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(54) **FIBER-OPTIC-MODULE TRAYS AND DRAWERS FOR FIBER-OPTIC EQUIPMENT**

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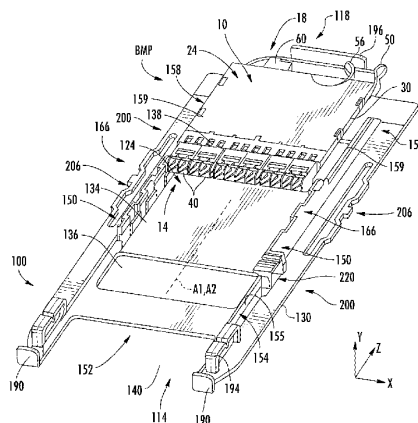
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(57) **ABSTRACT**

A unitary tray for operably supporting a fiber-optic module is disclosed. The tray includes a guide base and guide rails that define a central channel sized to accommodate the fiber-optic module. The fiber-optic module can be slid into a central module position from the back or the front of the tray, and then locked in the central module position. Opposing unitary side guides with slotted channels can be used to form a drawer that holds one or more of the trays. The drawers can be used to form fiber-optic equipment such as an interconnection unit that supports the modules and that allows for conveniently making multiple optical fiber interconnections.

20 Claims, 16 Drawing Sheets



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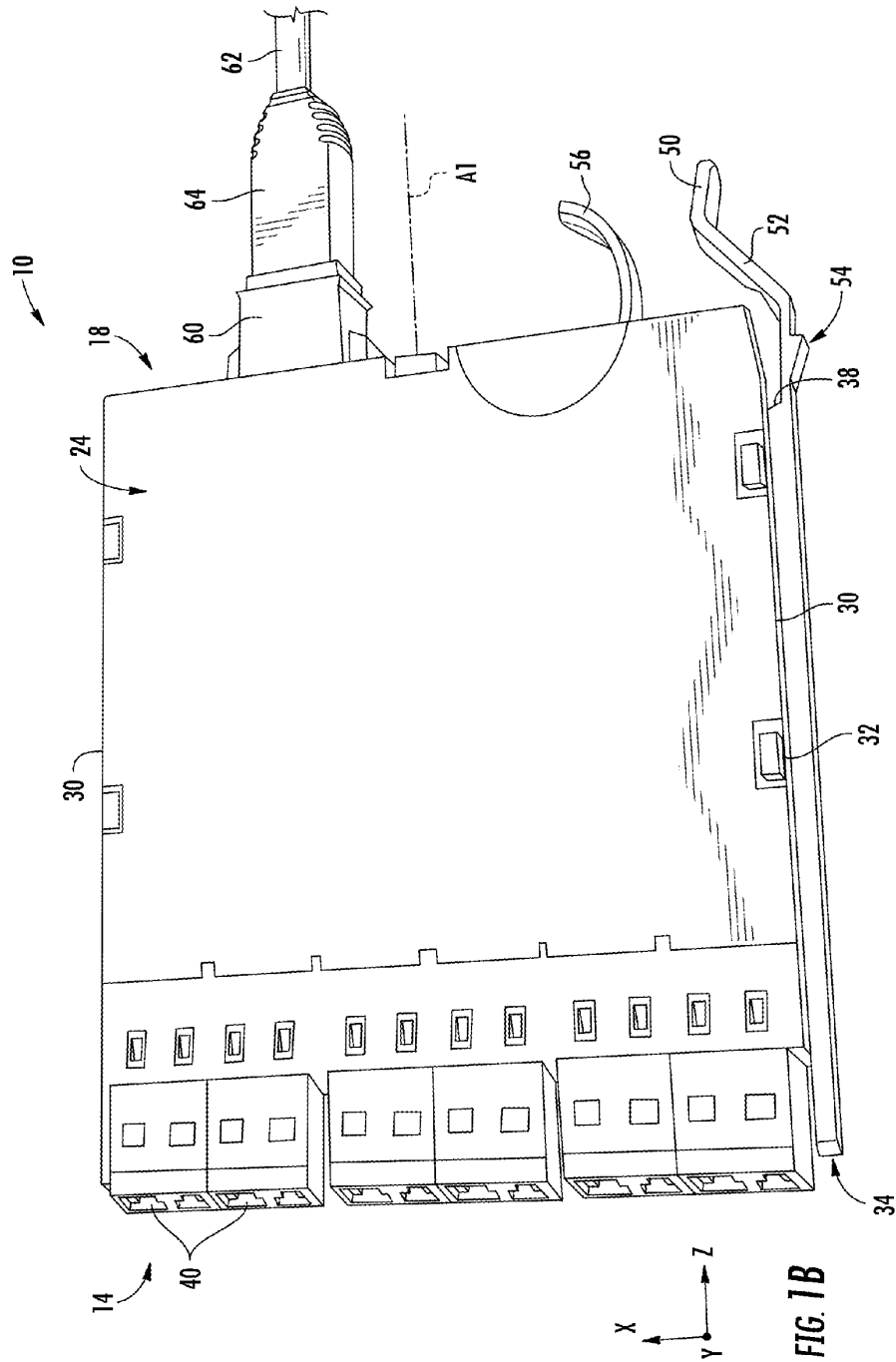
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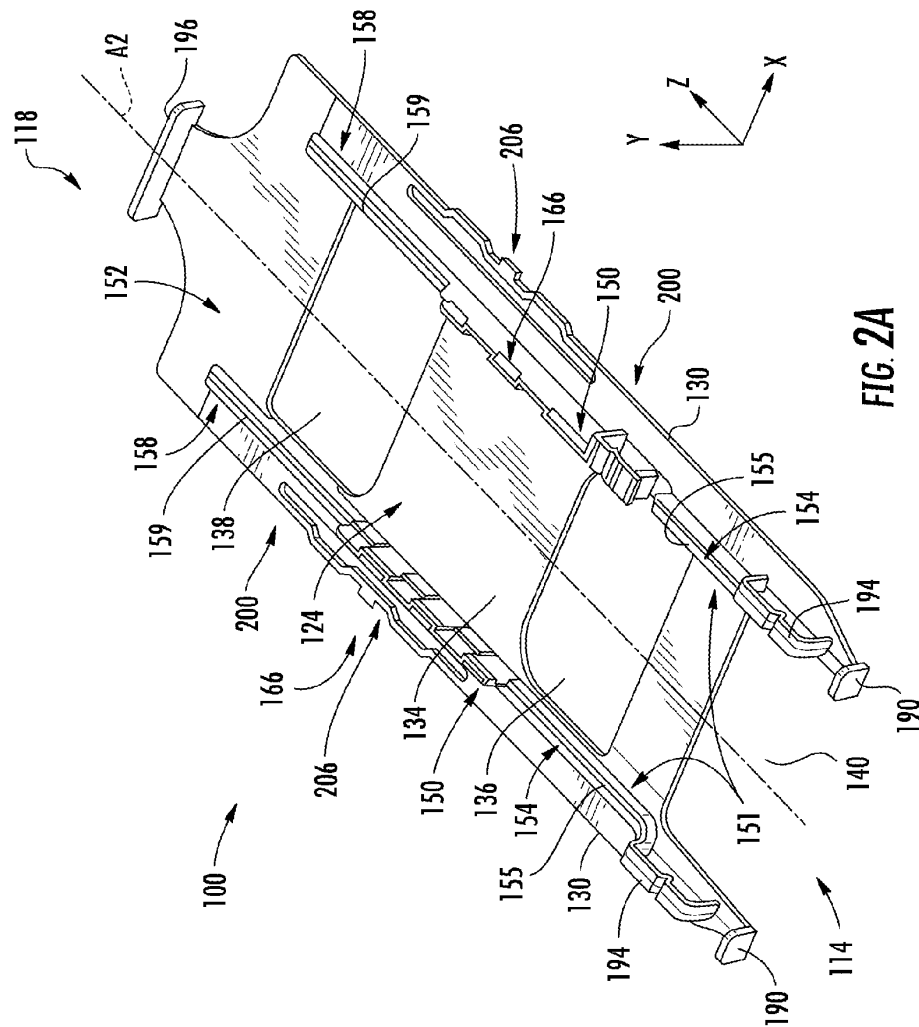
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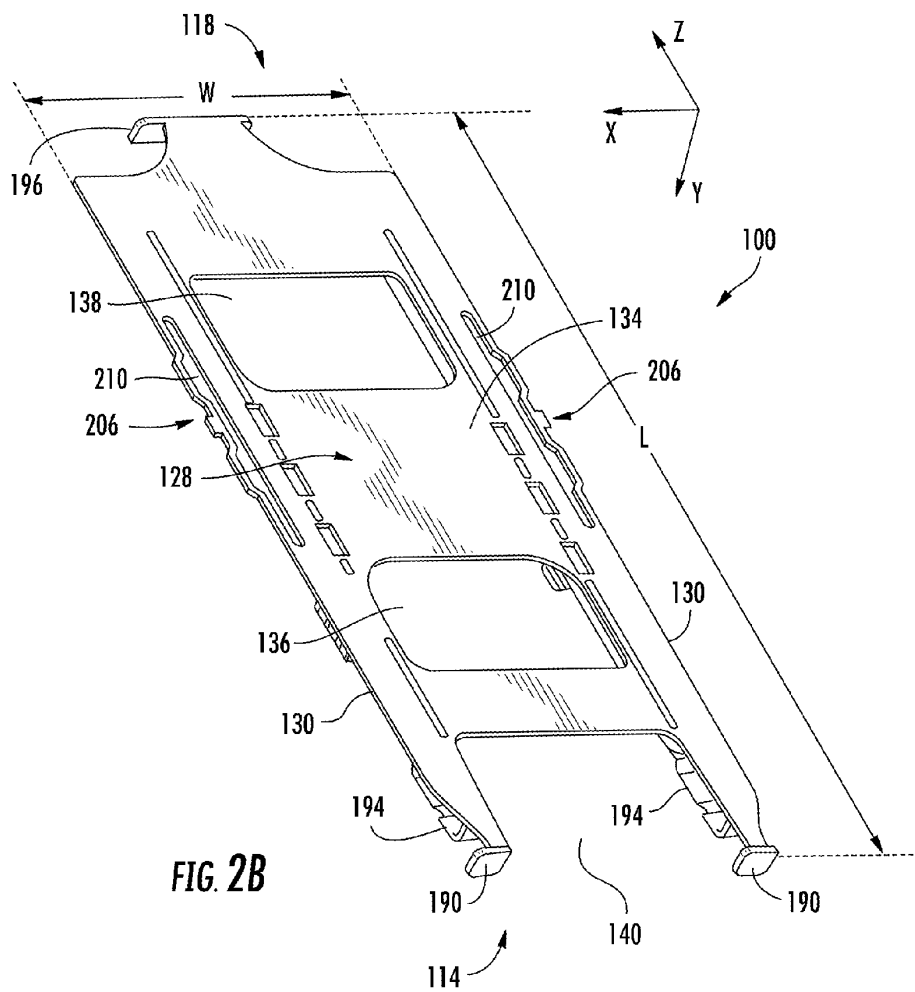
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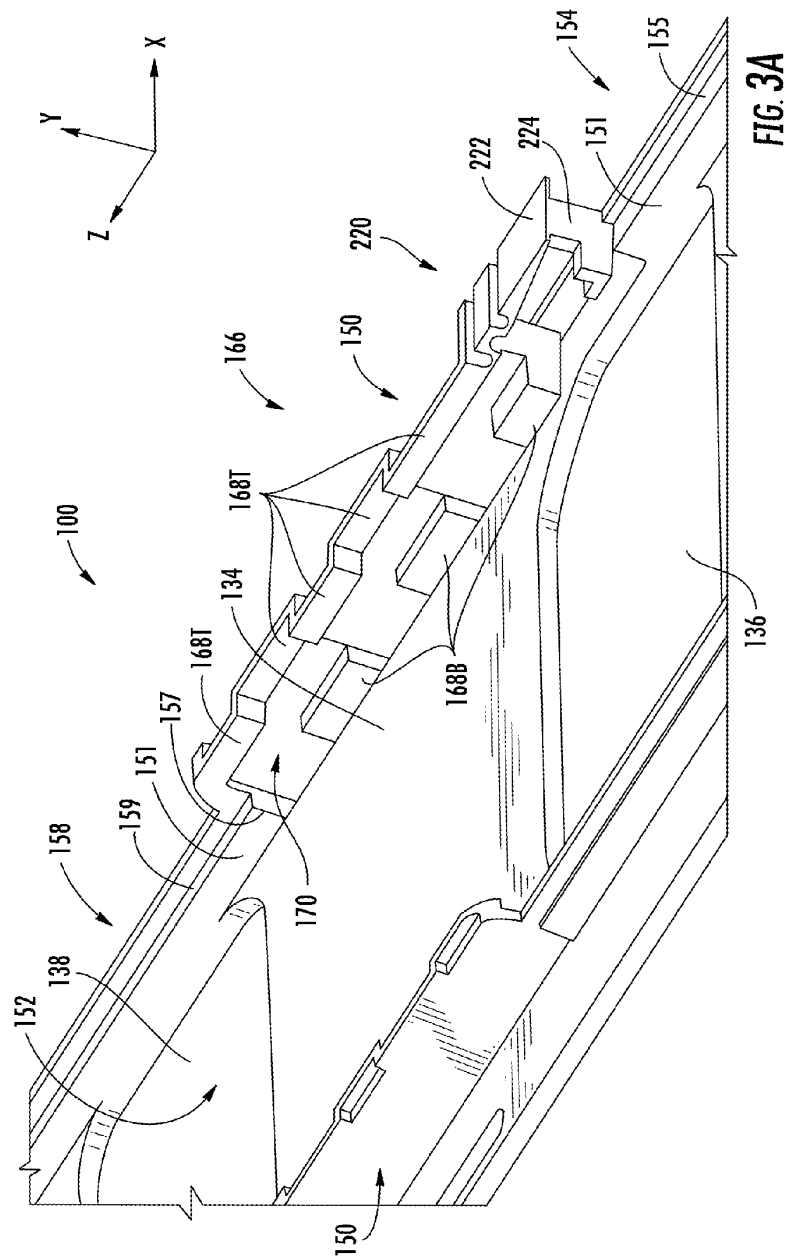
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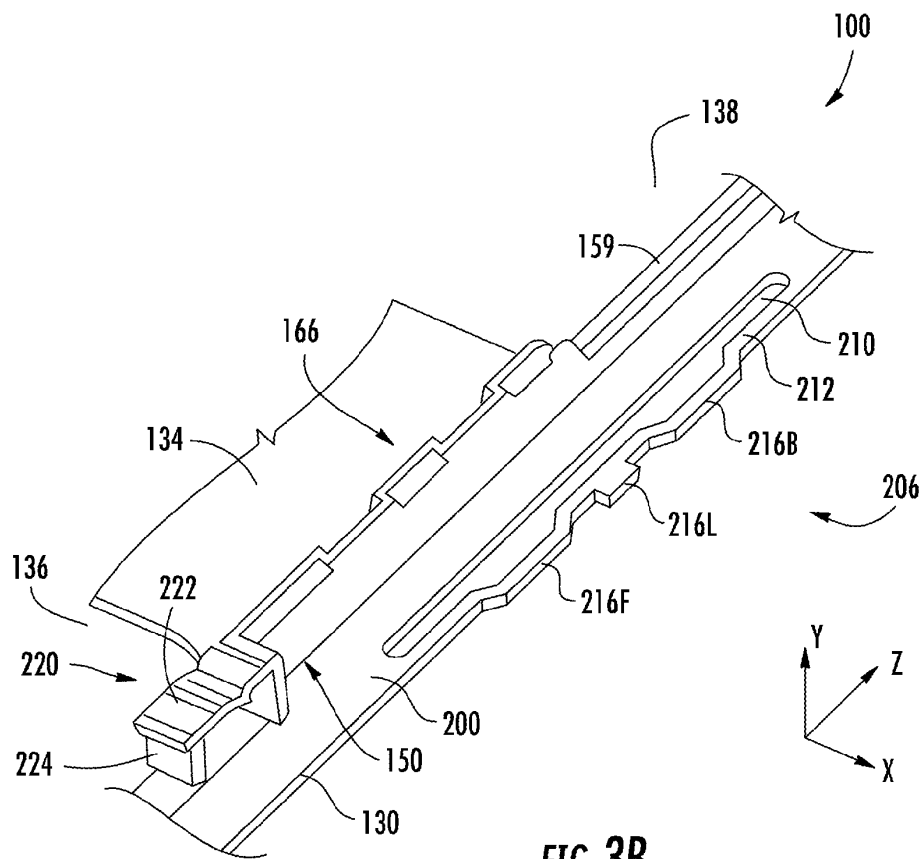
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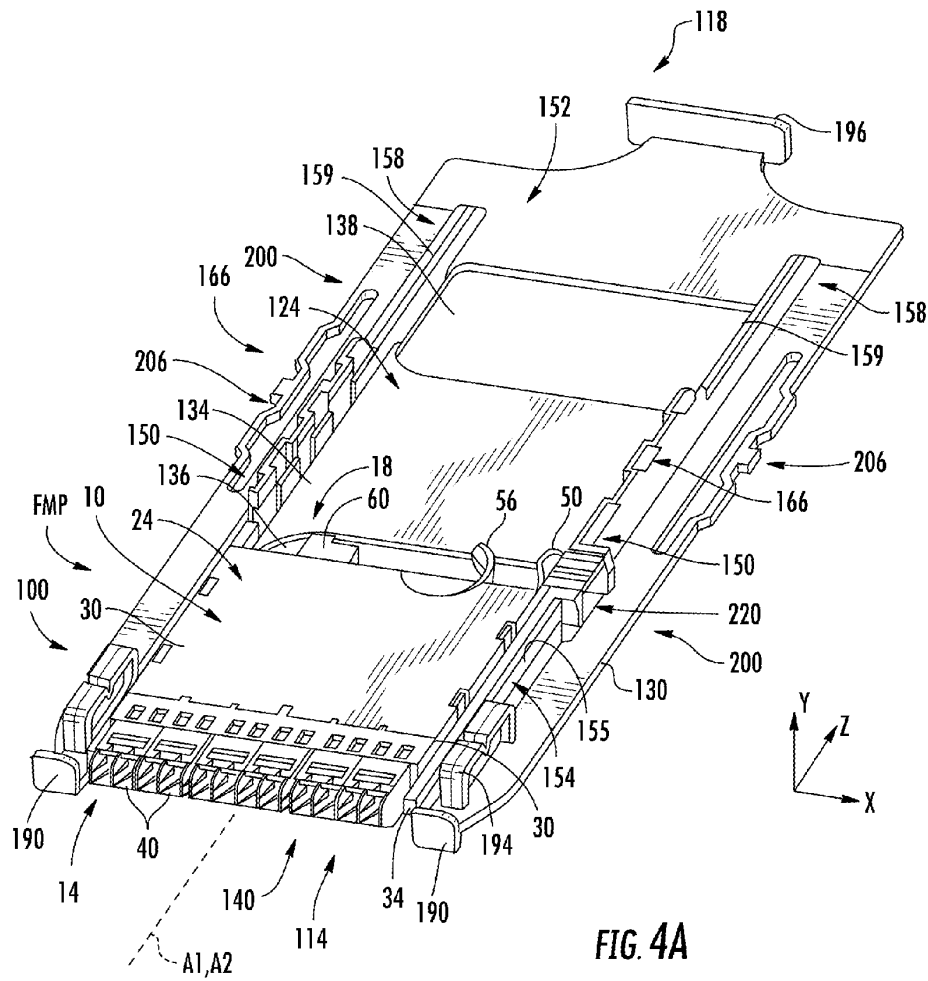












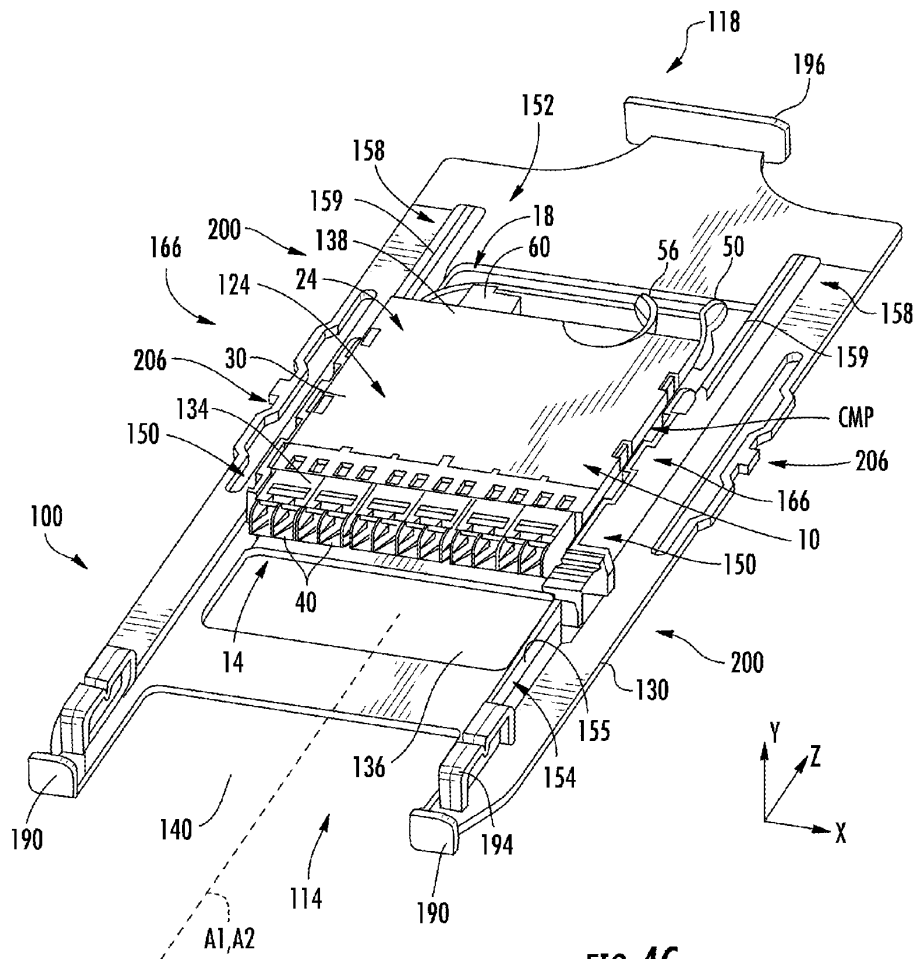
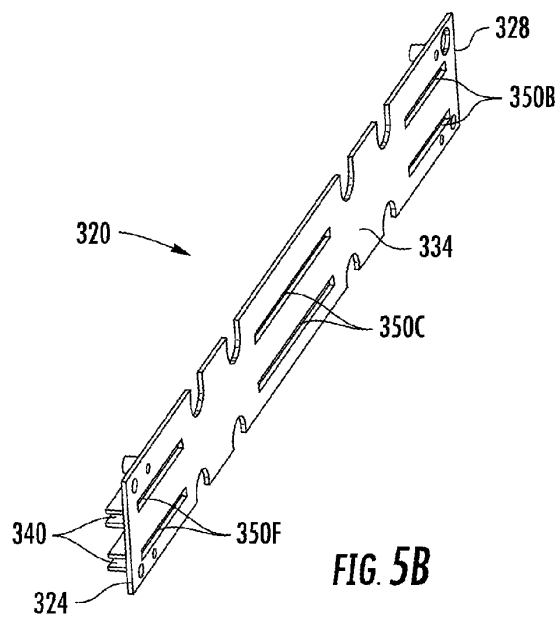
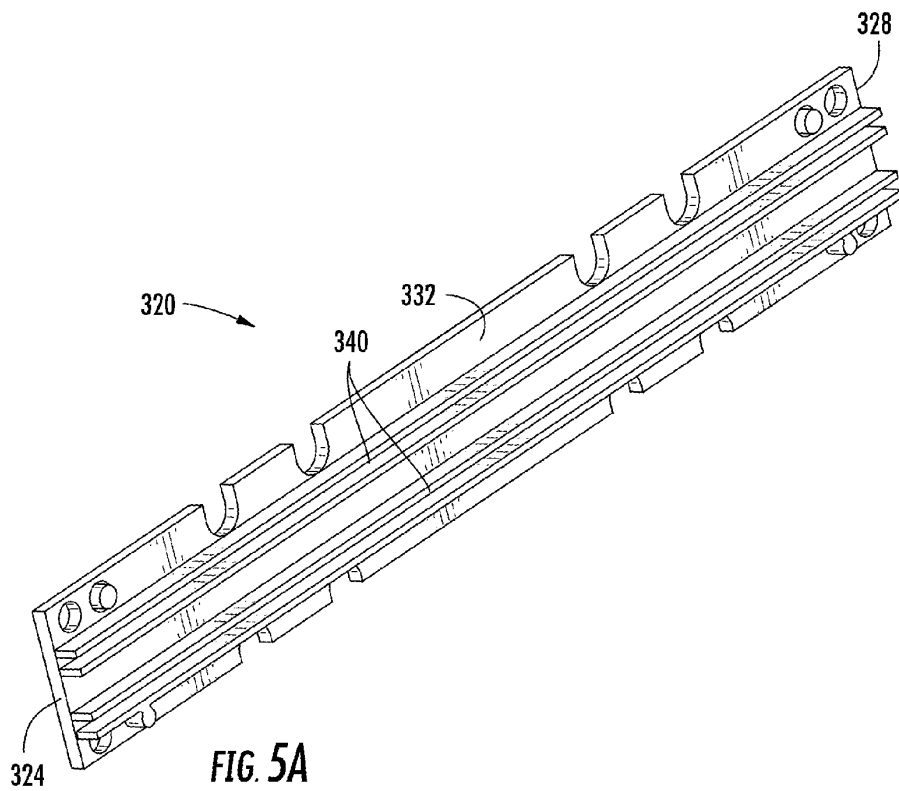
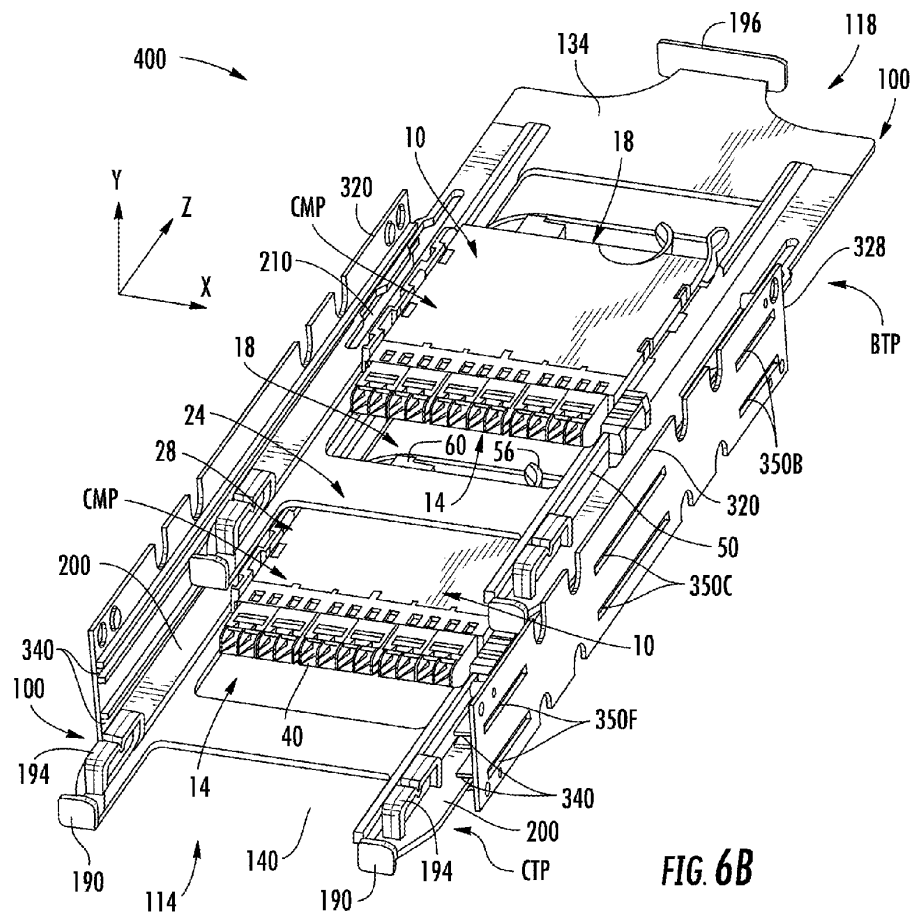
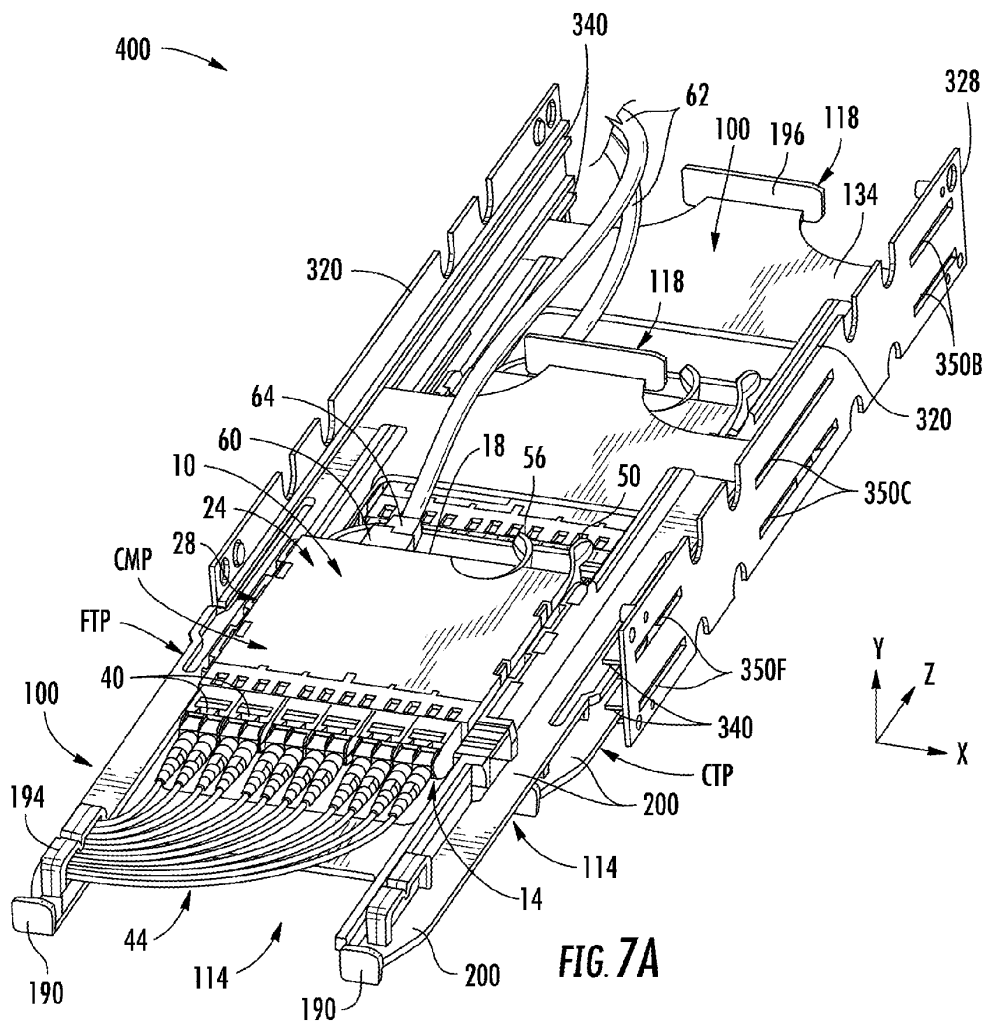
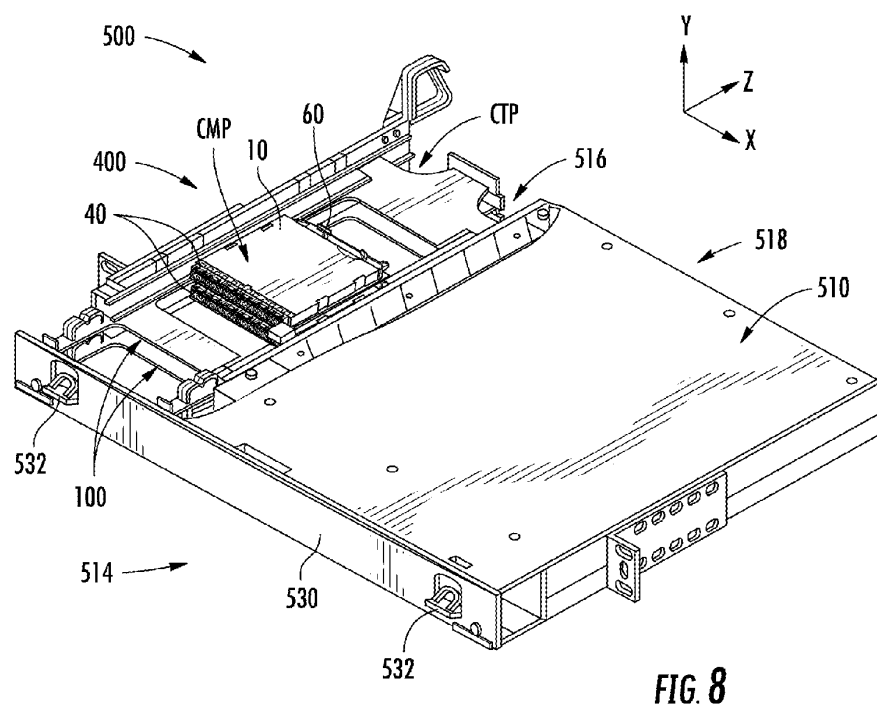


FIG. 4C









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FIBER-OPTIC-MODULE TRAYS AND DRAWERS FOR FIBER-OPTIC EQUIPMENT

FIELD

The present disclosure relates to fiber-optic modules provided in fiber-optic equipment that supports fiber-optic connections, and in particular to trays and drawers used to support the fiber-optic modules in the fiber-optic equipment.

BACKGROUND

Benefits of optical fiber include extremely wide bandwidth and low noise operation. Because of these benefits, optical fiber is increasingly being used for a variety of applications, including but not limited to broadband voice, video, and data transmission. Fiber-optic networks employing optical fiber are being developed and used to deliver voice, video, and data transmissions to subscribers over both private and public networks. These fiber-optic networks often include connection points linking optical fibers to provide "live fiber" from one connection point to another connection point. In this regard, fiber-optic equipment is located in data distribution centers or central offices to support interconnections. To support these interconnections, fiber-optic equipment is located in data distribution centers or central offices.

The fiber-optic equipment is customized based on the needs of the application. The fiber-optic equipment is typically included in housings that are mounted in equipment racks to optimize use of space. One example of such fiber-optic equipment is a fiber-optic module. A fiber-optic module is designed to provide cable-to-cable fiber-optic connections and to manage the polarity of fiber-optic cable connections.

A fiber-optic module is typically mounted in a tray that fits within a chassis or housing (called an interconnect unit or ICU). The tray is used to form a drawer within the housing, which in turn is mounted in an equipment rack or cabinet. Examples of such a tray, drawer and equipment rack are disclosed in U.S. Patent Application Publication No. 2010/0296790. A technician establishes fiber-optic connections to fiber-optic equipment mounted in the equipment rack by pulling out the drawer and pushing it back into the housing when the connections are completed.

Present-day trays and drawers are made of a fairly large number of parts, which makes them relatively complex and expensive. Further, the trays and drawers would benefit from configurations that better facilitate the insertion and alignment of the fiber-optic modules, as well as technician access to the modules so that the fiber-optic connections (e.g., jumper connections and trunk connections) can be more quickly made.

SUMMARY

An aspect of the disclosure is a unitary tray for operably supporting a fiber-optic module. The tray includes a base and guide rails that define a central channel sized to accommodate the fiber-optic module. The fiber-optic module can be slid into a central module position from the back or from the front of the tray, and then locked in the central module position. Unitary side guides with slotted channels can be used to form a drawer that holds one or more of the trays. The edges of the trays slidingly engage the slotted channels of opposing side guides. Flexures on the tray edges can be used to engage respective slots in the side guide channels so that the tray can have different tray positions (e.g., front, center and back) relative to the side guides. The drawers can be used to form

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fiber-optic equipment such as an interconnection unit that supports the modules and that allows for making multiple optical fiber interconnections. The tray as well as the side guides can be formed by a molding process, which greatly simplifies the fabrication of the trays and side guides.

Another aspect of the disclosure is a unitary tray for operably supporting a fiber-optic module that has a central axis and alignment rails. The tray has a base having front and back ends and opposite edges. The tray also includes parallel guide rails adjacent the edges that define a central open channel sized to accommodate the fiber-optic module. The tray further includes front and back insertion guides respectively formed in the parallel guide rails and configured to receive, support and align the fiber-optic module within the central open channel. The tray additionally has central guiding features formed on opposing inside surfaces of the parallel guide rails between the front and back insertion guides. The central guiding features are configured to receive the fiber-optic module and guide the fiber-optic module to a central module position within the tray. The tray has its unitary structure by virtue of being formed by molding, i.e., the tray is a molded structure.

Another aspect of the disclosure is a drawer for fiber-optic equipment that includes the tray as described above, and first and second opposing unitary side guides configured to slidingly engage the edges of the tray. In an example, the side guides are configured so that the tray can reside in a front tray position, a central tray position or a back tray position relative to the side guides. The tray can be locked in any of these positions and then unlocked to move the tray to another one of the positions.

Another aspect of the disclosure is a tray for operably supporting a fiber-optic module that has a central axis and alignment rails. The tray has a flat and generally rectangular base having front and back ends, a top side, and opposite edges. A pair of substantially parallel guide rails extending upwardly from the base and reside inboard of the edges. The guide rails have front and back ends and inside surfaces that define, along with a central portion of the base, a central open channel having a central axis and sized to accommodate the fiber-optic module. Front and back insertion guides are respectively formed in the inside surfaces of the guide rails adjacent the front and back ends and are configured to receive and support the fiber-optic module from the top side. The fiber-optic module alignment is supported so that the central axis of the alignment module is substantially aligned with the central axis of the central open channel. Central guiding features are formed on the inside surfaces of the guide rails between the front and back insertion guides. The central guiding features are configured to receive the fiber-optic module on the alignment rails from the top side and guide the fiber-optic module to a central position within the tray. The tray is formed as a unitary structure. In an example, the unitary structure is formed using a molding process using a single material.

Another aspect of the disclosure is a tray for operably supporting a fiber-optic module having alignment rails. The tray includes a flat, rectangular base having front and back ends and opposite edges. Parallel guide rails reside adjacent the edges and define, along with a portion of the base, a central open channel sized to accommodate the fiber-optic module. Front and back insertion guides are respectively formed in the inside surfaces of the guide rails adjacent the front and back ends and are configured to receive and support the fiber-optic module alignment rails and substantially align the central axis of the alignment module with the central axis of the central open channel. Slots are formed on opposing

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inside surfaces of the parallel guide rails between the front and back insertion guides. The slots run in the axial direction and are configured to receive the alignment rails of the fiber-optic module and guide the fiber-optic module to a central module position within the tray.

Another aspect of the disclosure is a drawer for fiber-optic equipment that utilizes the tray described above and that further includes first and second opposing unitary side guides. Each side guide has at least one channel configured to receive and slidingly engage the tongues of the tray and operably engage the respective flexures to releasably lock the tray a plurality of different tray positions relative to the side guides.

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 the description or recognized by practicing the embodiments as described in the written description and claims hereof, as well as the appended drawings. It is to be understood that both the foregoing general description and the following Detailed Description are merely exemplary, and are intended to provide an overview or framework to understand the nature and character of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding, and are incorporated in and constitute a part of this specification. The drawings illustrate one or more embodiment(s), and together with the Detailed Description serve to explain principles and operation of the various embodiments. As such, the disclosure will become more fully understood from the following Detailed Description, taken in conjunction with the accompanying Figures, in which:

FIG. 1A is a front elevated view of an example fiber-optic module;

FIG. 1B is a top-down view of the fiber-optic module;

FIG. 2A is a top elevated view of an example embodiment of a tray according to the present disclosure;

FIG. 2B is a bottom elevated view of the tray of FIG. 2A;

FIG. 3A is a close-up view of the center portion of the inside of one of the guide rails showing an example guiding feature as well other latching features;

FIG. 3B is a close-up view of the center portion of the outside of one of the guide rails showing an example tray positioning feature;

FIG. 4A is a front elevated view of the tray of FIG. 1 shown with the module of FIG. 3 disposed in a front position in the tray;

FIG. 4B is similar to FIG. 4A, but with the fiber-optic module disposed in a back position in the tray;

FIG. 4C is similar to FIGS. 4A and 4B, but with the fiber-optic module locked in a center position in the tray;

FIG. 5A and FIG. 5B are two elevated views from different sides of an example side guide used to form a drawer that can slidingly support one or more trays in multiple positions;

FIG. 6A through 6C are front elevated views of example embodiments of a drawer, showing the two trays operably supporting respective modules in the center position, and illustrating the front, back and center positions of the trays within the drawers;

FIG. 7A is similar to FIG. 6A and additionally shows jumpers and a fiber-optic cable operably connected to the fiber-optic modules;

FIG. 7B is similar to FIG. 7A but with the trays in different tray positions within the drawer; and

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FIG. 8 is a front elevated view of example fiber-optic equipment in the form of an interconnection unit (ICU) that houses the drawers and the fiber-optic modules supported by the trays.

DETAILED DESCRIPTION

Reference is now made in detail to various embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Whenever possible, the same or like reference numbers and symbols are used throughout the drawings to refer to the same or like parts. The drawings are not necessarily to scale, and one skilled in the art will recognize where the drawings have been simplified to illustrate the key aspects of the disclosure.

The claims as set forth below are incorporated into and constitute part of this Detailed Description.

The entire disclosure of any publication or patent document mentioned herein is incorporated by reference.

Cartesian coordinates are shown in some of the Figures for the sake of reference and are not intended to be limiting as to direction or orientation.

Fiber-Optic Module

FIG. 1A is an elevated view of an example fiber-optic module ("module") 10 for use with a tray 100, while FIG. 1B is a top-down view. An example module 10 is disclosed in U.S. Pat. No. 6,758,600. The module 10 is generally rectangular and has a central axis A1. The module 10 includes a front end 14, a back end 18, generally flat top and bottom sides 24 and 28, and edges 30. The edges 30 each include an alignment rail 32 having front and back ends 34 and 38. The alignment rails 32 run generally in the z-direction.

The front end 14 includes a number of adapters 40 where jumper cables ("jumpers") 44 can be connected. The adapters 40 are shown by way of example as being configured to accept LC fiber-optic connectors. However, adapters 40 can be configured for any fiber-optic connection type desired.

A lever 50 with an outside edge 52 is operably connected to back end 38 of one of alignment rails 32. The lever 50 includes a latch 54 on its outside edge 52. To facilitate moving lever 50 inward toward module 10, a finger hook 56 is provided adjacent the lever at module back end 18 so that a technician can use two fingers to squeeze the lever toward the finger hook.

The module 10 also includes at back end 18 an adapter 60 configured to connect to multiple optical fibers. An example adapter 60 is a multi-fiber adapter such as an MTP fiber-optic adapter configured to establish connections to multiple optical fibers (e.g., twelve (12) optical fibers) of an optical fiber cable 62 having a multi-fiber connector 64, such as an MTP connector. The module 10 may be configured to manage the polarity between the front-side adapters 40 and the back-side adapter 60.

Tray

FIG. 2A is a front elevated view of an exemplary embodiment of tray 100 according to the disclosure, while FIG. 2B is a bottom elevated view of the tray. The tray 100 is generally rectangular in shape and includes a front end 114, a back end 118, a top side 124, a bottom side 128, and opposite edges 130. The tray 100 also includes a generally flat rectangular base 134. The base 134 includes frontward and backward (i.e., rearward) access openings 136 and 138, as well as a U-shaped recess 140 at front end 114. In an example, base 134 is relatively thin, i.e., has a thickness TH in the range from about 0.060 inches to about 0.125 inches.

The tray 100 is configured to accommodate one fiber-optic module 10 in either a front module position FMP, a center

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module position CMP or a back module position BMP, as shown and discussed in greater detail below.

The tray 100 further includes a pair of generally parallel guide rails 150 that run longitudinally and that arise from the base. Guide rails 150 reside adjacent and inboard from respective edges 130. The guide rails 150 have respective inside surfaces 151 that, along with a central portion of base 134, define a central open channel 152 having a central axis A2.

The guide rails 150 include opposing front insertion guides 154 formed on inside surfaces 151 adjacent front end 114. The guide rails 150 also include opposing back insertion guides 158 formed on inside surfaces 151 adjacent back end 118. In an example, front and back insertion guides 154 and 158 are defined by respective front ledges 155 and back ledges 159 formed in the respective inner surfaces 151 of guide rails 150. The ledges 155 and 159 are configured to support alignment rails 32 on module 10.

The front and back insertion guides 154 and 158 on guide rails 150 are separated in the axial direction by a central guiding feature 166. FIG. 3A is a close-up view of the center portion of inside surface 151 of one of guide rails 150 and illustrates an example central guiding feature 166 in the form of top and bottom corrugations 168T and 168B. The top and bottom corrugations 168T and 168B are spaced apart in the vertical direction (i.e., the Y-direction) and are offset relative to each other in the horizontal direction (i.e., the Z-direction). The top and bottom corrugations 168T and 168B define a horizontal guide slot 170. The offset configuration of top and bottom corrugations 168T and 168B is used to accommodate features in a mold used when forming tray 100 by a molding process. In another example embodiment, guide slot 170 is continuous. The back insertion guides 158 each include a vertical edge 157 adjacent central guiding feature 166 that is configured to engage latch 54 of module 10 as discussed below.

With reference again to FIG. 2A, guide rails 150 each include at front end 114 front pull tabs 190 and jumper guides 194. Jumper guides 194 are configured to guide jumper cables 44, as discussed below in connection with FIGS. 7A and 7B. A centrally located back pull tap 196 is attached to base 134 at back end 118.

Guide rails 150 and edges 130 define tongues 200 formed by the portion of base 134 adjacent each of the edges. The tongues 200 each include a positioning feature 206. FIG. 3B is a close-up view of the center portion of outside of one of guide rails 150 showing an example tray positioning feature 206. In the example of FIG. 3B, positioning feature 206 is configured as a flexure by providing a relatively thin and elongated aperture 210 that defines a flexible wall 212 at edge 130. In an example embodiment, flexible wall 212 includes a front-position detent 216F, a back-position detent 216B and a locking detent 216L that resides about midway between the front-position and back-position detents. The flexibility of a flexure type of positioning feature 206 allows for the positioning feature to be flexed to disengage the positioning feature (including the detents formed thereon) from its complementary locking feature, as discussed below.

With reference to FIG. 3A and FIG. 3B, tray 100 also includes a module locking feature 220 along one of guide rails 150 in between front end guide 154 and central guiding feature 166. The module locking feature 220 is configured to lock module 10 in the center position of tray 100 as described below. The module locking feature 220 includes a lever 222 flexibly connected at its backward end to an end portion of central guiding feature 166 and connected at its forward end to a downwardly depending latching feature 224 that engages

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the front end 34 of module alignment rail 32 to lock module 10 in a center position of tray 100, as described below.

The tray 100 has a length L and a width W, which in an example are about 11 inches and 4.5 inches, respectively. Other sizes for tray 100 are possible, with the size being largely dependent upon on the size of the particular modules 10 being supported by the tray.

In an example embodiment, tray 100 is formed as a unitary structure. In an example, the unitary embodiment of tray 100 is formed by molding a single material. An example material for tray 100 is plastic.

Module Positions in Tray

FIGS. 4A through 4C are similar to FIG. 2A, except that they respectively show module 10 disposed in a front module position FMP, a back module position BMP and a center module position CMP. The front and back module positions FMP and BMP are temporary positions used to insert and lock module 10 in the center module position CMP.

With reference to FIG. 4A, module 10 can be disposed in tray 100 at front module position FMP as shown in FIG. 4A by aligning the module with tray front end 114 so that module central axis A1 and tray central axis A2 are substantially aligned in the Y-Z plane, with the module just above the tray at the tray front end. The module 10 can then be lowered onto (i.e., dropped into) tray 100 at front end 114 to initiate engagement of alignment rails 32 with the front end guides 154, with the alignment rails resting on ledges 155. The module 10 can then be slid into the center module position CMP as shown in FIG. 4C by urging the module in the +Z direction. At this point, alignment rails 32 engage central guide 166, i.e., they travel within guide slot 170 until latch 54 of lever 50 engages edge 157 of back insertion guides 158 to prevent further backward motion. The latch 54 is inwardly biased such that module 10 can be installed in tray 100 from either front end 114 or back end 118.

At this point, locking feature 220, which is normally in the latch position, has secured module 10 in the center module position. To release module 10 locking feature 220 must be depressed and the module slid forward. To disengage (unlock) module 10, a technician can insert their fingers through back opening 138 to access lever 50 and finger hook 56 and disengage latch 54. The technician can also disengage locking feature 220 by pushing down lever 222 of the locking feature. This allows module 10 to slide within guide slots 170 either axially forward or backward within tray 100. When moving module 10 to front module position FMP or back module position BMP, alignment rails 32 of the module transition from being guided by guide slots 170 to resting on front or back ledges 155 or 159. This allows module 10 to be easily lifted up and out of tray 100 when in front module position FMP or back module position BMP.

The tray 100 is configured so that module 10 can be placed directly in back module position BMP in essentially the same manner as it is placed in front module position FMP (including with module front end 14 facing tray front end 114). The module 10 is then moved in the -Z direction into center module position CMP. With reference to FIG. 4B, this is accomplished by disposing module 10 so that its axis A1 and tray axis A2 are substantially aligned in the Y-Z plane with the module just above the tray at the tray back end 118. The module 10 is then lowered (dropped) into place so that alignment rails 32 of the module rest on ledges 159 of back insertion guides 158. The module 10 is then urged in the -Z direction so that alignment rails 32 engage central guide 166, i.e., they travel within guide slot 170 until latch 54 of lever 50 engages edge 157 of back insertion guides 158 to prevent

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further backward motion. The module 10 is then locked into central module position CMP using locking feature 220 as described above.

Drawers with Movable Trays

An aspect of the disclosure is a drawer that operably supports one or more trays 100 as described above. FIG. 5A and FIG. 5B are two elevated views of different sides of an example side guide 320, wherein two such side guides are used to form a drawer 400, as shown in the elevated views of FIGS. 6A through 6C. The drawer 400 is configured so that each tray 100 supported thereby can be placed in a front tray position FTP (FIG. 6A), a center tray position CTP (FIG. 6C) and a back tray position BTP (FIG. 6B) and releasably locked in these positions.

The side guide 320 includes a front end 324, a back end 328, an inner side 332 and an outer side 334. The side guide 320 includes one or more open channels 340, with each channel sized to accommodate and support tongues 200 of tray 100. Two channels 340 are shown by way of example and are used to form example drawer 400 that supports two trays 100, as shown in FIGS. 6A through 6C. Thus, drawer 400 is formed by arranging two side guides 320 with their inner sides 332 facing each other and spaced apart so that one or more trays 100 can fit between the side guides with tongues 200 sliding in the corresponding side-guide channels 340.

As best seen in FIG. 5B, side guide 320 includes, in each channel 340, front, center and back slots 350F, 350C and 350B, with each slot configured to engage with positioning feature 206 formed on tongue 200, depending on the position of tray 100 relative to the side guide. For example, in FIG. 6A, the top tray 100 is in front tray position FTP relative to side guides 320, with tray positioning features 206 engaging front slots 350F. Likewise, in FIG. 6C, the bottom tray 100 is in center position CTP relative to side guides 320, with tray positioning features 206 engaging center slots 350C.

FIG. 6A shows drawer 400 with top tray 100 in front tray position FTP relative to side guides 220, with the tray positioning features 206 engaging front slots 350F. FIG. 6B shows the top tray 100 in back tray position BTP relative to side guides 220, with the tray positioning features 206 engaging back slots 350B. FIG. 6C shows both the top and bottom trays 100 in central tray position CTP relative to side guides 220, with their respective tray positioning features 206 engaging respective central slots 350C.

In an example embodiment, each positioning feature 206 is configured as a flexure having the aforementioned front and back detents 216F and 216B and locking detent 216L. In such an example embodiment, in front tray position FTP of tray 100 within drawer 400, front detent 216F engages front end 324 of side guide 320 and locking detent 216L and back detent 216B reside within front slot 350F. This allows the positioning features 206 to click into place on the respective side guides 320 and to hold (lock) tray 100 in front tray position FTP. The tray 100 can be disengaged from being locked in front tray position FTP by a user applying minimal pressure to flex the positioning feature 206 to release it from front slot 350F.

When tray 100 is in center tray position CTP, the entire positioning feature 206 fits within center slot 350C and is released by urging the tray forward or backward to inwardly flex the positioning feature so that it disengages from the center slot. The back tray position BTP of tray 100 has essentially the same locking configuration as front tray position FTP, but with back detents 350B engaged with back ends 328 of side guides 320.

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In an example, side guide 320 is a unitary structure. Further in the example, side guide 320 is formed by molding. An example material for side guide 320 is plastic.

FIG. 7A is similar to FIG. 6A and shows a number of jumper cables 44 attached to adapters 40 at front end 14 of module 10, with the top module in center module position CMP in tray 10, and the top tray in front tray position FTP. FIG. 7B is similar to FIG. 6B, but with trays 100 in different tray positions within drawer 400. The jumper cables 44 are shown as being guided by one of jumper guides 194 and connected to corresponding adapters 40 on module 10. Likewise, two fiber-optic cables 62 with multi-fiber connectors 64 are shown as being connected to respective adapters 60 at back ends 18 of two modules 10. The two fiber-optic cables 62 are shown as entering drawer 400 at back ends 118 of trays 100, while the jumper cables 44 enter from tray front end 114. Fiber-optic Equipment

FIG. 8 is an elevated and partially cut-away view of fiber-optic equipment shown by way of example as an interconnection unit (ICU) assembly 500. The ICU assembly 500 includes at least one drawer 400, which is shown by way of illustration as operably supporting two modules 10, which are shown in center module position CMP in trays 100. The exemplary ICU assembly 500 may be provided at a data distribution center or central office to support cable-to-cable fiber-optic connections and to manage a plurality of fiber-optic cable connections.

The ICU assembly 500 includes a fiber-optic equipment housing 510 that has a front end 514, a back end 518, and an interior 516. The housing 510 includes at front end 514 a front door 530 that swings downward to allow access to interior 516. The housing 510 includes front-door latches 532 configured to allow front door 530 to be latched in the closed position and unlatched to open the front door and allow access to housing interior 516 and drawers 400, trays 100 and modules 10 operably supported therein. The housing 510 optionally includes a similar back door (not shown) at back end 518.

Note that trays 100 can be pulled into front tray position FTP so that the trays extend beyond housing front end 514. Further, modules 10 operably supported in respective trays 100 can be moved between front and center module positions FMP and CMP to allow for easy access, servicing, installation and removal of the modules.

The housing 510 is configured so that it can be installed in a fiber-optic equipment rack (not shown) if desired. The housing 510 is shown as being 1U-sized, with "U" equaling a standard 1.75 inches in height, but could be any other U-size desired, or any other height desired.

As discussed above, trays 100 can be moved and extended from and retracted back into their drawer 400. Any number of trays 100 can be supported in drawers 400 within housing 510. Likewise, any number of modules 10 can be supported in trays 100.

It will be apparent to those skilled in the art that various modifications to the preferred embodiments of the disclosure as described herein can be made without departing from the spirit or scope of the disclosure as defined in the appended claims. Thus, the disclosure covers the modifications and variations provided they come within the scope of the appended claims and the equivalents thereto.

What is claimed is:

1. A tray for operably supporting a fiber-optic module that has a central axis and alignment rails, the tray comprising:
 - a base having front and back ends, a top side and opposite edges;

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parallel guide rails adjacent the edges that define a central open channel sized to accommodate the fiber-optic module;

front and back insertion guides respectively formed in the parallel guide rails and configured to receive, support and align the fiber-optic module within the central open channel;

central guiding features formed on opposing inside surfaces of the parallel guide rails between the front and back insertion guides, the central guiding features being configured to receive the fiber-optic module and guide the fiber-optic module to a central module position within the tray; and

wherein the tray is formed as a unitary, molded structure from a single piece of material.

2. The tray according to claim 1, further comprising a fiber-optic module locking feature formed on one of the guide rails and configured to operably engage a portion of the fiber-optic module to lock the module in the center module position.

3. The tray according to claim 1, further comprising front and back access openings formed in the base.

4. The tray according to claim 1, wherein the front and back insertion guides are configured so that the fiber-optic module can be lowered onto either the front or back insertion guide from the front side of the base and then slid into the central module position.

5. The tray according to claim 1, further comprising flexures formed on the respective edges of the base.

6. A drawer for fiber-optic equipment, comprising:
the tray of claim 5; and
first and second opposing unitary side guides configured to slidably engage the edges of the tray.

7. The drawer according to claim 6, wherein each of the side guides includes at least one channel, and wherein the side guides are configured so that the edges of the tray are slidably engaged by the respective channels of the opposing side guides.

8. The drawer according to claim 7, wherein each channel includes a plurality of slots, and wherein the flexure engages one of the slots to define a corresponding plurality of tray positions relative to the side guides.

9. The drawer according to claim 7, further comprising multiple trays and a housing having an interior that contains the side guides and the multiple trays.

10. A tray for operably supporting a fiber-optic module that has a central axis and alignment rails, the tray comprising:
a flat and generally rectangular base having front and back ends, a top side, and opposite edges;
a pair of substantially parallel guide rails extending upwardly from the base and residing inboard of the edges, the guide rails having front and back ends and inside surfaces that define, along with a central portion of the base, a central open channel having a central axis and sized to accommodate the fiber-optic module;
front and back insertion guides respectively formed in the inside surfaces of the guide rails adjacent the front and

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back ends and configured to receive and support the fiber-optic module alignment rails and substantially align the central axis of the alignment module with the central axis of the central open channel;

central guiding features formed on the inside surfaces of the guide rails between the front and back insertion guides, the central guiding features being configured to receive the alignment rails of the fiber-optic module and guide the fiber-optic module to a central position within the tray; and

wherein the tray is formed as a unitary structure from a single piece of material.

11. The tray according to claim 10, further comprising a fiber-optic-module locking feature formed on one of the guide rails between the front insertion guide and the central guiding features, the fiber-optic-module locking feature being configured to operably engage a portion of the fiber-optic module to lock the module in a center module position.

12. The tray according to claim 10, further comprising the fiber-optic module.

13. The tray according to claim 10, wherein the front and back insertion guides each include ledges upon which the alignment rails rest when the fiber-optic module is inserted into the tray from the top side at the front end or the back end of the tray, respectively.

14. The tray according to claim 10, further comprising tongues formed on the respective edges of the base, the tongues having formed therein respective flexures.

15. A drawer for fiber-optic equipment, comprising:
the tray of claim 14; and
first and second opposing unitary side guides, each having at least one channel configured to receive and slidably engage the tongues of the tray, with each channel having front, center and rear slots configured to operably engage at least a portion of the flexure so that the tray can be locked in either a front tray position, a center tray position or a back tray position relative to the side guides and unlocked from a given one of the tray positions by flexing the flexure.

16. The drawer according to claim 15, wherein each flexure has a front-position detent and a rear-position detent, with a locking detent therebetween.

17. The drawer according to claim 16, wherein the side guides include multiple channels and the drawer supports multiple trays.

18. The drawer according to claim 17, further comprising the fiber-optic modules operably arranged one in each of the trays, with each module having a plurality of front-end adapters and a single multi-fiber back end adapter.

19. The drawer of claim 18, further comprising one or more jumpers operably connected to the corresponding one or more front-end adapters and a multi-fiber fiber-optic cable operably connected to the back-end multi-fiber connector.

20. The drawer of claim 18, further comprising a housing having an interior that operably supports the drawer to form an interconnection equipment unit.

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