CONTACT CRIMPING TOOL EMPLOYING INDIVIDUAL INSULATION AND WIRE CRIMP ADJUSTMENTS PLUS LIGHTWEIGHT HOUSING HAVING SIDE ARMS AND OPPOSED PLATES

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ABSTRACT

A manual tool for attaching an electrical contact hav-
FIG. 2
CONDUCTOR SIDE (PARTLY DISASSEMBLED)

FIG. 3
CONDUCTOR SIDE PLATE

FIG. 4
INSULATOR SIDE (PARTLY DISASSEMBLED)

FIG. 5
EDGE/INTERNAL

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CONTACT CRIMPING TOOL EMPLOYING INDIVIDUAL INSULATION AND WIRE CRIMP ADJUSTMENTS PLUS LIGHTWEIGHT HOUSING HAVING SIDE ARMS AND OPPOSED PLATES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a tool for crimping an electrical contact to the end of a wire, and particularly to such a tool which has improved features of construction and operation. The tool is arranged to receive (1) a contact of the type having a nose (mating) portion, a body (mounting) portion, and a tail (wire-grasping) portion having two pairs of grasping tabs, and (2) the stripped end of a wire. By operation of its handles, the tool crimps the two pairs of tabs around the insulator and conductor portions, respectively, of said wire. The tool contains means for adjusting its crimping jaws to accommodate wires with different sized conductors, as well as different sized insulation sleeves.

2. Description of the Prior Art

Heretofore, tools for crimping a contact to a wire generally were not available with separate means for adjusting the tool to accommodate wires with different insulation and conductor sizes. Those that were available generally had awkward, complex, unreliable, and expensive adjustment means. Accordingly, it is an object of the present invention to provide a tool with improved dual adjustment means.

In addition, prior tools of the hand-held type generally were relatively heavy and thus caused operator fatigue after a relatively short period of use. Such relatively great weight was present because the tool's housing was made of structural metals, e.g., steel, in order to accommodate the manner in which relatively high stresses were produced in such tools during crimping. Accordingly, another object of the present invention is to provide a tool of simplified and improved design which obviates the need for housings of structural materials.

Further objects are to provide improved ram screw adjustment locking means and improved locator return positioning means. Still further objects and advantages of the invention are presented in the ensuing description thereof.

DRAWINGS

FIG. 1 is an exploded view of the tool of the invention.

FIG. 2 shows the crimping mechanism of said tool, viewed from the conductor side thereof.

FIG. 3 shows the conductor side plate of said tool.

FIG. 4 shows the crimping mechanism of said tool, viewed from the insulator side thereof.

FIG. 5 shows the internal operating components of said tool, viewed from an edge direction.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The tool of the invention comprises a housing 10 (FIG. 1) arranged to enclose, guide, and serve as a mounting support for the remaining parts of the tool. Attached to housing 10 are a pair of handles comprising fixed handle 12 and a movable handle 14 which is spring-urged away from handle 12. Connected to and inside the handles and housing 10 is a conventional linkage system 16 (partly shown in FIG. 4) for converting rotary motion of handle 14 to the linear motion of a ram link 18. Threadedly coupled to ram link 18 is a ram screw 20 having a head with eight flat sides, but which can have other even numbers of sides.

Housing 10 comprises a body portion and an upper, inverted U-shaped hoop portion. Two side plates 22 and 24 are assembled flush to the sides of the hoop portion of housing 10. Side plate 22 is termed the "insulator" side plate because it is closest to the insulator-crimping dies of the tool and side plate 24 is termed the "conductor" side plate because it is closest to the conductor-crimping dies of the tool. Each side plate comprises a flat member with a large body portion and an extending finger portion which fits into a correspondingly shaped recess in the body portion of housing 10. Side plates 22 and 24 are mounted to the hoop portion of housing 10 by means of four bolts 26 which pass through holes in insulator side plate 22, holes in the hoop of housing 10, and into threaded engagement in holes of conductor side plate 24. Conductor side plate 24 also contains two pins 28 which are force fit to plate 24 and which also pass through additional holes in the hoop portion of housing 10 and side plate 22 to rigidly couple the side plates to housing 10.

A pair of six-sided cams 34 and 36 are rotatably mounted together and in apertures 30 and 32 in side plates 22 and 24. Cam 34, which has a boss which is pivotally mounted within a socket on cam 36, has six faces with sequentially increased radial spacings for adjusting the position of an "insulator" crimping jaw (see below) in increments. Cam 36 is similarly shaped to adjust the position of a "conductor" crimping jaw (see below) in increments. Both cams 34 and 36 have slotted bosses which protrude from the side plates so that the cams can be adjusted with a screwdriver or coin to any of six numbered positions (indicated at 38 on conductor side plate 24; not shown on insulator side plate 22). The cams can have more or less sides than six.

Mounted to the respective insulator and conductor side plates 22 and 24 just below cams 34 and 36 are the "jaws" of the crimping dies. An "insulator" jaw 40, designed to crimp the insulator-grasping tabs of a contact, is mounted to insulator side plate 22, and a "conductor" jaw 42, designed to crimp the conductor-grasping tabs of a contact, is mounted to conductor side plate 24. Conductor jaw 42 contains a pin boss 44 which fits loosely in an aperture 46 in side plate 24. Aperture 46 intersects a groove 48 in plate 24 in which is mounted a wire spring 50 which overlies aperture 46 (FIG. 3) such that spring 50 must be pushed aside for boss 44 to be inserted in aperture 46. Spring 50 comprises a spring-wire member having two bent ends as shown, one of which fits in an aperture 52 in side plate 24, the other of which presses against the side of groove 48. After boss 44 is inserted and jaw 42 is flush against plate 24, spring 50 presses boss 44 and jaw 42 upwardly, holding jaw 42 against cam 36. Since aperture 46 is larger than boss 44, the position of conductor jaw 42 can be adjusted to six different positions in relation to that of plate 25 by means of conductor cam 36.

Insulator jaw 40 is similarly mounted to insulator side plate 22 (in association with a similar spring 54) and is similarly adjustable by means of insulator cam 34.

A contact of the type which is crimpable by the tool of the present invention is shown in U.S. Pat. No.
3,751,963


Insulator jaw 40 comprises two flat plates which are permanently joined together by press-fit pins. The upper plate has a recess into which the upstanding tabs of the contact tail are driven for crimping. The lower plate has a recess which is slightly lower than that of the upper plate and which is designed to fit around the wire just behind the end of the contact tail, whereby the portion of the face of the lower plate adjacent the recess prevents the insulator-grasping tabs of the contact from spreading rearwardly during crimping.

Conductor jaw 42 contains a crimping recess (with a center divider) on one edge thereof. During crimping, the upstanding “conductor” tabs of the contact are driven into the crimping recess of conductor jaw 42. The large recess in the face of jaw 42 accommodates movement of a locator 70 (see below).

The mating parts of the insulator and conductor crimping dies comprise an insulator anvil 56 and a conductor anvil 58. The insulator anvil 56 has an extending finger 60 with a concave upper surface which is designed to push the bottom surface of the contact, adjacent its insulator grasping tabs, into the crimping recess of insulator jaw 40. Anvil 56 also contains a recess which is shaped to fit around the head of ram screw 20, as indicated in FIG. 4.

Conductor anvil 58 contains a similar extending finger 64, also with a concave upper surface, designed to push the bottom surface of the contact, adjacent its conductor grasping tabs, into the crimping recess of conductor jaw 42. Anvil 58 contains a second recess 66, also shaped to fit around the head of ram screw 20. Anvil 58 also contains a longitudinal recess 68, communicating with recess 66 and designed to accommodate locator 70.

Locator or nest 70 comprises a generally L-shaped member, one leg of which contains an elongated through-hole 72, the other leg of which contains a longitudinal through-slot 78. Locator 70 is mounted to anvil 58 by a pin 74, which extends through hole 72 and which is press-fit into an aperture 76 in anvil 58. Thus locator 70 is permanently coupled to anvil 58 by pin 74, yet is able to slide about pin 74 in slot 64 of anvil 58 to a limited degree by virtue of the elongated shape of aperture 72. Slot 78 in locator 70 is designed to receive and hold the nose portion of the contact to be crimped. Locator 70 also includes a pin boss 71 adjacent hole 72; during downward movement of locator 70, boss 71 meets the lower ledge of recess 73 of conductor side plate 74 to limit downward travel of locator 70 (FIG. 3).

All of the foregoing parts are generally made of cold rolled steel of its equivalent, with the exception of (1) the die parts (jaws and anvils) which are made of hardened tool steel, and (2) housing 10 which, according to one aspect of the invention, can be made of a lighter material, such as aluminum.

OPERATION OF THE PREFERRED EMBODIMENT

Prior to operating the tool, the conductor and insulator cams 34 and 36 are each adjusted to one of their six positions in accordance with the respective sizes of the conductor and insulator of the wire to which a contact is to be crimped. A suitable table correlating various conductor and insulator sizes with the setting numbers (such as 38) on side plates 22 and 24 is provided with the tool.

Thereafter, the contact nose is inserted from the insulator side (FIG. 4) into slot 78 of locator 70. After a predetermined length of insulation has been stripped from the end of the wire, the wire is inserted and held between the tabs of the tail of the contact.

Lever 14 is then squeezed manually toward lever 12, causing linkage mechanism 16 to advance ram link 18 and ram screw 20 upwardly. Ram screw 20 then pushes insulator and conductor anvils 56 and 58 upwardly.

After a short distance of travel, the pin boss 74 on conductor anvil 58 engages the upper side of opening 72 of locator 70 and carries locator 70 upwardly. Since the contact to be crimped overlies fingers 60 and 64 on the insulator and conductor anvils 56 and 58 and is nestled in aperture 78 of locator 70, it will also be pushed and carried upwardly.

The four upwardly extending tabs of the contact are forced by fingers 60 and 64 into the crimp recesses of the insulator and conductor jaws 40 and 42. The tabs are there bent over and crimped around the conductor and insulator of the wire in conventional fashion. The tool preferably includes a conventional anti-reversal ratchet mechanism (not shown) to insure that the crimp dies will be closed tightly enough to make a good crimp before handles 12 and 14 can be opened.

After the contact is crimped to the wire, handles 12 and 14 are released, allowing them to open. This action is coupled to linkage system 16, which causes the head of ram screw 20 to move downwardly, pulling the conductor and insulator anvils 56 and 58, and hence locator 70, downwardly. Locator 70 moves the contact and wire downwardly, clear of jaws 40 and 42 whereby they may be removed as one assembly by simply pulling the wire out of the tool.

When anvil 58 completes its downward movement, locator 70 will be upwardly positioned in relation to anvil 58, i.e., the bottom of slot 72 of locator 70 will be adjacent pin 74, which is fixed to anvil 58; thus contact-receiving slot 78 will be exposed or in a “ready” position, as shown in FIG. 4. Locator 70 cannot assume any lower position than this (e.g., due to gravity) because ledge 73 (FIG. 3) of conductor side plate 24 will block pin boss 71 of locator 70 from further downward movement.

An initial assembly setup of the tool is made by adjusting ram screw 20 so that it extends the precise distance from ram link 18 such that the tool will provide optimum crimps for conductor and insulation sizes corresponding to the settings 38 of cams 34 and 36. The dimension between opposing flat sides at the head of ram screw 20 is just less than that of the spacing of side plates 22 and 24 of the assembled tool, whereby the dimension between opposing corners formed by adjoining sides of said head will be greater than the spacing of side plates 22 and 24. Thus ram screw 20 is locked when the tool is assembled and can be adjusted only when side plates 22 and 24 are disassembled.

During crimping, force is applied by ram screw 20 to push dies 56–40 and 58–42 upwardly, away from the base of housing 10. This force is applied to cams 34 and 36, which in turn transmit it to the sides of apertures 30 and 32 in the insulator and conductor side plates 22 and 24. The force is returned to housing 10 from side plates 24 and 26, mainly by way of pins 28, which bear against the sides of the two center through holes in the
U-shaped hoop of housing 10. By virtue of this arrangement, the crimp force is applied longitudinally to the sides in the hoop of housing 10, rather than to the inner surface of the curved portion thereof as in some prior tools, so that the legs of said hoop will not tend to be pulled together. By virtue of this arrangement it has been found that housing 10 can be fabricated of a less dense and non-structural metal (aluminum) rather than steel. This substantially decreases the weight of the tool, thus extending the time operators can use the tool without fatigue.

Although the above description contains many specificities, these are not intended to limit the scope of the invention, but merely to exemplify one preferred embodiment thereof. The true scope of the invention is intended to be indicated by the subject matter of the appended claims and their legal equivalents.

We claim:

1. A tool for crimping a contact to a wire and comprising a housing arranged to hold a pair of dies, push means, connected to said housing, for moving said dies together and locator means, coupled to one of said dies, for holding a contact in position to be crimped between said dies, characterized in that said housing comprises a pair of spaced arms on opposed sides of said dies for guiding said dies, a pair of side plates attached to said arms and positioned on two further opposite sides of said dies, also for guiding said dies, one of said dies being restrained from moving in response to force transmitted thereto from the other of said dies by a multi-sided cam which can be rotated to adjust the position of said one die and which is rotatably mounted in at least one of said side plates.

2. The tool of claim 1 wherein said push means comprises a threaded member having an even-numbered polygonal head, the diametrical spacings between opposing faces and opposing corners of said head being lesser and greater, respectively, than the spacing between the inside surfaces of said side plates, whereby said threaded member can be rotated to adjust the crimping action of said tool when said side plates are disassembled, but said threaded member will be locked in position when said side plates are assembled.

3. The tool of claim 1 wherein a face of one of said dies is positioned against one of said side plates and has a pin boss which is inserted in an aperture in said side plate, said aperture having a larger diameter than said pin boss, said side plate containing a slot which intersects said aperture, a wire spring mounted in said slot so as to bear against said pin boss of said die when said pin boss is located in said aperture.

4. The tool of claim 1 wherein said locator means is coupled to one of said dies by means which allows a limited amount of relative motion between said locator means and said anvil such that said locator means must follow motions of said anvil beyond said limited amount said locator means having a flat surface which adjoins the inside surface of one of said side plates, said flat surface of said locator means having a protruding member and said inside surface of said one side plate having a ledge positioned so that said protruding member contacts said ledge and limits travel of said locator means when said locator means moves, with said one die, away from the other of said dies.

5. The tool of claim 1 wherein said housing contains two pair of dies, each pair comprising a crimp jaw and an anvil which is moved toward its respective crime jaw by said push means, both of said crimp jaws being restrained from moving in response to force transmitted thereto from said anvils by a pair of multi-sided cams which can be rotated individually to adjust the respective positions of said crimp jaws, each cam being rotatably mounted in a respective one of said side plates, one of said cams being rotatably mounted in the other of said cams.

6. A tool for crimping a contact to a wire and comprising a housing arranged to hold a pair of dies comprising a crimp jaw and an anvil, push means, connected to said housing, for moving said anvil toward said crimp jaw, and locator means, coupled to said anvil, for holding a contact in position for crimping between said crimp jaw and said anvil, characterized in that said housing comprises a pair of spaced arms on opposite sides of said anvil and said crimp jaw for guiding said anvil, a pair of side plates attached to said arms and positioned on two further opposite sides of said anvil, also for guiding said anvil, said push means comprising a threaded member having an even-numbered polygonal head, the diametrical spacings between opposing faces and opposing corners of said head being lesser and greater, respectively, than the spacing between the inside surfaces of said side plates, whereby said threaded member can be rotated to adjust the crimping action of said tool when said side plates are disassembled, but said threaded member will be locked in position when said side plates are assembled.

7. The tool of claim 6 wherein said crimp jaw is restrained from moving in response to force transmitted thereto from said anvil by a multi-sided cam which can be rotated to adjust the position of said crimp jaw and which is rotatably mounted in at least one of said side plates.

8. The tool of claim 6 wherein a face of said crimp jaw is positioned against one of said side plates and has a pin boss which is located in an aperture in said side plate, said aperture having a larger diameter than said pin boss, said side plate containing a slot which intersects said aperture, a wire spring mounted in said slot so as to bear against said pin boss of said crimp jaw when said pin boss is located in said aperture, thereby to yieldably hold said pin boss of said crimp jaw against one side of said aperture of said side plate.

9. The tool of claim 6 wherein said locator means is coupled to said anvil by means which allows a limited degree of relative motion between said locator means and said anvil such that said locator means must follow movement of said anvil beyond said limited degree, said locator means having a flat surface which adjoins the inside surface of one of said side plates, said flat surface of said locator means having a protruding member and said inside surface of said one side plate having a ledge positioned so that said protruding member contacts said ledge and limits travel of said locator means when said locator means moves, with said anvil, away from said crimp jaw.

10. The tool of claim 6 wherein said housing contains two crimp jaws and two anvils which are moved toward said respective crimp jaws by said push means, both of said crimp jaws being restrained from moving in response to force transmitted thereto from said anvils by a pair of multi-sided cams which can be rotated individually to adjust the respective positions of said crimp jaws, each cam being rotatably mounted in a respective one of said side plates, one of saidcams being rotatably mounted in the other of said cans.