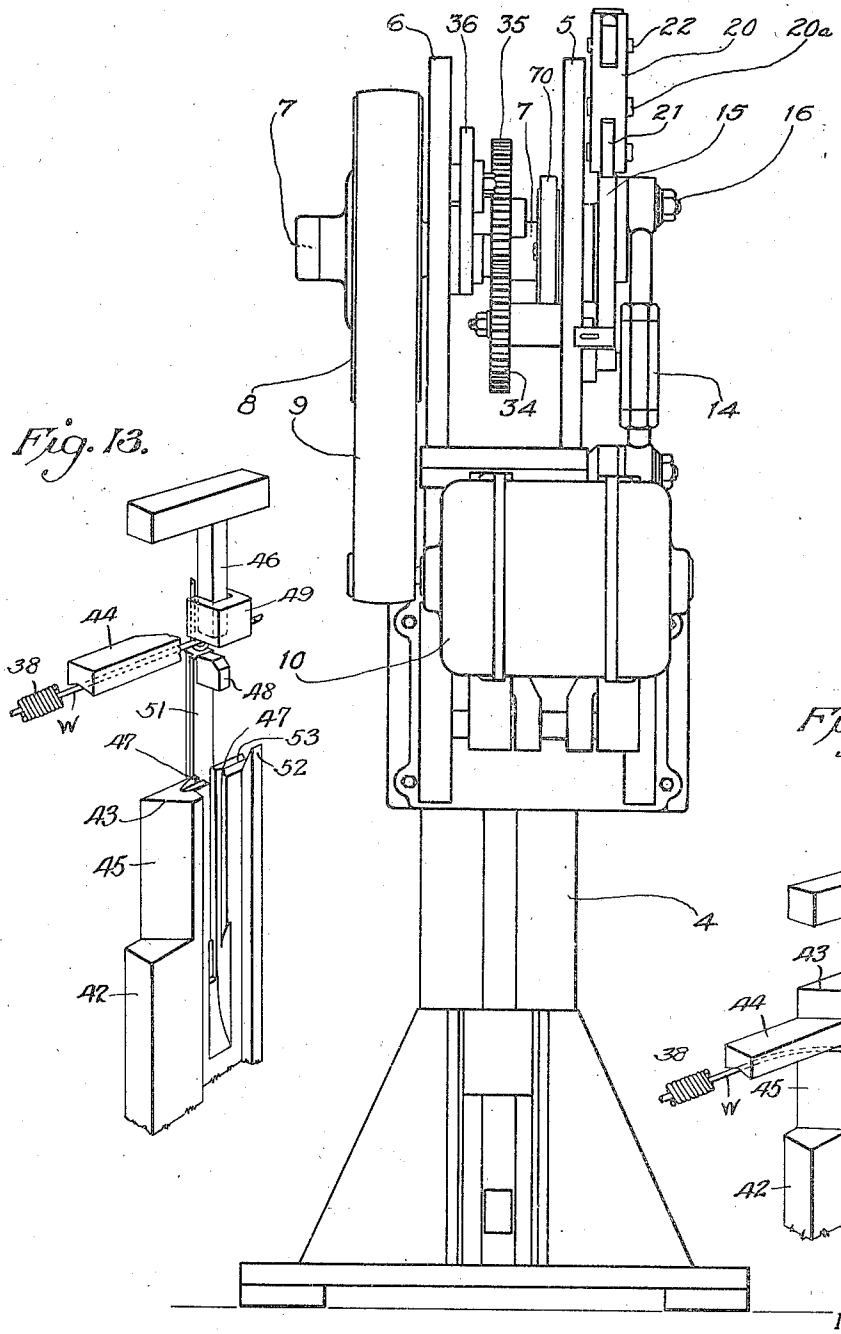


Fig. 13.

Fig. 14.

INVENTOR.

ALFRED L. ROSENMUND.

Fig. 3. BY

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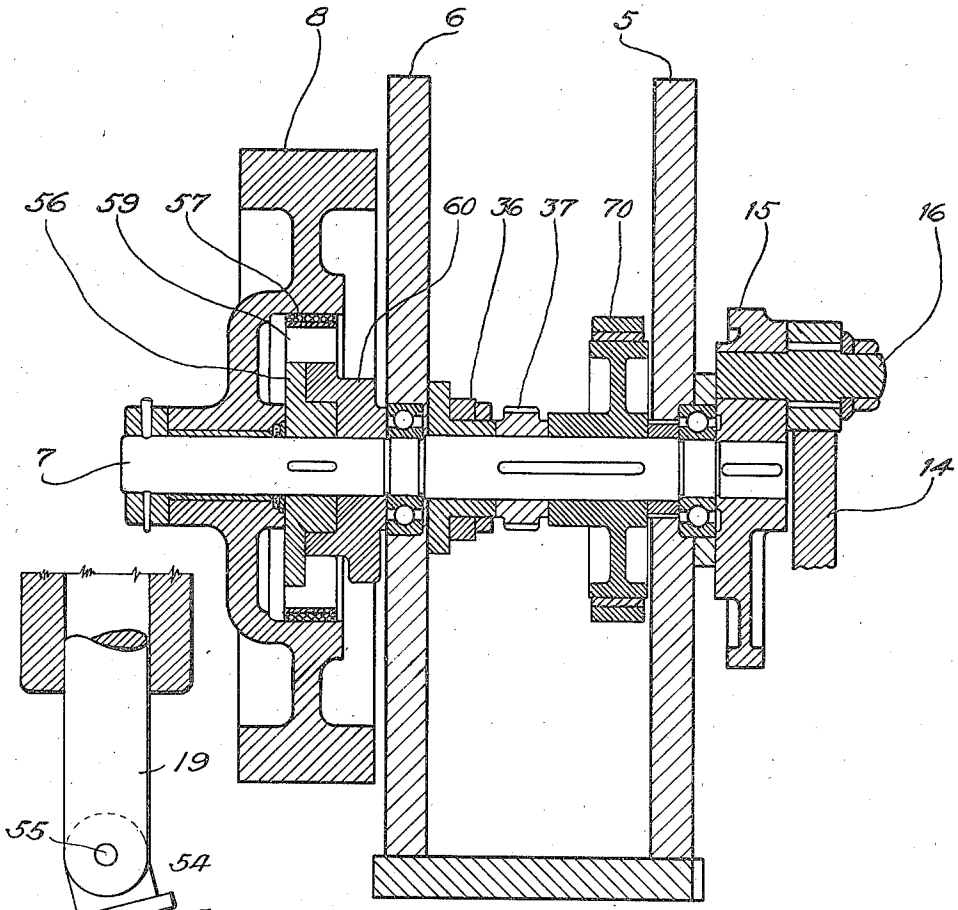


Fig. 4.

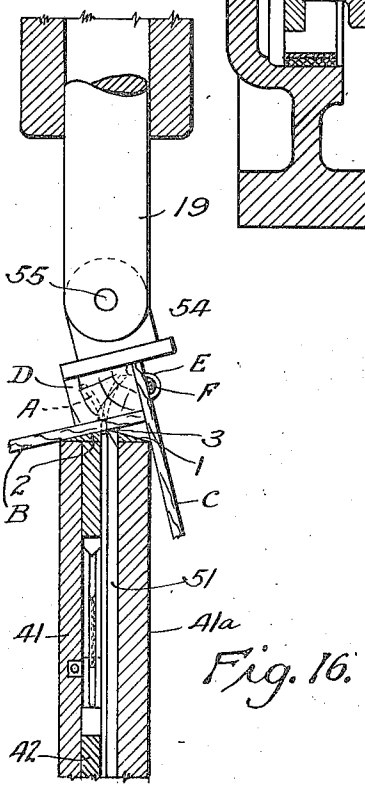


Fig. 16.

INVENTOR.

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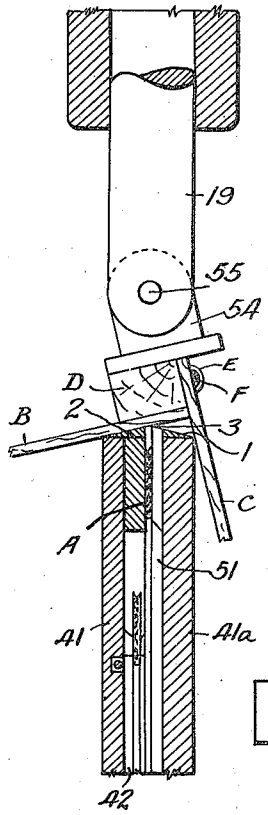
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Fig. 15.



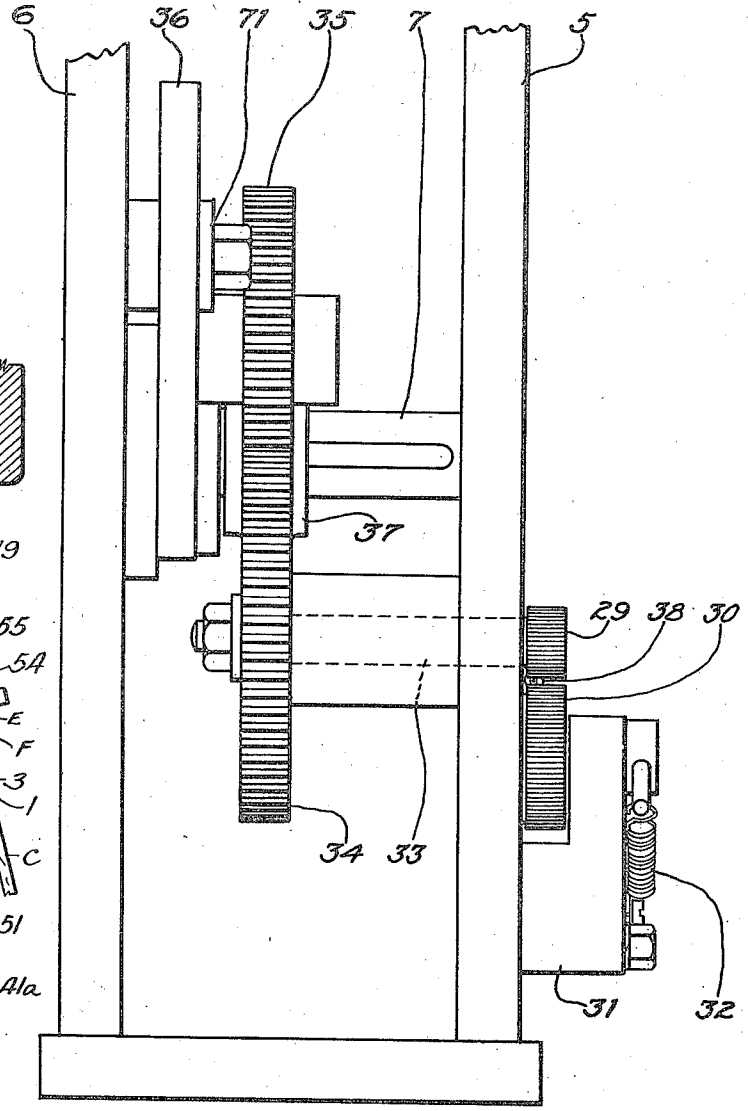


Fig. 5.

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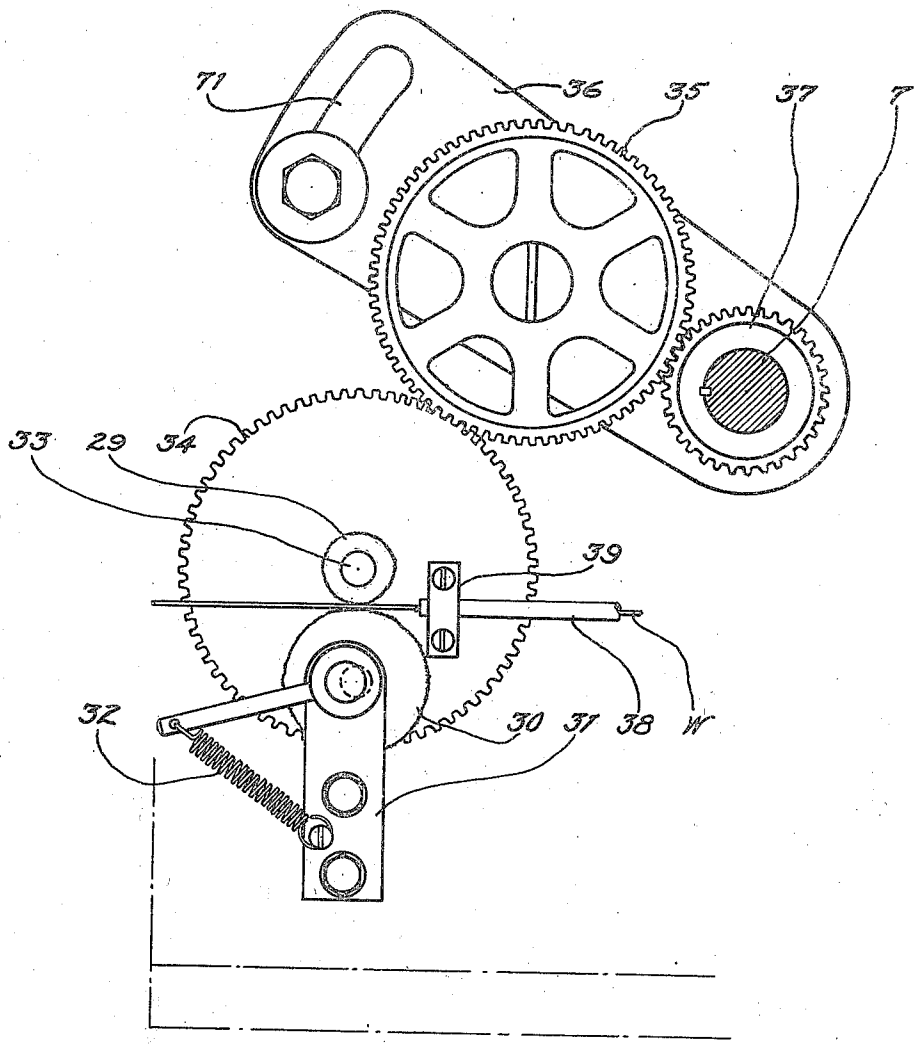


Fig. 6.

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March 1, 1938. A. L. ROSENMUND 2,109,910

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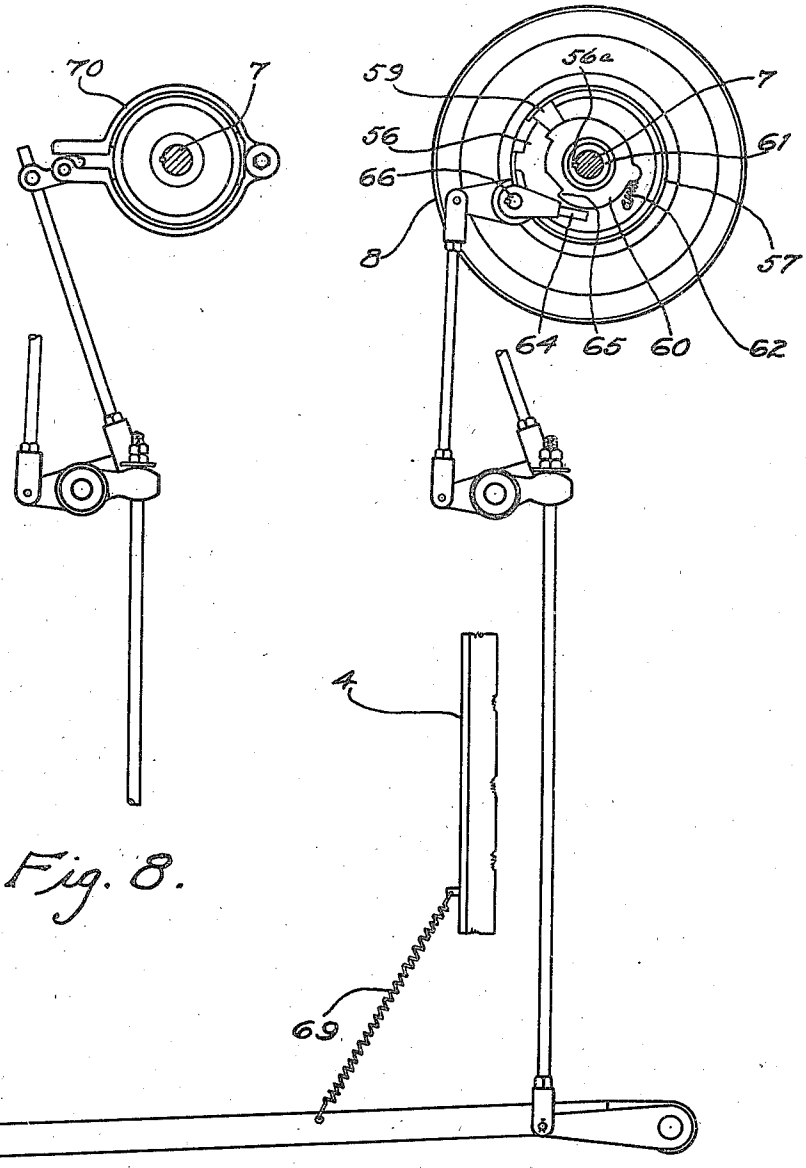


Fig. 8.

Fig. 7.

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Fig. 9.

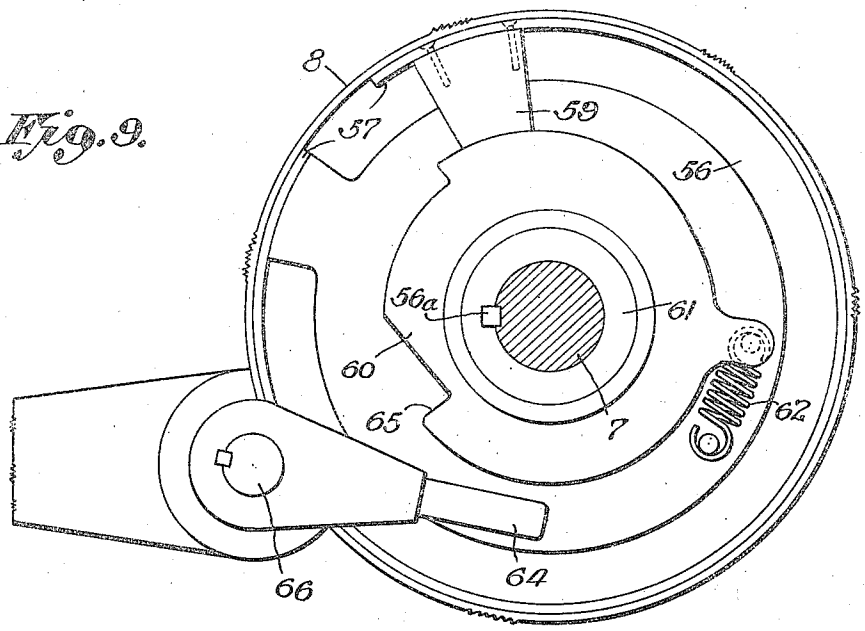
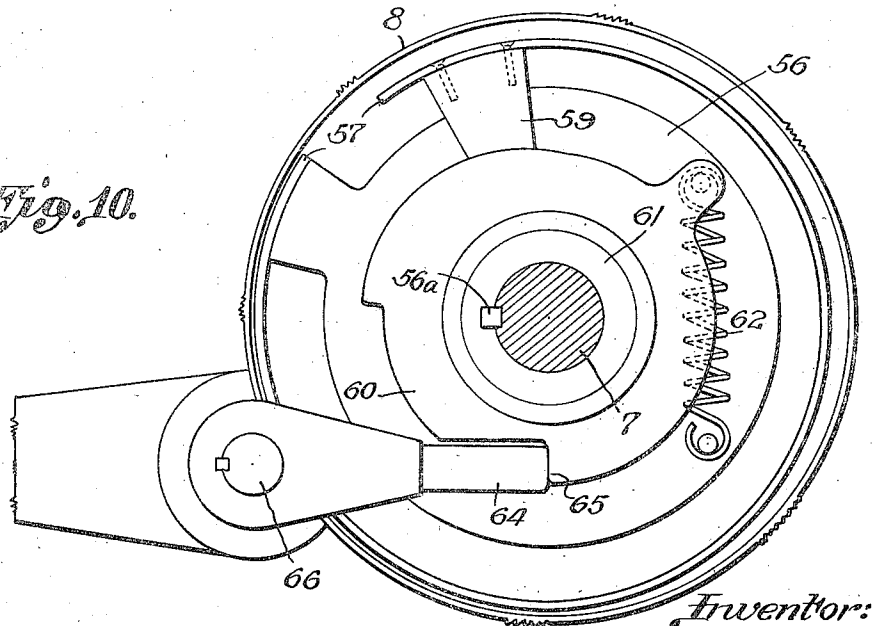


Fig. 10.



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March 1, 1938. A. L. ROSENMUND 2,109,910

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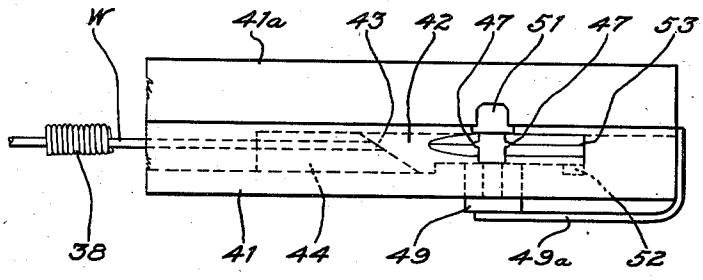


Fig. 11.

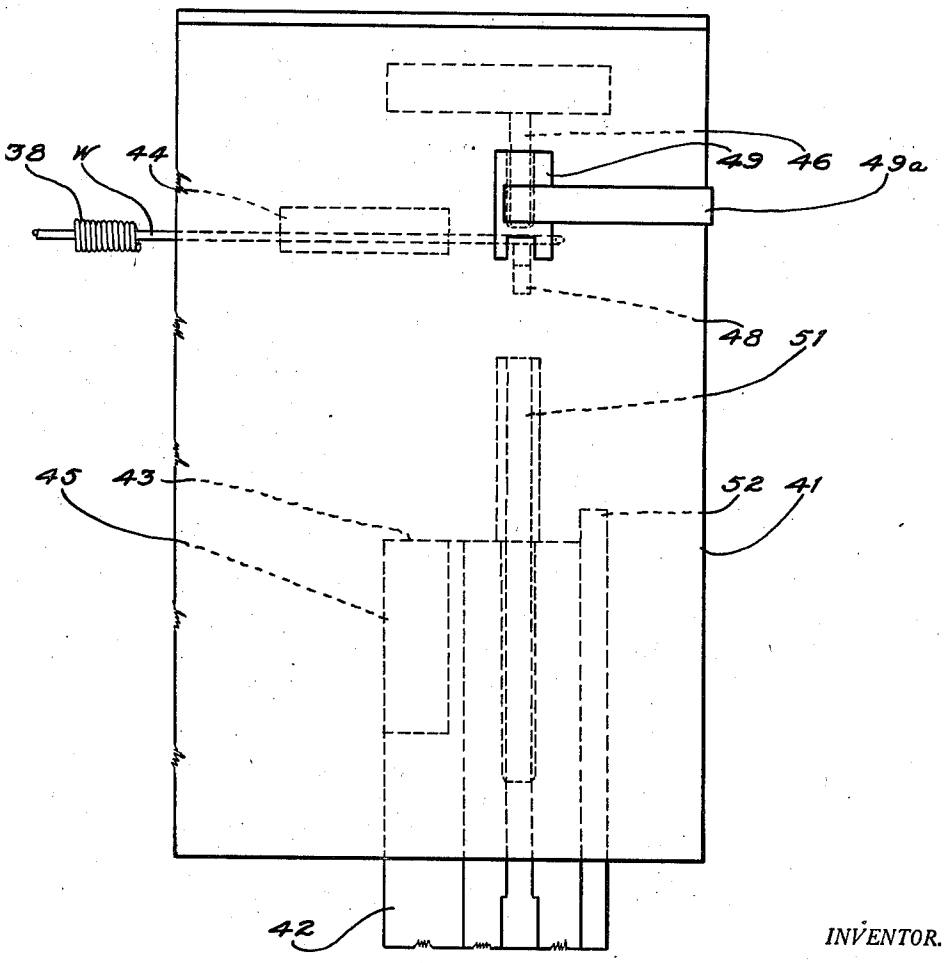


Fig. 12.

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Patented Mar. 1, 1938

2,109,910

UNITED STATES PATENT OFFICE

2,109,910

END STAPLING MACHINE

Alfred L. Rosenmund, Rockaway, N. J., assignor to Stapling Machines Co., a corporation of Delaware

Application October 3, 1934, Serial No. 746,655

17 Claims. (Cl. 1—11)

This invention relates to stapling machines and particularly to machines for stapling box ends to the box sides.

It is an object of the invention to provide a machine of the character described which may be economically manufactured and economically operated.

It is a further object of the invention to provide a machine of the character described which will operate efficiently at a high speed.

It is a further object of the invention to provide a machine of the character described which is adapted to operate without adjustment on box parts varying in thickness.

It is a further object of the invention to provide a machine of the character described which is so constructed and arranged that its various operating parts may be readily removed or adjusted for purposes of repair or otherwise.

It is a further object of the invention to provide a box end stapling machine constructed and arranged to form staples within a box and drive them into the cleats of a box side and close to the box side.

A further object of the invention is to provide a clutch which consists of few parts, is economical to manufacture, is durable, is positive in its action, and requires comparatively a small force to operate.

It is a further object of the invention to provide a machine of the character described with staple forming and driving mechanism adapted to form staples from staple stock wire fed continuously thereto and to drive the staples into the box parts without interrupting the feed of the staple stock wire.

It is a further object of the invention to provide a staple forming and driving mechanism adapted to form one staple while a previously formed staple is being driven into the box parts.

It is a further object of the invention to provide means for feeding the staple stock wire to the staple forming mechanism uniformly with substantially the same direction and degree of curvature.

One illustrative embodiment of the invention is shown in the accompanying drawings, in which:—

Figure 1 is a side elevation of a box end stapling machine embodying the invention, said view being taken from the wire-feed side of the end stapling machine.

Fig. 2 is a side elevation of the other side of the machine.

Fig. 3 is an enlarged rear view of the machine.

Fig. 4 is an enlarged vertical section through the clutch and main shaft.

Fig. 5 is an enlarged rear end view of the staple stock wire feeding mechanism.

Fig. 6 is a diagrammatic side view of the same seen from the right in Fig. 5.

Fig. 7 is a side elevation of the clutch and the mechanism for operating the same.

Fig. 8 is a side elevation of the brake for the main shaft and the mechanism for operating the same.

Fig. 9 is an enlarged view of the clutch assembly in clutching engagement.

Fig. 10 is a similar view but showing the parts in non-clutching position.

Fig. 11 is an enlarged top plan view of the stapling head.

Fig. 12 is a side elevation of the stapling head.

Fig. 13 is a perspective view of the staple forming and driving elements at the start of a staple forming and driving operation and showing the driver and former about to ascend to drive a completed staple and form another staple.

Fig. 14 is a similar view showing the position of the parts upon completion of a forming and driving operation.

Fig. 15 is an enlarged sectional end view of the stapling head with a box in position thereon, and showing also the clincher for clamping the box on the stapling head during a stapling operation. This view illustrates the form of the top surface of the stapling head which permits the box to be positioned thereon in such a manner as to receive the staple close to the box side.

Fig. 16 is a similar view showing the manner in which the clincher cooperates with the box on the stapling head during a staple driving operation.

Figs. 17 and 18 are horizontal sectional views of the stapling arm showing the manner in which the wire is fed to the staple forming and driving mechanism.

Referring to Figs. 15 and 16, the machine of the application is intended to drive a staple A through a box end B close to a box side C and into a box cleat D. The box side C and the box cleat D are secured together on another machine, usually by driving staples E through the box side C and into the cleat D. During this operation binding wires F are usually secured to the box side C by the staples E. Four of these side sections connected by the wires F constitute the four sides of the box when the four sections are folded into four-sided box form. To close the ends of the box, three of the side sections are folded at

right angles to each other and an end section B is placed inside the cleats D and stapled to the cleats D by the machine of this application.

Heretofore the top surface of the stapling head upon which the box end B rests has been a flat horizontal surface and the sides of the stapling head have been vertical, i. e., at right angles to the top of the stapling head. Thus the box end B when placed on the stapling head would take a horizontal position in contact with the top surface of the stapling head, and the side C would take a vertical position in contact with the side of the stapling head. Such positioning of the box parts necessarily prevented driving the staple close to the box side C and compelled the use of a wide cleat D. In the machine of the present invention the top surface of the stapling head is not flat, but consists of two angular surfaces 1 and 2, which slant upwardly at an angle to the horizontal and meet to form a ridge 3 along the longitudinal center line of the head through an opening in which the staple is ejected upwardly into the box parts. This arrangement permits the box end and the box side to be positioned on one of the slanting surfaces, as illustrated in Figs. 15 and 16, thus bringing the point at which the staple emerges from the stapling head closer to the side section C and locating the staple closer to the side section C. This arrangement permits the use of narrower cleats D. To drive staples into the cleat on the opposite box side, the box parts are positioned on the other slanting surface.

Heretofore box end stapling machines have been equipped with staple forming and driving mechanism in which the staple stock wire was fed intermittently in the intervals between staple forming and driving operations. In the present machine a staple forming and driving mechanism is provided which is so constructed and arranged as to permit the staple stock wire to be fed continuously to the staple forming and driving mechanism. This construction permits an increase in the speed of operation.

Referring to Figs. 1 and 2, the several operating mechanisms are supported by a base member 4. Secured to the upper part of the base member 4 is a frame member 5 having a lower jaw 5*a* which carries the staple forming and driving mechanism, and an upper jaw 5*b* which carries the clincher mechanism. Secured to the other side of the base member 4 and in spaced relationship to the frame 5 is a frame 6. The frames 5 and 6 and jaws 5*a* and 5*b* serve to support and carry the several mechanisms.

Mounted in bearings in frames 5 and 6 is a main shaft 7, from which the several mechanisms are operated. Main shaft 7 is driven through a clutch (hereinafter described in detail) through a pulley 8 and belt 9 from a motor 10 conveniently carried in suitable brackets secured to the rear of the base member 4. Any other suitable source of power may be substituted for the motor 10.

Referring to Fig. 1, the staple forming and driving mechanism is located in the nose of jaw 5*a* and is operated with a vertically reciprocating motion imparted through a rocking arm 11 pivoted to a bracket 12 carried by jaw 5*a*. Arm 11 is connected at its outer end to the staple forming and driving mechanism through a pin and slot connection 13 and at its inner end is pivotally connected to a connecting rod 14. Connecting rod 14 is connected at its upper end to a cam plate 15 keyed to shaft 7 by means of a crank pin 16, the connection being such that upon rotation of the cam plate 15 the arm 11 is rocked to impart a vertical reciprocating motion to the staple forming and driving elements located in the nose of the jaw 5*a*.

For operating the clincher mechanism carried by the upper jaw 5*b*, a clincher arm 17 is pivoted to jaw 5*b* at 18 and pivotally connected at its outer end to a clincher rod 19 which carries the clincher hereinafter described. To impart a vertical reciprocating motion to the clincher, the inner end of the clincher arm 17 is pivotally connected to a plate 20 at 20*a*, which plate 20 carries a roller 21 which rides on the cam plate 15. The upper end of the plate 20 is pivotally connected at 22 to a rod 23 which passes through a bracket 24 secured to the arm 17. A coiled spring 25 is interposed between the bracket 24 and a nut 26 on rod 23 to provide a yielding drive for the arm 17 to permit the clincher to operate without adjustment on different thicknesses of box parts.

The parts are so arranged that when the rocker arm 11 is operated to form and drive a staple the clincher arm 17 is operated to clamp the work on the stapling head.

The staple stock wire from which the staples are formed is coiled on a rotatable support 27 mounted on a bracket 28 at the rear of the machine. Referring to Fig. 6, the staple stock wire is drawn from the support 27 by knurled feed rolls 29 and 30. Feed roll 30 is eccentrically journaled in a bracket 31 secured to frame member 5 and is spring-pressed toward feed roller 29 by a spring 32. Feed roll 29 is keyed to a shaft 33 journaled in frame member 5. Also keyed to shaft 33 is a gear 34 which meshes with a gear 35 journaled in a plate 36 bolted to frame member 6. Gear 35 meshes with a gear 37 keyed to main shaft 7.

As the staple stock wire is drawn by the feed rolls 29 and 30 from the support 27 it is fed through a guide tube 38 to the staple forming and driving mechanism at the nose of the jaw 5*b*. As shown in Fig. 17, the guide tube 38 is supported by clamps 39 secured to lower jaw 5*a*. The tube is bent or curved as shown at "X" to remove previously formed bends in the wire and to cause the wire to emerge from the end of the tube with a definite tendency to feed uniformly in the proper direction to the staple forming mechanism. The outer end of the guide tube 38 is made flexible to permit the tube to flex in response to a flexing influence as shown in Fig. 17, and is also made resilient so that it will return to initial position when the flexing influence is withdrawn as shown in Fig. 18. The flexible and resilient end of guide tube 38 is so adjusted as to feed the wire W to a vertically reciprocating staple former 42 housed in housings 41 and 41*a* bolted to the nose of the jaw 5*a*.

As shown in Figs. 13 and 14, the staple former 42 is provided with a cutting edge 43 adapted to cooperate with a fixed cutter 44 carried by the housing 41*a* and sever a length of wire upon the upstroke of the staple former 42. Continued upward movement of the staple former 42 bends the severed wire around a loop bar 46 fixed to housing 41 to form the staple as shown in Fig. 14.

While the former 42 is in the normal path of travel of the wire W, the wire is deflected by a beveled surface 45 of former 42 and is fed to one side of the former 42. The wire continues to be fed around the former 42 until the former 42 descends below the normal path of travel of the

wire W, whereupon the resilient guide tube 38 returns the wire W to the normal path above the former 42 (see Fig. 13).

When the former 42 bends the severed wire about the loop bar 46 to form a staple, the legs of the formed staple are forced in grooves 47 of the former 42 as shown in Fig. 14. After the staple has been formed, the former 42 descends as shown in Fig. 13. As former 42 descends, the staple is forced out of the grooves 47 by means of a stripper 48 carried by the housing 41.

When the staple is stripped from the grooves 47 of the former 42 it is engaged by a spring pressed presser 49 which is pressed toward the staple by a spring 49a secured to housing 41. Presser 49 pushes the staple over against the side of a driver 51 which is rigidly secured to the back of former 42, as shown in Fig. 13. As the former 42 descends carrying the driver 51 down with it, the staple held by the stripper 48 remains stationary until the driver 51 passes below the staple, whereupon the presser 49 shifts the staple into the path of the driver 51 as shown in Fig. 13, the housing 41a holding the staple above the top of driver 51. Thus, upon the next upstroke of the former 42 and driver 51, the driver will engage and drive the staple upwardly into the work.

It should be noted that the staple former and driver are connected to reciprocate together but in different vertical planes and that each staple after being formed by the staple former is shifted from the plane of reciprocation of the former to the plane of reciprocation of the driver, thus permitting the formation of one staple while another staple is being driven, as best shown in Fig. 14.

As shown in Fig. 13, the upper right corner of the staple former 42 carries an extension 52 beveled to guide the wire end toward horizontal grooves 53 formed on the upper face of the former 42 to properly position the wire for the staple forming operation. Because of the bend "X" in guide tube 38, the wire is uniformly fed with the proper direction and curvature to be engaged by the beveled surface of the extension 52 and guided into the grooves 53. If for any reason an insufficient length of wire for a staple is fed, such insufficient length of wire will not reach the extension 52 and thus will not be moved thereby into the grooves 53 and no staple will be formed. In such case, the severed piece of wire will drop out of the machine through the recess in the front face of the former 42 when the former 42 descends.

Referring to Figs. 15 and 16, clincher rod 19 carries a clincher 54 swiveled to the rod 19 at 55. This swivel arrangement for the clincher permits the clincher to accommodate itself to the slant of the box parts, as shown in Fig. 15, thus permitting the use of the slanting surfaces 1 and 2 on the stapler head for the purpose hereinbefore referred to. The surfaces 1 and 2 are provided with suitable openings at the ridge 3 to permit the staple to be driven therethrough.

The clutch for operating the main shaft 7 is best shown in Figs. 9 and 10. Referring particularly to Fig. 9, the clutch mechanism for connecting pulley 8 to main shaft 7 is shown. A clutch collar 56 is keyed at 56a to the main shaft 7. Clutch collar 56 is secured to one end of a clutch band 57. Secured to the other end of the clutch band 57 is a block 59 which bears against the peripheral surface of a collar 60 which is loosely mounted on a hub 61 of the clutch collar 56. Collar 60 is connected to collar 56 by a spring 62 which normally holds collar 60 in the position shown in Fig. 9. In this position the cam-like peripheral surface of collar 60 acting through the block 59 forces the clutch band 57 into clutching contact with the pulley 8.

For moving collar 60 against the action of spring 62 to release the pressure on block 59 and break the clutch connection between the band 57 and the pulley 8, a buffer 64 is provided to engage a shoulder 65 of the collar 60.

As shown in Fig. 10, when the buffer 64 comes in contact with shoulder 65, collar 60 is moved against the action of spring 62, thus moving collar 60 from the position shown in Fig. 9 to the position shown in Fig. 10 and permitting the clutch band 57 to move inwardly and out of contact with the pulley 8.

Referring to Fig. 7, buffer 64 is fixed to a rock shaft 66 journaled in frame member 6. Rock shaft 66 is rocked by a foot pedal 67 through links and connecting rods, as shown. The arrangement is such that when foot pedal 67 is depressed buffer 64 is lowered out of engagement with shoulder 65, permitting spring 62 to move collar 60 to the clutching position shown in Fig. 9. When the pressure on foot pedal 67 is released, a spring 69 raises the foot pedal and rocks the shaft 66 in a counter-clockwise direction to raise the buffer 64 into contact with shoulder 65 and move collar 60 into the non-clutching position shown in Fig. 10.

It should be noted that collar 60 is provided with one shoulder 65 only so that when buffer 64 is disengaged from shoulder 65 the main shaft will make at least one complete revolution before the buffer can again engage shoulder 65 to disengage the clutch. The arrangement is such that one revolution of the main shaft causes one complete staple forming and driving operation. Of course, the machine will continue forming and driving staples as long as the foot pedal is depressed.

As shown in Fig. 8, the foot pedal 67 operating through links and rods operates a brake 70 on main shaft 7, the arrangement being such that when the pulley 8 is clutched to main shaft 7 the brake 70 is released and when the driving connection between the pulley 8 and the main shaft 7 is broken the brake 70 automatically operates to stop rotation of main shaft 7.

It should be noted that because of the cam action of the collar 60 on the block 59 very little force is required in the spring 62 to exert great outward pressure of the clutch band 57 against pulley 8, and that the clockwise force of pulley 8 against clutch band 57 tends to expand the band 57, thus increasing the friction and driving power and exerting a self-energizing effect.

Referring to Fig. 6, the length of the staple legs formed and driven may be varied by substituting a different gear for the gear 34. To permit the insertion of different sized gears 34, gear 35 is journaled in a plate 36 as hereinbefore explained, which plate 36 may be adjusted toward and from gear 34 through a bolt and slot connection 71, shown in Fig. 6.

The operation of the machine will be apparent from the foregoing detailed description. With the machine at rest, as shown in Fig. 1, the operator positions a box and box end on slanting surface 2, as shown in Fig. 15, with the box side C contacting with the upper corner edge of the stapling head in order to locate the ridge 3 of the stapling head through which the staple is driven as close as possible to the box side C.

With the machine at rest, the staple former and driver are in the position shown in Fig. 13. As there shown, a formed staple (formed during the preceding operation of the machine) is located above the driver 51 ready to be driven upward into the work, and the staple former is below the staple stock wire which has been partially fed across the path of reciprocation of the staple former. With the parts in the position stated, the operator steps on the foot pedal 67 to release the brake 70 and disengage buffer 64 from shoulder 65 of the collar 60. Thereupon spring 62 moves collar 60 to force clutch band 57 against pulley 8. This causes one revolution of main shaft 7.

During one revolution of main shaft 7 the previously formed staple which is positioned above the driver is driven upward into the work and another staple is formed and positioned over the driver for the next operation. As the staple former and driver ascend and descend, a sufficient length of wire for one staple is fed through the guide tube 38 to the staple head.

While the staple driver ascends to drive a staple into the work, the swiveled clincher block 54 descends and engages the box parts, as shown in Fig. 16, to clamp the box parts on the stapling head during the staple driving operation.

In practice the operator actually keeps the foot pedal depressed until he has driven the required number of staples at spaced intervals through the box end B and into the cleat D, shifting the box parts between stapling operations to space the several staples. When the end B has been stapled to the cleat D at one side of the box, the operator shifts the box parts to the other slanting surface on the stapling head and repeats the operation to staple the end B to the opposite cleat D.

The advantages of the machine have been pointed out hereinbefore. The several novel features contribute to a high speed box end stapling machine which may be economically manufactured and operated, and which permits the driving of staples closer to a box side than in previous known end stapling machines.

It will be understood that the invention is not to be limited to the specific construction shown for purposes of illustration as the invention may be variously embodied.

It will also be understood that all of the inventive features need not be used conjointly as they may be used in various combinations as defined in the subjoined claims.

The word "continuously" as used in the claims to define the movement or feed of the staple stock wire is intended to include a feed or movement which continues without interruption during a staple forming and driving cycle of operation as distinguished from a feed or movement which is interrupted during a staple forming and driving operation.

I claim:

1. In an end stapling machine, the combination of a stapling arm and a clincher arm, the stapling arm being adapted to support a box part during a stapling operation and having supporting surfaces each tapering from a side wall of the arm at an angle oblique to the plane of the side wall, and the clincher arm being provided with a clincher adapted to accommodate itself to the tapering supporting surfaces of the stapling arm and to clamp the box on either one of said surfaces.

2. In an end stapling machine, the combination of a stapling arm and a clincher arm, the stapling arm having a supporting surface tapering from a side wall of the arm at an angle oblique to the plane of the side wall, said supporting surface being adapted to receive thereon and support a box part prior to and during a stapling operation, and said stapling arm being provided with mechanism to drive a staple upwardly into the box part supported on the supporting surface, and the clincher arm being provided with a clincher adapted to accommodate itself to the tapering supporting surface of the stapling arm and to clamp the box part on said surface.

3. In an end stapling machine, a stapling arm carrying staple forming and driving mechanism adapted to operate within a box and close to the sides thereof to drive a staple upwardly into the work, said stapling arm having a supporting surface tapering from a side wall of the arm at an angle oblique to the plane of the side wall to receive thereon and support a box part prior to and during a stapling operation, whereby a box positioned on said tapering supporting surface and in contact with the side wall of the arm will permit driving a staple in close proximity to the side wall of the box.

4. In an end stapling machine, the combination of a stapling arm adapted to enter a box, staple forming and driving mechanisms carried at the extremity of said arm and operable upon moving wire to form a staple and drive it into box parts, and means to feed staple stock wire continuously and substantially horizontally along said arm to said mechanisms.

5. In an end stapling machine, the combination of staple forming and driving mechanisms operable upon moving wire within a box to form one staple with its legs upstanding while driving another staple upwardly into box parts, and means to feed staple stock wire continuously to said mechanisms.

6. In an end stapling machine, the combination of staple forming and driving mechanisms operable upon moving wire within a box to form one staple while driving another staple, and means to feed staple stock wire continuously to said mechanisms.

7. In an end stapling machine, the combination of a reciprocating staple former, a staple driver rigidly connected to the rear face of the staple former and extending upwardly above the top of the staple former, means to strip a formed staple from the staple former, means to press the formed staple toward the front face of the staple driver and to shift the staple over the staple driver when the top of the staple driver descends below the staple, whereby on the ascent of the staple former and staple driver, one staple will be formed by the staple former, while the previously formed staple is being driven by the staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

8. In an end stapling machine, the combination of means to form a staple, means to drive a staple, the staple former and the staple driver being connected and constructed and arranged to drive one staple while another staple is being formed, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

9. In an end stapling machine, the combination of means to form a staple, means to drive a staple, the staple former and the staple driver being rigidly connected to reciprocate together,

and means to feed staple stock wire continuously to said staple forming and driving mechanism.

10. In an end stapling machine, the combination of means to form a staple, a staple driver associated therewith, means to shift a formed staple from the staple former to the staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

11. In an end stapling machine, the combination of means to form a staple, a staple driver associated therewith, means to strip a formed staple from the staple former, means to shift the formed staple to the staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

12. In an end stapling machine, the combination of a reciprocating staple former, a fixed loop bar about which a staple is formed, a reciprocating staple driver, means to shift the formed staple from the fixed loop bar to the path of reciprocation of the staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

13. A staple forming and driving mechanism comprising, in combination, a reciprocating staple former, a reciprocating staple driver, the staple former and staple driver being constructed and arranged to form one staple while a previously formed staple is being driven, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

14. A staple forming and driving mechanism comprising, in combination, a reciprocating staple former, a driver connected thereto and reciprocating therewith, means to shift a formed staple from the path of reciprocation of the staple former to the path of reciprocation of the staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

15. A staple forming and driving mechanism comprising, in combination, a stationary loop bar, a movable staple former to form a staple over the loop bar, means to move the formed staple from the loop bar, a staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

16. A staple forming and driving mechanism comprising, in combination, a stationary loop bar, a movable staple former to form a staple over the loop bar, means to strip the formed staple from the staple former, means to move the formed staple from the loop bar, a staple driver, and means to feed staple stock wire continuously to said staple forming and driving mechanism.

17. A staple forming mechanism comprising, in combination, a stationary loop bar, a reciprocating staple former to form a staple over the loop bar, means to move the formed staple from the loop bar, and means to feed staple stock wire continuously to said staple forming mechanism.

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