Feb. 11, 1964 J. L. MIXON, JR 3,120,772

CRIMPING TOOL

Filed Jan. 25, 1961 2 Sheets-Sheet 1

Fig. 1

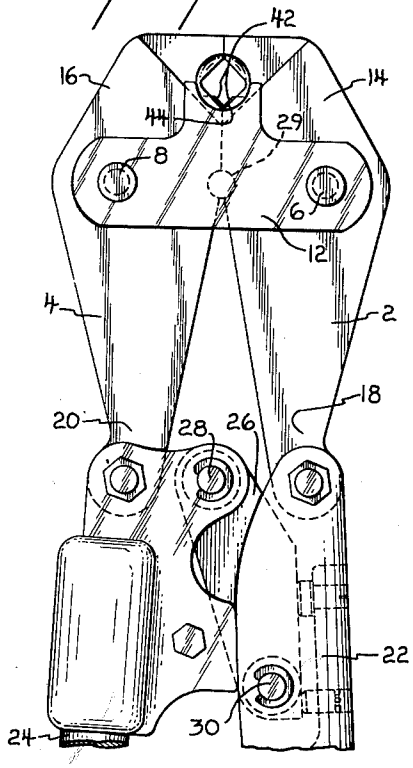


Fig. 2

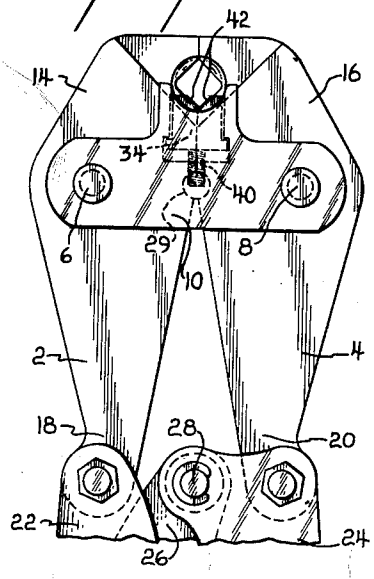


Fig. 3

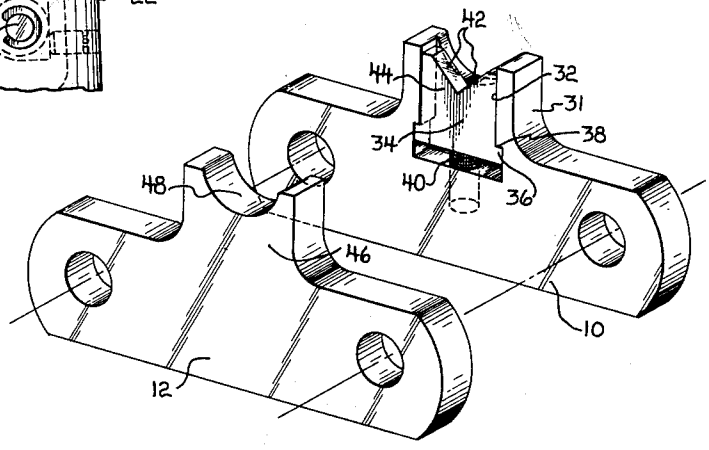
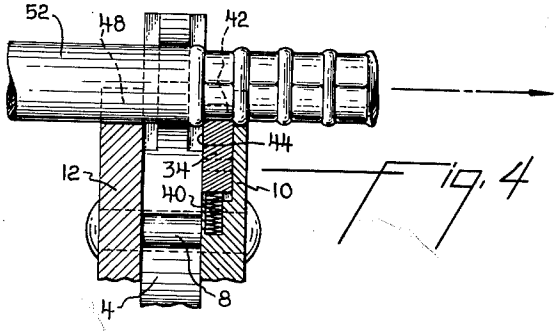


Fig. 4



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Fig. 5

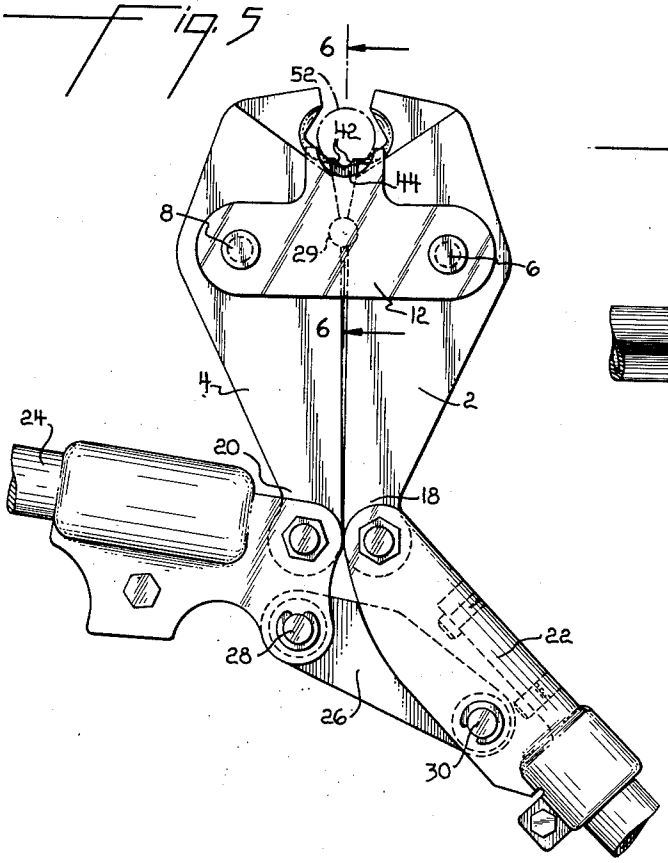


Fig. 6

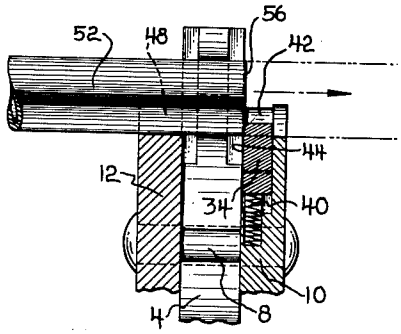
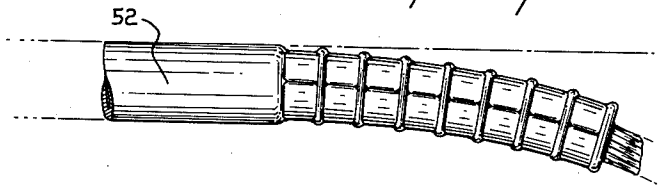


Fig. 7



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3,120,772

CRIMPING TOOL

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This invention relates to crimping tools for electrical connectors, particularly of the type intended for crimping connectors requiring a plurality of evenly spaced crimps.

One commonly used type of electrical connector comprises a tubular member into which the ends of the wires being connected are inserted and which is crimped at a plurality of spaced-apart locations thereby to secure each of the wires to the connector and form an electrical and mechanical union. Connectors of this general type are widely used in the electrical utility field for connecting relatively large wires, e.g. A.W.G. 8 and larger. A relatively high crimping force is required to crimp this type of connector and, in many cases, the crimp must be formed in the field by means of a relatively simple hand tool. The tools themselves are often quite heavy, particularly those intended for the relatively larger connectors, and the operator is also required to exert a relatively high force on the levers to form the crimp. The number of crimps required for a tubular connector of the type under consideration will vary from one connector to another but, in general, it is not uncommon for sixteen or more separate crimps to be required to form the completed connection.

Connectors of this type have been proved to be highly satisfactory but they suffer from the comparative disadvantage of requiring careful workmanship on the part of the operator forming the crimped connection. For best results the individual crimps should be evenly spaced along the length of the connector and this requirement is a burdensome one on the operator for the reason that the tooling used is relatively heavy and a large number of individual crimps are required. It can easily be appreciated that after a technician has formed half-a-dozen or so crimps on a connector, he may become so fatigued that he might fail to locate a crimp at the proper distance along the connector from the preceding crimp. With prior art tools, the correct spacing of the crimps was dependent upon the operators locating the tool precisely at the proper position without the asistance of a locating device.

A further problem arises when connectors of the type under consideration are crimped by means of a plier-type tool having one or both of its jaws pivotally mounted so that the dies on the jaws move relatively towards each other along an arcuate path. When the jaws of a tool of this type are closed, the one side of the movable die or dies moves a greater distance than the other side. As a result, one side of the connector is indented to a greater depth than the other side and the connector is longitudinally extruded on the side of greatest indentation by a greater amount than is the case on the opposite side. When several crimps are made, this differential between the extrusion on the side of the greatest indentation as compared with the opposite side causes the connector to assume an arcuate form since it becomes longer on the side of greatest indentation than on the opposite side. It should be added that this effect is not obtained with straight action type tools (i.e. those which are constructed in a manner such that the dies move along a rectilinear path towards and away from each other) but it would be desirable to avoid it with the pivoted jaw type tools also.

It is accordingly an object of the present invention to provide an improvement to crimping tools of the type used to form a plurality of crimps in an electrical connector. A further object is to provide a crimping tool having locating means thereon to assure uniform spacing of each of the individual crimps along the length of the connector. A still further object of the invention is to provide a crimping tool having supporting means for the connector to avoid arcuate deformation upon crimping thereof. A still further object is to provide a crimping tool having a stop to locate the first crimp formed in a tubular connector at a predetermined distance from the end of the connector.

These and other objects of the invention are achieved in a preferred embodiment comprising a pair of jaws movable relatively towards and away from each other and having crimping dies thereon to crimp a connector onto a wire. A locator is mounted on the tool and has a surface which is complementary to the surface imparted to the connector upon crimping. This locator may be mounted on one of the jaws or, as in the disclosed embodiment, on a strap plate which connects the two jaws. Advantageously, the locator has a resiliently-biased insert on which the above-mentioned conforming surface is provided, this insert being mounted in the strap plate which connects the tool jaws. The plate and/or insert partially cover the opening defined by the dies so that when a first crimp is made on a connector, the end thereof can be positioned against the plate or the insert to locate this first crimp at a predetermined distance from the end. After this first crimp has been made, the above mentioned surface on the locator is positioned against the crimped surface of the connector to locate the second crimp at a predetermined distance from the first crimp.

A further feature of the invention is the provision of a support for the connector on the opposite side of the jaws from the side on which the locator is provided. As explained above, there is a tendency for an initially straight connector to assume an arcuate shape when it is crimped by means of a tool having one or both of its jaws pivoted. The provision of a support for the connector on both sides of the crimping zone will, however, avoid this effect since the added supporting surface causes the connector to stretch on the side which would otherwise be shortened and thereby compensate for the extrusion on the side remote from the pivotal axis of the jaws.

In the drawing:

FIGURE 1 is a frontal view of a preferred embodiment of a tool in accordance with the invention.

FIGURE 2 is a view showing the opposite side of the tool.

FIGURE 3 is a perspective view showing a locator and connector support in accordance with the invention.

FIGURE 4 is a cross sectional view illustrating the operation of the locator.

FIGURE 5 is a view similar to FIGURE 1 showing the jaws in their open positions.

FIGURE 6 is a view similar to FIGURE 4 illustrating the use of the locator in locating the first crimp made in the connector.

FIGURE 7 shows the curving or bowing effect obtained with prior art crimping tools.

In the embodiment shown, the reference numerals 2, 4 denote a pair of jaws mounted on parallel spaced-apart pivotal axes 6, 8 and connected by straps 10, 12. Corresponding ends 14, 16 of the jaws have crimping dies thereon while the opposite ends of the jaws 18, 20 are pivotally connected to handle members 22, 24. These handles are pivotally connected by means of a link 26 and pivot pins 28, 30 so that upon relative movement of the handles towards each other from the positions of FIGURE 5, the die surfaces at 14 and 16 will also move relatively towards each other while rotating about a pin 29 which is positioned between the jaws.

Strap 10 has an extension 31 on its side which is adjacent to the ends 14, 16 of the jaws and this extension has a recess 32 on its side which is against the jaw members 2, 4. A block 34 is mounted in this recess and is normally biased towards the ends of the jaws by means of a spring 40, the amount of movement of the block being controlled by an enlarged end 36 on the block and shoulder means 38 in the recess. The surface 42 of this block is generally V-shaped in the embodiments shown and conform to the surface imparted to the connector when it is crimped by the die surfaces on the jaw ends 14, 16. Additionally, it will be noted that the block provides an abutment surface 44 which faces the dies and normally extends between, but off-set from, the die surfaces.

The strap 12 of the preferred embodiment also has an extension 46 which extends towards the ends 14, 16 of the jaws. The upper surface of this extension is arcuate and conforms to the surface of the uncrimped connector. The extension 46 and block 34 constitute supporting blocks which function to locate the crimps on the connector at evenly spaced intervals and prevent bending of the connector as is described below.

In use, the first crimp in the connector is formed by locating the tool with the end 56 of the connector 52 against the surface 44 or block 34 and closing the handles 24, 22 as shown in FIGURE 6. After this crimp has been formed, the second crimp and each subsequent crimp is formed by positioning the tool with the surface of the previously formed crimp nested in the block 34 on the complementary surfaces thereof. It will be appreciated that the operator can push the tool relatively against the terminal and seat the block surface in the previously formed crimp while he is closing the handles. In prior art tools, by way of contrast, it was necessary for the operator to hold the tool in its proper location relative to the connector but without the assistance of a locating or seating means and this procedure often resulted in the tool being displaced from the ideal location for a given crimp in the series of crimps.

The precise spacing of the multiple crimps along the axis of the connector thus constitutes one of the principle advantages of the invention. An additional advantage is achieved in that the bowing of the connector, as illustrated in FIGURE 7, is avoided. This effect arises when tools of the type shown in FIGURES 1, 2 and 5 are used (but not provided with the locating and supporting means of the invention) by virtue of the fact that the portions of the crimping dies which are remote from pivotal axis 29 move a greater distance than the portions which are close to this pivotal axis. As a result the upper side of the connector (as viewed in the drawing) is extruded to a greater extent than the lower side and the upper side thus elongates more than the lower side. As a result of this differential in the elongation, the connector assumes the arcuate form of FIGURE 7.

In accordance with the instant invention, the connector is supported, on its underside, on each side of the dies, as is apparent from FIGURES 4 and 6, by the surface 48 and by the surface 42 of the block. When the crimp is formed, this supporting arrangement counteracts the tendency of the connector to assume the arcuate configuration of FIGURE 7 by stretching the underside by an amount which equals the differential extrusion between the

underside and the upper side. The effect is analogous to the method of straightening a bent rod by lying it on an anvil with only its ends touching the anvil surface and hammering the rod intermediate its ends. Of course, when a connector is crimped in a tool in accordance with the invention, the connector never becomes bowed (as shown in FIGURE 7) but is prevented from assuming an arcuate shape.

In the particular embodiment of the invention shown in the drawing this anti-bowing feature is augmented by the fact that the surfaces 42 and 48 actually move radially away from the axis of pin 29 as the jaws are closed since the two jaws do not pivot on the axis of pin 29 but rather move over its surface and in doing so the strap members 10, 12 must be moved upwardly as viewed in the drawing. The surfaces 42 and 48 thus not only support the connector on each side of the crimping zone but also tend to bow it in the opposite direction (i.e. upwardly in the drawing) and thus stretch it by a slight amount. If the invention is utilized in a simple crossed-handle plier type tool, this movement of the supporting surfaces is not achieved.

The principles of the invention are applicable to tools other than the precise type of tool herein illustrated. The locating aspect of the invention is applicable to both straight action type tools (in which the dies move along rectilinear paths) as well as tools having pivoted jaw members. The other aspect of the invention, that is the prevention of bowing of the connector, is applicable only to tools having pivoted jaw members.

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.

I claim:

1. A crimping tool for forming a plurality of evenly spaced-apart crimps in a tubular connector comprising, a pair of coplanar jaws pivotally mounted on parallel spaced-apart axes, means for moving corresponding ends of said jaws relatively towards and away from each other, crimping die surfaces on said corresponding ends for crimping said connector upon movement of said ends towards each other, and a block on one side of said crimping die surfaces, said block having a supporting and locating surface complementary to the surface of a crimp formed by said crimping die surfaces, resilient means biasing said block outwardly to a position beyond the location of said connector when said connector is positioned between said jaws preparatory to crimping whereby, a first crimp formed in said connector can be positioned at a predetermined distance from the end of said connector by positioning said connector between said jaws with its end against a side of said outwardly biased block, and after formation of a first crimp, a second crimp can be precisely located and formed by placing said supporting surface of said block against said first crimp and moving said crimping die surfaces toward each other with concomitant compression of said resilient means.

2. A crimping tool for forming a plurality of evenly spaced-apart crimps in a tubular connector comprising, a pair of coplanar jaws pivotally mounted on parallel spaced-apart axes, means for moving corresponding ends of said jaws relatively towards and away from each other, crimping die surfaces on said corresponding ends for crimping said connector upon movement of said corresponding ends towards each other, and blocks on each side of said crimping die surfaces, one of said blocks having a supporting and locating surface complementary to the surface of said connector before crimping, and the second one of said blocks having a supporting and locating surface complementary to the surface of said connector

after crimping, resilient means biasing said second block outwardly to a position beyond the location of said connector when said connector is positioned between said jaws preparatory to crimping whereby, after formation of a first crimp in said connector, said supporting surface of said second block can be positioned against said first crimp with concomitant compression of said resilient means thereby to locate a second crimp a precise distance from said first crimp.

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