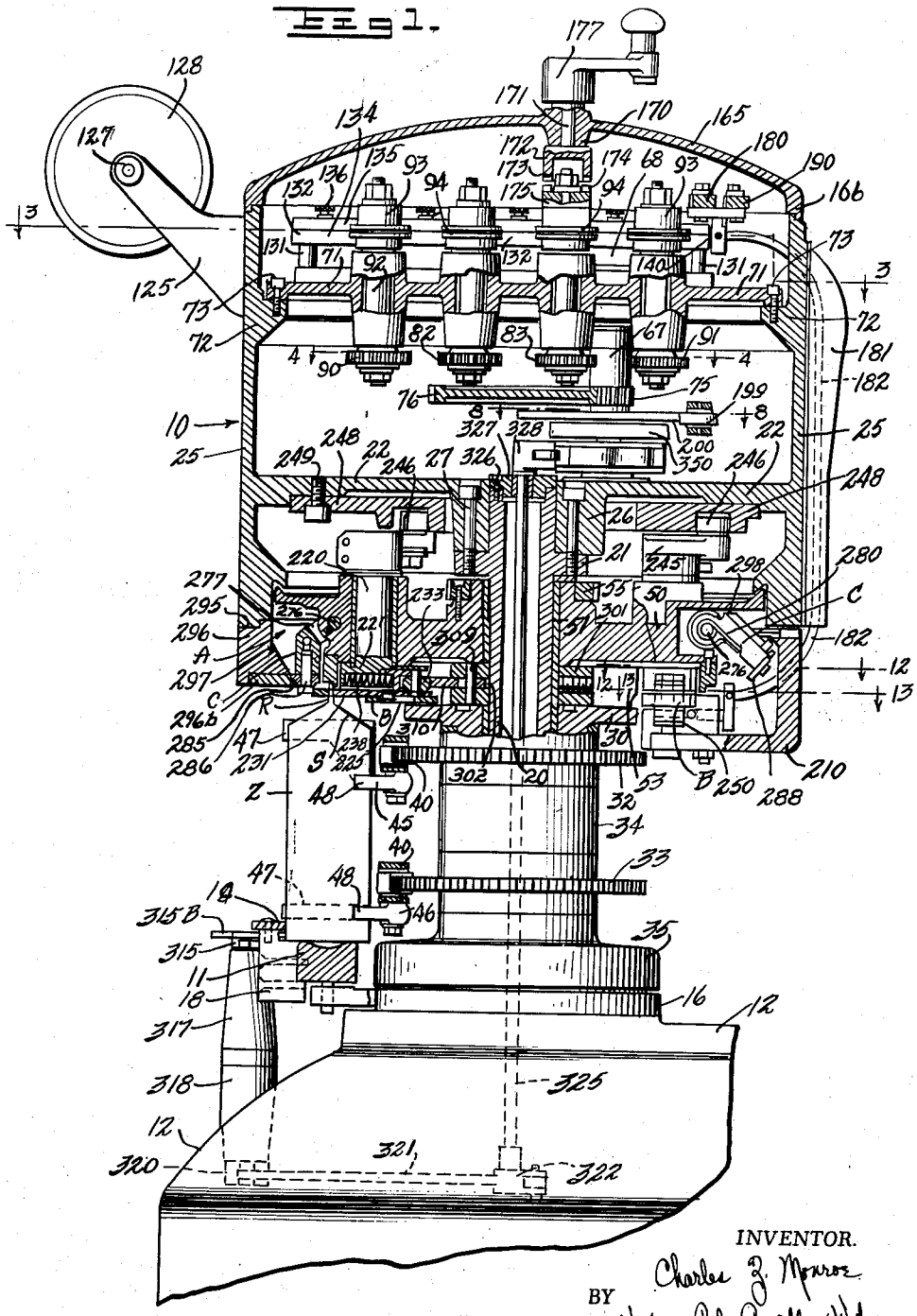
Dec. 1, 1953 C. Z. MONROE 2,661,032

WIRE FEED FOR STAPLING MACHINES

Filed April 21, 1949 5 Sheets-Sheet 1

Fig 1.



INVENTOR.

BY Charles Z. Monroe

Watson, Cole, Grindle & Watson

ATTORNEYS

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WIRE FEED FOR STAPLING MACHINES

Filed April 21, 1949 5 Sheets-Sheet 2

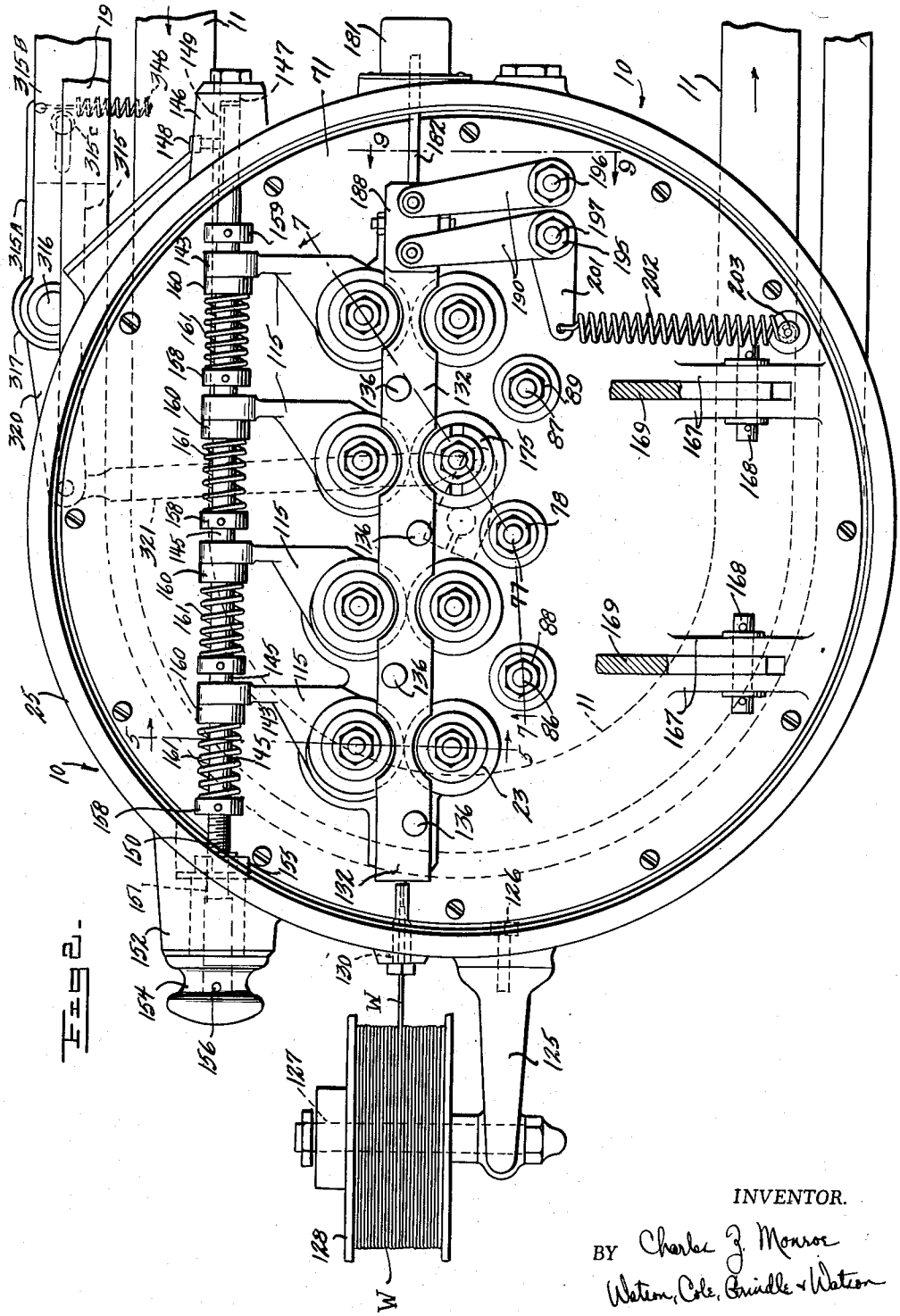

FIG. 2.

INVENTOR.

BY Charles Z. Monroe

Watson, Cole, Grindle & Watson

ATTORNEYS

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WIRE FEED FOR STAPLING MACHINES

Filed April 21, 1949 5 Sheets-Sheet 3

Fig 3.

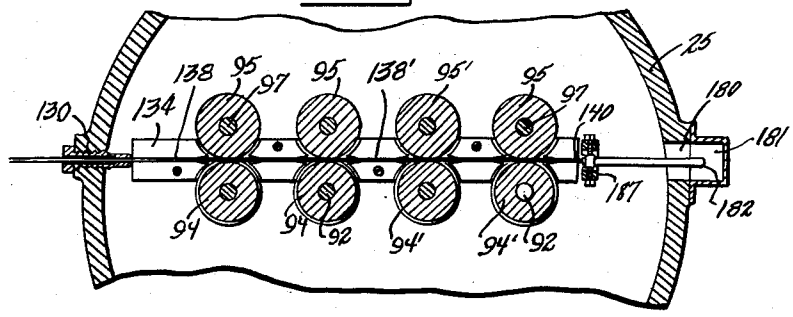


Fig 4.

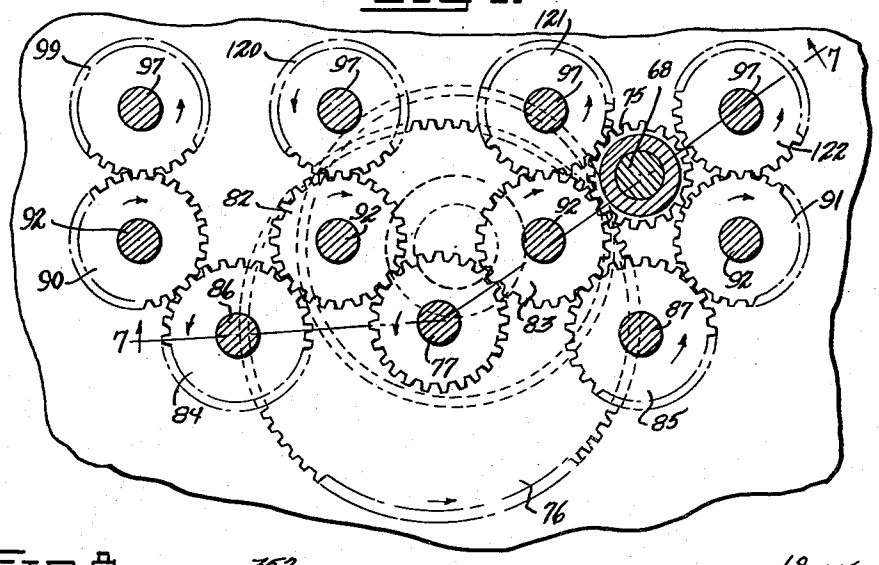


Fig 5.

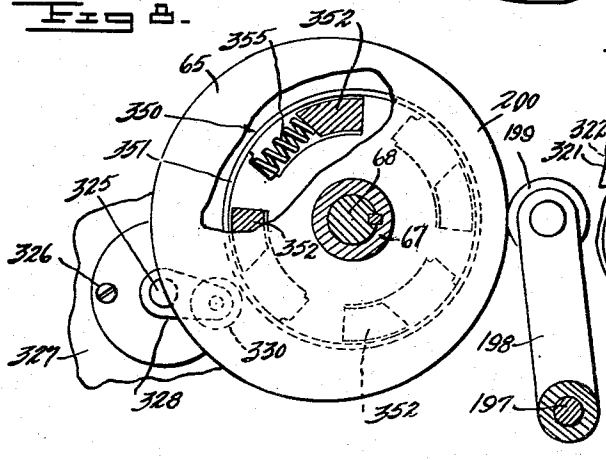
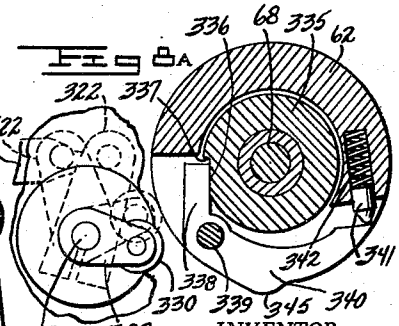


Fig 5A



INVENTOR.

BY Charles J. Monroe

Watson, Cole, Grindle + Watson

Attorneys

Dec. 1, 1953 C. Z. MONROE 2,661,032

WIRE FEED FOR STAPLING MACHINES

Filed April 21, 1949 5 Sheets-Sheet 4

Fig 5.

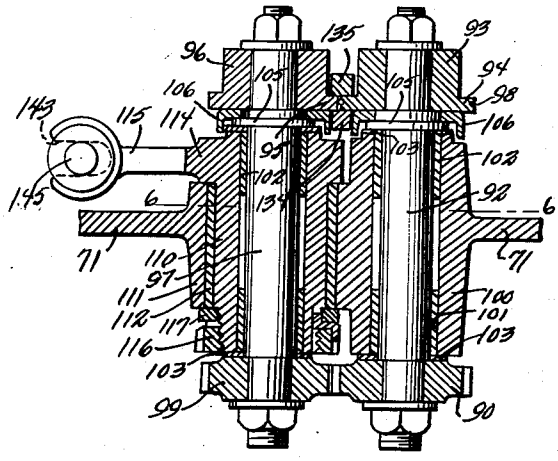


Fig 6.

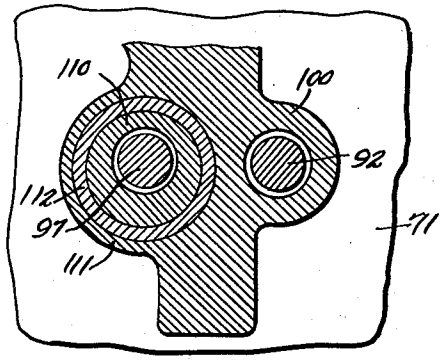
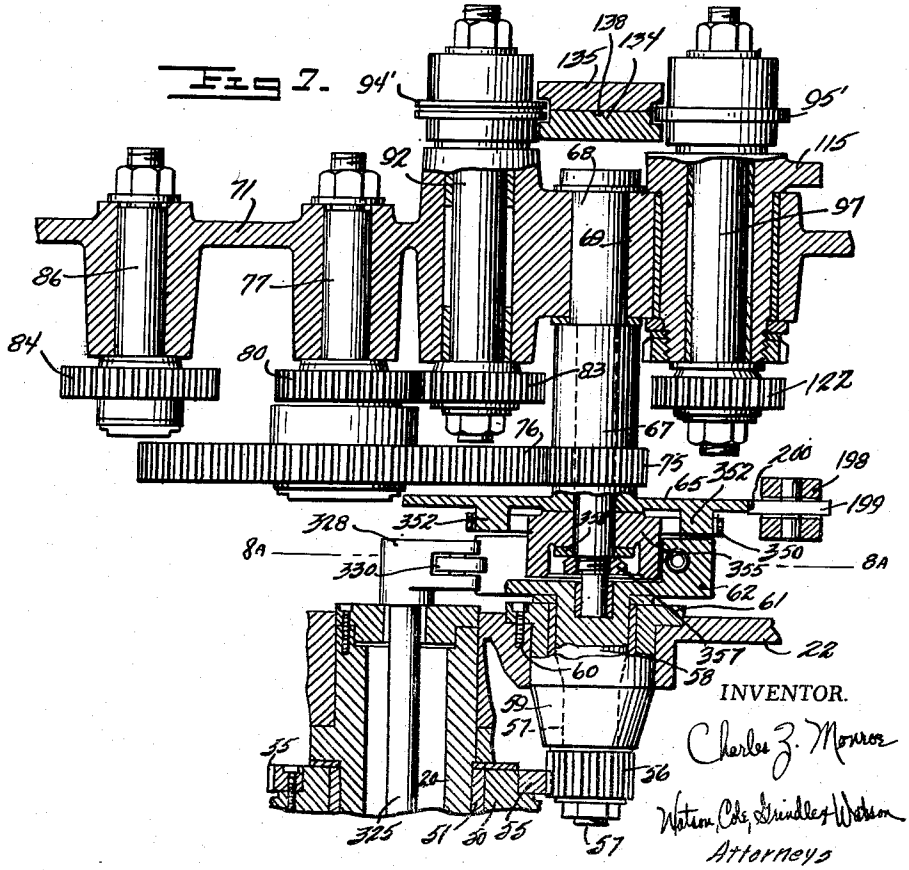


Fig 7.



INVENTOR.

Charles Z. Monroe

Watson, Cole, Grindley & Watson

Attorneys

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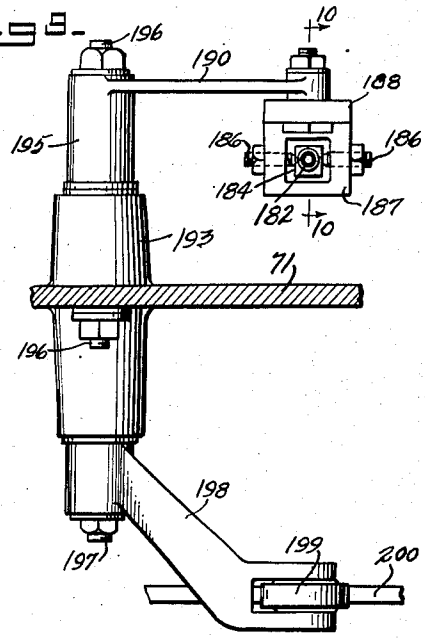
WIRE FEED FOR STAPLING MACHINES

Filed April 21, 1949 5 Sheets-Sheet 5

Fig 9.



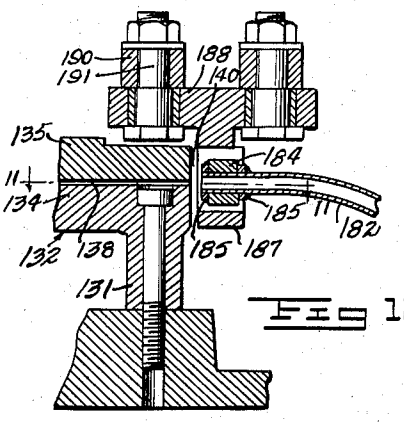


Fig 10.

Fig 11.

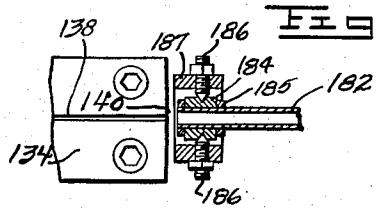


Fig 13.

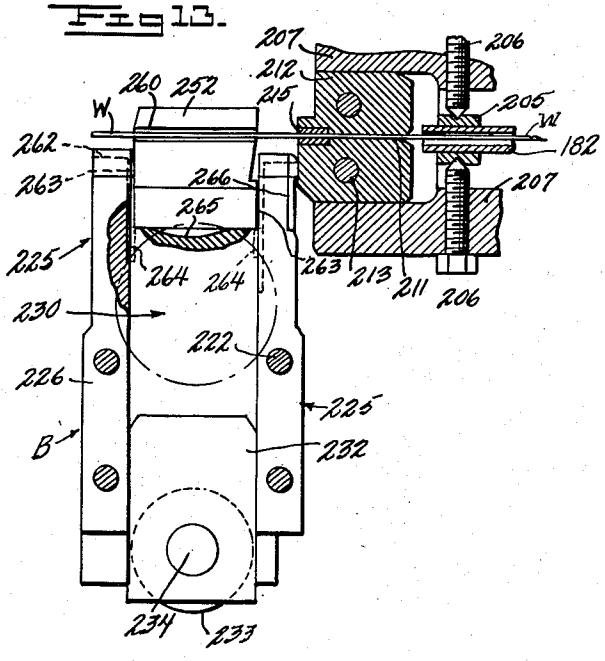
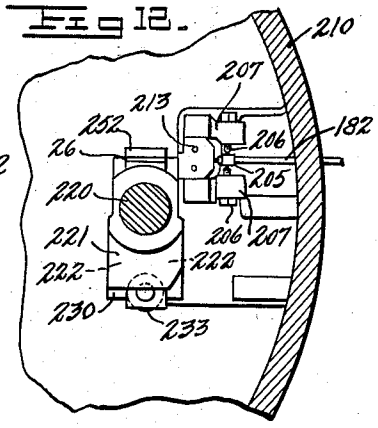


Fig 12.



INVENTOR.

BY Charles Z. Monroe

Watson, Cole, Grindle + Watson

ATTORNEYS

Patented Dec. 1, 1953

2,661,032

UNITED STATES PATENT OFFICE

2,661,032

WIRE FEED FOR STAPLING MACHINES

Charles Z. Monroe, Detroit, Mich., assignor to The Ex-Cell-O Corporation, Detroit, Mich., a corporation of Michigan

Original application December 17, 1946, Serial No. 716,761. Divided and this application April 21, 1949, Serial No. 88,780

7 Claims. (Cl. 140—125)

1

This invention relates to stapling machines and more particularly to machines for forming staples from wire and applying them to successive multi-ply units of sheet material, such as paper, in order to secure the layers together; as for example in fastening or securing the closure of a paper or paste-board container.

This application is a division of my copending application, Serial No. 716,761, filed December 17, 1946, now Patent No. 2,521,935, issued September 12, 1950.

The novel and improved stapling machine which comprises the subject matter of the present invention, while applicable to a variety of uses in the mechanical arts, is related primarily to the purpose of securing together the plies of folded material which comprise the top closure rib of a paraffin coated paper bottle, for example, one of the type disclosed in United States Patent No. 2,047,891, granted on July 14, 1936, to Henry T. Scott.

A stapling machine for use for similar purposes is disclosed in Patent No. 2,063,345 granted to Henry T. Scott on December 8, 1936, and it is the broad purpose and object of the present invention to provide a novel and improved mechanism of the general type disclosed in that patent, but which is adapted for operation on articles, such as paper bottles, fed to the machine continuously rather than in step-by-step fashion.

In its more particular aspects, the present invention contemplates the provision of novel wire supplying mechanism in a continuous stapling machine adapted to constitute an operative unit in the fully automatic container making and filling system disclosed in my copending application Serial No. 638,809, filed January 3, 1946, now abandoned, covering an apparatus for and method of fabricating paper containers. In this system, the containers, in the form of paper bottles, are delivered from the bottle forming machines to the charging device by which they are filled with milk or other fluent material, and thence to closing and sealing machines. The forming machines are arranged either singly or in tandem or multiple, whereby the capacity of the installation may be varied rather widely; and when running at maximum capacity the appropriate units must be such as to charge the fluid at a high rate without spillage, and to close, seal, and staple the filled containers properly at an equally high speed of operation.

The stapling machine illustrated and described herein is adapted to perform one of the last operations in the sequence of steps from the squaring out of the tubular paper blanks to the final delivery of the filled and sealed bottle, and it will contribute toward a fuller understanding of the invention if the units of the installation which precede the stapler are briefly reviewed by reference to the patents mentioned in the original application of which this application is a division.

2

In that original application the purposes, operation, and functions of my novel stapling machine are fully set forth, and it will be sufficient to state that the object of the present invention is to provide in such a stapling machine, or in an equivalent device for similar purposes, a novel and improved means for supplying wire or other filamentary material to the device, and the combined continuous and intermittent feeding of this material to the cutoff and staple forming mechanism. In the preferred embodiment of the invention, novel means are provided for interrupting the wire feed at times when there are no containers on the conveyor at the entrance to the machine.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which one embodiment of the invention is illustrated by way of example.

In the drawings,

Figure 1 is a vertical sectional view through a stapling machine embodying the principles of the invention, certain parts not directly related to the wire feeding being shown in elevation;

Figure 2 is a top plan view of the machine with the cover removed;

Figure 3 is a view in horizontal section taken on line 3—3 of Figure 1 and showing the staple wire feeding rollers or disks;

Figure 4 is a similar view taken on line 4—4 of Figure 1 and showing the transmission gearing for the wire feed;

Figure 5 is a vertical sectional view taken on line 5—5 of Figure 2, through the mating gears and disks of the first wire feed unit;

Figure 6 is a fragmentary view in horizontal section taken on line 6—6 of Figure 5;

Figure 7 is a detail view in vertical section through certain others of the feed disks and driving gears therefor, and taken on line 7—7 of Figures 2 and 4;

Figure 8 is a fragmentary horizontal sectional view on an enlarged scale, taken on line 8—8 of

Figure 1, and showing the clutch device for interrupting the wire feed drive;

Figure 8A is a fragmentary view in horizontal section taken on line 8A—8A of Figure 7;

Figure 9 is a fragmentary view in vertical section taken on line 9—9 of Figure 2, and showing the intermittent feed for the staple wire supply;

Figure 10 is a vertical sectional view taken on line 10—10 of Figure 9;

Figure 11 is a fragmentary view in horizontal section taken on line 11—11 of Figure 10;

Figure 12 is a fragmentary view in horizontal section of the device showing a stapler unit at the wire feeding and cutoff station, the section being taken substantially on line 12—12 of Figure 1; and

Figure 13 is a horizontal sectional view taken substantially on line 13—13 of Figure 1, and showing the initial position of the parts of a stapler unit in the process of cutting off a length of wire and forming a staple.

For an understanding of the general arrangement of the machine, the relative positioning of the principal parts, and its interrelation with the conveyor installation, reference is made to Figures 1 and 2 of the drawings. The stapling machine as a whole is indicated generally by the reference numeral 10 and it is associated with the conveyor track 11 along which the containers Z move from the forming and filling units, through the stapler, and on toward the delivery point. Figure 2 shows that the stapling machine is located within a loop or bight of the conveyor track 11 and, as will be understood as the description proceeds, the stapling steps are accomplished upon each container while it is passing around the substantially semi-circular portion of the run of the conveyor within the confines of the stapling machine 10.

Referring now more particularly to Figure 1 of the drawings, it will be seen that the machine 10 is mounted upon a base casting 12 which comprises a hollow framework adapted to support the stapling machine and that portion of the conveyor which is associated therewith.

The upper wall of the base casing 12 is provided with an opening within which is received a downwardly extending axial portion of the pedestal element 16. This pedestal is provided with a shelf-like extension which provides support for the conveyor track 11 as it curves around the stapling unit. The track 11 is provided with a lateral extension 18 to a flange of which there is bolted a side guard member 19 along which the containers Z are guided around the arcuate path of the conveyor.

Through the center of the pedestal 16 there passes a hollow tubular stem or post 20 which is rigidly clamped to the supporting pedestal 16 by means not shown but disposed within the hollow base casting 12. The post 20 extends upwardly from the base and the supporting pedestal and provides means for supporting the stapling machine 10 and an axle for the sprockets about which the conveyor chains are trained. Thus the upward portion of the post 20 is provided with a flange 21 to which is bolted the horizontal web or partition 22 which is an integral part of the housing casting 25 of the stapler 10. The web 22 is provided with a downwardly extending hollow boss 26 through which the connecting bolts or screws 27 pass, these bolts serving to rigidly secure the stapler housing to the post 20.

A rotary hub member is adapted to revolve around an intermediate portion of the post 20, a

protruding flange thereof being shown at 30. Fixed to the hub 30 are the upper and lower sprockets 32 and 33 which are separated one from the other by means of the ring 34. Beneath the lower sprocket 33 there is disposed a skirt 35 which is suitably secured to the hub 30 and serves to surround and protect certain of the moving parts.

The conveyor proper consists of the pair of superposed chains 40 which are trained about the sprockets 32 and 33 and follow generally the path of the conveyor track 11. In this connection reference is made to Figure 1 of the drawings. The chain 40 supports the conveyor flights 45 and 46. These flights are roughly L-shaped in configuration and comprise a rearwardly disposed projecting arm or blade 47 and a forwardly disposed projection or lip 48. The rear arm 47 of the upper flight 45 is displaced upwardly as clearly indicated in Figure 1 of the drawings, whereas the corresponding arms 47 and 48 of the lower flight 46 are substantially coplanar. The rear arms 47 of both flights serve to engage the rear wall of successive containers Z and push them along the track 11, the outer guard rail 19 serving to keep the containers in alignment. The forward lip 48 aids in preventing the displacement of the containers, especially when rounding the curve within the stapling area.

Although the stapling machine may be driven from its own source of the power, independently of the drive of the complete container-sealing organization, in the illustrated embodiment the stapler takes its driving power from the conveyor itself. The conveyor chains 40 are driven from a remote source (not shown), and the chains 40 drive the sprockets 32 and 33 which are keyed to the hub 30 which is adapted to rotate about the axial post 20.

As the containers Z move around the substantially semi-circular orbit within the stapling zone, the crimped and folded top rib portions R formed at the peak of the roof-like closure section S of the container is moved about the stapler within the zone of operation of the stapler mechanism proper, which is given the general reference character A. The operative details of the stapler mechanism are described in the copending application, and it is sufficient to state at this point that the mechanism comprises basically the turntable 50 which carries a plurality of individual stapler members or units B adapted to move about the axis of the machine and to perform the stapling operation upon the successive containers Z as they pass at substantially uniform velocity around the track 11 within the machine. The turntable 50 is rotatably mounted upon the vertical hollow post 20 being separated therefrom by means of the cylindrical bearing bushing 51. The turntable or stapler carrier 50 is spaced above the rotary hub 30 and is adapted to be driven thereby. For this purpose upwardly projecting lugs 53 are formed as vertical extensions on the upper portion of the drive hub 30, and these lugs are rigidly secured to the under part of the carrier 50 by suitable means not shown.

A ring gear 55 is bolted to the central upper annular flange of the carrier 50 and serves to transmit driving force to the wire feeding mechanism disposed in the upper part of the casing or housing 25. The transmission of force from the ring gear 55 to the wire feeding elements will be but briefly described at this point, this transmission including a certain de-clutching mechanism which will be described at a later point. Refer-

ring now to Figure 7 of the drawings, it will be seen that drive gear 55 meshes with a pinion 56 rigidly carried by the lower countershaft section 57, this portion of the countershaft being provided with a frusto-conical part 58 seated in a similar part of the hollow suspension bearing 59, this bearing being seated within a flanged opening in the web 22 of the housing 25 and rigidly secured therein by means of the screws 60 which pass through the flange 61.

The upper end of the lower countershaft section 57 is formed into a cup-like clutch portion 62 which is adapted to be engaged with and disengaged from the mating clutch portion 65 of the upper tubular countershaft section 67 which is carried by the depending rod or shaft 68 having its upper end rotatably received within an opening 69 in the supporting plate 71. This plate casting 71 comprises a multiple bearing support for the various elements of the wire feed and is secured to the inwardly extending annular flange 72 of the housing 25 by means of the screws 73 (see Figure 1).

Formed on the upper countershaft section 67 is a drive pinion 75 which meshes with a gear 76 rotatably carried by the lower end of the stub shaft 77 which is secured at its upper end to the web or plate casting 71 by means of the nut 78 (see Figures 2 and 7). The gear 76 is keyed to a tubular extension 79 of the smaller gear 80 which is of course also rotatably mounted on the depending shaft 77.

The gear 80 meshes with two gears 82 and 83 which in turn mesh respectively with the idler gears 84 and 85 which are in approximate alignment with the gear 80. The idlers 84 and 85 are rotatably carried by the depending shafts or axles 86 and 87 which are respectively secured by means of the nuts 88 and 89 to the plate 71. The idlers 84 and 85 mesh respectively with the gears 90 and 91 as indicated in Figure 4.

Reference to Figures 1, 2, 4, 5, and 6 will clearly establish the relationship of these several transmission gears and will also afford a clear understanding of the mounting thereof and their association with the wire feeding elements. Although Figure 5 is a section taken transversely through the mating gears and disks of the first wire feed unit, this figure may be taken as a generalized view of all four pairs of mating wire feeding members which comprise the constant speed feed. The gear 90 is fixed upon the lower end of the vertical stub shaft on axle 92 and rigidly secured to the upper end of this shaft is the feed wheel 93, this wheel being provided with a feeding flange or disk portion 94 the periphery thereof being provided with a groove 98. This flange or wheel portion 94 is adapted to rotate in cooperation with the periphery of the smooth flange 95 of a mating wheel or disk element 96 fixed to the shaft 97 which is disposed in parallel relation with the shaft 92, to draw the wire forwardly from the supply.

Upon the lower end of the shaft 97 there is fixed the gear 99 which meshes with the gear 90 and is driven thereby. Adjacent the shaft 92 the supporting web plate or casting 71 is provided with a hollow boss portion 100 within which the shaft 92 is adapted to rotate. Bearing bushings 101 and 102 are provided between the shaft and the opening in the boss 100 and end washers 103 are also provided at the top and bottom of this boss section. The shaft 92 is flanged as at 105 to provide a shoulder to prevent longitudinal movement thereof. A washer 106 provided with a dust seal flange is disposed between the flange 105 and the feeding wheel 93.

The shaft 97 which carries the gear 99 and the feeding wheel 96 is rotatably mounted within the eccentric bushing 110, suitable bearing bushings and washers being employed and given the same reference numerals as the corresponding elements used in connection with the shaft 92.

The eccentric bushing 110 is mounted within the hollow boss 111 of the supporting plane 71 and a bearing bushing 112 intervenes therebetween. The upper portion of the member 110 is provided with a flange 114 upon which an angular arm 115 is formed. The bushing 110 is rotatably secured within the boss 111 by means of the nut or locking ring 116 and the washer and cotter arrangement 117. The eccentricity of the mounting is clearly apparent in Figure 24.

As already mentioned, the same mating gears and feed wheels are repeated at the four points across the upper portion of the stapler housing as clearly indicated in Figures 1 and 4 of the drawings, the additional driven gears associated with the grooved feed wheels being designated 120, 121, and 122, these gears mating respectively with the gears 82 and 83 and 91, in the same manner as the two gears 90 and 99. Similarly by reference to Figure 3 of the drawings it will be understood how the respective pairs of feed wheels and connecting shafts are arranged, these elements being given the same designations as those in the first pair already described.

As indicated in Figures 1 and 2 of the drawings a bracket 125 is bolted as at 126 to the housing 25 of the stapler 10 and this bracket carries an axle 127 upon which is rotatably mounted a reel 128 carrying a supply of wire W. The wire is threaded through a tubular eye 130 screwed into or otherwise fixed in an opening in the wall of the housing 25 and aligned with the bites of the feed wheels 94 and 95 of the wire feeding mechanism. Mounted upon posts 131 secured to bosses formed on the supporting plate 71 is the stationary wire supporting and guiding device 132 which bridges the gaps between the successive feeding rollers or disks. The guide plate assembly consists of a lower plate 134 and an upper plate 135 which is clamped thereto by means of the screws 136. The lower plate 134 is centrally grooved as at 138 as clearly shown in Figure 3 of the drawings and both plates are narrowed and cut away to accommodate the pairs of feeding rollers, this being indicated in Figure 5 of the drawings. The wire W is fed along the groove 138 by the successive pairs of feed rollers and it emerges from the feed plate assembly 132 at the point 140, at which point it comes within the control of an intermittent feed device which will be presently described.

The successive pairs of feed rollers and the guide plates 132 comprise the essential portions of the constant speed wire feed for pulling the wire supply from the reel 128 and feeding it to the intermittent forwarding device to be described. An important feature of this section of the machine resides in the fact that the two right-hand sets of pairs of feed rollers 94' and 95' are very slightly larger than the left-hand pairs of feed rollers 94 and 95. The difference in size, however, is too small to be apparent from the drawings. Since all four sets of rollers are driven at the same speed, it will be at once perceived that the wire will tend to be very slightly stretched or tautened between the two central pairs of said rollers within the portion of

the groove 138 designated 138' in Figure 3. This arrangement serves to maintain the wire under tension and effectively removes even the slightest kinks or distortions which may be present in the wire, for example, such as it might have acquired from having been wound upon the reel 128.

Returning now to Figures 2 and 5 of the drawings it will be seen that each of the crank arms 115 is formed on one of the eccentric bushings 110 which support the shafts 97, upon the respective upper and lower ends of which are secured the feed disks or rollers 93 and the gears 99. It will be apparent that slight angular movements of the arms 115 will, by rotating the eccentric bushings 110, cause the smooth-periphery feed wheels 95 to release their grip upon the wire which is clamped between these wheels and the grooved mating wheels 94, and will release the frictional bite on the wire. Each of the arms 115 is bifurcated as at 143 and straddles the longitudinally adjustable rod or shaft 145. One end of this shaft 145 is received within the hollow boss 146 formed upon the casing 25. A stop abutment 147 is threaded into this boss and provides means for limiting the movement of the shaft 145 to the right in Figure 2. A set screw 148 threaded into the boss 136 projects into a groove or slot 149 in the rod 145 and prevents rotation of the rod 145.

The left-hand end of the rod 145 is threaded as at 150 and is screwed into the open threaded end of a rotatable cylindrical member 151. The member 151 is received in a boss 152 formed on the housing wall 25 and is held against longitudinal movement therein between the handle or knob 154 and the nut 155. It will thus be readily seen that rotation of the knob 154 which is pinned as at 156 to the bushing or sleeve 151 will cause the rod 145 to move in the direction of its length, by virtue of the threaded connection between the portion 150 of the rod and the internally threaded bushing 151.

At proper intervals along the rod 145 there are secured the stop sleeves 158, an additional stop 159 being provided beyond the right-hand crank arm 115. Slidably mounted on the rod 145 are the sleeves or collars 160 and these are adapted to contact the left-hand face of the bifurcated portion 143 of the crank arms 115. Between each of the fixed stop sleeves 158 and the slidable collars 160 there are disposed the coil springs 161. It will thus be seen that the springs 161 will tend to urge the crank arms 115 in a clockwise direction as viewed in Figure 2 and cause the eccentrically mounted wire feeding disks or wheels 95 to resiliently bear upon the wire W occupying the shallow grooves 98 in the feed wheels 94. This spring pressure may be applied, released, or adjusted by rotation of the knob 154 which will cause the fixed abutment sleeves 158 to advance or retract with relation to the crank arms 115. Thus the gripping pressure of the feed wheels may be released during the threading of the wire through the feed device or at any other desired or necessary time.

Also, during threading of the wire into the feed device, or upon other occasions, it may be found necessary to operate the feed wheels slowly or intermittently through manual means. A device for accomplishing this purpose is associated with the top cover or lid which is applied to the stapler housing 25. This cover or closure comprises the dome-like element 165 shown in Figure 1 which has a flanged sealing contact as at 166 with the upper rim of the housing 25. The cover 165 is hinged to the housing as shown in Figure 2. Spaced ears or lugs 167 are formed in the top plate or partition 71 of the housing and between each pair of these lugs there are pivotally mounted upon the pintles 168 the hinge arms 169 formed on the under side of the cover 165.

At a point directly above one of the vertical shafts or axles 92, preferably the one which carries the gear 83 and one of the feed rollers 94', there is provided in the cover 165 a hollow boss 170 through which projects a pin 171 having a downwardly facing cup-like socket portion 172 having its walls notched as at 173 to interlock with the corresponding projections 174 in the nut 175 which is keyed to the upper end of the shaft 92. Fixed to the upper end of the pin or shaft 171 is the crank handle 177 by means of which, when the lid or cover 165 is lowered, the socket 172 is engaged with the nut 175 and the shaft 92 may be rotated manually to feed the wire between the four pairs of feed wheels, while the drive from the conveyor is idle. This is possible by virtue of the one-way or over-running nature of the clutch 62 (Figure 7) interposed between the upper and lower sections 57 and 67 of the countershaft which forms a part of the wire feed transmission.

As related earlier, the actual stapling mechanism A comprises the turntable 50 which carries a plurality (in this case four) of individual stapling members B which move around the semicircular path of the containers Z as they pass through the machine. Each of these stapler units is supplied with the proper length of wire to form one staple, this length being cut off from the wire supply W as each successive unit passes a wire receiving station. Now in order to insure that the proper length of wire is fed into the individual units quickly while they are momentarily at the wire receiving station, and to prevent projection or feeding of the wire toward the path of the units while a succeeding unit is coming into position, provision must be made for converting the steady constant speed feed of the wire W by means of the feed rollers just described, into an intermittent feed timed to project a length of wire into the stapler unit at the proper instant and to withhold the supply until the next unit is in receiving position. This intermittent feed is accomplished by the mechanism now to be described. In line with the direction of feed of the wire by the feed rollers 94, 95 there is provided an opening 180 (Figure 3) in the wall of the housing 25. Secured to the exterior face of the housing and covering this opening is a supplemental casing or sheath 181 (Figure 1) which may be made of sheet metal and is bulged slightly for a purpose to be described. The sheath extends downwardly along the outer surface of the housing and terminates in the vicinity of the stapling mechanism A. Within this sheath there is suspended a somewhat flexible tube 182 the lower end of which is substantially fixed adjacent the delivery point of the wire to the stapler units. The upper end of the tube is carried by an oscillating support which is adapted to be moved to and from the point 140 at which the continuous length of wire W passes from the control of the constant speed wire feed.

Referring to Figures 1, 2, 3, 9, 10, and 11 of the drawings it will be seen that the upper end of the tube 182 is fixedly secured within the block 184 as by means of the welded flanges 185. The block 184 is swiveled, to accommodate ro-

tation in a vertical plane, upon the needle bearings 186 which are threaded through and locked to the side walls of the hollow depending portion 187 of the T-shaped bracket 188. The bracket 188 is suspended from a parallel motion which comprises the horizontal pair of arms 190. Each of these arms is pivotally connected with the bracket 188 by means of the pintle bolts 191.

Rising from the partition plate 71 is a double hollow boss 193 one portion of which is prolonged downwardly beneath the plate 71 as at 194. See Figure 9. One of the arms 190 has its cylindrical end 195 keyed to a shaft 196 which is rotatably received within one portion of the boss 193. A similar cylindrical portion is formed on the other arm 190 and is keyed to a longer shaft 197 which extends rotatably through the lower boss portion 194. Fixed upon the lower end of the shaft 197 is the angular crank arm 198, the free end of which is provided with a cam follower roller 199 which is adapted to follow the peripheral cam surface 200 formed on the element 65 of the countershaft 57, 67. In order to maintain the cam follower in contact with the cam surface 200 the cylindrical hub portion 195 of one of the arms 190 (preferably the one which is carried by the elongated shaft 197) is provided with an arm 201 which is connected by a spring 202 with a fixed point 203 on the plate 71. By this means the tube carrying bracket 188 is urged toward the constant speed delivery point 140 to the position shown in Figures 1, 10, and 11 of the drawings.

Recalling that the lower end of the wire carrying tube 182 is relatively stationary, it will be readily understood that by the action of the cam 200 the bracket 188 which supports the upper end of the tube 182 is oscillated back and forth in the direction of the length of the wire supply W, the bulged part of the casing 181 accommodating this movement of the relatively flexible tube. Obviously this displacement toward the right in Figures 1, 2, and 3 of the drawings will have the effect of elongating the total path of the wire from the receiving point 140 to the delivery point to the stapler unit and this elongation is of an amount equal to the length of wire needed for forming a single staple. Thus, during the movement of the wire carrying tube 182 toward the right at a speed equivalent to the rate of movement of the wire due to the feed rollers 94', 95' will have the net effect of causing the lower end of the wire adjacent the stapler units to remain stationary. Then upon return movement of the upper end of the tube carried by the bracket 188 to the point 140, the wire will be quickly fed into the properly positioned stapler unit.

The lower end of the tube 182 (Figure 13) is fixedly secured within a block 205 which is pivotally supported upon the needle bearings 206 which are carried by the two side brackets 207 which may be cast integrally with the insertable housing section 210 which is attached in any suitable way to the main housing 25 at the lower right-hand corner thereof as viewed in Figure 1. From the mouth of the tube 182 in the lower end thereof the wire W passes through an opening 211 in the guide block 212 which is rigidly secured between the side frames 207, as for example by means of the bolts 213. Within the forward end of the opening 211 there is situated a hardened steel bushing 215 which cooperates with a part of each of the successive stapling units in shearing off the required length of wire to form a staple.

So much of the stapling mechanism itself as is necessary to the understanding of the present vention will now be described by reference to Figures 1, 12, and 13. The turntable or carrier member 50 (Figure 1) is provided with four circumferentially spaced openings within which are rotatably secured the stub crank shafts 220 upon the lower end of each of which is formed the body portion 221 of a stapler unit which is of the general top plan configuration shown in Figure 12 of the drawings. To the lower part of this body portion 221 there is secured, as by means of the screws or bolts 222, an outside former which comprises the combined shear and gripping member and is designated generally by the reference numeral 225. This member comprises two side portions 226 connected by a lower bridging web. Between these side bars 226 of the member 225 and within the space provided between the lower part of the body portion 221 and the bottom web, there is disposed the sliding driver element 230. This element comprises a forwardly disposed plate-like portion 231 and a rearward bifurcated block portion 232 between the forks of which is rotatably disposed a cam following roller 233 rotatable upon the axle 234. The driver member 230 is adapted to slide between the side arms of the member 225. In order to urge the member 230 rearwardly toward its retracted position a coil spring 238 has one of its ends seated in a socket in the forward part of the body portion 221 of the unit. The rear end of the spring sits in a socket formed in the block 232 of the member 230.

To the upper end of each of the crank shafts 220 which rotatably support the stapler units there is clamped, as at 242, the crank arm 245, upon the outer end of which is carried a roller 246 which follows the cam groove 247 formed in the cam plate 248 bolted as at 249 to the under side of the partition 22. As more fully described in the original application, the stapler units B in their travel around the machine proceed past a series of stations, only two of which are definitely shown in the present disclosure, namely station I which will be seen at the right-hand side of the central portion of Figure 1, and station III which is indicated at the left-hand side of the figure. At station I the stapler unit extends chordwise of the circular path of the units and this is the station at which the wire is fed to the stapler unit and cut off to form a single staple. Station III, at the diametrically opposite side of the machine, is the point where the staple is driven through the rib R of the container Z.

When a stapler unit B is disposed at station I in Figures 12 and 13, it is in the position to have the wire W fed to it from the tube 182 through the mouth of the opening 211 in the feed block 212.

Referring now more particularly to Figures 1, 12, and 13, it will be seen that there is provided, beneath the path of the stapler unit B, an inside former which comprises a swinging anvil or holding lever and is designated generally by the numeral 250. This lever is pivotally mounted upon the housing insert casting 210 and has its angled forward portion 252 urged upwardly by a spring means (not shown).

The upwardly directed forward end 252 of the inside former 250 is slotted as at 260 to receive the end portion of the wire W when it is fed

through the feed block 212, as most clearly shown in Figure 13 of the drawings.

It will be seen that the forward ends of the side blocks 226 of the outside former 225 of the stapler unit are provided with the V-shaped notches 262, and the inner walls of the forward parts of the portions 226 are also provided with the grooves 263 of the gauge of the wire W. The side walls of the plate portion 231 of the sliding driving member 230 are also grooved as at 264 adjacent the grooves 263 of the member 225. The forward edge of the plate 231 of the driver is provided with a groove or notch 265 of a peculiar configuration, the central portion of the notch 265 being somewhat wider and deeper than the end portions thereof. Also a hardened steel shear-plate insert 266 is secured to the side wall of the side bar 226 of the former 225 to cooperate with the hardened tubular insert 215 set in the feed block 212, in severing the wire.

A detailed description of the operation of the stapler units will be found in the copending application, and it will be sufficient for present purposes to state that upon advancing the unit B from the position shown in Figure 13, where the inside former 250, 252 has received the projected end of the wire W, the cooperating shearing portions 215 and 266 sever the wire from the supply W as the unit passes the feed block 212. At this point the groove 260 in the forward end 252 of the inside former 250 is in substantial alignment with the notches 262 in the forward ends of the two side bars 226 of the outside former 225. The present phase of the invention is not concerned with the further progress of the unit past the cut-off station I and for a disclosure of subsequent steps in the staple forming and driving operation, reference must be made to the copending application.

Associated with each of the stapling units B and likewise carried by the turntable or carrier 50 are individual clincher devices C which cooperate with the staple driver element on the units B by backing up the staple on the remote or outer side of the rib B of the container, and these devices C are adapted to be brought into and released from their operative positions as the stapler members B are respectively moved to stations III and I. Referring more particularly to Figure 1, there are pivoted to the carrier 50 clincher elements C, by means of the pintle 276, upon which the ears 277 of the element are pivoted. A spring element 280 is coiled about each pintle 276 and a portion of the spring bears against the inner side of the member C while another portion of the spring bears against a fixed part of the carrier 250, the spring being initially tensioned to urge the member C outwardly and upwardly toward the position shown at the right-hand side of Figure 1.

Each of the clincher elements C is provided with a cam follower roller 285. Secured to the end of the member C is the clincher plate 288. The forward inwardly directed operative edge of the clincher plate 288 is adapted, at station III, to contact the outer face of the rib R of the container Z upon which the stapler is to operate. This is shown clearly in Figure 1 of the drawings. There is carried by the turntable 50 an annular ring 292 which has a downwardly projecting flange providing shoulders against which the rib R of the containers is guided during the semicircular path of the containers through the operating zone of the machine.

Carried upon the bottom edge 295 of the housing 25 is a generally circular cam member 296 which has its inwardly facing surface 297 formed with differently sloped camming areas. The cam element 296 may be broken away in the vicinity of station I since the clincher elements C are in their raised idle positions at this point and their outwardly and upwardly swinging movement is limited by the abutment indicated at 298 in Figure 1. The operative cam edge against which the roller 285 bears during the actual clinching operation may be supplied by a hardened wear resisting insert 296b.

Surrounding the central vertical hollow post 20 of the stapler (Figures 1, 11, and 12) and disposed between the upper end of the rotary hub 30 and the turntable 50 there is fixed, as by means of a set screw 300, a ring or collar 301, this collar being horizontally slotted upon one segment thereof as at 302, in order to receive the cam element 310 which is pivoted to a collar and guided by means of the spin 309. The surface of the cam 310 is curved or rounded and adapted to be contacted by the roller 233 of the staple driving member 230.

Another feature of the novel stapling machine comprises interrupter means whereby no wire will be fed to a stapler unit B passing station I if there is no container Z to occupy this position on the conveyor. To accomplish this purpose there is provided alongside of the straight approach section of the conveyor track 11 a pivoted arm 315 (Figures 1 and 2), the pivot pin or shaft of this arm being indicated at 316 and passing through the tubular bearing bosses 317 and 318 provided on the base casting 12. (See Figures 1 and 2.) The arm 315 comprises a slotted stub portion 315A to which a contact blade 315B is adjustably secured as by means of the bolts 315C. The lower end of the rod or shaft 316 within the base casting is provided with a crank arm 320 the free end of which is connected by means of a rod 321 to a crank 322 secured to the lower end of the vertical axial rock shaft 325 which passes through the hollow interior of the central post 20 of the machine. Secured by means of the screws 326 to the upper end of the post 20 is the bearing plate 327 through which the upper end of the rod or shaft 325 passes. (See Figures 7 and 8.) To this upper end of the shaft 325 there is fixed a crank 328 which carries a roller 330 at its free end. This crank 328 with its roller 330 is directed toward the clutch assembly which connects the two parts 57 and 67 of the countershaft which drives the wire feed (Figures 1 and 8A). The cupped upper portion 62 of the lower shaft portion 57 surrounds an inner member 335 which is rotatably disposed upon the depending rod 68. The outer peripheral wall of the member 335 is provided with a notch 336 which provides a shoulder 337 which functions as a ratchet tooth within which the pawl 338 is normally disposed. The pawl is pivotally carried by the member 62 by means of the pin 339. The tail 340 of the pawl is urged outwardly by means of the plunger 341 which is resiliently pressed by means of the spring 342 seated in a socket 343 in the member 62. The tail 340 of the pawl is also provided with a rounded protuberance 345 which normally, during the rotation of the part 62, clears the roller 330.

However, when a container Z is missing from the approach portion of the track 11 and the detector arm 315 is allowed to move inwardly across the track under the urging of the spring 346, the crank 320 moves outwardly and the other trans-

mission elements 321, 322, 325, and 328 are also rotated inwardly whereupon the roller 330 is brought into the path of the protuberance 345 on the pawl 330 and the pawl is tripped, withdrawing its operative end from the ratchet shoulder 337 of the inner member 335. Thus the drive from the lower portion 57, 62 of the countershaft and the driven member 335 is broken and the driven end of the countershaft 65, 67 is idle. Thus both the constant and intermittent feed mechanism for the wire W is interrupted until a container again moves the detector on 315 outwardly to its position shown in Figure 2.

In order to eliminate the possibility of shock of starting, stopping, operating, or interrupting the wire feed drive, a resilient transmission section is introduced in the countershaft assembly. The inner element 335 of the interrupter clutch is provided with a widened upper flange portion 350 which is provided in its overhanging portion with a series of spaced slots 351 (Figure 8). Projecting downwardly from the clutch member 65, which also provides the cam element 200, are a series of arcuate lugs 352 which conform substantially to one end portion of the slots 351 in the flange 350, but are of considerably less arcuate extent to provide space for the coil springs 355 which urge the lugs 352 toward the forward ends of the slots. Thus the drive is through the flange 350, the spring 355, and the lug 352 in transmitting the driving force from the member 335 to the member 65.

The member 335 is carried rotatably upon the lower portion of the vertical shaft or axle 68, a nut 357 being threaded upon the shaft and a bearing washer 358 being interposed between the nut and the member 335, both of these elements being received within a central recess in the element 335.

Various changes and modifications may be made in the embodiment illustrated and described herein without departing from the scope of the invention as defined by the subjoined claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a stapling machine of the class described, in combination, wire feeding mechanism comprising a series of pairs of feed rollers adapted to resiliently grip the wire between their peripheries, means for driving said pairs of rollers at the same speed, one roller on each pair being provided with an eccentric mounting, and means for urging said roller to swing toward wire engaging position, and for swinging the roller in the opposite direction to release the feeding tension, said means including crank arms on the respective eccentric mountings, a longitudinally shiftable rod, the ends of said crank arms being disposed adjacent said rod, longitudinally slidable abutments on said rod adapted to bear against said respective crank arms, fixed abuments on said rod, coil springs between said fixed and sliding abutments, and a handle for adjusting said rod longitudinally to adjust, release, and apply spring tension to said crank arms and thus to said wire gripping feed rollers.

2. In a stapling machine of the class described, in combination, wire feeding mechanism comprising a series of pairs of feed rollers adapted to grip the wire between their peripheries, means for driving said pairs of rollers at the same speed, said means comprising a transmission which includes a resilient drive coupling and an overrunning clutch arranged serially therein, means for automatically disengaging said clutch in the event that an article to be stapled is missing from its proper position in the machine, and means operatively connected with said wire feed rollers for manually actuating them, said overrunning feature permitting such manual operation without affecting the mechanical drive, and said resilient drive coupling serving to minimize shock on the wire feeding mechanism in starting and stopping the drive or during the operation of the device.

3. A wire feeding device for machines which are adapted for intermittent reception of the wire, such as stapling machines or the like, which device comprises, in combination, a carrier for a continuous supply of wire, means on the device for positively feeding said wire from said carrier at a substantially uniform speed to a certain point in its travel to said machine, operative means disposed on the device in a position beyond said point for alternately shortening and lengthening the path of the wire from said point to the machine, whereby in spite of the constant feed of the wire from said carrier, the end of the wire is presented intermittently to the machine, said operative means comprising a somewhat flexible tube through which said wire passes, the delivery end of said tube being swivelled on transverse pivots carried by the device but fixed against longitudinal movement adjacent the point of reception and use of the wire in said machine, and the entrance end of the tube being oscillatable to and from said certain point longitudinally of the wire, means on the device for oscillating said entrance end whereby the wire feed from the delivery end of said tube is intermittent, means also on the device for swivelling the entrance end of said tube also to permit any necessary rocking movement to accommodate itself to the smooth passage of the wire.

4. In a stapling machine of the class described, which includes means positioning an article to be stapled, the sub-combination of wire feeding mechanism comprising a series of pairs of feed rollers adapted to grip the wire between their peripheries; means operatively connected with said mechanism for driving said pairs of rollers at the same speed, said means comprising a transmission which includes a continuously rotatable drive shaft, means for driving said shaft in synchronism with the stapler machine, a driven member coaxially disposed with respect to said drive shaft, and gearing connecting said driven member with said feed rollers; an overrunning clutch in the transmission between said drive shaft and said driven member; supplemental means operatively connected with the mechanism for manually actuating said wire feed rollers, said overrunning feature permitting such manual operation without affecting the said mechanical driving means; and means adjacent said article positioning means for disengaging said overrunning clutch in the event an article to be stapled is missing from its proper position in said machine.

5. In a stapling machine of the class described, which includes means positioning an article to be stapled, the sub-combination of wire feeding mechanism comprising a series of pairs of feed rollers adapted to grip the wire between their peripheries; means operatively connected with said mechanism for driving said pairs of rollers at the same speed, said means comprising a

transmission which includes a continuously rotatable drive shaft, means for driving said shaft in synchronism with the stapler machine, a driven member coaxially disposed with respect to said drive shaft, and gearing connecting said driven member with said feed rollers; an overrunning clutch in the transmission between said drive shaft and said driven member; supplemental means operatively connected with the mechanism for manually actuating said wire feed rollers, said overrunning feature permitting such manual operation without affecting the said mechanical driving means; and means adjacent said article positioning means for disengaging said overrunning clutch in the event an article to be stapled is missing from its proper position in said machine, said overrunning clutch comprising an annular driving element carried by said shaft and a coaxial driven element carried by said driven member and enclosed by said annular driving element, a ratchet notch in said driven element and a pawl pivoted to said driving element and normally spring pressed into said notch, a cam nose on said pawl and an interrupter element adapted to be moved into the path of said cam nose and dislodge the pawl from said ratchet notch, in the absence of an article from its proper position in said machine.

6. A wire feeding device for machines which are adapted for intermittent reception of the wire, such as stapling machines or the like, which device comprises, in combination, a carrier for a continuous supply of wire, means for feeding said wire from said carrier at a substantially uniform speed to a certain point in its travel to said machine, operative means disposed on the device in a position beyond said point for alternately shortening and lengthening the path of the wire from said point to the machine, whereby in spite of the constant feed of the wire from said carrier, the end of the wire is presented intermittently to the machine, said operative means comprising a somewhat flexible tube through which said wire passes, the delivery end of said tube being swivelled on transverse pivots carried by the device but fixed against longitudinal movement adjacent the point of reception and use of the wire in said machine, an oscillatable support for the entrance end of said tube, a parallel crank motion connected with said support and adapted to oscillate the support in an approximately straight line longitudinally of the path of the wire at the point of entrance, whereby the entrance end of said tube is also oscillatable to and from said certain point longitudinally of the path of the wire.

7. In a stapling machine of the class described, in combination, means for positively and continuously feeding wire lengthwise at a substantially constant speed in a certain direction, a tubular conduit receiving the wire from said constant speed feeding means and mounted for oscillatory movement, means receiving said wire from said tubular conduit and guiding it to a stapling station, said tubular conduit being substantially U-shaped and thus conforming the contained portion of the wire to a similar configuration, means for oscillating said conduit for alternately lengthening and shortening said bight for causing said wire to be intermittently moved toward said receiving means, and means for synchronizing the oscillation of said conduit with the constant speed feeding means and with the operation of said stapling machine.

CHARLES Z. MONROE.

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