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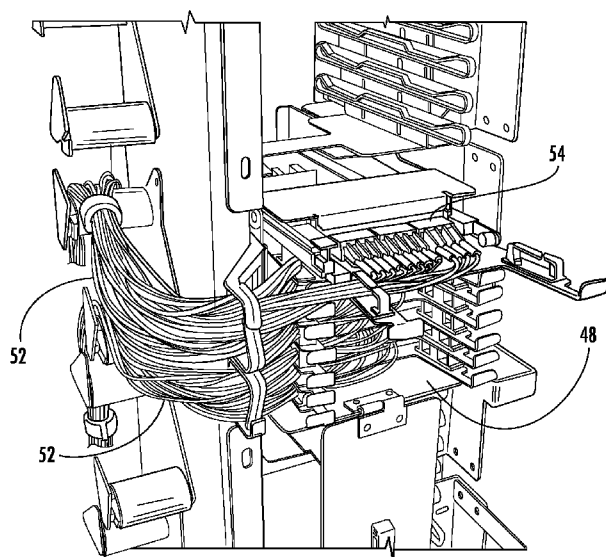


FIG. 4C

(57) Abstract: Fiber optic equipment assemblies employing non-U-width-sized housings supporting U-sized fiber optic modules, and related methods are disclosed. In one embodiment, the assembly may include the non-U-width-sized housing (58), at least one fiber optic equipment support member (68), and at least one U-sized fiber optic module (54). The non-U-width-sized housing may include an enclosure (60) forming an internal cavity (66). The at least one fiber optic equipment support member may be disposed within the internal cavity and configured to support at least one U-sized fiber optic module. The at least one U-sized fiber optic module may be disposed within the at least one fiber optic equipment support member (68) which may be disposed within the internal cavity. The at least one U-sized fiber optic module may have a height dimension wherein at least three of the at least one U-sized fiber optic module may be disposed within a U-unit height of unity.

FIBER OPTIC EQUIPMENT ASSEMBLIES EMPLOYING NON-U-WIDTH-SIZED HOUSINGS AND RELATED METHODS

RELATED APPLICATIONS

[0001] This application claims the benefit of priority under 35 U.S.C. § 119 of U.S. Provisional Application Serial No. 61/503,182 filed on June 30, 2011, the content of which is relied upon and incorporated herein by reference in its entirety.

BACKGROUND

Field of the Disclosure

[0002] The technology of the disclosure relates to fiber optic housings that support fiber optic modules to provide fiber optic equipment assemblies to support fiber optic connections.

Technical Background

[0003] The benefits of utilizing optical fiber include extremely wide bandwidth and low noise operation. Because of these advantages, optical fiber is increasingly being used for a variety of applications, including but not limited to broadband voice, video, and data transmission. As a result, fiber optic communications networks include a number of interconnection points at which multiple optical fibers are interconnected. Fiber optic communications networks also include a number of connection terminals, examples of which include, but are not limited to, network access point (NAP) enclosures, aerial closures, below grade closures, pedestals, optical network terminals (ONTs), and network interface devices (NIDs). In certain instances, the connection terminals include connector ports or nodes, typically opening through an external wall of the connection terminal. The connection terminals are used to establish optical connections between optical fibers terminated from the distribution cable and respective optical fibers of one or more “preconnectorized” drop cables, extended distribution cables, tether cables or branch cables, collectively referred to herein as “drop cables.” The connection terminals are used to readily extend fiber optic communications services to a subscriber. In this regard, fiber optic networks are being developed that deliver

“fiber-to-the-curb” (FTTC), “fiber-to-the-business” (FTTB), “fiber-to-the-home” (FTTH) and “fiber-to-the-premises” (FTTP), referred to generically as “FTTx.”

[0004] In conventional FTTx deployments depicted in **FIG. 1**, a fiber optic network **10** is provided. The fiber optic network **10** may deliver service to subscribers **12** through optical fiber distribution cables **14** and subscriber cables **16**. For example, the fiber optic network **10** may begin at a trunk cable **18** originating from a central office **20** leading to a splitter/splice cabinet **22** in the field where a distribution cable **14** is connected. The distribution cable **14** may then be routed aerially or below ground through the residential neighborhood served by the fiber optic network **10**. The subscriber cables **16** servicing individual subscribers **12** may be connected with the distribution cable **14** through terminations at mid-span access points **24**, branch cables **26**, and multi-port splitter boxes **28**. The central office **20** may be connected to a geographically-dispersed telecommunications network **30**.

[0005] At the central office **20**, signals may be combined on a single optical fiber **32** of the trunk cable **18** using a multiple access protocol, such as time division multiple access (TDMA). All the subscribers **12** may receive all signals transmitted on the single optical fiber **32** in their subscriber cable **16**, but due to encryption may only be able to decipher the signals they have permission to utilize.

[0006] The central office **20** may include fiber optic equipment in at least one conventional rack **34** to support the fiber optic network **10**; for example, the enhanced management frame (EMF) rack as shown in **FIG. 2**. The conventional rack **34** may have twenty-four conventional housings **36** wherein half are on the left **35** and half on the right **37**.

[0007] As illustrated in **FIG. 3A**, each conventional housing **36** in this example contains six module holders **38** that may slide partially in and out of the conventional housing **36** on slider rails **40**. A height dimension and a width dimension of the conventional housing **36** are depicted as H_1 and W_1 respectively. Conventional measurements dimensions for the width dimension W_1 is 8.6-inches and 5.5-inches for the height H_1 in this example. The conventional housing **36** is a non-U-width-sized housing because W_1 is not 19-inches or 23-inches. As depicted in **FIG. 3B**, the module holder **38** may comprise a cover **44** and contain a fiber optic module **42** having twelve

(12) fiber connections **46**. The cover **44** may pivot to enclose the fiber optic module **42**, which may be configured with splitters/couplers or wavelength-division multiplexing (WDM) devices.

[0008] Generally, more signals may be delivered to subscribers if more fiber connections **46** were available on the conventional rack **34**. As the subscribers **12** require more signal bandwidth, there is an unmet need for low-cost solutions at the central office **20** to provide more fiber connections **46** within the conventional rack **34**.

SUMMARY OF THE DETAILED DESCRIPTION

[0009] Embodiments disclosed in the detailed description include fiber optic equipment assemblies that include non-U-width-sized housing supporting U-sized fiber optic modules in an equipment frame, and related methods. A non-U-width-sized housing may be configured to accommodate U-sized fiber optic modules and thereby increase a number of fiber optic connections available for increasing bandwidth offered to subscribers in a fiber optic network.

[0010] In one embodiment, a fiber optic equipment assembly is disclosed. This fiber optic equipment assembly may include a non-U-width-sized housing, at least one fiber optic equipment support member, and at least one U-sized fiber optic module. The non-U-width-sized housing may include an enclosure forming an internal cavity disposed within. The at least one fiber optic equipment support member may be disposed within the internal cavity and configured to support at least one U-sized fiber optic module. The at least one U-sized fiber optic module may be disposed within the at least one fiber optic equipment support member disposed within the internal cavity. The at least one U-sized fiber optic module may have a height dimension wherein at least three of the at least one U-sized fiber optic module may be disposed within a U-unit height of unity. In this manner, the at least one U-sized fiber optic module may be disposed within a non-U-width-sized housing. In this regard as a non-limiting example, the non-U-width-sized housing of the fiber optic equipment assembly may enable more bandwidth to be delivered to subscribers by allowing more fiber optic modules to fit into a non-U space of the equipment frame.

[0011] In another embodiment, a fiber optic equipment assembly is disclosed. This fiber optic equipment assembly may include a non-U-width-sized housing, at least one fiber optic equipment support member, and at least one U-sized fiber optic module. The non-U-width-sized housing may include an enclosure forming an internal cavity disposed within. The at least one fiber optic equipment support member may be disposed within the internal cavity and configured to support at least one U-sized fiber optic module. The at least one U-sized fiber optic module may be disposed within the at least one fiber optic equipment support member, which is disposed within the internal cavity. The at least one U-sized fiber optic module may have a width dimension wherein at least three of the at least one U-sized fiber optic module may be disposed adjacent to each other along a horizontal direction within a U-unit height of unity in the non-U-width-sized housing. In this manner, the at least one U-sized fiber optic module may be disposed within a non-U-width-sized housing. In this regard as a non-limiting example, the non-U-width-sized housing of the fiber optic equipment assembly may enable even more bandwidth to be delivered to subscribers by allowing more fiber optic modules to fit into a non-U space of the equipment frame.

[0012] In another embodiment, a method of installing fiber optic equipment is disclosed. This method may comprise providing a non-U-width-sized housing including an enclosure forming an internal cavity. The method may also include disposing at least one fiber optic equipment support member within the internal cavity. The at least one fiber optic equipment support member may be configured to support at least one U-sized fiber optic module. The method may also include disposing the at least one U-sized fiber optic module within the at least one fiber optic equipment support member, which is disposed within the internal cavity. The at least one U-sized fiber optic module may have a height dimension wherein at least three of the at least one U-sized fiber optic module may be disposed within a U-unit height of unity. In this manner, the method of installing the fiber optic equipment may, for example, be less expensive because equipment racks compatible with non-U-width-sized housing sizes may use the U-sized fiber optic modules without the expense of new equipment racks.

[0013] Additional features and advantages will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from that

description or recognized by practicing the embodiments as described herein, including the detailed description that follows, the claims, as well as the appended drawings.

[0014] It is to be understood that both the foregoing general description and the following detailed description present embodiments, and are intended to provide an overview or framework for understanding the nature and character of the disclosure. The accompanying drawings are included to provide a further understanding, and are incorporated into and constitute a part of this specification. The drawings illustrate various embodiments, and together with the description serve to explain the principles and operation of the concepts disclosed.

BRIEF DESCRIPTION OF THE FIGURES

[0015] **FIG. 1** is a schematic diagram of subscribers of a fiber optic network connected to a central office with drop cables in the prior art;

[0016] **FIG. 2** is a perspective view of a fiber optic equipment frame loaded with twenty-four front-loading housings and module holders in the prior art;

[0017] **FIG. 3A** is a perspective view of a front-loading housing loaded with module holders in the prior art of the fiber optic equipment frame of **FIG. 2**;

[0018] **FIG. 3B** is a perspective, close-up view of the module holder with a module installed in the prior art as shown in the fiber optic equipment frame of **FIG. 2**;

[0019] **FIG. 4A** is a perspective, front view of an exemplary fiber optic equipment assembly employing a non-U-width-sized housing supporting U-sized fiber optic modules with a front door closed;

[0020] **FIG. 4B** is a perspective, front view of the fiber optic equipment assembly of **FIG. 4A** with the front door opened;

[0021] **FIG. 4C** is a perspective, front view of the fiber optic equipment assembly of **FIG. 4A** with the front door opened and at least one fiber optic module partially removed;

[0022] **FIG. 5A** depicts a perspective, front view of the fiber optic equipment assembly of **FIG. 4A**;

[0023] **FIG. 5B** depicts a perspective, side view of a first attachment member of the fiber optic equipment assembly of **FIG. 4A**;

[0024] FIG. 5C depicts a perspective view of an enclosure of the fiber optic equipment assembly of FIG. 4A;

[0025] FIG. 5D depicts a perspective, exploded front view of the fiber optic equipment assembly of FIG. 4A;

[0026] FIG. 6A depicts a perspective, rear view of the fiber optic equipment assembly of FIG. 4A;

[0027] FIG. 6B depicts a perspective, exploded rear view of the fiber optic equipment assembly of FIG. 4A;

[0028] FIG. 6C depicts a bottom view of the fiber optic equipment assembly of FIG. 4A;

[0029] FIG. 7A is a perspective, front-right view of at least one U-sized fiber optic module that can be supported by the non-U-width-sized housing of the fiber optic equipment assembly of FIG. 4A;

[0030] FIG. 7B is a perspective, front-left view of the at least one U-sized fiber optic module of FIG. 7A;

[0031] FIG. 7C is a perspective, exploded front view of the at least one U-sized fiber optic module of FIG. 7A;

[0032] FIG. 8A is a perspective, exploded front view of a fiber optic equipment support member of the fiber optic equipment assembly of FIG. 4A;

[0033] FIG. 8B is a perspective, front view of the U-sized fiber optic module of FIG. 7A before being received by a fiber optic module guide of the fiber optic equipment support member of the fiber optic equipment assembly of FIG. 4A;

[0034] FIG. 9 is a perspective, front view of the at least one U-sized fiber optic module received by the fiber optic module guide of the fiber optic equipment support member of the fiber optic equipment assembly of FIG. 4A;

[0035] FIG. 10 is a perspective view of at least one fiber optic equipment support member guide of the fiber optic equipment assembly of FIG. 4A;

[0036] FIG. 11 is a perspective view of the at least one fiber optic equipment support member disposed within the at least one fiber optic equipment support member guide of the fiber optic equipment assembly of FIG. 4A;

[0037] **FIG. 12** is a perspective view of a fiber optic equipment assembly of another embodiment wherein the at least one U-sized fiber optic module may be disposed adjacent to each other along a horizontal direction; and

[0038] **FIG. 13** is a perspective view of the fiber optic equipment assembly of **FIG. 12** providing more detail.

DETAILED DESCRIPTION

[0039] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, in which some, but not all embodiments are shown. Indeed, the concepts may be embodied in many different forms and should not be construed as limiting herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Whenever possible, like reference numbers will be used to refer to like components or parts.

[0040] Embodiments disclosed in the detailed description include fiber optic equipment assemblies that include non-U-width-sized housings supporting U-sized fiber optic modules in a fiber optic equipment assembly, and related methods. In one embodiment, the fiber optic equipment assembly may include the non-U-width-sized housing, at least one fiber optic equipment support member, and at least one U-sized fiber optic module. The non-U-width-sized housing may include an enclosure forming an internal cavity. The at least one fiber optic equipment support member may be disposed within the internal cavity and configured to support at least one U-sized fiber optic module. The at least one U-sized fiber optic module may be disposed within the at least one fiber optic equipment support member disposed within the internal cavity. The at least one U-sized fiber optic module may have a height dimension wherein at least three of the at least one U-sized fiber optic module may be disposed within a U-unit height of unity.

[0041] In this regard, **FIGS. 4A to 4C** illustrate schematic diagrams of one embodiment of a fiber optic equipment assembly **48** that includes a non-U-width-sized housing supporting U-sized fiber optic modules. As shown in **FIG. 4A**, the fiber optic equipment assembly **48** may be mounted in an equipment frame **50** and may be connected to a plurality of fiber optic cables **52**. **FIG. 4B** shows the fiber optic cables **52**

connected to the at least one U-sized fiber optic module **54**. **FIG. 4C** shows that the at least one U-sized fiber optic module **54** may be pulled partially out. The equipment frame **50** may be the same as the conventional rack **34**, and this would provide a compatibility benefit because a fiber optic equipment assembly **48** could be mounted in existing equipment at the central office **20**.

[0042] In **FIG. 5A** the main components of the fiber optic equipment assembly **48** in **FIGS. 4A** to **4C** are depicted. In this embodiment, the fiber optic equipment assembly **48** supports the at least one U-sized fiber optic module **54** comprising at least one fiber optic connection **56**. The terminology “U-sized” means that the at least one U-sized fiber optic module **54** has at least one dimension that is based on the rack unit (“U”), which is a unit of measurement used to describe the height of equipment intended for mounting in a 19-inch or 23-inch wide rack. One rack unit, also known hereinafter as a U-unit height of unity, is 1.75-inches high. Thus, the at least one U-sized fiber optic module **54** may be “U-sized” if the at least three of the at least one U-sized fiber optic module **54** may be disposed in a U-unit height of unity of 1.75-inches. The advantage of having components that are U-sized is that they may be compatible with standard equipment racks based on the rack unit. The embodiments in this enclosure enable at least one U-sized fiber optic module **54** to fit into the equipment frame **50** that is non-U-sized.

[0043] The plurality of fiber optic cables **52** may be connected to the at least one fiber optic connection **56** (not explicitly shown in **FIG. 5A**). The plurality of fiber optic cables **52** may support the fiber optic network **10** serving the subscribers **12**.

[0044] With continuing reference to **FIG. 5A**, the fiber optic equipment assembly **48** may include a non-U-width-sized housing **58** comprising an enclosure **60**. The width (W_1) of the non-U-width-sized housing **58** is “non-U-width-sized” because it is neither 19-inches nor 23-inches wide. The width W_1 and the height H_1 of the non-U-width-sized housing **58** may be the same dimensions as that for the conventional housing **36**. The non-U-width-sized housing **58** may be installed on the equipment frame **50** that may accommodate twenty-four non-U-width-sized housings **58**.

[0045] The enclosure **60** comprises a first wall **62** and a second wall **64**, and may form an internal cavity **66**. At least one fiber optic equipment support member **68** may be disposed within the internal cavity **66**. The at least one fiber optic equipment support

member **68** may be configured to support the at least one U-sized fiber optic module **54**. The at least one U-sized fiber optic module **54** may be disposed within the at least one fiber optic equipment support member **68**, which may also be disposed within the internal cavity **66**. Disposing the at least one U-sized fiber optic module **54** in the internal cavity **66** provides protection against damage to the fiber optic connections **56**.

[0046] A first attachment member **70** may be attached to the first wall **62**. An interface surface **72** of the first attachment member **70** may be used to hang the non-U-width-sized housing **58** from the equipment frame **50**. The advantage to hanging is that the non-U-width-sized housing **58** can be at least partially slid out in a horizontal direction **A₂** from the equipment frame **50** after bolts (not shown) are removed. A containment surface **73** (**FIG. 5B**) may also come into contact with the equipment frame **50** and prevent the interface surface **72** from disengaging from the equipment frame **50**.

[0047] With continuing reference to **FIG. 5A**, a second attachment member **74** may be attached to the second wall **64**. A first vertical support member **76** and a second vertical support member **78** may be attached to the second attachment member **74**. A first lateral restraint surface **80** of the second attachment member **74** between the first and second vertical support members **76, 78** helps restricts lateral movement in a second horizontal direction **A₃** of the non-U-width-sized housing **58** when it abuts the equipment frame **50**. A first contact surface **82** and second contact surface **84**, respectively, of the first and second vertical support members **76, 78** help restrict movement in a vertical direction **A₁** when they abut the equipment frame **50** (not shown in **FIG. 5A**).

[0048] The non-U-width-sized housing **58** may have a height (**H₁**) which is a non-integer multiple of the U-unit height of unity. For example, non-integer multiples of the U-unit height of unity could NOT be 1.75-inches, 3.5-inches, 5.25-inches, 7-inches, etc. The height **H₁** of the non-U-width-sized housing **58** may be measured in the vertical direction **A₁**. In a non-limiting embodiment **H₁** could be 5.7-inches which would be an integer of the U-unit height of unity. This is important because a gap of 1.3-inches, 7-inches less 5.7-inches, would be an inefficient use of space between housings.

[0049] A front door **86** may be attached to the enclosure **60** by cylindrical pin **88** disposed between the front door **86** and a door hinge member **90** attached to the enclosure **60**. The front door **86** may pivot upon the cylindrical pin **88**. The front door **86** may be

held in a closed position by a latch **92** which may interface with an orifice **94** of a door latch enclosure member **96**. The door latch enclosure member **96** may be attached to the enclosure **60**. The front door **86** may help protect the at least one fiber optic connection **56** and the bend radius of the plurality of fiber optic cables **52** from causing damage.

[0050] There are various components which also enable cabling to enter the non-U-width-sized housing **58** without damage. A cable management guide **98** and fiber guard bracket **99** attached at the front **100** of the non-U-width-sized housing **58** holds the plurality of fiber optic cables **52** to prevent damaging changes to their bend radius. A furcation bracket **102** attached at the rear **104** of the non-U-width-sized housing **58** may have orifices **106** to protect the bend radius of upstream cabling (not shown) entering the enclosure **60**. Also, a slack tray **108** may be attached to the rear **104** of the non-U-width-sized housing **58**. The slack tray **108** may have a turned lip **110** to enable excess upstream cabling to be collected in an organized manner to prevent breakage.

[0051] As shown in **FIG. 5C**, the first wall **62** and the second wall **64** may include crossbar portions **112**, **114** respectively. The first wall **62** and the second wall **64** may be attached when crossbar portion **112** of the first wall **62** may be welded to the second wall **64** and crossbar portion **114** of the second wall **64** may be welded to the first wall **62**. The internal cavity **66** is formed between the first wall **62** and the second wall **64**. Alternatively in other embodiments the welding may be replaced by fasteners.

[0052] The first wall **62** and the second wall **64** may be formed as thin-walled components made of a strong material, for example, such as plastic or sheet metal as non-limiting examples. The exterior surfaces may be finished with powder coating techniques to prevent corrosion and to prevent particles from flaking off and contaminating the at least one fiber optic connection **56**.

[0053] **FIG. 5D** provides more detail as to the components of the fiber optic equipment assembly **48**. At least one fiber optic equipment support member **68** may be disposed within at least one fiber optic equipment support member guide **118** which may be secured within the internal cavity **66** of the enclosure **60**. The at least one fiber optic equipment support member guide **118** may be secured to the first wall **62** and/or second wall **64**. The at least one fiber optic equipment support member **68** may comprise at least one contour guide **120** which may be disposed within at least one gap **122** of the at

least one fiber optic equipment support member guide **118**. The at least one contour guide **120** may be fastened to the rest of the at least one fiber optic equipment support member **68** and may assist in defining a movement of the at least one fiber optic equipment support member **68** within the at least one gap **122** of the at least one fiber optic equipment support member guide **118**.

[0054] At least one fiber optic module guide **123** may be attached to the at least one fiber optic equipment support member **68**. The at least one fiber optic module guide **123** may comprise a receiving groove **124**. The receiving groove **124** may be configured to receive at least one module groove **126** of the at least one U-sized fiber optic module **54**.

[0055] Moreover, at least one cable support guide **128** may also be attached to the at least one fiber optic equipment support member **68**. The at least one cable support guide **128** may assist in managing the bending radius of the plurality of fiber optic cables **52**.

[0056] **FIG. 6A** shows the rear **104** of the non-U-width-sized housing **58** including at least one mechanical transfer pull-off (MTP) connection **130** which enables additional fiber optic cables (not shown) to be connected to the at least one U-sized fiber optic module **54**.

[0057] **FIG. 6B** depicts an exploded view of the rear **104** of the non-U-width-sized housing **58**. A furcation support member **132** may be used to attach the furcation bracket **102** to the enclosure **60**. The furcation support member **132** may be made of a strong rigid material, for example, metal or plastic. The furcation support member **132** may enable the furcation bracket **102** to be more rigid than if furcation support member **132** were made longer to connect to the enclosure **60**. Alternatively, the furcation support member **132** may be made of a strong, relatively flexible material, such as plastic. **FIG. 6C** illustrates a bottom view of the non-U-width-sized housing **58** and depicts the positions of the furcation bracket **102** relative to the furcation support member **132**.

[0058] **FIGS. 7A to 7B** depict close-up views of the at least one U-sized fiber optic module **54** comprising the at least one module groove **126**, the at least one mechanical transfer pull-off (MTP) connection **130**, and the at least one fiber optic connection **56**. The at least one fiber optic connection **56** may be comprised of duplex LC adapters which may support single or duplex fiber connections and connectors.

[0059] FIG. 7B also illustrates a thickness dimension D_1 and a center 133 of the at least one U-sized fiber optic module 54. The center 133 is located half the thickness dimension D_1 into the at least one U-sized fiber optic module 54. In the vertical direction A_1 .

[0060] FIG. 7C depicts the inside of the at least one U-sized fiber optic module 54 with a module cover 134 removed. At least one internal module fiber optic cable 136 optically connects the at least one mechanical transfer pull-off (MTP) connection 130 with the at least one fiber optic connection 56. The volume 138 within the at least one U-sized fiber optic module 54 serves to protect the bend radius of the at least one internal module fiber optic cable 136. The cover 134 and container 140 of at least one U-sized fiber optic module 54 may be made generally of a strong resilient material, for example, plastic or metal.

[0061] FIG. 8A is a close-up of the at least one fiber optic equipment support member 68 in an exploded view showing the at least one contour guide 120 and the at least one fiber optic module guide 123 with a receiving groove 124 ready to be attached to the at least one fiber optic equipment support member 68 with fasteners 142. The fasteners 142 may comprise a permanent mechanical fastener, for example, a rivet; a removable fastener, such as a screw; or adhesive, such as epoxy. The at least one fiber optic equipment support member 68, at least one fiber optic module guide 123, and the at least one contour guide 120 may all be made of a strong resilient material such as plastic or metal. They may be made of different materials.

[0062] FIG. 8B is a close-up of the at least one module groove 126 of the at least one U-sized fiber optic module 54 before being received in the receiving groove 124 of the at least one fiber optic module guide 123. The benefit of the receiving groove 124 may be that it enables the at least one U-sized fiber optic module 54 to be removeably attached to the at least one fiber optic equipment support member 68.

[0063] FIG. 9 is a close-up of the at least one module groove 126 of the at least one U-sized fiber optic module 54 received in the receiving groove 124 of the at least one fiber optic module guide 123.

[0064] FIG. 10 is a close-up view of the at least one fiber optic equipment support member guide 118 showing at least one gap 122 where the at least one fiber optic

equipment support member **68** may be disposed (not shown). The at least one fiber optic equipment support member guide **118** may be made of a strong resilient material, for example, metal or plastic.

[0065] **FIG. 11** is a close-up view of three (3) of the at least one U-sized fiber optic module **54** received by the at least one fiber optic module guide **123** attached to the at least one fiber optic equipment support member **68**. The at least one fiber optic equipment support member **68** may be disposed in the at least one gap **122** of the at least one fiber optic equipment support member guide **118**. The distance **D₂** between the centers of adjacent members of the at least one U-sized fiber optic module **54** is U-sized and a U-fractional unit distance because, for example, at least an integer number of the at least one U-sized fiber optic module may be disposed within a U-unit height of unity. In **FIG. 11**, three (3) of the at least one U-sized fiber optic module **54** may be disposed within a U-unit height of unity as represented by distance **D₃**.

[0066] **FIG. 12** depicts another embodiment of the fiber optic equipment assembly **48(2)**. Unlike the embodiment of **FIG. 5A**, the at least one U-sized fiber optic module **54** may be disposed adjacent to each other along the second horizontal direction **A₃** within a unit height of unity as designated by **D₃**. In the fiber optic equipment assembly **48(2)** the at least one fiber optic equipment assembly **48(2)** the at least one fiber optic equipment support member **118(2)** may be attached to the crossbar portion **112** of the first wall **62** and another of the at least one fiber optic equipment support member **118(2)** may be attached to the crossbar portion **114** of the second wall **64**. Accordingly, the fiber optic equipment assembly **48(2)** may accommodate one-hundred forty-four (144) of the fiber optic connections **56** versus ninety-six (96) for fiber optic equipment assembly **48** shown in **FIG. 5A**. Further, the other external components are virtually the same as depicted in **FIG. 13**.

[0067] With continuing reference to the embodiment of **FIG. 5A**, a method of installing a fiber optic equipment may be disclosed. This method may comprise providing a non-U-width-sized housing **58** including an enclosure **60** forming an internal cavity **66**. The method may also include disposing at least one fiber optic equipment support member **68** within the internal cavity **66**. The at least one fiber optic equipment support member **68** may be configured to support at least one U-sized fiber optic module

54. The method may also include disposing the at least one U-sized fiber optic module **54** within the at least one fiber optic equipment support member **68**, which is disposed within the internal cavity **66**. The at least one U-sized fiber optic module **54** may have a height dimension wherein at least three of the at least one U-sized fiber optic module **54** may be disposed within a U-unit height of unity **D₃** (see **FIG. 11**). The non-U-width-sized housing **58** may have the height **H₁** which is a non-integer multiple of the U-unit height of unity.

[0068] The method may also comprise disposing the at least one fiber optic equipment support member **68** within at least one fiber optic equipment support member guide **118**. Then, at least one fiber optic equipment support member **68** may be secured within the internal cavity **66** of the enclosure **60**.

[0069] Further, the method may also comprise securing at least one fiber optic equipment support member guide **118** to at least one of a first wall **62** and a second wall **64** within the internal cavity **66**. Next, the at least one fiber optic equipment support member **68** may be received in the at least one fiber optic equipment support member guide **118**, wherein the enclosure **60** comprises the first wall **62** and the second wall **64**.

[0070] The at least one U-sized fiber optic module **54** may be received in at least one fiber optic module guide **123**, wherein each of the at least one fiber optic equipment support member **68** may comprise the at least one fiber optic module guide **123**.

[0071] In the method, a center of each of a plurality of U-sized fiber optic modules may be separated by a U-fractional unit distance **D₂**, and the at least one U-sized fiber optic module **54** may comprise the plurality of U-sized fiber optic modules.

[0072] Many modifications and other embodiments not set forth herein will come to mind to one skilled in the art to which the embodiments pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings.

[0073] Therefore, it is to be understood that the description and claims are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. It is intended that the embodiments cover the modifications and variations of the embodiments provided they come within the scope of the appended claims and their

equivalents. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A fiber optic equipment assembly, comprising:
a non-U-width-sized housing comprising an enclosure forming an internal cavity disposed therein;
at least one fiber optic equipment support member disposed within the internal cavity, the at least one fiber optic equipment support member configured to support at least one U-sized fiber optic module; and
the at least one U-sized fiber optic module disposed within the at least one fiber optic equipment support member disposed within the internal cavity, the at least one U-sized fiber optic module having a height dimension wherein at least three of the at least one U-sized fiber optic module can be disposed within a U-unit height of unity.
2. The fiber optic equipment assembly of claim 1, wherein the non-U-width-sized housing has a height which is a non-integer multiple of the U-unit height of unity.
3. The fiber optic equipment assembly of claim 1, wherein the at least one fiber optic equipment support member is disposed within at least one fiber optic equipment support member guide secured within the internal cavity of the enclosure.
4. The fiber optic equipment assembly of claim 1, wherein each of the at least one fiber optic equipment support member comprises at least one fiber optic module guide configured to receive the at least one U-sized fiber optic module.
5. The fiber optic equipment assembly of claim 1, wherein the at least one U-sized fiber optic module comprises a plurality of U-sized fiber optic modules, and a center of each of the plurality of U-sized fiber optic modules separated by a U-fractional unit distance.

6. The fiber optic equipment assembly of claim 1, wherein the non-U-width-sized housing is configured to support the at least one U-sized fiber optic module providing more than seventy-two (72) fiber connections.

7. The fiber optic equipment assembly of claim 1, wherein the non-U-width-sized housing is configured to support the at least one U-sized fiber optic module providing more than ninety-six (96) fiber connections.

8. The fiber optic equipment assembly of claim 1, wherein the enclosure comprises a first wall and second wall.

9. The fiber optic equipment assembly of claim 8, further comprising at least one fiber optic equipment support member guide secured to the at least one of the first wall and the second wall within the internal cavity and receiving the at least one fiber optic equipment support member.

10. The fiber optic equipment assembly of claim 9, wherein each of the at least one fiber optic equipment support members comprises at least one fiber optic module guide configured to receive the at least one U-sized fiber optic module.

11. A fiber optic equipment assembly, comprising:

- a non-U-width-sized housing comprising an enclosure forming an internal cavity disposed therein;

- at least one fiber optic equipment support member disposed within the internal cavity, the at least one fiber optic equipment support member configured to support at least one U-sized fiber optic module; and

- at least one U-sized fiber optic module disposed within the at least one fiber optic equipment support member disposed within the internal cavity, the at least one U-sized fiber optic module having a width dimension wherein at least three of the at least one U-sized fiber optic module can be disposed adjacent to each other along a horizontal direction within a U-unit height of unity in the non-U-width-sized housing.

12. The fiber optic equipment assembly of claim 11, wherein the non-U-width-sized housing has a height which is a non-integer multiple of the U-unit height of unity.

13. The fiber optic equipment assembly of claim 11, wherein the at least one fiber optic equipment support member is disposed within at least one fiber optic equipment support member guide secured within the internal cavity of the enclosure.

14. The fiber optic equipment assembly of claim 11, wherein each of the at least one fiber optic equipment support member comprises at least one fiber optic module guide configured to receive the at least one U-sized fiber optic module.

15. The fiber optic equipment assembly of claim 11, wherein the at least one U-sized fiber optic module comprises a plurality of U-sized fiber optic modules, and a center of each of the plurality of U-sized fiber optic modules separated by a U-fractional unit distance.

16. The fiber optic equipment assembly of claim 11, wherein the non-U-width-sized housing is configured to support the at least one U-sized fiber optic module providing more than seventy-two (72) fiber connections.

17. The fiber optic equipment assembly of claim 11, wherein the non-U-width-sized housing is configured to support the at least one U-sized fiber optic module providing more than ninety-six (96) fiber connections.

18. The fiber optic equipment assembly of claim 11, wherein the enclosure comprises a first wall and second wall.

19. The fiber optic equipment assembly of claim 18, further comprising at least one fiber optic equipment support member guide secured to the at least one of the first wall

and the second wall within the internal cavity and receiving the at least one fiber optic equipment support member.

20. The fiber optic equipment assembly of claim 19, wherein each of the at least one fiber optic equipment support members comprises at least one fiber optic module guide configured to receive the at least one U-sized fiber optic module.

21. A method of installing fiber optic equipment, comprising:

providing a non-U-width-sized housing comprising an enclosure forming an internal cavity disposed therein;

disposing at least one fiber optic equipment support member within the internal cavity, the at least one fiber optic equipment support member configured to support at least one U-sized fiber optic module; and

disposing the at least one U-sized fiber optic module within the at least one fiber optic equipment support member disposed within the internal cavity, the at least one U-sized fiber optic module having a height dimension wherein at least three of the at least one U-sized fiber optic module can be disposed within a U-unit height of unity.

22. The method of installing the fiber optic equipment of claim 21, wherein the non-U-width-sized housing has a height which is a non-integer multiple of the U-unit height of unity.

23. The method of installing the fiber optic equipment of claim 21, further comprising:

disposing the at least one fiber optic equipment support member within at least one fiber optic equipment support member guide; and

securing at least one fiber optic equipment support member within the internal cavity of the enclosure.

24. The method of installing the fiber optic equipment of claim 21, further comprising:

securing at least one fiber optic equipment support member guide to at least one of a first wall and a second wall within the internal cavity, and

receiving the at least one fiber optic equipment support member in the at least one fiber optic equipment support member guide,

wherein the enclosure comprises the first wall and the second wall.

25. The method of installing the fiber optic equipment of claim 21, further comprising receiving the at least one U-sized fiber optic module in at least one fiber optic module guide,

wherein each of the at least one fiber optic equipment support member comprises the at least one fiber optic module guide.

26. The method of installing the fiber optic equipment of claim 25, wherein the receiving the at least one U-sized fiber optic module in the at least one fiber optic module guide comprises separating a center of each of a plurality of U-sized fiber optic modules by a U-fractional unit distance, and the at least one U-sized fiber optic module comprises the plurality of U-sized fiber optic modules.

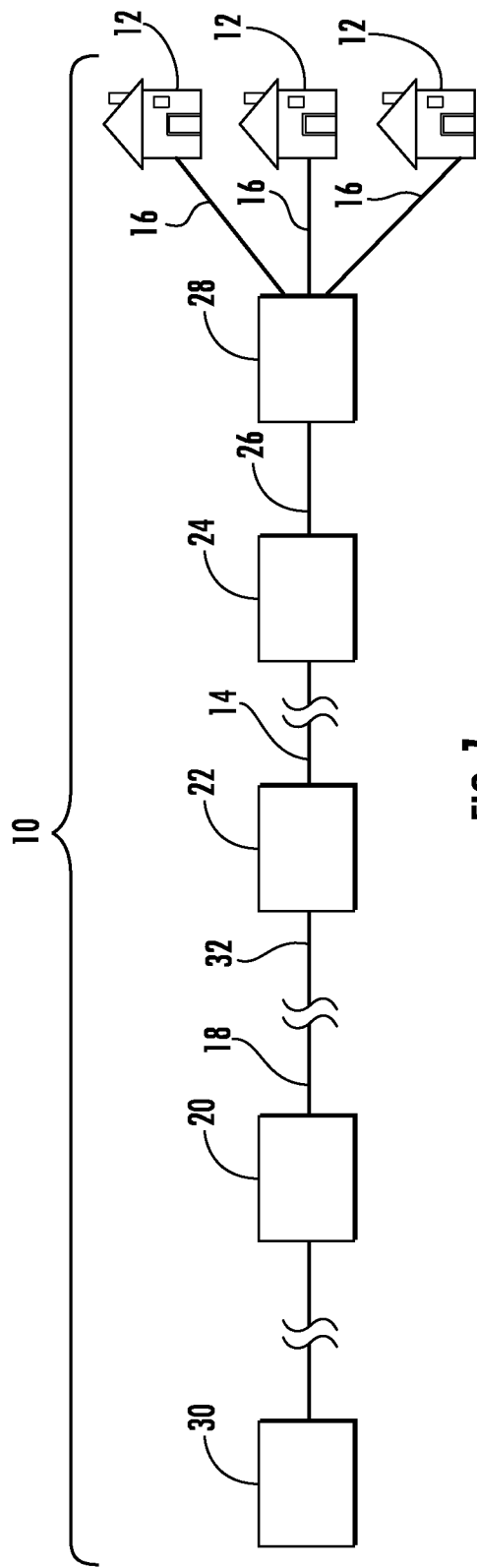


FIG. 1
(PRIOR ART)

2/23

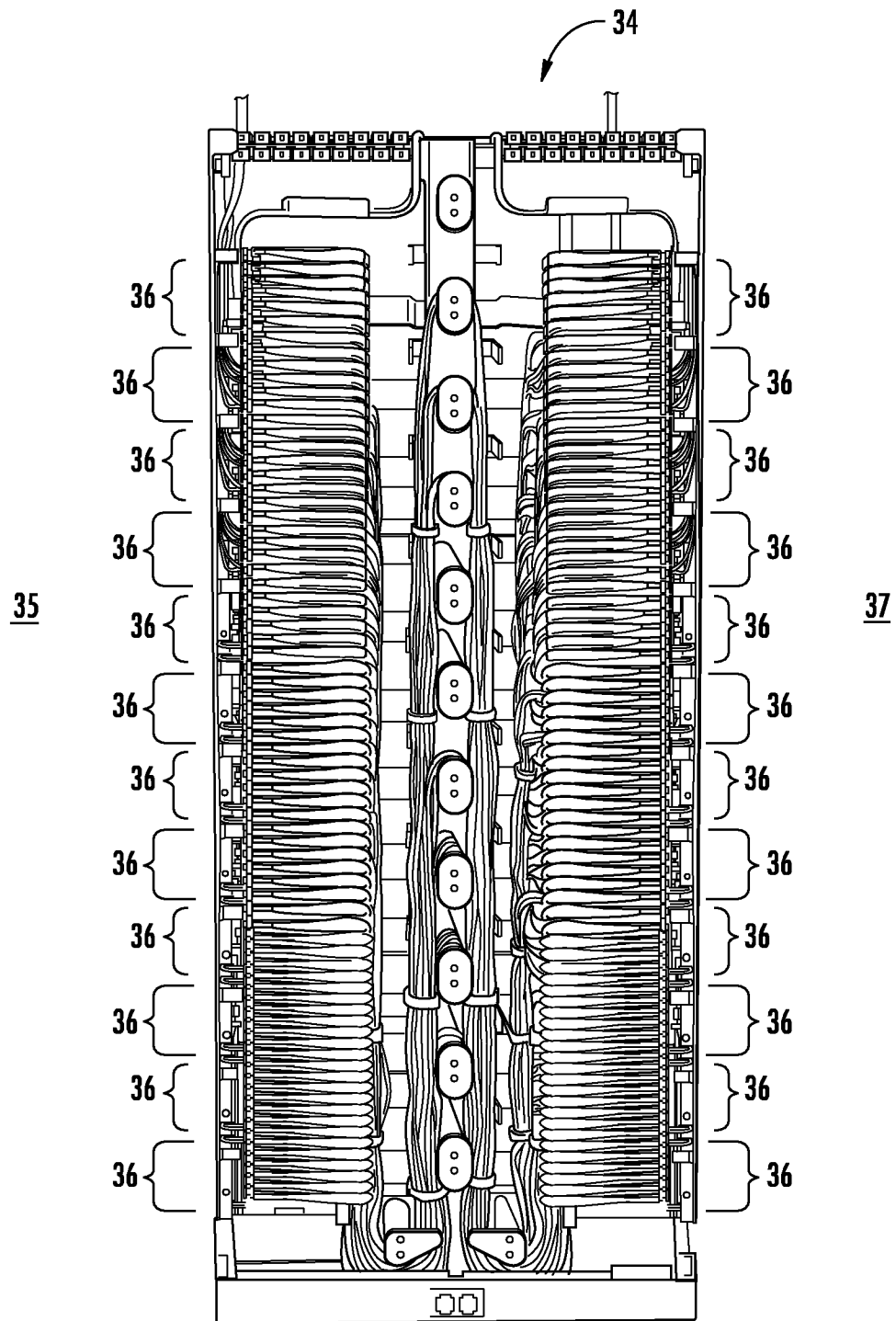
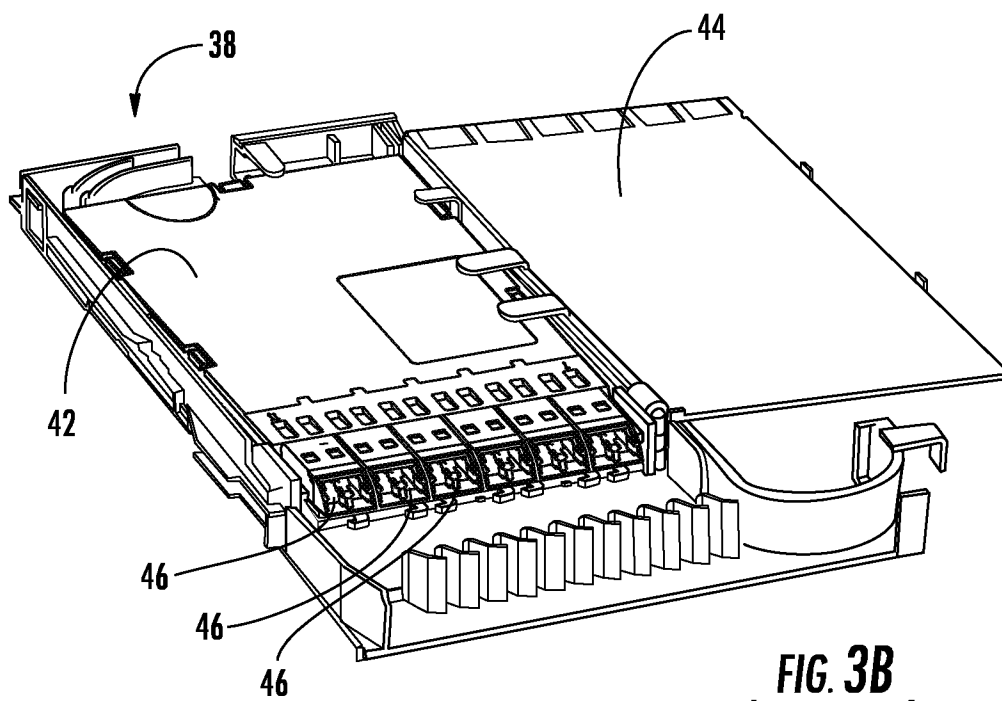
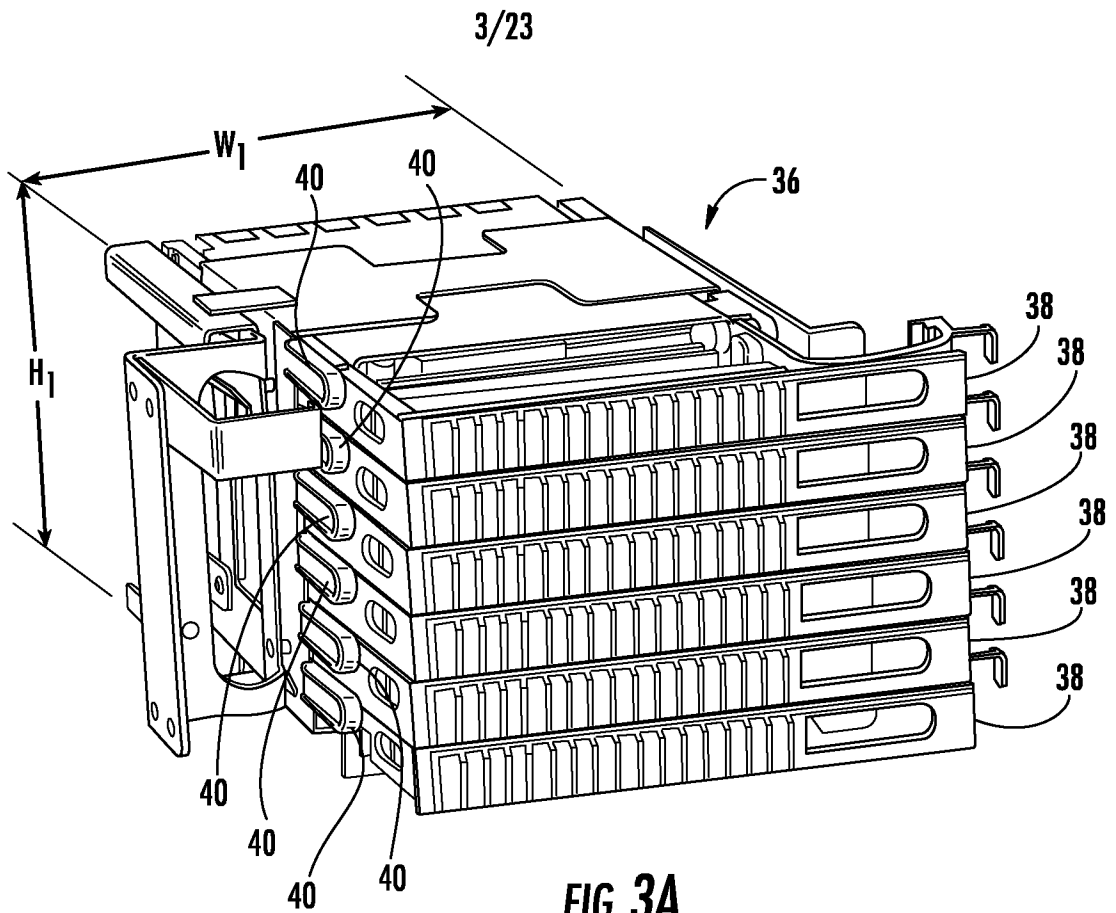


FIG. 2
(PRIOR ART)



4/23

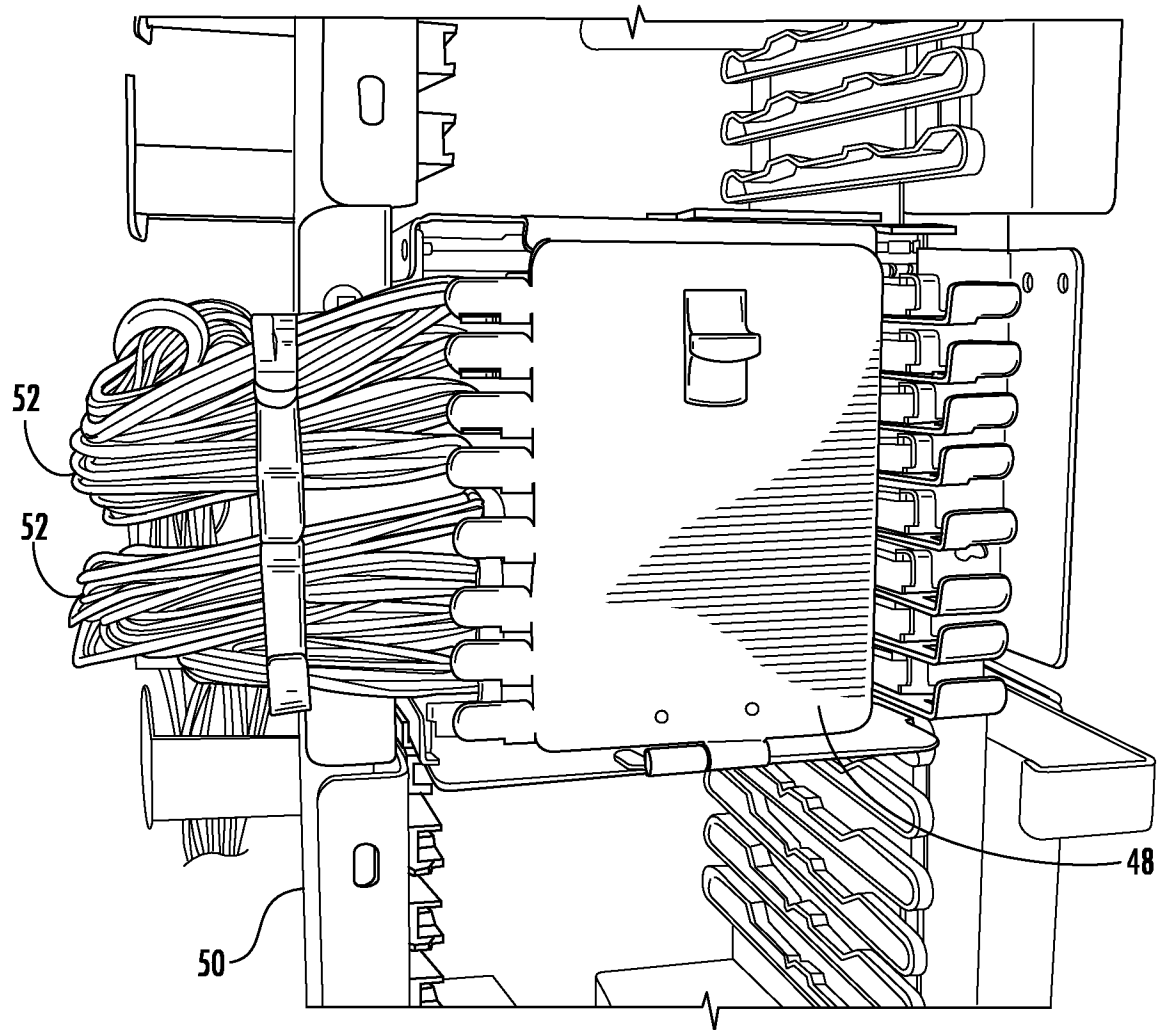
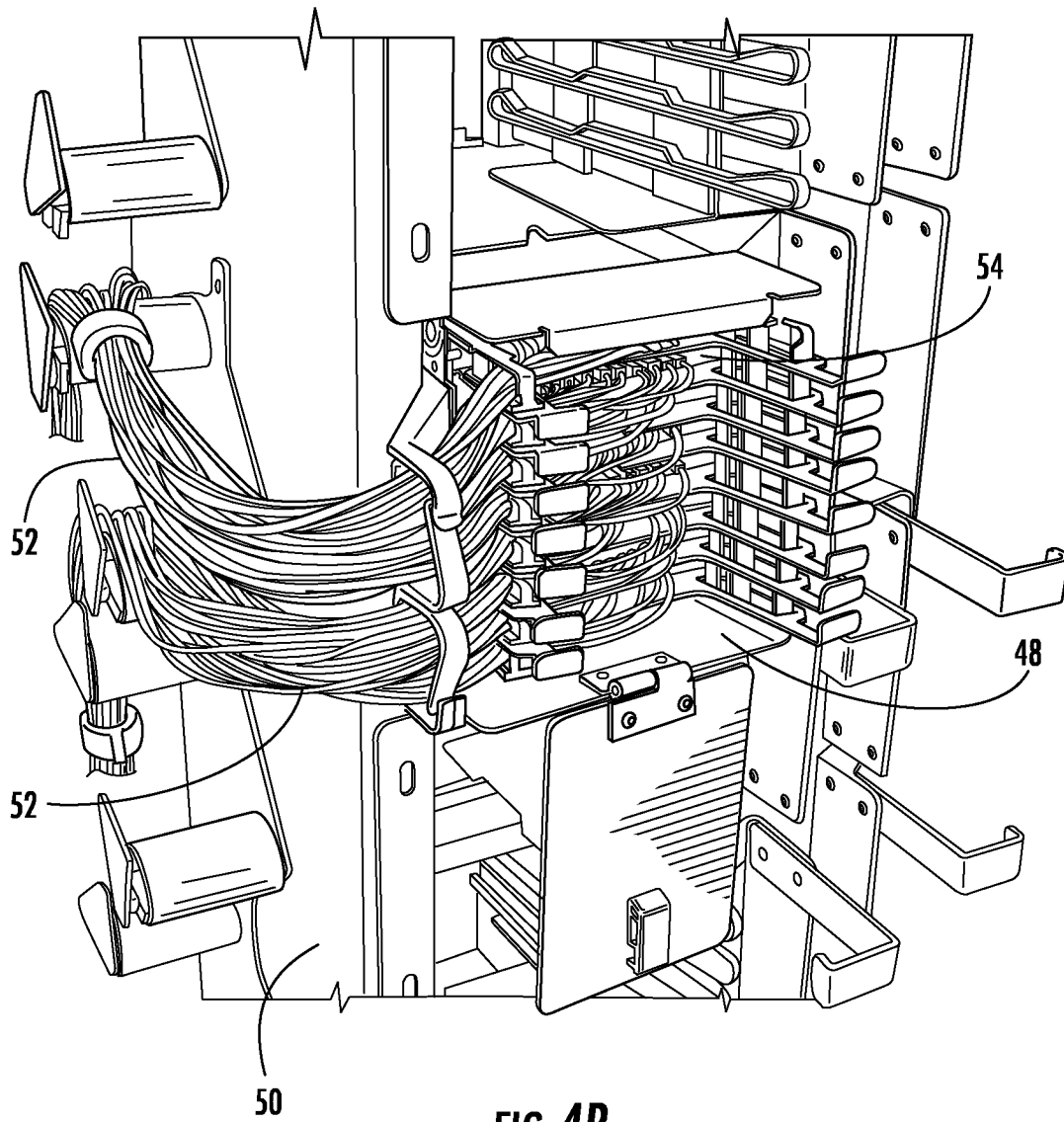


FIG. 4A

5/23



6/23

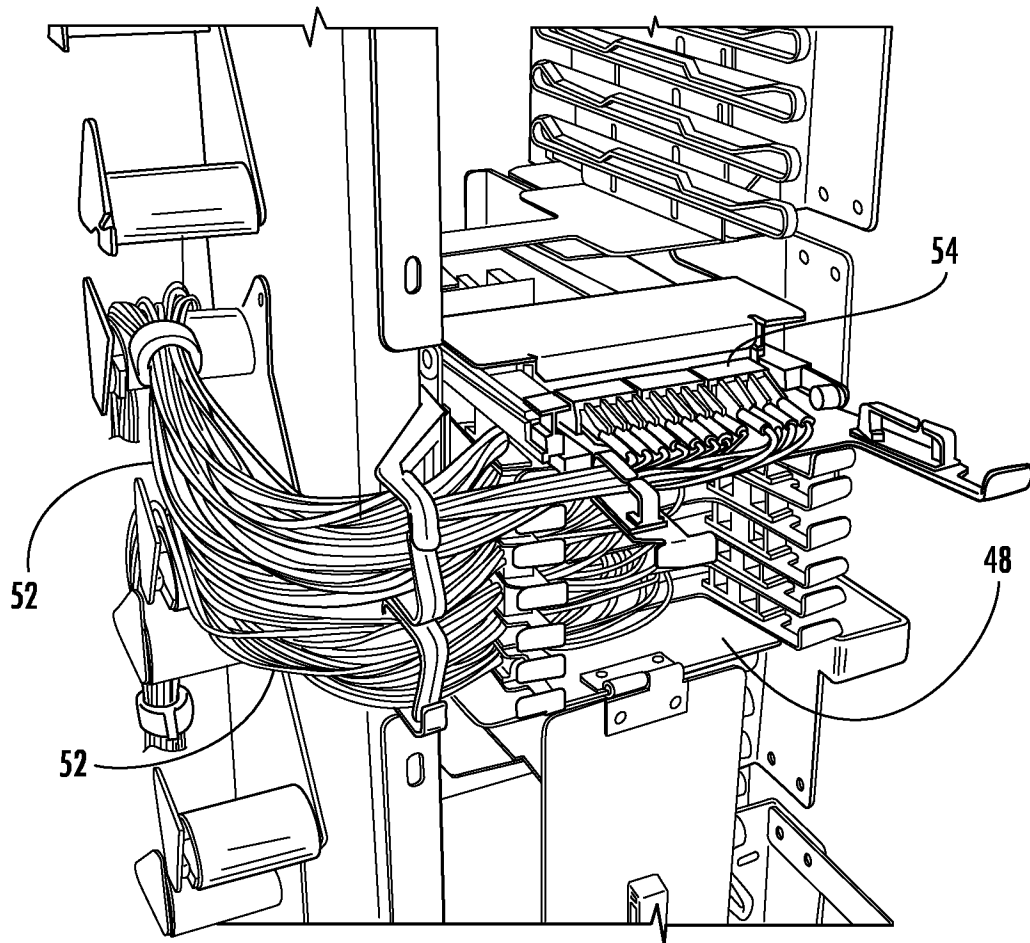
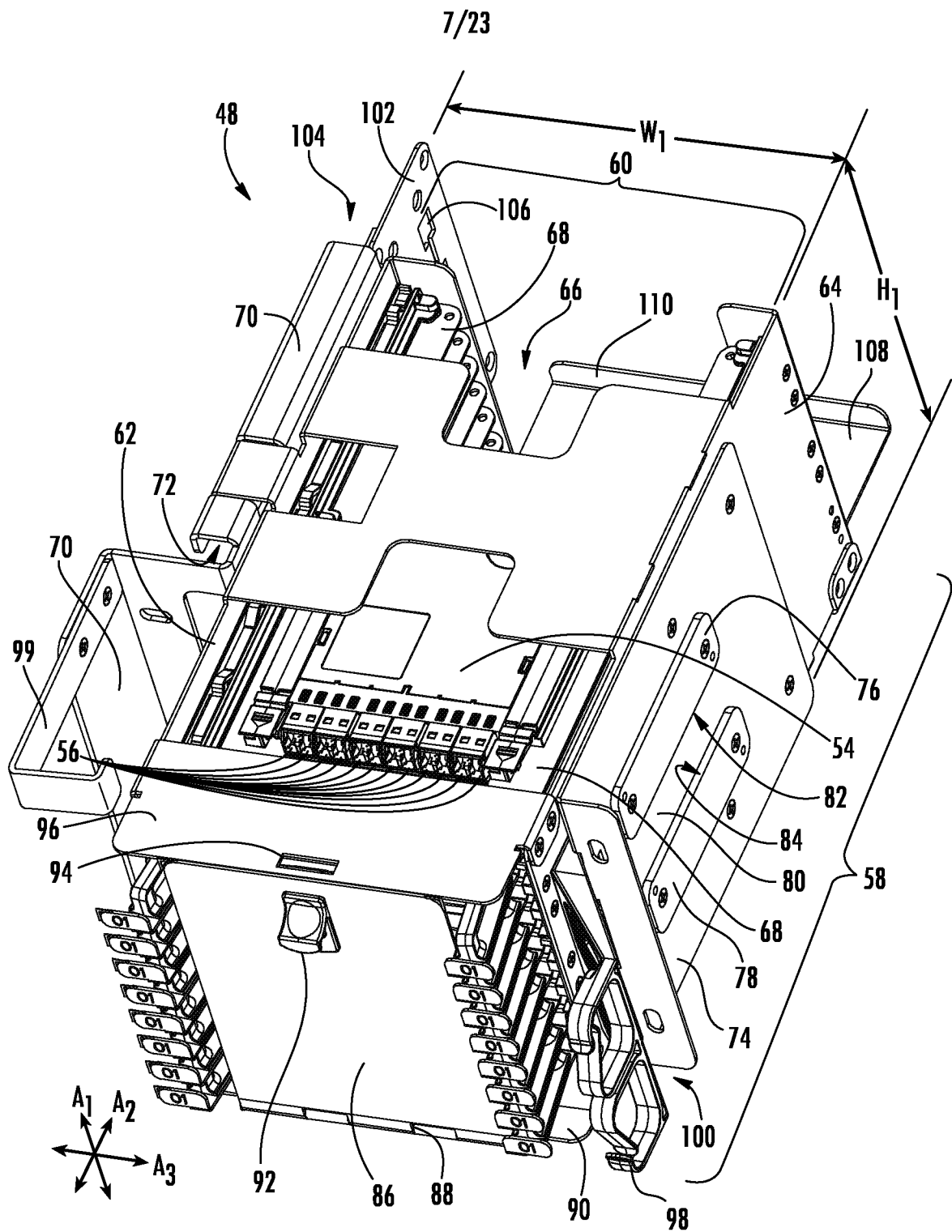


FIG. 4C



8/23

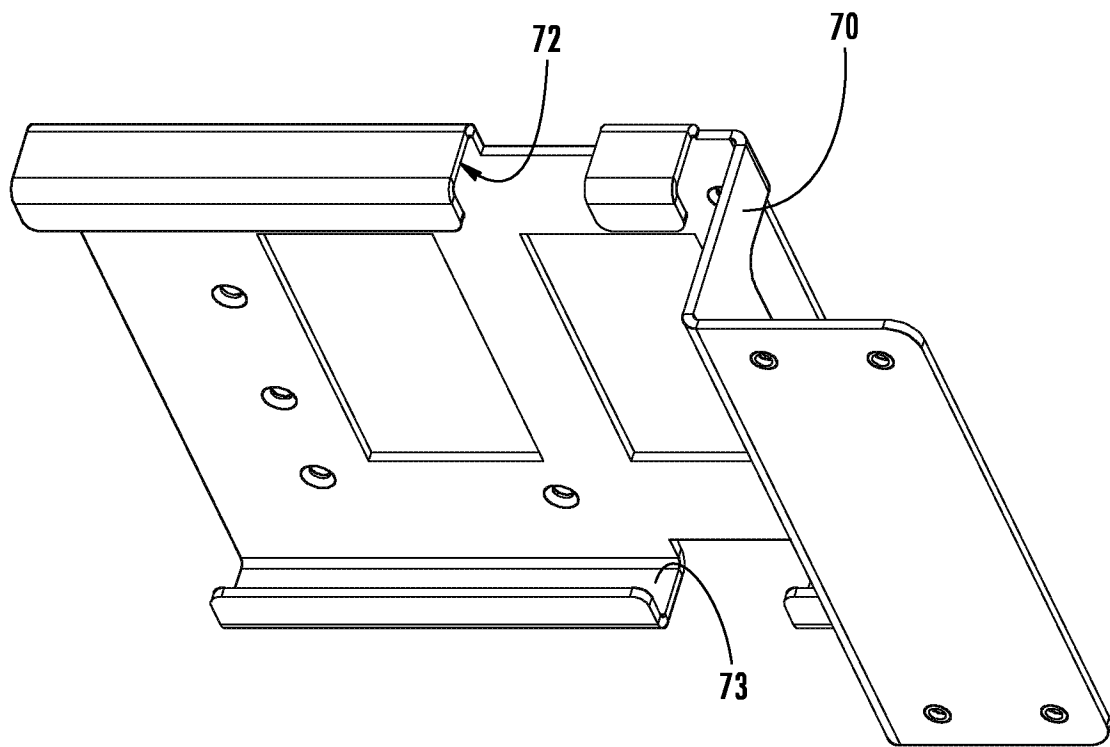
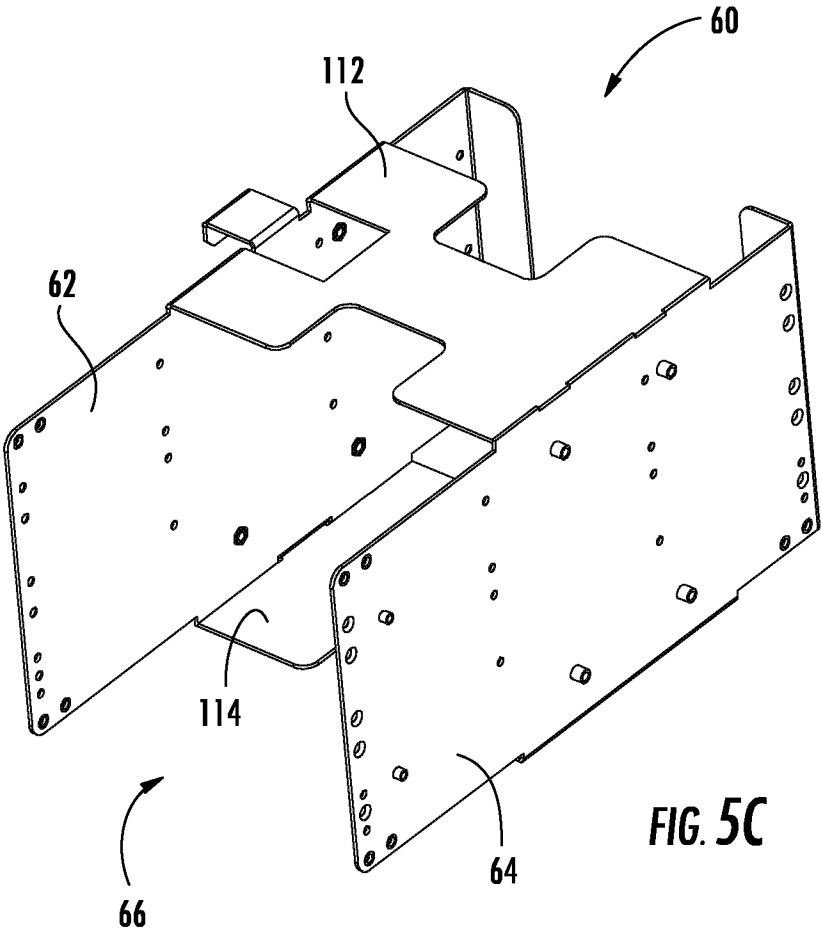
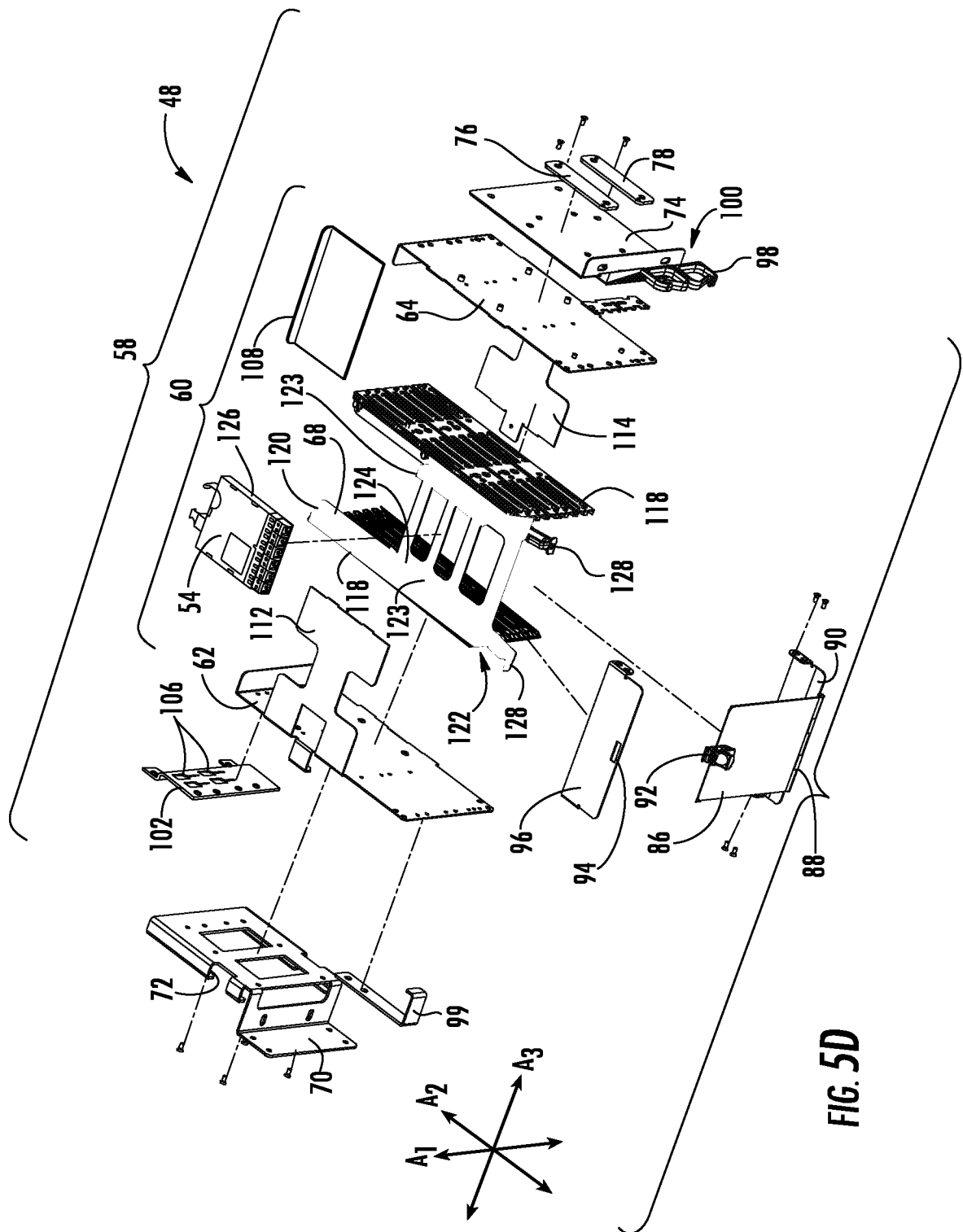


FIG. 5B



10/23



11/23

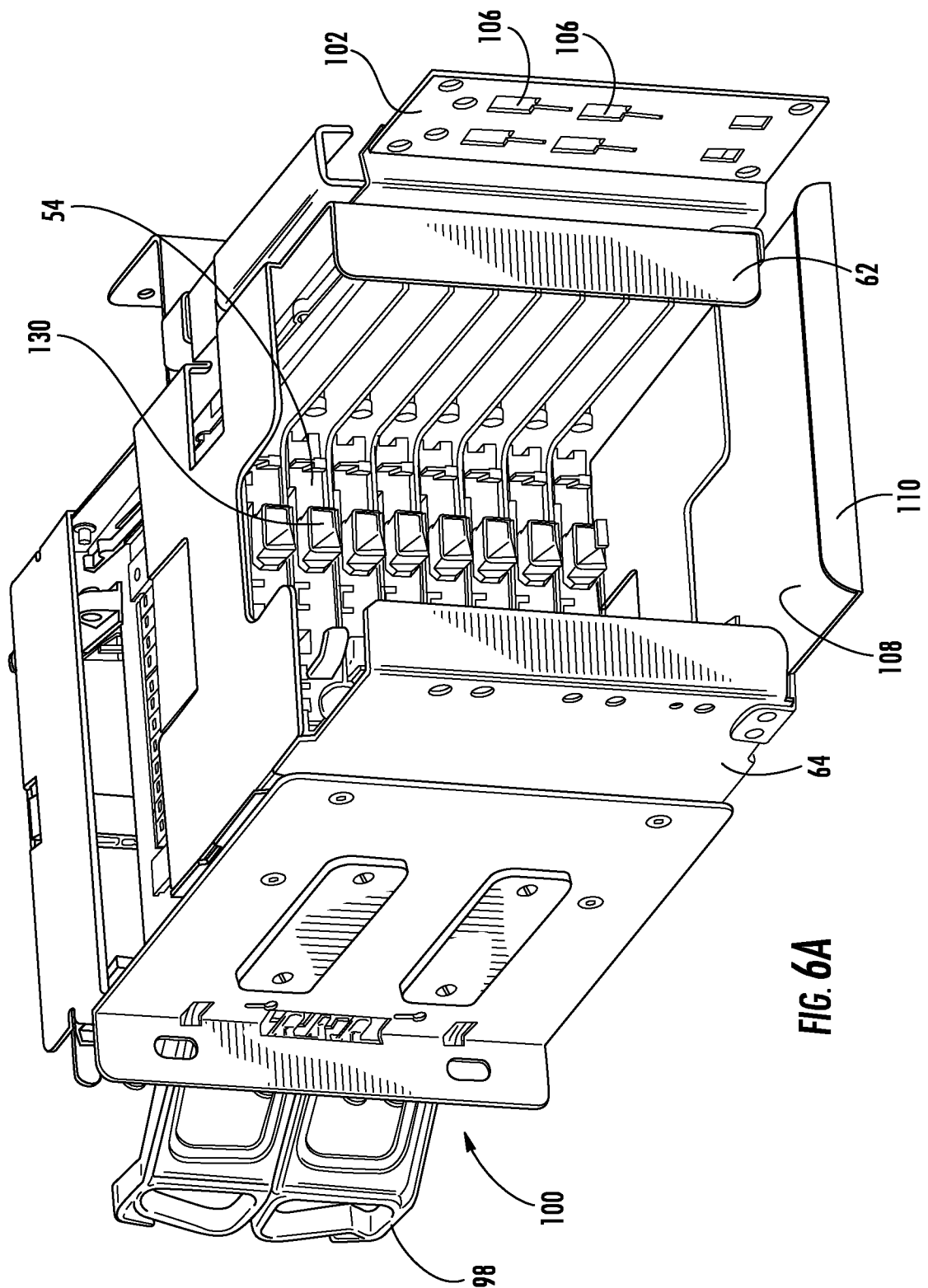


FIG. 6A

12/23

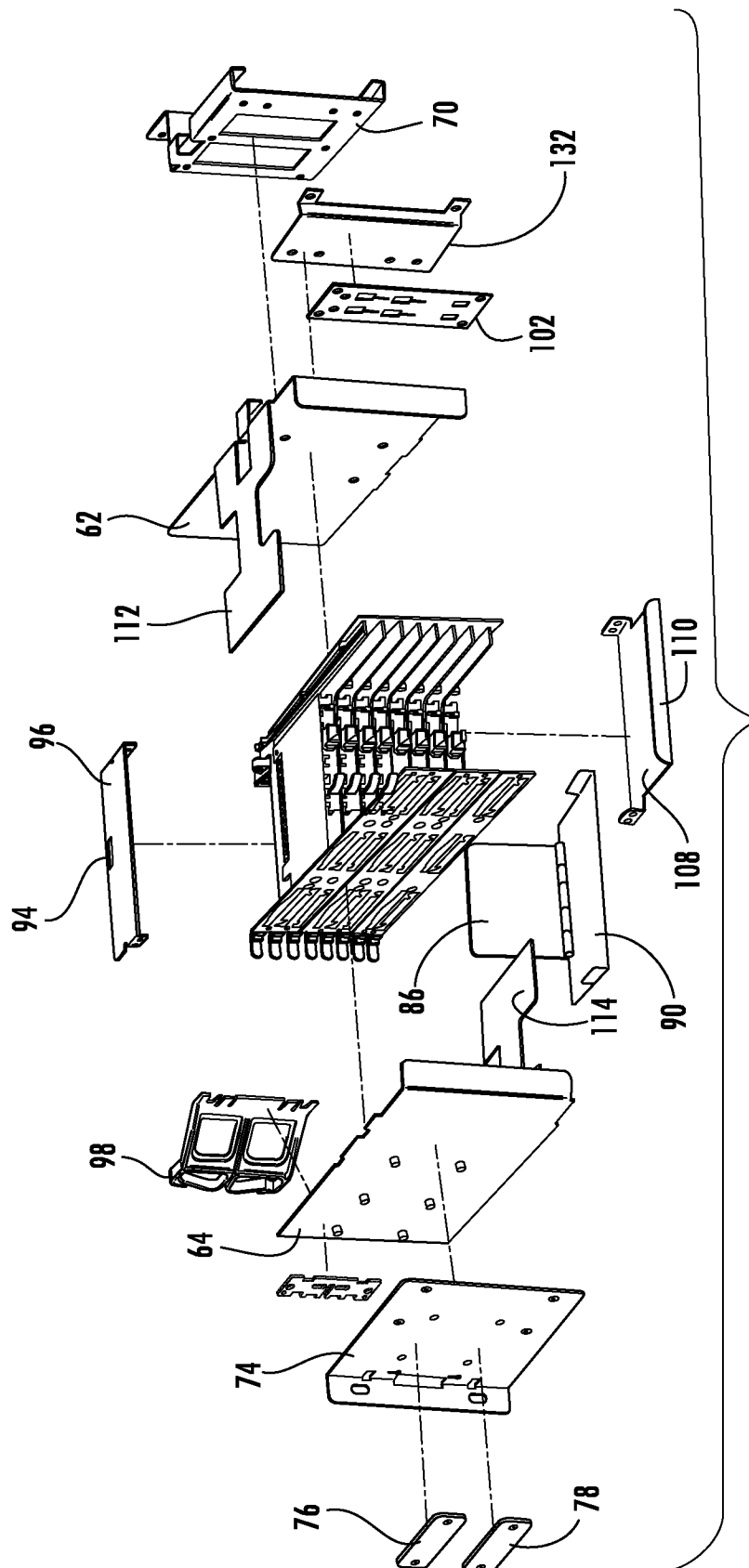
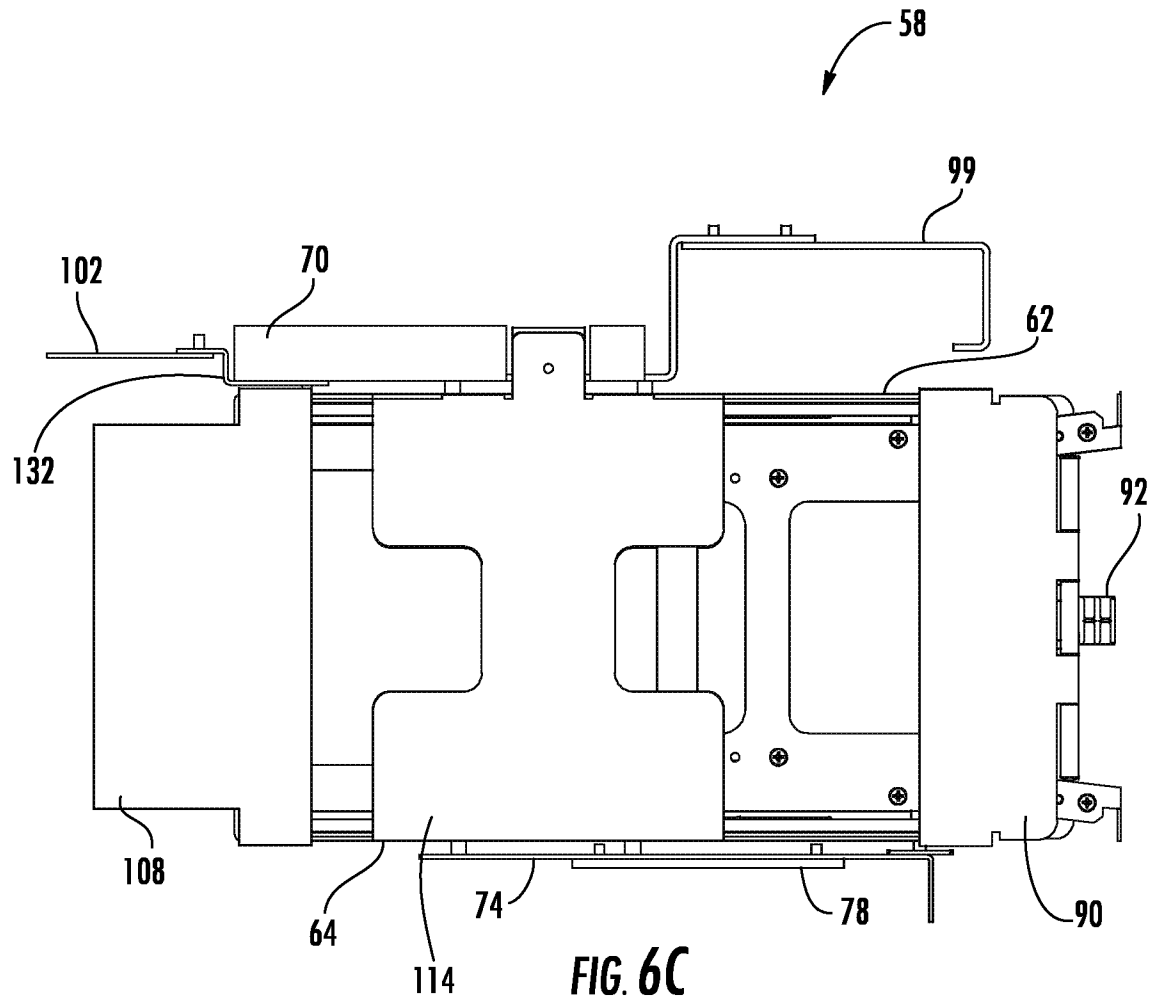
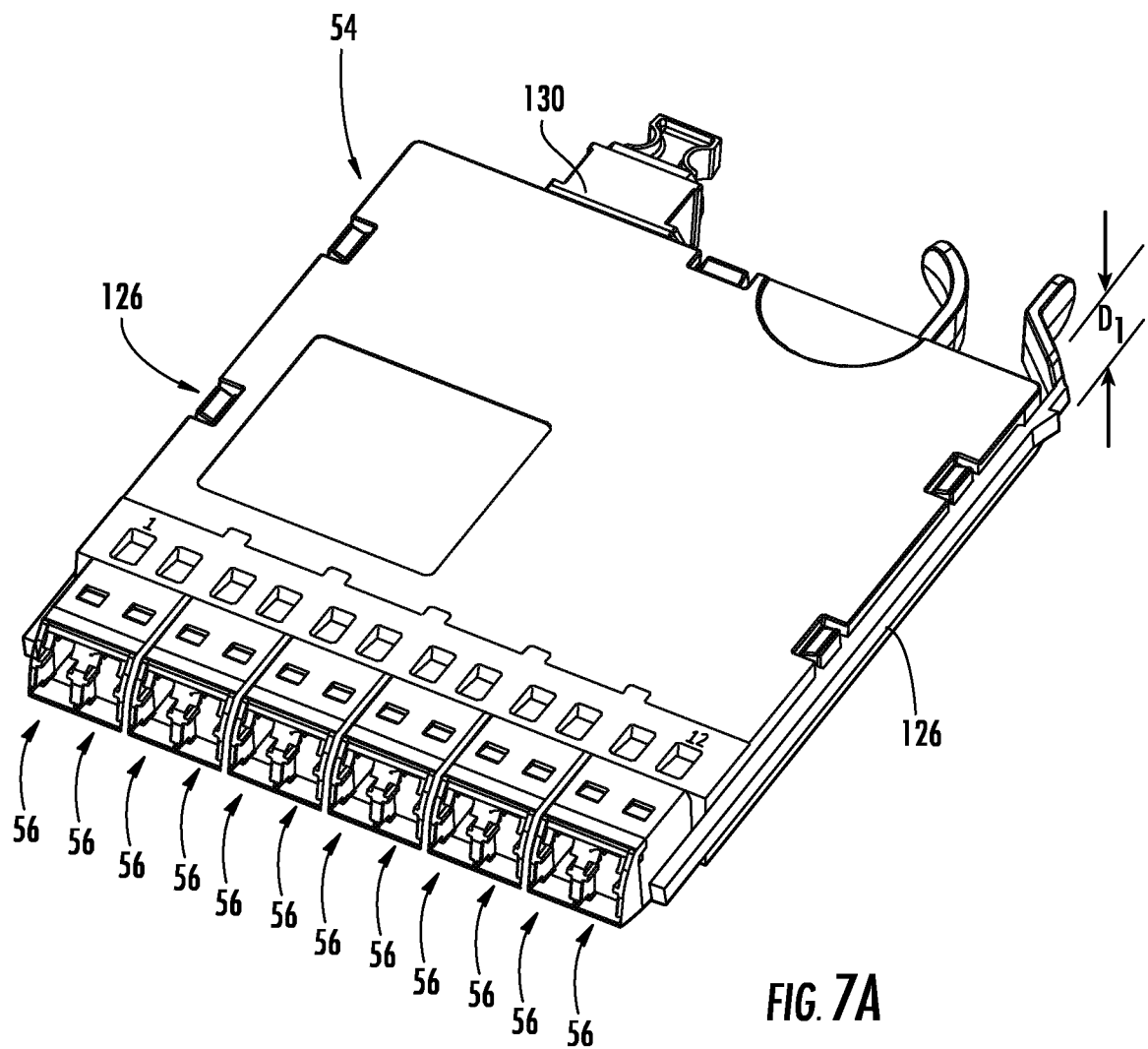


FIG. 6B

13/23



14/23



15/23

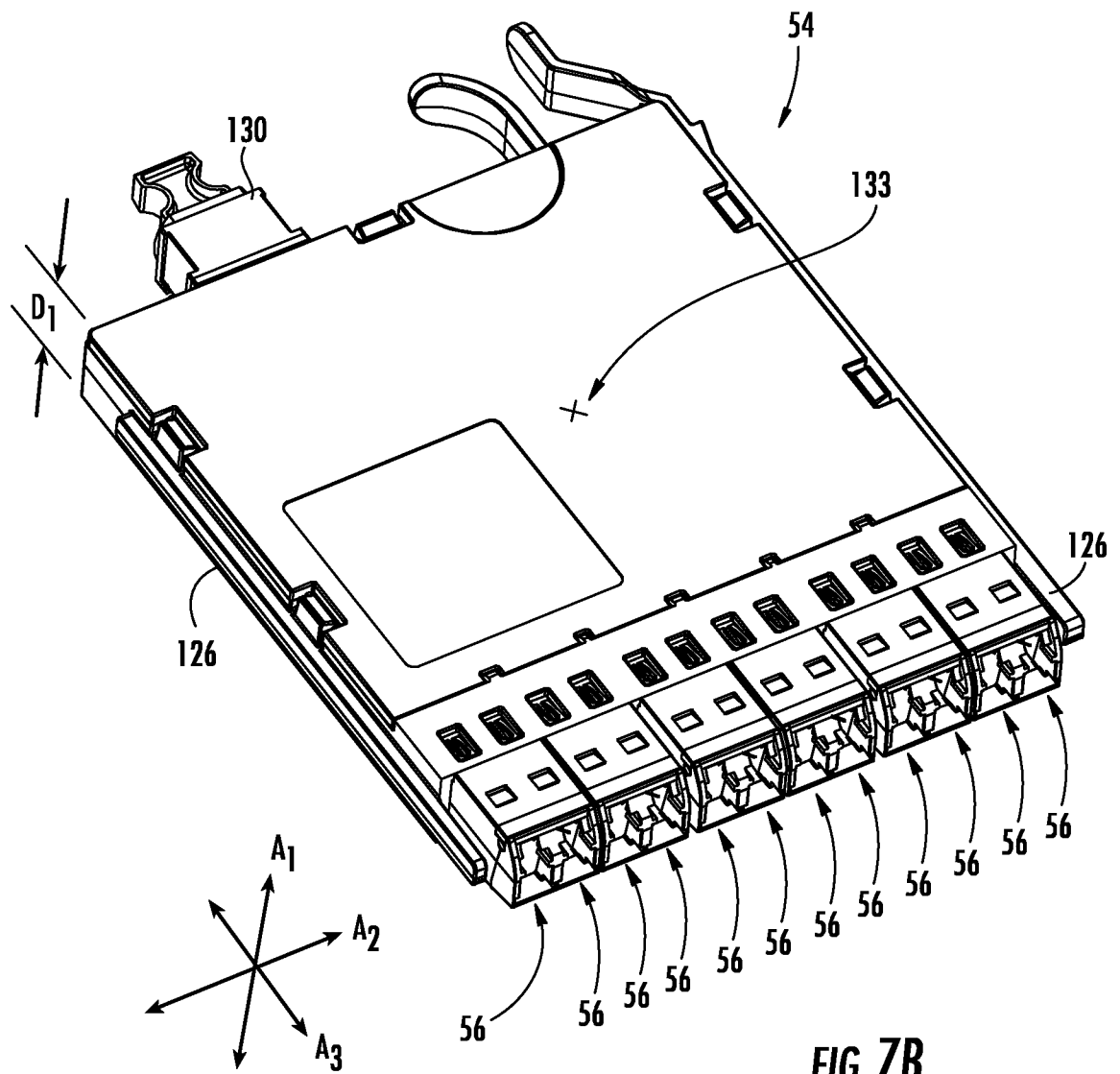
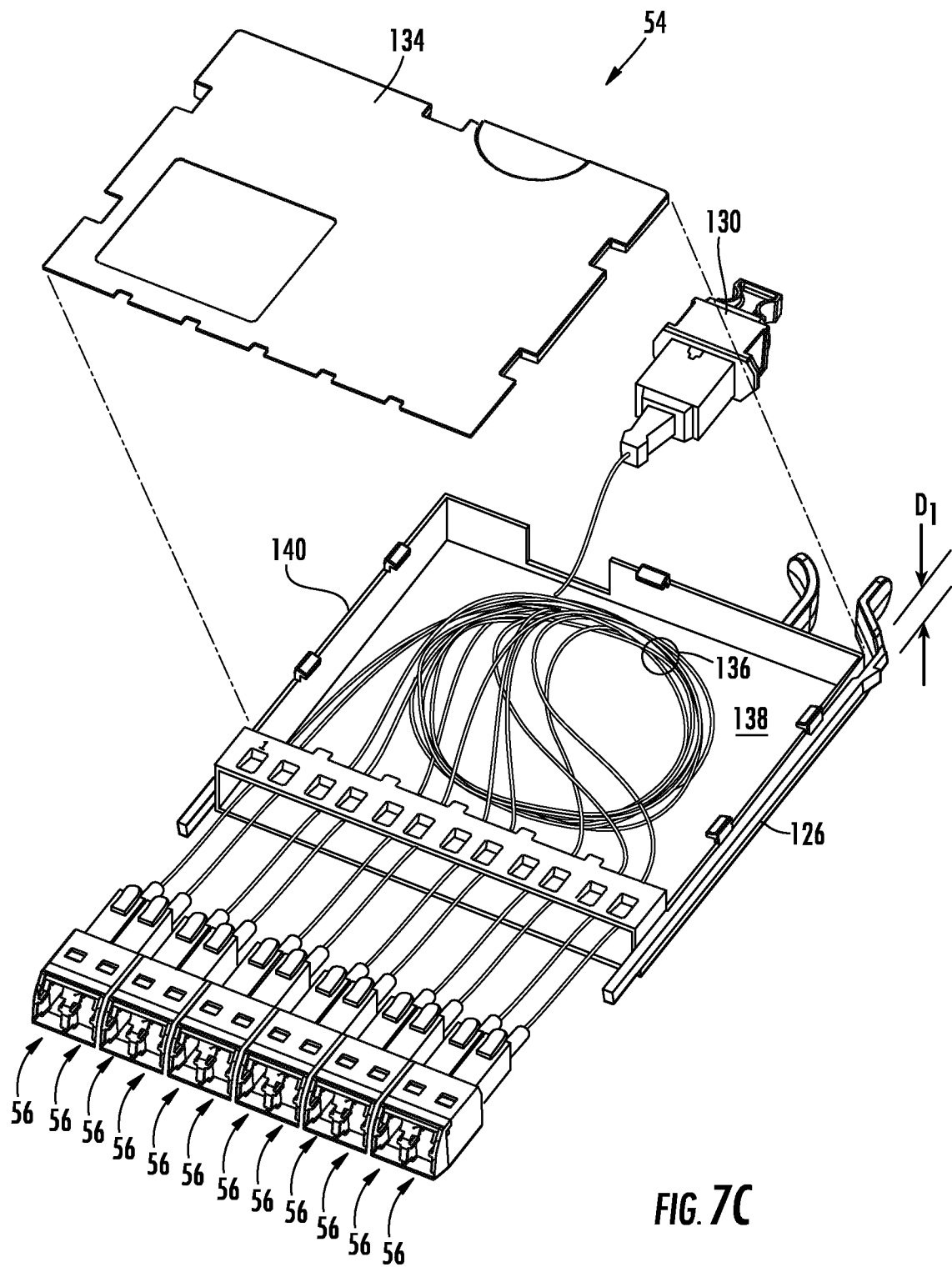


FIG. 7B

16/23



17/23

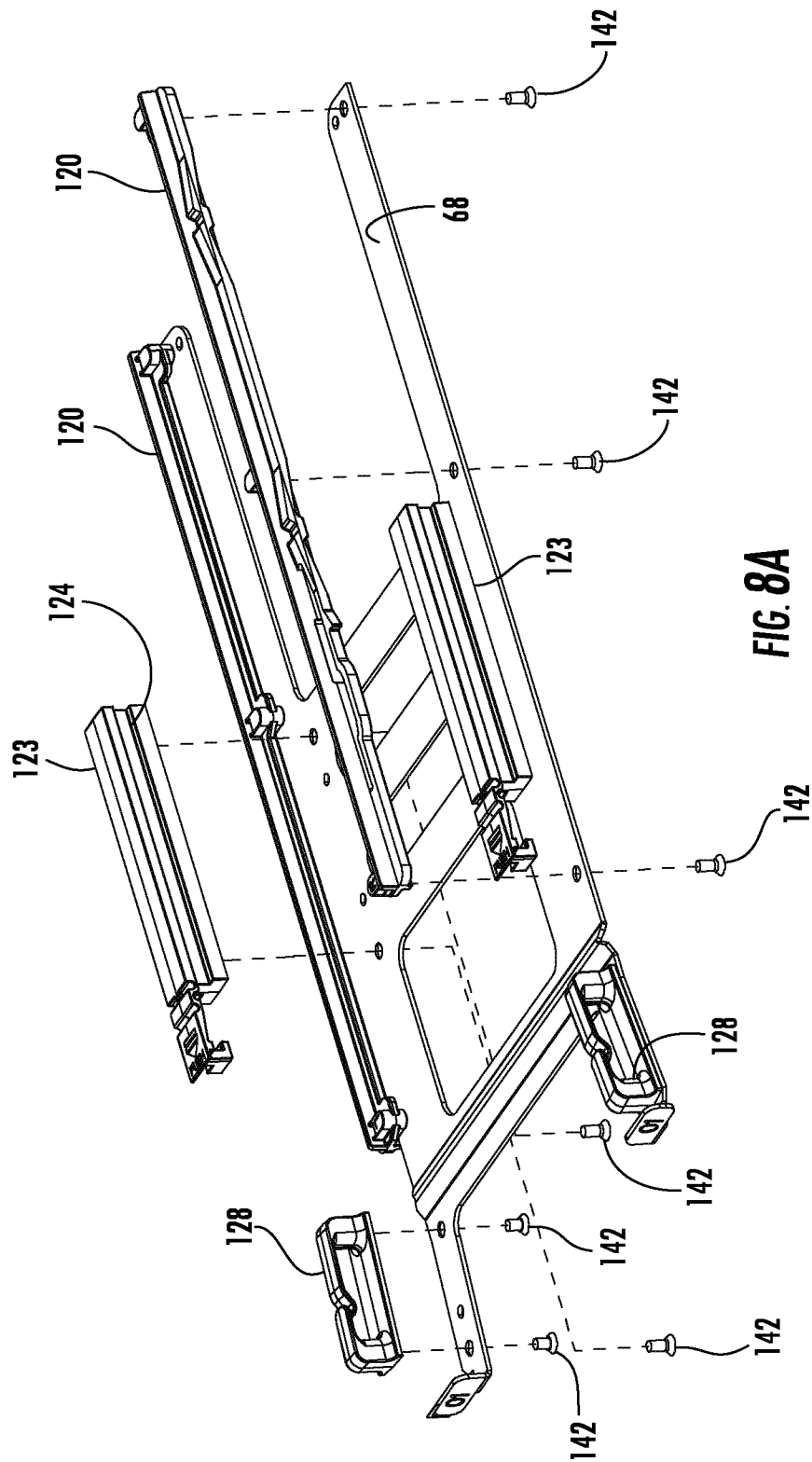


FIG. 8A

18/23

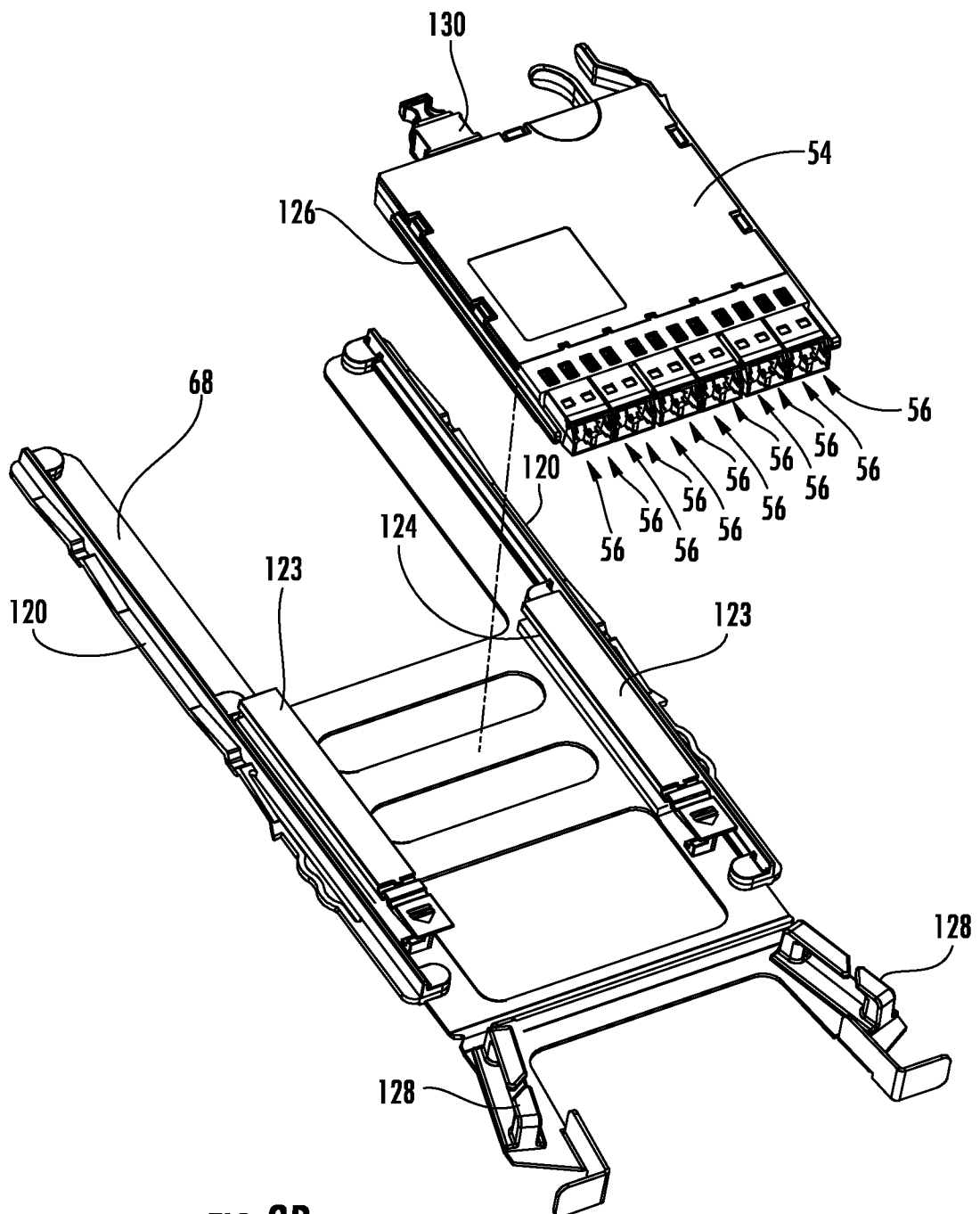
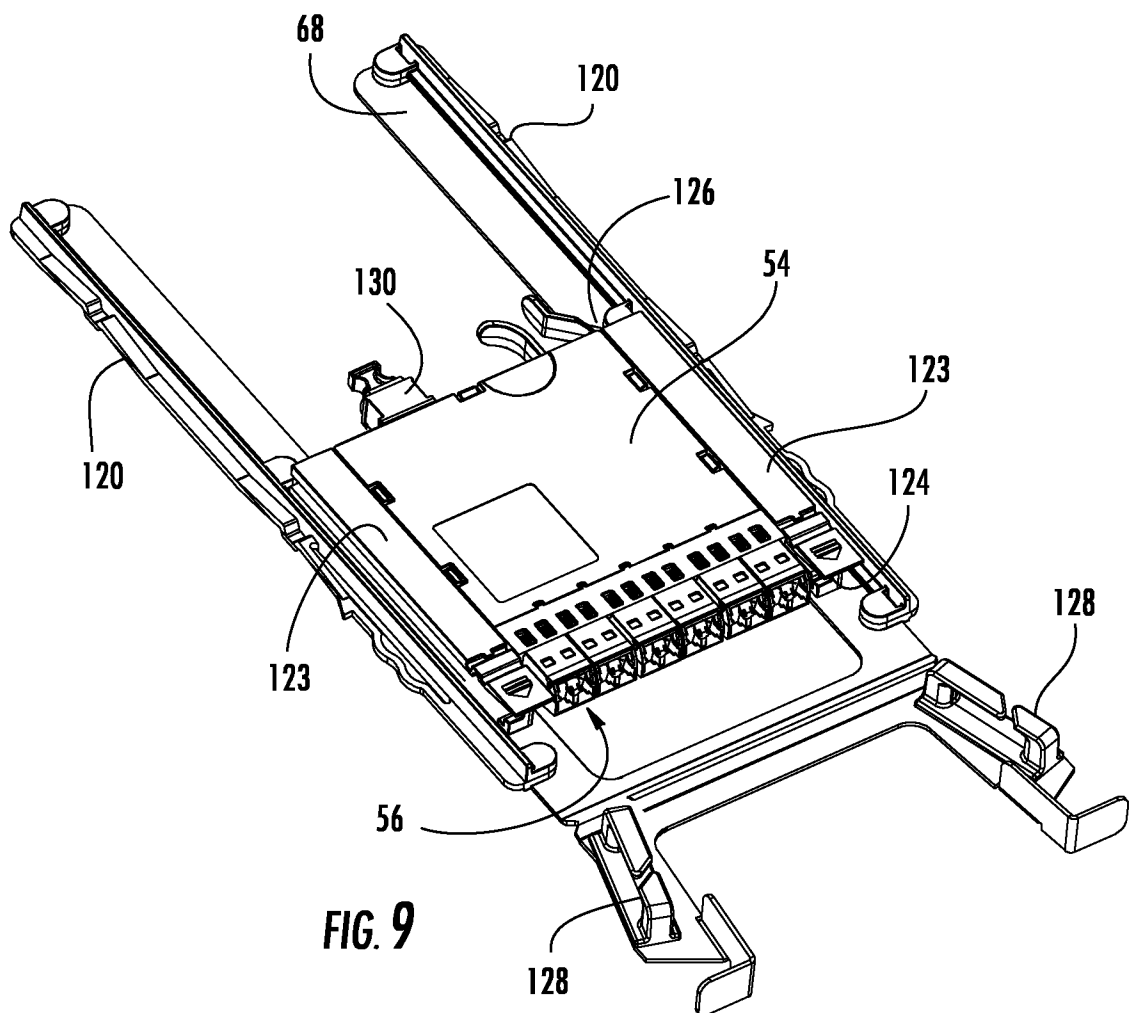
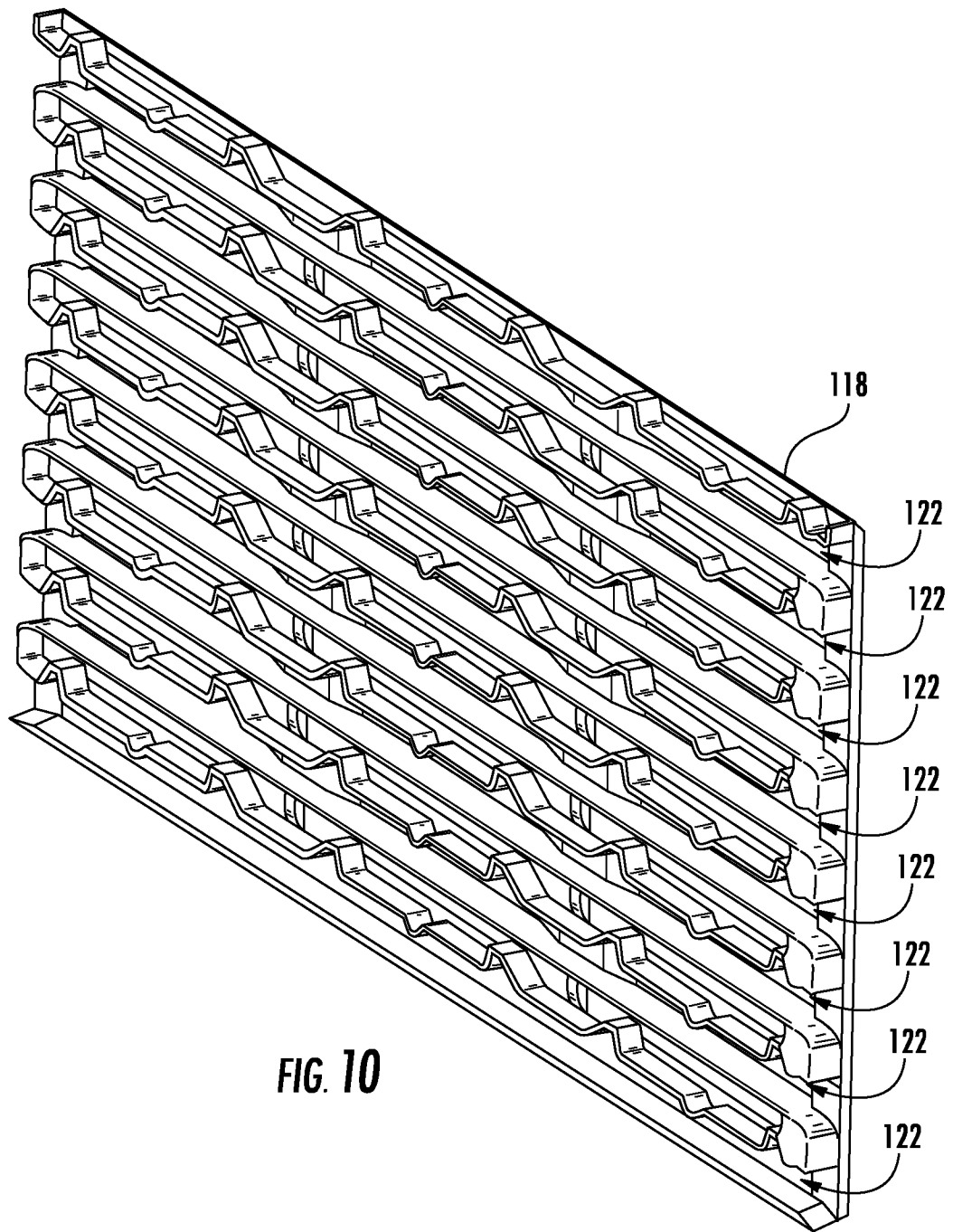


FIG. 8B

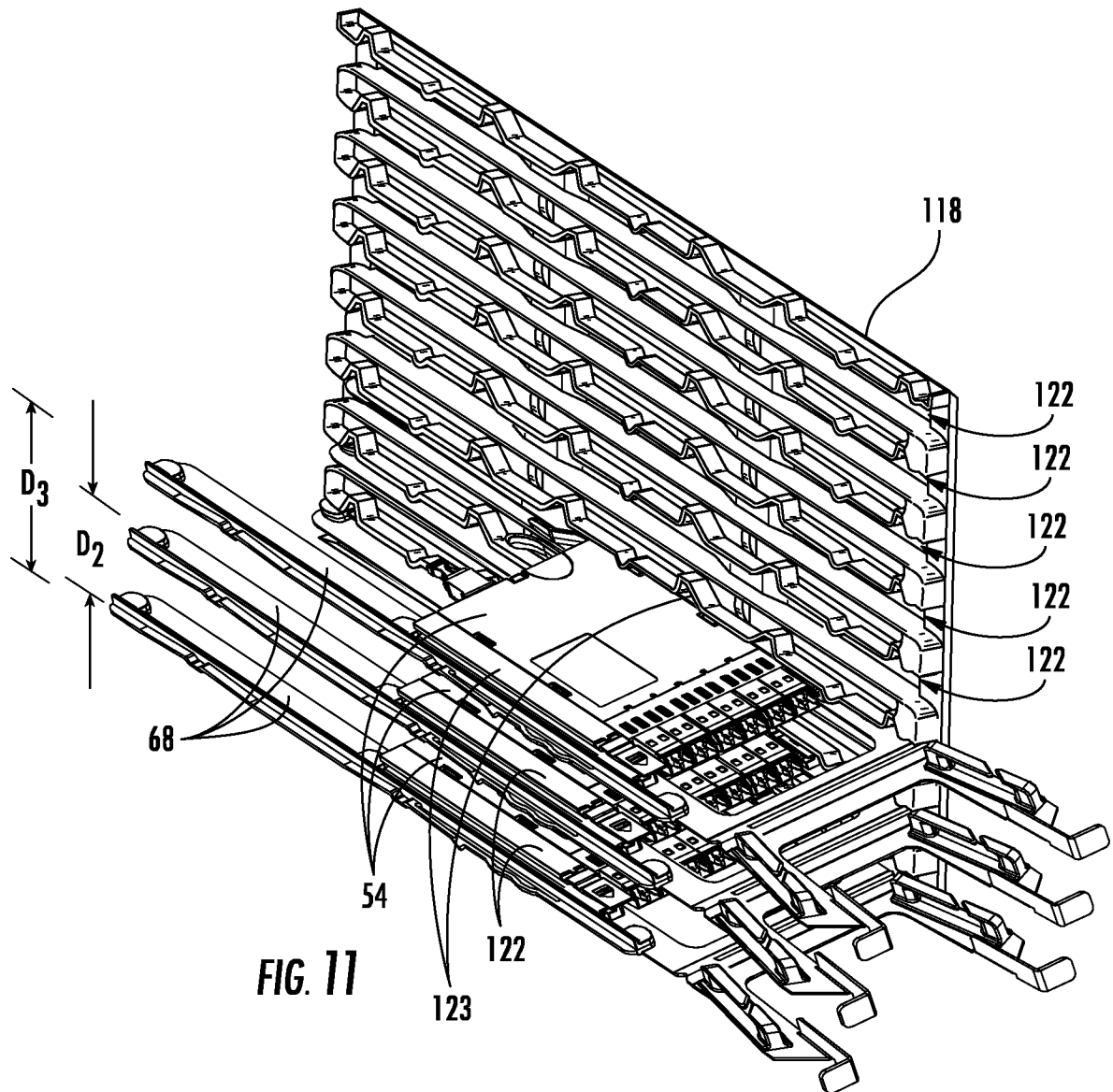
19/23



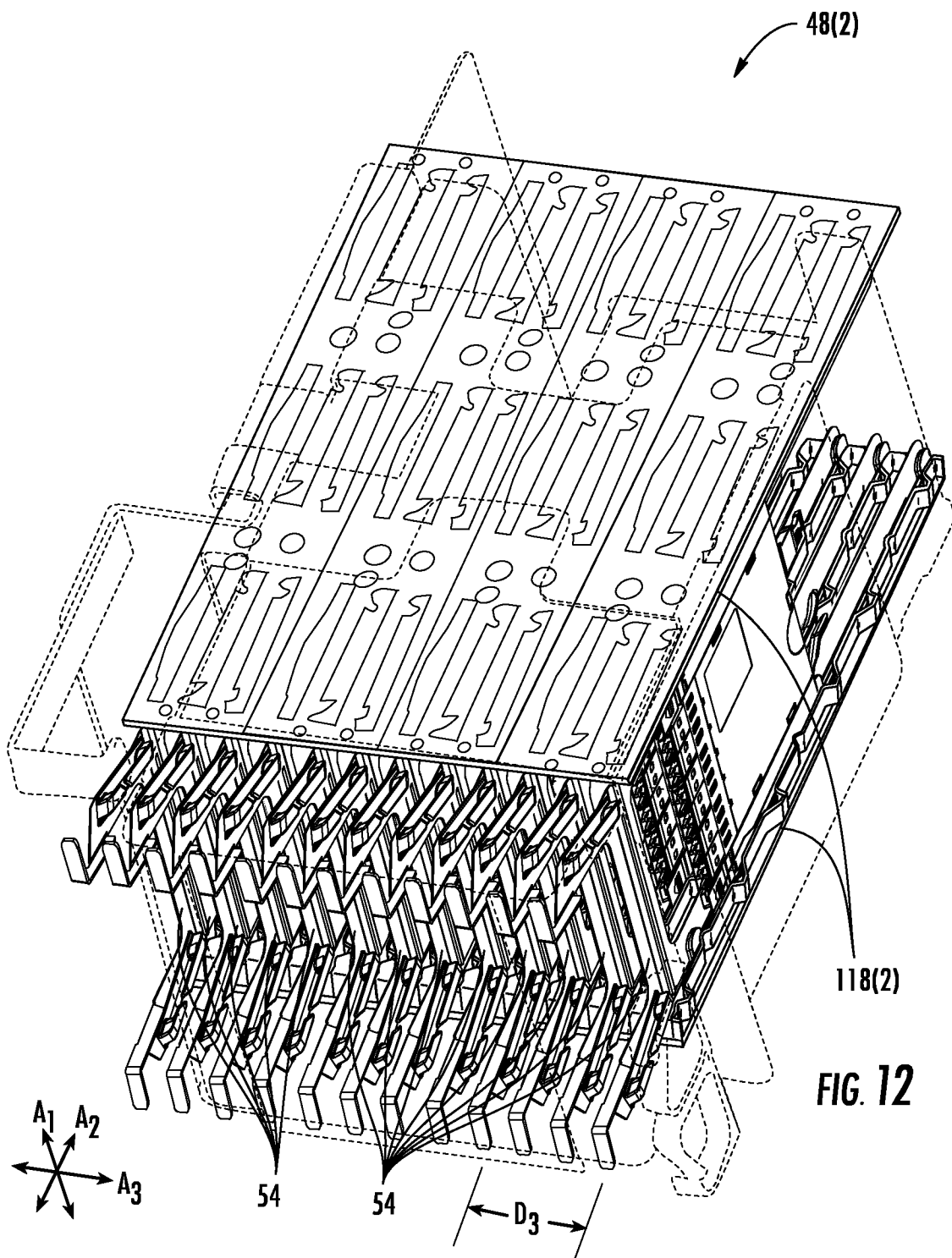
20/23



21/23



22/23



23/23

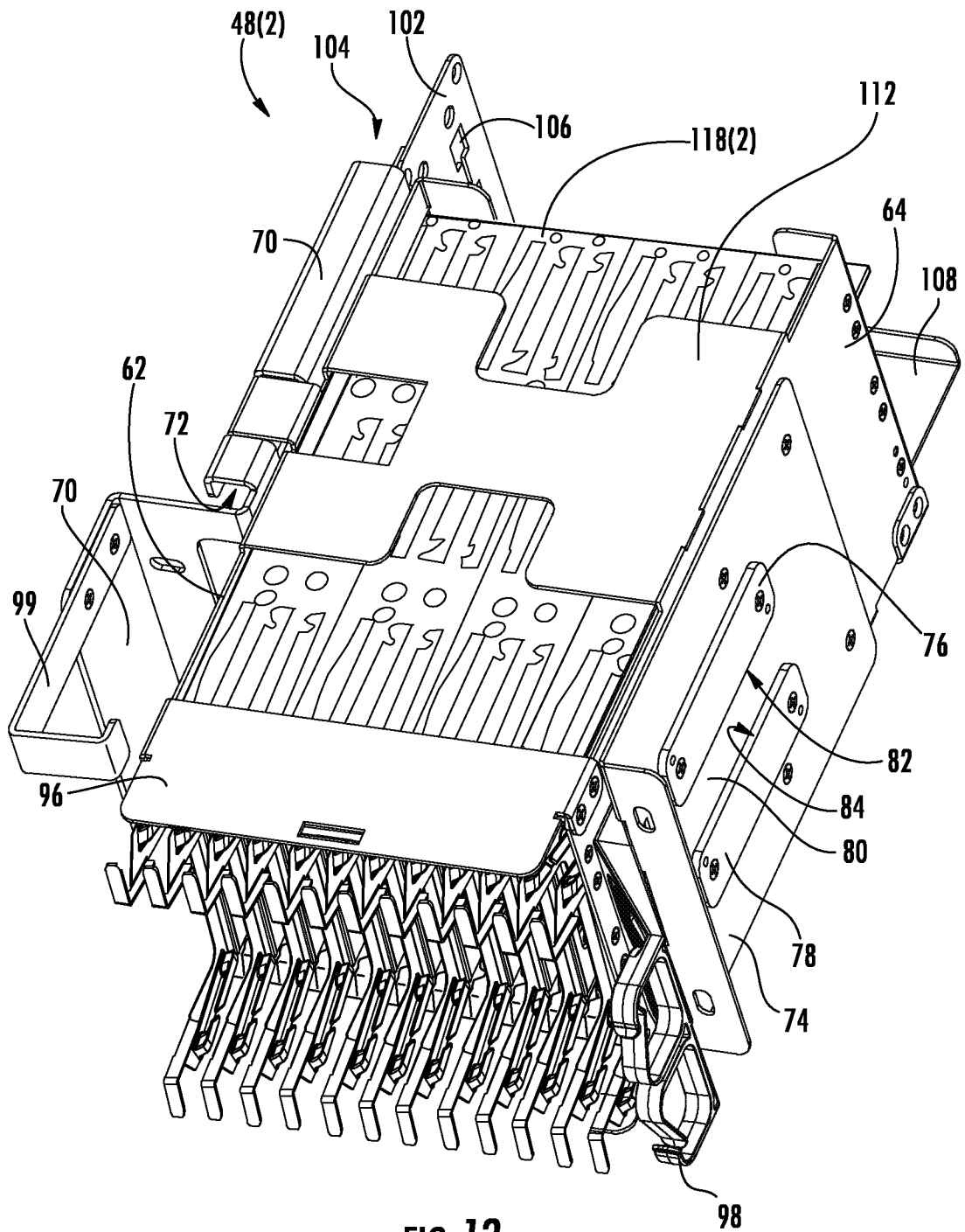


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/044125

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B6/44
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)
G02B

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 practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/296791 A1 (MAKRIDES-SARAVANOS ELLI [US] ET AL) 25 November 2010 (2010-11-25) paragraphs [0148] - [0151], [0121]; figures 33-35	1-26
X	EP 2 159 615 A2 (CORNING CABLE SYS LLC [US]) 3 March 2010 (2010-03-03) figures 1-4,6,7	1-26

☐

Further documents are listed in the continuation of Box C.

☒

See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

12 September 2012

Date of mailing of the international search report

25/09/2012

Name and mailing address of the ISA/

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Authorized officer

Elflein, Wilhelm

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/044125

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010296791 A1	25-11-2010	US 2010296790 A1	25-11-2010
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		EP 2159615 A2	03-03-2010
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