Dec. 10, 1940. W. J. NOLAN 2,224,743

ROTARY STITCHER

Filed Oct. 7, 1937 3 Sheets-Sheet 1

Fig. 1.

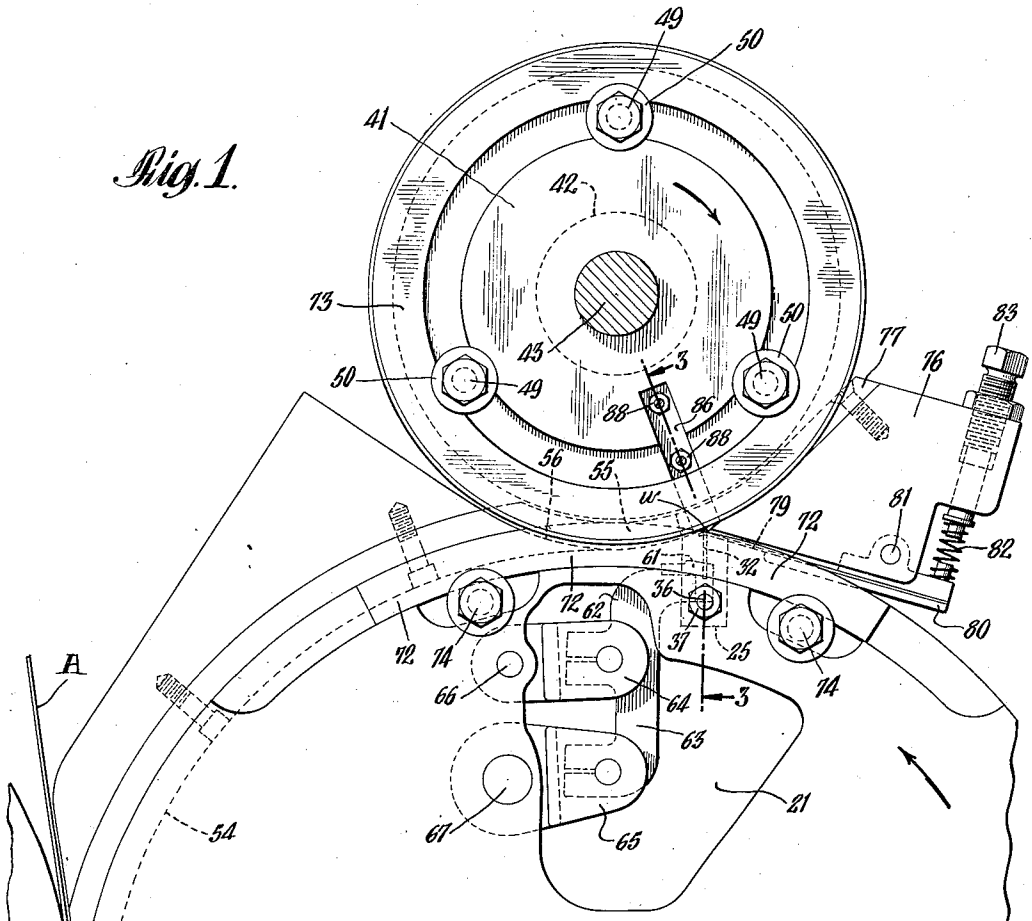
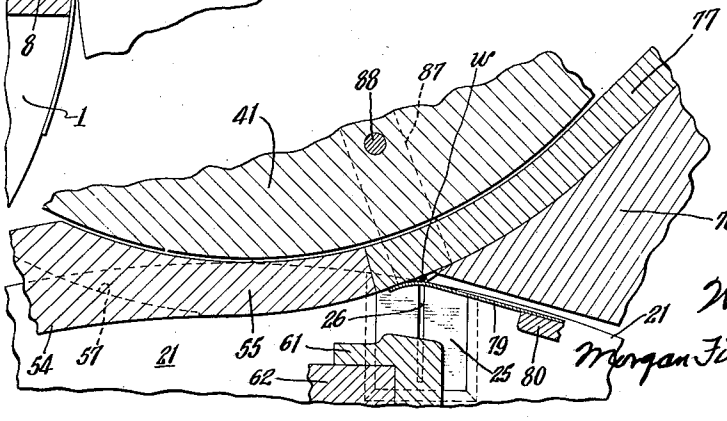


Fig. 2.



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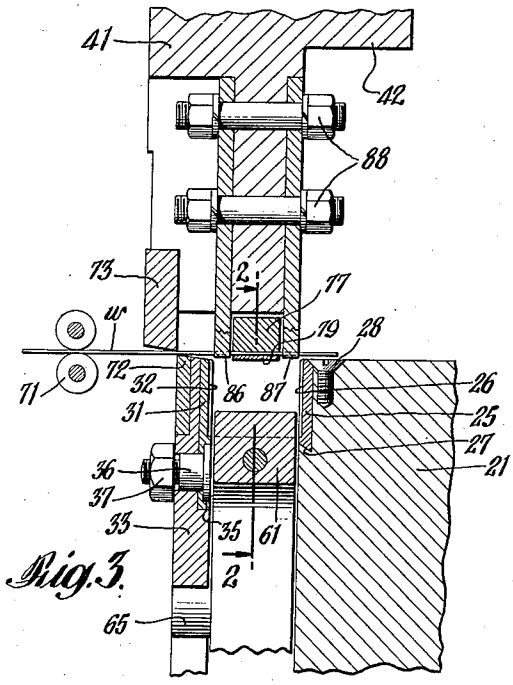


Fig. 3.

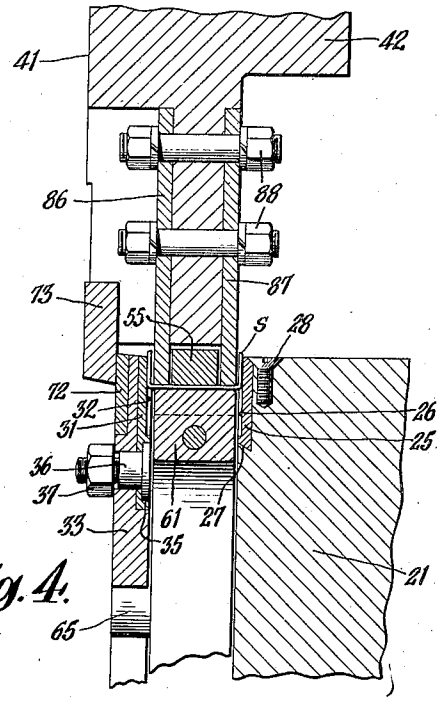


Fig. 4.

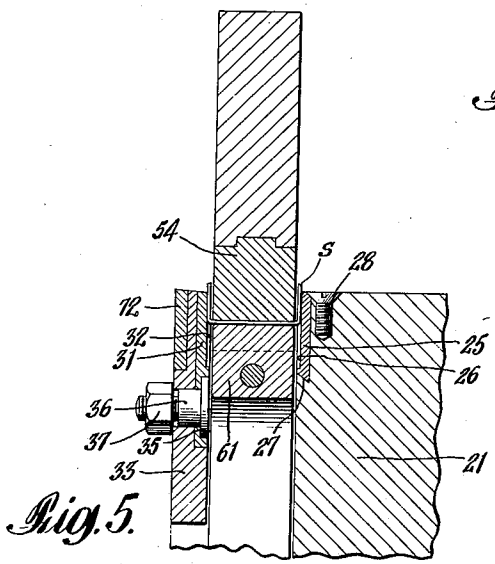
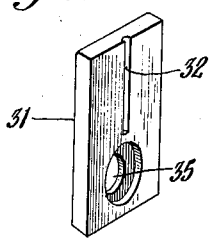


Fig. 5.

Fig. 6.



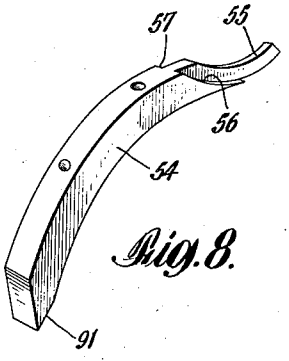


Fig. 8.

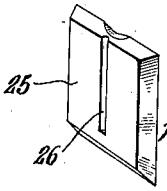


Fig. 7.

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Fig. 9.

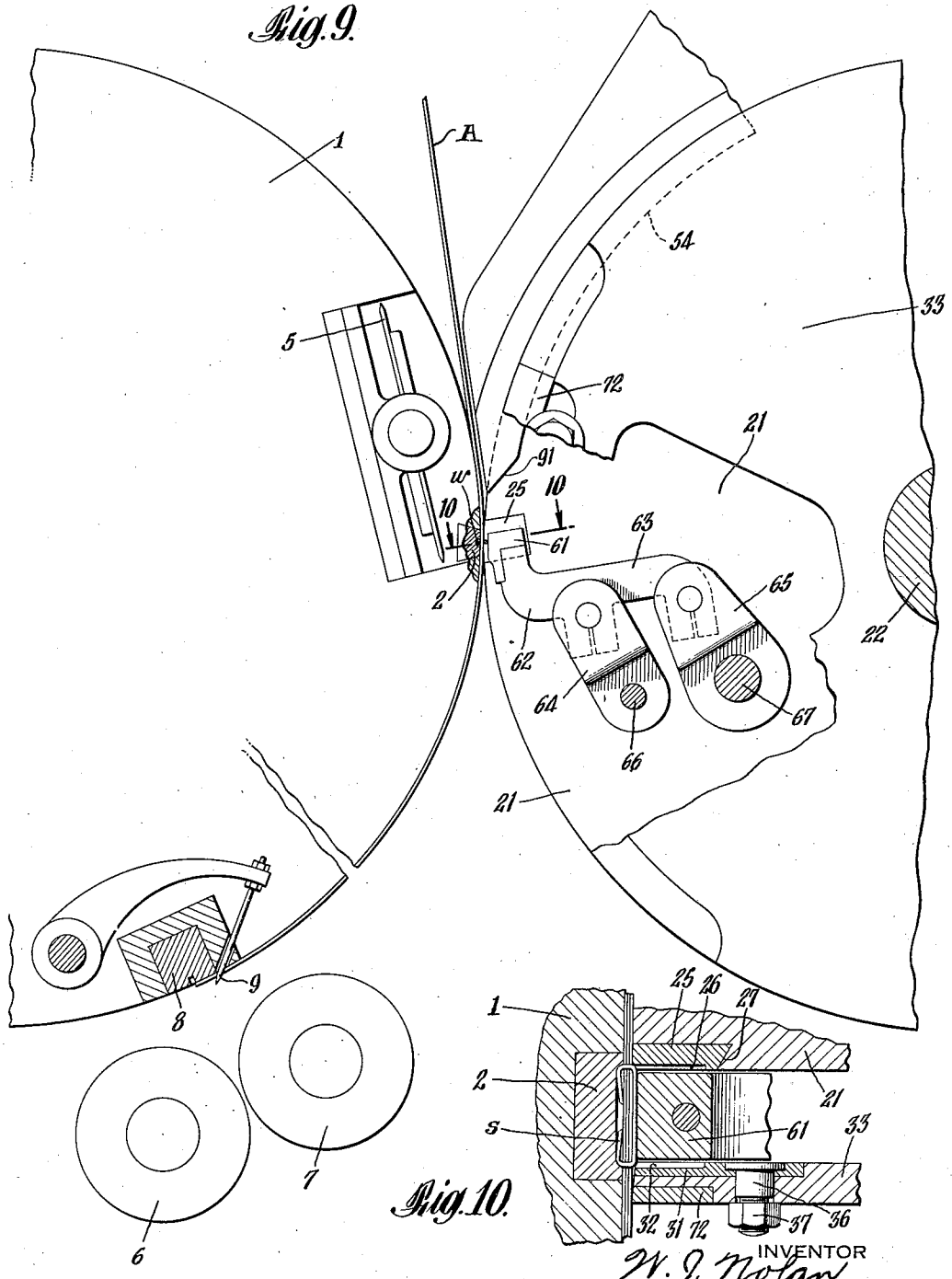


Fig. 10.

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UNITED STATES PATENT OFFICE

2,224,743

ROTARY STITCHER

William J. Nolan, Chicago, Ill., assignor to The Goss Printing Press Company, Chicago, Ill., a corporation of Illinois

Application October 7, 1937, Serial No. 167,679

15 Claims. (Cl. 1—7)

The invention relates to new and useful improvements in rotary stitchers, and more particularly to such improvements in rotary mechanisms for forming wire staples and clinching the staples through the perfected products of fast rotary printing presses.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Fig. 1 is a fragmentary elevation of a rotary staple-forming and clinching mechanism embodying the invention;

Fig. 2 is a sectional detail, taken on line 2—2 of Fig. 3, looking in the direction of the arrows;

Fig. 3 is an enlarged transverse sectional detail, taken on line 3—3 of Fig. 1;

Fig. 4 is a like section representing the parts in an advanced position from Fig. 1;

Fig. 5 is an enlarged transverse section showing the formed staple being swept along the horn;

Fig. 6 is a detached detail view of the grooved inner member of the staple-forming die shown in Figs. 3, 4 and 5;

Fig. 7 is a like view of the outer grooved member of the staple-forming die shown in said figures;

Fig. 8 is a detached perspective detail of that part of the horn that lies within the flanges of the rotating former.

Fig. 9 is an elevation of the folding cylinder and stitching cylinder and showing the staple clinching operation; and

Fig. 10 is an enlarged detail section taken on lines 10—10 of Fig. 9.

Objects of the invention are to provide a staple-forming and stitching mechanism which is fast, simple, sturdy and reliable, and to this end the invention provides staple-forming means having a minimum of parts and wherein those few staple making and handling parts and mechanisms have predominantly rotary and continuous movement as distinguished from reciprocatory and intermittent movement, such movements also in their operative relations being in a forward path of travel toward the stitching locus, and the parts which engage with and bend the wire during the staple-forming are all in motion together during the operation, whereas in present practice the wire is slid between and formed into staples by mechanisms some of which are stationary and others have diverse movements of different kinds and in different directions, some of which are very rapid and abrupt.

To this end, and with these objects in view, a mechanism is provided as a preferred embodiment, wherein a grooved forming die is mounted in fixed position within a cutting and stitching cylinder, and cooperating therewith is a backing member which backs the formed staple until it reaches the stitching position and then by a very short movement forces it into the product until clinched. Cooperating with the forming die is a rotary flanged former disc which runs within the forming die to a maximum depth approximately equal to the length of the staple legs at the common plane of the axes of the disc and cylinder. The flanges of the disc within the forming die straddle a reduced portion of the horn, and at that point the flanges and the enclosed horn are within the forming die. The staple wire is presented beneath the horn, just outside of the point of coincidence of the peripheries of the former disc and the cylinder is swept forward by engaging fingers on the disc, and by the rotary movement the unit length of wire is bent between the disc and the walls of the forming die, with the legs of the staple being bent up against the outside faces of the flanges. The staple legs at the same time slide down into the grooves of the forming die as it approaches the common axial plane of the disc and cylinder. The formed staple is then held firmly in the grooves of the forming die by the engaging fingers and due to the spring of the wire, and is swept forward along the horn to the stitching locus, there to be forced through the product and clinched by a very slight forward movement of the backing member. The very slight recession of the backing member from the clinching position is the only reciprocatory movement in the mechanism. It will be understood that the foregoing general description and the succeeding detail description as well are exemplary and explanatory but are not restrictive of the invention.

Referring now in detail to the embodiment of

the invention illustrated by way of example in the accompanying drawings, my novel staple-forming and stitching mechanism is shown applied to a mechanism comprising a cross folding cylinder 1 carrying one or more staple clinching dies 2 in a usual manner. The cylinder 1 (Fig. 9) is shown equipped with a cross folding or tucking blade 5, which is intermittently operated by suitable cam-controlled means to tuck the middle of the sheet, or the associated or collected sheets into the bite of a pair of folding off rollers 6 and 7 in a well-known manner. The cylinder may be provided also with sheet cutting means, a female sheet cutting member 8 being shown mounted on the cylinder, and in conjunction therewith a series of impaling pins 9 which engage the web lead when sheets are cut off, or for collecting sheets, and release them at the folding-off, all in a well-known manner. The male cutting member 10 is shown mounted on the staple-forming and stitching cylinder 21 (Fig. 1). The sheets to be stitched, or the web or associated webs from which the sheets are cut just subsequent to the stitching are indicated by A.

In rotative cooperation with the cylinder 1 is a cylinder 21, carried on a rotatable shaft 22, and mounted on the cylinder 21 is a staple-forming die mechanism. In accordance with certain features of the invention, this staple-forming die has few parts, all of which are stationary, that is, have no relative movement among themselves or with respect to the cylinder, the mechanism is in fixed position with reference to the cylinder, is entirely within the cylinder, and no parts project beyond its periphery. As here embodied, two stapling mechanisms are employed to simultaneously put two staples into the product at the cross fold, and the cylinder 21 is a short cylinder, with the stapling mechanism mounted on the flat ends of the cylinder.

The staple-forming die, as embodied (Figs. 1 to 7) comprises two opposed plates 25 and 31, of hardened metal, mounted in the cylinder structure, and having grooves 26 and 32 formed therein, respectively, to receive the legs of the staple as it is being formed from the cut length of wire as it is forced into the die between plates 25 and 31. The plate 25 fits into an undercut seat 27 in the end of the cylinder 21, and is held in place by screw 28. The other die plate 31 is seated in a recess in a supporting ring 33, which is fixed to and rotates with the cylinder 21 and is spaced apart from the flat end of the cylinder sufficiently for the staple-forming and stitching mechanism to be mounted in the space between the ring and the cylinder head. A counterbored opening 35 is formed in the plate 31 and a short bolt 36 with a shouldered head passes through that opening and through an opening in the ring 33, and is held in place by a nut 37. The staple-forming die is set in the rotary carrier 21 with the wire-receiving grooves 26 and 32 in a non-radial position, that is, a plane passing through the staple-forming grooves just described would be tangent to a relatively small circle concentric with the cylinder, this being necessary or advisable for the forming of the staple during the rotary movement of the cylinders.

In accordance with certain features of the invention, the former cooperating with the die mechanism to form the staple (Figs. 1 to 5), is likewise preferably traveling, and is rotatable about an axis exterior to the die-carrying cylinder. A suitable device, preferably a projection from the former, acts to carry the cut-off length of wire in between the former and the die, the ends of the wire being bent up along the outer sides of the former to form the staple legs, the legs at the same time passing downwardly into the grooves 26 and 32. The embodied form of means for taking the cut-off length of wire, forming the staple and delivering it to the horn comprises a rotatable disc 41 mounted above the cylinder 33, and having a hub 42 fixed on a shaft 43. Inset in radially-disposed recesses in opposite sides of the disc 41 are two fingers 86 and 87, which are fixed in position by bolts 88 passing through the fingers and the disc. The two fingers have wire-taking grooves in their outer ends, and they are spaced apart the width of the staple, and the outer sides thereof assist in forming and holding the staple. As the cylinder 21 and disc 41 rotate, the fingers 86 and 87 enter into the staple-forming die, with their outer faces making a close fit between the plates 25 and 31, and on reaching the plane common to the axes of both the disc and cylinder, the fingers project into the forming die substantially the length of the legs of the staple which is completely formed at this point (Fig. 4).

Suitable means cooperating with the staple-forming means are provided for guiding or conveying the formed staple to the stitching locus and to assist in guiding and maintaining the staple during the clinching operation. In the embodied form, a horn 54 extends from the staple-forming locus to the stitching locus, and its inner operative surface, along which the formed staple is swept, is concentric with the cylinder 21, and lies within the space between the flat end of the cylinder and the ring-like support 33, and within the periphery of the cylinder, so that the completed staple seated within the grooves 26 and 32 has its back or middle reach sweeping along the face of the horn. To effect the passage of the staple from the forming means to the horn, the forward part 55 of the horn is of lessened cross sectional area, and this lessened portion is reversely arced (Figs. 1 and 8) to fit the periphery of disc 41, and it lies within and between the flanges 86 and 87 (Figs. 1, 3, 4 and 8) at the staple-forming locus. This part of the horn, of less cross-sectional area, terminates at either side in arcuate shoulders 56 and 57 substantially concentric with the disc 41, and abutting the peripheries of the fingers 86 and 87 and beyond these shoulders the horn is of full cross-sectional area, so that the staple passes off the fingers 86 and 87, and it passes to and fits over the horn with the usual sliding fit (Fig. 5), for a purpose later to be described.

Means are provided for backing or supporting the middle or cross reach of the staple from the time and place of its formation until it is driven through the product and clinched. In the embodied form thereof, this backing member has a head 61 formed on the end of an angled body 62, which comprises a shank 63 extending from the head 61 inwardly within the cylinder 21. The shank 63 is pivotally mounted in the ends of spaced-apart arms 64 and 65, and the arm 64 at its opposite end has a pivotal mounting 66, and the arm 65 at its opposite end is fixed to a shaft 67, which is actuated in timed relation with the other mechanism. By this mounting the backing head 61 has a short parallel motion, to permit it to recede slightly during the staple driving and clinching.

The mechanism for supplying and cutting the

wire into unit lengths to form the staples *s* may be of any desired or suitable form so far as concerns the principal features of the invention, and an intermittent wire feed is shown conventionally at **71**. The embodied form of cutting means (Figs. 1, 3 and 4) comprises cooperating ring or arcuate shear cutters mounted, respectively, on the rotatable carriers **33** for the forming die and **41** for the former, and to make a shear cut as the wire is moved inwardly toward the staple-forming locus. As embodied, an arcuate cutter **72** is mounted on the outer side, and at the periphery of the support **33**, and this cutter is preferably held by tap-bolts **74**, screw-threaded into the cylinder head and overlapping the knife **72** so that it is angularly movable to present a new cutting edge as a previous cutting point in the edge becomes dull The co-operating shear cutter is in the form of a ring **73**, mounted in an annular shouldered seat on the outer face of the disc **41**, and it is held in place by tap bolts **49**, screw-threaded into the disc **41**, and having flanges or washers **50** overlapping the knife ring **73**, and is also angularly adjustable to present a new cutting edge as a previous cutting point becomes dull from repeated cutting.

The embodied form of means for presenting the wire from the supply so that a unit length may be cut off and carried to the staple-forming mechanism (Fig. 1) comprises a support **76**, having an upper portion or tongue **77** of arcuate form and of lessened cross-sectional area, which fits within and between the fingers **86** and **87** of the former, and is in effect a continuation of the part **55** of the horn which likewise lies within the former fingers **86** and **87**. On the under side of the support **76**, a flat spring **79** is mounted in a rigid holder **80**, which holder is pivotally mounted at **81** on the support **76**. The outer end of the pivoted support **80** is acted on by a spiral compression spring **82**, the pressure of which is nicely regulated by an adjusting screw **83**. The lead of the wire fed in from the supply comes in above the spring **79** and at the toe of the support **76**, and above the periphery of the cylinder **21** and before the fingers **86** and **87** (Figs. 1, 2 and 3). The fingers **86** and **87** have wire-engaging notches in their ends which engage the cut-off wire *w* and carry it into the former mechanism.

The manner of operation of the hereinbefore-described mechanism is substantially as follows:

The lead end of the wire *w* is fed in by the mechanism **71** to the position shown in Figs. 1, 2 and 3, and immediately it is engaged by the notches in the ends of the feeding fingers **86** and **87**, is swept forward and at once passes into the bite of the shearing cutters **72** and **73**, and the unit length of wire for a staple is cut off. The fingers **86** and **87** run continuously within the die-forming plates **25** and **31** at the die-forming locus (Figs. 1 and 4), and as the fingers carrying the cut-off wire pass within the periphery of the cylinder **21** and into the interior of the forming die, the wire is in alinement with the top ends of slots **25** and **32** of the die, and the outer parts of the wire are bent up against the outer faces of the fingers **86** and **87** to form the legs of the staples, which at the same time slide down into the grooves **26** and **32**, as shown in Fig. 4, and the spring of the stiff wire assists to hold the staple firmly in the groove. The staple is completely formed when it reaches the common plane of the axes of the two cylinders **21** and **41**, and the head **61** of the backing member is then just in contact with the central reach or bend of the staple, as shown in Fig. 4.

As previously described, the forward part of the horn **54** is of reduced cross section and lies within the space between the flanges **47** and **48**, and the staple is formed about this enclosed part of the horn **54**, and about the ends and outer faces of the fingers **86** and **87** (Fig. 4). From the periphery of disc **41** to the stitching locus, the horn is of full size in cross section, so that the formed staple fits to it with the usual sliding fit, this part of the horn being of arcuate shape conforming to the circular path of the forming die which holds the staple. The formed staple is held in position by the grooves **26** and **32** and the backing head **61**, and slides along the arcuate horn to the stitching locus. An over-forming device to bend inwardly slightly the legs of the staple may be employed in the usual manner, if desired, but is omitted from the drawings for the sake of clearness. The rear inner end of the horn **54** is beveled, as shown at **91**, to enable the staple to gradually pass through the product A as it approaches the clinching locus, the head **61** moving outwardly to continuously back up the staple which is clinched by the clinching die **2** in the cylinder **1**, as shown in Figs. 9 and 10. The backing head **61** then recedes during the rotation from the stapling locus back to the wire-taking locus. The only reciprocating device in the mechanism is the backing head **61**, which has a very limited and gradual movement, and the usual plurality of relatively reciprocable elements or devices is avoided, and no mechanism is projected outside of the carrier cylinder; the staple is formed by the coaction of parts that are all moving forwardly at the same speed and along rotational paths, and engagement of the wire or staple with the stationary horn, and the sliding of the staple therealong does not begin until after the staple has been formed.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a rotatable former moving within said die, means for carrying a wire in between the rotating die and former to form it into a staple, and a stationary horn extending from the staple-forming locus to the stitching locus to guide the staple until clinched.

2. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a rotatable former moving within said die, means for carrying a wire in between the rotating die and former to form it into a staple, and an arcuate horn to receive the staple, said horn extending from the staple-forming locus to the stitching locus, the horn and rotating die guiding the staple until clinched.

3. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a horn, a rotatable former, and means for carrying a wire in between the rotating die and former to form a staple about the horn and former.

4. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a horn, a rotatable former, and means

for carrying a wire in between the rotating die and former to form a staple about the horn and former, the horn and forming die cooperating to carry the staple to the stitching locus.

5. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a horn extending from a staple-forming locus to a stitching locus and having a staple engaging and guiding face concentric with the axis of rotation of said die, a rotatable former, and means for carrying a wire in between the rotating die and former to form a staple about the horn and former.

6. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a horn extending from the staple-forming locus to the stitching locus, a former mounted separately from the rotatable forming die, and means for carrying a wire to the forming locus to form a staple about the former and horn.

7. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a former mounted separately from the rotatable forming die, a horn extending from the staple-forming locus to the stitching locus and having a portion thereof located within said former at the staple-forming locus, and means for carrying a wire to the forming locus to form a staple about the former and horn.

8. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a former mounted separately from the rotatable forming die, a horn extending from the staple-forming locus to the stitching locus and having a portion of less cross section at the stitching locus which is located within the former, and means for carrying a wire to the forming locus to form a staple about the former and horn, the horn and rotating forming die guiding the staple to the stitching locus.

9. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a flanged former mounted separately from the forming die, a horn extending from the staple-forming locus to the stitching locus and lying between the flanges of the former at the staple-forming locus, and means for carrying a wire to the forming locus to form a staple about the flanges of the former and the enclosed horn.

10. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a flanged former mounted separately from the forming die, a horn extending from the staple-forming locus to the stitching locus and having a portion of full cross section to fit the interior of the staple, and a portion of less cross section located within the flanges of the former at the staple-forming locus, and means for carrying a wire to the forming locus to form a staple about the flanges of the former and the enclosed horn, the part of the former of full cross section and the forming die cooperating to carry the staple from the forming locus to the stitching locus.

11. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a traveling former mounted separately from the rotatable forming die, a horn extending from the staple-forming locus to the stitching locus and having a portion of less cross section at the stitching locus which is located within the former, and means for carrying a wire to the forming locus to form a staple about the former and horn, the horn and rotating forming die guiding the staple to the stitching locus.

12. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a traveling flanged former mounted separately from the forming die, a horn extending from the staple-forming locus to the stitching locus, one end thereof lying between the flanges of the former at the staple-forming locus, and means for carrying a wire to the forming locus to form a staple about the flanges of the former and the enclosed horn.

13. A rotary staple-forming and stitching mechanism including in combination a rotatable forming die, a rotatable former moving within said die, the axis of the die being outside the former and the axis of the former being outside the die, means for carrying a wire in between the rotating die and former to form it into a staple, and a backing member for backing the formed staple from the forming locus until it is clinched.

14. A rotary staple-forming and stitching mechanism including in combination a rotatable carrier and a forming die mounted thereon, a rotatable carrier having a flanged former, a horn extending between the staple forming locus and the stitching locus and extending between the flanges of the rotating former, and means rotating with the former for carrying a wire between the rotating forming die and the former to form a staple about the flanges of the former and the enclosed horn and within the forming die.

15. A rotary staple-forming and stitching mechanism including in combination a rotatable carrier having a clinching die, a rotatable carrier and a forming die mounted thereon, a rotatable carrier having a flanged former, a horn having parts of greater and less cross-section, having a part of less cross section lying between the flanges of the former at the staple-forming locus, means for presenting a length of wire, cooperating wire cutting members mounted on the forming die carrier and on the former carrier, means mounted on the former carrier for carrying a cut-off length of wire between the rotating forming die and the former to form a staple about the flanges of the former and the enclosed horn and within the forming die, the horn and die guiding the formed staple to the stitching locus, and a backing member mounted on the forming die carrier for backing the formed staple until it is clinched through the product by the clinching die.

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