HAND TOOL FOR CRIMPING TERMINALS

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Filed June 3, 1966, Ser. No. 555,173

U.S. Cl. 72—338

Int. Cl. B21D 43/28; B21K 27/06

7 Claims

ABSTRACT OF THE DISCLOSURE

Terminals in strip form are crimped onto wires by hand held apparatus comprising die, anvil, and shearing member located against anvil. Terminal strip is inserted into apparatus to locate leading terminal between die and anvil. Apparatus is manually actuated to move anvil relatively towards die until leading terminal is cramped. At the same time, shearing member is moved relatively past anvil to shear leading terminal from the strip. Hand held strip is then laid aside and the strip is inserted into terminal. Apparatus is again actuated to complete movement of anvil towards die and crimp the terminal onto the wire.

Background of the Invention

The present invention relates to hand tools for crimping contact terminals in strip form onto the ends of wires. Many types of electrical contact terminals are produced in the form of a continuous strip, either ladder type or end-to-end, for convenience and economy in manufacturing and for convenience in application to wire ends. Strip form terminals are ordinarily, and advantageously, applied to wire ends by means of automatic crimping machines which feed the strip to the crimping dies during each cycle of operation. Very high production rates can be achieved with such machines. These crimping operations are usually carried out in a production plant at a location remote from that at which the terminals are put to use.

There is always a necessity for crimping individual terminals onto wire ends in the field and at locations remote from the production facility having the automatic crimping machines. For example, it might be discovered that a particular terminal in an electronic device has been damaged and must be removed and replaced. Under such circumstances, the technician must repair the equipment by removing the terminal and crimping a new terminal onto the wire end with a suitable hand tool. The terminals are frequently quite small and the tools for performing these field crimping operations should be inexpensive and relatively simple because of the relatively limited use they receive. The present invention is thus directed to the problem of providing a suitable hand tool for crimping terminals in strip form onto the end of wires.

It is an object of the invention to provide an improved tool for crimping strip form terminals onto wire ends. A further object is to provide a hand tool which takes advantage of the fact that the terminals are manufactured in strip form. A further object is to provide a compact tool which can be used in restricted areas, for example, to apply a terminal to a wire which is already in a piece of equipment. A still further object is to provide a foolproof device which can be used by a technician having little training and which will always produce a high quality crimped connection.

These and other objects of the invention are achieved in a preferred embodiment of a tool comprising a crimping die and a crimping anvil, the anvil being adapted to support an individual contact terminal or connecting device during crimping. The die and anvil are movable in a first direction relatively towards each other. One side of the anvil comprises a wire insertion side from which the wire onto which a terminal is to be crimped is inserted and this side also defines a terminal strip shearing plane. A shearing member is disposed in this plane against the one side of the anvil and means are provided for concomitantly moving the shearing member in a direction opposite to the above-mentioned first direction while moving the anvil in the first direction. In use, the leading terminal of a short section of terminal strip is positioned on the anvil by the technician. The technician then squeezes the tool handles to cause the shearing member to move in the above-mentioned opposite direction and to cause the anvil to move in the first direction toward the die. During the initial stages of such movement, the leading terminal is sheared by the shearing member from the strip and the sheared off terminal is tightly gripped between the die and anvil and thus held in the tool. The technician is then relieved of the necessity of holding the terminal strip and can position the wire with his free hand in the crimping portion of the terminal. He then further squeezes the handles of the tool to crimp the female portion of the terminal onto the wire end. The preferred embodiment thus takes advantage of the fact that the terminals are manufactured in strip form in that the technician need not handle an extremely small individual terminal but rather handles a convenient length of the terminal strip.

In the drawing:

FIGURE 1 is a front view with parts broken away of a preferred form of hand tool in accordance with the invention;

FIGURE 2 is a side view of the upper portion of the tool of FIGURE 1 taken along the lines 2—2 of FIGURE 1;

FIGURES 3 and 4 are views taken along the lines 3—3 and 4—4 of FIGURES 2 and 3 respectively;

FIGURE 5 is a view similar to FIGURE 3 but showing the positions of the parts at a time midway through the operating cycle after the leading terminal has been sheared from the terminal strip;

FIGURE 6 is a view similar to FIGURE 5 but showing the positions of the parts at the end of the operating cycle;

FIGURE 7 is a perspective view of a section of terminal strip, the terminals being connected together head to tail in the strip shown;

FIGURE 8 is a view similar to FIGURE 1 of an alternative embodiment of the invention;

FIGURE 9 is a view similar to FIGURE 8 but showing the position of the parts at a time midway through the crimping cycle; and

FIGURE 10 is a perspective view of a section of terminal strip of a type adapted to be cramped onto wire ends by the tool of FIGURE 8.

The disclosed embodiment of the invention is adapted to crimp terminals of the type shown in FIGURE 7 onto the ends of wires. These terminals are manufactured in the form of strip 2, each terminal comprising a generally prismatic contact portion 4, a U-shaped ferrule forming portion 6 which is adapted to be cramped onto the conducting core 10 of the wire and a ferrule forming portion 8 which is adapted to be cramped onto the insulation 12 of the wire. The individual terminals of the strip are connected to each other by a separate slug 14 which is severed from the strip at the time of crimping as scrap material. This connecting slug 14 in the strip 2 is provided primarily for convenience of manufacturing and in feeding the strip in an automatic crimping machine. As will be explained below, the invention can be used in tools adapted to crimp terminals which do not have connecting slugs of this type.
Referring now to FIGURE 1, tool 16 in accordance with the invention has a housing 18 from which a fixed handle 20 extends. A movable handle 22 is pivoted within the housing 18 to the mechanism that effects reciprocating motion of a pair of spaced apart slide members or rams 24 when the handles are squeezed. In FIGURE 1, these ram members are shown in their lowered positions so that opening of the handles will cause these ram members to move upwardly from the position shown in FIGURE 1. The actual mechanism within the housing 18 may be of the type shown in U.S. Patent 2,892,368 or of any other suitable type. For purposes of the present invention it need only be said that squeezing of the handles causes the ram members 24 to move downwardly. Advantageously a full stroke compelling mechanism 25 is provided on the handles in order to insure that the technician will go through the complete operation when he crimps an electrical terminal, such mechanisms being described in detail in U.S. Patent 2,618,993.

The head portion of the tool comprises a frame 26 which is removably mounted in the housing 18 by means of a pin 28 extending between the sidewalls of the housing 18 and through a suitable notch in the frame piece and a latch arm 30 which cooperates with a notch in the frame piece. This arrangement for removably mounting operating tools of the type shown is described in detail in application Ser. No. 532,393, filed Mar. 7, 1966, by Martin Luther Klingler.

A downwardly extending cavity 32 is provided on the upper side of the frame piece and a centrally located passageway 34 extends downwardly toward the housing 18 from the floor of this cavity. A channel-shaped carrier 36 for the crimping dies and other tooling has a pair of parallel legs 38 which extend through the passageway 34 and which have a pin 40 extending between their lower ends. The ram members 24 have notches on their upper ends into which the ends of this pin extend so that downward movement of the ram members 24 causes the carrier 36 and the tooling mounted therein to be moved relative downwardly towards the tooling mounted in the cavity 32.

This tooling in the cavity 32 comprises a first shearing member 42, an anvil block 44, and a second shearing member 46. The anvil block 44 is being mounted in the cavity by screws 48 and 56 which extend through the sides of the frame member, through slots 50, 56 in the shearing members, and which are threaded into openings in the anvil block 44. The shearing member 42 is biased upwardly and against the underside of screw 48 (FIGURE 3) by means of a spring 52 which bears against the underside of the shearing member 42 and which is seated in suitable recesses 54 in the floor of the cavity 32. The shearing member 46 is biased upwardly and against the underside of screw 56 by means of a similar spring 58 seated in a recess 60. These shearing members can be moved downwardly within the limits defined by the slots 50, 56 as will be explained below.

The upper surface of the anvil block 44 is provided with a centrally located rib 62, the right-hand portion of which (as viewed in FIGURE 3) functions as a support surface 64 for the ferrule forming portions 6, 8 of the terminal. Immediately adjacent to the support surface, the rib is cut away or notched as shown at 66 so that the contact portion is not directly supported in the tool. The shearing member 46 has a slot 68 which is adapted to receive the connecting tab or slug 14 of the terminal with the exact portion of the slug 14 being disposed against the shearing plane 69 so that this connecting slug will be cleanly severed from the contact portion during the operating cycle of the tool.

The front side 70 of the anvil block (which faces rightwardly in FIGURE 3) constitutes a shearing plane for shearing the leading terminal portion of the strip (shown at position in the tool in FIGURE 3) from the next adjacent terminal. The shearing member 42 has an upwardly extending portion 72 which is normally above the terminal supporting surface 64 of the anvil block. A central opening 74 is provided in this portion of the shearing member, the diameter of this opening being sufficient to admit the terminal strip to the mechanism shown in FIGURE 3. Thus, when the terminal is properly inserted in the tool (FIGURE 3), the connecting tab of the leading terminal will be located in the slot 68 and the front portion of the connecting tab 14 of the next adjacent terminal will extend to the shearing plane 70.

The tooling contained in the U-shaped carrier 36 comprises a first die block 76, a second die block 77, a first depressor 82, and a second depressor 92, this tooling being held in assembled relationship by means of fasteners 78, 80 which extend through the die blocks and into the shearing blocks as shown. The depressor block 82 has a pair of spaced-apart downwardly extending legs 84 which are adapted to bear against the upper surface of the projection 72 of the shearing block on opposite sides of the center of the opening 74, see FIGURE 2. The die block 76 has a depending arm on the lower end of which is provided forming surfaces 86 for curling the sidewalls of the ferrule forming portion 8 of the terminal inwardly towards each other and in embracing relationship with the insulation 12 of the wire. The die block 77 has a similar depending arm 88 which has similar forming surfaces 90 adapted to curl and crimp the ferrule forming portion 6 of the terminal into crimped relation to the insulation of the wire. The die block 77 is cut away on its right-hand side, as seen in FIGURE 3, to form a recess 102 within which a stripper or knock-out punch 104 is mounted, this punch being resiliently biased downwardly by means of a spring 106. The end of this punch is so located that it will contact the terminal on the anvil between the ferrule forming portions 6 and 8 to remove the terminal from the tool after completion of the crimping operation. The depressor block 92 has a slot 94 extending upwardly from its underside to provide clearance for an additional stripper device comprising an arm 96 which extends from a shank 98 mounted at 100 on the external surface of the housing 18. The arm 96 extends transversely across the contact portion 4 of the terminal and, like the knock-out punch 104, facilitates removal of the terminal from the tool after crimping.

In use, the terminal strip and associated core wire usually have a supply of sections of strip similar to the strip 2. The strip may be of any length but should be of a length most convenient for handling. When the technician wishes to crimp an individual terminal onto a wire end, he merely inserts the strip through the opening 74 and between the anvil block and the upper tooling, and the connecting slug 14 at the rear end of the slug is disposed in the cavity of the terminal. After the notch 68 as shown in FIGURE 3. He then squeezes the handles to cause relative downward movement of the head portion 36 in the upper tooling until the depressor 84 moves against the upper surface of the projection 72 on the shearing block 44 and depresses this shearing block until the parts reach the position shown in FIGURE 5. During such relative downward movement of the shearing block, the terminal strip will be sheared in the plane of the side 70 of the anvil block and the technician can then lay the strip aside and turn his attention to the operation of inserting the wire into the terminal. It should also be noted that when the parts are in the position of FIGURE 5, the terminal will be held in the tool by the punch 104 and by the forming surfaces 86, 90 of the crimping dies. The connecting slug 14 of the terminal in the tool will not yet have been severed from the terminal since the depressor 92 will not have moved the shearing block 46 downwardly.

The technician can then grasp the wire 12 and position the stripped end portion 10 of the ferrule forming portion 6 in the terminal. The shearing member 42 will be held in its depressed position (FIGURE 5) and will not interfere with this wire inserting operation. After thus positioning the wire, the operator further squeezes...
the tool handles until the parts are in the positions shown in FIGURE 6 at which time the terminal will be crimped onto the wire and the connecting slug 14 will have been sheared from the contact portion in the plane of the side 60 of the block. This movement then opens the handles causing relative upward movement of the upper tooling and removes the terminal from between the crimping dies and anvils. If the terminal should tend to stick in the dies, it will be removed gently by the punch 104 and by the arm 96 as the head moves relatively upward.

FIGURE 8 illustrates an alternative embodiment of the invention. The tool shown in FIGURE 8 is adapted to crimp terminals in the form of a ladder strip or side strip 2'. In this type of strip, the individual terminals extend from a carrier strip 106 and are otherwise similar to the terminal strip of FIGURE 7 in that they have a contact portion 4', a crimp or ferrule-forming portion 6' adapted to be crimped onto the core of the wire and a crimp portion 8' adapted to be crimped onto the insulation of the wire. The contact portion comprises a fork-like contact member and this strip is not, of course, provided with connecting slugs such as the slug 14.

The tool of FIGURE 8 is identified by the same reference numerals, differentiated by prime marks, as are used for the previously described embodiment. This tool differs from the embodiment of FIGURE 1 in that the shearing member 46 is replaced by a fixed block 108 which is adapted to support the end portion of the contact section 4' of the terminal. Block 108 has a stop shoulder 109 which locates the terminal properly in the tool. The upper depressor 92 of the embodiment of FIGURE 1 is replaced by a plunger or hold-down device 110 which is resiliently biased downwardly and which functions to clamp the contact portion of the terminal against the block 108 during crimping. The shearing block 42' in the tool of FIGURE 8 has an upper surface 112 which is adapted to support the carrier strip 106 during crimping. The depressor block 82' has a lower surface 114 which, during downward movement of the tool head, moves against the carrier strip and pushes the carrier strip and the block 42' downwardly to effect the shearing operation. This depressor member 82' is also provided with an elongated opening 116 which is in alignment with the ferrule-forming portions 6', 8' of the terminal after the carrier strip has been sheared so that the wire can be inserted through the opening as indicated in FIGURE 9 in the manner previously described with reference to the embodiment of FIGURE 1. This opening must be sufficiently large to permit the crimped terminal to be extracted therethrough after completion of the crimping operation.

It has been found that tools in accordance with the invention are extremely convenient for crimping terminals in strip form onto wire ends at locations remote from production facilities at which crimping operations are usually carried out. Thus, the tool of the invention is useful for repairing or replacing terminals on equipment which is already installed in its final environment. The disclosed form of tool takes advantage of the fact that the terminals are in strip form in that it does not require separations of these terminals into individual units prior to their being positioned in the tool. Where the terminals are quite small, as is frequently the case, the handling of an individual terminal is much more difficult and tedious than the handling of a strip of terminals several inches long. By virtue of the fact that the strip can be laid aside by the technician after the parts reach the position of FIGURE 5, the technician can give his full attention to the precise and exacting job of positioning the wire end in the terminal.

Many alternative embodiments of the invention will be apparent to those skilled in the art. For example, many terminals in end-to-end strip form do not have the connecting slug 14 of the strip 2. Under such circumstances, the shearing member 46 is not required and the shearing member 42 should be such as to shear the next adjacent terminal from the leading terminal without damage to this next adjacent terminal. Many tools also shown in ladder strip form with the terminals in spaced apart parallel relationship and integral with a carrier strip. Under such circumstances, the invention can be utilized by rearranging the parts in a manner such that the leading terminal will be positioned between the dies while attached to the carrier strip and will be severed from the carrier strip during the operating cycle.

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.

We claim:
1. A hand tool for crimping electrical connecting devices in strip form onto the ends of wires comprising, a crimping die and a crimping anvil, means for moving said anvil in a first direction relatively towards said die, one side of said anvil comprising the wire insertion side thereof, a shearing member disposed in the plane of said wire insertion side, said shearing member comprising a spiral strip, means for moving said shearing member in the direction opposite to said one direction and for simultaneously moving said anvil relatively towards said die whereby, upon positioning the leading terminal of a hand held terminal strip between said die and anvil and upon relative movement of said anvil, said anvil is moved in said one direction and relative movement of said shearing member in said other direction, said leading terminal is sheared from said strip and gripped between said die and anvil, and said strip can be discarded, and a wire can be positioned in said terminal and said terminal is crimped onto said wire and said anvil relatively towards each other.

2. A hand tool for crimping electrical connecting devices in strip form onto the ends of wires comprising, a crimping die and a crimping anvil, said anvil being adapted to support one of said connecting devices during crimping, said anvil being movable in a first direction relatively towards said die, one side of said anvil comprising a wire insertion side, said one side defining a shearing plane, a shearing member disposed in said plane, depressing means for concomitantly moving said shearing member in a direction opposite to said one direction and for relatively moving said anvil in said one direction whereby, upon positioning the leading terminal of a hand held strip on said anvil and relatively moving said anvil in said one direction and relatively moving said shearing member in said opposite direction, said leading terminal is sheared from said strip and lightly gripped between said die and anvil, and upon insertion of a wire into said terminal and further relative movement of said anvil in said one direction towards said die, said terminal is crimped onto said wire.

3. A device as set forth in claim 2 wherein said connecting devices are in end-to-end strip form with a connecting slug between adjacent connecting devices, said tool having a second shearing member on the side of said die opposite to said one side, said second shearing member having a recess for reception of the connecting slug on said leading terminal of said strip, and including means for relatively moving said second shearing member in said opposite direction, during engagement of said anvil in said one direction whereby, connecting slug is severed from said leading terminal.

4. A device as set forth in claim 2 wherein said terminal strip comprises a ladder strip, said shearing member being effective to sever said leading terminal from said ladder strip.
5. A tool as set forth in claim 2 wherein said die and said depressing means are mounted in a tool head, said shearing member and said anvil being disposed in a tool frame, said head being movable towards said frame, said shearing member being resiliently mounted in said frame for movement in said opposite direction upon engagement with said depressing means.

6. A device as set forth in claim 5 wherein said depressing means comprises a block in said tool head, said block having a lower end portion engageable with said shearing member and having an opening therein to permit positioning of said wire in said tool after partial movement of said head towards said frame and severing of said leading terminal from said strip.

7. A method of crimping terminals in strip form onto the ends of wires comprising the steps of:
   manually inserting the leading end of a short length of strip into a crimping apparatus and locating the wire barrel portion of the leading terminal of said strip between the die and anvil of said apparatus, manually actuating said apparatus to move said die and anvil relatively towards each other, until said leading terminal is held between said die and anvil, and concurrently actuating a shearing means in said apparatus to shear said leading terminal from said strip,
   interrupting the movement of said dies relatively towards said anvil and laying aside said strip, manually inserting a wire into the wire barrel portion of said leading terminal and again actuating said apparatus to complete the movement of said die relatively towards said anvil and crimp said terminal onto said wire.

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U.S. Cl. X.R.

29—203; 72—410