Feb. 16, 1971 R. R. LAU ET AL 3,562,904

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 1

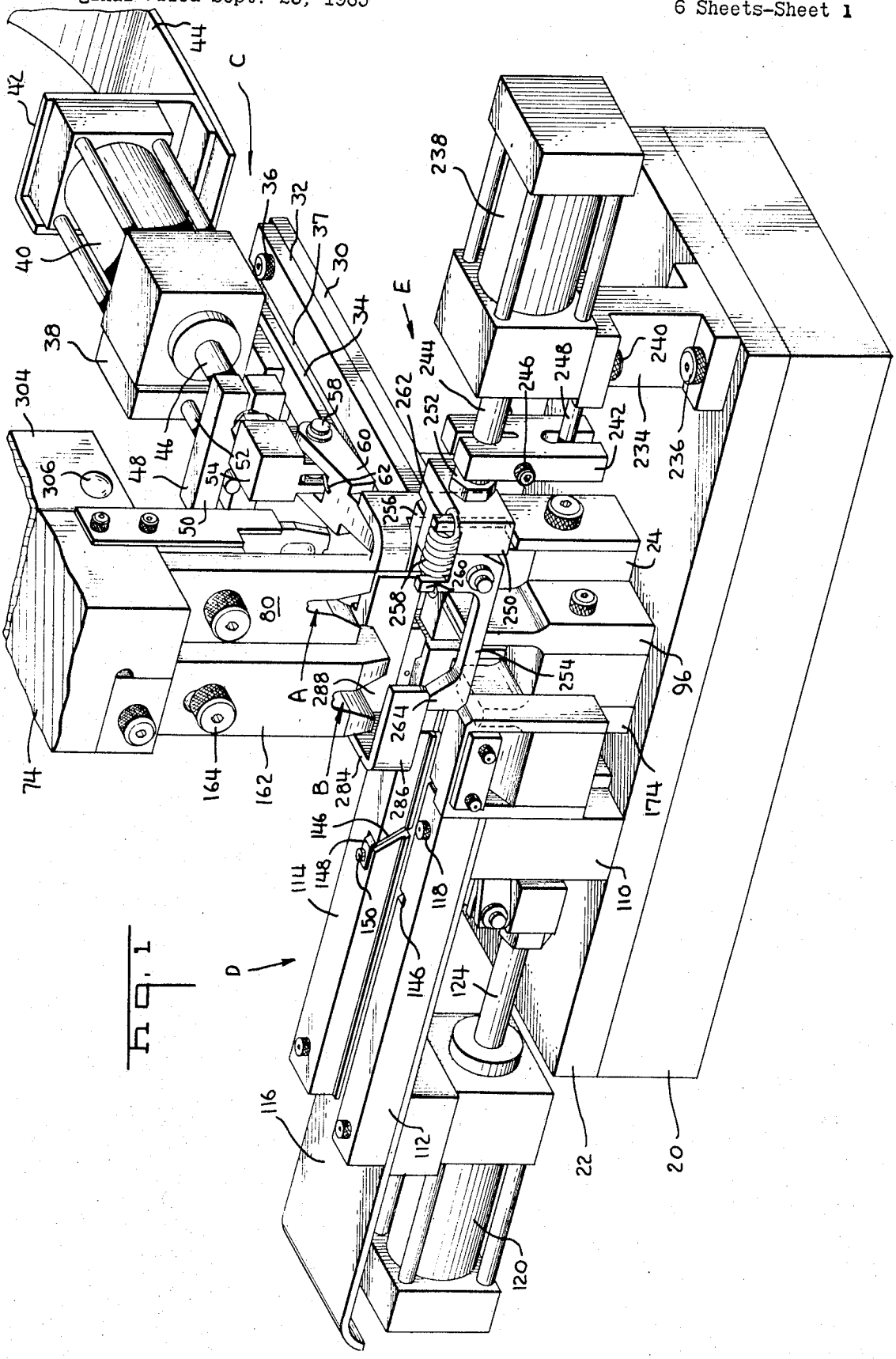
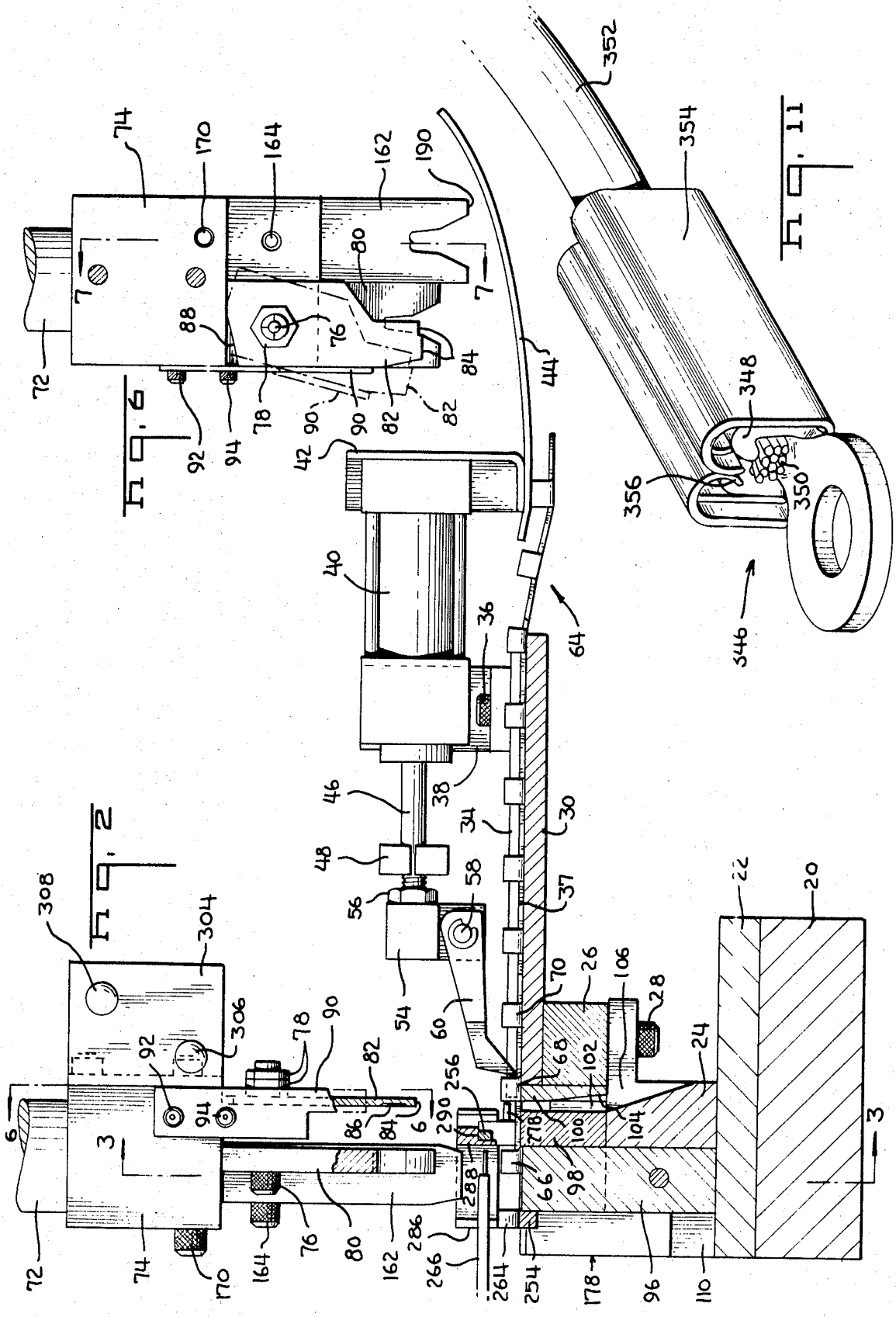


Fig. 1

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 2



METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 5

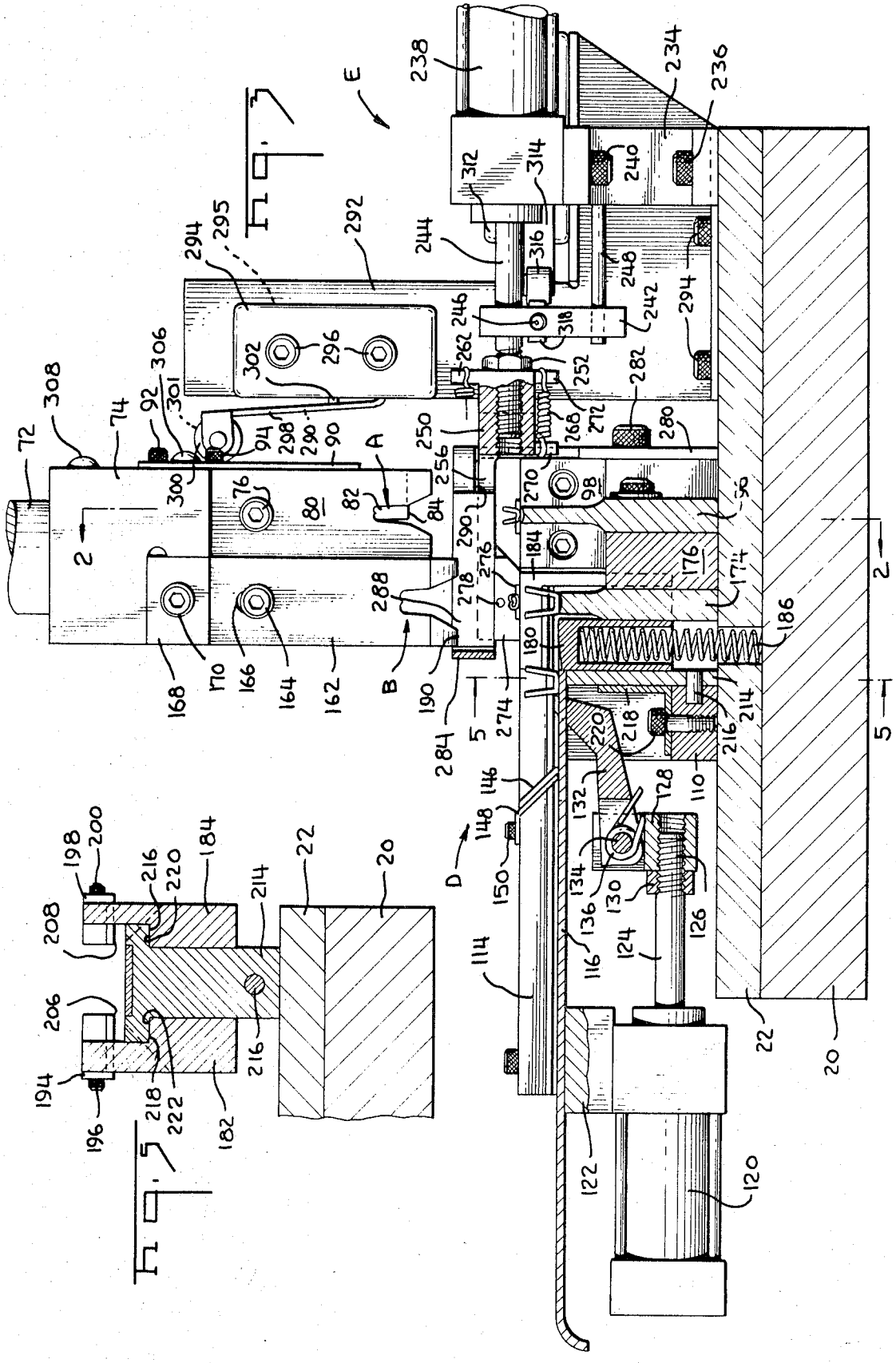


FIG. 5

Feb. 16, 1971 R. R. LAU ET AL 3,562,904

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 4

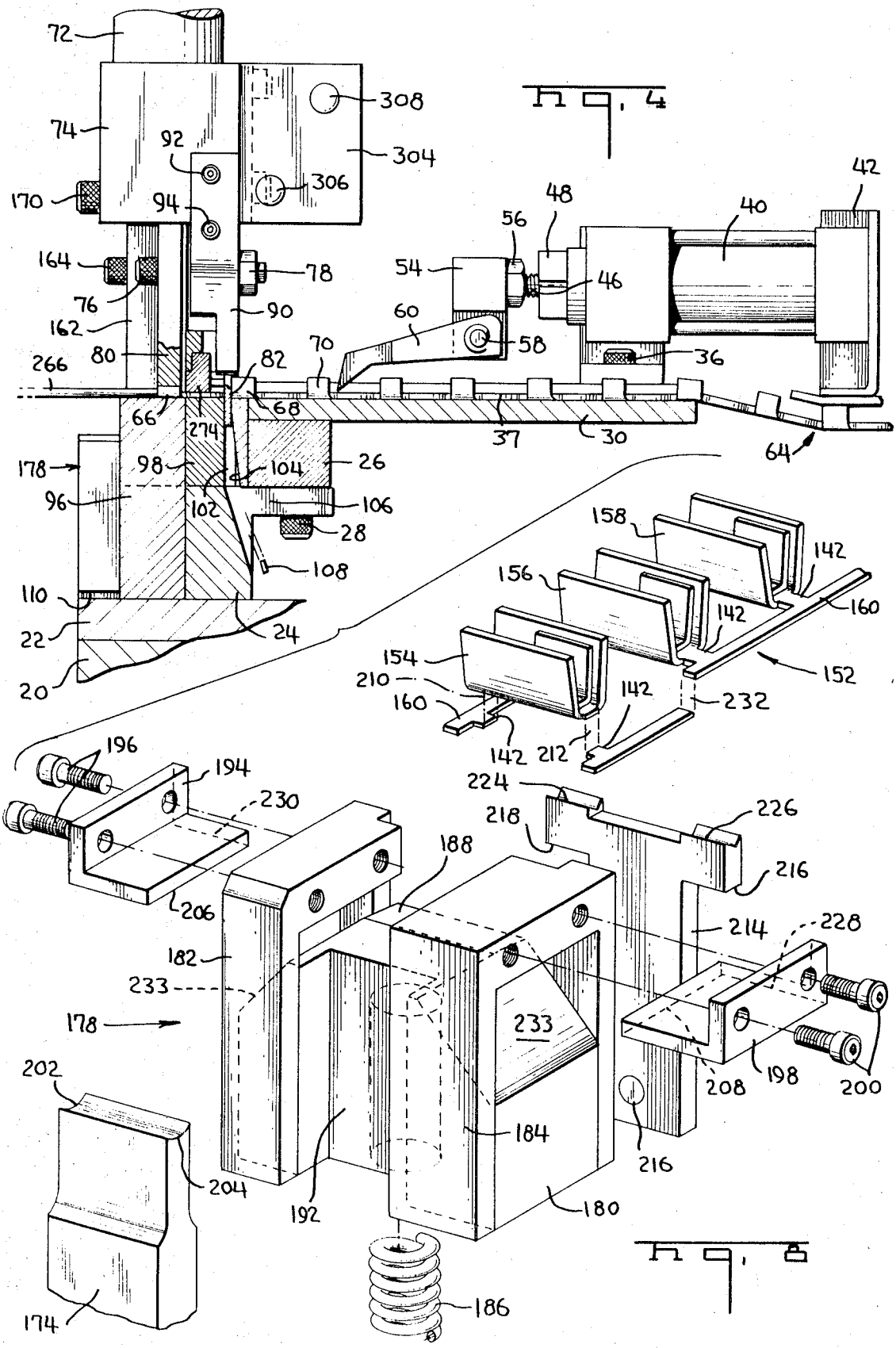


Fig. 4

Fig. 8

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 5

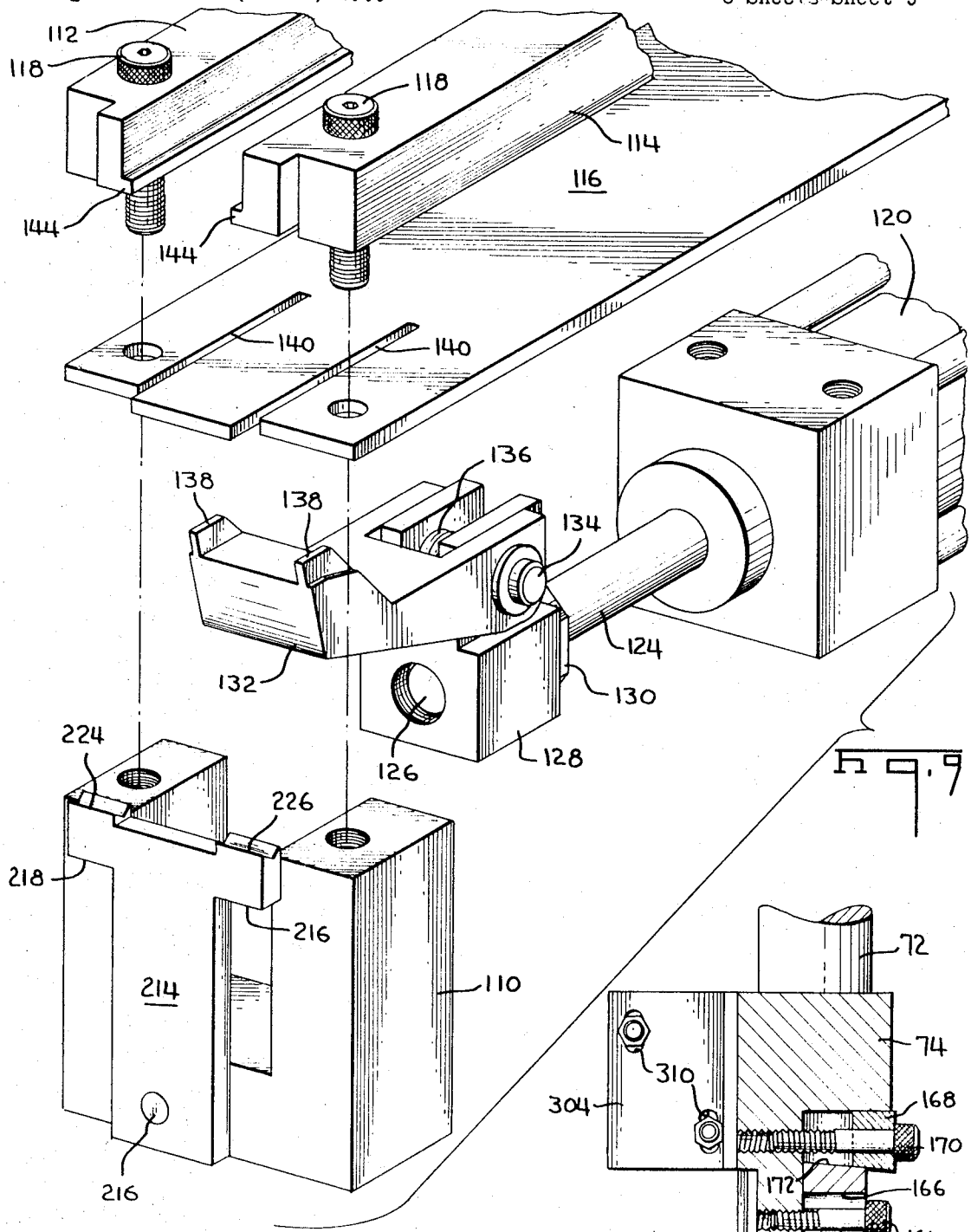


Fig. 9

Fig. 7

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Original Filed Sept. 23, 1965 6 Sheets-Sheet 6

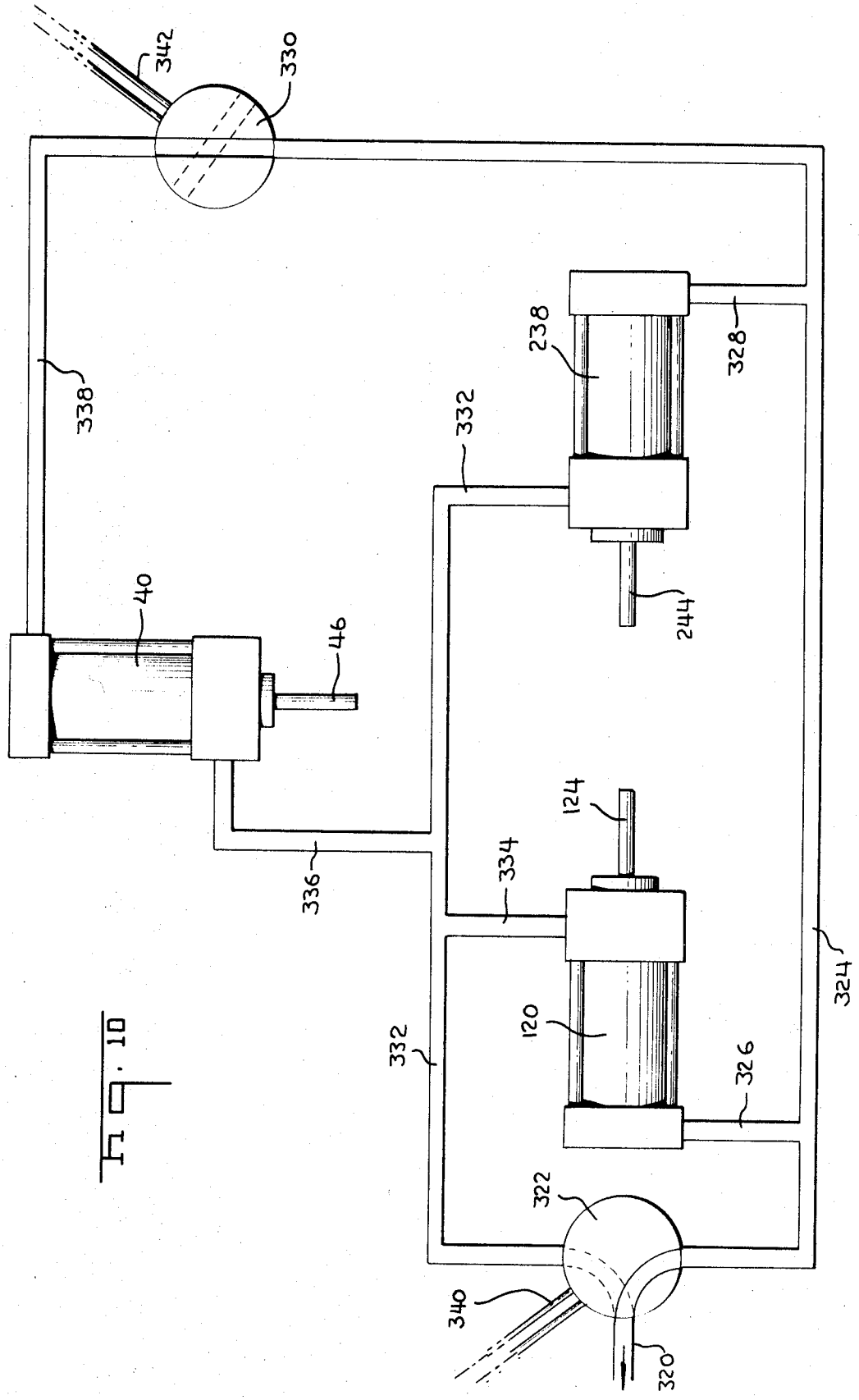


FIG. 10

United States Patent Office 3,562,904 Patented Feb. 16, 1971

3,562,904

METHOD FOR FORMING AN INSULATED ELECTRICAL CONNECTION

Ralph Rupp Lau, Harrisburg, Pa., and Gilbert Carl Sitz, Richardson, Tex., assignors to AMP Incorporated, Harrisburg, Pa.

Original application Sept. 23, 1965, Ser. No. 489,558, now Patent No. 3,386,153. Divided and this application Feb. 8, 1968, Ser. No. 704,048

Int. Cl. H01r 43/00

U.S. Cl. 29—628 2 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus is provided for forming an insulated electrical connection. An electrical terminal having an open U-shaped ferrule-forming portion is fed to a first crimping station. The stripped end of an insulated electrical conductor is inserted into the ferrule-forming portion and the terminal is crimped to the conductor. An open U-shaped insulating member is fed to a second crimping station. The terminal and conductor previously joined are transferred to the second crimping station in overlying relationship with the insulating member. The insulating member is then crimped around the terminal and conductor.

This application is a division of our prior copending application Ser. No. 489,558, filed Sept. 23, 1965 now U.S. Pat. No. 3,386,153.

In the electrical connection field there have been numerous attempts to pre-insulate an electrical terminal wherein both the terminal ferrule and the insulating member are of open U-shaped configuration. Most such attempts, prior to this invention, have been unsuccessful for various reasons, some of which will become apparent as this discussion proceeds.

At present, when it is desired to pre-insulate a terminal having an open U-shaped ferrule-forming portion, it is the practice to take such a terminal and secure thereto a strip of insulating material. The terminal, with the insulating material thus secured, is then placed between the jaws of a crimping tool. An electrical conductor is then inserted into the space formed by the open U, and the jaws of the crimping tool are then closed so as to accomplish in one operation the crimping of both the terminal and the insulating member to the electrical conductor. The force exerted by the crimping tool is carried through the insulating member to the terminal, this being necessary because the terminal does not come into direct contact with the crimping tool. Examples of this type of operation are disclosed in U.S. Pats. No. 2,786,191, granted to W. F. Broske, No. 2,845,606, granted to G. A. Fuller, and No. 3,048,650, granted to J. W. Allen et al.

The present invention provides several distinct advantages over the prior art above referred to. In the prior art devices the pressure applied during the crimping operation must be held within close limits. The pressure must be great enough to accomplish an effective crimp of the ferrule to the conductor but at the same time the pressure must be held below that point which would cause rupturing of the relatively fragile insulating material. This problem is avoided by the present invention wherein the crimping of the insulating member is accomplished in a separate operation from the crimping of the ferrule, thereby permitting relatively high pressure during the ferrule crimping operation and relatively low pressure during the insulating member crimping operation. Further, as will become apparent, the two stage operation of the present invention is accomplished with

no loss of time as compared with the single stage operation of the prior known devices.

In the single stage operation there is a limited number of materials which can be used for the insulating material because such material must be capable of withstanding high crimping pressure without rupturing and the material must be capable of transmitting the forces from the crimping tool to the ferrule. In the present invention these properties need not be possessed by the insulating material, the only essential requirement being that the material is an electrical insulator.

Another drawback of the known devices is that the terminals must be specially constructed and adapted to receive the insulating member. In contrast the present invention is designed for use with standard presently available terminals.

Also, the prior known devices require a step of securing the insulating material to the terminal prior to the crimping operation. This step is not necessary in practicing the present invention.

It is therefore an object of the present invention to provide a method an apparatus for forming an insulated electrical connection while avoiding the drawbacks of the known devices above referred to.

Another object is to provide for the pre-insulating of standard terminals.

A further object is to provide a method and apparatus for forming an insulated electrical connection utilizing high crimping pressure on the terminal ferrule and low crimping pressure on the insulating member.

A still further object is to provide a machine and method for performing two diverse crimping operations in the same time as now required for a single crimping operation.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purpose of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, in which like reference numerals refer to like parts:

FIG. 1 is a perspective view of the apparatus forming a preferred embodiment of the invention;

FIG. 2 is a side elevation, partly in section and taken along line 2—2 of FIG. 3;

FIG. 3 is a front elevation, partly in section and taken along line 3—3 of FIG. 2;

FIG. 4 is a view similar to FIG. 2 but showing the ram in its lowered position;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary view showing the crimping heads and movable shear blades as seen when looking along line 6—6 of FIG. 2 in the direction of the arrows;

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 6 and showing the adjustment means for one of the crimping heads;

FIG. 8 is an exploded perspective view of the movable shear assembly;

FIG. 9 is an exploded perspective view of the insulation strip feed assembly;

FIG. 10 is a fluid flow diagram showing schematically the power system of the invention; and

FIG. 11 is a perspective view showing the completed electrical connection made in accordance with the teachings of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 the apparatus comprises a first crimping and shearing station A, a second crimping and shearing station B, a terminal feed assembly C, an insulation feed assembly D, and a transfer assembly E. Briefly stated, the operation is such that a strip of electrical terminals is fed by assembly C to station A. An electrical conductor is positioned at station A above the terminal at the lead end of the strip. The parts are then crimped and the terminal is severed from its strip. A strip of insulating members is fed by assembly D to station B. Assembly E transfers the crimped terminal and conductor from station A to station B in a position above the insulating member at the lead end of the strip. The insulating member is then severed from its strip and crimped to the terminal and conductor thus forming a completed insulated electrical connection.

The various parts and operation of the device will now be described in detail.

The terminal feed assembly C is best illustrated in FIGS. 1, 2 and 4. To the frame **20** of the machine is secured a mounting plate **22**. An L-shaped bracket **24** is secured to plate **22** and carries thereon a spacing block **26** secured to bracket **24** by means of a screw **28**. Secured to block **26**, by means of set screws (not shown) is a plate **30** along the upper surface of which the strip of terminals will slide. A pair of guide members **32** and **34** are secured to plate **30** by means of four screws **36**, only two of which are shown. These guide members, together with plate **30**, form a channel **37** to define the path of movement of the terminal strip. Secured to guide member **34** by means of one of the screws **36** is a bracket **38** for suspending the upper portion of the feed assembly. A double-acting fluid cylinder **40** is secured to bracket **38** and carries at its rear portion a bracket **42** to which is secured the terminal strip guide **44**. The guide **44** functions to lead the strip into channel **37** from a supply source (not shown). The cylinder **40** has a piston member **46** which adjustably carries a stop member **48** for limiting the retracting motion of the piston. The stop **48** has a bifurcated end **50** which slides along a rod member **52** secured to a bracket **38**. The rod **52** serves to prevent any rotative movement of piston **46**. A forked member **54** is adjustably secured to piston **46** and is held in adjusted position by a nut **56**. The forked ends of member **54** receive a pin **58** which pivotally supports a feed finger **60**. The finger **60** is biased into engagement with the upper surface of guide members **32** and **34** by means of a spring **62** wrapped around pin **58**. A strip of terminals **64**, made up of individual terminals **66**, **68**, **70** is positioned in channel **37** and is fed therealong by engagement of the feed finger **60** with the upstanding barrel portion of the terminal, as best seen in FIG. 2. FIG. 2 shows finger **60** at the forward end of its stroke after having advanced terminal **66** into position at station A. FIG. 4 shows finger **60** at the rearward end of its stroke moving into position behind the barrel of terminal **70** to thereby move terminal **68** into position at station A upon the next forward stroke of finger **60**.

At the forward end of feed assembly C is the crimping and cutting station A which will now be described with particular reference to FIGS. 1, 2 and 3. A ram **72**, driven by suitable means, not shown, has at its end a mounting block **74** formed integrally with said ram. Secured to block **74** by means of a bolt **76** and lock nuts **78** is a first crimping head **80**. Also held in place by bolt **76** and nuts **78** is a shear blade **82**. The blade **82** has a lower cutting surface **84** and a recessed portion **86**. The upper

surface of blade **82** is relieved at **88** (see FIG. 6) to permit limited pivotal movement of the blade about bolt **76**. The blade is normally biased into a vertical position by means of a leaf spring **90** secured to block **74** by set screws **92** and **94**. Secured to plate **22** is a first crimping die **96** for cooperation with crimping head **80**. Adjacent to die **96** is a fixed shear member **98**. A second fixed shear member **100** is spaced from member **98** by a pair of spacers **102**, one of which is shown, and as shown in FIG. 4 the shear blade **82** moves between members **98** and **100** to sever the leading terminal from the strip. The shear face of member **100** is recessed at its lower end as indicated at **104** to provide clearance of the material severed from the terminal strip. Also the bracket **24** has a central groove **106** permitting the discharge of the severed material **108**, see FIG. 4.

The insulating member feed assembly D will now be described with reference to FIGS. 3, 8 and 9. A U-shaped block **110** is secured to plate **22**. A pair of gibs **112** and **114** are positioned in parallel relationship on the upper surface of a guide plate **116**. The gibs **112**, and **114**, the plate **116**, and the block **110** are secured together by a pair of set screws **118**. A double-acting fluid cylinder **120** is secured to plate **116** by a mounting block **122**. The piston **124** of cylinder **120** is provided with a threaded portion **126** to adjustably hold a fork member **128**. A nut **130** secures member **128** in adjusted position. A feed finger **132** is pivotally secured to member **128** by pin **134**. Encircling pin **134** is a spring **136** which biases finger **132** counterclockwise as seen in FIG. 3. Finger **132** is provided at its end with a pair of lugs **138** which ride in slots **140** in plate **116**. The lugs **138** will engage cross pieces **142** on the insulation strip to feed the insulating members to station B. Flanges **144** on gibs **112** and **114** overlie the slots **140** to maintain pieces **142** in engagement with lugs **138**. The gibs **112** and **114** are further provided with diagonal slots **146** within which are located spring strips **148** secured to the gibs by screws **150**. The strips **148** prevent retrograde movement of the insulation strip upon retraction of feed finger **132**. A typical insulation strip is shown in FIG. 8 and indicated generally at **152**. The strip **152** is of ladder configuration and consists of U-shaped insulating members **154**, **156**, **158** secured by the cross pieces **142** to carrier strips **160**. If the material of which the insulating members are made is sufficiently rigid only one carrier strip need be used. In such case only one of the lugs **138** of feed finger **132** will be used.

Suitable insulating materials are disclosed in the following U.S. Pats.: 2,715,716; 2,786,191; 2,806,214; 2,807,792 and 2,974,400.

Crimping and severing station B is best shown in FIGS. 1, 3 and 8. A second crimping head **162** is secured to block **74** adjacent to the first crimping head **80**. The head **162** performs the crimp on the insulating member. Since the material of the insulating members may vary, different crimping pressures are sometimes desired. The crimping pressure is controlled by the spacing between the movable crimping head and the fixed crimping die. To allow for varying the spacing of the crimping tools, head **162** is secured to block **74** by a screw **164** extending through an elongated slot **166** in head **162** (see FIG. 7). A wedge **168** is movable in block **74** by a screw **170** and contacts the tapered upper surface **172** of crimping head **162**. Movement of wedge **168** will cause the rising or lowering of head **162**. A second fixed crimping die **174** is secured to plate **22** and cooperates with crimping head **162**. A spacer member **176** separates the crimping dies **174** and **96**. Adjacent to die **174** is the movable shear assembly **178**, best shown in FIGS. 3, 5 and 8. The assembly comprises a central support **180** having end portions **182** and **184** secured thereto. The assembly is mounted for vertical reciprocating movement and is biased upwardly by a spring **186**. The upper surface **188** of support **180** constitutes an impact surface and lies beneath one end **190** of crimping

head 162. Upon descent of head 162 the end 190 will contact surface 188 and drive the shear assembly downward. The crimping die 174 is received in a channel 192 formed in the support 180. A shear member 194 is secured to end portion 182 by screws 196 and a shear member 198 is secured to end portion 184 by screws 200. The crimping die 174 has shear faces 202 and 204 at opposite ends of its upper surface. Shear member 194 has a shear face 206 and shear member 198 has a shear face 208. Upon descent of shear assembly 178 the shear faces 202 and 206 cooperate to cut the insulating strip along line 210 and shear faces 204 and 208 cooperate to cut the insulating strip along line 212. Located on the opposite side of shear assembly 178 from crimping die 174 is a shear member 214 secured to block 110 by a pin 216. An L-shaped spring plate 218 (see FIG. 3), secured to block 110 by screw 220, urges the shear member 214 into engagement with the shear assembly 178 and also serves to prevent any rocking movement of the assembly 178. The shear member 214 has lower surfaces 216 and 218 which cooperate with surfaces 220 and 222 on end portions 184 and 182 respectively to limit the upward movement of assembly 178. A pair of shear faces 224 and 226 are formed in the upper surface of shear member 214. Shear member 198 has a second shear face 228 and shear member 194 has a second shear face 230. When the shear assembly 178 is moved downwardly, shear faces 226 and 228 cooperate to sever one of the carrier strips 160 along line 232 and shear faces 218 and 230 cooperate to sever the other carrier strip 160. Support 180 is provided with bevelled surfaces 233 to provide a passageway for the discharge of the severed portions of the carrier strips.

The transfer assembly E is best shown in FIGS. 1 and 3. A support 234 is secured to plate 22 by screws 236 and a double-action fluid cylinder 238 is secured to support 234 by mounting screws 240. An adjustable stop member 242 is secured to the piston 244 of cylinder 238 by a set screw 246. The stop 242 limits the rearward movement of piston 244 and has a bifurcated end to receive a rod 248 secured to support 234. The rod 248 serves to prevent any rotative movement of piston 244. A mounting block 250 is threadably secured to position 244 and held in adjusted position by nut 252. The block 250 pivotally carries a pair of arms 254 and 256. The arm 254 is biased in a clockwise direction, as viewed in FIG. 1, by a spring 258 fastened at its ends to an ear 260 on arm 254 and an ear 262 on block 250. Arm 254 has an upstanding end portion 264 which serves to transfer a conductor 266 (see FIG. 2) from station A to station B. The other arm 256 is biased counter-clockwise, as viewed in FIG. 3, by a spring 268 fastened at its ends to an ear 270 on arm 256 and an ear 272 on block 250. The arm 256 has an end portion 274 having a groove 276 adapted to fit over the tongue portion of a terminal and transfer the terminal from station A to station B. A pin 278 (see also FIG. 2) extends laterally from the arm 256 into the plane occupied by the shear blade 82. Upon retraction of arm 256 the pin 278 will contact blade 82 and pivot the blade out of cutting position into the dotted line position shown in FIG. 6, for a purpose to be described later. A bracket 280 is secured to bracket 24 by screw 282 and has an upper U-shaped portion 284. One leg 286 of portion 284 serves as a stripper for the conductor 266 upon raising the ram 72. The other leg 288 serves the dual purpose of stripping the terminal from crimping head 162 and also of forming a guideway 290 for the arm 256.

FIG. 3 shows the microswitches for controlling the operation of the device. A bracket 292 is secured to plate 22 by screws 294. A pair of microswitches 294 and 295 are secured to bracket 292 by screws 296 and have spring arms 298 and 299, the latter being hidden in FIG. 3, carrying rollers 300 and 301. The arms 298 and 299 depress switches 302 for controlling the fluid flow to the various cylinders in a manner to be described. A bracket 304 is secured to block 74 and carries switch contacting cams 306 and 308. The cams 306 and 308 are adjustable in elongated slots 310 in bracket 304 (see FIG. 7) to vary the timing of the machine. A third microswitch 312 is secured to bracket 292 and carries a spring arm 314 and a roller 316. A switch contacting cam 318 is carried on stop member 242 of transfer assembly E. Upon reciprocation of the transfer cylinder piston 244 the cam 318 will contact roller 316 and actuate microswitch 312 to control the flow of fluid into cylinder 40 in a manner to be now described.

FIG. 10 shows schematically the fluid flow to the various cylinders in the device. Fluid enters the system via a conduit 320 from a fluid source (not shown) and enters solenoid controlled valve 322. The valve 322 is movable between a first position shown in full lines and a second position shown in dotted lines. When valve 322 is in its first position the fluid will flow from conduit 320 into branch 324, which branch communicates with the rear of cylinder 120 by means of artery 326 and with the rear of cylinder 238 by means of artery 328. Branch 324 terminates in a second solenoid controlled normally closed valve 330. When valve 322 is in its second position the fluid will flow from conduit 320 into branch 332, which branch communicates with the front of cylinder 120 by means of artery 334, with the front of cylinder 40 by means of artery 336, and with the front of cylinder 238 by means of branch 332. The valve 330 is movable between a first position shown in full lines and a second normally closed position shown in dotted lines. When valve 330 is in its first position, there is communication between branch 324 and artery 338 whereby fluid is introduced into the rear of cylinder 40, whereas when valve 330 is in its second position the fluid in branch 324 is blocked and cannot enter cylinder 40. Valve 322 is controlled by microswitches 294 and 295 through suitable wiring 340 while valve 330 is controlled by microswitch 312 through suitable wiring 342.

The sequence of operation of the above fluid system will now be described. Starting with the ram in the down position, the valves 322 and 330 will be in their dotted line position so that fluid will be in communication with the front of cylinders 120, 40 and 238 causing their respective pistons 124, 46 and 244 to be in their retracted position. As the ram ascends and nears its upper limit the cam 306 will contact roller 300 of microswitch 294 causing valve 322 to shift to its full line position thereby affording communication between conduit 320 and branch 324. Fluid in branch 324 will enter arteries 326 and 328 causing pistons 124 and 244 to move to their extended position. As piston 244 moves to its extended position the cam 318 fixed to said piston will contact roller 316 of microswitch 312 causing valve 330 to momentarily shift to its full line position. This will cause fluid flow into the rear of cylinder 40 and thereby cause the piston 46 to move to its extended position. The valve 330 will then immediately return to its normally closed position. Upon the next descent of the ram 72, and near the lower limit of its stroke, the cam 308 will contact the roller 310 of microswitch 295 causing valve 322 to shift back to its dotted line position whereby fluid will flow through branch 332 causing fluid to enter the front of cylinders 120, 40 and 238 whereby their respective pistons will again be retracted.

FIG. 11 shows the completed product made by the method and apparatus of the present invention. A terminal 346 has its ferrule portion 348 crimped to the bare wire 350 of a stripped electrical conductor 352. An insulating member 354 has its ends 356 crimped around the ferrule 348 and conductor 352 to produce an insulated electrical connection.

The overall operation of the device will now be described. A strip of terminals is placed in feed assembly C with terminal 66 in crimping position at station A. A strip of insulating members is placed in feed assembly D with the member at the lead end of the strip positioned to the

left of station B as viewed in FIG. 1. The ram **72** starts in the up position so assemblies C, D and E are all in their extended position. The conductor **266** is placed in position at station A in the region bounded by the ferrule of terminal **66** and the crimping head **80**. The operator then starts the machine, by depressing a foot pedal or the like, and the ram begins its descent. As the ram descends the crimping head **80** loosely engages the terminal **66**, and the shear member **82** severs terminal **66** from the remainder of the strip. As the ram **72** continues to descend cam **308** contacts roller **301** causing microswitch **295** to swing the valve **322** into the dotted line position of FIG. 10. This causes assemblies C, D and E to move to their retracted position. During retraction the feed finger **60** will ride over the terminals on the strip, the arm **256** will ride over and onto terminal **66**, and arm **254** will swing downwardly under conductor **266**. The head **80** then crimps the terminal **66** to conductor **266**. During a crimping operation there is a certain amount of extrusion which takes place as a result of the compressing of the material. Therefore, terminal **66** will elongate during crimping and provision must be made to allow for this elongation. It is for this purpose that shear blade **82** has a recessed portion **86** to partially compensate for this extruding effect. Also, the pin **278** on arm **256** will contact the shear blade **82** during the retraction of arm **256** and swing the blade out of cutting position to provide ample clearance for the elongation of the terminal and for the latter's subsequent transfer. The ram next ascends causing cam **306** to contact roller **300** causing microswitch **294** to shift to its full line position of FIG. 10 thus causing assembly D to feed an insulating member into position at station B and assembly E to transfer the crimped terminal and conductor into position at station B above the insulating member. When the arm **256** is approximately midway between stations A and B the end portion **274** will have moved away from station A where it would have blocked the feed in of another terminal. At this point the cam **318** will contact roller **316** causing microswitch **312** to momentarily swing valve **330** into its full line position of FIG. 10 thus causing assembly C to feed terminal **68** into position at station A. When the operator again depresses the foot pedal or the like the ram **72** will descend causing blade **82** to sever terminal **68** from the terminal strip and causing crimping head **80** to crimp terminal **68** to a second conductor which has been positioned at station A. In this embodiment the conductors are positioned by hand although obviously there could be suitable mechanism for performing this function. At the same time that terminal **68** is being crimped the crimping head **162** is crimping the insulating member to terminal **66** and the shear assembly **178** is severing the insulating member from its strip. The cycle is then repeated. It can be seen, therefore, that on each descent of the ram **72** two complete operations are performed whereby an insulating member is crimped to the terminal which was crimped on the preceding stroke of the ram. Thus there is no loss of time over a single stage operation wherein both the terminal and insulating member would be crimped together. Also, by adjustment of head **162** relative to head **80** it is possible to independently vary the crimping pressure of the insulation member relative to that of the terminal.

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.

What is claimed is:

1. A method of forming an insulated electrical connection wherein an electrical terminal having an open U-shaped ferrule-forming portion is secured to the stripped end of an insulated electrical conductor and wherein an open U-shaped insulating member is secured to the outer surfaces of said terminal and conductor, comprising the steps of feeding said terminal to a first crimping station, inserting the stripped end of said conductor into said ferrule-forming portion of said terminal, crimping said terminal to said conductor, feeding said insulating member to a second crimping station, transferring said terminal and conductor to said second crimping station in overlying relationship with said insulating member and crimping said insulating member about said terminal and conductor.

2. A method of forming an insulated electrical connection wherein an electrical terminal having an open U-shaped ferrule-forming portion is secured at a first station to the end of an insulated electrical conductor and wherein an open U-shaped insulating member is secured at a second station to the outer surfaces of said terminal and conductor, comprising the steps of feeding a first strip of said terminals along a first path whereby the terminal at the lead end of said first strip is positioned at said first station, positioning an end of said conductor in the region of the ferrule-forming portion of said lead-end terminal, severing said lead-end terminal from said first strip, crimping said terminal to said conductor to form an electrical and mechanical connection therewith, feeding a second strip of said insulating members along a second path to thereby position the member at the lead end of said strip at said second station, transferring said connected terminal and conductor to said second station along a third path to thereby position said terminal and conductor in the region above the bend in said U-shaped insulating member, severing said lead-end insulating member from said second strip, and crimping said insulating member to said terminal and conductor.

References Cited

UNITED STATES PATENTS

3,009,197	11/1961	Hahn	29—630
3,164,861	1/1965	Munroe et al.	18—5
3,283,398	11/1966	Andrew	29—203
3,436,006	4/1969	Cole	264—23

JOHN F. CAMPBELL, Primary Examiner

R. W. CHURCH, Assistant Examiner

U.S. Cl. X.R.

29—630, 33; 18—5; 113—119; 174—75