US 20250264674A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0264674 A1**

Eckhart et al. (43) **Pub. Date: Aug. 21, 2025**

(54) **OPTICAL CONNECTOR AND RECEPTACLE WITH INTERLOCK FEATURES**

(71) Applicant: **Molex, LLC**, Lisle, IL (US)

(72) Inventors: **Andrew Karl Eckhart**, Lombard, IL (US); **Wenzong Chen**, Naperville, IL (US); **Joshua Krantz**, Wheaton, IL (US)

(21) Appl. No.: **19/052,331**

(22) Filed: **Feb. 13, 2025**

Related U.S. Application Data

(60) Provisional application No. 63/556,025, filed on Feb. 21, 2024.

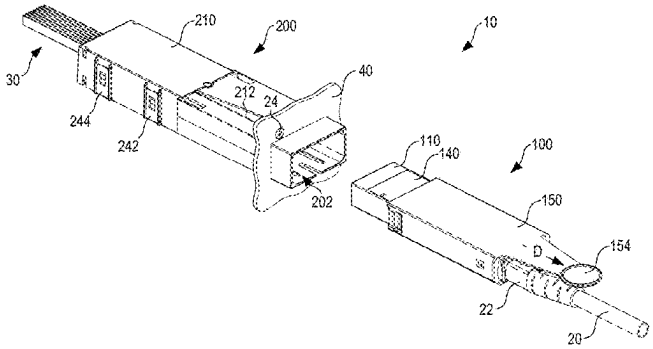
Publication Classification

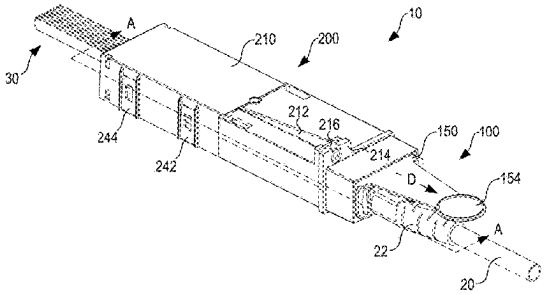
(51) **Int. Cl.**
G02B 6/38 (2006.01)

(52) **U.S. Cl.**
CPC ***G02B 6/3893*** (2013.01); ***G02B 6/3821*** (2013.01); ***G02B 6/3831*** (2013.01); ***G02B 6/3885*** (2013.01)

(57) **ABSTRACT**

Examples of optical connectors with interlock features are described. An example optical connector assembly includes a receptacle and a cartridge. The receptacle includes a receptacle housing having a receptacle cavity and a cantilevered latch tab within the receptacle cavity. The cartridge includes a cartridge housing with an interlock ledge along a side of the cartridge housing. The cartridge also includes a release sleeve with a ramped interlock aperture. The release sleeve is positioned over the cartridge housing of the cartridge. The interlock ledge on the cartridge housing is exposed in part though the ramped interlock aperture of the release sleeve. When the cartridge is inserted into the receptacle, the cantilevered latch tab of the receptacle mechanically joins and interferes with the interlock ledge of the cartridge, holding the cartridge in place within the receptacle.





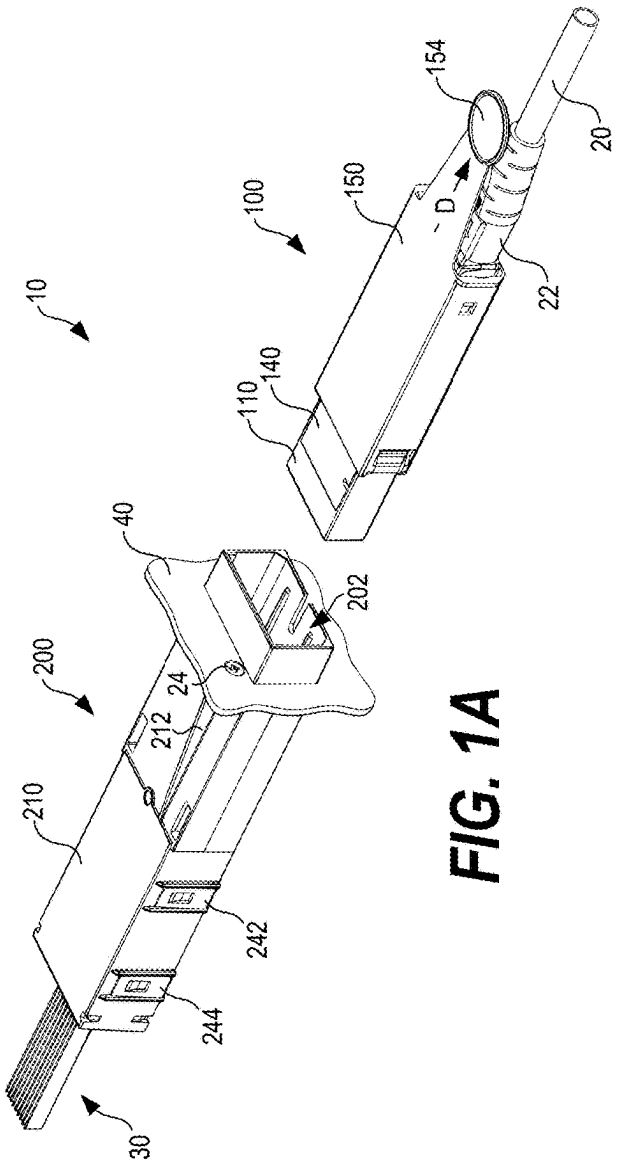

10
100
150
154
20
D
22
110
140
40
202
200
24
212
210
242
244
30

FIG. 1A

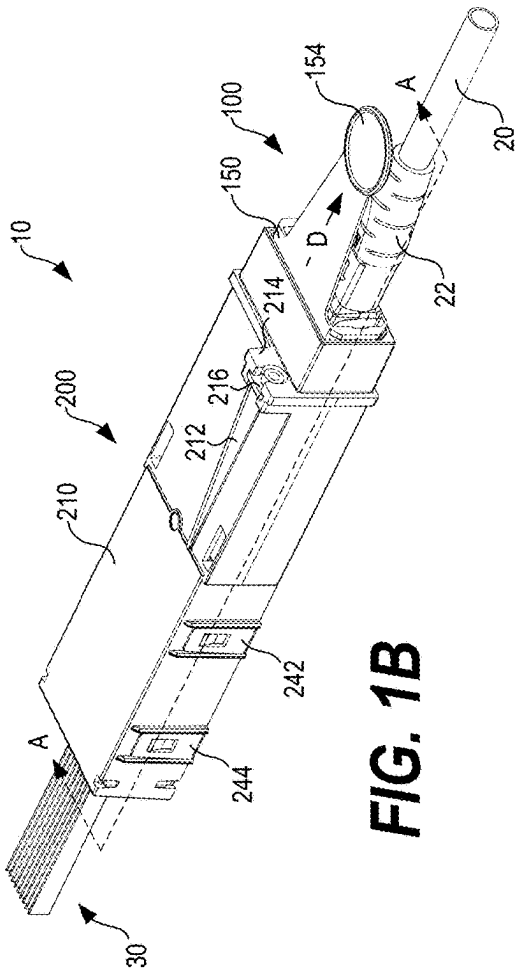

10
100
154
A
20
150
D
22
214
216
200
212
210
242
A
244
30

FIG. 1B

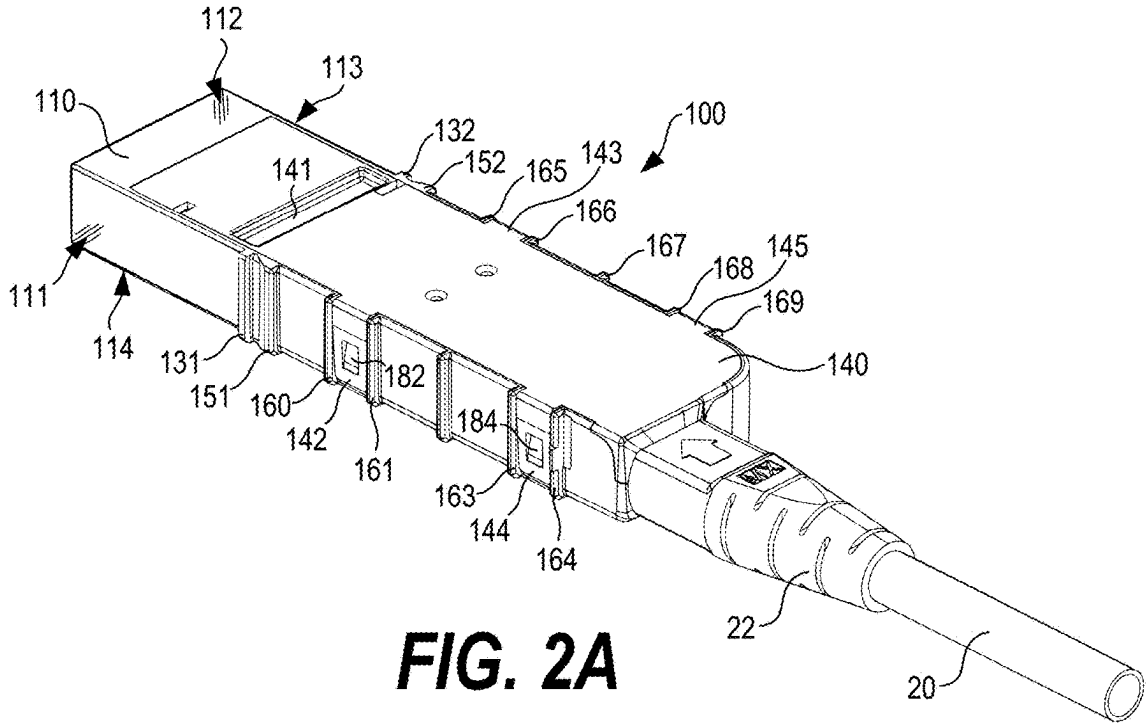

112
113
110
132
152
165
143
100
141
166
167
145
168
111
169
114
131
140
151
160
182
142
184
161
163
144
164
22
20

FIG. 2A

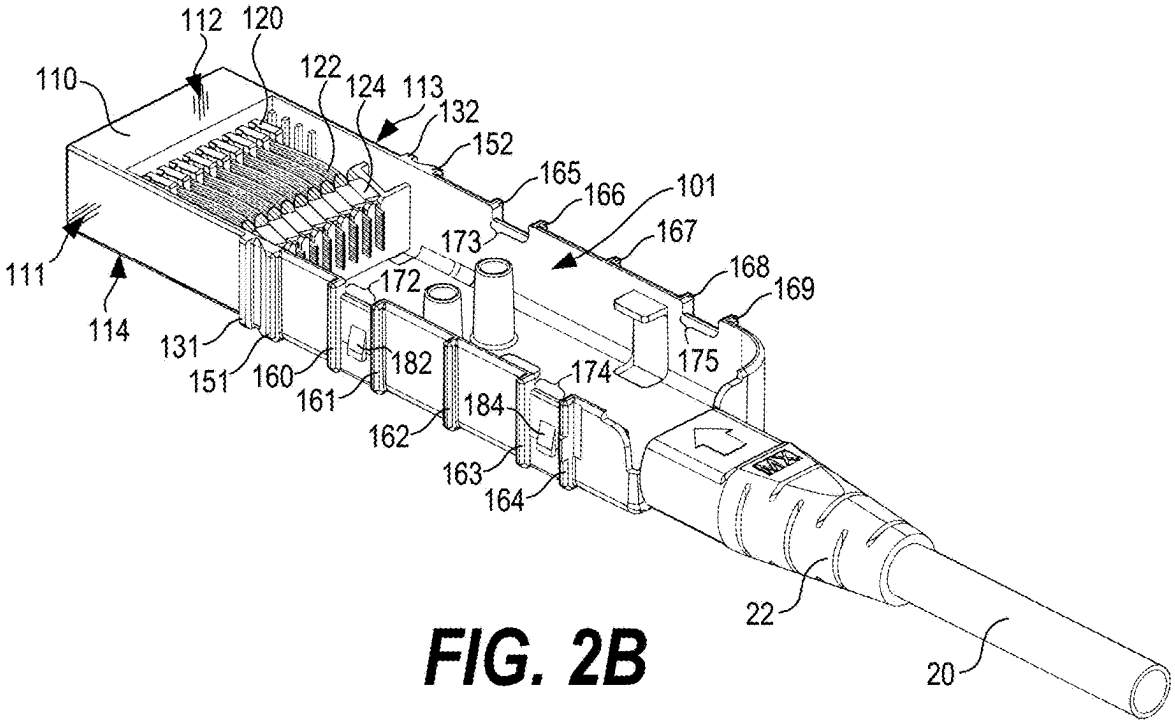

112
120
110
122
124
113
132
152
165
166
101
111
167
173
168
169
172
114
131
175
151
160
182
174
161
184
162
163
164
22
20

FIG. 2B

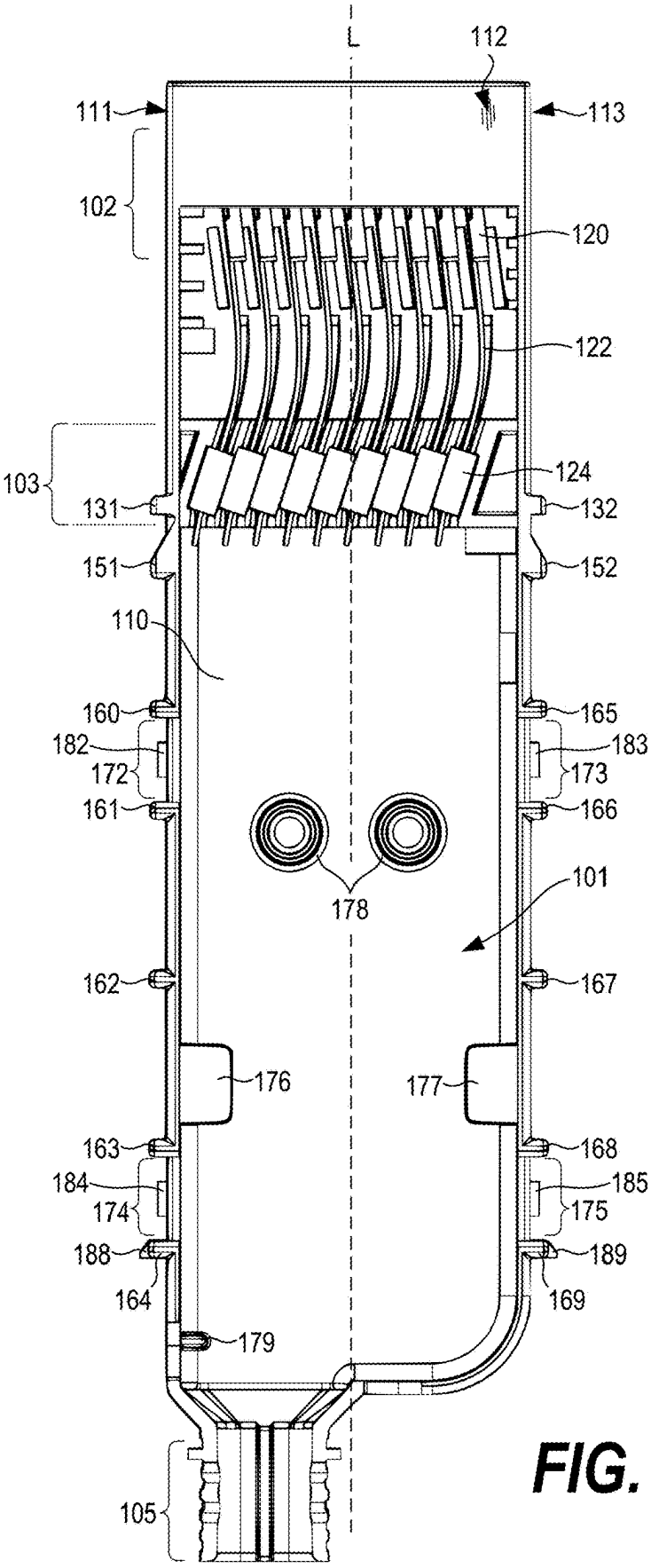

L
112
111
113
102
120
122
103
124
131
132
151
152
110
160
165
182
183
172
173
161
166
178
101
162
167
176
177
163
168
184
185
174
175
188
189
164
169
179
105

FIG. 2C

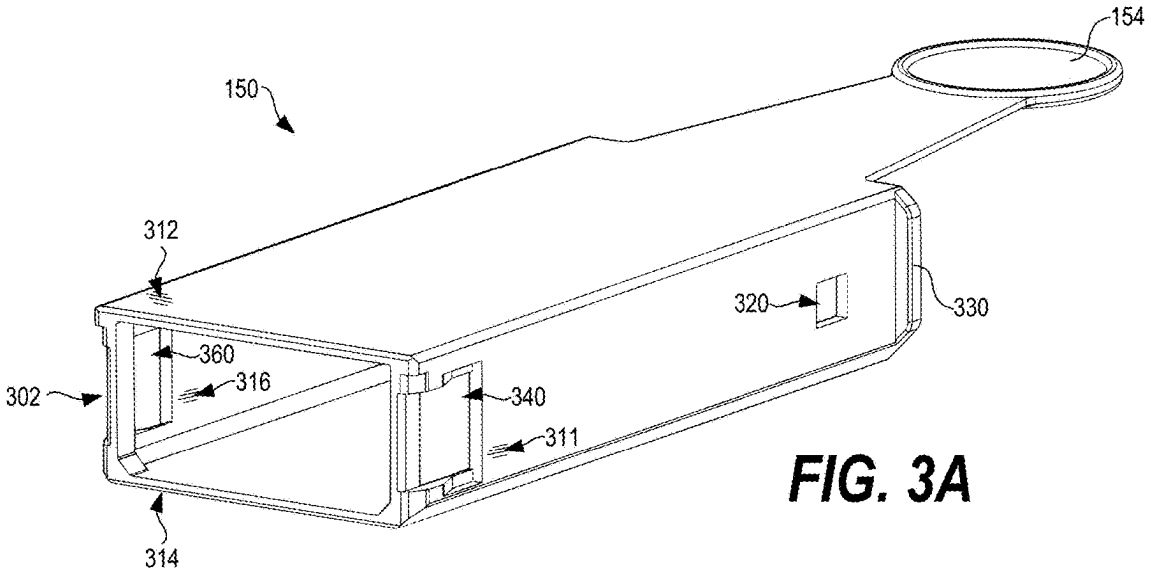


FIG. 3A

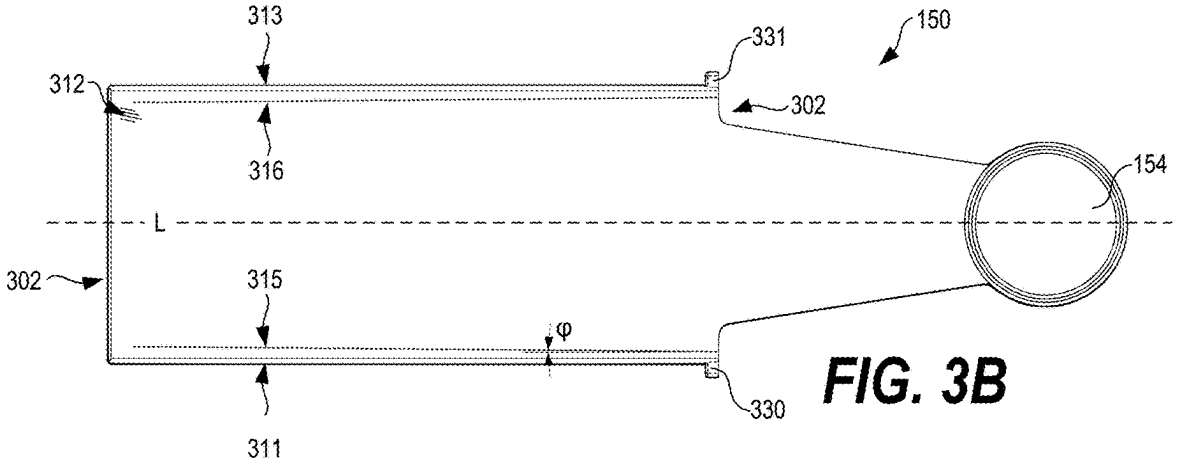


FIG. 3B

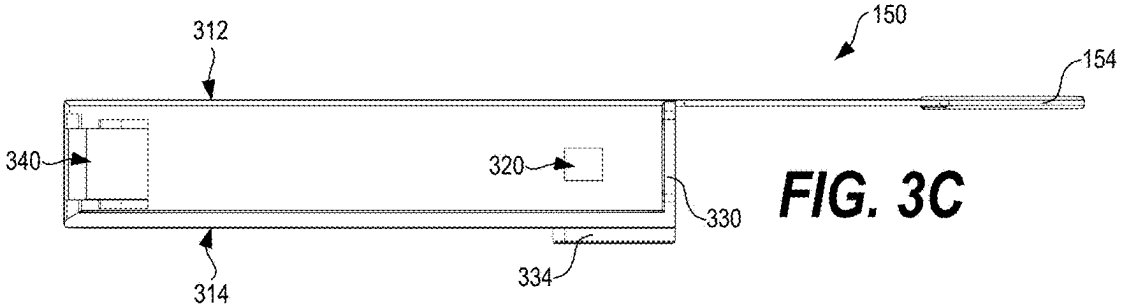


FIG. 3C

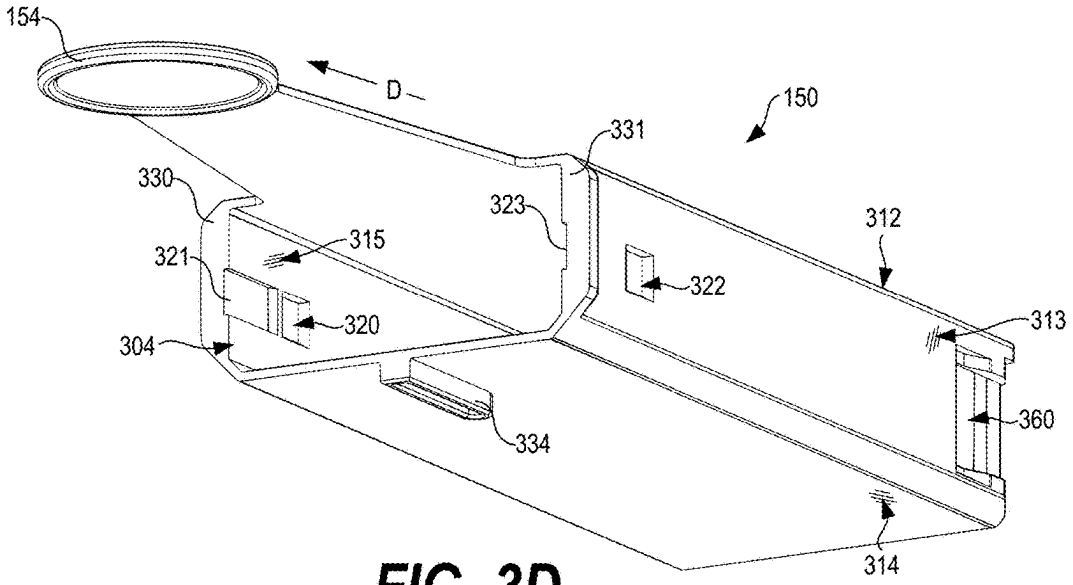

154
D
150
331
330
323
312
315
321
322
313
320
304
360
334
314

FIG. 3D

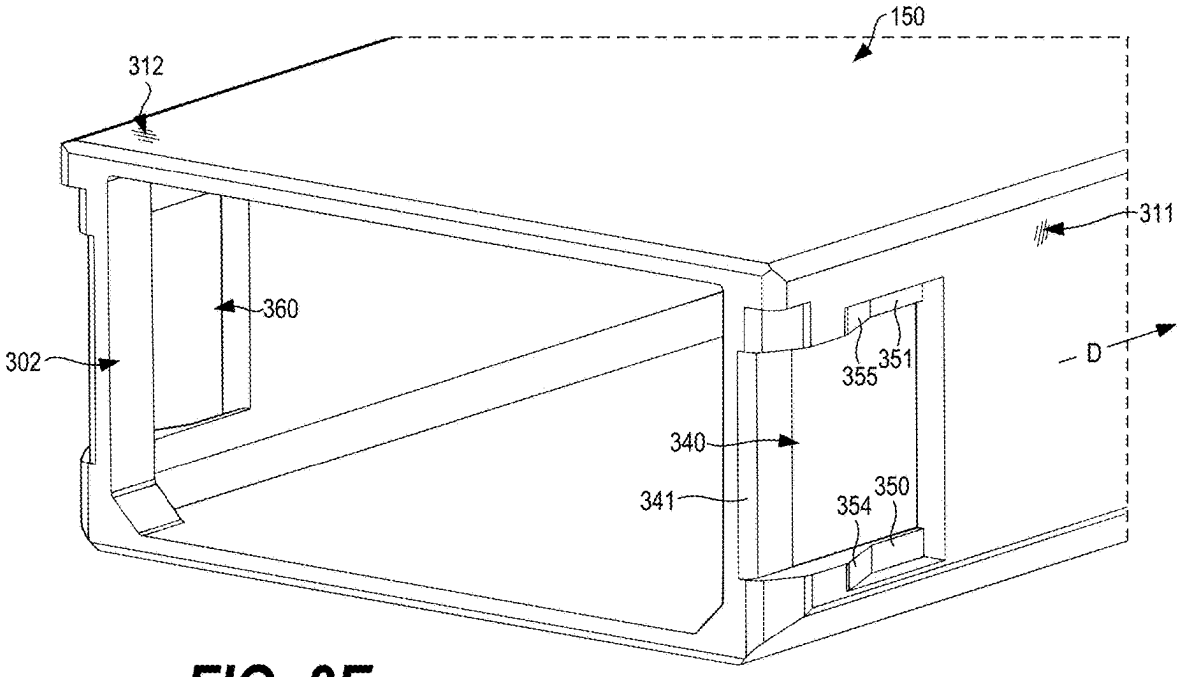

150
312
311
360
302
D
355
351
340
341
354
350

FIG. 3E

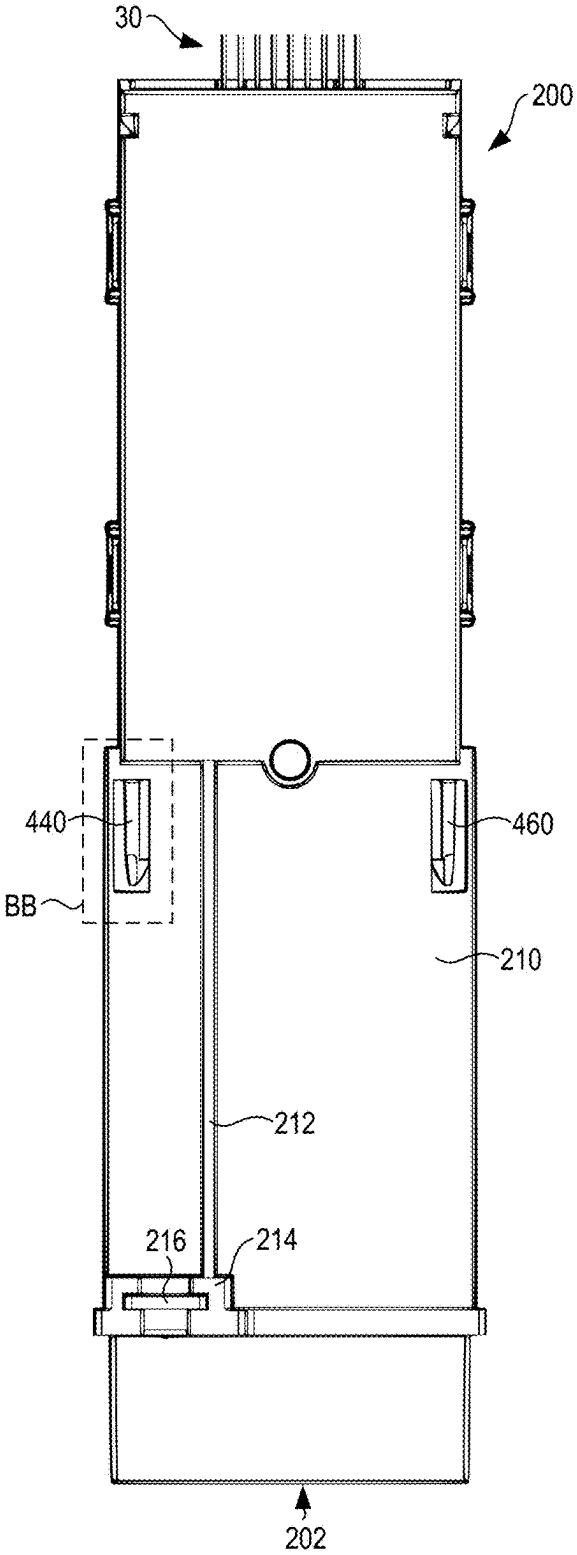

30
200
440
460
BB
210
212
216
214
202

FIG. 4A

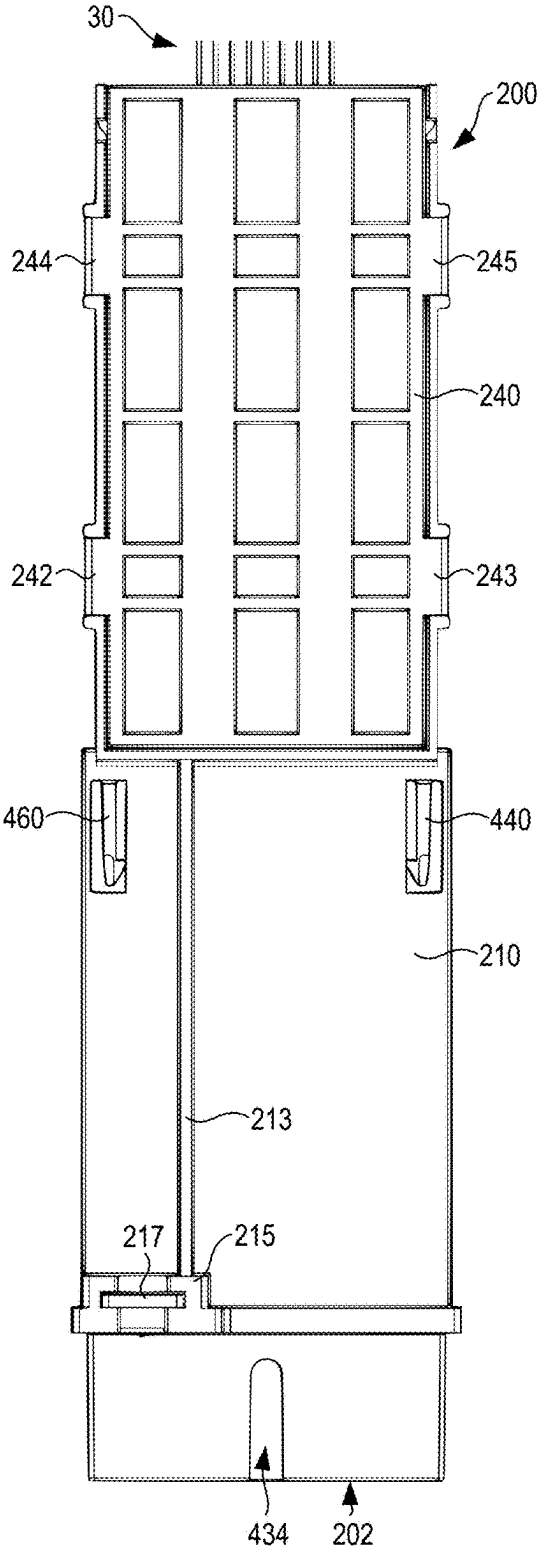

30
200
244
245
240
242
243
460
440
210
213
217
215
434
202

FIG. 4B

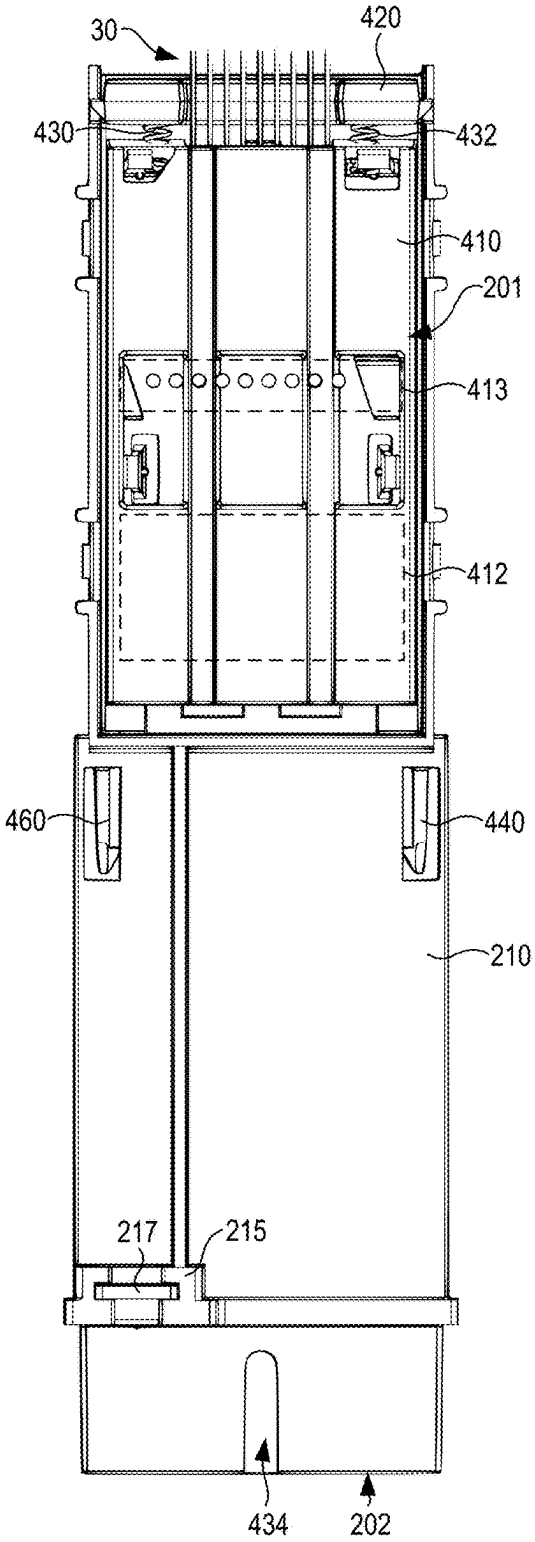

30
420
430
432
410
201
413
412
460
440
210
217
215
434
202

FIG. 4C

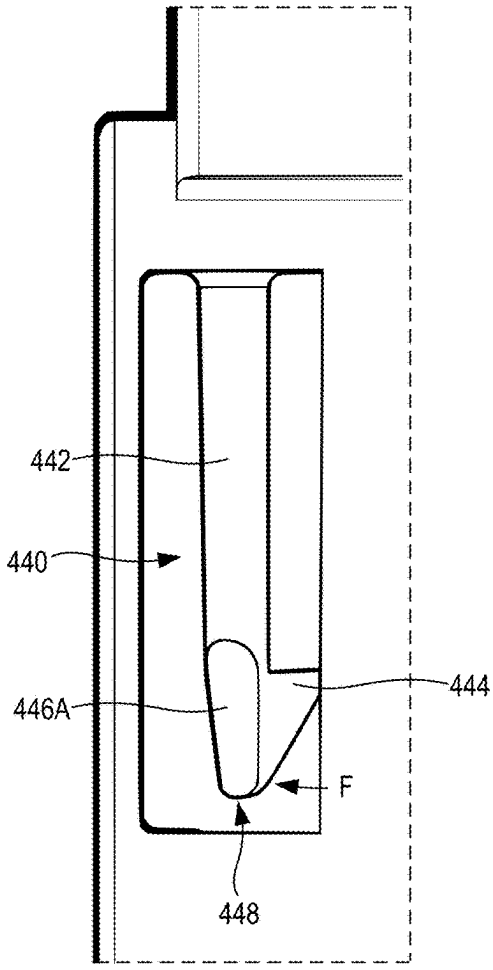

442
440
446A
444
F
448

FIG. 4D

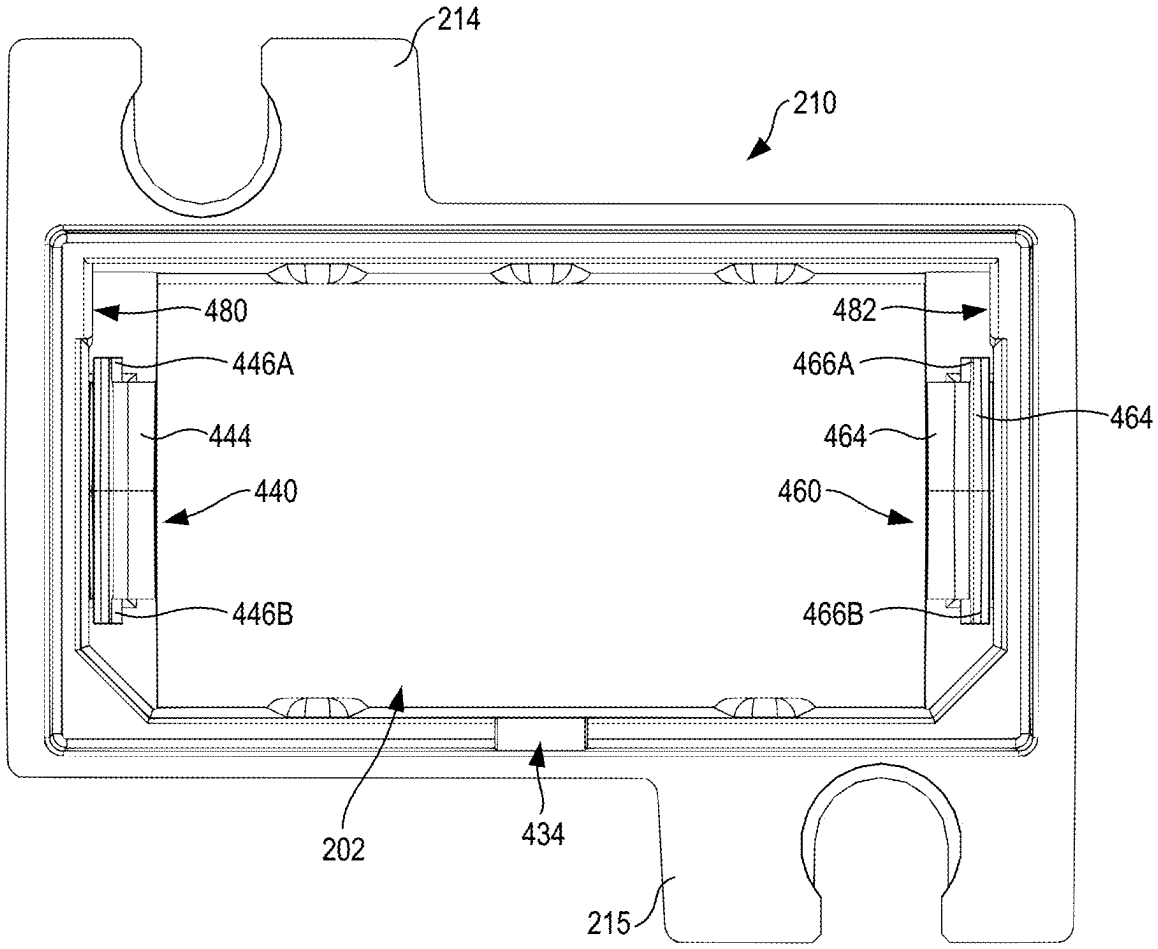

214
210
480
482
446A
466A
444
464
464
440
460
446B
466B
202
434
215

FIG. 4E

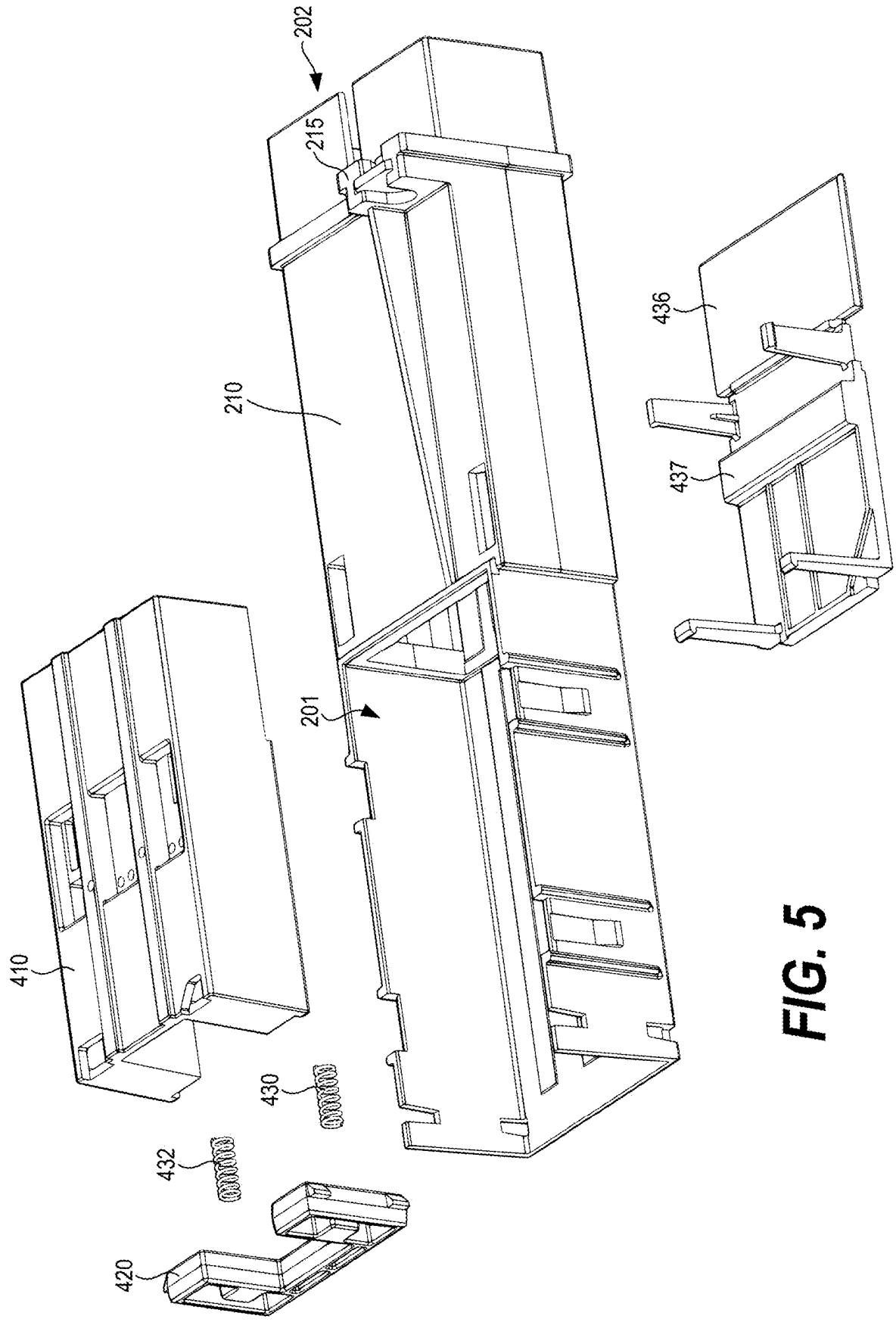


FIG. 5

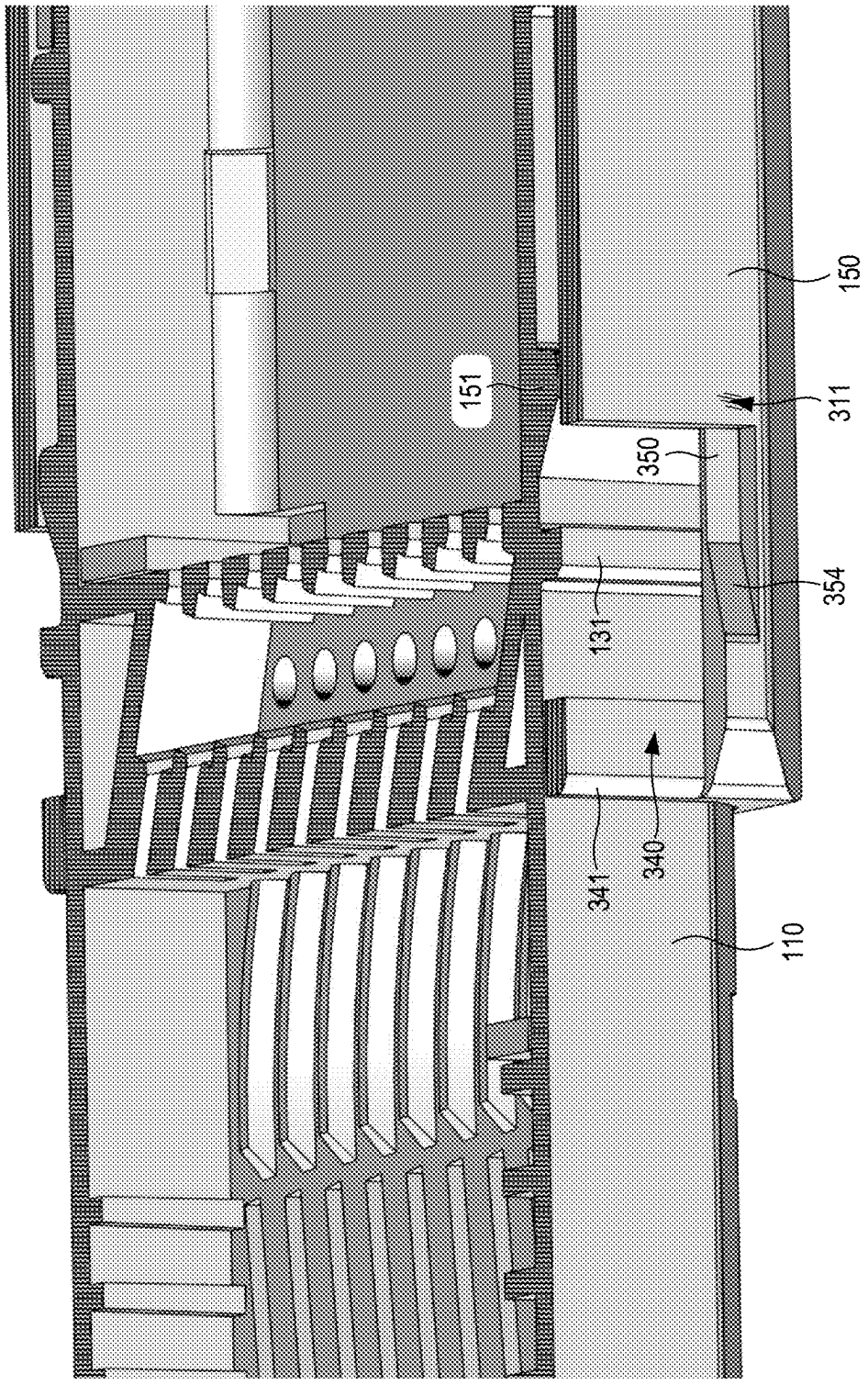


FIG. 6A

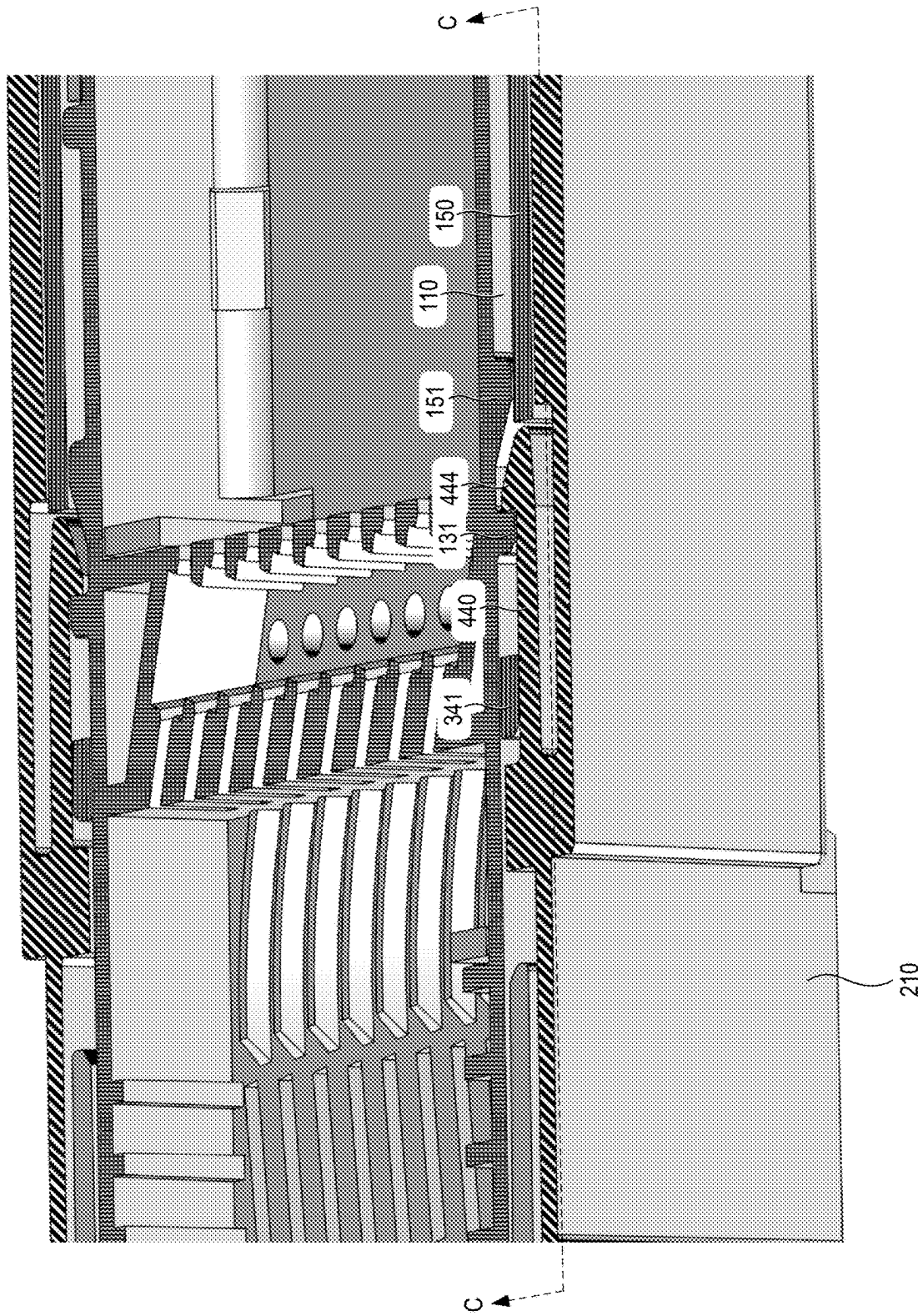


FIG. 6B

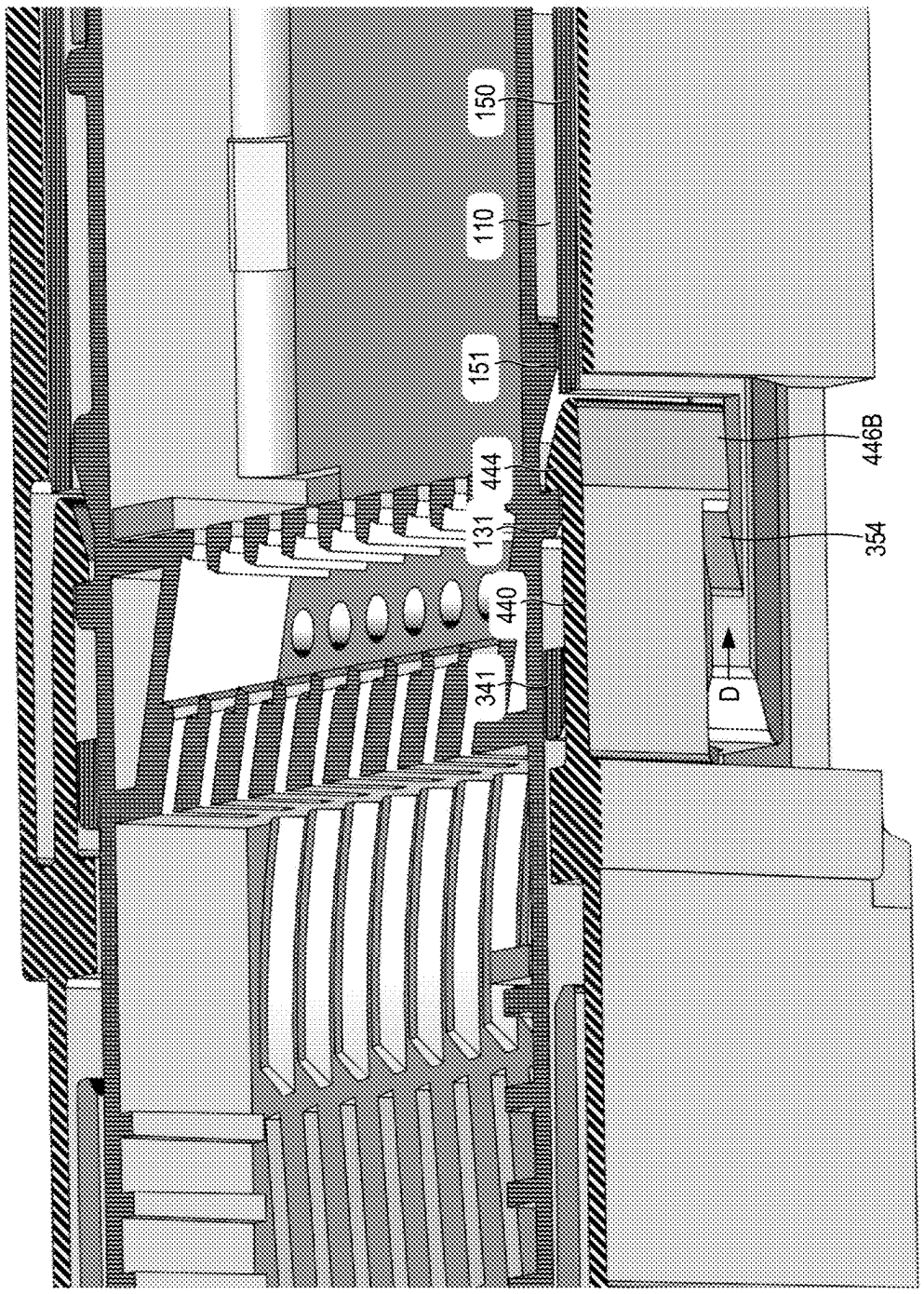


FIG. 6C

OPTICAL CONNECTOR AND RECEPTACLE WITH INTERLOCK FEATURES

BACKGROUND

[0001] The amount of data processed by computing, network switching, telecommunications, and related systems continues to increase. Data centers can include hundreds or thousands of networking and computing systems. The systems are interconnected by optical cables, copper cables, and various connectors, adapters, and terminations between them. The data throughput of the interconnection systems is high and increasing. A range of different input/output (I/O) connectors, cables, cable assemblies, and interconnect systems are designed for those types of data, power, and data and power interconnection applications.

[0002] Example interconnect systems include board-to-board, cable-to-cable, wire-to-wire, and cable-or wire-to-board systems. A variety of designs exist for each type of connector, cable assembly, and interconnect system, depending on the requirements of the power and data communications environment in which the connectors, assemblies, and systems are used. As one example, a cable-to-cable optical connector assembly includes an optical cartridge attached to the free end of a fiber optical cable assembly and an optical receptacle connector attached to a bulkhead. The optical cartridge can be inserted into the optical receptacle to establish optical communications through the optical connector assembly.

SUMMARY

[0003] Optical connector assemblies including latching or interlocking features are described herein. An example optical connector assembly with latching or interlocking features includes an optical receptacle and an optical cartridge. The optical receptacle includes a first row of optical ferrules, and the optical cartridge includes a second row of optical ferrules. The first row of optical ferrules is aligned with the second row of optical ferrules when the cartridge is inserted into the receptacle, for optical communications between them.

[0004] The receptacle includes a receptacle housing having a receptacle cavity and a cantilevered latch tab within the receptacle cavity. The cartridge includes a cartridge housing with an interlock ledge along a side of the cartridge housing. The cartridge also includes a release sleeve with a ramped interlock aperture. The release sleeve is positioned over the cartridge housing of the cartridge. The interlock ledge on the cartridge housing is exposed in part though the ramped interlock aperture of the release sleeve. When the cartridge is inserted into the receptacle, the cantilevered latch tab of the receptacle mechanically joins and interferes with the interlock ledge of the cartridge, holding the cartridge in place within the receptacle.

[0005] In other aspects of the embodiments, the ramped interlock aperture includes a chamfered corner bar, an aperture through a side wall of the release sleeve, a depressed platform edge region along an edge of the aperture, and a ramped edge region along the edge of the aperture. The interlock ledge of the cartridge housing is exposed through the aperture of the ramped interlock aperture. When the optical cartridge is inserted into the receptacle cavity of the optical receptacle, the latch tooth of the cantilevered latch tab mechanically interferes with the interlock ledge of the cartridge housing, to lock the optical cartridge within the optical receptacle. Further, when the optical cartridge is locked within the optical receptacle, the release knob of the cantilevered latch tab is seated on the depressed platform edge region of the ramped interlock aperture.

[0006] In other aspects of the embodiments, the release sleeve also includes a pull tab extending from a top wall of the release sleeve and an orientation key formed on a bottom wall of the release sleeve. The release sleeve also includes flange tabs extending from side walls of the release sleeve. In other aspects, the optical receptacle includes a ferrule sled and a spring to provide a spring bias to the ferrule sled. In still other aspects, from a front to a rear of the release sleeve, the inner side surfaces of the release sleeve are drafted to expand apart from each other. Also, from a front to a rear of the cartridge housing, the spacing ribs of the cartridge housing are progressively longer.

[0007] In other embodiments, an example optical cartridge includes a cartridge housing and a release sleeve extending around a length of the cartridge housing. The cartridge housing includes spacing ribs and an interlock ledge along a side of the cartridge housing. The release sleeve includes a ramped interlock aperture. The ramped interlock aperture includes a chamfered corner bar, an aperture through a side wall of the release sleeve, a depressed platform edge region along an edge of the aperture, and a ramped edge region along the edge of the aperture. The interlock ledge of the cartridge housing is exposed through the aperture of the ramped interlock aperture. The release sleeve also includes a pull tab extending from a top wall of the release sleeve and an orientation key formed on a bottom wall of the release sleeve. The release sleeve also includes flange tabs extending from side walls of the release sleeve in one example.

[0008] In other embodiments, an optical receptacle includes a receptacle housing, a ferrule sled, and a spring to provide a spring bias to the ferrule sled. The receptacle housing includes a receptacle cavity and a cantilevered latch tab within the receptacle cavity. The cantilevered latch tab includes an extension arm, a latch tooth at an end of the extension arm, and a release knob. The receptacle housing also includes an orientation keyway formed as a slot in a bottom wall of the receptacle housing. The receptacle housing also includes guide surfaces on rails within the receptacle cavity in one example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Many aspects of the present disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, with emphasis instead being placed upon clearly illustrating the principles of the disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0010] FIG. **1**A illustrates a perspective view of an optical connector assembly according to various embodiments of the present disclosure.

[0011] FIG. **1**B illustrates another perspective view of the optical connector assembly shown in FIG. **1**A according to various embodiments of the present disclosure.

[0012] FIG. **2**A illustrates a perspective view of the cartridge shown in FIG. **1**A with the release sleeve omitted from view according to various embodiments of the present disclosure.

[0013] FIG. **2**B illustrates a perspective view of the cartridge shown in FIG. **1**A with the release sleeve and cartridge cover omitted from view according to various embodiments of the present disclosure.

[0014] FIG. **2**C illustrates a top-down view of the cartridge shown in FIG. **1**A with the release sleeve and cartridge cover omitted from view according to various embodiments of the present disclosure.

[0015] FIG. **3**A illustrates a front perspective view of the release sleeve of the cartridge shown in FIG. **1**A according to various embodiments of the present disclosure.

[0016] FIG. **3**B illustrates a top-down view of the release sleeve shown in FIG. **3**A according to various embodiments of the present disclosure.

[0017] FIG. **3**C illustrates a side view of the release sleeve shown in FIG. **3**A according to various embodiments of the present disclosure.

[0018] FIG. **3**D illustrates a back perspective view of the release sleeve shown in FIG. **3**A according to various embodiments of the present disclosure.

[0019] FIG. **3**E illustrates a front view of the release sleeve shown in FIG. **3**A according to various embodiments of the present disclosure.

[0020] FIG. **4**A illustrates a top-down view of the receptacle shown in FIG. **1**A according to various embodiments of the present disclosure.

[0021] FIG. **4**B illustrates a bottom-up view of the receptacle shown in FIG. **4**A according to various embodiments of the present disclosure.

[0022] FIG. **4**C illustrates a bottom-up view of the receptacle shown in FIG. **4**A with the receptacle cover omitted from view according to various embodiments of the present disclosure.

[0023] FIG. **4**D illustrates the detail view designated "BB" in FIG. **4**A according to various embodiments of the present disclosure.

[0024] FIG. **4**E illustrates a front view of the receptacle housing shown of the receptacle shown in FIG. **4**A according to various embodiments of the present disclosure.

[0025] FIG. **5** illustrates components of the receptacle shown in FIG. **1**A according to various embodiments of the present disclosure.

[0026] FIG. **6**A illustrates the ramped interlock aperture of the cartridge taken along the sectional plane A-A shown in FIG. **1**A according to various embodiments of the present disclosure.

[0027] FIG. **6**B illustrates the cantilevered latch tab and the ramped interlock aperture of the cartridge taken along the sectional plane A-A shown in FIG. **1**A according to various embodiments of the present disclosure.

[0028] FIG. **6**C illustrates the cantilevered latch tab and the ramped interlock aperture of the cartridge taken along the sectional plane C-C shown in FIG. **6**B according to various embodiments of the present disclosure.

DETAILED DESCRIPTION

[0029] As noted above, the amount of data processed by computers, computing systems, and computing environments continues to increase. Data centers can include hundreds or thousands of networking and computing systems that are interconnected using optical cables, copper cables, and various connectors and terminations therebetween. An example interconnect system includes a cable-to-cable optical connector assembly. The optical connector assembly includes an optical cartridge at one end of a fiber optical cable assembly and an optical receptacle connector attached to a bulkhead. The optical cartridge can be inserted into the optical receptacle to establish optical communications through the optical connector assembly.

[0030] Optical connector assemblies including latching or interlocking features are described herein. An example optical connector assembly with latching or interlocking features includes an optical receptacle and an optical cartridge. The receptacle includes a receptacle housing having a receptacle cavity and a cantilevered latch tab within the receptacle cavity. The cartridge includes a cartridge housing with an interlock ledge along a side of the cartridge housing. The cartridge also includes a release sleeve with a ramped interlock aperture. The release sleeve is positioned over the cartridge housing of the cartridge. The interlock ledge on the cartridge housing is exposed in part though the ramped interlock aperture of the release sleeve. When the cartridge is inserted into the receptacle, the cantilevered latch tab of the receptacle mechanically joins and interferes with the interlock ledge of the cartridge, holding the cartridge in place within the receptacle.

[0031] Turning to the drawings, FIG. **1**A illustrates a perspective view of an optical connector assembly **10** (also "connector assembly **10**") according to various embodiments of the present disclosure. FIG. **1**B illustrates another perspective view of the connector assembly **10** shown in FIG. **1**A. The connector assembly **10** is provided as an example of an optical connector assembly that incorporates latching or interlocking features. The connector assembly **10** is illustrated as a representative example and is not drawn to any particular scale or size. The orientation, shape, size, style, proportion, and other characteristics of the connector assembly **10** can vary as compared to that shown and among the embodiments. In some cases, one or more features or components of the connector assembly **10** described herein can be omitted. In other cases, the connector assembly **10** can include other features or components that are not shown or described. Additionally, while the connector assembly **10** is described as an optical connector assembly, the concepts are not limited to use with optical interconnect applications or systems. The concepts can be extended to a range of different interconnect systems and applications.

[0032] Referring between FIGS. **1**A and **1**B, the connector assembly **10** includes an optical cartridge **100** (also "cartridge **100**") and an optical receptacle **200** (also "receptacle **200**"). FIG. **1**A illustrates the cartridge **100** separated from the receptacle **200**, and FIG. **1**B illustrates the cartridge **100** inserted into the receptacle **200**. The cartridge **100** includes a cartridge housing **110**, a cartridge cover **140**, and a release sleeve **150**, among other components described in further detail below. The receptacle **200** includes a receptacle housing **210** and a receptacle cover **240** (see FIG. **4**B), among other components described below. The receptacle housing **210** includes a receptacle cavity **202** as shown in FIG. **1**A, and the cartridge **100** fits into the receptacle cavity **202** as shown in FIG. **1**B.

[0033] An optical cable assembly **20** is terminated at (e.g., ends at) the cartridge **100**. A first array of optical ferrules is positioned and secured within the cartridge **100**. Individual fiber optic cables that extend within the cable assembly **20** are optically terminated to the optical ferrules within the cartridge **100**. Similarly, fiber optic cable ribbons **30** are terminated at the receptacle **200**. A second array of optical

ferrules is positioned and secured within the receptacle **200**. Individual fiber optic cables in the cable ribbons **30** are optically terminated to the optical ferrules within the receptacle **200**. When the cartridge **100** is inserted into the receptacle **200**, the first array of optical ferrules is aligned with the second array of optical ferrules, to permit the transmission of light between the first and second arrays of optical ferrules for optical communications between the cartridge **100** and the receptacle **200**. Thus, the connector assembly **10** facilitates optical communications between the fiber optic cables in the cable assembly **20** and in the cable ribbons **30**, as well as the connection and disconnection of the communications. These and other aspects of the embodiments are described in further detail below.

[0034] The receptacle **200** can be installed within the housing of a computing system or environment. For example, part of a housing wall **40** is shown in FIG. **1**A. An end of the receptacle **200** extends through an opening in the wall **40**, as shown in FIG. **1**A, and the receptacle **200** is secured in place with respect to the wall **40**. The receptacle **200** includes a bulkhead **214** (see FIG. **1**B) with a fastener eyelet **216**. The bulkhead **214** is positioned against a back surface of the wall **40** as the receptacle **200** is extended through the opening in the wall **40**, and a fastener **24** (see FIG. **1**A), such as a screw, is secured through the wall **40** and into the fastener eyelet **216**. A stiffening rail **212** is formed as part of the receptacle housing **210**, and it provides additional rigidity and support to the bulkhead **214**. The connector assembly **10** can also be implemented and embodied for "inline" applications, in which neither the receptacle **200** nor the cartridge **100** is attached to a housing or wall. In that case, the stiffening rail **212**, bulkhead **214**, fastener eyelet **216**, and possibly other features of the receptacle **200** can be omitted.

[0035] The connector assembly **10** includes latching or interlocking features. More particularly, the cartridge **100** and the receptacle **200** are interlocked with each other when the cartridge **100** is inserted into the receptacle **200** as shown in FIG. **1**B. Once interlocked, the cartridge **100** cannot be pulled out from within the receptacle **200** by pulling on the cable assembly **20**, for example, under expected ranges of forces and without damage. Thus, the connector assembly **10** includes features that prevent the unintended or inadvertent removal of the cartridge **100** from the receptacle **200**, which would result in the disruption of data communications through the connector assembly **10**.

[0036] The cartridge **100** can be pulled out and removed from within the receptacle **200**, but only by first disengaging the latching or interlocking features between them. For that purpose, the release sleeve **150** includes a pull tab **154**. A force applied to the pull tab **154**, or another part of the release sleeve **150**, in the direction "D" shown in FIGS. **1**A and **1**B will release or disengage the interlock between the cartridge **100** and the receptacle **200**. Thus, the cartridge **100** can be pulled out from within the receptacle **200** by pulling on the pull tab **154** of the release sleeve **150**. The latching and interlocking features of the connector assembly **10** are described in further detail below.

[0037] Turning to features of the cartridge **100**, FIG. **2**A illustrates a perspective view of the cartridge **100** shown in FIG. **1**A with the release sleeve **150** omitted from view. FIG. **2**B illustrates a perspective view of the cartridge **100** with the release sleeve **150** and the cartridge cover **140** omitted from view, and FIG. **2**C illustrates a top-down view of the cartridge **100** with the release sleeve **150** and cartridge cover **140** omitted from view. The cartridge **100** is illustrated as a representative example in FIGS. **2**A-**2**C and is not drawn to any particular scale or size. The orientation, shape, size, style, proportion, and other characteristics of the cartridge **100** can vary as compared to that shown and among the embodiments. In some cases, one or more features or components of the cartridge **100** can be omitted. In other cases, the cartridge **100** can include other features or components that are not shown or described.

[0038] With the release sleeve **150** omitted from view, both the cartridge housing **110** and the cartridge cover **140** are visible in FIG. **2**A. The cartridge housing **110** can be formed from a plastic or polymer, such as liquid crystal polymer (LCP), polyethylene (PE), polytetrafluoroethylene (PTFE), fluoropolymer, or other plastic or insulating material(s). The cartridge cover **140** can also be formed from a plastic or polymer, such as LCP, PE, PTFE, fluoropolymer, or other plastic or insulating material(s). The cartridge housing **110** and the cartridge cover **140** are not limited to being formed from polymers, however, and the cartridge housing **110** and the cartridge cover **140** can also be formed from other suitable materials. The cartridge housing **110** and the cartridge cover **140** can be formed using any suitable additive or subtractive manufacturing techniques, including molding, injection molding, printing, and other techniques.

[0039] The cartridge housing **110** includes side walls, a top wall, and a bottom wall. More particularly, as shown in FIGS. **2**A-**2**C, the cartridge housing **110** includes a first side surface **111** of a first side wall, a top side surface **112** of a top side wall, a second side surface **113** of a second side wall, and a bottom side surface **114** of a bottom wall. The first side surface **111** extends in a plane that is separated from and substantially parallel to the second side surface **113** in the example shown. The top side surface **112** extends in a plane that is separated from and substantially parallel to the bottom side surface **114** in the example shown. Referring to FIG. **2**C, a front of the cartridge housing **110** is positioned at the top of the page and a rear of the cartridge housing **110** is positioned at the bottom of the page. The cartridge housing **110** includes a neck **105** at the rear of the cartridge housing **110**, where the cable assembly **20** (see FIGS. **1**A and **1**B) is fed into the cartridge housing **110**.

[0040] The cartridge cover **140** is formed as a planar cover. When installed over the cartridge housing **110**, a top or outer surface of the cartridge cover **140** is relatively coplanar and coextensive with the top side surface **112** of the cartridge housing **110**. The cartridge cover **140** is omitted from view in FIGS. **2**B and **2**C so that the interior space **101** within the cartridge housing **110** can be seen. When installed over the cartridge housing **110**, the cartridge cover **140** encloses the interior space **101** within the cartridge housing **110**.

[0041] The cartridge cover **140** includes a depressed region **141**. An interior surface of the depressed region **141** contacts a row of fiber optic collets within the cartridge housing **110**, as described below, and holds the collets in place. The cartridge cover **140** also includes latching tabs, such as the latching tabs **142** and **144** shown in FIG. **2**A. The latching tabs **142** and **144** extend down from a first peripheral side edge of the cartridge cover **140** and interlock with features of the cartridge housing **110**. The cartridge cover

140 also includes latching tabs 143 and 145 that extend down from a second peripheral side edge of the cartridge cover 140.

[0042] The interior space 101 within the cartridge housing 110 is visible in FIGS. 2B and 2C. A row of optical ferrules is positioned and secured in the interior space 101 within the cartridge housing 110. More particularly, a row of optical ferrules is secured in the ferrule region 102 within the cartridge 100 as shown in FIG. 2C. Part of an example optical ferrule 120 is identified in FIGS. 2B and 2C at one end of the row of optical ferrules in the ferrule region 102. A row of collets is also secured in a collet region 103 within the cartridge housing 110 as shown in FIG. 2C. An example collet 124 is identified at one end of the collet region 103. Fiber optic cables extend from the cable assembly 20, into the interior space 101 of the cartridge housing 110, through the collets in the collet region 103, and are optically terminated to the optical ferrules the ferrule region 102.

[0043] For simplicity, fiber optic cables are illustrated only between the collet region 103 and the ferrule region 102 of the cartridge housing 110 in FIGS. 2B and 2C. It should be appreciated, however, that fiber optic cables can extend from the cable assembly 20 and into the interior space 101 of the cartridge housing 110, although fiber optic cables are not illustrated within the interior space 101 in FIGS. 2B and 2C. In some cases, a length of the fiber optic cables can be spooled or wound up within the interior space 101, before the cables are terminated to the optical ferrules in the ferrule region 102. The cartridge housing 110 includes features to help secure, protect, and organize the fiber optic cables within the interior space 101. For example, the cartridge housing 110 includes inner tabs 176 and 177, spooling pillars 178, and a bumper 179 within the interior space 101. Depending on the lengths of the fiber optic cables, the cables can be wound around the spooling pillars 178 and tucked or otherwise positioned under the inner tabs 176 and 177. Both the inner tabs 176 and 177 and the bumper 179 can be helpful to position the fiber optic cables away from the edges of the cartridge housing 110, so that the cables are not caught or pinched when the cartridge cover 140 is secured over the cartridge housing 110. A boot 22 of the cable assembly 20 (see FIGS. 1A and 1B) can be secured over the neck 105 of the cartridge housing 110.

[0044] The cartridge housing 110 includes features that are formed along the first side surface 111 and the second side surface 113. In the example shown, the cartridge housing 110 includes a first interlock ledge 131 along the first side surface 111 and a second interlock ledge 132 along the second side surface 113. The interlock ledges 131 and 132 are positioned along the sides of the collet region 103 and to the sides of the row of collets within the cartridge housing 110. The interlock ledge 131 is formed as a raised rib or ledge that extends away from the first side surface 111 in a direction perpendicular to a longitudinal axis "L" of the cartridge housing 110. The interlock ledge 132 is also formed as a raised rib or ledge that extends away from the second side surface 113 in a direction perpendicular to a longitudinal axis "L" of the cartridge housing 110.

[0045] The interlock ledges 131 and 132 are structures for mechanical interference with cantilevered latch tabs that extend within the receptacle cavity 202 (see FIG. 1A) of the receptacle 200. More particularly, the cantilevered latch tabs within the receptacle cavity 202 interlock with (i.e., mechanically interfere with) surfaces of the interlock ledges 131 and 132 when the cartridge 100 is fully inserted into the receptacle 200. A force applied to the pull tab 154 in the direction "D" shown in FIGS. 1A and 1B will release or disengage the interlock between the cartridge 100 and the receptacle 200. The interlock arrangement between the cartridge 100 and the receptacle 200 is described in further detail below with reference to FIGS. 6A-6C.

[0046] The cartridge housing 110 also includes a first latch bumper 151 along the first side surface 111 and a second latch bumper 151 along the second side surface 113. The latch bumper 151 is formed as a raised and angled bumper that extends away from the first side surface 111 in a direction perpendicular to a longitudinal axis "L" of the cartridge housing 110. The latch bumper 152 is also formed as a raised and angled bumper that extends away from the second side surface 113 in a direction perpendicular to a longitudinal axis "L" of the cartridge housing 110. The latch bumpers 151 and 152 provide angled bumpers for the cantilevered latch tabs within the receptacle cavity 202 (see FIG. 1A). The angled surfaces of the latch bumpers 151 and 152 help to bias and push the cantilevered latch tabs against the interlock ledges 131 and 132 as described in further detail below.

[0047] The cartridge housing 110 also includes spacing ribs 160-164 along the first side surface 111 and spacing ribs 165-169 along the second side surface 113. The spacing ribs 160-164 are formed as raised and rounded ribs. The spacing ribs 160-164 extend away from the first side surface 111 in a direction perpendicular to the axis "L" of the cartridge housing 110. The spacing ribs 165-169 are formed as raised and rounded ribs that extend away from the second side surface 113 in a direction perpendicular to the axis "L" of the cartridge housing 110. The spacing ribs 160-169 contact inner side surfaces of the release sleeve 150, when the release sleeve 150 is installed around the cartridge housing 110 and the cartridge cover 140. In other words, the inner side surfaces of the release sleeve 150 slide along the outer, rounded edges of the spacing ribs 160-169.

[0048] The spacing ribs 164 and 169, which are the closest to the neck 105 of the cartridge housing 110, include interlock teeth 188 and 189 (see FIG. 2C), respectively. The interlock teeth 188 and 189 extend and snap into channel openings of the release sleeve 150 as described below with reference to FIG. 3D. Along each side of the cartridge housing 110, the interlock ledges 131 and 132 are positioned toward the front of the cartridge housing 110, the spacing ribs 164 and 169 with the interlock teeth 188 and 189 are positioned towards the rear of the cartridge housing 110, and the latch bumpers 151 and 152 are positioned between the interlock ledges 131 and 132 and the spacing ribs 164 and 169.

[0049] The cartridge housing 110 also includes latching channels 172 and 174 along the first side surface 111 and latching channels 173 and 175 along the second side surface 113. On the first side of the cartridge housing 110, the latching channel 172 is positioned between the spacing ribs 160 and 161 and the latching channel 174 is positioned between the spacing ribs 163 and 164. On the second side of the cartridge housing 110, the latching channel 173 is positioned between the spacing ribs 165 and 166 and the latching channel 175 is positioned between the spacing ribs 168 and 169.

[0050] A locking tooth is positioned within each of the latching channels 172-175. As shown among FIGS. 2A-2C,

locking teeth **182-185** are positioned within the latching channels **172-175**, respectively. As shown in FIG. **2**A, the cartridge cover **140** includes latching tabs **142-145**. When the cartridge cover **140** is secured over the cartridge housing **110**, the latching tabs **142-145** of the cartridge cover **140** fit into the latching channels **172-175** of the cartridge housing **110**. Central openings in the latching tabs **142-145** also snap over the locking teeth **182-185** within the latching channels **172-175**, securing the latching tabs **142-145** and the cartridge cover **140** in place.

[0051] FIG. **3**A illustrates a perspective view of the release sleeve **150** of the cartridge **100** shown in FIG. **1**A. FIG. **3**B illustrates a top-down view of the release sleeve **150** shown in FIG. **3**A, and FIG. **3**C illustrates a side view of the release sleeve **150** shown in FIG. **3**A. Additionally, FIG. **3**D illustrates a back perspective view of the release sleeve **150** shown in FIG. **3**A. The release sleeve **150** is illustrated as a representative example in FIGS. **3**A-**3**C and is not drawn to any particular scale or size. The orientation, shape, size, style, proportion, and other characteristics of the release sleeve **150** can vary as compared to that shown and among the embodiments.

[0052] The release sleeve **150** can be formed from a plastic or polymer, such as LCP, PE, PTFE, fluoropolymer, or other plastic or insulating material(s). The release sleeve **150** is not limited to being formed from polymers, however, and the release sleeve **150** can also be formed from other suitable materials. The release sleeve **150** can be formed using any suitable additive or subtractive manufacturing techniques, including molding, injection molding, printing, and other techniques.

[0053] The release sleeve **150** includes a front opening **302** as shown in FIG. **3**A and a rear opening **304** as shown in FIG. **3**D. The release sleeve **150** is designed to be installed around or over the cartridge housing **110** and the cartridge cover **140**. When the release sleeve **150** is installed over the cartridge housing **110** and the cartridge cover **140**, the cartridge housing **110** extends through the front opening **302** and the rear opening **304** of the release sleeve **150**. FIG. **1**A illustrates the release sleeve **150** installed around the cartridge housing **110** and the cartridge cover **140**. As described in further detail below, the release sleeve **150** can also slide or move to some extent along the longitudinal axis "L" of the cartridge housing **110** when installed over the cartridge housing **110**.

[0054] The release sleeve **150** includes side walls, a top wall, and a bottom wall. More particularly, as shown in FIGS. **3**A-**3**D, the release sleeve **150** includes a first side surface **311** of a first side wall, a top side surface **312** of a top side wall, a second side surface **313** of a second side wall, and a bottom side surface **314** of a bottom wall. The first side surface **311** extends in a plane that is separated from and substantially parallel to the second side surface **313** in the example shown. The top side surface **312** extends in a plane that is separated from and substantially parallel to the bottom side surface **314** in the example shown.

[0055] The release sleeve **150** also includes a first inner side surface **315** and a second inner side surface **316** within the release sleeve **150**. On the exterior of the release sleeve **150**, the first side surface **311** extends in a plane that is substantially parallel to the second side surface **313**. However, within the release sleeve **150**, the first inner side surface **315** does not extend in a plane that is parallel to the second inner side surface **316**. Instead, the inner side surfaces **315** and **316** are drafted to expand apart from each other along the longitudinal axis "L" of the release sleeve **150** from the front opening **302** to the rear opening **304** of the release sleeve **150**. That is, the inner side surfaces **315** and **316** are closer to each other at the front opening **302** and further apart from each other at the rear opening **304**. With respect to the exterior side surface **311**, the inner side surface **315** can be formed at an angle φ of between 0.5-5 degrees (°). Examples of φ include 0.5°, 1°, 1.5°, 2°, 2.5°, and 3°, although other angles can be relied upon. Similarly, with respect to the exterior side surface **313**, the inner side surface **315** can be formed at an angle of between 0.5-5°.

[0056] The inner side surfaces **315** and **316** of the release sleeve **150** can contact the spacing ribs along the side surfaces of the cartridge housing **110** (see FIG. **2**C) when the release sleeve **150** is installed over the cartridge housing **110**. More particularly, the spacing ribs **160-164** along the first side surface **111** of the cartridge housing **110** can contact the inner side surface **315** of the release sleeve **150** when the release sleeve **150** is installed over the cartridge housing **110**. Additionally, the spacing ribs **165-169** along the second side surface **113** of the cartridge housing **110** can contact the inner side surface **316** of the release sleeve **150** when the release sleeve **150** is installed over the cartridge housing **110**.

[0057] The release sleeve **150** can slide or move to some extent with respect to the cartridge housing **110**, as described below. The inner side surfaces **315** and **316** of the release sleeve **150** can contact the outer edges of the spacing ribs **160-169** of the cartridge housing **110** while sliding to some extent. To maintain a minimal clearance or contact between the outer edges of the spacing ribs **160-169** and the angled inner side surfaces **315** and **316** of the release sleeve **150**, the spacing ribs **160-169** can be formed to have different lengths. For example, the spacing ribs **160** and **165** can be relatively shorter than the spacing ribs **161** and **166**. The spacing ribs **161** and **166** can be relatively shorter than the spacing ribs **162** and **167**. The spacing ribs **162** and **167** can be relatively shorter than the spacing ribs **163** and **168**, and the spacing ribs **163** and **168** can be relatively shorter than the spacing ribs **164** and **169**. Thus, from a front to a rear of the cartridge housing **110**, the spacing ribs **160-169** are progressively longer.

[0058] The release sleeve **150** includes a first ramped interlock aperture **340** formed through the first side surface **311** and first side wall. The release sleeve **150** also includes a second ramped interlock aperture **360** formed through the second side surface **313** and second side wall. The ramped interlock apertures **340** and **360** are positioned adjacent to the front opening **302** of the release sleeve **150**, on the two sides of the front opening **302**. The ramped interlock apertures **340** and **360** include openings or apertures through the side walls of the release sleeve **150**. Additional features of the ramped interlock apertures **340** and **360** are described below with reference to FIG. **3**E.

[0059] The release sleeve **150** also includes channel openings **320** and **322**. The channel openings **320** and **322** extend through the sidewalls of the release sleeve **150** and are positioned toward a rear of the release sleeve **150**, as shown in FIGS. **3**A and **3**D. Channel slots **321** and **323** are formed in the inner sidewalls of the release sleeve **150**. The channel slot **321** leads to and is aligned with the channel opening **320**, and the channel slot **323** leads to and is aligned with the channel opening **322**.

[0060] As shown in FIG. **2**C, the spacing ribs **164** and **169** of the cartridge housing **110** include interlock teeth **188** and **189**. The interlock teeth **188** and **189** can be snapped into the channel openings **320** and **322** of the release sleeve **150**, respectively, when the release sleeve **150** is installed over the cartridge housing **110**. To install the release sleeve **150** over the cartridge housing **110**, the front of the cartridge housing **110** can be inserted into the rear opening **304** of the release sleeve **150**. As the release sleeve **150** is pulled down from the front to the rear of the cartridge housing **110**, the interlock teeth **188** and **189** will ultimately extend into the channel slots **321** and **323** and snap into the channel openings **320** and **322**. Both the interlock teeth **188** and **189** and the ends of the channel slots **321** and **323** can include angled or chamfered edges to facilitate the interlock teeth **188** and **189** snapping from the channel slots **321** and **323** into the channel openings **320** and **322**. The release sleeve **150** can slide or move with respect to the cartridge housing **110** at least to the extent that the interlock teeth **188** and **189** can move within the channel openings **320** and **322**, respectively.

[0061] Referring to FIG. **3**D, the pull tab **154** of the release sleeve **150** extends from the top wall of the release sleeve **150**. A force applied to the pull tab **154** in the direction "D" will release or disengage the interlock between the cartridge **100** and the receptacle **200** as described herein. The release sleeve **150** also includes the flange tabs **330** and **331**, which extend from the side walls of the release sleeve **150** at the rear of the release sleeve **150**. The flange tabs **330** and **331** extend out and beyond the first side surface **311** and the second side surface **313** of the release sleeve **150**, respectively, perpendicular to the direction of the longitudinal axis "L". The flange tabs **330** and **331** provide a secondary means by which force can be applied to the release sleeve **150** in the direction "D". The release sleeve **150** also includes an orientation key **334**, which is formed on the bottom surface **314** of the release sleeve **150**. The orientation key **334** provides an additional means to prevent the cartridge **100** from being inserted into the receptacle **200** in an incorrect or unintended orientation, preventing damage to the optical ferrules in the cartridge **100** and the receptacle **200**.

[0062] FIG. **3**E illustrates a front view of the release sleeve **150**, and the ramped interlock aperture **340** is shown in more detail. The ramped interlock aperture **340** is formed as an opening through the first side surface **311** and side wall of the release sleeve **150**. The ramped interlock aperture **360** also formed as an opening through the second side surface **313** (see FIG. **3**D) and side wall of the release sleeve **150**. The ramped interlock aperture **340** includes a chamfered corner bar **341**, a first depressed platform edge region **350**, a second depressed platform edge region **351**, a first ramped edge region **354**, and a second ramped edge region **355**. The first ramped edge region **354** is formed as an angled surface extending from the first depressed platform edge region **350** to the first side surface **311**. The second ramped edge region **355** is formed as an angled surface extending from the second depressed platform edge region **351** to the first side surface **311**. The ramped interlock aperture **360** also includes a chamfered corner bar, first and second depressed platform edge regions, and first and second ramped edge regions, similar to the ramped interlock aperture **340**.

[0063] When the release sleeve **150** is installed around the cartridge housing **110**, the interlock ledge **131** and the latch bumper **151** (or at least portions thereof) are located within the open window of the ramped interlock aperture **340**. Similarly, the interlock ledge **132** and the latch bumper **152** are located within the open window of the ramped interlock aperture **360**. As described in further detail below, the cantilevered latch tabs within the receptacle cavity **202** interlock with (i.e., mechanically interfere with) surfaces of the interlock ledges **131** and **132** through the interlock apertures **340** and **360** when the cartridge **100** is fully inserted into the receptacle **200**. As also described below, the ramped edge regions of the interlock apertures **340** and **360** can release or disengage the cantilevered latch tabs from the interlock ledges **131** and **132**, releasing the cartridge **100** from within the receptacle **200**, when the release sleeve **150** is pulled in the direction "D" shown in FIG. **3**E.

[0064] FIG. **4**A illustrates a top-down view of the receptacle **200** shown in FIG. **1**A, and FIG. **4**B illustrates a bottom-up view of the receptacle **200**. The receptacle **200** is illustrated as a representative example in FIGS. **4**A and **4**B and is not drawn to any particular scale or size. The orientation, shape, size, style, proportion, and other characteristics of the receptacle **200** can vary as compared to that shown and among the embodiments. In some cases, one or more features or components of the receptacle **200** can be omitted. In other cases, the cartridge **100** can include other features or components that are not shown or described.

[0065] The receptacle **200** includes a receptacle housing **210** and a receptacle cover **240**. The receptacle housing **210** can be formed from a plastic or polymer, such as LCP, PE, PTFE, fluoropolymer, or other plastic or insulating material (s). The receptacle cover **240** can also be formed from a plastic or polymer, such as LCP, PE, PTFE, fluoropolymer, or other plastic or insulating material(s). The receptacle housing **210** and receptacle cover **240** are not limited to being formed from polymers, however and can also be formed from other suitable materials. The receptacle housing **210** and receptacle cover **240** can be formed using any suitable additive or subtractive manufacturing techniques, including molding, injection molding, printing, and other techniques.

[0066] As shown, the fiber optic cable ribbons **30** are terminated at the receptacle **200**. An array of optical ferrules is positioned and secured within the receptacle **200**. Individual fiber optic cables in the cable ribbons **30** are optically terminated to the optical ferrules within the receptacle **200**. The receptacle **200** can be installed within the housing of a computing system or environment. For that purpose, the receptacle **200** includes the bulkhead **214** with the fastener eyelet **216** on the top side as shown in FIG. **4**A and the bulkhead **215** with the fastener eyelet **217** on the bottom side as shown in FIG. **4**B. A top stiffening rail **212** and a bottom stiffening rail **213** are formed in the receptacle housing **210** to provide additional rigidity and support to the bulkheads **214** and **215**, respectively.

[0067] The receptacle cover **240** is omitted from view in FIG. **4**C so that the interior space **201** within the receptacle housing **210** can be seen. When installed over the receptacle housing **210**, the receptacle cover **240** encloses the interior space **201** within the receptacle housing **210**. The receptacle cover **240** includes latching tabs **242-245**, as shown in FIGS. **1**A and **4**B. The latching tabs **242-245** extend from first and second peripheral side edges of the receptacle cover **240** and interlock with features of the receptacle housing **210**, to secure the receptacle cover **240** in place.

[0068] The interior space **201** within the receptacle housing **210** is visible in FIG. **4**C. The receptacle **200** includes a ferrule sled **410**, a spring base **420**, and springs **430** and **432** within the interior space **201**. The spring base **420** is secured in place at the rear end of the receptacle **200** and provides seats for one end of the springs **430** and **432**. The springs **430** and **432** are positioned and compressed between the spring base **420** and the ferrule sled **410**. The springs **430** and **432** provide a spring bias that pushes the ferrule sled **410** toward the receptacle cavity **202** at the front end of the receptacle **200**.

[0069] A row of optical ferrules is positioned and secured within the ferrule sled **410**. More particularly, although not visible in FIG. **4**C, a row of optical ferrules is secured in the ferrule region **412** of the ferrule sled **410**. A row of collets is also secured in a collet region **413** within the ferrule sled **410**. Fiber optic cables extend from the fiber optic cable ribbons **30**, into the interior space **201** of the receptacle housing **210**, into the ferrule sled **410**, through the collets in the collet region **413**, and are optically terminated to the optical ferrules the ferrule region **412**. For simplicity, the fiber optic cable ribbons **30** are illustrated as extending only to the ferrule sled **410** in FIG. **4**D. The ferrule sled **410**, spring base **420**, and springs **430** and **432** are described in additional detail below with reference to FIG. **5**.

[0070] The receptacle housing **210** also includes an orientation keyway **434**. The orientation keyway **434** is formed as a type of slot in the bottom wall of the receptacle housing **210** (see also FIG. **1**A). The orientation key **334** of the cartridge housing **110**, as shown in FIG. **3**D, will slide into the orientation keyway **434** of the receptacle housing **210** when the cartridge **100** is correctly oriented and inserted into the receptacle **200**. The orientation key **334** and the orientation keyway **434** provide help to prevent the cartridge **100** from being inserted into the receptacle **200** in an incorrect or unintended orientation, preventing damage to the optical ferrules in the cartridge **100** and the receptacle **200**.

[0071] The receptacle housing **210** also includes cantilevered latch tabs **440** and **460** extending within the receptacle cavity **202**. The cantilevered latch tabs **440** and **460** are visible through openings in the receptacle housing **210** in FIGS. **4**A-**4**C. A detail view of the cantilevered latch tab **440** designated "BB" in FIG. **4**A is shown in FIG. **4**D. FIG. **4**E also illustrates a front view of the receptacle housing **210**, and the cantilevered latch tabs **440** and **460** are visible within the receptacle cavity **202** of the receptacle housing **210** in FIG. **4**E. The cantilevered latch tabs **440** and **460** can be formed from a polymer material integrally with the remainder of the receptacle housing **210** in one example.

[0072] Referring between FIGS. **4**D and **4**E, the cantilevered latch tab **440** includes an extension arm **442**, a latch tooth **444** at an end of the extension arm **442**, and release knobs **446**A and **446**B on opposite sides at the end of the extension arm **442**. The cantilevered latch tab **440** also includes a curved end **448**. Similarly, the cantilevered latch tab **450** includes an extension arm, a latch tooth **464** at an end of the extension arm, and release knobs **466**A and **466**B on opposite sides at the end of the extension arm. The cantilevered latch tabs **440** and **460** are elastic and can bend to some extent. For example, a force applied in the direction "F" at the end of the cantilevered latch tab **440**, as shown in FIG. **4**D, can bend the cantilevered latch tab **440** in the direction "F" to some extent. The cantilevered latch tab **440** will return to the position shown in FIG. **4**D after the force is removed. The elastic nature of the cantilevered latch tabs **440** and **460** facilitates the interlock feature between the cartridge **100** and the receptacle **200**, as described below.

[0073] Referring to FIG. **4**E, the receptacle housing **210** also includes guide surfaces **480** and **482** along rails in the receptacle cavity **202**. The guide surface **480** extends in a plane that is separated from and substantially parallel to the guide surface **482** in the example shown. The guide surfaces **480** and **482** are positioned, and spaced apart, to guide the release sleeve **150** down the receptacle cavity **202**. The guide surfaces **480** and **482** help to ensure that the leading chamfered corner bars of the ramped interlock apertures **340** and **360** of the release sleeve **150** push the cantilevered latch tabs **440** and **460** apart upon contact between them.

[0074] FIG. **5** illustrates components of the receptacle **200** shown in FIG. **1**A according to various embodiments of the present disclosure. The receptacle **200** includes the ferrule sled **410**, the spring base **420**, and the springs **430** and **432**, which all fit within the interior space **201**. The spring base **420** is secured in place at the rear end of the receptacle **200** and provides seats for one end of the springs **430** and **432**. When the receptacle **200** is assembled, the springs **430** and **432** are positioned and compressed between the spring base **420** and the ferrule sled **410**. The springs **430** and **432** provide a spring bias that pushes the ferrule sled **410** toward the receptacle cavity **202** at the front end of the receptacle **200**.

[0075] A row of optical ferrules is positioned and secured within the ferrule sled **410**. A row of collets is also secured within the ferrule sled **410**. A sled cover **436** is used to cover and secure the optical ferrules and the collets within the ferrule sled **410**. The sled cover **436** includes a raised region **437**. A surface of the raised region **437** contacts the collets within the ferrule sled **410**, holding the collets in place. Fiber optic cables extend from the fiber optic cable ribbons **30**, into the interior space **201** of the receptacle housing **210**, into the ferrule sled **410**, through the collets, and are optically terminated to the optical ferrules within the ferrule sled **410**.

[0076] FIG. **6**A illustrates the first ramped interlock aperture **340** of the cartridge **100** taken along the sectional plane A-A shown in FIG. **1**A. As shown, the ramped interlock aperture **340** is formed as an opening through the first side surface **311** and side wall of the release sleeve **150**. The ramped interlock aperture **340** includes the chamfered corner bar **341**, the first depressed platform edge region **350**, a second depressed platform edge region **351** (see FIG. **3**E), a first ramped edge region **354**, and a second ramped edge region **355** (see FIG. **3**E). The first ramped edge region **354** is formed as an angled surface extending from the first depressed platform edge region **350** to the first side surface **311**. When the release sleeve **150** is installed around the cartridge housing **110** as shown in FIG. **6**A, the interlock ledge **131** and the latch bumper **151** (or at least portions thereof) are located within the open window of the ramped interlock aperture **340**.

[0077] FIG. **6**B illustrates the cantilevered latch tab **440** of the receptacle **200** interlocked with the ramped interlock aperture **340** of the cartridge **100** taken along the sectional plane A-A shown in FIG. **1**A. In FIG. **6**B, the cartridge **100** is fully inserted into the receptacle **200** and interlocked with the receptacle **200**. As shown, the latch tooth **444** of the cantilevered latch tab **440** is interlocked with the interlock ledge **131** on one side of the cartridge housing **110**. Although

not shown in FIG. **6**B, the latch tooth **464** of the cantilevered latch tab **460** on the other side of the receptacle **200** is also interlocked with the interlock ledge **132** on the other side of the cartridge housing **110**. Once interlocked, the cartridge **100** cannot be pulled out from within the receptacle **200** by pulling on the cable assembly **20**, for example, under expected ranges of forces and without damage. Thus, the connector assembly **10** includes features that prevent the unintended or inadvertent removal of the cartridge **100** from the receptacle **200**, which would result in the disruption of data communications through the connector assembly **10**.

[0078] FIG. **6**C illustrates the cantilevered latch tab and the ramped interlock aperture of the cartridge taken along the sectional plane C-C shown in FIG. **6**B according to various embodiments of the present disclosure. The latch tooth **444** of the cantilevered latch tab **440** is interlocked with the interlock ledge **131** on one side of the cartridge housing **110**. The release knob **446**B is seated and resting against the depressed platform edge region **350**, as can be appreciated by a comparison of FIGS. **6**A and **6**C.

[0079] From the interlocked configuration shown in FIG. **6**C, the ramped edge regions of the interlock aperture **340** can release or disengage the cantilevered latch tab **440** from the interlock ledge **131**. More particularly, when the release sleeve **150** is pulled in the direction "D," the ramped edge region **354** will wedge under the release knob **446**B of the cantilevered latch tab **440**. This force, which is also in the direction "F" shown in FIG. **4**D, will cause the cantilevered latch tab **440** to bend and move away from the interlock ledge **131**, ultimately removing the interference between the latch tooth **444** and the interlock ledge **131**. Although not shown in FIG. **6**C, the ramped edge region **355** (see FIG. **3**E) will also wedge under the release knob **446**A of the cantilevered latch tab **440** when the release sleeve **150** is pulled in the direction "D." At the same time, the cantilevered latch tab **460** can be released from the interlock aperture **360** when the release sleeve **150** is pulled in the direction "D."

[0080] Terms such as "top," "bottom," "side," "front," "back," "right," and "left" are not intended to provide an absolute frame of reference. Rather, the terms are relative and are intended to identify certain features in relation to each other, as the orientation of structures described herein can vary. The terms "comprising," "including," "having," and the like are synonymous, are used in an open-ended fashion, and do not exclude additional elements, features, acts, operations, and so forth. Also, the term "or" is used in its inclusive sense, and not in its exclusive sense, so that when used, for example, to connect a list of elements, the term "or" means one, some, or all of the elements in the list.

[0081] Combinatorial language, such as "at least one of X, Y, and Z" or "at least one of X, Y, or Z," unless indicated otherwise, is used in general to identify one, a combination of any two, or all three (or more if a larger group is identified) thereof, such as X and only X, Y and only Y, and Z and only Z, the combinations of X and Y, X and Z, and Y and Z, and all of X, Y, and Z. Such combinatorial language is not generally intended to, and unless specified does not, identify or require at least one of X, at least one of Y, and at least one of Z to be included. The terms "about" and "substantially," unless otherwise defined herein to be associated with a particular range, percentage, or related metric of deviation, account at least for some manufacturing tolerances between a theoretical design and a manufactured product or assembly, such as the geometric dimensioning and tolerancing criteria described in the American Society of Mechanical Engineers (ASME®) Y14.5 and the related International Organization for Standardization (ISO®) standards. Such manufacturing tolerances are still contemplated, as one of ordinary skill in the art would appreciate, although "about," "substantially," or related terms are not expressly referenced, even in connection with the use of theoretical terms, such as the geometric "perpendicular," "orthogonal," "vertex," "collinear," "coplanar," and other terms.

[0082] The above-described embodiments of the present disclosure are merely examples of implementations to provide a clear understanding of the principles of the present disclosure. Many variations and modifications can be made to the above-described embodiments without departing substantially from the spirit and principles of the disclosure. In addition, components and features described with respect to one embodiment can be included in another embodiment. All such modifications and variations are intended to be included herein within the scope of this disclosure.

What is claimed is:

1. An optical connector assembly, comprising:

an optical receptacle comprising a receptacle housing, the receptacle housing comprising a receptacle cavity and a cantilevered latch tab within the receptacle cavity, the cantilevered latch tab comprising an extension arm, a latch tooth at an end of the extension arm, and a release knob; and

an optical cartridge comprising:

a cartridge housing comprising a plurality of spacing ribs and an interlock ledge along a side of the cartridge housing; and

a release sleeve extending around a length of the cartridge housing, the release sleeve comprising a ramped interlock aperture.

2. The optical connector assembly according to claim **1**, wherein:

the cartridge housing further comprises a latch bumper along the side of the cartridge housing;

a spacing rib among the plurality of spacing ribs comprises an interlock tooth; and

along the side of the cartridge housing, the interlock ledge is positioned toward a front of the cartridge housing, the spacing rib with the interlock tooth is positioned towards a rear of the cartridge housing, and the latch bumper is positioned between the interlock ledge and the spacing rib with the interlock tooth.

3. The optical connector assembly according to claim **1**, wherein:

the optical receptacle comprises a first row of optical ferrules; and

the optical cartridge comprises a second row of optical ferrules.

4. The optical connector assembly according to claim **1**, wherein the ramped interlock aperture comprises a chamfered corner bar, an aperture through a side wall of the release sleeve, a depressed platform edge region along an edge of the aperture, and a ramped edge region along the edge of the aperture.

5. The optical connector assembly according to claim **4**, wherein the interlock ledge of the cartridge housing is exposed through the aperture of the ramped interlock aperture.

6. The optical connector assembly according to claim **5**, wherein, when the optical cartridge is inserted into the

receptacle cavity of the optical receptacle, the latch tooth of the cantilevered latch tab mechanically interferes with the interlock ledge of the cartridge housing, to lock the optical cartridge within the optical receptacle.

7. The optical connector assembly according to claim **5**, wherein, when the optical cartridge is locked within the optical receptacle, the release knob of the cantilevered latch tab is seated on the depressed platform edge region of the ramped interlock aperture.

8. The optical connector assembly according to claim **1**, wherein the release sleeve further comprises a pull tab extending from a top wall of the release sleeve and an orientation key formed on a bottom wall of the release sleeve.

9. The optical connector assembly according to claim **1**, wherein the release sleeve further comprises flange tabs extending from side walls of the release sleeve.

10. The optical connector assembly according to claim **1**, wherein the optical receptacle further comprises a ferrule sled and a spring to provide a spring bias to the ferrule sled.

11. The optical connector assembly according to claim **1**, wherein inner side surfaces of the release sleeve slide along edges of the spacing ribs of the cartridge housing.

12. The optical connector assembly according to claim **11**, wherein:

from a front to a rear of the release sleeve, the inner side surfaces are drafted to expand apart from each other; and

from a front to a rear of the cartridge housing, the spacing ribs of the cartridge housing are progressively longer.

13. An optical cartridge, comprising:

a cartridge housing comprising a plurality of spacing ribs and an interlock ledge along a side of the cartridge housing; and

a release sleeve extending around a length of the cartridge housing, the release sleeve comprising a ramped interlock aperture.

14. The optical cartridge according to claim **13**, wherein the ramped interlock aperture comprises a chamfered corner bar, an aperture through a side wall of the release sleeve, a depressed platform edge region along an edge of the aperture, and a ramped edge region along the edge of the aperture.

15. The optical cartridge according to claim **14**, wherein the interlock ledge of the cartridge housing is exposed through the aperture of the ramped interlock aperture.

16. The optical cartridge according to claim **13**, wherein the release sleeve further comprises a pull tab extending from a top wall of the release sleeve and an orientation key formed on a bottom wall of the release sleeve.

17. The optical cartridge according to claim **13**, wherein the release sleeve further comprises flange tabs extending from side walls of the release sleeve.

18. An optical receptacle, comprising:

a receptacle housing, the receptacle housing comprising a receptacle cavity and a cantilevered latch tab within the receptacle cavity, the cantilevered latch tab comprising an extension arm, a latch tooth at an end of the extension arm, and a release knob;

a ferrule sled; and

a spring to provide a spring bias to the ferrule sled.

19. The optical receptacle according to claim **18**, wherein the receptacle housing further comprises an orientation keyway formed as a slot in a bottom wall of the receptacle housing.

20. The optical receptacle according to claim **18**, wherein the receptacle housing further comprises guide surfaces on rails within the receptacle cavity.

* * * * *