

TELECOMMUNICATIONS JACK ASSEMBLY

Field of the Invention

The present invention relates generally to electrical connectors. More specifically, the present invention relates to electrical connectors such as jacks used in the telecommunications industry.

Background of the Invention

Various electrical/fiberoptic connectors are known for use in the telecommunications industry to transmit voice, data and video signals. A common connector configuration includes a faceplate or outlet that is frequently mounted on a structure such as a wall. The faceplate defines a plurality of openings in which connectors can be mounted. A typical connector includes a modular jack defining a port sized for receiving a conventional 8 position modular plug. Other conventional types of connectors include SC connectors, ST connectors, BNC connectors, F connectors and RCA connectors.

With respect to electrical/fiberoptic connectors for the telecommunications industry, it is important that such connectors be easily installed, easily accessed after being installed and easily repaired. In this regard, it is desirable for the connectors to be front mounted within their corresponding faceplates. By front mounting the connectors, the connectors can be accessed without requiring their corresponding faceplates to be removed from the wall.

It is common for some electrical connectors to be configured to include a plug which is connectable to a jack mounted in the wall, or as part of a panel or other telecommunications equipment mounted to a rack or cabinet. The jack includes a housing which holds a plurality of closely spaced spring contacts in the appropriate position for contacting the contacts of a plug inserted into the jack. The spring contacts of the jack are often mounted to a printed circuit board, either vertically or horizontally. An RJ45 plug and jack connector system is one well known standard including closely spaced contacts.

Crosstalk between the contacts in telecommunications connectors is a concern due to the close spacing of the contacts. U.S. Patent Nos. 5,399,107; 5,674,093; and 5,779,503 are examples of various connectors including jacks and plugs which attempt to address the problem of crosstalk. It is desired to improve performance of the electrical connectors, such as an RJ45 connector, where crosstalk problems increase as higher frequencies are transmitted through the connector.

Summary of the Invention

One aspect of the present invention relates to a jack including a jack housing having a front portion positioned opposite from a back portion. The front portion defines an inner chamber and also defines front and rear openings for
5 accessing the inner chamber. The front opening comprises a port sized for receiving a plug. The rear portion of the jack housing defines an open channel that extends in a rearward direction from the front portion. The jack housing also includes a first comb that is secured to the jack housing within the inner chamber.

The jack also includes an insert assembly adapted to be secured to the
10 jack housing. The insert assembly includes a connector mount having a first side positioned opposite from a second side. The connector mount includes two resilient locking tabs for securing the connector mount to the jack housing, a second comb positioned at the first side of the connector mount, and an insulation displacement terminal housing positioned at the first side of the connector mount. The insert
15 assembly also includes a plurality of contact springs, and a plurality of insulation displacement terminals. The contact springs are separated by the second comb. Each of the contact springs includes a base end portion and a free end portion. The plurality of insulation displacement terminals are housed by the insulation displacement terminal housing. The insert assembly further includes a circuit board
20 that provides electrical connections between the insulation displacement terminals and the contact springs. The circuit board is mounted at the second side of the connector mount.

The insert assembly is secured to the jack housing by orienting the insert assembly such that the circuit board is received within the open channel, and
25 then sliding the insert assembly in a forward direction such that: one end of the insert assembly moves into the inner chamber of the jack housing through the rear opening of the jack housing; the locking tabs interlock with the jack housing; and the free end portions of the contact springs are received in the first comb.

Another aspect of the present invention relates to an insert for a jack.
30 The insert includes a connector mount having a main body including a first side positioned opposite from a second side. The connector mount includes a snap-fit structure positioned at the main body for securing the connector mount to the jack. The connector mount also includes a divider positioned at the first side of the main body, and an insulation displacement terminal housing positioned at the first side of
35 the main body. A plurality of contact springs are separated by the divider, and a plurality of insulation displacement terminals are housed by the insulation displacement terminal housing. A circuit board provides electrical connections

between the insulation displacement terminals and the contact springs. The circuit board is mounted at the second side of the main body.

A further aspect of the present invention relates to a jack for use with a faceplate having a front side positioned opposite from a back side. The faceplate defines an array of jack openings. The jack includes a jack housing adapted to be mounted within a first one of the jack openings defined by the faceplate. The jack housing is sized and shaped to be inserted into the first jack opening from the front side of the faceplate. The jack housing includes a first retaining structure positioned opposite from a second retaining structure. The first and second retaining structures are positioned to engage the front side of the faceplate when the jack housing is mounted in the first jack opening. At least one of the first and second retaining structures includes spaced-apart retaining shoulders separated by a gap. Each of the retaining shoulders has a width w_s that is larger than a width w_g of the gap located between the retaining shoulders. The jack also includes a resilient cantilever member having a base end positioned opposite from a free end. The base end is integrally connected with the jack housing and the free end is positioned generally within the gap between the spaced-apart retaining shoulders. The cantilever member includes a retaining tab positioned near the free end of the cantilever member. The retaining tab is positioned to engage the back side of the faceplate when the jack housing is mounted in the first jack opening such that the faceplate is captured between the retaining shoulder and the retaining tab. The cantilever member has a width w_c defined at the base end of the cantilever member. The total width w_t of the jack housing is at least two times as large as the width w_c .

Still another aspect of the present invention relates to a jack including a resilient cantilever member for retaining the jack within an opening of a faceplate. The resilient cantilever member includes a main body and wings that project transversely outward from opposite sides of the main body. The jack also includes deflection limiting surfaces positioned to engage the wings when the cantilever member has been deflected a first amount. Contact between the wings and the deflection limiting surfaces prevents the cantilever member from being overdeflected.

An additional aspect of the present invention relates to a jack including a jack housing defining a port sized for receiving a plug. The jack also includes a plurality of contact springs positioned within the housing. The contact springs include base end portions and free end portions. The jack further includes two separate and opposing comb structures for isolating the free end portions of the springs from one another. The opposing comb structures are relatively aligned so as

to generally form closed ended slots in which the free end portions of the contact springs are received.

One further aspect of the present invention relates to an electrical connector for connecting to a plug having a plurality of electrical contacts, the connector including a plurality of first and second metallic spring contacts. Each of the first and second spring contacts includes: 1) a circuit board connection end for connecting to a circuit board; 2) a first longitudinally extending section; 3) a main bend section; and 4) a second longitudinally extending section engageable with a contact of the plug. The first longitudinally extending section, the main bend section, and the second longitudinally extending section define a general V-shape. The second longitudinally extending section of the first spring contacts have two linear portions joined at a bend portion. The second longitudinally extending section of the second spring contacts extends linearly. A dielectric contact housing holds the spring contacts, wherein the contact housing defines an x-axis, a y-axis and a z-axis. The contact housing is configured for receipt of the plug in a direction of the x-axis, wherein the first and second spring contacts are arranged such that: 1) the first and second spring contacts alternate along the z-axis; 2) the first longitudinally extending sections of the first spring contacts are in a plane displaced along the y-axis from a plane defined by the first longitudinally extending sections of the second spring contacts; and 3) the main bends of the first spring contacts are displaced along the x-axis from the main bends of the second spring contacts.

A printed circuit board is mounted to the first and second spring contacts at the circuit board connection ends. The printed circuit board may define either a plane parallel to the x and z-axes, or a plane parallel to the y and z axes.

In the case of a one preferred embodiment, the contact housing includes a base for receiving each of the first longitudinally extending sections of the first and second spring contacts, wherein the base defines at least one channel extending in the direction of the x-axis between the first longitudinally extending sections of the first spring contacts and the first longitudinally extending sections of the second spring contacts. In the case of another preferred embodiment, the contact housing includes a base having a divider extending from a top surface, with the divider defining a plurality of alternating first and second channels. Each of the first and second channels receives one of the first and second spring contacts. The first channels extend at an angle to the x and y-axes, and the second channels extend parallel to the x-axis.

Another aspect of the present invention relates to an electrical connector for connecting to a plug having a plurality of electrical contacts where the connector includes a plurality of first and second metallic spring contacts. Each of

the first and second spring contacts includes: 1) a circuit board connection end for connecting to a circuit board; 2) a first longitudinally extending section; 3) a main bend section; and 4) a second longitudinally extending section. The first longitudinally extending section, the main bend section, and the second longitudinally extending section define a general V-shape. A dielectric contact housing holds the spring contacts, wherein the contact housing defines an x-axis, a y-axis and a z-axis. The contact housing is configured for receipt of the plug in a direction of the x-axis, wherein the first and second spring contacts are arranged such that: 1) the first and second spring contacts alternate along the z-axis; 2) the first longitudinally extending sections of the first spring contacts are in a plane displaced along the y-axis from a plane defined by the first longitudinally extending sections of the second spring contacts; and 3) the contact housing including a base for receiving each of the first longitudinally extending sections of the first and second spring contacts, wherein the base defines at least one channel extending in the direction of the x-axis between the first longitudinally extending sections of the first spring contacts and the first longitudinally extending sections of the second spring contacts.

Brief Description of the Drawings

Fig. 1A is a front, perspective view of a jack assembly constructed in accordance with the principles of the present invention;

Fig. 1B is a rear, perspective view of the jack assembly of Fig. 1A;

Fig. 2 is an exploded view of the jack assembly of Figs. 1A and 1B;

Fig. 3 is an exploded perspective view of one of the straight jacks used by the jack assembly of Figs. 1A and 1B;

Fig. 4 is an exploded, side view of the straight jack of Fig. 3;

Fig. 5 is a rear, perspective view of a jack housing used by the straight jack of Figs. 3 and 4;

Fig. 6 is a perspective view of a connector mount used by the straight jack of Figs. 3 and 4;

Fig. 7A is a perspective view of the straight jack of Figs. 3 and 4 with the jack insert fully assembled and aligned with the jack housing;

Fig. 7B is a rear view of the straight jack of Figs. 3 and 4 with the assembled jack insert inserted within the jack housing;

Fig. 8 is a cross-sectional view that vertically bisects two of the jacks of Figs. 1A and 1B;

Fig. 9 is a cross-sectional view taken along section line 9-9 of Fig. 8;

Fig. 10 is an exploded, perspective view of one of the angled jacks of Figs. 1A and 1B;

Fig. 11 is an exploded, side view of the angled jack of Fig. 10;

5 Figs. 12A-12E illustrate various views of a straight ST-type connector mounted on a support structure adapted to snap-fit within the faceplate shown in Figs. 1A and 1B;

Figs. 13A-13E illustrate various views of a straight RCA-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

10 Figs. 14A-14E illustrate various views of a straight F-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

Figs. 15A-15E illustrate various views of a straight duplex SC-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

15 Figs. 16A-16E illustrate various views of a straight SC-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

Figs. 17A-17E illustrate an angled duplex SC-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

Figs. 18A-18E illustrate a straight BNC-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

25 Figs. 19A-19E illustrate a blank or cover adapted to snap-fit within the faceplate of Figs. 1A and 1B;

Figs. 20A-20E illustrate an angled ST-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

Figs. 21A-21E illustrate an angled SC-type connector mounted on a support structure adapted to snap-fit within the faceplate of Figs. 1A and 1B;

30 Fig. 22 is a perspective view of a further jack assembly in accordance with the present invention including two jacks, each for receiving a plug;

Fig. 23 is a cross-sectional side view of the jack assembly of Fig. 22 through one of the jacks and showing a vertically mounted printed circuit board;

Fig. 24 is a perspective view of the vertical insert assembly used in the jack assembly of Fig. 22;

Fig. 25 is an end view of the vertical insert assembly of Fig. 24;

Fig. 26 is a top view of the vertical insert assembly of Fig. 24;

Fig. 27 is an opposite end view of the vertical insert assembly of Fig. 24 to the view of Fig. 24;

Fig. 28 is a bottom view of the vertical insert assembly of Fig. 24;

Fig. 29 is a side view of the vertical insert assembly of Fig. 24;

5 Fig. 30 is a cross-sectional side view of the vertical insert assembly of Fig. 24, taken along lines 30-30 of Fig. 26;

Fig. 31 is a further cross-sectional side view of the vertical insert assembly of Fig. 24, taken along lines 31-31 of Fig. 26;

10 Fig. 32 is a cross-sectional side view like the view of Fig. 30, showing a plug with its contacts in electrical contact with the spring contacts of the vertical insert assembly;

Fig. 33 is a further cross-sectional side view like the view of Fig. 31, showing the plug in electrical contact with the spring contacts of the vertical insert assembly;

15 Fig. 34 is a side view of the two configurations of the spring contacts of the vertical insert assembly of Fig. 24, shown in their relative positions;

Fig. 35 is a perspective view of the contact housing of the vertical insert assembly of Fig. 24;

Fig. 36 is an end view of the contact housing of Fig. 35;

20 Fig. 37 is a perspective view of a horizontal insert assembly for use with a horizontally mounted printed circuit board, for an alternative jack assembly;

Fig. 38 is an end front view of the horizontal insert assembly of Fig. 37;

Fig. 39 is a top view of the horizontal insert assembly of Fig. 37;

25 Fig. 40 is a bottom view of the horizontal insert assembly of Fig. 37;

Fig. 41 is a cross-sectional side view of the horizontal insert assembly of Fig. 37, taken along lines 41-41 of Fig. 39;

Fig. 42 is a further cross-sectional side view of the horizontal insert assembly of Fig. 37, taken along lines 42-42 of Fig. 39;

30 Fig. 43 is a cross-sectional side view of the horizontal insert assembly like the view of Fig. 41, showing a plug in electrical contact with the spring contacts of the horizontal insert assembly;

Fig. 44 is a further cross-sectional side view of the horizontal insert assembly like the view of Fig. 42, showing the plug in electrical contact with the spring contacts of the horizontal insert assembly;

35 Fig. 45 is a side view of the two configurations of the spring contacts of the horizontal insert assembly of Fig. 37, shown in their relative positions;

Fig. 46 is a perspective view of the contact housing of the horizontal insert assembly of Fig. 37;

Fig. 47 is an end view of the contact housing of Fig. 46; and

Fig. 48 is a top view of the contact housing of Fig. 46.

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Detailed Description of the Preferred Embodiments

Figs. 1A and 1B show an example of a jack assembly 20 constructed in accordance with the principles of the present invention. The jack assembly 20 includes a faceplate 22 adapted to be fastened to a structure such as wall. For example, the faceplate 22 includes openings 23 for allowing the faceplate 22 to be bolted, screwed or otherwise connected to the wall. Fig. 1A shows a front side of the faceplate 22 adapted to face away from the wall, and Fig. 1B shows a back side of the faceplate 22 adapted to face toward the wall. Referring to Fig. 1A, the faceplate 22 defines two rectangular openings 24 positioned one above the other. Each of the openings 24 has a height h_o and a width w_o .

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Referring still to Figs. 1A and 1B, two modular jacks are shown mounted in each of the openings 24 of the faceplate 22. For example, two straight jacks 26 are shown mounted in the lower opening 24, and two angled jacks 26' are shown mounted in the upper opening 24. The jacks 26, 26' include front faces 28, 28' that define ports 30, 30' each sized for receiving a plug 32 (shown in Fig. 2). A plurality of contact springs are positioned within each of the ports 30, 30'. The plugs 32 include resilient latches 33. When the plugs 32 are inserted in the ports 30, 30', the latches 33 interlock with front tabs 35, 35' of the jacks 26, 26' to retain the plugs 32 within the ports 30, 30'. To remove the plugs 32, the latches 33 are depressed thereby allowing the plugs 32 to be pulled from the ports 30, 30'.

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As shown in the illustrated preferred embodiment, the jacks 26, 26' and the plugs 32 are eight contact type (i.e., four twisted pair) connectors. While the various aspects of the present invention are particularly useful for modular connectors, it will be appreciated that other types of connectors could also be used.

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Referring to Figs. 3, 4 and 7A, one of the straight jacks 26 is shown. Generally, the straight jack 26 includes two basic components: a front jack housing 36; and a rear insert assembly 38. The jack housing 36 is adapted to be snap-fit into one of the openings 24 of the faceplate 22. The insert assembly 38 is adapted to be snap-fit within the jack housing 36. To mount the jack 26 in the faceplate 22, the insert assembly 38 is first connected to the jack housing 36, and then the jack 26 is inserted from the front side of the faceplate 22 into one of the openings 24.

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The jack housing 36 includes a front portion 40 positioned opposite from a back portion 42. The front portion 40 of the jack housing 36 includes

structure for securing the jack 26 to the faceplate 22. For example, the front portion 40 includes a first retaining structure 44 positioned opposite from a second retaining structure 46. Each of the retaining structures 44, 46 includes spaced-apart retaining lips/shoulders 48 separated by a gap 50. Each of the retaining shoulders 48
5 preferably has a width w_s , and each of the gaps preferably has a width w_g . It is preferred for each of the widths w_g to be equal to or less than each of the widths w_s . The widths w_s and w_g cooperate to define a total width w_t of the jack housing 36. The jack housing 36 also preferably includes a height h_j defined between the first and second retaining structures 44 and 46. It is preferred for the height h_j to be
10 larger than the height h_o of the openings 24 defined by the faceplate 22.

Referring to Fig. 3, the first retaining structure 44 includes a first resilient cantilever member 52 positioned between the retaining shoulders 48 of the first retaining structure 44. Similarly, the second retaining structure 46 includes a resilient cantilever member 54 positioned between the retaining shoulders 48 of the
15 second retaining structure 46. Each of the cantilever members 52, 54 includes a base end integrally formed with the jack housing 36, and a free end positioned adjacent to the front face 28 of the jack 26. Preferably, the free ends of the cantilever members 52, 54 are flush or slightly recessed with respect to the front face 28. Each of the cantilever members 52 and 54 also preferably has a width w_c measured at the base
20 ends of the cantilever members 52, 54. Preferably, the total width w_t of the jack 26 is at least two times as large as the width w_c . Such a size relationship assists in insuring that the cantilever members 52, 54 can be easily flexed.

As shown in Fig. 3, the resilient cantilever member 54 includes a rear tab 56 adapted for engaging the back side of the faceplate 22. Similarly, referring to
25 Fig. 5, the resilient cantilever member 52 also includes a rear tab 58 for engaging the back side of the faceplate 22. The cantilever member 52 further includes a front tab 60 for engaging the front side of the faceplate 22. Additionally, it is noted that the cantilever member 52 at least partially defines a portion of the port 30 of the jack 26. As a result, no portion of the jack housing 36 is provided for preventing the
30 cantilever member 52 from being overflexed. To overcome this problem, the cantilever member 52 includes a pair of wings 62 (shown in Fig. 5) that project transversely outward from a main body of the cantilever member 52. The wings 62 are positioned above recessed deflection limiting surfaces 64 formed on the jack housing 36. When the cantilever member 52 has been flexed downward a
35 predetermined amount, the wings 62 engage the deflection limiting surfaces 64 to prevent the cantilever member 52 from being overflexed.

Fig. 8 shows the jack 26 snap-fitted within the lower opening 24 of the faceplate 22. As shown in Fig. 8, the upper and lower sets of retaining shoulders

48 engage the front side of the faceplate 22 to prevent the jack housing 36 from being pushed completely through the opening 24. Similarly, the front tab 60 of the cantilever member 52 also engages the front side of the faceplate 22. The rear tabs 56, 58 of the cantilever members 52, 54 engage the back side of the faceplate 22 to prevent the jack 26 from dislodging from the opening 24. To mount the jack 26 within the opening 24, the rear portion of the jack is inserted into the opening 24. As the jack 26 is pushed into the opening 24, ramped surfaces of the rear tabs 56, 58 cause the cantilever members 52, 54 to flex inward until the rear tabs 56, 58 pass through the opening 24. Once the rear tabs 56, 58 have passed through the opening 24, the cantilever members 52, 54 snap outward thereby bringing the rear tabs 56, 58 into engagement or opposition with the back side of the faceplate 22. The entire jack 26 can be removed from the faceplate 22 by flexing the cantilever members 52, 54 inward, and concurrently pulling the jack 26 from the opening 24.

Referring again to Fig. 5, the front portion 40 of the jack housing 36 defines an inner chamber 66 for housing the contact springs 34. The inner chamber 66 can be accessed through the front of the jack housing 36 via the port 30, and also defines a rear opening 68 for allowing at least a portion of the insert assembly 38 to be inserted into the inner chamber 66. Still referring to Fig. 5, a comb 70 is secured to the jack housing 36 within the inner chamber 66. The comb 70 includes a plurality of dividers defining a plurality of slots. The slots are sized for receiving portions of the contact springs 34 such that the contact springs 34 are separated from one another. Guide rails 72 are positioned on opposite sides of the comb 70. The guide rails 72 project into the inner chamber 66 from sidewalls of the jack housing 36. The guide rails 72 each have a tapered vertical thickness such that the guide rails 72 are thicker adjacent the front side of the inner chamber 66 as compared to the rear side of the inner chamber 66. Latch openings 74 are defined by the sidewalls of the jack housing 36 at locations above the guide rails 72.

Referring still to Fig. 5, the back portion 42 of the jack housing 36 defines an open channel or trough 76 that extends in a rearward direction from the front portion 40. The trough 76 is preferably sized to receive and support the insert assembly 38 when the insert assembly is connected to the jack housing 36.

As shown in Figs. 3 and 4, the insert assembly 38 includes a printed circuit board 78, a connector mount 80, the contact springs 34, a plurality of insulation displacement terminals 82, and a termination cap 84. The contact springs 34 and the insulation displacement terminals 82 respectively include board contact portions 86, 88 that extend through the connector mount 80 and engage respective contact locations 90, 92 (e.g., plated through-holes) located on the printed circuit board 78. The printed circuit board 78 includes a plurality of tracings 79 (only a

representative one is shown) that electrically connect the contact locations 90 to the contact locations 92. In this manner, the printed circuit board 78 provides electrical connections between the contact springs 34 and the insulation displacement terminals 82.

5 The connector mount 80 preferably comprises a one-piece, plastic member having a main body 96 including a first side 98 positioned opposite from a second side 100. The printed circuit board 78 is mounted at the second side 100 of the main body 96. The first side 98 of the main body 96 is configured for holding or retaining the contact springs 34 and the insulation displacement terminals 82. For
10 example, the first side 100 of the main body 96 includes two combs 102, 104 (shown in Fig. 6) for receiving and separating the contact springs 34. Each of the combs 102, 104 includes a plurality of dividers defining slots sized for receiving the contact springs 34.

 The first side 98 of the main body 96 also includes an insulation
15 displacement terminal housing 106. The insulation displacement terminal housing 106 defines a plurality of slots 108 in which the insulation displacement terminals 82 are mounted. The slots 108 are sized to receive wires (not shown) desired to be terminated at the insert assembly 38. The termination cap 84 is configured for pressing the wires (not shown) into the slots 108 such that the wires are connected to
20 the insulation displacement terminals 82. For example, the termination cap 84 includes a plurality of slotted walls 110 that fit within the slots 108 when the termination cap 84 is pressed down against the insulation displacement terminal housing 106.

 The connector mount 80 also includes two resilient locking tabs 112
25 integrally connected to the main body 96 for securing the insert assembly 38 to the jack housing 36. The resilient locking tabs 112 include flexible lever members 114 positioned on opposite sides of the combs 102, 104. The locking tabs 112 are configured to snap within the latch openings 74 defined by the jack housing 36 to provide a snap-fit connection between the insert assembly 38 and the jack housing
30 36. While the lever members 114 are shown connected to the main body 96 of the connector mount 80, it will be appreciated that alternative snap-fit connecting structures could also be used. For example, the connector mount 80 could include holes, projections, or latches adapted to interlock with resilient tabs connected to the jack housing 36.

35 To provide precise alignment between the insert assembly 38 and the jack housing 36, the main body 96 of the connector mount 80 defines two slots 116 sized and positioned for receiving the guide rails 72 of the jack housing 36. The slots 116 are formed within sidewalls of the main body 96 and are positioned on

opposite sides of the combs 102, 104. Inner ends of the slots 116 are ramped to further enhance alignment between the jack housing 36 and the insert assembly 38.

Referring to Fig. 4, the contact springs 34 each preferably includes a base portion 118 and a free end portion 120. When the contact springs 34 are
5 mounted on the connector mount 80, the base portions 118 fit within the slots defined by the comb 102, and the free end portions 120 are aligned above the slots defined by the comb 104. Preferably, as shown in Fig. 4, adjacent springs 34 have non-parallel relationships with respect to one another to minimize crosstalk. A more detailed description relating to the spring configuration is provided below in
10 connection with Figs. 22-48.

To connect the insert assembly 38 to the jack housing 36, the assembled insert assembly 38 (shown in Fig. 7A) is placed within the trough 76 of the jack housing 36. For example, as shown in Fig. 7B, the insert assembly is positioned such that the circuit board 78 is received in the trough 76, and the main
15 body 96 of the connector mount 80 is supported by side walls 77 of the trough 76 (e.g., shoulders 79 of the main body 96 seat upon the tops of the side walls 77). As so positioned, the printed circuit board 78 is vertically offset from the bed of the trough 76.

Next, the insert assembly 38 is moved along the trough 76 in a
20 forward direction such that a front end of the insert assembly 38 (e.g. the end at which the contact springs 34 are mounted) moves into the inner chamber 66 of the jack housing 36 through the rear opening 68 of the jack housing 36. As the front end of the insert assembly 38 enters the inner chamber 66, the guide rails 72 of the jack housing 36 are received within the guide slots 116 defined by the connector mount
25 80. Also, the free end portions 120 of the contact springs 34 are received within the slots defined by the comb 70 located within the inner chamber 66. When the insert assembly 38 has been fully inserted within the inner chamber 66, the locking tabs 114 of the connector mount 80 snap within the latch openings 74 of the jack housing 36. To remove the insert assembly 38 from the jack housing 36, the locking tabs
30 112 can be depressed thereby allowing the insert assembly 38 to be pulled from the jack housing 36.

It is significant that the guide rails 72 and the guide slots 116 provide for precise positioning of the connector mount 80 within the jack housing 36. For example, the guide slots 166 and the guide rails 72 are configured to orient the
35 connector mount 80 at a precise vertical and horizontal position relative to the comb 70. At such a position, the springs 34 are received within the comb 70, and the printed circuit board 78 is preferably offset from or held above the bed of the trough 76. Because the board 78 is offset from the trough 76, printed circuit boards having

different thicknesses can be used without affecting the alignment of the connector mount 80 within the jack housing 36. As a result, the alignment of the connector mount 80 within the jack housing 36 is not dependent upon the thickness of the circuit board 78. Therefore, the rail and slot configuration eliminates variations in spring deflection and the resulting contact forces caused by tolerance variations in the thickness of the printed circuit boards.

Fig. 9 is a cross-sectional view taken along section line 9-9 of Fig. 8. As shown in Fig. 9, when the insert assembly 38 is fully inserted within the jack housing 36, the comb 70 secured within the jack housing 36 and the comb 104 connected to the connector mount 80 oppose one another and are aligned generally along a common vertical plane. As a result, the combs 70 and 104 cooperate to form closed ended slots 122 in which the free end portions 120 of the contact springs 34 are received. Vertical spacing s between the combs 70 and 104 is preferably sufficiently small to prevent the free end portions 120 of the springs 34 from becoming displaced from the slots 122. In this manner, the free end portions 120 of the springs 34 are captured between the two separate combs 70 and 104.

The spring alignment feature provided by the combs 70 and 104 is important because the contact springs 34 typically have a center to center spacing of about .050 inches. When a plug is inserted into the port 30, the plug engages the springs 34 causing the springs to deflect downwardly out of the comb 70. Absent the two cooperating combs 70 and 104, the springs can become misaligned and pushed into contact with one other during deflection. This is not surprising due to the relatively close spacing of the springs 34. However, by capturing the springs 34 between the two combs 70 and 104 as described above, such misalignment is prevented because the springs 34 always remain within their respective closed ended slots 122 during deflection.

Figs. 10 and 11 illustrate one of the angled jacks 26'. The angled jack 26' uses the same insert assembly 38 used by the straight jack 26. Consequently, no further description of the insert assembly 38 will be provided. The angled jack 26' includes a jack housing 36' that is similar to the jack housing 36 described with respect to the straight jack 26. However, the jack housing 36' has been modified to allow the jack 26' to mount at an angle relative to the faceplate 22. For example, the jack housing 36' includes first and second retaining structures 44' and 46' for providing a snap-fit connection between the jack 26' and the faceplate 22. The first and second retaining structures 44', 46' are preferably aligned along a line 124 that is oriented at an acute angle θ relative to the front face 28' of the jack 26'. Consequently, when the jack 26' is secured to the faceplate 22, the retaining

structures 44', 46' cause the front face 28' of the jack 26' to be angled relative to the front face of the faceplate 22.

The first retaining structure 44 includes two fixed retaining shoulders 126 (only one shown) positioned at opposite sides of the jack housing 36'. Similarly, the second retaining structure 46' includes two spaced-apart retaining shoulders 128 positioned on opposite sides of the jack housing 36'. A gap 130 separates the retaining shoulders 128. A resilient cantilever member 132 is positioned within the gap 130. The cantilever member 132 includes a rear stop 134 adapted to engage the back side of the faceplate 22.

Referring to Fig. 8, when the jack 26' is mounted within the upper opening 24 of the faceplate 22, the retaining shoulders 126, 128 engage the front side of the faceplate 22, while the rear stop 134 of the cantilever member 132 engages the back side of the faceplate 22. To mount the jack 26' within the opening 24, the rear portion of the jack is inserted into the opening 24 and the jack 26' is pushed into the opening 24. As the jack 26' is pushed into the opening 24, a ramped surface of the rear stop 134 causes the cantilever member 132 to flex upward until the rear stop 134 passes through the opening 24. Once the rear stop 124 passes through the opening 24, the cantilever member 132 snaps downward thereby bringing the rear stop 134 into engagement with the back side of the faceplate 22. The entire jack 26' can be removed from the faceplate 22 by flexing the cantilever member 132 upward, and concurrently pulling the jack 26' from the opening 24.

Another aspect of the present invention relates to a connector system that allows many different types of connectors to be used with a single, universal faceplate. For example, Figs. 12A-12E, 13A-13E, 14A-14E, 15A-15E, 16A-16E, 17A-17E, 18A-18E, 19A-19E, 20A-20E, and 21A-21E illustrate a variety of different telecommunications connectors that can be mounted in the openings 24 of the faceplate 22. For example, Figs. 12A-12E illustrate a straight ST type connector 220 mounted on a support structure or adapter 222 configured to be snap-fit within one of the openings 24 of the faceplate 22. The adapter 22 includes top and bottom shoulders 224 and 226 adapted to engage the front side of the faceplate, and a resilient cantilever member 228 having a rear stop 230 adapted to engage the back side of the faceplate. The adapter 22 has a total width generally equal to one-half the width of the opening 24 of the faceplate 22. The cantilever 228 preferably has a base end having a width less than or equal to one-half the total width 222 of the adapter. The cantilever 228 is preferably positioned within a gap 232 having a width that is less than or equal to corresponding widths of the shoulders 224.

Figs. 13A-13E show a straight RCA-type connector 320 secured to an adapter 322 configured to snap-fit within the faceplate 22. Figs. 14A-14E

illustrate a straight F-type connector 420 mounted on an adapter 422 configured to snap-fit within the faceplate 22. Figs. 16-16E show a straight SC-type connector 620 mounted on an adapter 622 configured to snap-fit within the faceplate 22. Figs. 18A-18E illustrate a straight BNC-type connector 820 mounted on an adapter 822 configured to snap-fit within the faceplate 22. Each of the adapters 332, 422, 622 and 822 has a similar size and configuration as the adapter 222 of Figs. 12A-12E.

Figs. 15A-15E illustrate a straight duplex SC-type connector 520 mounted on an adapter 522 configured to snap within one of the openings 24 of the faceplate 22. The adapter 522 is sized to entirely fill one of the holes 24 defined by the faceplate 22. The adapter 522 includes a lower retaining structure 526 (e.g., a slot) and an upper retaining structure 524. The upper retaining structure 524 includes two front shoulders 528 and a resilient cantilever 530 positioned between the shoulders 528. The cantilever 530 includes a rear stop 532.

Figs. 17A-17E illustrate an angled duplex SC-type connector 720 mounted on an adapter 722. The adapter is sized to fill an entire one of the holes 24 of the faceplate 22. The adapter 722 includes first and second oppositely positioned retaining structures 724, 726 adapted to provide a snap-fit connection with the faceplate 22. The retaining structures 724, 726 are aligned along a line that is oriented at an acute angle with respect to a front face 728 of the connector 720.

Figs. 19A-19E illustrates a blank 922 configured for covering one half of one of the openings 24 of the faceplate 22. The blank 922 has a planar cover surface 924. The blank 922 also includes first and second oppositely positioned retaining structures 924 and 926 for providing a snap-fit connection with the faceplate 22.

Figs. 20A-20E illustrate an angled ST-type connector 1020 mounted on an adapter 1022. The adapter 1022 is sized to fill one-half of one of the openings 24 of the faceplate 22. The adapter 1022 includes first and second retaining structures 1024 and 1026 configured to provide a snap-fit connection with the faceplate. The retaining structures 1024, 1026 are aligned along a line or at an acute angle with respect to the front face of the connector 1020.

Figs. 21A-21E illustrate an angled SC-type connector 1120 mounted on an adapter 1122. The adapter 1122 has substantially the same size and configuration as the adapter 1022 of Figs. 20A-20E.

A further aspect of the present invention is concerned with improving performance of electrical connectors including closely spaced electrical contacts where crosstalk may be a problem, especially as increasingly higher frequency signals are desired for use with the electrical connectors.

Figs. 22 and 23 show an example of one jack assembly 1010 including two jacks 1012 each sized for receipt of a plug 1014 (See Figs. 32, 33, 43 and 44). Plug 1014 typically includes a plurality of metallic contacts 1016, 1018 for making contact with electrical spring contacts 1040, 1042 within each jack 1012.

5 Contacts 1016, 1018 are housed in a housing 1020 of plug 1014. Plug 1014 also includes a latching tab 1022 for mounting plug 1014 to jack 1012. As shown in the illustrated preferred embodiments, jack 1012 and plug 1014 are 8 contact type (4 twisted pair) connectors as in an RJ45 connector.

As shown in Fig. 23, each jack 1012 includes a cavity 1030 for receipt of plug 1014. An outer housing 1032 encloses an insert assembly 1034. In the example of Fig. 23, insert assembly 1034 is a vertical insert assembly including a vertically mounted printed circuit board 1036. Insert assembly 1034 further includes a plurality of metallic spring contacts 1040, 1042 mounted to a contact housing 1044. Spring contacts 1040, 1042 have first ends 1050, 1052 disposed within cavity 1030 for contacting contacts 1018, 1020 of plug 1014. Spring contacts 1040, 1042 define a general V-shape. First ends 1050, 1052 flex inwardly as the plug 1014 is inserted into cavity 1030. Opposite ends 1054, 1056 of spring contacts 1040, 1042 extend from contact housing 1044 to mount to printed circuit board 1036, such as by soldering.

20 While the present invention is particularly useful in an RJ45 connector, other connectors including jack and plug arrangements where the electrical contacts are held in close proximity may also benefit by including one or more of the features disclosed herein for reducing crosstalk.

With respect to an RJ45 connector, there are eight contacts. The plugs and jacks have eight aligned contacts 1-2-3-4-5-6-7-8 (4 each of contacts 1016, 1018, and spring contacts 1040, 1042, respectively, each arranged in an alternating manner). See the example embodiments of Figs. 27 and 40 for the contact numbering. The plug contacts have four pairs of twisted pair cable terminated to them. These pairs are typically paired as follows: 4-5, 3-6, 1-2 and 7-8. Because of the pair arrangement, there is unbalanced capacitance and inductance which creates the crosstalk between pairs 2-3, 3-4, 5-6 and 6-7. Therefore, it is desirable that these contacts be isolated as much as possible from each other within the jack. Furthermore, the pairs in the jack can be balanced by positioning certain contact combinations together to cancel crosstalk. These pair combinations are 1-3, 2-4, 3-5, 4-6, 5-7 and 6-8. Therefore, it is desirable for the jack to have a lower amount of coupling between contacts 2-3, 3-4, 5-6 and 6-7, and to have a higher amount of coupling between contacts 1-3, 2-4, 3-5, 4-6, 5-7 and 6-8.

The present invention utilizes various features in the jack in the preferred embodiments to address crosstalk concerns. Staggering every other spring contact (1, 3, 5 and 7 in one row, and 2, 4, 6 and 8 in the other row, see Fig. 27) allows for the spring contacts to be moved further apart where isolation is desired, and the spring contacts where coupling is desired to be increased, are positioned closer to each other. The spring contacts are also positioned so that they are not in the same contact plane for a significant portion. The free ends of the spring contacts are in the same plane at the contact area with the plug, but before and after they are not in the same plane. (See Figs. 32 and 33). Each set of four spring contacts pivots at a location that is not in line with the other set of four spring contacts. (See Figs. 30, 31 and 34). Additionally, the set of four spring contacts which has a smaller angle relative to the other set has a further bend after its contact point with the plug to further increase the isolation between the spring contacts. Further, the contact housing utilizes air spaces in selected locations to further isolate certain spring contacts, and solid material in other selected locations to increase coupling. Positioning material with a higher dielectric constant will increase the coupling and, therefore, crosstalk between two conductors, and air, which has a lower dielectric constant than the housing material, will have less coupling between the two spring contacts. While all of the above noted features are preferred, variations are possible which utilize one or more selected features to improve performance by reducing crosstalk.

Referring now to Figs. 24-36, vertical insert assembly 1034 is shown in greater detail. Contact housing 1044 includes a base 1046 having a front 1060, a top 1062, a bottom 1064, and a rear 1066. It is to be appreciated that contact housing 1044 can be positioned in any orientation as desired in jack assembly 1010 or other mounting arrangement. Vertical insert assembly 1034 in Figs. 24-36 defines an x-axis, a y-axis and a z-axis (See Fig. 24) for purposes of this description.

Base 1046 includes two sets of longitudinal openings 1078 and 1080 arranged in a row, each for receipt of a spring contact 1040, 1042. Longitudinal openings 1078, 1080 extend in the direction of the x-axis. Each set is staggered in the y-axis direction to facilitate spacing of selected spring contacts to isolate some and couple others. Front channels 1082, 1084 communicate with longitudinal openings 1078, 1080, and also receive spring contacts 1040, 1042. Each first front channel 1082 communicates with one of first longitudinal openings 1078 to receive one first spring contact 1040. Each second front channel 1084 communicates with one of second longitudinal openings 1080 to receive one second spring contact. Second front channels 1084 are deeper than first front channels 1082 in the x-axis

direction. This results in spacing of the spring contacts 1040, 1042 in the x-axis direction at the apex region of each spring contact, and along the free ends except for the contact areas. Base 1046 further includes top and bottom openings or channels 1088, 1090 to facilitate manufacture of contact housing 1044 from molded materials, such as plastic, for example polyetherimide.

Base 1046 further includes longitudinal channels or passageways 1092, 1094 positioned between the sets of longitudinal openings 1078, 1080. This results in better decoupling of selected spring contacts, as noted above.

First spring contact 1040 includes a board contact end section 1100, and a coaxial and longitudinally extending main section 1102 positioned in longitudinal opening 1078 in base 1046. A front bend 1104 is positioned in front channel 1082 of base 1046. Longitudinal contact section 1106 extends upwardly at an angle from base 1046 in the Figs. so as to be positioned in the cavity 1030 of the jack 1012 for electrical contact with the plug 1014. Contact section 1106 further includes a bend region 1108 which positions bend region 1108 at an angle relative to a remainder of contact section 1106. Contact section 1106 of spring contact 1040 is comprised of two linear segments in the illustrated embodiment.

Second spring contact 1042 includes a board contact end section 1110, and a longitudinally extending main section 1112, both of which extend parallel to board contact section 1100 and longitudinally extending main section 1102 of first spring contact 1040. A front bend 1114 is positioned in front channel 1084 of base 1046. Front bend 1114 is larger in height than front bend 1104 of first spring contact 1040. Second spring contact 1042 includes a longitudinal contact section 1116 extending upwardly at an angle from base 1046 so as to be positioned in the cavity 1030 of the jack 1012 for electrical contact with the plug 1014. Contact section 1116 of spring contact 1042 is comprised of a linear segment in the illustrated embodiment. Both of spring contacts 1040, 1042 are convenient shapes to manufacture and maintain with a sufficient amount of flexibility to achieve proper contact with the contacts of plug 1014.

As shown by referencing Figs. 24-36, longitudinally extending sections 1102, 1112 are staggered in the y-axis direction in base 1046. Front bends 1104, 1114 are staggered in the x-axis direction, and bend 1108 positions the distal end 1109 of spring contact 1040 at an angle relative to distal end 1118 of contact section 1116 of second spring contact 1042. Further, base 1046 advantageously positions base material between spring contacts 1040, 1042 where more coupling is desired, and air is advantageously positioned in other selected areas between longitudinal passageways 1092, 1094 between spring contacts where less coupling between contacts is desired. In this manner, jacks 1012 can be provided which

address crosstalk concerns such as in category 6 systems, with bandwidths of 250 Megahertz.

Referring now to Figs. 37-48, a horizontal insert assembly 1134 is shown including a contact housing 1144 and two sets of spring contacts 1140, 1142.

- 5 Contact housing 1144 includes a base 1146 defining a front 1160, a top 1162, a bottom 1164 and a rear 1166. Horizontal insert assembly 1134 defines an x-axis, a y-axis, and a z-axis (See Fig. 37) for the purposes of this description. It is to be appreciated that horizontal insert assembly 1134 can be mounted in any orientation as desired in a jack assembly. Horizontal insert assembly 1134 includes a
- 10 horizontally positioned printed circuit board 1150 (See Figs. 41 and 42), instead of a vertical mount as in vertical insert assembly 1034.

- Base 1146 includes two opposed sidewalls 1152, and a rear connector assembly 1154 for terminating wires to horizontal insert assembly 1134. Base 1146 includes a divider 1180 for positioning individual first and second spring contacts
- 15 1140, 1142. Divider 1180 has side walls which define first and second channels 1182, 1184. Each of first channels 1182 includes a slight angled surface 1186, angled relative to the x and y-axes. Second channels 1184 each include a longitudinal surface 1188 extending generally parallel to the x-axis, and at a lower elevation from surface 1186 along the y-axis. Base 1146 further includes openings
- 20 1190, 1192 for allowing spring contacts 1140, 1142 to pass through base 1146 in the direction of the y-axis. Both first and second spring contacts 1140, 1142 define a general V-shape.

- First spring contact 1140 includes a board contact end section 1200, a first bend 1202, followed by a main longitudinal section 1204 for receipt in angled surface 1186. A second bend 1206 is followed by a longitudinal contact section
- 25 1208. A further bend 1210 positions distal end 1209 of contact section 1208 at an angle relative to a remainder of contact section 1208. Second spring contact 1142 includes a board contact end section 1220, a first bend 1222, followed by a longitudinal main section 1224 which resides in second channel 1184. Second
- 30 spring contact 1142 further includes a second bend 1226 followed by a longitudinal contact section 1228.

- As shown in the Figs., board contact end sections 1200, 1220 are staggered in two rows as shown in Fig. 40. Main sections 1204, 1224 are not parallel, and one set of spring contacts 1140 includes a bend 1210 in the contact
- 35 section 1208 which positions the distal ends of spring contacts 1140, 1142 so that the ends are not parallel. Also, bends 1206, 1226 are positioned such that the pivot points of spring contacts 1140, 1142 are not in the same line. These features

cooperate to isolate selected spring contacts to reduce crosstalk especially at higher frequencies as may be encountered in a category 6 standard.

While the various features of each of horizontal insert assembly 1134 and vertical insert assembly 1034 cooperate in an advantageous manner, it is to be appreciated that the noted features may be used individually or in various combinations as desired to address crosstalk concerns. Also, while horizontally mounted printed circuit boards and vertically mounted printed circuit boards are shown, it is to be appreciated that angled printed circuit boards are also possible with an appropriately configured contact housing.

With regard to the foregoing description, it is to be understood that changes may be made in detail, especially in matters of the construction materials employed and the shape, size, and arrangement of the parts without departing from the scope of the present invention. It is intended that the specification and depicted aspects of the invention may be considered exemplary, only, with a true scope and spirit of the invention being indicated by the broad meaning of the following claims.

WHAT IS CLAIMED IS:

1. A jack for use with a faceplate having a front side positioned opposite from a back side, the faceplate defining an array of jack openings, the jack comprising:

- 5 A) a jack housing adapted to be mounted within a first one of the jack openings of the faceplate, the jack housing being sized and shaped to be inserted into the first jack opening from the front side of the faceplate, the jack housing including:
- 10 a) a first retaining structure positioned opposite from a second retaining structure, the first and second retaining structures being positioned to engage the front side of the faceplate when the jack housing is mounted in the first jack opening;
- 15 b) a resilient cantilever member having a base end positioned opposite from a free end, the base end being integrally connected with the jack housing, the cantilever member including a retaining tab positioned near the free end of the cantilever member, the retaining tab being positioned to engage the back side of the faceplate when the jack housing is mounted in the first jack opening;
- 20 c) a front portion positioned opposite from a back portion, the front portion defining an inner chamber and also defining front and rear openings for accessing the inner chamber, the front opening comprising a port sized for receiving a plug, and the back portion of the jack housing defining an open channel that extends in a rearward direction from the front portion; and
- d) a first comb secured to the jack housing within the inner chamber;
- 25 B) an insert assembly adapted to be secured at least partially within the jack housing, the insert assembly:
- a) a connector mount having a first side positioned opposite from a second side, the connector mount including:
- 30 i. two resilient locking tabs for securing the connector mount to the jack housing;
- ii. a second comb positioned at the first side of the connector mount;
- iii. an insulation displacement terminal housing positioned at the first side of the connector mount;
- 35 b) a plurality of contact springs separated by the second comb, the contact springs including base end portions and free end portions;
- c) a plurality of insulation displacement terminals housed by the insulation displacement terminal housing; and



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d) a circuit board providing electrical connections between the insulation displacement terminals and the contact springs, the circuit board being mounted at the second side of the connector mount;

wherein the insert assembly is secured to the jack housing by orienting the insert assembly such that the circuit board is received within the open channel, and then sliding the insert assembly in a forward direction such that: one end of the insert assembly moves into the inner chamber of the jack housing through the rear opening of the jack housing; the locking tabs interlock with the jack housing; and the free end portions of the contact springs are received in the first comb.

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2. The jack of claim 1, wherein when the connector mount is secured to the jack housing, the circuit board fits within the open channel of the jack housing, the contact springs are positioned within the inner chamber of the jack housing, and the insulation displacement terminals are positioned outside the inner chamber.

15

3. The jack of claim 1, wherein the locking tabs snap within holes defined by the jack housing to secure the connector mount to the jack housing.

20

4. The jack of claim 1, further comprising a third comb mounted at the first side of the connector mount in general alignment with the free end portions of the contact springs, wherein when the connector mount is secured to the jack housing, the second and third combs align with one another and cooperate to form closed ended slots in which the free end portions of the contact springs are received.

25

5. The jack of claim 1, wherein one of the jack housing and the connector mount includes a pair of guide rails, and the other of the jack housing and the connector mount defines a pair of slots sized and position for receiving the guide rails as the first region of the connector mount is moved into the inner chamber of the jack housing.

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6. The jack of claim 5, wherein one of the guide rails and the slots are tapered.

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7. The jack of claim 5, wherein the guide rails and the slots are configured to position the insert assembly within the jack housing with the circuit board offset from a bed of the open channel such that alignment of the insert assembly within the jack housing is not dependent on a thickness of the circuit board.



8. The jack of claim 5, wherein the guide rails and the slots are configured to position the insert assembly at a first location relative to the first comb, and wherein a degree of deflection of the contact springs within the jack housing is not dependent on a thickness of the circuit board.
- 5
9. The jack of claim 1, wherein the jack housing has a total width w_t and the cantilever member has a width w_c defined at the base end of the cantilever member, the total width w_t being at least two times as large as the width w_c .
- 10
10. The jack of claim 9, wherein the cantilever member includes a main body and wings that project transversely outward from the main body.
11. An insert for a jack, the insert comprising:
- 15
- a) a connector mount having a main body including a first side positioned opposite from a second side, the connector mount including:
- i) a snap-fit connection structure positioned at the main body for securing the connector mount to the jack;
- ii) a divider positioned at the first side of the main body;
- 20
- iii) an insulation displacement terminal housing positioned at the first side of the main body;
- b) a plurality of contact springs separated by the divider;
- c) a plurality of insulation displacement terminals housed by the insulation displacement terminal housing; and
- 25
- d) a circuit board providing electrical connections between the insulation displacement terminals and the contact springs, the circuit board being mounted at the second side of the main body.
12. The insert of claim 11, wherein the contact springs include base end portions and free end portions, and wherein the divider includes one comb that receives the base end portions, and a second comb that aligns with the free end portions.
- 30
13. The insert of claim 11, wherein the snap-fit connection structure includes flexible lever members having locking tabs, and the divider is positioned generally between the flexible lever members.
- 35
14. A jack for use with a faceplate having a front side positioned opposite from a back side, the faceplate defining an array of jack openings, the jack comprising:



a jack housing adapted to be mounted within a first one of the jack openings of the faceplate, the jack housing having a total width w_t and the jack housing being sized and shaped to be inserted into the first jack opening from the front side of the faceplate;

- 5 the jack housing including a first retaining structure positioned opposite from a second retaining structure, the first and second retaining structures being positioned to engage the front side of the faceplate when the jack housing is mounted in the first jack opening;

- 10 at least one of the first and second retaining structures including spaced-apart retaining shoulders separated by a gap, each of the retaining shoulders having a width w_s and the gap having a width w_g that is smaller than each of the widths w_s ;

- 15 a resilient cantilever member having a base end positioned opposite from a free end, the base end being integrally connected with the jack housing and the free end being positioned generally within the gap between the spaced-apart retaining shoulders, the cantilever member including a retaining tab positioned near the free end of the cantilever member, the retaining tab being positioned to engage the back side of the faceplate when the jack housing is mounted in the first jack opening such that the faceplate is captured between the retaining shoulders and the retaining tab; and

20 the cantilever member having a width w_c defined at the base end of the cantilever member, the total width w_t of the jack housing being at least two times as large as the width w_c .

- 25 15. The jack of claim 14, wherein the cantilever member includes a main body and wings that project transversely outward from opposite sides of the main body.

16. The jack of claim 15, wherein the jack housing includes deflection limiting surfaces positioned to engage the wings when the cantilever member has been deflected a first amount, wherein contact between the wings and the deflection limiting surfaces prevents the cantilever member from being over deflected.

17. The jack of claim 16, wherein the jack housing includes a front end positioned opposite from a back end, the front end of the jack housing defining a port for receiving a plug, and the cantilever member at least partially defining a portion of the port.



18. A jack for use with a faceplate having a front side positioned opposite from a back side, the faceplate defining an array of jack openings, the jack comprising:
- a jack housing adapted to be mounted within a first one of the jack openings of the faceplate, the jack housing being sized and shaped to be inserted into the first jack opening from the front side of the faceplate;
 - the jack housing including a first retaining structure positioned opposite from a second retaining structure, the first and second retaining structures being positioned to engage the front side of the faceplate when the jack housing is mounted in the first jack opening;
 - at least one of the first and second retaining structures including spaced-apart retaining shoulders separated by a gap;
 - a resilient cantilever member having a base end positioned opposite from a free end, the base end being integrally connected with the jack housing and the free end being positioned generally within the gap between the spaced-apart retaining shoulders, the cantilever member including a retaining tab positioned near the free end of the cantilever member, the retaining tab being positioned to engage the back side of the faceplate when the jack housing is mounted in the first jack opening such that the faceplate is captured between the retaining shoulders and the retaining tab;
 - the cantilever member including a main body and wings that project transversely outward from opposite sides of the main body; and
 - the jack housing including deflection limiting surfaces positioned to engage the wings when the cantilever member has been deflected a first amount, wherein contact between the wings and the deflection limiting surfaces prevents the cantilever member from being over deflected.
19. The jack of claim 18, wherein the jack housing includes a front end positioned opposite from a back end, the front end of the jack housing defining a port for receiving a plug, and the cantilever member at least partially defining a portion of the port.
20. A jack comprising:
- a jack housing defining a port sized for receiving a plug;
 - a plurality of contact springs positioned within the housing, the contact springs including base end portions and free end portions; and
 - two separate and opposing comb structures for isolating the free end portions of the springs from one another, the opposing comb structures being



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relatively aligned so as to generally form closed ended slots in which the free end portions of the contact springs are received.

21. A connector assembly for use with a faceplate having a front side positioned
5 opposite from a back side, the faceplate defining an array of openings, the connector assembly comprising:

a support structure adapted to be mounted within a first one of the
openings of the faceplate, the support structure having a total width w_t and the
support structure being sized and shaped to be inserted into the first opening from
10 the front side of the faceplate;

the support structure including a first retaining structure positioned
opposite from a second retaining structure, the first and second retaining structures
being positioned to engage the front side of the faceplate when the support structure
is mounted in the first opening;

15 at least one of the first and second retaining structures including
spaced-apart retaining shoulders separated by a gap, each of the retaining shoulders
having a width w_s and the gap having a width w_g that is smaller than each of the
widths w_s ;

a resilient cantilever member having a base end positioned opposite
20 from a free end, the base end being integrally connected with the support structure
and the free end being positioned generally within the gap between the spaced-apart
retaining shoulders, the cantilever member including a retaining tab positioned near
the free end of the cantilever member, the retaining tab being positioned to engage
the back side of the faceplate when the support structure is mounted in the first
25 opening such that the faceplate is captured between the retaining shoulders and the
retaining tab;

the cantilever member having a width w_c defined at the base end of
the cantilever member, the total width w_t of the support structure being at least two
times as large as the width w_c ; and

30 a telecommunications connector secured to the support structure.

22. A jack housing for a jack for use with a mounting fixture having a jack
opening, the jack housing comprising:

A) a jack housing body adapted to be mounted within the jack
35 opening of the mounting fixture, the jack housing body including a first retaining
structure positioned opposite from a second retaining structure, the first and second
retaining structures being positioned to engage a front side of the mounting fixture
when the jack housing body is mounted in the jack opening;



B) a resilient cantilever member having a base end positioned opposite from a free end, the base end being integrally connected with the jack housing body, the cantilever member including a retaining tab positioned near the free end of the cantilever member, the retaining tab being positioned to engage a back side of the mounting fixture when the jack housing body is mounted in the jack opening;

C) a front portion positioned opposite from a back portion, the front portion defining an inner chamber and also defining front and rear openings for accessing the inner chamber, the front opening comprising a port sized for receiving a plug, and the back portion of the jack housing body defining an open channel that extends in a rearward direction from the front portion, the jack housing body adapted to receive an insert assembly having a plurality of flexible contact springs and a plurality of connection locations linked to the contact springs.

23. The jack housing of claim 22, further comprising a first comb for managing contact springs, the first comb secured to the jack housing body within the inner chamber;

24. The jack housing of claim 22, wherein the insert assembly includes locking tabs, the jack housing body including holes to receive the locking tabs.

25. The jack housing of claim 22, wherein the jack housing body includes guide rails for receipt in slots of the insert assembly.

26. The jack housing of claim 22, further including a second resilient cantilever member including a retaining tab positioned to engage the back side of the mounting fixture, the second cantilever member positioned on an opposite side of a front of the jack housing body.

27. The jack housing of claim 22, wherein the resilient cantilever member includes a front retaining tab to engage the front side of the mounting fixture.

28. The jack housing of claim 26, wherein the second cantilever member includes an open front end not engageable with the front side of the mounting fixture.

29. An electrical connector for connecting to a plug having a plurality of electrical contacts, the connector comprising:



- a) a plurality of first and second metallic spring contacts, each of the first and second spring contacts including:
- 1) a circuit board connection end for connecting to a circuit board;
 - 2) a first longitudinally extending section;
 - 3) a main bend section;
 - 4) a second longitudinally extending section engageable with a contact of the plug, wherein the first longitudinally extending section, the main bend section, and the second longitudinally extending section define a general V-shape;
- b) the second longitudinally extending section of the first spring contacts having two linear portions joined at a bend portion;
- c) the second longitudinally extending section of the second spring contacts extending linearly;
- d) a dielectric contact housing for holding the spring contacts, wherein the contact housing defines an x-axis, a y-axis and a z-axis, the contact housing configured for receipt of the plug in a direction of the x-axis, wherein the first and second spring contacts are arranged such that:
- 1) the first and second spring contacts alternate along the z-axis;
 - 2) the first longitudinally extending section of the first spring contacts are in a plane displaced along the y-axis from a plane defined by the first longitudinally extending section of the second spring contacts;
 - 3) the main bends of the first spring contacts are displaced along the x-axis from the main bends of the second spring contacts.
30. The connector of claim 29, further comprising a printed circuit board mounted to the first and second spring contacts at the printed circuit board connection ends.
31. The connector of claim 30, wherein the printed circuit board defines a plane parallel to the x and z-axes.
32. The connector of claim 30, wherein the printed circuit board defines a plane parallel to the y and z axes.
33. The connector of claim 32, wherein the contact housing includes a base for receiving each of the first longitudinally extending sections of the first and second spring contacts, wherein the base defines at least one channel extending in the direction of the x-axis between the first longitudinally extending sections of the first



spring contacts and the first longitudinally extending sections of the second spring contacts.

34. The connector of claim 31, wherein the contact housing includes a base
5 having a divider extending from a top surface, the divider defining a plurality of alternating first and second channels, each of the first and second channels receiving one of the first and second spring contacts, the first channels extending at an angle to the x and y-axes, the second channels extending parallel to the x-axis.
- 10 35. An electrical connector for connecting to a plug having a plurality of electrical contacts, the connector comprising:
- a) a plurality of first and second metallic spring contacts, each of the first and second spring contacts including:
- 15 board;
- 1) a circuit board connection end for connecting to a circuit
- 2) a first longitudinally extending section;
- 3) a main bend section;
- 4) a second longitudinally extending section, the first
longitudinally extending section, wherein the main bend section, and the second
20 longitudinally extending section define a general V-shape;
- b) a dielectric contact housing for holding the spring contacts, wherein the contact housing defines an x-axis, a y-axis and a z-axis, the contact housing configured for receipt of the plug in a direction of the x-axis, wherein the first and second spring contacts are arranged such that:
- 25 1) the first and second spring contacts alternate along the z-axis;
- 2) the first longitudinally extending section of the first spring contacts are in a plane displaced along the y-axis from a plane defined by the first longitudinally extending section of the second spring contacts;
- 3) the contact housing including a base for receiving each of the
30 first longitudinally extending sections of the first and second spring contacts, wherein the base defines at least one channel extending in the direction of the x-axis between the first longitudinally extending sections of the first spring contacts and the first longitudinally extending sections of the second spring contacts.

