

Apparatus for inserting electrical terminals into an electrical connector housing

There are described in US—A—4,055,889 and US—A—4,087,908, apparatus for inserting electrical terminals, each secured to an end of an electrical wire, into cavities opening into a forward surface of an electrical connector housing, the apparatus comprising a jig for locating the housing with its forward surface facing in a given direction, means spaced from the jig, for supporting a wire, with the terminal thereon in substantial axial alignment with, and facing, a cavity of the housing when the housing is located by the jig, means for moving the wire axially relative to the wire supporting means and towards the cavity to insert the terminal thereinto and means for guiding the terminal during such movement so that it enters the cavity.

In these known apparatus, the terminal is inserted into the cavity by means of a pair of jaws, which grip the wire at a position back from the terminal and move the wire towards the cavity. During such movement of the wire, the terminal is guided into the cavity by means of a pair of guide fingers which are closed about the terminal prior to the jaws being closed about the wire. Since the tooling just described is somewhat crowded in the vicinity of the forward face of the housing, the known apparatus are of use only where the housing has but a single row of cavities.

According to the present invention, however, apparatus as defined in the first paragraph of this specification are characterised in that the wire guiding means comprises a tunnel one end of which is proximate to the forward surface of the housing and in alignment with the cavity, the wire moving means comprising a pair of wire feed wheels positioned at the opposite end of the tunnel, a mechanism being provided for bringing the circumferential surfaces of the wheels into engagement with a wire supported by the supporting means, at opposite sides of the wire at a point on the wire, and means also being provided for driving both of the wheels at the same speed as one another but in opposite directions to one another with the circumferential surfaces of the wheels engaged with the wire to drive the wire along the tunnel and towards the cavity.

Since only the one end of the tunnel is proximate to the housing, the apparatus can be used where the housing has a plurality of rows of cavities (which may be closely spaced), without interference between the wire insertion tooling of the apparatus and the wires that project from terminals which have already been inserted into cavities of the housing during previous cycles of operation of the apparatus.

Despite the fact that the wire feed wheels are positioned at the end of the tunnel remote from the housing, the substantial resistance to insertion, of the terminals, is overcome since both of the feed wheels are driven. The fact that both

feed wheels are driven, makes for positive control of the wire. The tunnel can be dimensioned closely to receive the wire so that it does not buckle. The wire feed wheels can conveniently be reversed, to cause a pull test to be applied to the inserted terminal.

There is disclosed in US—A—3,245,135, an apparatus in which a wire is driven by feed wheels along a slot in a rotary drum. One of the wheels is an idler wheel and the wire, to which no terminal is secured, is driven towards a pair of dies spaced substantially from the drum, which crimp a terminal to the leading end of the wire.

US—A—3,817,127 discloses a machine for stripping ribbon cable. A pair of driven feed wheels feed the cable axially between a pair of grooved templates into a cable slitting area.

Various apparatus for inserting electrical terminals into housings are disclosed in US—A—4,164,065, US—A—4,074,424, US—A—3,329,002 and US—A—3,964,147.

For a better understanding of the invention, an embodiment thereof will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of apparatus for inserting electrical terminals, each on an end of an electrical wire, into cavities in an electrical connector housing;

Figure 2 is a perspective view of a wire guiding and terminal insertion assembly of the apparatus, to which a wire has been fed by a wire transfer carriage, a wire guiding lid of the assembly being shown in an open position, and a pair of wire feed wheels thereof in a retracted position;

Figure 2A is a perspective view of part of a modified wire guide channel member of the lid;

Figure 3 is a view similar to that of Figure 2 but showing the lid closed and in cross-section;

Figure 4 is a similar view to that of Figure 3 but showing the feed wheels in an advanced, wire feeding position;

Figure 5 is a similar view to that of Figure 4 but showing a wire after having been driven by the feed wheels to insert the terminal thereon into a cavity in the housing;

Figure 6 is a top plan view of the apparatus showing the lid in its open position and the wire transfer carriage and a cam carriage of the apparatus, in a retracted position;

Figure 7 is a fragmentary side view of Figure 6, shown partly in section;

Figure 8 is a fragmentary side view of the apparatus, shown partly in section, showing the cam carriage and the wire transfer carriage in an advanced position;

Figure 8A is a fragmentary side view of the apparatus, shown partly in section, showing the wire transfer carriage near the end of its return stroke towards its retracted position;

Figures 9 and 10 are views taken on the lines

IX—IX and X—X, respectively, of Figure 7 and Figure 6, respectively;

Figure 11 is a similar view to that of Figure 10, but showing the lid in its closed position;

Figure 12 is a fragmentary side view of the apparatus, shown partly in section, showing the lid in its closed position and the feed wheels in their retracted position;

Figure 13 is a similar view to that of Figure 12 but showing the feed wheels approaching their advanced position;

Figure 14 is a fragmentary side view of the apparatus, shown partly in section, showing the feed wheels in their advanced position and in engagement with a wire;

Figure 15 is an end view of the apparatus; and

Figure 16 is a timing diagram illustrating the sequence of operation of parts of the apparatus.

The terminal insertion apparatus, which is generally referenced 2, and its operation will now be described in outline with reference to Figures 1 to 5.

The apparatus 2 is constructed to insert terminals 4 (shown as being of circular cross-section), each crimped to an end portion 5 of a wire 6, into terminal receiving cavities 8 opening into a forward surface 9 of an insulating, electrical connector housing 10 adjustably located in a jig in the form of a housing support 12. Prior to the insertion of a terminal 4, the wires 6 are advanced laterally of their length by a wire transfer carriage 14 having notches 16 in which the wires are cradled. The carriage 14 intermittently advances the wires 6 across a track 15 and dwells when a wire 6' on the carriage 14 has come to rest on a wire guide platform 18 with the wire 6' extending across a wire locating slot 20 in the platform 18, with the leading end portion 5 of the wire 6', adjacent to the terminal 4' thereon, just beyond the slot 20, the wire 6' being substantially aligned for insertion of its terminal 4' into one of the cavities 8, by the notch 16 in which the wire 6' is cradled. The wire 6' is positioned on the platform 18 with the terminal 4' on the wire 6' facing the cavity 8. The trailing end of a wire 6'', the terminal of which was previously inserted into a cavity 8, is moved clear of the slot 20 as the carriage 14 reaches its dwell position.

A wire insertion guide lid 24 is now closed against the platform 18 about hinges 26 on a wire delivery platform 17, by linkage means described below. During closure of the lid 24, wire locating fingers 34 move, as indicated in broken lines in Figure 3, into the slot 20 and align the wire 6' with a guide channel 36 in the lid 24 which channel now provides a wire guiding tunnel in co-operation with the guide platform 18. The tunnel has a cross-section which is sufficient to permit free axial movement of the wire 6' down the tunnel without significant lateral movement of the wire 6'. The channel 36 shown in Figure 2, is of uniform cross-section

throughout its length and is intended for use with terminals which do not need to be radially oriented with respect to the cavities 8.

The channel 36' in the modified wire insertion guide lid member 24a shown in Figure 2A has an enlarged portion 37 and inclined terminal entry surfaces 39 and 41 for radially orientating a rectangular cross-section terminal (not shown). The guide lid member of the lid 24 is interchangeable for use with different terminals. The lid member 24a is made up of three sections to facilitate machining its channel portions 37, 39 and 41.

During closure of the lid 24 an ejector arm 28 moves into an ejector slot 30 in the platform 18, which is substantially nearer to the support 12 than the slot 20, so as to push the wire 6' clear of the platform 18 as shown in Figure 3. The wire 6' is now in the tunnel provided by the channel 36 and platform 18, as shown in Figure 3, ready to be driven down the tunnel by master and slave feed wheels, 22 and 23, respectively. The feed wheels 22 and 23 are then advanced to their wire driving position, by raising them from the position of Figures 2 and 3 to that of Figure 4 so that their circumferential surfaces 32 and 33 are in proximity to the wire 6' on either side thereof, the housing 10 having been repositioned in the support 12 for reception of the terminal 4', in the next vacant cavity 8. In the present embodiment, this repositioning is done manually.

A slave feed wheel carriage 126 carrying the wheel 23, and the lid 24, are so shaped as to guide the wire 6' on either side of the feed wheels 22 and 23, so as to restrain buckling of the wire 6' in the vicinity of the feed wheels during the insertion of the terminal 4' into its cavity 8. The wheels 22 and 23 are now moved together so that their surfaces 32 and 33 engage the wire 6' at opposite sides at a point on the wire 6', as shown in Figure 5. The wheels 22 and 23 are then rotated in opposite senses by an electric motor 134, as described below, whereby the wire 6' is driven axially towards the housing 10 until the terminal 4' is inserted into its cavity 8, upon which the wheels 22 and 23 are stopped. The wheels 22 and 23 are now reversed briefly, to exert a pull test on the wire 6' to ascertain that the terminal 4' is properly retained in the cavity 8, as described in detail below. The wheels 22 and 23 are then retracted, i.e. lowered, to their initial position (Figures 2 and 3) as the lid 24 is opened again and the wire transfer carriage 14 is returned in preparation for the next cycle of operation of the apparatus 2.

The apparatus 2 will now be described in greater detail.

As shown in Figure 1, an electric motor (not shown) turns a crank shaft 44 by means of a sprocket wheel 40, connected to the shaft of the motor, and a drive belt 42. The motor 43 runs continuously but is intermittently disconnected from the crank shaft 44 by a clutch

on the crank shaft 44. As will be apparent from Figure 7, the rotation of the shaft 44 is translated into linear movement of a cam carriage 38 by means of a crank 48 and a connecting rod 50. The rod 50 is connected to a transverse rod 54 in the cam carriage 38 by means of ball and socket joint 52 (Figure 6).

As best seen in Figures 7 to 13, the carriage 38 has a series of linear cams mounted thereon and these will now be described in order of their operation.

A wire transfer cam 60 acts during an advance stroke thereof, on a wire transfer cam follower 62 on a triangular take up arm 64, to cause the alarm 64 to rotate in an anti-clockwise (as seen in Figures 7 and 8) sense about a wire transfer cam pivot 66 mounted to the frame 57 of the apparatus 2. The arm 64 is shaped to convert the movement of the cam carriage 38 into a more limited linear movement of a platen 68 mounted to the apex of the arm 64 through a pin 70 and slot 72 connection, and being connected to the carriage 14 by springs 76.

The platen 68, (best seen in Figure 9) is also pivotally connected to the wire transfer carriage 14 by means of a shaft 74 shown in cross-section in Figure 9, and rides beneath the wire delivery platform 17 on a roller 75. As the platen 68 and the carriage 14 move through a wire delivery stroke, from the position of Figure 7 towards that of Figure 8, a bypass cam follower 86 on the carriage 14, riding on the upper (as seen in Figure 7) cam surface of a bypass cam 88, causes the cam 88 to swing, against the action of a light return spring 92, in an anti-clockwise (as seen in Figure 7) sense about a bypass cam pivot 90 mounted on the frame 57. There is no relative vertical movement between the platen 68 and the carriage 14 during the wire delivery stroke. At the beginning of the advance stroke of the carriage 14, as shown in Figure 7, a wire 6 is dropped between a guide plate 80 on the frame 57 and a pressure pad 78 on the frame 57. The advance movement of the wire transfer carriage 14 causes pawls 82 on the pad 78 to rise, against the action of springs 84 in the pad 78 which holds a series of wires 6 in the notches 16 in the transfer carriage 14, as the carriage 14 pushes the wires across the track 15. The cam follower 86 moves clear of the bypass cam 88, during the advance of the carriage 14, so that the lefthand (as seen in Figure 8) end of the cam 88 rises.

When the carriage 14 is returned i.e. is retracted, to be loaded with another wire 6, the bypass cam follower 86 rides down the lower (as seen in Figure 8A) cam surface of the bypass cam 88 which is held stationary by the frame 57 (see Figure 8A) so that the carriage 14 is depressed towards the platen 68 thereby compressing the springs 76, as shown in Figure 8A, so that the wires 6 on the track 15 are not damaged by being squeezed between the

carriage 14 and the pad 78. When the return stroke of the carriage 14 has been completed, the bypass cam follower 86 rises through a slot 87 in the bypass cam 88.

The return stroke of the carriage 14 is effected by means of a striker 107 (Figure 8A), mounted on the cam carriage 38 and which bears against a stroke plate 109, mounted on the platen 68. The action of the striker 107 is assisted by a transfer carriage return spring 108 mounted between the pin 70 on the platen 68 and the frame 57.

Following the engagement of the wire transfer cam 60 with the wire transfer cam follower 62, a lid cam 94 (Figures 9 to 11) on the cam carriage 38 engages a lid cam follower 96 on a lid cam follower arm 98 which is thus pivoted in a clockwise (as seen in Figures 10 and 11) sense about a pivot pin 100 to cause a link 102 on the arm 98 to rise, and a pivot arm 104 on the link 102 to swing in an anti-clockwise (as seen in Figures 10 and 11) sense to close the lid 24 about its hinges 26, as shown in Figure 11. The link 102 is adjustable (by means not shown) to ensure that the lid 24 is closed positively but without causing undue stress upon any of the lid linkage components. A slot 106 in the delivery platform 17 permits passage both of the link 102 and of the arm 104.

As shown in Figures 12 and 13, a feed wheel cam block 110 on the cam carriage 38, has an upper, wheel raiser cam surface 112 and a lower, wheel closer cam surface 114. The cam surface 112 acts on a wheel raiser cam follower 116 as the block 110 is moved to the left (as seen in Figures 12 and 13) to raise, to the position of Figure 12, the slave wheel carriage 126 and a master feed wheel carriage 118 carrying the wheel 22 and being journaled to a vertical shaft 120 fixed to the frame 57, by journal boxes 122 mounted on the carriage 118. In this position of the carriages 118 and 126, the wheels 22 and 23 lie on either side of the wire 6' on the platform 18. The wheel closer cam surface 114 now acts on a wheel closer cam follower 124 to cause the wheel carriage 126 to pivot in a clockwise (as seen in Figures 13 and 14) sense about a wheel closer pivot 128 so that the circumferential surfaces 32 and 33 of the feed wheels 22 and 23 engage the wire 6' between them. This movement of the carriage 126 also causes a slave feed wheel gear 130 to mesh with a master feed wheel gear 132 so that the wire feed motor 134 which drives the master feed wheel 22 by way of a drive shaft 136, also drives the slave feed wheel 23, but in the opposite direction to the master feed wheel 22. The arrangement of the wheels 22 and 23 and the gears 130 and 132 in the wheel carriages 118 and 126 is shown in cross-section in Figure 14.

The timing of the operations described above is illustrated schematically in Figure 16, in which:—

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Line A indicates the angular position of the crank shaft 44;

Line B indicates the advance (wire transfer) and return movements of the cam carriage 38;

Line C indicates the opening and closing movements of the lid 24;

Line D indicates the raising and lowering of the feed wheels 22 and 23;

Line E indicates the opening and closing movements of the feed wheels 22 and 23; and

Line F indicates the duration of forward and reverse running of the wire feed motor 134.

The advance movement of cam carriage 38 is effected by a 180° rotation of crank shaft 44, at which point, the clutch automatically disengages, thereby halting the carriage 38. Two limit switches (not shown) close when the apparatus is ready to insert the wire 6' into the connector housing 10. One of these switches is closed by the cam carriage 38 at the limit of its advance, and the other is closed by the closure of the lid 24 against the guide platform 18. These switches energise the wire feed motor 134, which operates at a preset speed to drive the feed wheels 22 and 23 which feed the wire 6' towards the connector housing 10.

After an initial delay of about 200 milliseconds after the wire feed motor 134 has been energised, a forward current detector (not shown) is enabled to detect the rise in the current taken by the motor 134 when the load on the motor 134 increases as a result of the insertion of the terminal 4' into the housing 10. The starting current of the motor 134 is quite high, in order to overcome the inertia of the gears 130 and 132, the feed wheels 22 and 23 and wire 6'. The 200 millisecond delay ensures that the forward current detector does not detect the starting current instead of the terminal insertion current, of the motor 134. The terminal insertion current is a measure of the increased torque on the feed wheels 22 and 23 resulting from resistance met by the terminal 4' when entering the cavity 8. Usually the terminal 4' will need to penetrate a moulded rubber gasket (not shown) on the housing 10 and to flex retaining means (not shown) in the cavity 8, which snap over an annular retaining shoulder on the terminal 4' when it has been fully inserted into the cavity 8. The terminals 4 shown, which are circular cross-section pin terminals, need not be in any particular angular orientation for insertion into the cavities 8. Where the terminals do, however, need to be angularly orientated, the channelled member of the lid 24 must be exchanged. For example for square cross-section terminals (not shown) according to US-A-3,363,224, the modified lid member 24a shown in Figure 2A should be used.

When the terminal insertion current has reached a value which is determined by the terminal insertion resistance as well as the kinetic energy of the wheels 22 and 23 and the wire 6', the supply voltage to the motor 134 is

reversed by means of a solid state switch (not shown). For a period of time of about 30 milliseconds, which period is adjustable by the operator, the reverse current is limited only by the armature resistance of the motor 134 and the available power, thereby to eliminate the kinetic energy stored in the armature of the motor 134 as quickly as possible and so rapidly to stop the motor 134, to prevent buckling of the wire 6' in the tunnel and consequent damage to insulation of the wire by the circumferential surfaces 32 and 33 of the feed wheels 22 and 23. The effect of the kinetic energy of the gears 130 and 132, feed wheels 22 and 23 and wire 6' is small at this time, since all these components have slowed down or have stalled during the insertion of the terminal 4'.

After said adjustable period of time and when the motor 134 has been stopped by the reverse current, the reverse voltage is maintained at a lower value by a torque limiting circuit (not shown) which allows the armature of the motor 134 to reverse direction and pull the wire 4' with a force preset by the operator, to carry out the wire pull test mentioned above. If the test is successful, the motor 134 is stalled, whereas if the test is unsuccessful the wire 6' is retracted. The duration of said adjustable period of time is set so as to be long enough for a defectively inserted terminal 4' to be retracted to a desired axial position. At the end of such period, a signal is transferred to the clutch so that the crank 48 is returned through 180° to complete the cycle of the apparatus 2.

Claims

1. Apparatus for inserting electrical terminals (4), each secured to an end of electrical wire (6), into cavities (8) opening into a forward surface (9) of an electrical connector housing (10), the apparatus comprising a jig (12) for locating the housing (10) with its forward surface (9) facing in a given direction, means (14, 15) spaced from the jig (12), for supporting a wire (6'), with the terminal (4') thereon in substantial axial alignment with, and facing, a cavity (8) of the housing (10) when the housing (10) is located by the jig (12), means (22, 23) for moving the wire (6') axially relative to the wire supporting means (14, 15) and towards the cavity (8) to insert the terminal (4') thereinto and means (18, 36) for guiding the terminal (6') during such movement so that it enters the cavity (8); characterised in that the guiding means comprises a tunnel (18, 36) one end of which is proximate to the forward surface (9) of the housing (10) and in alignment with the cavity (8), the wire moving means comprising a pair of wire feed wheels (22 and 23) positioned at the opposite end of the tunnel (18, 36), a mechanism (38, 110, 128, 126) being provided for bringing the circumferential surfaces (32, 33) of the wheels (22 and 23) into engagement with a wire (6') supported by the supporting means

(18)

Line A indicates the angular position of the crank shaft 44;

Line B indicates the advance (wire transfer) and return movements of the cam carriage 38;

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After an initial delay of about 200 milliseconds after the wire feed motor 134 has been energised, a forward current detector (not shown) is enabled to detect the rise in the current taken by the motor 134 when the load on the motor 134 increases as a result of the insertion of the terminal 4' into the housing 10. The starting current of the motor 134 is quite high, in order to overcome the inertia of the gears 130 and 132, the feed wheels 22 and 23 and wire 6'. The 200 millisecond delay ensures that the forward current detector does not detect the starting current instead of the terminal insertion current, of the motor 134. The terminal insertion current is a measure of the increased torque on the feed wheels 22 and 23 resulting from resistance met by the terminal 4' when entering the cavity 8. Usually the terminal 4' will need to penetrate a moulded rubber gasket (not shown) on the housing 10 and to flex retaining means (not shown) in the cavity 8, which snap over an annular retaining shoulder on the terminal 4' when it has been fully inserted into the cavity 8. The terminals 4 shown, which are circular cross-section pin terminals, need not be in any particular angular orientation for insertion into the cavities 8. Where the terminals do, however, need to be angularly orientated, the channelled member of the lid 24 must be exchanged. For example for square cross-section terminals (not shown) according to US—A—3,363,224, the modified lid member 24a shown in Figure 2A should be used.

When the terminal insertion current has reached a value which is determined by the terminal insertion resistance as well as the kinetic energy of the wheels 22 and 23 and the wire 6', the supply voltage to the motor 134 is

reversed by means of a solid state switch (not shown). For a period of time of about 30 milliseconds, which period is adjustable by the operator, the reverse current is limited only by the armature resistance of the motor 134 and the available power, thereby to eliminate the kinetic energy stored in the armature of the motor 134 as quickly as possible and so rapidly to stop the motor 134, to prevent buckling of the wire 6' in the tunnel and consequent damage to insulation of the wire by the circumferential surfaces 32 and 33 of the feed wheels 22 and 23. The effect of the kinetic energy of the gears 130 and 132, feed wheels 22 and 23 and wire 6' is small at this time, since all these components have slowed down or have stalled during the insertion of the terminal 4'.

After said adjustable period of time and when the motor 134 has been stopped by the reverse current, the reverse voltage is maintained at a lower value by a torque limiting circuit (not shown) which allows the armature of the motor 134 to reverse direction and pull the wire 4' with a force preset by the operator, to carry out the wire pull test mentioned above. If the test is successful, the motor 134 is stalled, whereas if the test is unsuccessful the wire 6' is retracted. The duration of said adjustable period of time is set so as to be long enough for a defectively inserted terminal 4' to be retracted to a desired axial position. At the end of such period, a signal is transferred to the clutch so that the crank 48 is returned through 180° to complete the cycle of the apparatus 2.

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(14, 15), at opposite sides of the wire (6') at a point on the wire (6'), and means (134, 130, 132) also being provided for driving both of the wheels (22 and 23) at the same speed as one another but in opposite directions to one another with the circumferential surfaces of the wheels (22 and 23) engaged with the wire (6') to drive the wire (6') along the tunnel (18, 36) and towards the cavity (8).

2. Apparatus according to Claim 1, characterised in that the wheel driving means comprises an electric motor (134) associated with an electrical circuit for detecting an increase in the torque on the feed wheels (22, 23) and being arranged to stop them when the torque has reached a predetermined value consequent upon the insertion of the terminal (4') into the cavity (8).

3. Apparatus according to Claim 2, characterised in that the means for stopping the feed wheels (22, 23) comprises a current reversing circuit arranged to be set to operate for a predetermined period of time after the torque on the feed wheels (22, 23) has reached the predetermined value, to eliminate the kinetic energy stored in the armature of the motor (134), the predetermined period of time being such as to cause the motor (134) and thus the feed wheels (22, 23) to stop rapidly enough to ensure that the wire (6') does not buckle.

4. Apparatus according to Claim 1 or 2, characterised by means for reversing the rotation of the feed wheels (22 and 23) to cause them to apply a pull test to the inserted terminal (4').

5. Apparatus according to any one of the preceding claims, characterised in that the tunnel is defined by a channel (36) in a lid (24), and a wire supporting platform (18), means (38, 98, 104) being provided for opening the lid (24) to allow the wire (6') to be positioned on the platform (18) and for closing the lid (24) to confine the wire (6') in the tunnel.

6. Apparatus according to Claim 5, characterised in that the platform (18) has a slot (20) therein, dimensioned to receive wire locating fingers (34) on the lid (24) during closure thereof, to align the wire (6') with the channel (36).

7. Apparatus according to Claim 5 or 6, characterised in that the platform (18) has a further slot (30) therein positioned substantially nearer to the jig (12) than the first mentioned slot (20), the further slot (30) being dimensioned to receive a wire ejector arm (28) on the lid (24) during closure thereof, to eject the wire (6') from the platform (18) after the terminal (4') has been inserted into the cavity (8) and subsequent to the lid (24) having been opened again to allow a further wire (6') to be positioned on the platform (18).

8. Apparatus according to Claim 5, 6 or 7, characterised in that the feed wheels (22 and 23) are movable towards the wire (6') on the platform (18) in an open position with their circumferential surfaces (32 and 33) spaced

from one another to allow the wire (6') to be received between them, the feed wheels (22, 23) being closed about the wire (6') when their circumferential surfaces (32 and 33) have been positioned on opposite sides of the wire (6').

9. Apparatus according to Claim 8, characterised in that a wire transfer carriage (14) is intermittently advanceable towards the platform (18) to position a wire (6') thereon, when the lid (24) is in its open position and when the feed wheels (22 and 23) are in their open position, so that the wire (6') is aligned with the space between the circumferential surfaces (32 and 33) of the feed wheels (22 and 23).

10. Apparatus according to Claim 9, characterised in that the advance of the wire transfer carriage (14), the closure of the lid (24) and the closure of the feed wheels (22 and 23) about the wire (6'), are effected by a single stroke of a single cam carriage (38) carrying cams (60, 94 and 110) which act sequentially upon cam followers (62, 96, 116) connected to the wire carriage (14), the lid (24) and the feed wheel carriage (118).

Patentansprüche

1. Vorrichtung zum Einsetzen elektrischer Anschlüsse (4), die jeweils an einem Ende eines elektrischen Drahtes (6) befestigt sind, in Hohlräume (8), die zu einer Vorderseite (9) eines elektrischen Verbindergehäuses (10) geöffnet sind, mit einer Haltevorrichtung (12), mit der das Gehäuse (10) mit seiner Vorderseite (9) in eine gegebene Richtungweisend festlegbar ist, einer Einrichtung (14, 15) im Abstand von der Haltevorrichtung (12), die einen Draht (6') abstützt, wobei der daran befindliche Anschluß (4') im wesentlichen mit einem Hohlraum (8) des Gehäuses (10) axial ausgerichtet und diesem zugewandt ist, wenn das Gehäuse (10) mittels der Haltevorrichtung (12) in seiner Lage gehalten ist, einer Einrichtung (22, 23), mittels der der Draht (6') axial gegenüber der Drahtstützeinrichtung (14, 15) und zum Hohlraum (8) bewegbar ist, um den Anschluß (4') in den Hohlraum einzusetzen, und einer Einrichtung (18, 36), mittels der der Anschluß (6') während dieser Bewegung so geführt wird, daß er in den Hohlraum (8) eintritt, dadurch gekennzeichnet, daß die Führungseinrichtung einen Tunnel (18, 36) aufweist, dessen eines Ende der Vorderseite (9) des Gehäuses (10) benachbart und mit dem Hohlraum (8) ausgerichtet ist, daß die Drahtbewegungseinrichtung ein Paar Drahtzuführräder (22 und 23) aufweist, die am entgegengesetzten Ende des Tunnels (18, 36) angeordnet sind, daß eine Vorrichtung (38, 110, 118, 126) vorgesehen ist, mittels der die Umfangsflächen (32, 33) der Räder (22 und 23) mit einem von der Stützeinrichtung (14, 15) abgestützten Draht (6') an entgegengesetzten Seiten des Drahtes (6') an einer Stelle des Drahtes (6') in Eingriff bringbar sind, und daß eine Einrichtung (134, 130, 132) vorgesehen



ist, die beide Räder (22 und 23) mit der gleichen Geschwindigkeit aber in entgegengesetztem Sinn antreibt, wobei die Umfangsflächen der Räder (22 und 23) mit dem Draht (6') in Eingriff stehen, um den Draht (6') längs des Tunnels (18, 36) und zu dem Hohlraum (8) vorwärtszubewegen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Radantriebsvorrichtung einen Elektromotor (134) aufweist, der einer Elektrischen Schaltung zum Feststellen einer Zunahme des Drehmomentes an den Zustellrädern (22, 23) zugeordnet und so angeordnet ist, daß er diese anhält, wenn das Drehmoment nach dem Einsetzen des Anschlusses (4') in den Hohlraum (8) einen vorherbestimmten Wert erreicht hat.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß die Einrichtung zum Anhalten der Zuführräder (22, 23) eine Stromumkehrschaltung aufweist, die so angeordnet ist, daß sie zum Betrieb während einer im voraus bestimmten Zeitspanne einstellbar ist, nachdem das Drehmoment an den Zustellrädern (22, 23) den vorherbestimmten Wert erreicht hat, um die im Anker des Motors (134) gespeicherte kinetische Energie auszuschalten, wobei die im voraus bestimmte Zeitspanne derartig ist, daß der Motor (134) und damit die Zuführräder (22, 23) veranlaßt werden, rasch genug anzuhalten, um zu gewährleisten, daß sich der Draht (6') nicht verwirft.

4. Vorrichtung nach Anspruch 1 oder 2, gekennzeichnet durch eine Einrichtung zum Umkehren der Drehung der Zuführräder (22 und 23), um sie zu veranlassen, den eingesetzten Anschluß (4') einer Zugprüfung zu unterziehen.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Tunnel von einer Rinne (36) in einem Deckel (24) und einer Drahtstützplattform (18) begrenzt ist, wobei eine Einrichtung (38, 98, 104) vorgesehen ist zum Öffnen des Deckels (24) damit der Draht (6') auf der Plattform (18) angeordnet werden kann, und zum Schließen des Deckels (24) um den Draht (6') in dem Tunnel einzugrenzen.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß in der Plattform (18) ein Schlitz (20) ausgebildet ist, der so bemessen ist, daß er den Draht lokalisierende Finger (34) am Deckel (24) während des Schließens desselben aufnimmt, um den Draht (6') mit der Rinne (36) auszurichten.

7. Vorrichtung nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß in der Plattform (18) ein weiterer Schlitz (30) ausgebildet ist, der wesentlich näher an der Haltevorrichtung (12) angeordnet ist als der zuerst genannte Schlitz (20), und daß der weitere Schlitz (30) so bemessen ist, daß er einen Drahtausstoßarm (28) an dem Deckel (24) während des Schließens desselben aufnimmt, um den Draht (6') von der Plattform (18) weggestoßen, nachdem der Anschluß (4') in den Hohlraum (8) eingesetzt

wurde und im Anschluß an das erneute Öffnen des Deckels (24), um einen weiteren Draht (6') auf der Plattform (18) anordnen zu können.

8. Vorrichtung nach Anspruch 5, 6 oder 7, dadurch gekennzeichnet, daß die Zuführräder (22 und 23) zu dem Draht (6') auf der Plattform (18) in geöffneter Stellung bewegbar sind, wobei ihre Umfangsflächen (32 und 33) einen Abstand voneinander haben, damit der Draht (6') zwischen ihnen aufnehmbar ist, und daß die Zuführräder (22, 23) um den Draht (6') geschlossen werden, wenn ihre Umfangsflächen (32 und 33) an entgegengesetzten Seiten des Drahtes (6') angeordnet worden sind.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß ein Drahttransportschlitten (14) intermittierend zur Plattform (18) vorwärtsbewegbar ist, um einen Draht (6') auf der Plattform anzuordnen, wenn der Deckel (24) sich in geöffneter Stellung befindet und die Zuführräder (22 und 23) in geöffneter Stellung sind, so daß der Draht (6') mit dem Raum zwischen den Umfangsflächen (32 und 33) der Zuführräder (22 und 23) ausgerichtet wird.

10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß das Vorwärtsbewegen des Drahttransportschlittens (14) das Schließen des Deckels (24) und das Schließen der Zuführräder (22 und 23) um den Draht (6') durch einen einzigen Hub eines einzigen Nockenschlittens (38) bewirkt wird, der Nocken (60, 94 und 110) trägt, die der Reihe nach auf Nockenfolgeglieder (62, 96, 116) wirken, welche mit dem Drahtschlitten (14), dem Deckel (24) und dem Zuführschlitten (118) verbunden sind.

Revendications

1. Appareil pour insérer des bornes électriques (4), fixées chacune à une extrémité d'un fil électrique (6), dans des cavités (8) s'ouvrant dans une surface avant (9) d'un boîtier (10) de connecteur électrique, l'appareil comprenant un gabarit (12) destiné à positionner le boîtier (10) de façon que sa surface avant (9) soit tournée dans une direction donnée, des moyens (14, 15) espacés du gabarit (12), destinés à supporter un fil (6') de manière que la borne (4') qu'il porte soit sensiblement en alignement axial sur, et soit tournée vers, une cavité (8) du boîtier (10) lorsque le boîtier (10) est positionné par le gabarit (12), des moyens (22, 23) destinés à déplacer le fil (6') axialement par rapport aux moyens (14, 15) de support du fil et vers la cavité (8) pour insérer la borne (4') dans cette dernière et des moyens (18, 36) destinés à guider la borne (4') pendant ce mouvement afin qu'elle pénètre dans la cavité (8); caractérisé en ce que les moyens de guidage comprennent un tunnel (18, 36) dont une première extrémité est proche de la surface avant (9) du boîtier (10) et en alignement avec la cavité (8), les moyens de déplacement du fil comprenant une paire de roues (22 et 23) d'alimentation en fil disposées à l'extrémité opposée du tunnel (18, 36), un



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mécanisme (38, 110, 118, 126) étant prévu pour amener les surfaces circonférentielles (32, 33) des roues (22 et 23) en contact avec un fil (6') supporté par les moyens de support (14, 15), sur des côtés opposés du fil (6'), en un point du fil (6'), et des moyens (134, 130, 132) étant également prévus pour entraîner les deux roues (22 et 23) à la même vitesse mais en sens opposés, les surfaces circonférentielles des roues (22 et 23) étant en contact avec le fil (6') pour entraîner le fil (6') le long du tunnel (18, 36) et vers la cavité (8).

2. Appareil selon la revendication 1, caractérisé en ce que les moyens d'entraînement des roues comprennent un moteur électrique (134) associé à un circuit électrique destiné à détecter un accroissement du couple appliqué aux roues d'alimentation (22, 23) et étant agencés pour les arrêter lorsque le couple a atteint une valeur prédéterminée à la suite de l'insertion de la borne (4') dans la cavité (8).

3. Appareil selon la revendication 2, caractérisé en ce que les moyens destinés à arrêter les roues d'alimentation (22, 23) comprennent un circuit d'inversion de courant agencé pour être réglé afin de fonctionner pendant une période de temps prédéterminée après que le couple imposé aux roues d'alimentation (22, 23) a atteint la valeur prédéterminée, afin d'éliminer l'énergie cinétique emmagasinée dans l'induit du moteur (134), la période de temps prédéterminée étant telle que le moteur (134) et donc les roues d'alimentation (22 et 23) s'arrêtent suffisamment rapidement pour empêcher le fil (6') de flamber.

4. Appareil selon la revendication 1 ou 2, caractérisé par des moyens destinés à inverser la rotation des roues d'alimentation (22 et 23) afin qu'elles appliquent un essai de traction à la borne insérée (4').

5. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le tunnel est défini par une rainure (36) ménagée dans un couvercle (24), et une plate-forme (18) de support de fils, des moyens (38, 98, 104) étant prévus pour ouvrir le couvercle (24) afin de permettre au fil (6') d'être positionné sur la plate-forme (18) et pour fermer le couvercle (24) afin de maintenir le fil (6') dans le tunnel.

6. Appareil selon la revendication 5, caractérisé en ce que la plate-forme (18) présente une encoche (20) dimensionnée pour recevoir des doigts (34) de positionnement de fil portés par le couvercle (24) pendant sa fermeture, de façon à aligner le fil (6') sur la rainure (36).

7. Appareil selon la revendication 5 ou 6, caractérisé en ce que la plate-forme (18) présente une autre encoche (30) positionnée sensiblement plus près du gabarit (12) que la première encoche citée (20), l'autre encoche (30) étant dimensionnée pour recevoir un bras (28) d'éjection de fil porté par le couvercle (24), pendant la fermeture de celui-ci, afin d'éjecter le fil (6') de la plate-forme (18) après que la borne (4') a été insérée dans la cavité (8) et après que le couvercle (24) a été de nouveau ouvert pour permettre à un autre fil (6') d'être positionné sur la plate-forme (18).

8. Appareil selon la revendication 5, 6 ou 7, caractérisé en ce que les roues d'alimentation (22 et 23) peuvent être rapprochées du fil (6') placé sur la plate-forme (18) dans une position d'ouverture, leurs surfaces circonférentielles (32 et 33) étant espacées l'une de l'autre pour permettre au fil (6') d'être reçu entre elles, les roues d'alimentation (22, 23) étant fermées autour du fil (6') lorsque leurs surfaces circonférentielles (32 et 33) ont été positionnées de part et d'autre du fil (6').

9. Appareil selon la revendication 8, caractérisé en ce qu'un chariot (14) de transfert de fil peut être avancé par intermittence vers la plate-forme (18) pour positionner le fil (6') sur celle-ci, lorsque le couvercle (24) est dans sa position d'ouverture et lorsque les roues d'alimentation (22 et 23) sont dans leur position d'ouverture afin que le fil (6') soit aligné sur l'espace compris entre les surfaces circonférentielles (32 et 33) des roues d'alimentation (22 et 23).

10. Appareil selon la revendication 9, caractérisé en ce que l'avance du chariot (14) de transfert de fil, la fermeture du couvercle (24) et la fermeture des roues d'alimentation (22 et 23) sur le fil (6') sont effectuées par une course unique d'un chariot unique (38) portant des cames (60, 94 et 110) qui agissent séquentiellement sur des galets de came (62, 96, 116) reliés au chariot (14) de fil, au couvercle (24) et au chariot (118) des roues d'alimentation.

