

PATENT SPECIFICATION

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 (72) Inventor ROBERT FRANKLIN EVANS



(54) ELECTRICAL TERMINALS AND CONNECTORS

(71) We, E. I. DU PONT DE NEMOURS AND COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of Wilmington, Delaware, 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 preformed, to be particularly described in and by the following statement:—

The present invention relates to electrical connectors and terminals for use therein, and particularly relates to self-stripping electrical connectors and terminals.

Electrical connectors including spring contact terminals and self-stripping wire terminals for connecting a plurality of insulated conductors to modular electronic circuit assemblies in complex electronics systems are well known in the art. A connector for terminating conductors for multiconductor cables is described in United States Patent No. 3,668,301, wherein an insert is used for forcing an insulated pair of electrical conductors into a cavity to destroy the electrical insulation and cause an electrical contact between the conductors and a conductive insert in the cavity. An electrical connector having an insulated housing with a cavity extending therethrough and an electrically conductive wedge is described in United States Patent No. 3,772,571. The wedge is driven downward against an insulated wire to break the insulation and provide an electrical connection between a terminal in the housing and the wire and wedge.

Viewed from one aspect the present invention provides an electrical terminal for connection to an insulated wire, which terminal includes a plate having an aperture formed therein, a pair of insulation skiving elements facing each other across said aperture for penetrating the insulation at two

longitudinally spaced regions when an insulated wire is pushed sideways into said aperture, and a pair of contact lips facing each other across said aperture inwardly of said insulation skiving elements and extending away from the plane of the plate whereby when the wire is pushed further into the aperture the insulation is held back by the skiving elements and the bare wire thus exposed is contacted by the contact lips.

Preferably the said aperture is elongate, one of the insulation skiving elements and one of the contact lips being situated at one end of the aperture and the other element and the other lips being situated at the opposite end of the aperture.

Preferably the said contact lips are also adapted to engage the edges of the insulation at said penetrations to oppose withdrawal of the wire from said aperture.

Preferably the terminal is formed from a single strip of metal having two openings spaced lengthwise thereof and bent to align said openings to define said aperture, the edge of one such opening being formed with said insulation skiving elements and the edge of the other opening being formed with said contact lips.

Preferably each of said insulation skiving elements comprises at least one V-shaped serration.

Viewed from another aspect the invention provides an electrical connector comprising an insulating housing and at least one electrical terminal mountable in said housing, said electrical terminal being as set forth above, said housing comprising a base having an internal surface for receiving said electrical terminal, said internal surface having an opening for receiving a wire when the latter is pushed into the said aperture in the terminal, and a cover having an internal portion which is arranged to push a wire into the said ap-

erture when the cover is engaged with the base.

Preferably the connector comprises a plurality of said electrical terminals mountable in the said base, the said base having a said internal receiving surface and a said opening for each of said terminals, and the said cover having a said wire pushing portion for each of said terminals.

10 An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of a connector of the present invention;

Figure 2 is a perspective view of a terminal of the present invention, as incorporated in the connector of Figure 1;

Figure 3 is an elevation view in section of the connector of Figure 1;

Figures 4-6 are elevation views similar to Figure 3 illustrating the self-stripping action in use of the connector;

Figures 7-9 are elevation views in section illustrating the versatility of the connector of Figure 1.

Referring to the drawings, the connector comprises a terminal 10 formed from strip metal spring stock including a contact 12 and a wire terminal 14. A base 16 for receiving the terminal 10, and a cover 18 engageable with the base provide an insulating housing for the terminal and wires inserted therein.

35 The wire terminal 14 of the terminal 10 is formed by bending and folding a strip having elongate openings 22 and 24 to form an aperture defined by opening 22 in overlying relationship with opening 24, and to provide upstanding wire guide members 26 and wire stop 28. Oval openings in strip 20 are bent in a U-shape to provide recesses 30 in wire guides 26 for receiving a wire inserted in the terminal and positioning it bridging the opening 22. Opening 22 is an elongate hexagon having V-shaped opposite ends 36. Opening 24 has contact lips 38 at opposite ends projecting away from overlying opening 22.

50 A contact 12 of the terminal 10 extends from the wire terminal 14. The contact 12 having a first flat section 40 extending from terminal 14, a first bowed section 42, a second bowed section 46, a lip 48 extending from bowed section 46 across the plane of strip 20, and a second flat section 44.

60 The base 16 of the insulating housing has side walls 50, rear wall 52, and a flat bottom surface 53. The cover 18 has side walls 54, rear wall 55 and a flat top surface 56. Cooperative circular openings 57 in the rear walls of the housing provide for receiving a plurality of wires in the connector. Opposing surfaces 60 and 62 of

base 16 and cover 18 have, respectively, recesses 64 for receiving contact terminals 10 and recesses 100 which form cavities for the contact terminals 10. An elongate rectangular through opening 68 is provided in the base 16 in each recess 64 substantially in alignment with openings 22 and 24 in wire terminal 10. Side walls 66 of the recess 64 confine the terminal in the housing. Surfaces 70 in communication with the recesses 64 provide for seating flat sections 40 and 44 of the contact ends 12 of the contact terminals 10, and lands 72 separate the contact ends 12 of terminals 10 from adjacent terminals in the housing. A groove 74 is provided for receiving the lip 48 of the contact end 12 of terminal 10. The groove is parallel to the front of base 16 and has a bottom surface 76, a front surface 78 and an inclined back surface 80. The groove 74 provides a stop for the flexing of the contact 12 of terminal 10 and prevents over-stressing of the contact. Posts 82 are provided on the walls 66 between adjacent recesses 64 in base 16. East post 82 has a first cylindrical section 84, a first frusto-conical section 86, a second cylindrical guide section 88, and a second frusto-conical section 90. The opposing surface 62 of cover 18, having recesses 100 therein, has rectangular insertion members 104 projecting from the recessed surface 102. Each member 104 has a concave surface 106 for engaging a wire. Holes 108 in cover 18 coincide with posts 82 and correspond in diameter with the first cylindrical section 84 of post 82 to provide an interference fit and secure the cover 18 on the base 16, when the cover 18 is engaged with the base. Pop-out discs 110 are provided in holes 108 for positioning cover 18 above base 16 during assembly of the connector.

Assembly of a plurality of insulated conductors in the connector assembly and the self-stripping feature of the connector assembly can be readily understood with reference to figures 4-6, wherein the self-stripping feature of the connector assembly is illustrated with reference to the wire W having an insulated sheath I.

The cover 18 is positioned over the base 16 having a terminal 10 disposed therein. Pop-out disc 110 in holes 108 support the housing 18 on posts 82 projecting from walls 66 between the recesses 64 in the first housing 16. Each wire W having an insulated sheath I is inserted in wire guide members 26 of the terminal 10 until the end of the wire engages the wire stop member 28 of the terminal 14, and the wire bridges the opening 22 in wire terminal 14. A suitable press is used to force cover 18 downward popping the disc 110

in holes 108 and engaging each concave surface 106 of member 104 with a respective insulated wire. The cover 18 is forced downward and the member 104 forces the wire against the opposing spaced sharp ends 36 of opening 22 and skives the insulated sheath I to expose the wire W at two points. The conductor is forced downward into opening 24 and the two exposed points of the conductor are engaged with the downturned opposing contact lips 38 of opening 24. The portion of the insulated conductor between the two exposed points is received in opening 68 in base 16, and the two exposed points of the conductor are firmly engaged in electrical contact with the downwardly projecting opposing lips 38 of opening 24 by member 104. The downwardly projecting edges of lips 38 engage the insulated sheath and prevent it from being retracted and preventing contact between lips 38 and the wire. The cover 18 and base 16 are locked together, by the interference fit between cylindrical sections 84 of posts 82 in base 16 and holes 108 in cover 18, providing sufficient pressure between the exposed segments of the wire and lips 38 to insure a reliable electrical connection between the lips 38 of the wire terminal 14 and the wire. The V-shaped ends 36 of opening 22 provide for skiving the insulation I from the wire and insure sufficient clearance between the ends 36 and the insertion member 104 to avoid damage to or severing of the wire W when inserted in the opening 22.

With particular reference to Figures 7-9, the versatility of the connector assembly and contact terminal of the present invention is illustrated. Figure 7 illustrates a wire to wire connection using identical connector blocks. Figure 8 illustrates an interconnection between a wire and a circuit board using a connector of figure 1. Figure 9 illustrates an interconnection between a wire and a conventional square pin disposed in a header block on a printed circuit board.

It will thus be seen that the invention, at least in its illustrated embodiment, provides a significant technical advance for reliable and efficient termination of one or more insulated wires. The edges of the insulation skiving elements and the contact lips retain the severed insulation to each side of the contact area with the exposed wire and reduce the possibility of the severed insulation interfering with the electrical connection. The connector illustrated in the drawings provides a versatile low profile electrical interconnection system for electronic circuit assemblies and systems.

WHAT WE CLAIM IS:—

1. An electrical terminal for connection

to an insulated wire, which terminal includes a plate having an aperture formed therein, a pair of insulation skiving elements facing each other across said aperture for penetrating the insulation at two longitudinally spaced regions when an insulated wire is pushed sideways into said aperture, and a pair of contact lips facing each other across said aperture inwardly of said insulation skiving elements and extending away from the plane of the plate whereby when the wire is pushed further into the aperture the insulation is held back by the skiving elements and the bare wire thus exposed is contacted by the contact lips.

2. An electrical terminal as claimed in claim 1, wherein the said aperture is elongate, one of the insulation skiving elements and one of the contact lips being situated at one end of the aperture and the other element and the other lip being situated at the opposite end of the aperture.

3. An electrical terminal as claimed in claim 1 or 2, wherein said contact lips are also adapted to engage the edges of the insulation at said penetrations to oppose withdrawal of the wire from said aperture.

4. An electrical terminal as claimed in any of claims 1 to 3, which is formed from a single strip of metal having two openings spaced lengthwise thereof and bent to align said openings to define said aperture, the edge of one such opening being formed with said insulation skiving elements and the edge of the other being formed with said contact lips.

5. An electrical terminal as claimed in any of the preceding claims, wherein each of said insulation skiving elements comprises at least one V-shaped serration.

6. An electrical terminal substantially as hereinbefore described with reference to the accompanying drawings.

7. An electrical connector comprising an insulating housing and at least one electrical terminal mountable in said housing, said electrical terminal being as claimed in any of claims 1 to 6, said housing comprising a base having an internal surface for receiving said electrical terminal, said internal surface having an opening for receiving a wire when the latter is pushed into the said aperture in the terminal, and a cover having an internal portion which is arranged to push a wire into the said aperture when the cover is engaged with the base.

8. An electrical connector as claimed in claim 7, which comprises a plurality of said electrical terminals mountable in the said base, the said base having a said internal receiving surface and a said opening for each of said terminals, and the said cover having a said wire pushing portion



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in holes 108 and engaging each concave surface 106 of member 104 with a respective insulated wire. The cover 18 is forced downward and the member 104 forces the wire against the opposing spaced sharp ends 36 of opening 22 and skives the insulated sheath I to expose the wire W at two points. The conductor is forced downward into opening 24 and the two exposed points of the conductor are engaged with the downturned opposing contact lips 38 of opening 24. The portion of the insulated conductor between the two exposed points is received in opening 68 in base 16, and the two exposed points of the conductor are firmly engaged in electrical contact with the downwardly projecting opposing lips 38 of opening 24 by member 104. The downwardly projecting edges of lips 38 engage the insulated sheath and prevent it from being retracted and preventing contact between lips 38 and the wire. The cover 18 and base 16 are locked together, by the interference fit between cylindrical sections 84 of posts 82 in base 16 and holes 108 in cover 18, providing sufficient pressure between the exposed segments of the wire and lips 38 to insure a reliable electrical connection between the lips 38 of the wire terminal 14 and the wire. The V-shaped ends 36 of opening 22 provide for skiving the insulation I from the wire and insure sufficient clearance between the ends 36 and the insertion member 104 to avoid damage to or severing of the wire W when inserted in the opening 22.

With particular reference to Figures 7-9, the versatility of the connector assembly and contact terminal of the present invention is illustrated. Figure 7 illustrates a wire to wire connection using identical connector blocks. Figure 8 illustrates an interconnection between a wire and a circuit board using a connector of figure 1. Figure 9 illustrates an interconnection between a wire and a conventional square pin disposed in a header block on a printed circuit board.

It will thus be seen that the invention, at least in its illustrated embodiment, provides a significant technical advance for reliable and efficient termination of one or more insulated wires. The edges of the insulation skiving elements and the contact lips retain the severed insulation to each side of the contact area with the exposed wire and reduce the possibility of the severed insulation interfering with the electrical connection. The connector illustrated in the drawings provides a versatile low profile electrical interconnection system for electronic circuit assemblies and systems.

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2. An electrical terminal as claimed in claim 1, wherein the said aperture is elongate, one of the insulation skiving elements and one of the contact lips being situated at one end of the aperture and the other element and the other lip being situated at the opposite end of the aperture.

3. An electrical terminal as claimed in claim 1 or 2, wherein said contact lips are also adapted to engage the edges of the insulation at said penetrations to oppose withdrawal of the wire from said aperture.

4. An electrical terminal as claimed in any of claims 1 to 3, which is formed from a single strip of metal having two openings spaced lengthwise thereof and bent to align said openings to define said aperture, the edge of one such opening being formed with said insulation skiving elements and the edge of the other being formed with said contact lips.

5. An electrical terminal as claimed in any of the preceding claims, wherein each of said insulation skiving elements comprises at least one V-shaped serration.

6. An electrical terminal substantially as hereinbefore described with reference to the accompanying drawings.

7. An electrical connector comprising an insulating housing and at least one electrical terminal mountable in said housing, said electrical terminal being as claimed in any of claims 1 to 6, said housing comprising a base having an internal surface for receiving said electrical terminal, said internal surface having an opening for receiving a wire when the latter is pushed into the said aperture in the terminal, and a cover having an internal portion which is arranged to push a wire into the said aperture when the cover is engaged with the base.

8. An electrical connector as claimed in claim 7, which comprises a plurality of said electrical terminals mountable in the said base, the said base having a said internal receiving surface and a said opening for each of said terminals, and the said cover having a said wire pushing portion

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for each of said terminals.

9. An electrical connector substantially as hereinbefore described with reference to 5 the accompanying drawings.

For the Applicants,
FRANK B. DEHN & CO.,
Imperial House,
15-19 Kingsway,
London WC2B 6UZ.

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