

Apparatus for terminating a series of wires simultaneously

The invention relates to apparatus for terminating individual wires of a series of wires simultaneously in respective contacts arranged in a row in an electrical connector, particularly for the manufacture of electrical harnesses.

In such apparatus, it is important that high production rates are achieved to minimise production costs and yet that the connections to the individual contacts are reliable. These requirements pose problems in locating the many wires accurately throughout the operational cycle and for termination or testing.

The invention may be regarded as an improvement in the apparatus disclosed in European Patent Application No. 78.300102.7, Publication No. 0 000 428, which discloses apparatus for terminating individual wires of a series of wires simultaneously in respective contacts arranged in a row in an electrical connector including a terminating station comprising a connector support and a ram reciprocable relative to the support to drive wires into wire-receiving parts of respective contacts of a connector mounted on the support and a wire holding head mounted for reciprocating movement between the terminating station and a wire supply to feed a series of wires from the supply to a location spaced from and between the connector and the ram, the wire holding head comprising a wire clamp and a wire guide mounted forwardly of the clamp and having a series of wire-receiving passageways retaining the wires in predetermined, laterally spaced, parallel, coplanar relation.

In the prior apparatus, lost motion between the wire guide and the clamp during the final stages of movement towards the terminating station causes substantial lengths of wires to project forwards at their leading ends in general alignment with the respective wire-receiving parts of the contacts. However, as the wires are spaced from the respective wire-receiving parts of the contacts, it is necessary to provide guide means, for example, a template defining wire-receiving channels, between the ram and the connector support to guide each wire precisely to the wire connecting portion during engagement by the ram, such precise location being necessary for reliable terminating particularly with very closely spaced contacts having wire-receiving slots.

A disadvantage of the prior apparatus is that the template may cause obstruction at the terminating station and impede the handling of connectors particularly where automatic connector feed is desired to increase the speed of operation.

According to one aspect of the invention, the wire guide is mounted for pivotal movement relative to the clamp and is engageable by an abutment provided on the ram during a terminating stroke to pivot towards the connector

support to guide leading ends of the wires to wire connecting parts of respective contacts.

This obviates the need for a separate wire guiding template and enables automatic connector feed techniques more readily to be used.

In a preferred form, the connector support comprises a series of connector holders located on a turret mounted for stepped rotation about an axis parallel to the path of movement of the wire holding head when the wire holding head is remote from the terminating station to bring connectors successively into alignment with the ram.

Rotation of the turret, will not therefore be impeded by the presence of a wire guide enabling rapid connector feed and high production rates.

A preferred embodiment is characterised in that, a wire support is provided between the severing and stripping station and the terminating station and comprises a wire locating comb movable into engagement with the wires to maintain their predetermined spacing after severing.

Accurate location of the severed ends of the wires by the comb enables a further series of testing or terminating steps readily to be carried out without risk of wire tangling.

Preferably a series of connector supports and wire supports are located on respective turrets mounted for synchronous stepped rotation about an axis parallel to the path of movement of the wire holding head after termination and severing.

The turrets convey a set of wires terminated at one end in a connector and with their other ends located by the combs laterally away from the terminating and operating stations, respectively.

The invention includes the provision of the connector supports in rotary turrets in the prior apparatus where both ends of the wires are terminated in connections at the terminating station and at the severing and stripping station, respectively.

A specific example of the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side elevation of the apparatus partly in cross-section immediately prior to termination of the wires;

Figure 2 is a similar view to Figure 1 after termination with, and immediately prior to, wire severing and stripping;

Figure 3 is a fragmentary view similar to Figure 2 after operation of a wire locating comb; and

Figure 4 is a diagrammatic end view of the terminating station.

The invention may be regarded as an improvement in the apparatus disclosed in the above-mentioned application to which refer-

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ence is hereby directed and which apparatus terminates a series of wires at one end by inserting it in a slotted plate connector such as that described in U.S. Patent Specification No. 3,760,335 and severs and strips the insulation from the other end in preparation for a separate terminating step.

As shown particularly in Figures 1 and 3, the apparatus comprises a wire terminating first station 11 and a wire stripping second station 12 spaced apart horizontally on a frame 10. A wire holding head (or shuttle) 13 is mounted for horizontal reciprocating movement on the frame to feed wires past the second station from a wire store (not shown) to the first station.

The wire terminating station comprises a ram 14 vertically reciprocable relative to a connector support 15 so that stuffers 16 drive wires into slotted wire-receiving portions of respective contacts arranged in a row in a connector 17. The ram carries an abutment pin 20 for engagement with the head 13 during downward movement.

The connector support 15 includes a series of connector holders 18 located on the periphery of a turret 19 mounted for stepped rotation on a horizontal axis to bring connector holders successively into alignment with the ram. An ejection mechanism 21 is mounted in the turret under each connector holder 18 and comprises one or more ejection pins 22 operatable by a push rod 23 against return springs to advance into the connector holder to engage and eject the connector from the holder. The push rod 23 is connected to a cam follower 24 engageable with an ejection cam (not shown) mounted on the frame after rotation of the turret past the termination and a test stage.

A steadying arm 25 is mounted on the frame for horizontal reciprocating movement by a piston and cylinder 26 to engage and steady the connector holder during termination.

A wire lengthening arm 30 having a roller 31 at a leading end is mounted immediately in front of the ram for vertical movement into a slot bounded by a transverse member 32 of each connector holder and a roller 33 supported by plates 34 attached to the turret to extend transversely of the path of movement of the wire holding head and to the wires. Movement of the arm 30 is effected by first and second piston and cylinder devices for wire lengthening and wire stripping operations, respectively, as explained below, enabling separate adjustment of the wire feed length and stripping length readily to be made.

The wire severing and stripping station 13 comprises a vertically reciprocating head assembly 36 carrying upper wire stripping and severing blades 37 and 38 respectively, for engagement with lower stripping and severing blades 39 and 40 mounted on the frame when the head assembly is at its limit of downward travel. Immediately behind the severing blade 38, is mounted a spring biased abutment pin 35

arranged to move downwardly with the head assembly to engage and depress a front guide on the wire holding head, as explained below. Immediately in front of the stripping blade is mounted a vertically extending wire guiding arm 42.

A vertically extending wire locating arm 43 is mounted at the front of the head assembly and a lower end of the arm is formed with a pair of downwardly facing, spaced parallel channels 44, which extend transversely of the path of movement of the wire holding head 13. A wire-engaging roller 45 is transversely mounted between the channels 44 for limited vertical movement against the action of a biasing spring 46.

A series of wire supports 48 are mounted on the periphery of a turret 27 mounted on the frame for stepped rotation about a horizontal axis in synchronism with the turret 19. Each wire support includes a wire engaging bar 28 supported directly below the roller on a compression spring 49 seated in the base of a channel section wire guide 50, the side walls of which are slotted to provide a pair of parallel, transverse wire-receiving combs 51. The wire guide 50 is mounted for vertical reciprocating movement on the elbow of a bell crank lever 52 having one arm 53 pivoted to one end of a link 55 pivoted at its other end to the turret so that the arm 53 with the link constitute an over-centre mechanism. The linkage is moved over-centre to raise the combs by the engagement of the pivot 54 with an operating rod 56 mounted for horizontal reciprocation by a piston and cylinder device 57. The other arm 58 of the bell crank acts as a trip lever for engagement with an abutment on the frame during rotation of the turret to restore the mechanism to its original state.

The wire holding head 13 comprises a rear wire clamping part 61 and a front wire guide 62 carried by arms 63 pivoted on opposite lateral sides of a base 64 of the clamping part 61. The wire guide defines a series of wire-receiving passageways retaining the leading ends of the wires laterally spaced in parallel, coplanar, relation. The clamping part 61 has a body also defining a series of wire-receiving passageways and a pair of wire clamping arms 67 are hinged to a lateral side of the body and retained in a wire clamping condition by a spring biased catch 65 pivoted to the opposite lateral side of the body. It should be noted that the catch is releasable by a roller 66 carried at the end of an abutment on the terminating ram engaging a cam surface of the catch during downward movement of the ram and compression spring 69 biases the clamping arms in an open condition in which the wire holding head can move freely along the wires.

The body of the wire holding head is mounted for reciprocation on rails 68 which extend between the stations and reciprocated by a 'flying' or 'rod-less' piston and cylinder

vice (not shown).

In operation of the apparatus to terminate a series of wires at one end and to prepare the other ends of the wires for termination or testing, the wire holding head 13 is advanced from behind the second station 12 to the first station 11 with the clamping arms 67 engaging the wires which protrude at leading ends from the guide 62 so that they are generally aligned above respective slotted wire-connecting portions of a connector mounted in the connector holder. The steady arm 25 is then advanced to hold the connector support precisely located. The ram 14 is then depressed to drive the wires into the respective wire-connecting portions. During final stages of movement of the ram the abutment pin 20 engages the guide 62 to depress the guide lowering the leading ends of the wires adjacent the respective wire-connecting portions ensuring that they are accurately driven into the wire-connecting portions. Downward movement of the ram also causes the roller 66 to engage and release the catch 65 permitting the clamping arms 67 to be raised by the spring 69 (Figures 1 and 4) releasing the wires.

The wire holding head is then returned along the wires to a location immediately behind the severing and stripping blades and the wire lengthening arm 30 is depressed to draw wires through the wire holding head.

The severing and stripping assembly 36 is then depressed during which movement the abutment pin (35) depresses the clamping arms on the head to clamp the wires and the abutment pin 35 depresses the guide 62 against a stop 71 on the frame base. During the final stages in the downward movement of the head the severing blades 38, 40 sever the wires and the stripping blades 37, 39 penetrate the insulation on the wires. The roller 45 also engages the wires to clamp them laterally. Further downward movement of the wire lengthening arm 30 pulls the wires to strip insulation from their ends (Figure 2).

The combs 51 are then raised by advancing rod 56 to push the linkage 53, 55 overcentre to maintain the severed ends of the wires in their predetermined laterally spaced relation (Figure 3).

Both the ram 11 and the head assembly 36 are then raised, together with the wire lengthening arm 30 and the connector steady-arm 25 and comb operating rod 56 withdrawn.

The turrets 19 and 27 are then indexed to convey the wires terminated at one end and held in predetermined laterally spaced relation by the combs at their other ends to a testing or termination station at the same time bringing another connector into alignment with the ram.

Subsequent rotary indexing of the turrets causes the ejection cam to operate the connector ejection mechanism, ejecting the connector from the holder and the trip arm 58 is

thrown to return the linkage 53, 55 to its former position lowering the combs 51.

Claims

1. Apparatus for terminating individual wires of a series of wires simultaneously in respective contacts arranged in a row in an electrical connector (17) including a terminating station (11) comprising a connector support (15) and a ram (14) reciprocable relative to the support to drive wires into wire-receiving parts of respective contacts of a connector mounted on the support, and a wire holding head (13) mounted for reciprocating movement between the terminating station and a wire supply to feed a series of wires from the supply to a location spaced from, and between, the connector and the ram (14), the wire holding head (13) comprising a wire clamp (61) and a wire guide (62) mounted forwardly of the clamp and having a series of wire-receiving passageways retaining the wires in predetermined, laterally spaced, parallel coplanar relation, characterised in that the wire guide (62) is mounted for pivotal movement relative to the clamp (61) and is engageable by an abutment (20) provided on the ram (14) during a terminating stroke to pivot towards the connector support (15) to guide leading ends of the wires to wire connecting parts of respective contacts in the connector (17).

2. Apparatus according to Claim 1, characterised in that the connector support (15) comprises a series of connector holders (18) located on a turret (19) mounted for stepped rotation about an axis parallel to the path of movement of the wire holding head (13) when the wire holding head (13) is remote from the termination station (11) to bring connectors successively into alignment with the ram (14).

3. Apparatus as claimed in Claim 1 characterised in that a wire support (48) is provided between the severing and stripping station (12) and the terminating station (11) and comprises a wire locating comb (51) movable into engagement with the wires to maintain their predetermined spacing after severing.

4. Apparatus according to Claim 3, characterised in that a series of connector supports (15) and wire supports (48) are located on respective turrets (19, 27) mounted for synchronous stepped rotation about an axis parallel to the path of movement of the wire holding head (13) after termination and severing.

Patentansprüche

1. Vorrichtung zum gleichzeitigen Abschließen einer Reihe von Drähten in entsprechenden Kontakten, die in einer Reihe in einem elektrischen Verbinder (17) angeordnet sind, mit einer Abschlußstation (11), die eine Verbinderstütze (15) und einen gegenüber der Stütze hin- und herbewegbaren Stoßel (14) aufweist, der



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device (not shown).

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Both the ram 11 and the head assembly 36 are then raised, together with the wire lengthening arm 30 and the connector steady-arm 25 and comb operating rod 56 withdrawn.

The turrets 19 and 27 are then indexed to convey the wires terminated at one end and held in predetermined laterally spaced relation by the combs at their other ends to a testing or termination station at the same time bringing another connector into alignment with the ram.

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2. Apparatus according to Claim 1, characterised in that the connector support (15) comprises a series of connector holders (18) located on a turret (19) mounted for stepped rotation about an axis parallel to the path of movement of the wire holding head (13) when the wire holding head (13) is remote from the termination station (11) to bring connectors successively into alignment with the ram (14).

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4. Apparatus according to Claim 3, characterised in that a series of connector supports (15) and wire supports (48) are located on respective turrets (19, 27) mounted for synchronous stepped rotation about an axis parallel to the path of movement of the wire holding head (13) after termination and severing.

Patentansprüche

1. Vorrichtung zum gleichzeitigen Abschließen einer Reihe von Drähten in entsprechenden Kontakten, die in einer Reihe in einem elektrischen Verbinder (17) angeordnet sind, mit einer Abschlußstation (11), die eine Verbinderstütze (15) und einen gegenüber der Stütze hin- und herbewegbaren Stößel (14) aufweist, der



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Drähte in Drahtaufnahmeteile entsprechender Kontakte eines auf der Stütze angebrachten Verbinders eintreibt, und mit einem Drahthaltekopf (13), der zwischen der Abschlußstation und einem Drahtvorrat hin- und herbewegbar angebracht ist und eine Reihe von Drähten vom Vorrat zu einer Stelle fördert, die einen Abstand vom Verbinder hat und zwischen dem Verbinder und dem Stößel (14) liegt, und der eine Drahtklemme (61) und eine Drahtführung (62) aufweist, welche vor der Klemme angeordnet ist und eine Reihe von Drahtaufnahmedurchführungen hat, die die Drähte in vorherbestimmtem Verhältnis seitlich in Abständen voneinander parallel in der gleichen Ebene halten, dadurch gekennzeichnet, daß die Drahtführung (62) gegenüber der Klemme (61) schwenkbar beweglich angebracht ist und bei einem Abschlußhub mit einem am Stößel (14) vorgesehenen Anschlag (20) in Eingriff bringbar und in Richtung Verbinderstütze (15) schwenkbar ist, um die führenden Enden der Drähte zu Drahtanschlußteilen entsprechender Kontakte im Verbinder (17) zu führen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Verbinderstütze (15) eine Reihe von Verbinderhaltern (18) aufweist, die an einer Revolvereinrichtung (19) angeordnet sind, welche um eine Achse parallel zur Bewegungsbahn des Drahthaltekopfs (13) bei von der Abschlußstation (11) entferntem Drahthaltekopf (13) stufenweise drehbar ist und die Verbinder nacheinander mit dem Stößel (14) zur Ausrichtung bringt.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß zwischen der Abtrenn- und Abisolierstation (12) und der Abschlußstation (11) eine Drahtstütze (48) vorgesehen ist, die einen Drahtlokalisierkamm (51) aufweist, der mit den Drähten in Eingriff bewegbar ist und nach dem Abtrennen den vorbestimmten Abstand zwischen ihnen aufrechterhält.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß eine Reihe von Verbinderstützen (15) und Drahtstützen (48) an entsprechenden Revolvereinrichtungen (19, 27) angeordnet sind, welche um eine Achse parallel zur Bewegungsbahn des Drahthaltekopfs (13) nach dem Abschluß und dem Abtrennen synchron stufenweise drehbar sind.

Revendications

1. Appareil pour la terminaison simultanée de fils individuels d'une série de fils dans des

contacts respectifs agencés en une rangée dans un connecteur électrique (17), comprenant un poste (11) de terminaison comportant un support (15) de connecteur et un coulisseau (14) pouvant exécuter un mouvement alternatif par rapport au support pour introduire des fils dans des parties de réception de fils de contacts respectifs d'un connecteur monté sur le support, et une tête (13) de maintien des fils montée pour exécuter un mouvement alternatif entre le poste de terminaison et une alimentation en fils pour faire avancer une série de fils de l'alimentation vers une position espacée de, et située entre, le connecteur et le coulisseau (14), la tête (13) de maintien de fils comprenant une bride (61) de fils et un guide (62) de fils monté en avant de la bride et présentant une série de passages de réception de fils retenant les fils dans une disposition coplanaire parallèle, espacée latéralement et prédéterminée, caractérisé en ce que le guide (62) de fils est monté de façon à pouvoir pivoter par rapport à la bride (61) et peut être engagé par une butée (20) située sur le coulisseau (14), pendant une course de terminaison, pour pivoter vers le support (15) de connecteur afin de guider des extrémités avant des fils vers des parties de connexion de fils de contacts respectifs situés dans le connecteur (17).

2. Appareil selon la revendication 1, caractérisé en ce que le support (15) de connecteur comprend une série de porte-connecteurs (18) situés sur une tourelle (19) montée de façon à pouvoir tourner pas à pas autour d'un axe parallèle à la course du mouvement de la tête (13) de maintien de fils lorsque la tête (13) de maintien de fils est éloignée du poste (11) de terminaison, afin d'amener les connecteurs successivement en alignement avec le coulisseau (14).

3. Appareil selon la revendication 1, caractérisé en ce qu'un support (48) de fils est prévu entre le poste (12) de sectionnement et de dénudage et le poste (11) de terminaison et comprend un peigne (51) de positionnement de fils pouvant être amené en prise avec les fils pour maintenir leur espacement prédéterminé après le sectionnement.

4. Appareil selon la revendication 3, caractérisé en ce que des séries de supports (15) de connecteurs et de supports (48) de fils sont disposés sur des tourelles respectives (19, 27) montées pour effectuer une rotation pas à pas synchrone autour d'un axe parallèle à la course du mouvement de la tête (13) de maintien de fils après la terminaison et le sectionnement.