Nov. 8, 1960 S. P. LIPPEL 2,959,763

ELECTRICAL CONNECTOR

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FIG. 1

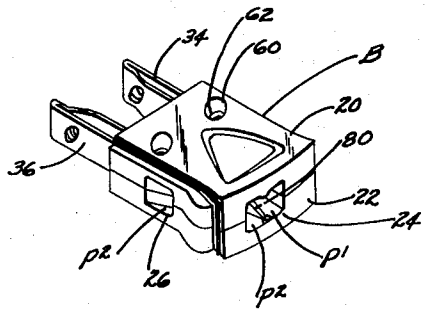


FIG. 2

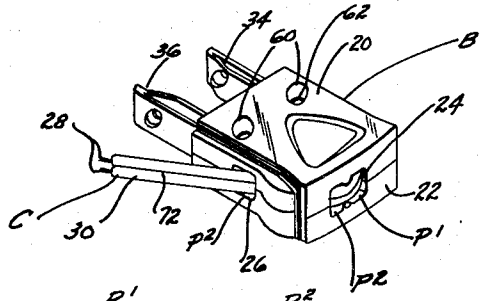


FIG. 3

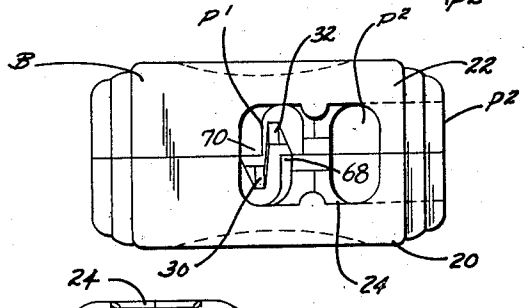
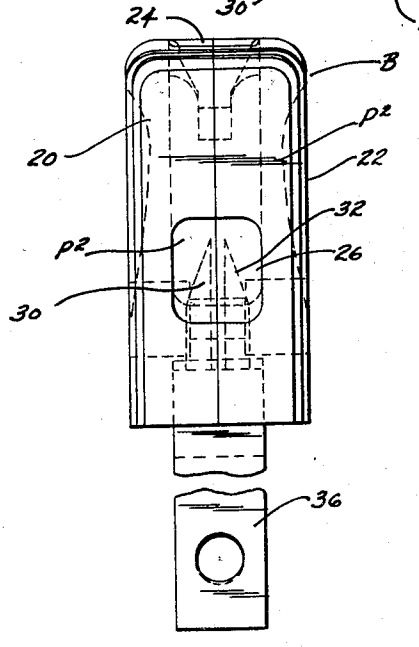


FIG. 4



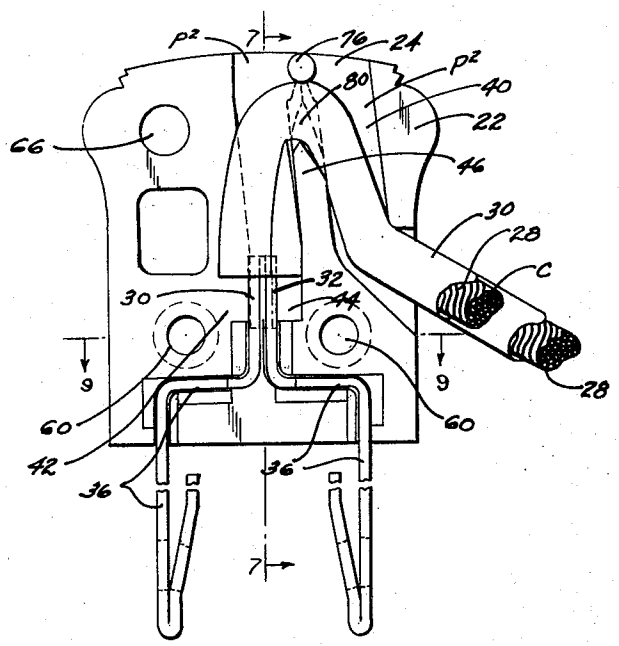
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ELECTRICAL CONNECTOR

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FIG. 5



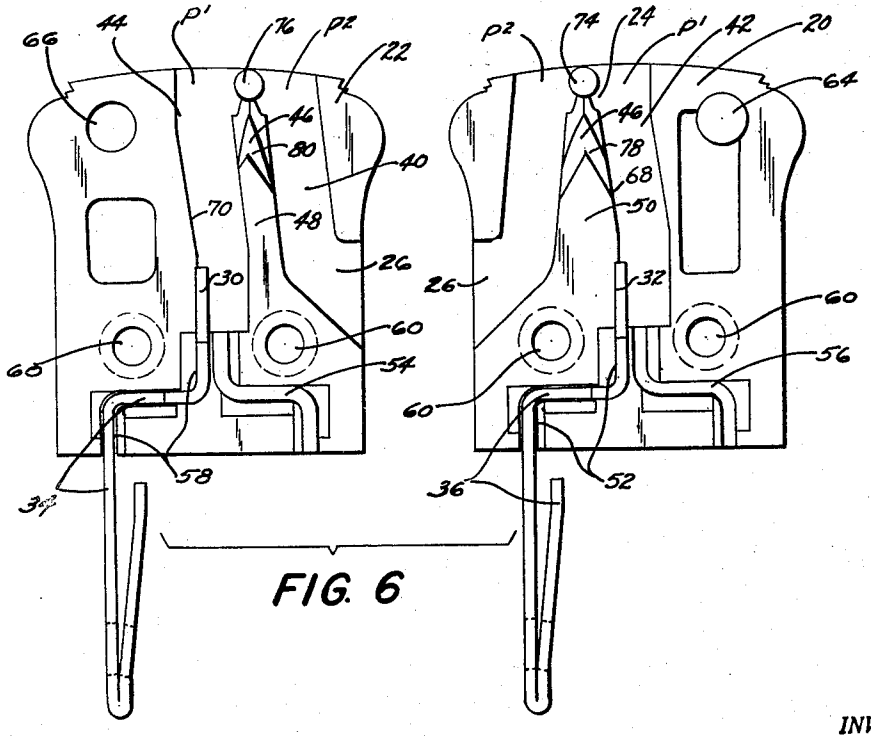


FIG. 6

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ELECTRICAL CONNECTOR

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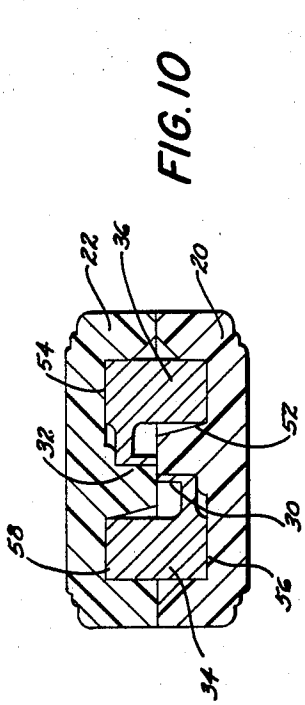


FIG. 10

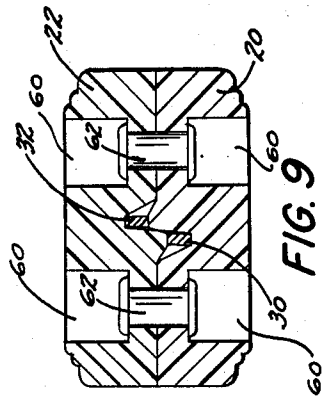


FIG. 9

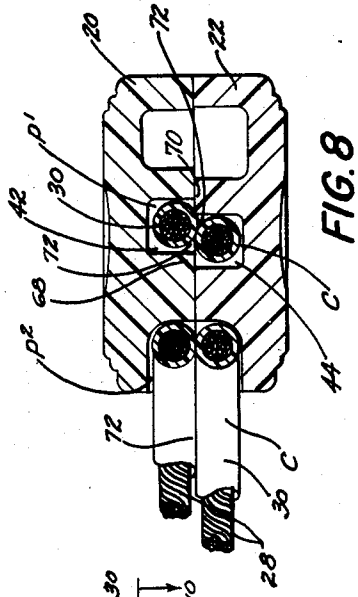


FIG. 8

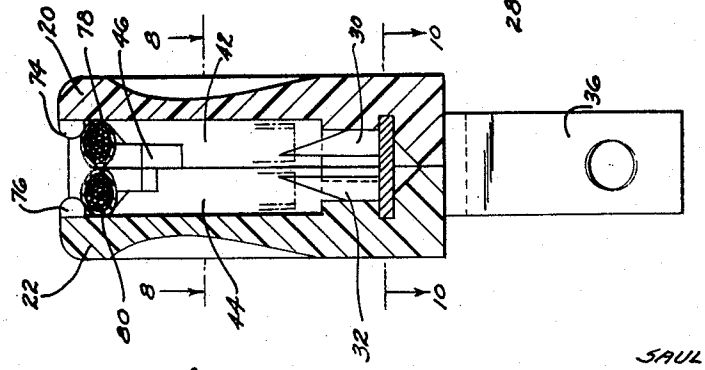


FIG. 7

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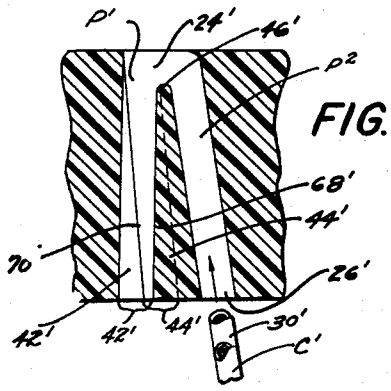


FIG. 11

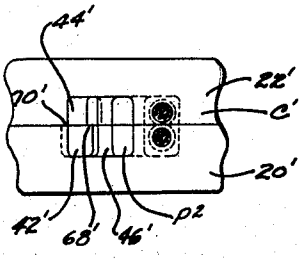


FIG. 11A

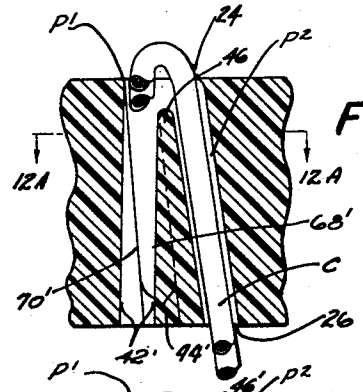


FIG. 12

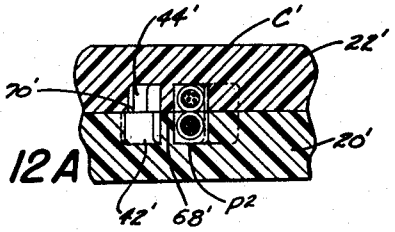


FIG. 12A

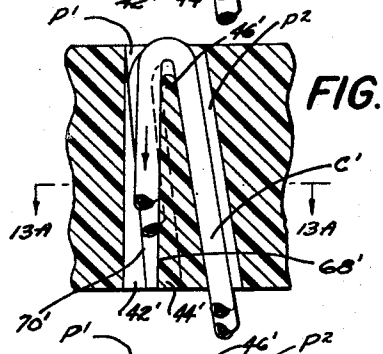


FIG. 13

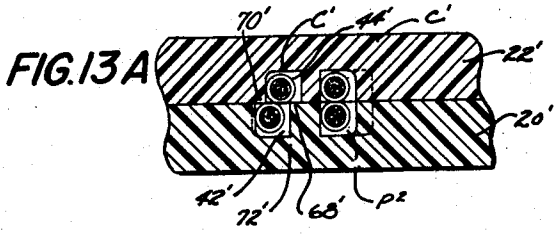


FIG. 13A

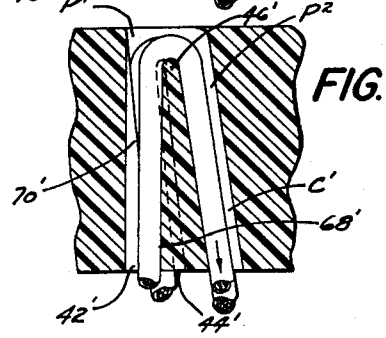


FIG. 14

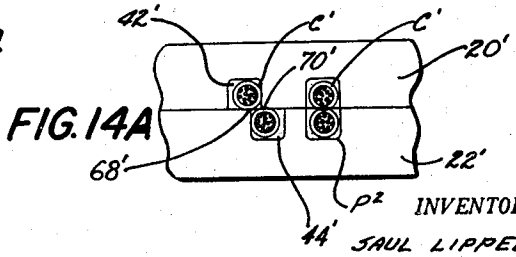


FIG. 14A

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United States Patent Office 2,959,763 Patented Nov. 8, 1960

2,959,763

ELECTRICAL CONNECTOR

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Filed July 27, 1956, Ser. No. 600,502

3 Claims. (Cl. 339—196)

This invention relates to an electrical connector and more particularly to an electrical connector for duplex electrical conductor cords.

The prime object of the present invention centers about the production of an improved electrical connector of the type disclosed in the Letters Patent to Sams and Feldman, No. 2,675,531, granted April 13, 1954.

This type of electrical connector comprises a body containing contact prongs, which form part of the contact terminals of the connector and to which the wires of the duplex cord are to be connected, the said body being formed internally with passages into and through which a duplex cord, the free end of which is merely cut or snipped with a scissors, is moved in such a manner that the exposed wire ends of the duplex cord are forced into the prong contacts for making the necessary electrical circuit connection. The connector thus comprises a unitary element having no movable parts and no securing members (such as binding posts or screws) that require manipulation, attachment of a duplex or multiple wire cord to the connector being achieved merely by the act of inserting the conductor cord into the connector, the wires or wire strand of the connector being moved into electrical contact and engagement with the connector prongs. There is thus provided a connector, the use of which eliminates the necessity of stripping the wire, removing the insulation or fastening the wire by means such as connecting screws, posts or the like, or of providing movable and manipulable elements for bringing the wires into contact engagement with prongs as are required in some of the more modern types of connectors.

It is the first purpose of the present invention to produce a connector of the type referred to in which the connector body is made of two sections which are capable of being readily moldable and which may then be joined together and assembled with the contact terminals to form the desired unitary structure. The first main object of the present invention, therefore, relates to the devising of a construction which serves to successfully achieve this purpose.

The main problem involved in the making of a connector of the referred to type is to so build the connector body and particularly the passages thereof thru which the conductor cord is to move so that (1) the conductor cord may first be easily and unerringly guided thru the passages towards the contact prongs and (2) the insulated wires of the duplex cord may be so moved thru the passage leading to the contact prongs that the ends of the wires may be maintained in proper and rigid alinement with the contact prongs for effecting the electrical circuit connection. It is a further prime object of the invention to construct a connector, particularly of the type in which the body comprises a pair of united sections, which effectively solves this main problem.

Another problem met with in the use of this connector is linked with the behavior of a duplex cord when after

being attached to the connector is pulled to tighten the connection. In pulling the cord after attachment, due to the difference in stretchability of the wires and the insulation, there is a movement (recession) of the wires in the insulating jacket, interfering with the connection of the wires to the contact prongs. It is, therefore, necessary to provide means for automatically constricting and thereby locking the cord in position at the inception of the pull exerted thereon. The provision of an effective constricting and locking means for the referred to connector unit is another principal object of the present invention.

Other objects include so designing the unitary connector that the pairs of wires and contact prongs are so positioned as to be at all times adequately insulated one pair from the other, and that the unit may be capable of being manufactured by quantity methods while maintaining the desired degrees of tolerances.

To the accomplishment of the foregoing objects and such other objects as may hereinafter appear my invention relates to the electrical connector as sought to be defined in the appended claims taken together with the following specification and the accompanying drawings in which:

Fig. 1 is a perspective view of the unitary electrical connector of the present invention;

Fig. 2 is a similar perspective view thereof showing the same with the duplex conductor wire inserted therein;

Fig. 3 is a top plan view of the connector drawn to an enlarged scale;

Fig. 4 is a side elevational view thereof;

Fig. 5 is a front elevational view thereof with one of the body sections (which may be referred to as the top section) removed therefrom;

Fig. 6 is an elevational view of the same showing the two sections namely, the bottom section and the top section separated into an open position (for purposes of illustration);

Fig. 7 is a view taken in cross-section in the plane of the line **7, 7** of Fig. 5;

Fig. 8 is a view of the connector (with a duplex wire inserted) taken in cross-section in the plane **8, 8** of Fig. 7;

Fig. 9 is a view of the connector taken in cross-section in the plane of the line **9, 9** of Fig. 5;

Fig. 10 is a view thereof taken in cross-section in the plane of the line **10, 10** of Fig. 7; and

Figs. 11 to 14A are sequential views (taken in vertical cross-section and in transverse cross-section) schematically depicting some of the principles of construction of the connector and the manner of using the same.

Referring now more in detail to the drawings and having reference first to Figs. 1 to 4 thereof which show the assembled connector unit and which partly shows the manner of using the same, the connector comprises in its generalized aspect a body B made of two sections **20** and **22** joined together, each section having channels mating with the other section, said channels defining a first passage P′ in said body extending inwardly from an opening **24** in said body and a second passage P^2 in said body extending inwardly from an aperture **26** in said body, said passages merging with each other at said opening **24** to form a return-bend loop.

The said passages P′ and P^2 are adapted to receive a duplex conductor cord C, Fig. 2, comprising a pair of insulated wires **28** joined together in an insulating jacket **30**, said duplex cord being insertable first through the second passage P^2 from the aperture **26**, to the opening **24**, and thence from said opening through the first passage P′ towards a plurality of prongs contacts which form part of said conductor unit. The pronged contacts comprise elements **30** and **32** which are formed integrally with the electrical terminals or blades **34** and

36 respectively of the connector. The pronged contacts 30 and 32 extend into said first passage P' in a direction opposite to the direction of insertion of the duplex cord C in said first passage P' for making electrical circuit connection with the wires 28, one prong for each wire of said duplex cord C.

Referring now to Figs. 5 and 6 of the drawings, the body sections 20 and 22 are shown detailingly to comprise two half sections which are adapted to be joined in a medial transverse plane (as shown in Figs. 1 to 4), each section 20 and 22 being formed with channels mating with channels in the other section, said channels defining the passages P' and P^2. Thus sections 20 and 22 are formed respectively with channels 38 and 40 which are adapted to mate when the sections are assembled to define or form the second passage P^2; and these sections are also formed respectively with the channels 42 and 44 which are adapted to mate when the sections are united to define or form the first passage P'. The body sections 20 and 22 each comprise a molded piece made of a suitable insulation and formed with the walls and cavities to produce the referred to channels and the other parts of the structure to be described later. The channels formed in the two sections merge with each other at the opening 24 to form a return-bend loop generally designated as 46. The channels 40 and 44 are otherwise separated by the wall formation 48 and the channels 38 and 42 by the wall formation 50.

For positioning and securely locking the electrical terminals including their integral prongs in position suitable cavities and wall parts are formed in the molded sections as best shown in Figs. 5 and 6 of the drawings. The electrical terminals desirably are shaped as shown in Figs. 5 and 6 in double-bent form. The receiving cavities for these terminals (defined by suitable wall parts) are the cavity 52 in section 20 which mates with the cavity 54 in section 22 and the cavity 56 in section 20 which mates with the cavity 58 in section 22. The pronged contacts 30 and 32 are located, one in one body section and the other in the other body section (20 and 22); thus, the prong 30 is located in the body section 20 and the prong 32 is located in the body section 22 (see e.g. Figs. 3 and 4). These prong contacts and their wire engaging points are thus located both transversely and vertically of the connector body B, and thus lie in a plane diagonally of the connector body B. The body sections may also be formed with the spaced holes designated as 60 for receiving rivets 62 to unite the sections in a unit (see Figs. 1 and 2). The mating sections may also be provided with additional locating means comprising a unitary pin 64 in section 20 which mates with a hole 66 in section 22.

The passages P' and P^2 and more particularly the channels which define the same are designed as aforesaid so that the conductor cord may be easily and unerringly guided through the passages towards the contact prongs and so that the insulated wires of the duplex cord may be moved through the passage P' leading to the contact prongs with the ends of the wires rigidified as they approach the prongs and maintained in proper and rigid alinement with the contact prongs for effecting the desired electrical circuit connection. The channels 38 and 40 which form the passage P^2 are the same in contour and formation as best shown in Fig. 6. The channels 42 and 44 which define the first passage P' are, however, different in contour and arrangement and for the purposes now to be described. In Fig. 5 is shown the channel 44 of the bottom section 22; and here the channel 42 of the mating section 20 (removed) is shown in phantom lines. Fig. 5 therefore depicts these channels 42 and 44 as diverging gradually in the direction from the opening 24 to the contact prongs 30 and 32. The channels 42 and 44 function to separately guide each of the two inserted wire parts of the duplex cord, each insulated wire being guided through one of the channels. The guide means are especially formed as part of these channels for accomplishing the above described purposes; and this guide means comprises the opposed wall corners 68 and 70 (see particularly Fig. 8) (see also Figs. 11 to 14) of the mating channels 42 and 44 respectively. These wall corners 68 and 70 act as rails for engaging the medial region of the insulating jacket 30 of the conductor cord C. In most cases these insulating jackets, particularly when formed of an insulation made of rubber or of plastic are formed medially with grooves 72 (see particularly Fig. 8); and in the movement of the cord into and through the passage P' the wall corner rails 68 and 70 engage these medial grooves for the guide function. As soon as the channels 42 and 44 diverge in the direction towards the contact prongs it will be observed that the said opposed corner rails 68 and 70 gradually converge in the same direction. The results are that as the duplex cord is moved into and through the passage P', the cord, first moving freely into the passage P' in the region of the opening 24 is then guided to move each of the insulated wires of the pair through its separate channel as clearly depicted in Fig. 8, the wall corner rails 68 and 70 exerting a gradually increasing constriction on the medially grooved region of the cord with the ultimate result that the ends of the wires are moved and maintained in proper and rigid alinement with the contact prongs for effecting the desired electrical circuit connection. This will be further explained in connection with the schematic views of Figs. 11 to 14A of the drawings.

In Figs. 11 to 14A, which show sequentially, schematic views depicting the movement of a duplex cord thru the passages P^2 and P' of the connector, the parts corresponding to the parts of the connector shown in Figs. 1 to 10 are indicated by the same but primed reference characters. Elevational view Fig. 11 and top view Fig. 11A depict the condition, indicated by the arrow, when the conductor cord C' is about to be passed into the aperture 26' of the passage P^2. Elevational view Fig. 12 and cross-sectional view Fig. 12A (taken in the plane of the line 12A—12A of Fig. 12) depict the condition when the cord C' has been threaded through the passage P^2, and after reaching the opening 24, has been looped about the return-bend loop 46' of the connector, for threading through the passage P'. Elevational view Fig. 13 and sectional view Fig. 13A (taken in the plane of the line 13A—13A of Fig. 13) depict the condition as the cord C' is being threaded through the passage P'. And elevational view Fig. 14 and bottom view thereof Fig. 14A depict the condition when the cord C' has been completely passed through the passage P' and the outside or other end of the cord has been pulled to seat the loop of the cord firmly on the return-bend loop 46'.

From these views it will be seen that the cord passes freely from the orifice 26' through the passage P^2, is then looped and passes freely from the opening 24' into the entrant end of the passage P'. It will then be seen that as the cord is threaded through the passage P', each insulated wire thereof is moved and guided into its own channel, and that as the channels 42' and 44' diverge and the corner rails 68' and 70' converge, the medial region (the grooves) 72' are engaged closer and tighter by the corner rails with the effect of stiffening or rigidifying the free ends of the cord for accurate alinement and positive inpingement connection with the contact prongs. In this action the insulated wires are oriented so as to lie transversely and, more particularly, diagonally of the connector sections. The constriction effected at the grooves also tends to give a slight separation to the wires. This also affords a substantial insulating separation between the prongs and the cord wires. It will also be observed that the channels have a cross-section substantially larger than the cord segments lodged therein, this permitting such separation and also permitting the use of different sizes of cords for a given size of a connector.

The means for locking the cord in its connected

or attached position is made to consist of elements which crimp and thereby constrict the cord as a pull is exerted on the outside end of the cord to seat the loop of the cord on the return-bend loop **46** (see Fig. 5; also Fig. 14). These elements comprise mutually facing camming walls formed at the reverse-bend loop **46**. This, and the effect thereof, is best shown in Fig. 8; the facing walls of the sections **20** and **22** at the loop, formed at the top with end beads **74** and **76**, are formed below the beads with converging wall faces **78** and **80** which act as camming means to constrict and grip the cord at the loop or bend. This means also serves as a strain-relief. It will also be noted that when the cord is lodged in its final position, the loop of the cord is fully housed by the connector.

To disconnect the conductor cord C from the connector, the operation shown in Figs. 11 to 14 is reversed. Thus the outside end of the cord is first pushed (Fig. 14) to free the cord loop from the reverse-bend loop **46'** (Fig. 13), forcing the cord to loop to the outside of the connector (as in Fig. 12), after which the cord is grasped at its loop and pulled; the cord is thus freed from the passage P' and may then be pulled free of the passage P^2.

The manner of making and using the connector of the present invention, the advantages thereof and the results achieved will be fully apparent from the above detailed description thereof. It will be further apparent that many changes may be made therein without departing from the spirit of the invention defined by the following claims.

I claim:

1. An electrical connector comprising a body made of two sections joined together in a plane transversely of said connector body, each section having a channel mating with a channel of the other section, said mating channels together defining a passage extending inwardly from an opening located at one end of said body and adapted to have inserted thereinto from said opening a duplex conductor cord comprising a pair of insulated wires joined together in an insulating jacket, a plurality of spaced terminal prongs having wire engaging contact points located at the opposite end of said body and lying in a plane diagonally of said body, one prong for each wire of the duplex cord extending into said passage and pointing in a direction opposite to the direction of insertion of said duplex cord, one of said prongs being located in one of said mating channels and the other of said prongs being located in the other of said mating channels, insertion and movement of said duplex cord into said passage resulting in forcing the wires of the duplex cord into said contact points for making electrical circuit connection, the walls of each said channel defining a wall corner rail, the said mating channels gradually diverging in the direction from said opening to said prongs, and opposed corner rails of said channels gradually converging in said direction, the said corner rails thereby defining guide means in said passage for guiding the duplex cord as the latter is moved into said passage and guiding each insulated wire through one of the channels and orienting the duplex cord to a position to lie diagonally of the connector body, said corner rails acting to engage the medial region of the insulating jacket of said duplex cord.

2. An electrical connector comprising a body made of two sections joined together in a plane transversely of said connector body, each section having channels mating with channels in the other section, said channels defining a first passage in said body extending inwardly from an opening located at one end of said body and a second passage in said body extending inwardly from an aperture located in a side of said body, said passages merging with each other at said opening to form a return-bend loop, the said passages being adapted to receive a duplex conductor cord comprising a pair of insulated wires joined together in an insulating jacket, said duplex cord being insertable first through said second passage from aperture to opening and then from said opening through the first passage, a plurality of spaced terminal prongs having wire engaging contact points located at an end of said body opposite said opening and lying in a plane diagonally of said body, said points extending into said first passage and pointing in a direction opposite to the direction of insertion of said duplex cord in said first passage for making electrical circuit connection with the wires, one point for each wire of said duplex cord, one of said prongs being located in one of the mating channels of said first passage and the other of said prongs being located in the other mating channel of said first passage, the walls of each said channel defining a wall corner rail, the said mating channels gradually diverging in the direction from said opening to said prongs, and opposed corner rails of said channels gradually converging in said direction, the said corner rails thereby defining guide means in said first passage for guiding the duplex cord as the latter is moved into said first passage and guiding each insulated wire through one of the channels and orienting the duplex cord to a position to lie diagonally of the connector body, said corner rails acting to engage the medial region of the insulating jacket of said duplex cord.

3. The electrical connector of claim 2, in which the said sections are formed at the return-bend loop with mutually facing camming walls for constricting the loop of the cord and thereby locking the same when the same is forced into said return-bend loop.

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