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(54) Title: OPTICAL FIBER STRAIN RELIEF DEVICE AND DISTRIBUTION CABINET

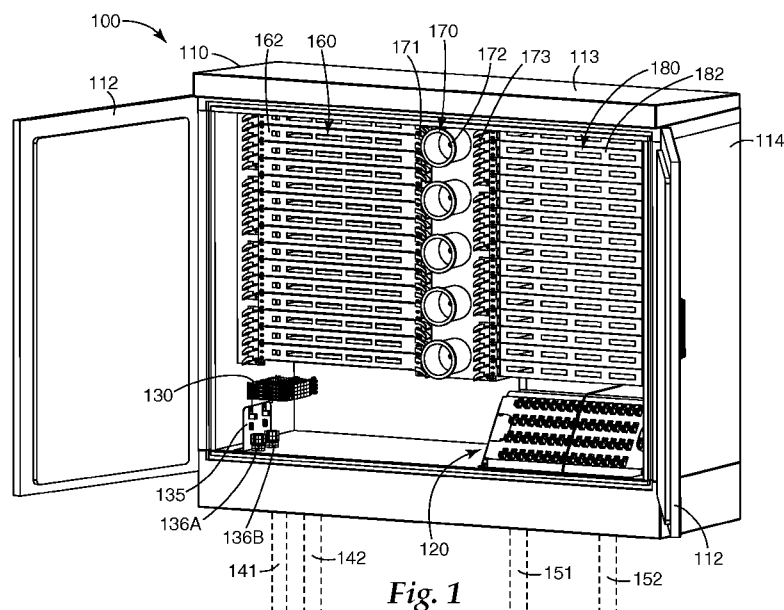


Fig. 1

(57) Abstract: A strain relief and grounding panel for a telecommunications enclosure that terminates a plurality of drop cables. The strain relief and grounding panel comprises at least one securing plate and an array of fastening mechanisms formed on the at least one securing plate. The fastening mechanisms receive and secure the support wire portion of the plurality of drop cables. The telecommunications disclosure receives the plurality of drop cables directly from a high density neighborhood or multi-dwelling unit. The strain relief and grounding panel can be placed in a distribution cabinet to form a terminal cabinet.



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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
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OPTICAL FIBER STRAIN RELIEF DEVICE AND DISTRIBUTION CABINET

The Field of the Invention

The present invention generally relates to telecommunications systems. More particularly, the present invention relates to an optical fiber distribution cabinet for an optical fiber based network.

Background

Telecommunication networks based on optical fiber cables are well known. As telecommunication cables are routed across networks, it is necessary to periodically open the cable and splice or tap into the cable so that data may be distributed to “branches” of the network. The branches may be further distributed until the network reaches individual homes, businesses, offices, and so on. The distributed lines are often referred to as drop lines or distribution lines.

Usually, the network comprises a central office (CO) and/or a fiber distribution hub (FDH) that distributes thousands of communication lines out to the series of closures/terminals that house these branching points, such as at a fiber closure, a fiber terminal closure, a fiber terminal, and the like.

Summary

A first aspect of the invention described herein provides a strain relief and grounding panel for a telecommunications enclosure that terminates a plurality of fiber optic drop cables. The strain relief and grounding panel comprises at least one securing plate and an array of fastening mechanisms formed on the at least one securing plate. The fastening mechanisms receive and secure the support wire portion of the plurality of drop cables. The optical fiber distribution cabinet receives the plurality of drop cables directly from a high density neighborhood or multi-dwelling unit.

In one aspect, the array of fastening mechanisms comprises a plurality of lugs arranged in a plurality of rows and columns on the at least one support plate, where the spacing between each column forms a guide channel of sufficient width to guide a plurality of drop cables.

In another aspect, at least two securing plates are formed in a stacked arrangement on a support structure, where each securing plate is detachable (either partially or

completely) from the support structure. The support structure can be the cabinet itself or a separate structure.

In another aspect, each fastening mechanism can receive a plurality of support wires.

5 In another aspect, each securing plate can secure and ground at least 200 drop cables.

In another aspect of the invention, an optical fiber distribution cabinet, comprises a splitter panel to receive a plurality of optical fibers from a central office of a telecommunication network, a distribution panel comprising a plurality of terminated drop
10 cables, the distribution panel linked to the splitter panel via a series of jumpers, and the strain relief and grounding panel described above.

In yet another aspect, the optical fiber distribution cabinet includes front access doors, side walls, a rear wall, a top wall, and a base. In another aspect, the optical fiber distribution cabinet is a passive device. In a further aspect, the cabinet is an outdoor
15 cabinet. In yet another aspect, the cabinet is mounted to one of a concrete pad and a telecommunications pole.

The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the present invention. The figures and the detailed description that follows more particularly exemplify these embodiments.

20 **Brief Description of the Drawings**

The present invention will be further described with reference to the accompanying drawings, wherein:

Fig. 1 is an isometric view of an optical fiber distribution cabinet according to an exemplary aspect of the present invention.

25 Fig. 2 is a close up isometric view of a strain relief and grounding panel of the cabinet according to an exemplary aspect of the present invention.

Fig. 3 is an isometric side view of the optical fiber distribution cabinet of Fig. 1.

Fig. 4 is a front view of the strain relief and grounding panel of Fig. 2.

Figs. 5A - 5C show cross section views of exemplary fiber optic drop cables.

30 Fig. 6 is a front view of an exemplary splitter unit.

Fig. 7 is a schematic view of an optical network that includes an optical fiber distribution cabinet according to an exemplary aspect of the present invention.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to
5 cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the appended claims.

Detailed Description

In the following Detailed Description, reference is made to the accompanying drawings, which form a part hereof, and in which is shown by way of illustration specific
10 embodiments in which the invention may be practiced. In this regard, directional terminology, such as “top,” “bottom,” “front,” “back,” “leading,” “forward,” “trailing,” etc., is used with reference to the orientation of the Figure(s) being described. Because components of embodiments of the present invention can be positioned in a number of different orientations, the directional terminology is used for purposes of illustration and is
15 in no way limiting. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention.

An optical fiber distribution cabinet for an optical fiber based network is described herein. In exemplary aspects, the fiber distribution cabinet is operated outdoors as an
20 above-ground, passive device that can accommodate several hundred fiber drops directly from a multi-dwelling unit (MDU) or high density neighborhood. The exemplary cabinet can provide grounding, routing, and strain relief for this high count of drop cables. In this sense, the fiber distribution cabinet herein is a terminal cabinet that can accommodate a large count of drop cable home runs. With this scheme, the need for additional and
25 separate fiber closures and terminals is eliminated.

Figs. 1-6 show an exemplary fiber distribution cabinet 100 and components thereof according to a first aspect of the present invention. As shown in Fig. 1, cabinet 100 is a sturdy structure having a generally rectangular body 110, with one or more front access doors 112, side walls 114, a top 113, a rear wall 117 (see Fig. 3) and a base 116. In a
30 preferred aspect, only a front access would be needed, such as is provided by doors 112 shown in Fig. 1. However, in an alternative aspect, side and/or rear access doors or panels can also be provided.

The body components can be constructed from any conventional cabinet material, such as a metal. In one aspect, the cabinet 100 is formed from aluminum. In another aspect, the cabinet 100 is formed from steel. In addition, cabinet 100 can be provided with insulation (not shown) disposed inside the walls and top of the cabinet. As illustrated,
5 cabinet 100 is an above-grade (i.e., above-ground) cabinet and can be mounted on a pad of concrete that provides a stable foundation. In an alternative aspect, the cabinet 100 can be pole mounted for an aerial network.

In an alternative embodiment, if required, cabinet 100 can further include one or more fans or an air conditioning unit. In this alternative embodiment, a battery or external
10 power source can be provided.

In an exemplary aspect, the interior region of cabinet 100 includes a splitter panel 160, a routing panel 170, and a distribution panel 180. The splitter panel and distribution panel can be conventional rack mounted devices (the rack backbone is omitted for simplicity). The splitter panel includes a plurality of individual splitter units 162 that can
15 provide a 1 (or 2) x N split of the incoming fiber (see e.g., Fig. 6). The splitter panel is preferably a passive device. The routing panel 170 includes a series of fiber guides 171, 173 and cable management spools 172 to manage jumper cables/patch cords coupling the splitter panel 160 to the distribution panel 180. The distribution panel includes a plurality of individual distribution units having terminated fiber drops (thereby acting as patch
20 panel).

In an alternative aspect, cabinet 100 can include a wavelength division multiplexing (WDM) panel (not shown) in place of or in addition to splitter panel 160.

In another alternative aspect, cabinet 100 can further include one or more active components.

In addition, in an exemplary aspect, cabinet 100 includes a strain relief and
25 grounding panel 120 that provides strain relief, cable management, and grounding for at least several hundred individual drop cables. In a preferred aspect, this component is a passive device.

Figs. 5A - 5C show exemplary drop cables 155A (single fiber), 155B (fiber ribbon)
30 and 155C (two discrete fibers). In this aspect, each drop cable includes a support wire 156, a thermoplastic resin or other jacket 154, one or more sets of strength members 157, and a single fiber 158 or multi-fiber ribbon 159. The support wire comprises a metal wire

and the strength members comprise dielectric (e.g., aramid) fibers. These types of drop cables are commercially available from Fujikura Ltd. (model DC-1) and other manufacturers. Alternatively, the cabinet 100 can accommodate other conventional drop fibers, such as a flat drop cable (available from Draka Comteq (e.g., EZ DROP cable), Prysmian, or other manufacturers), as would be apparent to one of skill in the art given the present description.

The drop cables originate at a customer's home, apartment, or premise. The drop cables are fed into cabinet 100 through one or more conduits (e.g., conduits 151 and 152) and can enter cabinet 100 through one or more ports (not shown) located in the base 116. Each drop cable is then routed through the rear interior of the cabinet along rear wall 117 and coupled to the rear portion of distribution panel (see e.g., Fig. 3). The interior region of cabinet 100 also includes one or more feeder cable ports 136A and 136B to receive the one or more feeder cables originating at the CO of the network. These feeder cables are fed into the cabinet 100 by one or more feeder conduits 141 and 142. The fiber lines from the feeder cable(s) are secured via a support plate 135, which provides strain relief. Individual lines are spliced via one or more splice tray units 130 and are subsequently connected to one or more individual splitter units 162 of the splitter panel 160.

In an exemplary aspect, strain relief and grounding panel 120 comprises a support structure 126 that supports one or more securing plates 121 that include a series of fastening mechanisms to secure the support wires 156 of each individual drop cable entering the cabinet 100. In this aspect, the strain relief and grounding panel 120 can be mounted in the cabinet interior on the base of the cabinet. Alternatively, the strain relief and grounding panel 120 could be mounted to a rear wall or a side wall of the cabinet. In another aspect, the support structure can be the cabinet itself and the securing plates can be mounted to the cabinet.

In this exemplary aspect, two securing plates 121A, 121B are shown in a stacked arrangement (with some spacing in between plates), although one, two, three, four, or more securing plates can be utilized. As is shown in Fig. 2, additional securing plates can be spaced behind the front-most securing plate 121A. Each plate can be slightly tilted (see e.g., Fig. 3) to provide additional cable management and routing towards the rear of the cabinet. In addition, each securing plate can be detachable (either partially or completely) from the strain relief and grounding panel support structure 126 to permit access to rear

plates during installation of the drop cables. Alternatively, the securing plates can be hingedly connected to the support structure 126 (e.g., via a downward rotation) to provide more straightforward access to all individual strain relief and grounding panels.

In this exemplary aspect, the fastening mechanisms comprise lugs 122. Each lug
5 122 has an entry hole sufficient in size to receive one or more support wires (which are stripped from the drop cables). In addition, each lug includes a locking mechanism, such as a screw, bolt or cam lock, to secure the one or more support wires. In the embodiment shown in Fig. 2, individual lug 122A secures a single support wire 156 from a single drop cable 155 (a single drop cable is shown for simplicity purposes only). In an exemplary
10 aspect, individual lug 122A can secure up to four support wires from four individual drop cables.

In an alternative aspect, the fastening mechanisms can be configured to secure the strength member portions of one or more of the drops cables.

As each lug is firmly secured to the plate 121, the secured support wires provide
15 relief against axial strains and/or pulling forces as the drop fibers are routed to the distribution panel. The fiber portion of the drop cable 155 is routed through the channel created between the columns of lugs up to the distribution panel.

In an alternative aspect, the fastening mechanisms can comprise clamps, clips, or posts and can utilize a spring mechanism to secure the drop cable support wire in place.

In addition, lugs 122 are arranged in an array of rows and columns for drop cable
20 organization and management. For example, as shown in Fig. 4, the spacing between adjacent columns can form a vertical cable guiding channel 124 of sufficient width to guide a group of drop cables (e.g., four, eight, twelve, sixteen, etc.) towards the distribution panel 180. This arrangement allows for the tight packing and management of
25 drop cables in an organized manner. For example, in one aspect, using the securing plate of Fig. 2, each column of fastening mechanisms can secure up to sixteen support wires – thus two vertical guiding channels can support thirty-two drop cables, which can be fully routed as a bundle to a single distribution panel unit 182.

Fig. 2 shows a plate 121A comprising sixty lugs in a 4 x 15 array. Such an
30 exemplary panel 121A can thus secure and route two hundred forty drop fibers to the distribution panel. Of course, the actual number of rows and columns of fastening

mechanisms can be varied for different applications (e.g., an array of 4 x 10, or 4 x 20, etc.).

As mentioned above, the fiber distribution cabinet 100 can accommodate several hundred fiber drops directly. In one exemplary aspect, cabinet 100 can accommodate at least 400 drop cables, and more preferably 480 individual drop cables. In another aspect, up to 1000 drop cables can be accommodated in cabinet 100. Thus, a greater or fewer number of drop cables can be accommodated by the cabinet 100, as would be apparent to one of skill in the art given the present description.

In a preferred aspect, the one or more securing plates 121 are made of metal and can thus act as a strain relief mechanism, a cable organizer, and as a grounding plate to ground metal support wires.

In addition, the strain relief and grounding panel 120 can further include one or more arcuate cable supports, such as curved plates 123A and 123B, which can guide the drop cables around potentially sharp bends. These arcuate cable supports have a curvature that prevents over-bending of the fiber cable, thus preventing a bending of the fiber cable past the minimum bend radius level for a particular type of drop cable. In addition, as shown in Fig. 3, one or more drop cable routing structures, such as rings 119, can be disposed in the cabinet 100 for further cable guiding. Each individual drop fiber is ultimately terminated in an individual input port of a distribution unit 182 of the distribution panel 180. In an exemplary aspect, each distribution panel unit can support up to thirty-two drop fibers. In a preferred aspect, each distribution panel unit 182 is a sliding panel. Alternatively, a plurality of hinged panel units may be utilized. For example, a conventional distribution panel unit such as a model no. 8423 patch panel, available from 3M Company, can be utilized.

For example, the drop cable fibers can be terminated inside a sliding panel unit 182 and the bundle can be tied down or otherwise secured in the back of cabinet 100. Once the panel unit 182 is pushed back to its secured position in the mounting rack (not shown), the bundle can have an "S"-shaped bend slack region that allows the panel to be pulled out for maintenance as needed.

Referring to Figs. 1 and 6, the feeder fibers are spliced onto connectorized pigtailed (e.g., SC/APC pigtailed), which are connected to the input ports 163 of the splitter panel units 160. An example splitter panel unit 162 is shown in Fig. 6, which shows an

exemplary splitter unit 162, which is configured as a 1 (or 2) by 32 splitter panel. The splitter outputs 164 can then be jumpered by a patch cord (not shown) to one of the many drop cables terminated at the distribution panel 180.

While the exemplary aspects described above show the strain relief and grounding panel 120 incorporated in a cabinet 100, it is also contemplated that strain relief and grounding panel 120 could be utilized in a different telecommunications enclosure. For example, panel 120 could be installed in a conventional cross connect cabinet or enclosure (e.g., indoors, underground, aerial, etc.) thus enabling the cross connect cabinet or enclosure to provide grounding and strain relief for hundreds of home run drop cables.

In another alternative aspect, for a point-to-point telecommunications network, cabinet 100 can omit the splitter panel. In this scheme, feeder cables can be terminated on a feeder panel and cross connected via patch cords to the drop cables terminated on the distribution panel. In this alternative aspect, the cabinet can include a strain relief and grounding panel 120, as is described above.

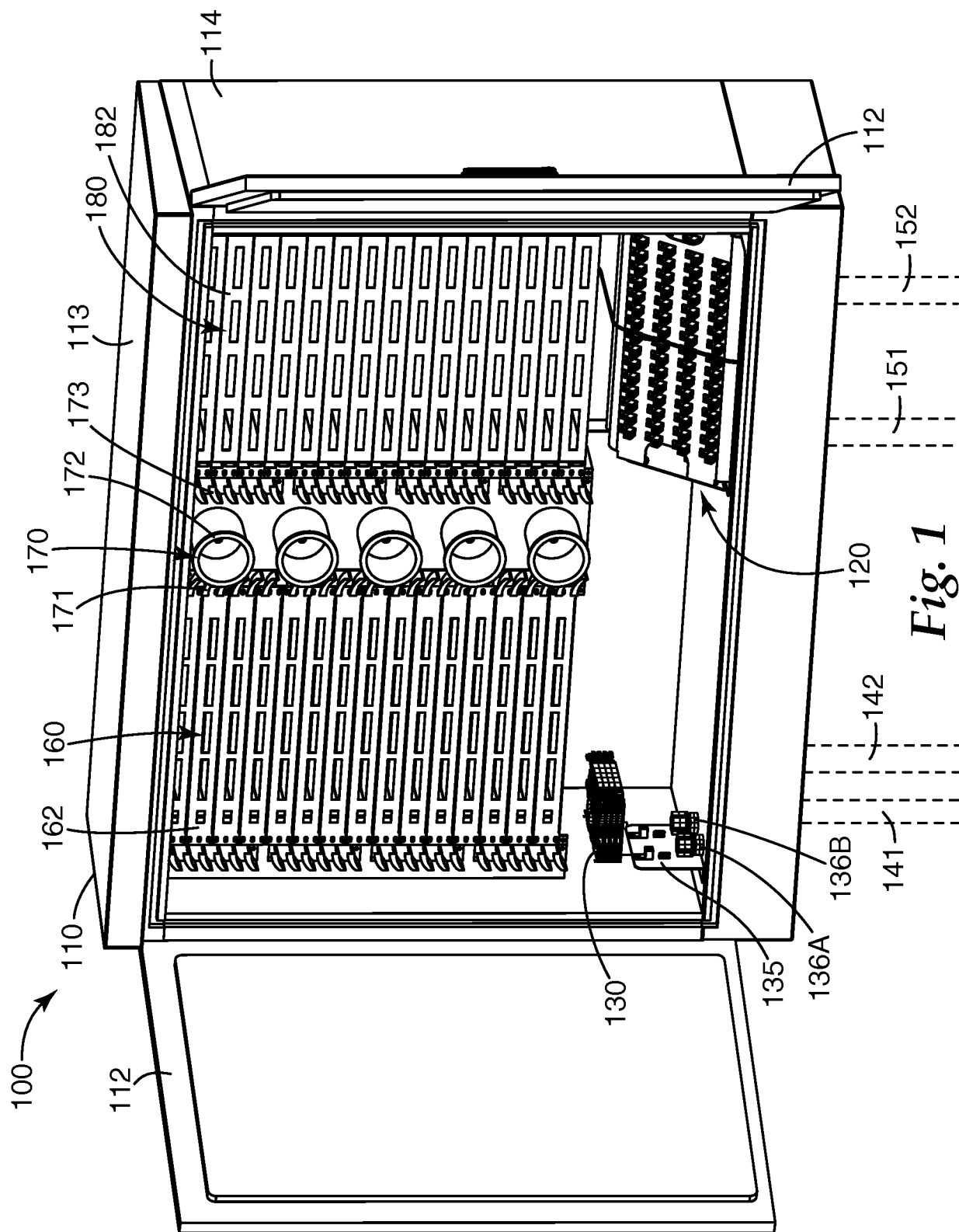
In operation, as is shown in the schematic network of Fig. 7, the feeder cable 50 can originate at the CO 10 and be fed directly into cabinet 100. For example, the feeder cable 50 can comprise a 12, 24 or 48 fiber count cable. As mentioned above, cabinet 100 is configured as a terminal cabinet, where a large number of drop cables 55 from a MDU or high density neighborhood 20 (e.g., 200 drop cables or more) are terminated in cabinet 100 itself. Thus, additional closures and terminals are not needed to be interposed in the network between the customer and the cabinet.

Although specific embodiments have been illustrated and described herein for purposes of description of the preferred embodiment, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate or equivalent implementations may be substituted for the specific embodiments shown and described without departing from the scope of the present invention. Those with skill in the mechanical, optical, and opto-mechanical arts will readily appreciate that the present invention may be implemented in a very wide variety of embodiments. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

WHAT IS CLAIMED IS:

1. A strain relief and grounding panel for a telecommunications enclosure that terminates a plurality of fiber optic drop cables, comprising:
 - at least one securing plate; and
 - 5 an array of fastening mechanisms formed on the at least one securing plate to receive and secure the support wire portion of the plurality of drop cables, wherein the telecommunications enclosure receives the plurality of drop cables directly from a high density neighborhood or multi-dwelling unit.
2. The strain relief and grounding panel of claim 1, wherein the array of fastening
10 mechanisms comprises a plurality of lugs arranged in a plurality of rows and columns on the at least one support plate, wherein the spacing between each column forms a guide channel of sufficient width to guide a plurality of drop cables.
3. The strain relief and grounding panel of claims 1 or 2 comprising at least two securing plates formed in a stacked arrangement on a support structure, wherein each
15 securing plate is detachable at least partially from the support structure.
4. The strain relief and grounding panel of any of the preceding claims, wherein each fastening mechanism can receive a plurality of support wires.
5. The strain relief and grounding panel of any of the preceding claims, wherein each securing plate can secure and ground at least 200 drop cables.
- 20 6. The strain relief and grounding panel of any of the preceding claims, wherein the telecommunications enclosure comprises an optical fiber distribution cabinet.
7. The strain relief and grounding panel of any of the preceding claims, further comprising one or more arcuate cable supports to guide the drop cables and prevent a bending of the drop cable past a minimum bend radius level for the drop cable.

8. An optical fiber distribution cabinet, comprising:
a splitter panel to receive a plurality of optical fibers from a central office of a telecommunication network;
a distribution panel comprising a plurality of terminated drop cables, the
5 distribution panel linked to the splitter panel via a series of patch cords; and
a strain relief and grounding panel of any of the preceding claims.
9. The optical fiber distribution cabinet of claim 8, wherein the cabinet includes front access doors, side walls, a rear wall, a top wall, and a base.
10. The optical fiber distribution cabinet of claim 8 or 9, wherein the optical fiber
10 distribution cabinet is a passive device.
11. The optical fiber distribution cabinet of any of claims 8, 9 and 10, wherein the cabinet is an outdoor cabinet.
12. The optical fiber distribution cabinet of any of claims 8, 9, 10 and 11, wherein the cabinet is mounted to one of a concrete pad and a telecommunications pole.
- 15 13. The optical fiber distribution cabinet of any of claims 8, 9, 10, 11, and 12, wherein the cabinet further includes a WDM panel in combination with the splitter panel.
14. A strain relief and grounding panel for a telecommunications enclosure that terminates a plurality of optical fiber drop cables, comprising:
at least one securing plate; and
20 an array of fastening mechanisms formed on the at least one securing plate to receive and secure the strength member portion of the plurality of drop cables, wherein the telecommunications enclosure receives the plurality of drop cables directly from a high density neighborhood or multi-dwelling unit.



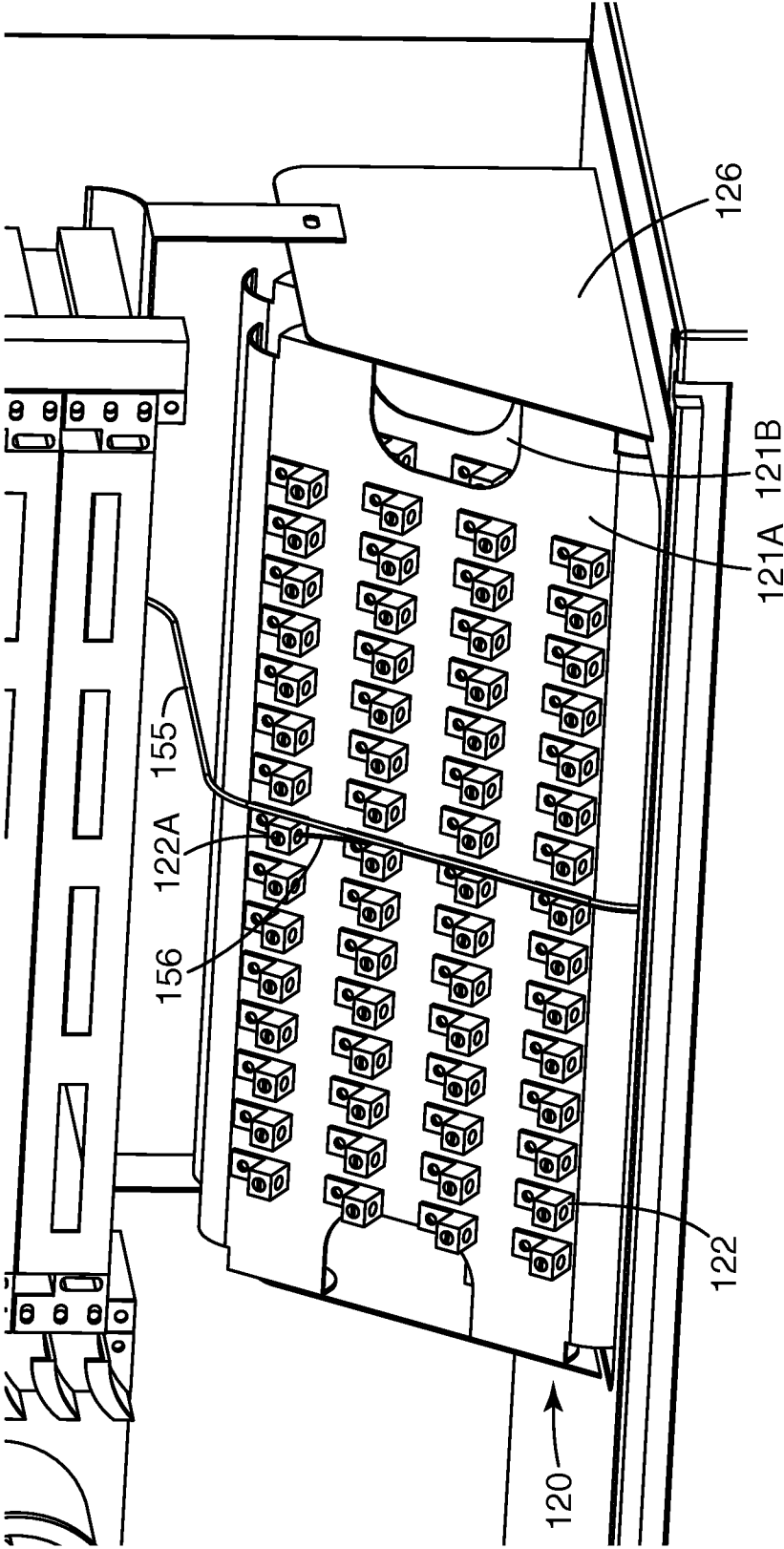


Fig. 2

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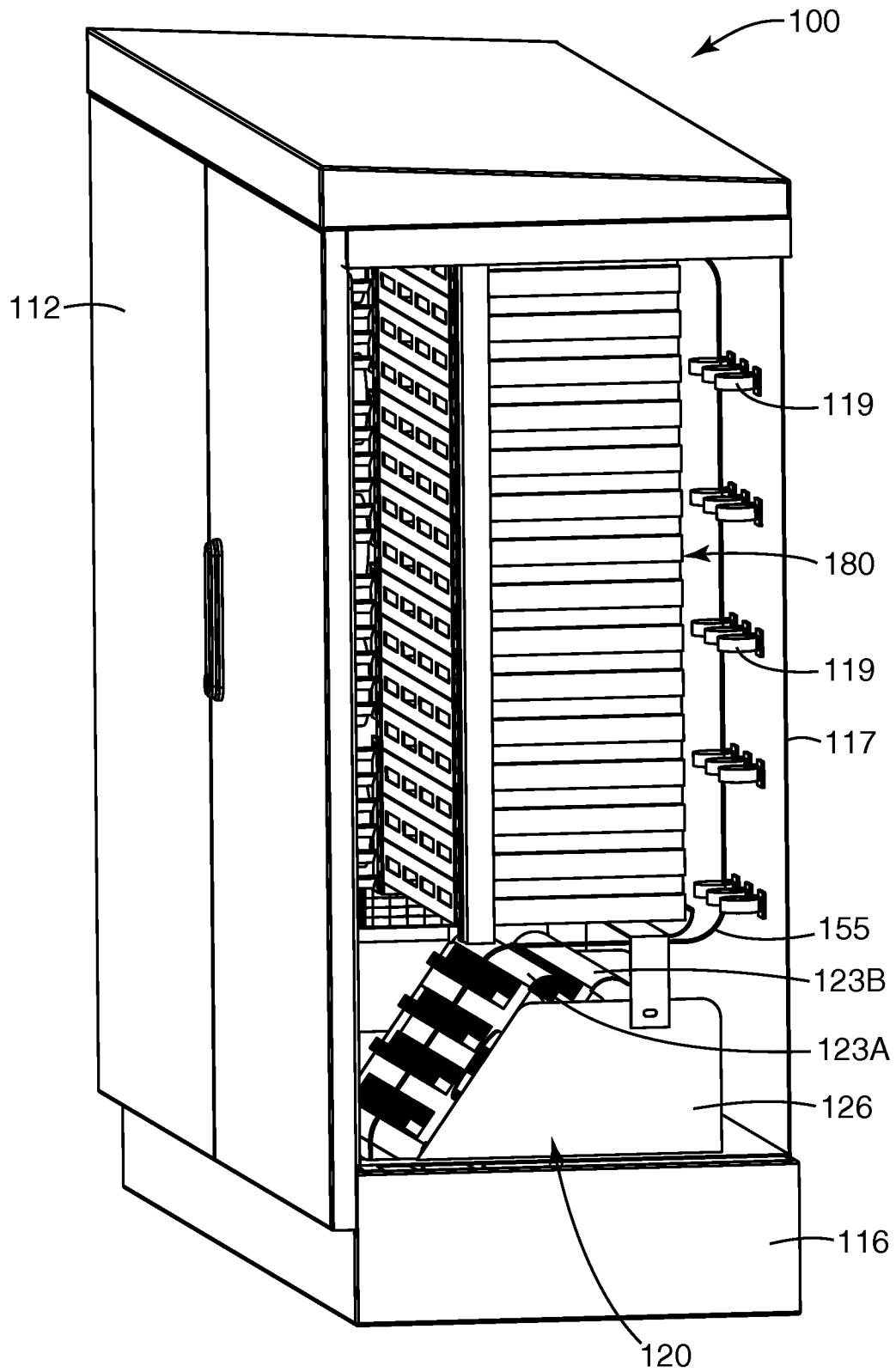
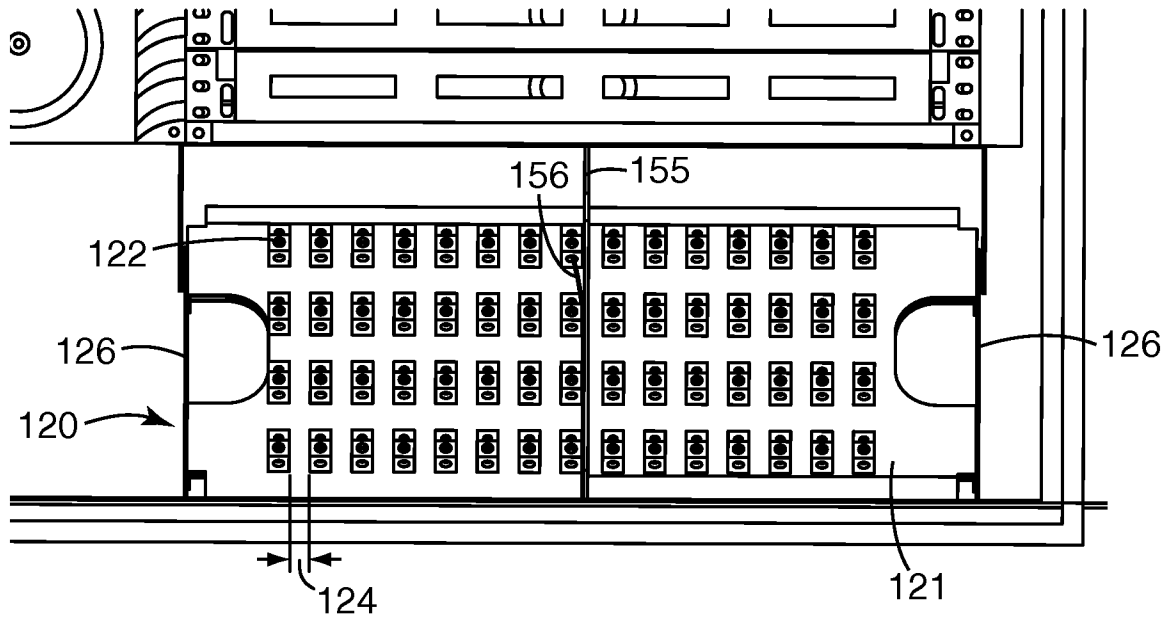
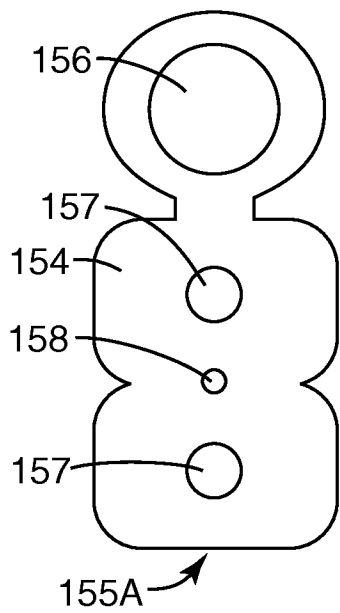
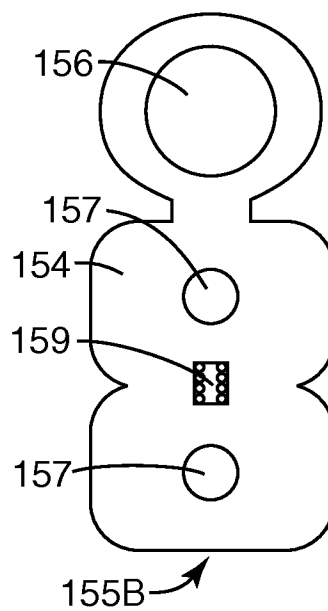
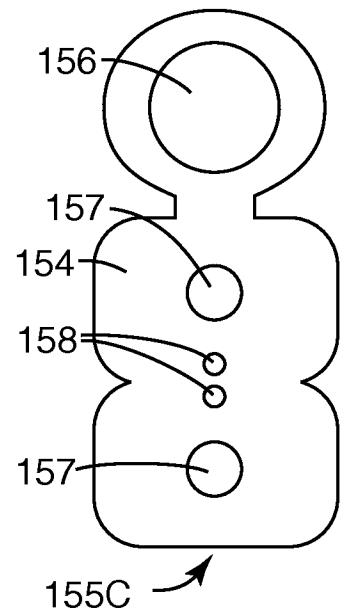
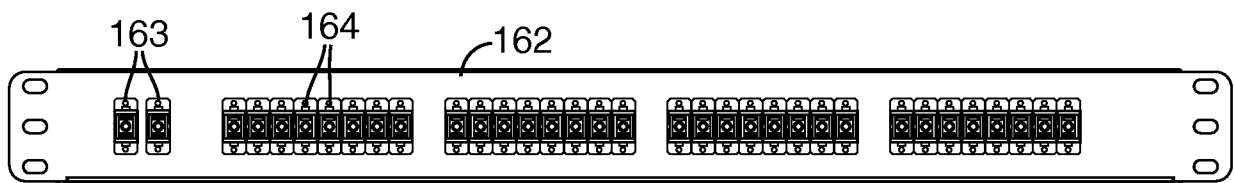
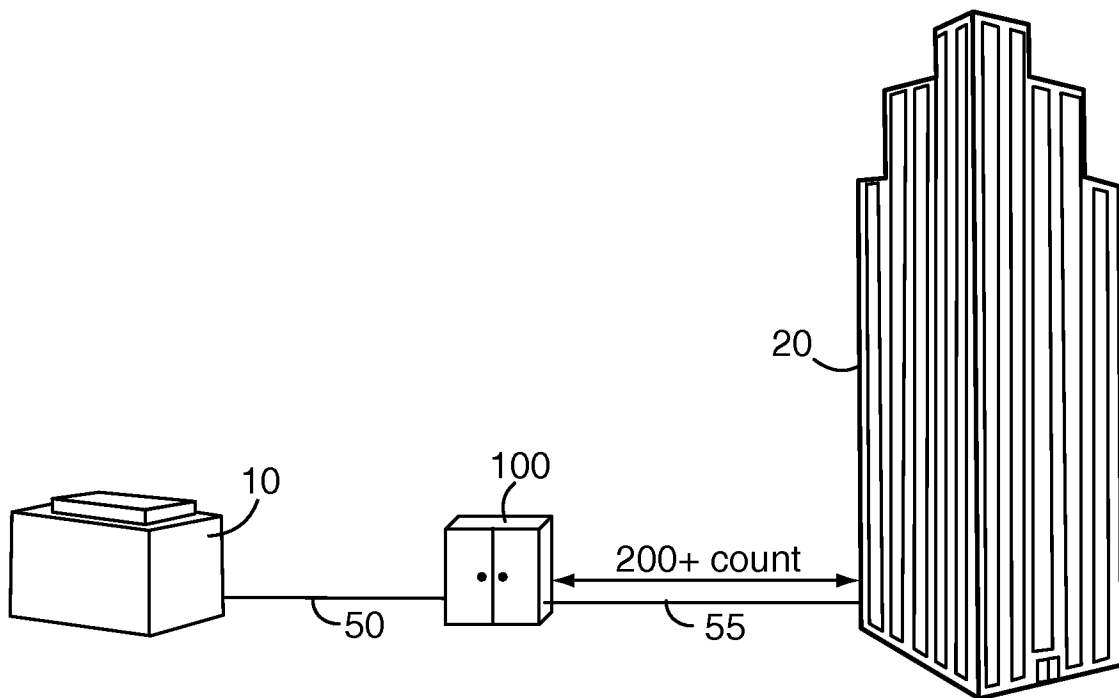


Fig. 3

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*Fig. 4**Fig. 5A**Fig. 5B**Fig. 5C*

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*Fig. 6**Fig. 7*