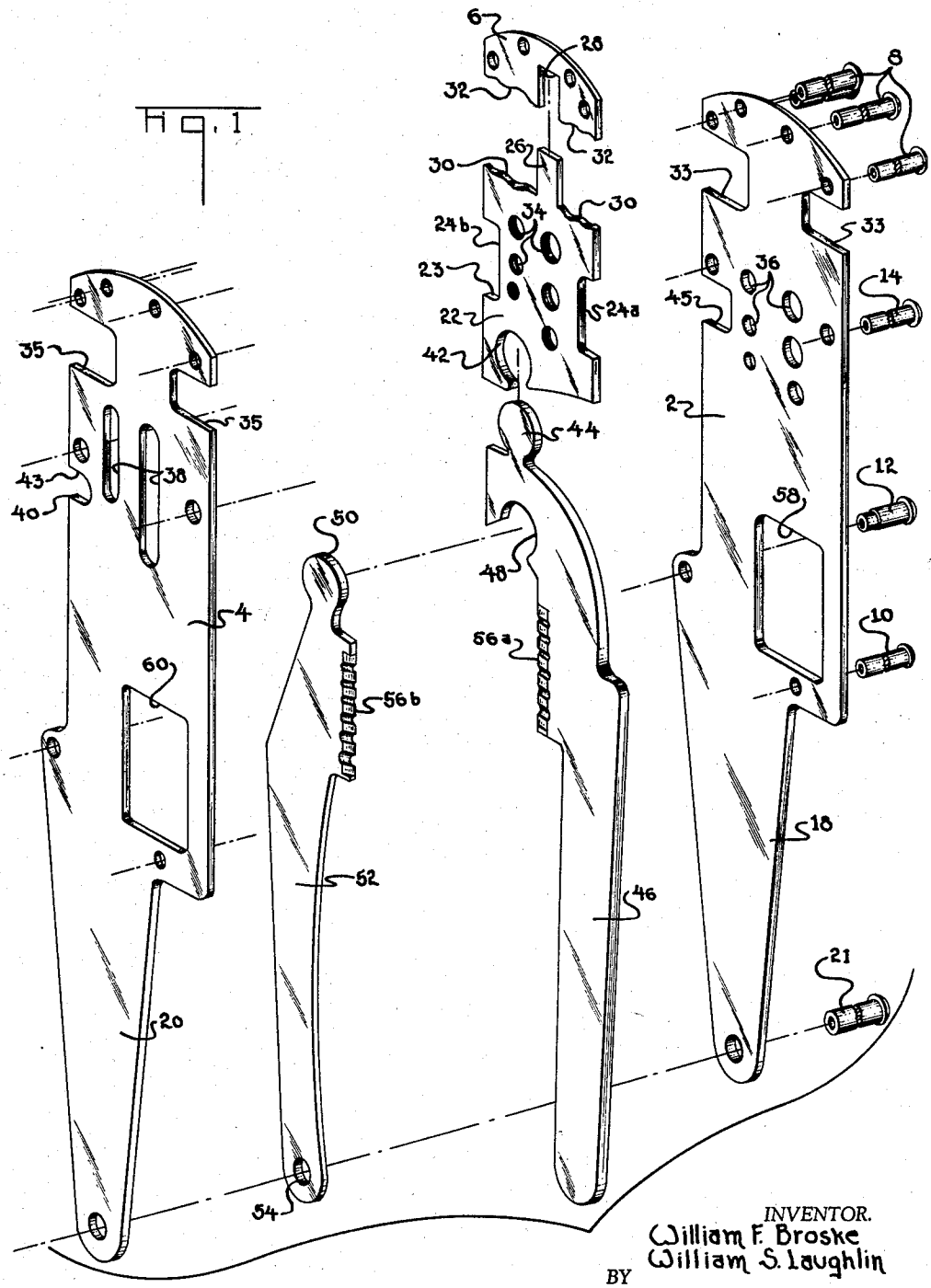
Feb. 16, 1960 W. F. BROSKE ET AL 2,925,004

CRIMPING TOOL

Filed Nov. 27, 1957 2 Sheets-Sheet 1

Fig. 1



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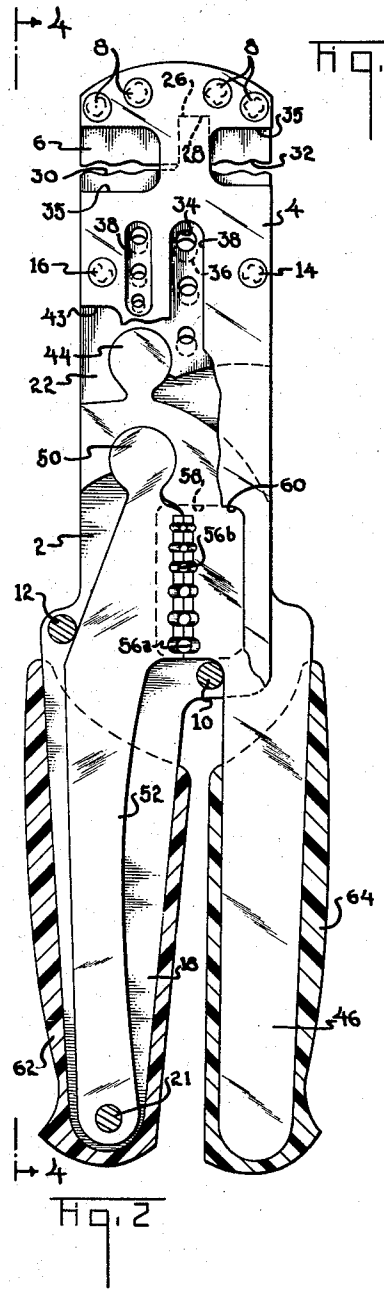

Fig. 2

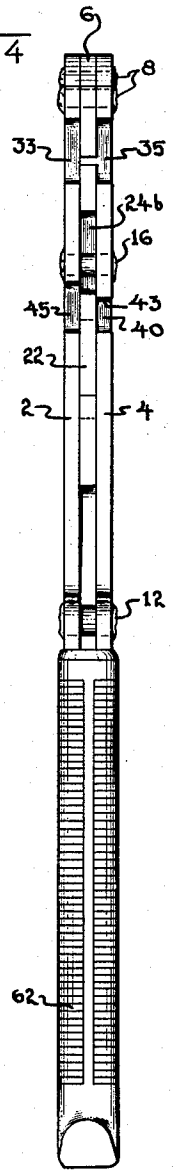

Fig. 4

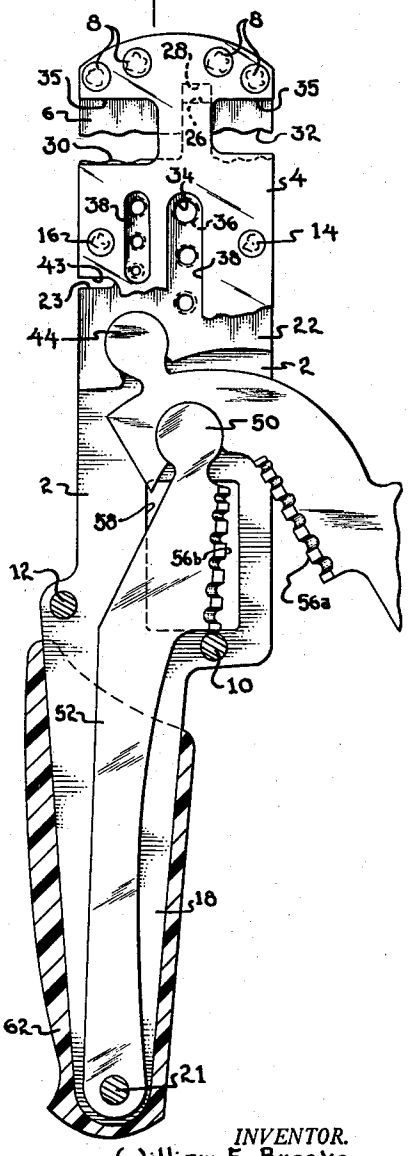

Fig. 3

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CRIMPING TOOL

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Application November 27, 1957, Serial No. 699,392
2 Claims. (Cl. 81—15)

This invention relates to a straight action type compressing tool, for example, of the type used for crimping electrical connectors.

The term "straight action type tool" is employed to denote hand tools of the class in which a pair of die surfaces or jaws move relatively towards and away from each other along a rectilinear path. Tools of this type have been proved to be highly satisfactory for crimping electrical connectors for the reason, among others, that the connector is crimped by the application of the compressing force evenly over the crimping area and from diametrically opposite sides. Several tools of the straight action type are commercially available, however, a demand exists for an inexpensive straight action tool which is capable of criming a range of connector sizes. A further desideratum in a tool of this type is that it be capable of incorporating functional parts in addition to crimping die surfaces; for example, it is desirable to provide a wire cutting device and a device for stripping wire insulation on the tool so that the operator with a single tool can perform all of the operations necessary for forming crimped connections without carrying several tools.

It is accordingly an object of the present invention to provide a straight action type compressing tool having a minimum number of parts. It is a further objective to provide a tool having components which can be produced by inexpensive metal forming or working operations such as stamping, and in which the parts can be assembled to each other with a minimum of labor and expense. A further object is the provision of a straight action crimping tool having its parts so arranged that additional working surfaces (other than the crimping surfaces) can be provided to perform wire cutting operations and insulation stripping operations.

These and other objects of the invention are accomplished in a tool which generally comprises a pair of side plates which are secured together by means of fasteners in spaced apart parallel relationship to each other. A sliding plate is positioned between the side plates and guided for rectilinear or straight line motion towards and away from a fixed plate which is also contained between the side plates. The sliding plate is pivotally secured to a handle and the handle in turn has pivotally secured thereto a link which is also connected to the side plates at one end thereof. The link, and the movable handle are pivoted together in such manner that they lie in the same plane and the pivotal connections themselves are such that pinned connections, for example, rivets or the like, are not required.

In the accompanying drawings:

Figure 1 is an exploded view of the parts which form a tool in accordance with the invention;

Figure 2 is a plan view with parts broken away of a tool formed from the parts of Figure 1 with the movable plate in the closed position (i.e. the position assumed at the end of the crimping stroke);

Figure 3 is a view similar to Figure 2 but showing the slidable plate in the open or retracted position;

Figure 4 is a side view of the preferred embodiment taken along the lines 4—4 of Figure 2.

In the disclosed embodiment of the invention, the reference numerals 2, 4 denote a pair of side plates which are secured together in parallel spaced apart relationship by means of a fixed spacer plate 6 and a plurality of rivets

8, 10, 12, 14, and 16. The rivets 8 extend through aligned openings in the plates and in spacer plate 6 while the rivets 10—16 extend directly through openings in the side plates 2, 4. Preferably these latter rivets 10—16 are shoulder rivets in order to assist in maintaining the side plates in their proper spaced parallel relationship. Each of the side plates provides an extension 18, 20 which serves as a fixed handle for the tool and a pin 21 extends through aligned openings in these handles adjacent the ends thereof.

A slidable plate 22 is positioned between side plates 2, 4 and provides on its edge which is opposed to fixed plate 6 a tongue 26 which is received within a conformingly shaped notch 28 in fixed plate 6. This tongue-notch arrangement functions as a guide for slidable plate 22 and additionally limits the travel of this plate towards fixed plate 6. Additional guide means for the slidable plate are provided by means of notches 24*a*, 24*b* through which the rivets 14, 16 extend. It will thus be apparent that slidable plate 22 is limited in its path of motion by the tongue-notch 26, 28 and by the notches 24*a*, 24*b* in cooperation with rivets 14, 16. Slidable plate 22 provides on each side of tongue 26 a plurality of crimping die surfaces 30 and fixed plate 6 provides corresponding die surfaces 32 on each side of notch 28. In the disclosed embodiment four sets of die surfaces are provided so that the tool can be adapted to crimp four different sizes of terminals. The side plates are notched as shown at 33 and 35 to permit access to these die surfaces.

Advantageously, the tool incorporates a bolt cutting feature in accordance with U.S. patent to Wenger, No. 2,560,318, and this can be accomplished by means of a plurality of threaded openings 34 in plate 22 which are adapted to receive the more common sizes of bolts which are used in the electrical arts. Plate 2 provides oversized unthreaded openings 36 which are in alignment with openings 24 when slidable plate 22 is in its retracted position and plate 4 is slotted as indicated at 38 to permit access to the threaded openings 34.

It is also desirable to provide a wire cutting device on a crimping tool and this can be accomplished by means of a notch 40 in plate 4 which is smaller than notch 24*b* and is located such that edges 43, 23 of these notches move past each other as sliding plate 22 moves. Wires can be severed then by inserting them in this notch through notch 24*b* in slidable plate 22, and through notch 45 in plate 2. When the slidable plate moves relatively past the edge 43 of notch 40 the wires will be sheared at the interface between the two adjacent plates 4, 22.

The linkage system for reciprocating plate 22 comprises a substantially circular socket 42 in plate 22 which receives a similarly shaped projection 44 on the end of a movable handle 46. Adjacent projection 44, this handle provides a similar circular socket 48 which receives a complimentary projection 50 provided on one end of a link 52. This link is pivoted at its opposite end by means of pin 21 which extends between fixed handles 18, 20. Advantageously, extensions 18 and 20 are sufficiently wide to completely cover this link when the slidable plate is in the retracted position. Since the pivotal connections are achieved by the interfitting parts 42, 44, 48, 50, the side plates are extended beyond the limits of travel of these connections in order to maintain the parts in assembled relationship.

The operation of the tool will be apparent from Figures 2 and 3. As handle 46 is moved relatively away from fixed handles 18, 20, the slidable plate 22 is retrated or drawn downwardly as viewed in Figures 2 and 3. Upon closure of the handles, the plate moves upwardly toward plate 6 and during this stroke the crimping of a terminal, the shearing of a bolt or the shearing of a wire can be accomplished as previously explained.

A wire insulation cutting and stripping feature is provided on the preferred embodiment on the adjacent edges of link **52** and handle **46** as shown at **56***a* and **56***b*. As is known to the art, the opposed edges are ground or milled to form cutting edges for insulation for the preferred wire sizes so that when the handle and link are brought together, the opposed cutting edges will cut into the insulation of a wire positioned therebetween. The insulation after cutting can then be stripped by pulling the wire out of the insulation which is retained by the edges on the handle and link. When the movable handle is in the position of Figure 2, insulation cutting edges **56***a*, **56***b* are against each other and between side plates **2**, **4**. It is therefore necessary to provide aligned openings **58**, **60** in these side plates in order to permit access to the insulation cutting and stripping edges. One of the advantageous features of the tool is that the side plates function as a guard which prevents the operator from accidentally cutting the palm of his hand as he closes the handles.

It is desirable to provide coverings or grips for the end of handle **46** and for the fixed handle formed by the extensions **18**, **20** and such handle coverings are shown at **62** and **64** in Figures 2–4.

Tools constructed in accordance with the invention offer the advantages of a straight action type crimping tool adapted to crimp a plurality of sizes of terminals, a compound toggle linkage system which permits the development of ample crimping pressures by the application of moderate forces on the handles, and finally the advantages of wire cutting, bolt cutting, and insulation stripping features which, as mentioned above, are desirable adjuncts to a crimping tool. Moreover, a tool constructed in accordance with the invention can be produced by simple manufacturing and assembly processes at a moderate cost and can be made extremely compact. For example, all of the parts of the tool as shown in Figure 1 can be produced by simple punch press operations. If desired, some of these parts may be heat treated for hardness, for example, the die surfaces at **30** and **32**, and the bearing surfaces at the pivotal connections. The tool can be constructed of relatively thin stock material, for example metal stock 0.083 inch in thickness has been used for a tool about 8 inches long which is adapted to crimp terminals for wire sizes AWG 10–22. Notwithstanding the relative thinness of the stock employed, the tool will be found to have adequate strength and will withstand prolonged usage. The use of relatively thin stock is desirable since the weight of the tool can be held to a minimum.

The fact that the tool can be made from relatively thin stock stems from the disclosed arrangement of having the link **52**, and the sliding plate **22** and the end portion of handle **46** retained between the side plates. The importance of this arrangement will be understood if it is observed that link **52**, for example, is compressively stressed when a terminal is crimped and the compressive stresses increase to the maximum level during the final stages of crimping. Since link **52** is comparatively thin in relationship to its length, it will act as a column as the compressive stresses are increased during crimping and tend to flex since columns ordinarily fail because of flexure rather than their being loaded to the ultimate strength of the material of which they are composed. In the case of the instant tool, however, the tendency of link **52** to flex is offset by side plates **2**, **4** which restrain this link against flexure upon loading and for this reason, thinner stock can be used for this link than that which would be required if it were not supported against flexure. In like manner, the sliding plate **22** and the handle **46** can be made from relatively thin stock since these parts are also supported against lateral distortion by the side plates. The side plates have no tendency to flex since they are placed in tension when the tool is used.

In the foregoing paragraph it is pointed out that a tool for crimping terminal sizes AWG 22–10 was made from stock 0.083 inch thick and punch press operations were employed to form these parts. Of course, for a larger tool adapted to crimp larger terminals, it might be found that thicker stock is required and that it will not be possible to form the parts by punch press operations. However, the advantage of the invention of permitting the use of thinner parts than would otherwise be required would nonetheless be obtained.

The assembly of the parts of the tool is also a simple and inexpensive operation since the various components need only be positioned in their proper relative positions and riveted through the aligned openings as shown in the drawing. Finally, an important feature of the tool is that the manufacturing tolerances for the parts need not be maintained within extremely rigid limits to achieve a proper functioning finished device. For example, the relative movement between fixed plate **6** and sliding plate **22** is limited by means of a tongue and notch **26**, **28**. Insofar as the extent to which the terminals are crimped then, manufacturing tolerances must be maintained on this tongue and notch **26**, **28** and on the crimping die surfaces but tolerances are not important as to the other dimensions of the sliding plate. Furthermore, in order for the wire strippers **56***a*, **56***b* to function properly it is necessary that the handle **46** and link **52** move closely against each other. If it is found after assembly of a tool that this cannot be achieved, the handle and link can be forced against each other to bring the insulation cutting surfaces against one another. If this is done, the proper spacing will still be maintained between the crimping dies at **30** and **32** and the additional movement will be taken up by a slight yielding of the rivets **8**.

While we have disclosed a preferred embodiment of our invention, it is not intended that the invention should be limited to the precise structure shown but that it is defined by the following claims viewed in their proper prospective against their prior art.

We claim:

1. A compressing tool comprising a pair of side plates in parallel spaced apart relationship, fixed handle means extending from corresponding ends of said side plates, a spacer having a first crimping die means thereon interposed between and secured to said side plates, a slidable plate having a second crimping die means thereon disposed between said side plates and slidable towards and away from said spacer, movable handle means pivotally connected to said slidable plate, link means pivotally connected at one end thereof to said movable handle means and pivotally anchored at its opposite end between said fixed handle means, said slidable plate, said movable handle means and said link being pivotally connected by interfitting inserts and sockets and being substantially coplanar and of substantially uniform thickness, and said side plates being spaced apart by a distance substantially equal to but slightly greater than said uniform thickness, whereby during use of said tool, said slidable plate, said movable handle and said link, are supported against flexure by said side plates.

2. A tool as set forth in claim 1 wherein said spacer and said slidable plate provide interfitting parts for guiding said slidable plate along a rectilinear path during movement thereof.

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