

PATENT SPECIFICATION

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(72) Inventors ROBERT PHILMORE REAVIS JR.
LINCOLN EDWIN ROBERTS
JOHN ROBERT SHOEMAKER



(54) IMPROVEMENTS RELATING TO ELECTRICAL CONNECTORS AND TERMINALS THEREFOR

(71) We, AMP INCORPORATED, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of Eisenhower Boulevard, Harrisburg, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The invention relates to electrical terminals.

An electrical terminal according to one aspect of the invention comprises a metal portion defining a wire engaging slot with parallel walls which slot opens at one end at a wire-receiving mouth through which an insulated wire can be forced transversely of its axis into the slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core, the portion being formed, on one side of the slot, with a slit which extends transversely of the slot and opens at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

The invention also includes an electrical terminal having a tubular metal portion with an axially extending open seam, defining a wire engaging slot with parallel walls, which slot opens at one end at a wire-receiving mouth through which an insulated wire can be forced transversely of its axis into the slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core, the tubular portion being formed, on one side of the slot, with a slit which extends trans-

versely of the slot and opens at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

According to another aspect of the invention, an electrical connector comprises a housing moulded of plastics material and formed with terminal-receiving through-cavities extending between a front and rear face of the housing, the floor of each cavity and the terminals received in respective through-cavities being formed with latching means which co-operate to retain the terminals in respective through-cavities, a rearward portion of each terminal being a metal tube with an axially extending open seam defining a wire engaging slot with parallel walls and having a wire-receiving mouth at a rear end of the tube, a slit being formed in the tube on one side of the slot to extend transversely of the slot and open at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the cavities opening onto one side of the housing adjacent the rear face to expose the slots so that one or more insulated wires can be forced transversely of their axes through the mouth into each slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core with the or each wire extending transversely of the tube axis, the slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

A specific example of the invention will now be described with reference to the ac-

companying drawings in which:

Figure 1 is a perspective view of an electrical connector according to the invention;

Figure 2 is a perspective view of the connector with elements exploded apart for clarity;

Figure 3 is a cross-sectional view of the connector housing taken along the line 3-3 in Figure 2;

Figure 4 is a cross-sectional view of the connector taken along the line 4-4 in Figure 1;

Figure 5 is a plan view of a portion of the connector with the cover member raised and parts broken away; and

Figure 6 is a plan view of a portion of the connector illustrating one manner in which a wire of relatively large diameter is connected to a terminal according to the invention.

The connector comprises a housing 10 moulded of suitable insulating plastics material, having a mating or forward face 12 and a rear face 14. A row of contact receiving cavities 16 extend side-by-side through the housing communicating with front and rear faces and a terminal 18 is retained in each cavity.

Each terminal is stamped and formed in one-piece from sheet metal stock and has at its forward end a flat tongue 20 having a reverse bend 22 to provide a rearwardly extending bifurcated contact portion 24 for engagement with conductors 8 on a printed circuit board 4. A resilient locking lance 26 is struck from the base of the tongue 20 to extend rearwardly of the terminal. A web 30, which is co-extensive with the tongue 20, joins the tongue with a rear portion 28 of the terminal which portion is tubular having walls 32, which are turned inwardly towards each other at their free ends to provide an axially extending open seam which constitutes a wire-receiving slot 34 which opens at the rear of the terminal to provide a wire-receiving mouth 40.

The slot is divided into two wire-receiving portions by shears which form slits 36 opening into the slot walls intermediate the slot ends and extending transversely of the slot at an oblique angle to its length to punched holes 35. The slot is thus divided into two semi-independent spring systems to receive two or more wires or one relatively coarse wire.

The underside of the tube is cut away at the rear end (Figure 4) so that upper portions of the walls define rearwardly extending cantilever springs. This feature is advantageous for the wire insertion operation described in U.K. Patent Application No. 11852/74 (Serial No. 1 463 829).

The through cavities 16 in the housing 65 are separated from each other towards the

forward face of the housing by T-shaped barriers 42 which extend from the floor of the housing part way to the upper wall 43 to define a recess 58 for receiving an edge of the printed circuit board 4. A recess 46 is formed in a floor 44 of each cavity and extends inwardly from the forward face to a blind end which defines a shoulder 48 for co-operation with the lance 26 of a terminal. An additional recess 50 formed in the floor extends from the rear face 14 of the housing and has a ramp 49 at a blind end.

An intermediate portion 51 of the cavity is constricted as shown in Figure 4 so that the terminals cannot move completely through the cavity on insertion from the rear face and the rearward portion of each cavity is enlarged to accommodate the tubular conductor receiving portion of the terminal. Openings 54 are provided on the upper side 52 of the housing to expose the slotted portion of the terminals where inserted into the cavities and are formed with arcuate inner ends 56 as shown in Figure 5. The walls between adjacent cavities project from the rear face at 53 to insulate the rear ends 38 of adjacent terminals from each other.

A removable cover 60 is provided on the rear face 14 of the housing and comprises a base 62 having flanges 64, 65 upstanding from the opposite sides of the base to define a channel section. Latch arms 68 extend from opposite ends of the cover and have outwardly displaced free end sections 70 formed with slots 72. The edges 66 of the flanges 64, 65 are chamfered to provide curved surfaces over which the wire 6 can be dressed when connected to the terminals.

A terminal is mounted in the housing by inserting it axially into a cavity from the rear face. During insertion the lance 26 is flexed into the plane of the tongue by the ramp 49 and then springs into the recess 46, abutting the shoulder 48 to prevent removal of the terminal. Over-insertion of the terminal is prevented by the constriction abutting the front end of the tubular portion.

Individual wires can be inserted into the slots by using the apparatus described in U.K. Patent Application No. 11852/74 (Serial No. 1 463 829) which provides gang insertion and trimming of the wires simultaneously. As the slit is very narrow the walls of the slot are substantially continuous and wires can be forced along the slot to be received on either side of the slit.

After insertion of the wires into the slots, the cover can be assembled with the housing by advancing the cover towards the rear face until the slots 72 in the arms 130

receive the bosses 74 as a snap fit.

The flange 64 then extends partially over the side 52 of the housing and partially covers the openings 54. The wires are thus confined between the flange 64 and the inner ends 56 of the openings 54 to extend perpendicularly of the slots.

Where individual wires are located on opposite sides of the slit 36 they will each be a separate spring system. This arrangement avoids a concentration of extremely high stresses in a localised zone which would result if two wires were located adjacent each other in a single slot of a terminal having only one spring system. The terminal can accommodate a relatively wide range of wire sizes. Where a relatively coarse gauge wire is inserted into the slot, it may be advantageous to locate this coarse wire at the intersection of the shear 36 and the conductor receiving slot 34 as shown in Figure 6. Where so located, four zones of electrical contact are established as the two spring systems both establish the connection.

An advantage of the terminal is that the wire receiving slot can be formed by a relatively simple, but precisely controllable, die forming operation and it is not necessary to punch a precisely dimensioned slot as is common in some prior art devices. It has been found that a very good mechanical connection between the wire and the terminal is achieved particularly where the wire is pulled in a direction normal to the axis of the tubular portion of the terminal. The cover orientates the wires perpendicularly to the axis of the terminal so than any tensile force applied to the wires is transmitted to the connection in the preferred normal direction.

The connector assembly is particularly advantageous for use in harness manufacturing methods as disclosed in U.S. Patent Application No. 11851/74 (Serial No. 1 463 828).

It should be noted that wires having the form of flat conductors may be used in the connector.

WHAT WE CLAIM IS:—

1. An electrical terminal comprising a metal portion defining a wire engaging slot with parallel walls which slot opens at one end at a wire-receiving mouth through which an insulated wire can be forced transversely of its axis into the slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core, the portion being formed, on one side of the slot, with a slit which extends transversely of the slot and opens at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the slot extending substantially

continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

2. An electrical terminal having a tubular metal portion with an axially extending open seam, defining a wire engaging slot with parallel walls, which slot opens at one end at a wire-receiving mouth through which an insulated wire can be forced transversely of its axis into the slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core, the tubular portion being formed, on one side of the slot, with a slit which extends transversely of the slot and opens at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

3. An electrical terminal according to Claim 2, in which a second similar transverse slit is formed in the tubular portion on the other side of the slot, the second slit opening at one end into the slot at a location opposite the first slit.

4. An electrical terminal according to Claim 2 or Claim 3, in which a web extends axially from a wall of the tubular portion opposite the slot which web is reversely bent to define a resilient contact tongue adapted to effect electrical contact to a printed circuit board.

5. An electrical connector comprising a housing moulded of plastics material and formed with terminal-receiving through-cavities extending between a front and rear face of the housing, the floor of each cavity and the terminals received in respective through-cavities being formed with latching means which co-operate to retain the terminals in respective through-cavities, a rearward portion of each terminal being a metal tube with an axially extending open seam defining a wire engaging slot with parallel walls and having a wire-receiving mouth at a rear end of the tube, a slit being formed in the tube on one side of the slot to extend transversely of the slot and open at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the cavities opening onto one side of the housing adjacent the rear face to expose the slots so that one or more insulated wires can be forced transversely of their axes through the mouth into each slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core with the or each wire extending transversely of the tube axis, the

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continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

2. An electrical terminal having a tubular metal portion with an axially extending open seam, defining a wire engaging slot with parallel walls, which slot opens at one end at a wire-receiving mouth through which an insulated wire can be forced transversely of its axis into the slot so that the walls of the slot penetrate the insulation to effect electrical connection to the wire core, the tubular portion being formed, on one side of the slot, with a slit which extends transversely of the slot and opens at one end into the slot at a location between the slot ends to divide the slot into two wire-receiving parts, one on each side of the slit, the slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

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slot extending substantially continuously through the wire-receiving parts so that the wire can be forced along the slot past the slit from one wire-receiving part to the other.

6. An electrical connector according to Claim 5, in which a cover member is releasably mounted on the housing and is adapted to cover the rear face and a portion of the one side adjacent the rear face thereby to maintain the wires extending transversely of the tube axis.

7. An electrical terminal substantially as hereinbefore described with reference to 15 and as shown in Figures 1 and 2, and 4 to

6 of the accompanying drawings.

8. An electrical connector substantially as described with reference to the accompanying drawings.

9. An electrical assembly comprising a 20 terminal according to any one of claims 1 to 4 or 7 and insulated wires received in respective wire-receiving parts, with the slot walls penetrating the insulations and effecting electrical connection with the wire 25 cores.

For the Applicants:
R. G. Stuart-Prince.
Chartered Patent Agent.

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