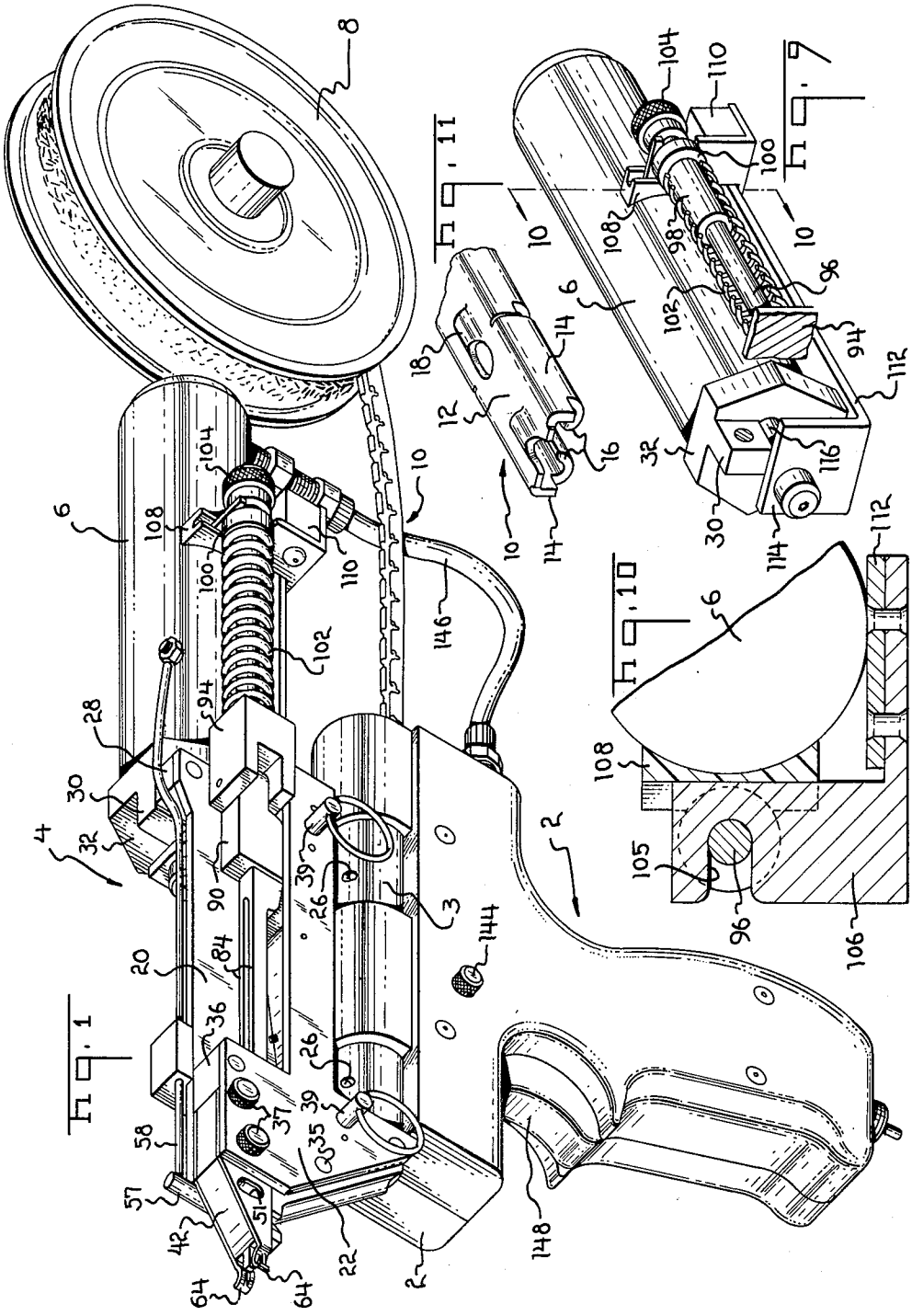
Oct. 6, 1964 H. E. STINE, JR 3,151,389

APPARATUS FOR MAKING ELECTRICAL CONNECTIONS

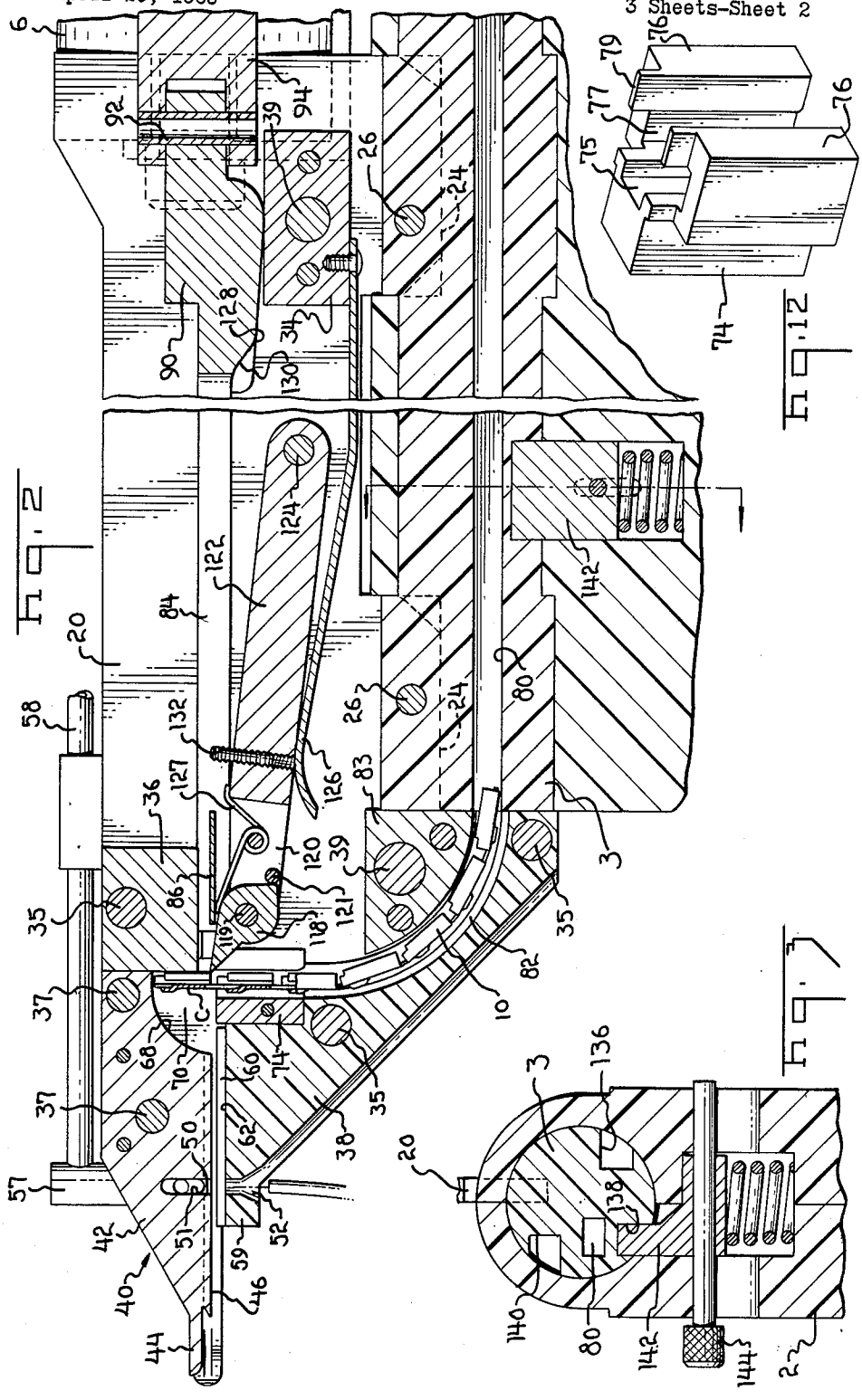
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Fig. 4

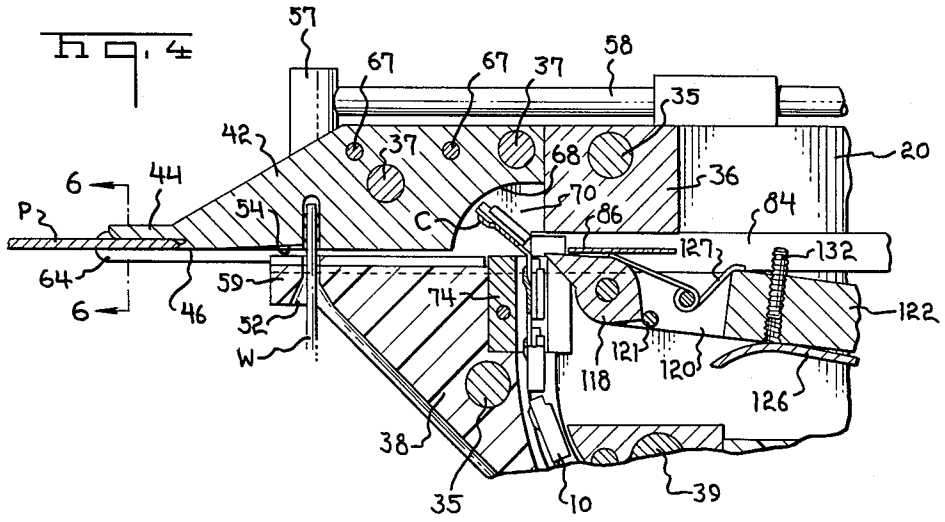


Fig. 5

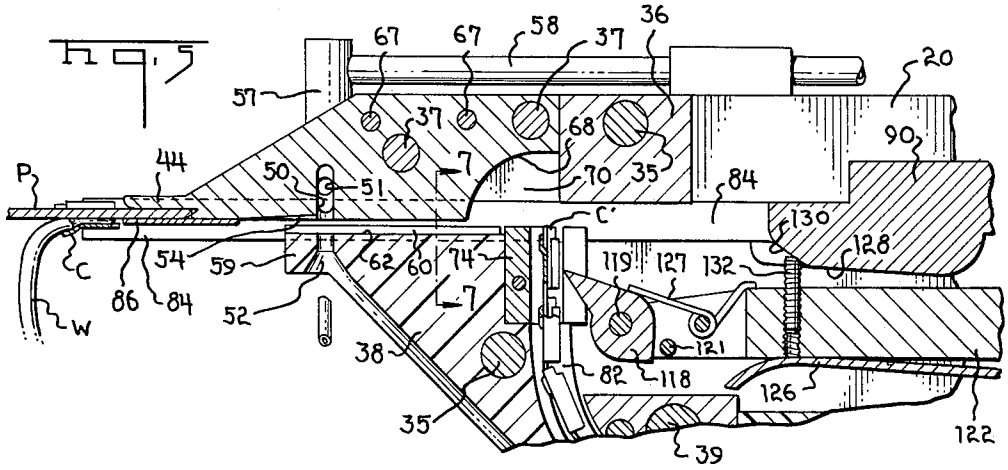


Fig. 7

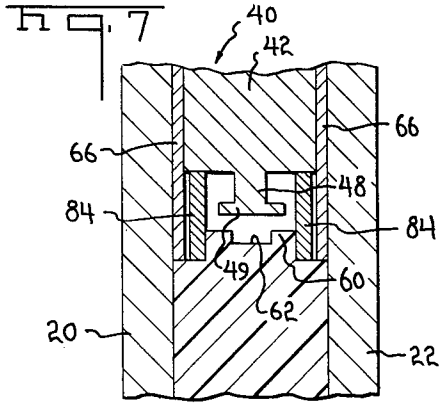


Fig. 6

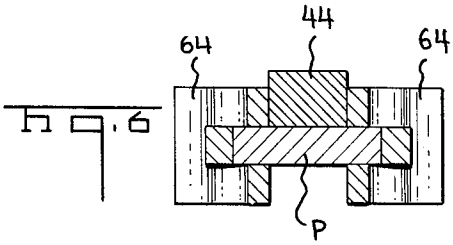
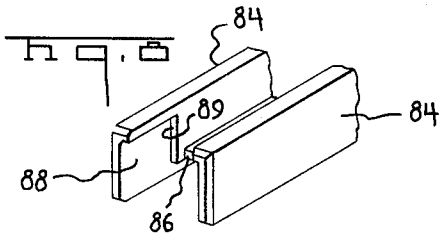


Fig. 8



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APPARATUS FOR MAKING ELECTRICAL CONNECTIONS

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Filed Apr. 29, 1963, Ser. No. 276,637
5 Claims. (Cl. 29—203)

This invention relates to devices for applying connector clips to terminal posts for the purpose of making electrical connections between wires and terminal posts.

In the co-pending application of Robert F. Cobaugh, Serial Number 171,074, filed February 5, 1962, for Electrical Connections, there is disclosed a method of making an electrical connection with a terminal post by means of a clip member which is slid past a conductor wire and onto a terminal post in a manner such that the wire is held against the post after the clip comes to rest thereon. The aforementioned Cobaugh application discloses two types of devices for applying the clips to the posts and other forms of applicators for such clips are disclosed in applications Serial Number 250,300, filed January 9, 1963, Serial Number 257,133, filed February 8, 1963, and Serial Number 221,286, filed September 4, 1962. The present invention relates to a still further form of applicator for applying connector clips to terminal posts in accordance with the Cobaugh application.

An object of the invention is to provide an improved applicator for applying connector clips to terminal posts to form an electrical connection between a wire and the terminal post. A further object is to provide an applicator for connector clips having an improved feeding means for feeding clips in end-to-end strip form. A further object is to provide a device having an improved means for separating the leading connector clip of a fed strip from the next adjacent clip on the strip. A still further object is to provide a clip applicator of simplified construction.

These and other objects of the invention are achieved in a preferred embodiment comprising an air operated hand tool having a reciprocable plunger which is movable along a rectilinear path extending over an anvil and onto a terminal post. The connector clips, in end-to-end strip form, are fed along a strip feed path which extends laterally of and intersects the path of reciprocation of the plunger so that the leading clip of the strip is positioned between the end of the plunger and the anvil and with its axis extending transversely of the path of reciprocation of the plunger. Upon movement of the plunger, the leading clip is engaged by the leading end of the plunger and bodily pivoted about its end at which it is secured to the next adjacent clip in the strip. This pivoting of the leading clip reorients it until its axis extends parallel to the path of reciprocation of the plunger so that upon further forward movement of the plunger the clip is broken from the next adjacent clip in the strip and carried by the plunger over the anvil and onto the terminal post. After the leading clip of the strip has been removed from the end of the strip and applied to the terminal post, and the plunger has returned to its original position the strip is fed a distance equal to the length of a single connector clip by means of a spring biased feed arm which is actuated by a camming surface on the plunger. Such feeding of the strip positions the next adjacent clip in alignment with the plunger and with its axis extending transversely of the plunger and in position for the next operating cycle.

In the drawing:

FIGURE 1 is a perspective view of a preferred form of air operated hand tool in accordance with the invention.

FIGURE 2 is a sectional side view showing the forward end of the tool.

FIGURE 3 is a view taken along the lines 3—3 of FIGURE 2.

FIGURES 4 and 5 are fragmentary sectional side views showing the forward end portion of the tool and illustrating the manner in which the leading connector clip is separated from the strip of connector clips and moved onto a terminal post.

FIGURES 6 and 7 are views taken along the lines and looking in the direction of the arrows 6—6 and 7—7 of FIGURES 4 and 5.

FIGURE 8 is a fragmentary perspective view showing the leading end portion of the plunger which pushes the connector clips onto the terminal posts.

FIGURE 9 is a fragmentary perspective view of the pneumatic cylinder and illustrating the coupling between the piston rod and the plunger.

FIGURE 10 is a fragmentary view taken along the lines 10—10 of FIGURE 9.

FIGURE 11 is a perspective view of a portion of a strip connector clips.

FIGURE 12 is a perspective view of a bending die and guide block forming a part of the preferred embodiment.

A preferred embodiment of the invention as shown on the attached drawing comprises a hand held pneumatic tool for applying connector clips to terminal posts. The disclosed tool comprises a handle 2 having a cylindrical support member 3 on its upper end on which the tool mechanism 4 is mounted. This tool is actuated by a pneumatic piston cylinder 6 and applies clips in strip form 10 which are drawn from a reel 8 mounted on a bracket extending rearwardly of the cylinder.

The specific type of connector clip which the disclosed tool is adapted to apply to a terminal post comprises (FIGURE 11) a flat web 12 having sidewalls 14 extending from its longitudinal sides. These sidewalls are reversely curled along their marginal edge portions as shown at 16 so that the clips are adapted to be telescopically moved over a terminal post and to hold a wire against the side of the post as disclosed more fully in the above mentioned application Serial Number 171,074. The disclosed form of clip also has an outwardly cupped section 18 at one end of the web which functions as a strain relief for the wire and as a means for clamping the wire in its assembled relationship to the terminal post. The clips are advantageously formed by conventional stamping and forming methods from strip stock so that they are secured together in head-to-tail relationship. The leading clip of the strip can be removed by bodily pivoting it relative to the next adjacent clip as will be apparent as the description proceeds.

Referring now to FIGURES 1 and 2, the clip applying mechanism 4 is mounted between a pair of generally parallel frame plates 20, 22 which extend across the upper portion of the tool. Frame plate 20 is secured to support member 3 by means of ears 24 on its lower side as viewed in FIGURE 2 which extend within slots in the cylindrical support member 3 and which are held in position by fasteners 26. At its rearward end, plate 20 is secured to a spacer block 28 which in turn is secured to a projection 30 on the cylinder head 32 of the pneumatic cylinder 6.

Plate 22 is maintained in spaced-apart relationship to plate 20 by means of a spacer block 34 situated between the plates at their rearward ends and additional spacer blocks 36 and 83 between the plates. Additionally, a block 38 is positioned between the plates at their forward ends and an anvil assembly 40 is held between the plates above the block 38.

The blocks 34, 36, 38 and 83 are secured by means of rivets 35 to the plate 22, and the subassembly com-

prising the plate 22 and these blocks is removably secured to the plate 20 by means of removable pins 39. The anvil assembly 40 is held between the forward ends of the two plates 20, 22 by means of removable pins 37, an arrangement permits rapid removal of the anvil and the plate 22 when it is desired to do so. As explained below, the anvil or subassembly on the plates 20 is changed when the size of the clip being applied is radically changed.

Anvil assembly 40 comprises an anvil block 42 having a relatively narrow axial extension 44 on its forward ends and having a shoulder 46 on its underside adjacent to its forward end. The underside of anvil block 42 has a T-shaped projection 48 which is adapted to straddlingly receive a connector clip as indicated in FIGURE 6 with the web against the surface of the head 49 of this projection and with the edges of the sidewalls bearing against the underside of the head. A wire receiving opening 50 extends transversely through projection 48 and into the block 42 where it communicates with a laterally extending opening 51 provided for the purpose of removing a severed section of insulation. Advantageously, the severed section of insulation is removed by means of an air blast from a nozzle 57 on the end of an airline 58 extending from cylinder 6. The block 38 has an end portion 59 which extends past the opening 50 and an additional opening 52 is provided in block 38 which is in alignment with the opening 50 of the anvil block. As indicated in FIGURE 2, wire is thus inserted from below through the opening 52 and into the opening 50.

The head of T-shaped projection 48 is provided with a tapered central groove 54 which communicates with opening 50 and which slopes therefrom towards the surface of the head 49 of the projection 48 and towards the forward end of the tool. As explained in the above mentioned Cobaugh application, the provision of such a groove facilitates severing of the end section of insulation from the wire W and the withdrawing of the metallic core from this end section during movement of the clip past the opening 50.

It is desirable to provide a resilient means on the anvil block to assist the operator in holding the tool against and in axial alignment with the terminal post during usage. To this end, there are provided a pair of spring fingers 64 on each side of the projection 44 of the anvil block, the spacing between these fingers being such that they will be flexed away from each other when a terminal post is positioned against the underside of projection 44 and against the shoulder 46. Fingers 64 extend from the ends of a pair of relatively thin plates 66 secured to the sides of the anvil block by means of fasteners 67.

The upper side of block 38 which extends parallel to the projection 48 has a central axially extending rib 60. This rib has a centrally located groove 62 for the accommodation of the outwardly cupped portion 18 of the connector clip as is apparent from FIGURE 6. The connector clip is thus guided during its movement over the projection 48 by the projection 48, by the rib 60, and by the side rails 84 of the reciprocable plunger which is described below.

The righthand end of anvil block 42 has an arcuate surface 68 extending upwardly and rightwardly as viewed in FIGURE 2 from the end of anvil projection 48. This cut-out section of the block defines a segmental cavity 70 enclosed on each side by the frame plates 20, 22 and partially enclosed at its rearward end by the block 36. The strip of connector clips is fed through an arcuate passageway 82. This passageway is defined by an arcuate surface on the lefthand side of spacer block 38 and by an arcuate surface on a separate block 83 which is riveted to plate 22. A bending die and guide block 74 is mounted in a recess at the upper end of passageway 82 which has a groove 75 in alignment with the passageway. The sides 76 of this block extend on the opposite sides of the channel 75 and are grooved as shown at 77 so as to confine the connector C' which is next adjacent to the

connector C disposed in the cavity 70. The rails 84 of the plunger (described below) are adapted to ride over the upper surface of the sides 76. Advantageously, ears are provided on these upper sides to guide the plunger rails during their movement towards the forward end of the tool.

The plunger which advances the clips over the anvil projection 48 and onto the terminal post comprises a pair of parallel rails 84 (FIGURE 8) which are connected together by means of a web 86 adjacent to their leading ends. The opposed faces of the leading ends are recessed as shown at 88 for the accommodation of a connector clip and to provide shoulders 89 which push the clip over the anvil projection as described below. Rails 84 extend rearwardly to a block 90 which has a pivotal connection 92 with the clevis block 94 on the end of a connecting rod 96. This connecting rod extends parallel to and beside the cylinder 6 and extends slidably through a bushing 98. The bushing has an enlarged collar 100 on its rearward end which defines the forwardly facing shoulder. A coil spring 102 surrounds the rod 96 and acts between this shoulder and the rearward side of clevis block 94. The rod 96 projects rearwardly beyond the shoulder 100 and has a nut 104 threaded onto its end.

The end of the rod 96 which extends beyond the bushing 98 is received in a slot 105 of a plate 106 (FIGURE 10). This plate has a slidable support 103 secured thereto which bears against the surface of the cylinder 6 to guide and support the rod during reciprocation as described below. On its lower end, plate 106 is secured to a support block 110 and extends beneath the cylinder 6 at which point it is fastened to a slide member 112. The slide member in turn extends axially along the underside of the cylinder and has an upwardly directed flange 114 on its end which is secured to the piston rod 116 of the piston-cylinder 6.

Upon leftward movement of the piston rod from the position of FIGURES 1 and 2, the slide member 112 is moved leftwardly and the bushing 100 is first moved leftwardly relative to the rod 96 until the spring 102 is compressed. Thereafter, the bushing 100, the rod 96, and the plunger 84 move leftwardly as a unit until the piston reaches the end of its stroke. During the final period of the application cycle, the plunger 84 moves leftwardly under the influence of the spring 102 only, the purpose of this arrangement being to achieve a more gentle pushing of the clip onto the post during final stages of assembly.

The strip 10 of connector clips is drawn from the reel 8 and fed through the axial passageway 80 in the cylindrical support member 3 which communicates with the previously mentioned arcuate passageway 82 in the block 38. Feeding of the strip is accomplished during retractile movement of the plunger 84 by means of a feed pawl 118 pivotally mounted in a recess 120 on the end of a rocker arm 122. This rocker arm is pivoted at its rearward end 124 to frame plate 22 and is normally urged in a clockwise direction as viewed in FIGURE 2 by means of a leaf spring 126 which bears against the underside of the rocker arm and which is secured at its rearward end to the block 34. Feed pawl 118 is resiliently biased in a counterclockwise direction relative to its axis of rotation 119 by means of a torsion spring 127 but is prevented from rotating about its axis in a counterclockwise direction beyond the position shown in FIGURE 2 by a stop pin 121.

During the forward movement of the plunger from the position of FIGURE 2 to the position of FIGURE 4, the underside 128 of the block 90 engages the upper surface of the rocker arm and causes it to pivot in a counterclockwise direction about its pivotal axis 124. During the final stages of the forward motion of the plunger, a central recess 130 having a sloping cam surface on the underside 128 of the block 90 engages a set screw 132 in the rocker and swings it to the extreme limit

of its counterclockwise motion. FIGURE 5 shows the positions of the parts immediately before this extreme limit of such counterclockwise motion has been attained. It will be apparent that upon further leftward movement of block 90 from the position of FIGURE 5, the pawl 118 will be moved relatively downwardly until it engages the lower end of the clip C'. Upon rightward movement of the plunger, the rocker arm 122 is swung in a clockwise direction under the influence of spring 126 to feed the clip C' into the arcuate cavity 70.

In use, the operator thus inserts the wire through the opening 52 and into the opening 50 and positions the tool on a terminal post with its ends disposed against the shoulder 46. The trigger 148 is then depressed to supply compressed air through a valve system (not shown) and through a line 146 to the rearward end of the piston cylinder 6. After such actuation of the piston cylinder, the plunger is driven leftwardly from the position of FIGURE 2 to the position of FIGURE 4 and thence to the position of FIGURE 5. It will be apparent from FIGURE 2 that the web 86 of the plunger engages the leading connector C at a location slightly above the plane in which it is integral with the next adjacent connector clip C'. Pushing of the clip C at this point causes the leading clip to be bodily pivoted along an arcuate path until it is disposed in alignment with the anvil projection 48 as shown in FIGURE 6. The clip C may be severed from the next adjacent clip C' when it reaches the end of its pivoting movement but if it is not severed after pivoting, it will be separated from the next adjacent clip immediately thereafter as it is pushed over the anvil by the plunger.

The severed clip C which is confined between the faces 88 of the plunger rails is moved axially over the anvil projection and past the wire disposed in the openings 52, 50 at which point the insulation of the wire is severed and the conducting core is drawn from the severed section as explained in the above mentioned Cobaugh application. The leading clip C with the wire disposed between the web and the post is thereafter pushed onto the terminal post as shown in FIGURE 5. Upon return movement of the plunger, the next succeeding clip C' is fed into the arcuate segmental cavity as explained above.

In order to facilitate usage of the tool in applying clips to relatively unaccessible terminal posts, the support barrel 3 is rotatable 90° in either direction from the position shown in the drawing. Referring to FIGURE 3, it can be seen that there are provided 3 openings 136, 138, and 140, which are adapted to receive a spring biased detent 142 contained in the handle. When it is desired to change the position of the operating mechanism 4 relative to the handle, it is merely necessary to move the finger piece 144 downwardly, rotate the support barrel 390° in the desired direction, and release the finger piece to permit the detent to enter the appropriate one of the recesses.

A salient advantage of the invention is that the severing of the leading connector clip from the strip and the feeding of the strip is substantially simplified. The disclosed embodiment avoids the need for separate shearing devices and transfer slides for shearing this leading clip from the strip and placing it in alignment with the plunger 86 since the plunger itself effects this severing and aligning function. Additionally, the feeding mechanism is of an extremely simple form and is actuated directly by the plunger itself.

A further advantage of the invention which should be mentioned is that the anvil can be rapidly changed when necessary as, for example, where the clips are being applied to different types or sizes of terminal post. Replacement or changing of the anvil can be accomplished by merely removing the pins 37, removing the anvil, and inserting an anvil of desired size. The disclosed form of tool also has the advantage of being adaptable to use

with different sizes of connector clips by removal of the subassembly including the plate 22 and the blocks 38, 34, 36, which are secured thereto and replacing this subassembly with a different assembly of the appropriate size.

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.

I claim:

1. A device for applying electrical connector clips to terminal posts, said connector clips having a web and upstanding sidewalls on two opposite sides of said web, said clips being secured together in end-to-end strip form, said device comprising: a plunger reciprocable along a rectilinear path, means for feeding a strip of said connectors along a feed path which intersects said rectilinear path whereby, the leading connector of said strip is disposed on said rectilinear path with its longitudinal axis extending transversely of said rectilinear path, means for supporting the next adjacent connector of said strip, means on said plunger for engaging said leading connector at a location remote from said next adjacent connector whereby, upon movement of said plunger past said leading connector, said leading connector is first reoriented and pivoted with respect to said next adjacent connector, and said leading connector is thereafter pushed away from, and broken away from, said next adjacent connector, said device including means for guiding said leading connector towards a terminal post during the remaining portion of the forward stroke of said plunger.

2. In a device of the type intended for applying channel-shaped clips to connector posts, said clips being secured together in end-to-end relationship in the form of a strip, said device comprising a plunger and an anvil, said plunger being reciprocable along a rectilinear path extending over said anvil thereby to push a clip onto a terminal post, the improvement to said device comprising: means for feeding said strip of clips along a strip feed path, said strip feed path intersecting said rectilinear path at a location between said anvil and the end of said plunger when said plunger is in its retracted position whereby, the leading clip of said strip is disposed on said path with its axis extending transversely thereof, means for supporting the clip on said strip which is next adjacent to said leading clip, and means on said plunger for engaging said leading clip at a location remote from its one end which is secured to said next adjacent clip whereby, upon movement of said plunger along said rectilinear path, said leading clip is first engaged by said plunger and bodily pivoted about said one end, and said leading clip is thereafter pushed by said plunger along said rectilinear path towards and over said anvil and is separated from said next adjacent clip.

3. In a device of the type intended for applying channel-shaped clips to connector posts, said clips having a web and having upstanding sidewalls on two opposite sides of said web, said clips being secured together in end-to-end relationship in the form of a strip, said device comprising a plunger and an anvil, said plunger being reciprocable along a rectilinear path extending over said anvil thereby to push a clip onto a terminal post, the improvement to said device comprising: feeding means for feeding said strip of clips along a strip feed path, said strip feed path intersecting said rectilinear path at a location between said anvil and the end of said plunger when said plunger is in its retracted position, said strip feed path guiding said clips in an orientation such that the leading clip of said strip is disposed between said anvil

and said plunger with the plane of its web extending normally of said rectilinear path, means for supporting the clip on said strip which is next adjacent to said leading clip, and means on said plunger for engaging said leading clip at a location remote from its one end which is secured to said next adjacent clip whereby, upon movement of said plunger along said rectilinear path, said leading clip is first engaged by said plunger and bodily pivoted about said one end, and said leading clip is thereafter pushed by said plunger along said rectilinear path towards and over said anvil and is separated from said next adjacent clip.

4. A device as set forth in claim 3 wherein said strip feed path extends parallel to said rectilinear path and curves across said rectilinear path between said plunger and said anvil, said feeding means comprising a feed lever

pivotally mounted between said rectilinear path and said strip feed path, and means movable with said plunger for swinging said feed lever during reciprocation of said plunger thereby to feed said strip.

5. A device as set forth in claim 3 including a pistol-grip handle portion, a support extending across said handle portion at the upper end thereof, said plunger and said anvil being mounted on said support, and said support being rotatable for purposes of adjustment about an axis extending parallel to said path of reciprocation.

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