United States Patent [19]

Brown

[11] **3,918,472**

[45] **Nov. 11, 1975**

[54] **PLIERS-TYPE WIRE-CRIMPER**

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[22] Filed: **July 8, 1974**

[21] Appl. No.: **486,465**

[52] **U.S. Cl.** **140/106**

[51] **Int. Cl.**[2] **B21F 1/04**

[58] **Field of Search** 72/384, 385, 389, 409, 72/410; 81/419; 140/102.5, 105, 106

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Assistant Examiner—E. M. Combs
Attorney, Agent, or Firm—Mattern, Ware and Davis

[57] **ABSTRACT**

A wire-crimper capable of shaping a section of small diameter wire into a generally offset-U-shaped or "crimped" configuration, while leaving the remaining wire unaffected, is composed of two pairs of interfitting and pivotally connected arms, the arms of each pair being planarly parallel but axially spaced from each other on the pivoting axis. Each arm has a crimping edge beyond the region where the two pairs are pivotally interconnected and intermeshed along the pivot axis. The crimping edge of each arm faces toward the crimping edges of the arms of the other pair. The wire shaping is accomplished by three of the crimping edges as they axially overlap while the fourth edge prevents bending of the remaining wire during the crimping operation.

9 Claims, 10 Drawing Figures

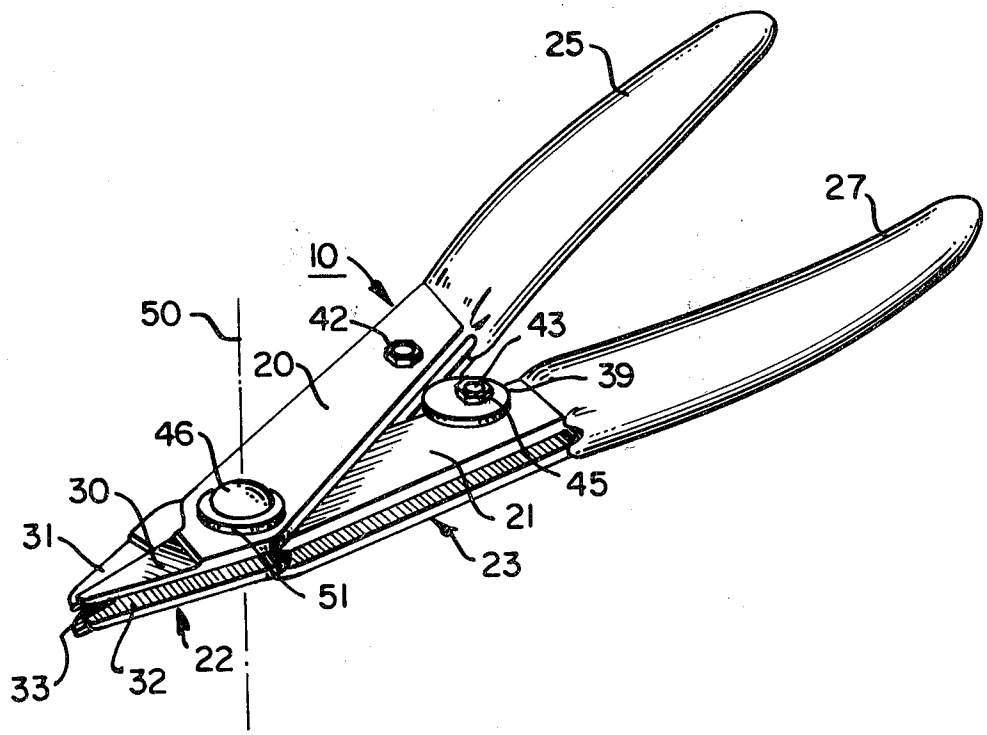


FIG. 1

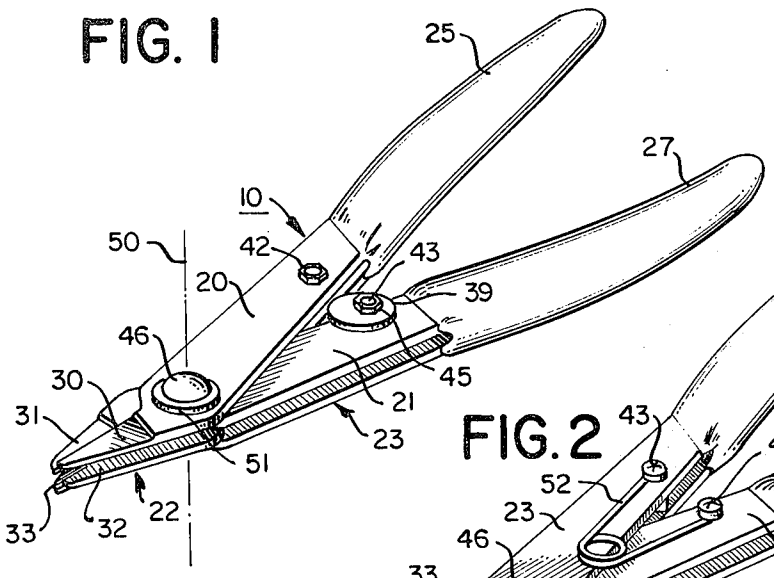


FIG. 2

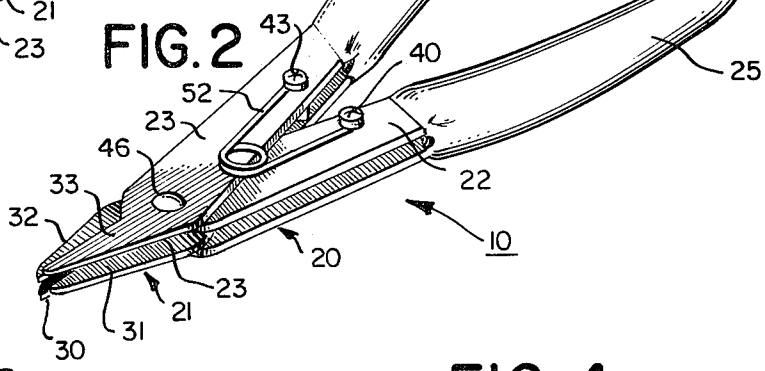
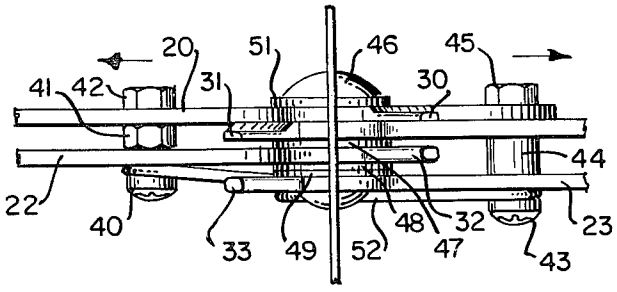
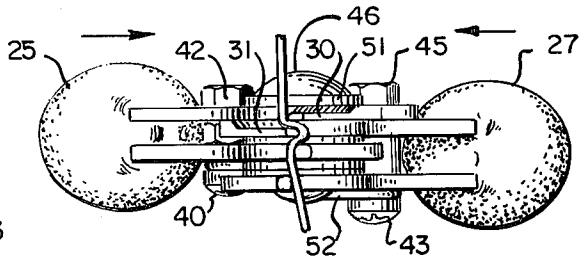


FIG. 3



PRIOR ART

FIG. 4



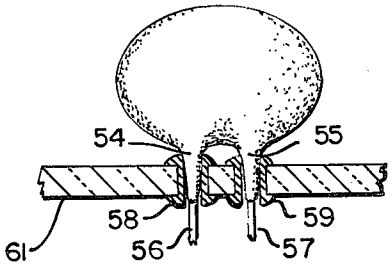


FIG. 5

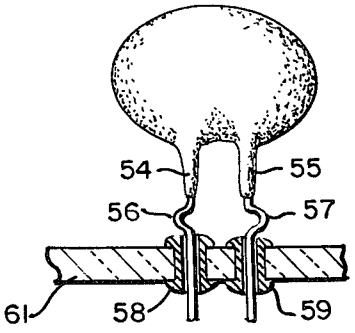


FIG. 6

FIG. 7

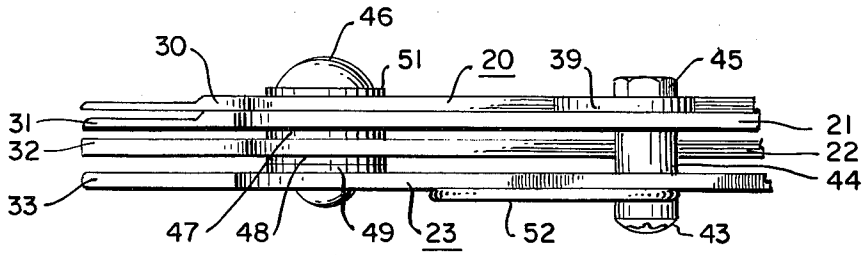


FIG. 8

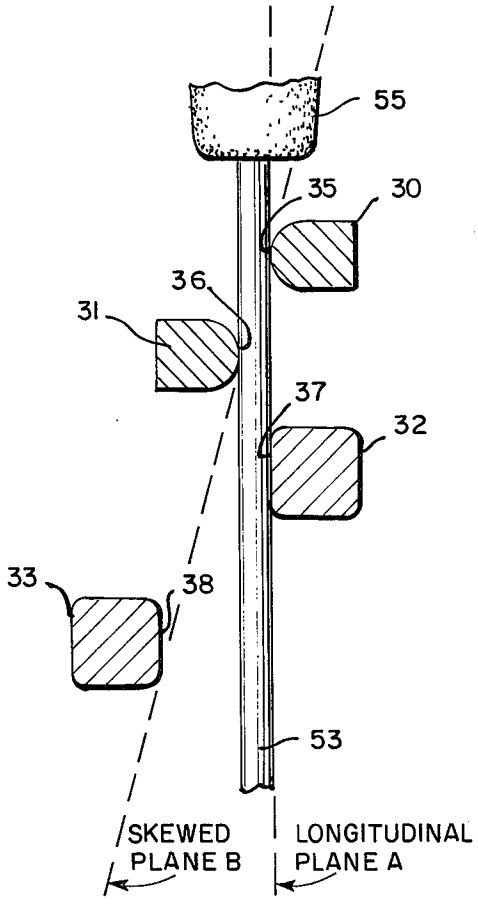


FIG. 9

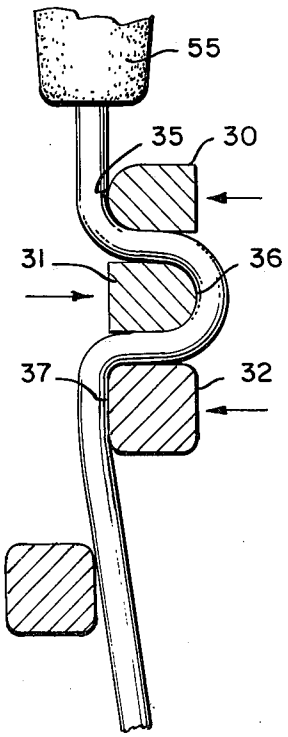
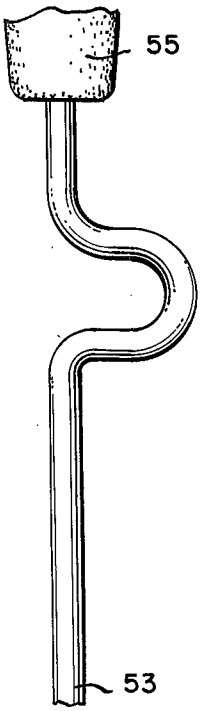


FIG. 10



PLIERS-TYPE WIRE-CRIMPER

BACKGROUND OF THE INVENTION

This invention relates to a wire-crimper capable of shaping a section of small diameter wire into a generally U-shaped configuration while leaving unaffected the remaining length of wire.

By performing the crimping operation upon the wire leads of miniature electronic components; e.g., ceramic capacitors, the insulation covering these leads closest to the ceramic body of the component will not be able to penetrate the soldering grommets used with many printed circuit cards for mounting such components. The crimping of the ceramic capacitor leads thus prevents potentially faulty electrical connections associated with solder connections made to wire leads covered by a ceramic coating. Stand-off spacing of the component at a desired height above the circuit board is another consequent advantage producing desirable electrical isolation or heat insulation.

SUMMARY OF THE INVENTION

The wire-crimper devices of this invention perform the shaping of small diameter wire into a U-shaped configuration by means of two pairs of arms pivotally interconnected and intermeshed about a pivoting axis. Each arm has a distal crimping edge beyond said pivot area; each edge faces the crimping edges of the other arm pair. The pairs of arms are moved pivotally by proximal actuating means, such as a common handle, joining the ends of the arm pair across the pivotal axis from the crimping edges. A wire placed between said crimping edges is transformed into a U-shaped configuration by the angular overlap or near overlap of three of the crimping edges, when the pairs of arms are closed, with the fourth edge preventing the bending movement of the remaining wire during the crimping operation, leaving a substantially straight wire end beyond the crimp.

The amount of angular overlap or near overlap of the said three crimping edges is adjustable by a stop means mounted to one of said arms, thus limiting the maximum overlap angle the pivotally mounted pairs of arms may subtend.

The pairs of arms are preferably maintained in the open position when crimping pressure is not applied by means of a torsion spring whose ends are mounted to one arm member of each pair.

Therefore, it is a principal object of this invention to provide a wire-crimper that is capable of shaping a section of wire into a generally U-shaped configuration and therefore preventing that section of wire from passing through a grommet orifice of sufficient diameter to allow the passage of the non-crimped wire.

Another object of this invention is to achieve wire crimping and yet to avoid producing any structural defects in the crimped wire.

Another object of this invention is to provide wire-crimpers incorporating a means for adjusting the size of the generally U-shaped configuration produced by the wire-crimper on a wire section.

An additional object of the invention is to provide a wire-crimper of the above character which is easily handled and manipulated by relatively unskilled users.

Another object of this invention is to provide a wire-crimper that remains in the open position automatically when crimping pressure is not applied.

A further object of this invention is to provide a wire-crimper of the above character which is not only effective but also inexpensive to manufacture.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

THE DRAWINGS

FIG. **1** is a top perspective view of a wire-crimper of this invention;

FIG. **2** is a bottom perspective view of the same wire-crimper;

FIG. **3** is a fragmentary front elevation view of the wire-crimper with the crimping jaws open and a wire to be crimped placed between the crimping jaws;

FIG. **4** is a corresponding front elevation view of the wire-crimper with the crimping jaws closed with a crimped wire segment therebetween;

FIG. **5** is a fragmentary cross-sectional view of a printed circuit board with soldering grommets supporting a ceramic capacitor;

FIG. **6** is a fragmentary cross-sectional view of a printed circuit board with soldering grommets supporting a ceramic capacitor with crimped capacitor leads;

FIG. **7** is a fragmentary side elevation view of the wire-crimper with the crimping jaws in a closed position;

FIG. **8** is an enlarged diagrammatic front sectional view of the crimping edges of the wire-crimper just prior to the crimping operation on a wire lead of an electronic component;

FIG. **9** is the same view as FIG. **8** showing the crimping jaws after completion of the crimping operation on a wire segment; and

FIG. **10** is a corresponding view of the resulting crimped wire lead.

DETAILED DESCRIPTION

In FIGS. **1** and **2** the construction of wire-crimper **10** can best be seen. Wire-crimper **10** is constructed from two pairs of arm members **20, 21, 22** and **23.** These arm members are preferably constructed from 0.050 inch thick carbon steel so as to be structurally able to crimp small electronic component wire leads with minimal flexing fatigue. Each pair of arm members incorporates a rearward handle portion that allows easy holding and operating of said wire-crimper. Thus arm members **20** and **22** are actuated by common proximal handle portion **25.** Likewise, arm members **21** and **23** are actuated by a common proximal handle portion **27.** In addition, each of the arm members of said pairs has a forward or distal end portions **30, 32, 31** and **33** respectively which all cooperate to perform the crimping operation. As best seen in FIGS. **3** and **4,** arm members **20** and **22** are axially spaced apart by machine screw **40** and a double nut assembly **41** and **42,** while arm members **21** and **23** are similarly spaced by machine screw **43** and a sleeve or washer and nut assembly **44** and **45** respectively.

As can be most clearly seen in FIG. **7,** the two pairs of arm members are free to pivot about the axis **50** of an interconnecting rivet **46** while the pivotal axial spacing of arm members **21** and **22** and arm members **22** and **23** are accomplished by washer **47** and washers **48** and **49** respectively. For crimping of small diameter electronic component wire leads, the above spacings preferably are 0.020 inches and from 0.040 to 0.060 inches respectively. Washer **51** allows the arm members to pivotally rotate more easily, while as seen in FIG. **2,** a torsion spring **52,** having its ends secured to

arm members 22 and 23 by machine screws 40 and 43 respectively, conveniently biases open the handle portions 25 and 27 of each arm member pair when crimping pressure is not applied.

As can best be seen in FIG. 7, arm member end portions 30 and 31 have narrower axial widths than corresponding arm members 20 and 21, while end portions 32 and 33 have the same widths as corresponding arm members 22 and 23. As seen best in FIGS. 8 and 9, crimping edges 35 and 36 of end portions 30 and 31 respectively are thus axially narrower in cross-section than crimping edges 37 and 38 of end portions 32 and 33 respectively. For crimping of small diameter electronic component leads these cross-sectional widths are each preferably 0.030 inches with a resultant vertical space of 0.020 inches when the thickness of the arm members is 0.050 inches. These vertical spaces between the crimping edges allow the crimped wire to bend around and pass between the crimping edges 35, 36 and 37 without appreciably flexing the corresponding end portions 30, 31 and 32.

FIG. 8 illustrates the position of the four crimping edges just prior to initiation of crimping deformation of wire 53. As shown in FIG. 8, the first pair of crimping edges 35 and 37 define a first longitudinal plane A parallel to wire 53, while the second pair of crimping edges 36 and 38 define a skewed plane B converging with plane A at an acute angle. As shown in FIG. 9, as end portions 30 and 32 move toward end portions 31 and 33, the wire is forced around crimping edges 35, 36 and 37 to form a generally U-shaped segment. Since crimping edges 35 and 36 are arched in cross-sectional configuration, said U-shaped configuration imparted to wire 53 is accomplished without producing any small radii turn segments to the wire, thus avoiding any undesirable structural fatigue points in the wire.

The depth of said U-shaped configuration is proportional to the maximum angular amount by which end portions 30, 31 and 32 intermesh. This degree of intermeshing is controlled by a stop means 39 attached to arm member 21 by a machine screw 43 and nut 45. As best seen in FIG. 1, as handles 25 and 27 are closed, stop means 39 makes physical contact with arm member 20, thus preventing any further closure of said handles and correspondingly restricting the intermeshing of end portions 30, 31, 32 and 33. During said closure of the end portions, crimping edges 37 and 38 coact, due to their relatively large axial spacing, lack of appreciable angular overlap, and generally straight cross-sectional configuration, serving to prevent wire 53 from sliding radially out of said end portions while not imparting any permanent deformation to that portion of said wire. A typical example of a crimped wire lead is shown in FIG. 10. Furthermore, as can be seen in FIGS. 8–10, the ceramic or other coating insulating material 60 surrounding the lead is not adversely affected by the crimping operation. FIGS. 6, 8, 9 and 10 also demonstrate the close proximity the crimping edges of said wire-crimper may have with the body of an electronic component, a highly desirable objective when the component is to be mounted to a printed circuit card.

It should also be noted that the above description is applicable to a wire-crimper utilizing only the end portions and crimping edges of the pairs of arm members when these crimping edges are intermeshed as shown in FIG. 9, by some other non-pivoted means, such as by a miniature "hydraulic press" mechanism. Such a device however would not be hand operated although it could be bench-mounted and hand or foot actuated.

Thus by performing the crimping operation on each wire lead of an electronic component; e.g., a ceramic capacitor as shown in FIG. 6, the insulating material 54 and 55 covering the wire leads 56 and 57 near the component body portion will not be able to penetrate the mounting grommets 58 and 59 where such insulating material can cause faulty electrical soldering connections between said wire leads and said grommets. In addition, the invention is able to perform the crimping operation at a point close to the electronic component body, thereby enabling mounting of the component as close to the printed circuit board 61 as may be desired. Such mounting is preferable to long lead mounting since the former type reduces the probability of wire lead bending and fatigue failure.

Thus what has been described is a wire-crimper for the shaping of small diameter wire into generally U-shaped offset segments while leaving unaffected the remaining portions of the wire. Such shaping is accomplished by the angular interaction of three axially spaced crimping edges of said device while the wire is held in the proper position by the cooperation of a fourth crimping edge. The invention is hand-holdable, of simple design and construction, and easy to operate.

It will thus be seen that the objects set forth above, among those made apparent in the preceding description, are efficiently attained and, since certain changes may be made in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language might be said to fall therebetween.

Having described the invention, what is claimed is:

1. A wire crimper for crimping a longitudinally elongated wire comprising:

A. a first longitudinally spaced pair of first and second arm ends, with respective first and second crimping edges defining a first longitudinal plane;

B. a second longitudinally spaced pair of third and fourth arm ends movable with respect to the first pair of arm ends between a first open position and a second closed position, the third arm end being longitudinally positioned between the first and second arm ends, and the fourth arm end being longitudinally spaced beyond the second arm end, the third and fourth arm ends having respective third and fourth crimping edges facing toward the first and second crimping edges when the arm ends are in the first open position, the fourth crimping edge being laterally offset from and defining with the third crimping edge a skewed second plane which intersects the first plane, positioning the fourth crimping edge near but not intermeshed with the second crimping edge and positioning the third crimping edge intermeshed between the first and second crimping edges when in the second closed position of the arm ends; and

C. means for moving the second pair of arm ends with respect to the first pair of arm ends between the first open position and the second closed position;

whereby a wire placed between the opposing crimping edges when the arm ends are in the first open position is forcibly crimped by movement of the arm ends toward the second closed position, being deformed in undulant fashion around the first, second and third crimping edges while restrained by the fourth crimping edge so that the wire portion adjacent the fourth crimping edge remains substantially straight and undisturbed after the arm ends are retracted from the second closed position.

2. A wire-crimper as defined in claim **1** wherein said pairs of arm members are pivotally interconnected at a pivot axis.

3. A wire-crimper as defined in claim **2,** further comprising a torsion spring having an axis near said pivot axis and two legs each respectively mounted to one arm end of each of said pairs of arm ends for maintaining said crimping edges apart in the second, open, position when no pressure is applied to said pairs of arm ends.

4. A wire-crimper as defined in claim **2,** further comprising a stop means mounted to one of said arm ends for limiting the arc through which the other of said pairs of arm ends may move whereby the axial intermeshing of said third crimping edge with said first and second crimping edges if correspondingly limited.

5. A wire-crimper as defined in claim **4,** wherein said stop means is mounted on a pivot axis and has an eccentric perimeter adjustably engaging an arm member of said other pair of arm members.

6. A wire-crimper as defined in claim **1,** wherein the first and third crimping edges are of smaller cross-sectional thickness than the second and fourth crimping edges, and wherein the second and fourth crimping edges are of approximately the same cross-sectional thickness.

7. A wire-crimper as defined in claim **1,** wherein the first and third crimping edges are arcuate, and wherein the engaging portion of the second crimping edge closest to the first crimping edge is arcuate, and wherein the configuration of the remaining portion of said second crimping edge as well as the fourth crimping edge are generally straight.

8. A wire-crimper as defined in claim **1,** wherein the longitudinal space between the first and third crimping edges and the longitudinal space between the second and third crimping edges is approximately equal to the wire diameter of the wire to be crimped, and wherein the longitudinal space between the third and fourth crimping edges is substantially greater than the wire diameter of the wire to be crimped.

9. A wire-crimper for crimping longitudinally elongated wire leads of small electronic components comprising:

A. a first pair of first and second arm members having respective first and second planar end portions parallel to and spaced from each other, with respective first and second crimping edges longitudinally spaced from each other and defining a first plane perpendicular to both the first and second planar end portions, the first pair of arm members having a common second distal handle end portion at its other end;

B. a second pair of third and fourth arm members pivotally interconnected with said first pair of arm members and having a first, open, position and a second, closed, position, the third arm member positioned between the first and second arm members, and the fourth arm member parallel to and spaced from the third arm member and longitudinally spaced closest to the second arm member, the third and fourth arm members having respective third and fourth planar end portions parallel to and spaced from each other, the third and fourth end portions having respective third and fourth crimping edges spaced from each other and facing towards the first and second crimping edges when the second pair of arm members is in the first, open, position, the fourth crimping edge angularly offset away from the other crimping edges so that the extension of a second skewed plane defined by the third and fourth crimping edges intersects the first plane in which the first and second crimping edges are positioned, so that when the second pair of arm members are in the second, closed, position, the fourth crimping edge approaches the first and second crimping edge but does not intersect the extension of the plane in which the first and second crimping edges are positioned, and the third crimping edge does intersect said first plane so as to intermesh between the first and second crimping edges, the second pair of arm members also having a common second distal handle end portion for pivotally moving the first and second pair of arm members from the first, open, position to the second, closed, position;

whereby a longitudinally elongated wire lead of an electronic component placed between the opposing crimping edges of the wire-crimper when the second pair of arm members are in the first, open position so that the electronic component is closest to the first crimping edge, is forced over the first, second, and third crimping edges while held by the fourth crimping edge so that the corresponding portion of the wire lead adjacent the fourth crimping edge remains in axial alignment with the portion of the wire lead closest to the electronic component above the point where the first crimping edge contacts the wire lead when the second pair of arm members are placed in the second, closed position.

* * * * *