

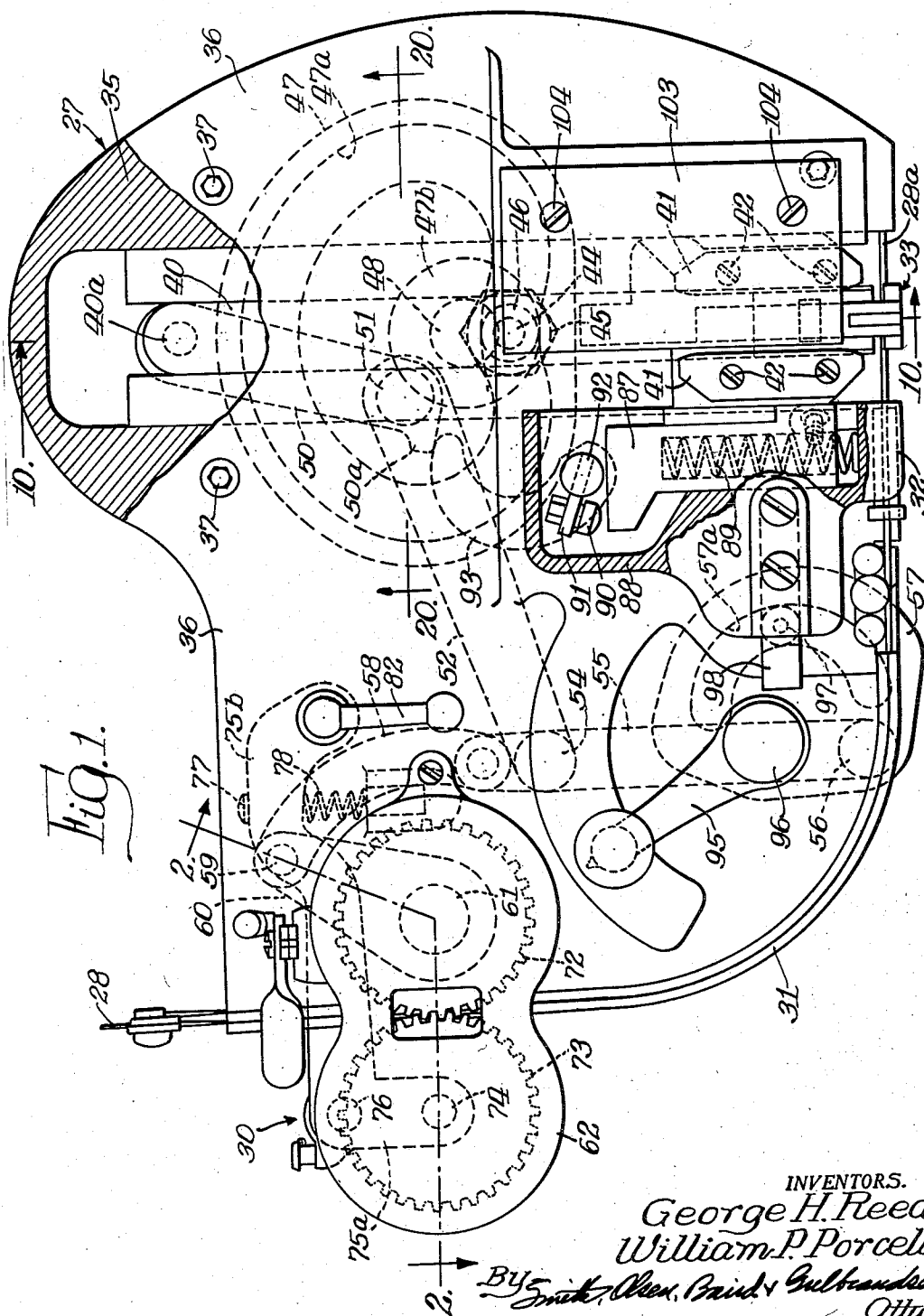
June 24, 1958

G. H. REED ET AL
STAPLING MACHINE

2,839,753

Filed April 15, 1955

5 Sheets-Sheet 1



June 24, 1958

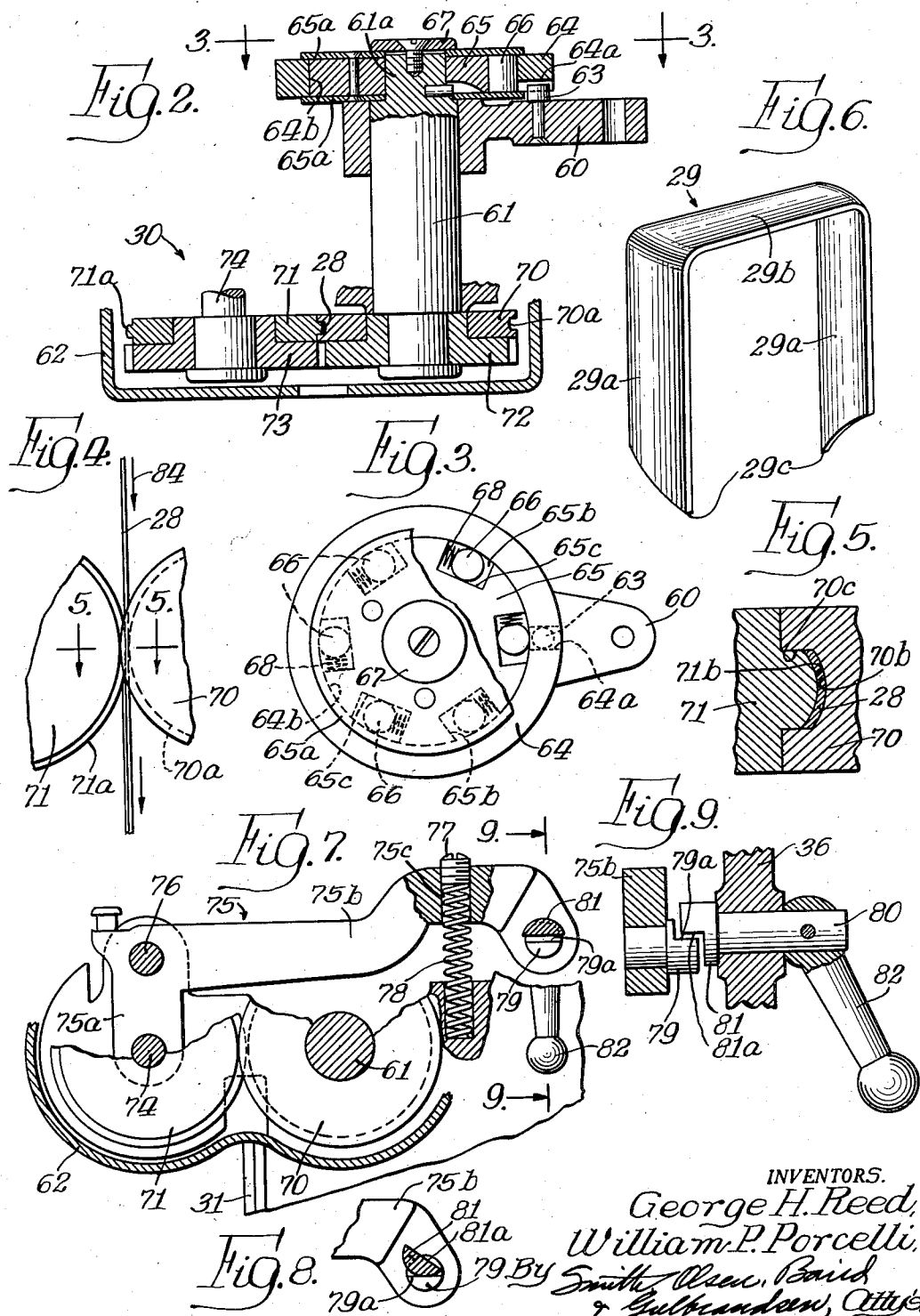
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STAPLING MACHINE

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5 Sheets-Sheet 2



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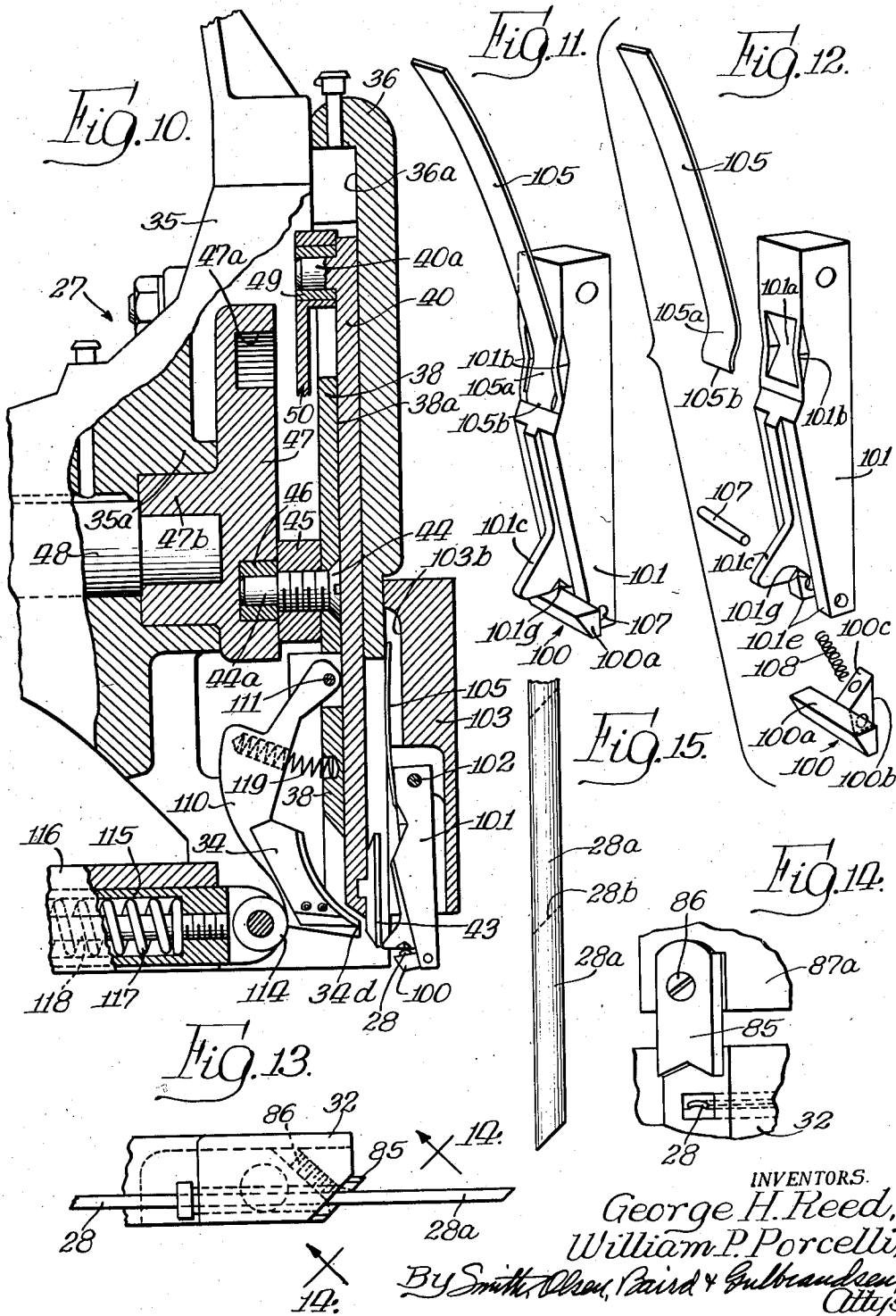
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5 Sheets-Sheet 3



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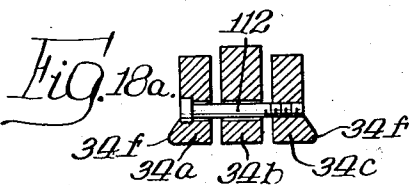
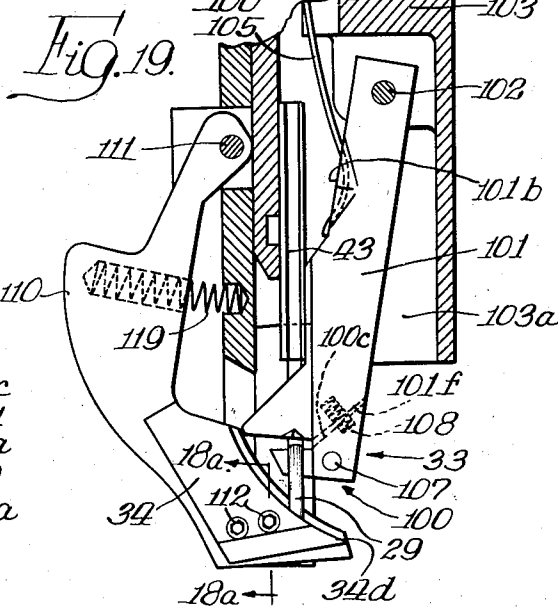
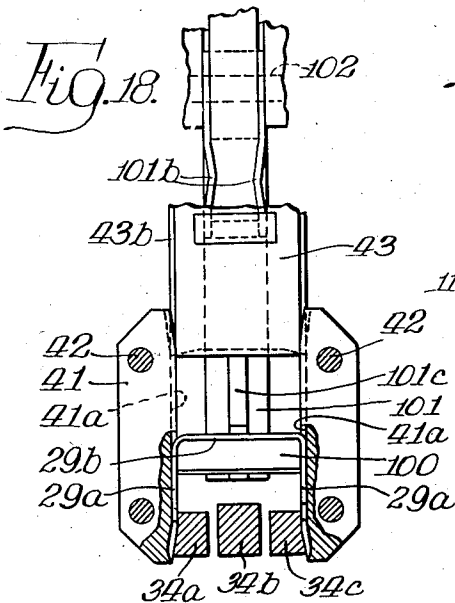
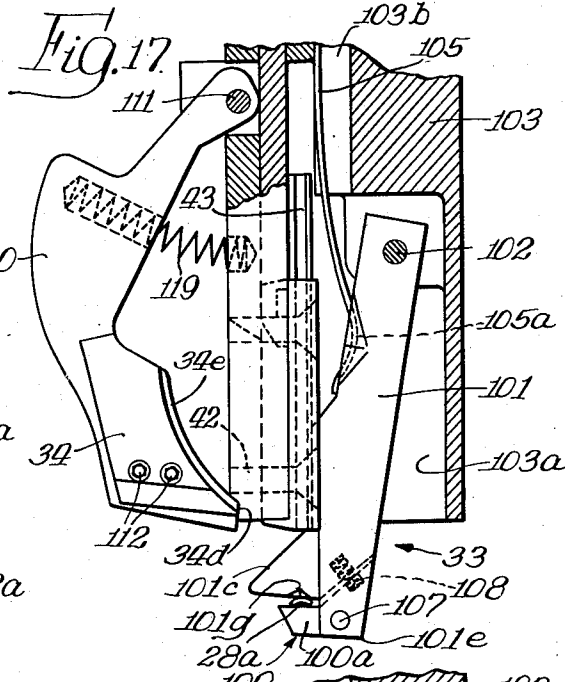
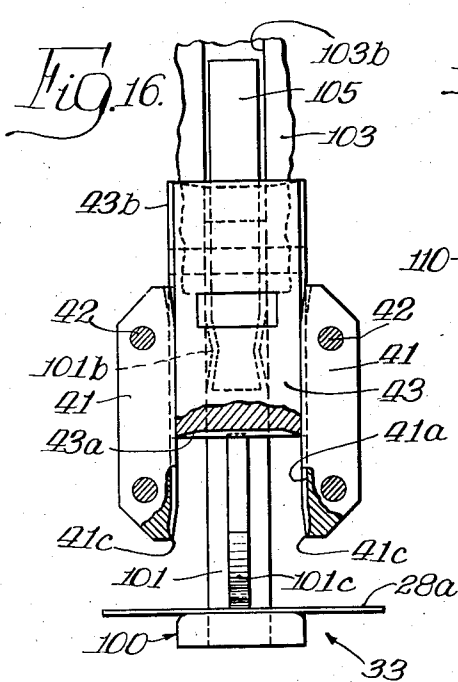
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G. H. REED ET AL
STAPLING MACHINE

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5 Sheets-Sheet 4



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STAPLING MACHINE

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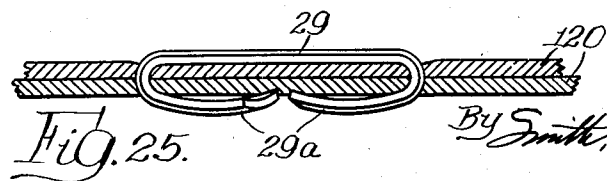
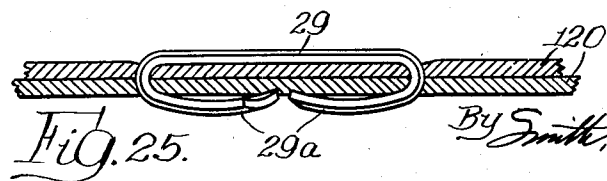
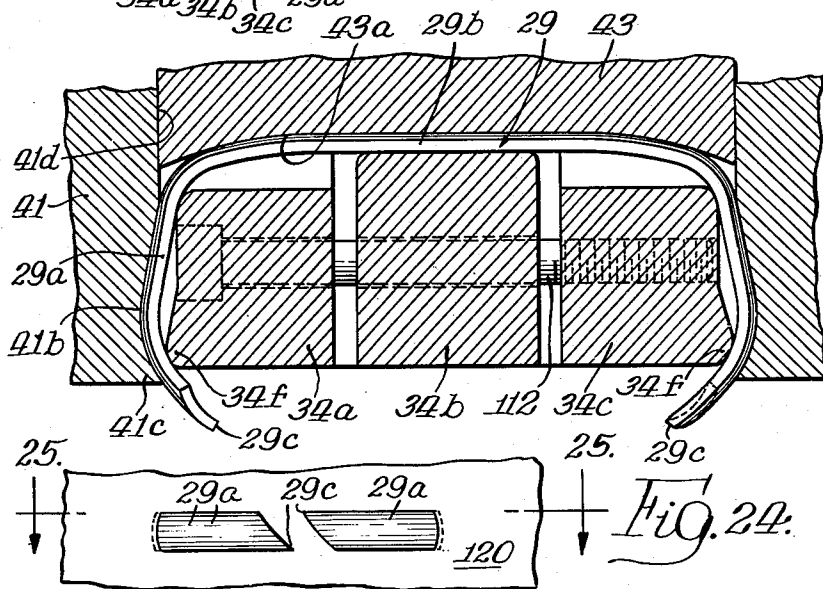
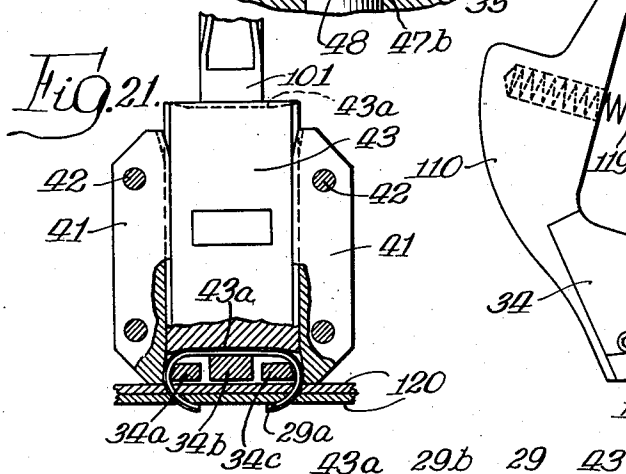
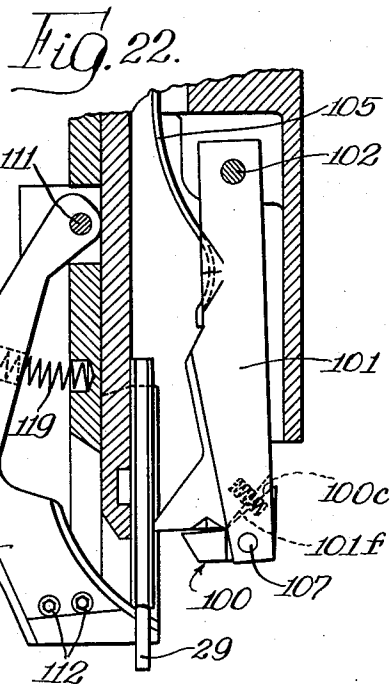
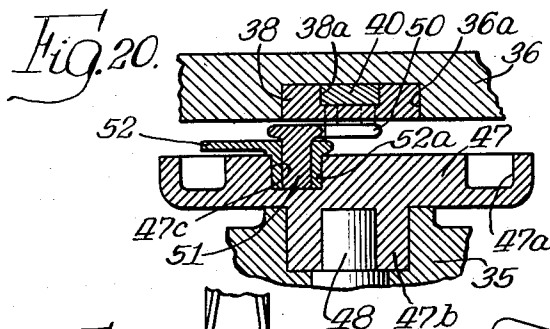


Fig. 23.

Fig. 24.

Fig. 25.

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2,839,753

STAPLING MACHINE

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corporation of Illinois

Application April 15, 1955, Serial No. 501,482

8 Claims. (Cl. 1—2)

This invention relates to improvements in stapling or stitching machines for use in stitching together the cover flaps of fiberboard boxes, cartons and the like. The present invention is an improvement upon those disclosed in United States Letters Patent of George H. Reed, No. 2,635,234, dated April 21, 1953, and in his pending application Serial No. 294,352, filed June 19, 1952.

In stitching or stapling machines of the type referred to it has been customary to provide an arm adapted to extend beneath the box flaps to be stitched together to serve as an anvil to deflect and clinch the legs of the staples driven through the flaps. This arrangement has been satisfactory for many purposes but the stitching of the top cover flaps of fiberboard cartons has continued to present a problem for the reason that it often has been impossible or impracticable to locate a clinching member on the underside of the top flaps when the carton is filled and closed.

It is, therefore, the principal object of the present invention to provide improved stapling apparatus by which the legs of a staple are curled and clinched within or beneath the overlapping cover flaps of a carton as the staple is being driven, without the use of a clinching member or anvil beneath the flaps. A further object of the invention is to provide a novel apparatus for varying and controlling the curl of the legs of the staple as they are driven through the material being stitched, without the use of a clinching anvil, and thereby controlling the shape of the clinched staple. Still another object of the invention is to provide a stapling machine having means for forming a staple and then driving the legs of the staple into the work while at the same time causing the legs to curl toward each other by means engaging them in advance of the work. Other objects relate to various features of construction and arrangement and to details of the improved machine which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment of the improved stapling machine is illustrated. In the drawings,

Figure 1 shows a partial front elevation of a staple forming and driving machine embodying the present invention with parts thereof removed and with other parts shown in vertical section;

Fig. 2 shows a sectional view taken on the line 2—2 of Fig. 1, illustrating the wire feeding mechanism;

Fig. 3 shows a rear elevation on the line 3—3 of Fig. 2 with parts broken away;

Fig. 4 shows a partial front elevation of the wire feeding wheels shown in Figs. 1 and 2 in engagement with the stapling wire;

Fig. 5 shows an enlarged section taken on the line 5—5 of Fig. 4, illustrating the means for imparting a transverse curvature to the stapling wire during the feeding operation;

Fig. 6 shows a perspective view of the preferred form

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of staple used in the practice of the present invention;

Fig. 7 shows a vertical section through the upper left-hand corner portion of the apparatus as illustrated in Fig. 1, illustrating the means for controlling the relative adjustment and separation of the wire feed rolls;

Fig. 8 shows a sectional view similar to the right-hand portion of Fig. 7, illustrating the position of the cam when the feed wheels are separated;

Fig. 9 shows a sectional view taken on the line 9—9 of Fig. 7;

Fig. 10 shows a vertical sectional view through the apparatus, taken on the line 10—10 of Fig. 1;

Fig. 11 shows a perspective view of the wire gripping and staple forming anvil embodied in the stapling apparatus illustrated in Figs. 1 and 10;

Fig. 12 shows an exploded perspective view of the parts of the anvil mechanism illustrated in Fig. 11;

Fig. 13 shows a bottom plan view of the wire cutting mechanism embodied in the stitching apparatus shown in Fig. 1;

Fig. 14 shows a sectional view taken on the line 14—14 of Fig. 13;

Fig. 15 shows a top plan view of a portion of the stapling, illustrating the method of dividing it into staple lengths by diagonal cuts;

Fig. 16 shows a front elevation of the wire gripping, staple forming and staple driving and clinching parts of the apparatus with portions thereof shown in vertical section, illustrating the parts in the relative positions which they occupy prior to the formation of a staple, with the staple leg supporting shoe in its retracted position;

Fig. 17 shows a side elevation of the parts illustrated in Fig. 16, looking toward the left as viewed in Fig. 16;

Fig. 18 is a view similar to that of Fig. 16, showing the relative positions of the parts after a staple has been formed and is about to be driven into the work;

Fig. 18a is a sectional view taken on the line 18a—18a of Fig. 19;

Fig. 19 shows a side elevation of the parts illustrated in Fig. 18, looking toward the left as viewed in Fig. 18, with the parts in the same relative positions;

Fig. 20 is a horizontal section taken on the line 20—20 of Fig. 1;

Fig. 21 is a view similar to those of Figs. 16 and 18, illustrating the relative positions of the parts after the staple has been almost completely driven and clinched;

Fig. 22 shows a side elevation of the parts in the relative positions they occupy in Fig. 21, looking toward the left as viewed in Fig. 21;

Fig. 23 shows an enlarged vertical section through the lower portion of the staple driver, adjacent portions of the staple formers and the intervening parts of the staple supporting shoe, illustrating in detail the method of curling the legs of the staple as it is being driven;

Fig. 24 shows a bottom plan view of a portion of the lower one of two carton flaps which have been stitched together by driving a staple in the manner illustrated in Fig. 23, showing the staple legs clinched on the under side of the lower flap; and

Fig. 25 shows a vertical section taken on the line 25—25 of Fig. 24.

As illustrated in the drawings, the invention is embodied in a machine comprising a stitching head 27 adapted to be located above the carton flaps which are to be stitched together with the use of the stapling wire 28 which is drawn from a spool or the like by means of feeding mechanism 30 and fed through a guide-way 31 and through a tubular shearing block 32 adjacent which it is cut off to form a length of wire 28a which is adapted to be formed into a U-shaped staple 29 (Fig. 6) while it is being held by anvil mechanism indicated generally at 33 and shown particularly in

Figs. 11 and 12. After the staple is formed it is driven through the flaps of the carton and, as the staple is driven, the anvil mechanism is retracted and the staple legs are supported on their inner sides by a retractable shoe 34 which gradually recedes as the staple is driven into the work. As the staple is driven, the legs 29a are curled inwardly toward each other as hereinafter described, so that the staple finally assumes the form shown in Figs. 24 and 25.

The head 27 of the machine comprises a frame or housing 35 having a face plate 36 secured to the front side thereof by screws 37. The face plate 36 is provided on its inner side with a vertical guideway 36a in which a former bar 38 is mounted to reciprocate. The former bar is provided on its outer side with a longitudinal groove 38a of rectangular cross section which is slidably engaged by a driving bar 40. The former bar 38 has secured to the lower end thereof two spaced parallel formers 41 which are attached by screws 42 and which are reversible in their positions on the bar so that the staple engaging portions thereof may be renewed without replacing the formers entirely. The formers 41 are adapted to bend the projecting ends of the staple wire length 28a downwardly to form the staple legs 29a as the former bar 38 is moved downwardly and, during this movement, the staple legs occupy longitudinal grooves 41a in the opposed faces of the formers, as more fully explained hereinafter.

The driving bar 40 has keyed to the lower end thereof a staple driver 43 which is reversible in its position on the driving bar and which is provided with slightly concaved end faces 43a, the lower one of which is adapted to engage the top wall 29b of the staple to effect the driving of the staple as the driving bar moves downwardly.

In order to actuate the former bar 38, it is provided between its ends with an aperture engaged by a threaded pin 44 which is held in place by a nut 45 and which is provided with a cylindrical extremity 44a having mounted thereon a roller 46 adapted to travel in a continuous irregular groove 47a formed in the side face of a cam 47. This cam has a hub portion 47b which is journaled in a bearing 35a formed in the housing 35. The hub portion is keyed to a shaft 48 which is also journaled in a bearing in the housing 35 and which is adapted to be driven at a uniform speed by an electric motor or the like. As the shaft is rotated, the cam 47 is driven at constant speed and the former bar 38 is actuated to cause the formation of a staple during each rotation of the cam.

The rotation of the cam 47 also serves to effect the reciprocation of the driving bar 40 through connections comprising a transversely extending pin 40a formed on the upper end thereof which is journaled in a bushing 49 secured in the upper end of a crank arm 50. The lower end of this crank arm is provided with a transversely extending pin 51 (Fig. 20) which is journaled in a sleeve 52a formed in the end of a link 52, the function of which is described hereinafter. This sleeve 52a is in turn journaled in a cylindrical recess 47c formed in the face of the cam 47 at a point displaced radially from the axis of the cam. Thus, when the cam is rotated, the pin 51 revolves about the axis of the cam and thereby causes the crank arm 50 to effect a reciprocation of the driving bar 40. The recess 47c in the cam is so located that the downward movement of the driving bar 40 will be effected in proper timed relation to the movement of the former bar 38 so that a staple will be formed and will be in readiness to be driven when the staple driver 43 carried by the driving bar 40 arrives at a position where it is about to engage the formed staple.

The wire feeding mechanism 30, shown particularly in Figs. 1, 2, 3, 4, 5, 7, 8 and 9, is actuated by the previously mentioned link 52 which is actuated by the cam

47 through the sleeve 52a (Fig. 20). This link is pivotally connected at 54 to a lever 55 which has its lower end pivoted at 56 on a plate 57 mounted for pivotal movement on the casing 35. The reciprocation of the link 52 in response to the rotation of the cam 47 causes an angular oscillation of the lever 55 which actuates a pivotally connected curved link 58 having a connection by a pivot pin 59 to the upper end of the lever 60 (Fig. 1) which actuates the wire feeding mechanism through an over-running clutch of the type disclosed in United States Letters Patent of Howard G. Allen, No. 1,513,021, dated October 28, 1924, whereby an intermittent feeding movement is imparted to the stitching wire 28.

The crank arm 60 is rotatably mounted upon a shaft 61 located in the housing 62 of the feed mechanism. This crank arm has a pin 63 projecting from the side thereof to engage a slot 64a formed in the side of the clutch driving ring 64 which is mounted to rotate about a clutch disk 65 fixed upon the reduced extremity 61a of the shaft. The disk 65 is provided with side plates 65a which are secured thereto and which overlap at their outer edges the inner margin of the ring 64, as shown in Fig. 3. The disk 65 and its plates 65a are held against movement endwise of the shaft by a cap member 67 which is secured to the end of the shaft. The disk 65 is provided with an annular series of spaced pockets 65b in each of which there is mounted a cylindrical roller 66. These pockets are provided with bottom walls 65c which are at right angles to radii of the disk and are so positioned that they converge with the surrounding annular surface 64b of the ring 64 toward one end of the pocket. Each roller 66 is thus adapted to wedge between a surface 65c and a surface 64b as it moves toward one end of its pocket but to be released as it moves toward the other end. A coil spring 68 is mounted in each pocket to press the contacting roller normally toward the small end of the pocket and when the ring 64 is rotated in a direction to urge the rollers 66 toward the small ends of the pockets, a driving connection is thereby established between the ring 64 and the disk 65 which is fixed upon the shaft 61. When the crank arm 60 is moved in the reverse direction, the ring 64 tends to move the rollers 66 toward the larger ends of the pockets 65b so that the ring 64 then moves freely around the disk 65 and the shaft 61 remains stationary. In this way an intermittent rotary motion is imparted to the shaft 61 by the reciprocatory movement of the link 52.

This intermittent motion is made use of for effecting an intermittent feed of the stitching wire 28 which passes between two feed wheels 70 and 71 which feed the stitching wire 28 and also impart an arcuate cross section thereto. These feed wheels are fixed on the hubs of two gears 72 and 73, respectively, which mesh with each other and cause the feed wheels to be rotated in opposite directions. The gear 72 is secured upon the end of the shaft 61 and the other gear 73 is journaled upon a shaft 74 which is fixed on the depending portion 75a of an L-shaped lever 75 pivoted on a pin 76 fixed in the face plate 36. The long arm 75b of the bell-crank lever 75 has a threaded aperture 75c which is threadedly engaged at its upper end by a plug 77. A coil spring 78 has its upper end engaging the plug 77 and its lower end seated in a recess in the face plate 36 so that it tends normally to rock the lever 75 about its pivot 76 and thereby move the feed wheel 71 toward the feed wheel 70 to press against the stitching wire 28.

In order to separate the feed wheels 70 and 71 from each other, the lever arm 75b is provided at its free end with a projecting cam 79 of semicircular cross section having a flat face 79a. A shaft 80 is rotatably mounted in the face plate 36 adjacent to lever arm 75b and a semicircular cam 81 is fixed on this shaft with its flat face 81a disposed opposite to the face 79a of the cam 79.

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A crank arm 82 is fixed upon the shaft 80 and may be manipulated by the operator to rotate the cam 81 from the position shown in Fig. 9 to the position shown in Fig. 8 and thereby separate the feed wheel 71 from the feed wheel 70.

The feed wheel 70 is provided around its periphery with an annular groove 70a which is engaged by an annular rib 71a formed on the periphery of the feed wheel 71. The bottom wall 70b of the groove is transversely curved and the outer annular surface 71b of the rib 71a has a similar transverse curvature so that, as the stitching wire 28 passes between the feed rolls in the direction of the arrow 84, shown in Fig. 4, it is substantially confined between the surfaces 70b and 71b, with only a slight clearance, and it is also confined between the side walls 70c of the groove. The stitching wire is thus caused to conform to the curvature of the surfaces 70b and 71b and this curvature is such that the stitching wire is stressed beyond the elastic limit of the metal so that a permanent transverse curvature is thereby imparted to the stitching wire and it has this transversely curved form when it enters the guide 31.

The depth of the arc of the transverse curvature in the stitching wire 28 may be varied by adjusting the position of the plug 77 in the lever arm 75b and thereby varying the compression of the spring 78 with a corresponding variation of the pressure with which the feed wheel 71 presses the stitching wire against the feed wheel 70. By thus varying the depth of the arc of transverse curvature in the stitching wire it is possible to vary the extent to which the legs of the staple are curled by the devices hereinafter described.

For the purpose of cutting off the increment of stitching wire 28a which is projected through the anvil mechanism 33, as shown in Fig. 1, the machine is provided with a cutting blade 85 (Fig. 14) which is attached by a screw 86 to a projecting portion 87a of a bar 87 mounted to reciprocate in a casing 88 on which the stitching wire shearing block 32 is formed. The casing 88 is attached to the face plate 36 and the bar 87 is mounted for vertical sliding movement therein, being held normally in its upper position by a coil spring 89 which is mounted in a tubular bore formed in the bar with its lower end resting on the casing immediately above the stitching wire guide 32.

The cutting blade 85 is provided at its lower end with a V-shaped cutting edge, as shown in Fig. 14, and it moves in a vertical plane which is at an angle to the longitudinal axis of the stapling wire 28 which moves through the shearing block 32 so that when the blade 85 descends, it cooperates with the stationary shearing die formed by the edge of the block to sever the wire along a diagonal line 28b, shown in Fig. 15. The result is that the resulting staple 29 formed from a length 28a of stapling wire has legs 29a (Fig. 6) which are pointed at their edges, as shown at 29c, the point for each leg being on the edge opposite to that on the other leg. This facilitates the driving of the staple and the desired curling action of the legs during the driving operation.

At the proper time in the cycle of operations, the bar 87 is moved downwardly to sever the stitching wire and this is effected by an adjustable pin 90 mounted on an arm 91 which is fixed on a shaft 92 journaled in the face plate 36 and arranged to extend into the interior of the housing 35. Within this housing a curved operating arm 93 is secured on the shaft 92 with its tip located in a position to be engaged by a projection 50a on the lower end of the link 50. Thus, once during each cycle, the projection 50a rocks the arm 93 in a counterclockwise direction, as viewed in Fig. 1, thereby causing the pin 90 to move the bar 87 downwardly against the compression of the spring 89 with the result that the blade 85 cuts off a length of stitching wire 28a. After this length is cut off, the former bar 38 is moved downwardly by

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the cam 47 with the result that the wire is formed into a staple having the shape shown in Fig. 6, after which the driving bar causes the driver 43 to project the staple through the work.

For the purpose of adjusting the length of the increment of the stitching wire 28 which is fed by the wire feeding mechanism 30 upon each rotation of the cam shaft 48, a handle 95 is provided to turn the plate 57 about its pivot 96 and thus vary the position of the pivot 56 of the lever 55, thereby varying the amplitude of movement of the crank arm 60 upon each reciprocation of the link 52. Also, the plate 57 is provided with an arcuate slot 57a engaged by a roller 97 mounted on a bar 98 attached to the casing 88. This casing is slidably mounted on the face plate 36 so that, if the plate 57 is adjusted by the handle 95 to increase the length of the increment 28a of stitching wire which is fed through the anvil mechanism 33 upon each rotation of the cam 47, the casing 88 will at the same time be adjusted to vary the spaced relation of the cutting blade 85 and the shearing block 32 with respect to the anvil mechanism 34 so that both legs of the staple to be formed will be of substantially the same length. These features of adjusting the length of the cut-off sections of staple wire and causing the legs of the staple to be of equal length do not in themselves constitute parts of the present invention.

The anvil mechanism 33 which holds the cut-off section of wire 28a when it is severed by the shearing device is shown particularly in Figs. 1, 10, 11, 12, 16, 17, 18 and 19 and comprises the anvil die 100 which is mounted on the lower end of the anvil carrier 101. This anvil carrier is pivotally mounted by a pin 102 in a chamber 103a formed in the lower end of a cover block 103 which is secured by screws 104 to the face plate 36. The anvil 100 and the lower part of the carrier 101 are normally caused to swing toward the path of movement of the driving bar 40 by the action of a leaf spring 105 which has its lower end 105a engaging a recess 101a in the anvil carrier. The side walls 101b of the recess 101a are bent inwardly to interlock with the curved portion 105a of the spring which is adjacent its lower extremity 105b. The upper end of the spring 105 extends into a recess 103b formed in the upper inner side of the block 103 where it coacts with the lower side face of the face plate 36, so that the spring operates normally to swing the lower end of the carrier 101 with its anvil 100 to a position where a V-shaped projection 101c, formed on the anvil carrier, lies in the path of movement of the staple driver 43, as shown, for example, in Fig. 17.

The anvil 100 has a part 100a over which the cut-off length of stitching wire 28a is adapted to be bent to form a staple of the form shown in Fig. 6. This part may be of various widths but it is shown as being rather wide so that the resulting staple will embrace a substantial portion of the carton flaps when it is driven and clinched as shown in Fig. 25. The part 100a is carried by a small block 100b which is pivotally mounted by a pin 107 between the flanges 101e on the lower end of the anvil carrier. The part 100b of the anvil has a tail portion which extends upwardly and rearwardly from the top of the part 100a and this tail portion has an inclined surface 100c which is adapted to engage an inclined surface 101f formed on the anvil carrier between the flanges 101e, thereby limiting the downward movement of the die portion 100a during the formation of the staple. A coil spring 108 is mounted in recesses formed in the part 100b of the anvil and in the lower part of the anvil carrier and this spring tends normally to move the anvil die 100a to the position shown in Fig. 17, where the pressure of the spring 108 is adapted to cause the anvil to grip the section 28a between its top face and the lower face of the projection 101c formed on the anvil carrier. One side of the projection 101c is provided with a V-shaped notch or guideway 101g which is adapted to engage the end of the wire 28 as it is being fed by the wire feeding mech-

anism 30 in order to direct the wire into proper position to be gripped and to cause the gripping to take place automatically as the gripping parts are separated against the compression of the spring 108 by the moving wire. The gripping of the wire 28a by the spring actuated anvil 100 continues until the anvil is moved downwardly during the staple forming operation to the position shown in Fig. 19.

After the wire has been positioned in the anvil mechanism in the manner illustrated in Figs. 1, 16 and 17, and after the section 28a has been cut off by the downward movement of the cutting blade 85, the cam 47 actuates the former bar 38 to cause the dies 41 to move downwardly and to engage and bend downwardly the projecting ends of the cut-off piece 28a. These end portions of this piece of wire pass into the longitudinal grooves 41a in the dies and, as the former bar 38 moves downwardly, they are bent downwardly to form a U-shaped staple as shown in Figs. 18 and 19. As this downward movement proceeds, the anvil 100 is adapted to tilt about its pivot 107 until the surface 100c engages the surface 101f, thus causing the anvil to be firmly supported during the formation of the staple. The staple is then free to move out of engagement with the anvil.

During the downward movement of the former 38, it carries downwardly the previously mentioned supporting shoe 34 which is carried by a curved arm 110 pivoted at 111 in an aperture in the former bar. The shoe 34 is adapted to extend between the staple legs when the staple is formed, as shown in Figs. 18 and 19, and it comprises three complementary parts 34a, 34b and 34c which are similar in shape, having pointed extremities 34d adapted to enter the space between the staple legs and having curved top surfaces adapted to be engaged by the driver 43 when they are cammed out of position during the process of driving the staple. The parts of the shoe are connected to each other and to the arm 110 at their upper ends but the body portions thereof are spaced apart. They are normally separated due to their own resiliency but may be drawn together by screws 112 which may be adjusted to vary their spaced relation and the pressure with which the outer parts 34a and 34c bear on the inner sides of the staple legs. This adjustability of the shoe is of importance in connection with control of the curling of the staple legs as herein-after more fully described. The adjustable shoe does not per se constitute a part of the present invention.

The shoe 34 is moved toward the staple leg supporting position shown in Fig. 18 by a roller 114 mounted on the end of a plunger 115 (Fig. 10) which is mounted to slide in a cylinder 116 attached to the housing 35. A coil spring 117 actuates the plunger to move the shoe 34 to the supporting position and the extent of that movement is limited by a rod 118 attached to the plunger which carries a disk adapted to engage a stop (not shown) to arrest the plunger. The shoe 34 is maintained in contact with the roller 114 by a coil spring 119 which has its ends mounted in sockets formed in the former bar 38 and in the arm 110. The shoe is retracted against the compression of the spring 117 during the staple driving operation by the engagement of the beveled ends of the driver 43 and the driving bar 40 with the inclined wedging surface 34e on the shoe members.

Referring now to the driving of the staple 29 after it has been formed in the position shown in Figs. 18 and 19, the first operation is the retraction of the anvil 100 by the descending driving member 43 which engages the inclined top face of the projection 101c. The driving member 43 then engages the top wall of the staple and forces it downwardly between the formers 41 and into the work with the ribs 43b on the sides of the driver traveling in the guide channels 41a of the formers. As this operation proceeds, the staple legs 29a travel in the guide channels 41a which have their back walls bowed outwardly toward their lower ends as shown at 41b.

The lower ends of these curved portions turn inwardly toward each other, as shown, in Fig. 23, and terminate in extremities 41c where the back wall of the groove is in vertical alignment with the back wall 41d of the straight portion of the groove 41a in the intermediate part of the former. As the staple legs 29a move downwardly, they are directed into the outwardly bulged portions 41b of the guide channels by the outwardly bulging lower side portions 34f of the shoe segments 34a and 34c. Thus, the staple legs are deflected first outwardly and then inwardly toward each other as they travel through the formers with the result that they curl inwardly toward each other. As this action continues, the parts of the shoe 34 are cammed out of the path of travel of the driving member 43 and the staple is completely driven and curled so that it takes the form shown in Figs. 24 and 25 where the flaps 120 of the carton are securely stitched together.

The curling action of the former dies and the shoe on the staple legs may be varied by adjusting the shoe 34 to vary the pressure of the projections 34a on the legs and the curling action may be further regulated by varying the depth of the crown of the stapling wire. It is desirable to employ stapling wire which is transversely curved since this form of wire has been found to have greater penetrating ability than flat wire and has greater column strength so that it is unlikely to bend or buckle except in response to the action of the projections 34f of the shoe and the portions 41a and 41c of the formers. The depth of the arc or crown of the stitching wire may be varied by adjusting the position of the threaded plug 77 in the arm 75b of the feeding mechanism 30. This varies the pressure of the feed wheels 70 and 71 on the stitching wire 28 so that the arc of the crown may be regulated in conjunction with the adjustment of the shoe 34 to obtain the best results. When the depth of the arc of the stitching wire is increased by adjustment of the pressure of the feed wheels 70 and 71, there is an increase in the compression of the legs of the staple between the parts 34f and 41c with a resulting increase of the curvature imparted to the staple leg as it is being driven. Similarly, where there is a decrease in the depth of the arc of the staple leg by varying the pressure of the feed wheels 70 and 71, there is a decrease in the pressure of the parts 34f and 41c on the staple leg with a corresponding decrease in the curvature imparted to the staple leg while it is being driven. Similar variations in curvature of the staple leg may be brought about by adjustment of the stud 112 to vary the spaced relation of the parts 34a and 34c of the shoe. It is believed to be important to have the tips 41c of the formers terminate substantially in line with the back walls of the straight portions of the former grooves 41a so that the top walls 29b of the staples will not be compressed or buckled as they pass the lower ends of the formers. This precaution insures the driving of complete staples without any deformation thereof other than the desired curling of the legs.

Although one form of the improved stapling machine has been illustrated and described, it will be understood that the machine may be modified in various ways without departing from the scope of the appended claims.

We claim:

1. The combination in a wire stitching machine, of means including staple formers for bending a length of stitching wire into the form of a staple, said staple formers having means for guiding the staple legs, means for driving said staple through said formers into the work, and means including parts of said formers engaging the outer sides of said staple legs and means engaging the inner sides of said staple legs for causing said staple legs to curl as they are driven.

2. The combination in a wire stitching machine, of means including staple formers for bending a length of stitching wire into the form of a staple, said staple

formers having means for guiding the staple legs, means for driving said staple through said formers into the work, said guiding means being bowed outwardly adjacent its lower end, and means positioned between the staple legs as they are driven for cooperating with said bowed guiding means to cause said legs to curl longitudinally as they are driven.

3. The combination in a wire stitching machine, of means including staple formers for bending a length of stitching wire into the form of a staple, said staple formers having means for guiding the staple legs, means for driving said staple through said formers into the work, said guiding means being bowed outwardly adjacent its lower end, and a retractable shoe positioned between said staple legs and adapted to cooperate with said bowed portions of said guiding means for causing said staple legs to curl longitudinally as they are driven.

4. The combination in a wire stitching machine, of means including staple formers for bending a length of stitching wire into the form of a staple, said staple formers having means for guiding the staple legs, means for driving said staple through said formers into the work, said guiding means being bowed outwardly adjacent its lower end, and a retractable shoe positioned between said staple legs and having outwardly projecting side portions adapted to cooperate with said outwardly bowed portions of said guiding means to cause the legs of said staple to bow inwardly toward each other as they are driven.

5. The combination in a wire stitching machine, of means including staple formers for bending a length of stitching wire into the form of a staple, said staple formers having means for guiding the staple legs, means for driving said staple through said formers into the work, said guiding means being bowed outwardly adjacent its lower end, and a retractable shoe positioned between said staple legs and adapted to cooperate with said bowed portions of said guiding means for causing said staple legs to curl longitudinally as they are driven, said shoe being adapted to be retracted gradually by said driving means as the staple is driven.

6. The combination in a wire stitching machine, of means including formers for bending a length of wire to

form a staple, said formers having guiding grooves which receive the legs of said staple, means for driving said staple through said grooves into the work, said grooves having upper straight portions of their back walls parallel to each other and having their lower portions bowed outwardly, the lower extremities of said back walls being in alignment with the parallel portions thereof, and means for engaging the inner sides of said staple legs and causing them to engage said bowed portions and to curl as they are driven.

7. The combination in a wire stitching machine, of an anvil for supporting a length of stitching wire, means for holding said length on said anvil, means including spaced formers for engaging the ends of said length on opposite sides of said anvil and bending them downwardly to form a staple, said formers having guide channels engaged by the legs of said staple, means for retracting said anvil and driving said staple from said formers into the work, and means including parts of said formers for curling the legs of said staple as the staple is driven.

8. The combination in a wire stitching machine, of an anvil for supporting a length of stitching wire, means for holding said length on said anvil, means including spaced formers for engaging the ends of said length on opposite sides of said anvil and bending them downwardly to form a staple, said formers having guide channels engaged by the legs of said staple, means for retracting said anvil and driving said staple from said formers into the work, a shoe movable between the legs of the staple, and means formed on said formers and on said shoe for curling the legs of said staple as it is driven, said shoe being retracted by said driving means as the staple is driven.

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