

RAPID DEPLOYMENT INDEXING TERMINAL ARRANGEMENT

Cross-Reference to Related Application

[0001] This application claims the benefit of U.S. Patent Application Serial No.

5 62/360,040, filed on July 8, 2016, the disclosure of which is incorporated herein by reference in its entirety.

Background

[0002] As demand for telecommunications increases, fiber optic networks are being extended in more and more areas. In facilities such as multiple dwelling units, apartments, condominiums, businesses, etc., fiber optic enclosures are used to provide a
10 subscriber access point to the fiber optic network. These fiber optic enclosures are connected to the fiber optic network through subscriber cables connected to a network hub. However, the length of subscriber cable needed between the fiber optic enclosure and the network hub varies depending upon the location of the fiber optic enclosure
15 with respect to the network hub. As a result, there is a need for a fiber optic enclosure that can effectively manage varying lengths of subscriber cable.

Summary

[0003] Some aspects of the disclosure are directed to a fiber distribution terminal including a base configured to mount to a surface; a spool arrangement
20 including a cable spool extending from a housing; and a multi-fiber cable wound on the cable spool. The spool arrangement is coupled to the base to enable rotation of the spool arrangement relative to the base. The cable spool and the housing rotate in unison when the spool arrangement rotates relative to the base. The housing defines a multi-fiber connection port and a termination region. The termination region is defined at an
25 intermediate shelf that provides a mounting location. The multi-fiber cable includes at least a first optical fiber extending from a first multi-fiber connector to a single-fiber optical connector that is optically accessible from the termination region. The multi-

fiber cable also includes at least a second optical fiber extending from the first multi-fiber connector to a second multi-fiber connector that is optically accessible from the multi-fiber connection port. The second optical fiber is indexed between the first and second multi-fiber connection ports.

5 **[0004]** In certain implementations, the termination region includes at least a single-fiber connection port.

[0005] In certain implementations, the termination region includes a plurality of single-fiber connection ports.

[0006] In certain implementations, the first and second multi-fiber connectors
10 define twelve fiber positions. In certain examples, the first and second multi-fiber connectors define twenty-four fiber positions.

[0007] In certain implementations, the multi-fiber connection port faces in an opposite from the single-fiber connection port.

[0008] In certain implementations, the base defines a cable port.

15 **[0009]** In certain implementations, the base cooperates with the housing to define a cable port.

[0010] In certain implementations, the base includes sidewalls that extend to surround the cable spool.

[0011] In certain implementations, housing includes a retention arrangement to
20 hold a splitter module at the splitter mounting location. In certain examples, the retention arrangement includes latches.

[0012] In certain implementations, a separator module is mounted to the housing at the mounting location. The separator module includes a separation housing carrying a plurality of outputs at which subscriber cables can be coupled to the separator
25 module.

[0013] In certain examples, the separator module includes an input connector. The termination region of the housing defines a single-fiber connection port sized to receive the input connector of the separator module.

- [0014] In certain examples, the separator module defines an input port. The termination region of the housing includes a single-fiber connector sized to be received in the input port of the separator module.
- [0015] In certain implementations, the separator module includes an optical power splitter disposed in the separation housing.
- [0016] In certain implementations, the separator module includes a wave division multiplexer disposed in the separation housing.
- [0017] In certain implementations, the cable port is environmentally sealed.
- [0018] In certain implementations, each of a plurality of separator modules is mounted to the mounting location of the fiber distribution terminal and interfaced with one of the single-fiber connection ports. Each separator module is configured to carrying signals from the single-fiber connection port to multiple outputs.
- [0019] In certain implementations, one of the separator modules includes an optical power splitter that splits the optical signals received from the respective single-fiber connection port to the outputs.
- [0020] In certain implementations, one of the separator modules includes a wave division multiplexer that divides the optical signals received from the respective single-fiber connection port to the outputs.
- [0021] In accordance with certain aspects, a fiber distribution architecture includes multiple fiber distribution terminals daisy-chained together.
- [0022] In certain implementations, a fiber distribution point receives a feeder cable. The fiber distribution point also receives a first multi-fiber connector of a first of the fiber distribution terminals.
- [0023] In certain implementations, the daisy-chain includes N fiber distribution terminals, where N is an integer greater than 2, so that the fiber distribution terminals are daisy-chained together from a first fiber distribution terminal to an Nth fiber distribution terminal. Another optical cable is routed from the fiber distribution hub to a multi-fiber connection port of the Nth fiber distribution terminal to mate with a second multi-fiber connector of the Nth fiber distribution terminal.

[0024] In certain examples, the fiber distribution point includes a fiber distribution hub.

[0025] A variety of additional aspects will be set forth in the description that follows. These aspects can relate to individual features and to combinations of features.

- 5 It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad concepts upon which the embodiments disclosed herein are based.

Brief Description of the Drawings

- 10 [0026] The accompanying drawings, which are incorporated in and constitute a part of the description, illustrate several aspects of the present disclosure. A brief description of the drawings is as follows:

[0027] FIG. 1 is a schematic diagram of an example multi-dwelling building in which multiple distribution terminals of FIG. 1 are chained together to provide an optical fiber distribution system with redundancy;

- 15 [0028] FIG. 2 is a schematic diagram of the multi-dwelling building of FIG. 1 in which service has been requested;

[0029] FIG. 3 is a schematic diagram of an example fiber distribution terminal suitable for use in the optical fiber distribution system of FIG. 1;

- 20 [0030] FIGS. 4-5 are perspective views of a fiber optic distribution terminal having example features of aspects in accordance with the principles of the present disclosure;

[0031] FIGS. 6-7 are perspective views of the fiber optic distribution terminal of FIGS. 4-5 with a spool arrangement exploded from a base;

- 25 [0032] FIG. 8 is a schematic diagram of an example separator module suitable for use with the fiber distribution terminal of FIG. 3;

[0033] FIGS. 9-10 are perspective views of an example separator module having example features of aspects in accordance with the principles of the present disclosure;

- [0034] FIG. 11 is a perspective view of the separator module exploded from the fiber optic distribution terminal of FIGS. 4-5;
- [0035] FIG. 12 is a perspective view of the separator module loaded on the fiber distribution terminal of FIG. 11;
- 5 [0036] FIG. 13 is a perspective view of an example separator module having two rows of output ports;
- [0037] FIG. 14 is a perspective view of an example separator module having four rows of output ports;
- [0038] FIG. 15 is a perspective view of the separator module of FIG. 14 loaded
10 on the fiber distribution hub of FIG. 4;
- [0039] FIG. 16 is a perspective view of another fiber optic distribution terminal having example features of aspects in accordance with the principles of the present disclosure;
- [0040] FIGS. 17 and 18 are forward and rearward perspective views of the fiber
15 optic distribution terminal of FIG. 16 with a spool arrangement shown exploded from a base;
- [0041] FIG. 19 is a perspective view of an example splitter module suitable for use with the fiber optic distribution terminal of FIG. 16;
- [0042] FIG. 20 is a perspective view of the splitter module of FIG. 19 installed
20 at the fiber optic distribution terminal of FIG. 16;
- [0043] FIG. 21 shows patch cords plugged into the termination region of the loaded distribution terminal of FIG. 20;
- [0044] FIG. 22 is a perspective view of another fiber optic distribution terminal
25 having example features of aspects in accordance with the principles of the present disclosure;
- [0045] FIG. 23 is a perspective view of an example splitter module suitable for use with the fiber optic distribution terminal of FIG. 22; and
- [0046] FIG. 24 is a perspective view of multiple splitter modules of FIG. 23 being installed at the fiber optic distribution terminal of FIG. 22.

Detailed Description

[0047] Reference will now be made in detail to the exemplary aspects of the present disclosure that are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like structure.

5 [0048] In general, a fiber distribution terminal includes a storage spool disposed within an enclosure from which a fiber optic cable may be dispensed. The fiber distribution terminal has at least one multi-fiber optical adapter port, at least one single-fiber optical adapter port, and a cable port through which the fiber optic cable passes
10 when deployed. The fiber distribution terminal also includes a termination region at which one or more subscriber fibers may be connected to one or more fibers of the fiber optic cable. The at least one single-fiber optical adapter port is disposed at the termination region. The termination region is carried by the storage spool such that the termination region rotates in unison with the storage spool relative to the enclosure
15 when fiber optic cable is dispensed from the storage spool.

[0049] In some implementations, all of the components of the fiber distribution terminal are installed in the field at the same time. In other implementations, however, some of the components of the fiber distribution terminal are installed initially (on a first date) and other components of the fiber distribution terminal are installed only after
20 those components are needed for service (on a subsequent date). For example, in some implementations, a fiber distribution terminal is initially installed and a fiber optic cable is routed to connect the fiber distribution terminal to a network access point (e.g., a fiber distribution hub). However, in examples, this fiber distribution terminal may be initially installed without an optical splitter module or wave division multiplexer. In
25 examples, this fiber distribution terminal may be installed with only a single subscriber port at the termination region.

[0050] A patch cord can be routed between the termination region (e.g., the single-fiber optical adapter port) of the fiber distribution terminal and a subscriber when service is requested by the subscriber. In some implementations, an optical splitter or
30 wave division multiplexer can be added to the fiber distribution terminal to provide

additional outputs at the termination region when service is requested by multiple subscribers. Patch cords can be connected to outputs of the optical splitter or wave division multiplexer to connect the subscribers to the fiber optic cables. In other implementations, however, the optical splitter or wave division multiplexer can be added to the fiber distribution terminal when service is requested by a single subscriber. In still other implementations, the optical splitter or wave division multiplexer can be pre-installed at the fiber distribution terminal prior to installation of the fiber distribution terminal.

[0051] FIG. 1 illustrates an example indexing environment 100 including multiple distribution terminals 110 daisy-chained together in a multi-dwelling building 101. The building 101 has multiple floors 102a-102d. The floor can be a basement. In the example shown, the building 101 has four floors 102a-102d. In other implementations, the building 101 may have any desired number of floors. Each distribution terminal 110 provides a connection point at which one or more subscribers on one or more floors can connect to the building network.

[0052] An access point of an optical network is disposed at one of the floors. For convenience, this disclosure will assume that the access point is a fiber distribution hub 105 disposed at the bottom floor 102a (e.g., a basement, a street-level floor, etc.) of the building 101. A feed cable 103 (e.g., from a central office of a service provider) is routed into the building 101 and received at the fiber distribution hub 105. In other examples, the hub 105 can be disposed at any of the floors 102a-102d. In still other examples, other types of network access nodes can be utilized. Additional information regarding one example type of network access node is provided in U.S. Application No. _____ [having attorney docket no. 02316.6990USP1], filed herewith, and titled "Fiber Splitter and Connection Module," the disclosure of which is hereby incorporated herein by reference.

[0053] The fiber distribution hub 105 can include a housing that is capable of receiving one or more optical splitters. Each optical splitter is configured to split optical signals supplied to the fiber distribution hub 105 by the feed fiber 103. In various implementations, an optical splitter mounted at the hub 105 can be a 1:2 splitter,

a 1:4 splitter, a 1:8 splitter, a 1:16 splitter, a 1:32 splitter, and/or a 1:64 splitter. Outputs of the optical splitter can be optically connected to optical fibers routed to the various floors 102a-102d of the building 101.

[0054] The optical splitters can be incrementally installed at the hub 105 as service is needed. For example, the hub 105 may initially be devoid of splitters. When one or more subscribers request service, one or more splitters may be installed at the hub 105. In some implementations, the splitters have output pigtails extending therefrom that can connect at adapters to the optical fibers routed to the floors 102a-102d. In other implementations, the splitters have output adapters configured to receive connectorized ends of the optical fibers routed to the various floors 102a-102d or intermediate fibers. The splitter input also may include a connectorized pigtail, an unconnectorized pigtail, or an adapter. The housing can also enclose various structures for making optical connections between optical fibers of optical cables. For example, the housing can include a plurality of fiber optic adapters for connecting fiber optic connectors, splice trays for protecting optical splices between optical fibers, or other types of structures.

[0055] The fiber distribution system is shown including fiber distribution terminals 110 at each of the upper floors 102a-102d. In other examples, a terminal 110 can provide service to and be disposed between two floors. Fiber optic cables 120 interconnect the fiber distribution hub 105 and the fiber distribution terminals 110. The fiber optic cables 120 can each include one or more optical fibers contained within a protective jacket. The optical fibers of the fiber optic cables 120 can be optically coupled to the feed fiber 103 through the optical splitter at the hub 105.

[0056] When initially installed, each fiber distribution terminal 110 includes a cable spool 112 about which a portion of the fiber optic cable 120 is paid out. In certain implementations, the cable spool 112 can be selectively locked in a single rotational orientation relative to the enclosure 110. Each fiber distribution terminal 110 defines a cable port 113 through which the fiber optic cable 120 exits the fiber distribution terminal 110 when the fiber optic cable 120 is paid out. Each fiber distribution terminal 110 also defines a multi-fiber connection port 114 and a termination region 115

including at least one single-fiber connection port 116. In certain implementations, the multi-fiber connection port 114 is spaced from the termination region 115.

[0057] In certain implementations, the single-fiber connection port 116 is carried by the cable spool 112 to rotate unitarily with the cable spool 112. In certain implementations, the termination region 115 is carried by the cable spool 112 to rotate unitarily with the cable spool 112. In certain implementations, the multi-fiber connection port 114 is carried by the cable spool 112 to rotate unitarily with the cable spool 112. In certain implementations, both the termination region 115—including the single-fiber connection port 116—and the multi-fiber connection port 114 are carried by the cable spool 112 to rotate unitarily with the cable spool 112.

[0058] At least one optical fiber of the fiber optic cable 120 extends between a first end 121 and a second end 122. The first end 121 is terminated at a multi-fiber connector, which is disposed external of the fiber distribution terminal 110. The second end 122 of at least one optical fiber of the fiber optic cable 120 is optically coupled to the at least one single-fiber connection port 116 at the termination region 115. For example, the second end 122 may be terminated at a single-fiber connector that is plugged into a first port of an optical adapter that also defines a second port, which forms the single-fiber connection port 116. In certain implementations, multiple optical fibers of the fiber optic cable 120 have second ends 122 routed to the termination region 115. Second ends 123 of a remainder of the optical fibers of the fiber optic cable 120 are optically coupled to the multi-fiber connection port 114. For example, the second ends 123 may be terminated at a multi-fiber connector that is plugged into a first port of a multi-fiber optical adapter that also defines a second port, which forms the multi-fiber connection port 114.

[0059] In some implementations, multiple distribution terminals 110 can be daisy-chained together in the field. For example, the cable 120 can be paid out of one of the distribution terminals 110 and a connectorized end 121 of the first cable 120 can be plugged into the multi-fiber connection port 114 of another distribution terminal 120. Accordingly, the distribution terminals can be deployed within an environment (e.g., a

multi-dwelling building 101, an office, etc.) and optically coupled together before or when service is connected to individual subscribers.

[0060] As will be discussed in greater detail in FIG. 2, the fiber optic cables 120 can be optically coupled to patch cords 135 at the fiber distribution terminals 110. The patch cords 135 can be routed (e.g., horizontally along the floor) to optical network terminals (ONT's) 130 or other types of interface devices (e.g., an interface box, an interface panel, etc.) corresponding to different subscriber locations (e.g., apartments, residences, offices, condominiums, etc.). An ONT 130 is an active device that converts optical signals from the service provider to electrical signals used at the subscriber locations. In some implementations, a fiber distribution terminal 110 services subscribers on the same floor 102a-102d as the fiber distribution terminal 110. In other implementations, a fiber distribution terminal 110 can service subscribers on adjoining floors.

[0061] In the example shown in FIG. 1, a first distribution terminal 110a is mounted at a second floor 102b of the building 101. The optical cable 120a of the first distribution terminal 110a is paid out from the respective cable spool 112 so that a connectorized end of the optical cable 120a can be connected at the fiber distribution hub 105. Accordingly, optical network signals provided to the fiber distribution hub 105 via the feed fiber 103 can be carried to the first distribution terminal 110a and made available to one or more subscribers (e.g., any subscribers on the second floor 102b) via one or more ports (e.g., the single-fiber connection port 116) at the termination region 115. The optical signals also are made available at the multi-fiber connection location 114 of the first distribution terminal 110a.

[0062] A user pulls on the free end 121 of the first cable 120a to unwind the first cable 120a from the spool 112 and to pull the unwound length of the first cable 120a out of the distribution terminal 110a through the cable port 113. As the user pulls the first cable 120a, the first cable 120a causes the storage spool 112 to rotate relative to the distribution terminal 110a. The termination region 115 rotates in unison with the cable spool 112 so that no strain is applied to the connectorized ends 122, 123 of the fibers of

the fiber optic cable 120a. The user continues pulling until a sufficient length of the cable 120a is deployed.

[0063] A second distribution terminal 110b is mounted at a third floor 102c of the building 101. The optical cable 120b of the second distribution terminal 110b is paid out from the corresponding cable spool 112 so that a connectorized end 121 of the optical cable 120b can be plugged into the multi-fiber connection location 114 of the first distribution terminal 110a. Accordingly, optical network signals provided to the fiber distribution terminal 110a can be carried to the second distribution terminal 110b and made available to one or more subscribers (e.g., any subscribers on the third floor 102c) via the one or more ports (e.g., the single-fiber connection port 116) at the termination region 115 of the second distribution terminal 110b. The optical signals also are made available at the multi-fiber connection location 114 of the second distribution terminal 110b.

[0064] A third distribution terminal 110c is mounted at a fourth floor 102d of the building 101. The optical cable 120c of the third distribution terminal 110c is paid out from the corresponding cable spool 112 so that a connectorized end 121 of the optical cable 120c can be plugged into the multi-fiber connection location 114 of the second distribution terminal 110b. Accordingly, optical network signals provided to the second fiber distribution terminal 110b can be carried to the third distribution terminal 110c and made available to any subscribers on the fourth floor 102d via the one or more ports (e.g., the single-fiber connection port 116) at the termination region 115. The optical signals also are made available at the multi-fiber connection location 114 of the third distribution terminal 110c.

[0065] In accordance with aspects of the disclosure, the system of FIG. 1 uses indexing of fibers to ensure that a live fiber will be provided at the first fiber position of a first multi-fiber connector received at each multi-fiber connection location 114 when the distribution terminals are strung together in a chain. For example, the fibers of a fiber distribution terminal 110 can be indexed between the multi-fiber connector terminating the free end 121 of the respective cable 120 and the multi-fiber connector

terminating the end 123 of the cable 120 that connects to the multi-fiber connection port 114.

[0066] After each indexing step, an additional fiber is no longer used since it is not connected to service through the first multi-fiber connector. The unused fibers in this instance would be dead fibers. In certain implementations, another optical cable 125 can be routed from the fiber distribution hub 105 to the multi-fiber connection location 114 of the third distribution terminal 110c to mate with the multi-fiber connector terminating the second end 123 of the cable 120c. The optical cable 125 provides redundancy within the system by providing a second path by which optical signals can be carried from the fiber distribution hub 105 to all of the distribution terminals 110a, 110b, 110c. The optical signals would be carried over the otherwise-would-be-dead fibers along the chain.

[0067] For example, the dead fibers can be used to carry signals as live fibers. These signals are carried from the fiber distribution hub 105, over the cable 125 to the third distribution terminal 110c, over the cable 120C to the second distribution terminal 110b, over the cable 120b to the first distribution terminal 110a. This implementation can double the capacity of the system by having signals traveling in one direction as they are indexed up in the multi-fiber connectors, and a second set of signals in the opposite direction as the fibers are indexed into the multi-fiber connectors as new fibers.

[0068] The above bi-directional usage is advantageous in a fiber loop or fiber ring. Another advantage could arise as a redundant fiber path that could serve the drop locations that are downstream from a cable cut. The system of FIG. 1 removes the dead fibers and provides options for using them as live fibers with the bi-directional usage.

The number can vary as the number of fibers in the multi-fiber connector varies.

Additional information regarding fiber indexing and bi-directional fiber indexing can be found in U.S. Publication No. 2014/0254986, the disclosure of which is hereby incorporated herein by reference.

[0069] FIG. 2 illustrates the indexing environment 100 of FIG. 1 after service has been requested. Various ways of connecting subscribers to the fiber distribution terminals 110 are illustrated in FIG. 2. In some implementations, a single subscriber

130 can be optically coupled to the single-fiber connection port 116 of a fiber distribution terminal 110. In other implementations, one or more optical separator modules 118 (e.g., optical power splitters, wave division multiplexers, etc.) can be mounted at the fiber distribution terminal 110 to provide a greater number of connection
5 ports at the termination region 115. Various types of optical separator modules 118 can provide different numbers (e.g., two, three, four, five, six, eight, twelve, sixteen, etc.) of connection ports.

[0070] For example, on the second floor 102b, the single-fiber connection port 116 provides service to a single customer or outlet. For example, a first end of a first
10 patch cord 135a can be plugged into the single-fiber connection port 116 of the fiber distribution terminal 110a. A second end of the first patch cord 135a can be plugged into an ONT 130a. Accordingly, optical signals carried from the hub 105 by the first cable 120a are dropped at the first fiber distribution terminal 110a and carried to the ONT 130a.

15 [0071] On the third floor 102c, however, a first type of optical separator modules 118a has been mounted to the second fiber distribution terminal 110b. The first type of optical separator module 118a has an input 117 that optically couples to the single-fiber connection port 116 of the second fiber distribution terminal 110b. The first type of optical separator module 118a defines two output ports 119 that define an
20 upgraded termination region 115'. A second patch cord 135b extends from an ONT 130b on the third floor 102c and plugs into one of the output ports 119 at the upgraded termination region 115'.

[0072] On the fourth floor 102d, a second type of optical separator modules 118b has been mounted to the third fiber distribution terminal 110c. The second type of
25 optical separator module 118b has an input 117 that optically couples to the single-fiber connection port 116 of the third fiber distribution terminal 110c. The second type of optical separator module 118b defines four output ports 119 that define an upgraded termination region 115'. A third patch cord 135c extends from an ONT 130c on the fourth floor 102d and plugs into one of the output ports 119 at the upgraded termination
30 region 115' of the third fiber distribution terminal 110c.

[0073] In still other implementations, the termination region 115 of a fiber distribution terminal 110 defines multiple single-fiber connection ports 116 that can each couple to an input of a separate optical splitter or wave division multiplexer. Each optical separator module 118 provides additional outputs to define an upgraded termination region 115'. In certain implementations, the multiple optical separator modules 118 need not be installed at once. Rather, the termination region 115 can support mixed use—support a subscribers at a single-fiber connector port 116 and support other subscribers at splitter outputs or wave division multiplexer outputs.

[0074] FIGS. 3-7 illustrate one example implementation of a fiber distribution terminal 110 suitable for use with the indexing environment 100 of FIGS. 1 and 2. The fiber distribution terminal 110 includes an enclosure 111 in which the cable spool 112 is disposed. An optical cable 120 is wound around the cable spool 112. The enclosure 111 defines a cable port 113 through which the optical cable 120 extends so that the free end 121 of the optical cable 120 is located external of the enclosure.

[0075] As shown in FIG. 3, the fibers of the cable 120 can be indexed between multi-fiber connectors at the first and second ends 121, 123. Each of the multi-fiber connectors defines a sequence of fiber positions. In certain examples, the sequenced fiber positions are configured in one or more rows. In examples, fibers with adjoining positions in the sequence have adjoining locations in the rows. In the example shown, each multi-fiber connector defines twelve fiber positions $P_1 - P_{12}$. A first fiber F_1 extends from the first fiber position P_1 at the first multi-fiber connector at the first end 121 of the cable 120 to the single-fiber connection port 116. For example, a second end 122 of the first fiber F_1 may be terminated at a fiber optic connector that is optically accessible through the single-fiber connection port 116.

[0076] A second fiber F_2 of the cable 120 extends from the second fiber position P_2 at the multi-fiber connector at the first end 121 of the cable 120 to the first fiber position P_1 at the second multi-fiber connector at the second end 123 of the cable 120. Subsequent fibers $[F_{2+N}]$ of the cable 120 extend from the subsequent fiber positions $[P_{2+N}]$ at the multi-fiber connector at the first end 121 of the cable 120 to the subsequent fiber positions $[P_{1+N}]$ at the second multi-fiber connector at the second end 123 of the

cable 120. A last fiber F_{12} of the cable 120 extends from the twelfth fiber position P_{12} at the multi-fiber connector at the first end 121 of the cable 120 to the eleventh fiber position P_{11} at the second multi-fiber connector at the second end 123 of the cable 120. Accordingly, the optical fibers of the cable 120 are indexed between the first and second multi-fiber connectors.

[0077] The enclosure 111 also defines a termination region 115 including at least one single-fiber connection port 116. The second end 122 of at least a first optical fiber F_1 of the cable 120 is optically coupled to the single-fiber connection port 116. In certain examples, the termination region 115 may include a plurality of single-fiber connection ports 116. In such examples, the second ends 122 of multiple optical fibers of the cable 120 are each optically coupled to one of the single-fiber connection ports 116. The second ends 123 of a remainder of the fibers $F_2 - F_{12}$ of the cable 120 are optically coupled to the multi-fiber connection port 114.

[0078] In some implementations, the single-fiber connection port 116 faces in a different direction than the multi-fiber connection port 114. In the example shown, the single-fiber connection port 116 faces in an opposite direction than the multi-fiber connection port 114. In other implementations, the single-fiber connection port 116 and the multi-fiber connection port 114 can face in the same direction. In certain implementations, the multi-fiber connection port 114 is disposed at an outer periphery of the enclosure.

[0079] In certain implementations, the termination region 115 is disposed at an intermediate ledge. Accordingly, the single-fiber connection port 116 of the termination region 115 is fully located within a footprint of the enclosure. In certain examples, the intermediate ledge is positioned so that a connectorized end of a cable (e.g., a patch cord 135) plugged into the single-fiber connection port 116 is fully located within a footprint of the enclosure. In the example shown, the intermediate ledge is spaced from parallel sections of the enclosure periphery. In some implementations, the intermediate ledge extends fully across a width of the enclosure. In other implementations, the intermediate ledge extends across a majority of a width of the enclosure. In still other implementations, the intermediate ledge extends across about

half of a width of the enclosure. In yet other implementations, the intermediate ledge extends across less than half of a width of the enclosure.

[0080] In certain implementations, the fiber distribution terminal 110 can be formed from a base 140 and a spool arrangement 145 (e.g., see FIGS. 6 and 7). The spool arrangement 145 includes the cable spool 112. In certain examples, the spool arrangement 145 also includes the termination region 115. In certain examples, the spool arrangement 145 also includes the multi-fiber connection port 114. In certain examples, the spool arrangement 145 also includes the multi-fiber connection port 114 and the termination region 115.

[0081] The spool arrangement 145 mounts to the base 140 to enclose the cable spool 112. For example, the spool arrangement 145 and base 140 cooperate to define a cavity in which the cable spool 112 is disposed. The spool arrangement 145 is coupled to the base 140 so as to be rotatable relative to the base 140. Rotating the cable spool 112 causes the spool arrangement 145 to rotate relative to the base 140. If the multi-fiber connection port 114 and/or the termination region 115 are disposed on the spool arrangement 145, then rotating the spool arrangement 145 causes the multi-fiber connection port 114 and/or the termination region 115 to rotate relative to the base 140.

[0082] The base 140 includes mounting members 141 suitable for mounting the base 140 to a surface. The mounting members 141 can include one or more mounting tabs through which fasteners can be inserted, one or more latching members, or other such attachment members. In certain examples, the base 140 defines the cable port 113 or a portion thereof. In certain examples, the base 140 includes a circumferential wall 144 sized to extend around the cable spool 112 when the spool arrangement 145 is mounted to the base 140. In certain examples, the cable port 113 is defined through the circumferential wall 144. In certain examples, the base 140 includes a spool mounting member 142 disposed within the circumferential wall 144. The spool mounting member 142 can be configured to fit within and provide stability to the cable spool 112. The spool 112 may define a hollow interior 112a (FIG. 7) that receives the spool mounting member 142 of the base 140.

[0083] In certain implementations, the spool arrangement 145 includes the termination region 115 coupled to an axial end of the cable spool 112. Accordingly, the spool 112 does not rotate relative to the termination region 115. Rather, the cable spool 112 and the termination region 115 rotate as a unit relative to the base 140. In certain
5 implementations, the multi-fiber connection port 114 is coupled to the axial end of the cable spool 112 to rotate in unison therewith. In some implementations, the single-fiber connection port(s) 116 and multi-fiber connection port 114 are coupled to an axial flange of the cable spool 112.

[0084] In other implementations, however, the spool arrangement 145 includes
10 a housing 146 to which the cable spool 112 is externally mounted. In certain examples, the spool 112 does not rotate relative to the housing 146. Rather, the cable spool 112 and the housing 146 rotate as a unit relative to the base 140. At least part of a multi-fiber optical adapter 148 and the single-fiber optical adapter 149 are disposed within the housing 146. In certain implementations, the housing 146 defines the intermediate
15 ledge 147 at which the termination region 115 is disposed. Accordingly, the single-fiber connection port 116 of the termination region 115 is fully located within a footprint of the spool arrangement 145. In certain examples, the intermediate ledge 147 is positioned so that a connectorized end of a cable (e.g., a patch cord) plugged into the single-fiber connection port 116 is fully located within a footprint of the spool
20 arrangement 145.

[0085] As shown in FIGS. 8-15, one or more separator modules 118 (e.g., optical power splitters or wave division multiplexers) can be added to a fiber distribution terminal 110. Each separator module 118 can include an input connector 117 or input port at which an optical connection is made to the single-fiber connection
25 port 116 of the fiber distribution terminal 110. Each separator module 118 can include one or more output ports 119 at which patch cords 135 can be received. In an example, an output port 119 can be a single-fiber output port. In another example, an output port 119 can be a multi-fiber output port. In still other examples, the outputs 119 of the separator module 118 can be defined by fiber optic connectors configured to be
30 received in corresponding optical ports.

[0086] A separation member 160 is disposed within the separator module 118. In some implementations, the separation member 160 includes an optical power splitter. In other implementations, the separation member 160 includes a wave division multiplexer. The separation member 160 has an input 161 and outputs 162. A fiber 163
5 extends between the input connector/port 117 and the splitter input 161. A plurality of fibers 164 extend between the splitter outputs 162 and the output ports 119. For convenience, the remainder of this specification will refer to the separator modules 118 as splitter modules. However, it is noted that a wave division multiplexer can be used in place of a splitter member within the module 118.

10 [0087] In the examples shown, a single splitter module 118 is mounted to the fiber distribution terminal 110 and connected to the single-fiber connection port 116. In other examples, however, the termination region 115 of the fiber distribution terminal 110 can include multiple connection ports 116. A separate splitter module 118 can be mounted at each of the connection ports 116. In certain implementations, the splitter
15 module 118 fits within a footprint of the fiber distribution terminal 110. In certain implementations, the splitter module 118 does not expand an outer periphery of the fiber distribution terminal 110 when mounted to the fiber distribution terminal 110. In certain implementations, the loaded fiber distribution terminal (i.e., the fiber distribution terminal to which the splitter module is mounted) has the same area as the unloaded
20 fiber distribution terminal. In certain implementations, an outer periphery of the splitter module 118 is generally flush with an outer periphery of the fiber distribution terminal 110 when the splitter module 118 is mounted to the fiber distribution terminal 110.

[0088] FIGS. 9 and 10 illustrate a first example optical splitter module 118 suitable for use with the fiber distribution terminal 110. The optical splitter module 118
25 includes an input 151 that is configured to mate with the single-fiber connection port 116 at the termination region 115 of the fiber distribution terminal 110. For example, the splitter module 118 can be configured to slide relative to the fiber distribution terminal 110 to mate the splitter input 151 with the single-fiber connection port 116 at the termination region 115.

[0089] The optical splitter module 118 includes a housing 150 carrying the input 151 and a plurality of outputs 152. In some implementations, the input 151 includes an optical connector 153 (e.g., an LC connector, an SC connector, an LX.5 connector, an MPO connector, etc.) having an accessible fiber tip. In certain implementations, the fiber tip of the input optical connector 153 is located within a footprint of the housing 150. In some implementations, the fiber tip can be accessible through an opening defined in the housing 150 (see FIG. 10). For example, the opening may be sufficiently large to accept part of the single-fiber optical adapter 149 of the fiber distribution terminal 110. In other implementations, the input optical connector 153 can be mounted to an exterior of the housing 150.

[0090] In some implementations, the outputs 152 are disposed at a periphery of the housing 150. In other implementations, the outputs 152 are disposed within a footprint of the housing 150. In certain implementations, the outputs 152 are exterior ports defined by optical adapters 154. Within the housing 150, an optical fiber extends from the input optical connector 153 to a passive optical splitter. Multiple optical fibers extend from the passive optical splitter to interior ports of the optical adapters 154. Accordingly, optical signals supplied to the input optical connector 153 (e.g., via the single-fiber connection port 116) are split onto the multiple optical fibers and carried to the outputs 154.

[0091] The outputs 152 define an upgraded termination region 115'. In some implementations, the optical adapters 154 extend outwardly from the housing 150 at the upgraded termination region 115'. In other implementations, the optical adapters 154 are disposed within the housing 150 and accessible through an aperture in the housing 150. In certain implementations, the optical adapters 154 are disposed in one or more rows. In an example, the optical adapters 154 are disposed in a single row. In other examples, the optical adapters 154 are disposed in two parallel rows (see FIG. 13). In an example, the optical adapters 154 in a first row are staggered relative to optical adapters in a second row to enhance finger access. In another example, the optical adapters 154 of two rows are aligned. In other implementations, the optical adapters 154 can be disposed in other configurations.

[0092] In certain implementations, the splitter module 118 includes a mid-shelf 155 that is configured to abut the intermediate ledge 147 of the fiber distribution terminal 110 when the splitter module 118 is installed at the fiber distribution terminal 110. In the example shown, the mid-shelf 155 is spaced from parallel sections of the housing periphery. In some implementations, the mid-shelf 155 extends fully across a width of the housing 150. In other implementations, the mid-shelf 155 extends across a majority of a width of the housing 150. In still other implementations, the mid-shelf 155 extends across about half of a width of the housing 150. In yet other implementations, the mid-shelf 155 extends across less than half of a width of the housing 150.

[0093] As shown in FIGS. 11 and 12, the splitter module 118 is positioned relative to the fiber distribution terminal 110 so that the splitter input 151 aligns with the single-fiber connection port 116. The splitter module 118 is installed on the fiber distribution terminal 110 by inserting the splitter input 151 into the single-fiber connection port 116. In the example shown, the splitter module 118 is installed on the fiber distribution terminal 110 by sliding the splitter module 118 relative to the fiber distribution terminal 110 until the input connector 153 is received within the external port of the adapter 149. In certain implementations, the splitter module 118 is slid until the mid-shelf 155 engages the intermediate ledge 147. In the example shown in FIGS. 9 and 10, the splitter module 118 slides upwardly relative to the fiber distribution terminal 110. In other examples, however, the splitter module 118 and fiber distribution terminal 110 can be configured so that the splitter module 118 slides downwardly or laterally relative to the fiber distribution terminal 110.

[0094] In other alternative implementations, the splitter module 118 can carry an optical adapter defining an exterior input port and the fiber distribution terminal 110 can carry an optical connector at the termination region 115. In such implementations, installing the splitter module 118 at the fiber distribution terminal 110 inserts the optical connector of the fiber distribution terminal 110 into the input port of the splitter module 118.

[0095] FIGS. 13-15 illustrate alternative implementations of optical splitter modules 118', 118''. The optical splitter module 118' shown in FIG. 13 is substantially identical to the optical splitter module 118 discussed above except that the optical splitter module 118' includes two rows of output optical adapters 154. The optical splitter module 118'' shown in FIG. 14 is substantially identical to the optical splitter module 118 discussed above except that the optical splitter module 118'' includes four rows of output optical adapters 154. Also, the housing 150'' of the optical splitter module 118'' is correspondingly deeper. FIG. 15 illustrates the optical splitter module 118'' installed on the fiber distribution terminal 110.

10 [0096] Of course, the optical splitter modules 118, 118', 118'' discussed herein could be implemented as wave division multiplexers instead. The same structural features would apply except that input fiber would lead to a wave division multiplexer (instead of a passive power splitter) within the respective housing 150, 150', 150''.

[0097] FIGS. 16-21 illustrate another example implementation of a fiber distribution terminal 210 suitable for use with the indexing environment 100 of FIGS. 1 and 2. The fiber distribution terminal 210 includes an enclosure 211 in which the cable spool 212 is disposed. An optical cable 220 is wound around the cable spool 212. The enclosure 211 defines a cable port 213 through which the optical cable 220 extends so that the free end 221 of the optical cable 220 is located external of the enclosure.

20 [0098] In certain implementations, the fibers of the cable 220 can be indexed between multi-fiber connectors at the first and second ends. Each of the multi-fiber connectors defines a sequence of fiber positions. A first fiber of the cable 220 extends from a fiber position at the first multi-fiber connector at a first end 221 of the cable 220 to a single-fiber connection port 216. For example, a second end of the first fiber may
25 be terminated at a fiber optic connector that is optically accessible through the single-fiber connection port 216.

[0099] A second fiber of the cable 220 extends from the second fiber position at the multi-fiber connector at the first end 221 of the cable 220 to the first fiber position at the second multi-fiber connector at the second end of the cable 220. Subsequent fibers
30 of the cable 220 extend from the subsequent fiber positions at the multi-fiber connector

at the first end 221 of the cable 220 to the subsequent fiber positions at the second multi-fiber connector at the second end of the cable 220. Accordingly, the optical fibers of the cable 220 are indexed between the first and second multi-fiber connectors.

[00100] The enclosure 211 also defines a termination region 215 including at least one single-fiber connection port 216. The second end of at least a first optical fiber of the cable 220 is optically coupled to the single-fiber connection port 216. The second ends of a remainder of the fibers of the cable 220 are optically coupled to the multi-fiber connection port 214. A connectorized end of an input cable I (e.g., a cable 220 from another distribution terminal 210, a feeder cable, etc.) can be plugged into the multi-fiber connection port 214 to interface with the second end of the cable 220. Signals carried by the input cable I are carried over the cable 220 from the second end to the first end 221. The signals also are carried to the single-fiber connection port 216.

[0100] In some implementations, the single-fiber connection port 216 faces in a common direction with the multi-fiber connection port 214. In certain implementations, the multi-fiber connection port 214 is disposed within an outer periphery of the enclosure 211. In the example shown, the multi-fiber connection port 214 is spaced from an outer periphery sufficient to allow a connector received at the port 214 to be disposed within the outer periphery. In certain examples, a boot of the connector also is disposed within the outer periphery.

[0101] In certain implementations, the termination region 215 is disposed at an intermediate ledge 247. Accordingly, the single-fiber connection port 216 of the termination region 215 is fully located within a footprint of the enclosure 211. In certain examples, the intermediate ledge 247 is positioned so that a connectorized end of a cable (e.g., a patch cord 235) plugged into the single-fiber connection port 216 is fully located within a footprint of the enclosure. In the example shown, the intermediate ledge 247 is spaced from parallel sections of the enclosure periphery. In some implementations, the intermediate ledge 247 extends fully across a width of the enclosure. In other implementations, the intermediate ledge 247 extends across less than half a width of the enclosure 211. In certain examples, the intermediate ledge 247 extends across less than a quarter of the width of the enclosure 211. In the example

shown, the intermediate ledge 247 is sized to hold only a single optical adapter 249 to define the single-fiber connection port 216.

[0102] As shown in FIGS. 17 and 18, the fiber distribution terminal 210 can be formed from a base 240 and a spool arrangement 245 (e.g., see FIGS. 6 and 7). The spool arrangement 245 includes the cable spool 212. In certain examples, the spool arrangement 245 also includes the termination region 215. In certain examples, the spool arrangement 245 also includes the multi-fiber connection port 214. In certain examples, the spool arrangement 245 also includes the multi-fiber connection port 214 and the termination region 215.

[0103] The spool arrangement 245 mounts to the base 240 to enclose the cable spool 212. For example, the spool arrangement 245 and base 240 cooperate to define a cavity in which the cable spool 212 is disposed. The spool arrangement 245 is coupled to the base 240 so as to be rotatable relative to the base 240. Rotating the cable spool 212 causes the spool arrangement 245 to rotate relative to the base 240. The multi-fiber connection port 214 and the termination region 215 are disposed on the spool arrangement 245. Accordingly, rotating the spool arrangement 245 causes the multi-fiber connection port 214 and the termination region 215 to rotate relative to the base 240.

[0104] The base 240 is suitable for mounting to a surface. In certain implementations, the base 240 defines apertures 241 through which fasteners can extend to secure the base 240 to a surface. In other implementations, the base 240 can include one or more mounting tabs through which fasteners can be inserted, one or more latching members, or other such attachment members. In certain examples, the base 240 defines the cable port 213 or a portion thereof. In the example shown, the cable port 213 has internal bend radius limiters 213a leading thereto to protect the cable 220 as the cable 220 is dispensed from the terminal 210.

[0105] In certain examples, the base 240 includes a circumferential wall 244 sized to extend around the cable spool 212 when the spool arrangement 245 is mounted to the base 240. In certain examples, an aperture 243 is defined through the circumferential wall 244 to provide entrance to a passage leading to the cable port 213.

[0106] In certain implementations, the spool arrangement 245 includes a housing to which the cable spool 212 is externally mounted. In certain examples, the spool 212 does not rotate relative to the housing. Rather, the cable spool 212 and the housing rotate as a unit relative to the base 240. In certain implementations, the housing defines the intermediate ledge 247 at which the termination region 215 is disposed. Accordingly, the single-fiber connection port 216 of the termination region 215 is fully located within a footprint of the spool arrangement 245. In certain implementations, at least part of a multi-fiber optical adapter 248 defining the multi-fiber connection port 214 and at least part of a single-fiber optical adapter 249 defining the single-fiber port 216 are disposed within the housing.

[0107] As shown in FIGS. 19-21, one or more separator modules (e.g., optical power splitters or wave division multiplexers) can be added to a fiber distribution terminal 210. Each separator module can include an input connector 217 or input port at which an optical connection is made to the single-fiber connection port 216 of the fiber distribution terminal 210. Each separator module can include one or more output ports 219 at which patch cords 235 can be received. In an example, an output port 219 can be a single-fiber output port. In another example, an output port 219 can be a multi-fiber output port. In still other examples, the outputs 219 of the separator module can be defined by fiber optic connectors configured to be received in corresponding optical ports.

[0108] A separation member is disposed within the separator module. In some implementations, the separation member includes an optical power splitter. In other implementations, the separation member includes a wave division multiplexer. For convenience, the remainder of this specification will refer to the separator modules as splitter modules 218. However, it is noted that a wave division multiplexer can be used in place of a splitter member within the module 218.

[0109] In the examples shown in FIG. 20, a splitter module 218 is mounted to the fiber distribution terminal 210 and connected to the single-fiber connection port 216. In certain implementations, the splitter module 218 fits within a footprint of the fiber distribution terminal 210. In certain implementations, the splitter module 218 does

not expand an outer periphery of the fiber distribution terminal 210 when mounted to the fiber distribution terminal 210. In certain implementations, the loaded fiber distribution terminal (i.e., the fiber distribution terminal to which the splitter module is mounted) has the same area as the unloaded fiber distribution terminal. In certain
5 implementations, an outer periphery of the splitter module 218 is generally flush with an outer periphery of the fiber distribution terminal 210 when the splitter module 218 is mounted to the fiber distribution terminal 210.

[0110] FIG. 19 illustrates an example optical splitter module 218 suitable for use with the fiber distribution terminal 210. The optical splitter module 218 includes an
10 input 251 that is configured to mate with the single-fiber connection port 216 at the termination region 215 of the fiber distribution terminal 210. For example, the splitter module 218 can be configured to slide relative to the fiber distribution terminal 210 to mate the splitter input 251 with the single-fiber connection port 216 at the termination region 215.

15 [0111] The optical splitter module 218 includes a housing 250 carrying the input 251 and a plurality of outputs 252. In some implementations, the input 251 includes an optical connector 253 (e.g., an LC connector, an SC connector, an LX.5 connector, an MPO connector, etc.) having an accessible fiber tip. In the example shown, the fiber tip of the input optical connector 253 is located within a footprint of the housing 250. The
20 fiber tip is accessible through an opening defined in the housing 250. For example, the opening may be sufficiently large to accept part of the single-fiber optical adapter 249 of the fiber distribution terminal 210. In other implementations, the input optical connector 253 can be mounted to an exterior of the housing 250. In still other implementations, the input 251 of the optical splitter module 218 is an exterior port of
25 an optical adapter carried by the housing 250.

[0112] In some implementations, the outputs 252 of the splitter module 218 are disposed at a periphery of the housing 250. In other implementations, the outputs 252 can be disposed within a footprint of the housing 250. In certain implementations, the outputs 252 are exterior ports defined by one or more optical adapters 254. Within the
30 housing 250, an optical fiber extends from the input optical connector 253 to a passive

optical splitter. Multiple optical fibers extend from the passive optical splitter to interior ports of the optical adapters 254. Accordingly, optical signals supplied to the input optical connector 253 (e.g., via the single-fiber connection port 216) are split onto the multiple optical fibers and carried to the outputs 254.

5 **[0113]** The outputs 252 define an upgraded termination region 215'. In some implementations, the optical adapters 254 extend outwardly from the housing 250 at the upgraded termination region 215'. In other implementations, the optical adapters 254 are disposed within the housing 250 and accessible through an aperture in the housing 250. In certain implementations, the optical adapters 254 are disposed in one or more
10 rows. In an example, the optical adapters 254 are disposed in a single row. In other implementations, the optical adapters 254 can be disposed in other configurations.

[0114] In certain implementations, the splitter module 218 includes a cut-out 255 that is configured to accommodate the intermediate ledge 247 of the fiber distribution terminal 210 when the splitter module 218 is installed at the fiber
15 distribution terminal 210. In the example shown, the cut-out 255 is spaced from parallel sections of the housing periphery. The cut-out 255 is sized in accordance with the intermediate ledge 247. In some implementations, the cut-out 255 extends fully across a width of the housing 250. In other implementations, however, the cut-out 255 extends across less than half a width of the housing 250. In certain examples, the cut-out 255
20 extends across less than a quarter of the width of the housing 250.

[0115] In certain implementations, the distribution terminal 210 and the splitter module 218 are configured to secure together. In various implementations, the distribution terminal 210 and splitter module 218 can be latched, fastened, or otherwise coupled together. In certain implementations, the distribution terminal 210 and splitter
25 module 218 each form part of an alignment and securement arrangement.

[0116] In certain examples, the terminal 210 and splitter module 218 define one or more guide slots and rider pegs that mate when the splitter module 218 is installed on the terminal 210. In the example shown, the housing of the distribution terminal 210 defines the guide slot 246a and the splitter module 218 includes the peg 246b
30 configured to ride in the guide slot 246a. In certain examples, the terminal 210 and

splitter module 218 define one or more slots 246c and tabs 246d that mate together when the splitter module 218 is installed on the terminal 210. In an example, the tab 246d latches within the slot 246c.

[0117] FIGS. 22-24 illustrate another example implementation of a fiber distribution terminal 310 suitable for use with the indexing environment 100 of FIGS. 1 and 2. The fiber distribution terminal 310 is substantially the same as the fiber distribution terminal 110 described above, except that a termination region 315 of the distribution terminal 310 includes multiple single-fiber connection ports 316. In the example shown, the termination region 315 includes four single-fiber connection ports 316. In other examples, the termination region 315 can include two, three, five, six, eight, etc. single-fiber connection ports 316. In still other examples, the termination region 315 may include one or more multi-fiber connection ports.

[0118] As shown in FIG. 23, an example splitter module 318 includes a housing 350 carrying an input 351 and a termination region 315'. In the example shown, the splitter module housing 350 has a width that is substantially smaller than a width of the terminal 310. Accordingly, multiple splitter modules 318 can be mounted at the termination region 315 of the terminal 310. For example, one splitter module 318 can be mounted at each single-fiber connection port 316 at the termination region 315. In the example shown, the splitter module 318 has a width that is less than a quarter of a width of the terminal 310.

[0119] In some implementations, the housing 350 defines a cut-out 355 configured to accommodate an intermediate ledge 347 of the fiber distribution terminal 310 when the splitter module 318 is installed at the fiber distribution terminal 310. The cut-out 355 extends across the width of the splitter module housing 350. In the example shown, the cut-out 355 is spaced from parallel sections of the housing periphery. The cut-out 355 has a depth sized in accordance with a depth of the intermediate ledge 347 of the terminal 310.

[0120] In the example shown, the cut-out 355 defines an aperture through which the splitter input 351 (e.g., a fiber optic connector 353) is accessible. In other examples, the splitter input 351 can be disposed outside of the splitter module housing 350. In the

example shown, optical adapters 354 extend out from the splitter module housing 350 to define exterior ports 352 at which subscriber cables can be attached to the splitter outputs. In other examples, the adapters 354 can be disposed fully within the housing 350. In still other examples, the splitter outputs can be fiber optic connectors disposed
5 internal or external of the housing 350.

[0121] In certain examples, the termination region 315' includes optical adapters 354 extending in a row along a depth of the splitter module housing 350. In the example shown, the row includes four optical adapters 354. In other examples, the row can include a greater or lesser number of optical adapters 354. In still other
10 examples, the optical adapters 354 can extend along a width of the splitter module housing 350. In still other examples, the optical adapters 354 can extend along a height of the splitter module housing 350 (e.g., facing towards a front of the terminal 310).

[0122] Having described the preferred aspects and implementations of the present disclosure, modifications and equivalents of the disclosed concepts may readily
15 occur to one skilled in the art. However, it is intended that such modifications and equivalents be included within the scope of the claims which are appended hereto.

What is claimed is:

1. A fiber distribution terminal comprising:
 - a base configured to mount to a surface;
 - a spool arrangement including a cable spool coupled to a housing, the cable spool being accessible from an exterior of the housing, the spool arrangement being coupled to the base to enable rotation of the spool arrangement relative to the base, the cable spool and the housing rotating in unison when the spool arrangement rotates relative to the base, the housing defining a multi-fiber connection port and a termination region, the termination region being defined at an intermediate shelf that provides a mounting location; and
 - a multi-fiber cable wound on the cable spool, the multi-fiber cable including at least a first optical fiber extending from a first multi-fiber connector to a single-fiber optical connector that is optically accessible from the termination region, the multi-fiber cable also including at least a second optical fiber extending from the first multi-fiber connector to a second multi-fiber connector that is optically accessible from the multi-fiber connection port, the second optical fiber being indexed between the first and second multi-fiber connectors.
2. The fiber distribution terminal of claim 1, wherein the termination region includes at least a single-fiber connection port.
3. The fiber distribution terminal of claim 1, wherein the termination region includes a plurality of single-fiber connection ports.
4. The fiber distribution terminal of claim 1, wherein the first and second multi-fiber connectors define twelve fiber positions.
5. The fiber distribution terminal of claim 4, wherein the first and second multi-fiber connectors define twenty-four fiber positions.

6. The fiber distribution terminal of claim 1, wherein the multi-fiber connection port faces in an opposite from the single-fiber connection port.
7. The fiber distribution terminal of claim 1, wherein the base defines a cable port.
8. The fiber distribution terminal of claim 1, wherein the base cooperates with the housing to define a cable port.
9. The fiber distribution terminal of claim 1, wherein the base includes sidewalls that extend to surround the cable spool.
10. The fiber distribution terminal of claim 1, wherein housing includes a retention arrangement to hold a splitter module at the splitter mounting location.
11. The fiber distribution terminal of claim 10, wherein the retention arrangement includes latches.
12. The fiber distribution terminal of claim 1, further comprising a separator module mounted to the housing at the mounting location, the separator module including a separation housing carrying a plurality of outputs at which subscriber cables can be coupled to the separator module.
13. The fiber distribution terminal of claim 12, wherein the separator module includes an input connector, and wherein the termination region of the housing defines a single-fiber connection port sized to receive the input connector of the separator module.

14. The fiber distribution terminal of claim 12, wherein the separator module defines an input port, and wherein the termination region of the housing includes a single-fiber connector sized to be received in the input port of the separator module.
15. The fiber distribution terminal of any of claims 12-14, wherein the separator module includes an optical power splitter disposed in the separation housing.
16. The fiber distribution terminal of any of claims 12-14, wherein the separator module includes a wave division multiplexer disposed in the separation housing.
17. The fiber distribution terminal of any of claims 7 and 8, wherein the cable port is environmentally sealed.
18. The fiber distribution terminal of claim 3, further comprising a plurality of separator modules, each separator module mounted to the mounting location and interfaced with one of the single-fiber connection ports, each separator module configured to carrying signals from the single-fiber connection port to multiple outputs.
19. The fiber distribution terminal of claim 18, wherein one of the separator modules includes an optical power splitter that splits the optical signals received from the respective single-fiber connection port to the outputs.
20. The fiber distribution terminal of claim 18, wherein one of the separator modules includes a wave division multiplexer that divides the optical signals received from the respective single-fiber connection port to the outputs.
21. A fiber distribution architecture comprising a plurality of the fiber distribution terminals of any of claims 1-20 daisy-chained together.

22. The fiber distribution architecture of claim 21, wherein at least two of the fiber distribution terminals are located on different floors of a multi-floor building.

23. The fiber distribution architecture of claim 21, further comprising a fiber distribution point that receives a feeder cable, the fiber distribution point receiving the first multi-fiber connector of a first of the fiber distribution terminals.

24. The fiber distribution architecture of claim 23, wherein the plurality of the fiber distribution terminal includes N fiber distribution terminals, where N is an integer greater than 2, and wherein the fiber distribution terminals are daisy-chained together from the first fiber distribution terminal to an Nth of the fiber distribution terminals, and wherein another optical cable is routed from the fiber distribution hub to the multi-fiber connection port of the Nth fiber distribution terminal to mate with the second multi-fiber connector of the Nth fiber distribution terminal.

25. The fiber distribution architecture of any of claims 23 and 24, wherein the fiber distribution point includes a fiber distribution hub.

FIG. 1

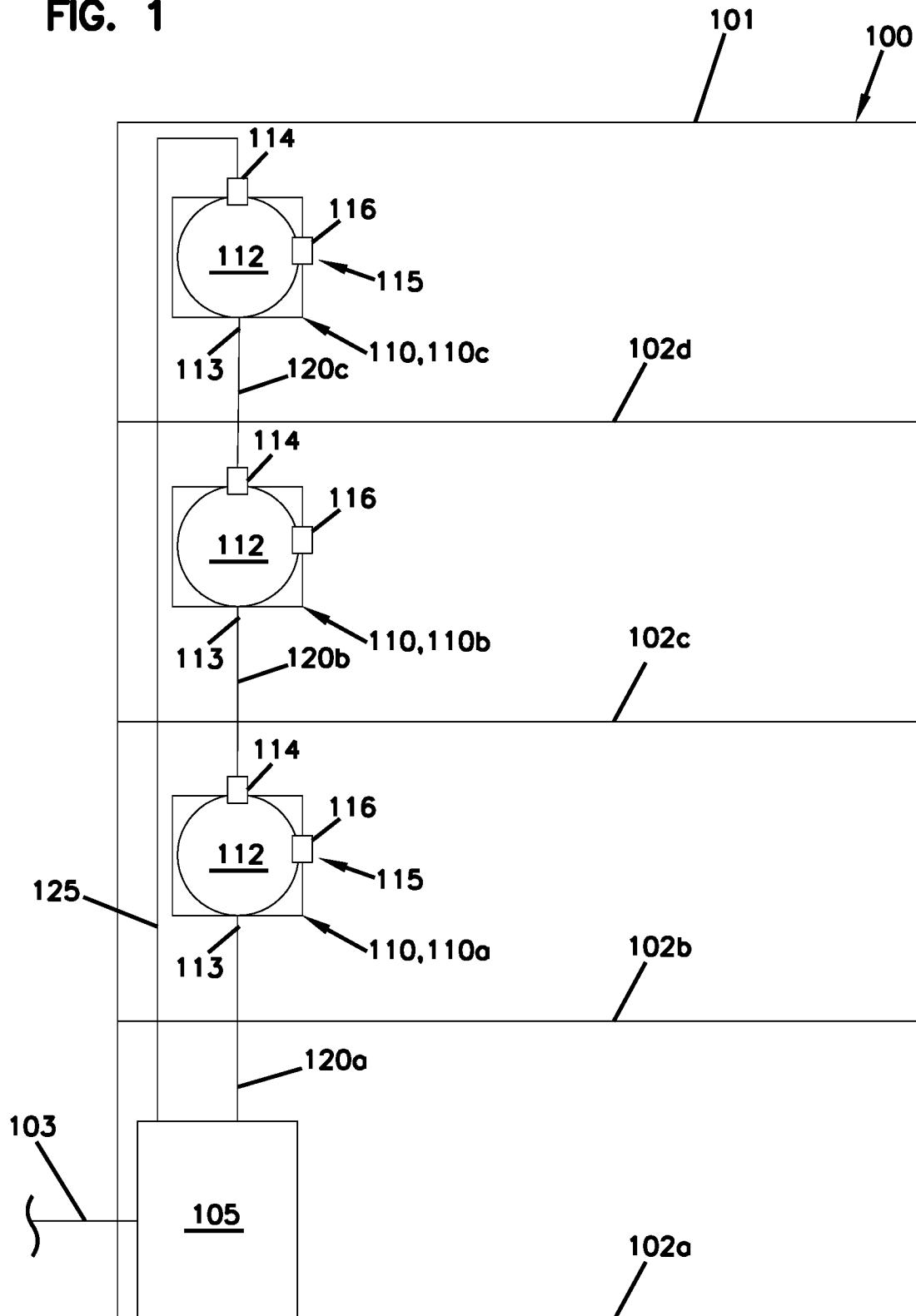


FIG. 2

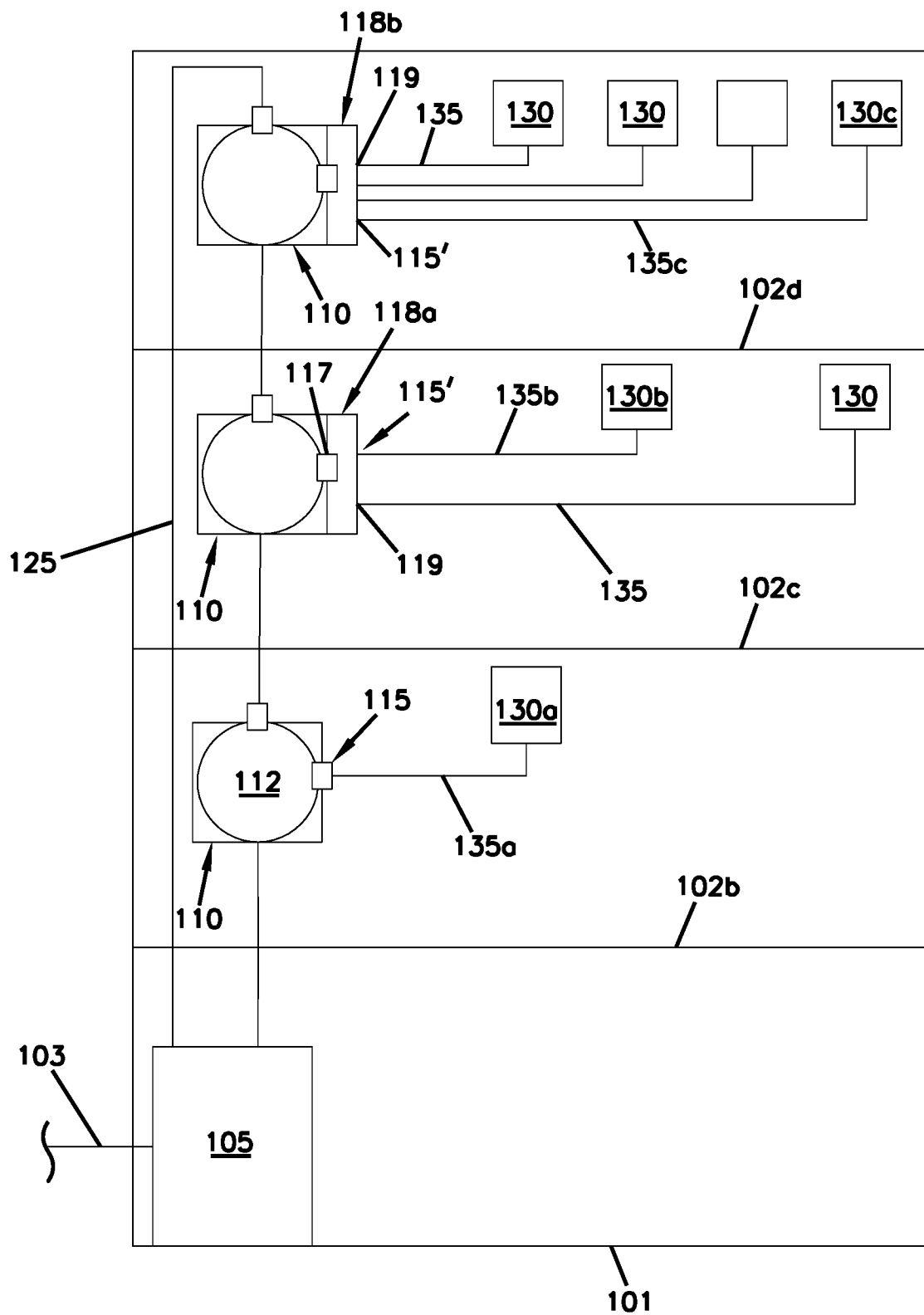


FIG. 3

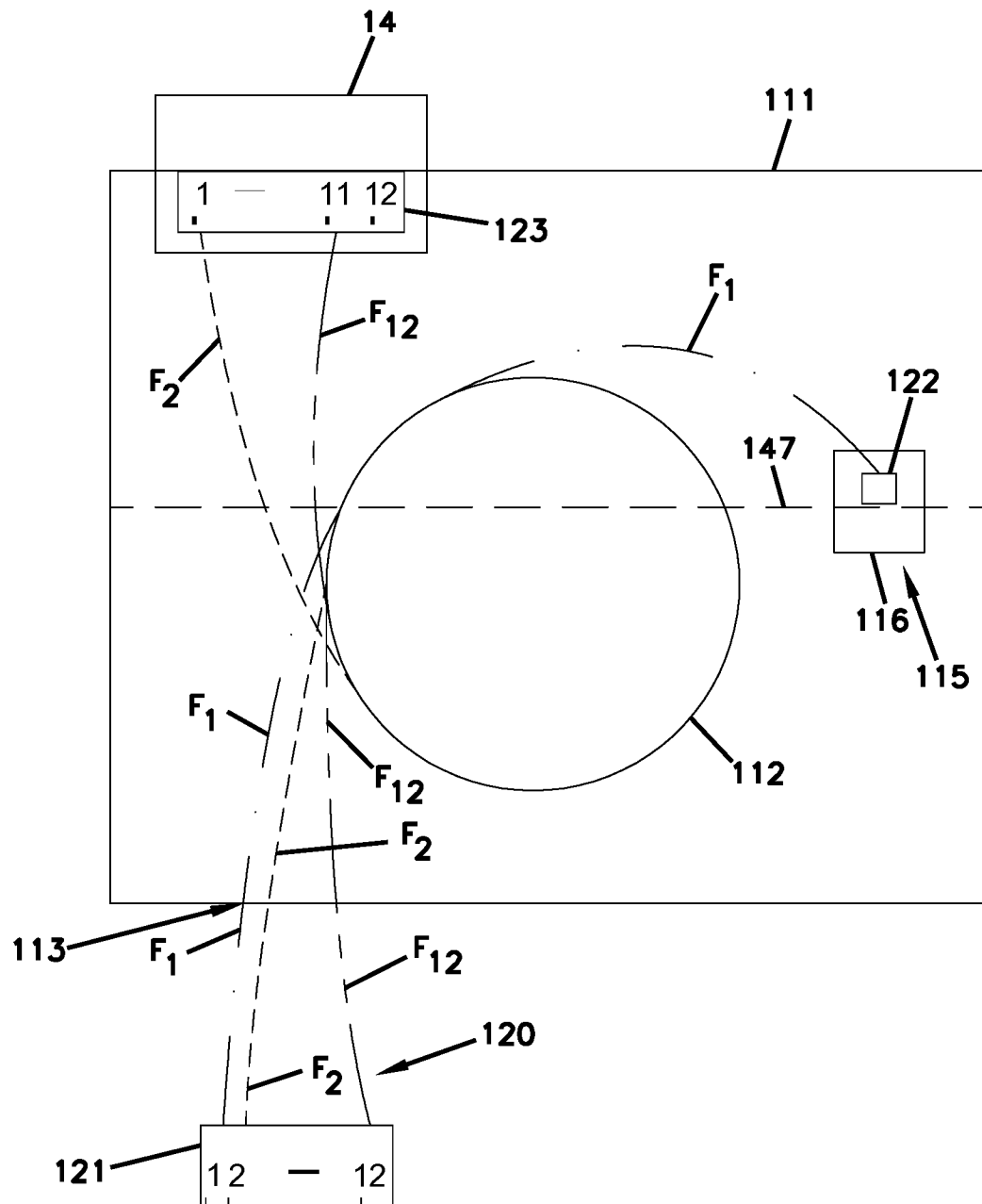


FIG. 4

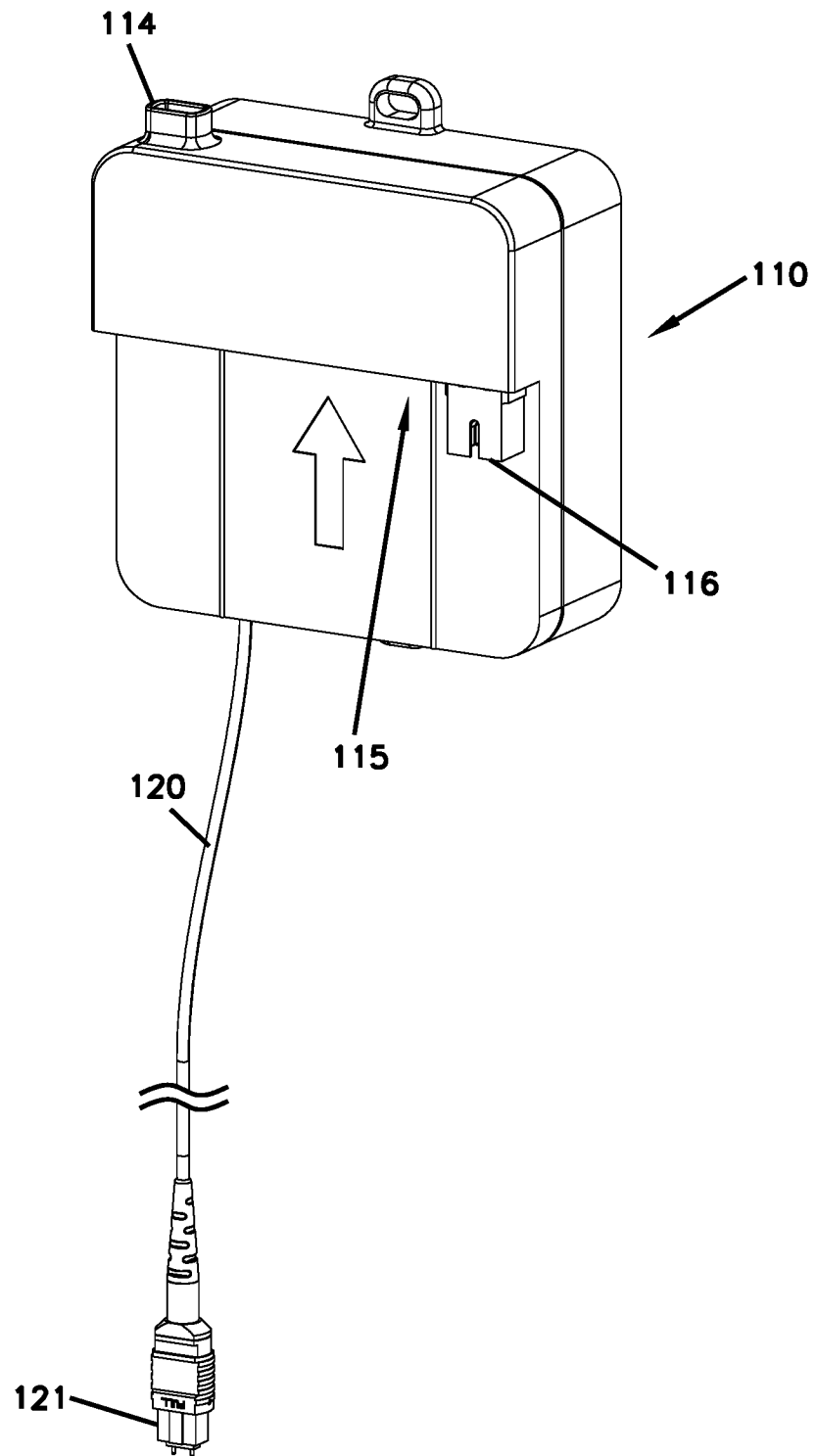
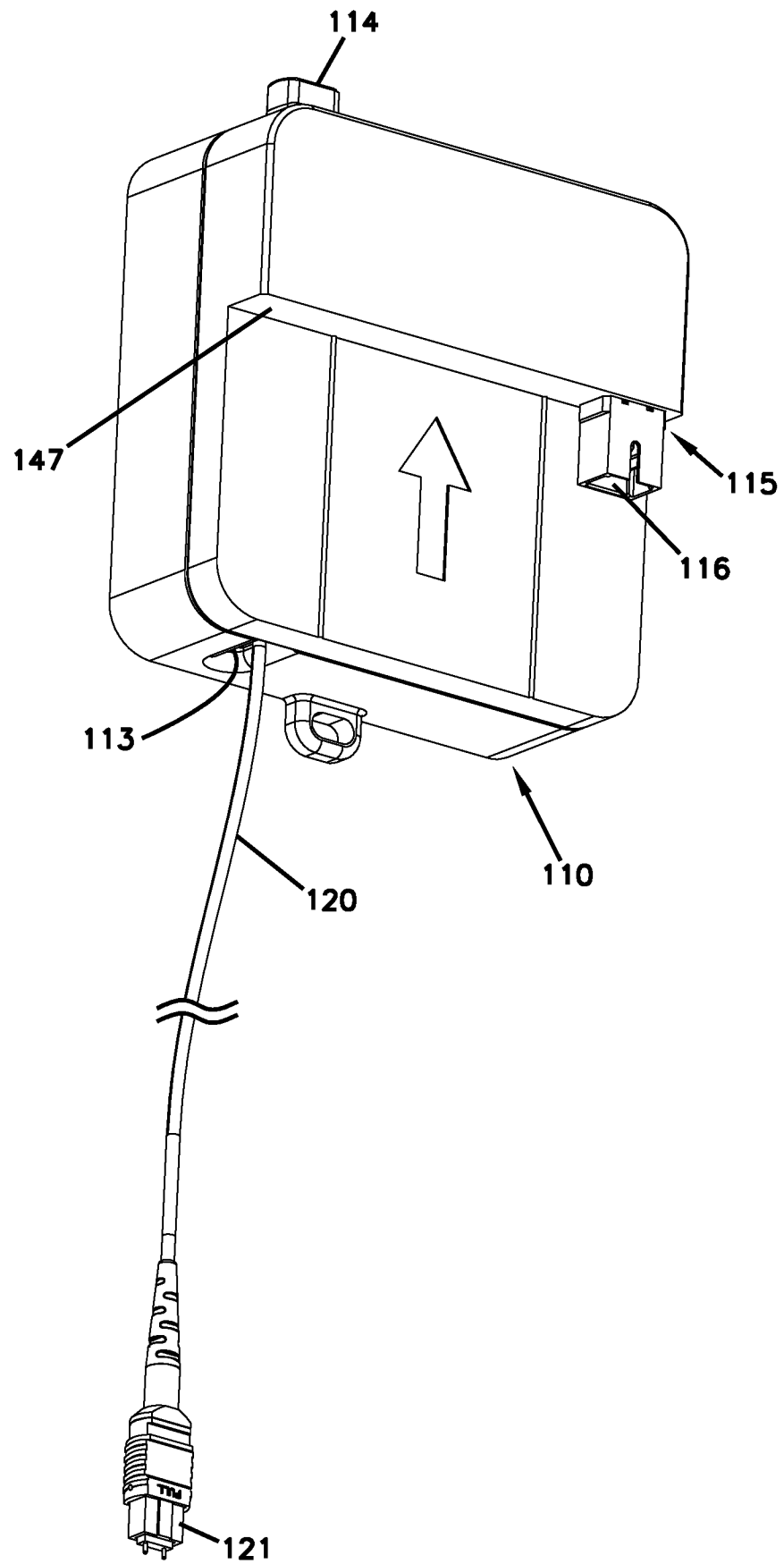


FIG. 5



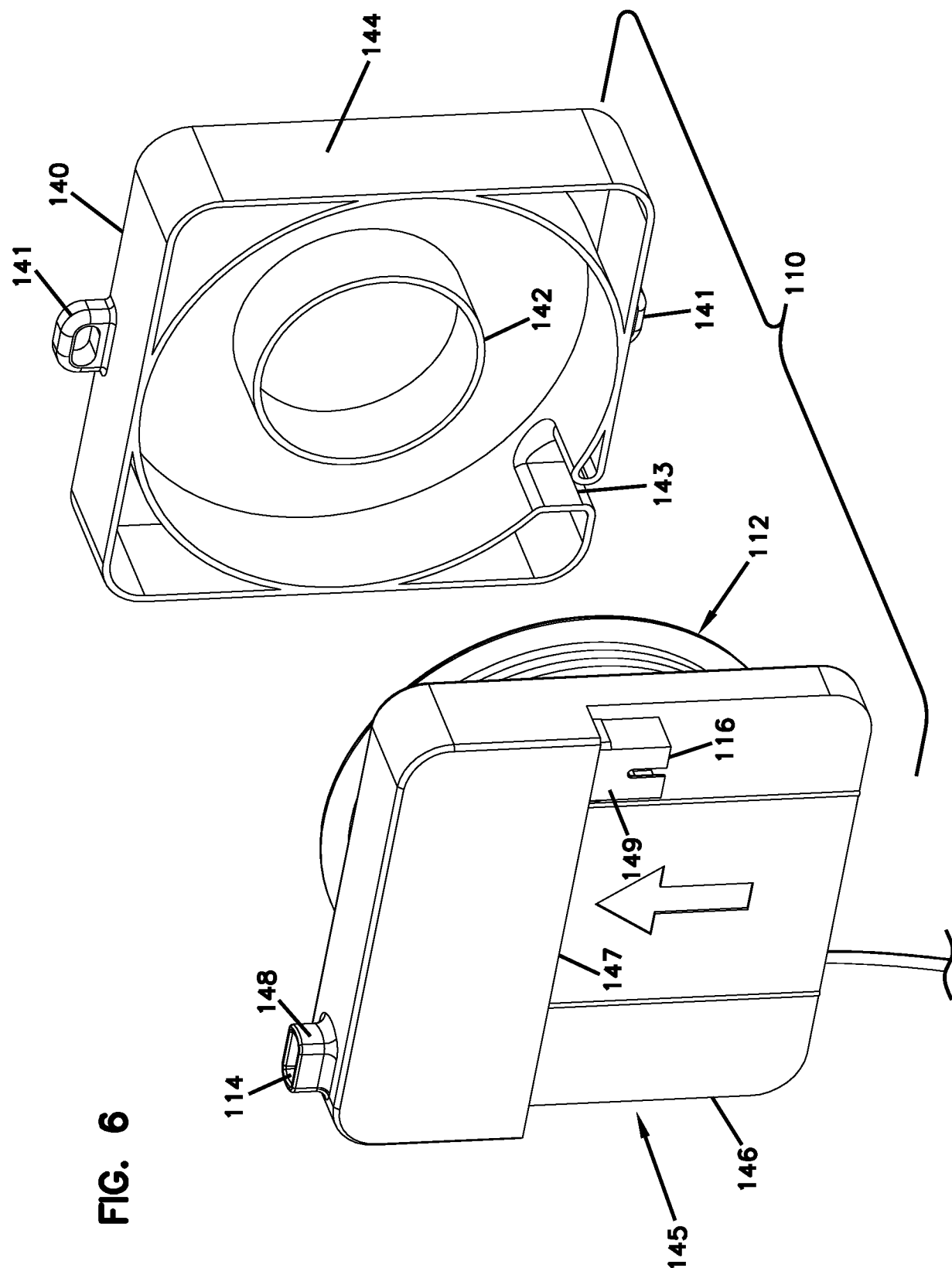


FIG. 6

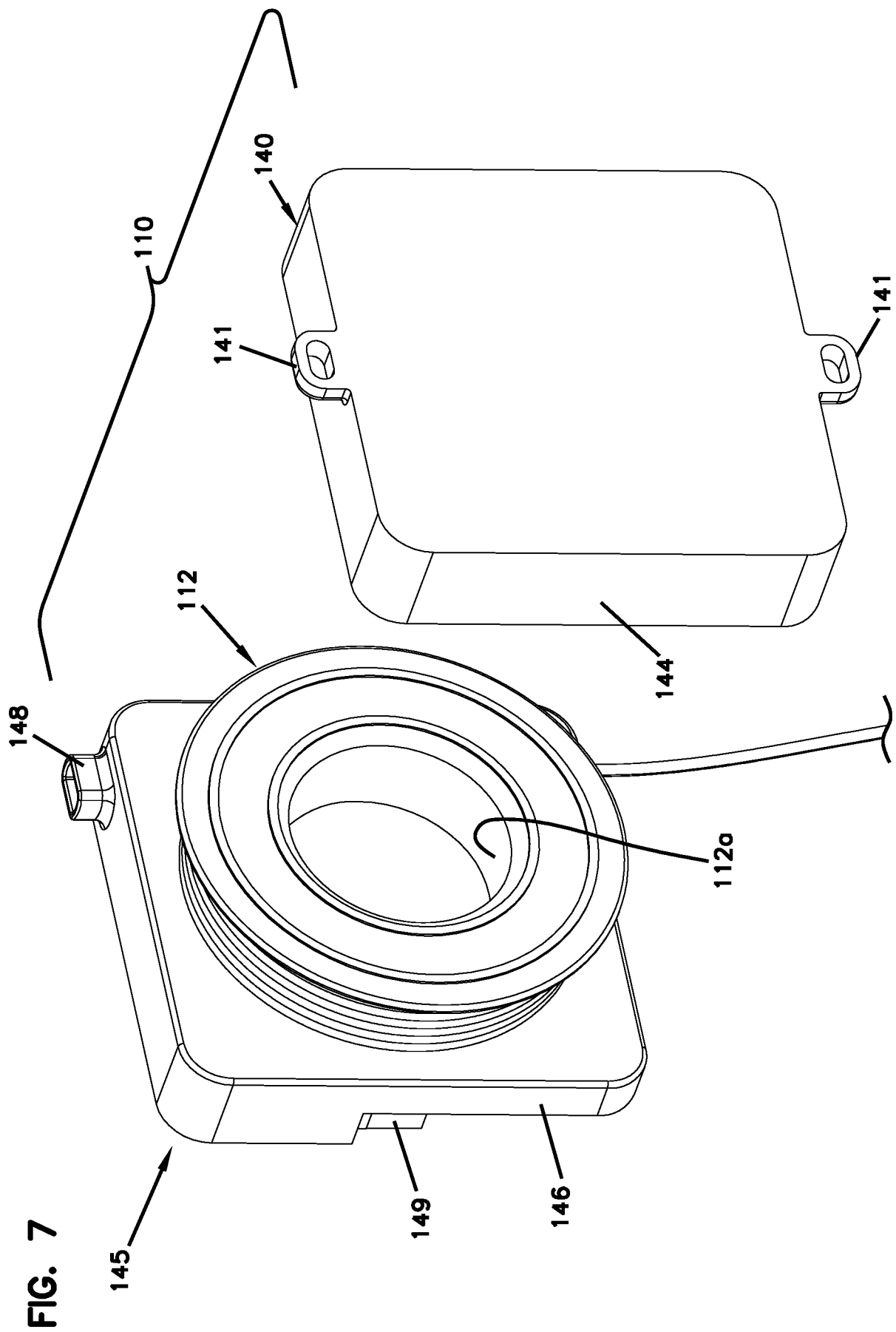


FIG. 8

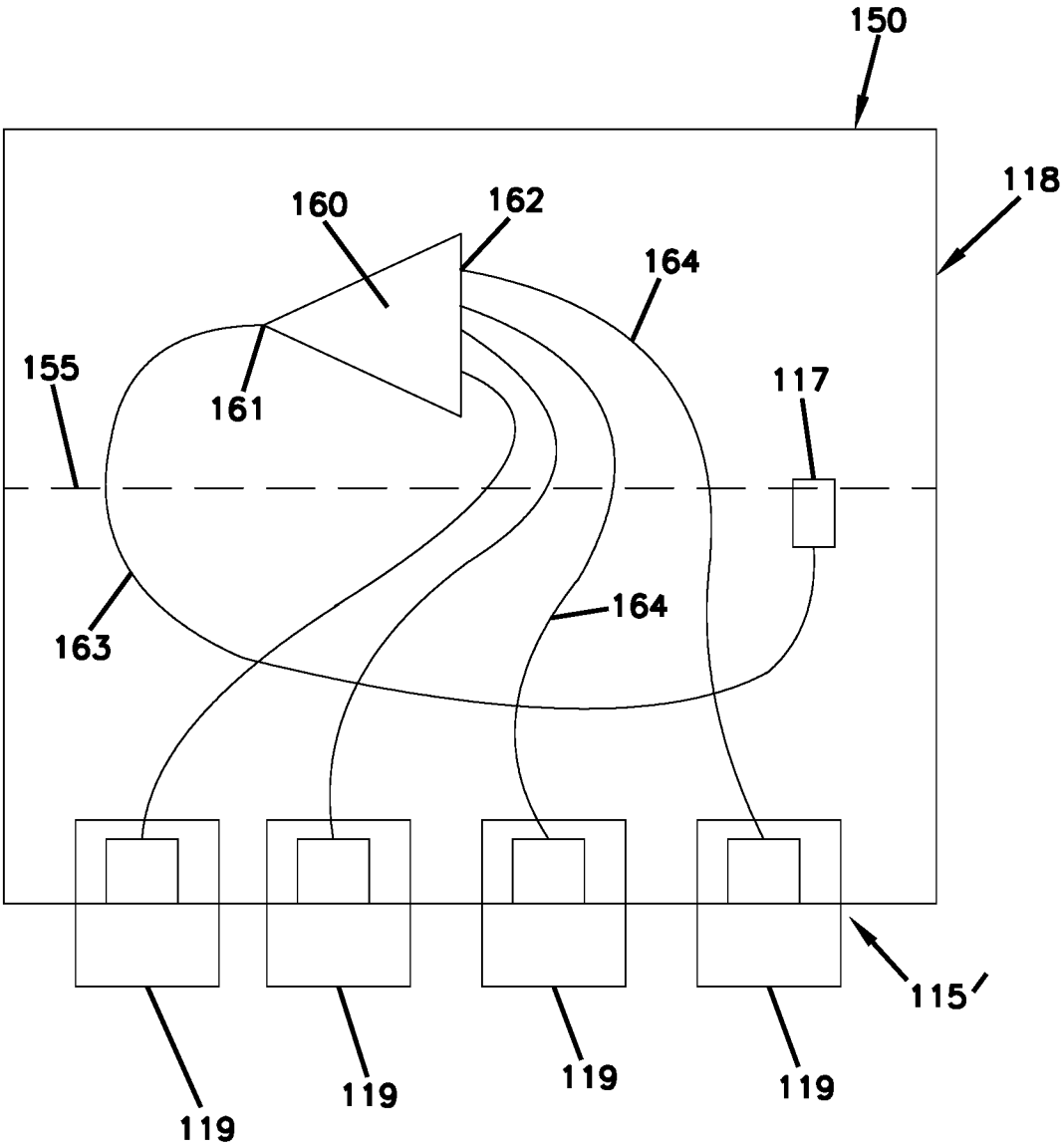


FIG. 9

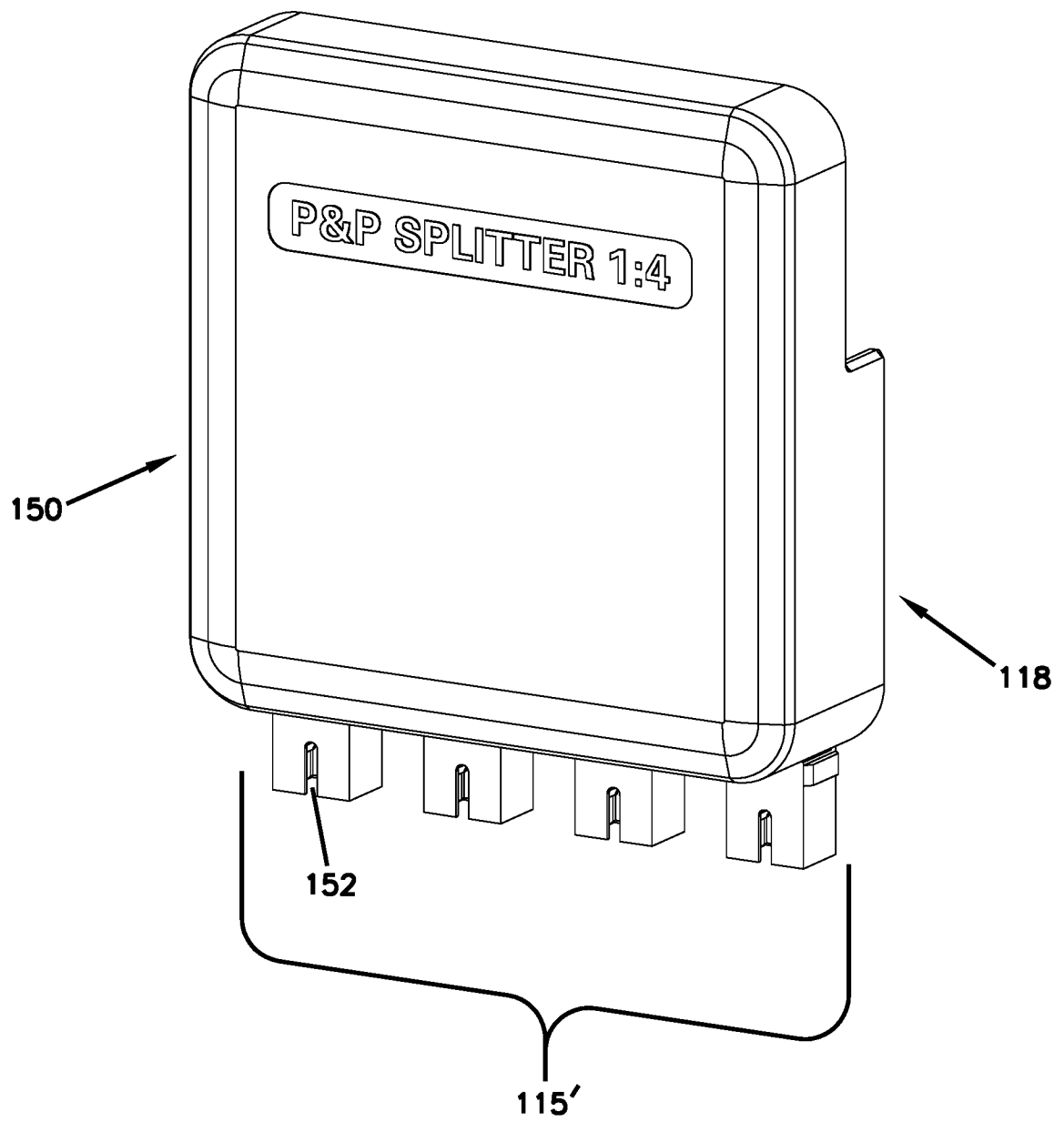


FIG. 10

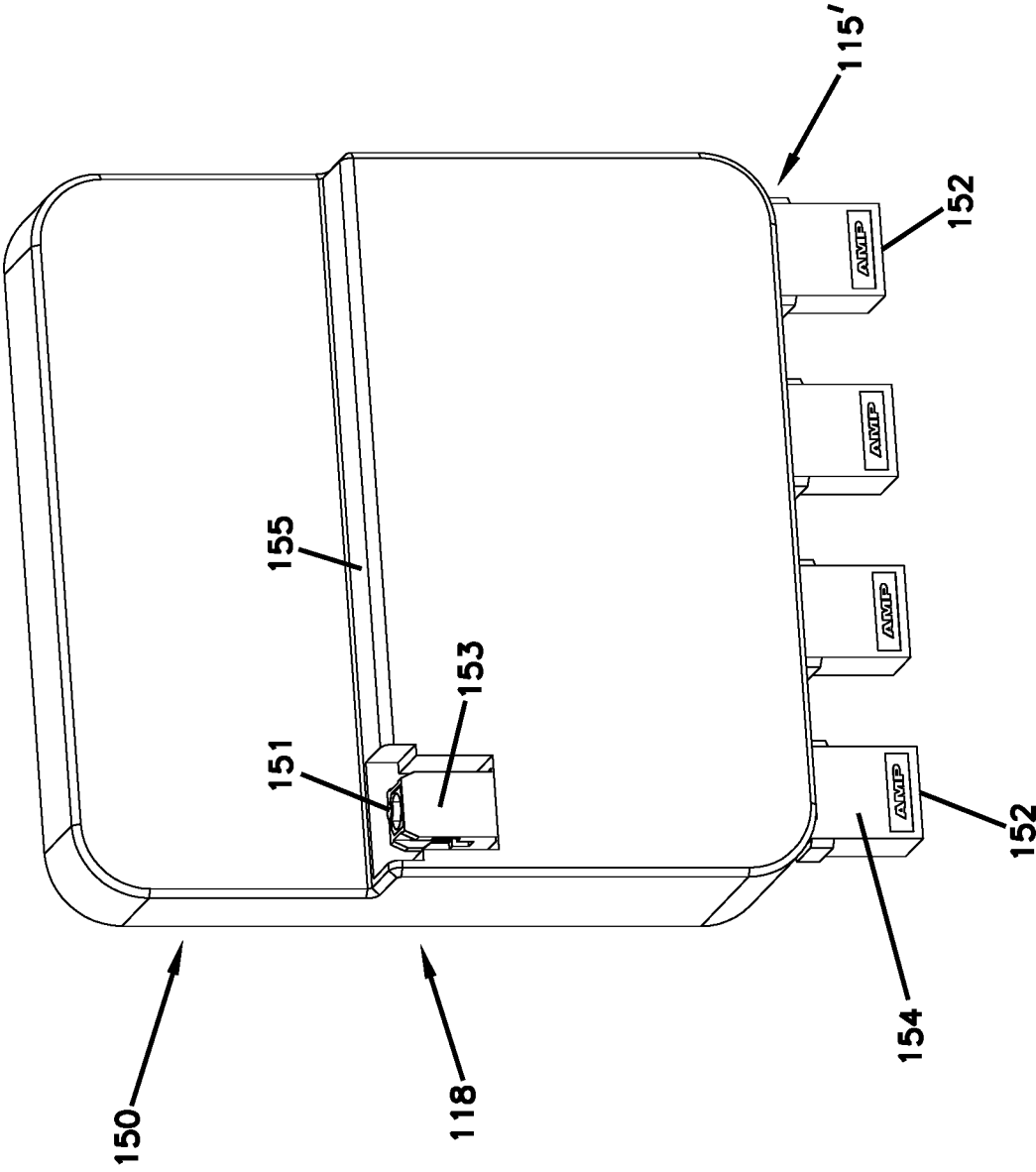


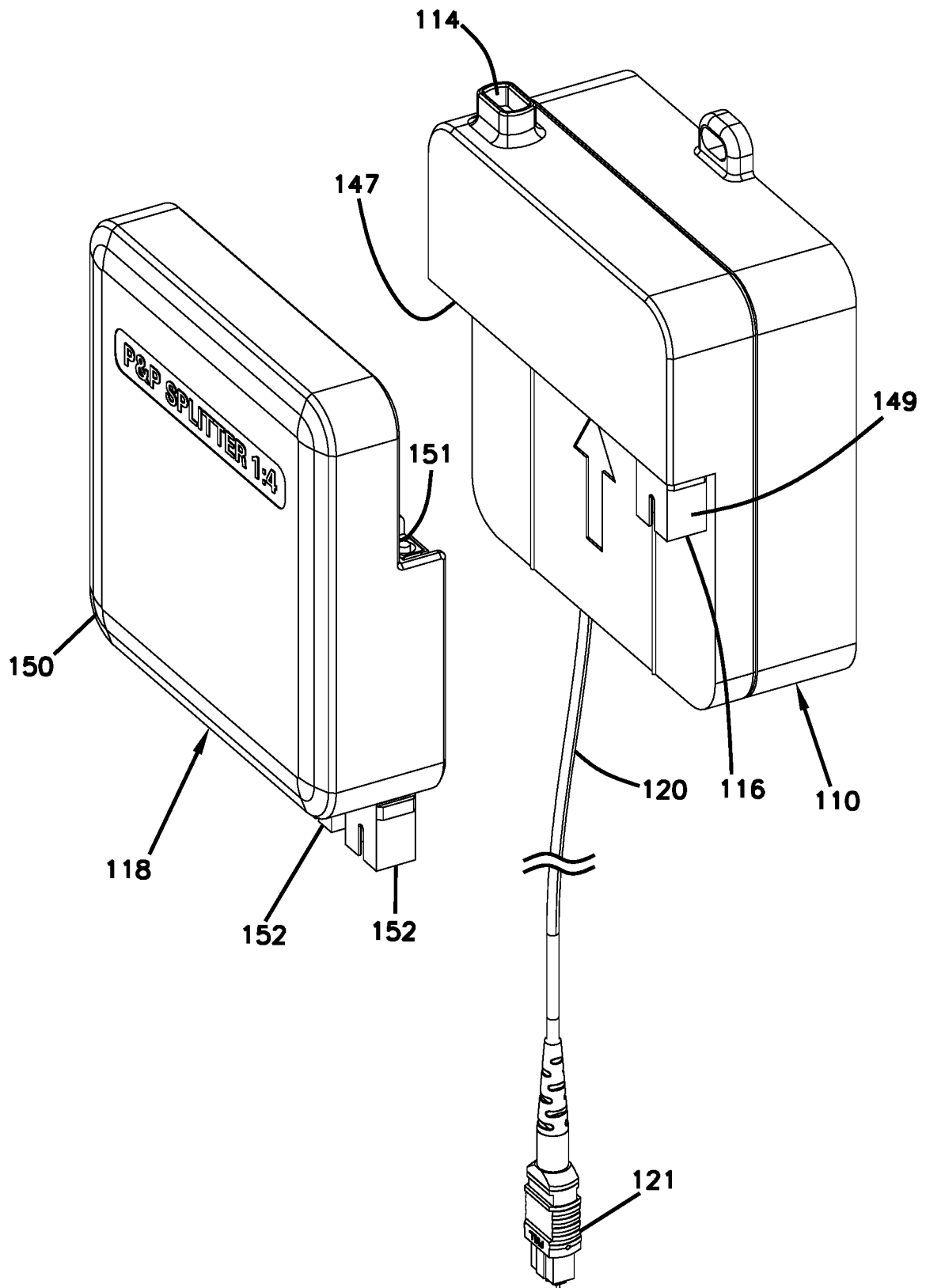
FIG. 11

FIG. 12

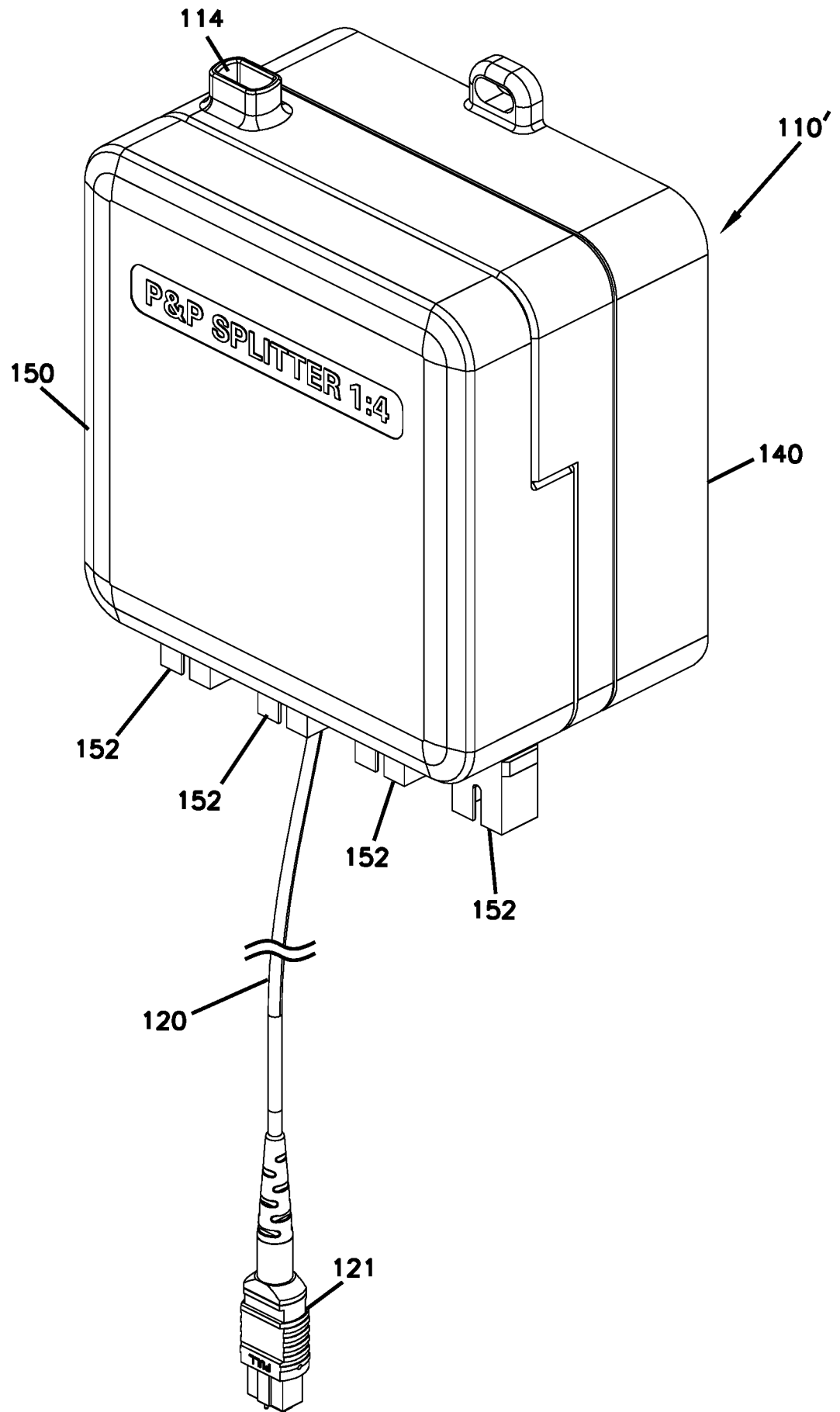


FIG. 13

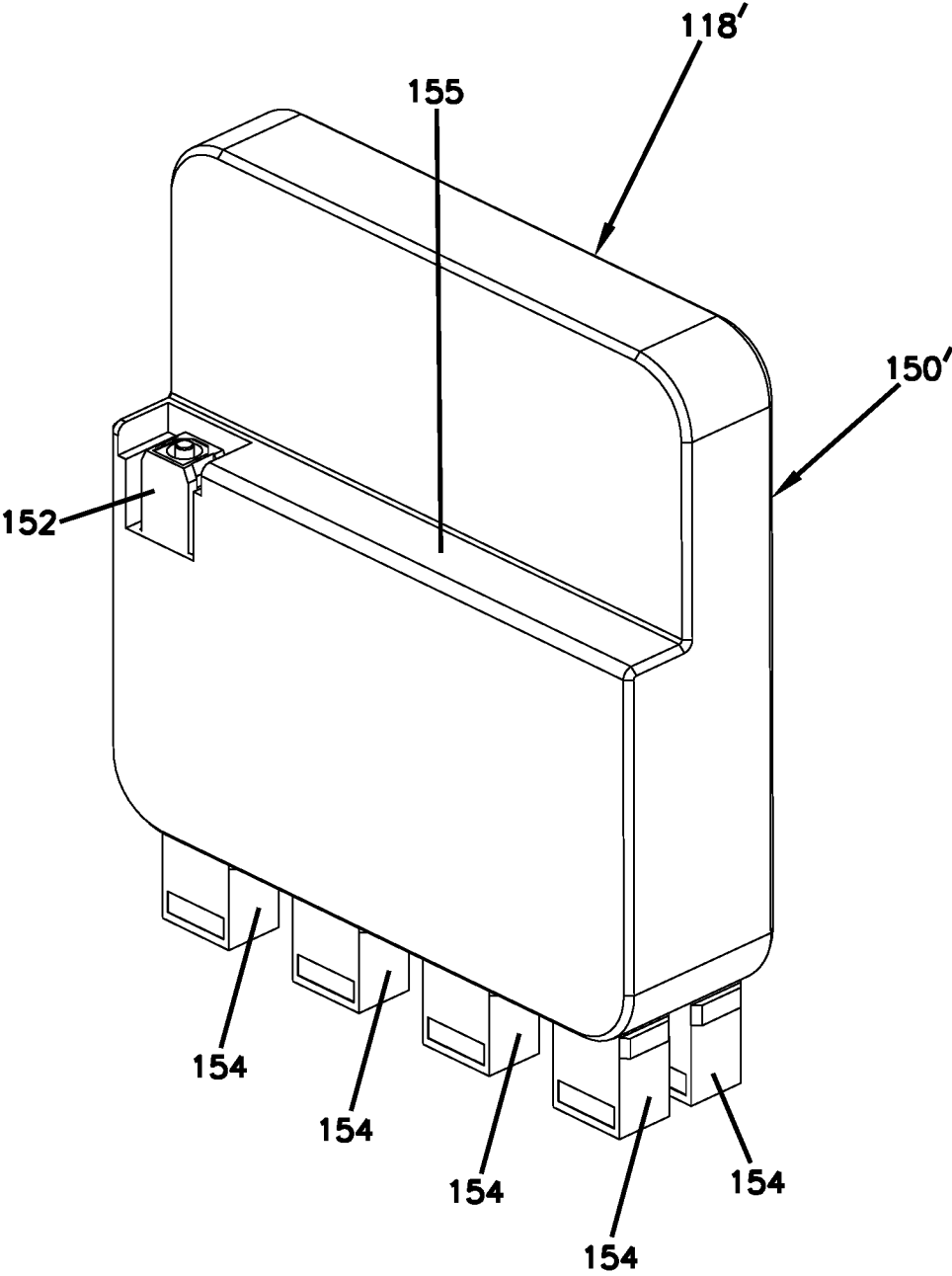


FIG. 14

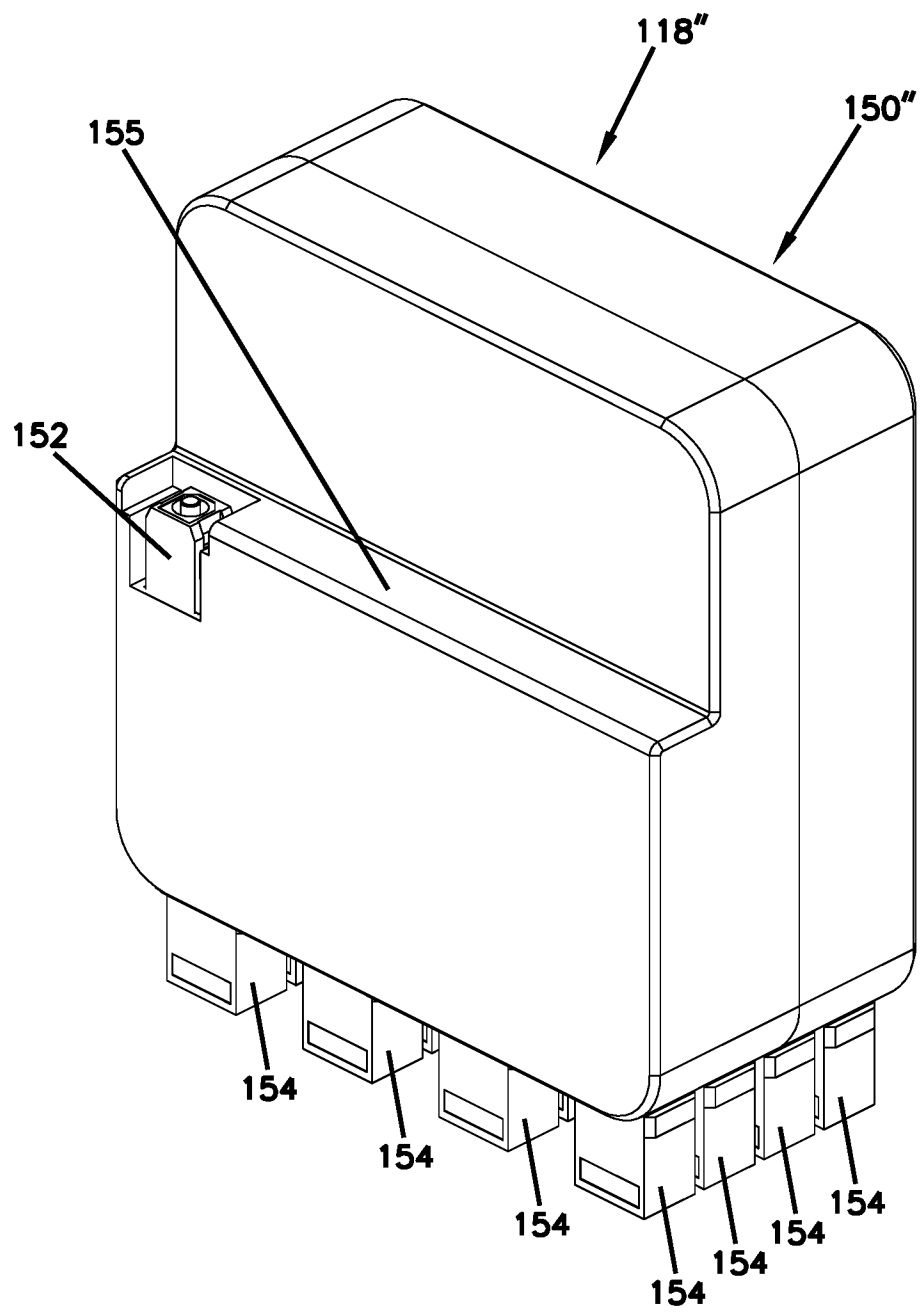


FIG. 15

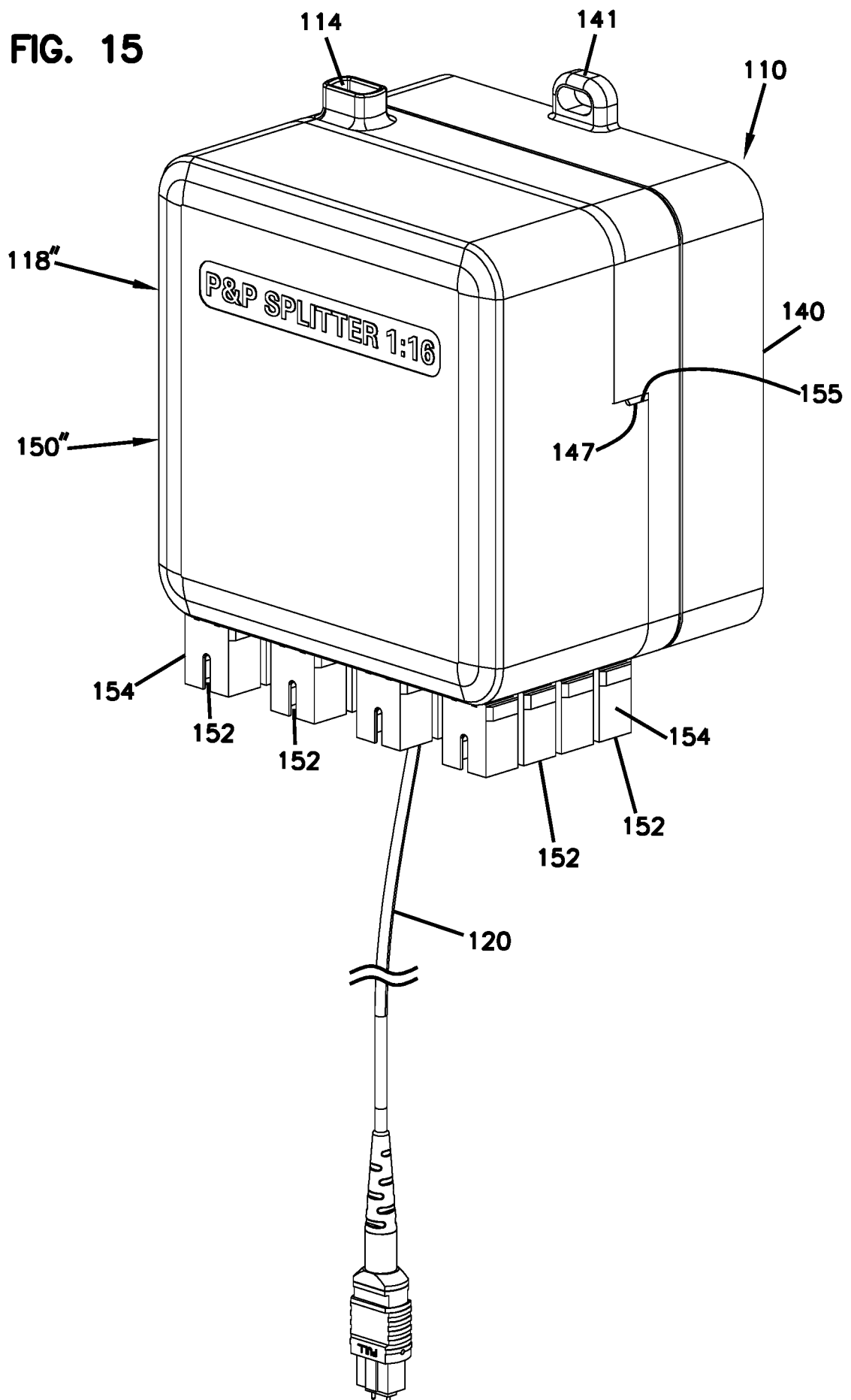
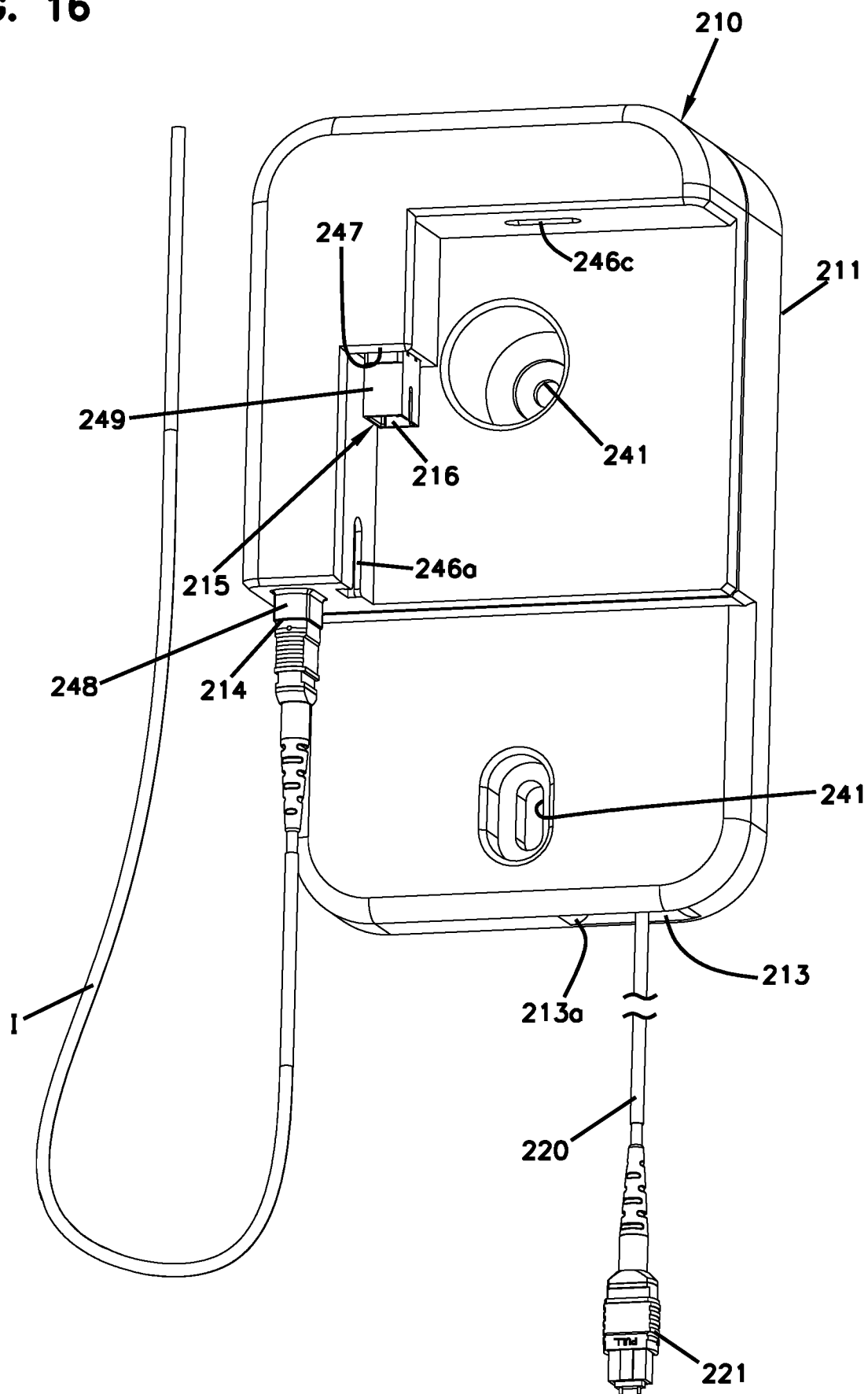


FIG. 16



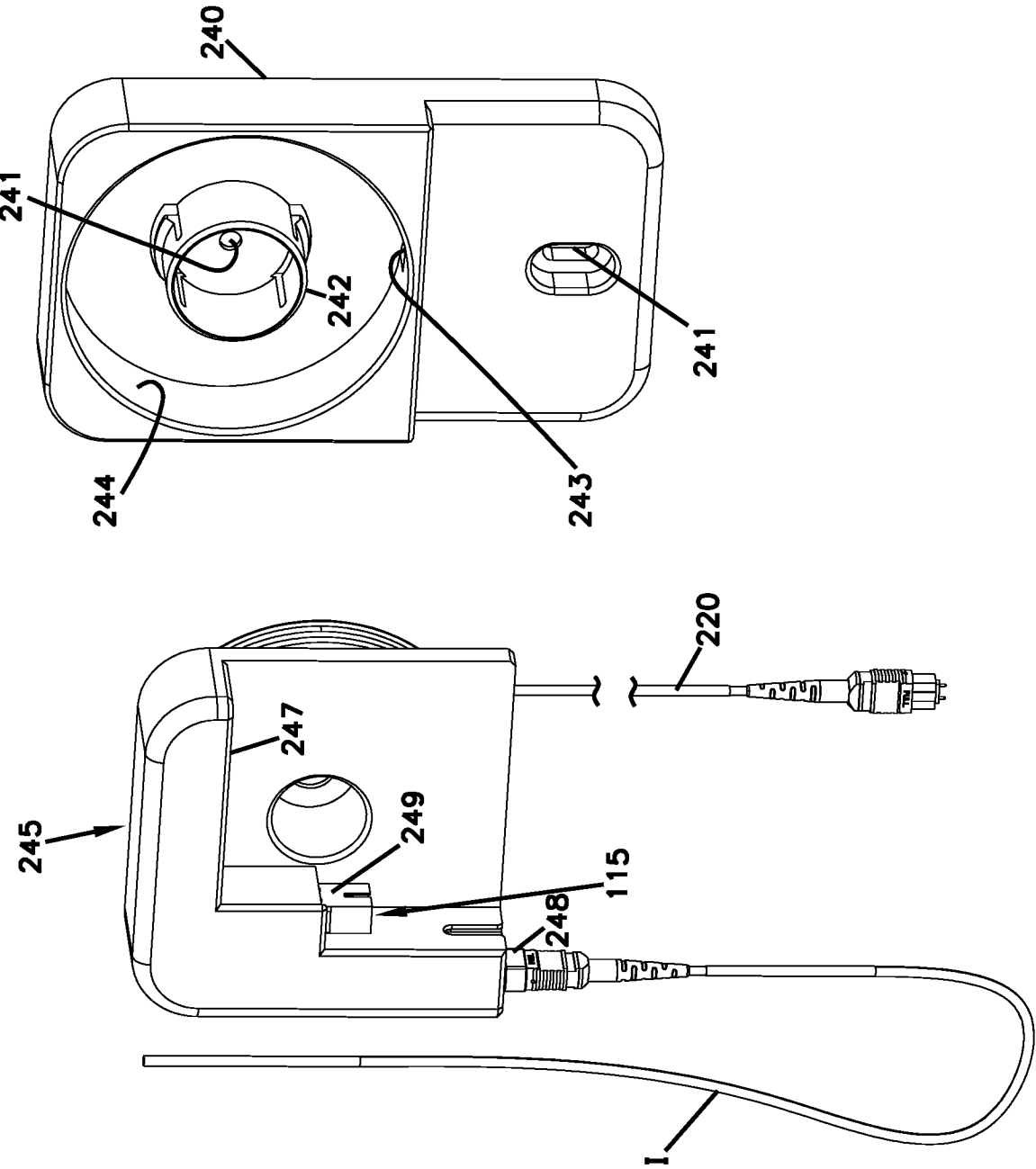


FIG. 17

FIG. 18

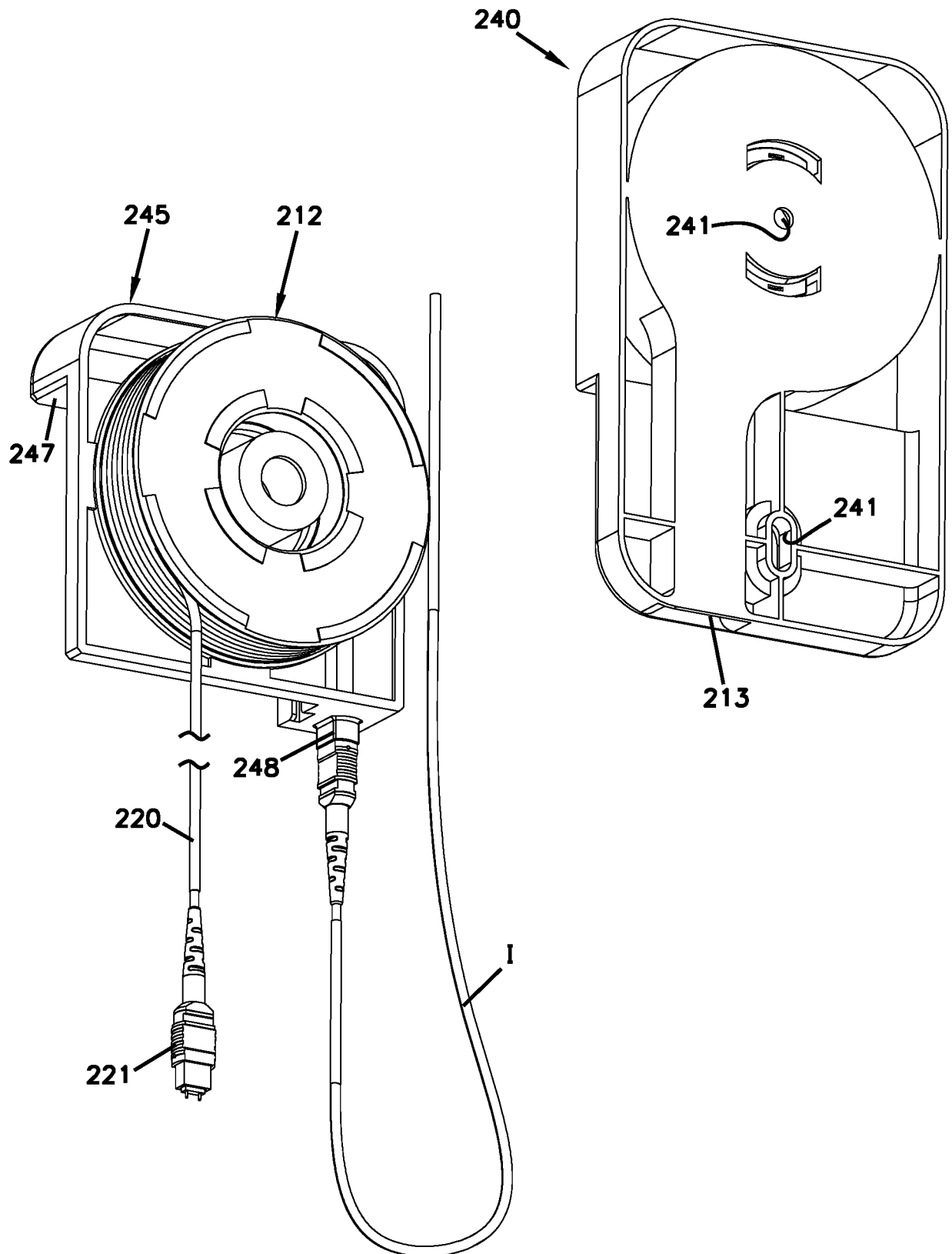


FIG. 19

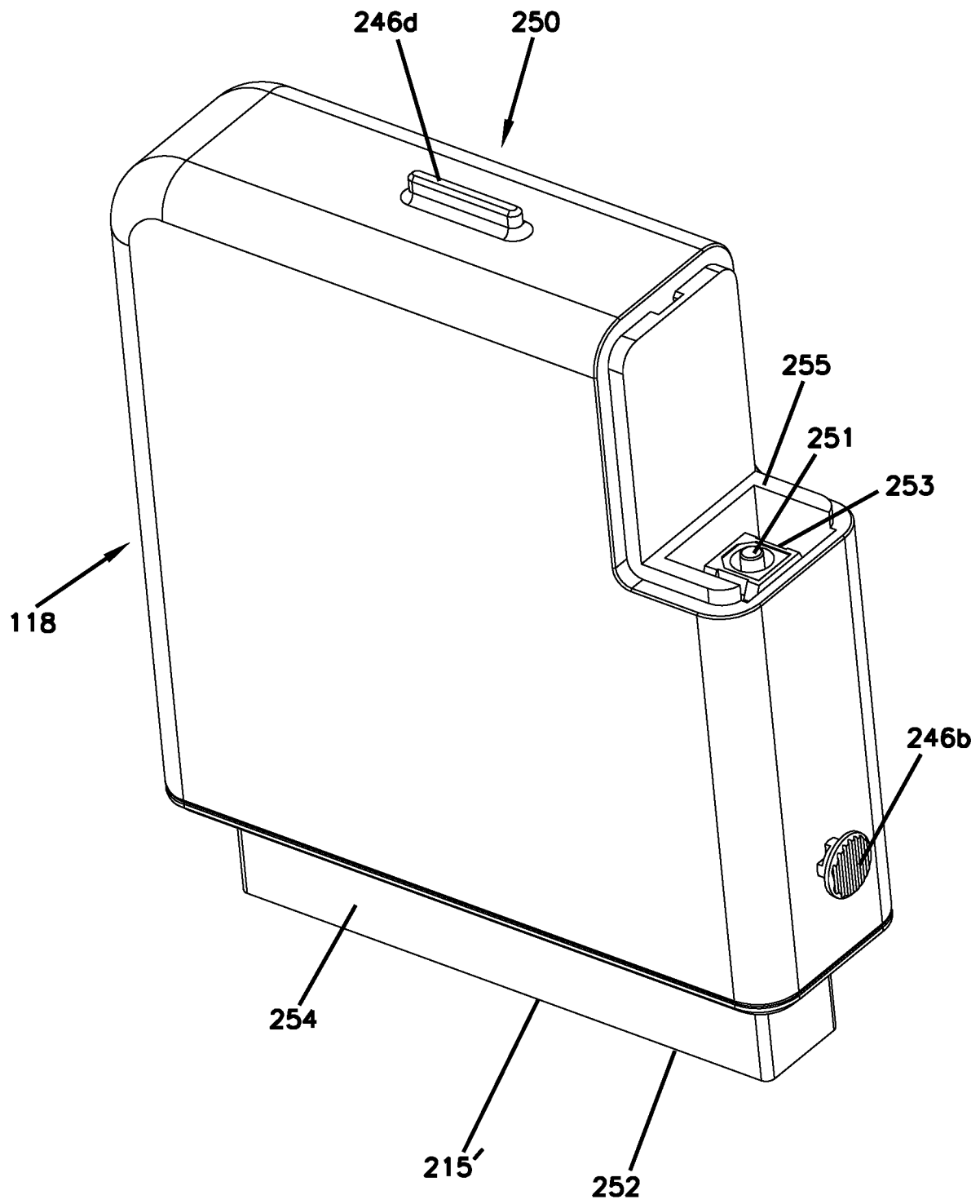


FIG. 20

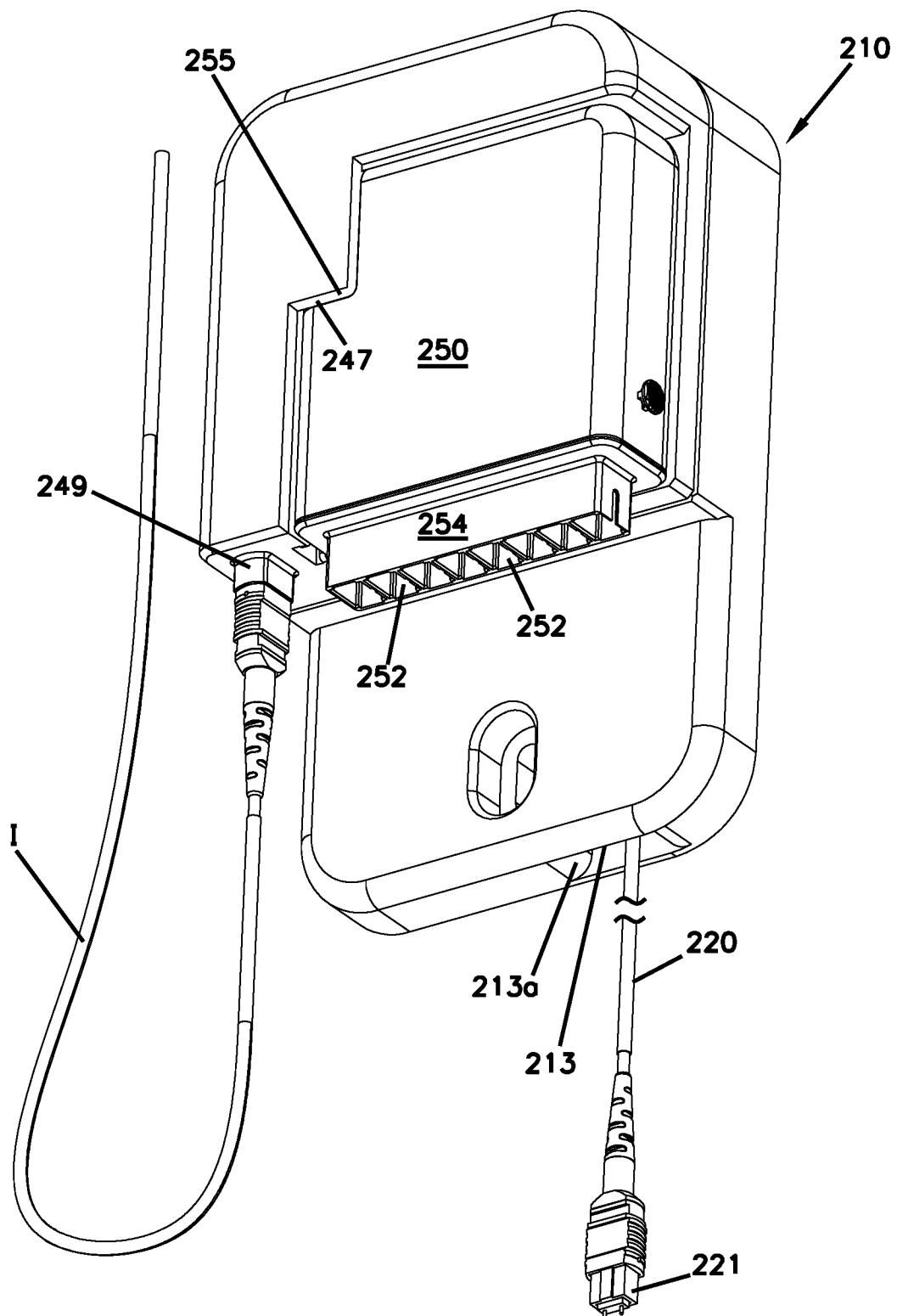


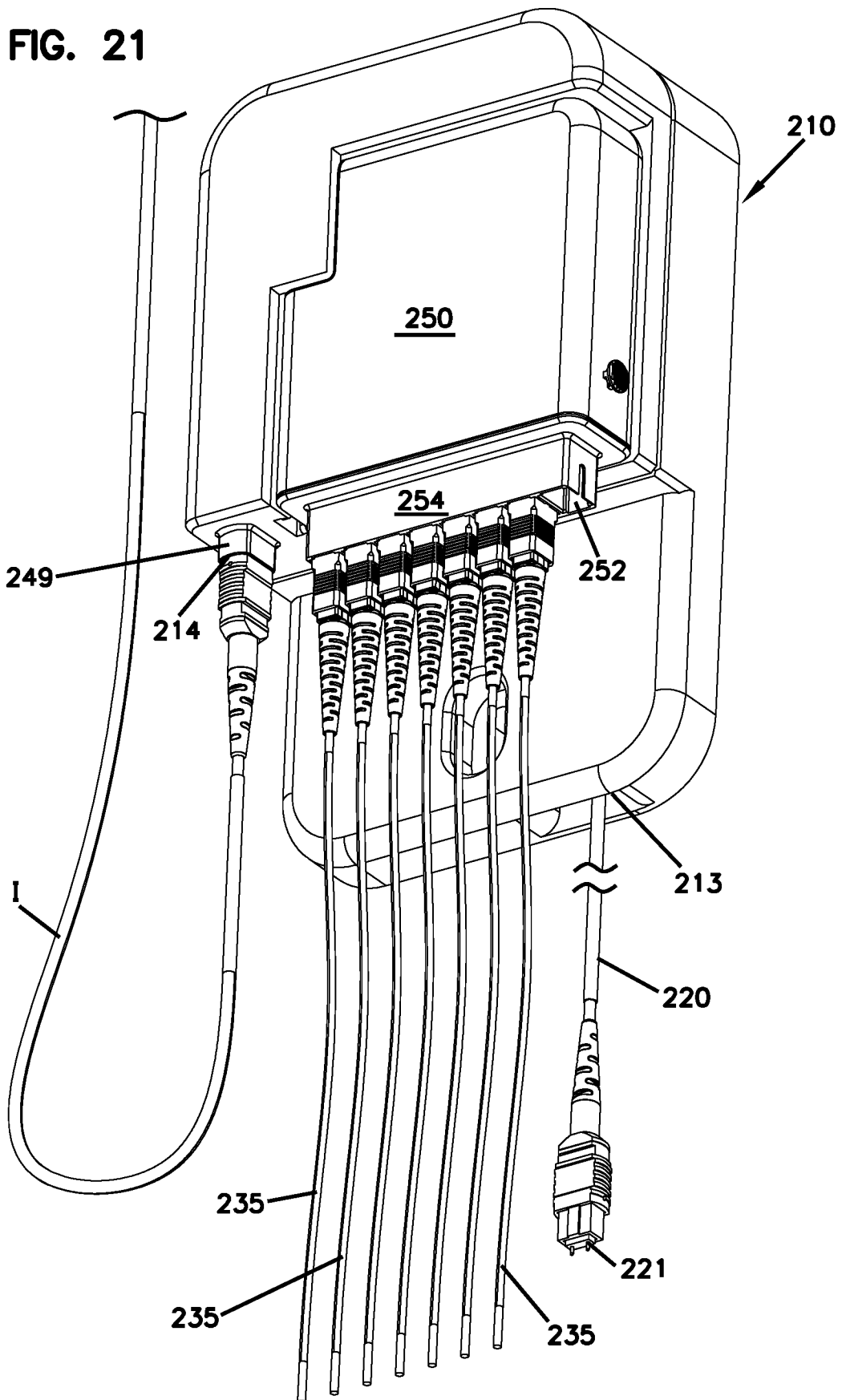
FIG. 21

FIG. 22

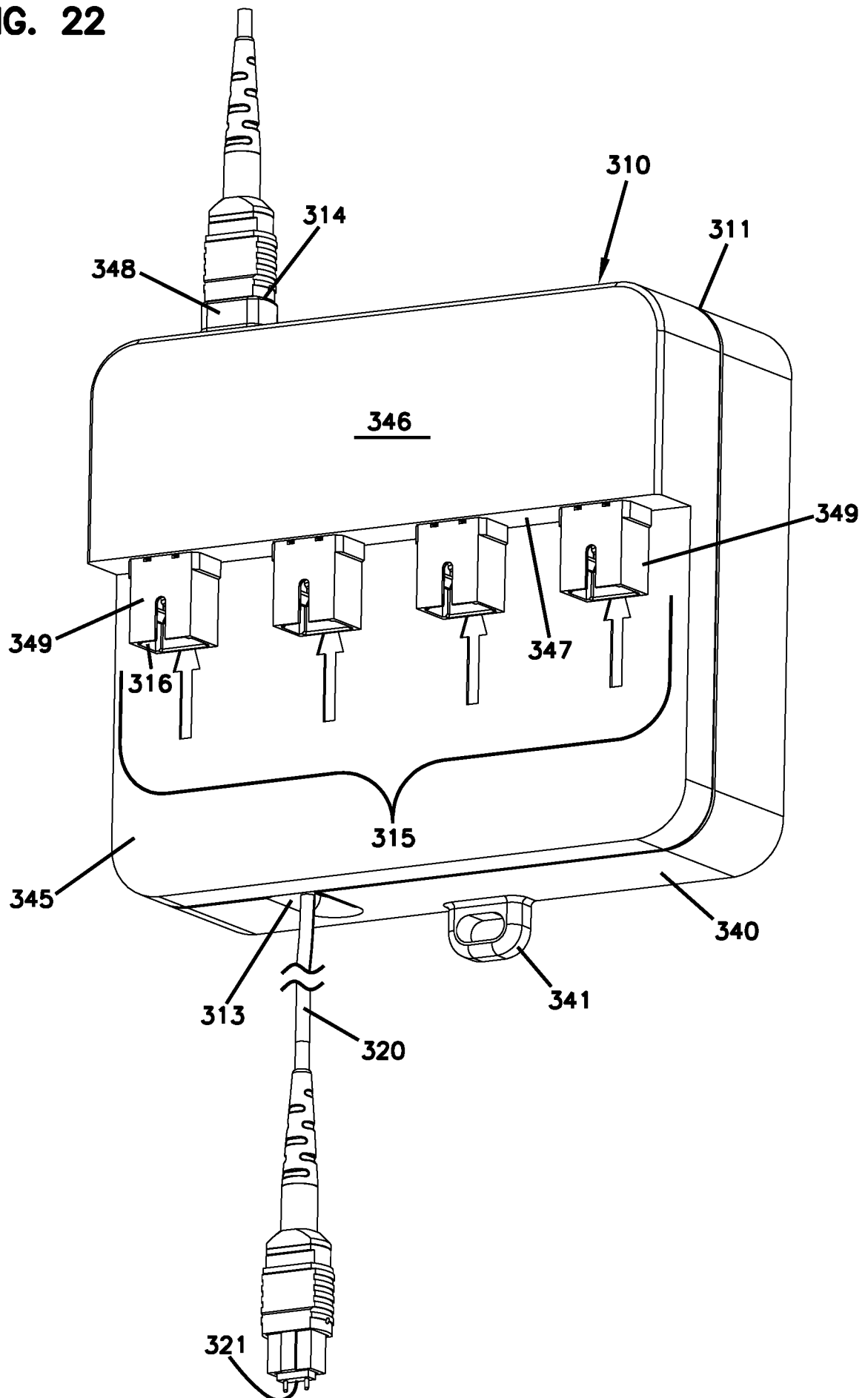


FIG. 23

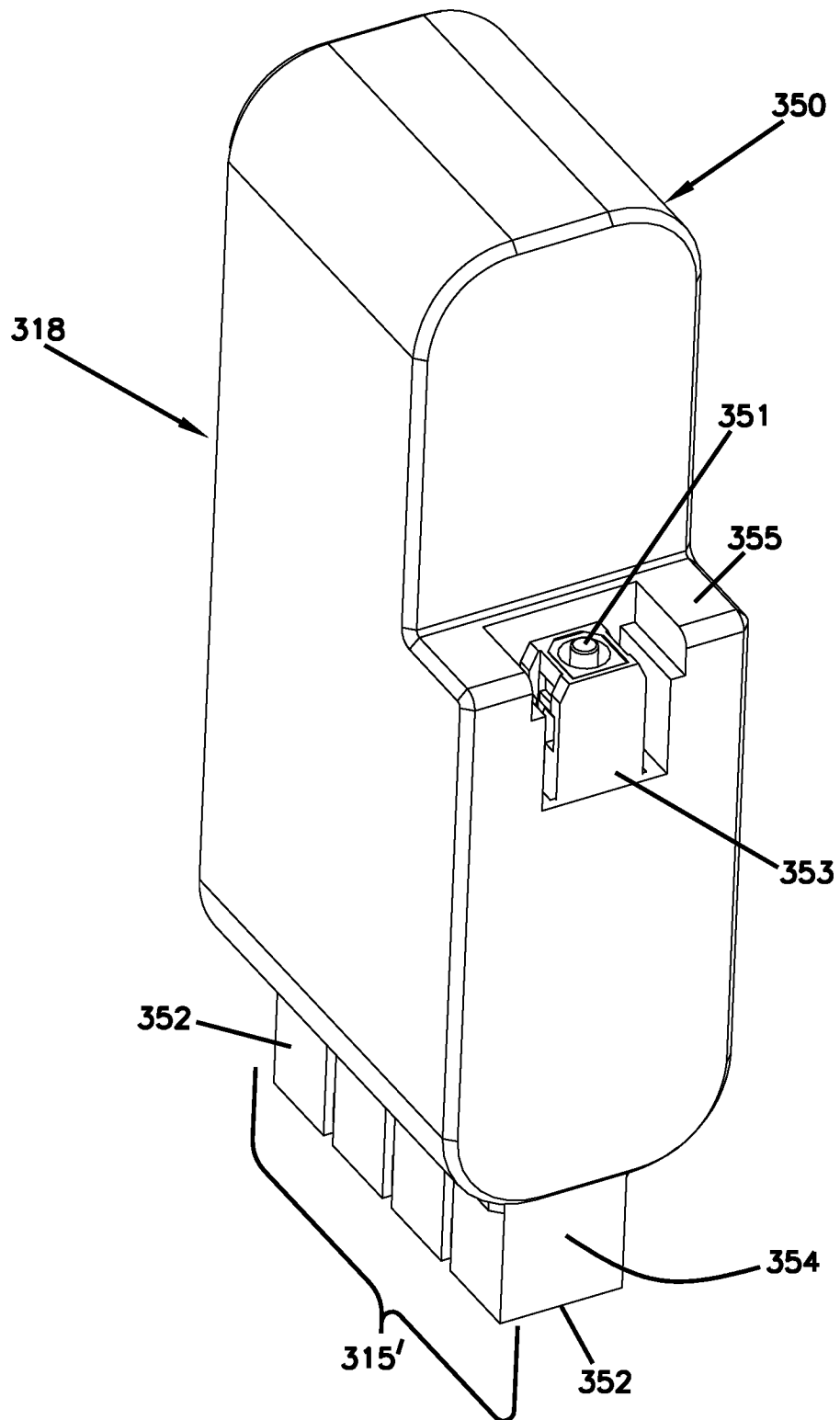
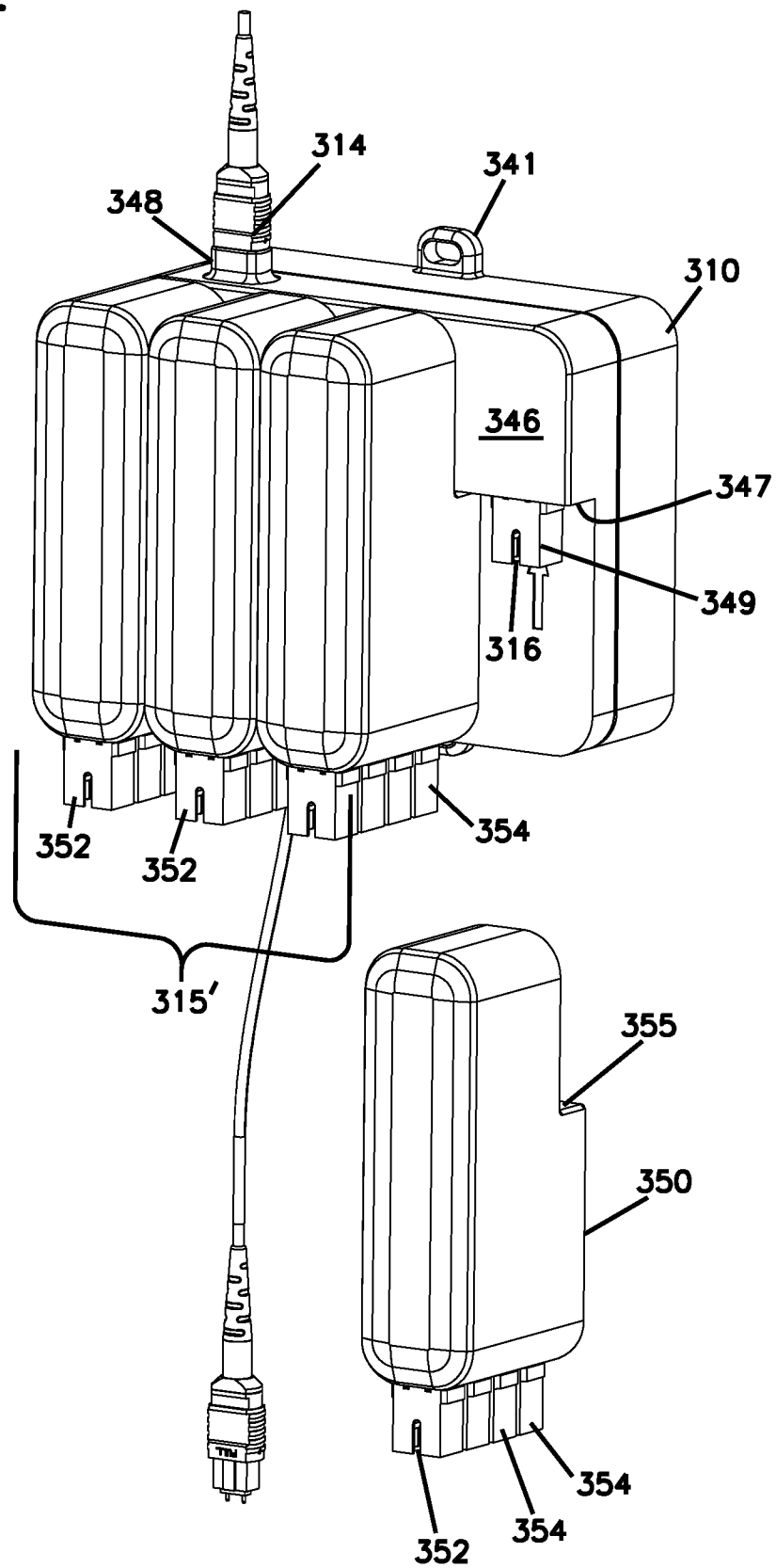


FIG. 24



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/067308

A. CLASSIFICATION OF SUBJECT MATTER

INV. G02B6/44

ADD. G02B6/38 H04B10/27 H04Q11/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B H04B H04Q

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 923 667 A1 (SCHNEIDER ELECTRIC IND SAS [FR]) 15 May 2009 (2009-05-15) page 3 page 5, line 12 - line 14 page 7, line 27 - page 10, line 22; figures 1-3,8-10 page 15, line 23 - line 28; figures 5,11 -----	1-25
Y	US 2013/209050 A1 (LEBLANC THOMAS G [US] ET AL) 15 August 2013 (2013-08-15) paragraph [0017] - paragraph [0023]; figures 1,2 paragraph [0027] - paragraph [0046]; figures 5,6 ----- -/--	1-25



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search

25 September 2017

Date of mailing of the international search report

04/10/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Bourhis, J

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/067308

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2014/254986 A1 (KMIT PAUL [US] ET AL) 11 September 2014 (2014-09-11) cited in the application paragraphs [0004], [0042] - [0050]; figures 1,2,5,29 -----	1-25
A	US 2015/355428 A1 (LEEMAN SAMUEL [BE] ET AL) 10 December 2015 (2015-12-10) figures 3,4,7-10 -----	7-9, 12-15
A	US 2009/317047 A1 (SMITH TREVOR D [US] ET AL) 24 December 2009 (2009-12-24) paragraphs [0009], [0043] - [0048]; figure 1 paragraphs [0051], [0062] - [0066], [0076], [0080]; figures 8,13 -----	10,11
X,P	WO 2016/132216 A1 (ADC COMMUNICATIONS PTY LTD [AU]; COMMScope CONNECTIVITY AUSTRALIA PTY) 25 August 2016 (2016-08-25) paragraphs [0029] - [0034], [0044], [0051], [0057]; figures 1-3 -----	1-3,7, 10,11, 17,21-25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/067308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2923667	A1	15-05-2009	NONE
US 2013209050	A1	15-08-2013	NONE
US 2014254986	A1	11-09-2014	US 2014254986 A1 11-09-2014 US 2016341914 A1 24-11-2016
US 2015355428	A1	10-12-2015	CN 105324696 A 10-02-2016 EP 2936228 A1 28-10-2015 ES 1141660 U 22-07-2015 PH 12015501408 A1 14-09-2015 RU 170443 U1 25-04-2017 RU 170725 U1 04-05-2017 RU 171105 U1 22-05-2017 RU 2014134404 A 25-01-2017 US 2015355428 A1 10-12-2015 WO 2014096134 A1 26-06-2014
US 2009317047	A1	24-12-2009	AR 072194 A1 11-08-2010 AU 2009259962 A1 23-12-2009 CN 102067001 A 18-05-2011 EP 2297604 A1 23-03-2011 RU 2011101738 A 27-07-2012 US 2009317047 A1 24-12-2009 US 2012308190 A1 06-12-2012 US 2014334791 A1 13-11-2014 US 2016195688 A1 07-07-2016 US 2017038550 A1 09-02-2017 WO 2009155487 A1 23-12-2009
WO 2016132216	A1	25-08-2016	AU 2016221423 A1 17-08-2017 US 2016238810 A1 18-08-2016 WO 2016132216 A1 25-08-2016