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Dang

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(54) **PCB-MOUNT ELECTRICAL CONNECTOR WITH SHIELDING FOR INHIBITING CROSSTALK**

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Related U.S. Application Data

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H01R 13/648 (2006.01)
H01R 13/6585 (2011.01)
H01R 13/6589 (2011.01)

(52) **U.S. Cl.**
CPC ***H01R 13/6585*** (2013.01); ***H01R 13/6589*** (2013.01)
USPC **439/607.05**

(58) **Field of Classification Search**
CPC H01R 13/6585; H01R 13/6589
USPC 439/607.05, 79
See application file for complete search history.

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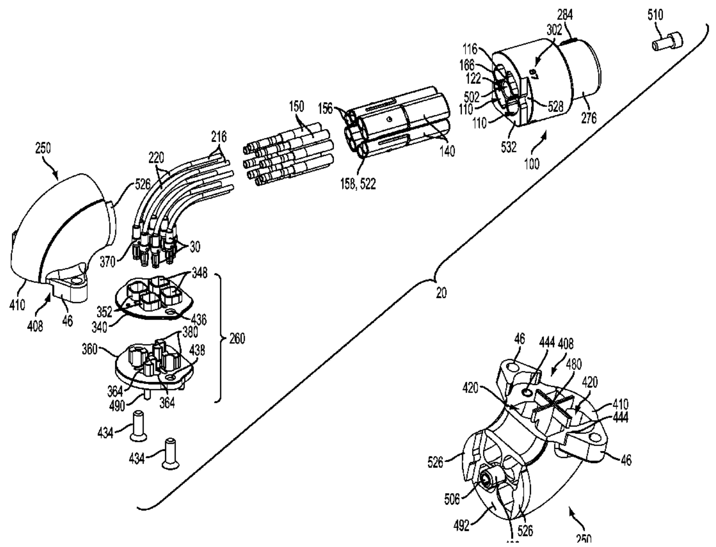
(57) **ABSTRACT**

A board-mount electrical connector includes an electrically conductive rear shell interposed between a contact-retaining front body and an insulator member that holds a plurality of board-mount contacts. The rear shell includes at least one electrically conductive shielding divider that extends through the insulator member and is positioned between two or more of the board-mount contacts. Also disclosed is a rear shell elbow for an electrical connector that is assembled from a pair of slidably interlocking members that form an X-shaped divider within the rear shell when assembled.

15 Claims, 5 Drawing Sheets



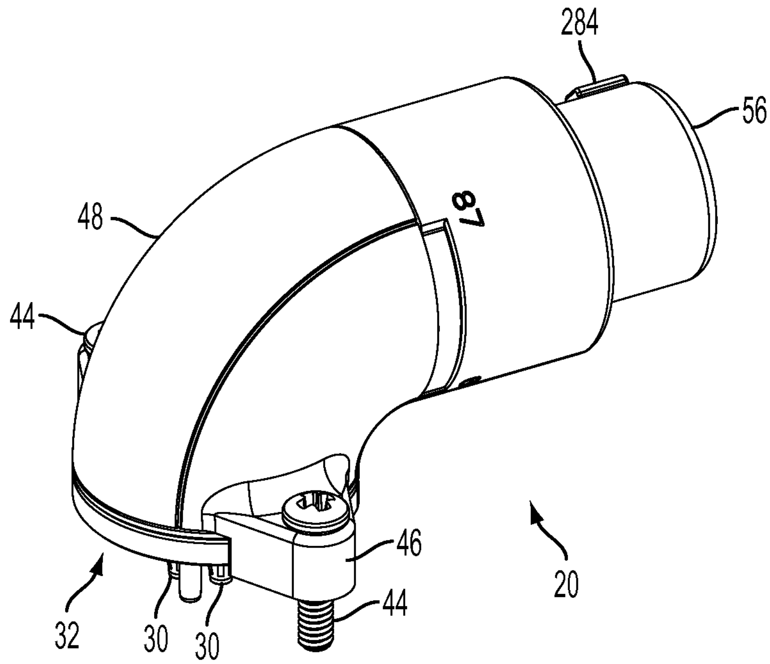

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FIG. 1

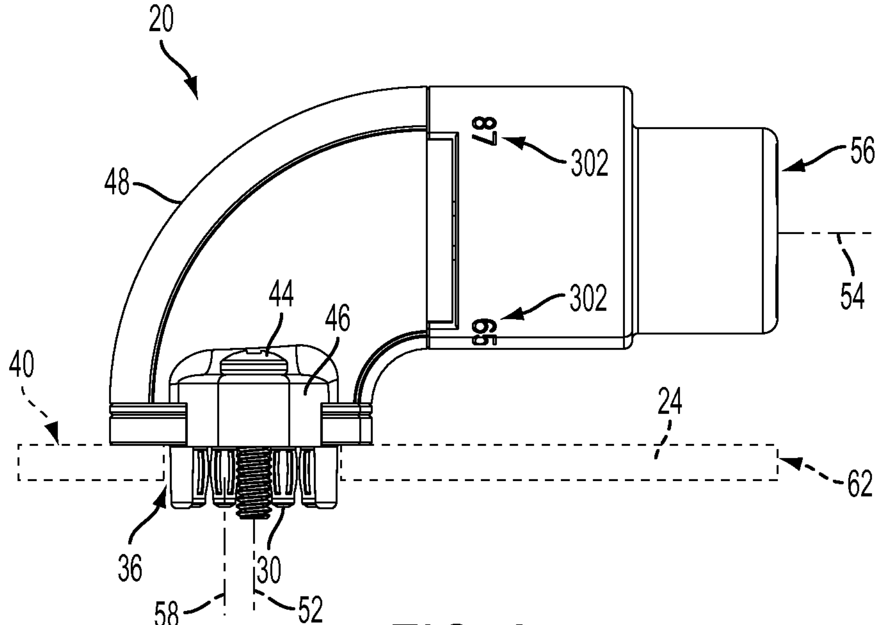
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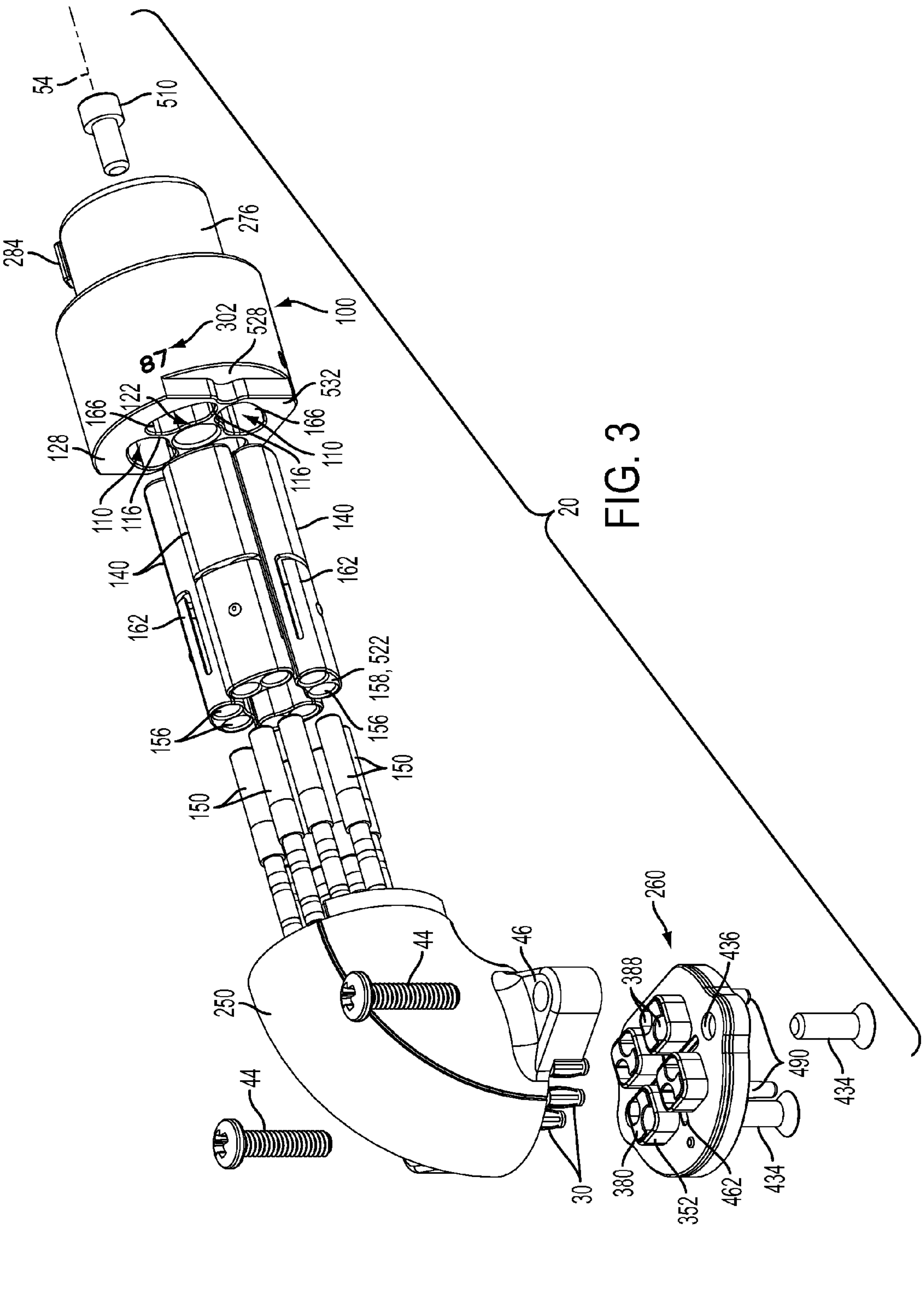
FIG. 2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100
302
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122
166
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116
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162
162
158, 522
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260
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436
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434
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380
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462
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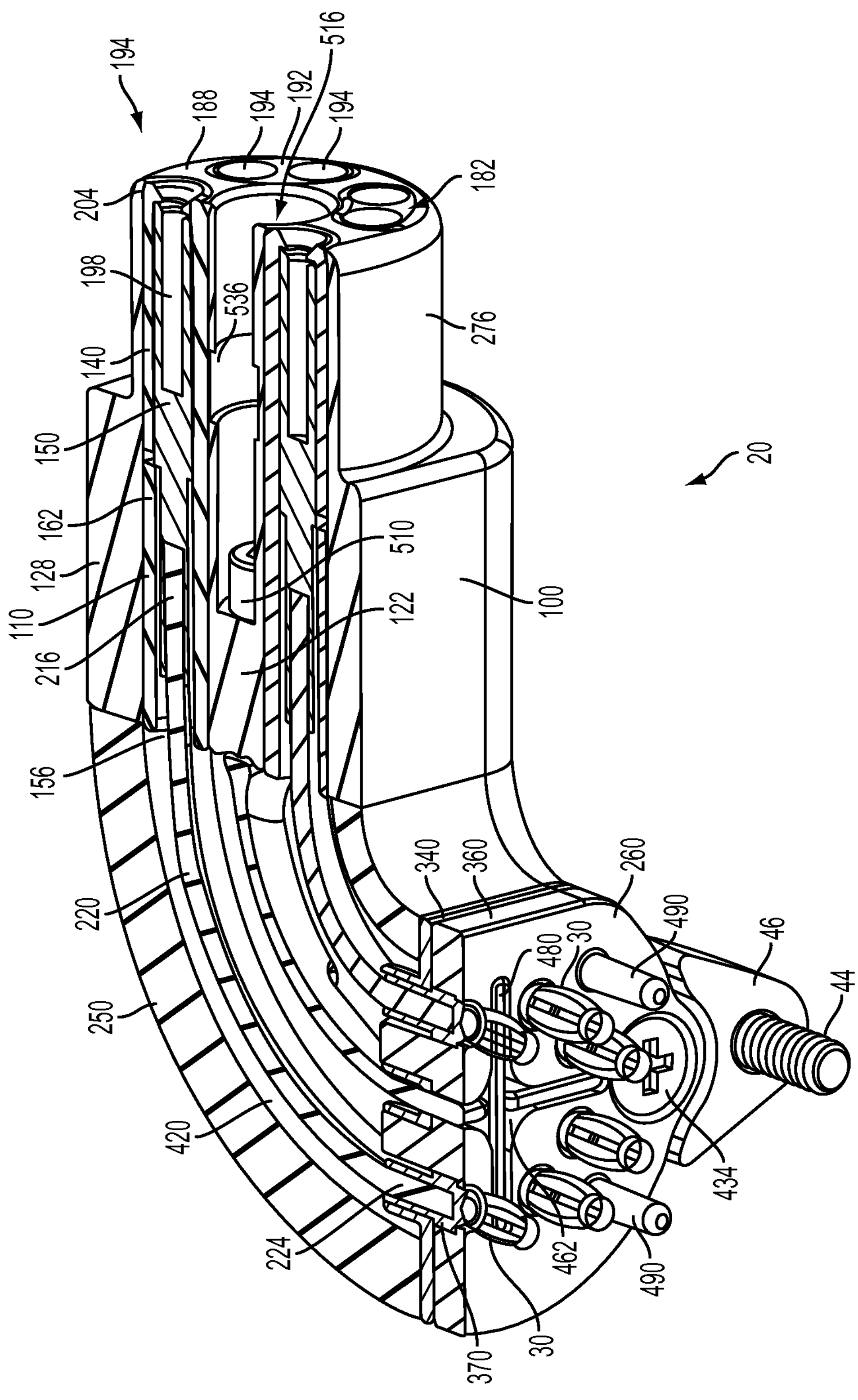
FIG. 3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188
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216
156
340
360
260
220
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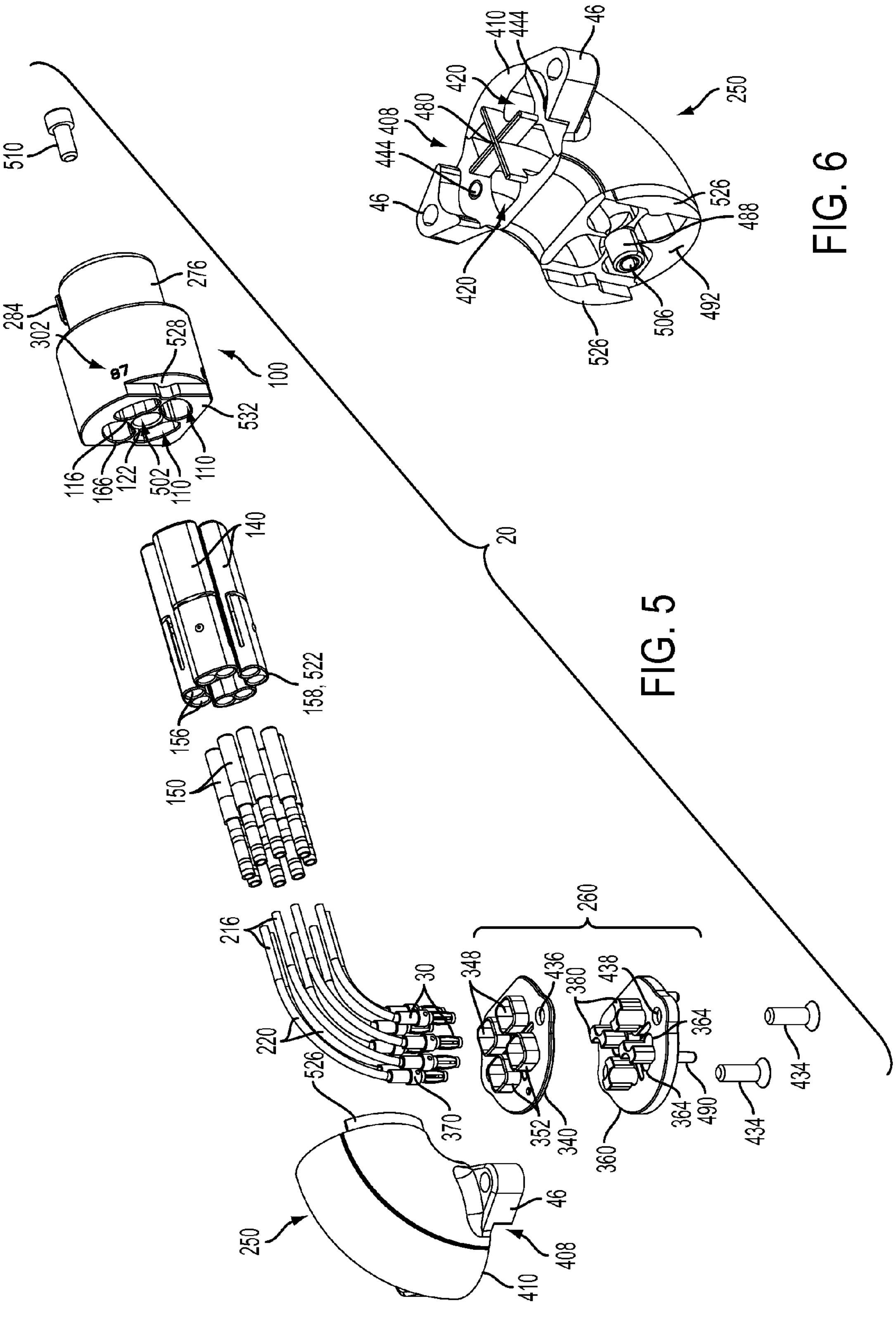
480
30
46
44
250
434
420
462
224
490
30
370

FIG. 4



510
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434
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488
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526

FIG. 5

FIG. 6

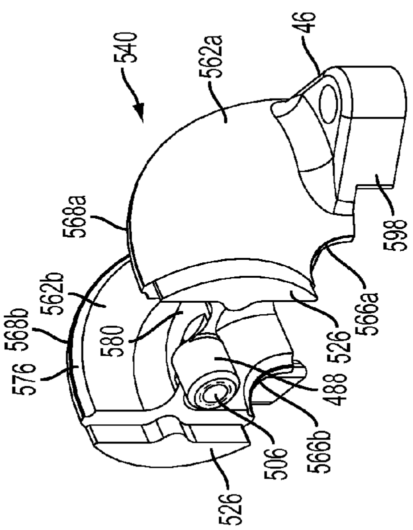

FIG. 7

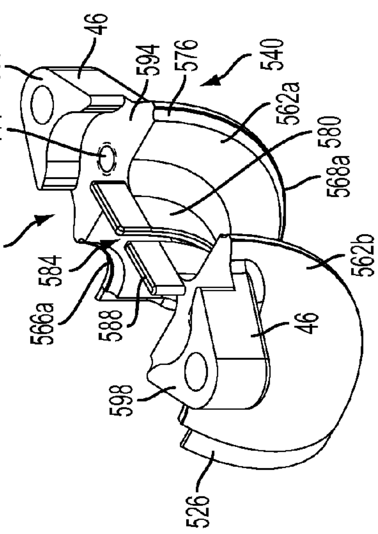

FIG. 8

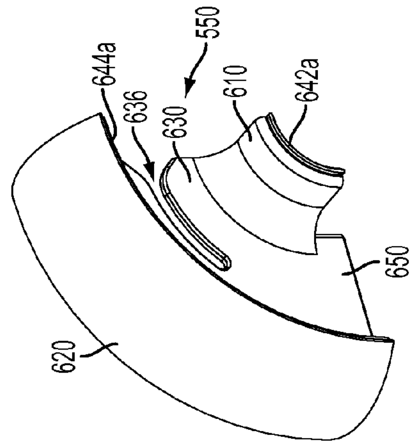

FIG. 9

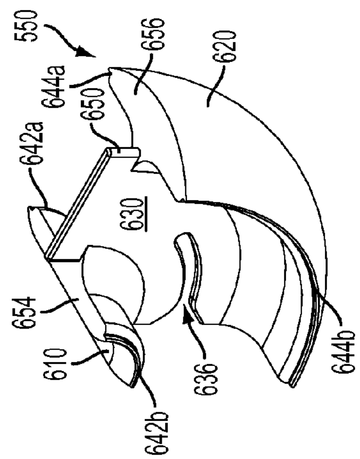

FIG. 10

PCB-MOUNT ELECTRICAL CONNECTOR WITH SHIELDING FOR INHIBITING CROSSTALK

RELATED APPLICATION

This application claims the benefit under 35 U.S.C. §119 (e) from U.S. Provisional Patent Application No. 61/615,866, filed Mar. 26, 2012, which is incorporated herein by reference.

TECHNICAL FIELD

The field of this disclosure relates to electrical connectors and, in particular, to board-mount connectors including shielding features for reducing interference and crosstalk amongst different conductors within the connector and/or at the electrical interconnection between the conductors and the printed circuit board.

BACKGROUND

Increasingly, electronic devices transmit and receive high-frequency electrical signals representing digital data. High-speed data transmission, such as so-called Ultra High-Speed (UHS) data transmission involves the transmission of data between electronic devices at rates of 1 to 10 gigabits per second using signal frequencies of 100 MHz to 500 MHz. There is a desire for future high-speed data transmission at even faster rates and at even higher frequencies. High-speed digital data transmission is facilitated by a data transmission system with a relatively high signal to noise ratio. One exemplary system includes a 1000BASE-T Ethernet network that includes category 5, 5E, 6 or 6A cables. Cables in such a system are designed to propagate data signals without exhibiting, inducing, generating or introducing appreciable noise in the data signals, and are terminated by electrical connectors at either end to either connect cables together, or to connect cables to electronic devices.

One wire-terminating connector designed for UHS data transmission is described in U.S. patent application Ser. No. 13/314,174, filed Dec. 7, 2011, titled "Electrical Connector for High-Speed Data Transmission" ("the '174 application"), which is assigned to the assignee of the present invention. Wire-terminating connectors such as those described in the '174 application do not address certain challenges associated with connectors of the kind that mount directly to a printed circuit board (PCB). Such board-mount (or PCB-mount) connectors serve as a connection point for coupling a wire-mount connector, or in some cases another board-mounted connector, to form a system of electrical interconnection between devices.

PCB-mount connectors are typically electrically connected to contact locations on the PCB via soldered or solderless unshielded contacts spaced closely together, which leaves the connector susceptible to crosstalk. Thus, a need remains for a board-mount connector with improved shielding features for reducing crosstalk, noise, and interference in high-speed data transmission systems, including shielding for adjacent conductors or pairs of conductors within the connector and at the PCB interface.

Some engineering applications require an angled PCB-mount connector mounted to a PCB along a first termination axis that is angled relative an interconnection coupling axis between the PCB-mount connector and a mating connector. Angled connectors include right-angle connectors, 45-degree connectors, and connectors of other various angles between

the termination axis and the interconnection coupling axis. The present inventors have recognized that angled PCB-mount connectors present particular challenges for shielding adjacent conductors or pairs of conductors of the connector and at their interconnection to the PCB. A need therefore also remains for improved shielding in an angled board-mount connector.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of a right-angle PCB-mount electrical connector according to an embodiment;

FIG. **2** is a side elevation view of the connector of FIG. **1** shown mounted to a PCB, which is illustrated schematically in dashed lines;

FIG. **3** is a partially exploded view of the connector of FIGS. **1-2**;

FIG. **4** is an isometric section view of the connector of FIGS. **1-2**;

FIG. **5** is a further exploded assembly view of the connector of FIGS. **1-4** with mounting screws of the connector omitted;

FIG. **6** is a bottom isometric view of a two-piece rear shell component of the connector of FIGS. **1-5** forming a shielding elbow thereof;

FIGS. **7** and **8** are respective top and bottom isometric views of a lateral elbow part of the rear shell of FIG. **6**; and

FIGS. **9** and **10** are respective top and bottom isometric views of a center elbow part which is shaped to slidably interlock with the lateral elbow part of FIGS. **7** and **8** to complete the rear shell of FIG. **6**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to FIGS. **1** and **2**, a board-mount electrical connector **20** according to a embodiment is mountable to a printed circuit board (PCB) **24** (FIG. **2**) to provide electrical interconnection to contact locations on PCB **24**. In the illustrated embodiment, connector **20** includes solderless press-fit pin contacts **30** (board-mount contacts) at a rear end **32** of connector **20** which are inserted into through a corresponding set of contact through-holes **36** in PCB **24**. Through-holes **36** will typically have conductive inner circumferential surfaces for making electrical contact with board-mount contacts **30**. In other embodiments, board-mount contacts **30** may be through-hole pin contacts which are soldered to PCB **24** or surface-mount contacts that engage conductive lands or pads (not illustrated) on the face **40** of PCB **24**, such as solder type surface-mount contacts or spring-loaded pogo pin solderless contacts. A pair of screws **44** or other fasteners extend through mounting flanges **46** of connector **20** and into mounting holes in PCB **24** to securely retain connector **20** to PCB **24**.

Connector **20** illustrated in FIGS. **1-2** is right-angle style including an elbow bend **48** forming a 90-degree angle between a mounting axis **52** of connector **20** and a coupling axis **54** along which a mating connector is moved for coupling to a mating end **56** of connector **20**. In the illustrated embodiment, mounting axis **52** is aligned with the insertion axes **58** of through-hole contacts **30**, which are generally perpendicular to face **40** of PCB **24** when mounted. In other embodiments, connector **20** may be a straight connector, in which the mounting axis and coupling axis are aligned, or may be an angled connector having an angle other than 90-degrees, such as 45 degrees, 30 degrees, or some other angle relative to a direction normal to the face of PCB.

One suitable mating connector is a wire-terminating pin connector of the kind described in U.S. patent application Ser.

No. 13/314,174, filed Dec. 7, 2011 ("the '174 application"), which is incorporated herein by reference. A commercially available version of such a mating connector is sold under the trademark OCTAX™ by Carlisle Interconnect Technologies of Tukwila, Wash. and St. Augustine, Fla., USA.

FIG. **3** is a partially exploded view of connector **20**. With reference to FIG. **3**, connector **20** includes a conductive front body **100** (front shell) defining four cavities **110** extending in an axial direction along the insertion axis **58** entirely through front body **100**. Cavities **110** are separated by four conductive fins **116** radiating from a conductive central core **122** and integrally interconnecting the central core **122** to a conductive peripheral barrel section **128** of front body **100**. Four insulating sheaths **140** are provided, each of which receives and carries a pair of socket contacts **150** in spaced-apart relation. Each of the contacts **150** is inserted into one of a pair of rear apertures **156** at the rear face **158** of a corresponding one of the sheaths **140**, and seated and retained in sheath **140** by a cantilevered latch **162**, as further described in the '174 application. Each sheath **140** is inserted into one of the cavities **110** via a rear opening **166** thereof, as further described in the '174 application. When assembled, the pair of contacts **150** held by sheath **140** are positioned in alignment with the insertion axis **58**.

FIG. **4** is an isometric section view illustrating the assembled connector **20**, including the arrangement of front body **100**, sheaths **140**, and socket contacts **150**. Socket contacts **150** are held by insulating sheaths **140** in alignment with front openings **182** of cavities **110** that extend through a front end **188** of front body **100**. Insulating sheaths **140** are made from an insulating material, for example a molded high-temperature composite thermoplastic material such as polyetherimide resin (e.g., molded glass-reinforced polyetherimide resin), and prevent contacts **150** from contacting each other or any of the conductive surfaces of front body **100**. A front face **192** of each sheath **140** includes a pair of front apertures **194** aligned with and providing access to a socket portion **198** of each of the contacts **150** retained in sheath **140**. Front face **192** or a surrounding front edge of each sheath **140** seats against an internal lip **204** of front body **100** bordering front opening **182**.

FIG. **5** is a more fully exploded view of connector **20**. With reference to FIGS. **4** and **5**, each of the socket contacts **150** is attached, by crimping or otherwise, to a first end **216** of a segment of wire **220**. In one embodiment, wires **220** are machine-bent segments copper wire that are gold plated and may have optional insulating sheaths added. In other embodiments, wire **220** includes insulated wire in which the insulation has been stripped from first end **216** prior to crimping. Each of the wires **220** extends through a conductive rear shell **250** of connector, further described below with reference to FIGS. **6-10**. A second end **224** of each wire **220** is connected to a crimping end of one of the board-mount contacts **30**. Board-mount contacts **30** are securely held in spaced-apart relation by a bottom insulator subassembly **260**, as further described below. If machine-bent solid copper wires are used, then wires **220** may be maintained in a generally parallel relationship within rear shell **250**. In other embodiments, such as when insulated wires are used, adjacent pairs of wires may be twisted pairs between the board-mount contacts **30** and the socket contacts **150** to further reduce crosstalk. For twisted pairs, insulated solid conductor wires (e.g. solid copper) are preferred to maintain control over twist rate/pitch, but multi-strand insulated wires may also be used.

Socket contacts **150** may preferably be a standard crimp contact of the kind often used in aerospace applications, such as 22 awg machined high-density socket contacts meeting US military specification MIL-C-39029 and commonly identified as Military Specification Part No. M39029/57-354. Although socket contacts **150** are utilized in the illustrated embodiment, connector **20** is considered a plug type connector because when connector **20** is mated with a mating connector, a front plug portion **276** of front body **100** seats within a cylindrical front shell portion of the mating socket type connector (which includes pin contacts). An orientation key **284** radially outward from front plug portion **276** and is sized to slidably mate with an orientation slot in the front shell of a mating connector to ensure the proper matching of conductors electrically coupled to the socket contacts **150** and pin contacts of the respective connectors. In an alternative embodiment, front body **100** may be formed in the shape of a socket body making connector **20** a socket connector. In other embodiments, contacts **150** may be pin contacts, another type of plug contact, or a type of contact other than a pin or socket contact, housed either in a plug body or socket body. Numbering indicia **302** (see also FIG. **2**) around an outer surface of barrel section **128** of front body **110** indicate the positions of the eight contacts **150** of connector **20**.

The central core **122**, fins **166**, and barrel section **128** of front body **100** are preferably all integrally formed in a monolithic structure to eliminate pathways for crosstalk or outside radio-frequency (RF) interference. Each of the fins **116** separates and shields adjacent ones of the cavities **110** from each other. Rear shell **250** includes similar shielding features in a monolithic construction or a two-piece interlocking assembly described below with reference to FIGS. **6-10**. Front body **100** and rear shell **250** are both preferably made from an electrically conductive material or a non-conductive material with a conductive coating or plating, such as aluminum alloy with electroless nickel plating, for example. Other suitable materials, such as gold or silver, can be used to plate front body **100**, and other suitable materials, such as steel, copper or other suitable electrically conductive material, can be used to form front body **100**. In other embodiments, front body **100** is made from an insulating material, such as molded polyetherimide or other suitable plastic resin, and is coated or plated with an electrically conductive material, such as silver, gold, or nickel. In a preferred embodiment, front body **100** is machined from a single unitary block of metal, but other methods of integrally forming front body **100** in a monolithic structure include molding, casting, and metal injection molding (MIM), for example.

Continuing with reference to FIGS. **4** and **5**, bottom insulator subassembly **260** includes an inner insulator plate **340** having four oblong openings **348**, each bordered by an inwardly depending skirt **352** and sized to accommodate a portion of a pair of the board-mount contacts **30**, and an outer insulator plate **360**. Outer insulator plate **360** includes four pairs of contact apertures **364** each pair aligned with one of the oblong openings **348** of inner insulator plate. Each contact aperture **364** is sized to allow a board end of one of the contacts **30** to pass therethrough. Oblong openings **348** and contact apertures **364** each include a small lip extending therearound which captures a shoulder portion **370** of contact **30** between insulator plates **340**, **360** and prevents contact **30** from moving relative to insulator subassembly **260**. Outer insulator plate **360** includes four hourglass-shaped pillars **380** projecting from an inwardly-facing surface of outer insulator plate **360** and extending into oblong openings **348** within skirts **352** to divide oblong openings **348** into two generally cylindrical electrically isolated contact-receiving spaces **388** (FIG. **3**). Pillars **380** cooperate with skirts **352** to provide mechanical support for contacts **30** and to inhibit adjacent contacts **30** from touching each other.

FIG. **6** is a bottom view of rear shell **250**. With reference to FIGS. **3-6** and particular reference to FIGS. **5** and **6**, insulator subassembly **260**, carrying contacts **30**, is nested in a bottom recess **408** in a rear end **410** of rear shell **250** between mounting flanges **46** (mounting feet) such that each of the oblong openings **348** and its associated pair of contact apertures **364** align with one of four wire-isolating passageways **420** of rear shell **250**. Two screws **434** (or pins or other fasteners) extend through mounting holes **436**, **438** in lateral portions of respective inner and outer insulator plates **340**, **360**, and thread into threaded bores **444** (FIG. **6**) in rear end **410** of rear shell **250** to secure insulator subassembly to rear shell **250**. Co-aligned crossed slots (X-shaped slots) in insulator plates **340**, **360** form an X-shaped slot **462** through insulator subassembly **260** providing clearance for a projecting portion of an X-shaped shielding divider **480** of rear shell **250** described in greater detail below with reference to FIGS. **6-10**. Outer insulator plate **360** includes two or more alignment pins **490** projecting outwardly therefrom for assisting in alignment of connector **20** to PCB **24** during insertion of contacts **30** into through-holes **36** in PCB **24** and to facilitate securing connector **20** to PCB **24**. Insulator plates **340**, **360** are both made of an electrically insulating material, for example a molded high-temperature composite thermoplastic material such as polyetherimide resin.

In an alternative embodiment, insulator subassembly **260** may be replaced by an injected insulator formed by an insert molding process, wherein an insert part subassembly including the rear shell **250**, wires **220** and crimp-connected contacts (board contacts **30** or socket contacts **150**, or both) are inserted into a mold cavity that is shut off against the inserted parts, then plastic material is injected into the cavity to encapsulate a portion of the insert part subassembly. In an insert molding process, an insulating thermoplastic resin such as polyetherimide is injected into wire-isolating passageways **420** to encapsulate wires **220** and an inner portion of board contacts **30** to stabilize and secure them to rear shell **250** while electrically insulating between contacts **30**. To facilitate insert molding, the insulation on wires **220** is preferably a temperature resistant material such as PTFE.

Turning again to FIG. **6**, rear shell **250** includes a central post portion **488** (mounting boss) that extends from a front major face **492** of rear shell and into a rear counterbore **502** (FIG. **5**) in front body **100**, when connector **20** is assembled. A threaded bore **506** in central post portion **488** threadably receives a socket-head cap screw **510** which is inserted through a front counterbore **516** (FIG. **4**) of front body **100** and tightened using a hex key to securely fasten and draw rear shell **250** and front body **100** together. A portion or edge of front major face **492** of rear shell **250** may abut a rear end **522** of sheaths **140** to urge sheaths **140** forwardly against lip **204** and/or retain sheaths **140** in cavities **110**, as best illustrated in FIG. **3**. Lateral tabs **526** extending forwardly from front major face **492** of rear shell extend into and seat in lateral notches **528** in left and right sides of front body **100** at a rear end **532** of front body **100** when connector is assembled **20**. Lateral tabs **526** and notches **528** prevent rotation of rear shell **250** relative to front body, and may be positioned and dimensioned to mate with a light interference fit or tight slip fit so as to achieve good electrical grounding contact between front body **100** and rear shell **250** for improved shielding performance. An inner circumferential groove **536** is provided in front counterbore **516** (FIG. **4**) to cooperate with a latching post portion of a mating connector for latching engagement between connectors and to ensure a good electrical grounding connection between front body **100** and a front shell portion of the mating connector.

Rear shell **250** is assembled from a lateral elbow part **540** (lateral shell part), illustrated in FIGS. **7** and **8**, and an interlocking center elbow part **550**, illustrated in FIGS. **9** and **10**. With reference to FIGS. **7** and **8**, lateral elbow part **540** includes left and right side walls **562***a* and **562***b* having respective minor arcuate edges **566***a*, **566***b* and respective major arcuate edges **568***a*, **568***b* which are parallel to minor arcuate edges **566***a*, **566***b*, and together with minor arcuate edges **566***a*, **566***b* define a bend shape of side walls **562***a*, **562***b*. Side walls **562***a*, **562***b* are joined by a central web portion **580** extending between inner surfaces of side walls **562***a*, **562***b* medially of the major and minor arcuate edges, i.e. from medially of edges **566***a* and **568***a* to medially of edges **566***b* and **568***b* and along a curved surface parallel thereto. A first slot **584** extending generally parallel to major and minor arcuate edges **566***a*, **566***a*, **568***a*, **568***b* is formed along a rear half of web portion **580** proximate rear end **410** (FIG. **6**). Arcuate edges **566***a*, **566***b*, **568***a*, **568***b* and slot **584** share a common axis of curvature. Arcuate edges **566***a*, **566***b*, **568***a*, and **568***b* are preferably coved (see cove surfaces **576**) to facilitate sliding interlocking engagement with center elbow part **550**. First and second lateral tab portions (blades) **586** and **588** of web portion **580** extend into recess **408** so that the height of tab portions **586**, **588** beyond a recess surface **594** of lateral elbow part **540** is approximately the same as or somewhat greater or less than the height of feet portions **598** of flanges **46** beyond the recess surface **594**. For example, feet portions **598** may extend beyond the distal ends of tab portions **586**, **588** by a distance of approximately 0.001 to 0.015 inches and more preferably 0.001 to 0.005 to ensure positive contact is made between feet portions **598** and grounding pads on the face **40** of PCB **24**. Screws **44** extend through mounting flanges **46** in rear shell **250** and are screwed into holes in PCB **24** adjacent such grounding pads to ensure that a positive grounding connection is made between the grounding pads and feet portions **598** and so that rear shell **250**, front body **100** and shielding shell components of a mating connector are all grounded to provide effective shielding of conductors in the connector system.

Turning now to FIGS. **9** and **10**, center shell part **550** includes spaced-apart curved front and rear walls **610** and **620**, respectively, and a flat central web portion **630** extending therebetween. Web portion **630** includes an arcuate second slot **636** along a front half of web portion **630** and sized so that web portions **580** and **630** of respective lateral and center elbow parts **540**, **550** can be slidably interlocked to form rear shell **250**. Front wall **610** includes left and right minor arcuate edges **642***a*, **642***b* which include bead surfaces that slidingly mate against respective coved minor arcuate edges **566***a* and **566***b* of lateral elbow part. Similarly rear wall **620** includes left and right major arcuate edges **644***a*, **644***b* which include bead surfaces that slidingly mate against respective coved major arcuate edges **568***a* and **568***b* of lateral elbow part **540** when elbow parts **540**, **550** are assembled to form rear shell **250**. Arcuate edges **642***a*, **642***b*, **644***a*, **644***b*, and second slot **636** share a common axis of curvature. A blade extension **650** of web portion **630** projects beyond co-planar bottom surfaces **654** and **656** of respective front and rear walls **610**, **620** by a distance equal to the distance that first and second lateral tab portions **586** and **588** of lateral elbow part **540** extend beyond recess surface **594** of lateral elbow part **540**. When rear shell **250** is assembled, blade extension **650** crosses through first slot **584** and perpendicular to first and second tab portions **586**, **588** to collectively with web portions **580**, **630** form an X-shaped shielding divider structure **480** (FIG. **6**) and defining, with walls **562***a*, **562***b*, **610** and **520**, four fullyenclosed wire-receiving passageways **420** in the four quadrants around the X-shaped divider structure **480**.

Elbow parts **540**, **550** are each made from an electrically conductive material or a non-conductive material with a conductive coating or plating, such as aluminum alloy with electroless nickel plating, for example. Other suitable materials, such as gold or silver, can be used to plate elbow parts **540**, **550**, and other suitable materials, such as steel, copper or other suitable electrically conductive material, can be used to form elbow parts **540**, **550**. Each of elbow parts **540**, **550** may be CNC machined from a monolithic piece of metal. In other embodiments, elbow parts **540**, **550** are made from an insulating material, such as molded polyetherimide or other suitable thermoplastic resin, that is coated or plated with an electrically conductive material, such as silver, gold, or nickel.

In still other embodiments, rear shell **250** (FIG. **6**) may be machined or otherwise formed from a single monolithic block of conductive metal or insulating material, without an interlocking assembly of elbow parts **540**, **550**. Other possible methods of integrally forming rear shell **250** in a monolithic structure include molding, casting, and metal injection molding (MIM), for example.

The projecting portion of X-shaped shielding divider **480** extends beyond rear end **410** and through X-shaped slot **462** in insulator subassembly **260** to provide shielding for contacts **30** all the way to PCB **24**. In some embodiments, the PCB **24** may itself be machined with slots therethrough in generally the same X-shaped configuration as the X-shaped slot **462** of insulator subassembly **260**, which slots in PCB **24** are plated with a conductive material to provide further shielding through the PCB **24** itself. In still other embodiments, the projecting portion of X-shaped divider **480** extending from rear end **410** of rear shell **250** may extend beyond insulator subassembly into an X-shaped plated slot in PCB **24**, making electrical grounding contact with the plated slot in PCB.

In yet other embodiments, the projecting portion of X-shaped divider **480** may extend through and beyond such an X-shaped slot in PCB **24** and even beyond the distal ends of contacts **30**, so as to provide shielding beyond the ends of contacts **30**. A shielding cap made of a conductive material (including an insulating material with a conductive plating) may be positioned over a distal end of such an X-shaped divider **480**, and attached to a bottom side of PCB **24** opposite face **40** to further enhance shielding between adjacent pairs of contacts **30**. Such a cap should preferably be dimensioned to contact the distal end of X-shaped divider **480** and attach to a grounding pad on the surface of PCB **24**, while not touching contacts **30**.

It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. The scope of the present invention should, therefore, be determined only by the following claims.

The invention claimed is:

1. A board-mount electrical connector, comprising:

a front body supporting a plurality of electrical contacts in spaced-apart alignment with a coupling axis along which a mating electrical connector is connectable to the board-mount electrical connector;

an insulator member supporting a plurality of board-mount contacts in spaced-apart relation and in alignment with a mounting axis of the electrical connector, each of the board-mount contacts being electrically connected to one of the electrical contacts; and

an electrically conductive rear shell interposed between the insulator member and the front body, the rear shell including at least one electrically conductive shielding divider extending through the insulator member and positioned between two or more of the board-mount contacts.

2. The electrical connector of claim **1**, wherein the shielding divider extends through the rear shell from a front end thereof adjacent the front body to an opposite rear end thereof proximate insulator member and the board-mount contacts, the shielding divider extending across an interior region of the rear shell to define multiple wire-receiving passageways that extend through the rear shell between the front and rear ends of the rear shell.

3. The electrical connector of claim **2**, further comprising a plurality of wires extending through the passageways, a first end of each of the wires connected to one of the electrical contacts and a second end of each of the wires connected to one of the board-mount contacts.

4. The electrical connector of claim **2**, wherein the shielding divider is X-shaped so as to form four passageways through the rear shell.

5. The electrical connector of claim **2**, wherein the rear shell includes an elbow such that the mounting axis and the coupling axis are angularly disposed, and the passageways and shielding divider extend through the elbow of the rear shell.

6. The electrical connector of claim **1**, wherein the front body is electrically conductive and includes multiple cavities extending in an axial direction along the coupling axis entirely through the front body, each of the cavities having a front opening at a front end of the front body and a rear opening at a rear end of the front body;

the rear shell is mated to the front body to provide electrical contact therebetween; and

further comprising multiple electrically insulating sheaths retaining the electrical contacts in spaced apart relation, the sheaths sized for insertion in the cavities so as to align the electrical contacts with the front openings in the front body, and to prevent the electrical contacts from contacting each other or the front body.

7. The electrical connector of claim **6**, wherein the rear shell abuts a rear end of the insulating sheaths and urges the insulating sheaths toward a front end of the front body.

8. The electrical connector of claim **1**, wherein the rear shell and front body include interengaging tabs and notches to prevent rotation of the front body relative to the rear shell.

9. The electrical connector of claim **1**, wherein the shielding divider is X-shaped and the insulator member includes an X-shaped slot that receives the X-shaped shielding divider.

10. The electrical connector of claim **1**, wherein the rear shell has a rear end opposite the front body, the rear end defining a recess and the shielding divider extending into the recess, and the insulator member is seated in the recess.

11. The electrical connector of claim **1**, wherein the insulator member includes a plurality of generally cylindrical electrically isolated contact-receiving spaces extending therethrough, the board-mount contacts seated in the contact-receiving spaces.

12. The electrical connector of claim **1**, wherein the shielding divider extends beyond the insulator member.

13. The electrical connector of claim **1**, wherein the shielding divider extends beyond distal ends of the board-mount contacts.

14. The electrical connector of claim **1**, wherein the insulator member is formed by injecting a resin within an interior region of the rear shell and around a portion of the board-mount contacts.

15. The electrical connector of claim **1**, wherein

each of the board-mount contacts includes an outwardly projecting shoulder portion;

the insulator member includes an inner insulator plate having openings formed therein, and an outer insulator plate defining contact apertures that are aligned with the openings in the inner insulator plate, and the inner and outer insulator plates are joined together to capture the shoulder portions of the board-mount contacts between the inner and outer insulator plates and prevent the board-mount contacts from moving along the mounting axis relative to the inner and outer insulator plates.

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