June 5, 1962 M. L. KLINGLER ETAL 3,037,545

BELTED TERMINAL CRIMPING TOOL

Filed April 10, 1959 3 Sheets-Sheet 1

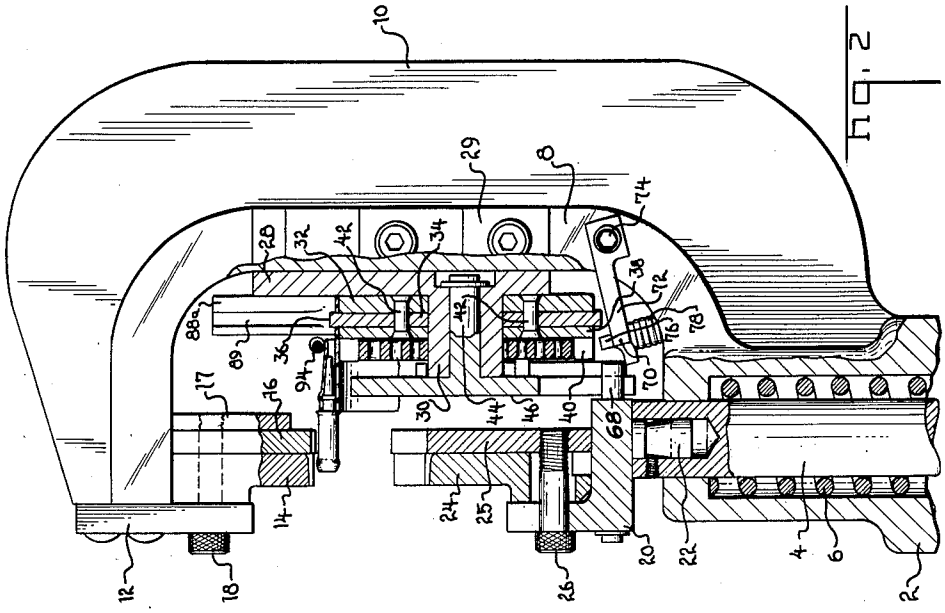


FIG. 2

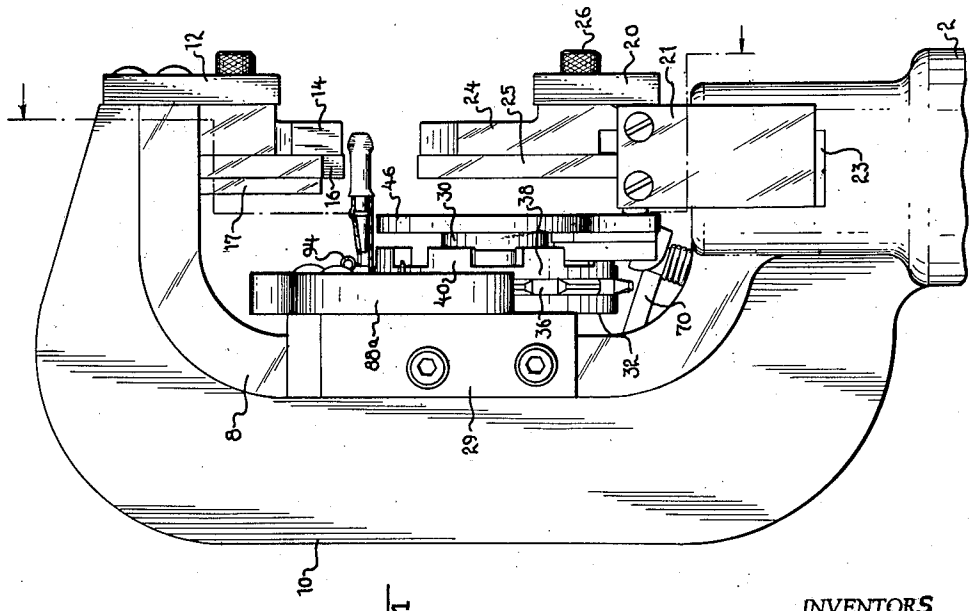


FIG. 1

INVENTORS
MARTIN L. KLINGLER
BY WILLIAM R. OVER

Lewis, Morris & Safford

June 5, 1962 M. L. KLINGLER ETAL 3,037,545

BELTED TERMINAL CRIMPING TOOL

Filed April 10, 1959 3 Sheets-Sheet 2

Fig. 3

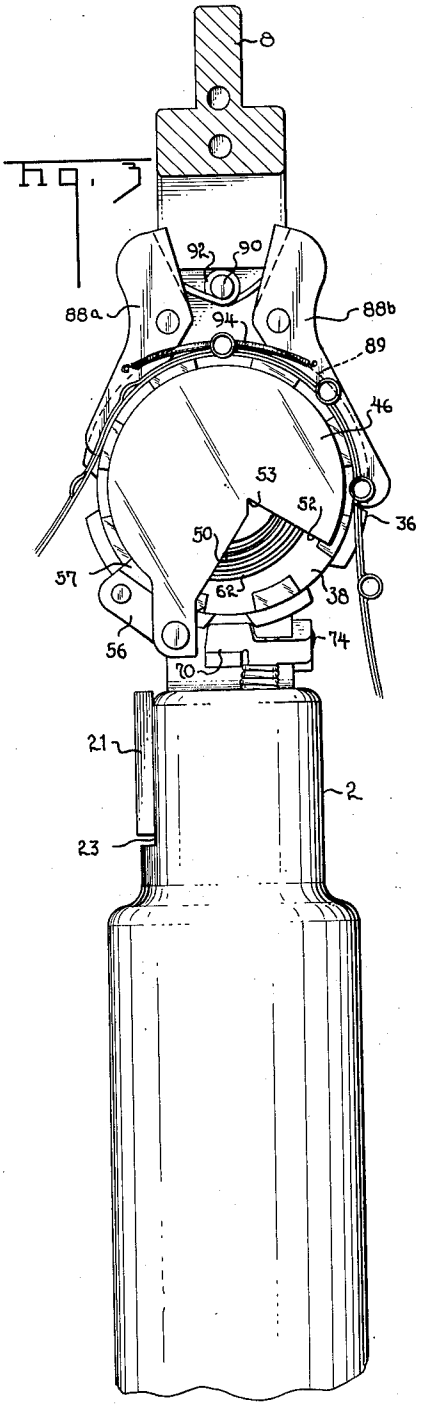


Fig. 5

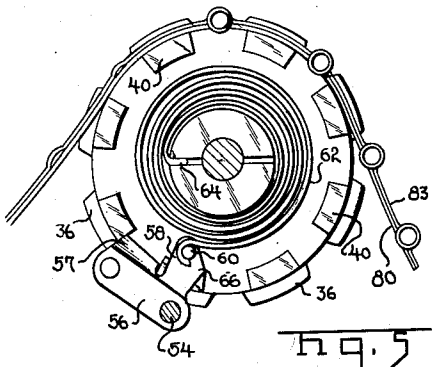
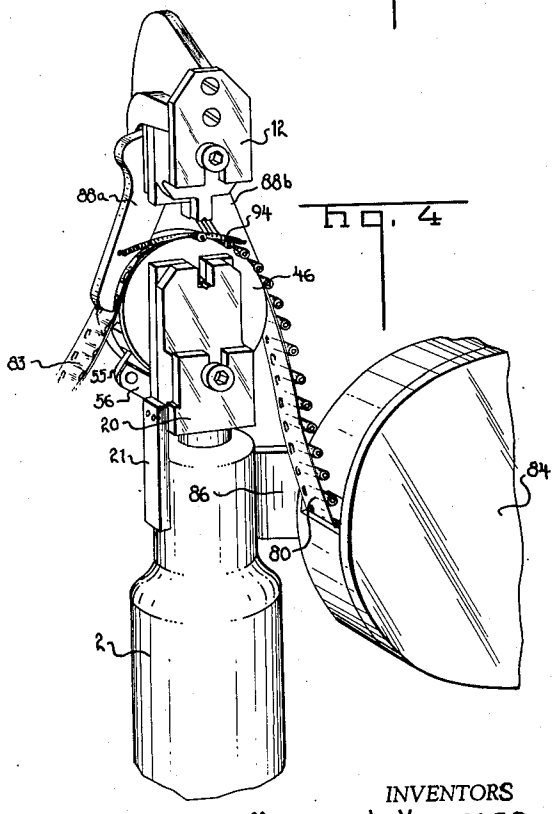


Fig. 4



INVENTORS
MARTIN L. KLINGLER
BY WILLIAM R. OVER

Curtis, Morris & Safford

June 5, 1962 M. L. KLINGLER ETAL 3,037,545

BELTED TERMINAL CRIMPING TOOL

Filed April 10, 1959 3 Sheets-Sheet 3

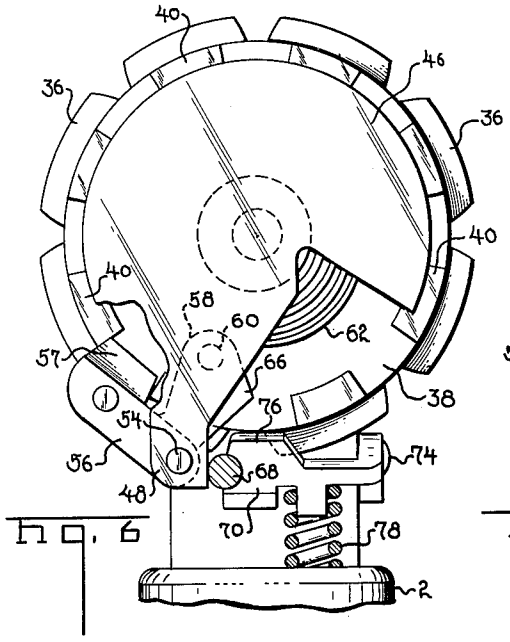


Fig. 6

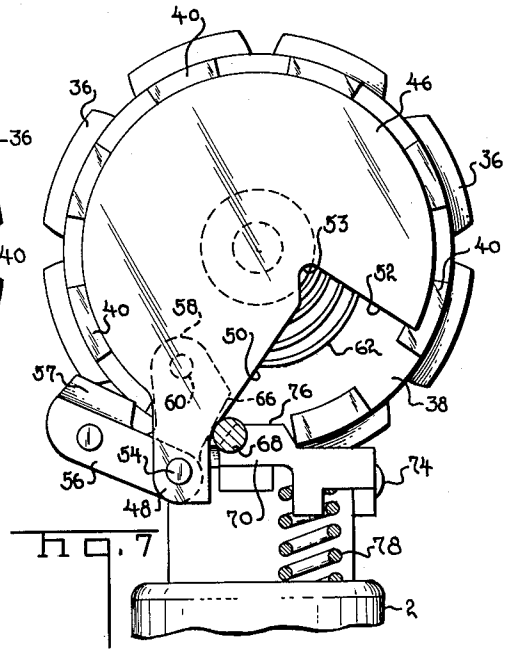


Fig. 7

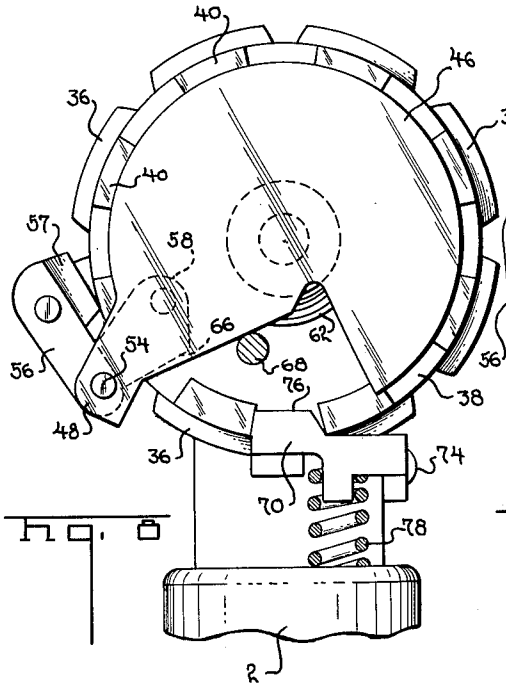


Fig. 8

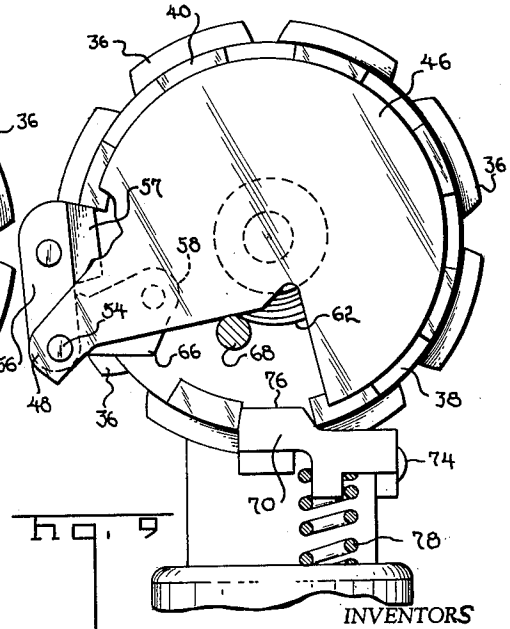


Fig. 9

INVENTORS
MARTIN L. KLINGLER
BY WILLIAM R. OVER

Lewis, Morris & Safford

United States Patent Office 3,037,545 Patented June 5, 1962

3,037,545

BELTED TERMINAL CRIMPING TOOL

Martin L. Klingler, Hershey, and William R. Over, Union Deposit, Pa., assignors to AMP Incorporated, Harrisburg, Pa.

Filed Apr. 10, 1959, Ser. No. 805,433
7 Claims. (Cl. 153—1)

This invention relates to crimping tools for electrical terminals and connectors wherein the terminals are supplied by means of a carrier such as a substantially endless strip or belt.

An object of the present invention is to provide an improved crimping apparatus having a feeding means for intermittently feeding a relatively flexible belt upon which terminals are removably secured at periodic intervals. A further object is to provide a crimping apparatus having automatic terminal feeding means for strip or belt form terminals which is not dependent upon the physical properties, such as stiffness, of the belt or strip for successful operation.

These and other objects are attained in a preferred embodiment comprising a pair of crimping dies movable relatively towards and away from each other and a feeding means comprising an intermittently movable surface which is adjacent the crimping dies and movable in timed sequence therewith. In the preferred embodiment, the movable surface comprises a dial having sprocket teeth thereon which engage perforations of the terminal carrying belt. A substantial portion of the length of the belt is supported on this surface of the dial and the accuracy and precision of the feeding operation depends not upon the movement of the belt over a stationary surface (as with prior art devices) but rather upon the indexing of the dial. Such indexing is achieved in the described embodiment herein by means of a spring which is resiliently loaded during movement of the dies and which is connected to the dial in a manner such that it causes the dial to index after the completion of the crimping stroke.

In the drawing:

FIGURE 1 is a side view of the head of a tool in accordance with the invention;

FIGURE 2 is a view similar to FIGURE 1 but looking from the opposite side and showing parts of the tool head in cross section;

FIGURE 3 is a frontal view of the preferred embodiment;

FIGURE 4 is a perspective view showing the tool and the magazine which supplies the terminals in belt form to the tool;

FIGURE 5 is a fragmentary view showing the indexing spring and its relationship to the dial; and

FIGURES 6, 7, 8 and 9 are fragmentary views showing the sequence of operations during indexing of the dial feed for the tool; in the interest of clarity, these views do not show the piston rod.

In the disclosed embodiment the tool is operated by means of a hydraulic cylinder 2, which also functions as a handle and tool body, having a piston rod 4 reciprocable therein and a spring 6 which surrounds the piston rod and normally biases the piston (not shown) downwardly as viewed in the drawing. It will be understood that any conventional control means can be provided for the piston-cylinder or that a mechanical force system can be substituted for the hydraulic system shown. Integral with the upper portion of cylinder 2 is a C-shaped tool head 8 having a reinforcing rib 10 in its external surface and having a die holder plate 12 secured to its end. Upper crimping dies 14, 16 are secured to this die holder plate by means of a clamping plate 17 and a screw 18 which extends through aligned openings in the dies and into a threaded opening in the clamping plate. An L-shaped

lower die holder 20 is secured to the end of piston rod 4 by means of a pin 22 which extends from the underside of die holder 20 into a recess in the end of the piston rod and is locked in place by means of a set screw as shown. Advantageously, a plate 21 is fastened to the side of the lower die holder and bears against a flat milled surface 23 on the cylinder in order to prevent rotation of the piston rod and to maintain the crimping dies in exact alignment. The lower dies 24, 25 are removably anchored to this die holder by means of a screw 26. It will thus be apparent that upon movement of the piston rod the lower dies move relatively towards, and into engagement with, the upper dies until the terminal positioned between the dies is crimped onto a wire.

The feeding mechanism for feeding the belt of terminals is carried by a mounting plate or base plate 28 which rests against the back of the C-shaped head and is secured in place by means of flanges 29 and screws which enter the tool head. This base plate has a central bearing boss 30 which extends towards the front of the tool and on this boss there is rotatably supported a feed dial which is composed of a circular plate 32, a sprocket wheel 34 having sprocket teeth 36 evenly spaced around its periphery, and a ratchet wheel 38 having teeth 40 projecting parallel to its axis towards the front of the tool. In the disclosed embodiment the number of teeth 40 on the ratchet wheel 38 is equal to the number of sprocket teeth 36 for reasons which will be apparent from the description which follows. The sprocket wheel, ratchet wheel, and plate 32 are secured together by means of rivets 42 so that they move as a unit during operation.

Bearing boss 30 is centrally bored and rotatably accommodates a stub shaft 44 which extends from a circular cam plate 46 which is of a diameter slightly less than the diameter of the dial. This cam plate has an ear 48 extending therefrom and is notched adjacent the ear as shown at 50 and 52. The two edges of the notch do not intersect at a right angle but a recess 53 is provided at the root of the notch.

A pin 54 is secured in ear 48 and extends inwardly towards the surface of the cam plate. This pin has a bell crank (FIGURE 5) rotatably mounted thereon, one arm 56 of which functions as a pawl having a tooth 57 on its end for engaging between the teeth 40 of the ratchet wheel as shown in FIGURE 6. As shown in FIGURE 4 this tooth is on a separate plate 55 which is secured to the end of arm 56 by a fastener. The other arm 58 of the bell crank extends inwardly towards the axis of rotation of the cam plate and has a pin 60 on its end around which is hooked one end of a spiral spring 62. This spring surrounds bearing boss 30 and has its inner end 64 anchored in a transverse slot in the boss. Arm 58 of the bell crank is not a regular shape but provides an extension 66 (FIGURE 6) which projects beyond edge 50 of the notch and is adapted to be engaged by a pin 68 which is integral with lower die holder 20.

In order to lock the ratchet wheel and the dial in position during a portion of the cycle there is provided a locking detent comprising a lever 72 (FIGURE 2) pivotally mounted at 74 to the tool head and having a laterally extending arm 70 upon the end of which there is provided a tooth 76 also adapted to enter between the teeth 40 of the ratchet wheel 38. Normally, and when the dies are apart, arm 70 is depressed by pin 68, as shown best in FIGURE 2, and this arm is held out of engagement with the ratchet wheel and against the force of a compression coil spring 78.

The belt of terminals shown in the illustrative embodiment comprises a lower strip 80 of plastic material and an upper strip 83. These two strips hold the terminals until they are crimped onto wire ends after which they

may be removed by the operator. This belting is fed to the tool from a cylindrical magazine 84 mounted on a bracket 86 which is secured to and extends from the hydraulic cylinder 2. In the disclosed embodiment, the coil of belting is merely placed in the magazine 84 and pulled therefrom during feeding of the belt by the tool. It is not necessary to mount the belting on a rotatable axis as is frequently required with continuous metallic strip. The belting, as shown best in FIGURE 4, extends from the magazine towards the dial and with its rearward edge against mounting plate 28. In order to hold the belting against the dial there are provided a pair of fingers 88*a*, 88*b* which are biased by means of a spring 92 on a pin 90 towards the surface of the dial. These fingers are provided with grooves 89 to permit passage of the teeth 36 of the sprocket during feeding. It is also desirable to provide a small coil spring 94 in order to retain that section of the belt which extends between the fingers against the surface of the dial.

In operation, and assuming that the parts are as shown in FIGURES 1 and 2 with an uncrimped terminal positioned between the dies, the operator first inserts the stripped end of a wire into the terminal barrel and then actuates the hydraulic system to drive the piston rod 4 upwardly. As this piston rod rises, pin 68 is first disengaged from lever arm 70 thereby permitting the tooth 76 on the end of this arm to enter between the teeth of the ratchet wheel at the bottom of the dial and lock the dial against rotation. Shortly thereafter, pin 68 engages bell crank arm portion 66 and causes the bell crank to rotate in a counterclockwise direction about its pivotal axis 54. The tooth 57 on arm 56 is disengaged from the ratchet wheel as shown in FIGURE 7 and the cam plate is therefore free to move the remainder of the up stroke of the piston rod. During the remainder of the stroke, pin 68 rotates the cam plate from the position of FIGURE 7 to the position of FIGURE 9 as the pin moves relatively along edge 50 of the cam plate notch. The tooth 57 rides over the adjacent ratchet wheel tooth until it is aligned with the next recess on the ratchet wheel which it enters under the influence of spring 62. It will also be understood that during the interval in which the cam plate is rotated, spring 62 is resiliently stressed or tightened and its overall diameter becomes smaller as shown by the drawing. By the time the ram reaches its top position, the terminal will have been crimped and the operator is then free to remove it from the belt as soon as the dies separate a slight distance. With a properly made belt, the terminal can be removed by a light pull.

As the ram 4 returns to its starting position the cam plate remains in its rotated position of FIGURE 9 since tooth 57 is engaged with the ratchet wheel and the ratchet wheel itself is held against rotation by tooth 76 of lever arm 70. Upon disengagement of tooth 76, from the ratchet wheel, when pin 68 depresses the lever arm, the cam plate and the dial are rotated from the position of FIGURE 9 to the position of FIGURE 6 under the influence of spiral spring 62. It will be understood that the spiral spring will always have some residual stress but the cam plate is prevented from counter clockwise rotation beyond the position of FIGURE 6 by pin 68 which it abuts.

It will be apparent from FIGURES 1 and 2 that when the terminal is crimped, its ferrule portion must move upwardly by a slight amount at the end of the crimping stroke of the ram. Such movement of the terminal is easily permitted by virtue of the flexible nature of the belt. It will also be apparent from these figures that the cam plate is of a diameter less than the diameter of the dial so that this cam plate does not interfere with the movement of the belt and terminals towards the dies. The ends of the terminals which project laterally beyond the edges of the belt are supported only by the belt and not on the surface of the dial. The belting material is capable of supporting the terminals in the manner shown, particularly when it is curved over and pressed against the dial.

The notch 53 in the cam plate does not ordinarily play any part in the operation of the tool. However, it will be apparent that if the tool were to be accidentally actuated with no dies in the dieholders, the ram 4 could move upwardly beyond its normal stopping point. If this were to happen, pin 68 would move upwardly beyond the position shown in FIGURE 9 which is its normal uppermost position and tooth 57 would tend to cause the ratchet to rotate in a clockwise direction from the position of FIGURE 9. If the pin did arise above this position, the pin would enter the notch and at the same time the tooth 76 on lever 70 would be cammed outwardly by the force exerted by the ratchet wheel. This notch 53 is therefore a means of preventing damage to the tool in case of misuse.

Changes 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.

We claim:

1. Apparatus for crimping electrical terminals wherein said terminals are removably secured to a flexible belt at regularly spaced intervals with the axes of said terminals extending transversely of said belt and with at least a substantial portion of the length of each terminal resting on said belt, said apparatus comprising, a pair of crimping dies, moving means including a reciprocable ram for moving said dies relatively towards and away from each other, a cylinder disposed adjacent said dies and rotatable about an axis extending substantially transversely of the path of reciprocation of said ram, said cylinder having regularly spaced sprocket teeth for engagement with perforations in said belt whereby said cylinder supports and engages a substantial length of said belt, and indexing means for indexing said cylinder when said dies are apart thereby to position an uncrimped terminal between said dies.

2. Apparatus for crimping electrical connectors onto wires wherein said connectors are removably secured to a flexible belt at regularly spaced intervals with the axes of said connectors extending transversely of said belt, said belt having regularly spaced perforations, said apparatus comprising, a pair of crimping dies, moving means including a reciprocable ram for moving said dies relatively towards and away from each other, a cylinder disposed adjacent said dies and rotatable about an axis extending substantially transversely of the path of reciprocation of said ram, said cylinder having regularly spaced sprocket teeth for engagement with said perforations in said belt whereby said cylinder supports and engages a substantial length of said belt, indexing means for indexing said cylinder when said dies are apart thereby to feed said belt, and a bearing surface extending in a plane adjacent said cylinder and normally of the axis thereof on the opposite side from said dies, said bearing surface functioning to prevent movement of said belt away from said cylinder.

3. Apparatus for crimping electrical terminals wherein said terminals are part of a belt with the axes of the individual terminals extending transversely of the belt axis, said apparatus comprising, a pair of crimping dies, moving means including a reciprocable ram for moving said dies relatively towards and away from each other, a cylinder disposed adjacent said dies and rotatable about an axis extending substantially transversely of the path of reciprocation of said ram, said cylinder having regularly spaced sprocket teeth for engagement with said belt whereby said cylinder supports and engages a substantial

length of said belt, pawl and ratchet indexing means for indexing said cylinder when said dies are apart thereby to position an uncrimped terminal between said dies, spring loadable actuating means for actuating said pawl and ratchet indexing means, and means driven by said ram during movement thereof for loading said spring loadable actuating means.

4. Apparatus for crimping electrical terminals wherein said terminals are part of a belt with the axes of the individual terminals extending transversely of the belt axis, said apparatus comprising, a pair of crimping dies, moving means including a reciprocable ram for moving said dies relatively towards and away from each other, a cylinder disposed adjacent said dies and rotatable about an axis extending substantially transversely of the path of reciprocation of said ram, said cylinder having regularly spaced sprocket teeth for engagement with said belt whereby said cylinder supports and engages a substantial length of said belt, a plate rotatable about the axis of rotation of, and independently of, said cylinder, pawl and ratchet means connecting said plate and said cylinder, loadable resilient means acting on said plate and permitting movement of said plate in a first direction of rotation but normally biasing said plate in the opposite direction, and means on said ram for rotating said plate in said first direction during movement of said ram to move said dies relatively towards each other whereby, said plate first rotates in said first direction relative to said cylinder, and said pawl is advanced relative to said ratchet, and said plate and cylinder then rotate in unison in said opposite direction by virtue of said pawl and ratchet means during return movement of said ram thereby to feed said belt.

5. Apparatus for crimping electrical terminals onto the ends of wires, said terminals being on a carrier strip, said apparatus comprising, a tool body having a generally C-shaped tool head, one arm of said head being integral with said tool body, a ram in said tool body reciprocable towards and away from the other arm of said head, a first die mounted on said ram for movement therewith and a second die mounted on the other arm of said head, a cylinder rotatably mounted on said head on an axis extending transversely of the direction of reciprocation of said ram, sprocket teeth on the surface of said cylinder for engagement with said carrier strip, a cam plate rotatable about the axis of rotation of, and independently of, said cylinder, said cam plate being interposed between said dies and said cylinder, spring means having one end secured to said cam plate, said spring means permitting rotation of said cam plate in a first direction from a rest position but normally biasing said cam plate for rotary movement in the opposite direction, camming means on said ram and said cam plate for rotating said plate in said first direction during movement of said ram towards said other arm of said head, a pawl on said cam plate and ratchet teeth on said cylinder, detent means engageable with said cylinder to hold said cylinder against rotation, and means on said ram for holding said detent means out of engagement with said cylinder when said ram is in its retracted position whereby, upon movement of said ram towards said other arm, said cylinder is locked against rotation by said detent means, said cam plate is rotated in said first direction, and said pawl is advanced relative to said ratchet teeth, and after return movement of said ram, said cylinder is unlocked to permit rotation and said spring rotates and indexes said cam plate and cylinder thereby to feed said carrier strip.

6. Apparatus for crimping electrical terminals onto the ends of wires, said terminals being on a carrier strip, said apparatus comprising, a tool body having a generally C-shaped tool head, one arm of said head being integral with said tool body, a ram in said tool body reciprocable towards and away from the other arm of said head, a first die mounted on said ram for movement therewith and a second die mounted on the other arm of said head, a cylinder rotatably mounted on said head on an axis extending transversely of the direction of reciprocation of said ram, sprocket teeth on the surface of said cylinder for engagement with said carrier strip, a cam plate rotatable about the axis of rotation of, and independently of, said cylinder, said cam plate being interposed between said dies and said cylinder, a spiral spring having its inner end fixed and having its outer end secured to said cam plate whereby, upon rotation of said cam plate from a rest position in a first direction, said spring is stressed and tends to return said plate to said rest position, a pin on said ram and a cam surface on said cam plate, said cam surface being engageable by said pin to rotate said plate in said first direction during movement of said ram towards said other arm of said head, a pawl on said cam plate cooperable with ratchet teeth on said cylinder, detent means engageable with said cylinder to hold said cylinder against rotation, said pin functioning as a means for holding said detent means out of engagement with said cylinder when said ram is in its retracted position whereby, upon movement of said ram towards said other arm, said cylinder is locked against rotation by said detent means, said cam plate is rotated by said pin in said first direction, and said pawl is advanced relative to said ratchet teeth, and after return movement of said ram, said cylinder is unlocked by said pin to permit rotation and said spring rotates and indexes said cam plate and cylinder thereby to feed said carrier strip.

7. Apparatus for crimping electrical terminals onto the ends of wires, said terminals being mounted on a carrier strip at spaced intervals, said apparatus comprising, a fixed crimping die and a movable crimping die, ram means for moving said movable die towards and away from said fixed die, a cylinder rotatably mounted on an axis extending transversely of the direction of reciprocation of said ram, sprocket teeth on the surface of said cylinder for engagement with said carrier strip, a cam plate rotatable about the axis of rotation of, and independently of, said cylinder, said cam plate being interposed between said dies and said cylinder, loadable resilient means permitting movement of said plate in a first direction of rotation but normally biasing said plate in the opposite direction, a pawl and ratchet acting between said plate and said cylinder, detent means engageable with said cylinder to hold said cylinder against rotation, means on said ram for holding said detent means out of engagement with said cylinder when said ram is in its retracted position, camming means acting between said ram and said plate for rotating said plate in said first direction during movement of said movable die towards said fixed die, and camming means acting between said ram and said pawl and ratchet means for disengaging said pawl and ratchet means during initial movement of said movable die towards said fixed die whereby, upon movement of said movable die towards said fixed die, said cylinder is locked against rotation, said pawl and ratchet means is disengaged, and said plate is rotated in said first direction, and after return movement of said ram, said cylinder is unlocked to permit rotation and said spring rotates and indexes said plate and said cylinder thereby to feed said carrier.

References Cited in the file of this patent

UNITED STATES PATENTS

1,836,500	Pool	Dec. 15, 1931
2,398,550	Nelson	Apr. 16, 1946