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RECEPTACLE CAGE HAVING EMI SHIELDING

Abstract

A receptacle connector assembly includes a receptacle cage having shielding walls forming a module channel configured to receive a pluggable module. The front end has a port open to the pluggable module to receive the pluggable module. The receptacle connector assembly includes an EMI shield coupled to the receptacle cage at the front end. The EMI shield has a shield member including a base coupled to the shielding wall to electrically connect to the receptacle cage. The shield member includes spring fingers extending from the base to distal ends and including a panel interface configured to engage a panel surrounding the receptacle cage to electrically connect the EMI shield to the panel. The spring fingers have variable heights relative to each other.

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Background/Summary

BACKGROUND OF THE INVENTION

[0001] The subject matter herein relates generally to communication systems.

[0002] Some communication systems utilize communication connectors to interconnect various components of the system for data communication. Some known communication systems use pluggable modules, such as I/O modules, that are electrically connected to the communication connector. Known communication systems provide electrical shielding, such as in the form of a receptacle cage surrounding or adjacent to the communication connector and the pluggable module to provide electrical shielding. Some receptacle cages provide an EMI shield at the front end of the receptacle cage including EMI springs, which may interface with a panel or other grounding structure. However, the EMI springs may make poor contact with the receptacle cage, such as due to the walls of the receptacle cage bowing outward or distorting when the pluggable modules are inserted into the receptacle cage. This causes inconsistent spring contact to the panel which causes poor EMI shielding and leads to diminished performance.

[0003] A need remains for a receptacle cage having improved EMI shielding.

BRIEF DESCRIPTION OF THE INVENTION

[0004] In one embodiment, a receptacle connector assembly is provided and includes a receptacle cage that has shielding walls extending between a front end and a rear end of the receptacle cage. The shielding walls form a module channel configured to receive a pluggable module. The front end has a port open to the pluggable module to receive the pluggable module. The receptacle connector assembly includes an EMI shield coupled to the receptacle cage at the front end. The EMI shield has a shield member including a base coupled to at least one of the shielding walls to electrically connect the EMI shield to the receptacle cage. The shield member including spring fingers extending from the base to distal ends, each spring finger including a panel interface configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel. The spring fingers have variable heights relative to each other.

[0005] In another embodiment, a receptacle connector assembly is provided and includes a receptacle cage that has shielding walls extending between a front end and a rear end of the receptacle cage. The shielding walls form a module channel configured to receive a pluggable module. The front end has a port open to the pluggable module to receive the pluggable module. The receptacle connector assembly includes an EMI shield coupled to the receptacle cage at the front end. The EMI shield has a shield member including a base coupled to the corresponding shielding wall to electrically connect the EMI shield to the receptacle cage. The shield member including spring fingers extending from the base to distal ends, each spring finger including a panel interface configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel, each spring finger has a height measured from the corresponding shielding wall to the panel interface, adjacent spring fingers have different heights relative to each other.

[0006] In a further embodiment, a receptacle connector assembly is provided and includes a receptacle cage that has shielding walls extending between a front end and a rear end of the receptacle cage. The shielding walls form a module channel configured to receive a pluggable module. The front end has a port open to the pluggable module to receive the pluggable module. The receptacle connector assembly includes an EMI shield coupled to the receptacle cage at the front end. The EMI shield has a shield member including a base coupled to at least one of the shielding walls to electrically connect the EMI shield to the receptacle cage. The shield member including spring fingers, each spring finger has an arc extending between a proximal end at the base and a distal end opposite the proximal end, each spring finger including a panel interface along the arc configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel. The spring fingers have different curvature at the corresponding panel interface.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a front perspective view of a communication system formed in accordance with an exemplary embodiment.

[0008] FIG. **2** is a perspective view of the pluggable module in accordance with an exemplary embodiment.

[0009] FIG. **3** is a perspective view of a portion of the EMI shield showing one of the shield members or a portion of one of the shield member in accordance with an exemplary embodiment.

[0010] FIG. **4** is a side view of the shield member in accordance with an exemplary embodiment.

[0011] FIG. **5** is a perspective view of a portion of the EMI shield showing one of the shield members or a portion of one of the shield member in accordance with an exemplary embodiment.

[0012] FIG. **6** is a side view of the shield member in accordance with an exemplary embodiment.

[0013] FIG. **7** is a front view of a portion of the communication system showing the shield member mounted to the shielding wall in accordance with an exemplary embodiment.

[0014] FIG. **8** is a front view of a portion of the communication system showing the shield member mounted to the shielding wall in accordance with an exemplary embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0015] FIG. **1** is a front perspective view of a communication system **100** formed in accordance with an exemplary embodiment. The communication system **100** includes a host circuit board **102** and a receptacle connector assembly **104** mounted to the host circuit board **102**. The receptacle connector assembly **104** is configured to receive a pluggable module **106** (example shown in FIG. **2**). The receptacle connector assembly **104** is configured to be electrically connected to the host circuit board **102** by the receptacle connector assembly **104**.

[0016] In an exemplary embodiment, the receptacle connector assembly **104** includes a receptacle cage **110** and a communication connector **112** (shown in phantom) adjacent the receptacle cage **110**. The communication connector **112** may be received in the receptacle cage **110**. In other various embodiments, the communication connector **112** may be located rearward of the receptacle cage **110**. In various embodiments, the receptacle cage **110** is enclosed and provides electrical shielding for the communication connector **112**. In an exemplary embodiment, the receptacle cage **110** is a stamped and formed cage member that includes a plurality of shielding walls **114** that define one or more module channels for receipt of corresponding pluggable modules **106**.

[0017] In the illustrated embodiment, the receptacle cage **110** is a single port receptacle cage configured to receive a single pluggable module **106**. In other various embodiments, the receptacle cage **110** may be a ganged cage member having a plurality of ports ganged together in a single row and/or a stacked cage member having multiple ports stacked as an upper port and a lower port.

[0018] The receptacle cage **110** includes a module channel **116** having a module port **118** open to the module channel **116**. The module channel **116** receives the pluggable module **106** through the module port **118**. In an exemplary embodiment, the receptacle cage **110** extends between a front end **120** and a rear end **122**. The module port **118** is provided at the front end **120**. Any number of module channels **116** may be provided in various embodiments arranged in a single column or in multiple columns (for example, 2×2, 3×2, 4×2, 4×3, 4×1, 2×1, and the like). Optionally, multiple communication connectors **112** may be arranged within the receptacle cage **110**, such as when multiple rows and/or columns of module channels **116** are provided.

[0019] In an exemplary embodiment, the shielding walls **114** of the receptacle cage **110** include a first end wall **130**, a second end wall **132**, a first side wall **134**, and a second side wall **136**. The side walls **134**, **136** extend between the end walls **130**, **132**. In various embodiments, the first end wall **130** is at a top of the receptacle cage **110**, and thus defines a top wall **130**, and the second end wall **132** is at a bottom of the receptacle cage **110**, and thus defines a bottom wall **132**. Other orientations are possible in alternative embodiments, such as the second end wall **132** or one of the side walls **134**, **136** defining the top wall. The bottom wall **132** may face, and possibly rest on, the host circuit board **102**. In various embodiments, the receptacle cage **110** may be provided without the bottom wall **132**. Optionally, the walls **114** of the receptacle cage **110** may include a rear wall **138** at the rear end **122**.

[0020] The shielding walls **114** define a cavity **140**. For example, the cavity **140** may be defined by the first end wall **130**, the second end wall **132**, the side walls **134**, **136** and the rear wall **138**. The cavity **140** includes the module channel(s) **116**. In various embodiments, the cavity **140** receives the communication connector **112**, such as at the rear end **122**. Other walls **114** may separate or divide the cavity **140** into additional module channels **116**, such as in embodiments using ganged and/or stacked receptacle cages. For example, the walls **114** may include one or more vertical divider walls between ganged module channels **116**. In various embodiments, the walls **114** may include a separator panel between stacked upper and lower module channels **116**. The separator panel may include an upper panel and a lower panel that form a space between the upper and lower module channels **116**, such as for airflow, for a heat sink, for routing light pipes, or for other purposes.

[0021] In an exemplary embodiment, the receptacle cage **110** includes an EMI shield **200** at the front end **120** for providing electrical shielding for the module channels **116**. For example, the EMI shield **200** may be provided at the port **118** to electrically connect with the pluggable module **106** received in the module channel **116**. In an exemplary embodiment, the EMI shield **200** is provided around the exterior of the receptacle cage **110** for interfacing with a panel **150**, such as when the front end **120** of the receptacle cage **110** extends through a cutout **152** in the panel **150**. The panel **150** may be a grounded component. The panel **150** may be a wall or other structure of a grounded electrical component. The panel **150** may be planar. In various embodiments, the panel **150** is a chassis. The EMI shield **200** may include deflectable features that are configured to be spring biased against the panel **150** to create an electrical connection with the panel **150**. The shield members **202** of the EMI shield **200** may extend along the shielding walls **114**. The shield members **202** may include spring fingers or other deflectable features that are configured to be spring biased against the pluggable module **106** to create an electrical connection with the pluggable module **106**. In an exemplary embodiment, the spring fingers are designed to occupy the space or gap in the cutout **152** around the outside of the receptacle cage **110** to prevent EMI leakage through the cutout **152**. The spring fingers may be designed to accommodate different gap lengths along the shielding walls **114**, such as when the shielding walls **114** are bowed or askew in the cutout **152**. In various embodiments, the shield members **202** are separate and discrete shield members **202** provided on the corresponding shielding walls **114**. In other various embodiments, the shield members **202** are integrated as a unitary structure with different segments extending along the corresponding shielding walls **114**.

[0022] Optionally, the receptacle connector assembly **104** may include one or more heat sinks (not shown) for dissipating heat from the pluggable modules **106**. For example, the heat sink may be coupled to the top wall **130** for engaging the pluggable module **106** received in the module channel **116**. The heat sink may extend through an opening in the top wall **130** to directly engage the pluggable module **106**. Other types of heat sinks may be provided in alternative embodiments.

[0023] In an exemplary embodiment, the pluggable modules **106** are loaded through the port **118** at the front end **120** to mate with the communication connector **112**. The shielding walls **114** of the receptacle cage **110** provide electrical shielding around the communication connector **112** and the pluggable module **106**, such as around the mating interface between the communication connector **112** and the pluggable module **106**. The EMI shield may include shield fingers along the interior of the shielding walls **114** configured to interface with the pluggable module **106**.

[0024] FIG. **2** is a perspective view of the pluggable module **106** in accordance with an exemplary embodiment. The pluggable module **106** has a pluggable body **170**, which may be defined by one or more shells. The pluggable body **170** may be thermally conductive and/or may be electrically conductive, such as to provide EMI shielding for the pluggable module **106**. The pluggable body **170** includes a mating end **172** and an opposite front end **174**. The mating end **172** is configured to be inserted into the corresponding module channel **116** (shown in FIG. **1**). The front end **174** may be a cable end having a cable extending therefrom to another component within the system.

[0025] The pluggable module **106** includes a connector interface, such as a module circuit board **176**, which is configured to be communicatively coupled to the communication connector **112** (shown in FIG. **1**). The module circuit board **176** may be accessible at the mating end **172**. The module circuit board **176** has a mating edge **178** and mating contacts at the mating edge **178** configured to be mated with the communication connector **112**. The module circuit board **176** may include components, circuits and the like used for operating and/or using the pluggable module **106**. For example, the module circuit board **176** may have conductors, traces, pads, electronics, sensors, controllers, switches, inputs, outputs, and the like associated with the module circuit board, which may be mounted to the module circuit board **176**, to form various circuits. In various embodiments, the pluggable module **106** may be a fiber optic module. The connector interface(s) may include fiber optic cables and/or optical generators to transmit optical signals.

[0026] The pluggable module **106** includes an outer perimeter defining an exterior of the pluggable body **170**. For example, the outer perimeter may be defined by a top **180**, a bottom **182**, a first side **184** and a second side **186**. The pluggable body **170** may have other shapes in alternative embodiments. The top **180**, the bottom **182**, the first side **184** and the second side **186** may have flat surfaces, such as to receive the spring fingers of the EMI shield **200** (shown in FIG. **1**).

[0027] In an exemplary embodiment, the pluggable body **170** provides heat transfer for the module circuit board **176**, such as for the electronic components on the module circuit board **176**. For example, the module circuit board **176** is in thermal communication with the pluggable body **170** and the pluggable body **170** transfers heat from the module circuit board **176**. Optionally, the pluggable body **170** may include a plurality of heat transfer fins (not shown) along at least a portion of the outer perimeter of the pluggable module **106**, such as along the top, for dissipating heat from the pluggable body **170**. A plate may connect the distal ends of the heat transfer fins to form a planar, flat surface, such as for interfacing with a heat sink.

[0028] FIG. **3** is a perspective view of a portion of the EMI shield **200** showing one of the shield members **202** or a portion of one of the shield member **202** in accordance with an exemplary embodiment. FIG. **4** is a side view of the shield member **202** in accordance with an exemplary embodiment. In an exemplary embodiment, the shield member **202** is a stamped and formed part being stamped from a metal sheet and bent into a predetermined shape. The shield member **202** includes a base **210** and a plurality of spring fingers **230** extending from the base **210**. The base **210** is configured to be coupled to the receptacle cage **110**. The spring fingers **230** are configured to interface with the panel **150** (shown in FIG. **1**).

[0029] The base **210** includes a front edge **212** and a rear edge **214**. The base **210** includes an inner surface **216** and an outer surface **218**. The inner surface **216** is configured to be coupled to the receptacle cage **110**. The base **210** extends between a first end **220** and a second end **222** of the shield member **202**. Optionally, another shield member **202** may extend from the first end **220** and/or the second end **222**, such as perpendicular to the shield member **202** shown in FIG. **3**. The base **210** may be generally planar extending along a base plane. The inner and outer surfaces **218** may be planar and parallel to each other. Optionally, the base **210** may be welded to the corresponding shielding wall **114**.

[0030] In an exemplary embodiment, a plurality of spring fingers **230** are provided along the shield member **202**. The spring fingers **230** extend rearward from the rear edge **214**. Gaps **224** are provided between the spring fingers **230** to allow the spring fingers **230** to be independently deflectable relative to each other. The spring finger **230** is deflectable, such as when mating to the receptacle cage **110**. Each spring finger **230** extends between a proximal end **232** and a distal end

234. The proximal end **232** is provided at the base **210**. The spring fingers **230** may be curved between the proximal end **232** and the distal end **234**. For example, each spring finger **230** may include an arc **236**. The arc **236** follows an arcuate path between the proximal end **232** and the distal end **234**. For example, the spring finger **230** may follow a smooth curve between the proximal end **232** and the distal end **234**. The curvature may be variable between the proximal end **232** and the distal end **234**, such as following a segment of an ellipse. For example, the curvature may be parabolic in shape. In other various embodiments, the curvature may be constant between the proximal end **232** and the distal end **234**, such as following a segment of a circle. The arc **236** may follow other curved shapes in alternative embodiments. In an exemplary embodiment, the spring finger **230** includes a foot **238** at the distal end **234**. The foot **238** may have a different curvature compared to the arc **236**. The foot **238** may be used to support the spring finger **230**, such as to support the spring finger **230** on the shielding wall **114**. In an exemplary embodiment, the spring finger **230** includes a panel interface **240** along the arc **236**. The panel interface **240** is the portion of the spring finger **230** configured to engage the panel **150** when the receptacle cage **110** is received in the cutout **152**. In an exemplary embodiment, the panel interface **240** is located remote from the proximal end **232** and remote from the distal end **234**. The panel interface **240** may be approximately centered between the proximal end **232** and the distal end **234**. The panel interface **240** may be provided at an apex of the arc **236** in various embodiments.

[0031] In an exemplary embodiment, the spring fingers **230** have variable heights relative to each other. Each spring finger **230** has a height **250** measured from the shielding wall **114** (for example, the inner surface **216** of the base **210**) to the panel interface **240**. The panel interfaces **240** of the spring fingers **230** are at different heights **250** (measured from the corresponding shielding wall **114**). Some spring fingers are short spring fingers (short height), some spring fingers are tall spring fingers (tall height), and some spring fingers are mid-height spring fingers. In an exemplary embodiment, adjacent spring fingers have different heights relative to each other. Optionally, at least some of the spring fingers **230** may have the same heights. For example, the outer-most spring fingers may have the same height and/or the inner-most spring fingers may have the same height and/or some of the spring fingers in-between may have the same height. Having the spring fingers **230** at different heights allows the spring fingers **230** to fill larger gaps at the edges or corners of the cutout **152** where there is less bowing of the shielding walls **114** and allows the spring fingers to fill smaller gaps in the middle of the shielding walls **114** where there is more bowing when the pluggable module **106** is plugged into the module channel **116**.

[0032] The spring fingers **230** have lengths **252** measured between the proximal ends **232** and the distal ends **234**. In an exemplary embodiment, the spring fingers **230** have the same lengths **252**. For example, each spring finger **230** may be stamped identically. In alternative embodiments, the spring fingers **230** may have variable lengths **252** relative to each other. For example, the spring fingers **230** may be stamped to have different lengths **252**. For example, the outer-most spring fingers **230** may be the longest and the inner-most spring fingers **230** may be the shortest, or vice-versa. Having the spring fingers **230** at different lengths **252** allows the spring fingers **230** to extend to different heights or have different shapes.

[0033] In an exemplary embodiment, the spring fingers **230** are bent between the proximal ends **232** and the distal ends **234** into the arcuate shapes to form the arcs **236**. Each spring finger **230** has a launch angle **254** from the base **210**. In an exemplary embodiment, the spring fingers **230** extend from the base **210** at different launch angles **254** relative to each other. For example, the outer-most spring fingers **230** may be bent at the steepest launch angle **254** and the inner-most spring fingers **230** may be bent at the shallowest launch angle **254**, or vice-versa. In other various embodiments, the spring finger **230** at the first end **220** may be bent at the steepest launch angle **254** and the spring finger **230** at the second end **222** may be bent at the shallowest launch angle **254**, or vice-versa, with the spring fingers therebetween stepped at different launch angles **254**. Having the spring fingers **230** at different launch angles **254** allows the spring fingers **230** to extend to different

heights or have different shapes.
[0034] In an exemplary embodiment, the spring fingers **230** are generally formed in the same shapes, but, due to the different launch angles **254**, have different heights **250**. The curvatures of the arcs **236** may be identical. The distal ends **234** may be at different heights from the shielding wall **114** (or the base plane of the base **210**). In other various embodiments, the arcs **236** of the spring fingers **230** may have different curvatures. For example, the spring fingers **230** may have different launch angles **254** and follow different curvatures to the distal ends **234**. The spring fingers **230** may have different curvatures (for example, radius of curvature) at the panel interface **240**. The spring fingers **230** may have different curvatures at the proximal ends **232**. The spring fingers **230** may have different curvatures at the distal ends **234**. The spring fingers **230** may have different arc lengths between the proximal ends **232** and the distal ends **234** thereof.
[0035] In various embodiments, the distal ends **234** of all of the spring fingers **230** may be located at a distance **256** from the base **210**. For example, all of the distal ends **234** may be located at the same distance **256** from the base **210**. However, in alternative embodiments, the distal ends **234** may be located at different distances **256** from the base **210**. For example, the outer-most spring fingers **230** may be at a closest distance from the base **210** and the inner-most spring fingers **230** may be at a furthest distance from the base **210**, or vice-versa. The distance **256** may be based on the length of the spring finger **230**, the shape of the curve of the spring finger **230**, and the like.
[0036] FIG. **5** is a perspective view of a portion of the EMI shield **200** showing one of the shield members **202** or a portion of one of the shield member **202** in accordance with an exemplary embodiment. FIG. **6** is a side view of the shield member **202** in accordance with an exemplary embodiment. In an exemplary embodiment, the shield member **202** is a stamped and formed part being stamped from a metal sheet and bent into a predetermined shape. The shield member **202** includes the base **210** and a plurality of the spring fingers **230** extending from the base **210**. The base **210** is configured to be coupled to the receptacle cage **110**. The spring fingers **230** are configured to interface with the panel **150** (shown in FIG. **1**).
[0037] The base **210** includes the front edge **212** and the rear edge **214**. The base **210** includes the inner surface **216** and the outer surface **218**. The inner surface **216** is configured to be coupled to the receptacle cage **110**. The base **210** extends between the first end **220** and the second end **222** of the shield member **202**. The base **210** connects the array of the spring fingers **230** to hold the spring fingers **230** relative to each other. The gaps **224** are provided between the spring fingers **230** to allow the spring fingers **230** to be independently deflectable relative to each other.
[0038] Each spring finger **230** extends between the proximal end **232** and the distal end **234**. The proximal end **232** is provided at the base **210**. The spring fingers **230** are curved between the proximal end **232** and the distal end **234** along the arc **236**. The arc **236** follows an arcuate path between the proximal end **232** and the distal end **234**. For example, the spring finger **230** may follow a smooth curve between the proximal end **232** and the distal end **234**. The curvature may be variable between the proximal end **232** and the distal end **234**, such as following a segment of an ellipse. For example, the curvature may be parabolic in shape. In other various embodiments, the curvature may be constant between the proximal end **232** and the distal end **234**, such as following a segment of a circle. The arc **236** may follow other curved shapes in alternative embodiments. The panel interface **240** is located along the arc **236**, such as approximately centered between the proximal end **232** and the distal end **234**. The panel interface **240** may be provided at an apex of the arc **236** in various embodiments.
[0039] In an exemplary embodiment, the spring fingers **230** have variable heights relative to each other. The height **250** is measured from the inner surface **216** of the base **210** (for example, from the shielding wall **114**) to the panel interface **240**. The panel interfaces **240** of the spring fingers **230** are at different heights **250**. In an exemplary embodiment, adjacent spring fingers have different heights relative to each other. Optionally, at least some of the spring fingers **230** may have the same heights. For example, the outer-most spring fingers may have the same height and/or the

inner-most spring fingers may have the same height and/or some of the spring fingers in-between may have the same height. In the illustrated embodiment, the outer-most spring fingers **230** are the tallest and the inner-most spring fingers **230** are the shortest. Having the spring fingers **230** at different heights allows the spring fingers **230** to fill larger gaps at the edges or corners of the cutout **152** where there is less bowing of the shielding walls **114** and allows the spring fingers to fill smaller gaps in the middle of the shielding walls **114** where there is more bowing when the pluggable module **106** is plugged into the module channel **116**. However, other arrangements are possible in alternative embodiments, such as having the tallest spring fingers **230** at the first end **220** and the shortest spring fingers at the second end **222**, or vice-versa.

[0040] In the illustrated embodiment, the spring fingers **230** have different lengths **252** measured between the proximal ends **232** and the distal ends **234**. The spring fingers **230** may have variable lengths **252** relative to each other. For example, the outer-most spring fingers **230** may be the longest and the inner-most spring fingers **230** may be the shortest, or vice-versa. Having the spring fingers **230** at different lengths **252** allows the spring fingers **230** to extend to different heights or have different shapes. In an exemplary embodiment, the spring fingers **230** extend from the base **210** at different launch angles **254** relative to each other. For example, the outer-most spring fingers **230** may be bent at the steepest launch angle **254** and the inner-most spring fingers **230** may be bent at the shallowest launch angle **254**, or vice-versa. Having the spring fingers **230** at different launch angles **254** allows the spring fingers **230** to extend to different heights or have different shapes.

[0041] In the illustrated embodiment, the arcs **236** of the spring fingers **230** may have different curvatures. For example, the spring fingers **230** may have different launch angles **254** and follow different curvatures to the distal ends **234**. The spring fingers **230** may have different curvatures (for example, radius of curvature) at the panel interface **240**. The spring fingers **230** may have different curvatures at the proximal ends **232**. The spring fingers **230** may have different curvatures at the distal ends **234**. The spring fingers **230** may have different arc lengths between the proximal ends **232** and the distal ends **234** thereof. The different curvatures of the spring fingers **230** allows the spring fingers **230** to extend to different heights and have different shapes.

[0042] In the illustrated embodiment, the distal ends **234** of all of the spring fingers **230** are located at the same distance **256** from the base **210**. For example, the spring fingers **230** have different arc lengths and different curvatures but still end at a common distance from the base **210**. However, in alternative embodiments, the distal ends **234** may be located at different distances **256** from the base **210**.

[0043] FIG. **7** is a front view of a portion of the communication system showing the shield member **202** mounted to the shielding wall **114**. FIG. **8** is a front view of a portion of the communication system showing the shield member **202** mounted to the shielding wall **114**. FIG. **7** shows the shielding wall **114** being planar. FIG. **8** shows the shielding wall **114** being bowed. The shielding wall **114** may bow outward, such as when the pluggable module **106** is loaded into the module channel **116**. For example, the central portion of the shielding wall **114** may bow outward, which changes the gap or spacing between the shielding wall **114** and the cutout **152** of the panel **150**.

[0044] The spring fingers **230** are designed to accommodate the bowed nature of the shielding wall **114**. For example, the spring fingers **230** are at different heights to allow the spring fingers **230** to fill larger gaps at the edges or corners of the cutout **152** where there is less bowing of the shielding wall **114** and to allow the spring fingers **230** to fill smaller gaps in the middle of the shielding wall **114** where there is more bowing when the pluggable module **106** is plugged into the module channel **116**. FIG. **8** shows how the different height spring fingers **230** are repositioned when the shielding wall **114** is bowed outward. For example, the base **210** is flexed or bowed outward with the shielding wall **114** and thus no longer planar but rather arch shaped. Bowing of the base **210** causes the spring fingers **230** near the central portion to move outward (for example, upward in the orientation shown in FIG. **8**), which lifts the panel interfaces **240** of the central spring fingers **230**

closer to the panel **150**. Optionally, the panel interfaces **240** of all of the spring fingers **230** may be generally coplanar when the shield member **202** is bowed outward with the shielding wall **114**.
[0045] It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (and/or aspects thereof) may be used in combination with each other. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its scope. Dimensions, types of materials, orientations of the various components, and the number and positions of the various components described herein are intended to define parameters of certain embodiments, and are by no means limiting and are merely exemplary embodiments. Many other embodiments and modifications within the spirit and scope of the claims will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein.” Moreover, in the following claims, the terms “first,” “second,” and “third,” etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. Further, the limitations of the following claims are not written in means-plus-function format and are not intended to be interpreted based on 35 U.S.C. § 112(f), unless and until such claim limitations expressly use the phrase “means for” followed by a statement of function void of further structure.

Claims

1. A receptacle connector assembly comprising: a receptacle cage having shielding walls extending between a front end and a rear end of the receptacle cage, the shielding walls forming a module channel configured to receive a pluggable module, the front end having a port open to the pluggable module to receive the pluggable module; and an EMI shield coupled to the receptacle cage at the front end, the EMI shield having a shield member including a base coupled to at least one of the shielding walls to electrically connect the EMI shield to the receptacle cage, the shield member including spring fingers extending from the base to distal ends, each spring finger including a panel interface configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel, the spring fingers having variable heights relative to each other.
2. The receptacle connector assembly of claim 1, wherein the panel interfaces of the spring fingers are at different heights measured from the corresponding shielding wall.
3. The receptacle connector assembly of claim 1, wherein each spring finger has a height measured from the corresponding shielding wall to the panel interface, adjacent spring fingers having different heights relative to each other.
4. The receptacle connector assembly of claim 1, wherein adjacent spring fingers have different heights.
5. The receptacle connector assembly of claim 1, wherein the spring fingers have variable lengths relative to each other.
6. The receptacle connector assembly of claim 1, wherein the spring fingers extend from the base at different launch angles relative to each other.
7. The receptacle connector assembly of claim 1, wherein each spring finger has an arc extending between a proximal end at the base and a distal end opposite the proximal end, the arcs of the spring fingers having different curvatures at the corresponding panel interface.
8. The receptacle connector assembly of claim 7, wherein the spring fingers have different arc lengths between the proximal ends and the distal ends thereof.
9. The receptacle connector assembly of claim 7, wherein the proximal ends of the spring fingers are at different launch angles from the base.

10. The receptacle connector assembly of claim 1, wherein the spring fingers have distal ends, each of the distal ends located a distance from the base.
11. The receptacle connector assembly of claim 1, wherein the spring fingers have distal ends, the distal ends being located at different distances from the base.
12. The receptacle connector assembly of claim 1, wherein the spring fingers have distal ends, the spring fingers having lengths measured between the base and the corresponding distal ends, the spring fingers having variable lengths relative to each other.
13. The receptacle connector assembly of claim 1, wherein the shield member extends between a first end and a second end, a plurality of the spring fingers located between the first end and the second end, the spring fingers located proximate to the first end and the second end being taller than the spring fingers located remote from the first end and the second end.
14. The receptacle connector assembly of claim 1, wherein the shield member extends between a first end and a second end, the spring fingers including a first spring finger proximate to the first end, a second spring finger proximate to the second end, and a third spring finger between the first spring finger in the second spring finger, the third spring finger being shorter than the first spring finger and the second spring finger.
15. A receptacle connector assembly comprising: a receptacle cage having shielding walls extending between a front end and a rear end of the receptacle cage, the shielding walls forming a module channel configured to receive a pluggable module, the front end having a port open to the pluggable module to receive the pluggable module; and an EMI shield coupled to the receptacle cage at the front end, the EMI shield having a shield member including a base coupled to the corresponding shielding wall to electrically connect the EMI shield to the receptacle cage, the shield member including spring fingers extending from the base to distal ends, each spring finger including a panel interface configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel, each spring finger having a height measured from the corresponding shielding wall to the panel interface, adjacent spring fingers having different heights relative to each other.
16. The receptacle connector assembly of claim 15, wherein the base extends along a base plane, the panel interfaces of the spring fingers located at different heights from the base plane.
17. The receptacle connector assembly of claim 15, wherein the base extends along a base plane, the spring fingers extending from the base at different launch angles relative to each other.
18. The receptacle connector assembly of claim 15, wherein the distal ends are at different heights from each other.
19. A receptacle connector assembly comprising: a receptacle cage having shielding walls extending between a front end and a rear end of the receptacle cage, the shielding walls forming a module channel configured to receive a pluggable module, the front end having a port open to the pluggable module to receive the pluggable module; and an EMI shield coupled to the receptacle cage at the front end, the EMI shield having a shield member including a base coupled to at least one of the shielding walls to electrically connect the EMI shield to the receptacle cage, the shield member including spring fingers, each spring finger having an arc extending between a proximal end at the base and a distal end opposite the proximal end, each spring finger including a panel interface along the arc configured to engage a panel adjacent the receptacle cage to electrically connect the EMI shield to the panel, the spring fingers having different curvature at the corresponding panel interface.
20. The receptacle connector assembly of claim 19, wherein the spring fingers have different arc lengths.
21. The receptacle connector assembly of claim 19, wherein the proximal ends extend from the base at different launch angles relative to each other.
22. The receptacle connector assembly of claim 19, wherein the panel interfaces of the spring

fingers are at different heights relative to each other measured from the corresponding shielding wall.