UNITED STATES PATENT OFFICE

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WIRE STITCHING MACHINE


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13 Claims. (CI. 1—3)

1 This invention relates to wire stitching machines, and more particularly to double stitching mechanism of the type adapted to form and drive two staples in different planes. Such mechanisms are used for driving pairs of staples in two parallel rows in stitching or by interrupting the feed of one wire, for driving single staples as and when required.

Wire stitching mechanism is known in which a grooved staple forming element carried in the stitching head is brought down on to an inside staple bending element, known as the "loop bar," to form the staple, which is then driven by a staple driving element whilst being supported by a lower staple supporting element. In adapting such mechanism to the forming and driving of two staples simultaneously difficulties arise in adapting the inside staple bending element and the staple supporting element, which supports the loop of a staple inwardly during the driving of staples into the work, since neither of these elements can be adapted to operate efficiently on either of staple simultaneously. Further, the cut-off lengths of wire, from which the staples are formed, are uncontrolled and easily displaced, and for these reasons double stitching mechanisms have proved deficient and unreliable in action.

One object of the invention is to overcome these deficiencies and to provide an improved stitching mechanism constructed to drive two stitches simultaneously. Other objects will appear in the description which follows.

According to the invention wire stitching mechanism comprises a stitching head provided with an outside staple forming element and a staple driving element adapted to form two staples simultaneously and therefrom drive simultaneously the two staples thus formed, a pair of inside staple forming elements oppositely disposed with respect to each other which are adapted to be reciprocated for performing motion which is transverse with respect to the motion of the said outside forming and driving elements and in timed relationship therewith for the purpose of feeding a pair of staple blanks into position for forming, supporting the said blanks in conjunction with the outside forming element during the subsequent forming thereof into staples, and thereafter disengaging from and moving laterally away from the said staples before the driving thereof during which the staples are independently supported. The inside staple forming elements may perform their reciprocatory motion by sliding in guides arranged on either side of the stitch driving element, preferably diametrically opposed to each other.

Further specifically the invention consists in providing on the stitching head two oppositely disposed sliding inside staple forming elements, so mounted that both of these are transversely reciprocated by centrally disposed staple forming and driving elements adapted to form and drive two staples simultaneously, the sliding elements being each adapted to guide and position the wire in conjunction with the outside staple forming element prior to the severing of the wire into blanks. Each of the said sliding elements is also provided with gripping means to hold the severed wire blank in position relative to itself whilst feeding the said blank into position for forming and preferably until the blank has been bent to form a staple.

In order to support the stitch against collapse whilst it is being driven, two independently mounted lower staple supporting elements are provided and these are such that they can adapt themselves independently to the movements of their respective staples during the driving thereof. These elements may be mounted each on a fixed pivot in the frame of the stitching head and below the inside staple forming elements.

In a preferred construction, adapted to well known wire stitching mechanism in which a fresh length of wire is being fed whilst the previously fed length is being driven, the fresh lengths of wire fed from spools are passed across and guided along by the exterior surfaces of an outside double grooved staple forming element, and over the two inside staple forming elements which have been actuated to take up the appropriate positions therefor, and which align the wires in conjunction with the said outside forming element. The two wires are thus accurately positioned on the inside staple forming elements prior to being severed from the spool. Further the fed wires are now gripped by the gripping members with which each inside forming element is provided for this purpose. Such gripping members may consist of pivoted jaws which are controlled from the outside driving element so that when the latter element rises after driving a stitch the gripping members are automatically brought into action. The wires are now severed leaving the blanks securely gripped by the jaws and, the previous stitches having been driven, the outside forming and driving elements rise above the level of the inside forming elements, enabling the latter to swing inwardly under spring pressure and thus feed the freshly cut-off
blanks into position below the outside forming element; these blanks are still held firmly by the gripping members in the proper position during the subsequent forming operation. After forming, the staples are driven, but before this operation the inside forming elements, with the gripping members still in action slide outwardly away from the formed staples leaving these to be supported during the driving operation by the outside forming element and the two independently mounted lower supporting elements.

An example of mechanism according to the invention will now be described with reference to the accompanying drawings. In the machine to be described, the upper outside staple forming element and the staple driver are centrally mounted in the stitching head, and two mechanisms co-operating with the said elements are mounted one on each side thereof, one of the said mechanisms being carried by the stitching head itself, and the other being carried by a cover plate. The cover plate is removably jointed to the stitching head in a vertical plane i.e. parallel to the centrally mounted driving and forming elements.

In the accompanying drawings:

Figure 1 is a partial front elevation of the stitching head in the position before the forming and driving of the staple, with the front mechanism removed.

Figure 2 is a sectional plan of Figure 1, on the line II—II of Figure 1.

Figure 3 is a sectional side elevation on the line III—III of Figure 1, in the direction indicated, but showing both the rear and front mechanisms.

Figure 4 is a part elevation of Figure 3, in the direction of the arrow A in Figure 3.

Figure 5 is a sectional plan on the line V—V of Figure 4 showing the disposition of the front mechanism.

Figure 6 is a side view of Figure 4 in the direction of the arrow B.

Figure 7 is a sectional side elevation showing the essential parts of Figure 3, in the position after forming and driving of the staple has been completed.

Figures 8 and 9 are a front and a side sectional elevation of a double staple driving element showing the staples before driving.

Figures 10 and 11 are a front and side sectional elevation of an outside staple forming element.

Figures 12 and 13 are a plan and elevation of an inside staple forming element or loop bar with its wire gripper.

Figures 14 and 15 are a plan and elevation of a lower staple supporting element.

Figure 16 is a section in a horizontal plane on the line XVI—XVI of Figure 3, showing the position of the staple blanks and the inside forming elements in position to be acted upon by the outside forming elements.

Figure 17 is a section in a horizontal plane on the line XVII—XVII of Figure 7, showing the position of the inside forming elements at the time the uncured wires are fed forward.

In Figures 2, 3, and 7, I—I represents the joint face between the cover plate and the stitching head proper.

In the various figures D indicates the feed wires supplied from spools (not shown), E indicates staple blanks severed from the feed wire, F indicates formed staples before driving and G staples after driving. CL1 indicates center lines of feed and CL2 center lines of stitch.

In these drawings sufficient of the machine framework and contiguous mechanism has been shown to make clear the relationship of the mechanism to be described, but is not referred to specifically unless essential to the explanation of the invention.

Referring now to the drawings and more particularly to Figures 1, 2 and 3, 1 indicates an outside staple former driven by a cam roller 3 moving in a cam groove 4, and 2 indicates a staple driving element driven by a link 5 and crankpin 6.

The element 1 is separately shown in Figures 10 and 11, and is constructed and adapted to operate on, and form into staples, two lengths of wire E by means of two wire grooves 1 arranged symmetrically about a central wall 8. The composite driving element 2 is shown separately in Figures 8 and 9 and has parallel legs 9 secured in relative position by a machine screw 10 and adapted to slide in the grooves of the element 1 on either side of the central wall 8. The ends of the legs 9 are shaped to engage the grooves 7 and the heads of staples F as shown.

The mechanism for feeding the wires D to the stitching head is not referred to specifically and is not shown in detail in the drawings.

The mechanisms now to be described are duplicated one on either side of the central forming and driving members 1 and 2, one set being mounted in the stitching head framework and one on the front cover, the joint face between these parts being shown at I—I. Referring now more particularly to Figure 3, two sliding elements 12 are provided mounted in guides in the stitching head 13 and the cover plate 14 respectively, and operated by the driving element 2 as described later. Pivot ed on fixed centers 15 in brackets 16, secured to the stitching head and cover plate, are two rocking elements 17 carrying adjustable set screws 18 abutting on the heads of vertical plungers 19 actuated by springs 20 and housed in the brackets 16. The lower ends of these plungers project downwards beyond these brackets to actuate wire grippers in a manner to be described later.

Normally the springs 20 hold the plungers 19 in their uppermost position shown in Figure 3, the upper limiting position being determined by the stop faces 21 of the sliding elements 12 sliding against the stitching head 13 and cover plate 14, and by the rocking elements 17 and set screws 18.

Two brackets 22 secured to the stitching head and cover plate respectively serve to house and support the inside staple forming elements 23 and the lower staple supporting elements 24. An inside staple forming element is shown separately in Figures 12 and 13. Each of these elements 23 is adapted to slide horizontally in guides in the brackets 22, and carries a wire gripper 25 pivoted at 26 on a pin secured in the inside staple forming element and pressed into the closing position by a spring 27. The grippers are thus normally closed, and the inside forming elements 23 are pressed by a pair of springs 28 against the stop faces 29 of the brackets 22. The elements 23 are operated by the lower end of the driving element 2 as will be explained later.

The lower staple supporting elements 24 are pivoted on fixed centers 30 and are normally held in the uppermost position shown in Figure 3, against the stop faces 31 of the brackets 22. Separate views of a staple supporting element 24 are shown in Figures 14 and 15 and the operation
and relative disposition of these elements are further shown in Figures 2, 4, 5, 6 and 7. Plungers 32, 34 and 36 are shown in Figures 3 and 5 and relative disposition of these elements are further shown in Figures 2, 4, 5, 6 and 7. Plungers 32, 34 and 36, are pressed down by springs 34 contained between the collars 35 and 36 so that the elements 24 are normally spring held in the position shown in Figure 3. The elements 24 are operated, as will be further described, during the driving of the staple by the lower end of the driving element 2, as shown in Figures 5 and 6.

The interaction of the various elements above described to carry the invention into effect will now be described in more detail.

The working cycle may conveniently be described starting from the position of the mechanism as shown in Figures 1 and 3. In this position the outer forming and driving elements and held by the grippers 25 of the inside staple forming elements 23. Following the sequence of events from this position, the forming element 1 drives downward ahead of the driving element 2 and in doing so forms the two staples by bending the cut lengths of wire E over the inside staple forming elements and folds the prongs of the staples against the toes 37 of the lower staple supporting element 24. The movement of the driving element 2 allows the elements 2 to regain their initial position and in turn allow the grippers 25 to close and grip the wire lengths D. These lengths are now severed from the spools. The wire feeding and severing means form no part of the present invention, and may take any convenient form. The continued upward motion of the forming and driving elements 1 and 2 allows the staple supporting elements 24 and the inside staple forming elements 23 to return to their initial position as shown in Figure 3. During the inward movement of the latter, the cut wire lengths or staple blanks E are firmly held by the grippers 25 and are thus accurately positioned whilst being fed into position directly under and parallel with the operating recesses in the outside forming element and vertically over the line of stitch. There is therefore no period during which the fed lengths of wire are not under full guidance and control.

Furthermore each staple during the period it is being driven into the work is supported by an independent fully efficient staple supporting element, each staple being thereby supported as efficiently as if the contiguous second staple were not present.

All the operating elements having regained their initial positions as shown in Figures 1 and 3, the cycle may be repeated indefinitely.

We claim:

1. Wire-stitching mechanism of the type specified comprising a stitching head, an outside staple former slidable in said stitching head and grooved to define two parallel planes of stitch, a double staple driver slidable in said outside former, a pair of inside staple forming elements moveable in guides in said stitching head transversely towards and away from said respective planes of stitch, a wire gripper carried by each of said inside formers, and means for actuating said inside formers and said wire grippers in timed relationship with the drive of the outside former and the staple driver such that the grippers are opened in their outer positions and closed in their inner positions.

2. Wire-stitching mechanism of the type specified comprising a stitching head, a double grooved outside staple former and a staple driver reciprocated centrally of said stitching head for forming two staples in parallel spaced planes of stitch and thereafter driving said staples, a pair of inside formers oppositely arranged on either side of said outside former and adapted to be moved transversely towards and away from said respective planes, a wire locating groove in each of said inside formers, means for reciprocating said inside formers in timed relationship with said outside former to bring said locating groove in line with the respective outer parallel faces of said outside staple former after the latter has fully descended, and means for feeding two wires from which new staples are to be formed said wires being fed in parallel directions each defined by one of said parallel faces and the locating groove aligned therewith.

3. Wire-stitching mechanism of the type specified comprising a stitching head, a double grooved outside staple former and a staple driver reciprocated centrally of said stitching head for forming two staples in parallel spaced planes of stitch and thereafter driving said staples, a pair of inside formers oppositely arranged on either side of said outside former, guideways for said in-
2,587,480

side formers directed in a common line perpendicular to the planes in which the staples are formed, a wire locating groove in each of said inside formers, means for reciprocating said inside formers in timed relationship with said outside former to bring said locating grooves in line with the respective outer parallel faces of said outside staple former after the latter has fully descended, and means for feeding two wires from which new staples are to be formed said wires being fed in parallel directions each defined by one of said parallel faces and the locating groove aligned therewith.

4. Wire stitching mechanism of the type specified comprising a stitching head, a double grooved outside staple former, and a staple driver reciprocated centrally of said stitching head for forming two staples in parallel spaced planes of stitch and thereafter driving said staples, a pair of inside formers oppositely arranged on either side of said outside former, guideways in said stitching head permitting motion of said inside formers transversely towards and away from said planes, a wire gripper carried by each of said inside formers, wire gripper operating mechanism for each gripper arranged in the stitching head on opposite sides of the driver, members carried on either side of said driver co-acting with said gripper operating mechanisms at a predetermined time, and other members carried on said driver co-acting with the inside formers to cause them to retract away from said planes of stitch.

5. The wire stitching mechanism according to claim 4, wherein the wire grippers have jaws pivoted on the inside formers.

6. The wire stitching mechanism according to claim 4, wherein the wire gripper operating mechanism comprises for each gripper, a sliding block, a pivoted rocker and a spring plunger, said sliding block being actuated by an inclined face on the driver.

7. The wire stitching mechanism according to claim 4, wherein the inside formers are spring pressed towards each other and are provided with wedge faces co-acting with other wedge faces on the staple driver whereby the inside formers are caused to retract from said planes of stitch.

8. Wire stitching mechanism of the type specified comprising a stitching head, a double grooved outside staple former and a staple driver reciprocated centrally of said stitching head for forming two staples in parallel spaced planes of stitch and thereafter driving said staples, a pair of inside formers oppositely arranged on either side of said outside former, guideways in said stitching head allowing reciprocating motion of said inside formers towards and away from each other, a wire gripper carried by each of said inside formers, wire gripper operating mechanism for each gripper arranged in the stitching head on opposite sides of the driver and adapted to be actuated for opening the grippers at the end of the down stroke of said driver, a wire locating groove on the inwardly facing side of each inside former, co-acting surfaces on the driver and each inside former whereby the inside formers are forced outwards on the down stroke of the driver to bring said locating grooves in line with the parallel outer faces of the outside former, and means for feeding two wires along the said parallel faces and into the said locating grooves.

The wire stitching mechanism according to claim 8, wherein means are provided for severing the freshly fed wires, and the grippers are timed to be closed on the wires for a period in the working cycle including the forming of the staples by the action of the inside and outside formers.

10. The wire stitching mechanism according to claim 8, wherein means are provided for severing the freshly fed wires, and the grippers are timed to be closed on the wires for a period in the working cycle including the movement of said inside formers from their outer positions aligned with the outer surfaces of the outside former into their inner positions parallel with the planes of stitch and the subsequent forming of the staples.

11. The wire stitching mechanism according to claim 1, including also a pair of staple supporting elements one for each staple, said supporting elements being independently mounted in the stitching head below the respective inside formers and adapted to move with and support the staple during the driving thereof.

12. The wire stitching mechanism according to claim 1, including also a pair of staple supporting elements independently pivoted in the stitching head below the respective inside formers and adapted to be displaced downwardly and laterally whilst supporting the staples during the driving thereof.

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