Sept. 20, 1938. E. J. SMITH ET AL 2,130,779

STAPLING AND RING FORMING MACHINE

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Fig. 1.

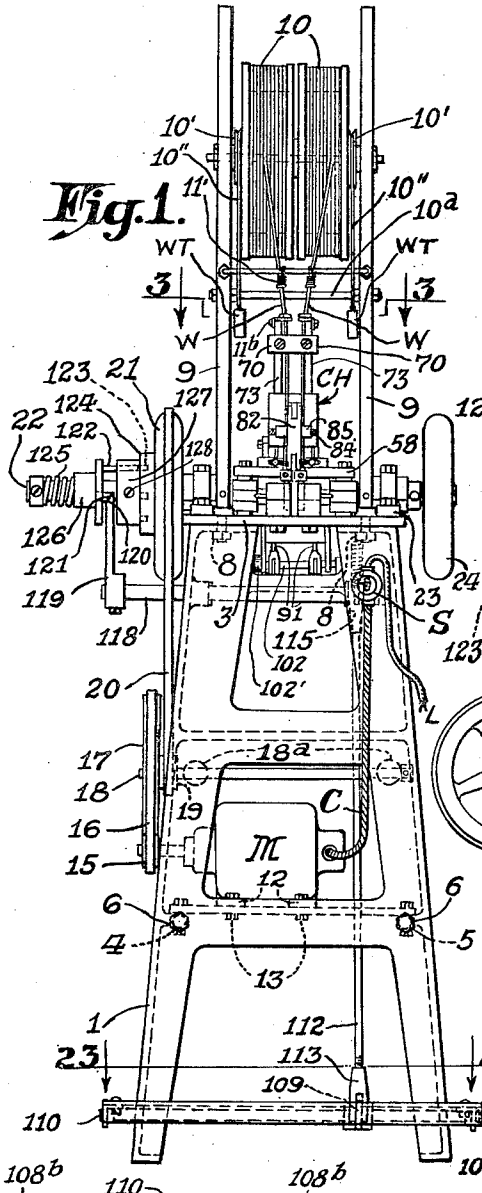


Fig. 2.

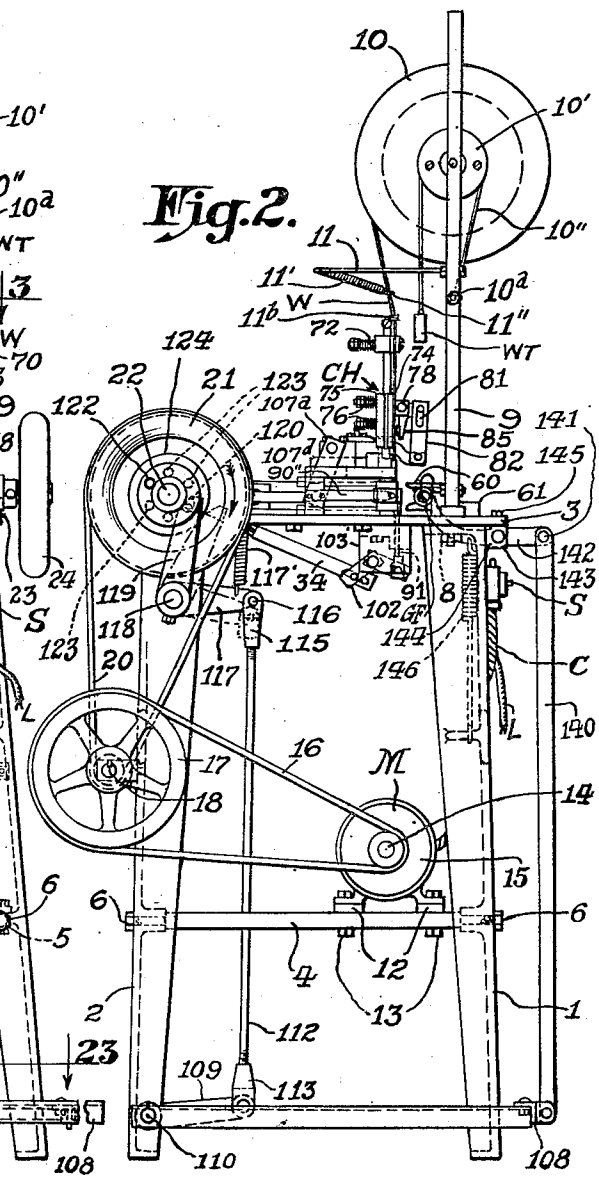
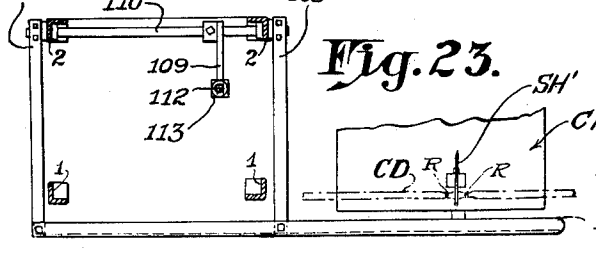


Fig. 23.



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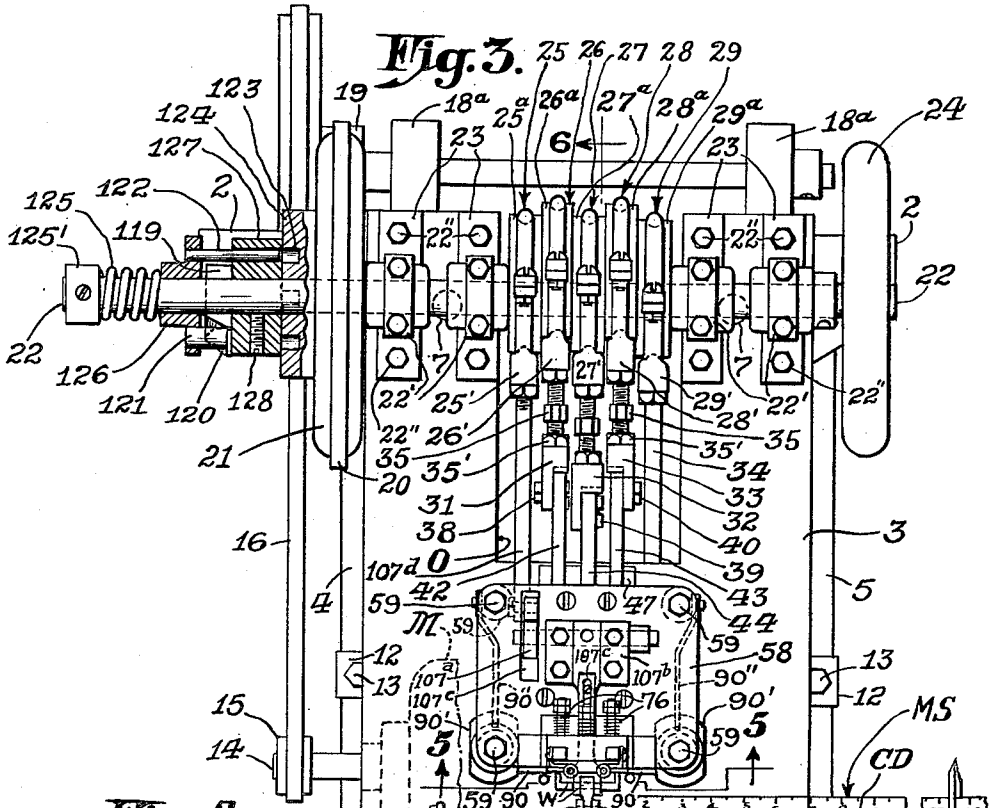
Edward J. Smith

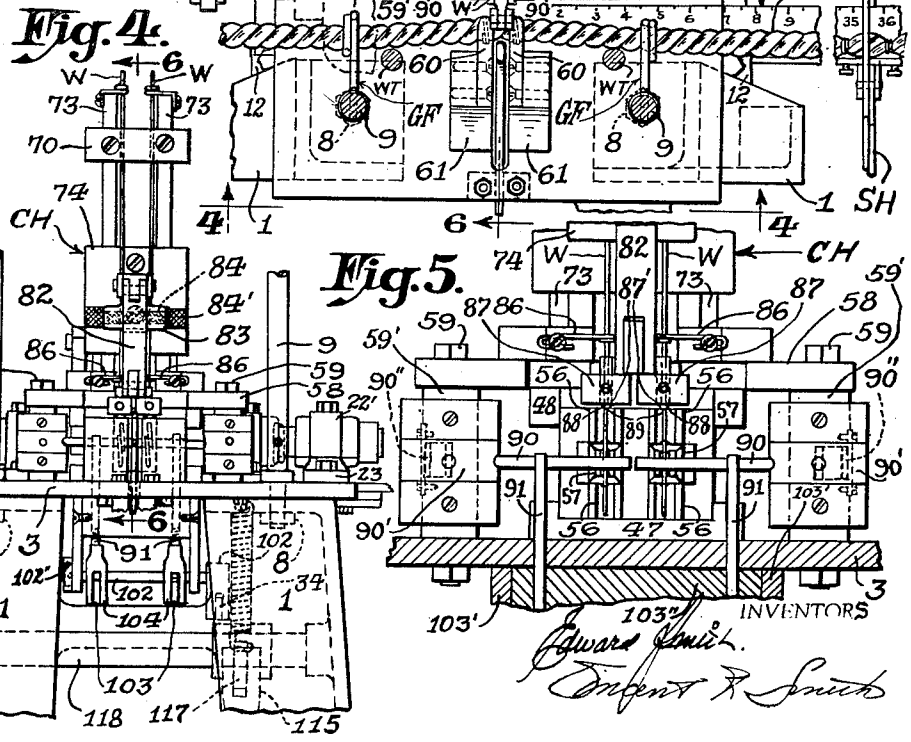
Vincent R. Smith

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STAPLING AND RING FORMING MACHINE

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Fig. 6.

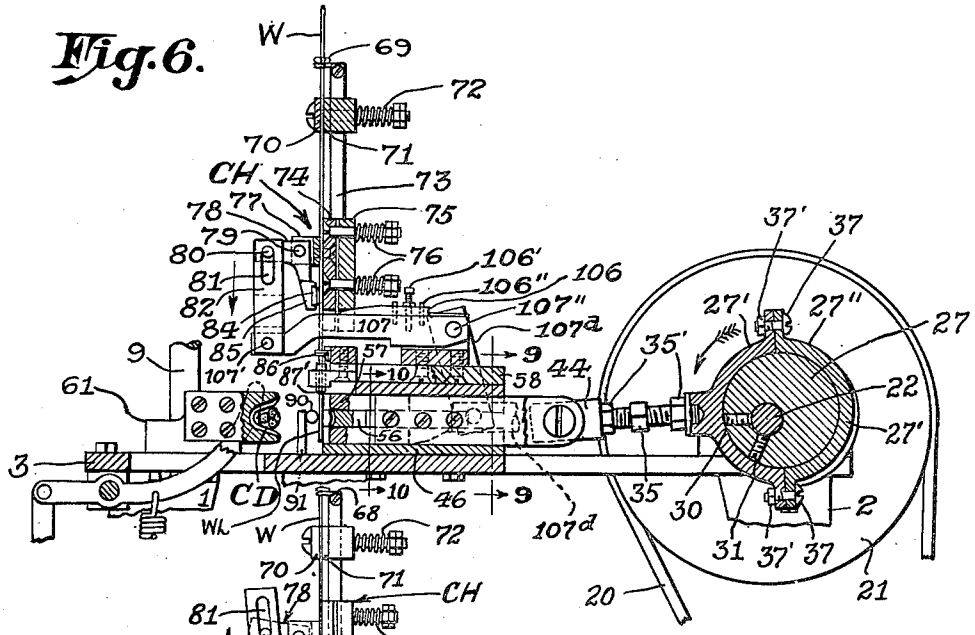


Fig. 7.

Fig. 8.

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Fig. 9.

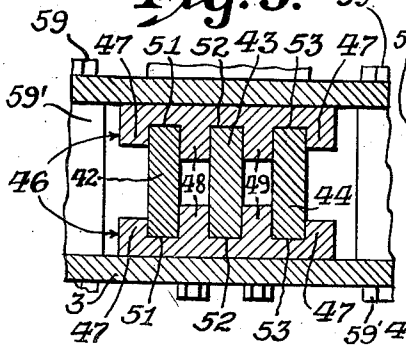


Fig. 10.

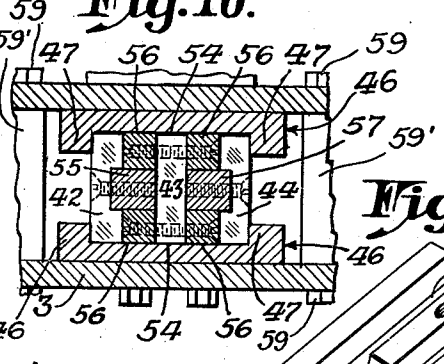


Fig. 11.

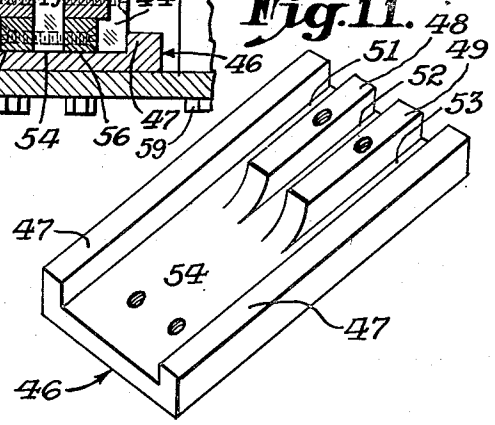


Fig. 13a.

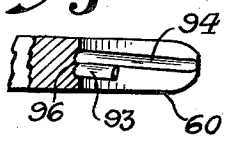


Fig. 13.

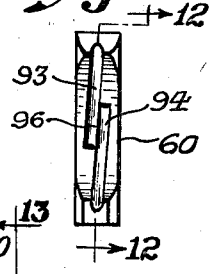


Fig. 12.

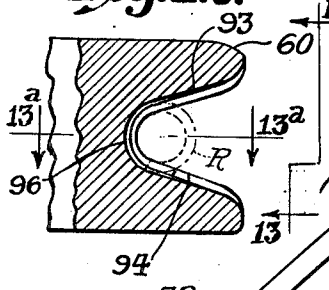


Fig. 14.

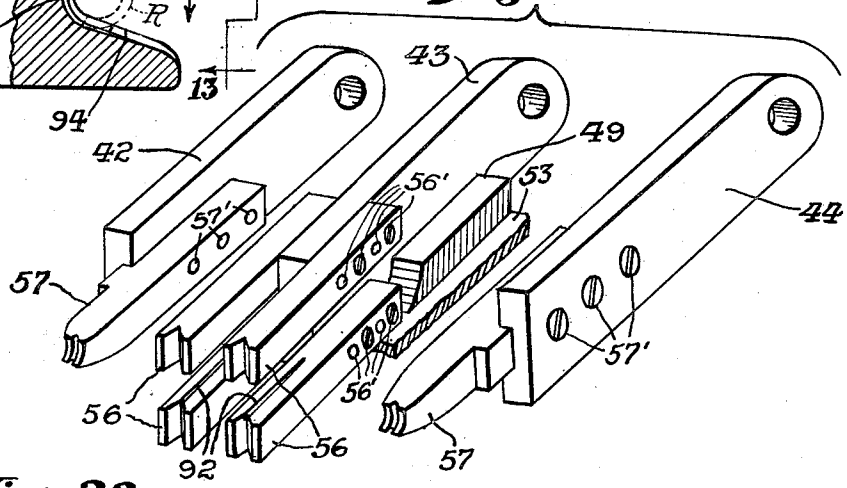
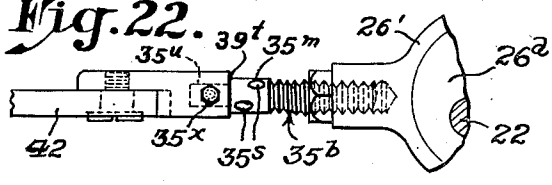


Fig. 22.



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Sept. 20, 1938. E. J. SMITH ET AL 2,130,779

STAPLING AND RING FORMING MACHINE

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Fig. 15.

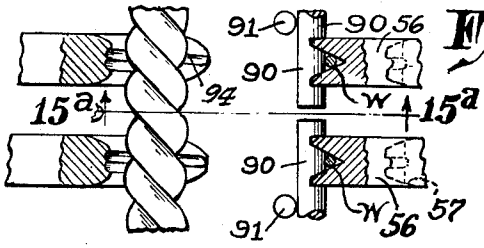


Fig. 15a

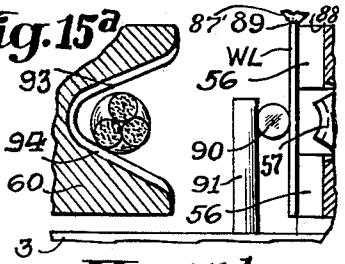


Fig. 16.

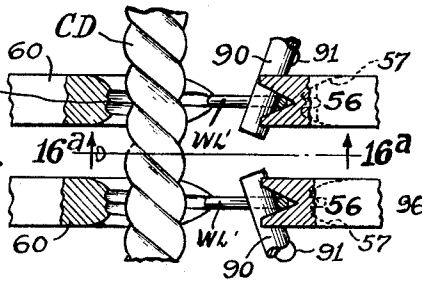


Fig. 15b.

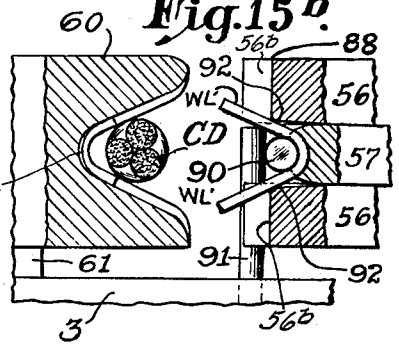


Fig. 17.

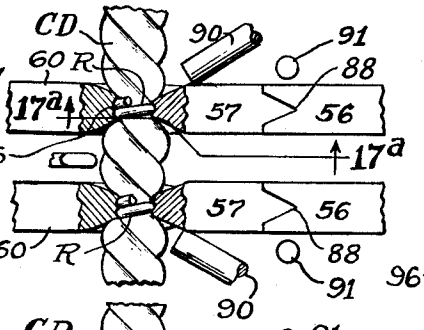


Fig. 16a.

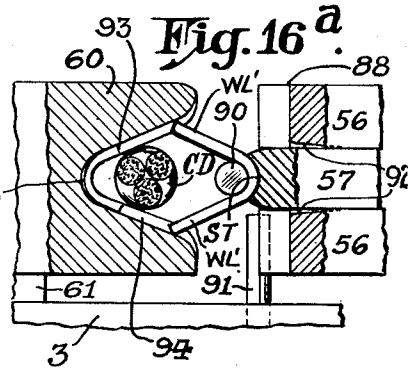


Fig. 18.

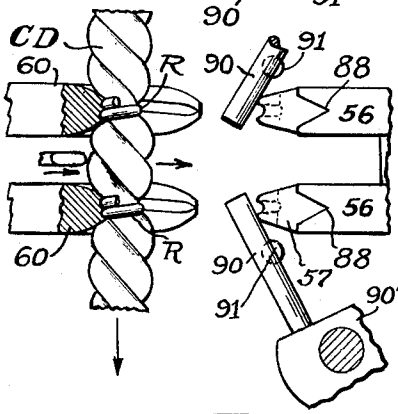


Fig. 17a.

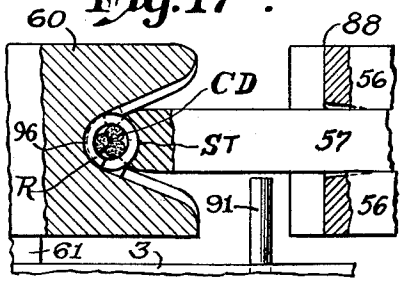


Fig. 19.

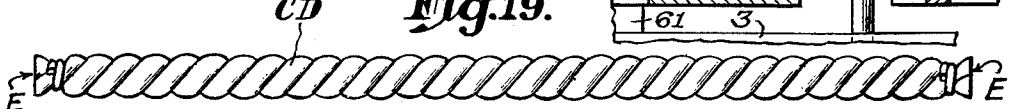


Fig. 20.

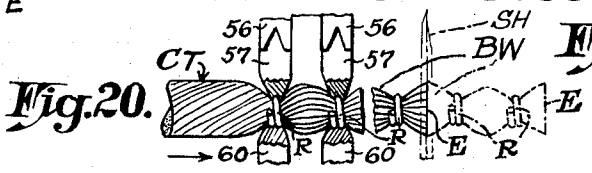
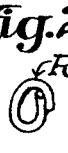


Fig. 21.



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Patented Sept. 20, 1938 2,130,779

UNITED STATES PATENT OFFICE

2,130,779

STAPLING AND RING FORMING MACHINE

Edward J. Smith and Vincent R. Smith,
West Norwood, N. J.

Application May 6, 1937, Serial No. 141,063

8 Claims. (Cl. 140—93)

Our invention relates to a wire stapling and ring forming machine, particularly to a duplex or multiplex type, and the method of simultaneously feeding a required length of wire from each of two individual reels, for simultaneously cutting the wire and forming the cut wire lengths into two separate rings for binding twisted or warped cordage, cotton twist, or for similar purposes, in any desired manner, such as the binding of cord ends to keep them from raveling, unweaving or untwisting, or for binding cord folds or doubling of cordage, or for binding twist cotton warps for making tuft balls.

One of the salient features of our invention is the elimination of irregular cam members, whereby all the duplicate method steps of the staple and ring forming operations are actuated by a certain piston mechanism, comprising, in combination, a plurality of eccentrics arranged upon a driven shaft, each adjustable independently of the other, for the correct timing of their respective functions, and through slotted parts connecting therefrom, for the correct pausing time provided for the progressive steps of the wire cutting, staple and ring forming, and the return movement of the dies for the next cycle of cutting the wires for the stapling and ring forming operations, the operator using a foot-pedal for a kick-off mechanism, which allows for the measuring of the required length of cordage for binding in the next cycle of operations.

Another salient feature of our invention is, the unique wire feeding mechanism, whereby two wires are drawn under tension from separate wire reels, each wire being fed accurately and simultaneously to the required length of wire for centering to the anvil forming the staple, the wire feed being actuated by a slidable cross-head provided with a wire gripper having a round file-like surface tangently engaging a flat similar surface upon the front plate of the crosshead which is operated through a connecting rod to one of the eccentrics.

Another salient feature of our invention is the swiveled anvils which assist in forming the staple, and its locking arrangement comprising a stub-rod or pin holding the anvil when the forming dies force the free ends of the cut wires over each anvil into the form of a staple, and as each of these staples moves into the stationary female dies provided with converging grooves, wherein the free ends of each staple engage for looping into a ring around the cordage, the stub-rod unlocks itself for the swiveling of the anvils which continue to hold the wires during the staple forming operation, and during the looping operation the anvils swing out clear from the forming dies while the rings are being formed around the cordage, and after the binding of these rings, the dies recede to their normal positions, and the anvils return also to the next forming operation under tension of a flat spring set in a slotted portion of the bearings of each anvil, the springs being secured onto a fixed post in the rear of each anvil.

Another important feature of our invention is the interlocking arrangement of all the moving dies, which are secured by screws to the piston-bars pivotally connected to adjustable connecting rods of the eccentrics upon the drive shaft, thus providing an interchangeable arrangement for using the right forming dies for the variable sizes of cordage, either hard or soft twisted, the binding rings to be measured to the exact length of the cut wires, however, one set of forming dies may enable the stapling and forming rings within one or two close sizes, this to be within a small fractional part of an inch, for example about one-sixteenth of an inch. Where the cordage is of wider range of differences, a separate set of dies are required, which is conveniently done by disconnecting the piston-bars where pivotally connected, and remove the top plate holding the dies interlocked, which allows for the replacement.

Other features of our invention will appear as the description proceeds in the following specifications, accompanied by the annexed drawings, in which:

Figure 1 is a view in front elevation of our duplex wire stapling and ring forming machine.

Figure 2 is a view in elevation of the left side of the same machine as shown in Figure 1.

Figure 3 is a plan view on an enlarged scale of the top portion of the same machine, taken on line 3—3 of Figure 1, additionally showing the cord being fed through guide-holders.

Figure 4 is a fragmentary view of the front of Figure 3, taken in the direction of the arrows 4—4, the cord being omitted.

Figure 5 is an enlarged view of that portion having the wire feeding mechanism, and the anvil locking mechanism, taken in the direction of the arrows 5—5 of Figure 3.

Figure 6 is a longitudinal section taken on line 6—6 of Figure 4, illustrating the wire feeding mechanism in a side elevation of that shown in Figure 5, also showing the eccentric driving arrangement for the reciprocating rectilinear mo-

tion of the forming dies for the stapling, wire cutting, and ring forming operations.

Figure 7 is a similar view in section, of the subsequent operation in the twin forming operation of the staples and rings around the cordage.

Figure 8 is a similar view in section, showing the final operation of the male and female dies forming the staple into a ring around the cordage.

Figure 9 is a fragmentary cross sectional view through the die members and the piston-bars, on line 9—9 of Figure 6.

Figure 10 is a similar view showing the interlocking arrangement of the same piston-bars and die members, taken on line 10—10 of Figure 6.

Figure 11 is a perspective view of one of the guide or bearing plates, both upper and lower plates being the same, and interlocking the piston-bars and die members as shown in Figures 9 and 10.

Figure 12 is an enlarged sectional view taken on line 12—12 of Figure 13, showing the converging grooves of one of the female dies.

Figure 13 is a front view looking into the converging grooves of the same female die, as indicated by arrows 13—13 of Figure 12.

Figure 13a is a transverse sectional view of the same female die shown in Figure 12, taken on line 13a—13a.

Figure 14 is an exploded view, showing in perspective the piston-bars and die members, there being a right and left male die secured to their respective piston-bars, each one the duplicate of the other, which interlock in between the wire cutting and forming dies for the staples and rings, there being a double set of dies, or four secured to the intermediate piston-bar.

Figure 15 is a full size plan view of the dies in their first method step of cutting the required length of wire for the particular size staple and ring to be formed, and shows the anvils locked by stub-rods or pins during this wire cutting operation and the initiative bending of the free ends of the cut wire into the staple form.

Figure 15a is a vertical sectional view of Figure 15, taken on line 15a—15a.

Figure 15b is a similar vertical sectional view as Figure 15a, but with the next step of the bending of the free ends of the cut wires into the staple form, the stub-rods or pins having moved out of their locking position from the anvils.

Figure 16 is a plan view similar to Figure 15, showing the next method step of the free ends of the cut wire now engaging the ring forming grooves of the duplex female dies.

Figure 16a is a vertical sectional view taken on line 16a—16a of Figure 16.

Figure 17 is similar plan view to Figure 16, showing the next method step, showing one of the male dies forming the free ends of one of the staples into a ring, which binds tightly the cordage as shown.

Figure 17a is a vertical sectional view taken on line 17a—17a of Figure 17.

Figure 18 is a similar plan view to Figure 17, showing the next and final operation, the forming dies having receded, and the bound cordage ready to be pushed out from the female dies wherein the wire ends WL' of both rings R may bind snugly in grooves 93 and 94, thus allowing the cordage to be drawn along for the next stapling and ring binding operation.

Figure 19 shows the finished severed section of the cordage, either soft or hard twisted, binded by the stapled rings at each end thereof, thus preventing raveling or untwisting of strands by the rings formed tightly around the cord, as herein before described in their progressive method steps of forming, the cord being cut in between the twin rings by shears or otherwise, as shown in Figure 3.

Figure 20 is an alternative diagrammatic view of the female dies and staple and ring forming dies forming two rings simultaneously around cotton twist cordage, and cut as shown in dotted lines, providing a similar method as the duplex stapling and ring forming operations herein before described, for warps of short lengths for tuft balls.

Figure 21 is a perspective of the ring formed in preceding method step operations described, with the cordage omitted, for the convenience of illustration.

Figure 22 is a modification of one of the eccentric adjustable connecting rods.

Figure 23 is a sectional plan view on line 23—23 of Figure 1, showing the foot-pedal working in combination with a cutting machine.

Referring to the drawings, the description of the progressive Figures 1 to 21, inclusive, have been more fully described than is usually the requirement, in order to bring out the careful detail operation of the method steps in the making of the wire staples and rings in duplex formation, and now we will describe the machine that provides for this twin or multiple stapling and ring binding around cordage or the like, in which the numeral 1 designates the front frame member, and 2 indicates the rear frame member, being secured to the bed-plate 3, and braced by tie-rods 4 and 5 and secured by lock nuts 6, the bed plate 3 being removable and replaceable from and upon, respectively, by lock nuts 7 and 8, the bed-plate 3 carrying most of the complete operative parts, later to be described, which provides quick assembling and less dismantling of parts usually the case where the frame has mounted thereon half of the parts.

Referring to Figures 1 and 2, the upright posts or standards 9 carry the wire reels 10, having a grooved collar 10' secured to each, and a wire 10'' fixed at 10a to the posts 9, fits around the grooved collar with a weight WT at the end thereof, thus providing a suitable tension for the wire W when feeding from the reel 10. A wire shock absorber by a bracket 11 having a yielding coil spring 11', or the like, with a loop 11'' therewith for the wire to pass through, and further through guides 11b prevents any shift in the wires W when being fed, due to any vibration or shock from the operating machine.

An electric motor M is mounted upon the supports 12 and secured by bolts 13 to the braces or tie-rods 4 and 5, the motor being operated by the cable C, through the switch S, as shown on upper part of the frame member 1, or may be upon the motor M if so desired. The switch S connects to any suitable source of current supply through the line wire-cable L. The motor M operates all operating parts through the power of drive shaft 14, drive pulley 15, belt 16 to large pulley 17 keyed to the countershaft 18 set in the bearings 18a and held by collars 18b, this countershaft driving a small pulley 19, or the pulleys 17 and 19 may be secured together and rotate upon the shaft 18, this is optional. The pulley 19 drives a belt 20 to the fly-wheel 21, which is adaptable to be a driven or as a free pulley by the shaft 22, later to be described. The motor M is operating at 1,750 R. P. M., approximately, so in order to have the right timing speed for the

stapling and ring forming operations, and the wire feeding and cutting operations, the reduction accomplished through the drive herein before described, is sufficient for an operative machine, either in an automatic feed for the cordage or in cycles as will be later described.

The shaft **22** is rotatable in removable bearings **22'** on blocks **23**, secured by bolts **22''** to the bed-plate **3**, and has a fly-wheel **24** for counterbalancing the operative parts at the other end of the shaft **22**. The bed-plate **3** has an opening or is cut out as at O, for operating thereat, a plurality of eccentrics **25**, **26**, **27**, **28** and **29** (see Figures 3, 6, 7 and 8) which are keyed to the shaft **22** by set screws **30** and **31**, or otherwise, and rotatably fitted about the periphery of all the eccentric discs **25ª**, **26ª**, **27ª**, **28ª**, **29ª**, and are removable by split straps **25'**, **26'**, **27'**, **28'** and **29'**, secured by screw-bolts **37** and nuts **37'**, to the caps **25''**, **26''**, **27''**, **28''** and **29''**. The straps are connected to adjustable connecting rods **30**, **31**, **32**, **33** and **34**, having a right and left screw threaded portion **35**, locked by nuts **35'**. The connecting rods **31**, **32** and **33** are pivotally connected at **38**, **39** and **40**, to the piston-bars **42**, **43** and **44**, slidable in upper and lower bearing and guide plates **46**, provided with side walls **47** and intermediate walls **48** and **49** for the guideways or bearing channels **51**, **52** and **53**, which continue into a non-walled portion or channel **54**, which allow for the full assembly of the interlocking and co-acting die members **56** and **57**, each having a vertical V shape groove section, and which are in duplicate sets, both the plates **46** and **47** being secured by top plate **58** and bolts **59**, spacers **59'**, to the bed-plate **3**. This provides an interchangeable die assembly, in which the screws **56'** and **57'** provide the replacement of any particular die member for another, without dismantling any other of the operating parts of the machine, this replacement being made through the pivotal connections **38**, **39** and **40**, and removing the top plate **58**.

The die members **56** are to be known as the wire cutting and stapling forming dies, and the die members **57** are to be known as male stapling and ring forming dies, operating into the female stationary dies, indicated at **60**, both of which are secured to blocks **61** mounted on the bed-plate **3**. All of these forming dies **56**, **57** and **60** are in duplicate, that is, there are two sets of forming dies to make two wire rings simultaneously in one cycle of operations, as clearly shown on the drawings, and herein before described. It is to be understood, we may provide more sets of dies to produce more than two binding rings at the same time, such as in short lengths of warps BW of cotton twist CD for making tuft balls, this as shown in Figure 20. We have shown two rings in this Figure 20, the same as we have shown in the cord end stapling and ring forming operations of this duplex die formation, as herein before described. But we can provide any number of forming die sets in making any multiple number of rings, if so desired, without very little change in our present machine.

Referring to the Figures 6, 7 and 8, which are shown in a middle or central section, as on line **6—6** of Figure 3, the two wires W are being fed from the reels **10** (see Figures 1 and 2) into wire guides **69**, and guide plates **70** and **71**, held in compression by springs **72** onto the post **73**. Slidable upon the posts **73** is a crosshead CH having divided plates **74** and **75** held in a slight binding tension or friction upon posts by springs **76**. Mounted upon the plate **74** is a bracket **77** having one arm pivoted at **80** in a slot **81** of a link **82** and the other arm **83** is provided with a fine file-like surface **84** in the wing spread portion **85** (see Figure 4) for a positive gripping tangently, both of the wires W simultaneously upon the similar fine file-like surface **84'** which may be flat, of the cross-head CH, to draw down the required length of wire for the cutting operation, each of the wires passing through further wire guides **86**, and then through the stationary or fixed cutting dies **87**, which are pointed like at **87'**, to meet the cutting edge **88** of the moving dies **56** (see Figure 15ª).

In Figure 6, the duplex wire cutting and stapling forming dies **56** move forward cutting off the wire lengths WL, also shown clearly in Figure 15ª at **89**, each wire length WL being exactly one-half above the center of the anvils **90**, also to be known as anvil rods **90**, which rotate or swivel on separate bearings **90'**; the anvils being held in a temporary locking position by stub-rods or pins **91**. When the male stapling and ring forming dies **57** move forward into the stapling position, (see Figures 7, 15ᵇ, and 16) the locking pins **91** move out of the way of the swinging anvils **90**, shown clearly in Figures 16 and 16ª, the male dies **57** have a curved channel portion to conform to the diameter of the anvils, plus the thickness of the wires to be stapled as at WL' in Figure 16ª, and the forming dies **56** now move forward and press the free ends WL of each wire length into the staple form, a sunken groove portion **92** engaging the free ends of the wires during the stapling operation, and guide them into engagement with the converging grooves **93** and **94** of the stationary female dies **60**, shown in Figure 16ª.

In Figure 8, the cutting and staple forming dies **56** have receded, but the male forming die continues to bear on the staples at ST, (also see Figures 17 and 17ª) after the anvils **90** swing clear as shown in Figure 17, after which the next step of forming the rings now takes place, the converging grooves **93** and **94** divert so that the free ends WL' of the wires or staples slide by each other and form into the ring as shown in Figure 21, the convexed walled portion **96** in between the grooves **93** and **94** providing for this ring forming operation, the ring R as shown in Figure 21, being bound around the cordage CD, as shown in Figures 17, 17ª, 18 and 19.

In Figure 8, the anvils are shown operated by the eccentric **29**, connecting rod **34**, slotted at **100** to receive a pin **101** of a link **102** pivoted on the shaft **103**, set in side plates or bearings **103'** secured to the block **103''** on the bed-plate **3**. Two levers **104** pivoted in a slot **104'** to each yoke **105**, have extended therefrom locking or holding pins or stub-rods **91**, which extend through the block **103''** and are slidable therein, a coil band spring **102'** holding unlocked the pins **91** during pausing time of rod **34**.

It is to be noted that an adjustment plate **106** is set by a screw **107**, as shown best in Figures 6, 7 and 8, for the setting of the travel of the crosshead CH to either move higher or lower depending whether the cut wire lengths WL are to be increased or decreased, and for centering same on the anvils exactly half and half. This plate is adjusted at **106'** by a set screw **106'** and two dowels or pins **106''** set in the crosshead lever **107**, which is pivoted at **107'** to the link **82**, and fulcrumed at **107''** to the link **107ª** which is pivoted to a bearing block **107ᵇ**, extending

through a slot 107c, in the top plate 58, the link 107a connecting pivotally to a connecting rod 107d of the eccentric 25.

A foot-pedal 108 operates a short lever 109 mounted upon a shaft 110 arranged in bearings 111 on the frame 2, and an adjustable extension rod 112 having a yoke 113 pivoted at 114 to the lever 109, connects to a similar yoke 115 pivoted at 116 to a lever 117 having a spring 117', the lever being secured upon the shaft 118, operating a trip lever 119 provided with a beveled or wedged end portion 120 to engage a similar wedged portion at the end of a trip-pin 121, for releasing a key-pin 122 in engagement with one of the spaced holes 123 in the hub 124 of the fly-wheel 21, which is loosely mounted upon the shaft 22.

In operation, the eccentrics 25, 26, 27, 28 and 29 secured to the shaft 22 by set screws 30 and 31, are set in motion through the motor M, when the operator steps on the foot-pedal 108, which actuates the trip-off mechanism, herein before described, which throws out the trip lever 119, as shown in dotted lines in Figure 2, thus allowing the clearance of the trip-pin 121 to rotate, at the same time, the spring 125 compressing from the fixed collar 125' to the slidable collar 126, forces the co-acting key-pin to slide in its bearing in the collar 127 keyed to the shaft 22 by the set screw 128, thereby engaging the key-pin into one of the spaced holes 123, whereby all the eccentrics 25, 26, 27, 28 and 29 start their die operations, such as the wire cutting, staple forming and ring forming in their respective order for the binding of the cordage CD, or other suitable material to be bound. After one cycle of operations have been completed, the beveled or wedged end of the trip-pin 121 has rotated once around and re-engages the beveled or wedged end portion of the trip lever 119, held in the re-engagement position by a spring 117' of the lever 117, whereby the trip-pin and trip lever become locked, the beveled faces on each throwing, wedging, or sliding out the clutch-like collar 126 with its secured key-pin 122 from its locking position in one of the spaced holes 123 of the hub of the fly-wheel 21, whereby the eccentrics 25, 26, 27, 28 and 29 now become in-operative until the next cycle of operations are started by the operator stepping on the foot-pedal, in the meantime, the motor M is always in running or operation, the fly-wheel pulley 21 rotating only as a loose pulley, free from any driving engagement with the operating mechanism for the wire feeding, cutting, stapling and ring forming operations, until set in motion through the foot-pedal 108 or by an automatic device we may adopt for this purpose. We may adopt an automatic feed attachment for feeding the cordage CD, and if so, it will synchronize with the wire cutting operation or at the first step operation or time to suit, if such is desired, it will of course necessitate a separate application, but it is to be understood that while this automatic feed is adaptable for our duplex operations, fast work is accomplished by the foot-pedal arrangement, and the variable lengths required of cordage to be bound, is easily measured by the ruling arrangement as shown at MS in Figure 3, with adjustable cutting shears disc or the like SH and SH', placed whereat the desired length of cordage is to be cut between the bound rings.

The slot in the link 82 (see Figure 6) allows for the required pause in the wire feeding mechanism, so the travel of the cutting dies co-ordinate in the correct timing for the cutting of each drawn wire by the wire gripper on the crosshead CH, and the movement of the cutting and staple forming dies, and the slotted portion 100 in the connecting rod 34 is for a similar time pause during the anvils locked position, clearly shown in Figure 8. The pivot 80 as shown in Figure 6 corresponds to the pivot 101 when the end 100a of the slot 100 and the pivot 80 is at the other or lower part of the slot 81, corresponds to the position of the pivot 101 in Figure 8, when the anvils are unlocked from their locking stub-rods or pins, as shown clearly in Figures 15a, 15b and 16a, of the initiative staple bending operations of each cut wire lengths.

In Figure 22, (see Sheet 4) we have shown a modification of a much preferred form of each of the adjustable connecting rods 31, 32 and 33, for example 31 and 33, whereat the adjusting screw 35b is provided with a collar portion 35m having holes 35s, and shouldered at 39t for a bearing 35u, so as to adjust the staple and ring forming dies 57 closer to the female stationary dies 60 for making a tighter or closer fitting ring R binding the cord CD. The same would apply to the connecting rod 32 which actuates the combined double set unit of wire cutting and staple forming dies 56. This adjustment is accomplished by unscrewing the set-screw 35x and inserting a rod-pin into the holes 35s and turning to suit and resetting the set-screw 35x onto the bearing 35u when adjusted.

In Fig. 23 we have shown a part sectional plan view, taken on line 23—23 of Figure 1, which illustrates the foot operating mechanism for the cycling of all operations in the making of the staples and rings in our twin-like or duplex formation, as herein before described. The foot-pedal 108 is connected to arm members 108b which are pivoted on the shaft 110, so as to actuate the short lever 109 and to the connections to the tripping mechanism, previously described. This foot-pedal 108 is extended, as shown in Figure 23, to a cord cutting machine CM, which is set alongside of our duplex staple and ring forming machine, whereat the operator stands feeding the cord along at the required length, and as each twin stapled rings R is drawn by the operator in front of the cutting knives or discs SH, the cord is cut in between the rings R, completing the severed ends E, as shown by dotted lines in Figure 20, to prevent raveling, untwisting or unweaving of the material strands. This cutting operation of the cord as above described is done at the same time the stapling and ring forming operation is done on our machine, one cutting operation to each cycle of ring binding in duplex formation, with the same foot-pedal 108 operated simultaneously.

In Figure 2, a rod or bar 140 is pivoted at 141 to a crescent or curve shaped lever 142 fulcrumed at 143 to a bearing 144 secured by screws or bolts 145 to the bed-plate 3. The curved lever 142 is counterbalanced by a spring 146 fixed to the frame 1 as shown, and another spring 117' serves the same purpose on the short lever 117, when the foot-pedal 108 is operated, the lever 142 moving out, as shown in the position in Figure 8, during the twin stapling and ring binding operations around the cord CD, after which the foot-pedal 108 returns to its neutral or in-operative position, as shown in Figures 1 and 2, at which time the lever 142, now moves in between the female dies 60 and pushes out the cord CD and the bound rings R thereat, which sometimes might bind themselves into the converging

grooves of the female dies, these grooves **93** and **94** having a ridge or incurved middle wall section **96**, approximately or slightly high enough to allow the free ends WL' of the staple ST as being formed thereat by the male dies **57**, as shown in Figures 16, 16[a] and 17, to pass each other in their ring binding formation. The cord feeders or guides GF secured to the upright posts or standards **9**, as shown clearly in Figures 2 and 3, provide a proper position for the cord to engage the female dies **60** when the staple and ring forming dies move the cord into the binding operation, these cord feeders being shown in Figures 2 and 3. In Figure 14, a channel **56[b]** is shown for engaging the free ends WL' of the staple also shown in Figure 15[b].

It is to be understood that our duplex stapling and ring forming machine may be adaptable to any use other than described, whereby two staples are formed at the same time in the same manner as hereinbefore described, in which it is notable that no cams are used in our construction or operations, as thick cams with heavy long levers and rollers, and gearing, are all eliminated in our new duplex design, whereby we provide a plurality of eccentrics, each independently operative and adjustable of the other, but all fixed onto a rotatable shaft, and operated by a drive pulley-fly-wheel when in clutch with a clutching member, or inoperative when out of clutch, as previously described. Our eccentric mechanism enables a simple, inexpensive and accessible machine, interchangeable for different sizes of dies for the required size of the wire ring binding operation.

The foregoing specification has particularly described the duplex stapling and ring forming operations, but it is to be understood that similar operations may be for only a single stapling and ring forming machine, and it is quite obvious that our duplex type gives double production, and this would be further increased by three, four or more rings being formed around the warp or cord, during one cycle of operations. By merely cutting in between the rings of the short length warps, tuft balls are produced in greater production. Our piston mechanism with the eccentrically driven disc members, and their quick adjustment to provide the correct wire cutting, stapling and ring operations, is our main salient feature, however, the same operative parts in their respective functionings, may be operated by a different driving mechanism, and therefore, we claim any means, or alterations, may be adopted in the operative parts of our invention, that may come within the scope of the drawings, the description thereof, and in the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is as follows:

1. In a stapling and ring forming machine of the character described, the combination of power means, piston mechanism operated thereby, movable wire cutting and stapling dies intermittently actuated by said mechanism, said dies being provided with V-shaped grooves, stationary female ring forming dies having converging grooves co-operating with said movable dies, movable male dies interposed between said stapling dies, wire shock-absorbers, wire guides, wire grippers and fixed cutting dies through which individual wires are fed from separate reels into a vertical position for a required length by said power means, anvils backed in a horizontal position, said means unlocking and swinging said anvils free of said movable stapling and male dies during the stapling and ring forming operations into said stationary female dies and binding the rings around a cordage fed horizontally therewith.

2. In a stapling and ring forming machine of the character described, the combination of power means, an eccentric-piston mechanism operated thereby, movable wire cutting and stapling dies intermittently actuated by said mechanism, said dies being provided with V-shaped grooves, stationary female ring forming dies having converging vertical grooves adaptable for co-operating into engagement with said movable wire cutting and stapling dies, movable male ring forming dies interposed between said stapling dies, wire shock-absorbers, wire guides, wire grippers and fixed wire cutting dies through which the individual wires are fed from separate reels into a vertical position for a required length by said power means, anvils backed in a horizontal position, said means unlocking and swinging said anvils free of said movable stapling and male dies during the stapling and ring forming operations into said stationary female ring forming dies and binding rings around a cordage fed horizontally therewith.

3. In a stapling and ring forming machine of the character described, the combination of power means, eccentric-piston mechanism operated thereby, movable wire cutting and stapling dies provided with staple forming grooves, a male ring forming die interposing between said wire cutting and stapling dies, a female ring forming die having converging grooves co-operating with said movable wire stapling dies, said power means adaptable to feed wire from a reel to and through a shock-absorber, wire guide and wire grippers to a fixed wire cutting die, an anvil normally locked in between said movable and stationary dies, said power means feeding said wire to a required wire length through and above said fixed wire cutting die for said movable cutting and stapling dies to cut said wire and form same into a staple onto said locked anvil, said means further unlocking and swinging said anvil free of said movable dies during the ring forming operation into said stationary female die and binding a ring around a warp-cordage fed therewith, for the production of tuft-balls.

4. In a stapling and ring forming machine of the character described, the combination of power means operating a plurality of adjustable eccentric driving members provided with removable split-strap members each of which has secured thereto an adjustable connecting rod pivotally secured to slidable piston-bars one of which carries movable wire cutting and stapling dies and the other carrying a movable male ring forming die interposing in between said stapling dies, a stationary female ring forming die having converging grooves co-operating with said stapling and male ring forming dies, said power means adaptable to feed wire from a reel to and through a shock-absorber, wire guide and wire grippers to a fixed wire cutting die, an anvil normally locked in between said movable and stationary dies, said power means feeding said wire to a required length through and above said fixed wire cutting die for said movable cutting and stapling dies to cut said wire and form same into a staple onto said locked anvil, said means further unlocking and swinging said anvil free of said movable dies during the ring forming operation into said sta-

tionary female dies and binding the rings around a cordage fed therewith.

5. In a stapling and ring forming machine of the character described, the combination of power means, a group of eccentric driving members independently and adjustably secured upon a driven shaft operated thereby, said group of eccentric members through a piston mechanism adaptable for actuating piston-bars slidable in fixed bearings, said piston-bars provided with movable wire cutting and stapling dies and a movable male ring forming die interposed between said stapling dies, stationary female ring forming dies having converging grooves, one of said eccentric members adaptable to operate a wire feeding mechanism comprising a slidable crosshead which actuates wire grippers whereby a required length of wire is fed from separate reels to and through shock-absorbers and guides to fixed cutting dies, anvils back in a horizontal position, said means operating one of said eccentric members for actuating said wire cutting and stapling dies to cut each required length of wire against said anvils and form the staples thereon, said means unlocking and swinging said anvils free of said movable stapling and male dies during the stapling and ring forming operations into said stationary female dies and binding the rings around a cordage fed horizontally therewith.

6. In a stapling and ring forming machine of the character described, the combination of power means, a group of eccentric driving members independently and adjustably secured upon a driven shaft operated thereby, said group of eccentric members through a piston mechanism adaptable for actuating piston-bars slidable in fixed bearings, said piston-bars provided with movable wire cutting and stapling dies and a movable male ring forming die interposed between said stapling dies, stationary female ring forming dies having converging grooves, one of said eccentric members adaptable to operate a wire feeding mechanism comprising a slidable crosshead which actuates wire grippers whereby a required length of wire is fed from separate reels to and through shock-absorbers and guides to fixed cutting dies, anvils back in a horizontal position, said means operating one of said eccentric members for actuating said wire cutting and stapling dies to cut each required length of wire against said anvils and form the staples thereon, said means unlocking and swinging said anvils free of said movable stapling and male dies during the stapling and ring forming operations into said stationary female dies and binding the rings around a cordage fed horizontally therewith, means for cutting said warp cordage in between and adjacent said rings.

7. In a stapling and ring forming machine of the character described, the combination of power means, an eccentric-piston mechanism operated thereby, movable wire cutting and stapling dies intermittently actuated by said mechanism, said dies being provided with V-shaped grooves, stationary female ring forming dies having converging vertical grooves adaptable for co-operating into engagement with said movable wire cutting and stapling dies, movable male ring forming dies interposed between said stapling dies, wire shock-absorbers, wire guides, wire grippers and fixed wire cutting dies through which the individual wires are fed from separate reels into a vertical position for a required length by said power means, anvils backed in a horizontal position, said means unlocking and swinging said anvils free of said movable stapling and male dies during the stapling and ring forming operations into said stationary female ring forming dies and binding rings around a cordage fed horizontally therewith, with further means to operate a foot-pedal actuating a trip-lever out of a locking position with a trip-pin and a biased spring controlled collar having a key pin extending through a fixed clutch member into locking engagement with a loosely mounted fly-wheel pulley upon said driven shaft operating all of said eccentric members secured thereon, whereby all of said members and movable dies are now operative until said trip-lever moves into engagement with said trip-pin thereby forcing said biased collar and its co-acting key pin out of locking engagement with said fly-wheel pulley whereby same rotates loosely upon said driven shaft thereby making inoperative all of said eccentric members and movable dies until an additional length of warp-cordage is fed for each successive cycle of wire stapling and ring forming operations around said warp cordage.

8. In a stapling and ring forming machine of the character described, the combination of power means operating independently adjustable eccentric driving members actuating piston-bars provided with co-acting wire cutting, stapling and male ring forming dies adaptable to move into cooperation with stationary female ring forming dies for feeding intermittently a required length of wire from separate reels through wire shock-absorbers, wire guides, wire grippers, into a vertical position between said wire cutting, stapling and male ring forming dies and said stationary female ring forming dies, anvils backed in a horizontal position, said means unlocking and swinging said anvils free of said stapling and ring forming dies during the stapling and ring forming operations into said female dies and binding the rings around a cordage fed horizontally therewith.

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