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(54) **PRE-WIRED POWER DISTRIBUTION SYSTEM**

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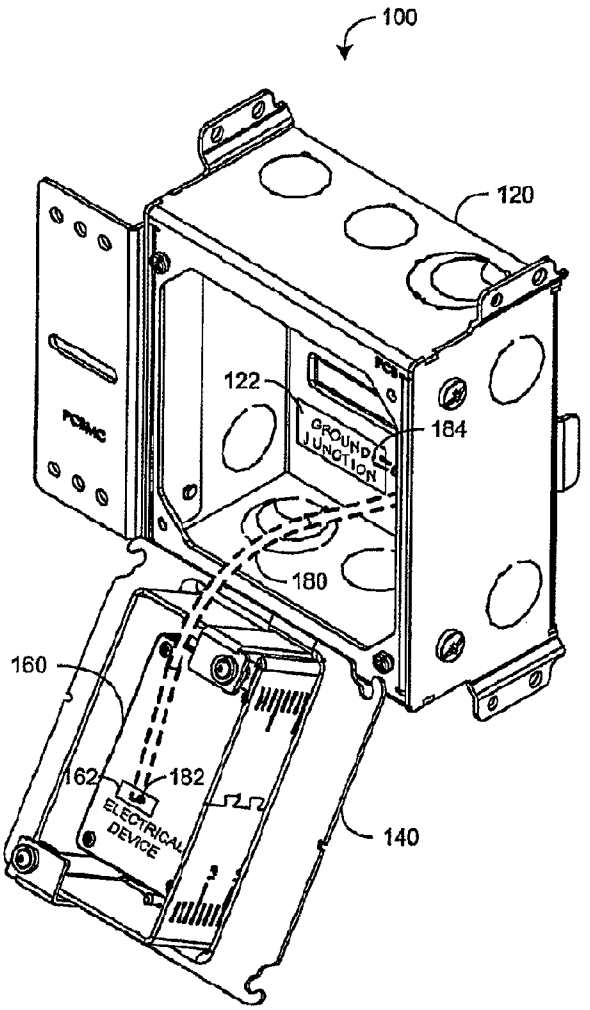
(57) **ABSTRACT**

A power distribution system has an electrical box configured to attach a power cable, a plaster ring releasably mounted to the box and one or more electrical devices installed into the ring. A pre-wired ground extends from a first end physically and electrically connected to a ground terminal on the electrical device. The plaster ring is movable between a closed position proximate the box and an open position distal the box. The pre-wired ground is configured as a lanyard so as to support the plaster ring as a wiring platform in the open position for connecting wires between the power cable and the electrical device or devices.



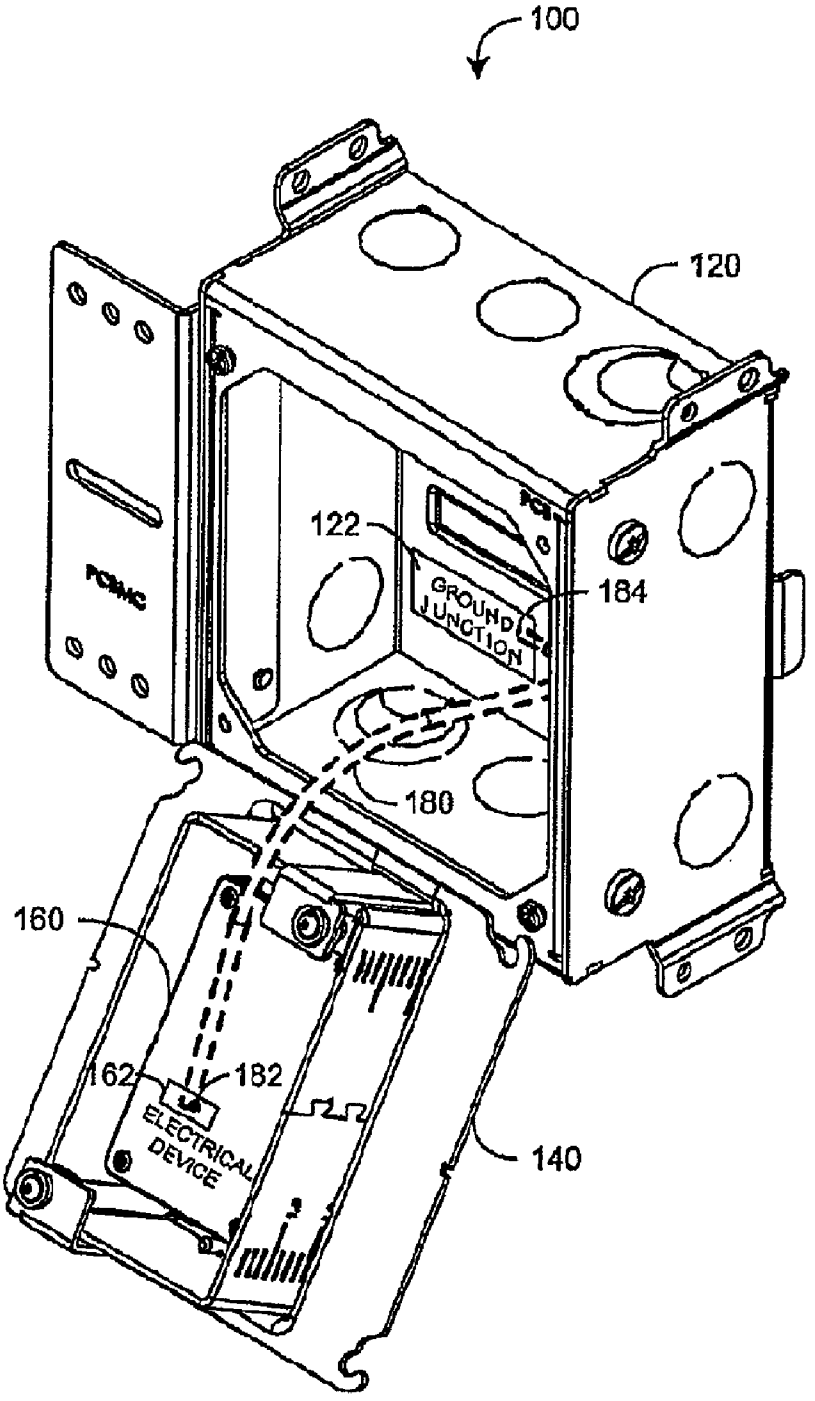

100
120
122
184
GROUND JUNCTION
180
160
162
182
ELECTRICAL DEVICE
140

FIG. 1A

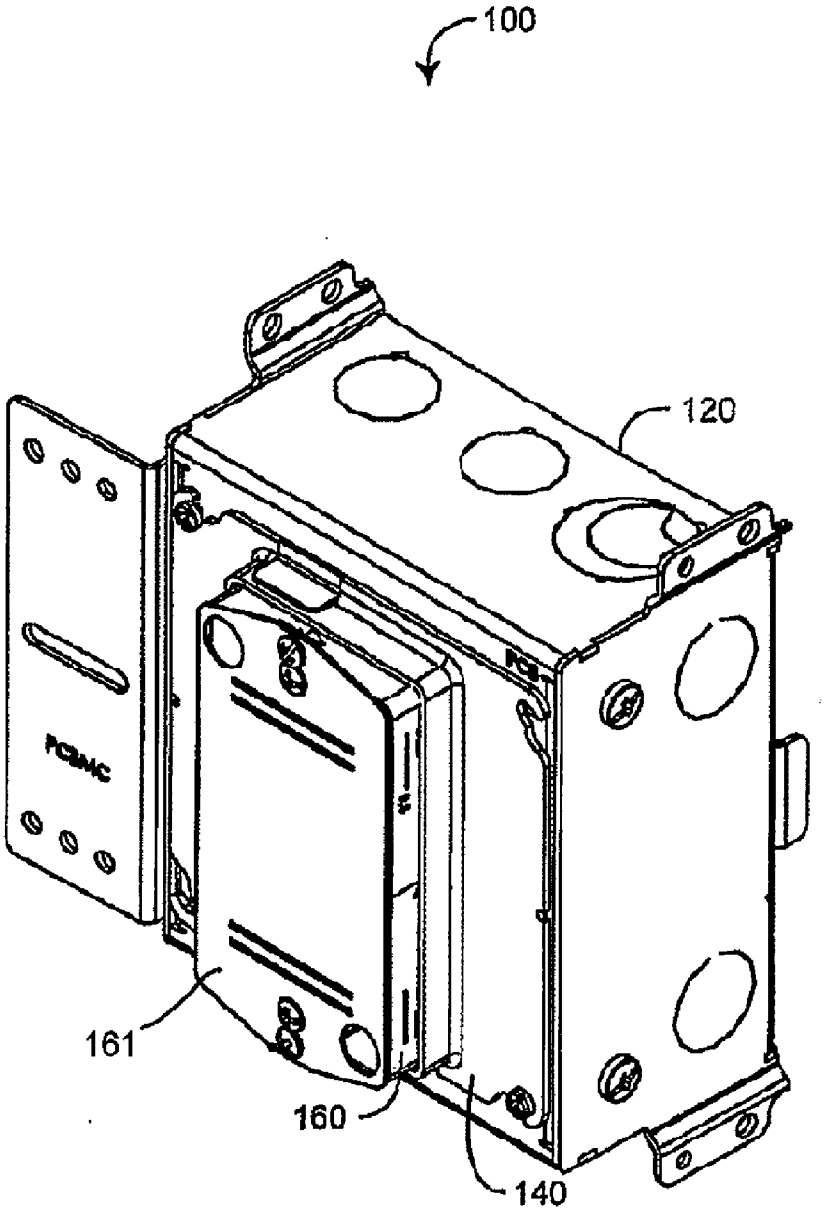


FIG. 1B

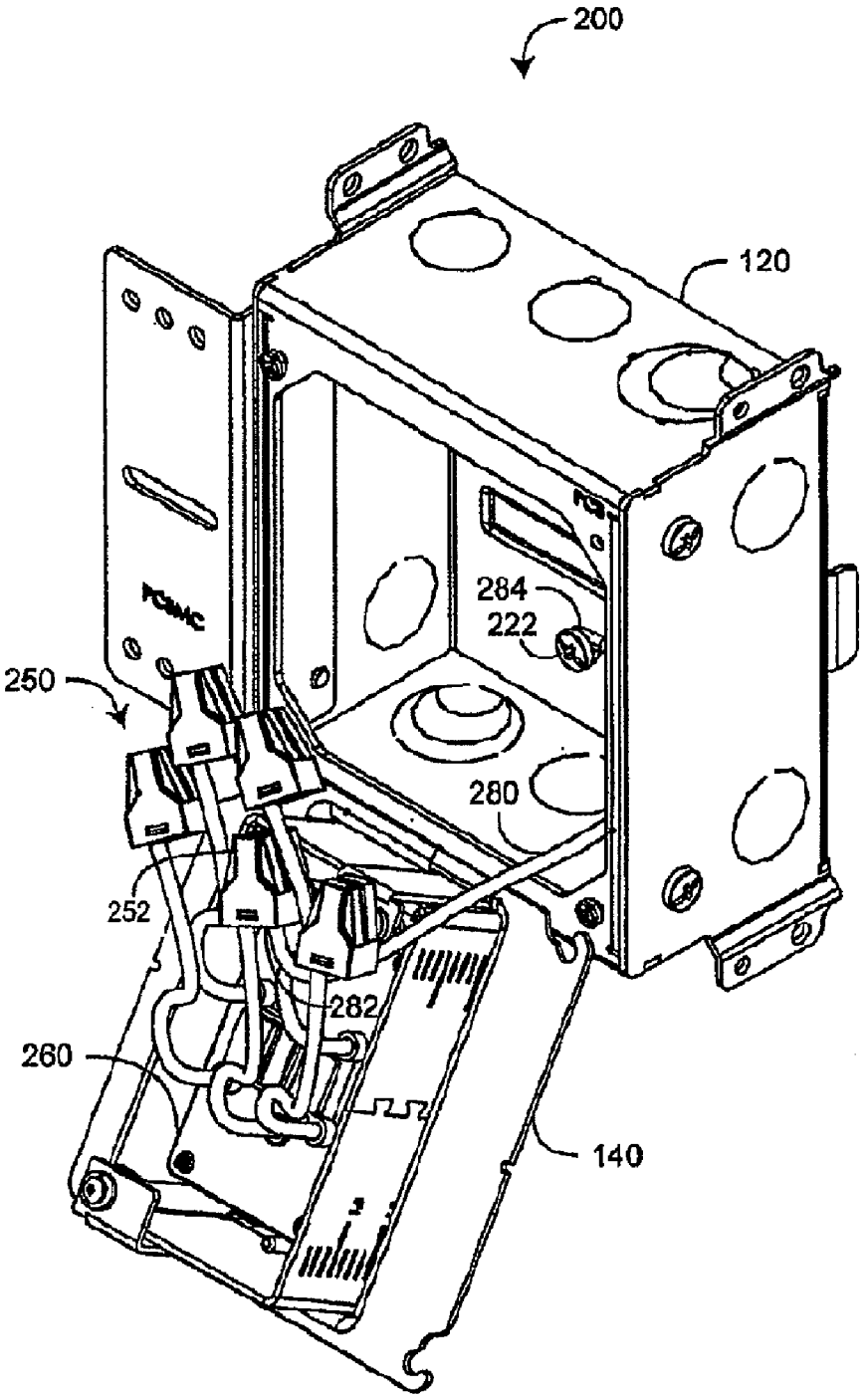


FIG. 2

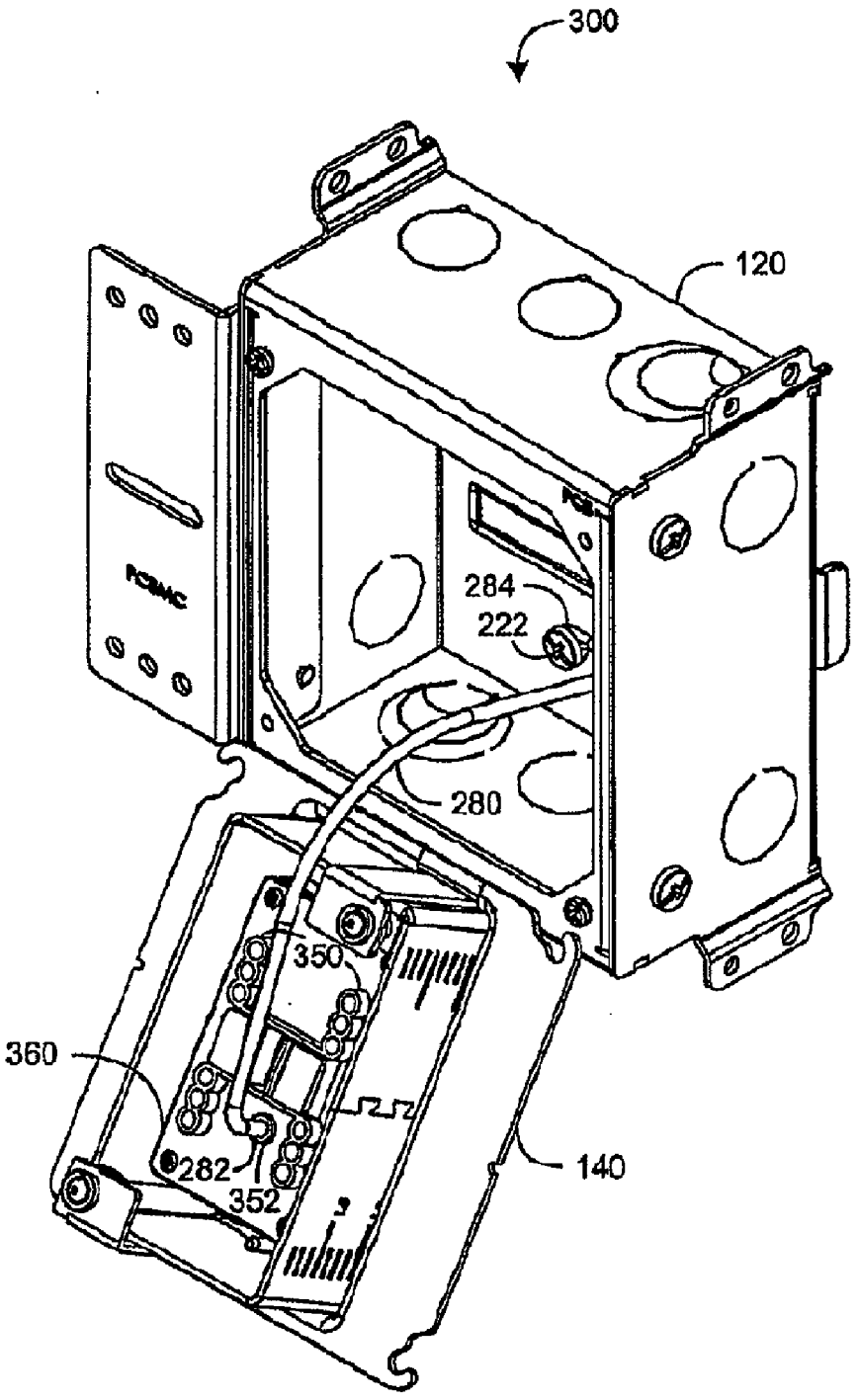


FIG. 3

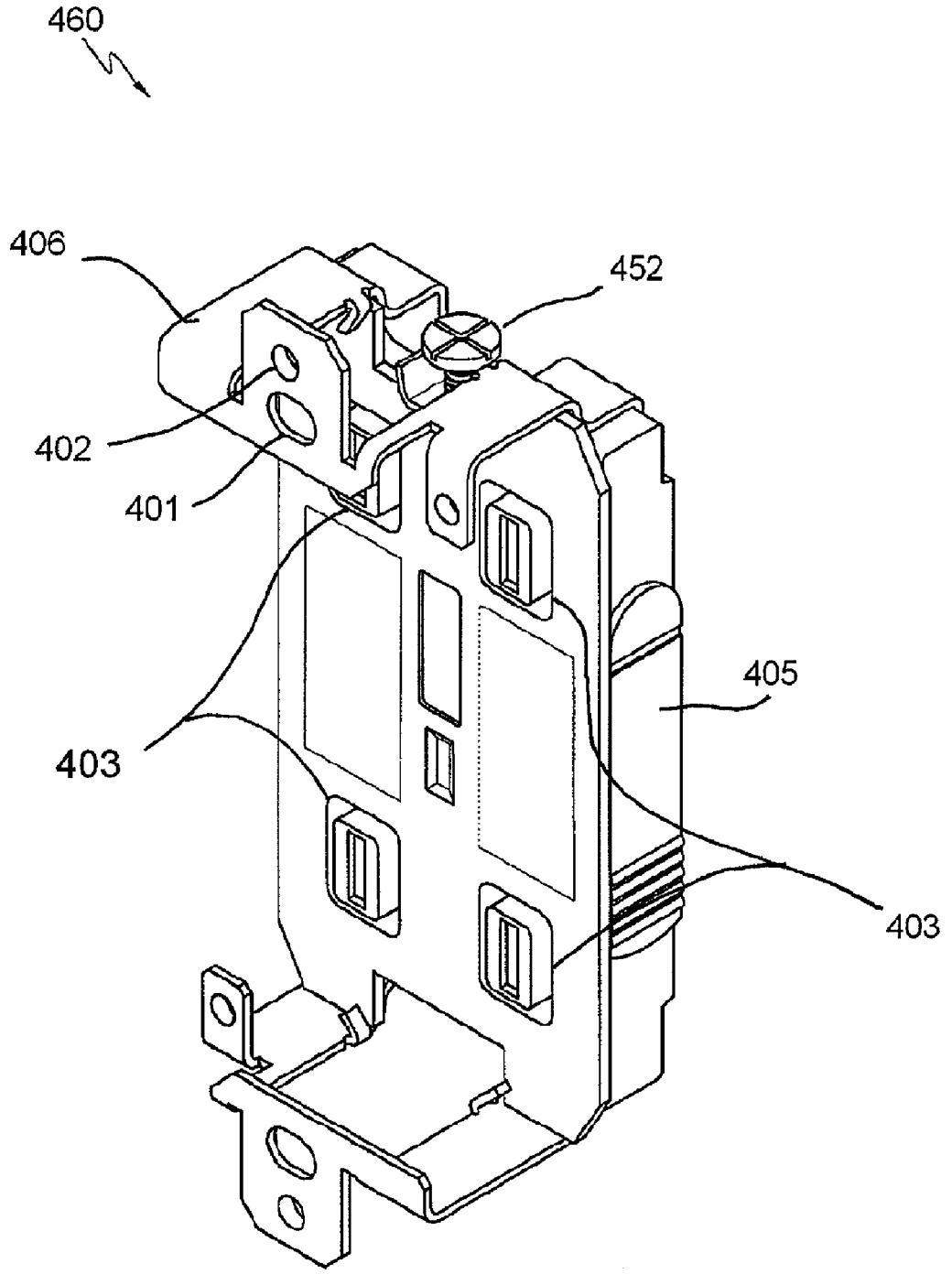


FIG. 4A

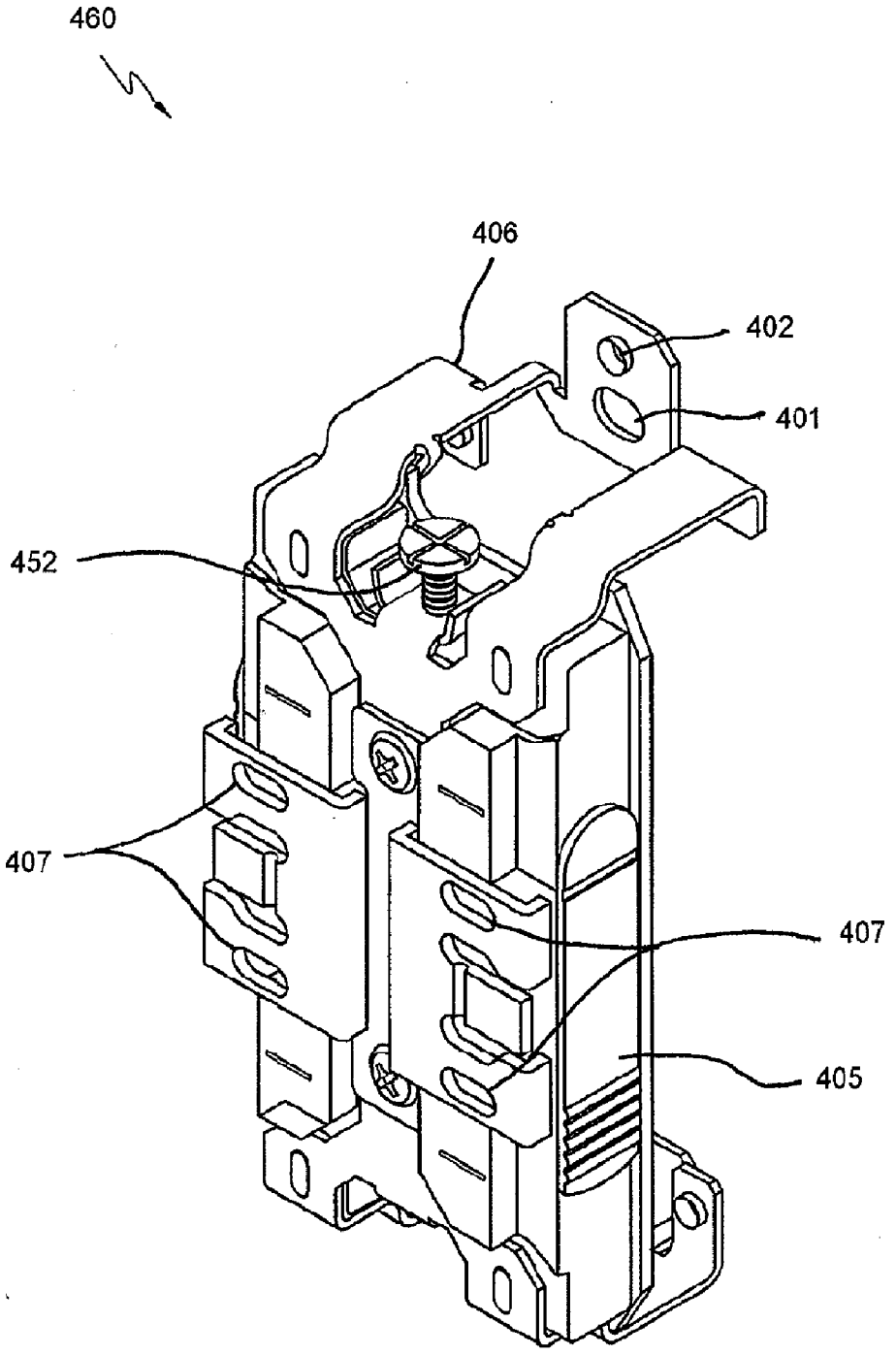


FIG. 4B

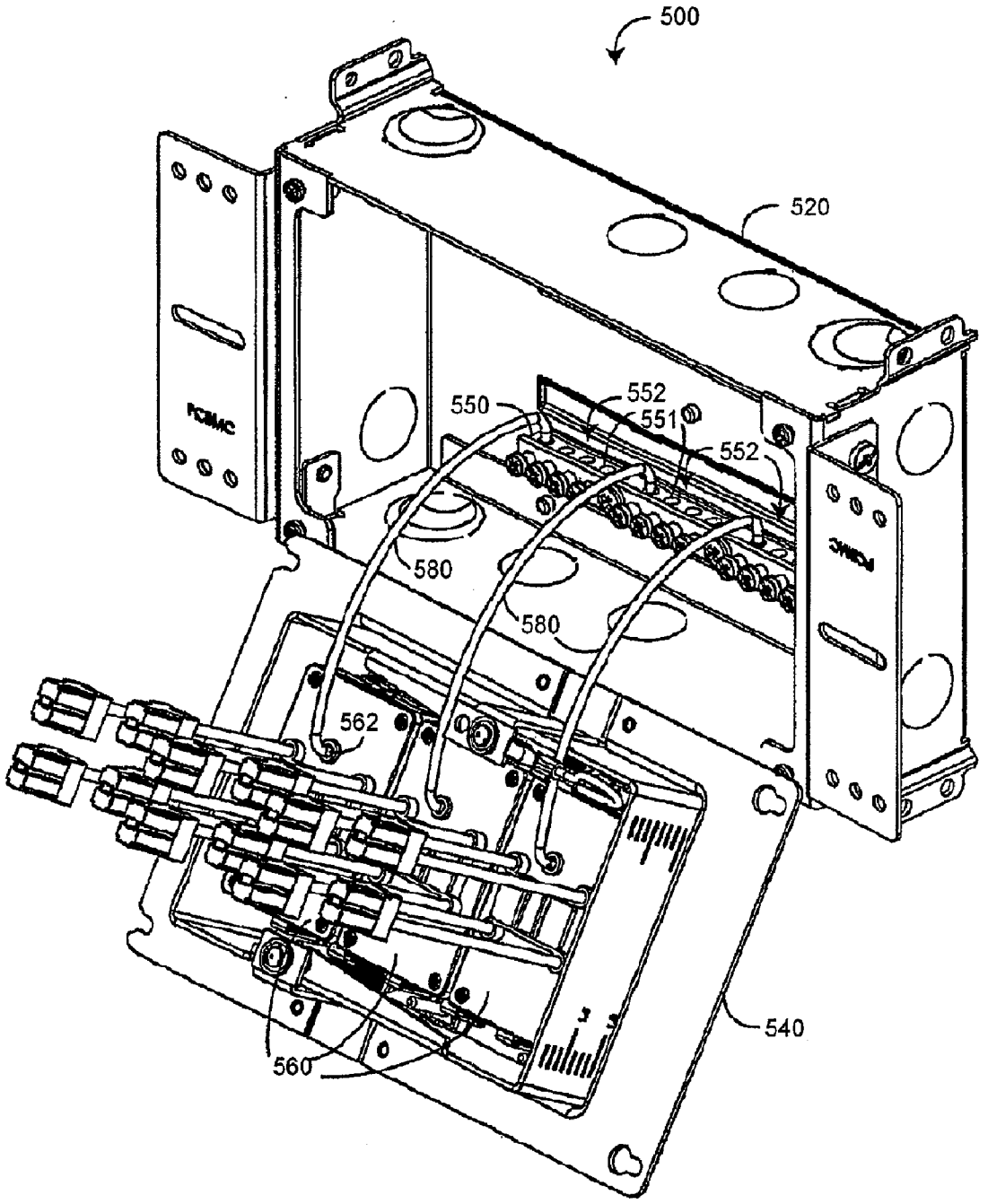


FIG. 5

PRE-WIRED POWER DISTRIBUTION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Application No. 60/833,966 filed Jul. 29, 2006 and entitled "Pre-wired Power Distribution System," which is incorporated by reference herein in its entirety.

INCORPORATION BY REFERENCE

[0002] Wiring modules and corresponding functional modules are described in U.S. Pat. No. 6,884,111 entitled Safety Module Electrical Distribution System, issued Apr. 26, 2005; U.S. Pat. No. 6,341,981 entitled Safety Electrical Outlet And Switch System, issued Jan. 29, 2002; and U.S. Pat. No. 6,894,221 entitled Safety Outlet Module, issued May 17, 2005. Modular electrical devices, electrical boxes and adjustable mounts are described in U.S. patent application Ser. No. 10/924,555 entitled Universal Electrical Wiring Component, filed Aug. 24, 2004. A wiring support platform is described in U.S. patent application Ser. No. 11/108,005 entitled Hinged Wiring Assembly, filed Apr. 16, 2005. All of the above-referenced patents and patent applications are hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0003] A power distribution system may comprise an electrical box, a plaster ring and an electrical device, such as an outlet or switch. During a roughing phase of construction, electrical boxes with attached plaster rings are mounted to wall studs at predetermined locations. A journeyman electrician routes power cables through building framing to the appropriate box. Then power cables are fed through openings in the rear or sides of the boxes and folded back inside. During a trim phase, electrical devices are mounted to the plaster rings.

SUMMARY OF THE INVENTION

[0004] Conventional electrical distribution systems consist of either prefabricated components customized for particular electrical distribution points within a building or individual components that must be planned for, ordered, allocated to building locations and then attached together and wired during installation at each electrical distribution point. Further, it is impractical to test each wired installation for conformance to construction standards.

[0005] A pre-wired power distribution system, in contrast, advantageously combines installation flexibility, convenience and verifiability. A combination electrical box, plaster ring, one or more electrical devices installed in the plaster ring and one or more pre-wired grounds between the electrical box and the electrical device or devices provides for a pre-tested ground path. In an embodiment, the electrical device is a wiring module configured to accept any of various functional modules. The pre-wired ground also functions as a lanyard between the electrical device and the electrical box, allowing the plaster ring to be pivoted to, and supported in, an open position to provide hands-free connection of power wires to the electrical device. This feature is particularly useful for wiring gang electrical boxes housing multiple electrical devices. In an embodiment, a ground bus bar mounted to the electrical box provides further flexibility by accommodating multiple grounds for power cables routed to the electrical box. In this manner, an electrical box, a plaster ring and wiring module or other electrical device or devices may be manufactured, assembled, distributed and/or installed as a pre-wired power distribution component, by itself or in combination with an adjustable mount.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIGS. **1**A-B are perspective views of a pre-wired power distribution system in an open position and a closed position, respectively;

[0007] FIG. **2** is a perspective view of a pre-wired power distribution system embodiment having a writing module with external push wire connectors;

[0008] FIG. **3** is a perspective view of a pre-wired power distribution system embodiment having a wiring module with internal push wire connectors;

[0009] FIG. **4**A is a front perspective view of an embodiment of a wiring module with internal push wire connectors;

[0010] FIG. **4**B is a rear perspective view of the wiring module of FIG. **4**A; and

[0011] FIG. **5** is a perspective view of a pre-wired power distribution system embodiment having a box-mounted ground bus bar.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] FIGS. **1**A-B illustrate a pre-wired power distribution system **100** having an electrical box **120** configured to attach at least one power cable, an adjustable plaster ring **140**, an electrical device **160** mounted to the plaster ring **140** and a ground lanyard **180** pre-wired between the electrical device **160** and the electrical box **120**. The electrical box **160** can be any type known in the art.

[0013] In some embodiments, the electrical device **160** is a wiring module that is configured to connect to a source of electrical power via a plurality of cables (e.g., hot, neutral, and ground cables). The plurality of cables (not shown) are fed through the electrical box **120** and connected to a wiring portion of the wiring module, as disclosed herein. In some embodiments, once the wiring module is connected to power cables and fully installed within the electrical box **120**, the wiring portion of the wiring module is substantially enclosed by the electrical box **120** and the adjustable plaster ring **140**, and is inaccessible to users. The wiring module also includes a user-accessible portion that removably accepts a functional module (not shown) that provides a selected electrical power distribution function. For example, the functional module may be an outlet receptacle or a switch. The user-accessible portion of the wiring module includes shielded connectors, or sockets, that mate with the functional module. The shielded connectors help reduce the risk of electrical shock to users when a functional module is not installed in the wiring module. In FIG. **1**B, the shielded connectors are concealed by a protective cover **161** that protects the connectors from foreign objects, for example, during a rough-in phase of construction. The functional module can be installed without accessing the wiring portion of the wiring module or the power cables.

[0014] In some embodiments, the electrical device **160** (e.g., a wiring module) is mounted to the adjustable plaster ring **140**. The adjustable plaster ring provides for an adjustable distance between the electrical device **160** and the electrical box **120**. For example, the adjustable plaster ring may include adjusting screws that can be turned to increase or decrease the distance between the electrical device **160** and the electrical box **120**. In this way, the depth of the electrical device **160** within a wall can be adjusted to result in the desired fit with the wallboard.

[0015] One lanyard end **182** is connected to a box ground junction **122** and another lanyard end **184** is connected to an electrical device terminal **162**. The plaster ring **140** can be releasably attached to the electrical box **120**. The plaster ring **140** is movable between an open position FIG. **1**A distal the electrical box **120** and a closed position FIG. **1**B proximate the electrical box **120**. The plaster ring **140** can be releasably attached to the electrical box **120** in the closed position. The ground lanyard **180** provides a ground path from the electrical device **160** to the electrical box and mechanically supports the plaster ring in the open position. In some embodiments, however, the ground lanyard **180** does not necessarily support the plaster ring in the open position.

[0016] In an embodiment, the ground lanyard **180** is a ground wire connected between a single point ground **222** (FIG. **2**) on the electrical box **120** and a ground terminal **252** (FIG. **2**) on the electrical device **160**, as described in further detail with respect to FIGS. **2-3**, below. In another embodiment, the ground lanyard **180** includes multiple ground wires connected between a ground bus bar **450** (FIG. **4**) mounted on a multi-gang electrical box **420** (FIG. **4**) and the ground terminals **462** (FIG. **4**) of multiple electrical devices **460** (FIG. **4**) mounted in a multi-gang plaster ring **440** (FIG. **4**), as described in further detail with respect to FIG. **4**, below. As described herein, the electrical devices **160** may be wiring modules that are configured to accept various functional modules. The electrical box **120** is adapted to utilize various adjustable or fixed stud brackets, and the plaster ring **140** may be adjustable. These aspects facilitate the positioning of the mounted electrical devices during wall installation of the ground wire supporting wiring assembly **100**. With this combination of features, a pre-wired power distribution system provides a broadly adaptable electrical system component.

[0017] The connections between the ground lanyard **180** and the electrical box **120** can be formed using any type of connection known in the art. For example, a connection between the ground lanyard **180** and the electrical box **120** or the electrical device **160** may comprise an electrical screw terminal or a push-in connector. In some embodiments, the electrical screw terminal is treated with a threadlocker material once the connection is made to improve the mechanical reliability of the connection. The ground lanyard **180** can also be soldered or clamped to the electrical box **120** or the electrical device **160**. Advantageously, in cases where the electrical device **160** is a wiring module, the connection between the ground lanyard **180** and the electrical box **120** or the electrical device **160** can be made substantially permanent because the wiring module need not be removed to replace an outlet receptacle, switch, or other similar functional module. In contrast, it would generally be undesirable to form a permanent ground connection between a conventional outlet receptacle or switch and an electrical box **120** because doing so may prevent the replacement of the conventional outlet receptacle or switch. The fact that the connections between the ground lanyard **180** and the electrical device **160** or the electrical box **120** can be made substantially permanent can also allow the connections to be made stronger (allowing the ground lanyard to support the weight of the electrical device **160** and adjustable plaster ring **140**, as described herein) and more reliable, both from a mechanical and an electrical standpoint.

[0018] The pre-wired ground lanyard **180** can be advantageously tested at the manufacturer. In an embodiment, the ground lanyard **180** is subjected to a mechanical pull test and an electrical continuity test. In a particular embodiment, the pull-test has at least a 20 lb. force. The mechanical pull test and the electrical continuity test would otherwise be too cumbersome to perform on ground connections installed by an electrician at a worksite. However, since the ground connection between the electrical device **160** and the electrical box **120** is installed at the manufacturer, these tests can be performed more efficiently than can be done at a worksite. Moreover, these tests can be performed using equipment that is too expensive or bulky to use at a worksite where the ground connection might otherwise be installed. In some embodiments, however, the ground lanyard **180** is not pre-wired but is instead configured to be connected upon installation of the electrical device **160** within the electrical box **120**.

[0019] Since the ground connection between the electrical device **160** and the electrical box **120** acts as a pull-tested lanyard **180**, the plaster ring **140** can be supported in an open position (FIG. **1**A) by the ground lanyard **180**, advantageously allowing an electrician hands-free access to one or more electrical devices **160** so as to wire these devices to power cables routed to the electrical box **120**. Upon wiring completion, the plaster ring **140** is moved to a closed position (FIG. **1**B) and secured to the electrical box **120**. Multiple electrical devices **160** can be pre-attached to the plaster ring **140** because doing so does not block access to the electrical box **120** or impede the wiring process. Further, the use of a ground bus bar as the electrical box ground junction **184** advantageously allows the ground wiring of one or more power cables to the bus bar without resorting to ad hoc pigtail junctions or the use of the electrical device connectors.

[0020] FIG. **2** illustrates a pre-wired power distribution system embodiment **200** having a wiring module **260** pre-wired with push-wire connectors **250**. A ground wire **280** extends between the wiring module **260** and an electrical box **120**. In some embodiments, the ground wire **280** includes a push-wire connector at some point along its length to be connected to a ground cable fed into the electrical box **120** along with other power distribution cables. The ground wire **280** has a first end **282** attached to a ground push-wire connector **252** and a second end **284** secured to a ground attachment point **222** in the interior of the electrical box **120**. In some embodiments, the ground attachment point **222** is a screw terminal. The push-wire connectors **250** are connected to internal crimp wires of the wiring module **260** and adapted to accept power and ground wires from cables (not shown) routed to the electrical box **120**. An electrician can easily and quickly attach the power wires to the appropriate push wire connectors **250** while the plaster ring **140** is supported by the ground wire **280**.

[0021] FIG. **3** illustrates another pre-wired power distribution system embodiment **300** having a wiring module **360** with internal push-wire connectors **350**. A ground wire **280** extends between the wiring module **360** and an electrical box **120**. The ground wire **280** has a first end **282** attached to a ground push-wire connector **352** and a second end **284** secured to a ground attachment point **222** in the interior of the electrical box **120**. The push-wire connectors **350** are adapted to accept power and ground wires from cables (not shown) routed to the electrical box **120**.

[0022] FIG. **4**A is a front perspective view of an embodiment of a wiring module **460** having internal push-wire connectors **407**. The wiring module **460** has a mounting bracket **406** with an aperture **401** to mount the wiring module **460** to an adjustable plaster ring (e.g., **140**) and an aperture **402** to attach a protective cover (e.g., **161**) to the wiring module **460**. The wiring module **460** also includes shielded connectors **403** for receiving a functional module (e.g., an outlet receptacle functional module or a switch functional module).

[0023] FIG. **4**B is a rear perspective view of the wiring module **460**. The wiring module **460** includes a screw terminal ground lanyard connection point **452**. In other embodiments, the ground lanyard connection point is, for example, an internal push-wire connector, a soldered joint, or a clamped joint. The wiring module **460** also includes internal push-wire connectors **407** for receiving power cables (e.g., hot, neutral, and ground power cables) routed to an electrical box (e.g., **120**). The internal push-wire connectors **407** can also be used for creating a ground connection between the wiring module **460** and an electrical box (e.g., **120**). For example, the wiring module **460** could be mechanically and electrically coupled to an electrical box via a pre-wired ground lanyard (e.g., **180**). The internal push-wire connectors **407** can be, for example, any type of push-in connector housed wholly or partially within the wiring module **460** for receiving power cables. In some embodiments, the internal push-wire connectors **407** are stab-in connectors. The wiring module **460** also includes a tab **405** that covers screw terminals that are in electrical contact with individual ones of the internal push-wire connectors **407**. The screw terminals can be used as an alternative to the internal push-wire connectors **407** if desired.

[0024] The internal push-wire connectors **407** are particularly advantageous in situations where space within the electrical box **160** is limited or in any other setting where it is desirable to conserve space within the electrical box **160**. This may be true, for example, in relatively shallow walls (e.g., walls measuring less than about 3" from the outside edge of a wall stud to the back wall). The internal push-wire connectors **407** conserve space within the electrical box **160** (or allow for the usage of a shallower depth electrical box **160**) because they do not include a length of wire between the wiring module and a connector as is the case for the embodiment illustrated in FIG. **2** having external push-wire connectors **250**. While such external push-wire connectors **250** are desirable under some circumstances, the internal push-wire connectors of FIGS. **3-4** can result in space and cost savings due to the elimination of wire joining the connectors (e.g., **250**) to the wiring module (e.g., **260**). It should be understood that the wiring module **460** with internal push-wire connectors can be used with or without a pre-wired ground lanyard (e.g., **180**).

[0025] FIG. **5** illustrates a pre-wired power distribution system embodiment **500** having a 3-gang electrical box **520**, a 3-gang adjustable plaster ring **540**, a ground bus bar **550** mounted directly to the electrical box **520**, three wiring modules **560** attached to the plaster ring **540** and a multiple wire ground lanyard **580**. The ground lanyard **580** extends between the bus bar **550** and ground terminals **562** on each of the wiring modules **560**. The bus bar **550** is configured to accept additional ground wires from power cables routed to and from the electrical box **520**. As such, the ground lanyard **580** supports the plaster ring **540** in the open position shown, providing a wiring platform for the electrician to wire all three wiring modules **560** as a unit without having to handle and hold each of the wiring modules individually during the wiring process.

[0026] Advantageously, the bus bar **550** is configured to allow the attachment of multiple ground wires **580** so as to provide ground connections for not only wiring modules, but also power cables routed in and out of the electrical box **520**. The bus bar **550** has a plurality of sections **552** and individual terminals **551** within each section. In an embodiment, there is one section **552** corresponding to each of the wiring modules **560** and multiple terminals **551** in each section. Each of the sections can be in electrical contact or electrically isolated. In this manner, ground wiring capacity increases with the size and electrical device mounting capacity of the electrical box **520**. Each terminal **551** is configured to accept a ground wire **580** from either a wiring module **560** or an attached power cable. In a 3-gang embodiment, the bus bar **550** has three sections corresponding to three wiring modules, and each section has four terminals configured to accept up to four ground wires, though other numbers of sections and terminals are also possible. The bus bar **550** advantageously eliminates the need for pigtail ground connections or the equivalent use of electrical device terminals. The bus bar **550** can be configured for use with external push wire connector wiring modules **260** (FIG. **2**), internal push wire connector wiring modules **360** (FIG. **3**) or any electrical devices having push-wire, screw terminal or similar wire connectors.

[0027] Although described and illustrated herein with respect to 1- and 3-gang embodiments, a pre-wired power distribution system can be configured for any number of electrical devices, including 2-gang, 4-gang, and other many-gang embodiments. A pre-wired power distribution system has been disclosed in detail in connection with various embodiments. These embodiments are disclosed by way of examples only and are not to limit the scope of the claims that follow. One of ordinary skill in art will appreciate many variations and modifications.

What is claimed is:

1. A power distribution system comprising:

an electrical box configured to receive a power cable;

a ground junction on the electrical box;

a plaster ring configured to releasably mount to the electrical box;

a wiring module mounted to the plaster ring and having a ground terminal; and

a pre-wired ground connection extending from a first end mechanically and electrically connected to the ground

junction and a second end mechanically and electrically connected to the ground terminal,

wherein the plaster ring can move between a closed position proximate the electrical box and an open position distal from the electrical box and the pre-wired ground connection is configured as a lanyard supporting the plaster ring in the open position for connecting wires between the power cable and the wiring module.

2. The power distribution system of claim 1, wherein the pre-wired ground connection is tested for electrical continuity.

3. The power distribution system of claim 1, wherein the pre-wired ground connection has been subjected to a mechanical pull test.

4. The power distribution system of claim 3, wherein the mechanical pull test has a force of at least about 20 lbs.

5. The power distribution system of claim 1, wherein the pre-wired ground connection and the ground junction are substantially permanently joined.

6. The power distribution system of claim 1, wherein the ground junction comprises a bus bar.

7. The power distribution system of claim 1, wherein the electrical box comprises a multi-gang electrical box and the plaster ring comprises a multi-gang plaster ring.

8. The power distribution system of claim 1, wherein the wiring module comprises external push-wire connectors for coupling to the power cable.

9. The power distribution system of claim 1, wherein the wiring module comprises internal push-wire connectors for coupling to the power cable.

10. The power distribution system of claim 1, wherein the wiring module comprises a wiring portion for coupling to a source of electrical power via one or more distribution cables and a user accessible portion with a connector to configured to accept and provide electrical power to a selected one of a plurality of types of functional modules without accessing the one or more distribution cables, the wiring portion at least partially enclosed by the electrical box.

11. The power distribution system of claim 10, wherein the functional module comprises an outlet receptacle or a switch.

12. The power distribution system of claim 1, wherein the plaster ring comprises an adjustable plaster ring to provide a variable distance between the electrical box and the wiring module.

13. An electrical wiring method comprising:

providing a power distribution system within a wall, the power distribution system comprising:

an electrical box configured to receive a power cable;

a ground junction on the electrical box;

a plaster ring configured to releasably mount to the electrical box;

a wiring module mounted to the plaster ring and having a ground terminal; and

a pre-wired ground connection extending from a first end mechanically and electrically connected to the ground junction and a second end mechanically and electrically connected to the ground terminal,

wherein the plaster ring can move between a closed position proximate the electrical box and an open position distal from the electrical box and the pre-wired ground connection is configured as a lanyard supporting the plaster ring in the open position for connecting wires between the power cable and the wiring module;

moving the plaster ring from the closed position to the open position;

attaching wires between the power cable and the wiring module; and

moving the plaster ring from the open position to the closed position.

14. The electrical wiring method of claim 13, further comprising coupling a functional module to the wiring module to provide a selected power distribution function.

15. A modular electrical wiring component comprising:

a wiring portion for coupling to a source of electrical power via at least one cable, the wiring portion comprising a first internal push-wire connector for coupling to the cable;

a user-accessible portion configured to accept and provide electrical power to a functional module that provides a selected electrical distribution function, wherein the user-accessible portion is configured to accept the functional module without access to the wiring portion.

16. The modular electrical wiring component of claim 15, further comprising a plaster ring mounted to the modular electrical wiring component and configured to releasably mount to an electrical box.

17. The modular electrical wiring component of claim 16, further comprising a second internal push-wire connector mechanically and electrically connected to a first end of a pre-wired ground connection, a second end of the pre-wired ground connection being mechanically and electrically connected to an electrical box.

18. The modular electrical wiring component of claim 17, wherein the plaster ring can move between a closed position proximate the electrical box and an open position distal from the electrical box, and wherein the pre-wired ground connection is configured as a lanyard supporting the plaster ring in the open position for connecting wires between the cable and the modular electrical wiring component.

19. The modular electrical wiring component of claim 18, wherein the pre-wired ground connection has been subjected to a mechanical pull test having a force of at least about 20 lbs.

20. An apparatus comprising:

a wiring module configured to mount within an electrical box, the wiring module having a functional side and a wiring side;

a first push-wire connector disposed on the wiring side of the wiring module, wherein the first push-wire connector is configured to terminate a power cable proximate said wiring side; and

at least one socket disposed on the functional side of the wiring module, the socket configured to receive a functional module wherein the functional module is removably installed in the wiring module proximate the functional side.

21. The apparatus claim 20, wherein the wiring module is releasably mounted within the electrical box by a plaster ring.

22. The apparatus claim 21, further comprising a second push-wire connector mechanically and electrically connected to a first end of a pre-wired ground connection, a second end of the pre-wired ground connection being mechanically and electrically connected to the electrical box.

23. The apparatus of claim 22, wherein the plaster ring can move between a closed position proximate the electrical box and an open position distal from the electrical box, and wherein the pre-wired ground connection is configured as a lanyard supporting the plaster ring in the open position for connecting wires between the power cable and the wiring module.

24. The apparatus of claim 23, wherein the pre-wired ground connection has been subjected to a mechanical pull test having a force of at least about 20 lbs.

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