

THIS SHEET HAS BEEN
REPLACED

A Wire Placing Tool

The invention relates to a tool for placing and, if necessary, cutting to length electrical conductors, with a housing suitable for connection of placing means, e.g., an industrial robot, with a placing finger which is arranged on the working side of the housing and in which a guide channel for a conductor is formed, and with means for advancing the conductor and cutting it to [the proper] length.

Wire placing tools of this type are known from, say, DE-OS 36 06 059, DE-OS 36 11 805, and DE-OS 38 20 636. They are used mainly for producing wire harnesses but they can be used for wiring components of machinery etc., too. The mouth of the guide channel of the placing finger is transferred to a particular point of connection at which the wire protruding from the guide channel is placed and contact with it is established. The wire is cut in a proper so-called cut-to-length module of the tool, which precedes the placing finger proper and is arranged at a considerable distance from the mouth of the wire guide channel.

Thus, these tools do not allow cutting the wire at the very point of contact. Yet this is particularly desired when the connection point is provided with a cut-clamp-contact, i.e., when the wire is connected with the so-called cut-clamp technique ["insulation-piercing cut-clamp blade technique"].

Therefore, the problem underlying the invention is to create a wire placing tool which has a simple structure and is particularly suitable for connecting wires with the cut-clamp technique, wherein the wire can be optionally cut at the respective connection point or can be run off to some other point after contact has been established.

In order to solve this problem, the above-identified tool according to the invention is characterised in that it has a pressure-application member which is arranged near the lateral mouth of the guide channel for the wire issuing from the mouth of the guide channel, is supported to be movable substantially across the axial direction of the guide channel near its mouth, and is coupled to proper placement means by which it can be adjusted between a standby position far from the mouth and a working position in which it extends beyond the edge of the mouth of the guide channel with a pressure-application surface substantially flush with the upper side of the edge of the mouth, and in that the wire-severing means are arranged cooperatively with a region of the wall of the guide channel near its mouth opening.

- 1 -

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 2 -

When the placing finger has been appropriately placed, the pressure-application member makes it possible to press the wire portion which issues from the mouth of the guide channel of the placing finger directly into the blade clamping slit of a terminal configured as a cut-clamp terminal. Since the means for cutting the wire are arranged near the mouth of the guide channel, severing the wire at the terminal renders a very short free end of the wire which can be accommodated in a shock-proof manner by suitable measures near the cut-clamp terminal without need for further measures for insulation, etc.

In a preferred embodiment, the pressure-application member has near the pressure-application surface a bridge region aligned with a wire issuing from the mouth of the guide channel, with the width of the bridge across the direction of the wire being substantially smaller than, or equal to, the wire diameter. The bridge region is conveniently delimited at least on one side by regions of greater width. It is ensured in this way that, upon being urged into the cut-clamp slit, the piece of wire is properly supported over the required length so that it cannot deviate in the pressing-in operation. If necessary, a protrusion can be provided on one side of the bridge and the protrusion by itself may be movable, if required. Thus, at the exit from the mouth of the guide channel, the wire may be bent under an angle, if required, and this regardless of whether it is cut, or not cut, at the associated point of contact.

As a rule, it is advantageous to have the bridge on both sides bounded by regions of greater width, one of which is contiguous with the surface of the placing finger next to the mouth of the guide channel so that, in the placement operation, the wire receives the necessary support as soon as it exits the mouth of the guide channel.

In a convenient embodiment, the cutting means comprise a knife adapted to be moved along the placing finger and having a knife blade which is movably mounted above a substantially horizontal portion of the guide channel. With respect to obtaining good cutting conditions, the knife blade is advantageously provided with a least one cutting edge which is inclined relative to the associated wall of the guide channel, has a cutting edge tip adapted to be pressed onto the associated wall of the guide channel, and is situated near the mouth of the guide channel. Thus, the wall of the guide channel forms the counterblade or the anvil at which the wire is severed. The point of cutting

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 3 -

can be situated close to the mouth of the guide channel. Since the anvil cut takes place in the guide channel proper, one obtains the advantage that practically no lateral space is required. After extended operation, only the cutting edge of the knife need be reground. The wear of the placing finger is insignificant. If necessary, the guide channel's wall region which serves as the counterblade or the anvil for the cutting edge can be made from a material particularly suitable for this purpose and can be configured even replaceable at, say, an insertion part.

Excellent space relations are obtained when the pressure-application member is supported in longitudinally movable fashion very close to the placing finger, while the knife blade can be supported, likewise in longitudinally movable fashion, next to the pressure-application member at the placing finger and/or the pressure-application member. As indicated above, the pressure-application member proper can be composed of a single part or of a number of parts. In the latter case, the wire path at the respective terminal can be influenced individually on both sides of the cut-clamp slit by bending the wire under an angle or deflecting it, for example, close to the cut-clamp slit.

The drawing shows an embodiment of the object of the invention. There show:

- Figure 1, a partially cut-open side view of a placement tool according to the invention to illustrate the state of leaving a connection point that was contacted,
- Figure 2, a front view, from below, of the placing finger of the wire-placing tool,
- Figure 3, a section along line III-III of Figure 1 of the placing finger of the tool shown in Figure 1,
- Figure 4, the placing finger of the wire-placing tool according to Figure 1 in a corresponding view illustrating the state after pressing the wire into the cut-clamp slit of a connection terminal,
- Figure 5, the placing finger according to Figure 4 in a corresponding view illustrating the state as wire is being severed.

The wire-placing tool has a housing 1 schematically shown in Figure 1, which is adapted to be attached to an industrial robot. On the working side of the housing 1 there protrudes from below a vertical placing finger 2 of substantially rectangular, narrow cross sectional form (Figure 3), which is

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 4 -

usually made from steel. The placing finger 2 is affixed to the housing 1 at 3; in it there is a guide channel 4 for a wire 5 which is supplied by a reel, not shown in detail. Before the placing finger 2 inside the housing there are arranged conveying means for the wire 5, which are indicated in the form of two program-controlled conveying roller pairs 7, each connected through a drive belt. Besides that, a controlled clamping device exists at 8 for the wire 5.

The guide channel 4 is substantially L-shaped. It has a substantially vertical portion 41 (Figure 1) which over a 90° arch is followed by a portion 42 which is curved like the arc of a circle and leads, in turn, to a short, substantially horizontal portion 43 from which the wire 5 issues to the outside through a mouth 10 situated on a flat vertical surface 9 of the placing finger 2. In a groove 11 of the placement tool (Figure 3), which is delimited by parallel sides, there is guided in longitudinally movable fashion a rectangular knife blade 12 one end of which is coupled to a program-controlled placement device indicated at 13 in Figure 1 and the other end of which is provided with an inclined cutting edge 14. The cutting edge 14, which extends over the major part of the width of the knife blade 12, is situated in a slit-like recess 15 of the placing finger 2 above the mouth 10 of the guide channel 4 in which wire 5 is additionally guided by a guide pin 16. Together with the cutting edge 16, with which an acute angle is included, it forms a cutting tip 18 which is situated within the recess 15 close to the opening 10 of the guide channel 4.

Thus, the knife blade 12 is arranged above the arched portion 42 and the horizontal portion 43 of the guide channel 4 so that its cutting tip 18 can cooperate with the lower bottom wall of the horizontal guide channel portion 43 which acts as a counterblade or anvil, as can be inferred from Figure 5.

Besides that, a pressure-application member 19 configured as a stamp is guided to be longitudinally movable in a grooved guide 20 (Figure 3) laterally from, and close to, the knife blade 12. The pressure-application member 19 can be optionally moved forward or backward in the vertical direction relative to the placing finger 2 through a program-controlled actuating device indicated at 21.

The pressure-application member 19 is formed with a pressure-application surface 22 on its front face, with the pressure-application surface extending over its major part on a horizontal plane and intended to bear on a wire

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 5 -

issuing from the mouth 10 and to support the same.

As can be recognized particularly in Figure 2, the vertical surface of the placing finger 2 is followed first by a pressure-application surface portion 23 which is substantially rectangular and has the same width as the placing finger 2. This narrow pressure-application surface portion 23 is centrally followed by a narrow rectangular bridge 24 bordered by a downwardly bent protrusion 25 which, in turn, has approximately the width of the placing finger 2.

Because of the arched curvature of the portion 42 and the intrinsic elasticity of the wire 5 the same would coil upwards in the form of a spring upon exiting from the mouth 10. The objective of the protrusion 25 is to prevent this and to press the wire downward near the cut-clamp terminal during the contact-establishing operation.

Figure 1 shows the state in which the wire exiting from the mouth 10 of the placing finger 2 is contacted in a preceding step at a connection point in a connection terminal 26. On both sides of a cut-clamp terminal 28 provided with a cut-clamp slit 27, the connection terminal 26 has a groove-like recess which has rectangular cross section and is limited by straight surfaces.

After the ensuing pressing of the wire 5 into the cut-clamp slit 27 of the connection terminal 26 by the pressure-application member 19, as described with the aid of Figure 4, the pressure-application member 19 is for a short time driven into the upper position illustrated in Figure 1, in which it does not obstruct the exit of the placing finger 2 from the right, groove-like recess 29 of the connection clamp 26. As soon as the placing finger 2 has receded from the terminal 26 at which contact was made, the pressure-application member 29 goes under program control downward into a position in which the pressure-application surface 29 rests on the wire 5 issuing from mouth 10 and counters its tendency to coil.

With the pressure-application member 19 in this position, the placing finger 2 is in the proper position placed above another terminal 26 so that it stands above the associated groove-like recess 29.

Then the placing finger 2 and the pressure-application member 19 are lowered; they enter into the groove-like recess 29 of the terminal 26, and, as a consequence, the wire portion exiting from the mouth 10 is pressed into the cut-clamp slit 27 of the cut-clamp terminal 28. Thus, the state shown in Figure 4 results.

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 6 -

There the wire portion is supported on both sides of the cut-clamp slit 27 by the region 23 and the protrusion 25, whereas support is obtained at the cut-clamp slit proper through the front face of the bridge 24 the width of which across the direction of the wire is smaller than, or at most equal to, or slightly greater than, respectively [sic!], the diameter of the wire 5. The protrusion 25 presses the wire 5 onto the bottom of the associated groove-like recess 29. In an other embodiment, it can be controlled separately by itself, for which purpose the pressure-application member 19 is divided into two parts, which are supported in movable fashion at each other and separately controllable, as indicated by the partition line at 30 with dashed lines in Figure 1.

After pressing the wire 5 into the cut-clamp slit 27 as shown in Figure 4, the knife blade 12 is moved into the position of cutting as per Figure 5, in which the cutting tip 18 in cooperation with the bottom wall of the horizontal portion 43 of the guide channel 4 severs the wire 5 directly at the side of the cut-clamp terminal 28.

If necessary, at this point the bottom wall of the horizontal guide channel portion 43 can be additionally inclined downward so that a downward orientation of the severed end of the wire 5 is obtained also on this side of the cut-clamp terminal 28. In other words, also there the same effect as that of the protrusion 25 can be achieved.

After termination of the cutting operation, the placing finger 2 is lifted; the pressure-application member 19 and the knife blade 12 return to their standby position according to Figure 1 and the wire-placing operation is continued.

The lower end of the placing finger 2 is rounded at the "edge" facing the guide pin 16; it can be likewise rounded or wedge-shaped at the corresponding front edge. This measure intends to facilitate the passage of wire support elements in the wiring operation when the wire support elements have retaining elements which can be deflected elastically and which close automatically after passage of the placing finger.

873z/jrb

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

- 7 -

Claims



1. A tool for placing and, if necessary, cutting to length, electrical conductors, with a housing suitable for connection of placing means, e.g., an industrial robot, with a placing finger which is arranged on the working side of the housing and in which a guide channel for a conductor is formed, and with means for advancing the conductor and cutting it to length, characterised in that it has a pressure-application member (19) which is arranged near the lateral mouth (10) of the guide channel (4) for the wire (5) issuing from the mouth of the guide channel, is supported to be movable substantially across the axial direction of the guide channel near its mouth, and is coupled to proper placement means (21) by which it can be adjusted between a standby position far from the mouth (10) and a working position in which it extends beyond the edge of the mouth of the guide channel (4) with a pressure-application surface (22) or is substantially flush with the upper side of the edge of the mouth, and in that the wire-severing means (12) are arranged cooperatively with a region of the wall of the guide channel near its mouth opening (10).

2. The tool according to Claim 1, characterised in that the pressure-application member (19) has near the pressure-application surface (22) a bridge region (24) aligned with a wire issuing from the mouth (10) of the guide channel, with the width of the bridge across the direction of the wire being substantially smaller than, or equal to, the diameter of the wire (5).

3. The tool according to Claim 2, characterised in that the bridge region (24) is bounded at least on one side by at least one region (23; 25) of greater width.

4. The tool according to Claim 2 or 3, characterised in that a protrusion (25) is provided on at least one side of the bridge (24).

5. The tool according to Claim 4, characterised in that the region of increased width (23; 25) has the same width as the placing finger (2).

873z/jrb

This Sheet Has Been Replaced





THIS SHEET HAS BEEN
REPLACED

- 8 -

6. The tool according to any one of Claims 2 to 5, characterised in that the bridge region (24) is on both sides bounded by regions of increased width (23, 25), one of which (23) is contiguous with a surface (9) of the placing finger next to the mouth (10) of the guide channel (4).
7. The tool according to any one of the preceding claims, characterised in that the wire-severing means comprise at least one knife with a knife blade (12), with the knife being guided to be movable along the placing finger (2) and the knife blade movably arranged above a substantially horizontal portion of the guide channel (4).
8. The tool according to Claim 7, characterised in that the knife blade (12) has at least one cutting edge (14) inclined relative to the associated wall of the guide channel (4).
9. The tool according to Claim 8, characterised in that the knife blade has a cutting edge tip (18) adapted to be pressed onto the associated wall of the guide channel.
10. The tool according to Claim 9, characterised in that the cutting edge tip (18) is situated near the mouth (10) of the guide channel.
11. The tool according to any one of the preceding claims, characterised in that the pressure-application member (19) is supported at the placing finger (2) to be movable in the longitudinal direction.
12. The tool according to Claims 7 and 11, characterised in that the knife blade (12) is movably supported at the placing finger (2) and/or the pressure-application member (19) after the pressing member (19).
13. The tool according to any one of Claims 2 to 13, characterised in that the pressure-application member (19) is composed of a number of parts and that a pressure-application surface section is associated with each of the parts.

873z/jrb

This Sheet Has Been Replaced

