

Description

Apparatus for Fabrication of a Crossover Wire Harness

The invention relates to apparatus that fabricates an electrical harness in which electrical connector assemblies are secured along outstretched electrical wires, and selected wires cross over one another, and extend toward and into selected wire positions in the connector assemblies.

Apparatus is known from U.S. Patent 4,043,017 for fabricating an electrical harness, in which electrical connector assemblies are secured along outstretched electrical wires. The known apparatus utilized two, spaced apart wire insertion mechanisms, each holding a connector assembly known, for example, in U.S. Patent 4,159,158. The known apparatus extends the wires between the connector assemblies and inserts the wires into counterpart wire positions within respective connector assemblies. Electrical terminals at the counterpart wire positions are of the insulation displacement type that become connected electrically to the wires merely upon insertion of the wires into the terminals. The counterpart wire positions of each connector assembly are in matched alignment with the counterpart wire positions of each other connector assembly, so that the wires extend parallel to one another from the counterpart wire positions of one connector to those of another. The known apparatus inserts the parallel wires into all the wire positions common to a single connector assembly.

It is desirable to provide an electrical harness in which selected wires, instead of extending parallel one another, cross over one another as they extend between connector assemblies. This type of harness is named a crossover wire harness. The known apparatus of U.S. Patent 4,043,017 must provide a first wire insertion mechanism for inserting a limited number of wires into a connector assembly, then provide a duplicate wire insertion mechanism that inserts crossover wires into the same connector assembly. Duplication of mechanisms increases both the cost and complexity of the apparatus.

It is an object to provide improved apparatus and method for fabricating a cross-over electrical wire harness.

According to the invention apparatus for fabricating a cross-over electrical wire harness in which electrical connector assemblies are secured along outstretched electrical wires, and the apparatus comprises a frame, a connector mounting means on the frame for mounting a connector assembly having counterpart wire positions, a wire holder on the frame for positioning electrical wires in selected alignment with the counterpart wire positions, a wire feeding means for feeding electrical wires to the wire holder, and a wire stuffer for engaging and transferring the wires into the counterpart wire positions wherein electrical terminals receive the transferred wires

and establish electrical connections thereto, is characterized in that, the wire holder and the connector mounting means are transportable relative to each other to align a selected, counterpart wire position of the connector assembly with a selected wire held in the wire holder to enable cross-over connections to be made and the wire holder holds corresponding wires horizontally of their lengths and elevated in respect to the connector mounting means during relative transport of the wire holder (35) and the connector mounting means.

The invention also includes a method for fabricating a crossover wire harness comprising the steps of: feeding a plurality of electrical wires to a wire holder, holding the wires in the wire holder horizontally of their lengths without the wires crossing over one another, which is characterized in transporting an electrical connector assembly relative to the wire holder to align a respective wire position of the connector assembly with a selected held wire, transferring the selected wire from the wire holder into the aligned wire position of the connector assembly, and holding the remaining wires by the wire holder elevated in respect to the connector assembly and the wires previously transferred thereto during transport of the connector assembly relative to the wire holder.

The apparatus of the invention provides an individual wire insertion station capable of assembling either crossover wires or non-crossover wires into an associated connector assembly. The invention requires a single wire holder that holds the wires horizontally of their lengths, initially without crossing over one another so that they may droop under the action of gravity without entangling. A connector assembly is transported under the wire holder to align the wire positions of the connector assembly with the wires held by the wire holder. The wires are transferred at different times from the wire holder into the associated wire positions. The wire holder also holds corresponding wires elevated in respect of the connector assembly and the wires previously transferred thereto, to avoid entangling of the elevated wires with the connected wires during transport of the connector assembly relative to the wire holder.

The advantage of the invention resides in the apparatus having an individual wire insertion mechanism for assembling either crossover wires or non-crossover wires in a connector assembly of a wire harness.

Another advantage of the invention resides in apparatus for assembling wires in a crossover wire harness, wherein a wire holder holds wires without tangling, a wire stuffer transfers the wires from the wire holder into selected wire positions within a connector assembly, an indexing means transports the connector assembly relative to the wire holder, and the wire holder holds the wires elevated in respect to the connector assembly and the wires previously transferred thereto, to avoid wire entanglement.

An understanding of the invention will be obtained by way of example from the description accompanying the drawings in which:

Figure 1 is a side elevation view of the apparatus according to the invention with parts cut away and with parts in section;

Figure 2 is a front elevation view of the apparatus shown in section taken along the line 2—2 of Figure 1;

Figure 3 is a fragmentary view in section taken along the line 1—1 of Figure 2 and illustrating a wire holder about to receive wires;

Figure 4 is a view similar to Figure 3 and illustrating full receipt of wires in the wire holder;

Figure 5 is a view similar to Figure 4 and showing transfer of a wire from the wire holder into a connector assembly;

Figure 6 is an enlarged fragmentary view in section taken along the line 6—6 of Figure 3 illustrating the positions of a wire holder and a pressure plate during initial receipt of wires in the wire holder;

Figure 7 is a view similar to Figure 6 and taken along the line 7—7 of Figure 4;

Figure 8 is a view similar to Figure 7, showing a connector assembly mounted below the wire holder;

Figure 9 is a view similar to Figure 8, illustrating a wire stuffer transferring a wire from the wire holder into the connector assembly;

Figure 10 is a fragmentary, enlarged, side elevation view of the wire stuffer, the wire holder and the connector assembly prior to wire transfer;

Figure 11 is a view similar to figure 10 showing the wire stuffer transferring a wire from the wire holder to the connector assembly;

Figure 12 is a view similar to Figure 11 illustrating an alternate wire stuffer transferring all the wires from the wire holder to the connector assembly;

Figures 13—17 are schematic perspective views illustrating various assembly steps during fabrication of a crossover wire harness; and

Figure 18 is a diagrammatic view illustrating a pattern of wires in the crossover wire harness of Figure 17.

With reference to Figures 1 and 2, the apparatus 1 of the invention includes a frame 1 comprising several frame members, including a base 3, external walls 4, 5, and a table 6 supported by the walls 4 and 5. Figure 2 shows the table 6 supported also by external walls 7, 8 and further by interior walls 9, 10. A pair of support plates 11, 11 are carried by the bridge between the walls 9, 10. A pair of rams 12, 12 are slidably supported on the plates 11, 11. A pin 13 connects the rams 12, 12 and is received between the arms of respective yokes 14, 14 mounted on a shaft 15, in turn rotatably mounted by the walls 9, 10. A known stepping motor 16 on the shaft 15 will rotate the shaft 15, pivot the yokes 14 and slidably reciprocate the rams 12, 12. Each ram 12, 12 has inclined cam surfaces 17, 17. Pins 18, 18 impinge respective cam surfaces 17, 17 and pass through respective bores 19, 19 in the table 6. The pins 18, 18 are secured in a bottom plate 20.

Figures 1—5 illustrate that the bottom plate 20 is raised or lowered by the pins 18, 18, in turn, raised by the cam surfaces 17, 17 (when the rams 12, 12 are reciprocated left to right as shown in Figure 1). A planar pressure plate 21 (Figures 2 and 3) has a first portion 21A supported on and secured to legs 22, in turn, secured to the bottom plate 20. A second portion 21B of the pressure plate 21 is secured to and supported by rectangular legs 23. The legs 23 slidably impinge the bottom plate 20 to support the portion 21B coplanar with the portion 21A, and to permit slidable traverse of the portion 21B alongside and coplanar with the portion 21A. A column 24 and a bifurcated column 25 project through clearances 26 of the pressure plate 21 and slidably support corresponding adjacent legs 23 during raising or lowering of the legs 23 together with the bottom plate 20.

Figures 1—5 illustrate generally at 27, a carriage, in the form of a block that carries the columns 24, 25, and that is slidably supported along horizontal rails 28 supported by the frame 2. The carriage 27 is threadably mounted on a horizontal lead screw 29 that is connected by a known coupling 30 to an output shaft 31 of a known electrical stopping motor 32. The motor 32 is mounted on a plate 33 that is part of the frame 2. The carriage slidably supports the legs 23 during raising or lowering of the bottom plate 20. Further, activation of the motor 32 will turn the lead screw 29 so that the carriage 27 will traverse along the lead screw and the rails 28. The pressure plate portion 21B will accompany the carriage 27 and will traverse alongside the pressure plate portion 21A. The legs 23 will accompany the carriage 27 and will slidably traverse along the surface of the bottom plate 20.

Figure 1 shows a vertical panel 34 that is part of the frame 2 and is mounted on the plate 33. The panel 34 carries a wire holder 35 having a plurality of parallel, elongated slots 36. The slots 36 overlie the path of traverse of the carriage 27. The frame 2 includes flanges 37, 38, 39 and 40, each mounted on the panel 34. A wire stuffer is generally shown at 41 and includes a reciprocating blade 42 mounted on a carriage 43. The carriage is slidably mounted along parallel rails 43, 44 (Figure 2) carried by the flanges 37, 39. The carriage 43 is threadably mounted along a lead screw 45 rotatably carried by the flanges 37, 39. The lead screw 45 is connected by a known coupling 46 to an output shaft 47 of a known electrical stepping motor 48. The lead screw 45 is rotated by the motor 48 to index the carriage 43 and position the associated stuffer blade 42 in selected alignment with each slot 36.

A mechanism shown generally at 49 reciprocates the stuffer blade 42 into and out of an associated aligned slot 36. The mechanism 49 includes a polygon shaped ram 50 that is slidably received by the carriage 43 and that carries the stuffer blade 42. The ram 50 is slidably mounted along a track 51 on a polygon shaped link 52, also part of the mechanism 49.

The link 52 is pivotally connected by a pin 53 to a lever 54, that is pivotally mounted by a pivot

connection 55 in the flange 38. The other end of the lever is connected pivotally by a link 56, adjustable in length, to a shaft 57. A known spring wrap clutch 58 couples the shaft 57 eccentrically to the output shaft (not shown) of an electric motor 59. According to a known operation, while the motor 59 turns its output shaft, the clutch 58 permits one orbital revolution of the eccentric mounted shaft 57. The orbital revolution causes operation of the mechanism 49 in one cycle, to reciprocate the stuffer blade 42 first into and then out of the associated, aligned slot 36 of the wire holder 35.

Figure 1 further shows an array of auxiliary stuffer blades 42A carried by the ram 50. The carriage 43 is indexed to position the stuffer blades 42A in alignment respectively with all the slots 36 of the wire holder 35. Then, upon one cycle of the mechanism 49, the stuffer blades 42A are reciprocated into and out of the aligned, associated slots 36.

Operation of the apparatus 1 is described with reference to Figure 2, in conjunction with Figures 13—17. A wire harness 60, is shown as it is being assembled by the apparatus 1, and includes a first connector assembly 61 having its counterpart wire positions numbered 1A—6A, respectively. Insulated electrical wires 62—67 have been inserted into these respective, counterpart wire positions and therein are electrically connected with electrical terminals (not shown). The connector assembly 61 the terminals thereof and the manner of electrically connecting the wires to the terminals are known from U.S.A. patent 4,159,158. There is known in U.S.A. patent 4,043,017, apparatus for feeding the wires 62—67 parallel to one another and for inserting these wires into a connector assembly such as the connector assembly 61. This known apparatus includes a wire feed shuttle 68 (Figure 2) adapted for mounting on a table 69 of the apparatus 1.

As shown in Figures 3 and 6, the feed shuttle 68 projects the wires 62—67 along the table 69 toward and in alignment with respective slots 36 of the wire holder 35. The pressure plate 21 is raised by operating the stepping motor 16 to a first position shown in Figure 6 to support the wires 62—67 partially within and along the flared entryways lengthwise of the slots 36. As shown in Figures 4 and 7, the pressure plate 21 is raised by rotation of the stepping motor 16 to a second position, urging the wires 62—67 into respective slots 36; the lengths of the wires being retained longitudinally along the slots 36 by friction fit therein.

The pressure plate then is lowered by reverse rotation of the stepping motor 16 to a third position shown in Figures 1, 2, 3, 5, 8, 9, and 10. A second connector assembly 70, similar to the first connector assembly 61, is mounted on the pressure plate portion 21B and is held in place by the bifurcated column 25. The connector assembly 70 has counterpart wire positions 1B—6B, and is indexed by the carriage to position these wire positions in desired matched

alignment with corresponding slots 36 of the wire holder 35. For example, Figures 8, 9, 10, 11, 13 and 14 show the wire position 1B aligned with the slot 36 which retains the wire 62. The stuffer blade 42 is aligned with the same slot by suitable indexing of the carriage 43. The mechanism 49 is cycled to reciprocate the stuffer blade 42 into and out of the slot, (Figure 11) dislodging and transferring the wire from the slot into the counterpart wire position 1B of the connector assembly 70, to establish therein an electrical connection with a known electrical terminal, not shown, of the connector assembly 61. For example, it may be desirable to assemble the wire 63 (Figure 15) in the counterpart wire position 5B of the connector assembly 70. The wire position 5B must be indexed by the carriage 27 (Figure 1) into matched alignment with the slot 36 that retains the wire 63. Also, the stuffer blade 42 must be indexed by the carriage 43 into alignment with the same slot. The mechanism 49 is cycled to reciprocate the stuffer blade 42 and transfer the wire 63 from the slot 36 to the counterpart wire position 5B.

In similar fashion, the counterpart wire position 2B and the stuffer blade 42 may be aligned with the slot 36 that retains the wire 66. Cycling of the mechanism 49 will transfer the wire 66 into the wire position 2B. To complete the assembly, reference is made to Figure 12 that shows an array of stuffer blades 42A capable of being indexed by the carriage 43 into alignment respectively, with all the slots 36. The connector assembly 70 is indexed by the carriage 27 to align the empty wire positions 1B—6B in matched alignment, respectively, with the wires remaining in the slots 36. Upon cycling of the mechanism 49, all the wires yet remaining in the slots 36 will be transferred into associated empty wire position 1B—6B that previously have not received any of the wires 62—67. The completed assembly 60 is shown in Figures 16 and 17. The wires 62—67 cross over one another to extend the desired counterpart wire positions in the connector assemblies 61 and 70. It is important to recognize that the wire holder 35 holds the wires initially without crossing one another as they project horizontally of their lengths from the feed rollers 68, 68, so that the unheld portions of the wires may droop under the action of gravity without entangling. Further, the held wires are elevated in respect to the wires previously transferred to the connector assembly to avoid entanglement of the wires during transport of the carriage 27 together with the connector assembly 70 relative to the wire holder 35. Thereby, the wires may cross over one another, without entanglement, as the connector assembly 70 is transported relative to the wire holder 35.

Other modifications and embodiments of the invention are intended to be covered by the scope of the appended claims. For example, the wire stuffer blades 42, 42A may vary in number to accommodate connector assemblies having different numbers of counterpart wire positions. The stepping motors may be operated by

manually actuated switches or by known electrical sequence control circuits that operate faster than manual switching operations.

Claims

1. Apparatus (1) for fabricating a cross-over electrical wire harness (60) in which electrical connector assemblies (61, 70) are secured along outstretched electrical wires (62—67), and the apparatus comprises a frame (1, 2), a connector mounting means (25) on the frame (2) for mounting a connector assembly (70) having counterpart wire positions (1B—6B), a wire holder (35) on the frame for positioning electrical wires in selected alignment (36) with the counterpart wire positions (1B—6B), a wire feeding means (68) for feeding electrical wires (62—67) to the wire holder (35), and a wire stuffer (41) for engaging and transferring the wires into the counterpart wire positions (1B—6B) wherein electrical terminals receive the transferred wires and establish electrical connections thereto, characterized in that, the wire holder (35) and the connector mounting means (25) are transportable relative to each other to align a selected, counterpart wire position (1B—6B) of the connector assembly with a selected wire held in the wire holder (35) to enable cross-over connections to be made, and the wire holder (35) holds corresponding wires horizontally of their lengths and elevated in respect to the connector mounting means during relative transport of the wire holder (35) and the connector mounting means (25).

2. The apparatus according to claim 1, further characterized in that; the wire stuffer (41) includes a wire engaging blade (42), indexing means (49) to index the blade into alignment with a selected wire held by the wire holder, and a reciprocable ram (50) that mounts the blade (42) and that reciprocates the blade to engage and transport the selected wire (62—67) from the wire holder (35) to a corresponding counterpart wire position (1B—6B) in the connector assembly (70).

3. The apparatus according to claim 2, further characterized in that; the wire stuffer (41) includes a group of additional stuffer blades (42A) mounted on the ram (50) for reciprocation therewith, such blades being equal in number to the wires held by the wire holder prior to transfer of any such wires to a connector assembly (70) on the connector mounting means (49), and the indexing means being constructed for transporting the additional stuffer blades (42A) along the ram (50) into alignment with such wires held by the wire holder (35).

4. The apparatus according to claim 1, further characterized in that; a carriage (27) is provided for mounting and transporting an electrical connector assembly (70) relative to the wire holder (35).

5. The apparatus according to claim 4, further characterized in that; indexing means are provided to cooperate with the wire holder (41) to mount and hold the associated wires (62—65)

elevated from the connector assembly (70) and the wires previously transported thereto, during the transport of the connector assembly (70) by the carriage (27).

6. The apparatus according to claim 5, wherein the wire stuffer (41) includes a single, wire engaging blade (42) for transport into matched alignment with a respective selected wire (62) held by the wire holder (35).

7. The apparatus according to claim 6, wherein the wire stuffer (41) include a group of wire engaging blades (42A) for transport into matched alignment with respective wires (62—67) held by the wire holder (35) and not previously transferred to the connector assembly (70).

8. A method for fabricating a crossover wire harness comprising the steps of: feeding a plurality of electrical wires (62—67) to a wire holder (35), holding the wires (62—67) in the wire holder (35) horizontally of their lengths without the wires crossing over one another, characterized by transporting an electrical connector assembly (70) relative to the wire holder (35) to align a respective wire position of the connector assembly (70) with a selected held wire (62), transferring (43) the selected wire (62) from the wire holder (35) into the aligned wire position (1B) of the connector assembly (70), and holding the remaining wires (63—67) by the wire holder (35) elevated in respect to the connector assembly and the wires previously transferred thereto during transport of the connector assembly relative to the wire holder.

9. The method according to claim 8, and further including the steps of: transferring selected wires (62—67) individually from the wire holder (35) into respective wire positions (1C—6C) of the connector assembly (70), transporting the connector assembly (70) to align the empty wire positions (1C—6C) thereof into alignment with the remaining wires (62—67) held by the wire holder (35), and transferring all the remaining wires from the wire holder to the empty wire positions of the connector assembly (70).

Patentansprüche

1. Vorrichtung (1) zum Herstellen eines elektrischen Kabelbaums (60) mit Überkreuzungen, bei dem elektrische Verbinderanordnungen (61, 70) entlang von ausgestreckt angeordneten elektrischen Drähten (62—67) befestigt sind, wobei die Vorrichtung einen Rahmen (1, 2), eine Verbinderbefestigungseinrichtung (25) auf dem Rahmen (2) zur Befestigung einer Gegenstück-Drahtpositionen (1B—6B) aufweisenden Verbinderanordnung (70) einen an dem Rahmen vorgesehenen Drahthalter (35) zum Positionieren elektrischer Drähte in ausgewählter Ausrichtung (36) mit dem Gegenstück-Drahtpositionen (1B—6B), eine Drahtfördereinrichtung (68) zum Befördern elektrischer Drähte (62—67) zu dem Drahthalter (35), sowie ein Drahtstopfglied (41) zum Angreifen an den Drähten und Übertragen derselben in die Gegenstück-Drahtpositionen

manually actuated switches or by known electrical sequence control circuits that operate faster than manual switching operations.

Claims

1. Apparatus (1) for fabricating a cross-over electrical wire harness (60) in which electrical connector assemblies (61, 70) are secured along outstretched electrical wires (62—67), and the apparatus comprises a frame (1, 2), a connector mounting means (25) on the frame (2) for mounting a connector assembly (70) having counterpart wire positions (1B—6B), a wire holder (35) on the frame for positioning electrical wires in selected alignment (36) with the counterpart wire positions (1B—6B), a wire feeding means (68) for feeding electrical wires (62—67) to the wire holder (35), and a wire stuffer (41) for engaging and transferring the wires into the counterpart wire positions (1B—6B) wherein electrical terminals receive the transferred wires and establish electrical connections thereto, characterized in that, the wire holder (35) and the connector mounting means (25) are transportable relative to each other to align a selected, counterpart wire position (1B—6B) of the connector assembly with a selected wire held in the wire holder (35) to enable cross-over connections to be made, and the wire holder (35) holds corresponding wires horizontally of their lengths and elevated in respect to the connector mounting means during relative transport of the wire holder (35) and the connector mounting means (25).

2. The apparatus according to claim 1, further characterized in that; the wire stuffer (41) includes a wire engaging blade (42), indexing means (49) to index the blade into alignment with a selected wire held by the wire holder, and a reciprocable ram (50) that mounts the blade (42) and that reciprocates the blade to engage and transport the selected wire (62—67) from the wire holder (35) to a corresponding counterpart wire position (1B—6B) in the connector assembly (70).

3. The apparatus according to claim 2, further characterized in that; the wire stuffer (41) includes a group of additional stuffer blades (42A) mounted on the ram (50) for reciprocation therewith, such blades being equal in number to the wires held by the wire holder prior to transfer of any such wires to a connector assembly (70) on the connector mounting means (49), and the indexing means being constructed for transporting the additional stuffer blades (42A) along the ram (50) into alignment with such wires held by the wire holder (35).

4. The apparatus according to claim 1, further characterized in that; a carriage (27) is provided for mounting and transporting an electrical connector assembly (70) relative to the wire holder (35).

5. The apparatus according to claim 4, further characterized in that; indexing means are provided to cooperate with the wire holder (41) to mount and hold the associated wires (62—65)

elevated from the connector assembly (70) and the wires previously transported thereto, during the transport of the connector assembly (70) by the carriage (27).

6. The apparatus according to claim 5, wherein the wire stuffer (41) includes a single, wire engaging blade (42) for transport into matched alignment with a respective selected wire (62) held by the wire holder (35).

7. The apparatus according to claim 6, wherein the wire stuffer (41) include a group of wire engaging blades (42A) for transport into matched alignment with respective wires (62—67) held by the wire holder (35) and not previously transferred to the connector assembly (70).

8. A method for fabricating a crossover wire harness comprising the steps of: feeding a plurality of electrical wires (62—67) to a wire holder (35), holding the wires (62—67) in the wire holder (35) horizontally of their lengths without the wires crossing over one another, characterized by transporting an electrical connector assembly (70) relative to the wire holder (35) to align a respective wire position of the connector assembly (70) with a selected held wire (62), transferring (43) the selected wire (62) from the wire holder (35) into the aligned wire position (1B) of the connector assembly (70), and holding the remaining wires (63—67) by the wire holder (35) elevated in respect to the connector assembly and the wires previously transferred thereto during transport of the connector assembly relative to the wire holder.

9. The method according to claim 8, and further including the steps of: transferring selected wires (62—67) individually from the wire holder (35) into respective wire positions (1C—6C) of the connector assembly (70), transporting the connector assembly (70) to align the empty wire positions (1C—6C) thereof into alignment with the remaining wires (62—67) held by the wire holder (35), and transferring all the remaining wires from the wire holder to the empty wire positions of the connector assembly (70).

Patentansprüche

1. Vorrichtung (1) zum Herstellen eines elektrischen Kabelbaums (60) mit Überkreuzungen, bei dem elektrische Verbinderanordnungen (61, 70) entlang von ausgestreckt angeordneten elektrischen Drähten (62—67) befestigt sind, wobei die Vorrichtung einen Rahmen (1, 2), eine Verbinderbefestigungseinrichtung (25) auf dem Rahmen (2) zur Befestigung einer Gegenstück-Drahtpositionen (1B—6B) aufweisenden Verbinderanordnung (70) einen an dem Rahmen vorgesehenen Drahthalter (35) zum Positionieren elektrischer Drähte in ausgewählter Ausrichtung (36) mit dem Gegenstück-Drahtpositionen (1B—6B), eine Drahtfördereinrichtung (68) zum Befördern elektrischer Drähte (62—67) zu dem Drahthalter (35), sowie ein Drahtstopfglied (41) zum Angreifen an den Drähten und Übertragen derselben in die Gegenstück-Drahtpositionen



(1B—6B) aufweist, wobei elektrische Anschlüsse die übertragenen Drähte aufnehmen und elektrische Verbindungen mit diesen herstellen, dadurch gekennzeichnet, daß der Drahthalter (35) und die Verbinderbefestigungseinrichtung (25) relativ zueinander transportabel ausgebildet sind, um eine ausgewählte Gegenstück-Drahtposition (1B—6B) der Verbinderanordnung mit einem in dem Drahthalter (35) gehaltenen ausgewählten Draht auszurichten, um die Herstellung von Verbindungen mit Überkreuzungen zu ermöglichen, und daß der Drahthalter (35) entsprechende Drähte während der relativen Transportbewegung des Drahthalters (35) und der Verbinderbefestigungseinrichtung (25) horizontal in ihrer Längserstreckung sowie in einer angehobenen Stellung in bezug auf die Verbinderbefestigungseinrichtung hält.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Drahtstopfglied (41) ein Drahtangreif-Messer (42), eine Fortschalteinrichtung (49) zum Fortschalten des Messers in Ausrichtung mit einem von dem Drahthalter gehaltenen, ausgewählten Draht, sowie eine hin- und hergehend bewegbare Ramme (50) beinhaltet, an der das Messer (42) angebracht ist und die das Messer in hin- und hergehender Weise bewegt, so daß dieses an dem ausgewählten Draht (62—67) angreift und diesen aus dem Drahthalter (35) in eine entsprechende Gegenstück-Drahtposition (1B—6B) in der Verbinderanordnung (70) transportiert.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß das Drahtstopfglied (41) eine Gruppe weiterer Stopfmesser (42A) beinhaltet, die an der Ramme (50) in zusammen mit dieser hin- und hergehend bewegbarer Weise montiert sind, wobei die Anzahl dieser Messer der Anzahl der Drähte entspricht, die der Drahthalter vor der Übertragung eines jeglichen Drahts zu einer auf der Verbinderbefestigungseinrichtung (49) befindlichen Verbinderanordnung (70) hält, und daß die Fortschalteinrichtung zum Transportieren der weiteren Stopfmesser (42A) entlang der Ramme (50) in Ausrichtung mit solchen von dem Drahthalter (35) gehaltenen Drähten ausgebildet ist.

4. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß ein Schlitten (27) zum Montieren und Transportieren einer elektrischen Verbinderanordnung (70) relativ zu dem Drahthalter (35) vorgesehen ist.

5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß eine Fortschalteinrichtung zum Zusammenarbeiten mit dem Drahthalter (41) vorgesehen ist, um die zugehörigen Drähte (62—65) in einer von der Verbinderanordnung (70) und den zuvor zu der Verbinderanordnung transportierten Drähten angehobenen Stellung montiert zu halten, während die Verbinderanordnung (70) von dem Schlitten (27) transportiert wird.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß das Drahtstopfglied (41) ein einziges Drahtangreif-Messer (42) beinhaltet, das

in passende Ausrichtung mit einem von dem Drahthalter (35) gehaltenen, jeweils ausgewählten Draht (62) transportierbar ist.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß das Drahtstopfglied (41) eine Gruppe von Drahtangreif-Messern (42A) beinhaltet, die in passende Ausrichtung mit den jeweiligen Drähten (62—67) die von dem Drahthalter (35) gehalten werden und nicht zuvor zu der Verbinderanordnung (70) übertragen worden sind.

8. Verfahren zum Herstellen eines Kabelbaums mit Überkreuzungen, mit folgenden Schritten: Befördern einer Mehrzahl elektrischer Drähte (62—67) zu einem Drahthalter (35), Halten der Drähte (62—67) in dem Drahthalter (35) horizontal in ihrer Längserstreckung, ohne daß sich die Drähte überkreuzen, gekennzeichnet durch Transportieren einer elektrischen Verbinderanordnung (70) relativ zu dem Drahthalter (35) zum Ausrichten einer entsprechenden Drahtposition der Verbinderanordnung (70) mit einem ausgewählten, gehaltenen Draht (62), Übertragen (43) des ausgewählten Drahts (62) von dem Drahthalter (35) in die damit ausgerichtete Drahtposition (1B) der Verbinderanordnung (70), und Halten der verbleibenden Drähte (63—67) durch den Drahthalter (35) in einer angehobenen Stellung in bezug auf die Verbinderanordnung und die zuvor in diese übertragenen Drähte während des Transports der Verbinderanordnung relativ zu dem Drahthalter.

9. Verfahren nach Anspruch 8, gekennzeichnet durch folgende weitere Schritte: einzeln erfolgreiches Übertragen ausgewählter Drähte (62—67) von dem Drahthalter (35) in jeweilige Drahtpositionen (1C—6C) der Verbinderanordnung (70), Transportieren der Verbinderanordnung (70) zum Bewegen der leeren Drahtpositionen (1C—6C) der Verbinderanordnung (70) in Ausrichtung mit den von dem Drahthalter (35) gehaltenen, verbleibenden Drähten (62—67), und Übertragen aller verbleibenden Drähte von dem Drahthalter in die leeren Drahtpositionen der Verbinderanordnung (70).

Revendications

1. Appareil (1) de fabrication d'un harnais de fils électriques (60) à croisements dans lequel les ensembles à connecteurs électriques (61, 70) sont fixés le long de fils électriques étendus (62—67), et l'appareil comprend un bâti (1, 2), des moyens (25) de montage de connecteur sur le bâti (2) pour le montage d'un ensemble à connecteur comportant des positions de fils correspondantes (1B—6B), un porte-fils (35) sur le bâti destiné à positionner les fils électriques en alignement choisi (36) avec les positions de fils correspondantes (1B—6B), des moyens (68) d'avance de fils destinés à faire avancer de fils électriques (62—67) vers le porte-fils (35), et un pousse-fils (41) destiné à prendre et transférer les fils dans les positions de fils correspondantes (1B—6B) dans lesquelles des bornes électriques reçoivent les fils



transférés et établissant des connexions électriques avec eux, caractérisé en ce que le porte-fils (35) et les moyens (25) de montage de connecteur peuvent être transportés l'un par rapport à l'autre pour aligner une position de fils correspondante choisie (1B—6B) de l'ensemble à connecteur avec un fil choisi maintenu dans le porte-fils (35) pour permettre la réalisation de connexions croisées, et le porte-fils (35) maintient des fils correspondants horizontalement sur leurs longueurs et élevés par rapport au moyen de montage de connecteur durant le transport relatif du porte-fils (35) et des moyens (25) de montage de connecteur.

2. Appareil selon la revendication 1, caractérisé en outre en ce que le pousse-fils (41) comprend une lame (42) de prise de fil, des moyens d'indexage (49) destinés à amener par indexage la lame en alignement avec un fil choisi maintenu par le porte-fil, et un coulisseau (50) à mouvement alternatif qui porte la lame (42) et qui fait exécuter un mouvement alternatif à la lame pour la faire porter contre et transporter le fil choisi (62—67) du porte-fils (35) vers une position de fil correspondants et associée (1B—6B) dans l'ensemble à connecteur (70).

3. Appareil selon la revendication 2, caractérisé en outre en ce que le pousse-fil (41) comprend un groupe de lames supplémentaires (42A) de poussée montées sur le coulisseau (50) afin d'exécuter un mouvement alternatif avec lui, ces lames étant en nombre égal à celui des fils maintenus par le porte-fils avant le transfert de certains, quelconques, de ces fils vers un ensemble à connecteur (70) situé sur les moyens (49) de montage de connecteurs, et les moyens d'indexage étant conçus pour transporter les lames supplémentaires (42A) de poussée le long du coulisseau (50) jusqu'en alignement avec les fils maintenus par le porte-fils (35).

4. Appareil selon la revendication 1, caractérisé en outre en ce qu'il est prévu un chariot (27) pour le montage et le transport d'un ensemble à connecteur électrique (70) par rapport au porte-fils (35).

5. Appareil selon la revendication 5, caractérisé en outre en ce qu'il est prévu des moyens d'indexage pour coopérer avec le porte-fils (41)

afin de monter et maintenir les fils associés (62—65) élevés par rapport à l'ensemble à connecteur (70) et aux fils précédemment transportés vers lui, durant le transport de l'ensemble à connecteur (70) par le chariot (27).

6. Appareil selon la revendication 5, dans lequel le pousse-fils (41) comprend une seule lame (42) de prise de fil destinée à être amenée en alignement apparié avec un fil choisi respectif (62) maintenu par le porte-fils (35).

7. Appareil selon la revendication 6, dans lequel le pousse-fils (41) comprend un groupe de lames (42A) de prise de fils destinées à être amenées en alignement apparié avec des fils respectifs (62—67) maintenus par le porte-fils (35) et n'ayant pas été précédemment transférés vers l'ensemble à connecteur (70).

8. Procédé de fabrication d'un harnais de fils à croisements, comprenant les étapes qui consistent: à faire avancer plusieurs fils électriques (62—67) vers un porte-fils (35), à maintenir les fils (62—67) dans le porte-fils (35), horizontalement sur leurs longueurs, sans que les fils se croisent mutuellement, caractérisé en ce qu'il consiste à transporter un ensemble à connecteur électrique (70) par rapport au porte-fils (35) pour aligner une position de fils respective de l'ensemble à connecteur (70) avec un fil maintenu choisi (62), à transférer (43) le fil maintenu choisi (62) du porte-fils (35) dans la position de fils alignée (1B) de l'ensemble à connecteur (70), et à maintenir les fils restants (63—67) par le porte-fils (35) élevés par rapport à l'ensemble à connecteur et aux fils, précédemment transférés vers cet ensemble, pendant le transport de l'ensemble à connecteur par rapport au porte-fils.

9. Procédé selon la revendication 8, comprenant en outre les étapes qui consistent: à transférer les fils choisis (62—67) individuellement du porte-fils (35) jusque dans des positions de fils respectives (1C—6C) de l'ensemble à connecteur (70), à transporter l'ensemble à connecteur (70) pour aligner ses positions de fils vides (1C—6C) avec les fils restants (62—67) maintenus par la porte-fils (35), et à transférer tous les fils restants du porte-fils vers les positions de fils vides de l'ensemble à connecteur (70).

