

April 21, 1953

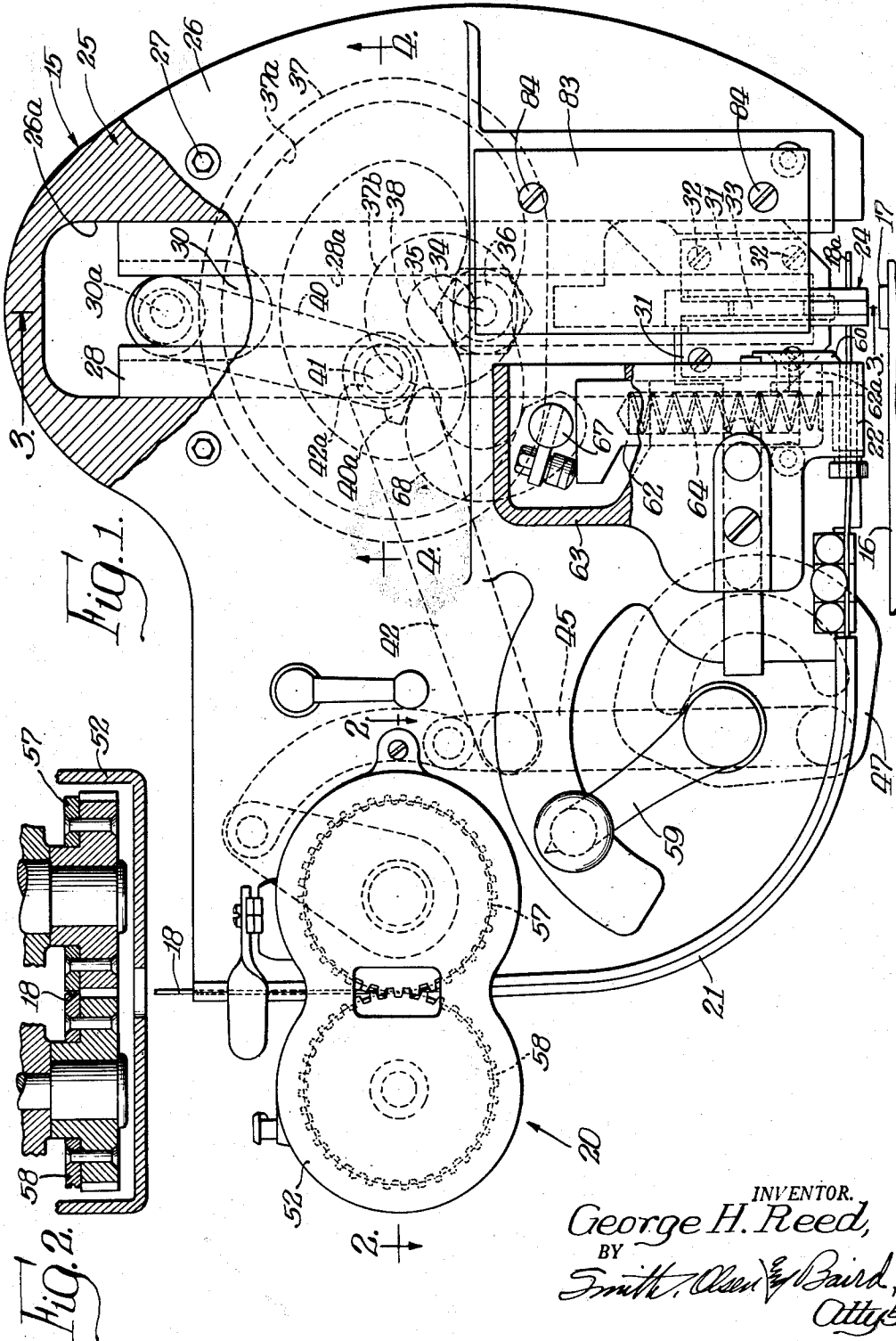
G. H. REED

2,635,234

STAPLE FORMING AND DRIVING MACHINE

Filed July 26, 1950

3 Sheets-Sheet 1



April 21, 1953

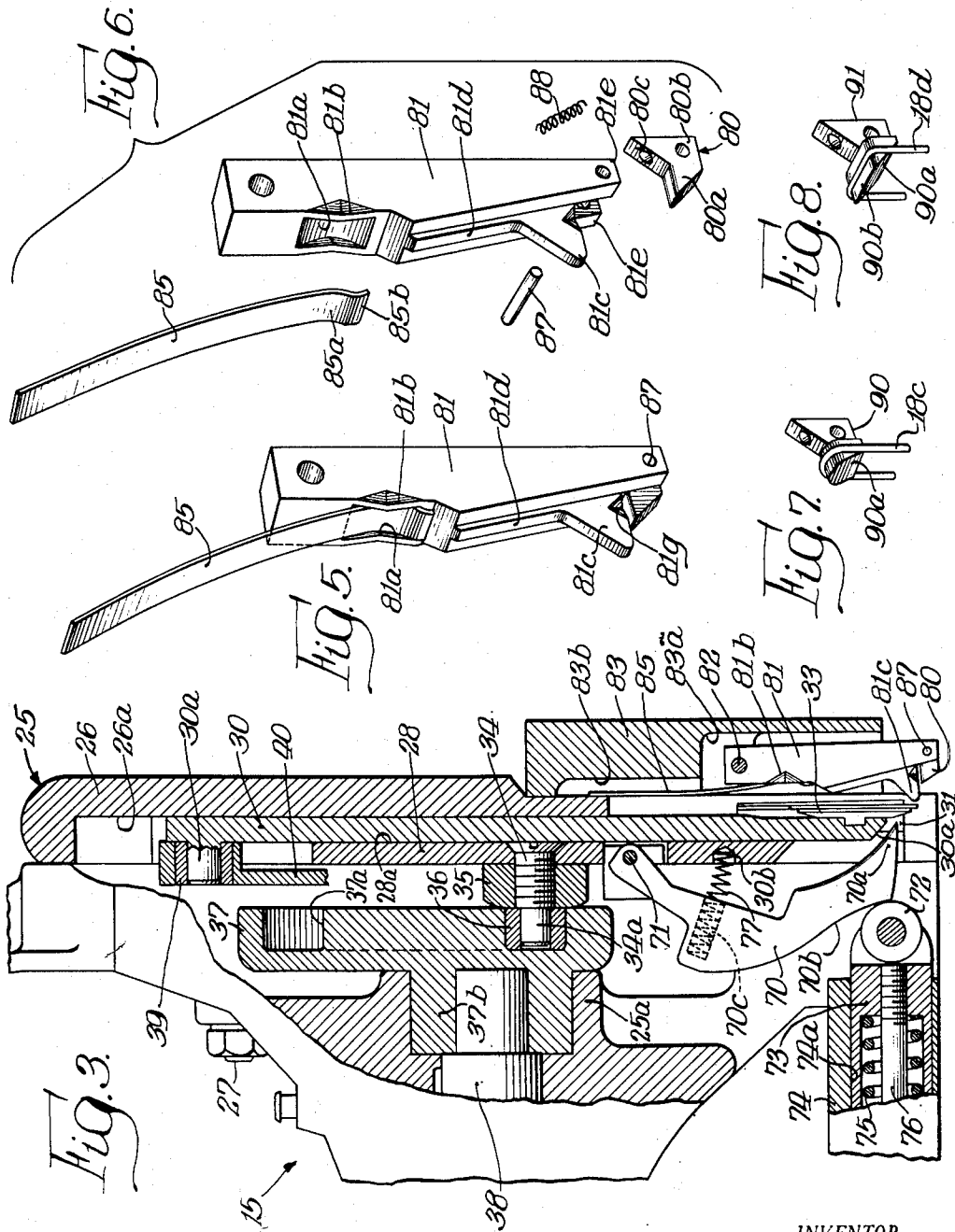
G. H. REED

2,635,234

STAPLE FORMING AND DRIVING MACHINE

Filed July 26, 1950

3 Sheets-Sheet 2

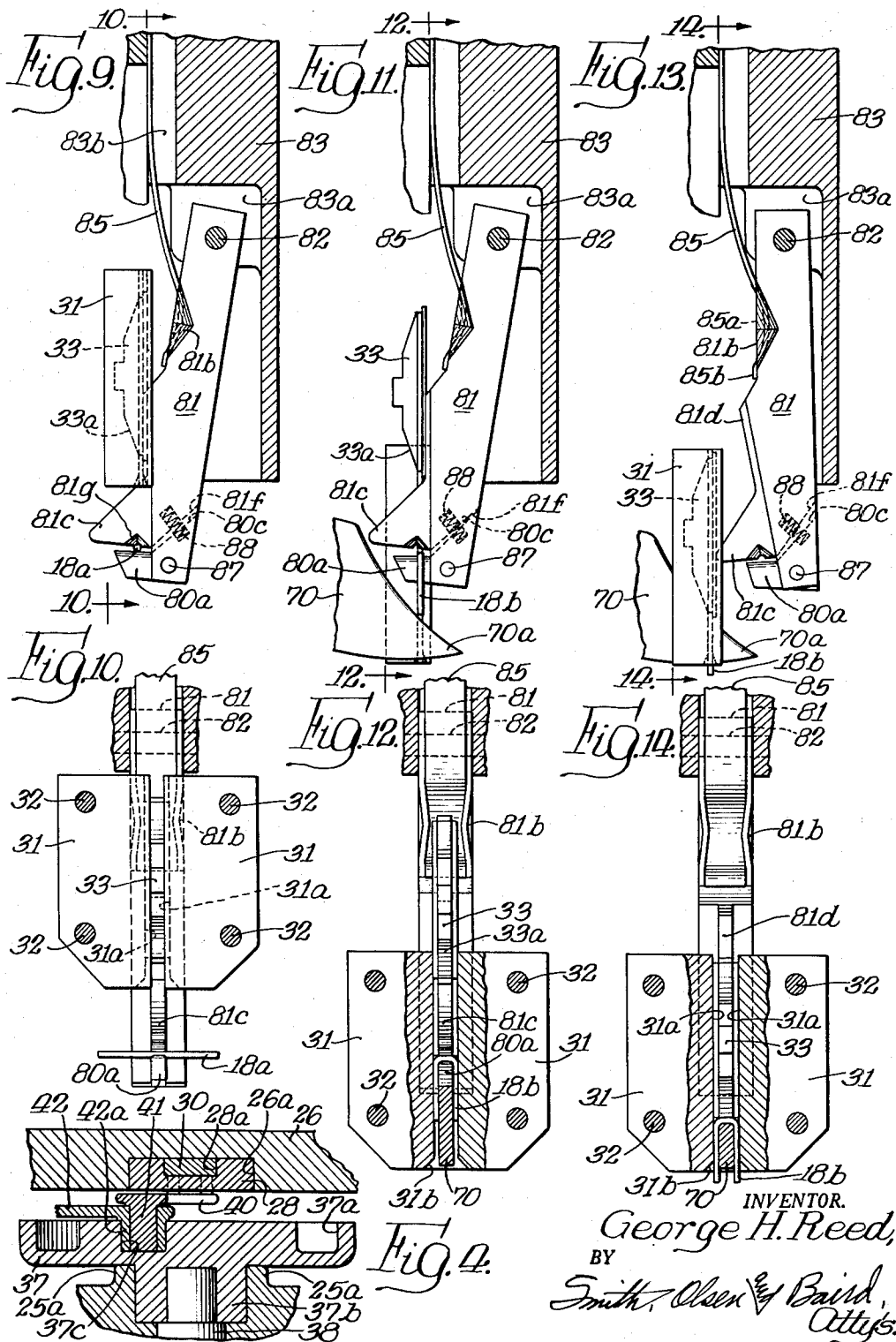


INVENTOR.
 George H. Reed,
 BY
 Smith, Olsen & Baird,
 Attys.

2,635,234

STAPLE FORMING AND DRIVING MACHINE

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,635,234

STAPLE FORMING AND DRIVING MACHINE

George H. Reed, Chicago, Ill., assignor to Acme Steel Company, Chicago, Ill., a corporation of Illinois

Application July 26, 1950, Serial No. 175,971

10 Claims. (Cl. 1—2)

1

This invention relates to improvements in staple forming and driving machines wherein the stapling wire is fed from a source of supply, is cut into successive lengths, the cut length is formed into a staple over a supporting anvil device, the anvil device is withdrawn and the formed staple is driven while being supported by a movable shoe which is retracted as the driving proceeds.

The principal object of the invention is to provide a machine of the type referred to having improved anvil mechanism for gripping and supporting a cut length of wire while it is being formed into a staple. A further object is to provide a wire stitching machine having anvil mechanism comprising an anvil die which permits the formation of staples of very small sizes and which may be replaced by other anvil dies of other forms and sizes in order to form staples of other sizes and shapes. Another object is to provide an improved machine of the type referred to wherein increments of stitching wire may be fed intermittently without the necessity of timing any wire gripping mechanisms in relation to these feeding operations as in prior machines. Still another object is to provide improved anvil mechanism which will not deform the wire fed thereto but will tend to remove irregularities in the wire. A further object is to provide means for permitting the length of wire to be cut off to move bodily in response to the motion of the cutting blade so that any tendency to deform the wire adjacent the cut is avoided. Another object is to provide anvil mechanism comprising means for holding the wire and permitting it to shift slightly, if necessary, as it is engaged by the formers, whereby a proper alignment of the wire is obtained without employing any special aligning device. Other objects relate to various features of construction and arrangement 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 is illustrated. In the drawings,

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

Fig. 2 shows a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 shows a vertical section taken on the line 3—3 of Fig. 1;

2

Fig. 4 shows a horizontal section taken on the line 4—4 of Fig. 1;

Fig. 5 is a perspective view of the anvil mechanism which is embodied in the machine shown in Figs. 1—4, inclusive;

Fig. 6 is a perspective view, similar to that of Fig. 5, showing the parts of the anvil mechanism separated from each other;

Fig. 7 shows a perspective view of a modified form of anvil die which may be embodied in the anvil mechanism illustrated particularly in Figs. 5 and 6;

Fig. 8 shows a perspective view of another form of anvil die which may be embodied in the construction illustrated in Figs. 5 and 6;

Fig. 9 shows a vertical section similar to the lower right-hand portion of Fig. 3, illustrating the relative positions of the parts of the anvil mechanism when it is engaged by the length of stapling wire to be formed into a staple, with the staple driver and the staple formers occupying elevated positions;

Fig. 10 shows a sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 shows a sectional view similar to that of Fig. 9 illustrating the relative positions of the parts after the staple formers have been moved downwardly and the staple has been formed and with the supporting shoe occupying a position to support the staple as it is being driven;

Fig. 12 shows a sectional view taken on the line 12—12 of Fig. 11;

Fig. 13 shows a sectional view similar to that of Fig. 9 illustrating the relative positions of the parts after the anvil mechanism has been retracted by the downward movement of the staple driver and illustrating the driver after it has partially driven the staple into the work; and

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

As illustrated in the drawings, the invention is embodied in a stapling machine of the general construction and arrangement of that disclosed in U. S. Patent No. 644,754, granted on March 6, 1900, to Matthew V. Allen, and essentially comprising a stapling head 15 which carries the staple forming and driving mechanism and which is adapted to cooperate with a clincher arm 16 carrying a clincher die 17 adapted to be engaged by the legs of the staple to clinch them on the underside of the parts which are stapled together. The flaps of a fibreboard box, for example, or other parts to be stapled, are placed over the clincher arm 16 and the clincher die

3

17 occupies a position beneath the point where the staple is to be applied. The stapling wire 18, drawn from a spool or the like, by means of feeding mechanism indicated generally at 20, and including cooperating feed wheels 57 and 58 arranged in an associated casing 52, is fed through a guideway 21 and through a tubular shearing die 22 where it is cut off to form a length of wire 18a which is to be formed into a staple above the clincher die 17. While the staple is being formed, it is held by the anvil mechanism indicated generally at 24 and as the staple is driven, this anvil mechanism is retracted to permit the driving of the staple into the work.

The head 15 of the machine comprises a frame or housing 25 having a face plate 26 secured to the front side thereof by means of screws 27. The face plate 26 is provided on the inner side thereof with a vertical guideway 25a in which a former bar 28 is mounted to reciprocate. The former bar is provided on its outer side with a longitudinal groove 28a of rectangular cross section which is slidably engaged by a driving bar 30. The former bar 28 has secured to the lower end thereof two staple formers 31, shown particularly in Figs. 1, 10, 12 and 14, which are held in place by screws 32 and which are provided on their opposed faces with longitudinal grooves 31a adapted to engage the projecting portions of the length of stapling wire 18a to cause the formation of a U-shaped staple in cooperation with parts of the anvil mechanism 24 when the former bar 28 is moved downwardly.

The driving bar 30 has keyed to the lower end thereof a staple driver 33 which is adapted to engage the head of the U-shaped staple and drive it downwardly through the work while at the same time causing the retraction of the anvil mechanism 24 as hereinafter more fully described.

For the purpose of actuating the former bar 28, it is provided between its ends with an aperture engaged by a threaded pin 34 which is held in place by a nut 35 and which is provided with a cylindrical extremity 34a having mounted thereon a roller 36 adapted to travel in a groove 37a formed in a cam 37. This groove 37a has the irregular contour shown particularly in Fig. 1 and the cam has a hub portion 37b which is journaled in a bearing 25a formed in the housing 25. This hub portion is keyed to a shaft 38 which is also journaled in a bearing formed in the housing 25 and which is adapted to be driven at uniform speed by an electric motor or the like. With this arrangement, it will be apparent that during rotation of the shaft 38, the former bar 28 will be periodically moved downwardly and then retracted so that a staple is formed during each rotation of the cam.

In order to effect the reciprocation of the driving bar 30, this bar is provided at its upper end with a transversely extending pin 30a upon which is journaled a bushing 39 secured in the upper end of a crank arm 40. The lower end of this crank arm is provided with a transversely extending pin 41, shown particularly in Fig. 4, which is journaled in a sleeve 42a formed upon the end of a link 42. This sleeve 42a is journaled in a cylindrical recess 37c formed in the face of the cam 37 at a point displaced laterally from the axis of this cam. Thus, when the cam 37 is rotated, the pin 41 revolves about the axis of the cam and thereby causes the crank arm 40 to effect a reciprocation of the driving bar 30. The recess 37c in the cam is so located that the downward move-

4

ment of the driving bar 30 will be effected in proper timed relation to the movement of the former bar 28 so that a staple will be formed and will be in readiness to be driven when the staple driver 33 carried by the driving bar arrives at a position where it is about to engage the formed staple. As disclosed in the Allen patent mentioned reciprocation of the link 42 brings about intermittent operation of the wire feeding mechanism 20 so that suitable increments of wire 18a are successively fed to a cutting blade 60, mounted for reciprocation in an associated casing 63 slidably carried by the face plate 26, and successively cut off by the blade 60 and supplied to the anvil 24 to provide the successive staples. In the arrangement, a rotatably mounted handle 59 is carried by the face plate 26 and suitably interconnected with the lever 42 by a pivotally mounted lever 45 and suitably interconnected with the casing 63 by a pivotally mounted plate 47. More particularly, the handle 59 may be selectively rotatably set to adjust the stroke of the lever 42, and consequently the length of the increment of wire 18a that is fed by the wire feed mechanism 20 to the anvil 24, and simultaneously to adjust the position of the casing 63 carrying the blade 60 with respect to the anvil 24, and consequently to maintain substantially equal the lengths of the two legs of the substantially U-shaped staple that is ultimately formed. Specifically, the blade 60 is secured on the projecting portion 62a of a bar 62 that reciprocates vertically in the casing 63; and the bar 62 is intermittently operated downwardly against the bias of an associated compression spring 64 by an arrangement including a shaft 67 journaled in the face plate 26 and operated by a curved arm 68 cooperating with a projection 48a provided on the lower end of the link 40.

As the staple is being driven, the legs of the staple are supported against buckling by a supporting shoe 70 which is pivoted at 71 in a recess formed in the former bar 28, as shown in Fig. 3. This shoe has a lower pointed extremity 70a which is adapted to be projected between the legs of the staple to hold them against bending inwardly while they are being driven and it has a rear cam surface 70b which coacts with a roller 72 carried by the end of a plunger 73 which is mounted to reciprocate in a tubular bore 74a formed in a cylinder 74 attached to the lower part of the housing 25. A heavy coil spring 75 normally tends to hold the plunger 73 and the roller 72 in their forward positions, somewhat to the right of that shown in Fig. 3, the extent of the movement in this direction being limited by a rod 76 having a rear shoulder which engages a stop, not illustrated. The roller 73 normally occupies a forward position, somewhat to the right of that shown in Fig. 3, but it is adapted to yield when the supporting shoe 70 is forced toward the left, as viewed in Fig. 3 by the downward movement of the driving bar 30 and the staple driver 33 which have beveled lower extremities 30a and 33a, respectively, adapted to engage the inclined front face of the tip portion 70a of the supporting shoe. The shoe 70 is held in engagement with the roller 72 by a coil spring 77 which extends into a recess 70c formed in the shoe and into another recess 30b which is formed in the face of the former bar 28.

Having described the general operation of the machine and the construction of some of its parts, a more particular reference will now be made to the construction and operation of the anvil mechanism 24 which has previously been referred to.

5

This mechanism is illustrated particularly in Figs. 3, 5, 6, 9, 10, 11, 12, 13 and 14 of the drawings and comprises the anvil proper or anvil die 80 which is mounted at the lower end of an anvil carrier 81 pivotally mounted by a pin 82 in a chamber 83a formed in the lower part of a block 83 which is secured by screws 84 to the front face of the plate 26. The anvil 80 and the lower part of the carrier 81 are normally caused to swing toward the path of movement of the driving bar 30 by the action of a leaf-spring 85 which has its lower end mounted in a recess 81a formed in the anvil carrier as illustrated particularly in Figs. 5 and 6. The side walls 81b of the recess 81a are bent inwardly to interlock with the curved portion 85a of the spring which is adjacent its lower extremity 85b. The upper end of the spring 85 extends into a recess 83b formed in the upper inner side of the block 83 where it coacts with the bottom edge of the plate 26, as shown in Fig. 3, so that it operates normally to swing the lower end of the carrier 81 with its anvil 80 to a position where a V-shaped projection 81c, formed on the anvil carrier, lies in the path of movement of the staple driver 33 in the manner shown, for example, in Fig. 9. At this time, the rib 81d which extends upwardly from the projection 81c, is positioned between the forming dies 31, as shown in Figs. 9 and 10. The spring 85 may be readily removed for replacement by pulling on its upper end.

The anvil die 80 has a part 80a over which the cut-off piece of wire 18a is adapted to be bent to form a staple having a U-shaped top. This part 80a is carried by a small block 80b which is pivotally mounted by a pin 87 between the flanges 81e which constitute the lower extremity of the anvil carrier 81. The part 80b of the anvil die has a tail portion which extends upwardly and rearwardly from the top of the part 80a and this tail portion has an inclined surface 80c which is adapted to engage an inclined surface 81f formed on the anvil carrier 81 between the flanges 81e, thereby limiting the downward movement of the die portion 80a during the formation of the staple. A coil spring 88 is mounted in a recess formed in the rearwardly extending part 80b of the anvil and in the lower part of the anvil carrier and this spring tends normally to move the anvil proper 80a to the position shown in Fig. 9 where the pressure of the spring 88 is adapted to cause the anvil to grip the section 18a of stapling wire between its top face and the lower face of the projection 81c formed on the carrier. The side of the part 81c is provided with a notch or guide-way 81g of V-shaped cross section which is adapted to engage the end of the wire 18 as it is being fed by the wire feeding mechanism 20 in order to direct the wire into proper position beneath the portion 81c and above the portion 80a of the anvil. The gripping of the wire by the spring actuated anvil continues until the anvil is moved downwardly during the staple forming operation to the position shown in Fig. 11.

After the wire has been positioned in the anvil mechanism in the manner illustrated in Figs. 1, 9 and 10, and after the section of wire has been cut off by the downward movement of the cutting blade 69, the cam 37 actuates the former bar 28 to cause the former dies 31 to move downwardly and engage the projecting ends of the cut-off piece 18a of the wire. These end portions of this piece of wire pass into the grooves 31a formed in the former dies and as the former bar 28 moves downwardly they are bent downwardly to form

6

a U-shaped staple as shown in Figs. 11 and 12. As this downward movement proceeds, the anvil 80 is adapted to tilt about its pivot 87 until the surface 80c engages the surface 81f, as shown in Fig. 11, thus causing the anvil to be firmly supported during the formation of the staple. This movement of the anvil separates the part 80a of the anvil from the projection 81c of the carrier so that the staple is free to move out of engagement with the anvil. This separation of the anvil and the staple is then effected by the downward movement of the staple driver 33 which then takes place in response to the downward movement of the driving bar 30. As the driving member 33 moves downwardly it engages the inclined front face of the part 81c of the anvil carrier and cams this member 81 toward the right as viewed in Fig. 11 against the action of the leaf spring 85. Meanwhile, the supporting shoe 70 will have been moved inwardly by the spring 75 until its pointed extremity 70a occupies a position between the legs of the staple. As the driving member 33 moves downwardly the anvil carrier 81 and the anvil are moved to the position shown in Fig. 13, the staple is disengaged from the anvil 80, and the staple is then driven downwardly by the driver 33 through the work which is supported on the clincher die 17. As the staple is driven, the driving member 33 gradually cams the supporting shoe 70 out of its supporting position by coaction with the upper inclined face of the portion 70a thereof so that the supporting shoe is gradually retracted against the compression of the coil spring 75. While these operations are taking place, the anvil carrier 81 and the anvil are retained in the position shown in Fig. 13 by the driving member 33 which then coacts with the tip of the part 81c.

After the staple has been driven, the driving bar 30 is moved upwardly, following the former bar 28 which will have previously been moved upwardly by the action of the cam 37. When the driving member 33 has moved upwardly beyond the projection 81c of the anvil carrier, this carrier is again moved to the position shown in Fig. 9 by the action of the spring 85, and the anvil 80 will be moved by the spring 88 to the position shown in Fig. 9 where it engages a new length of wire fed by the mechanism 20. Thus, the cycle of operations may again be repeated with the feeding of a section of wire, the cutting off of that section, the forming of a staple and the driving of a staple taking place during each rotation of the cam 37.

The machine is provided with mechanism, not shown, for insuring that each time a staple is formed and driven, the cam 37 will rotate a single revolution so that all of the parts start and stop their operations in the same relative positions in each cycle.

The present construction has the advantage that when the wire 18 is fed by the feeding mechanism 20 through the stationary die 22 it moves to its position between the projection 81c of the carrier 81 and the portion 80a of the anvil and is automatically gripped by the action of the spring 88 without the necessity of operating or timing any gripper actuating mechanism causing the operation of any other gripping device. As the wire moves to this position it may be guided, if necessary, by the beveled V-shaped surface 81g formed on the part 81c of the carrier, so that the wire is ordinarily properly located and gripped even though the end of the wire is not initially in accurate alignment with the place which the

wire is to occupy between the part 81c and the part 80a. In the event that the wire is not positioned with sufficient accuracy by the V-shaped surface 81g, it is found that the wire will be shifted transversely of its length on the part 80a as the staple is bent by the former 31, due to the action of the bell-shaped mouth 31b of the former which is shown particularly in Figs. 10, 12 and 14. As the bending of the cut-off wire takes place to form the staple, the inclined surfaces 31b will cause a shifting of the wire to effect a sufficiently accurate positioning thereof. This alignment of the wire by the parts 81g and 31b takes place regardless of the size of the wire and the adjustable mounting of the part 80a of the present invention has the advantage that it permits the size of the wire to be changed without any change of the anvil or cooperating parts of the wire gripping device, since the part 80a has sufficient amplitude of movement to grip varying sizes of wire, within a considerable range, under the influence of the spring 88. When there is a substantial change in the size of the wire, however, it is necessary to change the formers 31, the driver 33, the feed wheel 58, and the guideway 21. The tubular shearing die may be used with a substantial range of wire sizes without change but the passageway through this member should preferably be of the same shape and only slightly larger than the wire. As the wire is pushed into position over the die to be gripped the die cooperates with the part 81c of the anvil carrier to straighten out small irregularities in the wire, which is of great advantage particularly when fine wire is employed.

As the staple is formed by bending the cut section of wire 18a over the portion 80a of the anvil, this part of the anvil moves bodily downward to the position shown in Fig. 11 and the passage of the parts of the forming dies 31 over the staple legs tends to cause them to become straight if there are any irregularities present in the wire when it is cut off. This action arises from the fact that the portions of the wire which become the legs of the staple occupy the grooves in the edges of the dies 31 as the staple is formed and the dies move downwardly to a point beyond the staple legs. Also, as the former dies 31 move downwardly to form the staple legs, the staple wire may shift slightly on the anvil, which moves downwardly to the position shown in Fig. 11, to cause the legs to assume the proper positions on driving, if it is not initially aligned correctly.

A further advantage of the present invention is that the anvil die 80 may be shaped to give any desired contour to the crown of the staple and the anvil provides a continuous support for the wire which is bent over it so that a crown of any desired shape may be perfectly formed. The die 80 shown in Figs. 5 and 6 is slightly flat on the top with rounded corners so that the crown of the staple 18b has a corresponding configuration. If desired, the anvil die may have the form shown at 90 in Fig. 7 where the part 90a over which the staple 18c is formed has a top surface formed by a single radius so that the crown of the staple is substantially semicircular in form. In Fig. 8 the anvil die 91 is shown as having a portion 90a provided with a flat top surface 90b so that the top or crown of the staple 18d is substantially at right angles to its legs. When such an anvil is employed it is, of course, necessary to change the dimensions of the formers 31, the driver 33, and associated parts in order to accommodate the different width of the crown of the staple being formed.

Although one form of the invention has been shown and described by way of illustration together with modifications of the anvil die, it will be understood that the invention may be constructed in various other forms without departing from the scope of the appended claims.

I claim:

1. The combination in a wire stitching machine, of means for feeding a wire endwise, a carrier, an anvil die movably carried by said carrier and about which a length of the wire may be bent, a stationary part carried by said carrier and positioned opposite said die, yielding means biasing said die and said part toward each other to grip the wire therebetween, and means for guiding the end of the wire in its endwise feeding movement between said die and said part so as automatically to separate said die and said part against the bias of said yielding means to receive the wire therebetween.

2. The wire stitching machine set forth in claim 1, wherein said guiding means includes a recess formed in said part and receiving the end of the wire.

3. The wire stitching machine set forth in claim 1, wherein said guiding means includes an inclined notch formed in the edge of said part and receiving the end of the wire.

4. The combination in a wire stitching machine, of means for feeding wire endwise, an anvil having a die about which a length of the wire may be bent, a carrier having said anvil pivotally mounted thereon, said carrier having a part positioned opposite said die, resilient means for causing said part and said die to grip the wire therebetween, said die and said part being automatically separated to receive the end of the wire therebetween by the feeding movement of the wire endwise between said die and said part, means including a shearing blade for cutting off a length of wire held between said die and said part, and means for bending the cut off length of wire over said die to form a staple, said resilient means accommodating limited movement of said anvil with respect to said carrier during the cutting operation and accommodating substantial movement of said anvil with respect to said carrier during the bend operation.

5. The combination in a wire stitching machine, of an anvil having a die about which a length of wire may be bent, a carrier having spaced flanges at its lower end between which said anvil is pivotally mounted with said die projecting laterally, said carrier having a part projecting over said die, and resilient means engaging said carrier and said anvil for effecting pivotal movement of said anvil with respect to said carrier and thereby causing said die to cooperate with said part to grip the wire therebetween.

6. The combination in a wire stitching machine, of means for feeding wire endwise, an anvil having a die about which a length of said wire may be bent, a carrier having spaced flanges at its lower end between which said anvil is pivotally mounted with said die projecting laterally, said carrier having a part projecting over said die, resilient means engaging said carrier and said anvil for effecting pivotal movement of said anvil with respect to said carrier and thereby causing said die to cooperate with said part to grip the wire therebetween, means including a downwardly moving cutting blade for cutting off a length of wire positioned over said die and held between said die and said part, said resilient means accommodating limited movement of said anvil with

respect to said carrier while the cutting takes place.

7. The combination in a wire stitching machine, an anvil having a die about which a length of wire may be bent, a carrier having said anvil pivotally mounted on the lower end thereof, said carrier having a projecting part adapted to cooperate with said die to grip the wire therebetween, a support to which the upper portion of said carrier is pivotally connected, a staple former movable transversely to the wire held on said die, said carrier having a recess on the side thereon on which said part is located, and a leaf spring seated in said recess and engaging said support for causing said carrier to be actuated to move said part and said die toward the path of travel of said staple former.

8. The combination in a wire stitching machine, of means for feeding wire endwise, an anvil having a die about which a length of the wire may be bent, a carrier having said anvil movably mounted thereon, said carrier having a part positioned opposite said die, yielding means for causing said die to cooperate with said part to grip the wire therebetween, said die being automatically moved away from said part against the bias of said yielding means to receive the end of the wire therebetween by the feeding movement of the wire endwise between said die and said part, forming means adapted to coact with the wire held upon said die to bend it about said die, said die being adapted to move to a predetermined extent away from said part upon the initial movement of said forming means, and means engageable with said anvil for limiting said movement of said die away from said part.

9. The combination in a wire stitching machine, of an anvil having a die about which a length of wire may be bent, a carrier having spaced flanges at its lower end between which said anvil is pivotally mounted with said die projecting laterally, said carrier having a part

projecting over said die, and resilient means engaging said carrier and said anvil for effecting pivotal movement of said anvil with respect to said carrier and thereby causing said die to cooperate with said part to grip the wire therebetween, said carrier and said anvil having parts adapted to coact to limit the separation of said projecting part and said die.

10. The combination in a wire stitching machine, of an anvil having a die about which a length of wire may be bent, a carrier having said anvil pivotally mounted on the lower end thereof, said carrier having a projecting part adapted to cooperate with said die to grip the wire therebetween, a support to which the upper portion of said carrier is pivotally connected, a staple former movable transversely to the wire held on said die, said carrier having a recess on the side thereon on which said part is located, and a leaf spring seated in said recess and engaging said support for causing said carrier to be actuated to move said part and said die toward the path of travel of said staple former, the walls of said recess and said leaf spring being formed to interlock detachably for holding said spring attached to said carrier and permitting the removal of said spring.

GEORGE H. REED.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
578,907	Young	Mar. 16, 1897
1,212,546	Pagliarul	Jan. 16, 1917
1,434,936	Watson	Nov. 7, 1922
1,733,328	Belluche	Oct. 29, 1929
1,760,031	Allen	May 27, 1930
1,791,091	Fisher	Feb. 3, 1931
1,932,743	Kleinschmit et al.	Dec. 4, 1934
2,190,684	Sims et al.	Feb. 20, 1940
2,216,453	Paulin	Oct. 1, 1940