Jan. 25, 1966 M. L. KLINGLER 3,230,758

CRIMPING TOOL WITH STRIP FEED MECHANISM

Filed March 23, 1964 4 Sheets-Sheet 1

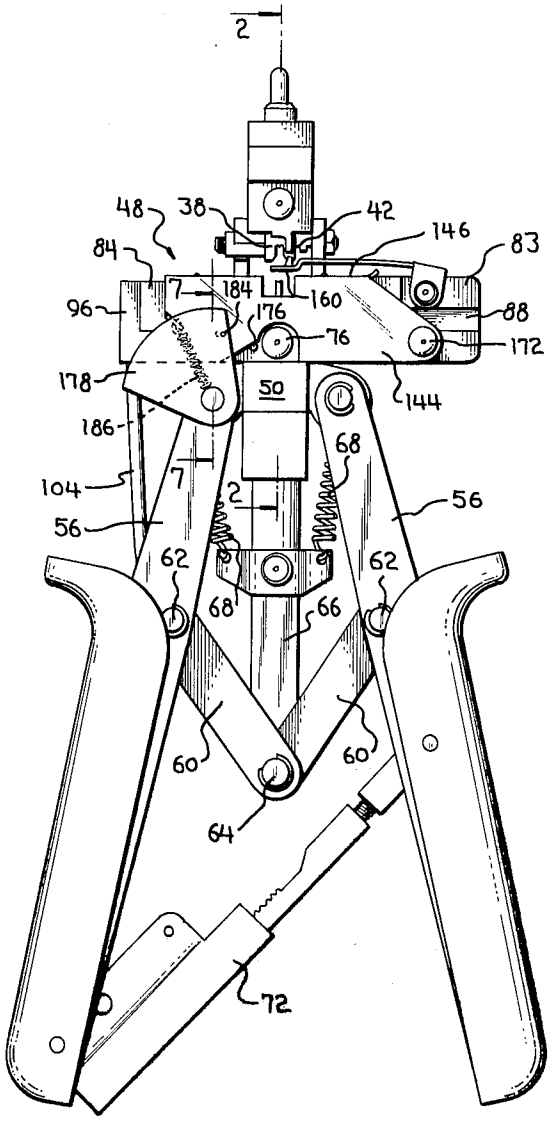

Fig. 1

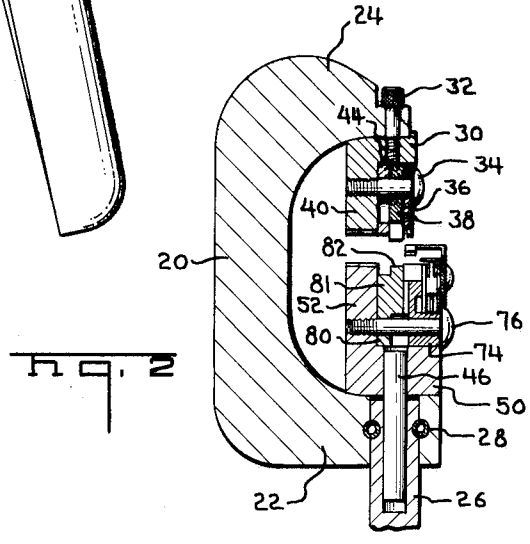

Fig. 2

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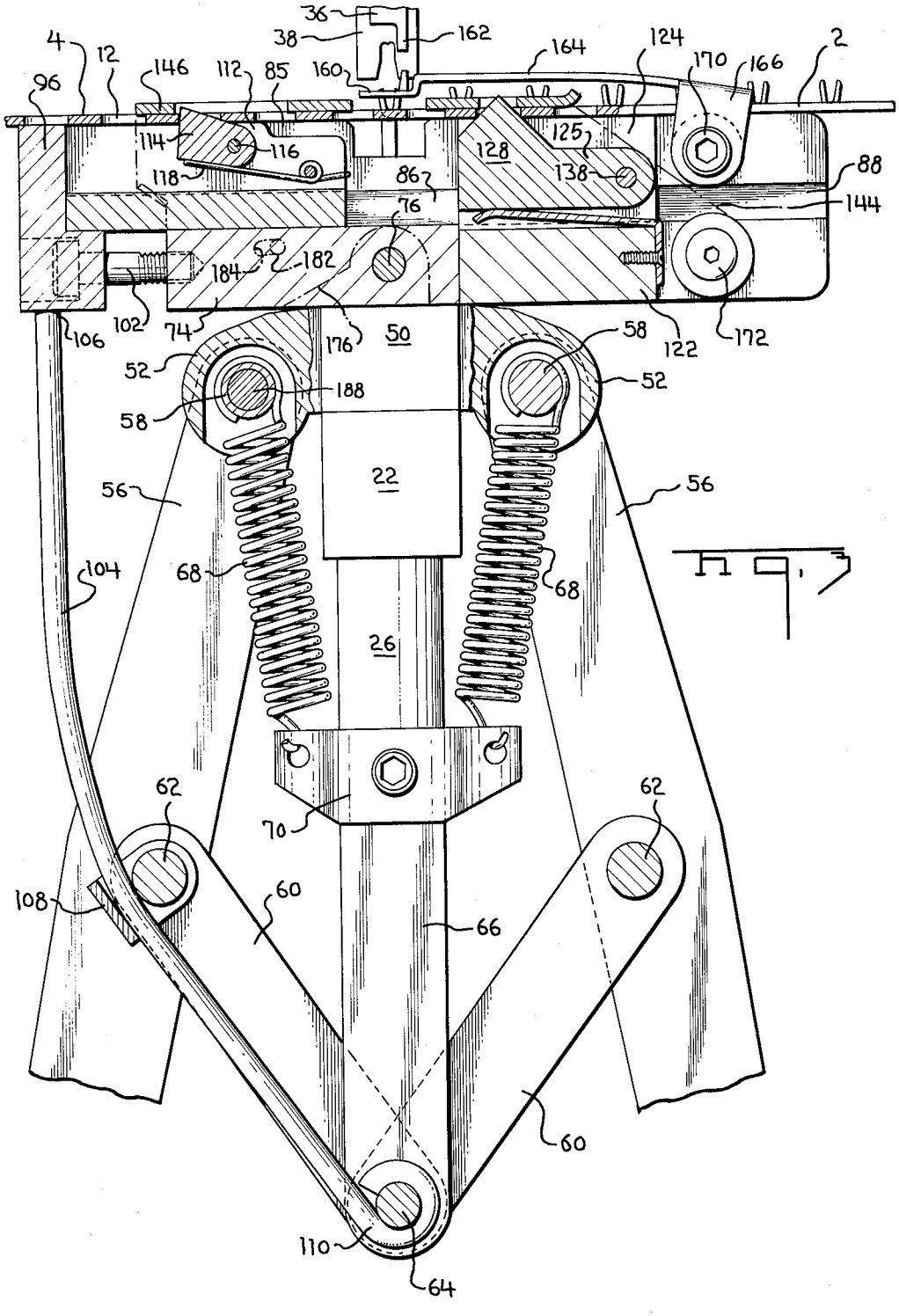

Fig. 1

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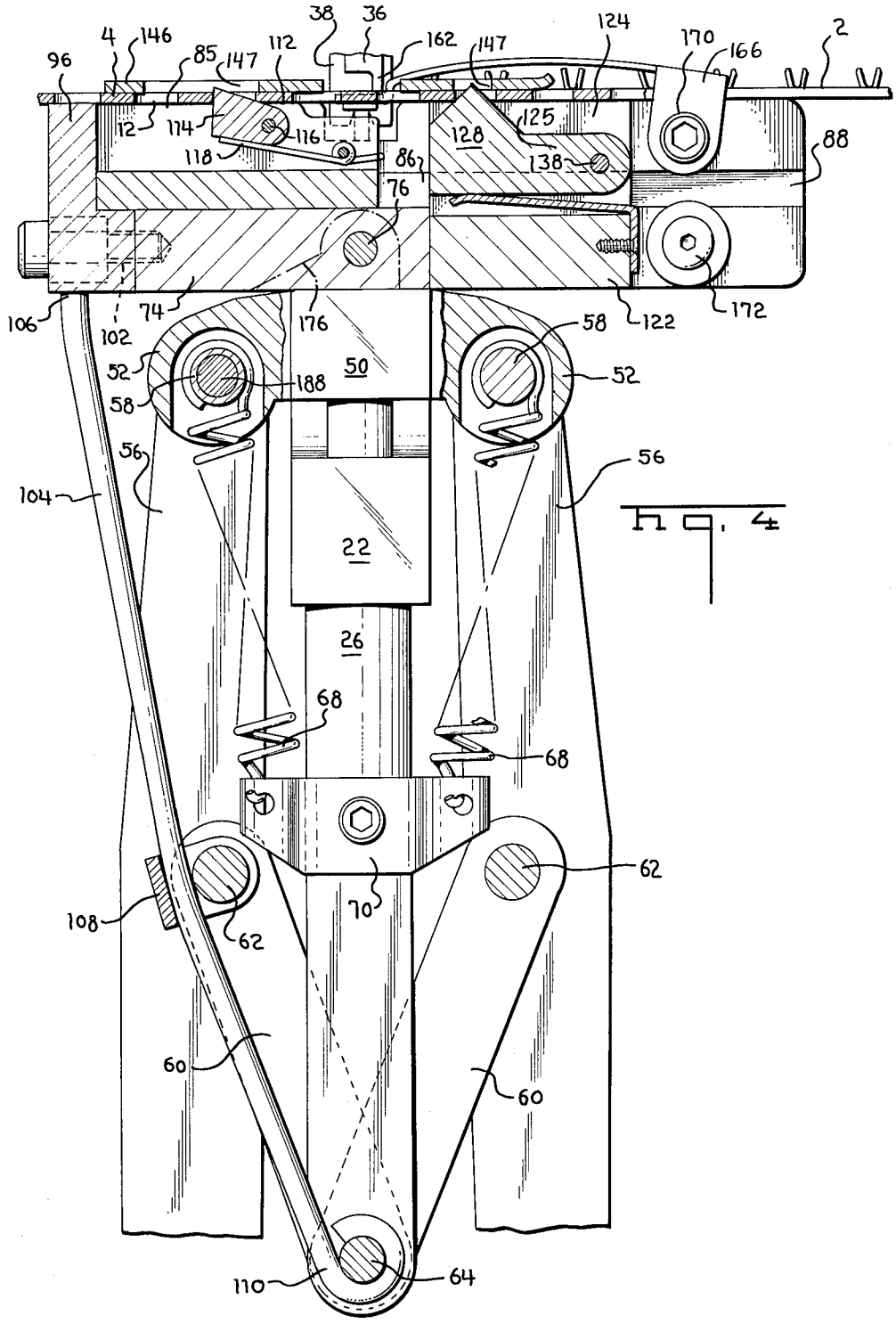

Fig. 4

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Fig. 5

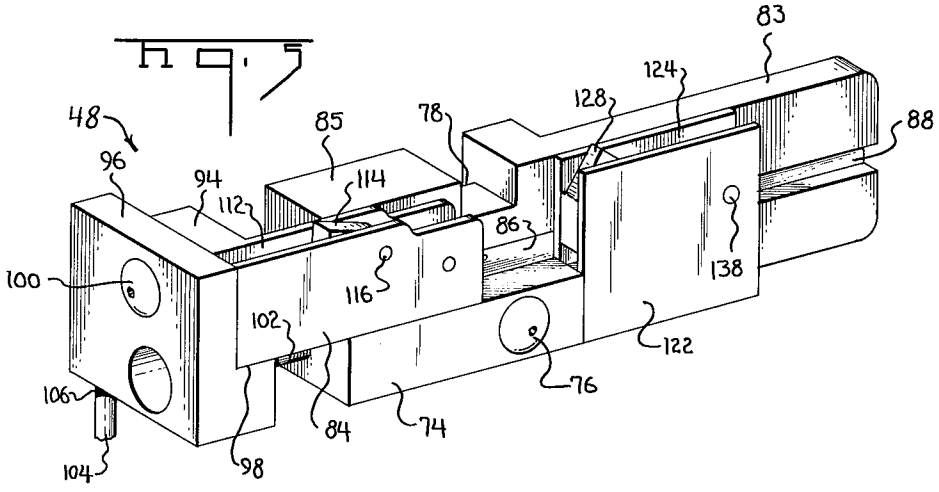


Fig. 6

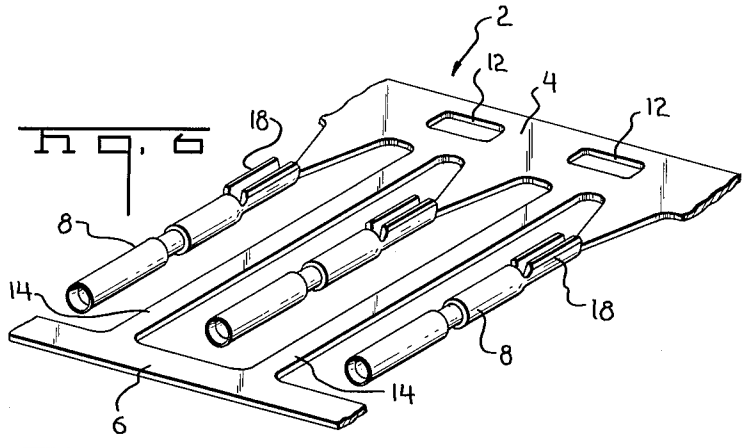
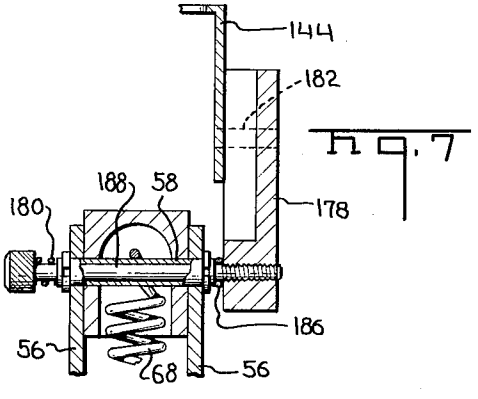


Fig. 7



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3,230,758

CRIMPING TOOL WITH STRIP FEED MECHANISM

Martin Luther Klingler, Hershey, Pa., assignor to AMP Incorporated, Harrisburg, Pa.

Filed Mar. 23, 1964, Ser. No. 353,871
3 Claims. (Cl. 72—410)

This invention relates to crimping devices for crimping electrical terminals in strip form onto the ends of wires.

An object of the invention is to provide a crimping device having an improved feeding means for feeding terminals in strip form towards the crimping dies. A further object is to provide an improved hand tool for crimping electrical terminals onto wires. A still further object is to provide a manually actuated hand tool for crimping terminals in strip form onto wire ends including means for feeding the strip during each operating cycle of the tool.

These and other objects of the invention are achieved in a preferred embodiment thereof comprising a hand tool having a C-shaped frame member on which a fixed crimping die is mounted. A ram is slidably contained in the frame member for movement towards and away from the fixed crimping die. A crosshead is secured to the ram and extends laterally on each side of the path of reciprocation of the ram, this crosshead including a movable crimping die for cooperation with the fixed crimping die to crimp a terminal onto a wire end. Uncrimped terminals in strip form are fed across the crosshead to position the leading terminal of the strip between the crimping dies by a feeding means which comprises a feed slide mounted on the crosshead and reciprocal, with respect to the crosshead, towards and away from the path of movement of the ram. This feed slide is provided with a pawl which engages the strip and advances the strip across the crosshead during movement in one direction. The feed slide is reciprocated by means of a wire spring which is secured at one end to the slide and extends obliquely towards the frame of the tool. The opposite end of this spring is secured to the frame at a location remote from the crimping dies. The preferred embodiment of the invention includes a manually actuated toggle mechanism for moving the crosshead towards and away from the fixed die. The arrangement is such that during movement of the crosshead towards the fixed die, the wire spring is straightened and urges the feed slide towards the path of reciprocation of the ram. When the crosshead moves in the opposite direction, the wire spring is flexed and moves relatively away from the ram thereby to move the feed slide away from the path of reciprocation of the ram.

In the drawing:

FIGURE 1 is a frontal view of a preferred form of hand tool in accordance with the invention;

FIGURE 2 is a side view taken along the lines 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary frontal view of the tool of FIGURE 1 showing the position of the parts of the strip feed mechanism at the beginning of the operating cycle;

FIGURE 4 is a view similar to FIGURE 3 but showing the positions of the parts after closure of the tool handles;

FIGURE 5 is a fragmentary perspective view of the crosshead on which the strip feed mechanism is mounted;

FIGURE 6 is a perspective view of a section of terminal strip;

FIGURE 7 is a view taken along the lines 7—7 of FIGURE 1.

The disclosed embodiment of the invention is particularly adapted to apply terminals in strip form as shown in FIGURE 6 onto wire ends. The strip 2 comprises a

pair of parallel carrier or side strips 4, 6, and contact terminals 8 which are integral with the carrier strip 4. The two carrier strips are connected together by means of transverse rungs 14 and the terminals are disposed between adjacent rungs. Carrier strip 4 is provided with spaced-apart pilot holes 12 formed during the manufacture of the strip which are utilized in feeding the strip as described below. Each terminal has a pair of upstanding ears 18 adjacent to the carrier strip 4 which, during crimping, are curled towards each other and downwardly into surrounding relationship with a wire.

The disclosed form of crimping tool has a C-shaped frame member comprising a web 20, and upper arm 24, and a lower arm 22. A rod 26 secured to the lower arm 22 by means of pins 28 extends downwardly as viewed in the drawing constituting an integral extension of the frame. An L-shaped die holder 30 is mounted on the underside of upper arm 24 by means of a screw 32. A depressor 36 (the function of which is fully described below), and a fixed crimping die 38 are mounted on the die holder 30 by means of a screw 34 which extends through the depressor, through the die 38, through a suitable spacer 44 and into the depending arm 40 of the die holder. As shown from FIGURE 1, the lower end of this arm 40 is provided with slots 42 which provide clearance for the transverse rungs 14 of the terminal strip when the leading terminal of the strip is crimped.

A ram 46 is slidably contained in an axial bore in rod 26 and extends upwardly as viewed in FIGURE 2 beyond the lower arm 22. A crosshead generally indicated at 48 is secured to the upper end of the ram 46 and comprises an L-shaped block 50 mounted on the upper end of the ram and a crosshead plate 74 (FIGURE 5) secured to the block 50. Ears 52 extend from block 50 on each side of the ram and handles 56 are pivotally connected to these ears by means of pins 58. Each handle 56 is pivotally connected intermediate its ends by means of parallel link plates 60 to the lower end portion 66 of the rod 26. In the disclosed embodiment these parallel plate links are pivotally connected to pins 62 in the handles at one end and to a common pivot pin 64 on rod portion 66 at their opposite ends. It will be apparent that the arrangement shown constitutes a toggle type linkage which is arranged such that when the handles are moved relatively towards each other, the block 50 and the crosshead 48 will be moved upwardly towards the upper arm 24 of the frame. In order to return the handles to their initial position, return springs 68 are provided which are connected at one end to the pivot pins 58 and at their opposite ends to a yoke 70 mounted on the rod portion 66.

It is desirable in connector crimping tools to provide a full stroke compelling mechanism between the handles which insures that after commencement of a crimping operation, the dies will be moved towards each other by the requisite amount required to crimp the terminal. A mechanism of this type 72 is provided on the disclosed tool and comprises a telescoping ratchet mechanism of the general type shown in U.S. Patent No. 2,560,318.

The crosshead frame plate 74 is secured to mounting plate 50 by means of a screw 76 and extends laterally on each side of the ram 46. On its rearward side, crosshead plate 74 has a vertical slot 78 within which the lower or movable crimping die 82 is contained. This crimping die extends upwardly from a flange 81 which, in turn, is integral with a plate 80. The plate 80 is interposed between the upwardly extending arm 52 of mounting block 50 and the rearward side of the crosshead plate 74, the mounting of the parts being achieved by means of the screw 76 which extends through aligned openings in the

crosshead plate **74**, the die plate **80**, and is threaded into the arm **52**.

The terminal strip is fed over the upper surface portions **83**, **85** of the cross head plate from right to left in FIGURE 1 by means of a feed slide **84** (FIGURE 5). This feed slide comprises a plate disposed against the frontal surface of the crosshead plate on the left-hand side thereof and normally projects leftwardly beyond the end of the cross-head plate. Feed slide **84** has a rightwardly extending guide bar **86** integral therewith which is slidably received in a groove **88** on the face of the crosshead plate. A flange **94** extends rearwardly from the left-hand side of the feed slide and bears against the face of an L-shaped block **96**, the flange **94** of the feed slide being supported by a ledge on this L-shaped block as indicated at **98**. A screw **100** is threaded through the block **96** and into the flange **94** of the feed slide to secure these parts together.

In order to prevent leftward movement of the feed slide and the block **96** beyond the position shown in FIGURES 1 and 3, a stop is provided in a form of a screw **102** which extends through an oversized opening in the block **96** and is threaded into the crosshead plate on the left-hand side thereof.

Reciprocation of the feed slide is achieved by means of a wire spring **104** which extends into a slightly oversized opening on the underside of the block **96**. When the parts are in their normal position (FIGURE 3) this spring extends downwardly and slightly convergently with respect to the central axis of the tool towards the left-hand pivot pin **62**. The spring **104** extends through a guide **108** mounted on the left-hand pin **62** then extends between the link plates **60** and towards the pin **64**. The lower end of this spring is curled around and secured to the fixed pin **64** on the frame extension **66**. Spring **104** is advantageously of spring steel and is capable of undergoing repeated flexure without failure.

In operation, when the handles **56** are closed to move the crosshead upwardly from the position of FIGURE 3 to the position of FIGURE 4, the upper end **106** of the spring **104** is forced to move relatively rightwardly towards the center of the tool, that is towards the crimping dies. Such movement of the upper end of the spring is brought about by virtue of the fact that its lower end **110** of the spring is secured to the pivot pin **64** so that the spring is partially straightened as is apparent from a comparison of FIGURES 3 and 4. It should be added that the guide member **108** through which the spring extends assists in effecting the inward movement of the upper end of the spring since this guide member moves rightwardly towards the axis of the tool along an upwardly arcuate path. The rightward movement of the upper end **106** of the spring during upward movement of the crosshead causes the feed slide **84** to move rightwardly from the position of FIGURE 3 to the position of FIGURE 4. After completion of the crimping operation, the operator releases his grip on the handles **56** which then move apart under the influence of the springs **68**. During such movement of the handles, the crosshead moves downwardly towards the pivot pin **64** and the spring **104** is forced to flex resulting in relative leftward movement of the upper end of the spring and the feed slide.

The feed slide is provided with a relatively deep slot **112** extending parallel to the crosshead plate and a feed pawl **114** is pivotally mounted in this slot on a pivot pin **116**. A torsion spring **118** bears against the underside of pawl **114** and normally urges this pawl in a clockwise direction about its pivotal axis **116**. The left-hand side of pawl **114** is relatively steep so that during leftward movement of the feed slide from the position of FIGURE 4 to the position of FIGURE 3, the pawl will enter one of the pilot holes and drag the terminal strip leftwardly. The right-hand side of the pawl slopes gently towards the upper surface of the crosshead plate so that the slide can move rightwardly and the pawl will be depressed beneath the carrier strip during such movement.

A stop pawl is provided on the right-hand side of the tool frame as viewed in FIGURE 3 to prevent rightward movement of the strip when the feed slide is moved rightwardly during upward movement of the crosshead. This stop pawl **128** has a rightwardly extending arm **125** pivotally mounted on a fastener **138** within a slot **124** in a housing **122**. This housing is secured to the crosshead plate by the fastener **138** which extends from the rearward side of the crosshead plate through the crosshead plate and through a threaded opening in housing **122**.

A cover plate **144** mounted on the face of crosshead plate **74** has a rearwardly extending flange **146** on its upper end which projects over the carrier strip **4** and which has suitable slots **147** through which the pawls **114**, **128** project. The function of this flange is to hold the carrier strip against the upper surface portions of the crosshead plate and to guide the strip during feeding.

The cover plate **144** is pivotally mounted on its right-hand side on the crosshead plate **74** by means of a fastener **172**. When the terminal strip is initially threaded through the tool, the cover plate **144** must be raised in order to permit the strip to be positioned beneath the flange **146** of the cover plate. The raising and lowering of the cover plate **144** is facilitated by a camming and latching mechanism comprising a sector plate **178** which is secured to a screw **188** (FIGURE 7) which extends through the pin **58**. Screw **188** is normally biased leftwardly in FIGURE 7 by means of a coil spring **180** interposed between the head of the screw **188** and one of the surfaces of the handle **56**. It will thus be apparent that if the head of the screw **188** is pressed, the sector plate **178** will move rightwardly from the position shown in FIGURE 7. A pin **182** is provided in the sector plate and extends towards the cover plate **144**. Normally this pin is disposed in a slot **184** (see FIGURE 3) in the cover plate and maintains the cover plate in its lowered position and in engagement with the terminal strip. When it is desired to raise the cover plate, the head of the screw **188** is pushed rightwardly in FIGURE 7 and the sector plate is swung in a clockwise direction until the pin **182** moves beyond a cam surface **176** on the lower side of the cover plate. Finger pressure on the screw **188** is then released to permit the sector to move relatively towards the cover plate until pin **182** is disposed beneath the cam surface **176**. The sector plate is then swung in a counterclockwise direction causing the pin to move relatively over the camming surface **176** and raise the cover plate. When it is desired to lower the cover plate the head of the screw **188** is merely pressed and the cover plate is pulled downwardly against the upper surface of the crosshead by means of a spring **186** which is secured to the left-hand side of the cover plate and to the screw **188**. After the cover plate has moved back to its normal position (FIGURE 1) the pin **182** is moved into the slot **184** under the influence of the spring **180** to lock the cover plate in its lower position.

At the time of crimping the leading connector or terminal onto a wire, it is necessary to shear this leading connector at the rearward end of its ferrule forming portion **18** from the section **10** of the strip. This shearing operation is carried out by means of a shear plate **160** disposed in front of the fixed crimping die **38** in a location such that upon downward movement of the plate, the section **10** of the terminal strip will be displaced downwardly relative to the terminal which will be positioned and held between the crimping dies. Plate **160** is disposed immediately beneath a leg **162** on depressor **36** so that upon upward movement of the crosshead and the plate, the shearing plate will be engaged by this leg and moved relatively downwardly with respect to the movable die. Shearing plate **160** has an integral spring arm **164** which extends rightwardly above the crosshead. The end of this arm has a forwardly extending flange

166 which is bent downwardly in front of the crosshead plate and is secured to the crosshead plate by a screw **170**.

In use, the parts will normally be in a position shown in FIGURE 1 with the crosshead in its lowered position and with an uncrimped terminal position between the crimping dies. The operator first locates the end portion of a wire between the crimping dies and above the ferrule forming portion of the terminals. The handles are then closed to cause upward movement of the crosshead and the lower crimping die with concomitant rightward movement of the feed slide relative to the crosshead plate. The rightward movement of the feed slide results from the fact that the pin **64** moves relatively downwardly from the position of FIGURE 3 to the position of FIGURE 4 and the spring **104** is thereby partially straightened. Since the ends of this spring are fixed, the upper end of the spring **106** is forced to move rightwardly in FIGURE 3 moving the feed slide in the same direction. The pawl **114** is depressed during this portion of the cycle and moves beneath the carrier strip **2** until this pawl moves beneath the next adjacent pilot ball in the strip at which time it springs upwardly and enters next adjacent hole.

After the terminal has been completely crimped onto the wire, the handles are permitted to return to their initial position under the influence of the springs **68**. During the portion of the cycle, the spring **104** returns to its original curvature (FIGURE 1) and causes the feed slide to move leftwardly thereby advancing the terminal strip a distance equal to the spacing between the terminals. The feed slide is thus reciprocated by the flexing and unflexing of the spring **104** as a result of the closing and opening of the handles.

Change in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

I claim:

1. A device for crimping electrical connectors in strip form onto the ends of wires, said tool comprising a fixed crimping die, a movable crimping die movable towards and away from said fixed die along a predetermined path, connector strip supporting means secured to said movable die and extending laterally of said path, reciprocable strip feeding means slidably mounted on said strip supporting means for movement towards and away from said path to feed connector strip towards and away from said path and to position the leading connector of said strip between said dies, an elongated spring member which is stiffly flexible laterally of its axis, said spring member having one end secured to said reciprocable strip feeding means at a location beside said path and having its other end secured at a point lying on said path and remote from said dies, and actuating means for moving said movable die and said supporting means towards and away from said fixed die and for concomitantly moving said fixed point relatively away from said towards said dies to flex and unflex said spring means, said one end of said spring means being moved relatively towards and away from said path during flexing and unflexing of said spring means to move said feeding means towards and away from said path.

2. A device as set forth in claim **1** wherein said spring member comprises a wire spring.

3. A device as set forth in claim **1** wherein said fixed die is mounted on a frame member, said frame member having portions thereof on said path, said movable die and said strip supporting means being slidably mounted on said frame member, said actuating means comprising a pair of handles mounted on said strip supporting means, said axes being disposed on opposite sides of said frame and said path, each of said handles having link means pivotally connected thereto intermediate the ends of said handles, said link means being pivotally connected to said frame at a common pivotal axis, and said point at which said other end of said spring is secured lying on said axis.

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WILLIAM FELDMAN, *Primary Examiner.*

MICHAEL BALAS, *Examiner.*