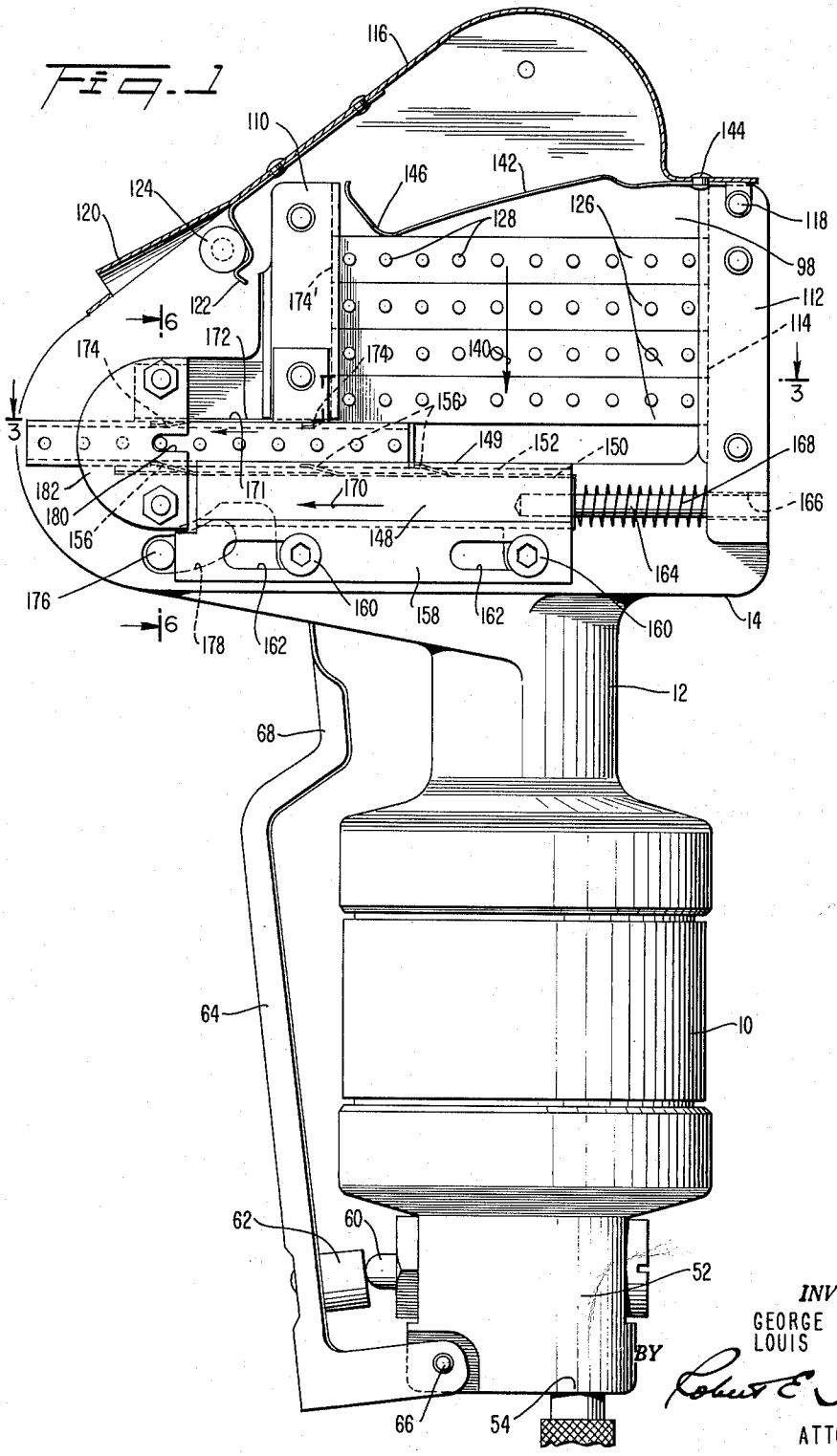
Jan. 26, 1965 G. USTIN ETAL 3,167,107

MAGAZINE TYPE CRIMPING TOOL

Filed March 20, 1961 4 Sheets-Sheet 1

Fig. 1




INVENTORS
GEORGE USTIN
LOUIS NETTA

BY Robert E. Isner

ATTORNEY

Jan. 26, 1965 G. USTIN ETAL 3,167,107

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Filed March 20, 1961 4 Sheets-Sheet 2

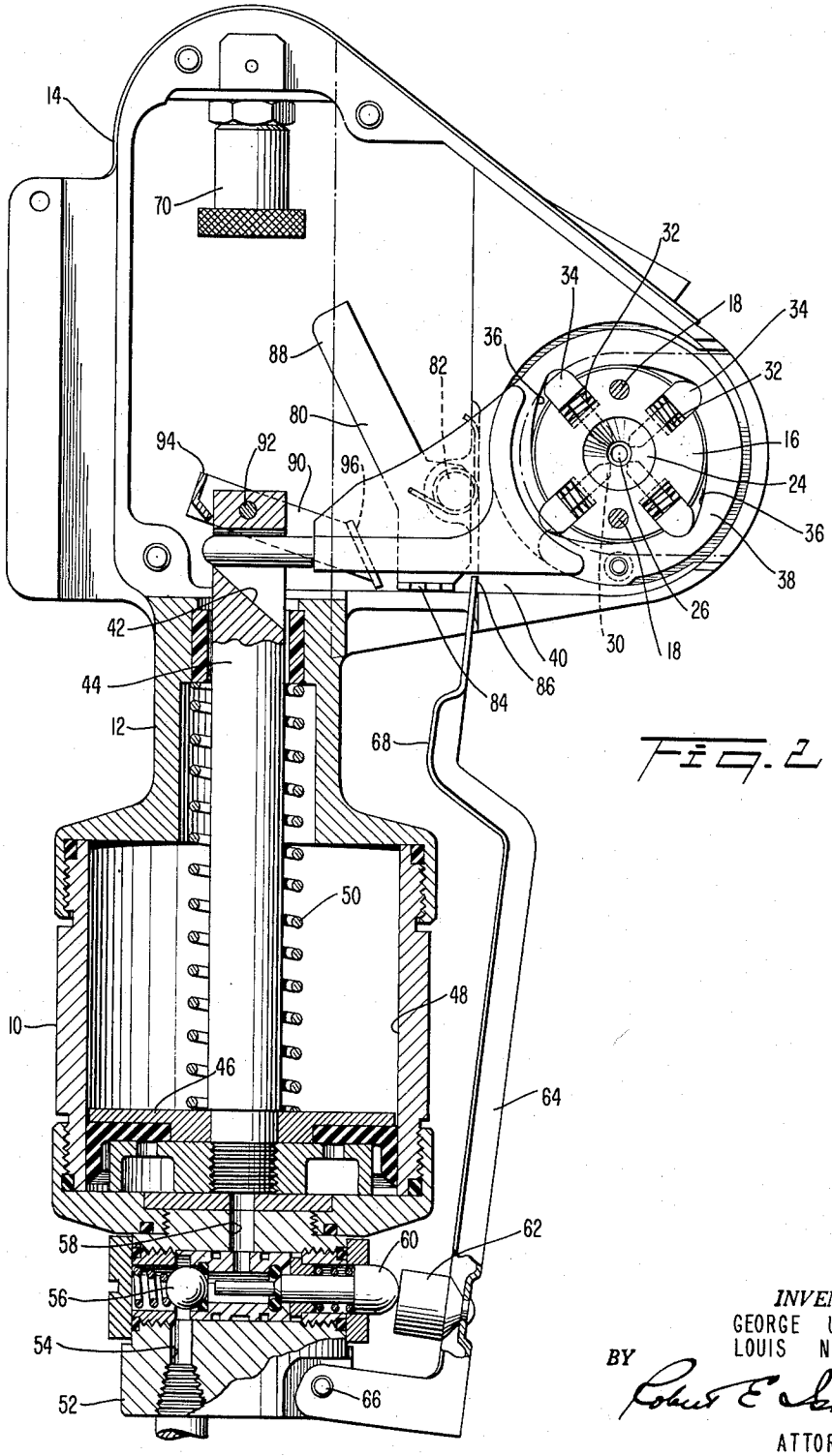



Fig. 2

INVENTORS
GEORGE USTIN
LOUIS NETTA

BY

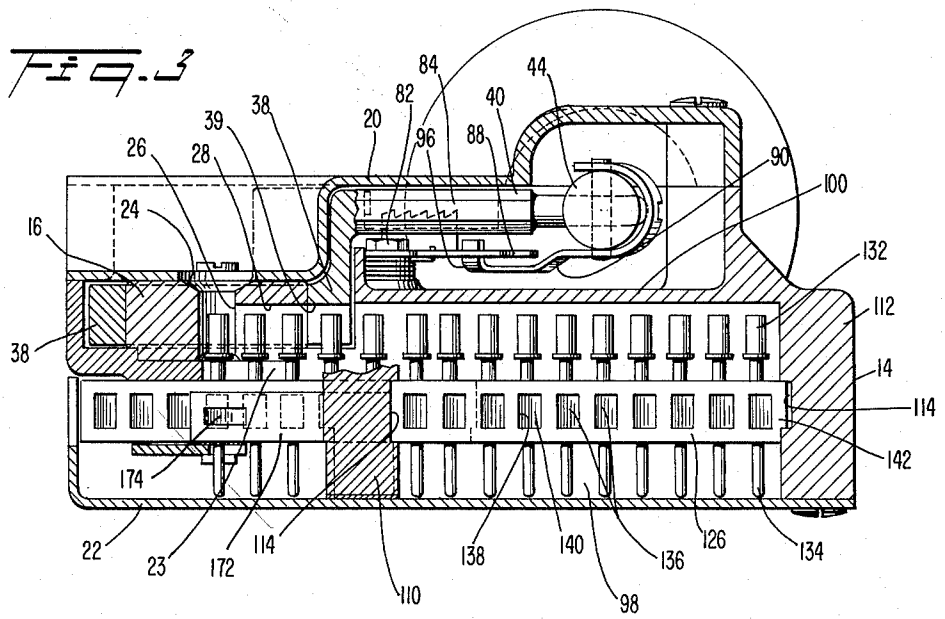
ATTORNEY

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FIG. 3



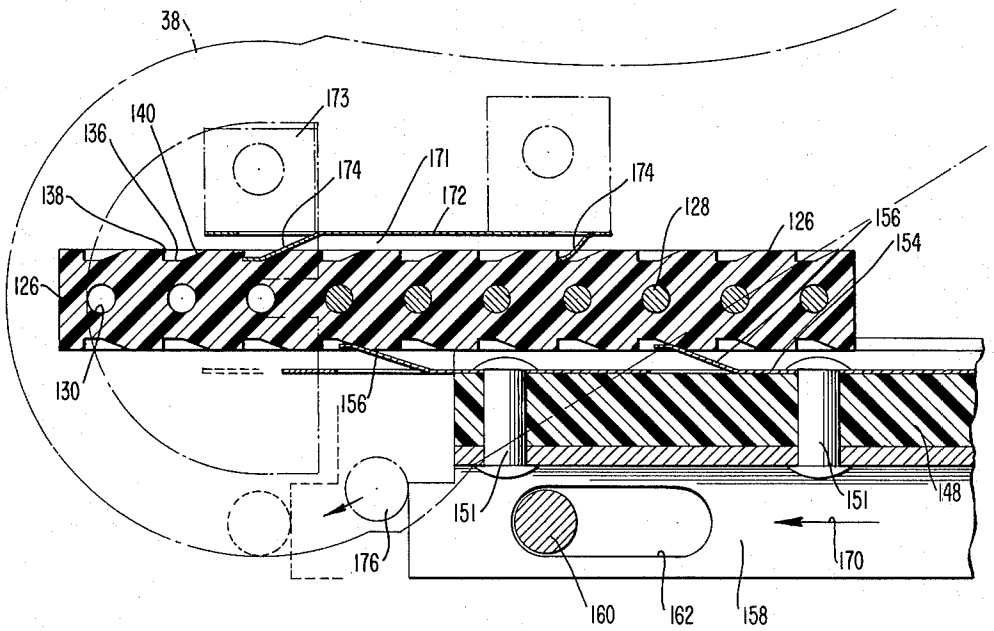




FIG. 4

*INVENTORS*
GEORGE USTIN
LOUIS NETTA

*BY*

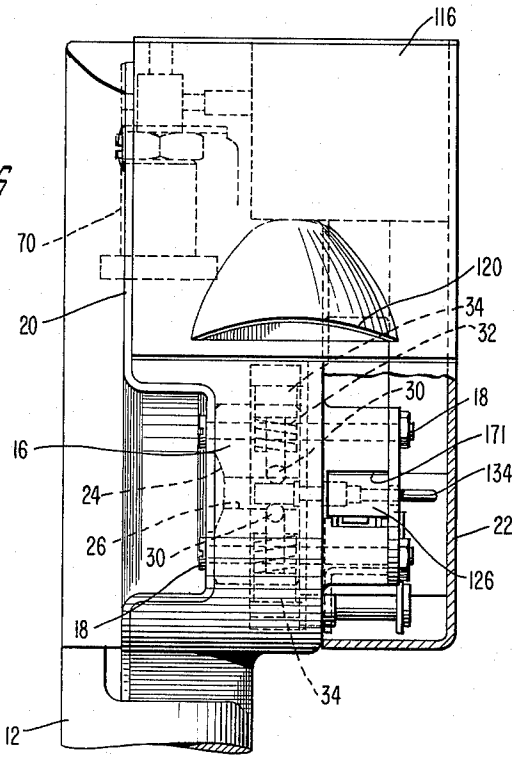
ATTORNEY

Jan. 26, 1965 G. USTIN ETAL 3,167,107

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Filed March 20, 1961 4 Sheets-Sheet 4

Fig. 5



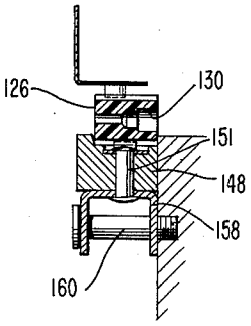




Fig. 7

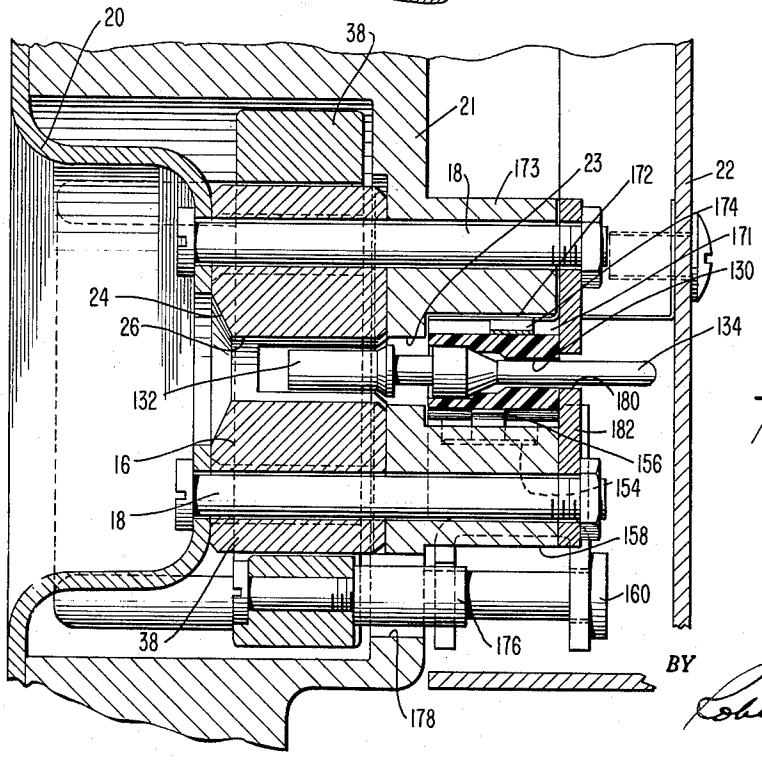



Fig. 6

INVENTORS
GEORGE USTIN
LOUIS NETTA

BY Robert E. Lane

ATTORNEY

United States Patent Office 3,167,107 Patented Jan. 26, 1965



3,167,107

# MAGAZINE TYPE CRIMPING TOOL

George Ustin, Verona, and Louis Netta, Elizabeth, N.J., assignors to Buchanan Electrical Products Corporation, Hillside, N.J., a corporation of New Jersey

Filed Mar. 20, 1961, Ser. No. 97,082
1 Claim. (Cl. 153—1)

This invention relates to power operated crimping tools and particularly to an improved construction for a clip feed magazine type power operated crimping tool adapted for the symmetrical crimping of electrical connectors and similar electrical assemblies.

Crimping tools incorporating a bored dieholder having a plurality of radially displaceable crimping dies reciprocably mounted therein and an associated operating member having a cammed die member actuating surface mounted for rotative displacement relative to the dieholder are well known in the art. A power operated crimping tool of this general type that may be selectively utilized as a portable or bench mounted tool is disclosed in the copending application Serial No. 2,065, filed January 12, 1960, now Patent No. 3,086,574.

This invention may be briefly described as an improved construction for power operated crimping tools of the general type disclosed in my above identified copending application that serves to reduce the number of manipulative operations required to be performed by the operator in the fabrication of crimped electrical assemblies. In its broad aspects the subject invention includes utilization of an internal electrical connector element supply magazine adapted to contain a plurality of electrical connector clips each having a multiplicity of electrical connector elements releasably mounted in predetermined spatial array thereon in association with means for cyclically and sequentially presenting individual clip mounted electrical contact elements at an operating location at which workpiece formation and deformation is effected.

Among the advantages of the herein disclosed invention are a permitted reduction of the number of manual operations required to be performed by the tool operator in the fabrication of crimped electrical assemblies; the provision of an internally contained supply of electrical connector elements in predetermined spatial array; the provision of means for effecting a continuous cyclic presentation of electrical connector elements at an operating location at which workpiece formation and deformation are effected; and a permitted increase in the rate of fabrication of crimped electrical assemblies with a reduction in attendent operator fatigue and unit fabrication costs.

The object of the invention is the provision of an improved construction for power operated crimping tools.

Another object of this invention is the provision of a magazine type clip feed crimping tool.

The above and other objects and advantages of the invention will appear from the following specification and claim and from the appended drawings which illustrate the principles of the invention and a preferred embodiment of a crimping tool construction that is presently contemplated by the inventor to be the best mode for carrying out such principles.

Referring to the drawings:

FIGURE 1 is a front elevational view of a presently preferred construction of a power operated crimping tool incorporating the principles of this invention with one of the cover plates removed from the crimping mechanism housing assembly to show the magazine and clip feed components thereof.

FIGURE 2 is a rear elevational view, partially in section, of the tool illustrated in FIGURE 1;



FIGURE 3 is a sectional view taken on the line 3—3 of FIGURE 1;

FIGURE 4 is an enlarged sectional view of the clip feed components of the subject tool;

FIGURE 5 is an end elevational view of crimping mechanism housing assembly as viewed from the left in FIGURE 1;

FIGURE 6 is a sectional view taken on the line 6—6 of FIGURE 1;

FIGURE 7 is a detailed section of the clip feed components illustrated in FIGURE 4.

As mentioned earlier, the subject invention is in the nature of an improvement over the power operated crimping tool construction illustrated in the copending application Serial No. 2,065, now Patent No. 3,086,574. The herein disclosed construction for the power cylinder mechanism, the crimping die assembly and the full cycling mechanism are essentially the same as that disclosed in the aforesaid copending application. In the interests of brevity such components will be only briefly described and a detailed disclosure and description thereof may be had by suitable reference to the above identified copending application.

Referring to the drawings and initially to FIGURES 1 and 2 thereof, the power operated crimping tool forming the subject matter of the herein disclosed invention generally includes a substantially barrel-shaped power cylinder housing portion 10, an adjacent piston rod containing neck portion 12 of appreciably reduced external diameter and a terminally disposed electrical connector clip magazine and crimping mechanism housing assembly generally designated 14. Disposed within the clip magazine and crimping mechanism housing assembly 14 is a generally disc shaped dieholder or plunger body 16 secured, as by a plurality of bolts 18, to the sidewall cover plate 20 and to the dieholder housing element 21 (see FIGURE 6) that forms an internally disposed portion of the clip receiving magazine and crimping mechanism housing assembly 14. As best shown in FIGURES 2, 3 and 6, the dieholder 16 is provided with a conically shaped terminal wire entry and workpiece removal aperture 24 inwardly terminating in an axially disposed workpiece receiving bore 26 that defines an operating location at which workpiece formation and deformation are effected. As best shown in FIGURES 3 and 6, the rear surface of the dieholder 16 is provided with a radial electrical connector element transmission channel 28 that merges with said bore 26. The adjacent portion of the dieholder housing 21 is provided with a connector element transmission element 23 in alignment therewith. The dieholder 16 is conventionally provided with a plurality of radially disposed die member receiving bores each having a crimping die or plunger member 30 reciprocably therein.

Each crimping die or plunger member 30 is biased radially outwardly by a suitable biasing spring and is provided with an exposed cam surfaced head portion 34.

Surrounding the dieholder 16 and rotatably displaceable relative thereto is an operating member 38. The operating member 38 is provided with a plurality of cam surfaces 36 engaging the outwardly biased cam surfaced head portions 34 of the individual crimping die members 30 and adapted to convergingly displace said die members 30 in response to a clockwise rotative displacement (as viewed in FIGURE 2) of the operating member 38 related to the dieholder 16 and to permit outward displacement of said die members 30 by said springs 32 in response to counterclockwise rotative displacement thereof. As best shown in FIGURE 3, the operating member 38 is provided with an enlarged connector element transmission channel 39 sized to be in alignment with the

channel 28 in the dieholder 16 irrespective of the rotative position of said operating member relative thereto.

The operating member 38 is provided with an extension leg portion 40 sized to have the terminal end thereof disposed out of the plane of the dieholder 16 and within a slot 42 adjacent the exposed end of reciprocable piston rod member 44. The other end of the piston rod 44 is connected to a piston generally designated 46 disposed in a cylinder 48 and normally biased in retracted position by a spring member 50. Secured to the end of the cylinder housing 10 is a valve body 52 having an impelling fluid entry port 54 connected through a valve assembly generally designated 56 to a conduit 58 in fluid communication with the cylinder 48.

The valve assembly 56 is adapted to be operated by displacement of a spring biased valve plunger 60. The plunger 60 is displaceable by a button member 62 mounted on the control lever or valve operator 64 pivotally mounted on the valve body 52 at 66. As shown in FIGURES 1 and 2, the valve operator or control lever 64 is sized to overlie the surface of the barrel shaped cylinder housing 10 and is biased out of abutting engagement therewith by the spring biased plunger 60. The free end of the valve operator 64 is provided with an inwardly bent terminal portion 68 deformed to generally conform to the surface configuration of the housing portions 10 and 12.

As will be apparent to those skilled in the art, rotative displacement of the valve operator 64 about its pivotal mounting 66 will effect advance of the button 62 and inward displacement of the plunger 60. The inward displacement of the plunger 60 will result in actuation of the valve assembly 56 and in admission of the impelling fluid, suitably compressed air, into the cylinder 48 through the bore 58. The admission of the impelling fluid into the cylinder 48 effects displacement of the piston 46 in a direction away from the bore 58 against the action of the biasing spring 50 and in concomitant lineal advance of the piston rod 44. The lineal advance of the piston rod 44 results, due to disposition of the terminal end portion of the operating member 40 in the slot 42, in a concomitant rotative displacement of the operating member 38 and in conventional converging advance of the crimping dies 30 toward the axis of the workpiece receiving bore 26 forming the operating locations.

As is conventional with the basic type of crimping mechanism illustrated, the amount of crimping die advance is directly responsive to and is controlled by the amount of rotative displacement of the operating member 38 relative to the dieholder 16. In the instant embodiment, the amount of rotative displacement of the operating member 38 is, in turn, directly responsive to and is controlled by the amount of lineal advance of the piston rod 44. In order to control the amount of lineal advance of the piston rod 44 and hence to control the amount of crimping die advance there is provided an adjustable piston rod stop assembly generally designated 70, positioned in the path of the lineal advance thereof. In the illustrated construction, the stop assembly 70 may be selectively positioned relative to the path of lineal advance of the piston rod 44 in accordance with the selective dictates of a workpiece and locked in such position to render such setting substantially tamperproof to undesired adjustment as might be effected by the operator or other unauthorized personnel.

In order to prevent possible undercrimping of a workpiece, the subject tool includes a substantially tamperproof full cycling mechanism to assure that once a crimping operation is initiated upon a given workpiece, a full cycle of operation must be completed prior to initiation of operations upon a subsequent workpiece. To this end there is provided a trigger lock member, generally designated 80, pivotally mounted as at 82 and spring biased in the counterclockwise direction, as viewed in FIGURE 2. One end thereof is provided with a flanged ratchet surface 84 engageable by a tang 86 disposed on the end of the control lever 64 and the other end thereof includes an extending arm portion 88. The extending arm portion is positioned to be engageable by a trigger release member 90 pivotally mounted, as at 92, upon the end of the piston rod 44. The trigger release member 90 is provided with an arcuately shaped contact surface 94 sized to engage the piston rod assembly 70 and a dependent flanged trigger lock tripping surface 96 positioned to engage the extending arm portion 88 upon piston rod advance.

In operation of the described unit, a displacement of control lever 64 is sufficient to effect admission of impelling fluid into the cylinder 48 and advance of the piston rod 44, as described above, results in engagement of the tang 86 with the flanged ratchet surface 84 on the trigger lock member 80. The ratchet surface 84 is positioned to permit displacement of the tang 86 relative thereto in the counterclockwise direction, as viewed in FIGURE 2, but to preclude return or clockwise displacement thereof subsequent to initiation of advance thereof. Prior to engagement of the stop assembly 70 by the advancing piston rod 44, the flanged tripping surface 96 of the trigger release 90 will engage the extending arm 88 of the trigger lock 80 and will be rotatively displaced in the clockwise direction thereby with a consequent advance of the contact surface 94 in front of the end of the piston rod. Immediately prior to piston rod contact with the stop assembly 70, however, the advanced contact surface 94 of the trigger release 90 will engage the stop surface and continuing piston rod advance will effect a rapid counterclockwise displacement of the trigger release member 90. The rapid counterclockwise displacement of the trigger release member 90, through the engagement of the tripping surface 96 with the extending arm 88, effects a concomitant clockwise displacement of the trigger lock 80 about its pivotal mounting 82. Such pivotal displacement of the trigger lock 80 and concomitant arcuate displacement of the flanged ratchet 84 results in disengagement of the tang 86 therewith and consequent permitted clockwise displacement of the control lever 64 and return of the spring biased valve plunger member 60 to their rest positions wherein the valve assembly 56 is closed and the spring 50 returns the piston 46 and piston rod 44 to the position illustrated in FIGURE 2. The lineal return displacement of the piston rod 44 effects a counterclockwise rotative displacement of the operating member 38 relative to the dieholder 16 and in permited divergent displacement of the crimping dies 30 out of the operating location as defined by the bore 26 by their individual biasing springs 32. The lineal return displacement of the piston rod 44 also effects a disengagement of the trigger release member 90 from the trigger lock 80 and permits the latter to return it to its latching position for the next operation cycle.

By the above described full cycling mechanism structure it will be seen that irrespective of whether the valve operator 60 is depressed a great or small amount, any displacement thereof sufficient to effect admission of impelling fluid into the cylinder 48 will result in locking engagement of the tang 86 with the ratchet 84. Such engagement effectively precludes any return displacement of the valve operator 60 until the piston rod 44 reaches its limit of lineal advance, i.e., by engagement with the stop assembly 70. Thus the above described structure insures that once a cycle of operation has been initiated, a full cycle of operation must be completed prior to the initiation of a succeeding cycle upon a subsequent workpiece. Such structure effectively precludes an operator from undercrimping a workpiece by momentary actuation of the valve operator 60.

As best shown in FIGURES 1 and 3, the housing 14 includes an internally disposed electrical contact or connector element magazine and an electrical connector clip feed assembly to cyclically present clip mounted elec-

trical connector elements at the operating location as defined by the axial bore 26 of the dieholder 16. The electrical connector element magazine, generally designated 98, is defined by the interior wall 100, the cover plate 22 and a pair of spaced parallel standards 110 and 112, with the latter conveniently being a portion of said housing and integral with said interior wall 100. The standards 110 and 112 are suitably recessed, as at 114, on their facing surfaces to provide a pair of longitudinally disposed channels adapted to position and guide the feeding displacement of electrical connector bearing clip members disposed within said magazine 98. Loading access to said magazine 98 is had by means of a cover member 116 hingedly mounted at the end of standard 112, as at 118, and provided with an externally accessable finger grip 120 for operator displacement thereof. A latching snap spring 122 releasably engageable with a pin 124 is secured thereto to maintain the cover 116 in closed position.

Adapted to be disposed in parallel abutting relationship within the magazine 98 and positioned by the recesses 114 in the standards 110 and 112 are a plurality of elongate clip members 126 each having a plurality of electrical connector members, such as the illustrated terminal pin type members 128, releasably mounted in predetermined spaced relationship therein. As best shown in FIGURES 3, 4 and 6, the clip members 126 are preferably of elongate rectangular block configuration having their end portions disposed within said recesses 114 and provided with a plurality of selectively shaped electrical connector receiving bores 130 disposed in uniform spaced relation therein. The bores 130 are shaped and sized in accordance with the particular configuration of proprietary design of connector elements to be employed and are arranged to releasably contain the intermediate body portion of such elements in such a way as to have the wire receptacle portions 132 thereof uniformly extend from one side of the clip members 126 and the dependent terminal pin portions 134 (or socket portions thereof) uniformly extend from the other side thereof and to permit extraction displacement thereof only from the side of the clip member adjacent the wire receptacle portions 132 of the contact elements.

As best shown in FIGURES 3 and 4, the upper and lower facing surfaces of the clip members 126 are provided with discrete uniformly spaced indexing recesses, generally designated 136, spaced inwardly from the defining edges thereof. Each such indexing recess 136 is shaped to provide an indexing shoulder 138 disposed perpendicular to the direction of clip member advance and a bevelled or sloped guide surface 140 adjacent thereto. The shoulders 138 are uniformly spaced apart a distance equal to the spacing between the longitudinal axes of the bores 130 so as to permit a cyclic controlled displacement thereof by the hereinafter described clip feed assembly. As best illustrated in FIGURE 3, the trailing end 142 of such clip member 126 is made of a slightly different configuration than the leading end thereof which, in conjunction with a selective shaping of the recesses 114 in the magazine standards 110 and 112, will insure loading of the clip members 126 in proper orientation relative to the hereinafter described clip feed assembly.

The clip members 126 are readily and inexpensively molded from a plastic material, suitably polyethylene, and are easily loaded and reloaded with connector elements by auxiliary mechanical means.

The plurality of clip members 126 disposed in the magazine 98 are displaceably biased in the direction indicated by the arrow 140 in FIGURE 1 by a pressure spring 142 having one end thereof secured to the cover member 116, as at rivet 144, and its free end 146 disposed in engagement with the top surface of the upper clip member 126 therein.

The base or exit end of the heretofore described internally disposed clip member magazine 98 is effectively constituted by a reciprocable slide member 148 positioned to receive, support and displace the lowermost clip member 126 contained in said magazine. The upper or clip supporting surface 152 of said slide 148 is provided with marginal flanges 149 sized to externally abut the corners of a clip 126 mounted thereon and with a longitudinal centrally disposed recess 150 positioned to underlie the recesses 136 in the supported clip 126. Positioned within the recess 150 and secured thereto by rivets 151 is a clip feed index member 154 in the form of a thin strip of spring steel. In order to effect continuous feeding of the clip members, the clip feed index member 154 is sized to extend beyond the lead end of the slide 148 and is provided with a plurality of aligned and spaced springlike indexing fingers 156 extending upwardly therefrom and having their terminal ends disposed above the marginally located clip member supporting surfaces 152 of the slide 148 and positioned to operatively engage the recesses 136 in a clip member 126 supported thereby irrespective of the longitudinal positional relationship of said clip member or members relative to said slide.

The clip feed slide member 148 is secured as by the aforementioned rivets 151, to the upwardly disposed base portion of an inverted U-shaped support member 158. The U-shaped support member 158 in turn is slideably supported by a pair of pin members 160 extending from the dieholder housing 21 and riding in displacement limiting guide slots 162 in the dependent side wall portion thereof. Mounted on the trailing end of the slide member 148 is a guide pin 164 sized to extend through an aperture 165 in the standard 112. The pin 164 serves to locate a biasing spring 168 disposed in surrounding relation therewith which serves to normally bias the clip feed slide 148 in the advanced or clip feeding position as indicated by the arrow 170.

As best shown in FIGURE 1, the bottom end of the magazine defining standard 110 is spaced from the upper surface of the slide 148 a distance sufficient to accommodate a clip member 126 therebetween and defines the entry end of a clip member transmission channel 171 through which clip members are cyclically advanced to sequentially present the wire receptacle portions 132 of the contact members at the operating location. Such clip transmission channel is partially defined by a latching member 172 in the form of a thin strip of spring steel having one end secured to the standard 112 and the other end secured to an extending boss 173 on the dieholder housing 21. The latching member is provided with a plurality of springlike latching fingers 174 extending from the surface thereof and adapted to compressively and operationally engage the recesses 136 on the abutting upper surface of a clip member 126 supported by the slide 148. As best shown in FIGURE 6, the clip transmission channel is disposed in alignment with the connector element transmission channel 28 in the dieholder 16 and with the auxiliary channel 23 in the dieholder housing member 21 to permit an unimpeded longitudinal advance of the extending wire receptacle portions 132 of the clip mounted connector elements into the operating location.

As indicated earlier, the clip feed slide 148 is biased in the clip advancing direction as indicated by the arrow 170 by the spring 168. Retractive displacement of the clip feed slide 148 in the direction opposite to that indicated by the arrow 170 is effected by the abutting engagement of a slide drive pin 176 which extends through an arcuate slot 178 in the dieholder housing wall 21 with the leading end of the slide support member 158. The slide drive pin 176, conveniently in the form of a bolt, is connected to the operating member 38 and is adapted to be arcuately displaced in response to rotative displacement of said operating member 38 relative to the dieholder 16. Such arcuate displacement of the slide drive pin 176 within the slot 178 results in a retractive lineal displacement of the slide support 158, the slide 148 and the clip feed index member 154 mounted thereon. During such retractive

displacement of the clip feed index member 154 concomitant displacement of the clip member 126 supported by the slide 148 is prevented by the engagement of the latching fingers 174 with the shoulders 138 of the recesses 136 disposed on the upper surface of the clip member. As a consequence, such retraction is effected relative to the slide supported clip member 126 and serves to remove the indexing finger 156 from operative engagement with one set of shoulders 138 of the recesses 136 on the underside of the slide supported clip and to place them into operative driving engagement with the next rearwardly adjacent set of shoulders 138 for subsequent slide advance by the biasing spring 168.

Operation of the subject tool requires preloading of the magazine 98 with a plurality of electric connector bearing clip members 126. When so loaded, closure of the cover member 116 biases the clip members 126 in the direction indicated by the arrow 140 and assures disposition of the undersurface of the lead clip member 126 in engagement with the clip supporting surface 152 of the slide member 148. In order to prepare the tool for operation, however, the lead electrical contact element mounted in the slide supported clip 126 must be advanced into the operating location as defined by the bore 26 of the dieholder 16. Such advance may be effected by repeated manipulation of the control lever 64. Each such manipulation will effect an advance and retraction of the piston rod 44 and a concomitant rotative displacement of the operating member 38 relative to the dieholder 16. Upon each rotative displacement of the operating member 38 in the direction effecting crimping die advance, the slide drive pin 176 will be displaced through a predetermined arc and will cause the slide support 158 and slide 148 to be retractively displaced, against the action of the biasing spring 168 an amount sufficient to move the rearmost indexing finger 156 from operative engagement with one of the shoulders 138 on the underside of the slide supported clip 126 into operative engagement with the next rearwardly adjacent shoulders 138. Upon the return rotative displacement of the operating member 38, the concomitant return displacement of the slide drive pin 176 permits the biasing spring 168 to advance the slide 148 a predetermined amount. Upon slide advance the engagement of the aforesaid indexing finger 156 with the shoulder 138 effects an equal degree of advance of the slide supported clip member 126. Repetition of such operation effects a cyclic lineal advance of the slide supported clip member 126 into the clip transmission channel 171 and a concomitant displacement of the extending wire receptacle portion 132 of the lead electrical connector element 128 mounted thereon through the transmission channels 28, 23 and 39 in the dieholder 16, dieholder housing 21 and operating member 38, respectively, and into the bore 28 of the dieholder 16 defining the operating location.

With the lead connector element so positioned, the wire receptacle portion 132 is disposed in the path of advance of the crimping dies 30 and in proper location for workpiece formation. Workpiece formation is readily effected by mere introduction of the insulation stripped end of a terminal wire lead into the conical entry aperture 24 of the dieholder and into said wire receptacle portion 132 of the connector element disposed in the bore 26. Subsequent to such workpiece formation, manipulation of the control lever 64 results in an advance of the pston rod 44, rotative displacement of the operating member 38 relative to said dieholder 16 and a concomitant converging advance of the crimping dies 30 and to effect deformation of the workpiece at the operating location.

The rotative displacement of the operating member 38 necessary to effect crimping die advance, also results in an arcuate displacement of the slide drive pin 176 to effect a retractive displacement of the clip feed slide 148 against the action of the biasing spring 168. During such retractive displacement of the slide 148, retraction of the slide supported clip 126 is prevented by the latching engagement of the latching fingers 174 with the shoulders 138 on the upper surfaces thereof. Such displacement of the slide 148 relative to the slide supported clip member 126 results in a shift of the indexing fingers 156 out of engagement with one set of shoulders 138 on the underside of the slide supported clip 126 and into operative engagement with the shoulders 138 next rearwardly adjacent thereto. The return rotative displacement of the operating member 38, in response to retraction of the piston rod 44, results in a return displacement of the slide drive pin 176 in conjunction with the permitted divergent displacement of the crimping dies 30 by the biasing springs 32 to their retracted position. Removal of the now deformed workpiece from the operating location through the conical entry aperture 24 clears the bore 26 and permits the biasing spring 168 to advance the slide 148 and slide supported clip member 126 and to thereby introduce the next succeeding clip mounted electrical connector element 128 into the operating location. Advance of the slide supporting clip member 126 continues as above described. When the trailing end of such clip 126 is advanced past the standard 110, the presence of the magazine biasing spring 142 causes the next succeeding clip member 126 in the magazine 98 to be displaced into engagement with the slide 148 to assure an unbroken continuity of operation up to the connector element capacity of said magazine. Preferably, such magazine is reloaded with new clip members prior to its complete emptying in order to avoid the priming operation described above.

Having thus described our invention, we claim:

In a crimping tool, the combination comprising:

(*a*) a dieholder having an axially disposed bore defining an operating location and a radially disposed transmission channel communicating therewith;

(*b*) a plurality of dies mounted in said dieholder;

(*c*) an operating member disposed in encircling engagement with said dieholder and rotatably displaceable relative thereto for effecting advance of crimping die members into said operating location;

(*d*) a magazine sized to contain a plurality of stacked electrical connector supporting clip members intermediate a loading and delivery end thereof;

(*e*) a slide member disposed adjacent said delivery end of said magazine and adapted to reciprocate intermediate an advanced and a retracted position along a path parallel to said channel in said dieholder;

(*f*) means mounted on said slide member for engaging the lowermost clip member for effecting advance thereof in response to advance of said slide member;

(*g*) means normally biasing said slide member in the advanced position;

(*h*) means responsive to rotative displacement of said operating member for displacing said slide member and clip engaging means from its advanced position to its retracted position so that when a crimped contact is removed from the workpiece receiving location, said biasing means will advance said clip member so that another contact will be positioned in said workpiece receiving location; and

(*i*) means for forcing another clip member into engagement with said clip engaging means when said first clip member is spent.

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