

[54] **TERMINAL APPLICATOR**

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[51] Int. Cl. ....H01r 43/04  
[58] Field of Search .....29/203 D, 203 DT, 203 R, 203 P

[56] **References Cited**

**UNITED STATES PATENTS**

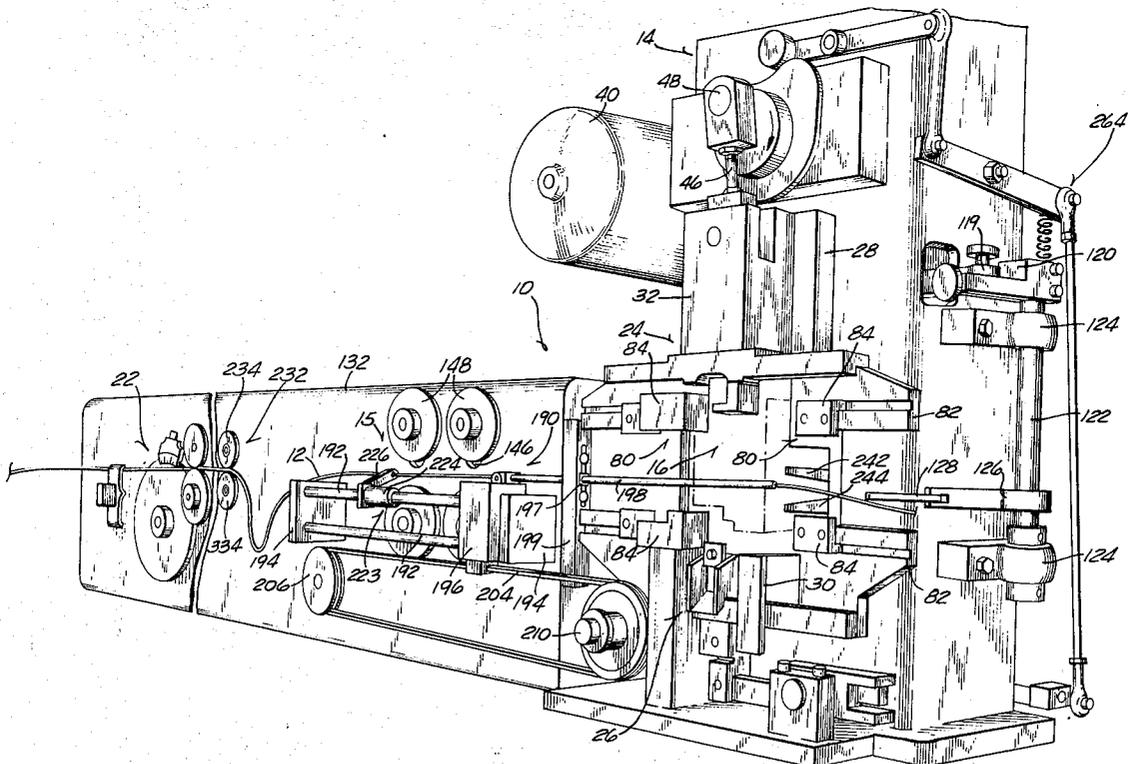
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[57] **ABSTRACT**

An automatic terminal applying machine including a pair of terminal applicators, a wire cutting and stripping assembly located between and in line with the applicators, a wire measuring unit, a wire feed assembly including a wire guide assembly to accurately align the wire in the cutting and stripping assembly, and a wire drag and discharge assembly for holding the wire during terminal application and discharging the wire from the assembly after terminal application to a collection trough or wire stacking device. The cycle of operation of each of the assemblies is controlled by a number of cams secured to a common drive shaft and controlled by a one revolution pin clutch. A clutch controlled loop assembly provides a loop in the wire to minimize drag movement of the wire guide tube.

**21 Claims, 17 Drawing Figures**



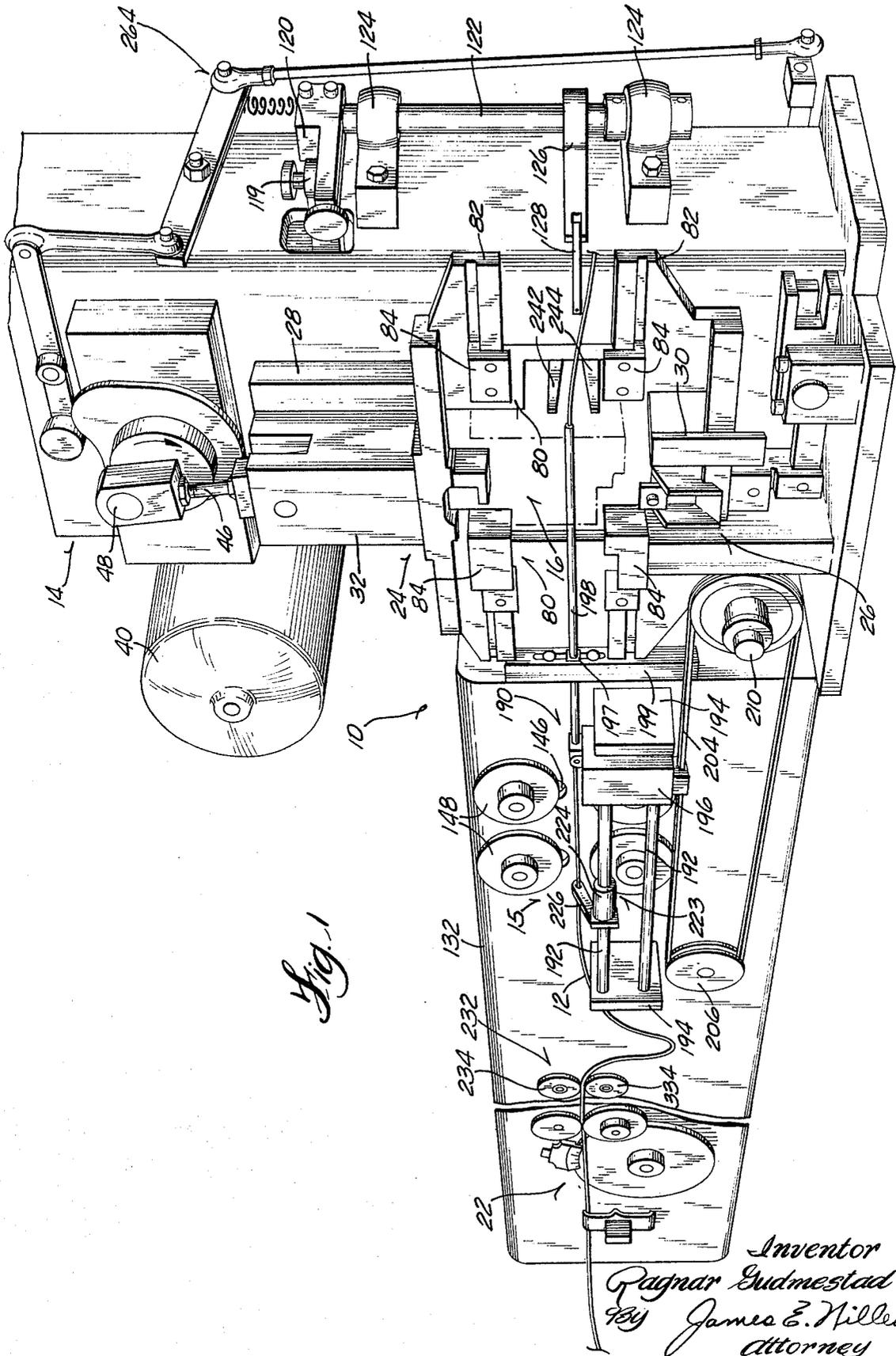


Fig. 1

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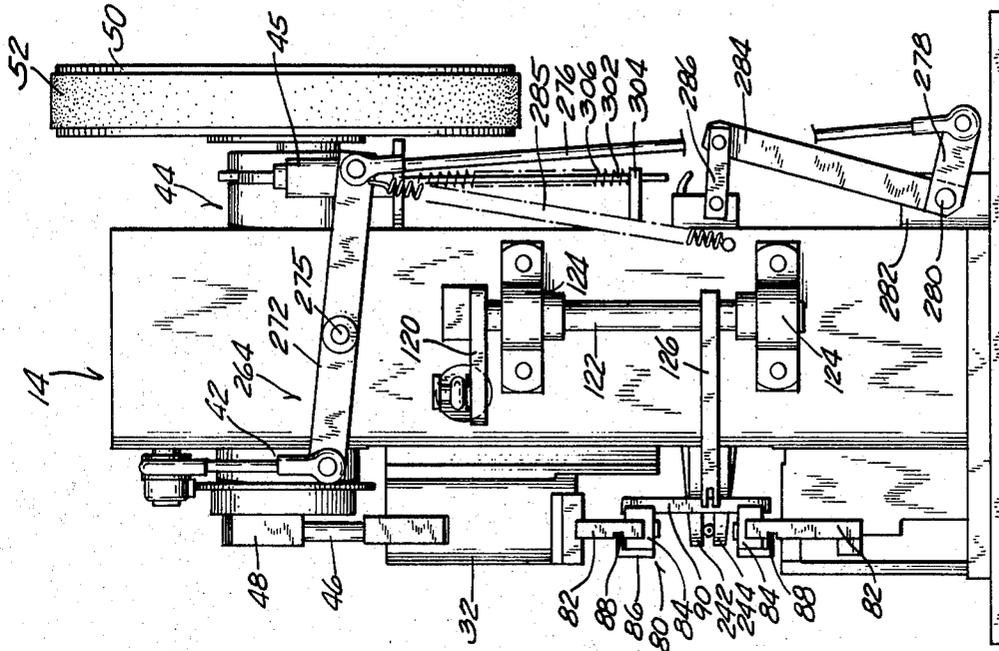


Fig. 3

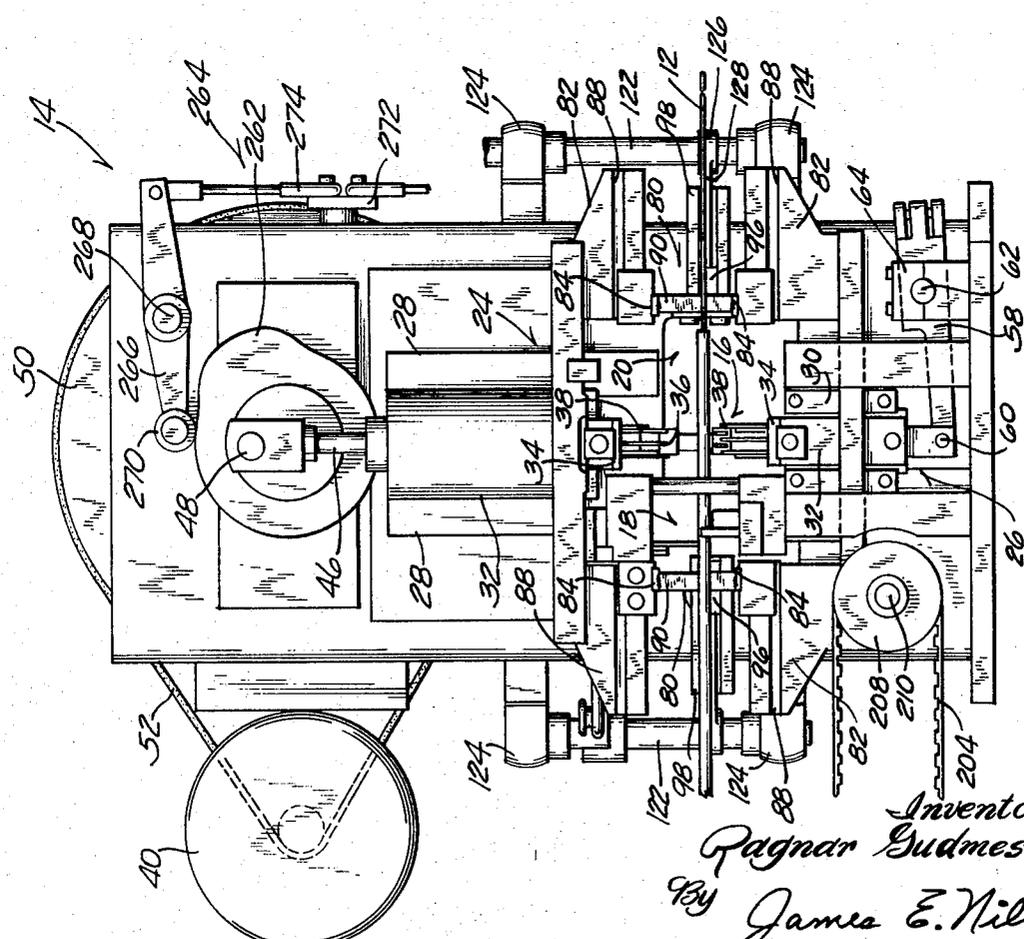


Fig. 2

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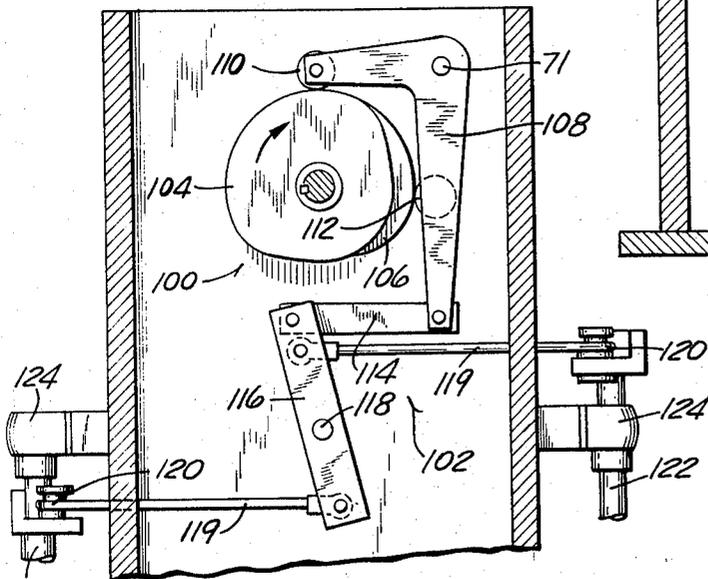
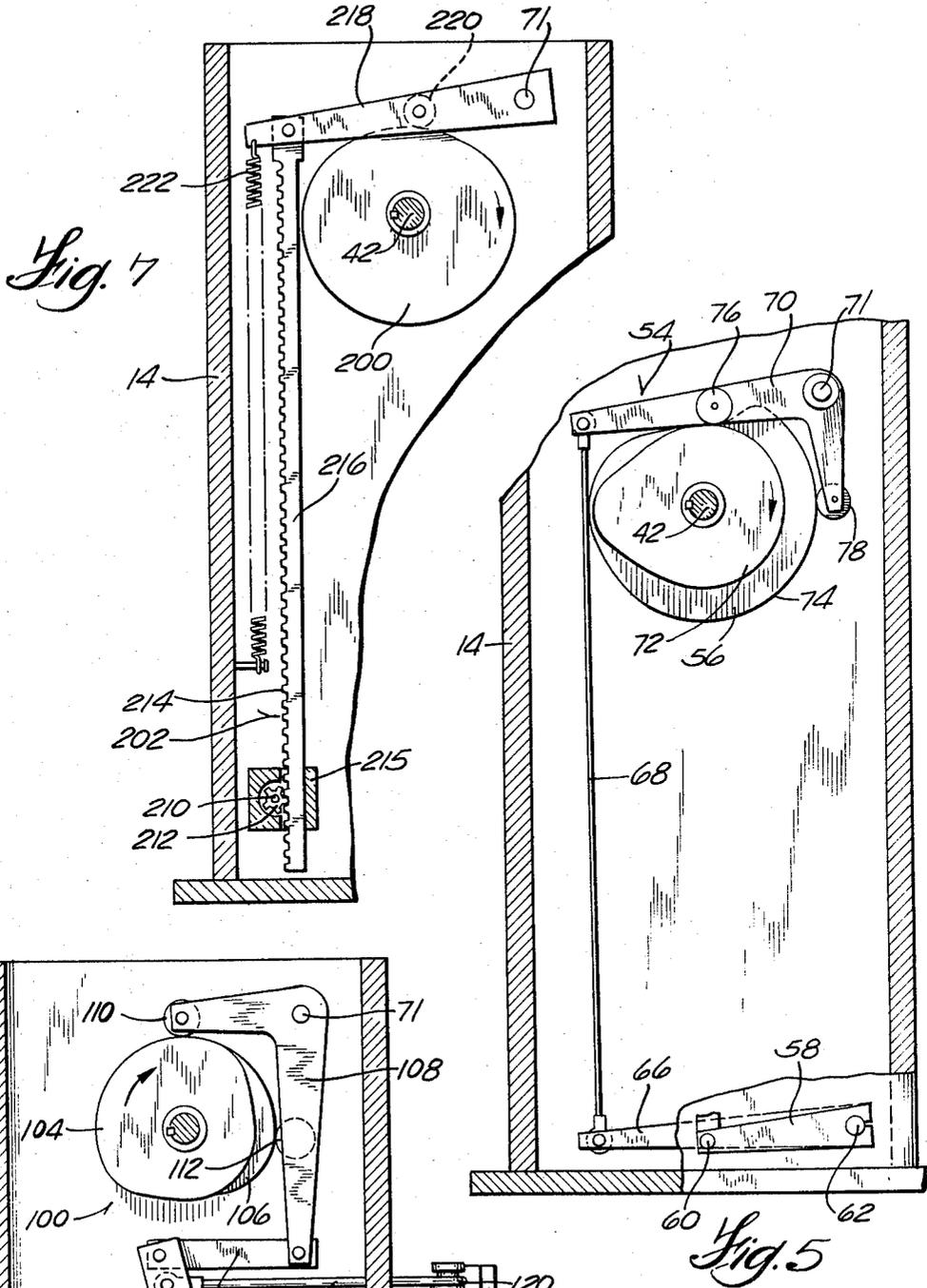
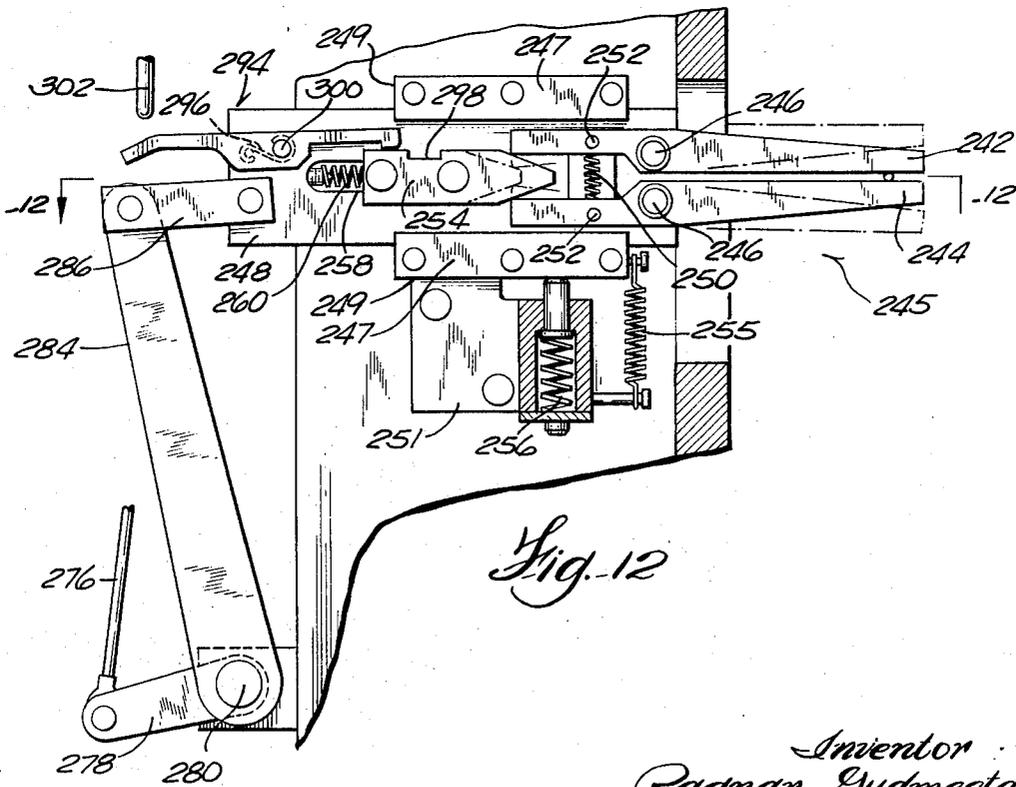
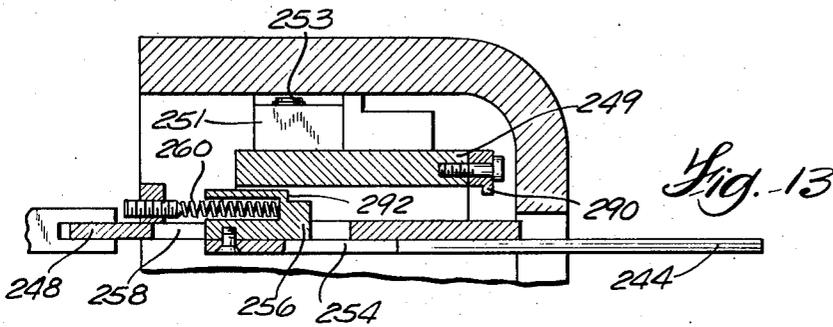
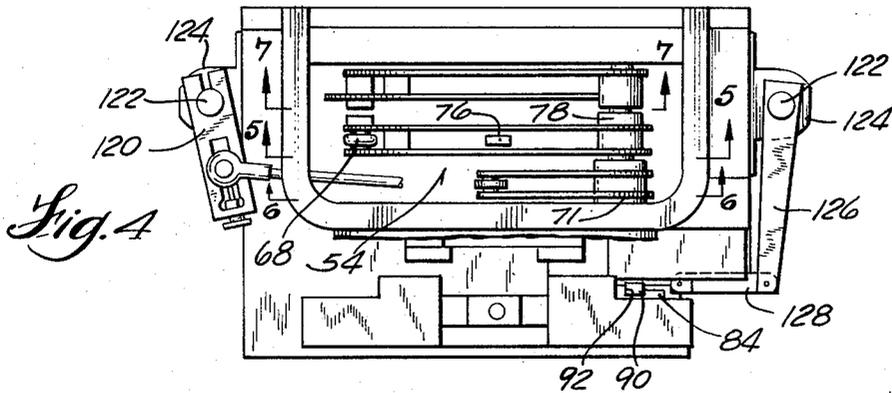


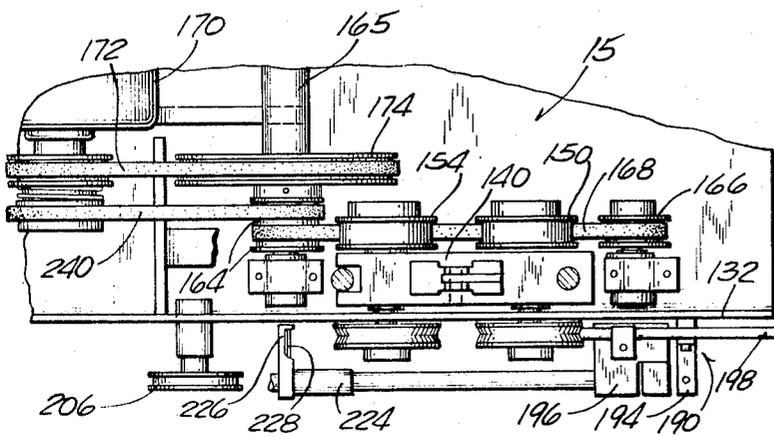
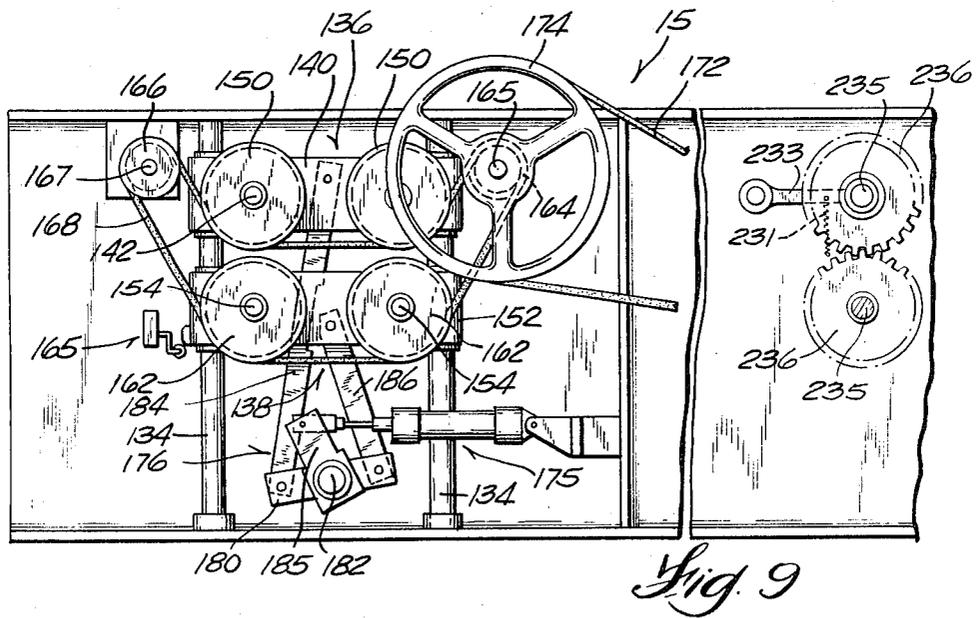
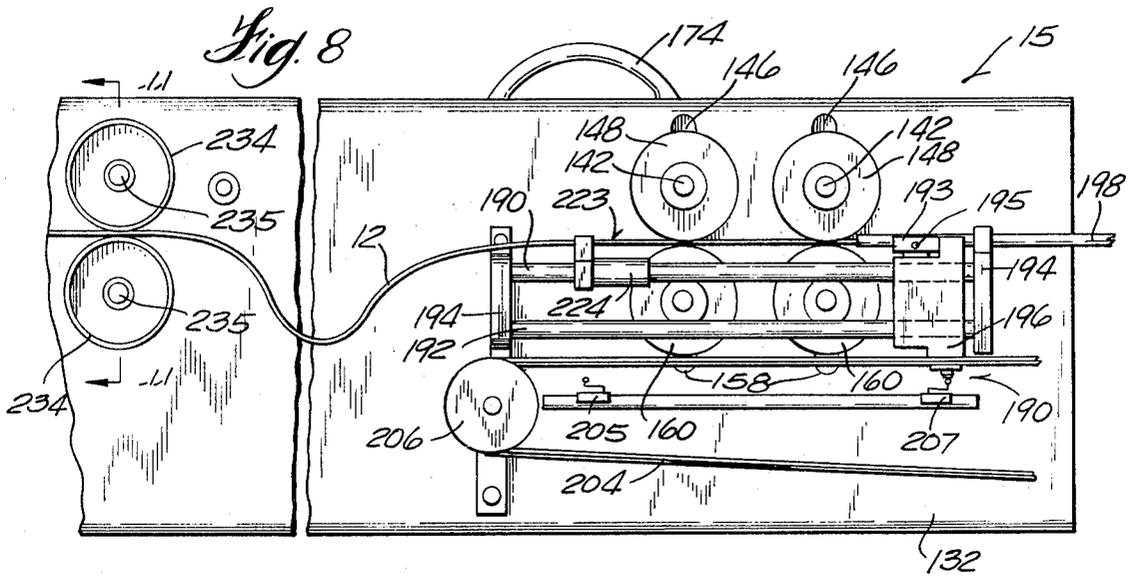
Fig. 6

Fig. 5

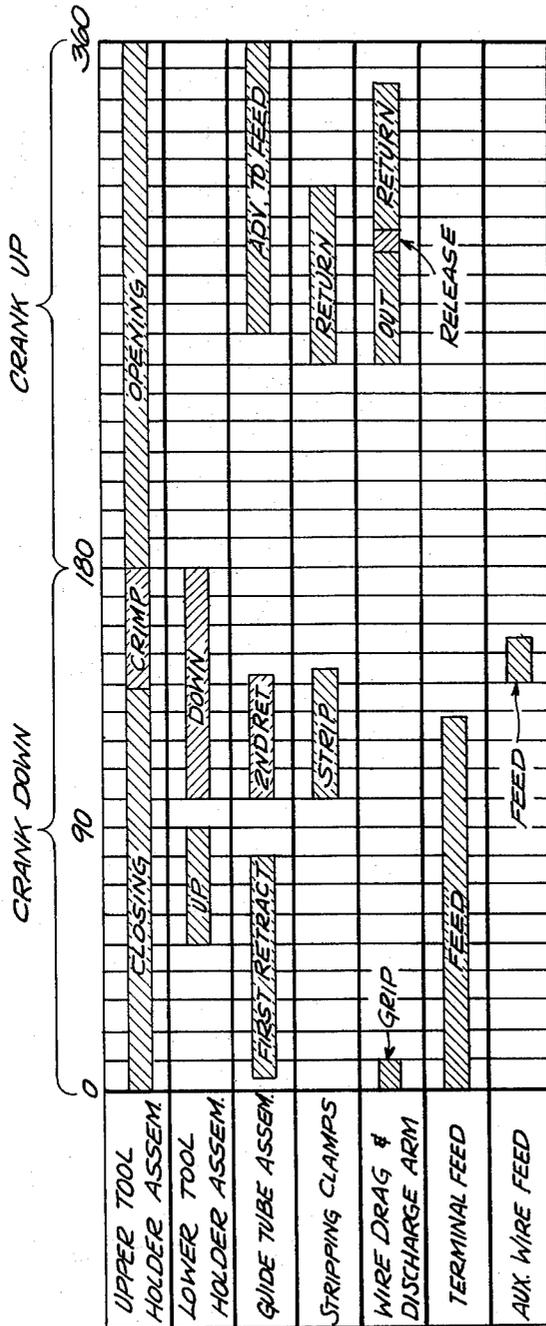
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*Fig. 10*

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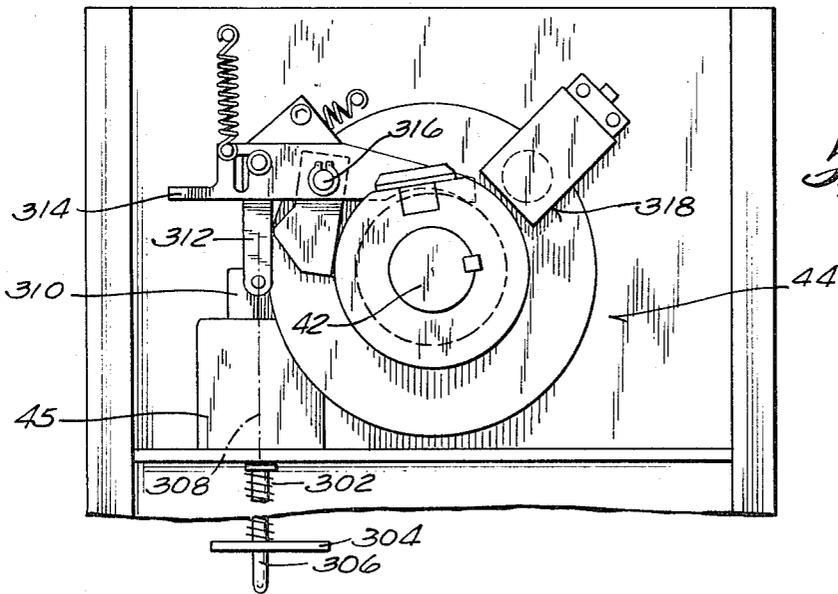
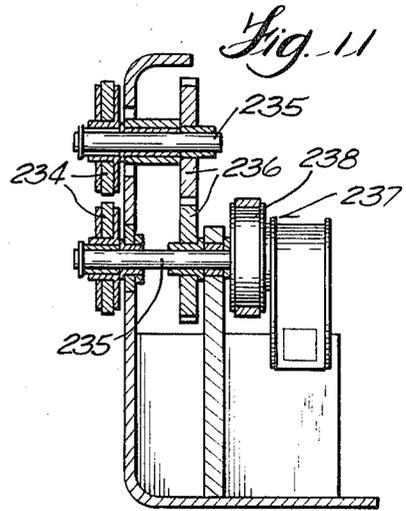
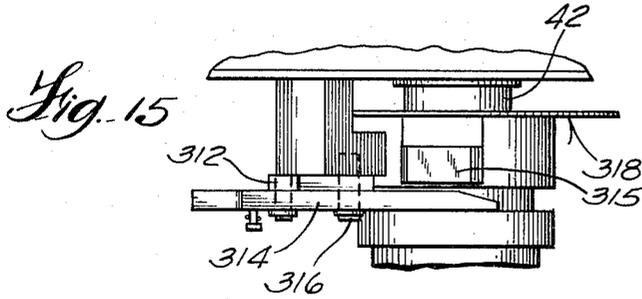


Fig. 14

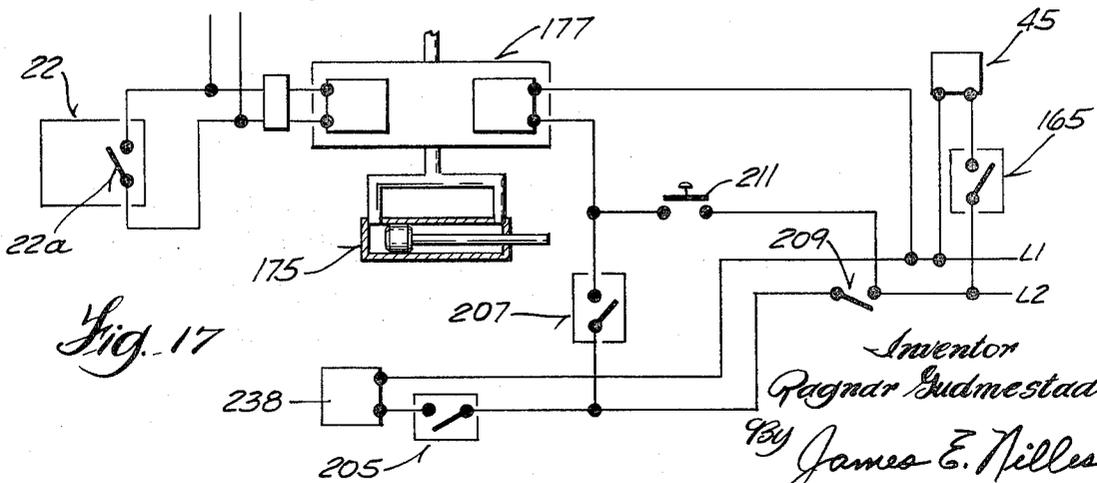


Fig. 17

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## TERMINAL APPLICATOR

## BACKGROUND OF THE INVENTION

Automatic and semi-automatic machines for cutting, stripping and applying terminals to the stripped ends of the cut length of wire are quite well known. These machines are highly sophisticated but are not capable of applying terminals to one or both ends of a piece of wire of any length. There are machines available for cutting, stripping and applying a single terminal to one end of a piece of wire of limited length, such as described in U.S. Pat. No. 3,231,961. There are also machines for applying terminals to the stripped ends of two pieces of wire, see my co-pending application filed June 15, 1970 and entitled "Conveyor Transfer Unit" as Ser. No. 46,391. Both of these machines have been highly successful in their limited fields of use but do not have the versatility required to meet the entire need of the industry.

## SUMMARY OF THE INVENTION

The apparatus of the present invention can be used to apply terminals to both ends of a piece of wire of any practical length. A wire measuring unit as described in U.S. Pat. No. 3,425,129, issued on Feb. 4, 1969, can be used to control the length of wire fed to the terminal applicators. The wire is accurately aligned with the cutting and stripping assembly and the terminal applicators by a guide tube assembly which includes a tube that extends through the terminal applicators. The wire is cut and the ends stripped by pulling the wire through the stripping blades into alignment with the terminal applicators. This is one of the important features of the invention because the wires are pulled rather than pushed into alignment with the terminal applicators thereby reducing the possibility of misalignment. The pulling motion removes any slack in the wire and assures very good accuracy in locating the wire in the terminal.

Another important feature of the present invention is the provision of a slack loop in the wire at the appropriate time in the cycle of operation of the machine. Slack is automatically provided in the wire by a wire loop assembly provided in the wire feed assembly. This loop in the wire eliminates any drag which might interfere with the motion of the guide tube assembly and eliminates any undue stress on the terminal at the end of the wire when the wire is pushed through the applicators. The withdrawing motion of the guide tube assembly is also interrupted momentarily to eliminate the possibility of a loop occurring in the wire between the guide tube and stripping clamp which would have a tendency to misalign the wire in the terminal applicators.

Other objects and advantages will be apparent when the following detailed description is read in connection with the accompanying drawings.

## THE DRAWINGS

- FIG. 1 is a perspective view of the automatic wire cutting and terminal applying apparatus of this invention;  
 FIG. 2 is a front view in elevation of the press frame for the terminal applicators and cutting and stripping apparatus of this invention;  
 FIG. 3 is a side view in elevation of the press frame shown in FIG. 2;  
 FIG. 4 is a top view of FIG. 2 showing the cam followers within the press frame;  
 FIG. 5 is a section view taken on line 5—5 of FIG. 4 showing the lower tool holder cam cluster and linkage assembly;  
 FIG. 6 is a section view taken on line 6—6 of FIG. 4 showing the stripper cam cluster and linkage assembly;  
 FIG. 7 is a section view taken on line 7—7 of FIG. 4 showing the cam and rack drive for the wire guide tube;  
 FIG. 8 is a side view in elevation showing the wire guide tube assembly and the wire drive wheel apparatus;  
 FIG. 9 is a side view in elevation of the drive arrangement for the wire drive wheel assemblies;  
 FIG. 10 is a top view of the wire drive apparatus and wire guide tube;

FIG. 11 is a section view taken on line 11—11 of FIG. 8 showing the wire loop assembly drive clutch;

FIG. 12 is a section view in elevation of a portion of the press frame showing the wire drag and discharge assembly;

FIG. 13 is a top view of the wire drag and discharge assembly;

FIG. 14 is an end view of the pin clutch release mechanism and the trip rod for the drag and discharge assembly;

FIG. 15 is a top view of the pin clutch release mechanism;

FIG. 16 shows the timing cycle chart for the cam shaft; and

FIG. 17 is a schematic view of the wiring diagram for the switches.

## DESCRIPTION OF THE INVENTION

The apparatus 10 of the present invention provides a means for automatically applying electric terminals to one or both ends of a piece of insulated wire 12 of any desired length. As seen in FIG. 1, this apparatus 10 generally includes a press frame or base assembly 14 having a cutting and stripping apparatus 16 and terminal applicators 18 and 20 located on each side of the cutting and stripping apparatus 16. The wire 12 is fed to the press frame 14 by means of a wire feed assembly 15, as more particularly described hereinafter. The length of the wire 12 fed to the press frame 14 is controlled by means of a wire measuring device 22 of the type as shown in U.S. Pat. No. 3,425,129, issued Feb. 2, 1969, and entitled, "Measuring Apparatus." The measuring device 22, as described in said patent, controls the length of the wire 12 by stopping the operation of the wire feeding apparatus 15 after the preselected length of wire has passed through the measuring device 22. A complete cycle of operation of the apparatus 10 of this invention is initiated after the wire 12 is fed to the apparatus.

## The Cutting and Stripping Apparatus

The cutting and stripping apparatus 16 as seen in FIGS. 2 and 3 is substantially similar in operation to the cutting and stripping apparatus shown in U.S. Pat. No. 3,368,428, issued on Feb. 13, 1968. The present apparatus 16 includes an upper tool holder assembly 24 and a lower tool holder assembly 26, each mounted for reciprocal movement in jib guides 28 and 30 provided on the front of the press frame 14. Each of the assemblies 24 and 26 includes upper and lower guide blocks 32 and a tool holder 34 for supporting wire severing blades 36 and insulation cutting and stripping blades 38. The tool holder assemblies 24 and 26 are moved toward each other simultaneously to cut the wire 12 and to strip the insulation at the ends of the wires as is generally understood in the art.

In this regard, the upper tool holder assembly 24 is moved continuously through a cutting cycle by means of an electric motor 40 which is connected to a cam shaft 42 through a pin clutch 44. More particularly, the guide block 32 is connected to the cam shaft 42 by means of a link 46 and a pin 48 which provides an eccentric connection to the cam shaft 42. The cam shaft 42 is journaled for rotation in bearings provided on the press frame 14. A fly wheel 50 is connected to the pin clutch 44 and is driven by a belt 52 connected to the drive shaft of the motor 40. The upper tool holder 24 is driven continuously through a complete cycle in each revolution of the cam shaft 42 due to the eccentric location of the pin 48 on the cam shaft 42. The fly wheel 50 is rotated continuously by the motor 40 and the pin clutch 44 actuated by means of a solenoid 45 to drive the cam shaft 42 through one revolution as described hereinafter. The upper dies for the terminal applicators 18 and 20 are carried on the tool holder assembly 24 as is generally understood in the art.

The lower tool holder assembly 26 is moved through a cutting cycle by means of a linkage assemblage 54 connected to the lower guide block 32 and to a cam cluster 56 provided on the cam shaft 42. (FIGS. 2, 3 and 5). Linkage assembly 54 includes a lever arm 58 pivotally connected to the lower guide block 32 by a pin 60 and mounted for pivotal movement on a pivot shaft 62 which is journaled for pivotal motion in a bear-

ing block 64. A lever arm 66 is connected to the shaft 62 and a link 68 is connected to the lever arm 66 and to a bell crank 70 which is mounted for pivotal movement on a pin 71.

Means are provided for producing positive mechanical movement of the motion of the tool holder assembly 26 to assure a clean cutting action in cutting the wire 12. Such means is in the form of the cam cluster 56 which includes a primary cam 72 and a conjugate cam 74. Bell crank 70 includes a first cam follower 76 on one end which is positioned to follow the cam 72, and a second cam follower 78 on the other end which is positioned to follow the conjugate cam 74. The conjugate cam 74 is angularly offset from the primary cam 72 to provide equal and opposite mechanical forces to the bell crank 70. It should be apparent that the pivotal movement of the bell crank 70 will rotate the pivot shaft 62 to move the tool holder 26 up and down in the guides 30. Since both the upper and lower tool holders 24 and 26, respectively, are operatively connected to the cam shaft 42, positive synchronization of the movement of the tool holders 24 and 26 is assured.

Stripping of the insulation from the cut ends of the wire 12 is accomplished by means of clamp assemblies 80 which are mounted for sliding movement in slide plates 82 provided on the tool holder assemblies 24 and 26. Each of the clamp assemblies 80 includes a pair of stripping clamps 84 mounted on the slide plates 82 and retained thereon by tabs 86 which are positioned within grooves 88 provided in the plates 82. Each pair of stripping clamps 84 is connected to a key 90 which is positioned in a groove 92 provided in the clamps 84 (FIG. 4). Each of the keys 90 is secured to a guide block 96 which is positioned in fixed guide plates 98 mounted on the frame 14. The stripping clamps 84 are thus free to move vertically with respect to the keys 90 and move laterally with the key 90.

In this regard, the clamp assemblies 80 are moved toward and away from the cutting and stripping blades 38 by means of a stripper cam cluster 100 (FIG. 6) and a linkage assembly 102. The cam cluster 100 includes a primary cam 104 and a conjugate cam 106. The linkage assembly 102 includes a bell crank 108 mounted for pivotal movement on the pin 71 and having a first cam roller 110 positioned to follow the periphery of the stripper cam 104 and a second cam roller 112 positioned to follow the periphery of the conjugate cam 106. The bell crank 108 is connected by a link 114 to a bar 116 which is mounted for pivotal movement on a pivot pin 118. The motion of the bar 116 is transferred by connecting rods 119 to lever arms 120 which are secured to pivot shafts 122. The pivot shafts 122 are pivotally mounted in bearing brackets 124 and are connected to the guide blocks 96 by lever arms 126 and links 128. The arrangement of the wire stripping linkage assembly 102 provides equal but opposite motion to each of the guide blocks 96 to strip the end of the severed wire 12 on each side of the cutting blade 34. The motion of the clamp assemblies 80 is synchronized with the motion of the tool holder assemblies 24 and 26 by the common connection to the cam shaft 42.

#### The Wire Feed Assembly

Referring to FIGS. 7 through 10, the wire 12 is fed to the press frame 14 by means of the feed assembly 15 which is operatively connected to the wire measuring device 22. The feed assembly 15 includes a support plate or frame 132 and a pair of fixed shafts 134 mounted in a parallel vertical relation on one side of the frame 132. An upper wire drive assembly 136 and a lower wire drive assembly 138 are mounted for movement toward and away from each other on the shafts 134. The upper drive assembly 136 includes a support plate 140 having a pair of shafts 142 journaled for rotation in bearings provided in the plate 140. The shafts 142 project through slots 146 in the frame 132 above the wire 12. A drive wheel 148 is secured to each of the shafts 142 and a drive pulley 150 is secured to the other end of each of the shafts 142. The lower drive assembly 138 also includes a support plate 152 and a pair of shafts 154 journaled for rotation in bearings

provided in the plates 152. The shafts 154 extend outward through slots 158 in the frame 132 to a position below the wire 12. A drive wheel 160 is secured to the end of each of the shafts 154 and a drive pulley 162 is secured to the other end of each of the shafts 154. The drive pulleys 160 and 162 are connected by a belt 168 to a drive pulley 164 on a drive shaft 165 and an idler pulley 166 on a shaft 167. The drive wheels 148 and 160 are driven by means of a motor 170 connected by a belt 172 to a pulley 174 mounted on the shaft 165 for the drive pulley 164.

The support plates 140 and 162 are moved toward and away from each other on the shafts 134 by means of a pneumatic piston and cylinder assembly 175 and a linkage assemblage 176 (FIG. 9). The linkage assemblage 176 includes a swivel bar 180 secured to a pivot shaft 182 and a link 184 connecting the bar 180 to the support plate 140 and a link 186 connecting the bar 180 to the support plate 152. The shaft 182 is pivoted by means of the pneumatic cylinder assembly 175 which is connected to the shaft 182 by an arm 185 to provide equal and opposite motion to the movement of the support plates 140 and 152. The drive wheels 148 and 160 are driven continuously by the motor 170 and the air cylinder assembly 175 is actuated by means of a solenoid valve 177 to move the support plates 140 and 152 toward each other on the shafts 134 so that the drive wheels 148 and 160 engage the wire 12. The drive wheels 148 and 160 will remain in the drive position until the measuring device 22 provides a signal to the air cylinder 175 to open the drive wheels. The movement of the lower drive assembly 138 is used to actuate a switch 165 to start the operation of the apparatus 10 as described hereinafter.

#### The Wire Guide Tube Assembly

Means are provided for precisely locating the wire 12 in alignment with the clamp assemblies 80 in the press frame 14. In this regard, the wire 12 must be accurately located in the clamp assemblies 80 and the terminal applicators 18 and 20 to assure accuracy in cutting and stripping the ends of the wires. Such means as seen in FIGS. 1, 8 and 10 is in the form of a guide tube assembly 190 which is mounted on the support frame 132. The assembly 190 includes a pair of fixed bars 192 supported in a parallel spaced relation by brackets 194 on the frame 132. Slide block 196 is mounted for reciprocal motion on the bars 192. A guide tube 198 is secured to the slide block 196 by means of a support block 193 pivotally mounted on the slide block 196 by a pin 195. The guide tube 198 extends outward therefrom through a guide block 197 which is mounted for vertical motion in a bracket 199 and biased to the upper position by means of a spring. The guide tube 196 is aligned with the terminal applicators 18 and 20 and the clamp assemblies 80 and is free to follow the motion of the clamp assembly. The wire 12 is threaded through the guide tube 198.

Means are provided for moving the guide tube 198 into the press frame 14 and for withdrawing the guide tube 198 from the press frame 14 when the wire 12 is to be cut. Such means is in the form of a cam 200 mounted on drive shaft 42 and a rack and pinion drive assembly 202 as seen in FIGS. 2, 7 and 8. In this regard, the slide block 196 is secured to a belt 204 which is reeved around an idler pulley 206 mounted on plate 132 and a drive pulley 208 mounted on the press frame 14. The drive pulley 208 is mounted on a drive shaft 210 which is journaled for rotation in the press frame 14. The drive pulley is driven by means of the drive assembly 202 which includes a pinion gear 212 provided on the shaft 210 and a rack 214 provided on a rack arm 216 which is connected to a lever arm 218 pivotally mounted on pin 71. A cam follower 220 is provided on the lever arm 218 in a position to engage the periphery of cam 200. The lever 218 is biased into engagement with the periphery of the cam 200 by means of a spring 222. The rack arm is held in engagement with the gear 212 by means of a guide bracket 215 provided on the press frame 14. The pivotal motion of the lever 218 in following the contour of the cam

200 is transferred through the rack 214 and gear 212 to the belt 204. The slide block 196 is used to actuate switches 205 and 207 provided at each end of the lower bar 192. Each of these switches 205 and 207 is provided with a knee so that they are actuated by the movement of the slide block 196 in one direction only.

#### The Wire Loop Assembly

Slack in the form of a loop (shown in FIGS. 1 and 8) is provided in the wire 12 between the measuring device 22 and the guide tube assembly 190 to allow the guide tube 198 to move freely into the press frame 14 by means of a loop assembly 232 provided on the frame 132. The loop assembly 232 (FIGS. 8, 9 and 11) includes a pair of wire drive wheels 234 mounted on shafts 235. The upper shaft 235 is mounted on a link 233 which is pivotally mounted on the frame 132 and biased downward by means of a spring 231. The shafts are connected by gears 236 and are driven by the motor 170 for the wire feed assembly 15. In this regard, a conventional electrically actuated friction clutch 237 made by Precision Instruments is provided on one of the shafts 235 and a pulley 238 provided on the clutch 237. The pulley 238 is connected to the drive pulley 164 by a belt 240. The clutch 237 is actuated by means of the switch 205 provided on the feed assembly 15 to provide one-third of a revolution to the drive wheels 234 and approximately 3 inches of slack in the wire 12.

The wire 12 is held in line with the guide tube 198 in the feed assembly 15 by means of a wire guide 223 provided on the upper bar 192. The guide 223 includes a cylinder 224 mounted for sliding motion on the rod 192 and an arm 226 extending radially outward from the cylinder. The leaf spring 228 is mounted on the arm 226 to hold the wire in a fixed position on the arm and in alignment with drive wheels 148 and 160.

#### Wire Drag and Discharge Assembly

Means are provided for holding the wire 12 in a fixed position on withdrawal of the guide tube 198 from the cutting and stripping assembly 16 and for discharging the cut length of wire 12 from the apparatus 10 after the application of the electric terminals to the ends of the wire. Such means is in the form of a wire drag and discharge assembly 245 as shown in FIGS. 2, 3, 12 and 13. The assembly 245 includes an upper jaw 242 and a lower jaw 244 each mounted for pivotal movement on pins 246 provided on a slide plate 248 which is retained for sliding movement in a channel block 249 by plates 247. Jaws 242 and 244 are biased to an open position with respect to the wire 12 by means of a spring 250 secured to pins 252 provided on each of the jaws 242 and 244. The jaws 242 and 244 are closed to engage the wire 12 by means of a wedge 254 supported by a slide block 256 for sliding movement in a slot 258 provided in the slide plate 248. The wedge 254 is biased by a compression spring 260 into wedging engagement with the end of the jaws 242 and 244. The compression spring 260 has sufficient force to pivot the jaws about pins 246 against the bias of spring 250 and into engagement with the wire 12.

Means are provided to allow the jaws 242 and 244 to move downward with the wire 12 during the cutting and stripping motion. Such means is in the form of a support bracket 251 secured to the press frame 14. The channel block 249 is mounted for pivotal movement on the support bracket 251 by means of a pin 253. The channel block 249 is biased clockwise (FIG. 12) by a balance spring 255 and is moved upward against the bias of the spring 255 by a spring 256 and a plunger 257 provided in bracket 251.

The wire 12 is discharged from the apparatus 10 by moving the assembly 245 outward to a position clear of the clamp assemblies 80, and by opening the jaws 242 and 244 to release the wire 12. The assembly 245 is moved outward by means of a cam 262 secured to the cam shaft 42 and a linkage assembly 264 as shown in FIGS. 2 and 3. In this regard, the linkage as-

sembly 264 includes a first rocker arm 266 pivotally mounted on a pin 268 and having a cam follower 270 positioned to follow the contour of cam 262. The other end of the rocker arm 262 is connected to a second rocker arm 272 by link 274. The second rocker arm 272 is mounted for pivotal movement on pin 275 and is connected by a link 276 to a lever arm 278 which is secured to a shaft 280 journaled for rotation in a bearing block 282. The motion of the shaft 280 is transferred to the slide 248 by a lever 284 and a link 286. The rocker arm 275 is biased by a spring 285 in a clockwise direction to assure that the cam roller 270 follows the contour of the cam 262.

Means are provided for releasing the wire 12 from the jaws 242 and 244 of the drag assembly 240 after the wire has been moved clear of the clamp assembly 80. Such means is in the form of a limit stop 290 provided on the support plate 249 in a position to engage a shoulder 292 provided on the slide block 256. Upon engagement of the shoulder 292 with the stop 290, the wedge 254 will stop as the slide plate 248 continues to move outward. As the ends of the jaws 242 and 244 move away from the end of the wedge 254, the spring 250 will pivot the jaws to an open position. The wire 12 will drop out of the jaws 242 and 244. A wire collecting trough or wire stacking device can be located in a position to receive the wire from the clamp assembly 80. The slide 248 is then drawn back into the press frame 14 to a position where the jaws 242 and 244 can engage the next length of wire 12.

The jaws 242 and 244 are maintained in the open position until the wire has been fed into the press frame by means of a latch 294 which is biased by spring 296 into engagement with a notch 298 provided in the wedge 258. The latch 294 is pivotally mounted on a pin 300 on the side plate and engages the notch 298 as the slide plate 248 is moved out of the press frame and the wedge 254 held in a fixed position by the limit stop 290.

The latch 294 is released to allow the wedge 254 to move forward to close the jaws 242 and 244 on the wire 12 by means of a rod 302 which is connected to the plunger 310 of the solenoid 45. In this regard (FIGS. 12 and 14), the rod 302 is mounted in a bracket 304 provided on the press frame 14 in a position to engage the end of the latch 294. The rod 302 is biased by a spring 306 upwardly into a hole 308 provided in the plunger 310 of the solenoid 45. When the solenoid is actuated to initiate a cycle of motion of the cam shaft 42, the downward movement of the plunger 310 will push the rod 302 into engagement with the latch 294. The latch will rotate about the pin 300 until it clears the notch 298 allowing the spring 260 to push the wedge against the jaws 242 and 244.

#### Drive Clutch for Press Frame

The press frame 14 is driven through one revolution or one cycle of motion by means of the pin clutch 44 which connects the flywheel 50 to the shaft 42. The operation of a pin clutch is generally understood and is fully described in my co-pending application, Ser. No. 46,391, filed June 15, 1970, on a Conveyor Transfer Unit. The pin clutch 44 (FIGS. 14 and 15) is actuated by the movement of plunger 310 of solenoid 45. The solenoid 45 is connected by a link 312 to a release lever 314 pivotally mounted on pin 316. The pivotal movement of the release lever 314 releases pin 315 for movement into engagement with a gear plate on flywheel 50 as is generally understood in the art. The pin clutch 44 will produce one cycle of revolution of the cam shaft 42 and then will be disengaged from the flywheel 50. A disc type friction brake 318 can be used to aid in stopping the cam shaft 42 after one revolution.

The electric circuit (FIG. 17) for this apparatus includes the three micro switches 165, 205, and 207, start switches 209 and 211, and the limit switch 22a in the measuring device 22. Switch 209 is closed to establish the automatic circuit for continuous operation of the system. The motors 40 and 170 are normally energized before switch 209 is closed. Switch 211 is then momentarily closed to initiate the first cycle of operation and the cycles are repeated by the momentary closing of

switch 207. The switch 207 is normally open and connected to the double acting solenoid valve 177 which controls the pneumatic cylinder assembly 175. Switch 207 is momentarily closed by the motion of the slide block 196 to close the drive assembly 15 and feed wire to the press frame 14. When the preset amount of wire 12 has been fed to the press frame 14, the measuring unit 22 will close the limit switch 22a which is also connected to the solenoid valve 177 to reverse the pneumatic cylinder assembly 175 and open the wire feed drive assembly 15. Switch 165 which is connected to energize the solenoid 45 is closed by the final motion of the lower drive wheel assembly 138. Switch 205 is closed by the withdrawal motion of the guide tube assembly 190 to actuate the clutch 237 for the wire loop assembly 232. Switch 207 is closed on the return motion of the guide tube assembly 190 to actuate the pneumatic assembly 175 and restart the cycle. If switch 209 is open, the switch 211 can be used to provide single cycles of operation.

#### Operation of the Apparatus

In operation, the press frame 14 is stopped with the cam shaft 42 positioned at a point where the pin 48 for the upper tool holder assembly 24 is located at top dead center, as seen in FIG. 2. The guide tube assembly 190 is normally located at the right end of the frame 132, as seen in FIGS. 1 and 8. It should be noted that in this position, the end of the guide tube 198 is positioned adjacent to the jaws 242 and 244 of the drag assembly 245. The measuring device 22 is set to the desired length of wire. The apparatus is started by closing the switch 209 to set up the automatic circuit. Both the electric motors 40 and 170 should be energized. Switch 211 is then closed to start the first cycle of operation. Cycles of operation are repeated by the momentary closing of switch 207 by the movement of slide block 196.

The air cylinder 175 is actuated by closing either switch 207 or 211 to close the drive wheel assemblies 136 and 138 on the wire 12 to start feeding wire through the guide tube 198 into the press frame. When the desired length of wire 12 is fed through the guide tube 198, the measuring device 22 will close switch 22a to reverse the pneumatic piston and cylinder assembly 175 and open the drive wheel assemblies 136 and 138. Feeding of wire 12 through the guide tube 198 will stop. The lower drive wheel assembly 138 as it approaches the end of its downward movement will engage and close switch 165 which energizes the solenoid 45 for the pin clutch 44 and drag assembly 245. The solenoid plunger 310 of the solenoid 45 simultaneously actuates the pin clutch 44 and trips the drag assembly 245. The pin clutch is actuated by the motion of plunger 310 which pulls the release lever 314 away from the clutch allowing the clutch pin 315 to engage the gear on the flywheel. The drag assembly 245 is tripped by the downward movement of the plunger 310 which moves the trip rod 302 against the latch 294 to release the wedge 254. The jaws 242 and 244 will close on the wire 12 holding the wire in a fixed position.

The cycle of operation of the various assemblies on the press frame 14 is shown in FIG. 16. The actuation of each of the assemblies is referred to with respect to the angular amount of movement of the cam shaft 42. In this respect, it will be noted that the upper tool holder assembly 24 moves continuously through a full cycle since it is connected to the cam shaft 42 by the pin 48. The guide tube assembly 190 will start to retract from the drag assembly 245 after the shaft 42 has moved 5° and will stop moving when the cam shaft 42 has moved through 80°. One end of the guide tube 198 will then be adjacent the left hand clamp assembly 80 and the other end in abutting engagement with the wire holding assembly 223 on shaft 192. The lower tool holder assembly 26 will start to move upward after the cam shaft has moved 60°.

The clamp assemblies 80 will close on the wire 12 and at approximately 90° of motion of the cam shaft 42, the wire 12 is cut by the cutting blades 36. As the wire 12 is cut, the guide

tube 198 will start to move again at 98° of movement of the cam shaft 42 and at 100° of movement of the cam shaft 42, the clamp assemblies 80 will start to move outward to strip the ends of the wire 12. The guide tube 198 moves outward and downward with the clamp assemblies 80 to prevent the formation of a loop in the wire between the clamp assemblies 80 and the guide tube which could possibly cause the wire to be misaligned with the terminal applicator 18.

The lower tool holder assembly 26 starts to move downward after 100° of motion of the cam shaft at the same rate as the downward motion of the upper tool holder assembly 24. The stripping motions of the clamp assemblies 80 will continue until the cam shaft 42 has moved through 145°. The motion of the guide tube 198 also is stopped at approximately 145° of motion of the cam shaft 42.

The wire terminals are crimped onto the stripped ends of the wire 12 during the movement of the cam shaft 42 from 139° to 180°. The motion of the upper tool holder assembly 24 will reverse at 180° and start to move back upward to its original position. It should be noted that when guide tube assembly 190 reaches the left end of the rods 192, the slide block 196 will engage the switch 205, closing the circuit to the friction clutch 237 of the wire loop assembly 232. The clutch 237 will drive the wheels 234 through approximately one-third of a revolution pulling approximately 3 inches of slack into the wire 12 between the drive wheels 234 and the guide tube 198. As pointed out above, this slack is necessary since the force provided for moving the guide tube assembly 190 is not sufficient to pull wire through the wire measuring device.

After the cam shaft 42 has moved through 250°, the wire drag and discharge assembly is moved outward to discharge the wire from the apparatus 10. The wire 12 is released after 300° and the drag assembly 245 returned to the starting position in the press frame 14 with the jaws 242 and 244 biased to the open position. Stripping clamp assembly 80 will start to return to their starting position when the cam shaft 42 moves from 250° to 310°.

The guide tube assembly 190 will start to advance into the press frame 14 when the cam shaft 42 reaches 260° and will reach the end of its movement in the press frame 14 at approximately the same time as the cam shaft reaches top dead center. If the apparatus is on automatic operation, the slide block 196 will engage the switch 207 to initiate a second cycle of operation of the apparatus 10.

I claim:

1. The combination of a wire cutting and stripping assembly, a terminal applicator positioned on each side of said wire cutting and stripping assembly, means for feeding the wire to said cutting and stripping means, said means including a guide tube assembly for aligning the wire in the cutting and stripping assembly and means for pulling said wire through said wire cutting and stripping assembly into alignment with said terminal applicators.

2. The combination according to claim 1 including a wire measuring unit operatively connected to control the operation of the wire feeding means.

3. The combination according to claim 1 wherein said guide tube assembly comprises a pair of support bars, a guide block mounted for reciprocal motion on said support bars, a guide tube mounted on said guide block, the wire being fed through said guide tube, and means for moving said guide block on said support bars to move the guide tube into said cutting and stripping apparatus and withdrawing said guide tube from said apparatus.

4. The combination according to claim 1 including means for providing a loop in the wire.

5. The combination according to claim 1 including means for holding said wire in said cutting and stripping means on withdrawal of said guide tube from said frame.

6. The combination according to claim 1 wherein said feeding means includes a pair of fixed shafts, an upper and lower drive wheel assembly mounted for movement toward and away from each other on said shafts, said assemblies each in-

cluding a pair of drive wheels positioned to engage said wire, and a pneumatic piston and cylinder assembly operatively connected to said assemblies for moving said drive wheels into engagement with said wire.

7. The combination according to claim 4 wherein said means for providing a loop in the wire includes a pair of drive wheels positioned to engage the wire and means actuated by said guide tube assembly for driving said drive wheels.

8. An automatic wire cutting and terminal applying machine comprising

- a wire cutting and stripping assembly,
- an electric terminal applicator positioned on at least one side of said wire cutting and stripping assembly,
- a wire feed assembly positioned to feed wire into said wire cutting assembly,
- a selectively settable measuring unit operatively connected to control said wire feed assembly and means for pulling the wire through said wire cutting and stripping assembly into alignment with said terminal applicator.

9. The machine according to claim 8 including means for driving said wire cutting and stripping assembly and said terminal applicators through a cycle of operation.

10. The machine according to claim 9 including means actuated by said wire feed assembly for actuating said drive means.

11. The machine according to claim 8 including a wire guide tube assembly supported by said wire feed assembly and including a guide tube through which the wire is fed into said wire cutting and stripping assembly.

12. The machine according to claim 11 wherein said wire guide tube assembly includes a pair of support bars, a guide block mounted for reciprocal motion on said support bars between an extended position and a withdrawal position, and means connected to said drive means for moving said guide block in timed relation to the motion of said wire cutting and stripping assembly and said terminal applicators.

13. The machine according to claim 12 including means for drawing a loop in the wire prior to moving said guide tube into said cutting and stripping assembly.

14. The machine according to claim 13 including means actuated by said guide block on moving to the withdrawn position for actuating said loop drawing means.

15. The machine according to claim 8 wherein said wire feed assembly includes a support plate, a pair of bars supported in a parallel spaced relation adjacent said support plates, an upper and a lower drive wheel assembly mounted for reciprocal motion on said bars, each drive wheel assembly including a wire drive wheel positioned for movement into engagement with said wire, and means for moving said drive wheel assemblies toward and away from each other.

16. The machine according to claim 15 including means for continuously rotating said drive wheels.

17. The machine according to claim 11 including means for holding the wire while said guide tube assembly is being withdrawn from said cutting and stripping assembly.

18. An apparatus for feeding wire to a cutting and stripping assembly having a terminal applicator located on each side, and wire pulling clamp assemblies on each side of said cutting and stripping assembly said apparatus comprising,

- a frame,
- a pair of shafts mounted in a parallel spaced relation on one side of said frame,
- an upper and a lower drive wheel assembly mounted on said shafts, each of said drive wheel assemblies including a pair of drive wheels positioned to engage the wire,
- means for driving said wheels,
- and means for moving said drive wheel assemblies toward each other to bring said wheels into operative engagement with said wire to feed wire to the clamp assemblies.

19. The apparatus according to claim 18 including a guide tube assembly mounted on said frame and including a guide tube through which said wire is threaded.

20. The apparatus according to claim 19 including means for moving said guide tube into the cutting and stripping apparatus.

21. The apparatus according to claim 19 including means for moving said wire to provide a slack loop next to said wheel guide tube assembly.

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