United States Patent [19]

Mille

[11] **3,813,753**

[45] **June 4, 1974**

[54] **APPARATUS FOR APPLYING TERMINALS FROM A CARRIER STRIP TO WIRE**

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[22] Filed: **Nov. 22, 1972**

[21] Appl. No.: **308,689**

[52] **U.S. Cl.** ..... **29/203 DT**

[51] **Int. Cl.** **H01r 43/04**

[58] **Field of Search** ..... 29/203 D, 203 R, 203 S, 29/203 MW

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Primary Examiner—Thomas H. Eager

[57] **ABSTRACT**

Apparatus mounting crimping dies and feeding means for crimping successively fed terminals and dislodging the crimped terminals from a feeding carrier, by synchronized relative movement between the crimping dies and carrier feeding means.

4 Claims, 9 Drawing Figures

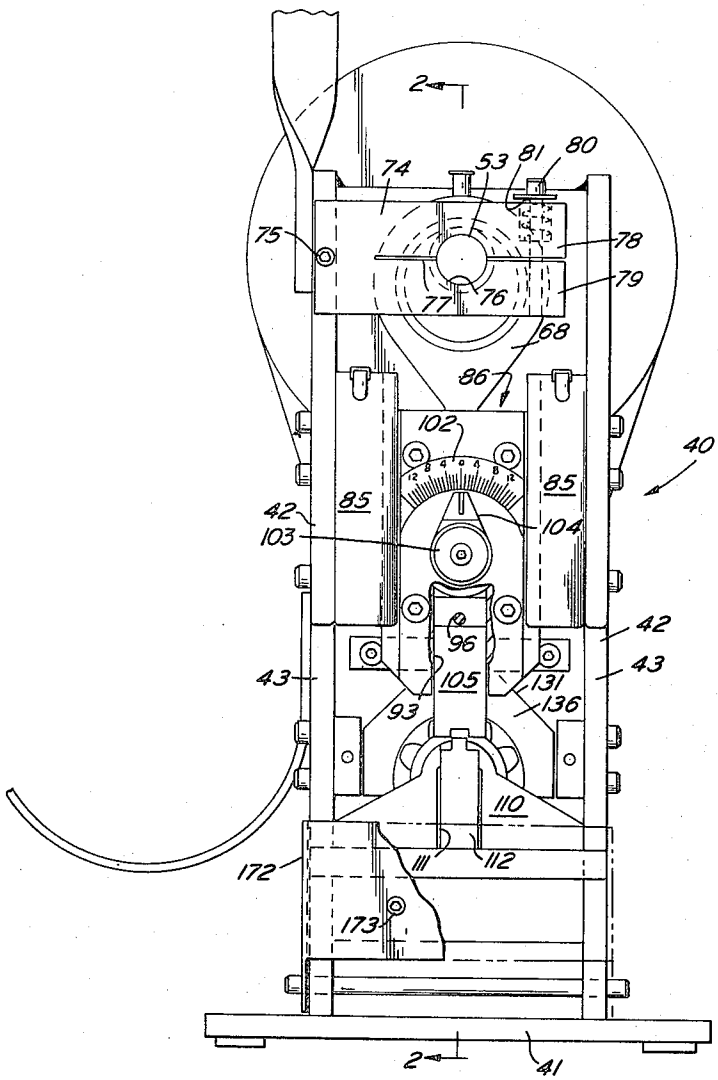


FIG. 1

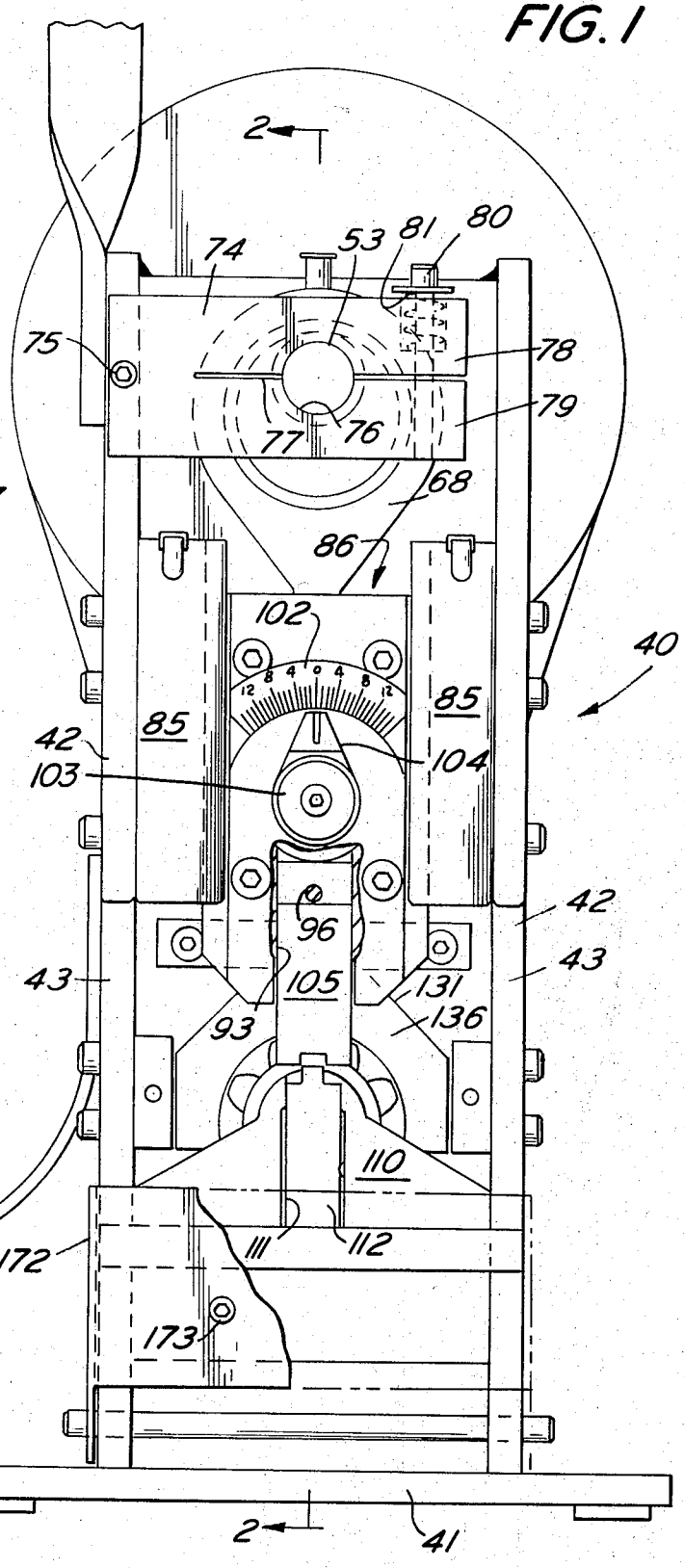

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FIG. 4

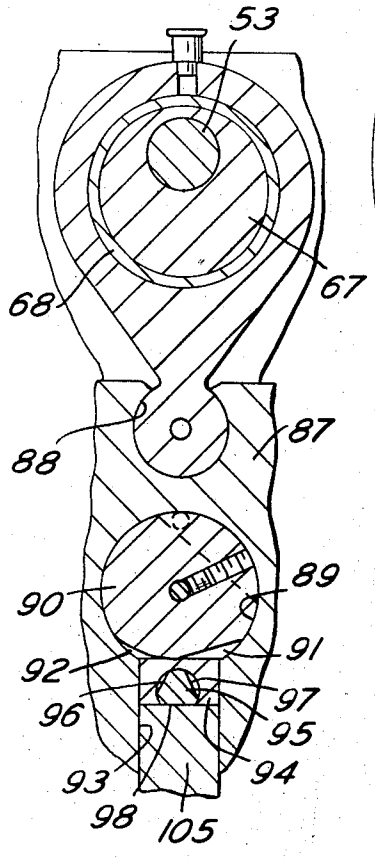

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FIG. 2

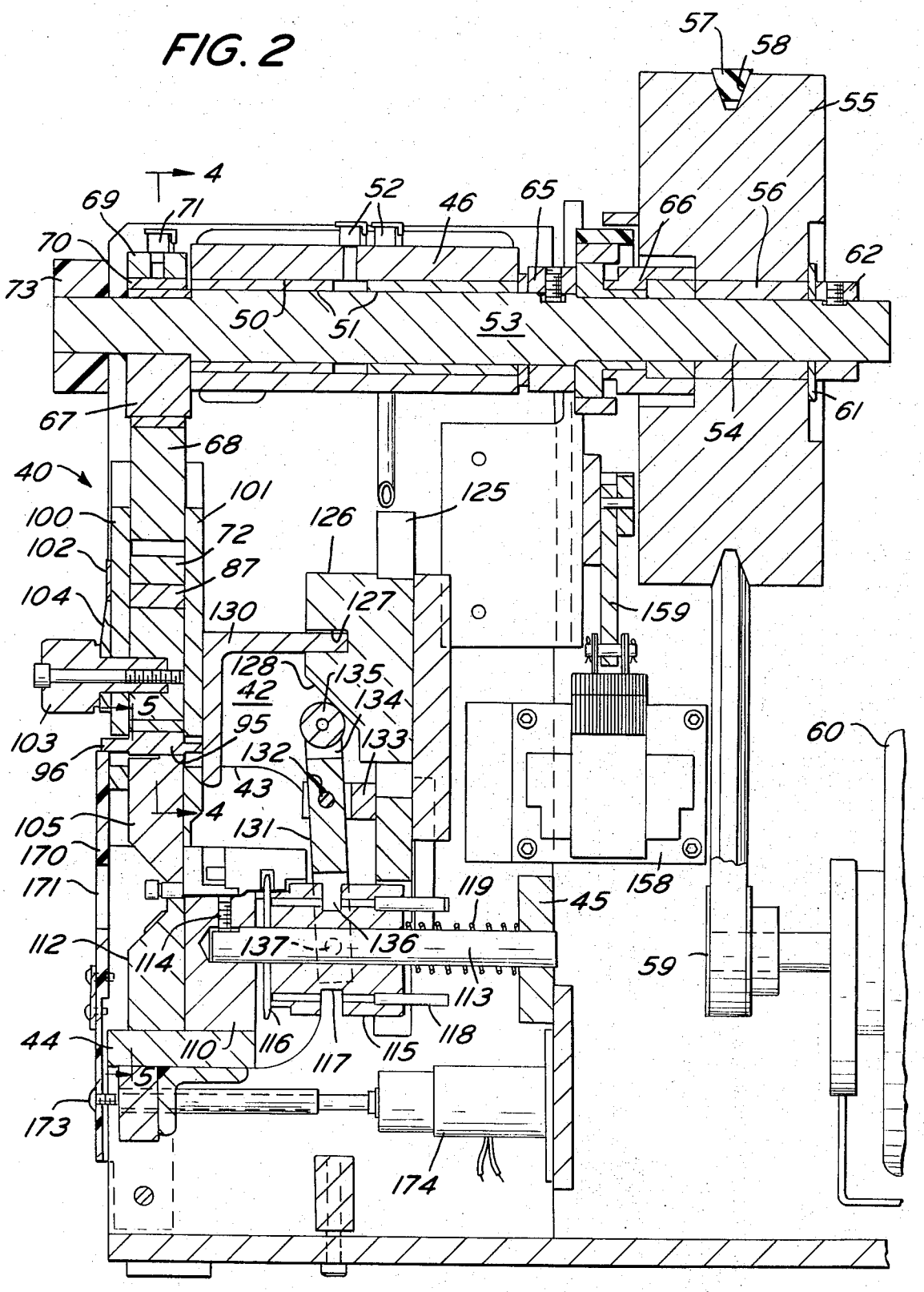
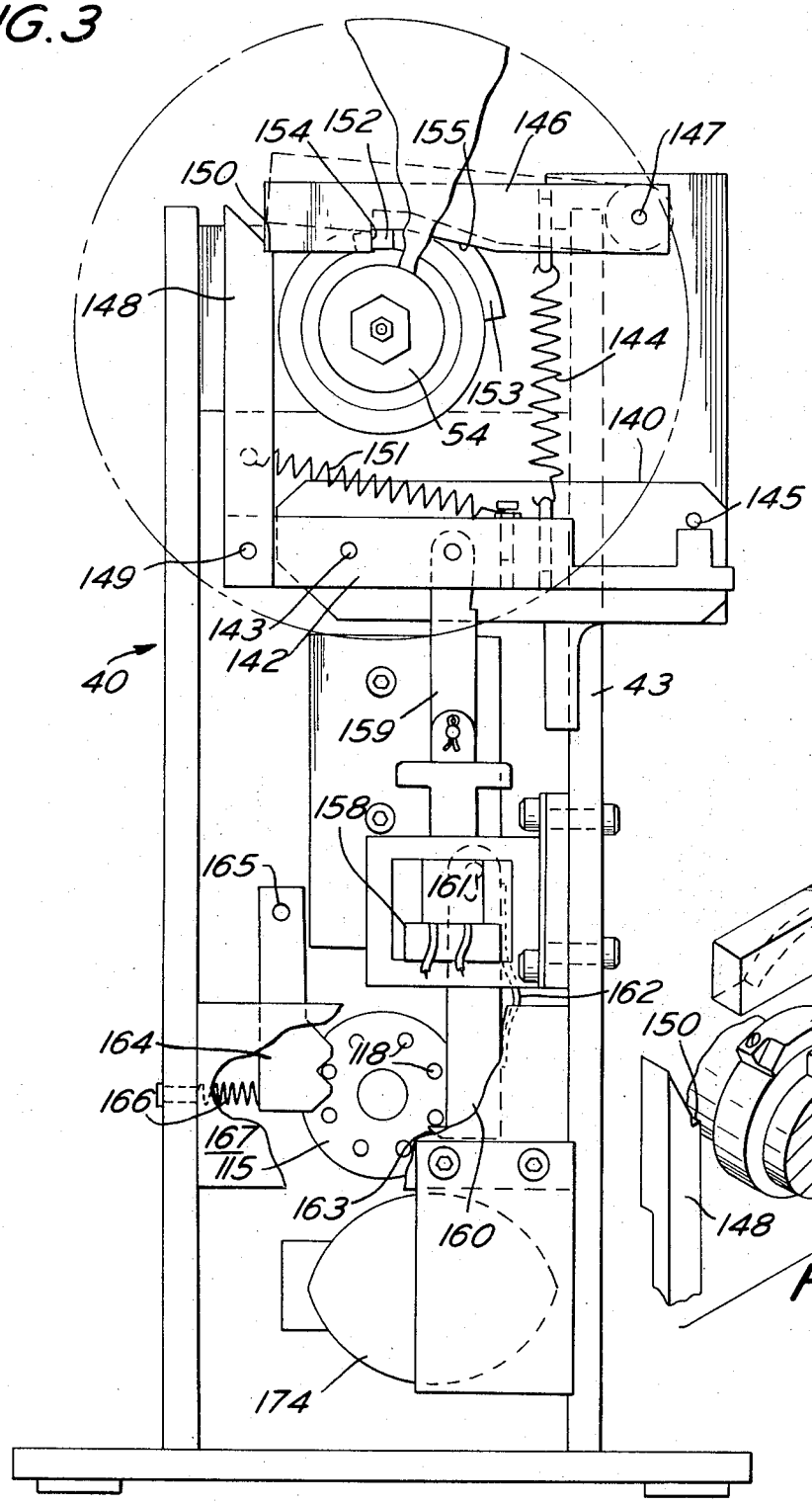

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FIG. 3


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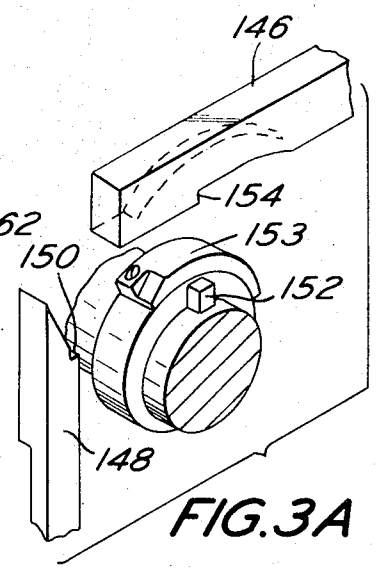

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FIG. 3A

FIG. 5

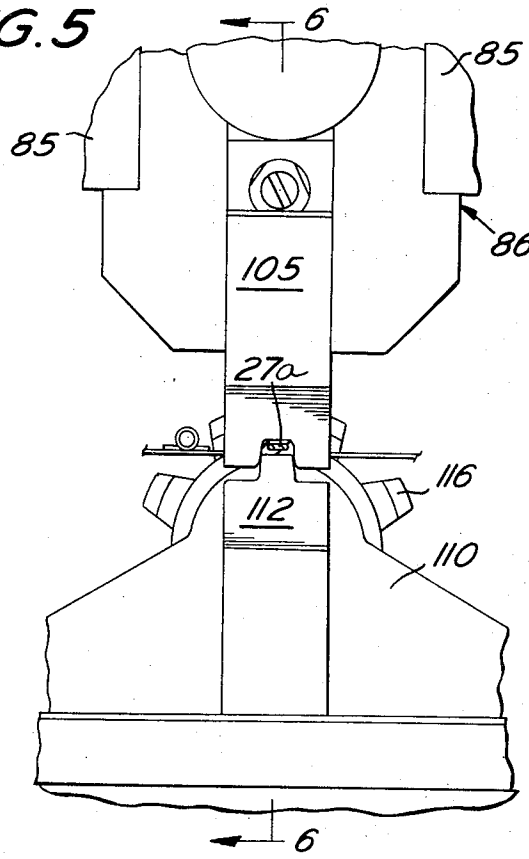
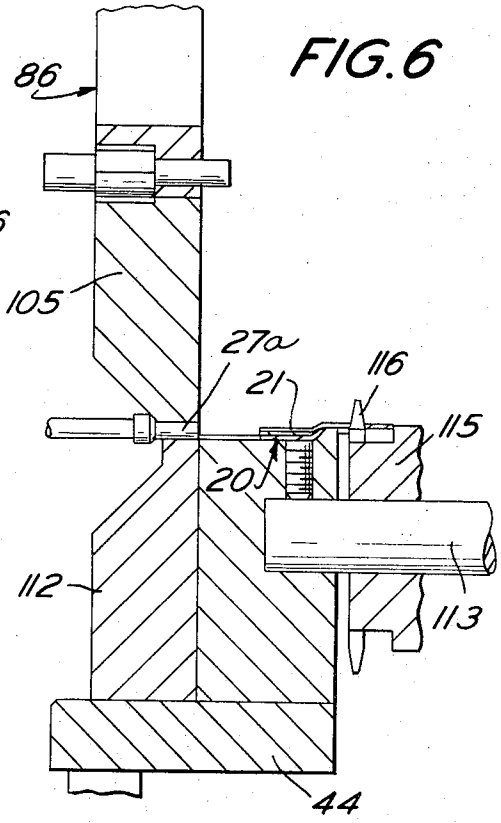


FIG. 6



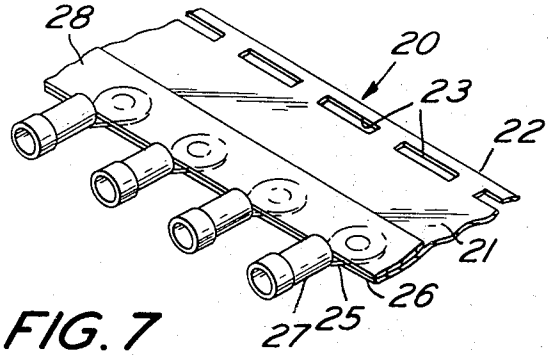


FIG. 7

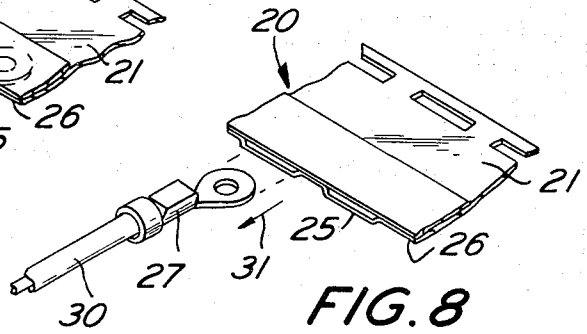


FIG. 8

APPARATUS FOR APPLYING TERMINALS FROM A CARRIER STRIP TO WIRE

BACKGROUND OF THE INVENTION

The high speed and large quantity application of wire terminals to wires has, heretofore, been subject to substantial difficulties, both in involving relatively complex and unreliable equipment, subject to frequent malfunction and breakdown, as well as being relatively slow and of limited output per machine, so that undue members of machines and operators were required.

More particularly, one major difficulty encountered in prior relatively high rate terminal crimping procedures was that of rapid, reliable and precise feeding of terminals to the crimping dies. The apparatus of the instant application utilizes terminal carrier strip means or tape, such as that disclosed in my copending U.S. Pat. application Ser. No. 243,781, filed Apr. 13, 1972.

SUMMARY OF THE INVENTION

It is, therefore, an important object of the present invention to provide apparatus for applying terminals to wires which utilizes strip carried terminals for accurate and dependable feeding of the terminals to a crimping station, where wire ends are associated with the fed terminals to be crimped together, and the crimped terminal together with the associated wire is separated from the carrier strip by relative movement between the crimping means and strip feeding means.

It is a further object of the present invention to provide terminal applying apparatus of the type described which is capable of use in conjunction with a wide variety of terminal sizes and styles, as by mere interchange of crimping dies, the terminals being automatically and precisely positioned at the crimping station for a crimping operation responsive to proper location of a wire end, and wherein wire ends may be fed manually, if desired, while the apparatus permits of automatic wire end feeding to the terminal applying apparatus.

It is still another object of the present invention to provide a terminal applying apparatus having the advantageous characteristics mentioned in the preceding prargraphs which is entirely safe and foolproof in operation, durable and reliable throughout a long useful life, and extremely simple in construction for economy of manufacture and maintenance.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view showing the terminal applying apparatus of the present invention in a non-crimping position, partly broken away for clarity.

FIG. 2 is a sectional elevational view taken generally along the line 2—2 of FIG. 1, showing interior construction.

FIG. 3 is a rear elevational view of the apparatus of FIG. 2, as from the right-hand side thereof, with parts broken away for ease of understanding.

FIG. 3A is a perspective view of the upper members in FIG. 3.

FIG. 4 is a partial sectional elevational view taken generally along the line 4—4 of FIG. 2.

FIG. 5 is a partial sectional view taken generally along the line 5—5 of FIG. 2, but showing the dies in closed position.

FIG. 6 is a sectional elevational view taken generally along the line 6—6 of FIG. 5.

FIG. 7 is a partial perspective view illustrating a terminal feeding carrier strip for use in the instant apparatus, prior to crimping.

FIG. 8 is a perspective view similar to FIG. 7, but illustrating the carrier strip and a terminal after crimping and separation from the strip.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and initially to FIGS. 7 and 8 thereof, a carrier, strip or tape is generally designated **20**, and may include an elongate flexible sheet **21**, say of plastic sheeting, or other material capable of being coiled, as for convenience in storage, shipment and use. The sheet **21** may be provided at one longitudinal region, say along one side edge **22**, with feed elements **23**, such as sprocket holes or other suitable feed elements for cooperation with strip feeding means, as will appear more fully hereinafter.

Additionally, the sheet **21** may be provided, as by deformation, see FIG. **8**, with receivers or sockets **25** adjacent to the opposite longitudinal side edge **26**, for receiving portions of respective terminals **27**. Thus, the enlarged end or head of each terminal **27** may be conformably received in a respective carrier deformation **25**, with the barrel or remainder of the terminal extending beyond the adjacent carrier edge **26**. A securement member or adhesive tape or strip **28** may be applied over the received portions or heads of terminals **27** to releasably retain the latter in their receiving deformations **25**.

The carrier **20** and associated terminals **27**, as shown in FIG. **7**, illustrate the condition prior to crimping assembly with respect to a wire end. FIG. **8** illustrates the carrier **20** and a terminal **27***a* as associated with a wire end **30**, being crimped thereon. Further, the crimped terminal **27***a* is illustrated as having been separated or disassociated from the carrier **20**, as by movement along the direction of arrow **31**.

Considering now the terminal applying apparatus of the present invention shown in FIGS. **1–3**, being essentially a press and generally designated **40**, the press **40** may include a generally horizontal base member or plate **41**, from which upstand a pair of generally parallel, upright side members or plates **42**. The side pieces or plates **42** are each formed at a vertically intermediate location with a forwardly opening cutout **43**. A bed member or plate **44** extends laterally between the pair of spaced side members **42**, being disposed generally horizontally and suitably secured to the side members in lower regions of the cutouts **43**. A lateral frame member or spreader bar **45** extends between rearward regions of the side members **42**, rearwardly of the cutouts **43**. Additionally, a top member or block **46** is disposed generally horizontally and extends laterally be-

tween upper regions of the side members 42, being suitably fixed thereto.

The structure thus far described may be considered as the framework of a press, including the upright side pieces 42, press bed 44, rear frame member 45 and top member 46.

The top member or block 46 may be formed with a generally horizontal, forwardly and rearwardly extending through bore 50 having journal bushings therein, as at 51, and provided with lubricating means, such as oil cups 52, all for rotatably receiving a flywheel shaft 53 journaled in the block 46.

The shaft 53 extends rearwardly beyond the upper regions of side plates 42, overhanging the journal block 46, as at 54, and there carries a flywheel 55 rotatably journaled on the overhanding shaft region, as by a journal bushing 56. The flywheel 55 is suitably driven, as by appropriate transmission means, say a belt 57 engaged in flywheel groove 58, being trained about both the flywheel and a drive pulley 59 on the shaft of a drive motor 60.

The flywheel 57 is suitably retained in rotative relation on the shaft extension 54, as by a thrust bearing 61, and collar 62, both on the rear end region of the shaft extension. Forwardly of the pulley 55, circumposed about the shaft 53 and associated therewith in disengageable driving relation, as through a collar 65, or other suitable means, there is provided a clutch 66. The clutch 66 may be conventional, and, as appears more fully hereinafter, may be of the single revolution type wherein the shaft 53 may be coupled in driven relation with respect to the flywheel 55 for a single rotation of the shaft (or other suitable limited annular displacement) upon each actuation of the clutch.

Crank means, as in the form of an eccentric 67 may be fixed to the forward region of shaft 53 for rotation therewith, and a connecting rod, arm or pitman 68 may include a crank portion 69 rotatably journaled about the circumference of eccentric 67, as by a journal bushing 70. Suitable lubrication means, such as an oil cup 71 and appropriate passageways, may afford the necessary lubrication to the crank end portion 69 of connecting rod 68. The other end of the connecting rod 68 depends to a generally cylindrical formation or wrist pin 72. An adjustable braking means, as at 73, may assume the form of a block 74 having one end anchored, as by a fastener 75 to one of the frame sides 42, the left frame side as seen in FIG. 1. The block 74 is formed with a generally circular through opening 76 receiving the forward end region of shaft 53, and the block is split, as by a slot 77 to define a pair of resilient legs 78 and 79 for adjustable frictional braking engagement with the received portion of shaft 53. Braking adjustment is obtained by a fastener 80 applying a resilient clamping force, as through spring 81 to the legs 78 and 79.

Along the forward region of each side plate 42, on the inner side thereof above the respective cutout 43, there are provided a pair of grooved blocks, guides or slideways 85, see FIG. 1. The slideways 85 extend generally vertically in parallel spaced relation, having their facing sides grooved for slidably receiving a crosshead, generally designated 86. That is, the guideways or blocks 85 are suitably fixed to respective side plates 42 to define vertically disposed ways over the press bed 44. The crosshead 86 is vertically slidable in the guideways 85 and connected to the pitman 68, for vertical up and down movement of the crosshead upon rotation of shaft 53.

More specifically, the crosshead 86 includes a crosshead body or block 87 disposed between said guide members or blocks 85 and having its opposite side edges slidably received in the facing grooves of the guide members. Formed in the upper end of crosshead block 87 is a generally cylindrical, forwardly and rearwardly extending bore 88, which opens upwardly through the upper end of the crosshead body and rotatably receives the lower end wrist pin formation 72 of the connecting rod 68. In this manner the connecting rod 68 is connected to the crosshead body 87 for vertical movement therewith and oscillatory rotative movement relative to the latter.

In addition, the crosshead body 87 is formed, generally medially thereof, with a forwardly and rearwardly disposed, generally cylindrical recess or cavity 89 adapted to receive a rotary adjustment cam 90. The cam 90 is formed on its periphery with a flat 91, which merges smoothly, as by a spiral surface 92, with the remainder of the periphery.

The generally cylindrical recess 89 of crosshead body 87 opens generally vertically downwardly, as by a groove or slot 93, in which is located a slidable block 94 and a rotary cam 95 having one or more peripheral flats, as at 96, 97 and 98. As best seen in FIG. 4, the block 94 may have its upper surface in engagement with its adjustment cam 90. Thus, by selective location of the adjustment cam 90, the block 94 is adjusted vertically in the slot 93. Additionally, the rotary adjustment member 95 is selectively rotatively shiftable to place a desired flat surface 96, 97 or 98 in downwardly facing relation. As the flat surfaces 96, 97 and 98 are chordal and at different radii, it will be understood that each such surface will be located at a different vertical position in the slot 93.

The crosshead 86 further includes a pair of front and rear crosshead plates 100 and 101 secured on the front and rear surfaces, respectively, of the crosshead body 87. The front crosshead plate 100 may be provided with an arcuate scale 102, generally concentric with the adjustment cam 90, and a manually actuable knob 103, and associated pointer 104, may be secured to the adjustment cam 90 for selectively effecting rotation thereof and calibrating the selected position of rotation. Further, the rotary, plural-sided cam 95 may include a manually actuable extension 96, say cross slotted for a screwdriver, and rotatable to place a selected flat 96, 97 or 98 in downwardly facing relation.

One die member 105 of crimping dies is disposed in the slot 93, with its upper end in abutting engagement with the downwardly facing surface of rotary cam 95. That is, the downwardly facing surface of rotary cam 95 determines the elevation of crimping die number 105, and the die member is suitably secured at this predetermined elevation by an suitable means, such as one or more set screws in the die body 87.

In certain applications, as in the crimping of insulated terminals or terminals having an insulating sleeve, it is sometimes advantageous to employ split dies, say having forward and rearward sections separately adjustable to achieve selectively desired crimping action at different locations and according to the thickness of insulation. For this purpose, the cam 95 may serve to selectively adjustably position one section of a split die

relative to another section, as required by the circumstances.

Fixedly mounted on the upwardly facing press bed 45 is a die holder or block 110, which is provided with a generally vertical slot or groove 111, in substantial alignment with the groove 93 of crosshead 86, for holding a lower die element 112 in cooperating relationship with the upper die element 105. The upper and lower die elements 105 and 112 are, of course, replaceable with other die elements, and have their working faces specifically configured for crimping engagement with wire terminals of a particular type and size.

A generally forwardly and rearwardly extending, horizontal rod or way 113 extends between the die block 110 and frame member 45, see FIG. 2. The rod 113 may be suitably fixed in position, as by a fastener 114. Slidably circumposed about the rod or way 113, generally coaxially therewith, is a generally cylindrical carrier drive member 115. That is, the cylindrical carrier drive member 115 is rotatably and longitudinally slidable or shiftable on the rod 113, and fixedly carried on its forward end a toothed feed member or sprocket wheel 116. Thus, the carrier feed member or sprocket wheel 116 rotates with the drive member 115 coaxially of the shaft 113 and is shiftable with the drive member forwardly and rearwardly toward and away from the crimping dies 105 and 112.

Intermediate the ends of the cylindrical drive member 115, there is formed thereon an annular, circumferential groove 117, for a purpose appearing presently. Projecting rearwardly from the rear end of the drive member 115 are a plurality of index members or pins 118, being arranged in a circular array about and concentric with the rod 113 in equiangularly spaced relation with respect to each other. Suitable resilient means, such as a coil compression spring 119 is circumposed about the rod 113 between fixed frame member 45 and drive member 115 may be employed to resiliently urge the latter toward its forward position of longitudinal shifting movement.

Additional guide members or ways 125 upstand fixedly between the side plates 43 and there mount a crosshead or slide member 126 for up and down vertical movement generally over the drive member 115. The crosshead or slide member 126 is provided with a forwardly opening notch 127 and formed with an oblique, downwardly and forwardly facing cam surface 128. A drive bracket 130 is suitably fixed to the rear ram plate 101, projecting rearwardly therefrom and into the notch or groove 127 for effecting vertical reciprocation of crosshead 126 together with that of the crosshead or ram 86.

A drive member shifting means, lever or yoke 131 is disposed generally vertically between the nether carrier drive cylinder 115 and upper reciprocable cam member 126, including a generally horizontal, laterally extending pivotal mounting member or pin 132 carried by a fixed block 133. The shifting member 131 includes an upper lever or arm 134 upstanding from the pivot 132 and carrying on its upper end a cam follower or roller 135. Depending from the pivot 132, the drive member 131 includes a bifurcated lever or yoke portion 136 having inwardly projecting pins or gudgeons entering slidably into peripheral groove 117.

Thus, upon oscillatory rotation of shifting member 131 about its pivotal mounting 132, the drive member or cylinder 115 is caused to shift forwardly and rearwardly along the way member 113. Further, reciprocation of crosshead 86 effects, through bracket 130, reciprocation of cammed crosshead 126, the cam surface 128 engaging with and operating upon the cam follower or roller 135 to oscillate the shift member 131 to shift the drive member 115 rearwardly upon each downward stroke of the crosshead 86.

Operating mechanism for the clutch 65 may be best seen in FIG. 3, there being a mounting plate 140 carried by a bracket 141 fixed to a side plate 43. A normally generally horizontally disposed trip lever 142 is pivoted intermediate its ends, as by pin 143 to the mounting plate 140. Resilient means, such as a coil extension spring 144 urge the trip lever 142 counterclockwise, as seen in FIG. 3, toward a limiting position in abutting engagement with a stop member or pin 145. An upper trip lever 146 is pivotally mounted at one end, as by the pin 147, to the support bracket 141 and extends therefrom over the shaft 54. The coil extension spring 44 extends between the upper and lower trip levers 146 and 142, to normally urge the latter toward each other. A trip latch 148 is pivotally connected at one end, as at 149, to one end of the lever 142, and upstands therefrom toward the free end of lever 146. The latch 148 is provided on its upper end with a lever receiving formation or notch 150. An additional resilient means or coil extension spring 151 is connected between the latch 150 and the lower trip lever 142 to urge the latch toward the shaft 54 and toward lever 146. Carried by the shaft 54 is a clutch deactivating or disengaging member 152, and a non-repeat segment 153. The underside of trip lever 146 is formed with an undercut 155 having an abutment edge 154 for holding engagement with the clutch deenergizing member 152 to deenergize the clutch. The non-repeat segment 153 is generally coplanar with the trip latch 148 to shift the latter outward upon each shaft revolution and permit downward movement of trip lever 146 into retaining engagement with clutch deenergizing member 152.

Suitable actuating means for effecting clutch deenergization, and consequent rotation of shaft 54 may be provided, say in the form of a solenoid 158 mounted for vertical shifting movement and connected by a link 159 to the lower trip lever 142 to swing the latter clockwise, as seen in FIG. 3 against the force of spring 144. This raises trip latch 148, and raises trip lever 146 to disengage holding edge 154 from clutch deenergizing member 152, so that the clutch is engaged and the shaft 54, together with clutch member 152 and non-repeat member 153 rotate about the shaft axis. Upon about one-quarter turn of shaft 54, the non-repeat segment 153 engages trip latch 148 to shift the latter outwardly and release trip lever 146 for downward movement to locate abutment edge 154 in position to limit clutch control member 152 to a single revolution. This clutch deenergization or engagement to effect a single revolution of shaft 54 may be effected manually, as by a foot switch, or automatically, if desired, as by sensing the proper position of a wire end to which a terminal is to be applied.

Depending from the solenoid 158 for up and down shifting movement therewith is an indexing finger or dog 160 suitably pivoted, as at 161, and spring-biased, as by a leave spring 162, or other suitable means in the clockwise direction to a limiting position. The indexing finger or dog 160 is movable downwardly, and provided on its underside with an inclined surface 163 for

engagement with one of the drive member pins **118** to ride over the pin, and on its upper stroke to pull the pin upwardly and rotate the drive member **115** a predetermined angular distance. In order to hold the drive member **115** in each predetermined angular position of its indexing movement, there is provided a detent arm **164** pivoted, as by pin **165** at its upper end, and resiliently biased, as by spring **166** toward the circular array of pins **118.** The detent member or arm may be provided with a formation of groove **167** for releasably receiving and holding a respective drive member pin **118,** as shown in FIG. **3.**

Thus, upon each rotation of shaft **54,** as described hereinbefore, the drive cylinder **115** is angularly shifted a predetermined amount, to locate each successive pin **118** in held relation with respect to the detent **164.** It will now be appreciated that the carrier strip **20** is fed stepwise laterally across or through the instant apparatus by successive angular displacements of the drive cylinder **15,** together with the feed wheel or toothed sprocket member **116.** At each successive location of carrier strip **20,** a terminal **25** is located in position between the upper and lower die parts **105** and **112,** in which position the apparatus is at rest. That is, the drive motor **60** and flywheel **55** may be rotating, but the clutch **66** is disengaged from the shaft **54.**

The wire end may be inserted into the terminal barrel **27** positioned between the die parts, either automatically or manually, and the solenoid **158** operated, either by signal from the operator or automatic signal to effect movement of the die parts **105** and **112** toward each other, as between the position of FIG. **1** and that of FIG. **5.** With the die parts **105, 112** closed to securely crimp the terminal **25** to the received wire end, the drive cylinder **115** is shifted rearwardly, by the aforedescribed coaction of cam **126,** and lever **131,** the sprocket wheel **116** shifting the carrier strip **21** sufficiently rearwardly to reduce the holding action of the carrier or tape on the terminal being crimped to facilitate subsequent separation of the terminal and tape.

For additional safety, particularly in manual operation, there may be provided a guard plate **170** located in front of the die parts **105, 112** and having an opening **171** permitting passage of a wire end to the crimping location. The guard plate **170** may be pivotally mounted to the front of the apparatus, as by a swingable member or hinge **172** which carriers an inwardly projecting member or pin **173.** An interlock safety switch **174** may be located rearwardly behind the pin **173,** and may be electrically connected in the electrical power supply to the motor **60,** so that the motor cannot operate unless the switch **174** is closed by closing movement of the guard **170** and engagement by the pin **173.**

From the foregoing it will now be apparent that the device of the present invention provides a terminal applying apparatus which applies terminals from a carrier strip to wire ends, being simple, durable and reliable in construction, safe and high speed in operation, capable of substantially complete automation, and which otherwise fully accomplishes its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. Apparatus for applying terminals from a carrier strip to wire, said apparatus comprising a frame, die holder means on said frame, die carrier means on said frame mounted for movement toward said die holder means to a terminal crimping position and away from said die holder means to a terminal releasing position, strip feeding means on said die holder means and mounted for movement in one direction to longitudinally step a carrier strip through the space between said die holder and carrier means and in another direction to displace the strip transversely away from and toward said die holder and carrier means, and operating means connected between said die carrier means and strip feeding means to move the latter intermittently in said one direction when said die holder and carrier means are out of said crimping position and in said other direction when said holder and carrier means are in said crimping position, to crimp successive terminals and dislodge crimped terminals from said carrier strip, said die carrier means comprising a crosshead reciprocable toward and away from and having a die receiving groove opening toward said die holding means, said crosshead being provided with a cavity communicating with the interior of said groove remote from said die holding means, a rotary fine adjustment cam of varying diameter selectively positionable in said cavity to locate a desired diameter toward said groove, a rough adjustment block slidable in said groove away from said die holding means to a position in limiting abutment with said fine adjustment cam at said desired diameter, said block having a cavity opening into said groove away from said fine adjustment cam, and a rotary rough adjustment cam of different diameters selectively positionable in said block cavity to locate a desired diameter toward said groove, whereby said groove is adapted to receive a die selectively positioned in said groove by engagement with a desired diameter of said rough adjustment cam.

2. Apparatus according to claim **1,** said fine adjustment cam having a spiral surface defining said varying diameters.

3. Apparatus according to claim **1,** said rough adjustment cam having angularly spaced chordal surfaces defining said different diameters.

4. Apparatus according to claim **3,** said fine adjustment cam having a spiral surface defining said varying diameters.

* * * * *