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(54) **Title**: SYSTEM FOR INTELLIGENT PATCHING OF TELECOMMUNICATION CABLES WITH A COMMUNICATION NETWORK

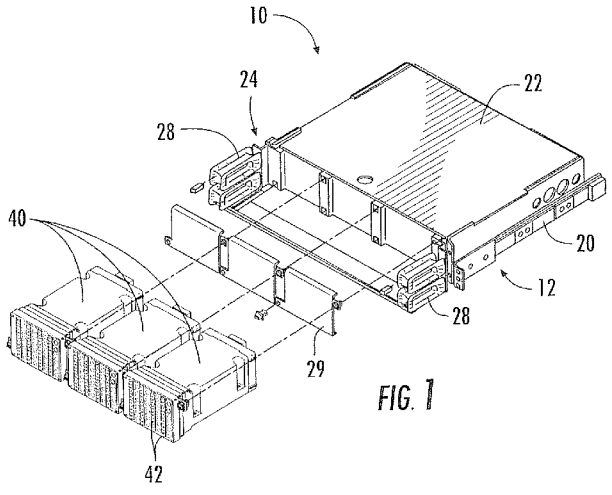


FIG. 1

(57) **Abstract**: A datacommunications patching system includes: a mounting frame; a first module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on another side thereof; and a backplane that is mounted in the mounting frame. The backplane electrically connects to the first module via the first connector when the first module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the first module via the second connector when the first module is mounted in the mounting frame in a second orientation that is inverted from the first orientation.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

SYSTEM FOR INTELLIGENT PATCHING OF TELECOMMUNICATION CABLES WITH A COMMUNICATION NETWORK

RELATED APPLICATIONS

[0001] The present application claims priority from U.S. Provisional Application Nos. 61/139,209, filed December 19, 2008, and 61/222,233, filed July 1, 2009, and U.S. Utility Application No. 12/640,267, filed December 17, 2009, the disclosures of which are hereby incorporated herein in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates generally to networks and, more particularly, to network patching systems.

BACKGROUND

[0003] A network patching system is typically used to interconnect the various communication lines within a closet or computer room. In a conventional network patching system, the communication lines are terminated within a closet in an organized manner via one or more patch panels mounted on a rack or frame. Multiple ports are included in the patch panel, typically in some type of organized array. Each of the different ports is connected with a communications line. In small patching systems, all communications lines may terminate on the patch panels of the same rack. In larger patching systems, multiple racks may be used, wherein different communications lines terminate on different racks. Interconnections between the various communications lines are made connecting patch cords to the ports. By selectively connecting the various communications lines with patch cords,

any combination of communications lines can be interconnected.

[0004] In many businesses, employee computers are assigned an IP address so that the employee, via the computer, can interface with a network. When an employee changes office locations, it may not be desirable to assign a new IP address. Rather, to preserve consistency in communications, it may be preferred that the IP address previously associated with the employee be transferred to the network port(s) in the employee's new office. To accomplish this task, patch cords in a communication closet are rearranged so that the previous IP address is now associated with his/her new office.

[0005] As employees move, and/or change positions, and/or add or subtract lines, the patch cords in a typical closet may require frequent rearrangement. Network patching systems that have the ability to sense a plug in a patch panel port or sense a connection between two patch panel ports are referred to as intelligent patching systems. Intelligent patching systems are described in U.S. Patent No. 6,222,908, which is incorporated herein by reference in its entirety. Another current intelligent patching solution is the IPatch system, available from Systimax Solutions, Inc. (Richardson, Texas). In the IPatch system, a circuit board is connected to the system to provide the capability of determining whether a patch cord is plugged into a particular port. Also, the circuit board is connected with a push button and an LED associated with each port to provide connectivity information and guide a technician who is tracing a connection.

[0006] This product has some potential areas for improvement, largely due to the trend in the market to increase port density from 24 ports per Rack Mounting Unit (RMU – defined as a space 19 inches in width and 1.75 inches in height) to 36 ports/RMU. The additional ports and the circuitry required for them reduce the space available for the circuit board. Also, the circuit board is mounted in the front of the panel and has a single connection to a panel bus at the rear of the rack. This connection limits the panel to only a single orientation, as opposed to the dual "Alpha/Beta" orientation shown in, for example, U.S. Patent No. 7,416,347 to Livingston et al.

[0007] It may be desirable to provide an intelligent patching system that can offer higher port density.

SUMMARY

[0008] As a first aspect, embodiments of the present invention are directed to a datacommunications patching system. The patching system comprises: a mounting frame; a

first module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on another side thereof; and a backplane that is mounted in the mounting frame. The backplane electrically connects to the first module via the first connector when the first module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the first module via the second connector when the first module is mounted in the mounting frame in a second orientation that is inverted from the first orientation. This configuration can enable the patching system to automatically detect an Alpha or Beta orientation of the module, which can then be used on conjunction with an intelligent patching system to track connectivity.

[0009] As a second aspect, embodiments of the present invention are directed to a datacommunications patching system, comprising: a mounting frame; a module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on an opposite side thereof, wherein one of a plurality of tracer lights is associated with a respective one of each of the connector ports; and at least one dust cap inserted into one of the plurality of connector ports, the dust cap formed of a material that provides a visual indication when illuminated with a respective one of the plurality of tracer lights, and that permits the passage of infrared radiation.

[0010] As a third aspect, embodiments of the present invention are directed to a datacommunications patching system, comprising: a mounting frame; a first module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on another side thereof; and a backplane that is mounted in the mounting frame. The backplane electrically connects to the first module via the first connector when the first module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the first module via the second connector when the first module is mounted in the mounting frame in a second orientation that is inverted from the first orientation. The backplane includes circuitry configured to recognize whether the first module is in the first orientation or the second orientation. The backplane further includes a tab, and each of the first and second connectors includes a slot configured to receive the backplane tab.

BRIEF DESCRIPTION OF THE FIGURES

[0011] **Figure 1** is an exploded front perspective view of an intelligent patching

system according to embodiments of the present invention.

[0012] **Figure 2** is an exploded front perspective view of the shelf and backplane of the patching system of **Figure 1**.

[0013] **Figure 3** is a greatly enlarged front perspective view of an exemplary port module of the patching system of **Figure 1**.

[0014] **Figure 4** is a greatly enlarged rear perspective view of the port module of **Figure 3**.

[0015] **Figure 5** is a schematic top view of the backplane of **Figure 2**.

DETAILED DESCRIPTION

[0016] The present invention will be described more particularly hereinafter with reference to the accompanying drawings. The invention is not intended to be limited to the illustrated embodiments; rather, these embodiments are intended to fully and completely disclose the invention to those skilled in this art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity.

[0017] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0018] In addition, spatially relative terms, such as "under", "below", "lower", "over", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "under" or "beneath" other elements or features would then be oriented "over" or "above" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted

accordingly. As used herein, "vertical" has the conventional meaning, *i.e.*, upright; or at a right angle to the horizon.

[0019] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein the expression "and/or" includes any and all combinations of one or more of the associated listed items.

[0020] Where used, the terms "attached", "connected", "interconnected", "contacting", "mounted" and the like can mean either direct or indirect attachment or contact between elements, unless stated otherwise.

[0021] Also, as used herein the term "port" is intended to encompass telecommunications connectors and devices employed to facilitate the interconnection of telecommunications cords and cables for the transmission of signals therebetween. A connector may include an adapter that facilitates the interconnection of two termination devices (as may be employed in the interconnection of fiber optic cords and cables, particularly within a connector block), a jack or the like typically employed with copper cables and cords, or other devices that provide a location or site for the interconnection of cables and cords.

[0022] Further, as used herein, it will be understood that, as used herein, the term "Alpha/Beta" when referring the orientation of a communications module indicates that the module may be oriented in one of two orientations (the "Alpha" orientation being 180 degrees inverted from the "Beta" orientation), wherein cords and cables may be connected with the module in either orientation, but the numbering system of the ports of the module and the connectivity with other devices differs with the orientation. An exemplary "Alpha/Beta" orientation is described in greater detail in U.S. Patent No. 7,416,347 to Livingston et al., *supra*.

[0023] Turning now to the figures, a patching system, designated broadly at **10**, is illustrated in **Figure 1**. The patching system **10** includes a shelf **12** and three port modules **40**

(more or fewer modules **40** may be included in other embodiments). These components are described in greater detail below.

[0024] Turning now to **Figures 1** and **2**, the shelf **12** includes a generally horizontal main panel **14**, a rear wall **16**, side walls **18**, and a cover **22**. Together these panels form a box structure with an open front end. Slide members **20** are attached to each of the side walls **18** and enable the shelf to slide forward from a rack on which it is mounted (not shown) for work by a technician. Four module guides **32** are mounted to the main panel **14** generally parallel to the side walls **18** and spaced apart from each other. With the cover **22** in place, the shelf **12** has a height of approximately 2 RMU.

[0025] A trough **24** is attached to the front edges of the side walls **18** and main panel **14**. The trough **24** has three module openings **26** that are configured to receive modules **40**. Also, the trough **24** includes a pair of cable loops **28** on each side that are configured and oriented to receive cables and cords inserted into adapters **42** in the modules **40**. A front window **27** is positioned below and in front of the module openings **26**. **Figures 1** and **2** also illustrate module doors **29** that can be placed over the module openings **26** when a module **40** is not present.

[0026] Those skilled in this art will appreciate that, although the shelf **12** is illustrated and described herein, mounting frames of different configurations may also be employed with embodiments of the present invention.

[0027] Referring still to **Figure 2**, a backplane **34** is mounted to and positioned above the rear portion of the main panel **14**. The backplane **34** includes three connection tabs **36** on its front edge **35**. As can be seen in **Figure 5**, the backplane **34** comprises a printed wiring board that includes circuitry that monitors the connectivity of ports **42** in the modules **40**. Exemplary circuitry for "intelligent" patching is known to those of skill in this art and need not be described in detail herein.

[0028] The backplane **34** further includes circuitry that can detect the orientation (*i.e.*, Alpha or Beta) of the modules **40**. Such circuitry may comprise, for example, contact pads that are positioned to detect different mating contacts in connectors of the module **40** (described in greater detail below). Other configurations may also be suitable for other embodiments of the present invention.

[0029] Referring now to **Figure 3**, each of the modules **40** includes a plurality of fiber optic adapters **42**. In the illustrated embodiment, the adapters **42** are disposed in an

array of 6 rows and 4 columns, although other arrangements may be employed. The individual adapters **42** are oriented such that they are vertically oriented. A "vertically oriented" adapter is one in which its keyway, which accepts a mating key on a mating terminal, is located in a vertical wall or edge of it opening. This arrangement is a 90 degree re-orientation from conventional adapters. Those skilled in this art will recognize that, although fiber optic adapters are shown herein, other varieties of datacommuncations ports and/or connectors may also be employed.

[0030] In this embodiment, each adapter **42** is monitored by an infrared (IR) sensor that detects the presence of a connector in the adapters **42**. Each adapter **42** also has a corresponding LED **43** that helps to guide a technician to the correct adapter **42** during maintenance and a push button **45** that assists with connectivity operations.

[0031] Referring now to **Figure 4**, the rear surface of each of the modules **40** includes two different connector slots **44a, 44b**. Each of the connector slots **44a, 44b** is sized to receive one of the connection tabs **36**. The connector slots **44a, 44b** are located on the module **40** so that, when the module **40** slides through one of the module openings **26** and toward the backplane **34**, one of the connector slots **44a, 44b** is positioned to receive the connection tab **36**. If the module **40** is in an "Alpha" orientation, the connection tab **36** is inserted in the connector slot **44a**; if instead the module **40** is in a "Beta" orientation (*i.e.*, inverted 180 degrees from the Alpha orientation), the connection tab **36** is inserted into the connector slot **44b**. The module guides **32** are positioned to encourage straight-line entry of the module **40** into and through the module openings **26** so that the proper connector slot **44a, 44b** aligns with and enables insertion of the connection tab **36**.

[0032] **Figure 4** also illustrates fiber optic adapters **49**, which are attached to cables (not shown) and are mounted on the rear side of the module **40**.

[0033] Those skilled in this art will appreciate that, although the adapters **42** and the connector slots **44a, 44b** are shown on the front and rear of the module **40**, these components may be positioned on other sides of the module **40** (for example, on the top and bottom of the module).

[0034] Connection of the connection tab **36** with a connector slot **44a, 44b** allows the backplane **34** to recognize the Alpha/Beta orientation of the module **40**. For example, the connector slot **44a** may include a contact in one position (*e.g.*, the leftmost portion), whereas the connector slot **44b** may include a contact in another location (*e.g.*, the rightmost portion).

When the connector slot **44a** receives a tab **36** with multiple contact pads, a mating contact pad on the tab **36** can detect the contact of the connector slot **44a** and thus determine that the module **40** is in an Alpha orientation. Conversely, if the connector slot **44b** receives the tab **36**, a different mating contact pad on the tab **36** detects the differently located contact of the connector slot **44** and determines that the module **40** is in a Beta configuration. This information about the module oreintation can then be used in conjunction with intelligent patching circuitry on the backplane **34** to correctly track and monitor the connectivity of the ports **42** of the module **40**.

[0035] As discussed, the adapters **42** are fiber optic adapters that receive fiber optic connectors. Such adapters typically include some means, such as dust caps **50** (**Figures 3** and **4**), for preventing dust from entering the adapter when the adapter is not in use. A conventional dust cap is inserted into the adapter to prevent the accumulation of dust. However, when an IR-based port detection technique is employed by an intelligent patching system, the system can misinterpret a typical dust cap inserted in an adapter as a connector. To address this issue, in some embodiments the dust caps are formed of a material that is translucent to IR radiation. Such dust caps can allow an IR beam transmitted across the adapter **49** to pass and avoid signaling the presence of an object to the backplane **34**.

[0036] In some embodiments, it may be desirable for the dust cap material to compliment the intelligent system during installation, maintenance and connection. Some patching systems include a tracer light (often red) to indicate the status of the particular adapter. The dust cap material may be chosen to reveal the tracer light, or to glow, when the tracer light is activated. Such a configuration can enable an operator to see the light without removing the dust cap, which can significantly simplify installation.

[0037] Exemplary materials for the dust cap include a thermoplastic elastomer (TPE), and in particular ethylene-propylene copolymers. A particularly suitable material is DYNAFLEX® G2780-001 TPE, available from GLS Corporation, McHenry, Illinois. This material is also ROHAS compliant, and meets zero halogen requirements demanded in some applications.

[0038] The foregoing embodiments are illustrative of the present invention, and are not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from

the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That Which is Claimed is:

1. A datacommunications patching system, comprising:

a mounting frame;

a first module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on another side thereof; and

a backplane that is mounted in the mounting frame;

wherein the backplane electrically connects to the first module via the first connector when the first module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the first module via the second connector when the first module is mounted in the mounting frame in a second orientation that is inverted from the first orientation.

2. The patching system defined in Claim 1, wherein the backplane includes circuitry configured to recognize whether the first module is in the first orientation or the second orientation.

3. The patching system defined in Claim 1, wherein the backplane includes a tab, and each of the first and second connectors includes a slot configured to receive the backplane tab.

4. The patching system defined in Claim 1, further comprising a second module mounted in the mounting frame and including a plurality of connector ports on one side thereof and third and fourth connectors on another side thereof;

wherein the backplane electrically connects to the second module via the third connector when the second module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the second module via the fourth connector when the second module is mounted in the mounting frame in a second orientation that is inverted from the first orientation.

5. The patching system defined in Claim 1, wherein the connector ports are fiber optic adapters.

6. The patching system defined in Claim 5, wherein each of the fiber optic adapters includes a vertical edge, and wherein the vertical edge includes a keyway recess.

7. The patching system defined in Claim 6, wherein each of the first and second connectors includes a slot that is horizontally oriented.

8. The patching system defined in Claim 1, wherein the backplane includes circuitry configured to identify whether a respective port of the plurality of ports on the first module is connected with a mating connector.

9. The patching system defined in Claim 1, further comprising at least one dust cap inserted into one of the plurality of connector ports.

10. The patching system defined in Claim 9, wherein the dust cap is formed of a material that provides a visual indication when illuminated with a tracer light, and that permits the passage of infrared radiation.

11. A datacommunications patching system, comprising:

a mounting frame;

a module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on another side thereof, wherein one of a plurality of tracer lights is associated with a respective one of each of the connector ports; and

at least one dust cap inserted into one of the plurality of connector ports, the dust cap formed of a material that provides a visual indication when illuminated with a respective one of the plurality of tracer lights, and that permits the passage of infrared radiation.

12. The patching system defined in Claim 11, wherein the dust cap is formed of a thermoplastic elastomer.

13. The patching system defined in Claim 12, wherein the thermoplastic elastomer is a polyethylene-polypropylene copolymer.

14. The patching system defined in Claim 11, wherein the material of the dust cap is ROHAS compliant.

15. The patching system defined in Claim 11, wherein the material of the dust cap glows when illuminated with the tracer light.

16. The patching system defined in Claim 11, wherein the plurality of ports comprises a plurality of fiber optic adapters.

17. The patching system defined in Claim 11, further comprising a backplane mounted in the mounting frame, and wherein the backplane includes circuitry that identifies whether a respective port is connected with a mating connector.

18. A datacommunications patching system, comprising:

a mounting frame;

a first module mounted in the mounting frame and including a plurality of connector ports on one side thereof and first and second connectors on an opposite side thereof; and

a backplane that is mounted in the mounting frame;

wherein the backplane electrically connects to the first module via the first connector when the first module is mounted in the mounting frame in a first orientation, and wherein the backplane electrically connects to the first module via the second connector when the first module is mounted in the mounting frame in a second orientation that is inverted from the first orientation;

wherein the backplane includes circuitry configured to recognize whether the first module is in the first orientation or the second orientation; and

wherein the backplane includes a tab, and each of the first and second connectors includes a slot configured to receive the backplane tab.

19. The patching system defined in Claim 18, wherein the connector ports are fiber optic adapters.

20. The patching system defined in Claim 19, wherein each of the connector ports includes a vertical edge, and wherein the vertical edge includes a keyway recess.

21. The patching system defined in Claim 18, wherein the backplane includes circuitry configured to identify whether a respective port of the plurality of ports on the module is connected with a mating connector.

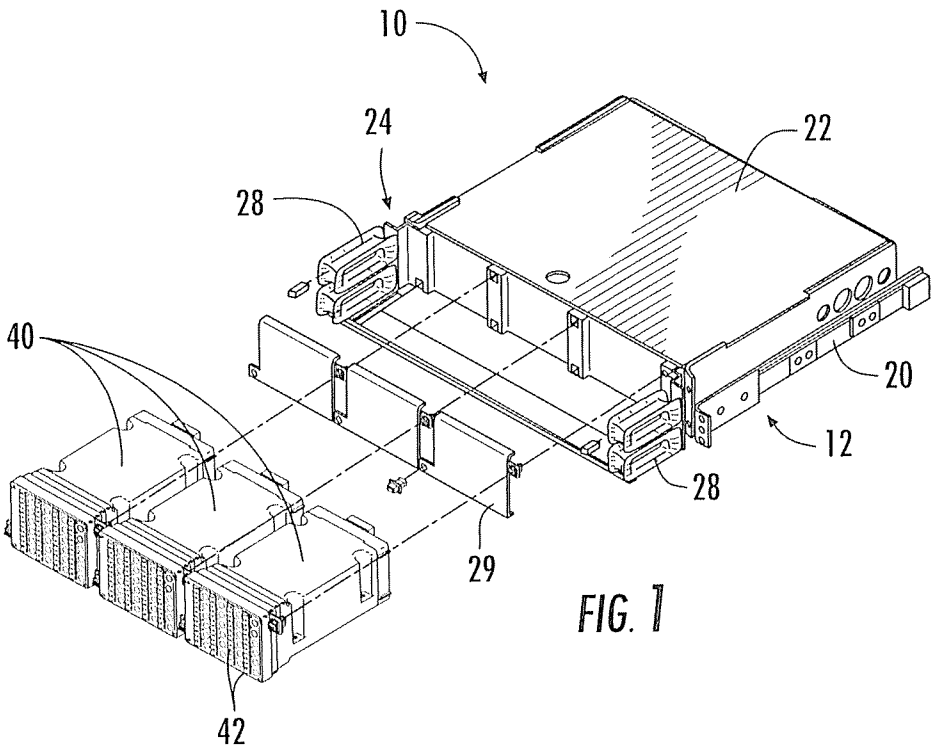


FIG. 1

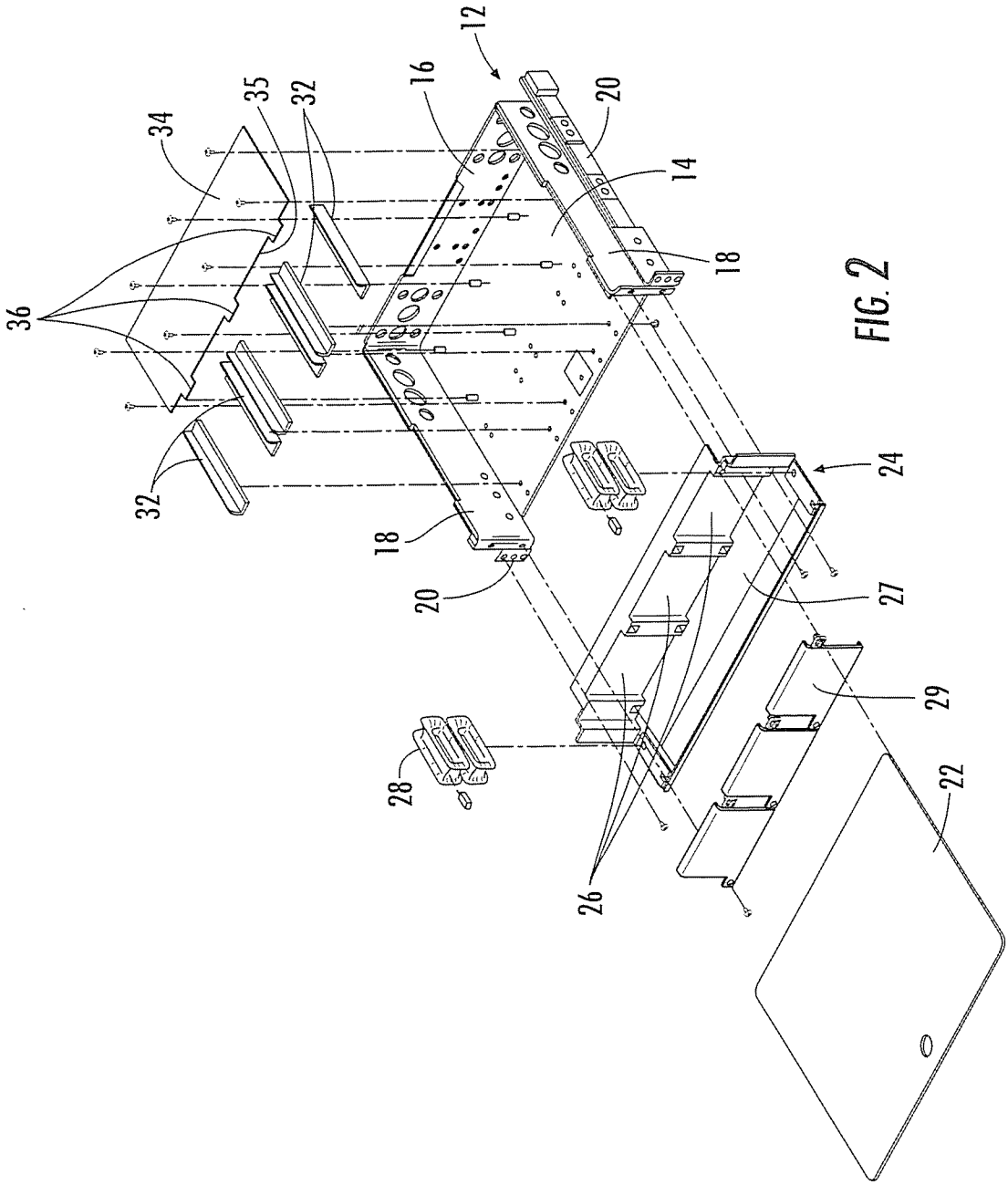


FIG. 2

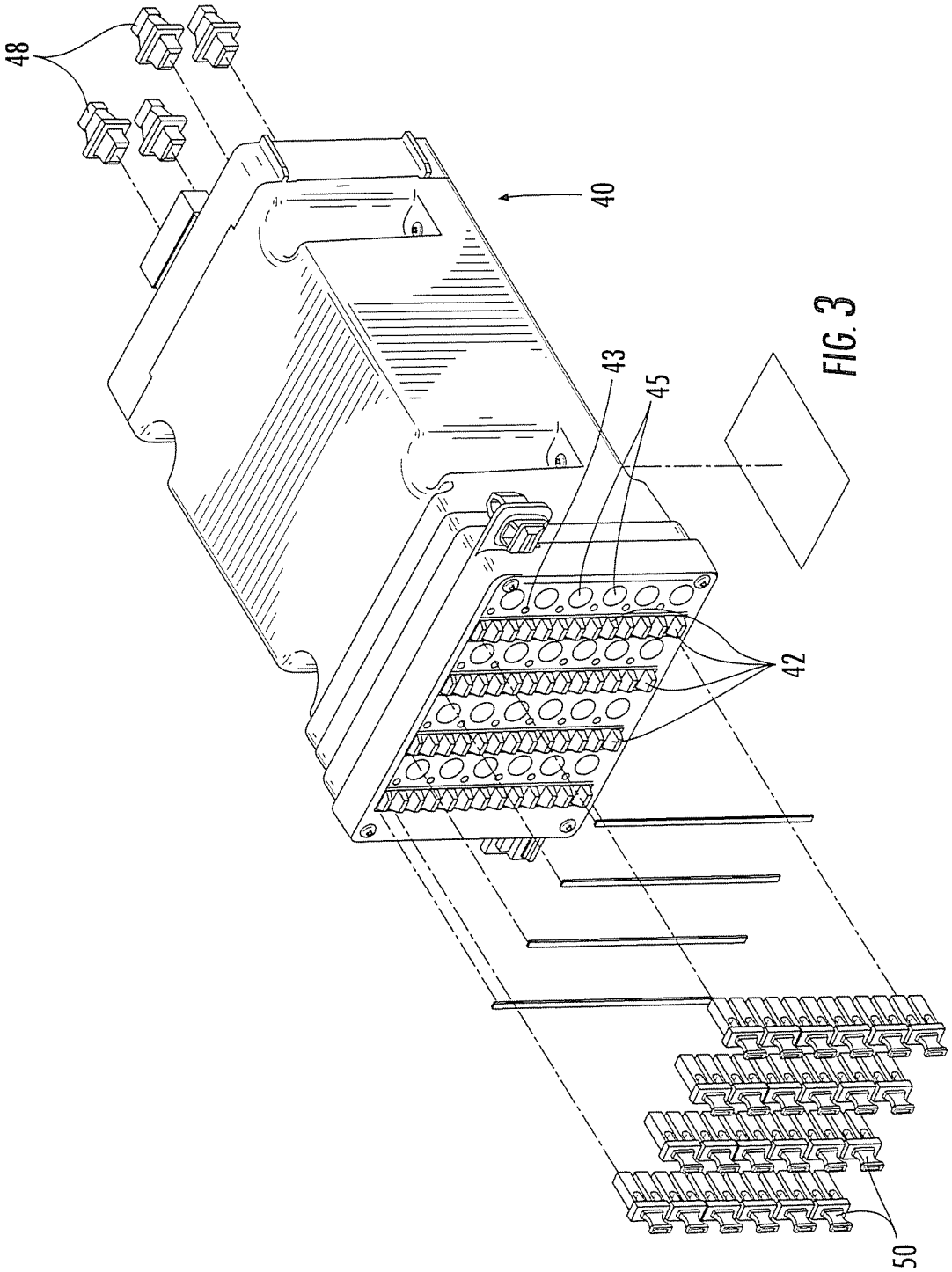


FIG. 3

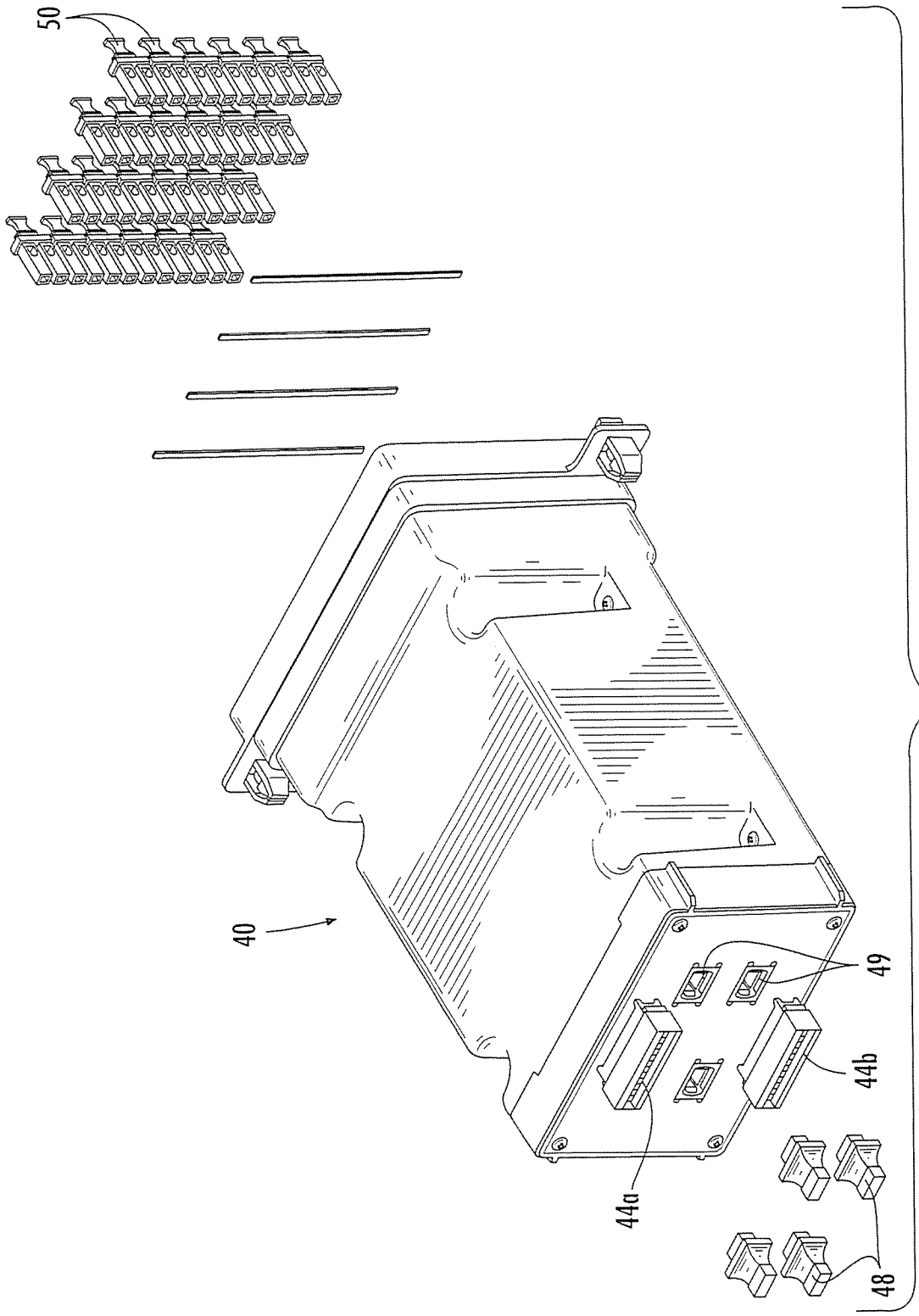


FIG. 4

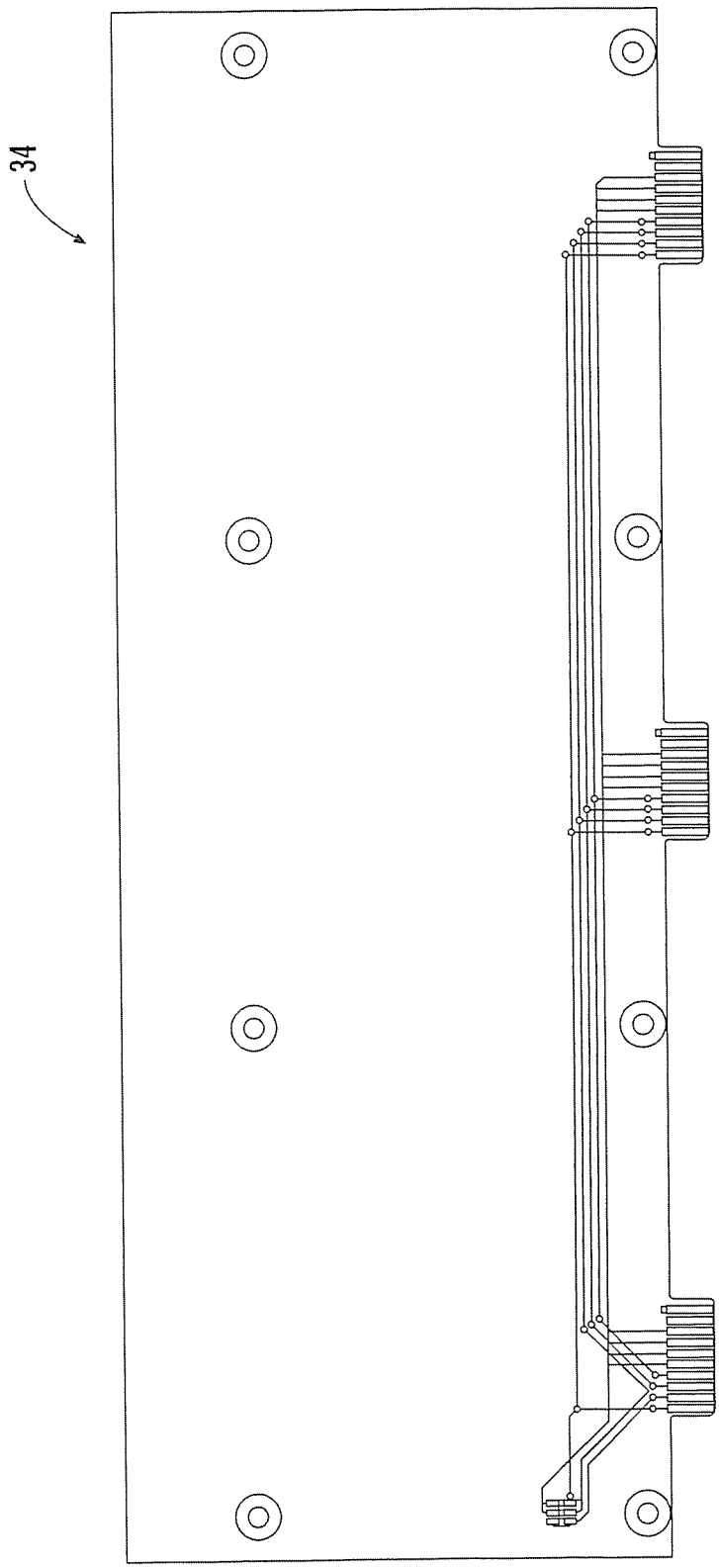


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/068621

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04Q1/08 H04Q1/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2004/097138 A1 (KHA THONG BINH [US] ET AL) 20 May 2004 (2004-05-20) paragraphs [0042], [0056], [0059]; figures 15,16,17	1-8, 18-21 9-17
Y	WO 00/56111 A1 (ERICSSON TELEFON AB L M [SE]) 21 September 2000 (2000-09-21) page 1, line 36 - page 2, line 9 page 5, lines 25-27 page 7, line 23 - page 8, line 2	9-17
A	US 2007/081315 A1 (MONDOR ROBERT M [US] ET AL MONDOR ROBERT M [US] ET AL) 12 April 2007 (2007-04-12) paragraph [0031]	1-21
A	US 2008/096438 A1 (CLARK GORDON P [US] ET AL) 24 April 2008 (2008-04-24) paragraphs [0063] - [0065]	1-21

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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