United States Patent [19]

Wagner

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[54] **APPARATUS FOR APPLYING TERMINALS MOUNTED ON A TAPE TO WIRES**

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[73] Assignee: **AMP Incorporated,** Harrisburg, Pa.

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[21] Appl. No.: **274,035**

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

[51] **Int. Cl.**.. **H01r 43/04,** B21d 11/04, B21d 31/02

[58] **Field of Search** ..... 29/203 D, 203 DT, 29/203 DTS, 203 P; 72/412, 415, 421; 140/111

[56] **References Cited**

UNITED STATES PATENTS

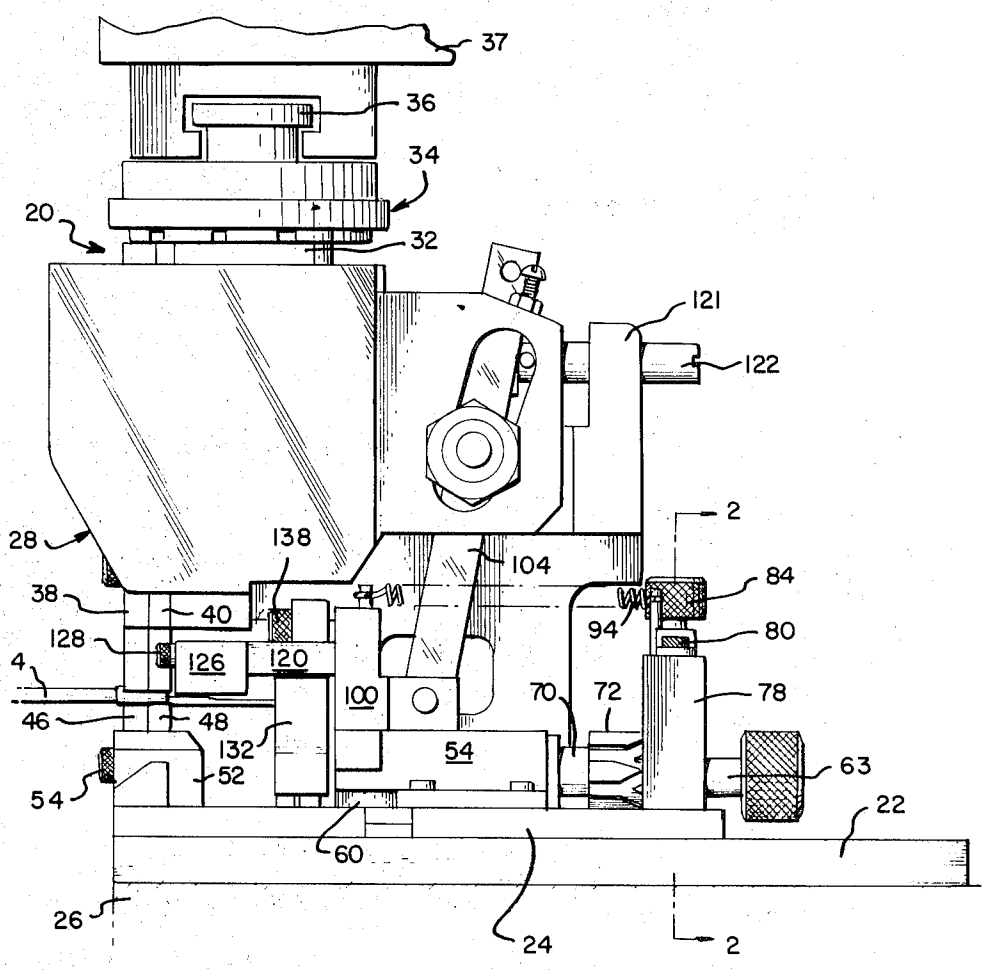
3,037,545	6/1962	Klingler et al.	29/203 DTS
3,135,310	6/1964	Stolz	29/203 DTS
3,184,950	5/1965	Sitz	72/331
3,386,153	6/1968	Lau et al.	29/203 DTS
3,416,212	12/1968	Busler et al.	29/203 DTS
3,550,239	12/1970	Rider	29/203 DTS
3,553,814	1/1971	Rider	29/203 DTS

Primary Examiner—Charles W. Lanham
Assistant Examiner—E. M. Combs
Attorney—William J. Keating et al.

[57] **ABSTRACT**

Apparatus for applying terminals which are mounted on a flexible tape to wires comprises crimping dies and a sprocket for advancing the tape to position the leading terminal in alignment with the dies. An actuating means is provided which moves the dies towards and away from each other and which also indexes the sprocket thereby to feed the tape. The actuating means also moves the sprocket away from the dies to remove the crimped terminal from the tape.

3 Claims, 10 Drawing Figures



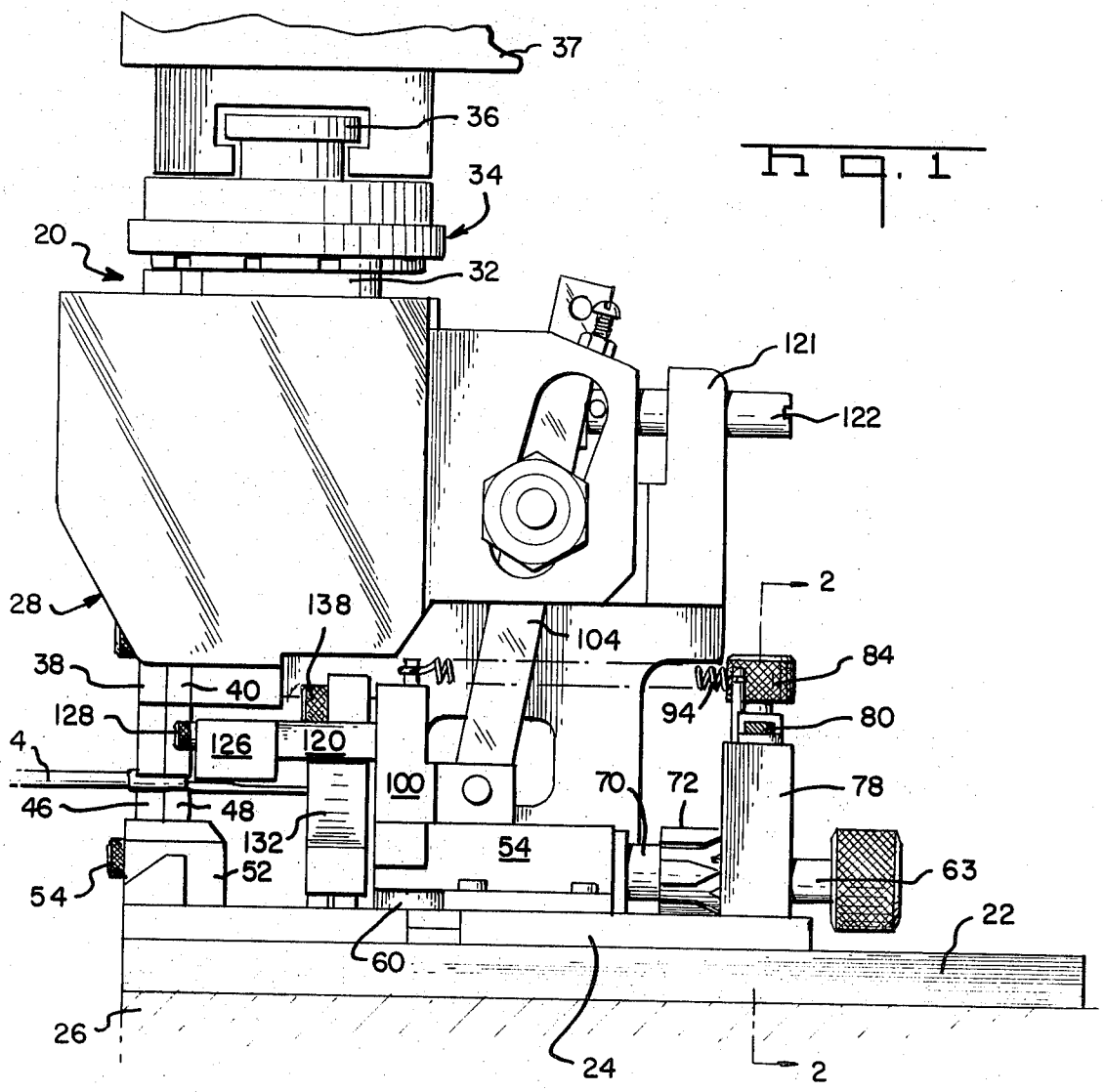

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Fig. 1

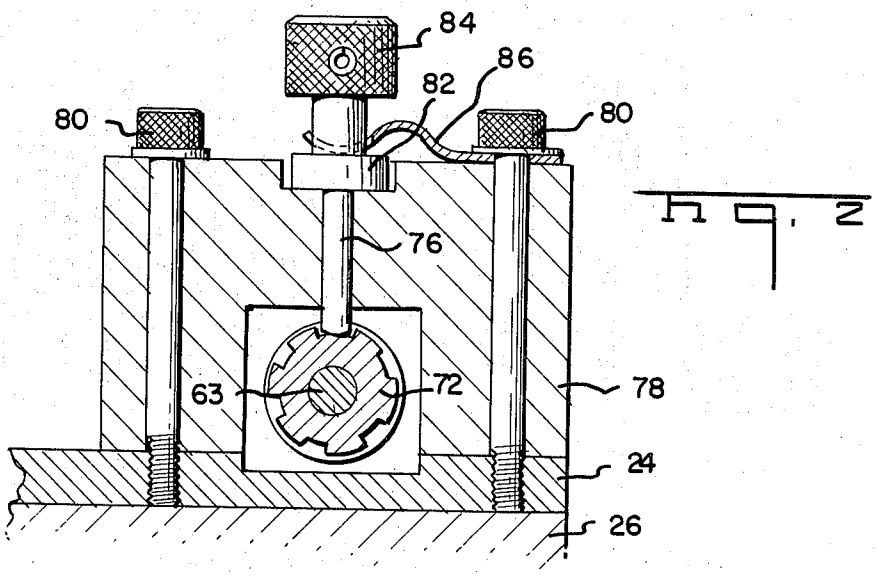
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Fig. 2

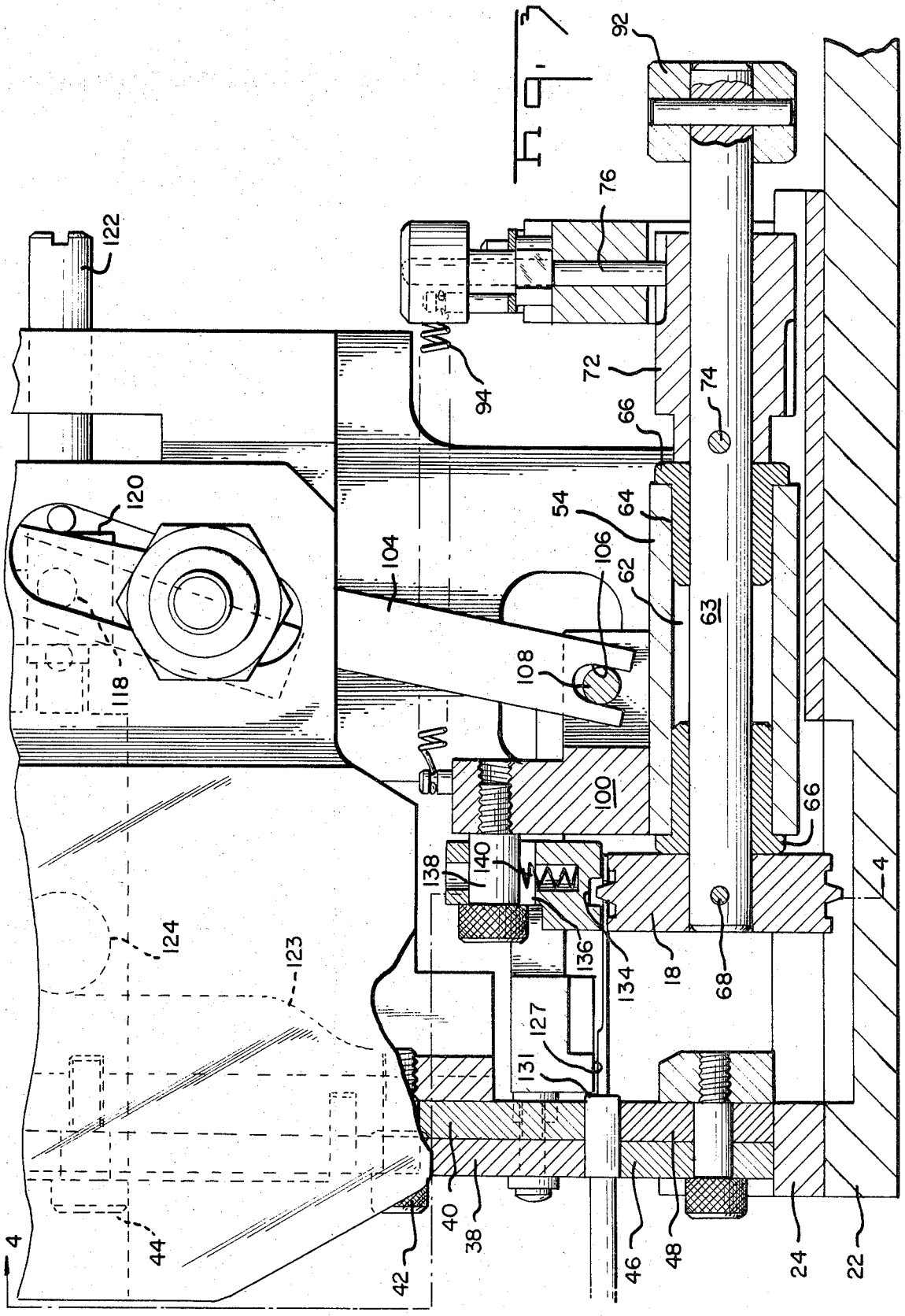
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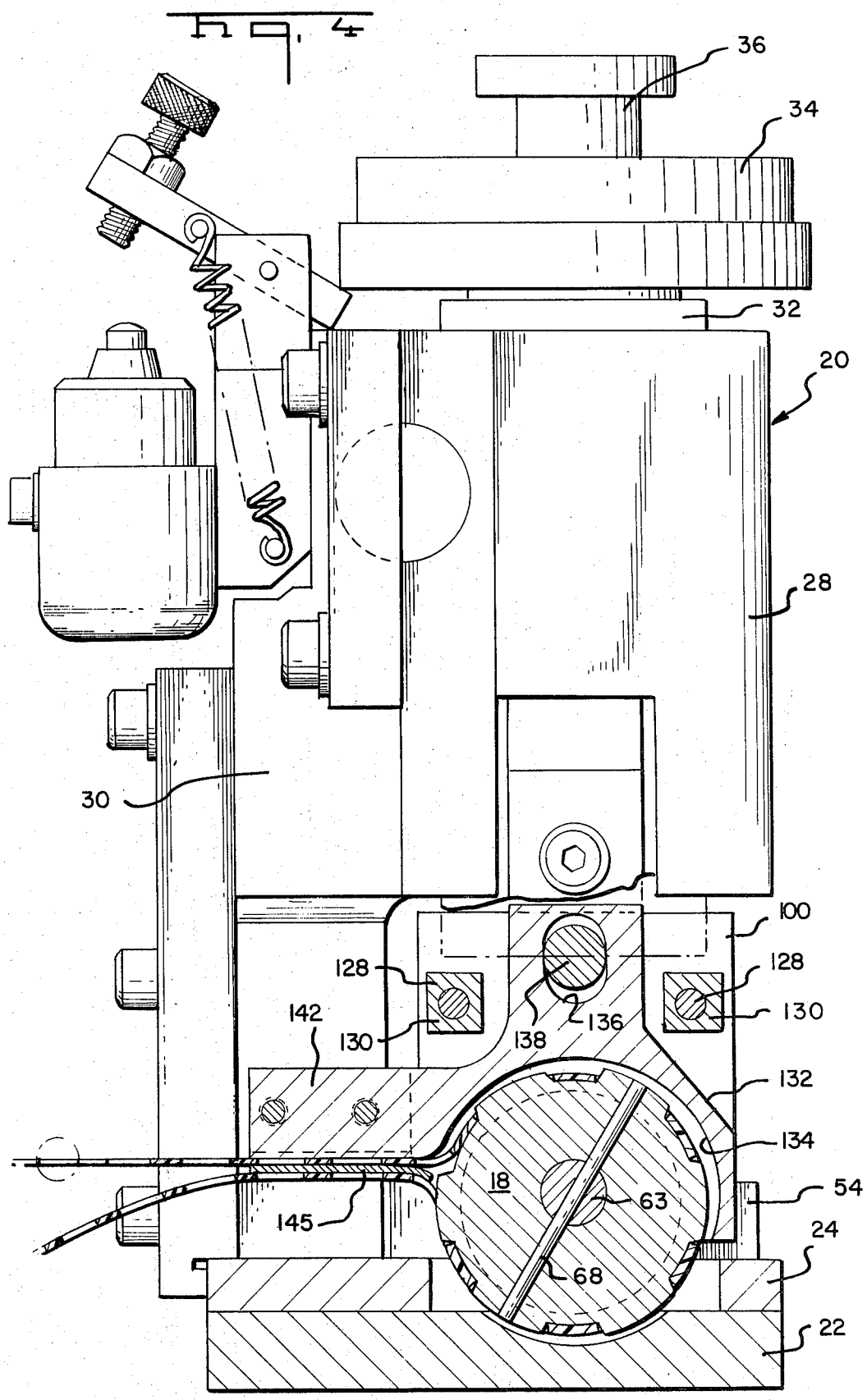
Fig. 4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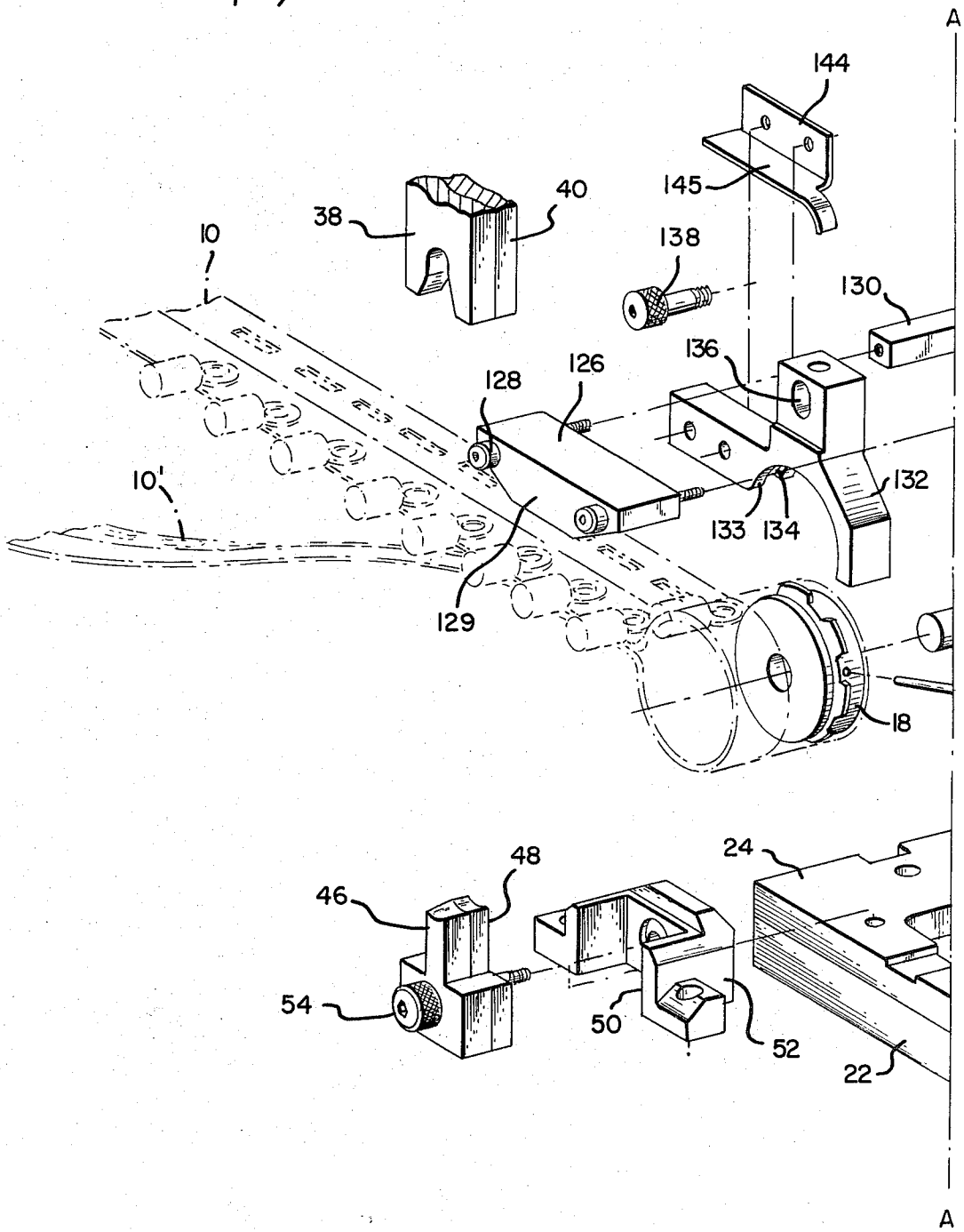
68
22

Fig. 5A1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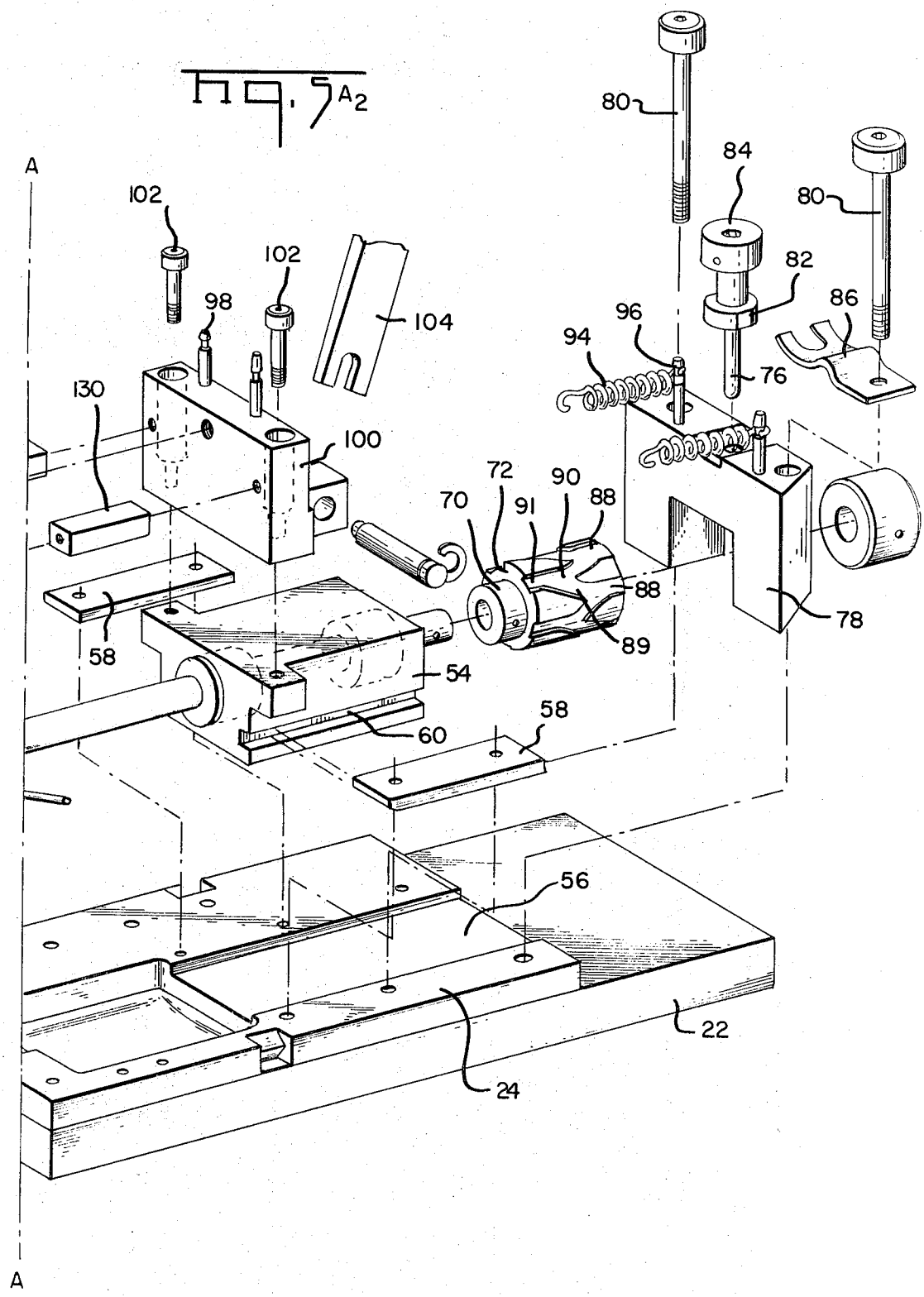
22
A

Fig. 5A2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78
A

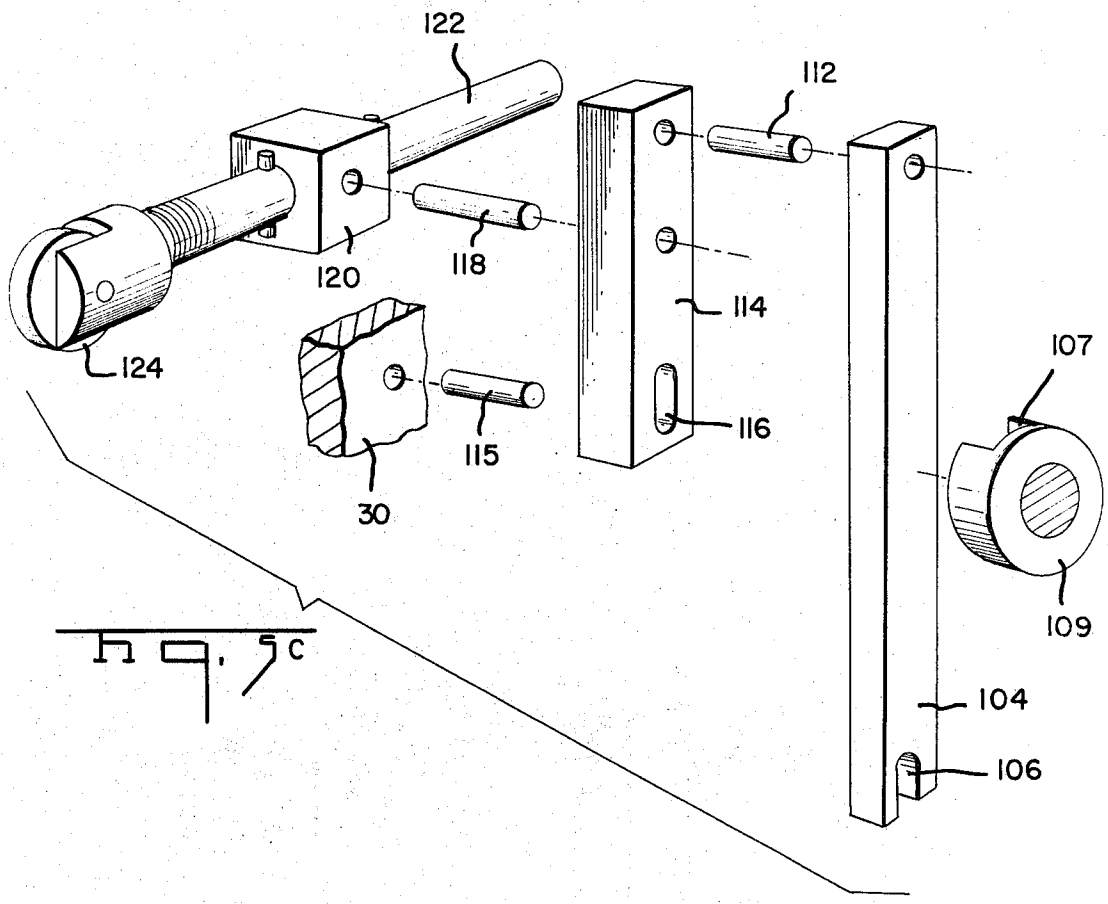
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Fig. 5C

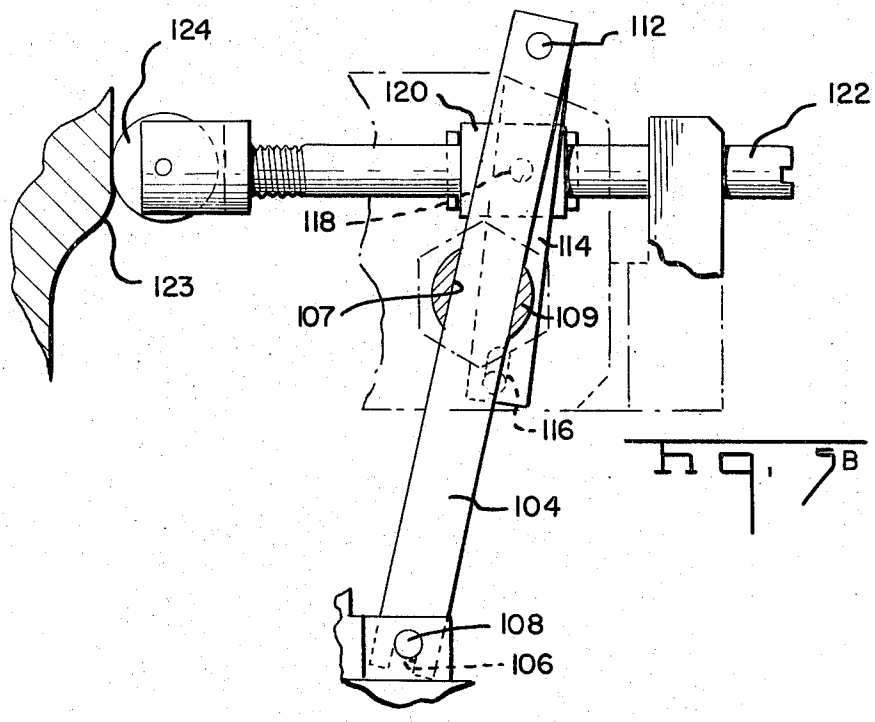
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Fig. 5B

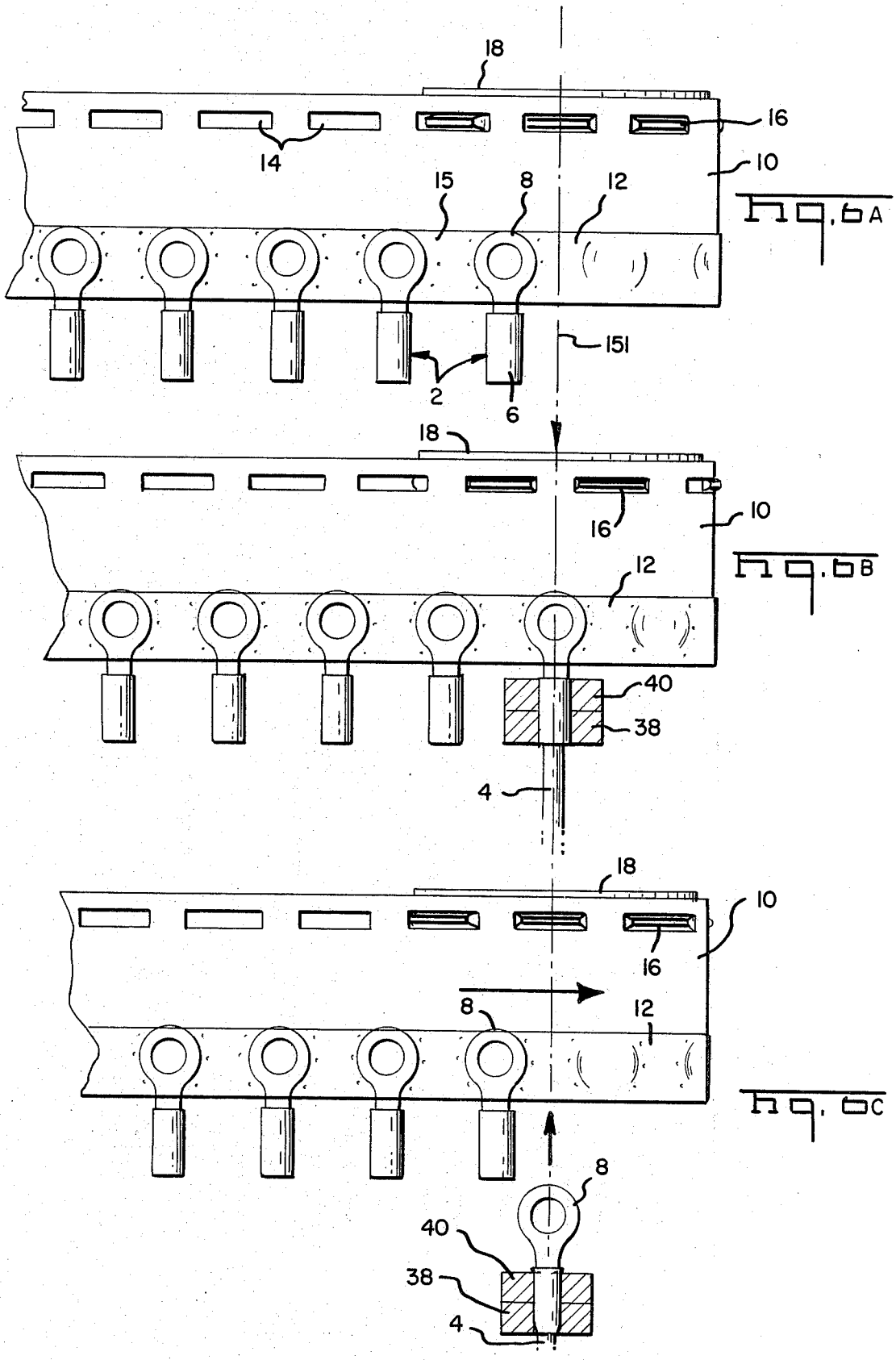

Fig. 6A

Fig. 6B

Fig. 6C

APPARATUS FOR APPLYING TERMINALS MOUNTED ON A TAPE TO WIRES

BACKGROUND OF THE INVENTION

This invention relates to applicators of the type adapted for crimping terminals onto wires, the terminals being attached to a flexible tape for convenience in feeding the terminals to an applicator.

The U.S. Pat. No. 3,037,545 to Klingler et al. discloses and claims an apparatus for crimping tape terminals to wires which comprises crimping dies and a sprocket for feeding the tape during each operating cycle so as to position an uncrimped terminal between the dies the dies for the next operating cycle. An improvement on this Klingler et al. apparatus is disclosed in the U.S. Pat. No. 3,553,814 to Rider which apparatus provides, in addition to feeding means for the tape, a means for moving the feeding means away from the crimping dies while the dies are closed onto the terminal. During operation of the Rider apparatus, a terminal is crimped onto a wire, the tape on which the terminal is mounted is moved away from the terminal while the terminal is held between the crimping dies to remove the terminal from the tape, the dies move to their open positions to release the terminal, and the tape is fed so that an uncrimped terminal will be located between the dies for the next operating cycle. The tape of apparatus disclosed in the Rider patent has been found to be highly advantageous by virtue of the fact that the crimped terminal is removed from the tape so that under given operating conditions, an operator can apply a larger number of terminals to wires per hour with the Rider apparatus.

The present invention is specifically directed to the achievement of a terminal applicator having the terminal stripping or removing features of the applicator disclosed in U.S. Patent but which is of more simple construction than the Rider apparatus and which can be used in automatic and semi-automatic lead making machines.

It is accordingly an object of the invention to provide an improved applicator for applying terminals, which are mounted on a flexible tape, to wires. It is a further object to provide a terminal tape applicator which can be used with a standard bench press and which can also be used in an automatic lead making machine. A further object is to provide a terminal applicator which is relatively simple in construction. A further object is to provide an improved applicator for tape terminals having improved mechanism for moving the crimping dies, for feeding the tape, and for stripping the crimped terminals from the tape.

These and other objects of the invention are achieved in a preferred embodiment thereof which is briefly described in the foregoing abstract, which is described in detail below, and which is shown in the accompanying drawing in which:

FIG. 1 is a side view of an applicator in accordance with the invention.

FIG. 2 is a view taken along the lines 2—2 of FIG. 1.

FIG. 3 is a fragmentary sectional sideview showing the positions of the parts at an intermediate stage of the operating cycle and prior to stripping of a crimped terminal from the tape to which the terminals are secured.

FIG. 4 is a frontal view taken along the lines 4—4 of FIG. 3.

FIG. 5A is a perspective exploded view of the principle structural elements of the apparatus including the crimping dies, the tape feed sprocket, and the camming means for indexing the tape feed sprocket.

FIG. 5B is a fragmentary side view of the actuating means of the feed sprocket indexing mechanism.

FIG. 5C is a perspective exploded view of the actuating means for the feed sprocket indexing mechanism.

FIG. 6A is a fragmentary semi-diagramatic view of a short portion of tape extending over the feed sprocket of an apparatus in accordance with the invention this view showing the position of the tape and sprocket at the beginning of an operating cycle.

FIG. 6B is a view similar to view 6A but showing the positions of the parts at the time of crimping the leading terminal of the tape onto a wire.

FIG. 6C is a view similar to FIG. 6A but illustrating the removal for stripping of a crimped terminal from the tape.

Referring first to FIGS. 6A–6C, it is now common practice to mount electrical terminals 2 in side-by-side relationship on a flexible plastic tape 10 with the barrel portions 6 of the terminals extending laterally beyond one edge of the tape. The barrel portions of the terminals are adapted to be crimped onto the ends of the wires 4 and as each terminal is crimped onto a wire, it is removed from the tape as indicated in FIG. 6C.

The type of terminal 2 disclosed has a contact end portion 8 in the form of a ring-tongue and the terminals are secured to the tape 10 by means of a binding tape 12 which extends along one side of the tape 10 and which is bonded in the vicinity of each terminal to the main tape 10 as indicated at 15. To remove an individual terminal from the tape, it is necessary to pull the terminal away from the tape until the bonds are broken.

The tape 10 has spaced-apart perforations 13 adjacent to the side opposite to the side on which the terminals are secured. These perforations are adapted to receive the teeth 16 of a sprocket wheel or other toothed feeding device 18 to feed the tape to the crimping station of an applicator. As will be explained below, the tape is fed by the sprocket wheel during each operating cycle and the sprocket is moved relatively away from the crimping dies as indicated in FIG. 6C to strip a crimped terminal from the tape.

Referring now to FIGS. 1–4, a preferred form of applicator 20 in accordance with the invention comprises a pressbase-plate 22, an applicator base plate 24 mounted on the pressbase-plate, and a ram housing 28 which is integral with a side-plate 30 and which is located above the spacer-plate. The ram housing and side plate provided a passageway in which an applicator ram 32 is slidably contained. The upper end of the applicator ram is provided with an insulation crimp selector dial 34 and a coupling knob 36. As best shown in FIG. 1, the coupling knob is coupled to the lower end of the ram 37 of a conventional bench press having a platen 26 and a press base plate 22 on which the applicator is mounted.

A crimping die 38 is secured to the forward side of die 40 as shown in FIG. 3 and die 40 is secured to the forward side of the ram by a fastener 42. These two dies cooperate with two crimping anvils 46, 48 which are mounted in a recess 50 in an anvil holder 52 secured to the spacer-plate 24, the mounting arrangement for these dies comprising a fastener 54 which extends

through the anvils and is threaded into the anvil holder. The crimping die **38** and the anvil **46** function to crimp a portion of the barrel **6** of a terminal onto the insulation of a wire **4** and the die **40** cooperates with the anvil **48** to crimp the remainder of the barrel **6** onto the stripped end of the wire as shown best in FIG. **3.**

The previously identified feed sprocket **18** for the tape **10** is mounted in alignment with, and behind, the crimping anvils on the end of the shaft **63** by means of a pin **68.** Shaft **63** extends rearwardly through an opening **62** in a slide block **54** which is slidably supported in a rearwardly extending channel **56** on the upper surface of the spacer-plate **24.** As best shown in FIG. **5,** guide gibs **58** are secured to the applicator base plate **24** on each side of the channel **56** and extend into grooves **60** in the sides of the slide block **54** so as to retain the slide block on the applicator base plate and accurately guide it towards and away from the dies as will be explained below.

The shaft **63** is supported in the opening **62** by bearings **64** at each end of the openings, these bearings having radially extending collars **66** which serve as spacers between the sprocket **18** and the lefthand end of the slide block (as viewed in Figures) and between the righthand end of the slide block and a reduced diameter section **70** of a barrel cam **72.**

The barrel cam **72** is fixed to the shaft **63** by a pin **74** so that the barrel cam, the shaft, and the sprocket must rotate as a unit during operation. A cam follower pin **76** extends vertically through a mounting block **78** which is fixed to the plate **24** by fasteners **80** and which straddles the barrel cam **72.** Adjacent to its upper end, pin **76** has a radially extending collar **82** and, above this collar, a head **84.** A leaf spring **86** mounted on the surface of block **78** has a notched inner end which bears against the upper surface of collar **80** and biases the lower end of the pin **76** against the surface of the barrel cam **72.** The pin can be raised by the lifting head **84** against the biasing force of the spring **86** so that the shaft **63** can be turned manually by means of a knob **92** secured to the rearward end of the shaft. Such manual rotation of the shaft is carried out only when the belt or tape is initially threaded over the sprocket wheel.

The surface of the barrel cam **72** has a series of axial cam tracks **88** extending leftwardly from its rearward end. The tracks **88** merge with diagonally extending tracks **89** which in turn merge with axial tracks **91** and diagonal tracks **90.** The diagonal tracks **90** merge with the next adjacent axial track **88** on the righthand end of the cam. The arrangement is such that if the shaft is moved rightwardly from the position of FIG. **3,** the cam will be rotated as the tracks **88, 89,** and **91** move past the end of the cam follower pin **76.** When the shaft is returned to its initial position, that is when it is moved leftwardly to the position of FIG. **3,** the cam will be rotated in the same direction through an additional arc as the cam track **90** guides the pin **76** relatively into the next adjacent axial cam track **88.** The manner of imparting axial movement to the rod to bring about such indexing of the shaft is described below.

The slide block **54** is biased rearwardly (rightwardly as viewed in FIG. **3**) by springs **94** which are anchored to pins **96** extending from the mounting block **78** and which extend to pins **98** that are mounted in an L-shaped mounting block **100** secured by fasteners **102** to the slide block **54.** Slide **54** is reciprocated by a lever **104** which has a notch **106** in its lower end through which a pin **108** extends. This pin extends across a recess in the block **100** so that when the lever **104** is swung through a slight counterclockwise arc as viewed in FIG. **3,** the slide will be moved rightwardly. When the lever **104** is swung through a slight clockwise arc back to its initial position, the slide block will be moved leftwardly to its initial position.

The lever **104** is oscillated during each operating cycle by an upper reciprocable rod **122** in the following manner. The lever **104** is slidingly supported intermediate its ends in a groove **107** in a bearing block **109** which is adjustably mounted on the frame housing as shown at **110.** The upper end of lever **104** is pivotally connected by means of a pin **112** to the upper end of a short lever **114** disposed beside the lever **104.** Lever **114** has an elongated slot **116** at its lower end into which a pin **115** extends, this pin being fixed in the housing sidewall **30.** Intermediate its ends, the lever **114** is connected by a pin **118** to a block **120** which is fixed to the reciprocable rod **122.** The rod **122** is supported in the frame housing and in an upwardly projecting arm **121** and has a cam follower **124** on its end. This cam follower bears against the surface of a cam **123** which is mounted on the applicator ram. The springs **94** bias the lever **104** in a counterclockwise direction as viewed in FIG. **1** so that the cam follower **124** is always maintained against the surface of the cam **123.**

The location of the cam **123** on the applicator ram is such that the lever **104** is moved through a counterclockwise arc during descent of the ram causing partial indexing of the shaft **63** so that the leading terminal **2** on the tape is advanced until it is located precisely between the upper and lower crimping dies, compare FIGS. **6A** and **6B.** During ascent of the ram, the lever **104** is moved through a clockwise arc and the tape is further advanced although the leading terminal which will have been crimped onto the wire is removed from the tape during this final stage of indexing.

It will be apparent from FIG. **3** that the sprocket wheel **18** supports only one surface of the tape **10** and it is desirable to provide a fixed guide for guiding the opposite surface of the tape, the surface on which the terminals are mounted. To this end, a fixed tape guide block **126** is provided in front of the sprocket wheel **118** and has lower surface **127** against which the tape bears. The front surface **219** of this block also functions to guide the inner ends of the barrel portions **6** of the terminals as shown at **131.**

Additional guiding and tape retaining means are provided in the form of a block **132** having an arcuate surface **133** which is spaced from the cylindrical surface of the sprocket. This arcuate surface has a central recess **134** for the accommodation of the sprocket teeth so that the righthand end of the tape as viewed in FIG. **3** is contained between the arcuate guide surface **133** and the surface of the sprocket, see FIG. **3.** Block **132** is supported on the mounting block **100** by a fastener **138** which extends into a vertical slot **136** in the block **132** and is threaded into the block **100.** A spring **140** is interposed between the lower side of fastener **138** in the block **132** so that the guide block is biased downwardly as viewed in FIG. **3** and the tape is lightly clamped on each side of the sprocket teeth.

The tape is guided also by means of a guide plate **144** which is secured to a laterally extending arm **142** of the guide block **132.** The guide plate **144** has a horizontally

extending flange **145** on its end which projects forwardly of the arm **142** and the end of this arm which is adjacent to this sprocket slopes downwardly as shown. As shown best in FIG. **4**, the tape is threaded above the flange **145** and extends over the sprocket and leaves the sprocket in a manner such that it passes beneath the flange **145**.

The fixed tape guide block **126** and the block **132** are secured to and spaced from the slide block **54** by means of channels **128** and spacer bars **130**, the spacer bars being interposed between the mounting block **100** and the guide block **132**. It will thus be apparent that this guide structure will be reciprocable with the sprocket during insertion as described below.

The applicator disclosed is intended for use in a fully automatic lead making machine of the type disclosed in U.S. Pat. No. 3,019,679. In machines of this type, the applicator ram is continuously reciprocated by the press ram and during the interval between crimping operations, wire is fed from a reel or other endless source, insulation is stripped from the end of the wire, and the wire is inserted into an uncrimped terminal in the applicator.

In operation, during initial downward movement of the ram, the shaft **63** and the sprocket **18** are moved leftwardly. Simultaneously, the shaft is indexed as the barrel cam moves past the fixed cam follower **76**. The leading uncrimped terminal **2** of the tape will, after this indexing operation, be located on the center line **151** of the crimping dies. The wire end is then inserted into the terminal and the terminal is crimped when the dies arrive at their bottom dead center positions. While the dies move upwardly, the shaft **63** is again rotated and is moved rightwardly as viewed in FIG. **3** by the lever **104**. It will be understood that during the cycle, the wire is gripped by the wire transfer device disclosed in the lead making machine and the rightward movement of the shaft **63** and the sprocket **18** will result in the terminal being broken free from the belt.

As shown in FIG. **4**, the tape **10** can be unloaded from the sprocket wheel on the same side as the side of entry. This feature is advantageous where terminals on tape are crimped onto the above identified U.S. Pat. No. 3,019,679. It will be apparent from a review of the disclosure of that patent that the tape cannot be fed away from the sprocket on the opposite side from the side of loading because of the presence of other parts of the leading making machine.

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.

What is claimed is:

1. Apparatus for crimping individual electrical connecting devices onto wires, said connecting devices being mounted at spaced-apart locations on a tape with the axes of said connecting devices extending laterally of said tape, said apparatus comprising:

a pair of cooperable crimping dies, said dies being movable relatively towards and away from each other along a predetermined path between open and closed positions,

a feed sprocket for said tape, a feed sprocket shaft, said feed sprocket being fixed to said feed sprocket shaft, said shaft extending transversely of said predetermined path,

said shaft being axially movable between first and second positions said sprocket being proximate to said path when said shaft is in said first position with the leading connecting device on said tape being on said path and between said dies, and said sprocket being spaced from said path when said shaft is in said second position,

actuating means for moving said dies relatively towards and away from each other along said path and for concomitantly moving said shaft between said first and second positions, and,

cam means on said shaft, said cam means being effective to index said sprocket, during axial movement of said shaft, through an arc equal to the angular spacing between adjacent connecting devices on a portion of said tape extending over said sprocket whereby, during each operating cycle of said apparatus, the leading connecting device on said tape is crimped, said sprocket is moved away from said path to effect removal of said leading connecting device from said tape while said leading connecting device is restrained from movement, and said sprocket is indexed to locate the next adjacent connecting device on said predetermined path.

2. Apparatus as set forth in claim **1** wherein said actuating means comprises a lever pivoted intermediate its ends, one end of said lever having a lost motion connection with said shaft, and means responsive to movement of said dies for oscillating said lever.

3. Apparatus as set forth in claim **2** wherein said cam means comprises a barrel cam coaxially mounted on said shaft and including a fixed cam follower cooperable with said barrel cam.

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