

Nov. 22, 1949

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2,488,940

STAPLING MACHINE HAVING RETRACTABLE CLINCHING ANVILS

Filed March 26, 1946

6 Sheets-Sheet 1

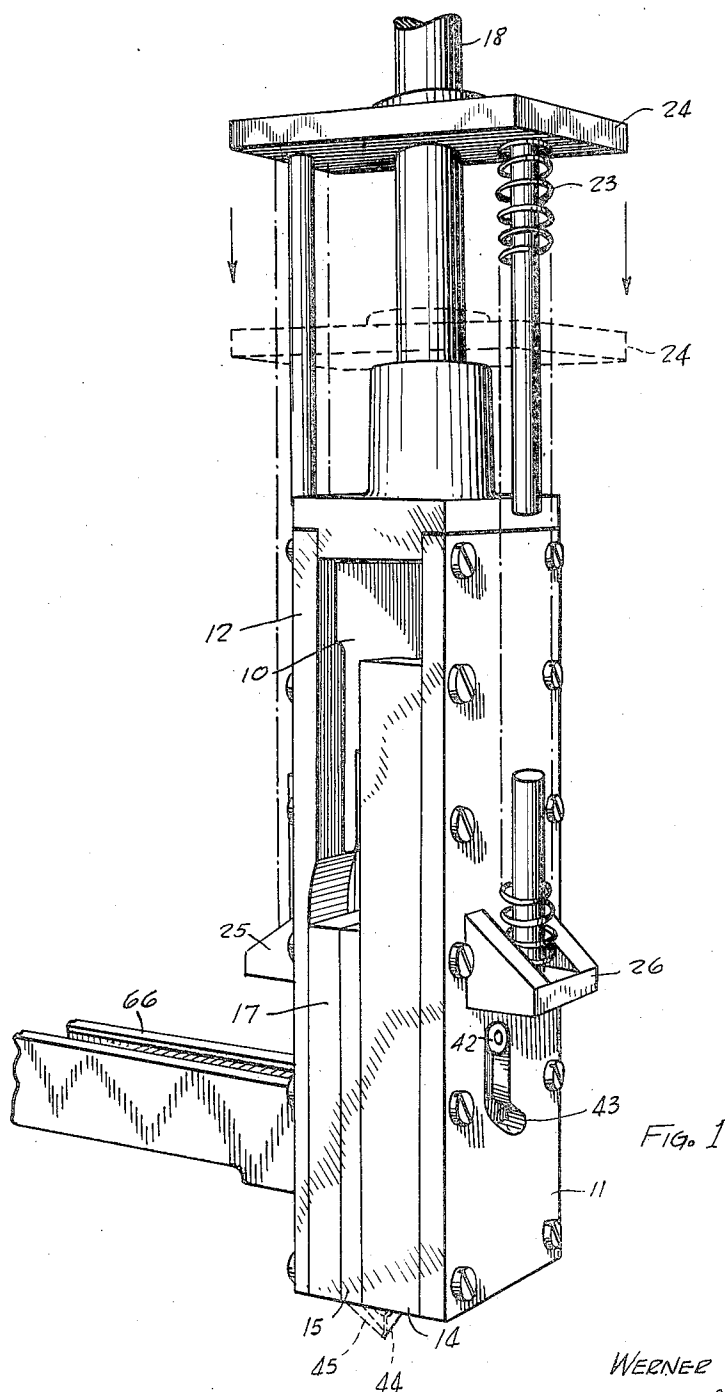


FIG. 1

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6 Sheets-Sheet 2

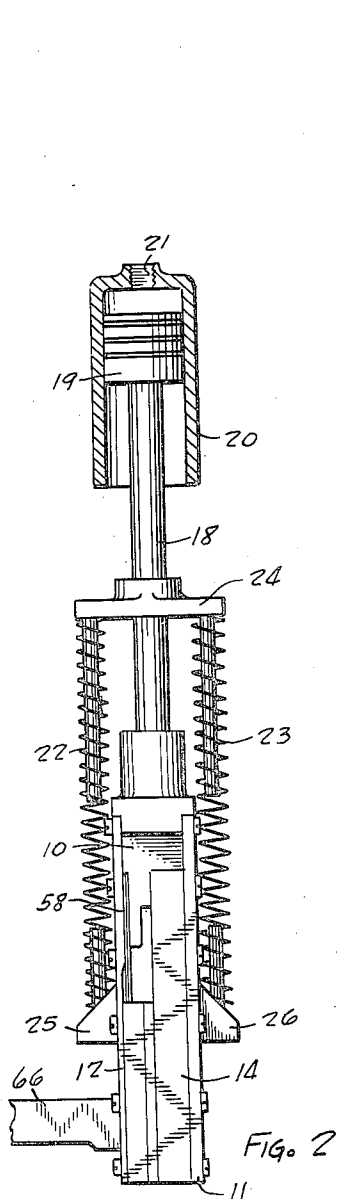


Fig. 2

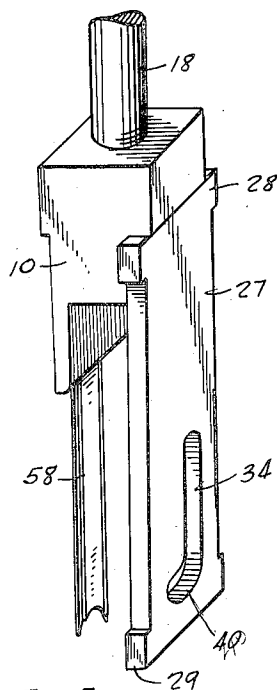


Fig. 5

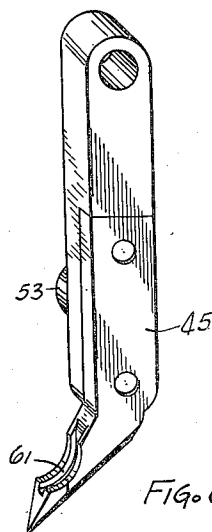


Fig. 6

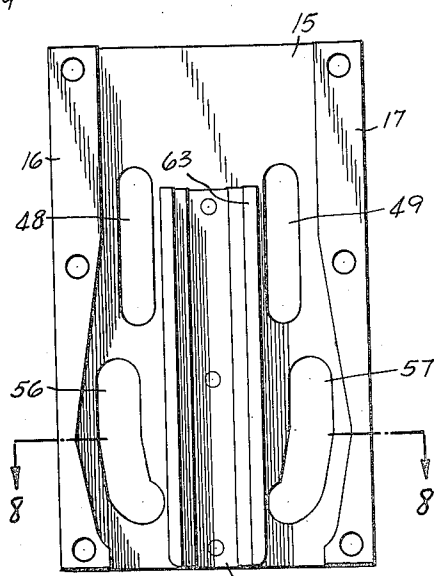


Fig. 7

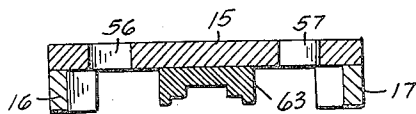


Fig. 8

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6 Sheets-Sheet 3

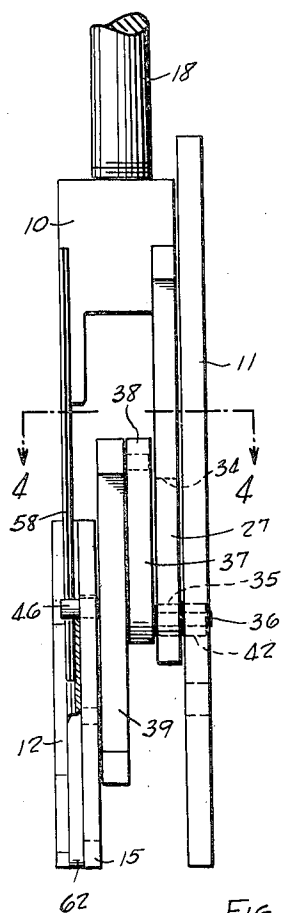


Fig. 3

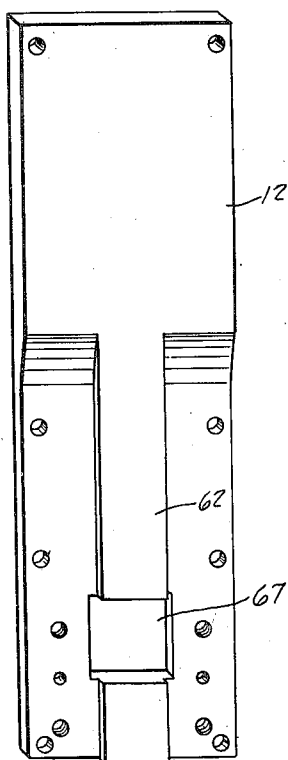


Fig. 9

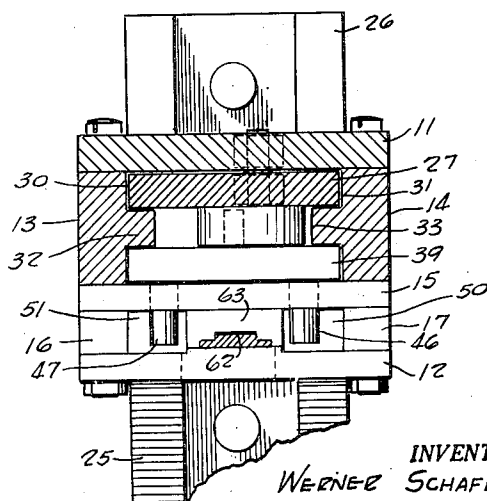


Fig. 4

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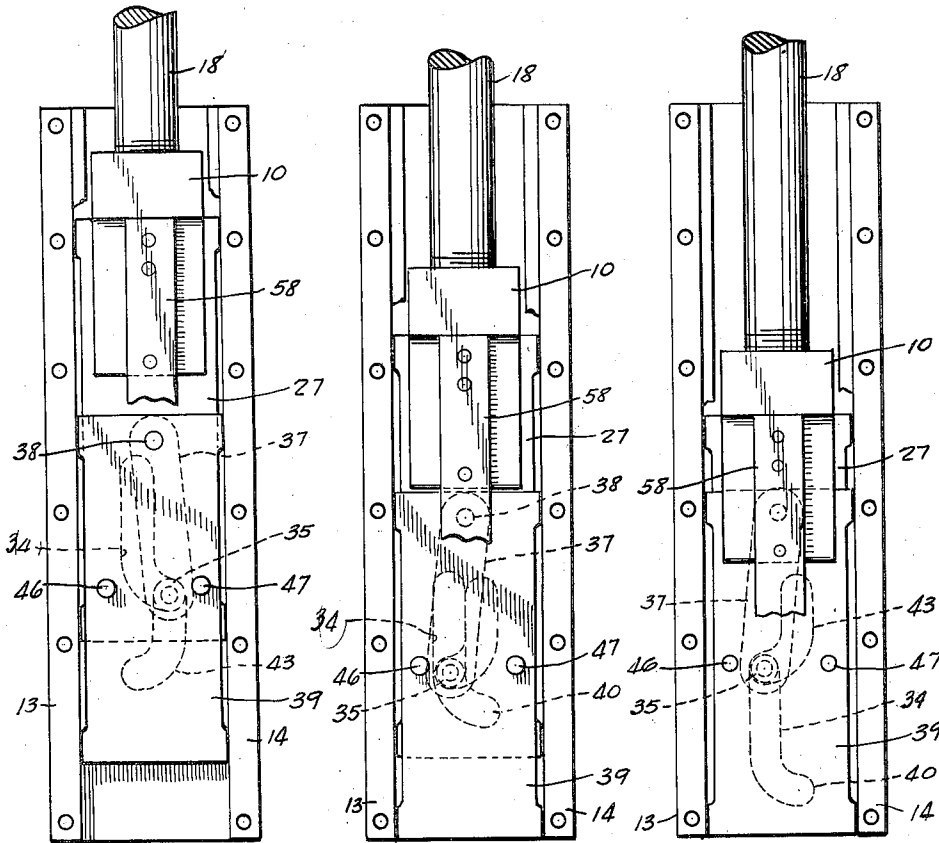


Fig. 11

Fig. 12

Fig. 13

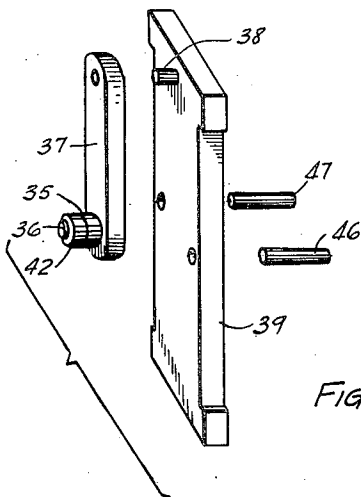


Fig. 10

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6 Sheets-Sheet 5

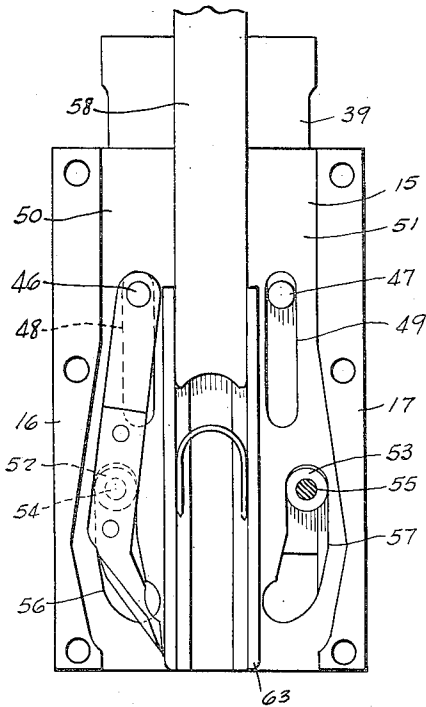


Fig. 14

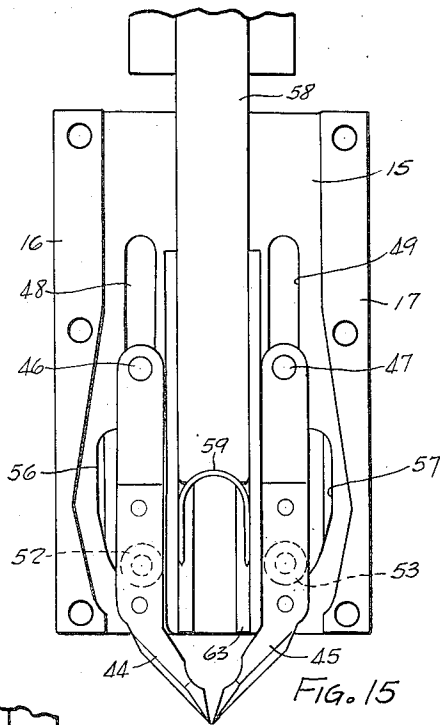


Fig. 15

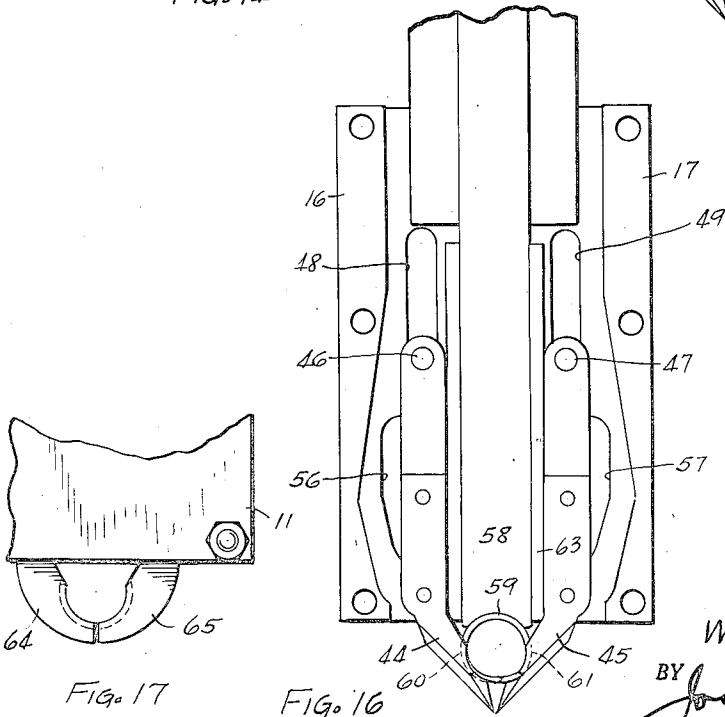


Fig. 16

Fig. 17

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STAPLING MACHINE HAVING RETRACTABLE CLINCHING ANVILS

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6 Sheets-Sheet 6

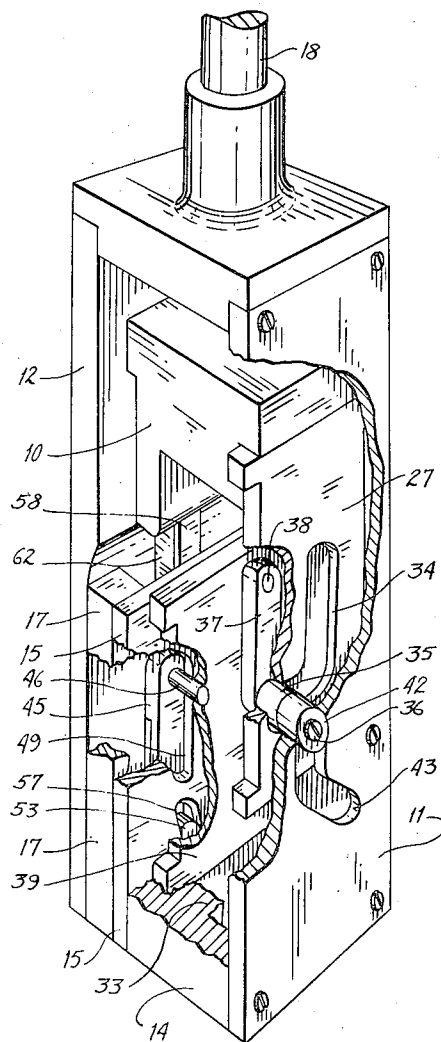


FIG. 18

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UNITED STATES PATENT OFFICE

2,488,940

STAPLING MACHINE HAVING RETRACTABLE
CLINCHING ANVILS

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Application March 26, 1946, Serial No. 657,087

11 Claims. (Cl. 1—3)

1

The present invention relates to stapling machines and is concerned primarily with a stapling machine of the retractable anvil type.

During recent years there has been developed a type of stapling machine which is capable of driving staples into material under those conditions when only one face of the material is available and it is not possible nor practical to support or back the material from the opposite face. Stapling machines of this character consist essentially of a pair of anvils which are first driven into the material after which the staples are driven onto the anvils. The anvils are subsequently withdrawn and this type of stapling machine has therefore become known as a retractable anvil stapling machine.

Ordinarily, a stapling machine is employed for the purpose of joining together two pieces of material such as the flaps of a carton which may be either in abutting or overlapping relation. However, these are certain other uses to which a stapling machine of the retractable anvil type is believed to be adapted and this invention is concerned primarily with the provision of a stapling machine of the retractable anvil type that is adapted to such specific uses.

There are occasions when it is desirable that a staple not only pierce or penetrate the material into which it is driven but also be clinched about an article or member that is imbedded within this material. A good example of this condition is the anchoring of the ends of springs in mattresses. If these springs are to be secured in position by staples, it is essential that the staple pierce the burlap or other material employed as the mattress casing and be clinched about the end of a spring at the same time compressing a certain amount of the mattress material about the spring so as to achieve a connection between the material and the spring. Another example which might be cited is the closing of the ends of stockinets about ham butts, picnic shoulders, and the like, wherein it is important that a staple compress the material of the stockinet about the bone over which the staple is clinched.

With the foregoing conditions in mind, the present invention has in view as its foremost objective the provision, in a stapling machine which includes a pair of retractable anvils, of mechanism for imparting to the anvils a compound movement. This movement should include two separately identified components. The first is a straight outward movement away from the machine and which component will cause the anvils to pierce the material being stapled, and this

2

component is followed by a movement of the anvils towards one another whereby they are moved into a position encompassing the particular member around which staples are to be clinched.

Another highly important object of the invention is to provide, in a retractable anvil stapling machine of the type indicated, means for positively guiding and controlling the anvils during this compound movement to positively eliminate any floating action. It is highly important that the anvils be positively moved into their clinching position so that material such as the burlap in a mattress will be compressed about the member over which the staple is clinched, such as the spring of the mattress.

From the very nature of the holding function required of a staple which is clinched by the stapling machine of this invention, it is desirable if not actually essential that the free ends of the staple in their finally clinched position assume a side by side overlapping relation. With this desideratum in mind, a further object of the invention is to provide, in a retractable anvil stapling machine of the character noted, a pair of complementary anvils, each of which is formed with a groove that is adapted to receive a leg of the staple and function as a guide therefor during the staple clinching operation. The free end of the groove in one anvil is offset at one side with respect to the free end of the groove in the other anvil so that as a staple is driven, the free ends of the staple legs will pass one another and assume the side by side overlapping relation that is so essential. When anvils of this type are employed it is possible to drive a narrow staple which in its ultimate position assumes substantially the formation of a circle or ring.

In all retractable anvil stapling machines, it is necessary to provide for the driving of the anvils first and then the driving of a staple onto the anvils. In accordance with the present invention these two driving operations are accomplished by a single stroke of the plunger of the stapling machine. Important features and advantages of the invention are tied up with the provision of operating connections between the anvils and the plunger. These will become apparent as the description of the invention proceeds.

Various other more detailed objects and advantages of the invention such as arise in connection with carrying out the above noted ideas in a practical embodiment will, in part become apparent, and in part be hereinafter stated as the description of the invention proceeds.

3

The invention therefore comprises a retractable anvil stapling machine which includes a pair of complementary retractable anvils that are positively guided and controlled during a compound movement which provides for the anvils being first moved outwardly to penetrate material and then together into position encompassing a member about which a staple is to be clinched. The anvils are formed with complementary guide grooves, the ends of which are laterally offset to cause the ends of a staple to assume a side by side overlapping relation in clinched position.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein:

Figure 1 is a perspective view of a retractable anvil stapling machine designed in accordance with the precepts of this invention.

Figure 2 is a side view mainly in elevation but with parts shown in section of the plunger and mechanism immediately associated therewith.

Figure 3 is a view in side elevation of the lower end of the plunger and the operating connections for the anvils which are connected thereto.

Figure 4 is a horizontal section through the machine being taken about on the plane represented by the line 4—4 of Figure 3.

Figure 5 is a detailed perspective of the plunger and certain elements carried thereby.

Figure 6 is a detailed perspective of one of the retractable anvils.

Figure 7 is a view in front elevation of a partition plate which is included in the casing structure and which is formed with cam slots for guiding the anvils.

Figure 8 is a detailed horizontal section taken about on the plane represented by the line 8—8 of Figure 7.

Figure 9 is a detailed perspective of the back plate of the casing.

Figure 10 is another detailed perspective developing the slider plate which is included in the operating connections between the plunger and the anvils together with certain parts that are associated therewith and shown in exploded relation.

Figure 11 is an elevational view taken from the front with the front casing plate removed and showing the plunger and certain other elements in position at the start of a staple driving cycle.

Figure 12 is a view similar to Figure 11 showing the position of the several elements after the staples have been driven to clinching position.

Figure 13 is another view similar to Figures 11 and 12 illustrating the position of the mechanism after a staple has been driven.

Figure 14 is an elevational view looking from the rear with the rear casing plate removed and showing one of the anvils at the beginning of a cycle.

Figure 15 is a view similar to Figure 14 showing both of the anvils in clinching position.

Figure 16 is another view similar to Figures 14 and 15 showing a staple as driven onto the anvils and clinched thereby.

Figure 17 is a detailed showing in elevation of a pair of modified anvils which may be employed; and

Figure 18 is a perspective view of the machine with parts broken away and shown in section to permit illustration of internal features of the machine.

4

General assembly

The retractable anvil stapling machine of this invention consists essentially of a casing structure which houses the moving parts and which also functions as a guide for the moving elements; a plunger together with means for actuating the plunger; a pair of retractable anvils together with mechanism for operatively connecting the anvils to the plunger and guiding them during their movement; a staple driving blade that is carried by the plunger; and a magazine for receiving a supply of staples to be driven. Each of these parts will now be described in detail.

The casing structure

The casing structure includes a front casing plate 11 which is formed with a cam slot 43 having a vertical leg and a downwardly inclined leg. The purpose of this cam slot will later become apparent. The outer face of the front casing plate 11 carries a spring seat 26 for a purpose to be later described.

Secured to the inner face of the front casing plate 11 at the respective side edges thereof are a pair of side casing members 13 and 14. Extending inwardly from the side member 13 is a rib or bead 32 which cooperates with the front casing wall 11 to provide a groove-like passage 30. Likewise, extending inwardly from the side member 14 is a rib or bead 33 which cooperates with the front casing plate 11 to define a groove-like passage 31. The passages 30 and 31 are in oppositely confronting relation and cooperate to function as a guide for a member that is received therein as will be later described.

Secured against the inner end edges of the casing side members 13 and 14 and against which it is held in abutting relation with respect to these edges is a partition plate 15. This partition plate 15 is formed with a pair of upper straight slots 48 and 49 which are symmetrically spaced apart and a pair of lower cam slots 56 and 57 which are of somewhat irregular formation as depicted in Figure 7. The purpose of these slots 48, 49, 56 and 57 will later be described.

Held against the partition plate 15 on the face opposite to that which is engaged by the casing side members 13 and 14 are a pair of side plates 16 and 17. A rear casing plate 12 bears against the side plates 16 and 17. It is notable that the partition plate 15, the side plate 17, and the rear casing plate 12 cooperate to define a passage 50 that is intended to receive one of the anvils as will be later described. Likewise, the partition plate 15, side plate 16, and the rear casing plate 12 cooperate to define another passage 57 for receiving the other of the anvils. Also, entering into the definition of these anvil passages 50 and 51 is a vertical member 63 that is mounted on the inner face of the rear casing plate 12 and which is formed with a vertical groove or passage 62 which accommodates the staple pusher as will be later described. Mounted on the outer face of the rear casing plate 12 is another spring seat 25 which corresponds to the spring seat 26 on the front casing wall 11.

The front casing wall 11, side members 13 and 14, partition plate 15, side plates 16 and 17, and rear casing plate 12 may be maintained in assembled relation in any preferred manner such as by the screw bolt and nut assemblies (not designated) which are illustrated in the drawings and which pass through aligned openings in the respective parts. As is clearly brought out in Fig-

5

ures 1 and 18, the side plates 16 and 17 and the partition plate 15 extend up from the bottom a distance that is in the neighborhood of one-half the height of the front and rear plates 11 and 12. Moreover, the rear casing plate 12 is somewhat thinner where the side plates 16 and 17 are connected thereto. The side members 13 and 14 extend up above the partition plate 15 but are still somewhat shorter than the front and rear casing plates 11 and 12. A cap member (not designated) spans the front and rear casing plates 11 and 12 at the top.

The plunger

A plunger is designated 10 and is shown as mounted for reciprocation in a channel defined by front casing plate 11, rear casing plate 12, and side members 13 and 14. Secured to the upper end of the plunger 10 is a connecting rod 18 which passes through the cap member aforesaid. Carried by the upper end of the connecting rod 18 is a piston 19 that is slidably received in a cylinder 20. The closed end of the cylinder 20 is provided with an opening 21 through which a pressure medium is adapted to be introduced into the cylinder 20 to actuate the piston 19 and thereby drive the plunger 10 downwardly.

The connecting rod 18 carries a crossbar 24, and a pair of springs 22 and 23 are disposed between this crossbar 24 and the spring seats 25 and 26. As the plunger 10 is driven downwardly these springs 22 and 23 are compressed so that when the actuating pressure is relieved the springs 22 and 23 will be effective to retract the plunger into its upper position which it assumes at the beginning of a staple driving cycle.

It is noted that the piston and cylinder assembly 19 and 20 together with the springs 22 and 23 are merely illustrative of one means which may be employed for actuating the plunger 10. The invention is not to be limited in this respect as any means or mechanism for actuating the plunger may be employed.

The anvils

An anvil 44 is operatively mounted in the passage or channel 51 while a complementary anvil 45 is similarly received in the passage 50. The anvil 45 is shown in detail in Figure 6, and it will be noted that this anvil includes a piercing head or end that is pointed and formed with a guide groove 61 onto which the free end of a staple is driven. The anvil 44 is formed with a complementary guide groove 60 and when these anvils assume the position depicted in Figures 15 and 16 the free ends of the grooves 60 and 61 are laterally offset so that the staple ends which are guided thereby may pass one another and assume a side by side overlapping relation.

The anvil 44 carries a pin 54 on which is rotatably mounted a roller 52 that is received in the cam slot 56. Likewise, the anvil 45 carries a pin 55 on which is rotatably mounted a roller 53 that is received in the cam slot 57.

The upper end of the anvil 44 is formed with an opening which receives a pin 46 that extends through the straight slot 49 with the end remote from the end that is secured to the anvil 44 anchored to a slider plate 39 which is mounted for reciprocation in the space defined by the partition plate 15, side members 13 and 14, and the ribs or beads 32 and 33. In a similar manner the upper end of the anvil 45 is formed with an opening which receives a pin 47 that extends through the straight slot 49 and is anchored to the slider plate 39.

6

Secured to the upper end of the slider plate 39 and substantially centrally thereof is a pin 38 which extends outwardly from the face of the slider plate 39 that is remote from the partition plate 15. An arm or link 37 is pivotally mounted on this pin 38. This arm 37 assumes a depending position with respect to the pin 38 and its lower free end carries a pin 36 on which are mounted a pair of rollers 35 and 42. The roller 42 is received in the cam slot 43 formed in the front casing plate 11 while the roller 35 is received in a cam slot 34-40 that is formed in a cam plate 27. The cam plate 27 is secured to the plunger 10 and is provided with tongues 28 and 29 which are received in the passages 30 and 31 whereby the cam plate 27 is accurately guided as it reciprocates with the plunger 10.

Briefly summing up the operation of the above described mechanism which causes the anvils 44 and 45 to be driven by the plunger 10, it is noted that at the beginning of a driving cycle the roller 35 on the pin 36 of the arm 37 is received in the horizontal end portion 40 of the cam slot 34-40. At the same time the roller 42 is received in the vertical leg of the cam slot 43 in the front casing wall 11. As the plunger 10 is moved downwardly a corresponding motion is imparted to the cam plate 27. This is transmitted through the roller 35 and thence through the arm 37 to the slider plate 39.

As the slider plate 39 is moved downwardly this downward motion is transmitted through the pins 46 and 47 to the anvils 44 and 45. This downward movement is continued up to the point where the anvils have reached their final clinching position at which time the roller 42 will have been subjected to the camming influence of the inclined leg of the cam slot 43. This moves the roller 42 together with the pin 36 and roller 35 to the right (speaking with reference to the showing of Figures 1 and 18). This causes the roller 35 to be moved over into the vertical portion 34 of the cam slot 34-40. The plate 27 and plunger 10 may now be moved downwardly without affecting the slider plate 39 and the anvils 44 and 45 which are operatively connected thereto.

Staple driving mechanism

A magazine for a supply of staples is represented at 66. This magazine will include a supply of staples such as shown at 59. The magazine 66 extends outwardly from the outer face of the rear casing plate 12 and the latter is formed with an opening 67 which permits the passage of a staple 59 therethrough. A staple pusher 58 has its upper end connected to the plunger 10 and the staple pusher 58 is received in the groove 62 whereby it is guided in its reciprocal movement. The lower end of the staple pusher 58 is shaped to conform to the shape of a staple being driven, this being clearly brought out in Figures 5, 14, 15 and 16.

Operation

While the operation of the above described stapling machine is believed to be self-evident from the description of the parts given, it is noted that at the start of a staple driving cycle the plunger 10 is in the uppermost position depicted in Figure 11. The motivating force is now applied to move the plunger 10 downwardly. During the first part of this downward motion the slider plate 39 is moved downwardly through the operating connections provided by the cam plate 27, cam slot portion 40, roller 35, and arm 37.

As the slider plate is so moved the anvils 44 and 45 are moved downwardly. At first, this is a straight movement as provided for by the upper portions of the slots 56 and 57. This will cause the pointed ends of the anvils to first pierce the material being stapled. However, due to the lower inwardly converging portions of the cam slots 56 and 57, this straight movement concludes with a bringing of the anvils together into the clinching position depicted in Figure 15.

When this point is reached, the inclined leg of the cam slot 43 will have moved the roller 42 laterally and thereby cause the roller 35 to become positioned in the vertical portion 34 of the cam slot 34-40 in the plate 27. Thus, the downward movement of the plunger 10 may be continued without imparting any movement to the slider plate 39. As this downward movement of the plunger 10 is continued the staple pusher 53 picks up a staple 59 and drives it onto the anvils 44 and 45. When so driven, the free ends of the legs of the staple are received in and guided by the grooves 60 and 61. They are thereby clinched into the side by side overlapping relation depicted in Figure 16.

As the downward stroke of the plunger 10 is completed the actuating pressure is relieved, whereupon the springs 22 and 23 move the plunger upwardly. During the first part of this movement the plate 27 will simply move past the roller 35 because the latter is received in the vertical component 34 of the cam slot 34-40. However, as the upper movement is continued the inclined leg of the cam slot 43 will affect the roller 42 so as to move the roller 35 over into the horizontal component 40 of the cam slot 34-40 whereupon the driving relation between the cam plate 27 and slider plate 39 is again established so that the plunger 10 moves the slider plate upwardly and thereby retracts the anvils 44 and 45.

The modification

The anvils which are depicted in Figures 7, 14, 15 and 16 are particularly adapted to pierce material in that they are pointed. Under some conditions such as the application of stockinets to ham butts, the actual piercing is not required and the pointed ends may be eliminated. Figure 17 discloses a modified form of anvils in which the anvils 64 and 65 have rounded ends. However, these anvils are imparted the same compound movement above described and are actuated in the same manner as described in connection with the other figures of the drawings.

While preferred specific embodiments of the invention are hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exact constructions, mechanisms, and devices illustrated and described because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. A stapling machine comprising a casing, an operating pressure cylinder, a plunger slidable in the casing associated with said cylinder, anvils slidable in said casing and operatively connected to the plunger, a slider upon which said anvils are pivotally mounted, rollers on said anvils extending into cam slots arranged in a plate secured to the casing, and an arm operatively connected to said plunger and slider for operation of the anvils.

2. A stapling machine comprising a casing, a

plunger slidable in said casing, anvils slidable in said casing, a slider upon which said anvils are pivotally mounted, a plate arranged in said casing, and having cam slots, means on said anvils cooperating with said cam slots for guiding the anvils to clinching position, an arm pivotally mounted on said slider, and a plate mounted on said plunger, and operatively associated with said arm.

3. In a stapling machine of the kind described, in combination, a casing, a plunger slidably mounted in the casing, a staple driving member carried by said plunger, a plate secured to the plunger and having a cam slot, a slide plate, an arm operably connected to said slide plate and angularly movable with respect thereto, means on said arm coactably engaged in said cam slot whereby said arm is adapted to be movable relative to said plunger carried plate or operatively connected thereto, a pair of anvils hingedly connected to said slide plate, a guide plate secured within the casing and having cam slots formed therein, and rollers on said anvils engaged in said last-mentioned cam slots.

4. In a stapling machine of the character described, the combination of a casing, a plunger slidably mounted in said casing, a staple driving member carried by said plunger, a plate carried by said plunger and formed with a cam slot, an arm, a projection extending from one end of said arm through said cam slot, said projection in one position providing for relative movement between said arm and plate and in another position operatively connecting said arm to said plate, said casing including a wall formed with another cam slot into which said projection extends, said last mentioned cam slot being adapted upon movement of said plate to move said projection from one of said positions to the other, a slide plate to which the other end of said arm is pivotally connected, a pair of anvils hingedly connected to said slide plate, a guide plate, and cooperating cam elements on said guide plate and anvils respectively for guiding said anvils in their movement.

5. In a stapling machine of the character described, a casing having an outer wall formed with a cam slot, a plunger slidably mounted in said casing, a staple driving member carried by said plunger, a plate carried by said plunger and formed with an L-shaped cam slot, an arm, a shaft extending from one end of said arm through both of said cam slots, a roller on said shaft received in said L-shaped cam slot, a second roller on said shaft received in said casing wall, a slide plate to which the other end of said arm is pivotally connected, a pair of anvils pivotally connected to said slide plate, a guide plate formed with cam slots, and rollers carried by said anvils received in said last mentioned cam slots for guiding said anvils in their movement.

6. In a stapling machine of the kind described, a casing, a plunger movably mounted in the casing, a slider plate, an arm pivotally mounted on said slider plate, operating connections between said arm and said plunger, a pair of anvils operatively connected to said slider plate, a staple pusher connected to the plunger, and coactive means arranged on the anvils and casing to initially move and guide the anvils subsequently to the movement of the anvils to a staple-clinching position.

7. In a stapling machine of the kind described, in combination, a casing having an opening at its lower end, a plunger slidably mounted in said

casing, a stapling member rigidly secured to the plunger, a plate carried by said plunger and having an L-shaped cam slot, an arm having a projection extending into said slot whereby the location of said projection in one portion of said slot operatively connects said arm to said plate with said projection, when located in the other portion of said slot, being slidable therein whereby said plate may move relative to said arm, a slider plate to which said arm is pivotally connected, a pair of anvils hingedly connected to said slider plate, other means having cam slots and secured within the casing, and cam rollers arranged on said anvils and movable in said last-mentioned cam slots; said opening in said casing permitting the anvils to engage the work.

8. In a stapling machine of the kind described, in combination, a casing having an open end, a plunger, mounted for reciprocation in said casing, a staple driving member secured to said plunger, a plate fastened to the plunger and having an L-shaped cam slot formed therein, a slider plate, an arm pivotally connected to said slider plate at one end, and means carried by said arm at the other end adapted to assume two different positions in said cam slot, one of said positions providing relative movement between said arm and plate that is carried by said plunger and the other operatively connecting said arm and plunger carried plate, anvils adapted to assume a retracted position within said casing and to protrude beyond said open end of said casing in clinching position, and a guide plate secured within the casing and having cam slots, said anvils having instrumentalities coactable with the last-mentioned cam slots; whereby as said plunger is operated said anvils will be initially protruded from without the casing and into clinching position, and said stapling driving member will subsequently be effective to thrust a staple into operative relation with said anvils.

9. In a staple machine of the kind described, the combination of a casing having an open end, a plunger slidably mounted in the casing, a staple driving member fastened to said plunger, a plate carried by said plunger and formed with an L-shaped cam slot, an arm having a projection at one end received in said slot and adapted to assume two positions therein, one of said positions providing relative movement between said arm and plate, and the other establishing an operative connection between said arm and plate, a slider plate to which said arm is pivotally connected, a guide plate secured within the casing and having cam slots, a pair of anvils hingedly connected to said slider plate and adapted to assume either a retracted position within said casing or be protruded beyond said open end into clinching position, and rollers carried by said

anvils and engaging the cam slots in said guide plate; whereby as said plunger is reciprocated the anvils will be initially protruded to a position effective for clinching a staple, and said stapling member will subsequently advance a staple into contact with said anvils to be clinched thereby.

10. In a stapling machine of the kind described, in combination, a casing having an open end, a plunger slidably mounted in said casing, a staple driving member rigidly secured to the plunger, a plate carried by said plunger and having a cam slot, an arm having a projection extending into said slot whereby one position of said projection in said slot operatively connects said arm to said plate with said projection being slidable in said slot in another position whereby said plate may move relative to said arm, means for moving said projection from one of said positions to the other as an incident to movement of said plunger, a slider plate to which said arm is pivotally connected, a pair of anvils hingedly connected to said slider plate and adapted to assume a retracted position within said casing or be protruded beyond said open end in clinching position, other means having cam slots and secured within the casing, and cam rollers arranged on said anvils and movable in said last mentioned cam slot.

11. A stapling machine comprising a casing, a plunger slidable in said casing, a pair of complementary anvils slidable in said casing, each of said anvils having a guide groove which terminates at the end of the anvil in which it is formed, said anvils being adapted to assume a clinching position with the end of the guide groove in one anvil laterally offset with respect to the end of the guide groove in the other anvil, a slider plate upon which said anvils are pivotally mounted, a plate arranged in said casing and having cam slots therein, means on said anvils cooperating with said cam slots for guiding the anvils to clinching position, an arm pivotally mounted on said slider plate, and a cam plate mounted on said plunger and operatively associated with said arm.

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