May 13, 1969 C. K. BROWN 3,443,299

APPARATUS FOR TRIMMING AND CONNECTING WIRES

Filed Jan. 20, 1967 Sheet 1 of 3

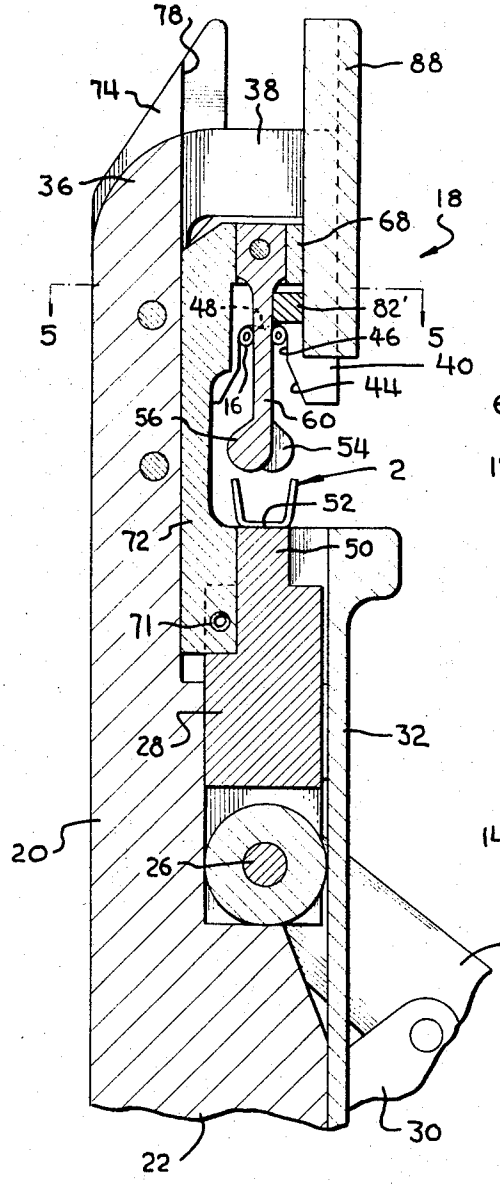

Fig. 3

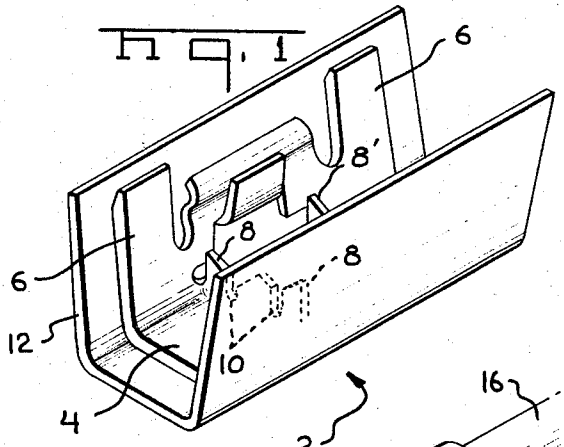

Fig. 1

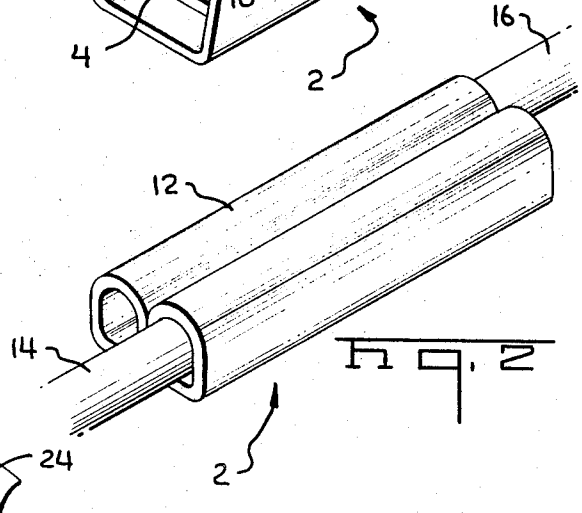

Fig. 2

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Fig. 5

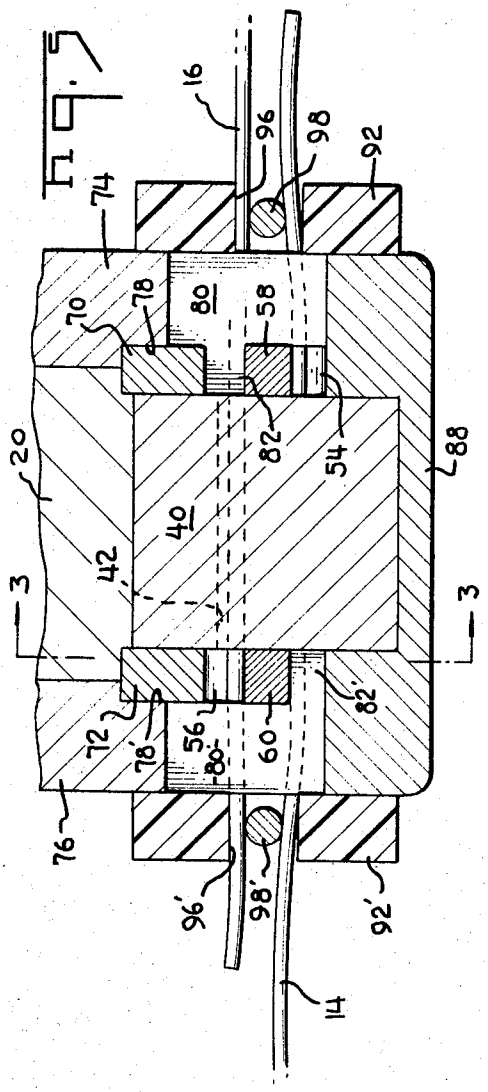


Fig. 6

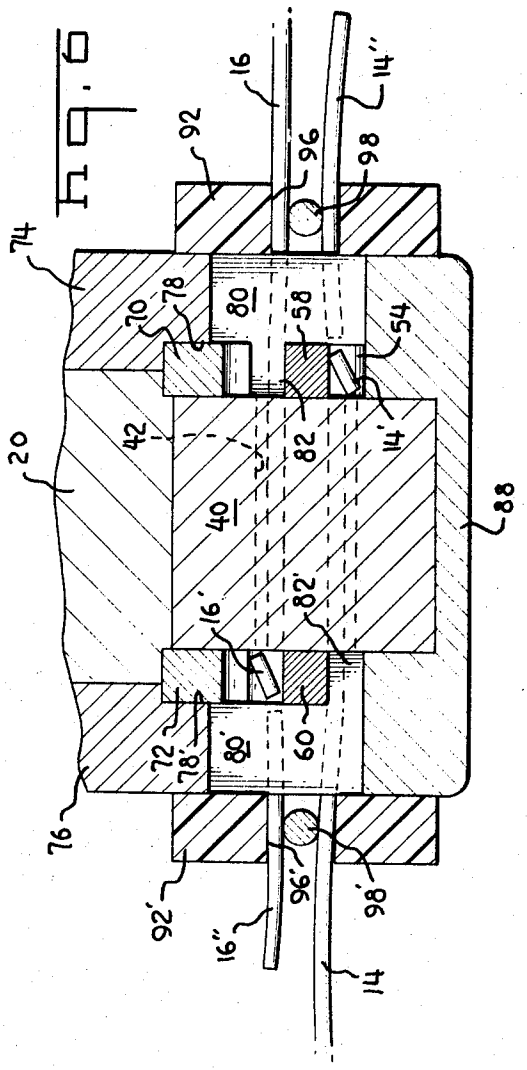
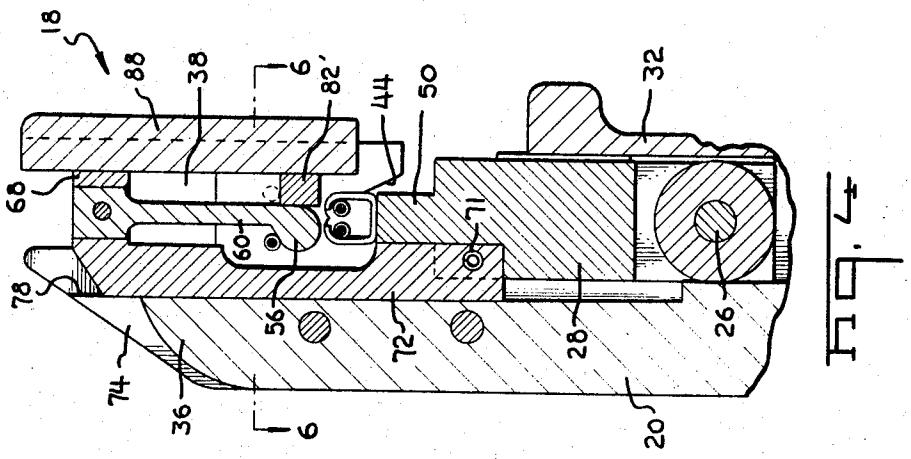


Fig. 7



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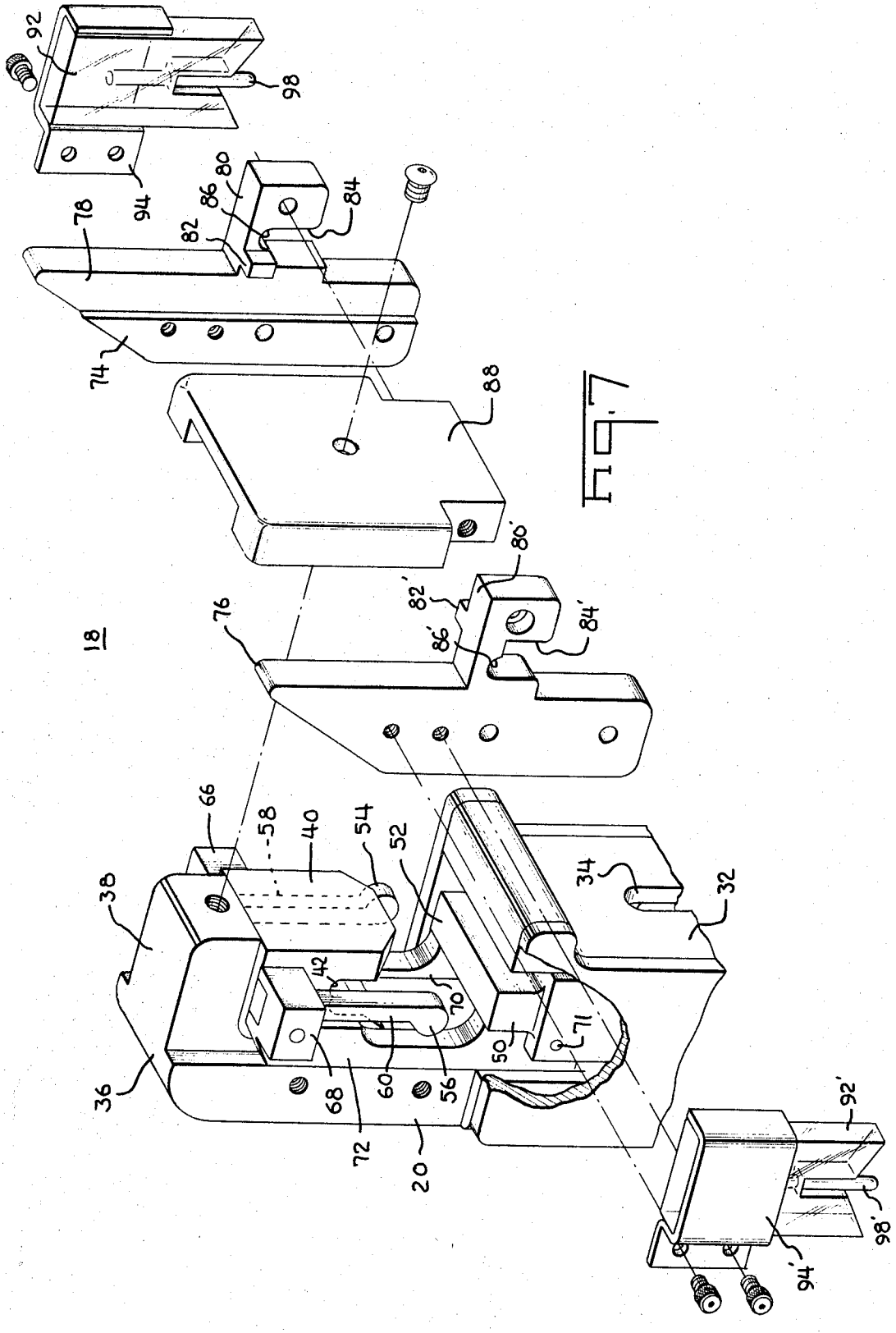

Fig. 7

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3,443,299

APPARATUS FOR TRIMMING AND CONNECTING WIRES

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Int. Cl. B21b *41/00;* B21d *9/08, 37/12*
U.S. Cl. 29—203 6 Claims

ABSTRACT OF THE DISCLOSURE

Tool for trimming and connecting overlapping wires extending axially towards each other has crimping dies and shearing members on each side of the crimping dies. Shearing members extend parallel to path of movement of the dies and have oppositely directed lateral extensions on their ends, the extension on one member extending in the opposite direction from the extension on the other member. Wires are overlapping between crimping dies with the end portions of the wires extending between one of the extensions of the shearing member and one of the dies. Shearing members are moved toward the one die to trim the wires in the planes of the sides of the dies so that upon subsequent movement of dies towards each other, a connector is crimped onto the overlapping wires.

Cross-references to related applications

This application is related to the following pending applications:

Application Ser. No. 432,621
filed: Feb. 15, 1965, inventors: James E. Marley, Lincoln E. Roberts, John A. Ward; Patent No. 3,328,-872

Application Ser. No. 573,078
filed: Aug. 17, 1966; inventor: William R. Over

Application Ser. No. 539,230
filed: Jan. 7, 1966; inventors: Richard E. Reem, John R. Vickery, Jr.; Jatent No. 3,328,872

The above-identified pending applications and the instant application are assigned to a common assignee.

Background of the invention

This invention is particularly directed to the problem of trimming the ends of a pair of overlapping wires which extend axially towards each other and electrically connecting the over-lapping trimmed ends. An important use of the invention occurs in the splicing of the ends of telephone cables which contain a relatively large number of individual conductors. Other uses of the invention will be apparent to those skilled in the art.

Telephone cable splicing operations are usually carried out in the field, that is, either in a man-hole or on a platform adjacent to a telephone pole, by a lineman who stands in front of the two ends of the cable, selects two wires to be connected, and effects the connection by any one of several methods. The cable ends are usually arranged such that there is a certain amount of slack in the wires and this slack wire must be trimmed from the wire ends at the time the connection is made. Thus, each operation of connecting two wires by the lineman involves both a wire trimming operation, in which this slack is eliminated, and a wire connecting operation. The trimming and connecting operations have heretofore usually been carried in sequence; that is, the lineman first cuts the excess wire from the wire ends and then connects the wire either by means of a suitable crimping connector or by twisting. The above-identified copending applications and the instant disclosure are directed to apparatus and methods for carrying out the wire trimming operation and

the wire connecting operation substantially in a manner such that a significant time saving is achieved as compared to prior art splicing methods. The instant invention is particularly directed to an improved wire connecting tool which permits simplified wire lacing operations, that is, the positioning of the wires in the tool prior to the trimming and connecting operations.

Summary of the invention

An object of the invention is to provide an improved apparatus for trimming and connecting the ends of a pair of wires extending axially towards each other. A further object is to provide an improved tool for trimming the ends of wires and crimping an open U-type electrical connector onto the trimmed ends. A still further object is to provide a trimming and wire connecting apparatus in which the operation of positioning the wires in the apparatus is greatly simplified.

These and other objects of the invention are achieved in a preferred embodiment thereof comprising a crimping die and a crimping anvil which are movable relatively towards and away from each other along a predetermined path. A pair of wire shearing members are provided, one member being disposed on each side of the crimping die and extending in the medial plane of the die and anvil. Each of the shearing members are provided with a laterally extending arm which projects transversely of the path of movement of the die and anvil relatively towards each other. These arms extends in opposite directions, that is, one arm extends towards one side of the die and the other arm extends towards the other side. The shearing members are movable relatively towards the crimping die, function as a shearing means. In use, die so that these arms, in cooperation with the sides of the wires are positioned between the die and anvil with the end portions of the wires extending between one of the laterally extending arms and the die. The shearing members are first moved relatively towards and past the die to shear the end portions of the wires so that two trimmed over-lapping wires remain between the die and anvil. Upon subsequent movement of the die relatively towards the anvil, an open U-type connector positioned on the anvil is crimped around the over-lapping wires thereby to electrically connect them to each other. As will be explained below, one of the most important advantages of the invention is the ease with which wires can be positioned between the die and anvil of the apparatus. The die and anvil which crimp the electrical connector onto the wires can, therefore, be replaced by other wire joining means, for example, by a pair of welding heads or by suitable wire connecting devices of the type intended to make a mechanical connection between wires.

Brief description of the drawings

FIGURE 1 is a perspective view of an open U-type wire connecting device which is used with the herein disclosed embodiment of the invention;

FIGURE 2 is a perspective view of a completed electrical connection;

FIGURE 3 is a side view partially in section of a preferred embodiment of the invention and showing the positions of the parts when the jaws are separated from each other at the beginning of the operating cycle, this view being taken along the lines 3—3 of FIGURE 5;

FIGURE 4 is a view similar to FIGURE 3, but showing the positions of the parts at the end of the operating cycle;

FIGURE 5 is a sectional view taken along the lines 5—5 of FIGURE 3 and showing the manner in which the wires are located in the tool at the beginning of the operating cycle;

FIGURE 6 is a view taken along the lines 6—6 of FIGURE 4; and

FIGURE 7 is a perspective exploded view of the head portion of the tool.

Description of the preferred embodiment

FIGURE 1 shows an open U-type electrical connector 2 having a web 4 and sidewalls 6 of a type which is intended to be used with the apparatus of the present invention. Connectors of this general type, as more fully described in the above-identified Marley et al. application have a pair of struck-up tongues 8, 8' in the web which extend transversely of the connector axis. Each tongue 8 is provided with a pair of side-by-side slots on notches 10, the width of these notches slightly less than the diameter of the metallic cores of the wires 14, 16. In most connectors of this type, a film 12 of suitable insulation such as Mylar (polyethylene terephthalate) is provided which extends beyond the sidewalls 6 and beyond the ends of the web 8. When the connector 2 is crimped onto the wires 14, 16, the wires are located between the sidewalls of the connector in parallel relationship to each other and with each wire disposed above a pair of the aligned slots in tongues 8, 8'. The sidewalls are bent inwardly and downwardly towards the web so that the wires are forced into the slots 10. The edges of the slots penetrate the insulation of the wire and establish electrical contact with the metallic cores of the wires. It should be mentioned that the electrical connectors described in the above-identified Marley application are relatively longer than the connector shown in FIGURES 1 and 2 and are provided with four struck-up tongues similar to the tongues 10 rather than two tongues. The connectors shown in the Marley application are adapted to make butt splices between wires (in which the wires do not overlap each other) rather than lap splices as shown in FIGURE 2. The connector shown in FIGURES 1 and 2 are otherwise substantially similar to the connectors shown in the Marley et al. application.

The present invention is directed to an improved apparatus for crimping the connector 2 onto the wires 14, 16 and simultaneously trimming the ends of the wires. The simultaneous trimming and crimping technique is highly advantageous from a time and motion standpoint, particularly in the telephone industry, for the reason that it reduces the time required to make the connection.

Referring now to FIGURES 3–6, a preferred form of tool 18 in accordance with the invention has a frame 20 from which an integral handle 22 extends. A movable handle 24 is pivotally connected at its upper end 26 to a slide member 28 slidably mounted in the frame. The movable handle 24 is also connected by a link 30 intermediate its ends to the integral handle so that upon closure of the handles 24, 22, the slide member 28 will move upwardly as viewed in the drawing from the position of FIGURE 3 to the position of FIGURE 4. A suitable cover plate 32 is mounted on the right hand side of the tool as viewed in FIGURE 3 and the movable handle 24 extends through a slot 34 in this plate 32 as shown best in FIGURE 5.

The upper end 36 of the tool frame 20 has a forwardly extending flange or head portion 38 against which there is mounted by suitable fasteners a crimping die block 40. Die block 40 has a trough-like forming recess 42 extending between its ends on its underside, this forming recess as viewed from the side (FIGURE 3) having generally convergent sidewall portions 44 and parallel sidewall portions 46 which are curved inwardly and towards each other and meet at a centrally disposed cusp 48. An anvil block 50 is provided on the upper side of the slide member 28 and has an upper surface 52 which is opposed to the forming cavity 42, this upper surface being adapted to support an uncrimped connector 2 as shown best in FIGURE 3.

Shearing members are provided on each side of the die block 40 and extend along the path of reciprocation of the die towards the anvil. Each shearing member comprises a mounting means or support portion 58, 60 and a laterally extending shearing arm 54, 56. The support portions 58, 60 of the shearing members are relatively narrow, having a width substantially less than the width of the forming cavity 42 as apparent from FIGURES 3 and 7 and these support portions are aligned with each other on opposite sides of the die block and centrally with respect to the cavity 42. The shearing arm 54 of the right hand support member 58 (as viewed in FIGURE 7) extends forwardly or rightwardly as of the medial plane of the die block while the shearing arm 56 of the lefthand shearing element extends rearwardly or leftwardly. As will become apparent as this description procedes, these shearing members must extend laterally with respect to their respective support members 58, 60 and in the disclosed embodiment these shearing legs are somewhat rounded in order to facilitate the positioning of the wires into the tool in the beginning of the operating cycle.

The support members 58, 60 have enlarged upper ends which are secured to forwardly extending enlargements 66, 68 of a pair of carrier members 70, 72. The carrier members are also disposed on each side of the die block 40 and on each side of the tool frame 20. These carrier members extend downwardly as viewed in FIGURES 3 and 4 behind the anvil block 50 and are secured by a suitable pin 71 to the upper end of the slide member 28 so that upon movement of the slide member 28, the shearing members will also be carried upwardly from the position of FIGURE 3 to the position of FIGURE 4.

Sides plates 74, 76 are secured against the sides of the tool frame by suitable fasteners and are cut-away from their inner surfaces as shown at 78, 78' to provide guideways for the carrier member 70, 72. Intermediate their ends, each of these side plates is provided with a forwardly extending arm 80, 80' which is recessed as shown at 84, 84' on its underside. Each of the recesses 84, 84' on the undersides of these arms 80, 80' has a relatively deep side as shown at 86, 86', the deep side of the recess 86 being on the forward or right hand side of the arm 80 while the deep portion 86' of the recess 84' is on the rearward portion of the arm. It will be noted that the recesses are in approximate alignment with the two cylindrical portions on each side of the cusp 48 of the die cavity 42. Finally, it will be noted that the arms 80, 82' have inwardly directed guide block portions 82, 82' which bear against the sides of the carrier portions 58, 60 of the shearing members and guide them along the paths of reciprocation towards the die block 40, see FIGURE 5. The die block 40 and the side plates 74, 76 are covered by a suitable front plate 88 secured to the tool frame and to the forwardly extending arms 80, 80' of the side plates, as shown in FIGURE 7.

Wire lacing guide plates 92, 92' are mounted on each side of the tool and against the stationary side plates 74, 76 by means of suitable brackets 94, 94' which are secured by fasteners to the tool frame. Each of these wire lacing guide members has a relatively deep slot 96, 96' on its underside and a pin 98, 98' is embedded in the guide member to substantially bisect this slot thereby to form a pair of side-by-side notches. The guide members 92, 92' are advantageously of a suitable rubber-like material such as polyurethane for the reason that during use, the wires are pulled into these members and such material will not damage the insulation of the wires.

In use, the parts will normally be positioned as shown in FIGURE 3 with the anvil block and slide 28 in their lowered positions relative to the die block and with the severing members extending downwardly towards the upper surface of the anvil block. When the parts are in this position, the laterally extending arms 54, 56 of the shearing members are disposed between the die cavity 44 and the anvil surface 52 and directly above the uncrimped connector supported on the upper surface of the anvil.

The operator first grasps the wire **16**, moves it inwardly and beneath the lower ends of the shearing arms **54, 56** and beyond the arm **56** of the lefthand shearing member. He then moves this wire upwardly until it is located as shown in FIGURE 3. This wire, referring particularly to FIGURE 5, extends through the rearward slot in the right-hand end guide member **92**, beneath the arm **80**, past the rearward side of the support member **58**, through the die cavity, past the rearward side of the support member **60** and above the arm **56**, beneath the arm **80'**, and through the rearward slot in the lefthand guide member **92'**. The wire **14** is similarly positioned on the forward sides of the support members **58, 60** and in the forward or right hand slots of the guide members **96**. When the wires are in these positions (FIGURE 5) it will be apparent that the wire **16** extends past the non-shearing side of the shearing member **58, 54** (that is, on the side opposite from the side on which the arm **54** is provided) and past the shearing side of the shearing member **56, 60**. Similarly, the wire **14** extends past the non-shearing side of the shearing member **56, 60** and past the shearing side of the shearing member **54, 58**. The opeartor then merely closes the handles to move the shearing members upwardly and to move the uncrimped connector into the forming cavity **42** of the die block. Upon upward movement of the shearing members, the end portions of the wires are sheared in the planes of the sides of the die block **40** so that the overlapping trimmed ends of the wires remain between the die and anvil. The connector is, of course, subsequently crimped onto these overlapping trimmed ends.

It should be noted that the disclosed embodiment of the invention, the wires **14, 16** will also be sheared in the planes of the outside surfaces of shearing members **54, 58** and **56, 60** when the enlarged lower end of these shearing members move upwardly past the undersides of the arms **80, 80'**. As a result, short slugs of scrap wire **14', 16'** are produced on each side of the tool in addition to the scrap wire ends, **14'', 16''**. These short slugs will usually fall out of the tool or if they do not fall out, they are easily removed. However, the tool can be modified to avoid the production of these slugs if desired. For example, a guide means other than the arms **80, 80'** for the support members **58, 60** might be provided which would not produce this second and unnecessary shearing action on the wires.

A distinct advantage of the apparatus shown is that the wire threading operation is greatly simplified requiring as it does only that the wires be positioned on one side or the other of the shearing members **58, 54** and **65, 60**. The wires need not be threaded above and below shearing members as with prior art tools, such as the type which produce lap-type splices.

As previously noted, an important feature of the invention is the shearing of the overlapping ends of the wires prior to the wire connecting operation and the ease with which the tool can be threaded with wires of this shearing operation. It follows that the wire trimming aspects of the invention can be utilized with wire connecting tools of the type other than the particular tool shown. For example, a pair of trimming devices in accordance with the invention might be provided in conjunction with a tool having two welding electrodes movable towards and away from each other to weld the wires after they have been trimmed.

While the invention is herein disclosed in a hand tool embodiment, it will be apparent that the principles of the invention can be used in bench mounted tools having connector feeding means and other refinements.

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. Apparatus for trimming the ends of a pair of overlapping wires and crimping an open U-type connecting device onto the trimmed ends comprising,

a pair of crimping member comprising a crimping die and a crimping anvil, said crimping members being movable relatively towards each other along a predetermined path,

a pair of severing members disposed on each side of one of said crimping members,

said severing members each comprising a support member extending towards the second one of said crimping members, said support members being relatively thin and being aligned with each other on opposite sides of said one crimping member,

each of said severing members having a severing arm, said severing arms extending in opposite directions laterally of said path,

and actuating means for moving said severing members towards and past said one crimping member in advance of movement of said one crimping member relatively towards said other crimping member,

whereby, projecting ends of conductors disposed between said crimping members are severed in the planes of the sides of said one crimping member prior to crimping of said connecting device onto said wires.

2. Apparatus as set forth in claim **1** wherein said one crimping member comprises said crimping die.

3. Apparatus as set forth in claim **1** wherein said support members are secured to carrier members, said carrier members extending parallel to said path towards the other one of said crimping members, said carrier members being concatenated with said actuating means whereby said support members and said severing arms move towards said one crimping member simultaneously with relative movement of said crimping members towards each other.

4. A device as set forth in claim **1** wherein said apparatus comprises a hand tool comprising a frame portion and a slide member slidably mounted on said frame portion, said crimping anvil being on said slide member and said crimping die being on said frame member, said support members and said severing arms being concatenated with, and movable with, said slide member.

5. In a wire connecting means of the type comprising a pair of crimping members movable relatively towards each other along a rectilinear path, a pair of spaced-apart shearing members disposed on each side of said crimping members, said shearing members being movable relatively towards one of said crimping members to shear a wire extending between said shearing members and said one crimping member, the improvement comprising:

a supporting means for each of said shearing members extending parallel to said path, said supporting means being in alignment with each other on opposite sides of said one crimping member,

said shearing members extending in opposite lateral directions with respect to said path and normally of the axes of wires positioned between said crimping members

whereby, said wires can be positioned between said crimping members with the end portion of each wire passing between one of said shearing members and said one crimping member and said wires will be trimmed after movement of said supports and said shearing members past said one crimping member, and a terminal located between said crimping members will be crimped onto the overlapping trimmed ends of said wires.

6. Apparatus for trimming the ends of a pair of overlapping wires and electrically connecting the overlapping trimmed ends comprising,

a pair of wire joining members movable relatively to-

wards and away from each other along a predetermined path, said wire joining members being effective to electrically connect a pair of wires positioned therebetween upon movement of said joining member relatively towards each other,

a pair of severing arms disposed between said joining members, said severing arms extending laterally of said path in opposite directions and being coplanar with the sides of one of said joining members,

mounting means for said severing arms, said mounting means extending parallel to said path and towards said one joining member,

means for moving said severing arms and said mounting means towards said one joining member in advance of movement of said wire joining members towards each other

whereby, upon positioning said wires with their axes extending between said joining members, through the planes of said sides of said one joining member and with the end portions of said wires extending between one of said severing arms and said one wire joining member and upon moving said mounting means and said severing arms towards said one joining member and moving said joining members relatively towards each other, the end portions of said wires are trimmed and said wires are electrically connected to each other.

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THOMAS H. EAGER, *Primary Examiner.*

U.S. Cl. X.R.

72—331, 409