

**(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE**

(11) Application No. AU 2005264949 B2

(54) Title
Multi-position fiber optic connector holder and method

(51) International Patent Classification(s)
G02B 6/00 (2006.01) **G02B 6/38** (2006.01)
G02B 6/44 (2006.01)

(21) Application No: **2005264949** (22) Date of Filing: **2005.06.13**

(87) WIPO No: **WO06/009687**

(30) Priority Data

(31) Number **10/871,555** (32) Date **2004.06.18** (33) Country **US**

(43) Publication Date: **2006.01.26**
(44) Accepted Journal Date: **2008.08.07**

(71) Applicant(s)
ADC Telecommunications, Inc.

(72) Inventor(s)
Vongseng, Soutsada;Barth, Michael K.;Zimmel, Steven C.;Smith, Trevor D.

(74) Agent / Attorney
Davies Collison Cave, Level 15 1 Nicholson Street, Melbourne, VIC, 3000

(56) Related Art
EP0975180
Sugita et al. "SC-Type single-mode optical fiber connectors"
EP0871047
US5930425
Iwano S-I et al. "Mu. type optical fiber connector system"
US6149315
WO0075706

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
26 January 2006 (26.01.2006)

PCT

(10) International Publication Number
WO 2006/009687 A3

(51) International Patent Classification:
G02B 6/44 (2006.01) G02B 6/38 (2006.01)

(74) Agent: BRUESS, Steven, C.; Merchant & Gould P.C.,
P.O. Box 2903, Minneapolis, MN 55402-0903 (US).

(21) International Application Number:
PCT/US2005/020940

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA,
MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ,
OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL,
SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC,
VN, YU, ZA, ZM, ZW.

(22) International Filing Date: 13 June 2005 (13.06.2005)

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SI, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CII, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, ML, MR, NE, SN, TD, TG).

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/871,555 18 June 2004 (18.06.2004) US

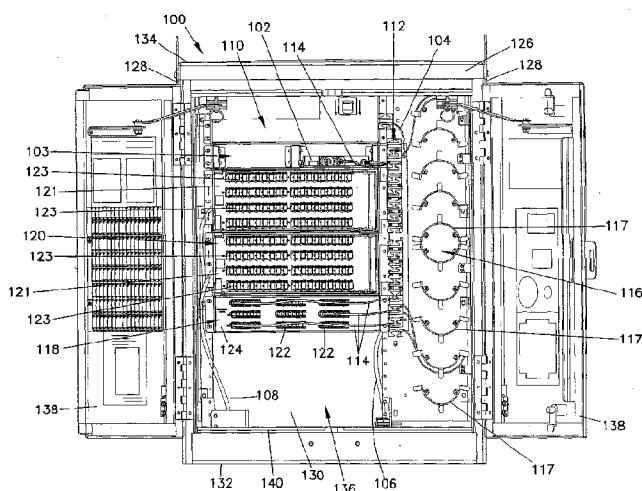
(71) Applicant (for all designated States except US): ADC
TELECOMMUNICATIONS, INC. [US/US]; 13625
Technology Drive, Eden Prairie, MN 55344-2252 (US).

Published:

- with international search report
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

[Continued on next page]

(54) Title: MULTI-POSITION FIBER OPTIC CONNECTOR HOLDER FOR STORING FIBER OPTIC CONNECTORS IN
TELECOMMUNICATIONS CONNECTION CABINET AND CORRESPONDING METHOD



(57) Abstract: A telecommunications connection cabinet (100) including an excess fiber storage area (118). The excess fiber storage area (118) including a bulkhead (124) for receiving fiber connector holders (122) for protecting the connectors (182) terminating the excess fibers from contamination. The telecommunications connection cabinet (100) also comprises a fiber optic splitter (102) receiving a first fiber optic cable (104) and splitting an optical signal carried by the cable into a plurality of fiber distribution cables (114), each fiber distribution cable (114) terminated by a fiber optic connector (180) having a polished end face (182).

WO 2006/009687 A3



(88) Date of publication of the international search report:
6 April 2006

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MULTI-POSITION FIBER OPTIC CONNECTOR HOLDER AND METHOD**Field**

The present invention relates generally to fiber optic telecommunications connection devices. More specifically, the present invention relates to multi-position holders for fiber optic connectors.

Background

Fiber optic connectivity and service is being extended to more and more customers, both commercial and residential. However, not all customers to whom this service is available are currently ready to accept and utilize such service. Additionally, new service and connection devices may be provided in residential or commercial real estate development projects but at a time prior to when the units are constructed or ready for occupancy. In such circumstances, it is desirable to have an easily scalable solution for aiding connection of new customers to existing connections within a piece of installed connection equipment and expansion of the number of connections available within that installed equipment.

Summary

20

In one aspect the invention provides a splitter and storage apparatus comprising:
a splitter housing;

a first cable exit member protruding linearly outwardly from one end wall of the housing, the first cable exit member tapering inwardly as the first cable exit member
25 extends away from the housing;

an input cable entering the housing;
a plurality of first output cables exiting from the housing through the first cable exit member, first ends of the first output cables being terminated with optical connectors;
an optical splitter arrangement positioned with the interior of the housing, the
30 optical splitter arrangement configured to receive a signal from the input cable, the optical splitter arrangement further configured to output the signal to second ends of the first

- 2 -

output cables; and

a connector storage module being configured to receive and store the optical connectors of the first output cables, the connector storage module being separate from the splitter housing.

5 The invention also provides a splitter and storage apparatus comprising:
a housing;
an optical splitter arrangement for splitting a first optical signal into a plurality of optical signals, the optical splitter arrangement retained within the housing;
an input cable extending into the housing to transmit the first optical signal to the
10 optical splitter arrangement;
a first cable exit member protruding from the housing, the first cable exit member defining an aperture having a maximum cross-dimension, the first cable exit member protruding from the housing a distance greater than the maximum cross-dimension of the aperture; and
15 a first plurality of output cables extending outwardly from the housing through the cable exit member to transmit at least some of the plurality of optical signals from the optical splitter arrangement, the plurality of output cables having connectorized ends; and
a connector storage module being configured to receive and store the connectorized ends of the first output cables, the connector storage module being separate from the
20 housing.

The invention further provides a splitter and storage apparatus comprising:
a fiber optic splitter;
a splitter housing in which the fiber optic splitter is located;
a first plurality of splitter output cables that extend outwardly from the splitter
25 housing at an exit location, each of the splitter output cables of the first plurality being terminated by a fiber optic connector; and
a first exit member projecting outwardly from the splitter housing at the exit location, the first exit member defining a passage through which the splitter output cables extend, the passage defining a transverse cross-sectional area at a first location along a

- 2A -

length of the passage, and the first plurality of splitter output cables occupying at least a majority of the transverse cross-sectional area of the passage at the first location; and

a connector storage module being configured to receive and store the fiber optic connectors of the splitter output cables, the connector storage module being separate from the splitter housing.

The invention also provides an apparatus comprising:

- a fiber optic splitter;
- a splitter housing in which the fiber optic splitter is located;
- a first plurality of splitter output cables that extend outwardly from the splitter housing at a first exit location, each of splitter output cables of the first plurality of splitter output cables being terminated by a fiber optic connector;
- a first exit member that projects outwardly from the splitter housing at the first exit location, the first exit member defining a passage through which the first plurality of splitter output cables pass;
- a second plurality of splitter output cables that extend outwardly from the splitter housing at a second exit location, each of splitter output cables of the second plurality of splitter output cables being terminated by a fiber optic connector;
- a second exit member that projects outwardly from the splitter housing at the second exit location, the second exit member defining a passage through which the second plurality of splitter output cables pass;
- a first connector holder that is separate from the splitter housing, the first connector holder including a first connector holder housing that receives and holds at least some of the fiber optic connectors that terminate the first plurality of splitter output cables, the first connector holder not including a functional fiber optic adapter; and
- a second connector holder that is separate from the splitter housing, the second connector holder including a second connector holder housing that receives and holds at least some of the fiber optic connectors that terminate the second plurality of splitter output cables, the second connector holder not including a functional fiber optic adapter.

In embodiments, the present invention relates to a telecommunications equipment cabinet including a splitter connecting an outside plant cable to a plurality of fiber optic cables. The cabinet may include a splitter mounting area, a cable management structure,

- 2B -

an array of adapters for optically connecting two fiber optic cables terminated with connectors, and an excess cable storage area. Customer equipment cables may be connected to rear of adapters within the adapter array. Cables from the splitter may be directed to the cable management structure and to the excess cable storage area where
5 connectors terminating these cables are stored and protected until a connection between the outside plant cable and the customer equipment cable is desired.

In embodiments, the present invention relates to a connector holder with at least one opening in the housing for receiving a fiber optic connector and protecting a polished end face of the connector. The connector holder may include a housing with a releasable
10 latch on one end and a mounting tab on the other end which cooperate to releasably mount the housing within an opening in a bulkhead.

In embodiments, the present invention still further relates to a method of increasing the connection capacity of a fiber optic telecommunications connection cabinet. A splitter may be mounted in the cabinet and a cable from the splitter is connected to an outside plant
15 cable. The splitter may split an optical signal from the outside plant cable into a plurality of optical fiber cables terminated with optical fiber connectors. This plurality of cables may be directed from the splitter to a cable management area and to an excess cable storage area. A plurality of connectors of these cables may be inserted within a connector holder and the connector holder is inserted within a mounting opening in the excess cable
20 storage area. The cabinet may include an array of adapters which may be used as needed to connect a cable from the splitter to a customer equipment cable.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of the
25 specification, illustrate embodiments of the present invention and together with the description, serve to explain the principles of the invention. A brief description of the drawings is as follows:

FIG. 1 is a front view of a fiber optic telecommunications connection cabinet including a multi-position fiber optic connector holder according to the present invention,
30 with only illustrative cables shown to indicate routing.

FIG. 2 is a front view of a second embodiment of a fiber optic telecommunications

- 2C -

connection cabinet including a multi-position fiber optic connector holder according to the present invention, with only illustrative cables shown to indicate routing.

FIG. 3 is a front perspective view of a mounting bulkhead for receiving a multi-position fiber optic connector holder as shown in FIGS. 1 and 2, with a multi-position fiber optic connector holder inserted within one of a plurality of mounting openings.

FIG. 4 is a front perspective view of a multi-position fiber optic connector holder according to the present invention.

FIG. 5 is a rear perspective view of the multi-position fiber optic connector holder of FIG. 4.

FIG. 6 is a second rear perspective view of the multi-position fiber optic connector holder of FIG. 4.

FIG. 7 is a front view of the multi-position fiber optic connector holder of FIG. 4.

FIG. 8 is a rear view of the multi-position fiber optic connector holder of FIG. 4.

5 FIG. 9 is a top view of the multi-position fiber optic connector holder of FIG. 4.

FIG. 10 is a bottom view of the multi-position fiber optic connector holder of FIG. 4.

10 FIG. 11 is a side cross-sectional view of the multi-position fiber optic connector holder of FIG. 7, taken along line 11-11.

FIG. 12 is a cross-sectional view of the multi-position fiber optic connector holder of FIG. 7, taken along line 12-12.

FIG. 13 is a second cross-sectional view of the multi-position fiber optic connector holder of FIG. 7, taken along line 13-13.

15 FIG. 14 is a front perspective view of a fiber optic splitter module as shown within the cabinets of FIGS. 1 and 2.

FIG. 14A is a top view of a fiber optic device according to the present invention.

20 FIG. 15 is a front view of a third embodiment of a telecommunications connection cabinet according to the present invention.

FIG. 16 is a front view of a fourth embodiment of a telecommunications cabinet according to the present invention.

FIG. 17 is a front perspective view of fifth embodiment of a telecommunications connection cabinet according to the present invention.

25 FIG. 18 is a front view of a sixth embodiment of a telecommunications cabinet according to the present invention, with the excess fiber storage area mounted adjacent an inside surface of a side wall.

30 FIG. 19 is a front perspective view of a mounting bulkhead for receiving a multi-position fiber optic connector holder as shown in FIG. 18, with a multi-position fiber optic connector holder inserted within one of a plurality of mounting openings.

Detailed Description

Reference will now be made in detail to the exemplary aspects of the present invention that are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer 5 to the same or like parts.

FIG. 1 shows a telecommunications connection cabinet 100 such as might be mounted on a pedestal or other mount in an area where fiber optic connectivity for customers is desired. Cabinet 100 provides a location for outside plant fiber optic cables to be connected to fiber optic distribution cables. The 10 distribution cables are then lead to customer equipment to provide fiber optic service and connectivity at the customer's location. A typical arrangement for providing service to customers might include utilizing a splitter to break the signal from an outside plant (OSP) cable into a plurality of distribution cables, each distribution cable providing a connection to a particular piece of customer equipment. A 15 common splitter might separate the optic signal within the OSP cable into thirty-two individual signals and also combine those thirty-two signals into the OSP cable in a bi-directional communication configuration. Cabinet 100 is similar in nature to that disclosed in the commonly-owned U.S. Patent Application serial no. 10/613,764, filed on July 2, 2003, entitled "Telecommunications Connection Cabinet," the 20 disclosure of which is incorporated herein by reference.

A plurality of cables 108 connected to the customer equipment may be directed into cabinet 100. One or more OSP cables 106 may be directed into cabinet 100 to a splice arrangement, such as a splice tray or panel 110. OSP cables 106 may be spliced within splice panel 110 to a secondary cable 104. Secondary 25 cable 104 is directed from splice panel 110 to a first cable management structure 112 and lead to a splitter 102 within a splitter mounting area 103. Splitter 102 separates the optical signal transmitted over OSP cable 106 and secondary cable 104 into up to thirty-two signals directed into an equal number of fiber distribution cables 114. Cables 114 are directed from splitter 102 through cable management area 112 and 30 into a second cable management and slack storage area 116 including a plurality of cable slack storage spools 117. From slack storage area 116, cables 114 may be directed to either a connector holder within an excess cable storage area 118 or to an adapter within an adapter array 120. Each of these cables 114 are preferably terminated with a fiber optic connector.

Within excess cable storage area 118, a plurality of connector holders 122 are installed within mounting slots in a bulkhead 124. Connector holder 122 (described in further detail below) includes a plurality of openings for receiving and releasably holding the fiber optic connector. The openings in connector holder 122 5 preferably do not provide a continuous optical path but rather house and protect a polished end face of an optical fiber within each cable 114 which is mounted to the terminal fiber optic connector. This protection may be provided in combination with an endcap, such as shown in commonly-owned U.S. Patent Application serial no. 10/610,325, filed on June 30, 2003, entitled "Fiber Optic Connector Holder and 10 Method," the disclosure of which is incorporated herein by reference. Alternatively, connector holder 122 may enclose and protect the polished end face of the connector terminating cable 114 without the need for a protective endcap.

Within adapter array 120, a plurality of fiber optic adapters 123 are mounted which receive the connector terminating cable 114. The connector of cable 114 is received within an opening in a front side of an adapter 123. Adapter 123 15 also includes an opening on an opposite rear side which is adapted to receive a connector terminating one of the customer equipment cables 108. Adapters 123 within adapter array 120 may optically connect one of the cables 114 to one of the cables 108, for transmission of an optical signal from OSP cable 106 to the customer 20 equipment connected to that cable 108. Such cable terminating connectors and adapters 123 are well known in the industry. As shown in FIG. 1, the connectors are SC connectors and it is anticipated that other types, formats, styles and sizes of telecommunications connectors may be used.

Cabinet 100 includes a front 126, a pair of opposing sides 128, a rear 25 wall 130, a base 132 and a top 134, all cooperating to define an interior 136 within which the various components described above are mounted. The components are accessible through an opening 140 in front 126 which may be closed off by a pair of doors 138.

Referring now to FIG. 2, an alternative embodiment 200 of a 30 telecommunications connection cabinet includes the same components as cabinet 100. Some of the components are altered in appearance or location but the functional characteristics are similar to cabinet 100. Cabinet 100 includes a pair of adapter array panels 121, and each panel 121 includes a total of four rows of eighteen adapters 123, or seventy-two adapters 123. Cabinet 200 includes three

such adapter array panels, totaling two hundred sixteen adapters 123. Both cabinets 100 and 200 include a single bulkhead 124 within excess cable storage area 118. Each bulkhead 124 includes openings for mounting three rows of three connector holders 122. Each connector holder 122 includes a total of eight openings for 5 receiving, storing and protecting eight cable connectors of cables 114, providing total storage for up to seventy-two connectors.

Referring now to FIG. 3, a bulkhead 224 is shown with nine openings 226 in a front face 228 including a rear surface 229, and one connector holder 122 positioned within one of the openings 226. A pair of opposing sidewalls 230 extend 10 rearward from opposite ends of front face 228 to a pair of mounting flanges 232. Mounting flanges 232 include fastener openings 234 for mounting bulkhead 224 to one of a cabinet 100 or 200, or a similarly configured cabinet. Bulkhead 224 is similar to bulkhead 124 in FIGS. 1 and 2, except configured so that front face 228 would be angled toward one side of the cabinet within which it is mounted. Angling 15 of bulkheads including devices for receiving fiber optic connectors is known in the industry and provides for improved cable management and density of installation while aiding in bend radius protection, among other advantages. As shown in FIGS. 1 and 2, above, bulkhead 124 has equal length sidewalls 230 so that bulkhead 124 is not angled toward either side of cabinet 100 or 200.

20 Each opening 226 includes a first or top end 227 and a second or bottom end 225. A pair of ears 236 are positioned one each in a pair of opposing sides extending from top end 227 to bottom end 225, the ears 236 cooperating with a keying feature 238 on connector holder 122 to orient connector holder 122 within opening 226. Connector holder 122 includes a releasable latch 240 at one end and a 25 tab 242 on the opposite end (shown in FIGS. 4 to 6, below) which cooperate to releasably hold connector holder 122 within opening 226. It is desirable that the direction of force that may be applied to connector holder 122 by tension in cables 114 be controlled to prevent accidental release of connector holder 122 from opening 226. Keying features 238 and ears 236 cooperate to ensure that connector 30 holder 122 is properly oriented within opening 226 to resist accidental release caused by such cable tension.

Openings 226 within front face 228 of bulkhead 224 (and bulkhead 124) are sized to also receive up to eight adapters 123 when connector holders 122 are not in position. This allows bulkheads 124 and 224 to provide additional space

for optically connecting cables 114 with customer equipment cables 108 for added connection capacity with cabinets 100 and 200, as well as similarly configured cabinets.

Referring now to FIGS. 4 to 13, connector holder 122 includes a housing 160 with eight openings 150 for receiving and releasably holding connectors of cables 114. As described above, cables 114 are terminated by an SC style connector and openings 150 are configured to receive and releasably hold an SC connector. As shown in FIGS. 4 to 6, openings 150 extend through housing 160 from a front 162 to a rear 164 and can each receive a connector of a cable 114 with a dust cap about the polished end face of the optical fiber held by cable 114 and the connector. Such a dust cap is shown in the above-referenced and incorporated U.S. Patent Applications. Alternatively, openings 150 might be close-ended so that the polished end face of the connector can be protected from contamination with or without a dust cap.

Housing 160 includes a first end or top 152 and a second end or bottom 154. Releasable latch 240 is mounted to top 152 and tab 242 is in bottom 154. Extending between top 152 and bottom 154 along sides 166 of housing 160 are rails 156. Keying feature 238 is positioned along rail 156 and extends beyond a rear face 158 of rail 156. A portion of housing 160 extending beyond rear face 158 of rail 156 is sized to fit within opening 226. When inserted within opening 226, rear face 158 of rail 156 engages front face 228 and keying feature 238 engages one of the ears 236 to properly orient top 152 and bottom 154 of housing 160.

To insert housing 160 within opening 226, bottom 154 is first positioned within opening 226 through front face 228 so that a locking face 243 of tab 242 is behind front face 228 at bottom end 225 and engages rear surface 229 of front face 228. Top 152 is then inserted within opening 226. A ramped face 244 of releasable latch 240 engages top end 227 of opening 226 and deflects to permit ramped face 244 and locking face 241 of releasable latch 240 to pass through opening 226. Locking face 241 of releasable latch 240 engages rear surface 229. Opposing both locking faces 241 and 243 are rear faces 158 of rails 156, which are engaging front face 228. Both keying features 238 engage ears 236 of opening 226. Releasable latch 240 includes a finger tab 246 which may be depressed to retract locking face 241 so that locking face 241 disengages from rear surface 229 and permits removal of housing 160 from opening 226. Housing 160 is configured to be

inserted through front face 228 of bulkheads 124 or 224 when cabinet 100 or 200 is access through opening 140 in front 126.

Referring now to FIGS. 7 to 13, housing 160 of connector holder 122 includes an orientation slot 170 and latching arms 168 within each opening 150.

5 Latching arms 168 cooperate with latching features of an SC style adapter to allow such connectors to be releasably held within openings 150. For other styles and types of connectors, different latching features might be included within opening 150 to permit these connectors to be releasably held. Orientation slot 170 may 10 cooperate with an orientation feature on the exterior of an SC connector to orient all connectors within openings 150 in the same fashion. Such orientation of connectors is not essential for SC connectors, which have generally symmetrical latching features, but may be desirable for other connectors with different latching 15 configurations.

Referring now to FIG. 14, splitter 102 includes a housing 172 with a 15 cable entry 174 for secondary cable 104 and a pair of cable exits 176 for cables 114. As shown, each cable exit 176 allows for up to sixteen cables 114 to exit housing 172. Terminating each cable 114 is a connector 180 with a polished end face 182, shown as an SC connector. Other sizes and layouts of cable exits are anticipated. Different numbers of cables 114 may exit housing 172, depending on the connection 20 requirements to be satisfied and the optical splitter arrangement within splitter 102. Mounted to one side of housing 172 is a releasable latch 178 to hold splitter 102 within splitter mounting area 103 of cabinet 100 or 200, or similarly configured telecommunications connection cabinets.

FIG. 14A shows a fiber optic device module 202 similar in layout to 25 splitter 102 with secondary cable 104 and a plurality of cables 114. Secondary cable 104 may be a single strand cable and module 202 may include a splitter to connector cable 104 with cables 114, such as described above with regard to module 102. Alternatively, cable 104 may be a multi-strand cable and module 202 may serve 30 only as a fan-out module separating the strands into cables 114. Each of the cables 114 are terminated by a connector 180 and each connector 180 is inserted within a connector holder 122. Such a module 202 may be used in the method of adding connection capacity described below.

A method of adding connection capacity to cabinet 100 might include installing a preconfigured splitter 102 in combination with one or more connector

holders 122. It is desirable to provide for easy field expansion of connection capacity within cabinet 100 so that cabinet 100 does not need to anticipate the ultimate connection configuration for a particular customer service area when installed. Cabinet 100 may be installed with only enough connection capacity to serve the immediate need forecasted for a customer area and allow for incremental expansion as more connections are needed in the area. The following method of adding connection capacity to cabinet 100 is also applicable to cabinet 200 and may be used to initially configure cabinet 100 prior to installation or to expand the capacity of cabinet 100 in the field.

10 To increase connection capacity within cabinet 100, a splitter 102 preconfigured with a cable 104 and thirty-two cables 114 terminated by connectors 180 is used. The splitter 102 is mounted within splitter mounting area 103 and the free end of cable 104 is led into cable management structure 112 and to splice panel 110. In splice panel 110, the free end of cable 104 is spliced into an end of an OSP cable 106. This splice optically connects OSP cable 106 to each of the cables 114. Connectors 180 of cables 114 are pre-inserted within four connector holders 122. Cables 114 are led from splitter 102 through cable management structure 112 to second cable management structure 116 where excess cable length may be retained within the cable slack storage arrangement. Since splitter 102 may be preconfigured for use with different cabinets as well as cabinet 100, the length of cables 114 of splitter may be longer than required for cabinet 100 and this excess length may be held about the cable slack storage spools 117 (see FIG. 1).

20 From second cable management area 116, cables 114 and connector holders 122 with connectors 180 inserted are positioned within excess cable storage area 118. Each connector holder 122 is simply snapped into one of the openings 226 of bulkhead 124. Addition of extra connection capacity is now completed. When a customer connection is required, a customer equipment cable 108 is led into cabinet 100 and terminated with a connector 180. This connector is inserted within a rear opening of an adapter 123 within adapter array 120. Alternatively, when cabinet 30 100 is installed, the rear of all adapters 123 in adapter 122 may have customer equipment cables 108 prewired and these cables led to the customer premises in anticipation of future customer hookups. When such a prewired customer desires a live connection, a cable 114 merely needs to be inserted into the front of the appropriate adapter 123. One of the cables 114 within excess cable storage area 118

is selected and its connector 180 is removed from connector holder 118. The selected cable 114 is re-routed within second cable management area 116 as needed to provide a desired length of cable and the connector 180 is inserted within the appropriate adapter 123 in adapter array 120. If connector 180 of the selected cable 114 includes a dust cap to protect the polished end face of the fiber, this dust cap is removed prior to insertion into the adapter 123.

5 Splitter 102 includes thirty-two cables 114 and connectors 180, inserted within four connector holders 122 when splitter 102 is installed. As these cables 114 and connectors 180 are transferred into adapter array 120, some or all of 10 the connector holders 122 may be emptied of all connectors 180. When this happens, the empty connector holder 122 may be removed from excess cable storage area 118 and discarded or recycled. Removal of these empty connector holders 122 would free openings 226 in bulkhead 124 to permit connector holders of additional splitters 102 to be installed and more capacity to be added to cabinet 100.

15 If a connection to customer equipment needs to be terminated, the connector 180 of the appropriate cable 114 may be removed from the adapter 123. The cable 114 is then rerouted within the cable management structure 116 and the connector 180 inserted within an opening 150 of a connector holder 122 within excess cable storage area 118.

20 Splitter mounting area 103 of cabinet 100 includes spaces to mount up to four splitters 102, while cabinet 200 provides spaces to mount up to eight splitters 102. Thus configured, cabinet 100 has a capacity to connect up to split up to four OSP cables into thirty-two cables 114 each, or up to a total of one hundred twenty eight cables 114. Within adapter array 120 there are a sufficient number of 25 adapters 123 to permit connection of each of these cables 114 to a corresponding customer equipment cable 108.

However, cabinet 200 has the capacity to split up to eight OSP cables into thirty-two cables 114 each, or up to a total of two hundred fifty-six cables 114. Adapter array 120 in cabinet 200 only provides a total of two hundred sixteen 30 adapters 123 for receiving connectors from cables 114. Once adapter array 120 has been fully populated with cables 114, there may be up to forty excess cables 114 within excess cable storage area 118 which are not provided with an adapter 123 for connection with a customer equipment cable 108.

As shown in FIGS. 4 to 13, housing 160 of connector holder 122 with eight openings 150 has generally the same footprint as an array of eight adapters 123. When adapter array 120 has been fully populated with cables 114 from splitters 102, connector holders 122 may be removed from openings 226 in bulkhead 124 and up to eight adapters 123 may be positioned in each opening 226. By fully filling five of the openings in bulkhead 124 with adapters 123, an additional forty cables 114 can be connected with customer equipment cables 108, effectively increasing the capacity of adapter array 120 so that the forty excess cables 114 may be utilized. Even with five of the openings 226 in used by adapters 123, there are still openings 226 remaining for connector holders 122 so that cables 114 can be stored when connections with customer equipment cables are eliminated or changed.

FIG. 15 shows a third alternative embodiment of a telecommunications connection cabinet 300, similar in configuration to cabinets 100 and 200, but including bulkhead 224 in excess cable storage area 118. Adapter panels 121 and bulkhead 224 are angled toward cable management structure and slack storage 116 to improve transfer of cables 114 from cable management structure 116 to adapters 123 and to connector holders 122. In addition, cables supports 302 are provided on both panels 121 and bulkhead 224 to provide support to cables 114 extending to adapters 123 and connector holders 122, respectively.

FIG. 16 illustrates a fourth embodiment of a telecommunications connection cabinet 400 according to the present invention. Cabinet 400 is similar in configuration to the previously described cabinets 100, 200 and 300, with a cable management structure 416 with cable slack storage along both sides of adapter array 120 and excess cable storage area 118. Adapters 123 adjacent the left side of panels 121 are angled toward the left side of cabinet 400 and adapters 123 adjacent the right side of panels 121 are angled toward the right side of the cabinet.

FIG. 17 is a fifth embodiment of a telecommunications cabinet 500 including side-by-side structure 502 within the cabinet. Each structure 502 is similar in configuration to the contents of cabinet 400.

FIG. 18 is sixth embodiment of a telecommunications cabinet 600 where excess cable storage area 118 is positioned alongside one of an interior wall 602. FIG. 19 shows a bulkhead 604 including a plurality of openings 226 for receiving connector holders 122. The other elements within cabinet 600 are similar to the earlier described cabinets Bulkhead 604 includes a pair of mounting flanges

- 12 -

606 and 608 for connection to the interior 602 and cabinet rear wall 130, respectively.

The above specification, examples and data provide a complete description of the manufacture and use of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in
5 the claims hereinafter appended.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or
10 steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general
15 knowledge.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A splitter and storage apparatus comprising:
 - a splitter housing;
 - 5 a first cable exit member protruding linearly outwardly from one end wall of the housing, the first cable exit member tapering inwardly as the first cable exit member extends away from the housing;
 - 10 an input cable entering the housing;
 - 15 a plurality of first output cables exiting from the housing through the first cable exit member, first ends of the first output cables being terminated with optical connectors;
 - 20 an optical splitter arrangement positioned with the interior of the housing, the optical splitter arrangement configured to receive a signal from the input cable, the optical splitter arrangement further configured to output the signal to second ends of the first output cables; and
 - 25 a connector storage module being configured to receive and store the optical connectors of the first output cables, the connector storage module being separate from the splitter housing.
2. The splitter and storage apparatus of claim 1, wherein the input cable enters the splitter housing through the end wall from which the first cable exit member protrudes.
3. The splitter and storage apparatus of claim 2, wherein the input cable does not enter the splitter housing through the first cable exit member.
- 25 4. The splitter and storage apparatus of claim 1, further comprising:
 - a second cable exit member protruding from the end wall adjacent the first cable exit member; and
 - 30 a plurality of second output cables extending through the second cable exit member outwardly from the housing, a first end of each of the second output cables being terminated with a connector, and a second end of each of the second output cables communicatively coupled to the optical splitter arrangement.

2005264949 15 Jul 2008

- 14 -

5. The splitter and storage apparatus of claim 1, wherein the first cable exit member includes a base portion coupled to the splitter housing, the base portion extending from a first end arranged adjacent the splitter housing to a second, inwardly tapered end, the first cable exit member also including an end portion tapering outwardly from the base portion.
6. The splitter and storage apparatus of claim 1, wherein at least a portion of the first cable exit member flares outward.
- 10 7. The splitter and storage apparatus of claim 1, wherein the first output cables extending through the first cable exit member include at least six cables.
8. The splitter and storage apparatus of claim 1, wherein the first output cables extending through the first cable exit member include sixteen cables.
- 15 9. The splitter and storage apparatus of claim 1, wherein the splitter housing can be releasably coupled to a telecommunications connection cabinet.
10. The splitter and storage apparatus of claim 9, further comprising a latch configured 20 to facilitate releasably coupling the splitter housing to a telecommunications connection cabinet.
11. The splitter and storage apparatus of claim 1, wherein the optical connectors terminating the first output cables extending through the first cable exit member include 25 SC connectors.
12. The splitter and storage apparatus of claim 1, wherein the end walls are not parallel with respect to one another.
- 30 13. A splitter and storage apparatus comprising:
a housing;

- 15 -

an optical splitter arrangement for splitting a first optical signal into a plurality of optical signals, the optical splitter arrangement retained within the housing;

an input cable extending into the housing to transmit the first optical signal to the optical splitter arrangement;

5 a first cable exit member protruding from the housing, the first cable exit member defining an aperture having a maximum cross-dimension, the first cable exit member protruding from the housing a distance greater than the maximum cross-dimension of the aperture; and

10 a first plurality of output cables extending outwardly from the housing through the cable exit member to transmit at least some of the plurality of optical signals from the optical splitter arrangement, the plurality of output cables having connectorized ends; and

a connector storage module being configured to receive and store the connectorized ends of the first output cables, the connector storage module being separate from the housing.

15

14. The splitter and storage apparatus of claim 13, further comprising:

at least a second cable exit member protruding from the housing; and

15 a second plurality of output cables extending outwardly from the housing through the second cable exit member to transmit at least some of the plurality of optical signals from the optical splitter arrangement.

16. The splitter and storage apparatus of claim 14, wherein the second cable exit member is positioned adjacent to the first cable exit member.

25 16. The splitter and storage apparatus of claim 13, wherein the input cable does not extend through the first cable exit member.

17. The splitter and storage apparatus of claim 13, wherein the connectorized ends of the first output cables include SC connectors.

30

18. The splitter and storage apparatus of claim 13, wherein thirty-two output cables are

coupled to the optical splitter arrangement and extend outwardly from the housing.

19. The splitter and storage apparatus of claim 13, wherein at least first and second cable exit members protrude from the housing, and wherein sixteen output cables extend 5 outwardly through each cable exit member.

20. The splitter and storage apparatus of claim 13, wherein at least first and second cable exit members protrude from the housing, and wherein at least six output cables extend outwardly through each cable exit member.

10

21. The splitter and storage apparatus of claim 13, wherein the connector storage module includes a molded, one-piece, plastic connector holder having a front side and an opposite rear side, the front side of the connector holder defining a plurality of openings, each opening being configured to receive the connectorized end of one of the first output 15 cables from only the front of the connector holder.

22. The splitter and storage apparatus of claim 13, whereing at least sixteen output cables extend outwardly through the first cable exit member.

20 23. The splitter and storage apparatus of claim 13, wherein at least six output cables extend outwardly through the first cable exit member.

24. The splitter and storage apparatus of claim 13, wherein the maximum cross-dimension is defined by a circular diameter of the aperture.

25

25. A splitter and storage apparatus comprising:
a fiber optic splitter;
a splitter housing in which the fiber optic splitter is located;
a first plurality of splitter output cables that extend outwardly from the splitter 30 housing at an exit location, each of the splitter output cables of the first plurality being terminated by a fiber optic connector; and

5 a first exit member projecting outwardly from the splitter housing at the exit location, the first exit member defining a passage through which the splitter output cables extend, the passage defining a transverse cross-sectional area at a first location along a length of the passage, and the first plurality of splitter output cables occupying at least a majority of the transverse cross-sectional area of the passage at the first location; and

a connector storage module being configured to receive and store the fiber optic connectors of the splitter output cables, the connector storage module being separate from the splitter housing.

10 26. The splitter and storage apparatus of claim 25, wherein the first exit member projects outwardly from an end wall of the splitter housing, and wherein an input cable enters the splitter housing through the end wall from which the exit member projects.

15 27. The splitter and storage apparatus of claim 26, wherein the input cable does not enter the splitter housing through the first exit member.

28. The splitter and storage apparatus of claim 25, wherein the first exit member includes a boot.

20 29. The splitter and storage apparatus of claim 25, further comprising:

a second exit member projecting from the splitter housing adjacent the first exit member; and

25 a second plurality of splitter output cables extending through a passage defined by the second exit member, each of splitter output cables of the second plurality of splitter output cables being terminated by a fiber optic connector, the passage of the second exit member defining a transverse cross-sectional area at a first location along a length of the passage, and the second plurality of splitter output cables occupying at least a majority of the transverse cross-sectional area of the passage at the first location along the length of the passage of the second exit member.

30

30. The splitter and storage apparatus of claim 25, wherein the splitter output cables

extending through the first exit member include at least six cables.

31. The splitter and storage apparatus of claim 25, wherein the first plurality of splitter output cables extending through the first exit member include at least sixteen cables.

5

32. The splitter and storage apparatus of claim 25, wherein the splitter housing is configured to be releasably coupled to a telecommunications connection cabinet.

10 33. The splitter and storage apparatus of claim 25, further comprising a latch configured to facilitate releasably coupling the splitter housing to a telecommunications connection cabinet.

34. The splitter and storage apparatus of claim 25, wherein the fiber optic connectors terminating the splitter output cables include SC connectors.

15

35. The splitter and storage apparatus of claim 25, wherein the connector storage module includes a connector storage block having a front side and an opposite rear side, the connector storage block defining a plurality of connector storage receptacles in which at least some of the fiber optic connectors terminating the splitter output cables are stored, 20 the connector storage receptacles each having a construction different from a functional fiber optic adapter.

36. An apparatus comprising:

a fiber optic splitter;

25

a splitter housing in which the fiber optic splitter is located;

a first plurality of splitter output cables that extend outwardly from the splitter housing at a first exit location, each of splitter output cables of the first plurality of splitter output cables being terminated by a fiber optic connector;

30

a first exit member that projects outwardly from the splitter housing at the first exit location, the first exit member defining a passage through which the first plurality of splitter output cables pass;

a second plurality of splitter output cables that extend outwardly from the splitter housing at a second exit location, each of splitter output cables of the second plurality of splitter output cables being terminated by a fiber optic connector;

5 a second exit member that projects outwardly from the splitter housing at the second exit location, the second exit member defining a passage through which the second plurality of splitter output cables pass;

10 a first connector holder that is separate from the splitter housing, the first connector holder including a first connector holder housing that receives and holds at least some of the fiber optic connectors that terminate the first plurality of splitter output cables, the first connector holder not including a functional fiber optic adapter; and

a second connector holder that is separate from the splitter housing, the second connector holder including a second connector holder housing that receives and holds at least some of the fiber optic connectors that terminate the second plurality of splitter output cables, the second connector holder not including a functional fiber optic adapter.

15

37. The splitter module of claim 36, wherein sixteen splitter output cables extend through each of the first and second exit members.

20 38. A splitter and storage system, substantially as hereinbefore described, with reference to the accompanying drawings.

39. A splitter and storage apparatus, substantially as hereinbefore described, with reference to the accompanying drawings.

25 40. An apparatus, substantially as hereinbefore described, with reference to the accompanying drawings.

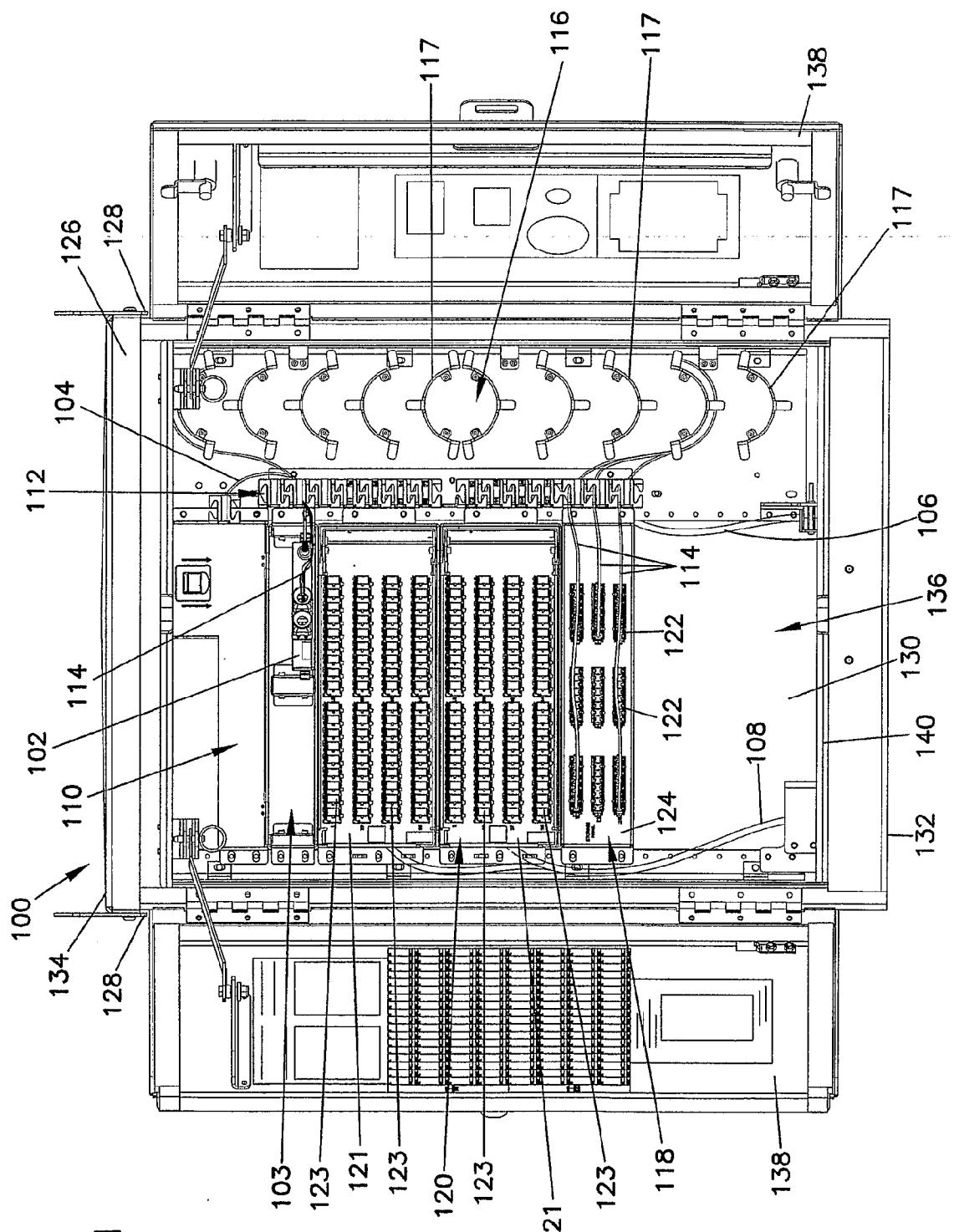


FIG. 1

FIG. 2

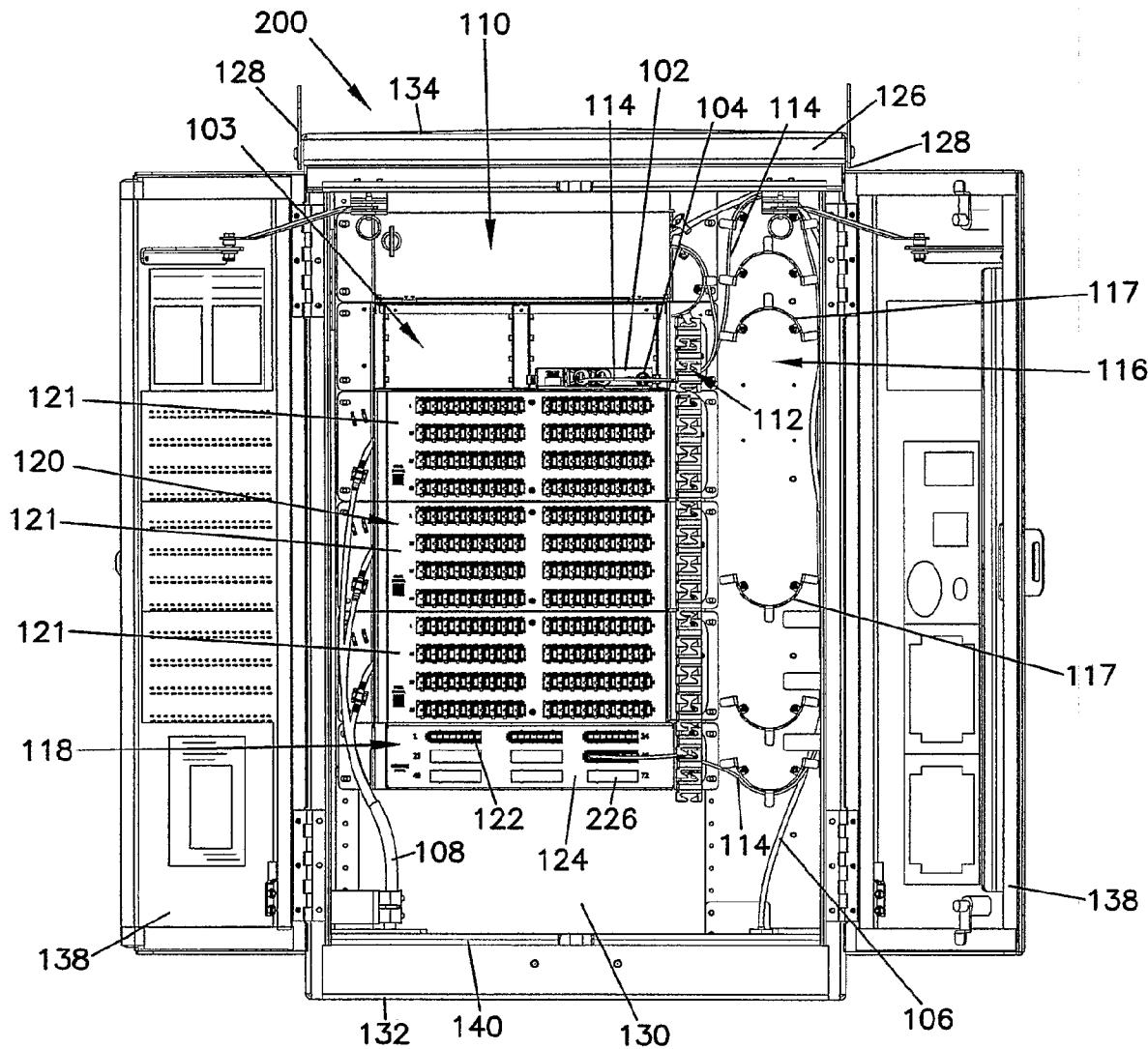
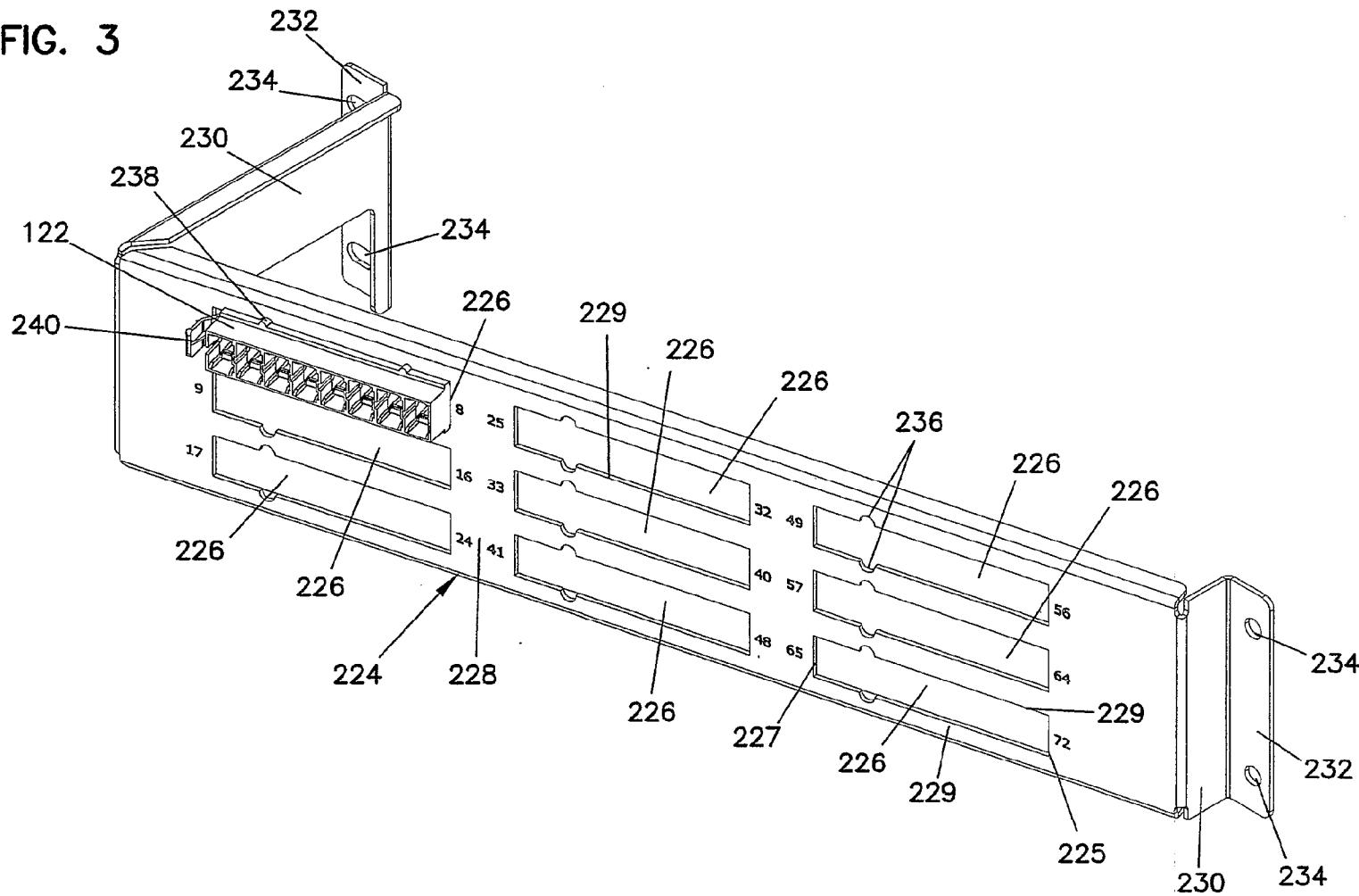
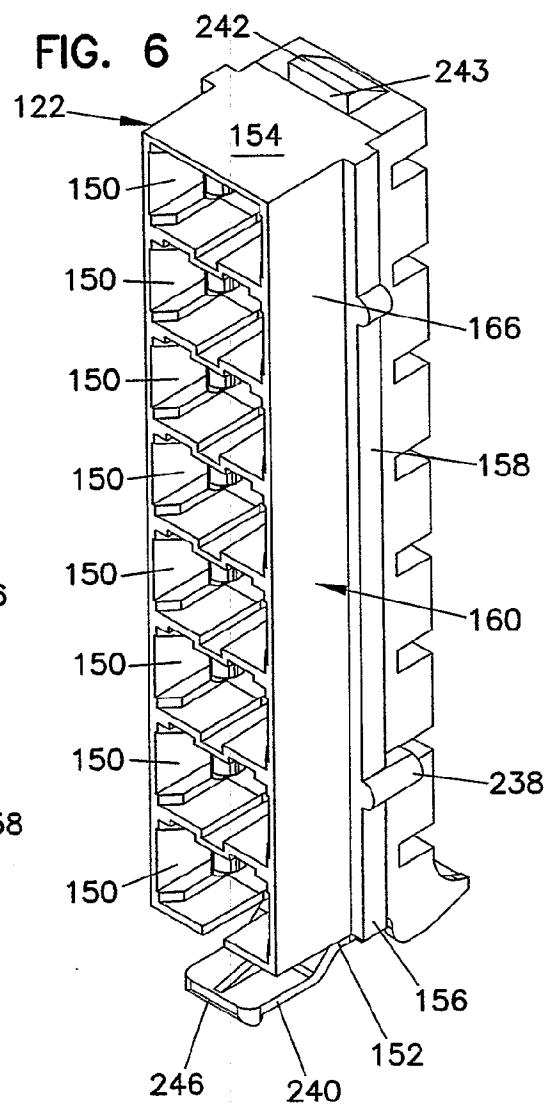
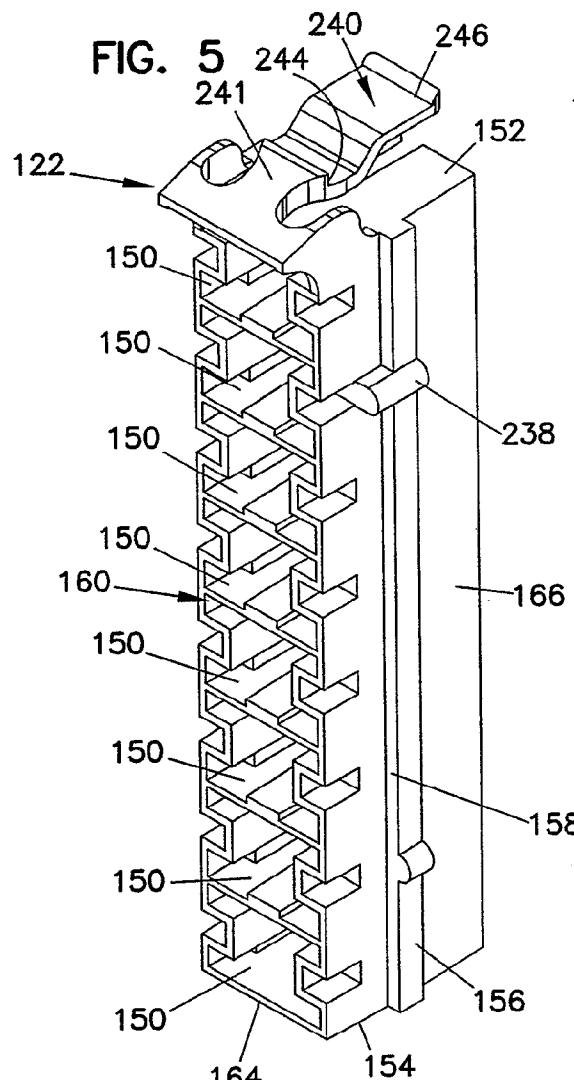
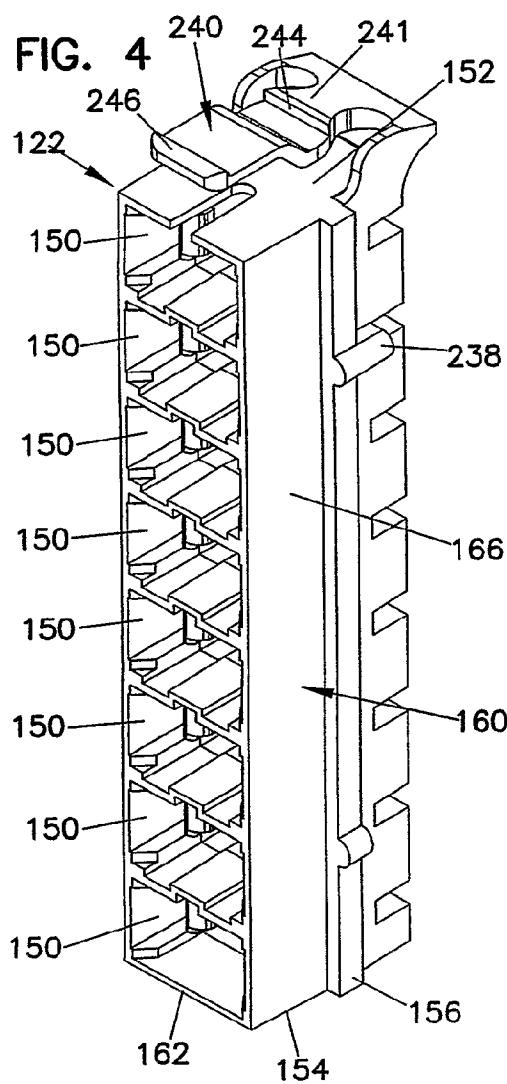


FIG. 3





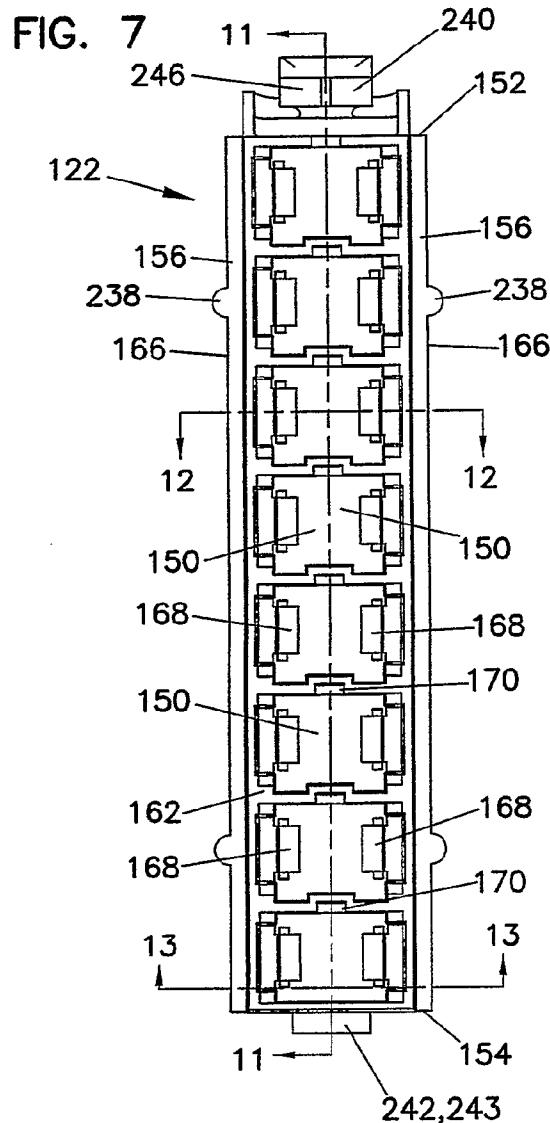


FIG. 11

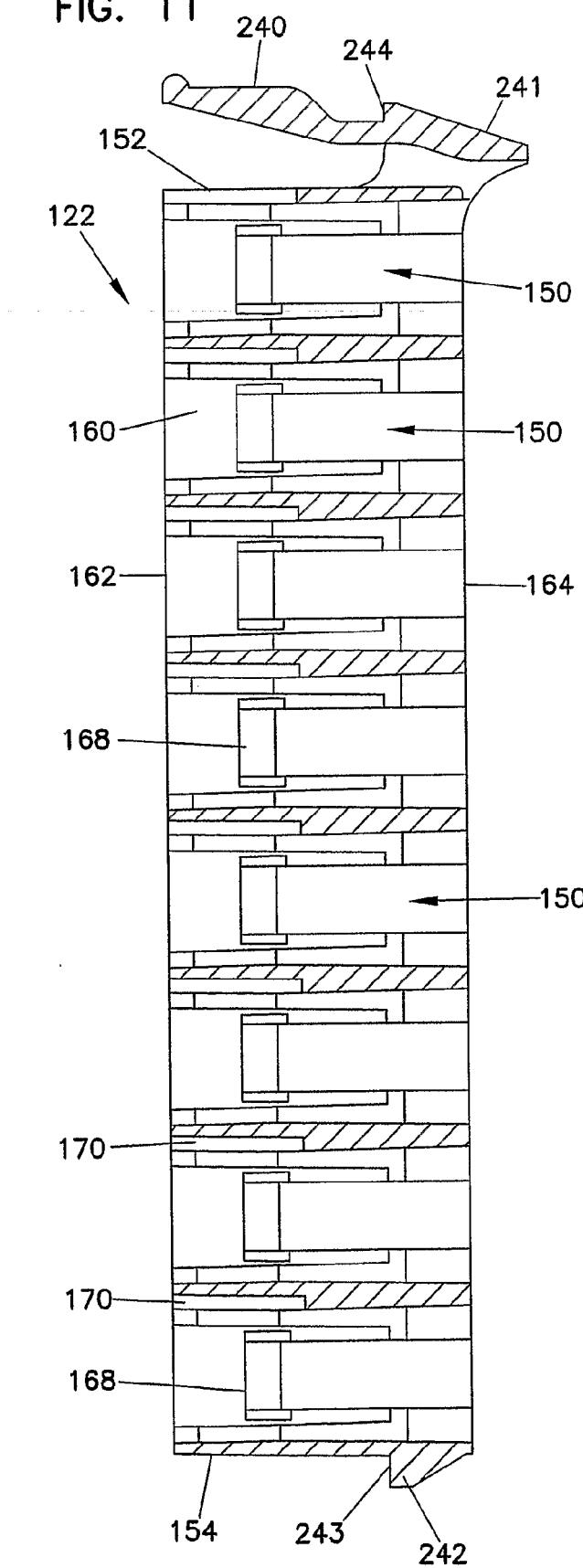


FIG. 12

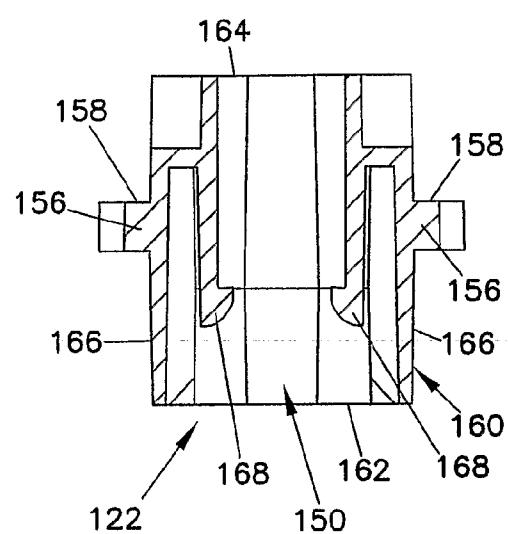
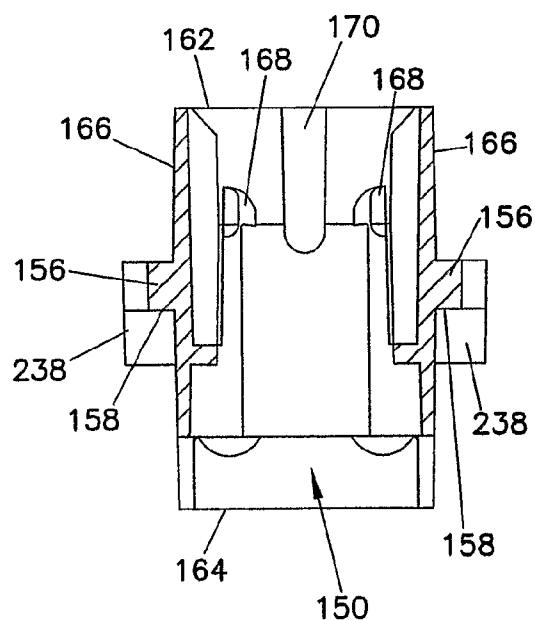


FIG. 13



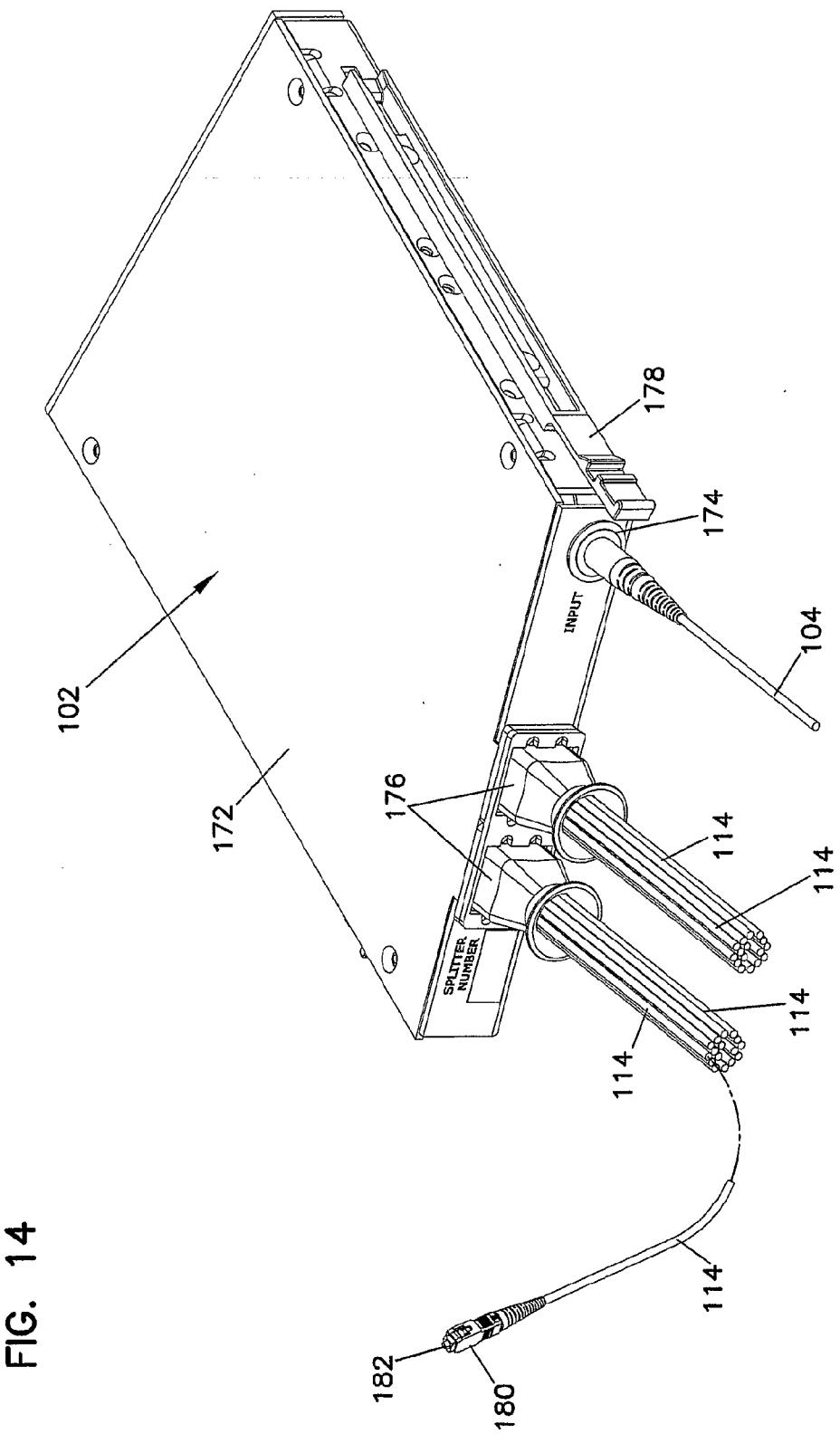


FIG. 14A

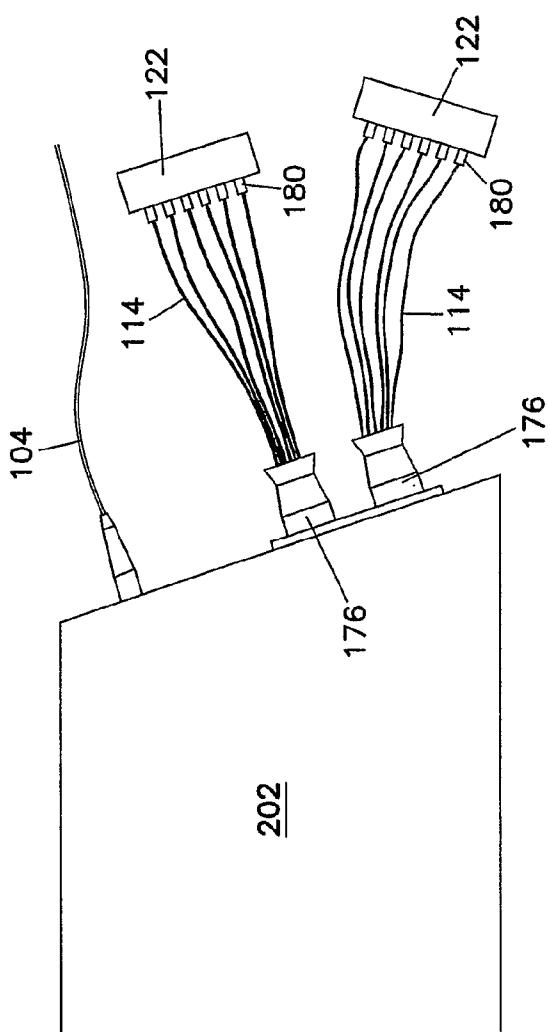


FIG. 15

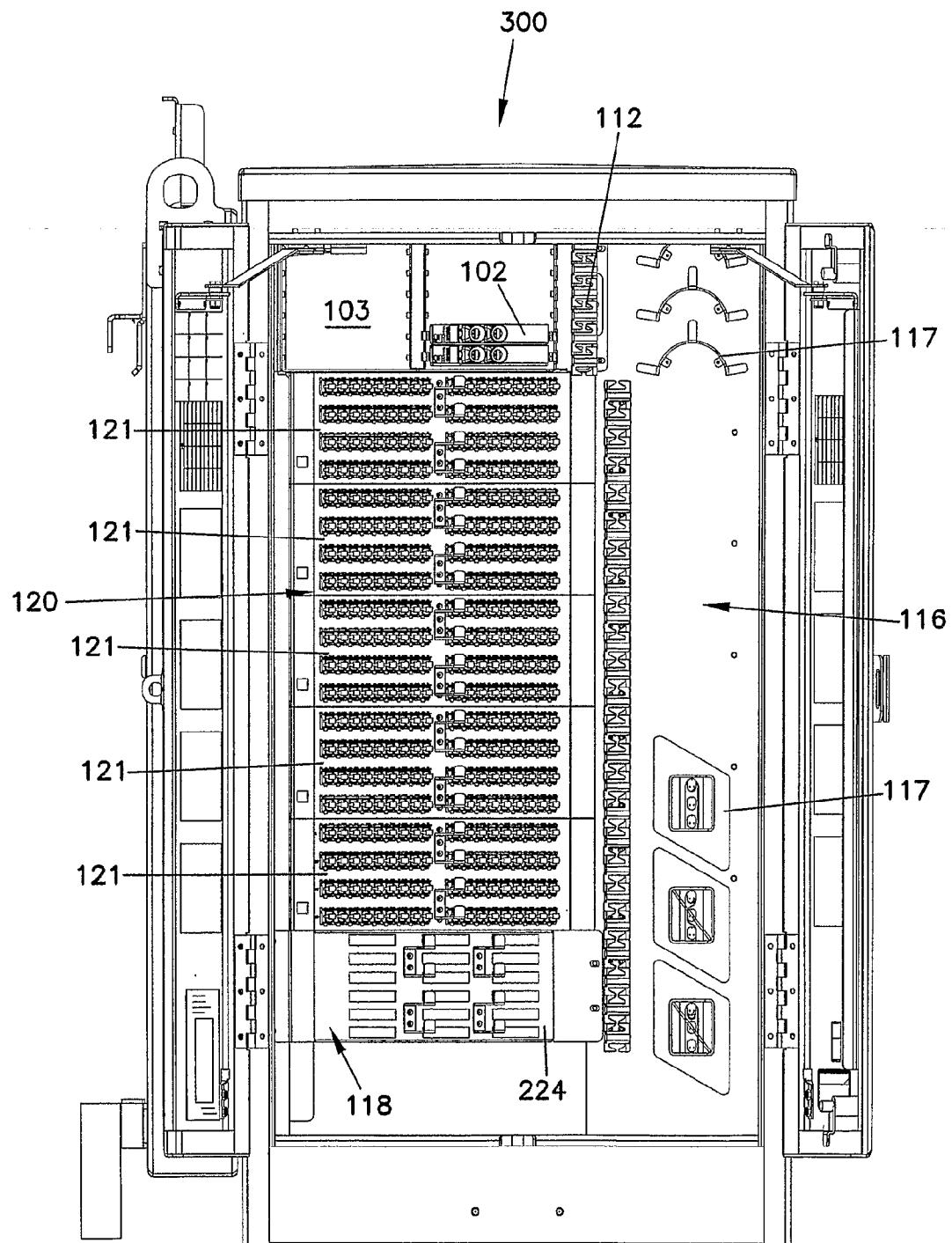
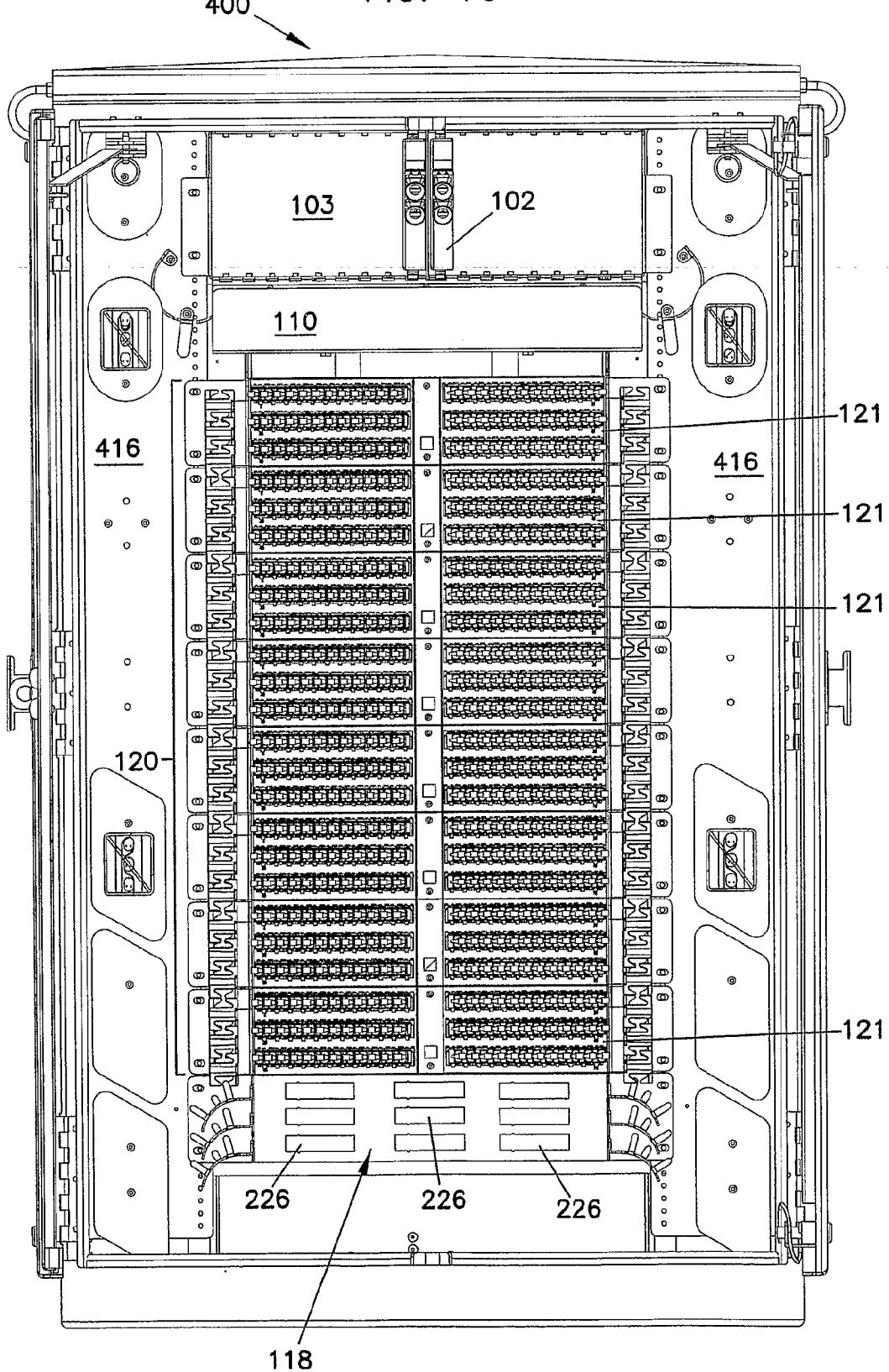


FIG. 16



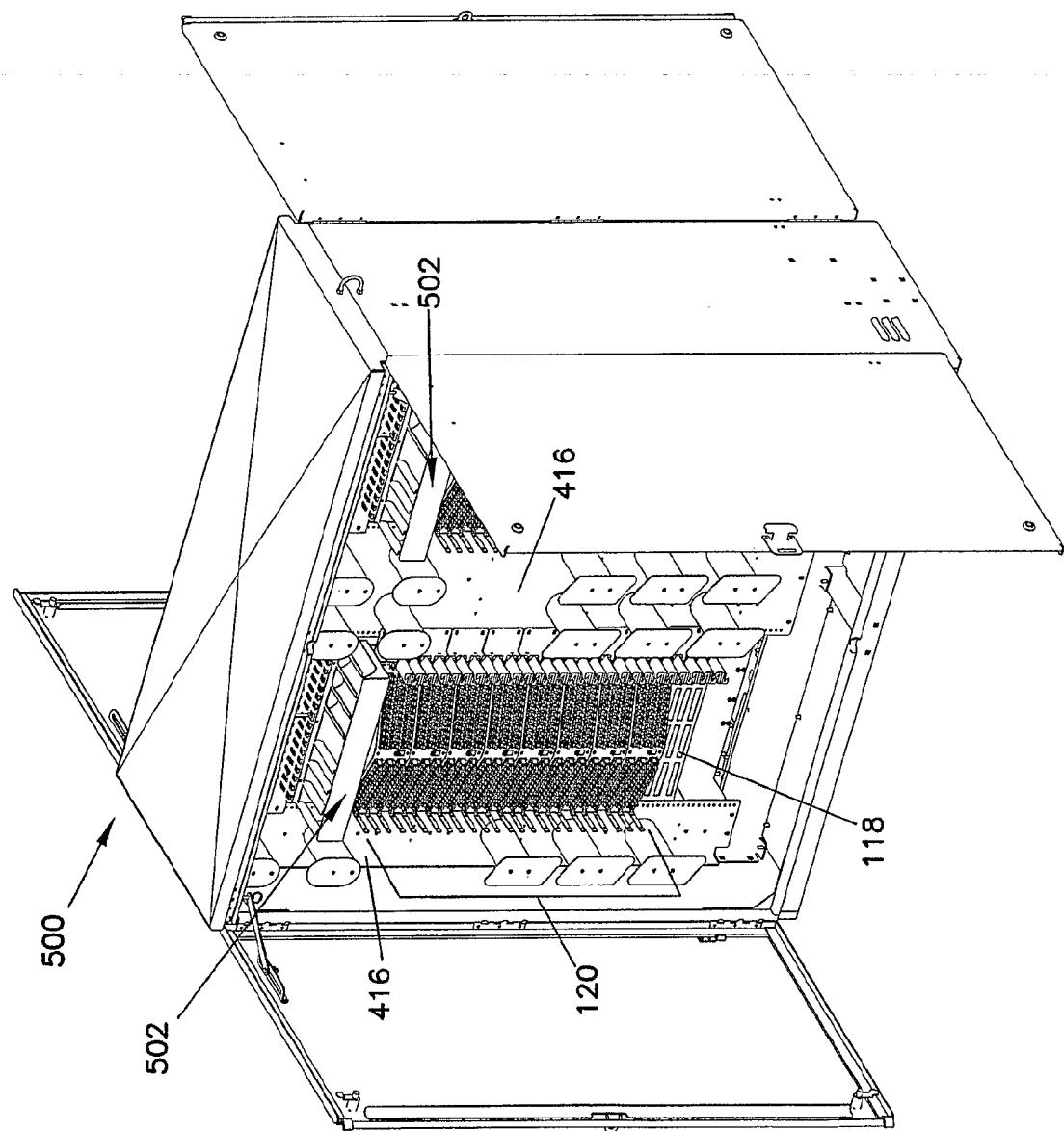


FIG. 17

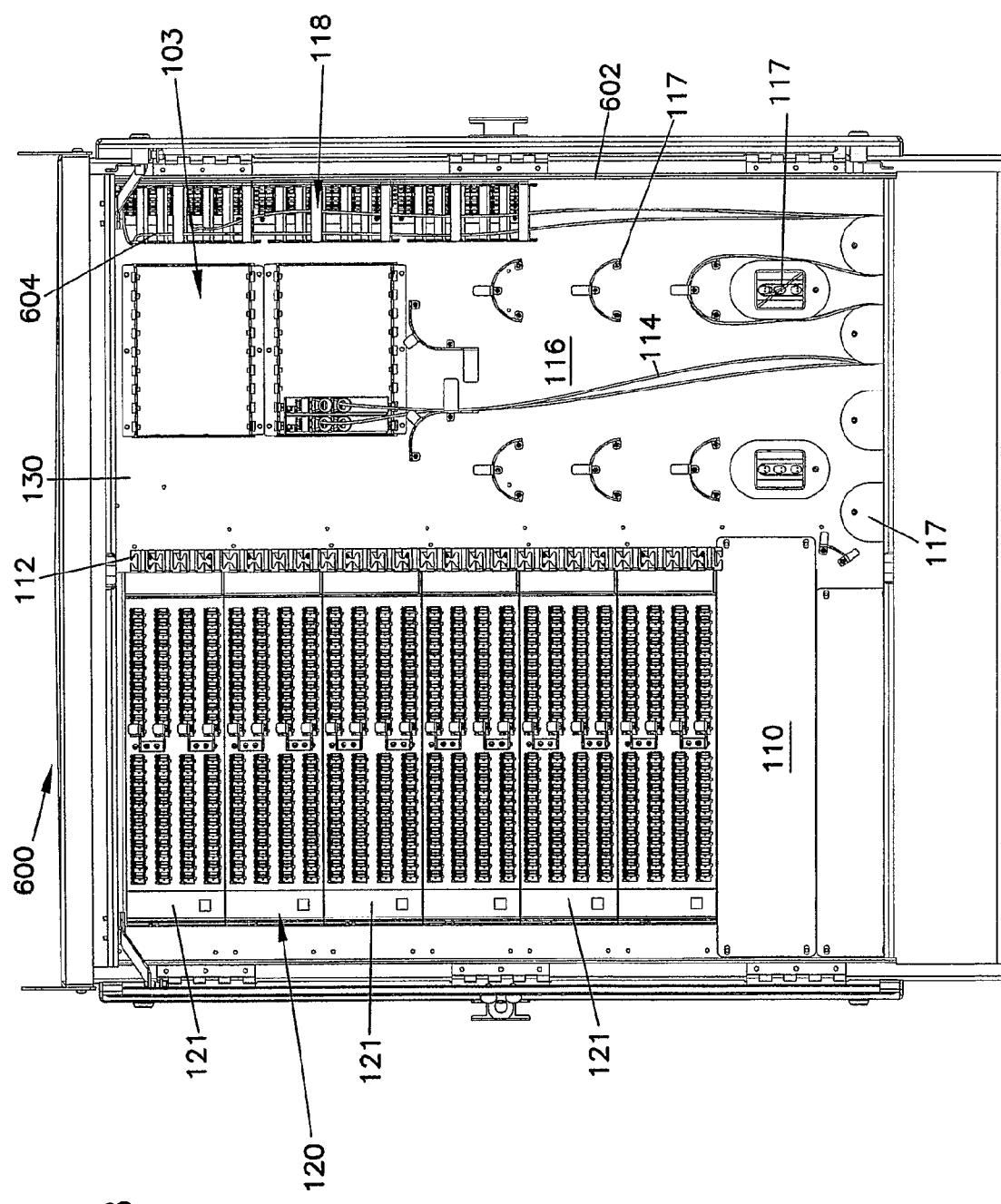


FIG. 18

FIG. 19

