US010302885B2

(12) **United States Patent**
Morris et al.

(10) **Patent No.: US 10,302,885 B2**
(45) **Date of Patent: May 28, 2019**

(54) **FIBER TERMINAL RACK MOUNT WITH FRONT-TO-BACK FIBER ROUTING MANAGEMENT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/788,341**

(22) Filed: **Oct. 19, 2017**

(65) **Prior Publication Data**

US 2018/0129004 A1 May 10, 2018

Related U.S. Application Data

(60) Provisional application No. 62/417,639, filed on Nov. 4, 2016.

(51) **Int. Cl.**
G02B 6/44 (2006.01)

(52) **U.S. Cl.**
CPC ***G02B 6/4452*** (2013.01); ***G02B 6/445*** (2013.01)

(58) **Field of Classification Search**
CPC G02B 6/445; G02B 6/4452; G02B 6/4463
See application file for complete search history.

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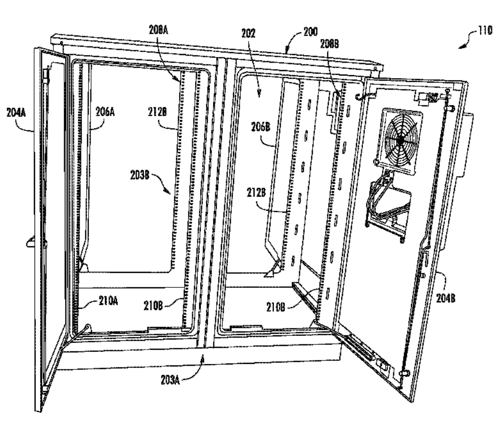
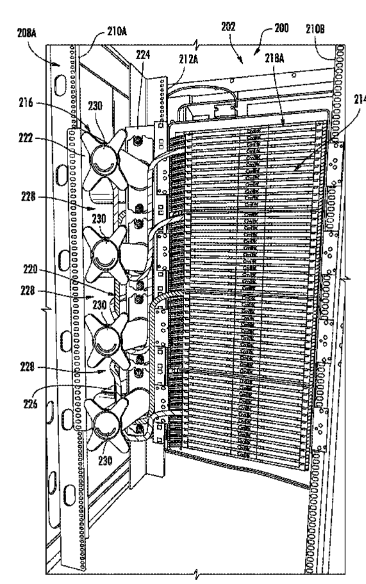
(57) **ABSTRACT**

A fiber terminal rack mount with front-to-back fiber routing management is disclosed herein. The terminal rack mount is configured to be mounted in a remote terminal to facilitate fiber management of fiber optic cables routed from fiber optic equipment. In exemplary aspects disclosed herein, the fiber terminal rack mount comprises two vertically oriented panels with a plurality of horizontally oriented shelves positioned therebetween. The panels are configured to mount to vertical rails of a remote terminal cabinet of the fiber terminal. The panels and shelves also define routing channels for routing fiber optic cables therethrough, thereby facilitating front-to-back fiber routing between fiber optic equipment mounted in the fiber terminal. In this manner, as an example, the fiber terminal rack mount may more easily support fiber routing between back-to-back mounted fiber optic equipment, which may increase as fiber optic connectivity density increases.

22 Claims, 11 Drawing Sheets





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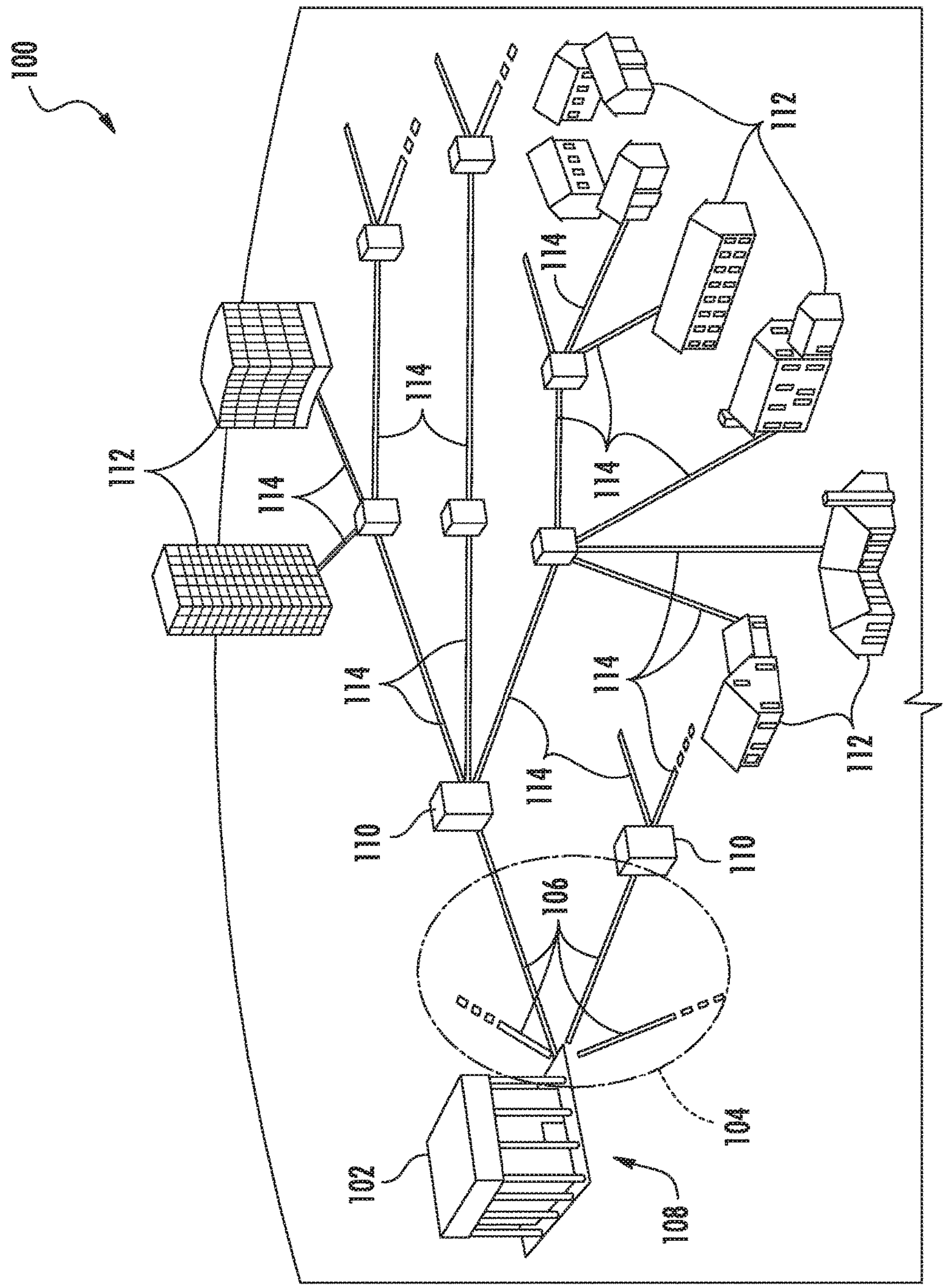
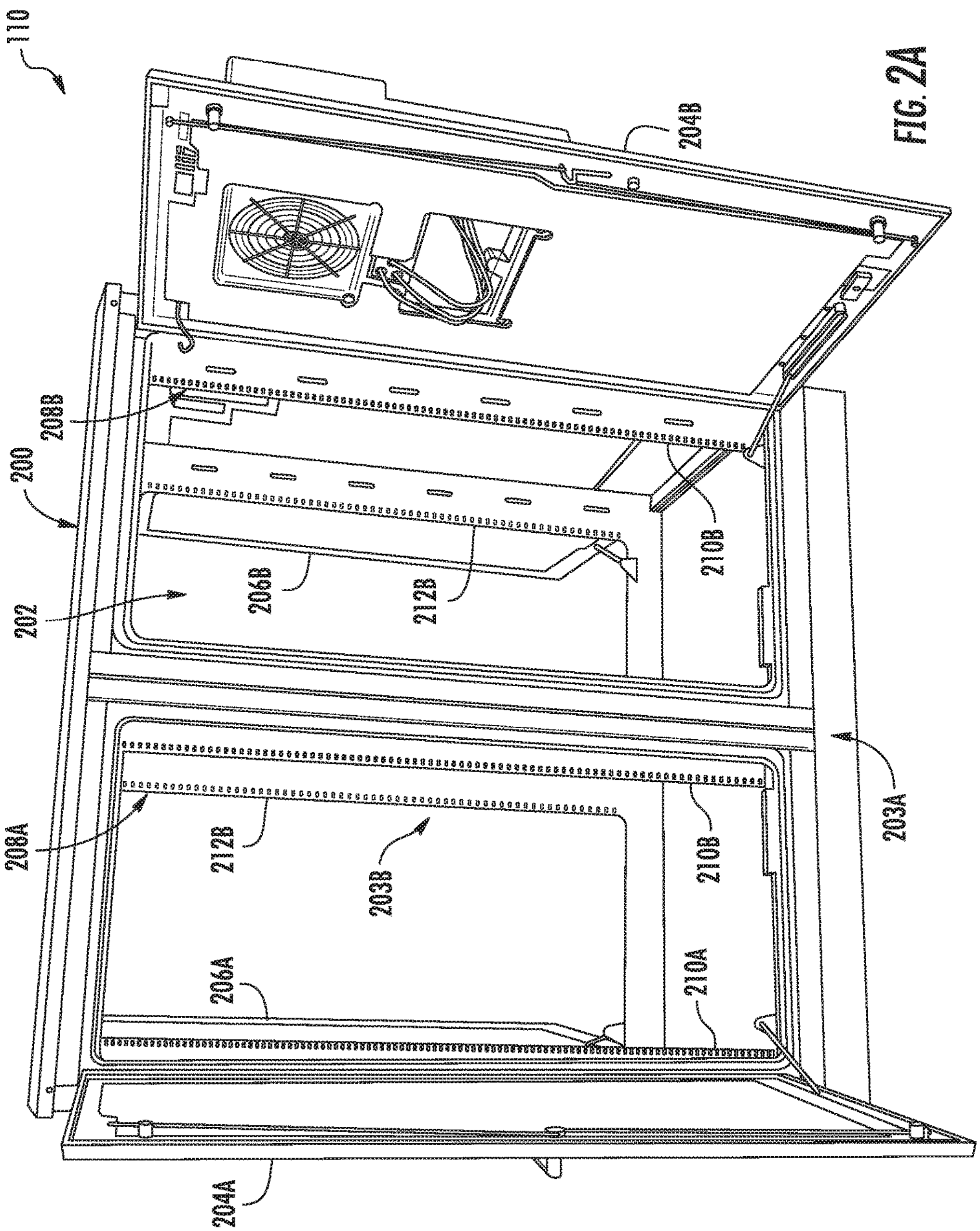


FIG. 1


110
200
202
206B
212B
208B
204B
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208A
212B
203B
210B
203A
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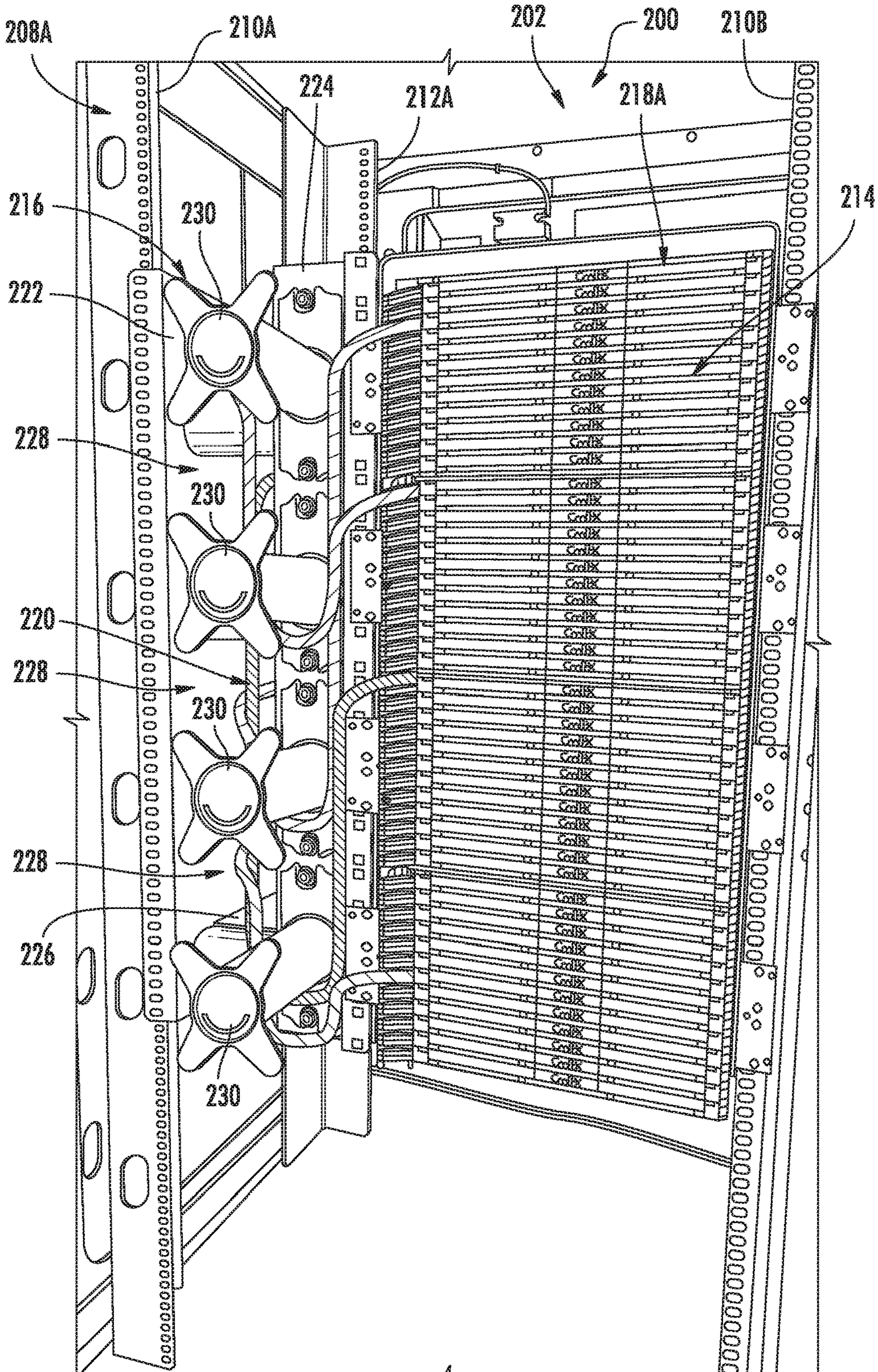
210A
204A

FIG. 2A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210A
202
200
210B
224
212A
218A
216
230
214
222
228
230
220
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230
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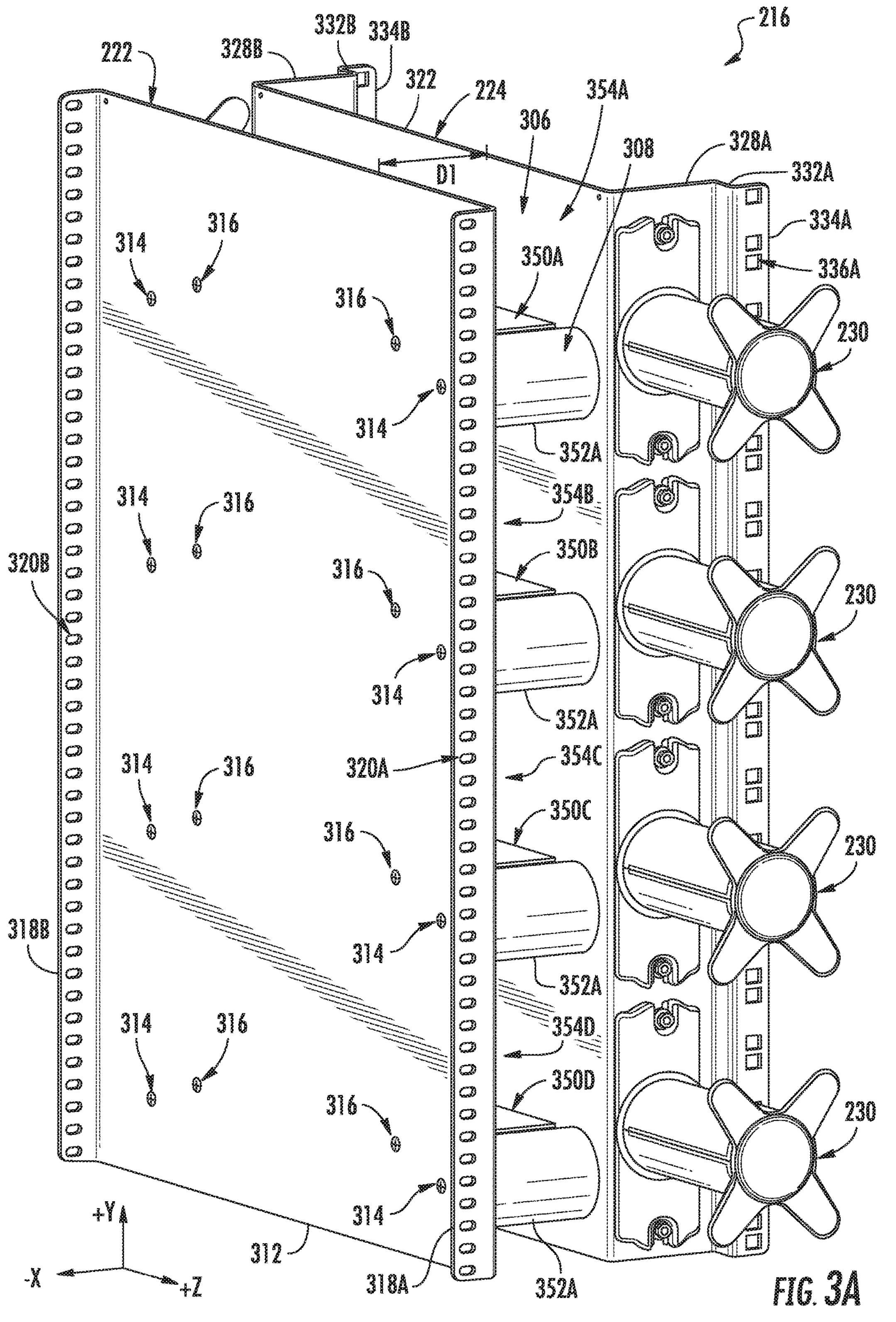
226
230
CoolIX

FIG. 2B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328A
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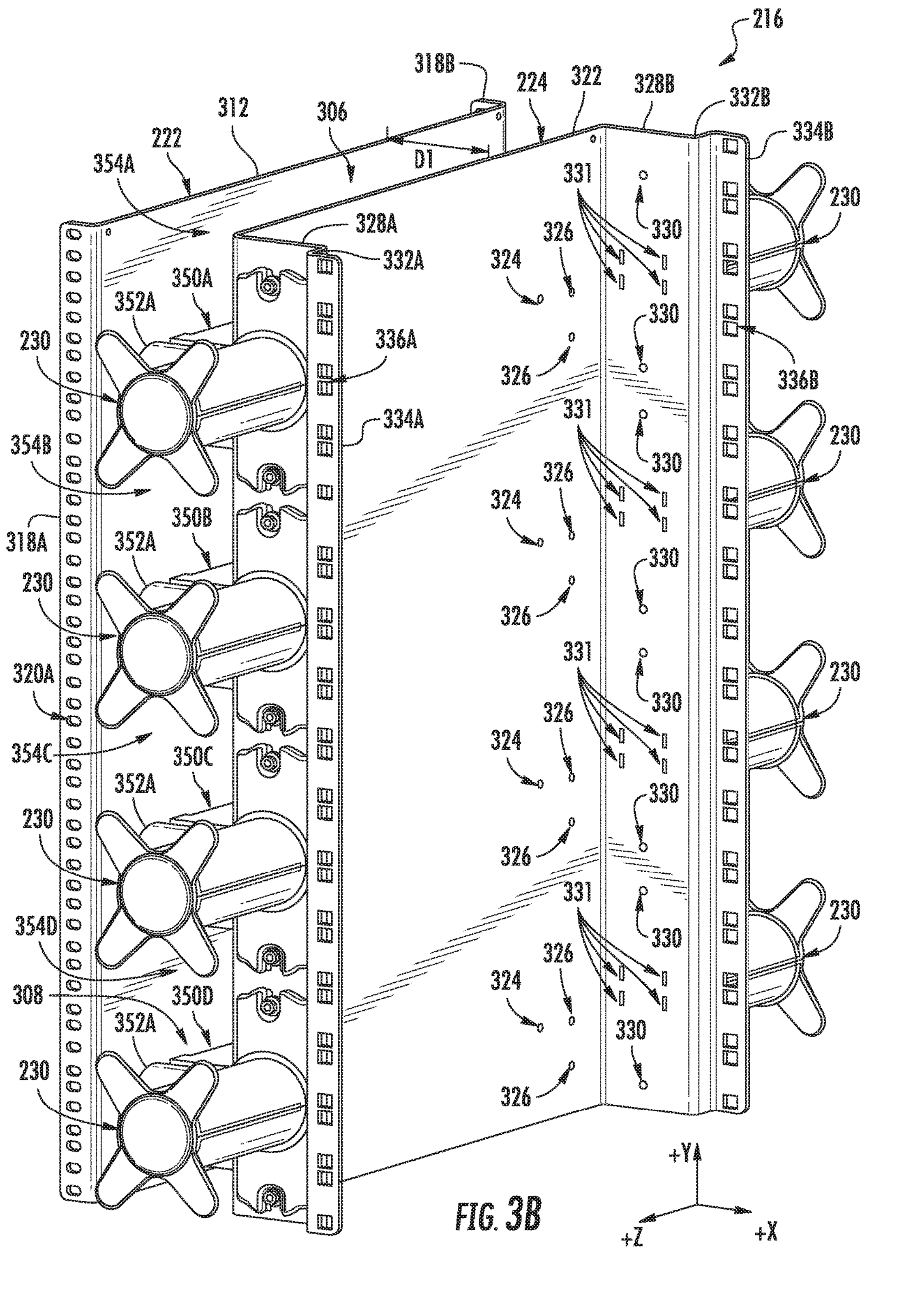
230
352A
354B
350B
320B
320A
354C
350C
318B
354D
350D
+Y
-X
+Z
312
318A

FIG. 3A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350A
352A
336A
336B
354B
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354C
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354D
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350D
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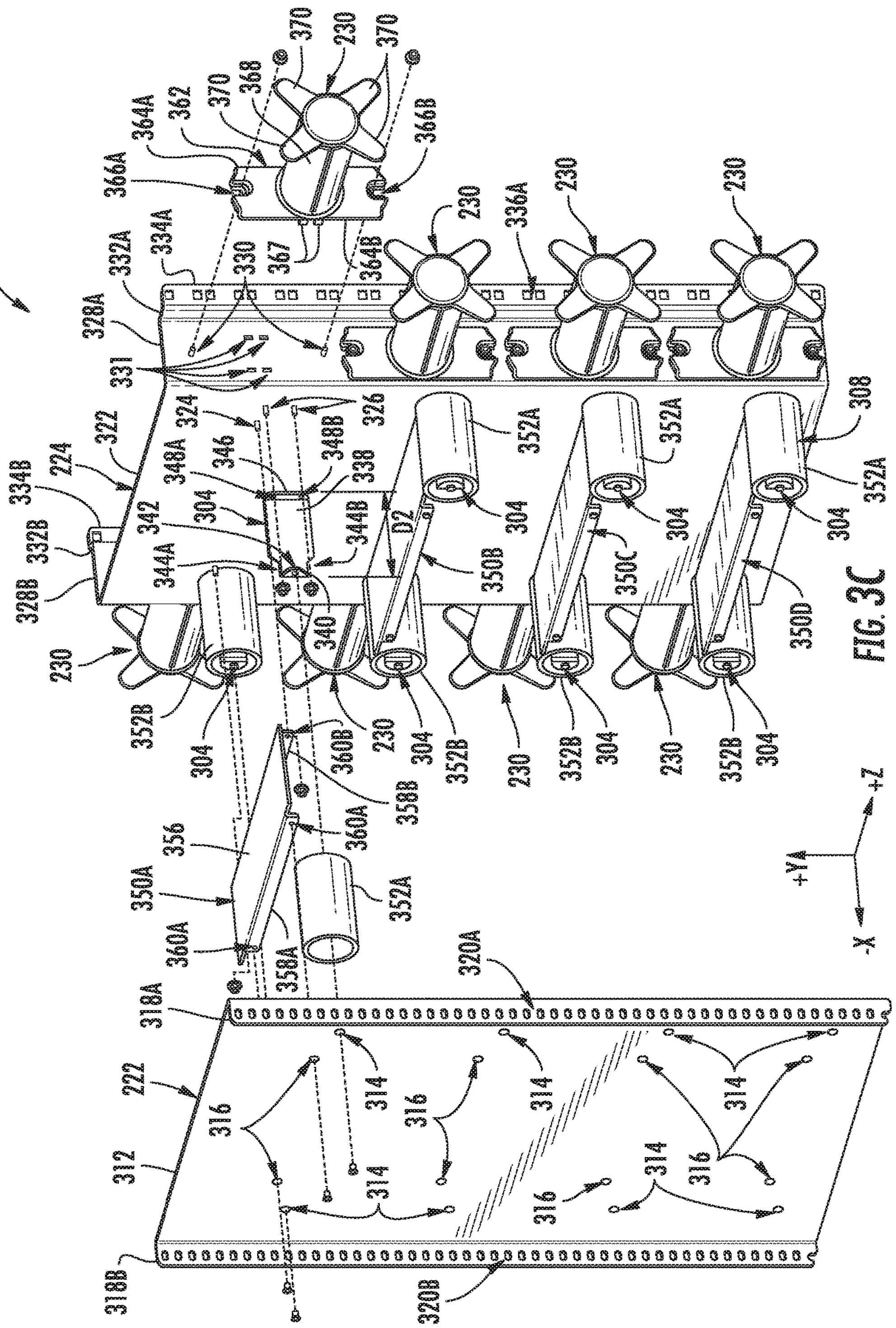
+Z
+X

FIG. 3B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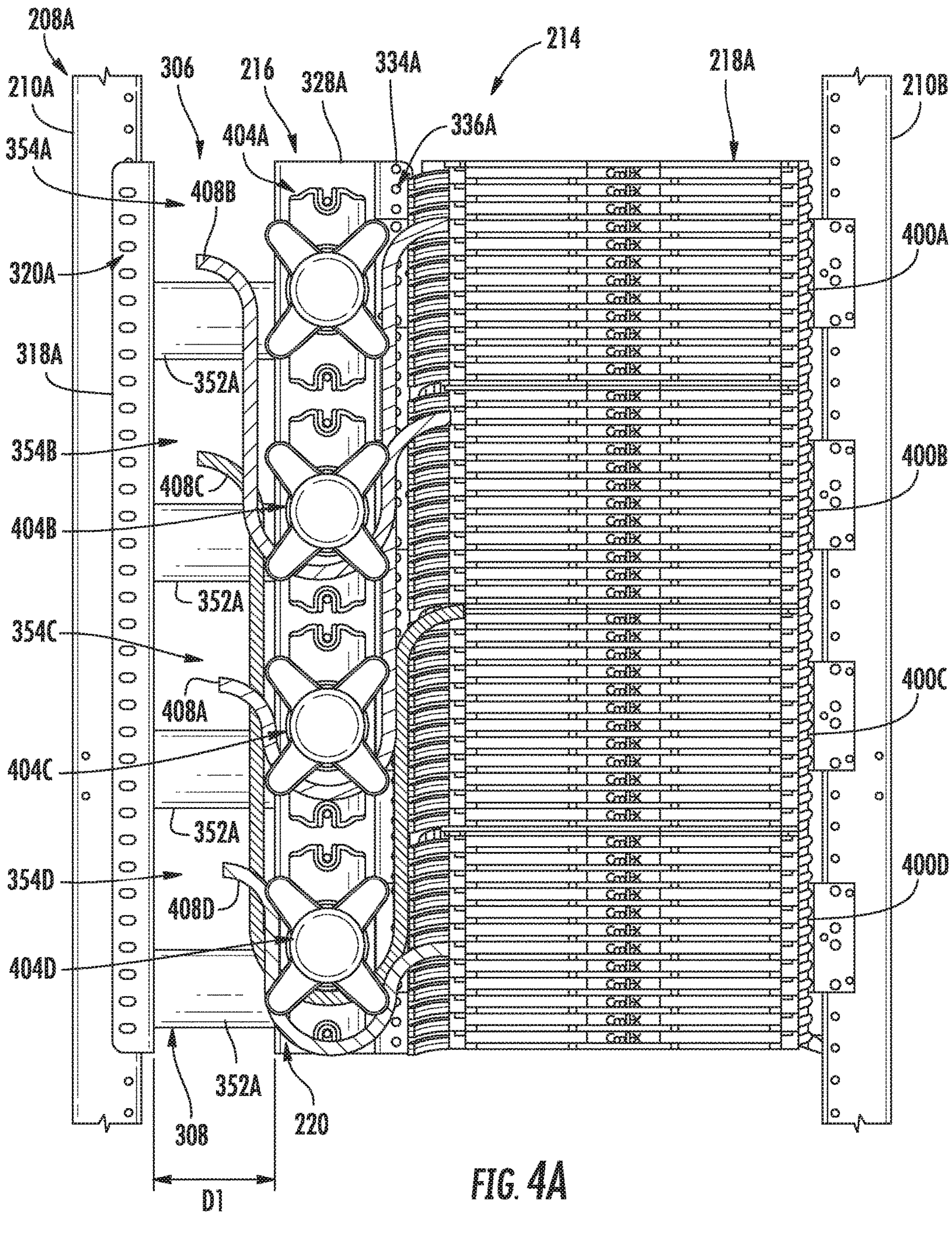
322
224
334B
332B
328B
348A
348B
346
338
304
342
344A
344B
340
D2
350B
350C
350D
352A
352B
308
360B
358B
360A
356
350A
358A
+YA
+Z
-X
320A
318A
222
312
316
314
318B
320B

FIG. 3C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354B
400B
408C
404B
352A
354C
400C
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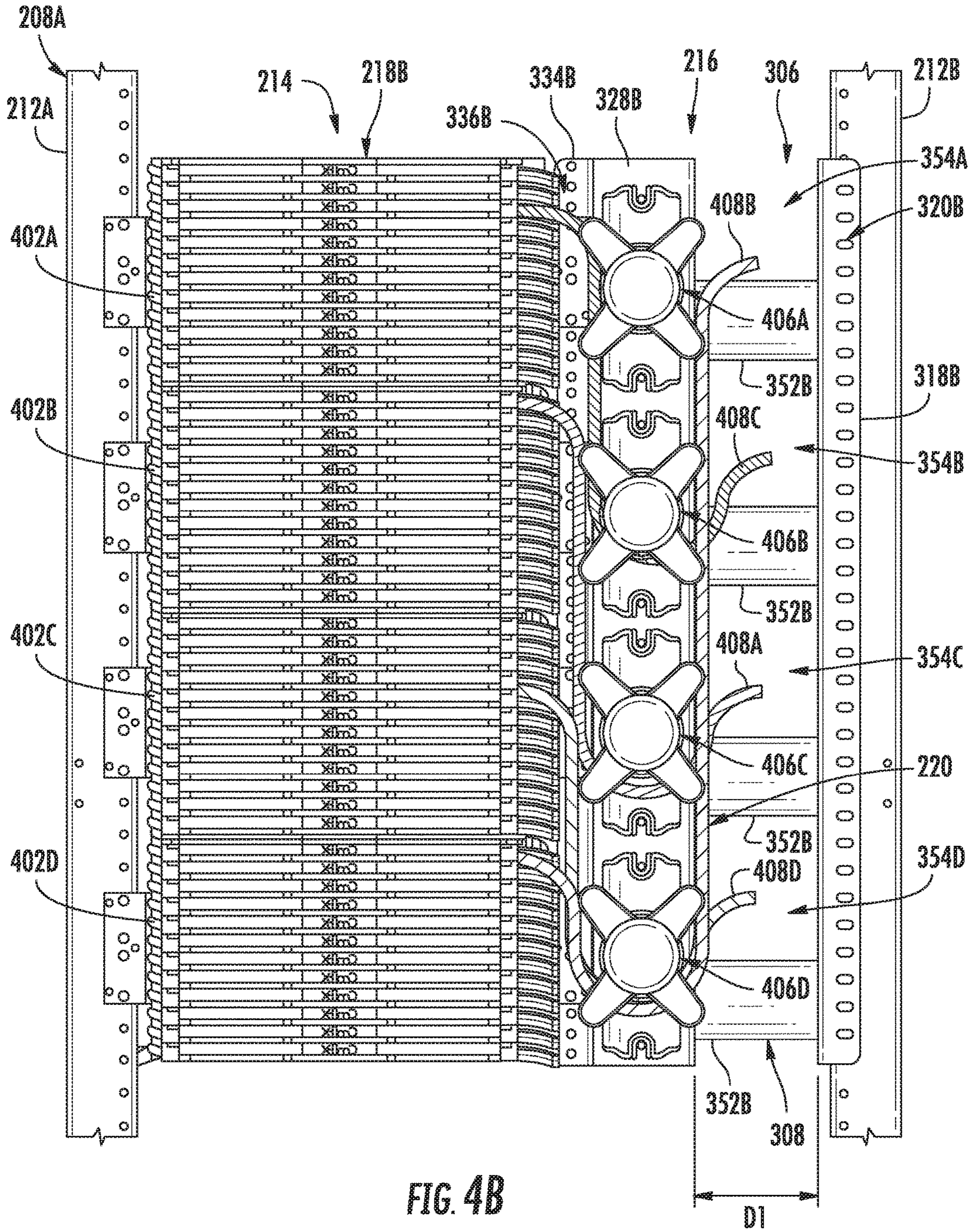
404C
352A
354D
400D
408D
404D
352A
308
220
D1

FIG. 4A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402B
408C
354B
406B
352B
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406C
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354D
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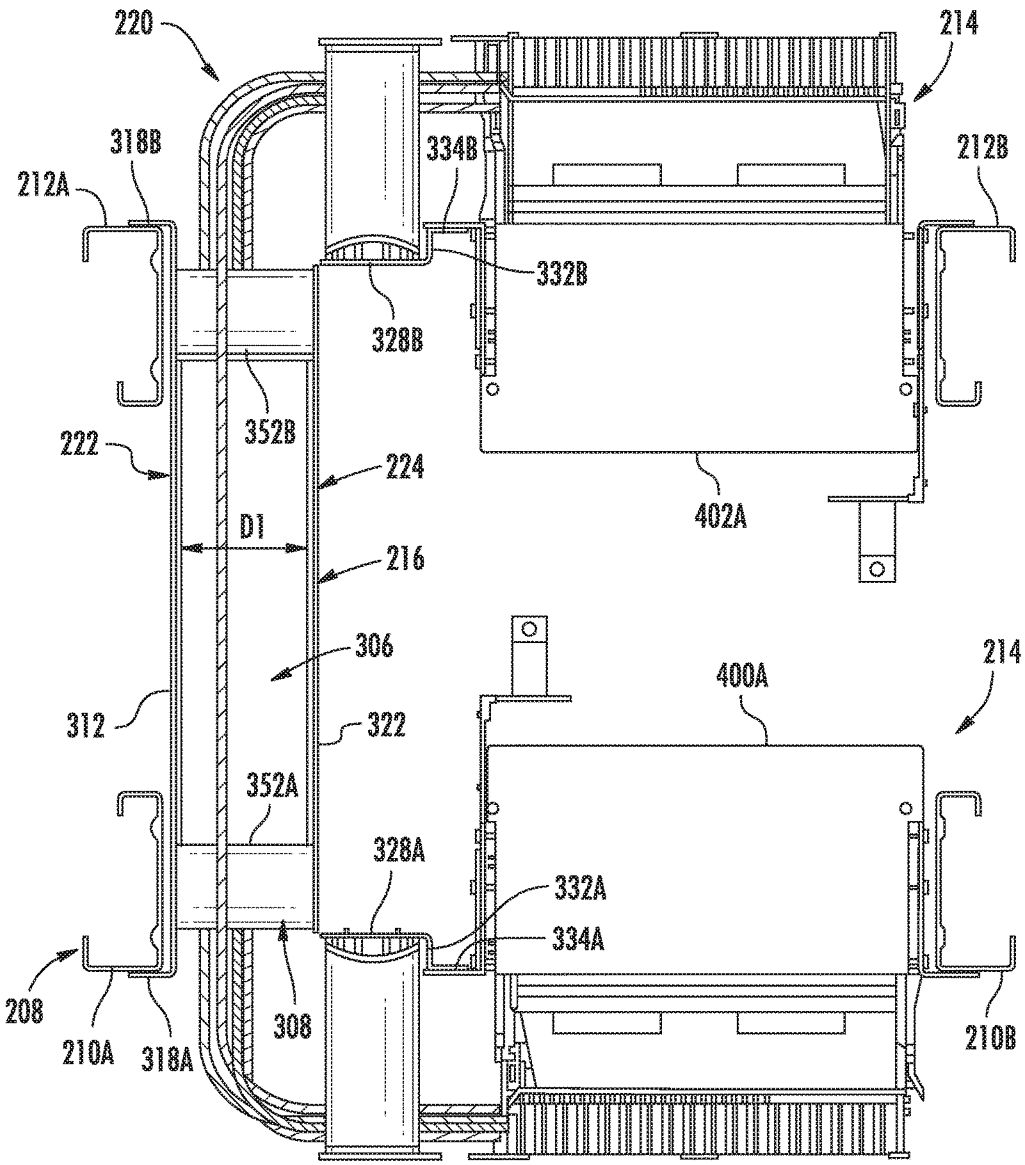
352B
308
D1

FIG. 4B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212A
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222
224
402A
D1
216
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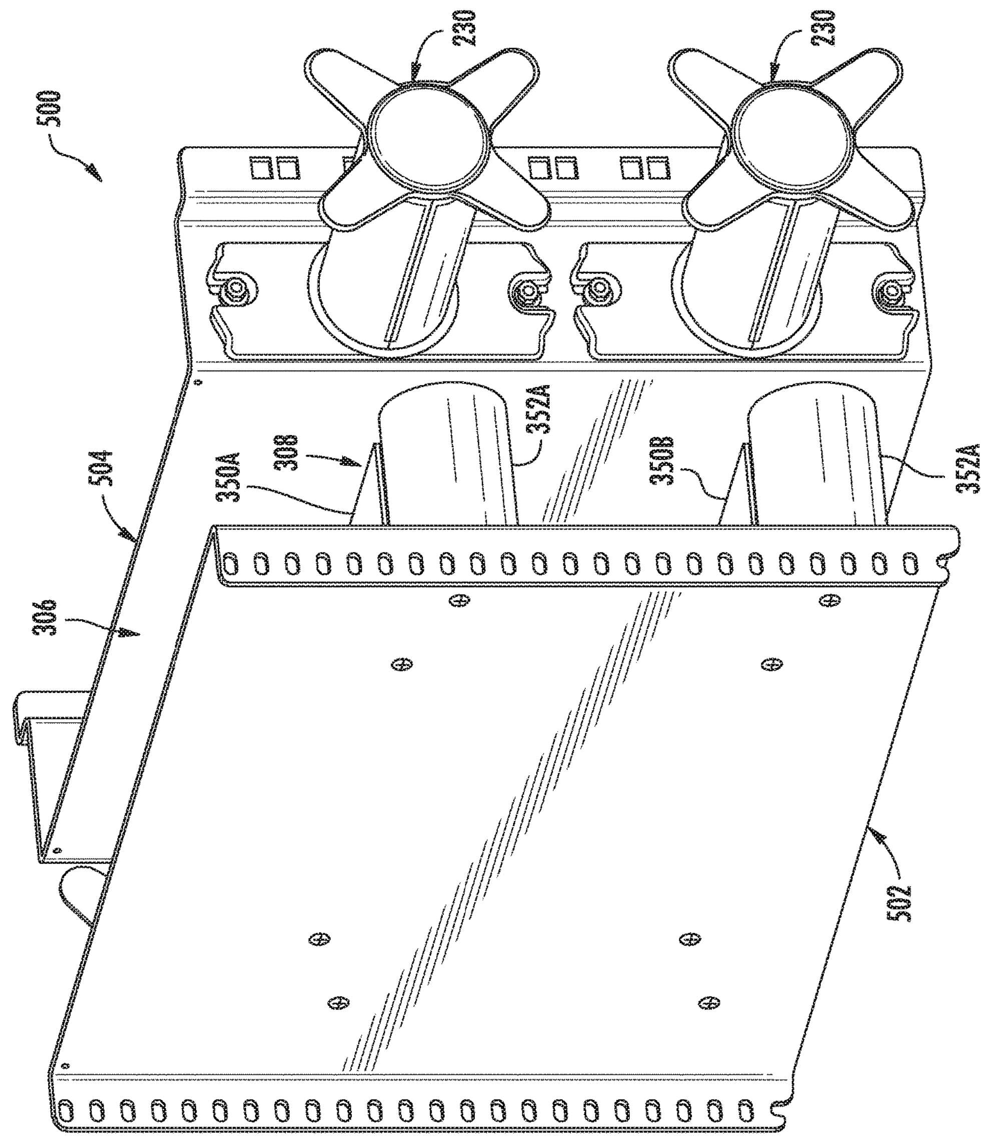
352A
328A
332A
334A
208
308
210A
318A
210B

FIG. 4C

FIG. 5



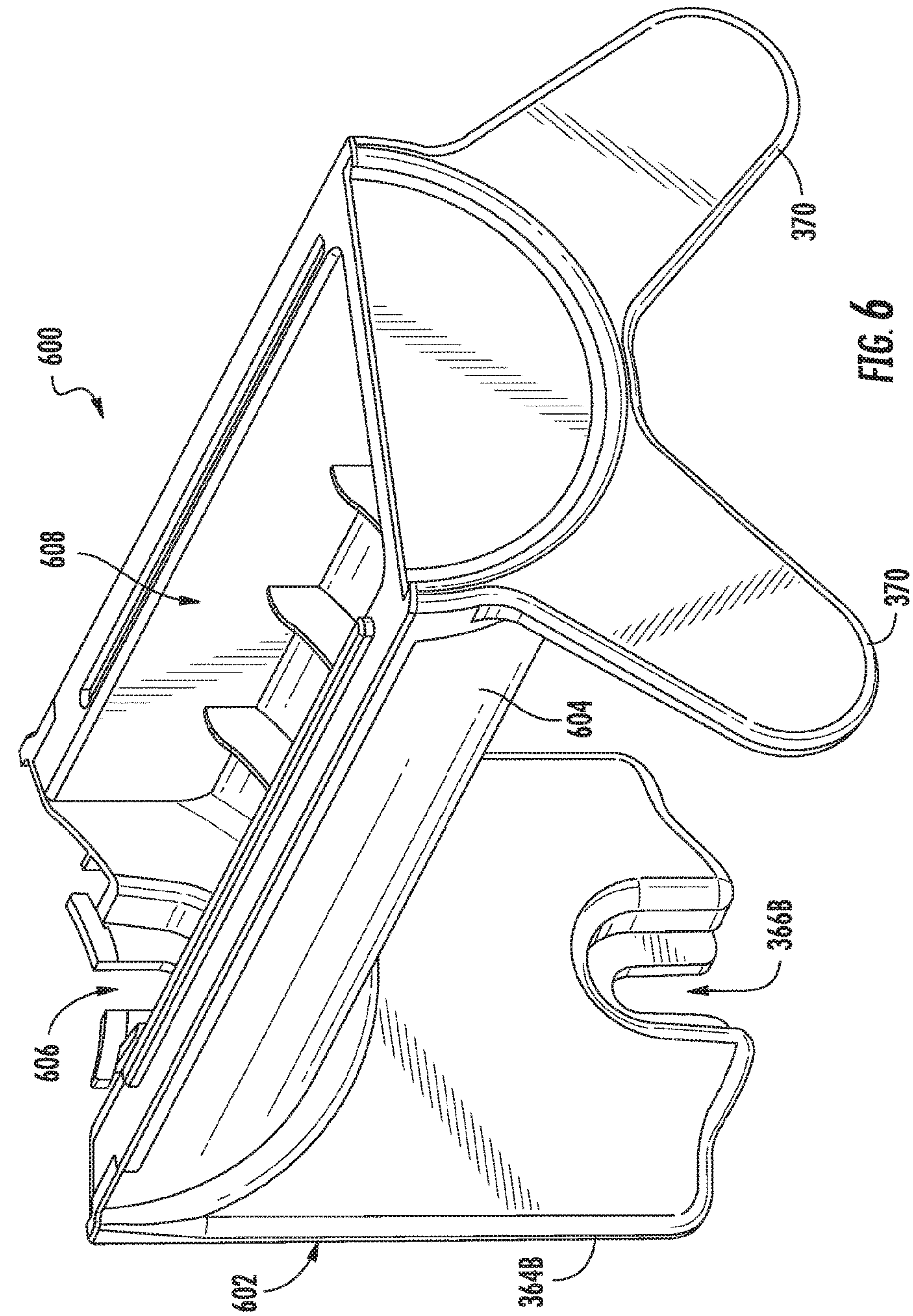


FIG. 6

FIBER TERMINAL RACK MOUNT WITH FRONT-TO-BACK FIBER ROUTING MANAGEMENT

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of priority of U.S. Provisional Application Ser. No. 62/417,639, filed Nov. 4, 2016, the content of which is relied upon and incorporated herein by reference in its entirety.

BACKGROUND

The disclosure relates generally to fiber optic equipment that includes fiber routing management, and more particularly to a fiber terminal rack mount with front-to-back fiber routing management which can be installed in a fiber terminal rack of a fiber terminal cabinet to provide fiber routing management.

To improve network performance, communication and data networks are increasingly employing optical fiber. The benefits of optical fiber are well known and include higher signal-to-noise ratios and increased bandwidth. To further improve network performance, fiber optic networks are increasingly providing optical fiber connectivity all the way to end subscribers. These initiatives include various fiber-to-the-premises (FTTP), fiber-to-the-home (FTTH), and other fiber initiatives (generally described as FTTx).

A fiber optic network provides optical signals over a distribution network comprised of fiber optic cables. Optical signals may be carried over fiber optic cables to end subscribers via remote terminals. A remote terminal, as used herein, is a device used in fiber optic distribution networks that may convert between optical and electrical signals and/or provide high density fiber termination optical cross-connect for routing optical signals.

FIG. **1** is a schematic diagram of an exemplary optical network that includes remote terminals for converting electrical signals to optical signals, and vice versa, and for carrying optical signals over a fiber optic network. The fiber optic network **100** in FIG. **1** provides optical signals from switching points **102** over a distribution network **104** comprising fiber optic feeder cables **106**. The switching points **102** include optical line terminals (OLTs) or forward lasers/return receivers **108** that convert electrical signals to and from optical signals. The optical signals may then be carried over the fiber optic feeder cables **106** to remote terminals **110**. The remote terminals **110** act as consolidation points for splicing and making cross-connections and interconnections, as well as providing locations for couplers and splitters. The couplers and splitters in the remote terminals **110** enable a single optical fiber to serve multiple subscriber premises **112**. Distribution cables **114** (e.g., optical and/or electrical) exit the remote terminals **110** to carry optical signals between the fiber optic network **100** and the subscriber premises **112**. Typical subscriber premises **112** include single-dwelling units (SDU), multi-dwelling units (MDU), businesses, and/or other facilities or buildings. End subscribers in the subscriber premises **112** may contain network devices configured to receive electrical signals as opposed to optical signals. Thus, if the distribution cables **114** are optical cables, then optical network terminals (ONTs) and/or optical network units (ONUs) may be provided at the subscriber premises **112** to convert optical signals received over the distribution cables **114** to electronic signals. The distribution cables **114** leaving the remote terminals **110** can be run to one or more network interface devices (NIDs) for further routing and distribution to subscriber premises **112**. The remote terminals **110** may convert between optical and electrical signals and/or provide high density fiber termination optical cross-connect for routing optical signals. In particular, remote terminals **110** contain high density termination housings that terminate one or more fiber optic cables (e.g., feeder cables **106**).

A remote terminal comprises a remote terminal cabinet containing high density termination housings that terminate one or more fiber optic cables. Routing of the high termination density housings can be complicated, particularly for high density termination housings oriented in a back-to-back orientation (which requires jumper management between the front and rear facing fiber termination housings). While there is an increased demand for higher density fiber termination within the fiber termination housings, there is also limited right of way space regarding the location of these remote terminal cabinets.

Accordingly, there is a desire to minimize the size and footprint of the remote terminal cabinet and maximize the density fiber termination contained therein, particularly for fiber termination housings in a back-to-back orientation.

SUMMARY

Embodiments of the disclosure are directed to a fiber terminal rack mount with front-to-back fiber routing management. The fiber terminal rack mount is configured to be mounted in a remote terminal to facilitate fiber management of fiber optic cables routed from fiber optic equipment. In exemplary aspects disclosed herein, the fiber terminal rack mount comprises two vertically oriented panels with a plurality of horizontally oriented shelves positioned therebetween. The panels are configured to mount to vertical rails of a remote terminal cabinet of the remote terminal, with oppositely facing fiber optic equipment also mounted in the remote terminal cabinet. The panels and shelves also define routing channels (e.g., pass through channels) for routing fiber optic cables (e.g., fiber jumpers) therethrough, thereby facilitating front-to-back fiber routing between the front and back of the fiber optic equipment mounted in the remote terminal. In this manner, as an example, the fiber terminal rack mount may more easily support fiber routing between the back-to-back mounted fiber optic equipment, which may increase as fiber optic connectivity density increases. In other non-limiting embodiments, the fiber terminal rack mount further comprises fiber routing hubs disposed on each end of the rack mount to aid in routing fiber optic cables.

One embodiment of the disclosure relates to a fiber terminal rack mount for mounting fiber optic equipment in a fiber terminal rack having a front vertical rail set at a front of the fiber terminal rack and a back vertical rail set at a back of the fiber terminal rack. The fiber terminal rack mount comprises a rack attachment panel, chassis attachment panel, and at least one attachment member. The rack attachment panel comprises first and second rack attachment flanges vertically oriented at opposite ends of the rack attachment panel. The rack attachment panel is configured for the first rack attachment flange to attach to at least one front vertical rail of the front vertical rail set of the fiber terminal rack and the rack attachment panel is also configured for the second rack attachment flange to attach to at least one back vertical rail of the back vertical rail set of the fiber terminal rack. The chassis attachment panel comprises at least one chassis attachment flange vertically oriented at

an end of the chassis attachment panel. The at least one chassis attachment flange is configured to attach to a first fiber optic equipment chassis facing a first direction. The at least one attachment member is positioned between the rack attachment panel and the chassis attachment panel. The at least one attachment member attaches the rack attachment panel and the chassis attachment panel to one another by a separation distance. The rack attachment panel and the chassis attachment panel at least partially define a routing space between the rack attachment panel and the chassis attachment panel. The routing space is configured to receive and route therein at least a portion of a fiber optic cable between the front and back of the fiber terminal rack.

An additional embodiment of the disclosure relates to a method for routing fiber optic equipment mounted in a fiber terminal rack having a front vertical rail set at a front of the fiber terminal rack and a back vertical rail set at a back of the fiber terminal rack. The method comprises connecting a first end of a first fiber optic cable to a first port housed within a first fiber optic equipment chassis. The first fiber optic equipment chassis is at least partially mounted to the fiber terminal rack by attachment to a chassis attachment panel of a fiber terminal rack mount. The fiber terminal rack mount is attached by first and second rack attachment flanges of a rack attachment panel to a front vertical rail of the front vertical rail set and a back vertical rail of the back vertical rail set of the fiber terminal rack. The method further comprises routing the first fiber optic cable from the front to the back of the fiber terminal rack through a routing space at least partially defined by a separation distance between the chassis attachment panel of the fiber terminal rack. The chassis attachment panel is attached to the fiber terminal rack by at least one attachment member positioned therebetween. The method further comprises connecting a second end of the first fiber optic cable to a second port positioned towards the back of the fiber terminal rack relative to the first port.

An additional embodiment of the disclosure relates to a remote terminal system. The remote terminal system comprises a remote terminal cabinet defining a chamber, a fiber terminal rack, fiber optic equipment, and a fiber terminal rack mount. The fiber terminal rack is positioned within the chamber of the remote terminal cabinet. The fiber terminal rack has a front vertical rail set at a front of the fiber terminal rack and a back vertical rail set at a back of the fiber terminal rack. The fiber optic equipment comprises a front chassis, back chassis, and a first fiber optic cable. The front chassis is positioned at the front of the fiber terminal rack and comprises a first front port. The back chassis is positioned at the back of the fiber terminal rack and comprises a first back port. The first fiber optic cable connects the first front port in the front chassis to the first back port in the back chassis. The fiber terminal rack mount comprises a rack attachment panel, a chassis attachment panel, and at least one attachment member. The rack attachment panel comprises first and second rack attachment flanges vertically oriented at opposite ends of the rack attachment panel. The first rack attachment flange is attached to at least one front vertical rail of the front vertical rail set of the fiber terminal rack and the second rack attachment flange is attached to at least one back vertical rail of the back vertical rail set of the fiber terminal rack. The chassis attachment panel comprises first and second chassis attachment flanges vertically oriented at opposing ends of the chassis attachment panel. The first chassis attachment flange is attached to the front chassis and the second chassis attachment flange is attached to the back chassis. The at least one attachment member is positioned between the rack attachment panel and the chassis attachment panel. The at least one attachment member attaches the rack attachment panel and the chassis attachment panel to one another by a separation distance. The rack attachment panel and the chassis attachment panel at least partially define a routing space between the rack attachment panel and the chassis attachment panel, where at least a portion of the first fiber optic cable is positioned within the routing space.

An additional embodiment of the disclosure relates to a fiber terminal rack mount for mounting fiber optic equipment in a fiber terminal rack having a front and a back. The fiber terminal rack mount comprises a rack attachment panel, a chassis attachment panel, at least one attachment member, and a fiber routing hub. The rack attachment panel comprises at least one rack attachment flange vertically oriented at an end of the rack attachment panel. The at least one rack attachment flange is configured to attach to the fiber terminal rack. The chassis attachment panel comprises at least one chassis attachment flange vertically oriented at an end of the chassis attachment panel. The at least one chassis attachment flange comprises at least one chassis attachment aperture configured to attach to a first fiber optic equipment chassis facing a first direction. The at least one attachment member is positioned between the rack attachment panel and the chassis attachment panel. The at least one attachment member attaches the rack attachment panel and the chassis attachment panel to one another by a separation distance. The fiber routing hub comprises a first end and a second end, the first end attached to the chassis attachment panel. The rack attachment panel and the chassis attachment panel at least partially define a routing space between the rack attachment panel and the chassis attachment panel. The routing space is configured to receive and route therein at least a portion of a fiber optic cable between the front and back of the fiber terminal rack. The fiber routing hub is positioned between the routing space and the at least one chassis attachment aperture of the at least one chassis attachment flange.

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.

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 embodiments, and together with the description serve to explain principles and operation of the various embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of an exemplary optical network that includes remote terminals for supporting fiber optic equipment for converting electrical signals to optical signals, and vice versa, and for distributing such optical signals over a fiber optic network;

FIG. **2**A is a perspective view of an exemplary remote terminal cabinet of an exemplary remote terminal that can be provided in the optical network in FIG. **1**, wherein the remote terminal cabinet defines a chamber and comprising a plurality of doors, a left fiber terminal rack positioned within a left portion of the chamber, and a right fiber terminal rack positioned within a right portion of the chamber;

FIG. **2**B is a perspective view of an exemplary fiber terminal rack mount partially mounting exemplary fiber optic equipment to the left fiber terminal rack within the chamber of the remote terminal cabinet of FIG. **2**A, wherein the fiber terminal rack mount comprises two vertically oriented panels with a plurality of horizontally oriented shelves positioned therebetween to provide front-to-back fiber routing management for the fiber optic equipment, wherein the fiber optic equipment includes a front plurality of fiber optic equipment chassis and a back plurality of fiber optic equipment chassis and a plurality of fiber optic cables connecting the front plurality of fiber optic equipment chassis and back plurality of fiber optic equipment chassis with a portion of the plurality of fiber optic cables routed through the fiber terminal rack;

FIG. **3**A is a left perspective view of the fiber terminal rack mount of FIG. **2**B, wherein the fiber terminal rack mount comprises a rack attachment panel, a chassis attachment panel, a plurality of attachment members positioned therebetween, the rack attachment panel and the chassis attachment panel defining a routing space between the rack attachment panel and chassis attachment panel;

FIG. **3**B is a right perspective view of the fiber terminal rack mount of FIG. **3**A;

FIG. **3**C is an exploded perspective view of the fiber terminal rack mount of FIG. **3**A;

FIG. **4**A is a front view of the first fiber optic equipment chassis of FIG. **2**B;

FIG. **4**B is a back view of the second fiber optic equipment chassis of FIG. **2**B;

FIG. **4**C is a top view of the front plurality of fiber optic equipment chassis, back plurality of fiber optic equipment chassis, fiber optic rack mount, and plurality of fiber optic cables of FIG. **2**B;

FIG. **5** is a perspective view of another embodiment of the fiber terminal rack mount of FIG. **4**A with a reduced height; and

FIG. **6** is a perspective view of another embodiment of a fiber routing hub of the fiber terminal rack mount of FIGS. **2**B-**5**, the fiber routing hub comprising a partially curved sidewall.

DETAILED DESCRIPTION

Embodiments of the disclosure are directed to a fiber terminal rack mount with front-to-back fiber routing management. The fiber terminal rack mount is configured to be mounted in a remote terminal to facilitate fiber management of fiber optic cables routed from fiber optic equipment. In exemplary aspects disclosed herein, the fiber terminal rack mount comprises two vertically oriented panels with a plurality of horizontally oriented shelves positioned therebetween. The panels are configured to mount to vertical rails of a remote termination cabinet of the remote terminal, with oppositely facing fiber optic equipment also mounted in the remote terminal cabinet. The panels and shelves also define routing channels (e.g., pass through channels) for routing fiber optic cables (e.g., fiber jumpers) therethrough, thereby facilitating front-to-back fiber routing between the front and back of the fiber optic equipment mounted in the remote terminal. In this manner, as an example, the fiber terminal rack mount may more easily support fiber routing between the back-to-back mounted fiber optic equipment, which may increase as fiber optic connectivity density increases. In other non-limiting embodiments, the fiber terminal rack mount further comprises fiber routing hubs disposed on each end of the rack mount to aid in routing fiber optic cables.

FIG. **2**A is a perspective view of an exemplary remote terminal cabinet **200** of the remote terminal **110** of FIG. **1**. The remote terminal cabinet **200** defines a chamber **202** and has a front **203**A and a back **203**B (e.g., rear). The remote terminal cabinet **200** comprises a plurality of doors (e.g., left front door **204**A, right front door **204**B, left back door **206**A, right back door **206**B), a left fiber terminal rack **208**A positioned within a left portion of the chamber **202**, and a right fiber terminal rack **208**B positioned within a right portion of the chamber **202**. The remote terminal cabinet **200** is configured to provide a convenient and environmentally protected housing to house fiber optic equipment mounted therein. The remote terminal cabinet **200** may also include other supporting components and features for fiber optic equipment mounted therein, such as fans and/or other cooling equipment to provide temperature control (e.g., cooling) and/or operating components, such as power supplies, for providing power to active components of the fiber optic equipment mounted therein.

The left front door **204**A of the remote terminal cabinet **200** provides access to a front of the left fiber terminal rack **208**A. The left back door **206**A of the remote terminal cabinet **200** provides access to a back of the left fiber terminal rack **208**A. The right front door **204**B provides access to a front of the right fiber terminal rack **208**B, and the right back door **206**B provides access to a back of the right fiber terminal rack **208**B. Each of the left fiber terminal rack **208**A and right fiber terminal rack **208**B comprises a plurality of vertical rails for mounting termination housings thereto. More specifically, each of the left fiber terminal rack **208**A and right fiber terminal rack **208**B comprises a left front rail **210**A, a right front rail **210**B, a left back rail **212**A (shown in FIG. **2**B), and a right back rail **212**B, which may each comprise one or more apertures (e.g., holes, slots, etc.) for mounting thereto. Accordingly, the left and right front vertical rails **210**A, **210**B could be part of a front vertical rail set, and the left and right back vertical rails **212**A, **212**B could be part of a back vertical rail set. However, each vertical rail set could only include one of the rails.

In this regard, FIG. **2**B is a perspective view of fiber optic equipment **214** (including front and back fiber optic equipment) partially mounted to the left fiber terminal rack **208**A within the chamber **202** of the remote terminal cabinet **200** of FIG. **2**A by a fiber terminal rack mount **216**. Fiber optic equipment **214** may include cables, chassis, fiber optic modules, fiber optic cassettes, fiber optic panels, fiber optic adapters, splitters, couplers, etc. The fiber optic equipment **214** comprises a plurality of front chassis **218**A (e.g., fiber optic equipment chassis, termination housing, first chassis, etc.), a plurality of back chassis **218**B (e.g., fiber optic equipment chassis, termination housing, second chassis, etc.) (shown in FIGS. **4**B-**4**C), and a plurality of fiber optic cables **220** connecting one of the plurality of front chassis **218**A and the plurality of back chassis **218**B with a portion of the plurality of fiber optic cables **220** routed through the fiber terminal rack mount **216** (discussed below in more detail).

As explained below in more detail, the fiber terminal rack mount **216** provides high density fiber termination optical cross-connect for routing optical signals, provides fiber routing management, and mounts the plurality of front and back chassis **218**A, **218**B to a fiber terminal rack **208**A, 208B. The fiber terminal rack mount **216** may be configured to mount new fiber optic equipment into preexisting fiber terminal racks **208**A, **208**B. For example, the fiber terminal rack mount **216** can be used to mount chassis **218**A, **218**B that have a width smaller than that of the fiber terminal rack **208**A, **208**B (e.g., a standard 23 inch width fiber terminal rack **208**A, **208**B with a 12 inch width chassis **218**A, **218**B). More specifically, in exemplary aspects disclosed herein, the fiber terminal rack mount **216** comprises a rack attachment panel **222** and a chassis attachment panel **224** with a plurality of horizontally oriented shelves **226** positioned therebetween. The rack attachment panel **222** is attached to the left front rail **210**A and the left back rail **212**A. The rack attachment panel **222**, chassis attachment panel **224**, and a plurality of shelves **226** collectively define a plurality of routing channels **228** (e.g., pass through channels) for routing fiber optic cables (e.g., fiber jumpers) therethrough, thereby facilitating front-to-back fiber routing. As shown, the plurality of front chassis **218**A are mounted to the right front rail **210**B, and the plurality of front chassis **218**A are mounted to the left front rail **210**A by the fiber terminal rack mount **216**. Further, fiber optic cables **220** connected to the plurality of front chassis **218**A are routed through the routing channels **228** of the fiber terminal rack mount **216** to the plurality of back chassis **218**B. In this manner, as an example, the fiber terminal rack mount **216** may more easily support fiber routing between the back-to-back mounted fiber optic equipment **214**, which may increase as fiber optic connectivity density increases. Further, the fiber terminal rack mount **216** comprises a plurality of fiber routing hubs **230** disposed on each end of the fiber terminal rack mount **216** to aid in routing the fiber optic cables **220**.

The fiber terminal rack mount **216** is configured to have a 16U height, but could be configured for other heights. The plurality of front and back chassis **218**A, **218**B are 4U units, but any other sized chassis could be used (e.g., 1U, 2U, etc.) depending on networking requirements and needs. The designation "U", as used herein, refers to a standard equipment shelf size of a fiber optic equipment rack or a cabinet. This may also be referred to as "RU." For example, an equipment rack may support 1U-sized shelves, with "U" equal to a standard 1.75 inches in height. Typically, the more rack space (the more "U"s) a fiber optic housing takes up, the higher the fiber capacity in the fiber optic housing.

To further illustrate and explain the fiber terminal rack mount **216** with front-to-back fiber routing management, FIGS. **3**A-**3**C are provided to illustrate views of the fiber terminal rack mount **216** of FIG. **2**B. The fiber terminal rack mount **216** comprises a rack attachment panel **222**, a chassis attachment panel **224**, and a plurality of attachment members **304** positioned therebetween that attach the rack attachment panel **222** to the chassis attachment panel **224**. The fiber terminal rack mount **216** further comprises a routing space **306** defined between the rack attachment panel **222** and the chassis attachment panel **224**, a routing management assembly **308** positioned within the routing space **306** (e.g., between the rack attachment panel **222** and the chassis attachment panel **224**), and a plurality of fiber routing hubs **230** attached to the chassis attachment panel **224**. The rack attachment panel **222** is configured for attachment to a fiber terminal rack **208**A, **208**B, and the chassis attachment panel **224** is configured for attachment to front and back chassis **218**A, **218**B (e.g., in a back-to-back configuration).

The rack attachment panel **222** (e.g., made of metal) comprises a body **312** with a plurality of attachment mount apertures **314** and a plurality of shelf mount apertures **316** defined therein, which are discussed in more detail below. The rack attachment panel **222** further comprises a front rack attachment flange (e.g., a first rack attachment flange) **318**A and a back rack attachment flange (e.g., a second rack attachment flange) **318**B at opposite ends of the rack attachment panel **222** and extending in the same direction (e.g., –X direction) so that the front and back rack attachment flanges **318**A, **318**B are configured to abut mounting surfaces of front and back vertical rails **210**A, **210**B, **212**A, **212**B of the fiber terminal racks **208**A, **208**B. The front rack attachment flange **318**A and back rack attachment flange **318**B are vertically oriented (e.g., extending from a top of the body **312** to a bottom of the body **312**) so that the front and back rack attachment flanges **318**A, **318**B are configured to abut mounting surfaces of front and back vertical rails **210**A, **210**B, **212**A, **212**B of the fiber terminal racks **208**A, **208**B. The front rack attachment flange **318**A comprises a plurality of front rack attachment apertures **320**A (e.g., hole, slot, etc.) to attach the front rack attachment flange **318**A to a rail of the remote terminal cabinet **200** (e.g., left front rail **210**A, right front rail **210**B, left back rail **212**A, right back rail **212**B). The back rack attachment flange **318**B comprises a plurality of back rack attachment apertures **320**B (e.g., hole, slot, etc.) to attach the back rack attachment flange **318**B to a rail of the remote terminal cabinet **200** (e.g., left front rail **210**A, right front rail **210**B, left back rail **212**A, right back rail **212**B). In certain embodiments, the plurality of rack attachment apertures **320**A, **320**B are vertically spaced along a length of the front and back rack attachment flanges **318**A, **318**B, respectively so that at least some of the rack attachment apertures **320**A, **320**B align with at least some apertures of the vertical rails **210**A, **210**B, **212**A, **212**B of the fiber terminal racks **208**A, **208**B.

The chassis attachment panel **224** (e.g., made of metal) comprises a body **322** with a plurality of attachment mount apertures **324** and a plurality of shelf mount apertures **326** defined therein (discussed in more detail below). The chassis attachment panel **224** further comprises a front mount wall **328**A and a back mount wall **328**B at opposite ends of the chassis attachment panel **224** and extending in the same direction (e.g., +X direction) so that the plurality of front and back chassis **218**A, **218**B can be mounted in a back-to-back configuration. The front mount wall **328**A and back mount wall **328**B are vertically oriented (e.g., extending from a top of the body **322** to a bottom of the body **322**) so that the plurality of front and back chassis **218**A, **218**B can be mounted in a back-to-back configuration. In certain embodiments, the front mount wall **328**A and/or back mount wall **328**B comprise a plurality of fiber routing hub mount apertures **330** for mounting the plurality of fiber routing hubs **230** (discussed in more detail below). Additionally, in certain embodiments, the front mount wall **328**A and/or back mount wall **328**B could comprise a plurality of fiber routing hub mount slots **331** for each set of fiber routing hub mount apertures **330** to facilitate alignment of the plurality of fiber routing hubs **230** during mounting (discussed in more detail below). Each set comprises four fiber routing hub mount slots **331**, but more or fewer could be used.

In certain embodiments, the chassis attachment panel **224** further comprises a front intermediate wall **332**A extending from the front mount wall **328**A (at an end opposite from the body **322**) to provide an offset depth of the front fiber routing hubs **230** relative to a mounting surface of the plurality of front chassis **218**A. The chassis attachment panel **224** further comprises a back intermediate wall **332**B extending from the back mount wall **328**B (at an end opposite from the body **322**) to provide an offset depth of the back fiber routing hubs **230** relative to a mounting surface of the plurality of back chassis **218**B. The front intermediate wall **332**A and back intermediate wall **332**B are vertically oriented (e.g., extending from a top of the body **322** to a bottom of the body **322**) and extend outward from a center of the body **322** so that the offset depth of the fiber routing hubs **230** relative to mounting surfaces of the plurality of front and back chassis **218**A, **218**B is close to the center of the fiber terminal rack mount **216** and the corresponding remote terminal cabinet **200**. In this manner, the offset depth can be varied to accommodate fiber routing hubs **230** of different lengths and/or chassis **218**A, **218**B of different depths. Accordingly, the front intermediate wall **332**A and back intermediate wall **332**B extend in opposite directions (e.g., away from a center of the body **322**). More specifically, the front intermediate wall **332**A extends in a +Z direction and the back intermediate wall **332**B extends in a −Z direction.

The chassis attachment panel **224** further comprises a front chassis attachment flange **334**A extending from the front intermediate wall **332**A (at an end opposite from the front mount wall **328**A). The chassis attachment panel **224** further comprises a back chassis attachment flange **334**B extending from the back intermediate wall **332**B (at an end opposite from the back mount wall **328**B). The front and back chassis attachment flanges **334**A, **334**B are configured to abut mounting surfaces of the front and back chassis **218**A, **218**B to mount the front and back chassis **218**A, **218**B to the fiber terminal rack mount **216**. The front chassis attachment flange **334**A and back chassis attachment flange **334**B are vertically oriented (e.g., extending from a top of the body **322** to a bottom of the body **322**) and extend away from the body **322** in the same direction as the front mount wall **328**A and back mount wall **328**B (e.g., in the +X direction). In this manner, the front and back chassis attachment flanges **334**A, **334**B are configured to allow mounting of the front and back chassis **218**A, **218**B in a back-to-back configuration. The front chassis attachment flange **334**A comprises a plurality of chassis attachment apertures **336**A (e.g., hole, slot, etc.) to attach the front chassis attachment flange **334**A to the plurality of front fiber optic equipment chassis **218**A and the back chassis attachment flange **334**B comprises a plurality of chassis attachment apertures **336**B (e.g., hole, slot, etc.) to attach the back chassis attachment flange **334**B to the plurality of back fiber optic equipment chassis **218**B (discussed in more detail below).

In certain embodiments, the chassis attachment apertures **336**A, **336**B are vertically spaced along a length of the front and back chassis attachment flange **334**A, **334**B, respectively. In this manner, the front rack attachment flange **318**A is parallel to, but offset from the front mount wall **328**A, and the back rack attachment flange **318**B is parallel to, but offset from the back mount wall **328**B to provide an offset depth of the front and back fiber routing hubs **230** relative to the front and back chassis **218**A, **218**B. In this manner, the offset depth can be varied to accommodate fiber routing hubs **230** of different lengths and/or chassis **218**A, **218**B of different depths. In certain embodiments, the front intermediate wall **332**A and the back intermediate wall **332**B are omitted. Accordingly, the front rack attachment flange **318**A extends from an end of the front mount wall **328**A, such that the front rack attachment flange **318**A and front mount wall **328**A are in the same plane, and similarly, the back rack attachment flange **318**B extends from an end of the back mount wall **328**B, such that the back rack attachment flange **318**B and back mount wall **328**B are in the same plane.

The plurality of attachment members **304** (e.g., made of plastic) are positioned between the rack attachment panel **222** and the chassis attachment panel **224**, and attaches the rack attachment panel **222** to the chassis attachment panel **224**, thereby defining a routing space **306** a separation distance D**1** between the rack attachment panel **222** and the chassis attachment panel **224** (e.g., between the rack attachment panel body **312** and the chassis attachment panel body **322**). The separation distance D**1** correlates with a separation length D**2** of the attachment member **304**, such that altering a length of the attachment member **304** alters the separation distance D**1**. The distance (e.g., separation distance D**1**) between the rack attachment panel **222** and the chassis attachment panel **224** may vary depending on mounting requirements, such as to accommodate chassis of different widths within the same fiber terminal rack **208**A, **208**B. For example, the separation distance D**1** could be increased to mount fiber optic equipment **214** with a decreased width, or the separation distance D**1** could be decreased to mount fiber optic equipment **214** with an increased width.

Each of the plurality of attachment members **304** comprises a body **338** with a left tab **340** at a first end of the body **338** and a right tab **346** at a second end of the body **338** opposite the first end of the body **338**, which are configured to abut the rack attachment panel **222** and chassis attachment panel **224** for attachment thereto, as explained below. The left tab **340** comprises a mounting aperture **342**, a top recess **344**A, and a bottom recess **344**B. The top recess **344**A and bottom recess **344**B result in a reduced height of the body **338** at a left side of the body **338** relative to a right side of the body **338**. The reduced height may facilitate ease of manufacturing of the attachment member **304** (e.g., tooling clearance for manufacturing the left tab **340**) and/or ease of assembly of the fiber terminal rack mount **216** (e.g., tooling clearance for access to fasteners connecting the attachment member **304** to the chassis attachment panel **224**). The right tab **346** comprises a top mounting aperture **348**A and a bottom mounting aperture **348**B, although in certain embodiments only one mounting aperture may be used.

The left tab mounting aperture **342** aligns with the rack attachment panel attachment mount aperture **314**, such that a fastener (e.g., screw, washer, threaded standoff, stud, and/or nut, etc.) can be inserted through the left tab mounting aperture **342** and rack attachment panel attachment mount aperture **314** to attach the attachment member **304** and rack attachment panel **222** to each other. The right tab mounting apertures **348**A, **348**B align with the chassis attachment panel attachment mount apertures **324**, such that a fastener (e.g., screw, washer, threaded standoff, stud, and/or nut, etc.) can be inserted through each of the right tab mounting apertures **348**A, **348**B and chassis attachment panel attachment mount apertures **324** to attach the attachment member **304** and chassis attachment panel **224** to each other. The plurality of right tab mounting apertures **348**A, **348**B prevents the attachment member **304** from rotating relative to the chassis attachment panel **224**. It is noted that the left tab **340** and the right tab **346** could have fewer or more mounting apertures **342**, **348**A, **348**B.

In this manner, the attachment member **304** attaches the rack attachment panel **222** to the chassis attachment panel **224**, and provides a separation distance between them, where the separation length extends from the left tab **340** to the right tab **346**. In some embodiments, the separation distance between the rack attachment panel **222** and the chassis attachment panel **224** are at least the length of the attachment member **304** (e.g., from the left tab **340** to the right tab **346**). Further, it is noted that a plurality of attachment members **304**, a plurality of left tab mounting apertures **342**, and/or a plurality of right tab mounting apertures **348**A, 348B prevents the rack attachment panel 222, the chassis attachment panel 224, and/or the attachment member 304 from rotating relative to one another.

In certain embodiments, when the rack attachment panel 222 is attached to the chassis attachment panel 224 by the attachment member 304, the rack attachment panel front and back rack attachment flanges 318A, 318B extend in a first direction (e.g., −X direction), and the chassis attachment panel front and back chassis attachment flanges 334A, 334B extend in a second direction (e.g., +X direction) opposite the first direction. In other words, the rack attachment panel front and back rack attachment flanges 318A, 318B extend outwardly from the routing space 306, and the chassis attachment panel front and back chassis attachment flanges 334A, 334B extend outwardly from the routing space 306 so that the rack attachment panel 222 can mount to front and back vertical rails (e.g., rails 210A, 210B, 212A, 212B) and front and back chassis 218A, 218B and provide a routing space 306 extending from front to back.

The routing management assembly 308 comprises a plurality of shelves 226 (e.g., first shelf 350A, second shelf 350B, third shelf 350B, fourth shelf 350D) that collectively define a plurality of routing channels 228 (e.g., a first fiber routing channel 354A, a second fiber routing channel 354B, a third fiber routing channel 354C, a fourth fiber routing channel 354D) for fiber routing management (e.g., to receive fiber optic cables 220 through the fiber routing channels 354A, 354B, 354C, 354D). In certain embodiments, the first shelf 350A is positioned towards a top, the second shelf 350B is positioned below the first shelf 350A, the third shelf 350C is positioned below the second shelf 350B, and the fourth shelf 350D is positioned below the third shelf 350C. Each shelf 350A, 350B, 350C, 350D may have associated therewith a front routing cylinder 352A (e.g., hollow cylinder and/or made of plastic) and a back routing cylinder 352B (e.g., hollow cylinder and/or made of plastic) at ends of the self 350A, 350B, 350C, 350D. The shelves 350A, 350B, 350C, 350D collectively define a plurality of routing channels 228, as explained below in more detail.

The shelf 350A, 350B, 350C, 350D comprises a horizontal plate 356 (e.g., made of metal) with a left flange 358A extending downwardly from a left side and a right flange 358B extending downwardly from a right side (opposite the left side). The left flange 358A comprises a plurality of mounting apertures 360A therein (e.g., a first mounting aperture 360A towards a front end of the left flange 358A, and a second mounting aperture 360A towards a back end of the left flange 358A) for attaching the shelf 350A, 350B, 350C, 350D to the rack attachment panel 222. The right flange 358B comprises a plurality of mounting apertures 360B therein (e.g., a first mounting aperture 360B towards a front end of the right flange 358B, and a second mounting aperture 360B towards a back end of the right flange 358B) for attaching the shelf 350A, 350B, 350C, 350D to the chassis attachment panel 224. The shelf left flange mounting aperture 360A aligns with the rack attachment panel shelf mount aperture 316, such that a fastener (e.g., screw, washer, threaded standoff, stud, and/or nut, etc.) can be inserted through the shelf left flange mounting aperture 360A and the rack attachment panel shelf mount aperture 316 to attach the shelf 350A, 350B, 350C, 350D and rack attachment panel 222 to each other. Similarly, the shelf right flange mounting aperture 360B aligns with the chassis attachment panel shelf mount aperture 326, such that a fastener (e.g., screw, washer, threaded standoff, stud, and/or nut, etc.) can be inserted through the shelf right flange mounting aperture 360B and the chassis attachment panel shelf mount aperture 326 to attach the shelf 350A, 350B, 350C, 350D and chassis attachment panel 224 to each other. Additionally, the left and right flanges 358A, 358B provide structural support and stiffness to the horizontal plate 356. The shelf 350A, 350B, 350C, 350D may attach the rack attachment panel 222 to the chassis attachment panel 224 in addition to or instead of the attachment member 304.

The left flange 358A and right flange 358B each extend along a length of the horizontal plate 356. In certain embodiments, the length of the left flange 358A and right flange 358B is less than the length of the horizontal plate 356. In this manner, the front end and/or back end of the horizontal plate 356 extends past ends of the left flange 358A and/or right flange 358B.

The front routing cylinder 352A is positioned around an attachment member 304 at a front end of the shelf 350A, 350B, 350C, 350D, such that the horizontal plate 356 is approximately tangent with an outer surface of the front routing cylinder 352A. This configuration is made possible by the decreased length of the left and right flanges 358A, 358B relative to the length of the horizontal plate 356. In certain embodiments, a height of the attachment member body 338 corresponds in size to the inner diameter of the front routing cylinder 352A to reduce movement of the front routing cylinder 352A relative to the attachment member 304 and/or shelf 350A, 350B, 350C, 350D. For example, the height of the attachment member body 338 could be slightly more than the inner diameter of the front routing cylinder 352A for a friction fit attachment.

Similarly, the back routing cylinder 352B is positioned around an attachment member 304 at a back end of the shelf 350A, 350B, 350C, 350D, such that the horizontal plate 356 is approximately tangent with an outer surface of the back routing cylinder 352B. This configuration is made possible by the decreased length of the left and right flanges 358A, 358B relative to the length of the horizontal plate 356. In certain embodiments, a height of the attachment member body 338 corresponds in size to the inner diameter of the back routing cylinder 352B to reduce movement of the back routing cylinder 352B relative to the attachment member 304 and/or shelf 350A, 350B, 350C, 350D. For example, the height of the attachment member body 338 could be slightly more than the inner diameter of the back routing cylinder 352B for a friction fit attachment.

In certain embodiments, as shown in FIGS. 3A-3C, the routing management assembly 308 comprises a plurality of shelves 350A, 350B, 350C, 350D that define a plurality of fiber routing channels 354A, 354B, 354C, 354D therebetween (e.g., within the routing space 306). Each of the plurality of shelves 350A, 350B, 350C, 350D is oriented horizontally (e.g., extending from a front to a back), and/or vertically aligned. It is noted that more or less shelves 350A, 350B, 350C, 350D and fiber routing channels 354A, 354B, 354C, 354D may be used depending on routing management requirements and preferences. In certain embodiments, a first fiber routing channel 354A is defined by the rack attachment panel body 312, the chassis attachment panel body 322, and the first shelf 350A. A second fiber routing channel 354B is defined by the rack attachment panel body 312, the chassis attachment panel body 322, the first shelf 350A, and the second shelf 350B. A third fiber routing channel 354C is defined by the rack attachment panel body 312, the chassis attachment panel body 322, the second shelf 350B, and the third shelf 350C. A fourth fiber routing channel 354D is defined by the rack attachment panel body 312, the chassis attachment panel body 322, the third shelf 350C, and the fourth shelf 350D. In certain embodiments, the fiber terminal rack mount **216** omits shelves **350**A, **350**B, **350**C, **350**D and/or provides alternative front-to-back routing features (e.g., using attachment members **304**, studs, etc.).

In certain embodiments, the fiber terminal rack mount **216** comprises a plurality of fiber routing hubs **230** (e.g., a plurality of front fiber routing hubs **230** and a plurality of back fiber routing hubs **230**) to organize and manage the fiber optic cables **220**. More specifically, the plurality of fiber routing hubs **230** comprise a fiber routing hub **230** horizontally adjacent to (e.g., horizontally offset from) each fiber routing channel **354**A, **354**B, **354**C, **354**D (discussed below in more detail), where the cylindrical sidewall **368** of each fiber routing hub **230** could be at least approximately horizontally aligned with the respective shelf **350**A, **350**B, **350**C, **350**D. A plurality of front fiber routing hubs **230** are vertically aligned and attached to the front chassis attachment flange **334**A (e.g., between the front chassis attachment apertures **336**A and the chassis attachment panel body **322**, between the front chassis attachment apertures **336**A and the routing space **306**, between the front chassis attachment apertures **336**A and the plurality of fiber routing channels **354**A, **354**B, **354**C, **354**D, etc.), and a plurality of back fiber routing hubs **230** are vertically aligned and attached to the back chassis attachment flange **334**B (e.g., between the back chassis attachment aperture **336**B and the chassis attachment panel body **322**, between the back chassis attachment aperture **336**B and the routing space **306**, between the back chassis attachment aperture **336**B and the plurality of fiber routing channels **354**A, **354**B, **354**C, **354**D, etc.). However, fewer or more fiber routing hubs **230** could be used. In this manner, the fiber terminal rack mount **216** is configured to provide a fiber routing hub **230** adjacent to each end of each fiber routing channel **354**A, **354**B, **354**C, **354**D. This allows a user to adjust slack of fiber optic cables **220** at both ends of the fiber terminal rack mount **216**. Further, the plurality of front and back fiber routing hubs **230** are configured to be positioned adjacent to the front and back chassis **218**A, **218**B to provide a wrapping point for fiber optic cables **220** to organize and manage the fiber optic cables **220**.

With continuing reference to FIG. 3C, each of the fiber routing hubs **230** comprises a mounting base **362** with a top portion **364**A and a bottom portion **364**B. A top slot **366**A is defined at a top of the top portion **364**A, a bottom slot **366**B is defined at a bottom of the bottom portion **364**B, and a plurality of mounting tabs **367** extend from a back of the mounting base **362**. The fiber routing hub top slot **366**A and fiber routing hub bottom slot **366**B align with the chassis attachment panel fiber routing hub mount apertures **330** for attachment of the fiber routing hub **230** to the chassis attachment panel **224**, such that a fastener (e.g., screw, washer, threaded standoff, stud, and/or nut, etc.) can be inserted through the top slot **366**A and chassis attachment panel fiber routing hub mount aperture **330** and a fastener can be inserted through the bottom slot **366**B and chassis attachment panel fiber routing hub mount aperture **330**. Further, the plurality of mounting tabs **367** (positioned between the top and bottom slots **366**A) align with and are inserted into the plurality of fiber routing mount slots **331**. Insertion of the plurality of mounting tabs **367** into the fiber routing mount slots **331** facilitates alignment of the fiber routing hub mount apertures **330** with the top and bottom slots **366**A, **366**B. Two of the four mounting tabs **367** are shown, although more or fewer mounting tabs **367** could be used. In this manner, the fiber routing hub **230** is attached to the chassis attachment panel **224**. The open end of the top slot **366**A and bottom slot **366**B facilitates assembly of the fiber routing hub **230** to the chassis attachment panel **224** by inserting a fastener into the chassis attachment panel **224** and then sliding one of the top slot **366**A and bottom slot **366**B into position around the fastener.

The fiber routing hub **230** further comprises a cylindrical sidewall **368** extending perpendicularly from a first end of the fiber routing hub **230** to a second end of the fiber routing hub **230**. The cylindrical sidewall **368** separates the top portion **364**A of the mounting base **362** from the bottom portion **364**B of the mounting base **362** and provides a wrapping surface for the fiber optic cables **220**. The cylindrical sidewall **368** is of a predetermined size and diameter to ensure that the fiber optic cables **220** do not exceed a minimum bend radius, preventing damage to the fiber optic cables. Each of the fiber routing hubs **230** comprise a plurality of fingers **370** extending perpendicularly at a second end of the fiber routing hub **230** (e.g., the plurality of fingers **370** at least approximately parallel to the mounting base **362**). More specifically, the plurality of fingers **370** (e.g., four fingers **370**) are circumferentially spaced around a periphery of the cylindrical sidewall **368**. Of course, additional or fewer fingers **370** could be used depending on networking requirements and needs. The plurality of fingers **370** keep the fiber optic cables **220** wrapped around the fiber routing hubs **230**. Further, the routing space **306** and fiber routing channels **354** extend from the front to the back, and the fiber routing hubs **230** are positioned horizontally offset from the routing space **306** and fiber routing channels **354** (e.g., between the chassis attachment aperture **336**A, **336**B and the routing space **306**, and/or between the chassis attachment aperture **336**A, **336**B and the fiber routing channels **354**). In this manner, as explained in more detail below, the fiber optic cables **220** all generally follow the same wrapping path minimizing crowding of the fiber optic cables **220**.

FIGS. **4**A-**4**C are views of the plurality of front fiber optic equipment chassis **218**A, plurality of back fiber optic equipment chassis **218**B, fiber terminal rack mount **216**, and plurality of fiber optic cables **220** of FIG. **2**B. As shown, the front rack attachment flange **318**A of the rack attachment panel **222** of the fiber terminal rack mount **216** is attached to the left front rail **210**A of the left fiber terminal rack **208**A, and the back rack attachment flange **318**B of the rack attachment panel **222** of the fiber terminal rack mount **216** is attached to the left back rail **212**A of the left fiber terminal rack **208**A. The front chassis attachment flange **334**A is attached to a left side of each of the plurality of front fiber optic equipment chassis **218**A (e.g., by a left L bracket). The right side of each of the plurality of front fiber optic equipment chassis **218**A is attached to the right front rail **210**B (e.g., by a right L bracket). Similarly, the back chassis attachment flange **334**B is attached to a right side of each of the plurality of back fiber optic equipment chassis **218**B (e.g., by a right L bracket). The left side of each of the plurality of back chassis **218**B is attached to the right back rail **212**B (e.g., by a left L bracket). In this manner, each of the plurality of front chassis **218**A is attached to the left fiber terminal rack **208**A and each of the plurality of back chassis **218**B is attached to the left fiber terminal rack **208**A. Alternatively, the fiber terminal rack mount **216** could be mounted to the right front rail **210**B and the right back rail **212**B, such that the front and back chassis **218**A, **218**B are attached to the left front rail **210**A and left back rail **212**A. Either way, as shown, the plurality of front chassis **218**A, and plurality of back chassis **218**B can be set up in a back-to-back configuration.

The plurality of front chassis **218**A comprises a first front chassis **400**A positioned towards a top of the fiber terminal rack **208**, a second front chassis **400**B positioned below the first front chassis **400**A, a third front chassis **400**C positioned below the second front chassis **400**B, and a fourth front chassis **400**D positioned below the third front chassis **400**C. The plurality of back chassis **218**B comprises a first back chassis **402**A positioned towards a top of the fiber terminal rack **208**, a second back chassis **402**B positioned below the first back chassis **402**A, a third back chassis **402**C positioned below the second back chassis **402**B, and a fourth back chassis **402**D positioned below the third back chassis **402**C. Of course, more or fewer chassis could be used depending on networking requirements and needs. The plurality of front chassis **218**A and the plurality of back chassis **218**B are configured in a back-to-back orientation (shown in FIG. **4**C).

As shown, the fiber routing hubs **230** comprise a first front fiber routing hub **404**A mounted to the chassis attachment panel front mount wall **328**A proximate the first fiber routing channel **354**A, a second front fiber routing hub **404**B mounted to the chassis attachment panel front mount wall **328**A proximate the second fiber routing channel **354**B, a third front fiber routing hub **404**C mounted to the chassis attachment panel front mount wall **328**A proximate the third fiber routing channel **354**C, and a fourth front fiber routing hub **404**D mounted to the chassis attachment panel front mount wall **328**A proximate the fourth fiber routing channel **354**D. The first front fiber routing hub **404**A is towards a top (e.g., between the first front chassis **400**A and the first fiber routing channel **354**A, and/or between the first front chassis **400**A and the first shelf **350**A), the second front fiber routing hub **404**B is positioned below the first front fiber routing hub **404**A (e.g., between the second front chassis **400**B and the second fiber routing channel **354**B, and/or between the second front chassis **400**B and the second shelf **350**B), the third front fiber routing hub **404**C is positioned below the second front fiber routing hub **404**B (e.g., between the third front chassis **400**C and the third fiber routing channel **354**C, and/or between the third front chassis **400**C and the third shelf **350**C), and the fourth front fiber routing hub **404**D is positioned below the third front fiber routing hub **404**C (e.g., between the fourth front chassis **400**D and the fourth fiber routing channel **354**D, and/or between the fourth front chassis **400**D and the fourth shelf **350**D).

Similarly, the fiber routing hubs **230** further comprise a first back fiber routing hub **406**A mounted to the chassis attachment panel back mount wall **328**B proximate the first fiber routing channel **354**A, a second back fiber routing hub **406**B mounted to the chassis attachment panel back mount wall **328**B proximate the second fiber routing channel **354**B a third back fiber routing hub **406**C mounted to the chassis attachment panel back mount wall **328**B proximate the third fiber routing channel **354**C, and a fourth back fiber routing hub **406**D mounted to the chassis attachment panel back mount wall **328**B proximate the fourth fiber routing channel **354**D. The first back fiber routing hub **406**A is towards a top (e.g., between the first back chassis **402**A and the first fiber routing channel **354**A, and/or between the first back chassis **402**A and the first shelf **350**A), the second back fiber routing hub **406**B is positioned below the first back fiber routing hub **406**A (e.g., between the second back chassis **402**B and the second fiber routing channel **354**B, and/or between the second back chassis **402**B and the second shelf **350**B), the third back fiber routing hub **406**C is positioned below the second back fiber routing hub **406**B (e.g., between the third back chassis **402**C and the third fiber routing channel **354**C, and/or between the third back chassis **402**C and the third shelf **350**C), and the fourth back fiber routing hub **406**D is positioned below the third back fiber routing hub **406**C (e.g., between the fourth back chassis **402**D and the fourth fiber routing channel **354**D, and/or between the fourth back chassis **402**D and the fourth shelf **350**D).

The plurality of fiber optic cables **220** comprises a first fiber optic cable **408**A, second fiber optic cable **408**B, third fiber optic cable **408**C, and fourth fiber optic cable **408**D. Of course, more or fewer fiber optic cables could be used depending on networking requirements and needs. In the exemplary embodiment shown in FIGS. **4**A-**4**C, the first fiber optic cable **408**A could be routed by connecting one end of the first fiber optic cable **408**A with a port (e.g., first front port) of fiber optic equipment **214** housed within the first front chassis **400**A. The first fiber optic cable **408**A is then routed generally vertically downward and wrapped around a bottom part of the cylindrical sidewall **368** of the third front fiber routing hub **404**C. The first fiber optic cable **408**A is then routed generally vertically upward over the front routing cylinder **352**A to and through the third fiber routing channel **354**C of the fiber terminal rack mount **216** (e.g., from a front to the back of the fiber terminal rack mount **216**). Once through the third fiber routing channel **354**C, the first fiber optic cable **408**A is routed over the back routing cylinder **352**B and then generally vertically downward and wrapped around a bottom part of the cylindrical sidewall **368** of the third back fiber routing hub **406**C. The second end of the first fiber optic cable **408**A is then routed generally vertically upward to a port (e.g., first back port) of fiber optic equipment **214** housed within the second back chassis **402**B. The front routing cylinder **352**A, back routing cylinder **352**B, and fiber routing hub cylindrical sidewall **368** all provide minimum bend radiuses of the fiber optic cables **220**, thereby reducing the risk of damage (e.g., due to sharp edges, corners, pinching, etc.) to the fiber optic cables **220**.

The other remaining fiber optic cables **408**B, **408**C, **408**D can be similarly routed (e.g., from a second front port to a second back port). More specifically, the second fiber optic cable **408**B is routed from the second front chassis **400**B, around the second front fiber routing hub **404**B, through the first fiber routing channel **354**A, around the fourth back fiber routing hub **406**D, to the fourth back chassis **402**D. The third fiber optic cable **408**C is routed from the third front chassis **400**C, around the fourth front fiber routing hub **404**D, through the second fiber routing channel **354**B, around the second back fiber routing hub **406**B, to the first back chassis **402**A. The fourth fiber optic cable **408**D is routed from the fourth front chassis **400**D, around the fourth front fiber routing hub **404**D, through the fourth fiber routing channel **354**D, around the fourth back fiber routing hub **406**D, to the third back chassis **402**C.

In this manner, the fiber optic cables **220** are routed between the plurality of front chassis **218**A to the plurality of back chassis **218**B through the fiber routing channels **354**A, **354**B, **354**C, **354**D of the fiber terminal rack mount **216** and the slack of the fiber optic cables **220** is minimized. In particular, as shown, the fiber optic cables **220** all follow similar vertical paths. More specifically, the fiber optic cables **220** all follow a generally vertical path from their respective chassis **218**A, **218**B to a fiber routing hub **230**, and a generally vertical path (e.g., along the routing space **306**) from a fiber routing hub **230** to their respective fiber routing channel **354**A, **354**B, **354**C, **354**D. This facilitates fiber optic cable organization and management by having connections that are easy to follow and trace, and avoids crowding. Of course, this embodiment is exemplary and additional or fewer fiber optic cables **220** could be used, the fiber optic cables **220** could be routed differently, and/or the fiber optic cables **220** could be wrapped differently (e.g., interwoven through the fiber routing hubs **230**), depending on networking requirements and needs.

Further, the fiber optic cables **220** are retained in place by a portion thereof being at least partially positioned between the plurality of fiber routing hub fingers **370** and the fiber routing hub mounting base **362**, thereby preventing the fiber optic cables **220** from slipping off the fiber routing hub **230**. Which fiber routing hub **230** (front and/or back) each of the fiber optic cables **220** wraps around may vary depending on the length of the fiber optic cable **220**. For example, the first fiber optic cable **408**A wraps around the third front fiber routing hub **404**C, but could wrap around the second front fiber routing hub **404**B if the first fiber optic cable **408**A was shorter, or around the fourth front fiber routing hub **404**D if the first fiber optic cable **408**A was longer. In all of those scenarios, the first fiber optic cable **408**A would be similarly routed, and have reduced slack. Accordingly, the fiber terminal rack mount **216** provides comprehensive and robust front-to-back fiber management.

FIG. **5** is a perspective view of another embodiment of the fiber terminal rack mount **216** of FIG. **4**A with a reduced height. As shown in FIG. **5**, the fiber terminal rack mount **500** comprises a rack attachment panel **502**, chassis attachment panel **504**, attachment member (not shown), routing space **306**, routing management assembly **308**, and fiber routing hubs **230**. The fiber terminal rack mount **500** and components thereof are similar to that of FIGS. **2**B-**4**C except where otherwise noted. In particular, the fiber terminal rack mount **500** is sized and configured for a 4U height (e.g., two 2U chassis). Accordingly, the rack attachment panel **502** and chassis attachment panel **504** are reduced in height (e.g., about half) compared with the fiber terminal rack mount **216** of FIGS. **2**B-**4**C. The routing management assembly **308** comprises two shelves **350**A, **350**B, two front fiber routing hubs **230**, and two back fiber routing hubs **230** (not shown).

FIG. **6** is a perspective view of another embodiment of a fiber routing hub **600** of the fiber terminal rack mount **216**, **500** of FIGS. **2**B-**5**. The fiber routing hub **600** is similar to that of FIGS. **2**B-**5**, except where otherwise noted. More specifically, the fiber routing hub **600** comprises a mounting base **602** comprising a bottom portion **364**B with a bottom slot **366**B. A partially cylindrical sidewall **604** (e.g., partially curved sidewall) extends perpendicularly from the mounting base **602**, is curved only at a bottom portion thereof (e.g., forming a semicircle), and includes an open top aperture **608**. The top slot **606** is positioned in the mounting base **602** at a center of the cylindrical sidewall **604**. The fingers **370** extend downwardly and perpendicularly at a second end of the fiber routing hub **600**. Thus, the fiber routing hub **600** has a reduced height compared with the fiber routing hub **230** of FIGS. **2**B-**5** but still provides a wrapping surface for the fiber optic cables **220**.

Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not actually recite an order to be followed by its steps or it is not otherwise specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it is no way intended that any particular order be inferred.

It will be apparent to those skilled in the art that various modifications and variations can be made without departing from the spirit or scope of the invention. Since modifications combinations, sub-combinations and variations of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and their equivalents.

What is claimed is:

1. A fiber terminal rack mount for mounting fiber optic equipment in a fiber terminal rack having a front vertical rail set at a front of the fiber terminal rack and a back vertical rail set at a back of the fiber terminal rack, the fiber terminal rack mount comprising:

a rack attachment panel comprising first and second rack attachment flanges vertically oriented at opposite ends of the rack attachment panel, the rack attachment panel configured for the first rack attachment flange to attach to at least one front vertical rail of the front vertical rail set of the fiber terminal rack and the rack attachment panel configured for the second rack attachment flange to attach to at least one back vertical rail of the back vertical rail set of the fiber terminal rack;

a chassis attachment panel comprising at least one chassis attachment flange vertically oriented at an end of the chassis attachment panel, the at least one chassis attachment flange configured to attach to a first chassis facing a first direction; and

at least one attachment member positioned between the rack attachment panel and the chassis attachment panel, the at least one attachment member attaching the rack attachment panel and the chassis attachment panel to one another by a separation distance;

wherein the rack attachment panel and the chassis attachment panel at least partially define a routing space between the rack attachment panel and the chassis attachment panel configured to receive and route therein at least a portion of a fiber optic cable between the front and back of the fiber terminal rack.

2. The fiber terminal rack mount of claim **1**, wherein the at least one attachment member has a separation length and the separation distance is at least the separation length.

3. The fiber terminal rack mount of claim **1**, wherein the at least one chassis attachment flange comprises a first and a second chassis attachment flange, and wherein the first chassis attachment flange is configured to attach to the first chassis facing the first direction, and the second chassis attachment flange is configured to attach to a second chassis facing a second direction opposite the first direction.

4. The fiber terminal rack mount of claim **3**, further comprising a plurality of shelves positioned within the routing space, the plurality of shelves defining a plurality of routing channels configured to receive at least a portion of a fiber optic cable therein to connect the first chassis to the second chassis.

5. The fiber terminal rack mount of claim **1**, further comprising at least one shelf horizontally positioned within the routing space.

6. The fiber terminal rack mount of claim **5**, wherein the at least one shelf comprises a first shelf and a second shelf, the first shelf and the second shelf defining a first fiber routing channel therebetween.

7. The fiber terminal rack mount of claim **6**, wherein the at least one shelf further comprises a third shelf, the second shelf and the third shelf defining a second fiber routing channel therebetween.

8. The fiber terminal rack mount of claim **5**, further comprising a hollow cylinder horizontally positioned at an end of the at least one shelf.

9. The fiber terminal rack mount of claim 1, further comprising a fiber routing hub comprising a first end and a second end, the first end attached to the chassis attachment panel.

10. The fiber terminal rack mount of claim 9, wherein the fiber routing hub further comprises at least one finger perpendicularly extending from the second end of the fiber routing hub.

11. The fiber terminal rack mount of claim 9, wherein the fiber routing hub further comprises an at least partially curved sidewall extending from the first end to the second end of the fiber routing hub.

12. The fiber terminal rack mount of claim 9, wherein

the at least one chassis attachment flange comprises at least one chassis attachment aperture configured to attach to the first chassis, and

the fiber routing hub is positioned between the routing space and the at least one chassis attachment aperture of the at least one chassis attachment flange.

13. A remote terminal, comprising:

a remote terminal cabinet defining a chamber;

a fiber terminal rack positioned within the chamber of the remote terminal cabinet, the fiber terminal rack having a front vertical rail set at a front of the fiber terminal rack and a back vertical rail set at a back of the fiber terminal rack;

fiber optic equipment comprising a front chassis, back chassis, and a first fiber optic cable, the front chassis positioned at the front of the fiber terminal rack and comprising a first front port, the back chassis positioned at the back of the fiber terminal rack and comprising a first back port, and the first fiber optic cable connecting the first front port in the front chassis to the first back port in the back chassis; and

a fiber terminal rack mount comprising:

a rack attachment panel comprising first and second rack attachment flanges vertically oriented at opposite ends of the rack attachment panel, the first rack attachment flange attached to at least one front vertical rail of the front vertical rail set of the fiber terminal rack and the second rack attachment flange attached to at least one back vertical rail of the back vertical rail set of the fiber terminal rack;

a chassis attachment panel comprising first and second chassis attachment flanges vertically oriented at opposing ends of the chassis attachment panel, the first chassis attachment flange attached to the front chassis and the second chassis attachment flange attached to the back chassis; and

at least one attachment member positioned between the rack attachment panel and the chassis attachment panel, the at least one attachment member attaching the rack attachment panel and the chassis attachment panel to one another by a separation distance;

wherein the rack attachment panel and the chassis attachment panel at least partially define a routing space between the rack attachment panel and the chassis attachment panel, at least a portion of the first fiber optic cable positioned within the routing space.

14. The remote terminal system of claim 13, wherein the at least one attachment member has a separation length and the separation distance is at least the separation length.

15. The remote terminal system of claim 13, further comprising at least one shelf horizontally positioned within the routing space.

16. The remote terminal system of claim 15, wherein the at least one shelf comprises a first shelf and a second shelf, the first shelf and the second shelf defining a first fiber routing channel therebetween, at least a portion of the first fiber optic cable positioned within the first fiber routing channel.

17. The remote terminal system of claim 16, wherein the at least one shelf further comprises a third shelf, the second shelf and the third shelf defining a second fiber routing channel therebetween.

18. The remote terminal system of claim 17, wherein the front chassis further comprises a second front port, the back chassis further comprises a second back port, and the fiber optic equipment further comprises a second fiber optic cable connecting the second front port to the second back port, at least a portion of the second fiber optic cable positioned within the second fiber routing channel.

19. The remote terminal system of claim 13, further comprising a fiber routing hub comprising a first end and a second end, the first end attached to the chassis attachment panel, the first fiber optic cable at least partially wrapped around the fiber routing hub.

20. The remote terminal system of claim 19, wherein the fiber routing hub further comprises at least one finger perpendicularly extending from the second end of the fiber routing hub, at least a portion of the first fiber optic cable positioned between the at least one finger and the chassis attachment panel.

21. The remote terminal system of claim 19, wherein the fiber routing hub further comprises an at least partially curved sidewall extending from the first end to the second end of the fiber routing hub.

22. The remote terminal system of claim 19, wherein

the first chassis attachment flange comprises at least one chassis attachment aperture configured to attach to a first chassis facing a first direction; and

the fiber routing hub is positioned between the routing space and the at least one chassis attachment aperture of the first chassis attachment flange.

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