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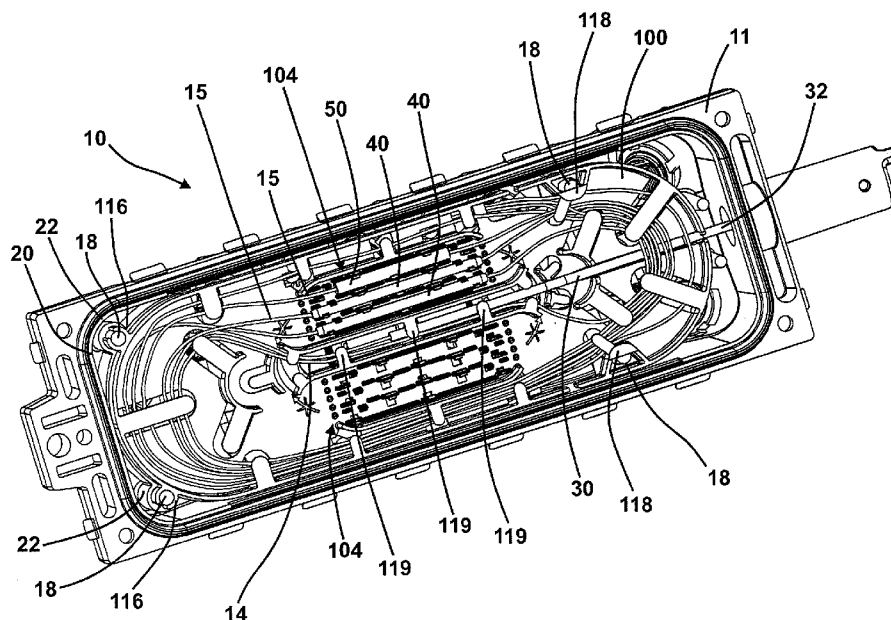
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(54) Title: SPLICE TRAY FOR A TELECOMMUNICATIONS PRODUCT

FIG. 2



(57) Abstract: A splice tray includes a base, a splice containment area projecting from the base, and one or more channels defined by the splice containment area. Each channel having a first set of retaining structures configured to hold a first type of splice and a second set of retaining structures configured to hold a second type of splice. The first type of splice has a first length and a first width and the second type of splice has a second length and a second width. The first length is longer than the second length and the first width is less than the second width.

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— *with international search report (Art. 21(3))*

## **SPLICE TRAY FOR A TELECOMMUNICATIONS PRODUCT**

### **CROSS-REFERENCE TO RELATED APPLICATION**

[0001] This application is being filed on February 28, 2020 as a PCT International Patent Application and claims the benefit of U.S. Patent Application Serial No. 62/812,587, filed on March 1, 2019, the disclosure of which is incorporated herein by reference in its entirety.

### **BACKGROUND**

[0002] Fiber optic networks are prevalent because service providers want to deliver high bandwidth communication capabilities to customers. Networks that utilize fiber optic cables often require optical fiber splicing and storage. A splice tray can be used to store spliced optical fibers inside telecommunications equipment including closures, panels, cabinets, and the like. In certain examples, a splice tray can be used inside a telecommunications closure that includes one or more connector ports. One or more drop cables can be inserted into the connector ports to deliver the high bandwidth communication capabilities to one or more subscriber locations.

### **SUMMARY**

[0003] This disclosure relates generally to devices used in the telecommunications industry. More particularly, this disclosure relates to a splice tray that has an arrangement for holding different types of splices having different dimensions within the same area. In certain examples, the splice tray holds both single and mass fusion splices within a splice containment area.

[0004] In one aspect, a splice tray comprises a base, a splice containment area projecting from the base, and one or more channels defined by the splice containment area. Each channel has a first set of retaining structures configured to hold a first type of splice and a second set of retaining structures configured to hold a second type of splice. The first type of splice has a first length and a first width and the second type of splice has

a second length and a second width. The first length is longer than the second length and the first width is less than the second width.

[0005] In another aspect, a splice tray comprises a base, a splice containment area projecting from the base, and one or more channels defined by the splice containment area. Each channel has a first set of retaining structures configured to hold a single splice and a second set of retaining structures configured to hold a mass fusion splice.

[0006] A variety of additional inventive aspects will be set forth in the description that follows. The inventive aspects can relate to individual features and to combinations of features. It is to be understood that both the forgoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad inventive concepts upon which the examples disclosed herein are based.

### **DESCRIPTION OF THE FIGURES**

[0007] The following drawing figures, which form a part of this application, are illustrative of described technology and are not meant to limit the scope of the disclosure in any manner.

[0008] FIG. 1 is an exploded view of a telecommunications closure.

[0009] FIG. 2 is an isometric view of a splice tray installed relative to a cover.

[0010] FIG. 3 is an isometric view of the splice tray installed relative to a base.

[0011] FIG. 4 is an isometric top view of the splice tray.

[0012] FIG. 5 is an isometric bottom view of the splice tray.

[0013] FIG. 6 is a detailed view of splice attachment areas on the splice tray.

[0014] FIG. 7 is a sectional view of the splice tray taken along the line 7-7 of FIG. 6.

[0015] FIG. 8 is a detailed isometric view of the splice tray.

[0016] FIG. 9 is a detailed isometric view of retaining structures on the splice tray.

[0017] FIG. 10 illustrates a method of assembling the telecommunications closure.

### **DETAILED DESCRIPTION**

[0018] Various embodiments will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various embodiments does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible embodiments for the appended claims.

[0019] FIG. 1 is an exploded view of a telecommunications closure 10. As shown in FIG. 1, the telecommunications closure 10 includes a cover 11 that attaches to a base 13. For example, the base 13 includes a plurality of slots 24 that each receive a corresponding tab 26 of the cover 11 to attach the base 13 to the cover 11. The cover 11 includes a plurality of hardened connector ports 12. In certain examples, the telecommunications closure 10 is a multiport service terminal (MST). In some further examples, the telecommunications closure 10 is a mini MST.

[0020] Inside the telecommunications closure 10, a track device 20 is installed onto the cover 11, and a splice tray 100 is mounted onto the track device 20 and cover 11. The telecommunications closure 10 is configured to store a plurality of optical fibers. The splice tray 100 manages one or more splices between the optical fibers stored inside the closure.

[0021] The splice tray 100 is a multi-functional splice holder that secures both a first type of splice and a second type of splice in the same containment area. The first type of splice has a first length and a first width, while the second type of splice has a second length and a second width. The first length differs from the second length. In certain examples, the first length is longer than the second length. Also, the first width differs from the second width. In certain examples, the first width is less than the second width. Accordingly, the splice tray 100 is configured to contain different types of splices having different dimensions within the same containment area.

**[0022]** FIG. 2 is an isometric view of a splice tray 100 installed relative to a cover 11. As shown in FIG. 2, the splice tray 100 includes attachment locations 116, 118 that each receive a post 18 that projects from the cover 11. In the examples depicted in the drawings, the posts 18 are cylindrically shaped. In certain examples, the posts 18 have a circumference that gradually decreases as the posts 18 project away from the cover 11. As shown in FIG. 2, the attachment locations 116 align with attachment locations 22 of the track device 20. When the closure is assembled, the posts 18 extend beyond the attachment locations 22 of the track device 20 so that the posts 18 enter into the attachment locations 116 of the splice tray 100. In this manner, the splice tray 100 mounts over the track device 20 and is secured to the cover 11.

**[0023]** The track device 20 is secured next to one end of the splice tray 100. In alternative examples, the track device 20 can be secured to an opposite end of the splice tray 100. In further examples, a track device 20 can be secured to each end of the splice tray 100. Accordingly, the splice tray 100 and track device 20 may have a variety of configurations.

**[0024]** Still referring to FIG. 2, a feeder cable 30 enters the telecommunications closure 10 through an opening 32. The feeder cable 30 includes a plurality of optical fibers 14 that break out inside the telecommunications closure 10. The optical fibers 14 are spliced to one or more optical fibers 15 from a splitter cable 16 by splices 40, 50. The splices 40 are used to join single optical fibers and are referred to throughout this disclosure as single splices. The splice 50 is used to join multiple optical fibers and is referred to throughout this disclosure as a mass fusion splice. The splices 40, 50 each have a tubular shape. In the depicted example, the tubular shape of the splices 40, 50 has an oval cross-sectional shape. In other examples, the tubular shape of the splices 40, 50 may have circular, quadrilateral, or other geometric cross-sectional shape.

**[0025]** The splice tray 100 includes a splice containment area 104 configured to contain both the single and mass fusion splices 40, 50. As shown in the depicted example, the dimensions of the splices 40 differ from the dimensions of the splice 50. The splices 40 have a first length and a first width, while the splice 50 has a second length and a second width. In the example shown in FIG. 2, the first length of the splices 40 is longer than the

second length of the splice 50. Further, the first width of the splices 40 is less than the second width of the splice 50.

**[0026]** FIG. 3 is an isometric view of the splice tray 100 installed relative to the base 13. As shown in FIG. 3, the track device 20 can provide structural support for the splice tray 100 inside the telecommunications closure 10. Further, the track device 20 protects the optical fibers 15 that break out from the splitter cable 16 from exposure to other elements in the telecommunications closure 10, and also limits the bend radius of the optical fibers 15 when routed from one corner to the next along the interior perimeter of the cover 11 inside the telecommunications closure 10.

**[0027]** FIGS. 4 and 5 are isometric top and bottom views, respectively, of the splice tray 100. As shown in FIGS. 4 and 5, the splice tray 100 includes a base 102 having a first end 112 and a second end 114. At the second end 114, the base 102 includes an opening 117 configured to receive the feeder cable 30 (see FIG. 2). A channel 125 having a sloped surface extends from the opening 117 and is configured to guide the feeder cable 30 towards a position between the first and second ends 112, 114 of the splice tray 100. Tabs 119 are configured to contain the feeder cable 30 inside the channel 125. Advantageously, the channel 125 and tabs 119 facilitate the breakout of the optical fibers 14 from the feeder cable 30 at the center of the splice tray 100, and improve the stability of the feeder cable 30 inside the telecommunications closure 10. Further, the opening 117 and channel 125 permit only one entry point for the feeder cable 30 to aid consistent assembly between different operators.

**[0028]** While in use, a generous portion of slack for the optical fibers 14 is provided inside the telecommunications closure 10 to permit maintenance or replacement of the splices 40, 50 without requiring cable replacement. The slack is stored in a storage regions 106 within the splice tray 100. Cable management components 108, such as tabs, are located within the storage region 106 for retaining and managing the slack for the optical fibers.

**[0029]** Referring now to FIGS. 2, 4, and 5, the splice tray 100 includes the attachment locations 116 at the first end 112 of the base 102, and the attachment locations 118 at the second end 114 of the base 102. As described above, the attachment locations 116, 118 are

configured to attach the splice tray 100 to the cover 11 of the telecommunications closure 10.

**[0030]** The attachment locations 116 have a cylindrical shape that extends from an outside perimeter of the splice tray 100. The cylindrical shape includes a slit opening 138 that runs along the length of the attachment location 116. The attachment locations 116 are configured to fit around the posts 18 to secure the first end 112 of the splice tray 100 relative to the cover 11, and the attachment locations 116 may have a variety of configurations, shapes, and sizes to match a variety of configurations, shapes, and sizes for the posts 18 that project from the cover 11.

**[0031]** The attachment locations 118 each have a cylindrical portion 136 that extends orthogonally from the base 102 (see FIG. 4), and that is configured to fit around the posts 18. The cylindrical portion 136 includes a slit opening 144 that runs along the length of the attachment location 118. The attachment locations 118 also include a stop 120 that is substantially parallel to the base 102 (see FIG. 5), and that is configured to engage a distal end of the posts 18. The attachment locations 118 are configured to secure the second end 114 of the splice tray 100 relative to the cover 11, and may have a variety of configurations, shapes, and sizes to match a variety of configurations, shapes, and sizes for the posts 18.

**[0032]** Still referring to FIGS. 4 and 5, the base 102 of the splice tray 100 includes one or more slots 146 on opposite sides of the base 102. The slots are configured to receive one or more optical fibers such as the optical fibers 15 from a splitter cable 16 so that the optical fibers 15 can be guided to the splice containment area 104 on the splice tray 100 for splicing with the one or more optical fibers 14 from the feeder cable 30.

**[0033]** The splice tray 100 includes one or more splice containment areas 104. Each splice containment area 104 includes a plurality of walls that project from the base 102. The splice containment areas 104 are configured to contain simultaneously both the single splices 40 and mass fusion splices 50 on the splice tray 100. In some examples, the base 102 and splice containment area 104 are molded together and are a single piece. In other examples, the splice containment area 104 is a modular component that is attachable to the

base 102 such that the base 102 and splice containment area 104 are separately molded pieces.

**[0034]** FIG. 6 is a detailed view of the splice containment areas 104 on the splice tray 100. As shown in FIG. 6, the plurality of walls that project from the base 102 define one or more channels 110 in each of the splice containment areas 104. For example, the plurality of walls define at least three channels 110 on a first side 121 of the splice tray 100 and at least three channels 110 on a second side 123 of the splice tray 100. The channels 110 on the first and second sides 121, 123 are parallel. In alternative examples, the channels 110 on the splice tray 100 may have a variety of configurations, placements, shapes, and sizes.

**[0035]** As shown in FIG. 6, each channel 110 has a first set of retaining structures 130 configured to contain the single splices 40 (see FIG. 2) and a second set of retaining structures 140 configured to contain the mass fusion splices 50 (see FIG. 2).

**[0036]** The first set of retaining structures 130 in each channel 110 include at least one retaining structure 132 at a first end 122 of the channel 110 and at least one retaining structure 132 at a second end 124 of the channel 110. At the first end 122 of each channel 110, the retaining structures 132 are positioned on opposite sides of the channel 110. At the second end 124 of each channel 134, the retaining structures 132 are also positioned on opposite sides of the channel 110. The retaining structures 132 at the first end 122 are offset with respect to a long axis of each channel 110, and the retaining structures 132 at the second end 124 are also offset with respect to the long axis. Each retaining structure 132 provides a snap fit attachment for the single splices 40 in the splice containment areas 104 on the splice tray 100.

**[0037]** The first set of retaining structures 130 at the first end 122 of each channel 110 includes two retaining structures 132, and the first set of retaining structures 130 at the second end 124 of each channel 110 includes two retaining structures 132. In alternative examples, the first set of retaining structures 130 at the first end 122 may include less than or more than two retaining structures 132, and similarly, the first set of retaining structures 130 at the second end 124 may include less than or more than two retaining structures 132.

**[0038]** The second set of retaining structures 140 include at least one retaining structure 142 in a central portion 126 of each channel 110 between the first and second ends 122, 124. In some examples, the second set of retaining structures 140 include at least two retaining structures 142 in the central portion 126. In further examples, the second set of retaining structures 140 include three or more retaining structures 142 in the central portion 126.

**[0039]** The retaining structures 142 are positioned on opposite sides of each channel 110 in the central portion 126, and are offset with respect to the long axis of each channel 110. Each retaining structure 142 provides a snap fit attachment for the mass fusion splices 50 in the splice containment areas 104 on the splice tray 100.

**[0040]** Still referring to FIG. 6, the splice tray 100 includes a plurality of dimples 160 that project from the base 102 of the splice tray 100. The plurality of dimples 160 include a first set of dimples positioned next to the first ends 122 of the channels 110 and a second set of dimples positioned next to the second ends 124 of the channels 110. The dimples 160 contain the single splices 40 in an axial direction relative to the base 102 of the splice tray 100.

**[0041]** Additionally, the retaining structures 132 of the first set of retaining structures 130 at the first and second ends 122, 124 of each channel 110 contain the mass fusion splice 50 in the axial direction relative to the base 102 of the splice tray 100.

**[0042]** In addition to containing the single splices 40 in the axial direction, the dimples 160 also guide a first set of optical fibers (e.g., optical fibers 14) fused by the single splices 40 or the mass fusion splice 50, and a second set of optical fibers (e.g., optical fibers 15) fused by the single splice 40 or the mass fusion splice 50.

**[0043]** FIG. 7 is a sectional view of the splice tray 100 taken along the line 7-7 of FIG. 6. Referring now to FIG. 7, the diameter of the mass fusion splices 50 is larger in size than the diameter of the single splices 40. As shown in FIG. 7, the retaining structures 132 of the first set of retaining structures 130 each have a first height H1 that extends from the base 102 of the splice tray 100. The retaining structures 142 of the second set of retaining structures 140 each have a second height H2 that extends from the base 102. The second

height H2 is larger than the first height H1. This allows the retaining structures 142 to contain the mass fusion splices 50 in a radial direction (e.g., a direction orthogonal to the base 102), while the retaining structures 132 are configured to contain the single splices 40 in the radial direction.

**[0044]** As further shown in FIG. 7, the plurality of dimples 160 define pathways 128 having a first width W1. Each channel 110 has a second width W2. The first width W1 of the plurality of dimples 160 is smaller than the second width W2 of the channels 110. In this manner, the dimples 160 contain the single splice s 40 in the axial direction relative to the base 102 of the splice tray 100. Also, the plurality of dimples 160 can engage the protective buffering tube of the optical fibers 14, 15 to guide the optical fibers 14, 15 on the splice tray 100.

**[0045]** FIG. 8 is a detailed isometric view of the splice tray 100. As shown in FIG. 8, the retaining structures 132 of the first set of retaining structures 130 each provide a snap-fit attachment for the single splices 40 at the first and second ends 122, 124 of each channel 110. Similarly, the retaining structures 142 of the second set of retaining structures 140 each provide a snap-fit attachment for the mass fusion splices 50 at the central portion 126 of each channel 110. Each of the retaining structures 132, 142 includes an arm 150 and a tab 152.

**[0046]** FIG. 9 is a detailed view of the retaining structures 132, 142. The arms 150 are flexible and are configured to flex around the single splices 40. The tabs 152 each include a ramped surface 154 and a shoulder surface 156 that engage the single splices 40.

**[0047]** Referring back to FIG. 8, some of the walls that project from the base 102 in each splice containment area 104 do not include the tabs 152. These walls do not provide structural fixation for the splices 40, 50, but rather define the channels 110 in the splice containment area 104 and provide guidance for an operator to insert the splices 40, 50 into the channels 110.

**[0048]** In accordance with the foregoing, the splice tray 100 is configured to secure both the single splices 40 and mass fusion splices 50 in both axial and radial directions in the same containment area. The splice tray 100 includes a set of snap-fit features that are

offset from each other along the long axis to secure the single splices 40 and mass fusion splices 50 in the radial direction. An interior set of snap-fit features secure a mass fusion splice 50 while an exterior set of snap-fit features secure a single splice 40. Adjacent to the snap-fit features are dimples 160 that project orthogonally from the base 102 of the splice tray 100. The dimples 160 prevent the single splices 40 from dislodging in the axial direction, while the exterior set of snap-fit features prevent the mass fusion splices 50 from dislodging in the axial direction.

**[0049]** Advantageously, the splice tray 100 provides consistently defined locations for splice fixation that eliminates the need to use Room-Temperature-Vulcanizing (RTV) adhesive having a placement that is highly dependent on an operator. The splice tray 100 provides a dedicated location and consistent method for securing both the single and mass fusion splices 40, 50.

**[0050]** FIG. 10 illustrates a method 200 of assembling the telecommunications closure 10. As shown in FIG. 10, the method 200 includes attaching the track device 20 to the cover 11 (step 202); routing the optical fibers 15 through the track device 20 (step 204); attaching the splice tray 100 to the cover 11 (step 206); splicing one or more optical fibers together such as from the splitter cable 16 and the feeder cable 30 (step 208); managing one or more single splices 40 or mass fusion splices 50 by using the splice tray 100 (step 210); and attaching the cover 11 to the base 13 to seal the telecommunications closure 10 (step 212).

**[0001]** The various embodiments described above are provided by way of illustration only and should not be construed to limit the claims attached hereto. Those skilled in the art will readily recognize various modifications and changes that may be made without following the example embodiments and application illustrated and described herein, and without departing from the true spirit and scope of the following claims.

What is claimed is:

1. A splice tray comprising:

a base;

a splice containment area projecting from the base; and

one or more channels defined by the splice containment area, each channel having a first set of retaining structures configured to hold a first type of splice and a second set of retaining structures configured to hold a second type of splice, the first type of splice having a first length and a first width and the second type of splice having a second length and a second width, the first length is longer than the second length and the first width is less than the second width.

2. The splice tray of claim 1, wherein the first set of retaining structures in each channel include at least one retaining structure at a first end of each channel and at least one retaining structure at a second end of each channel.

3. The splice tray of claim 2, wherein the first set of retaining structures at the first end are positioned on opposite sides of the channel, and the first set of retaining structures at the second end are positioned on opposite sides of the channel.

4. The splice tray of claim 3, wherein the first set of retaining structures at the first end are offset with respect to a long axis of each channel, and the first set of retaining structures at the second end are offset with respect to the long axis.

5. The splice tray of claim 4, wherein the first set of retaining structures at the first end include at least two retaining structures, and the first set of retaining structures at the second end include at least two retaining structures.

6. The splice tray of claims 1 or 2, wherein the second set of retaining structures are in a central portion between the first and second ends of the channel.

7. The splice tray of claim 6, wherein the second set of retaining structures are positioned on opposite sides of the channel in the central portion.
8. The splice tray of claim 7, wherein the second set of retaining structures include at least two retaining structures in the central portion.
9. The splice tray of claim 6, wherein the first set of retaining structures have a first height extending from the base, and the second set of retaining structures have a second height extending from the base, and wherein the second height is taller than the first height.
10. The splice tray of claim 6, wherein the first and second sets of retaining structures each permit the first type of splice to snap-fit into the first and second ends of each channel, and permit the second type of splice to snap-fit into the central portion of each channel.
11. The splice tray of claim 6, wherein a first splice containment area defines at least three channels on a first side of the splice trays, and a second splice containment area defines at least three channels on a second side of the splice tray.
12. The splice tray of claims 1 or 6, further comprising dimples projecting from the base, the dimples configured to prevent axial movement of the first type of splice.
13. The splice tray of claim 12, wherein a first set of dimples are positioned next to the first ends of the channels and a second set of dimples are positioned next to the second ends of the channels.
14. The splice tray of claim 13, wherein the dimples define pathways having a first width and each channel has a second width, the first width being smaller than the second width.
15. The splice tray of claims 1 or 6, wherein the splice tray is configured for installation inside a multiport service terminal having a plurality of hardened connector ports.

16. The splice tray as in any one of the preceding claims, further comprising a first type of splice and a second type of splice held in adjacent channels in the splice containment area.

17. The splice tray of claim 16, wherein the first type of splice is a single splice and the second type of splice is a mass fusion splice.

18. A splice tray comprising:

a base;

a splice containment area projecting from the base; and

one or more channels defined by the splice containment area, each channel having a first set of retaining structures configured to hold a single splice and a second set of retaining structures configured to hold a mass fusion splice.

19. The splice tray of claim 18, wherein the dimensions of the single splice differ from the dimensions of the mass fusion splice.

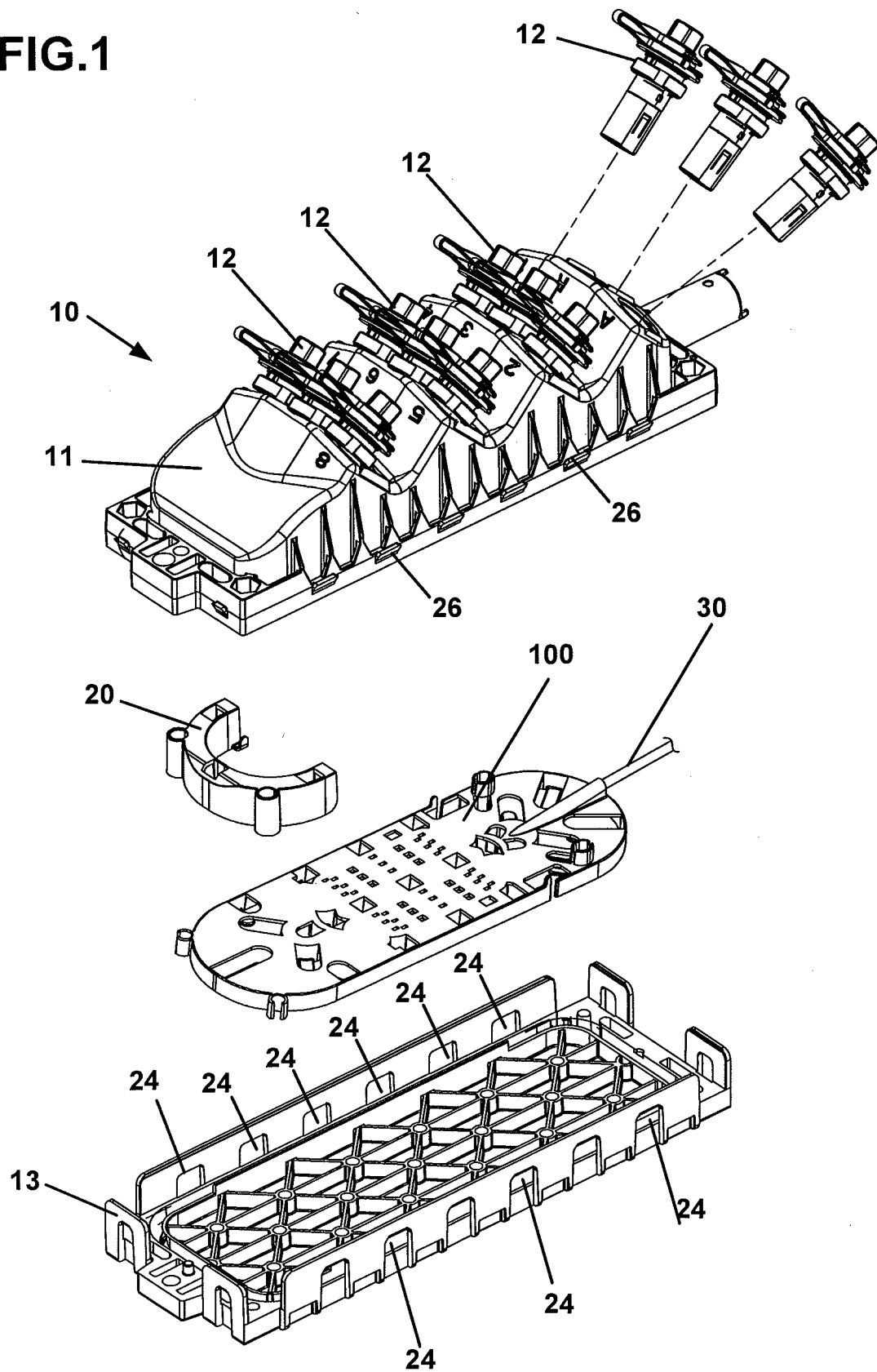
20. The splice tray of claim 18, wherein the single splice has a first length and the mass fusion splice has a second length, and the first length is longer than the second length.

21. The splice tray of claim 20, wherein the single splice has a first width and the mass fusion splice has a second width, and the first width is less than the second width.

22. The splice tray of claim 21, further comprising a single splice and a mass fusion splice held in adjacent channels in the splice containment area.

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FIG.1



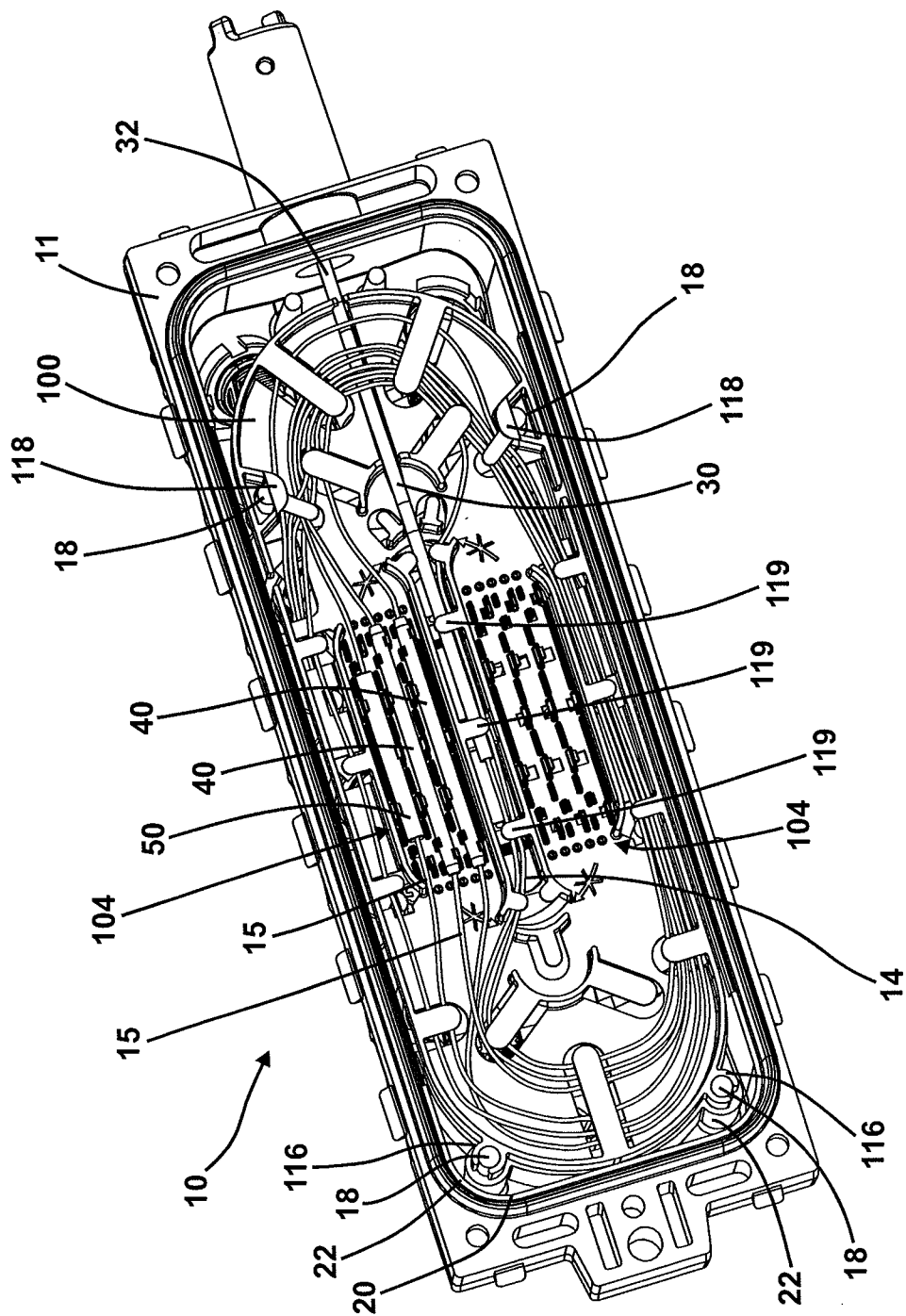


FIG. 2

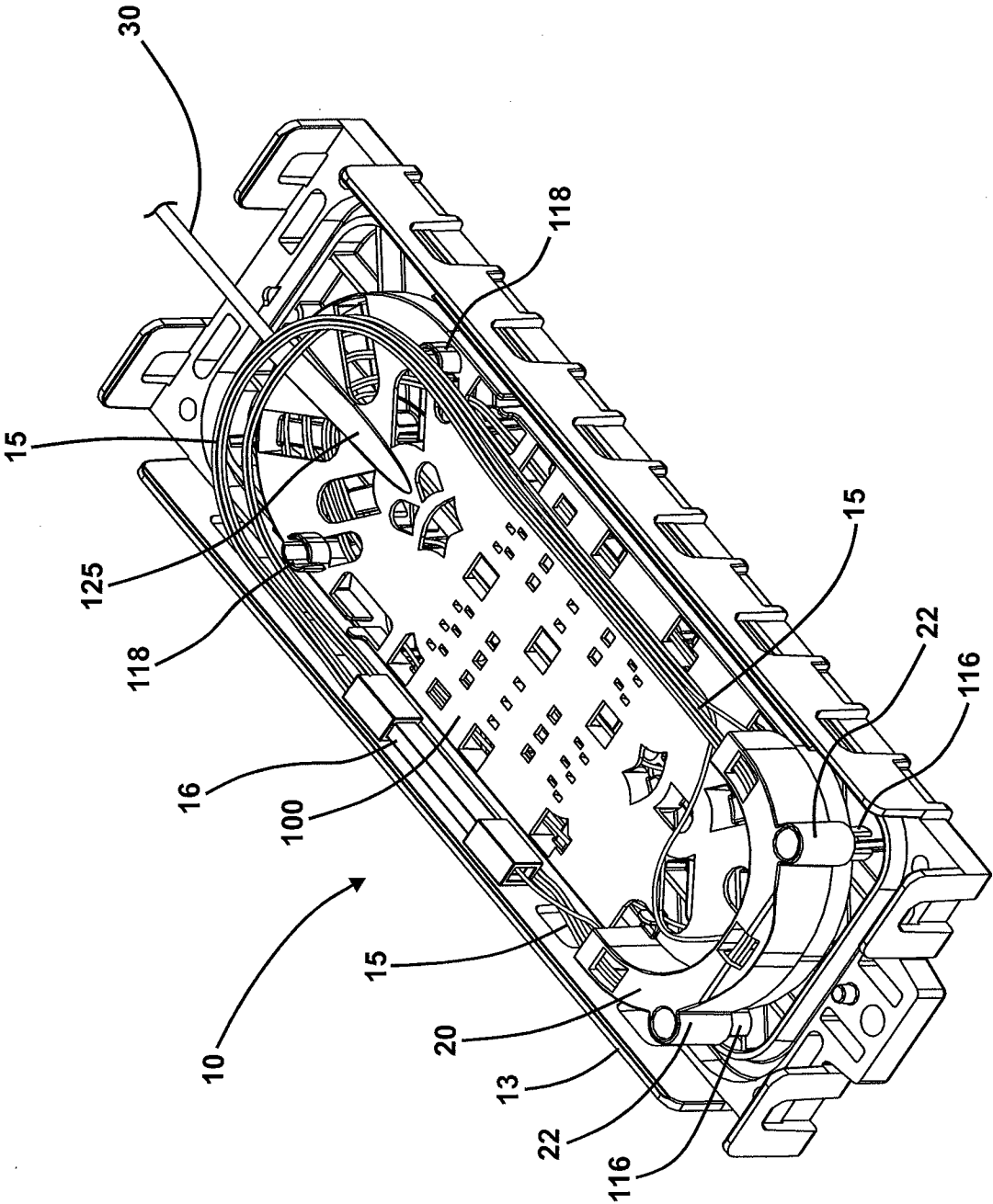
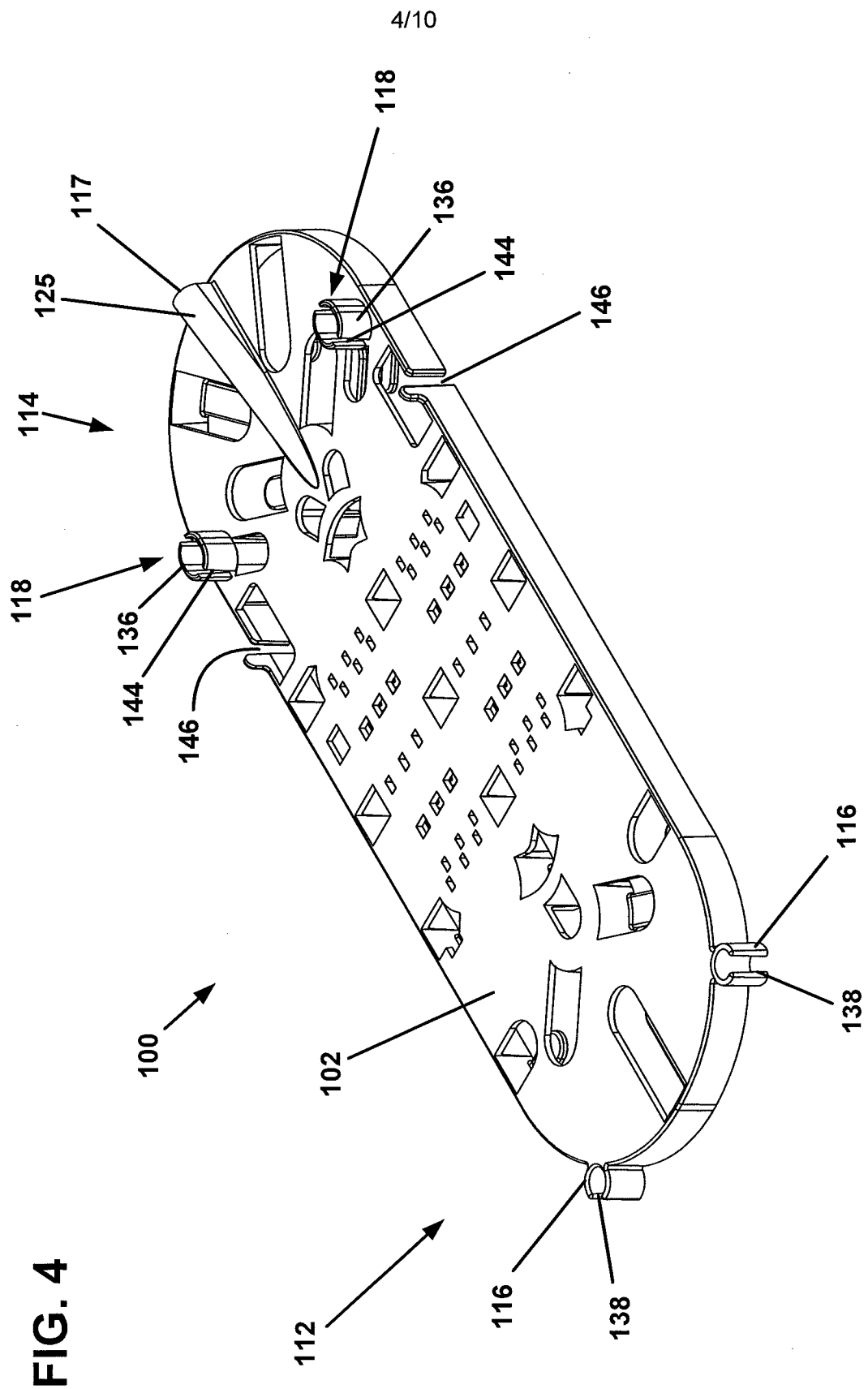


FIG. 3



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FIG. 5

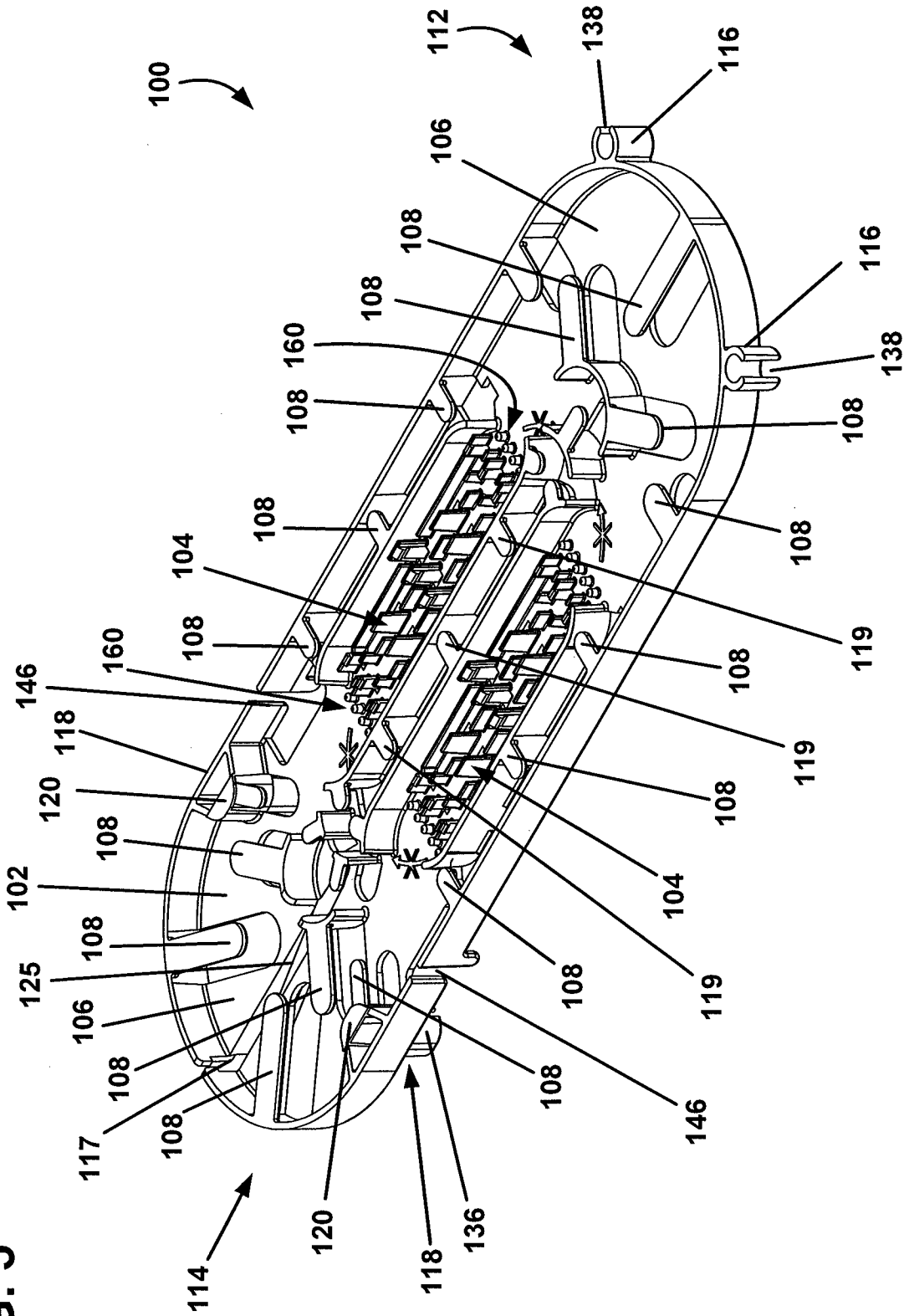
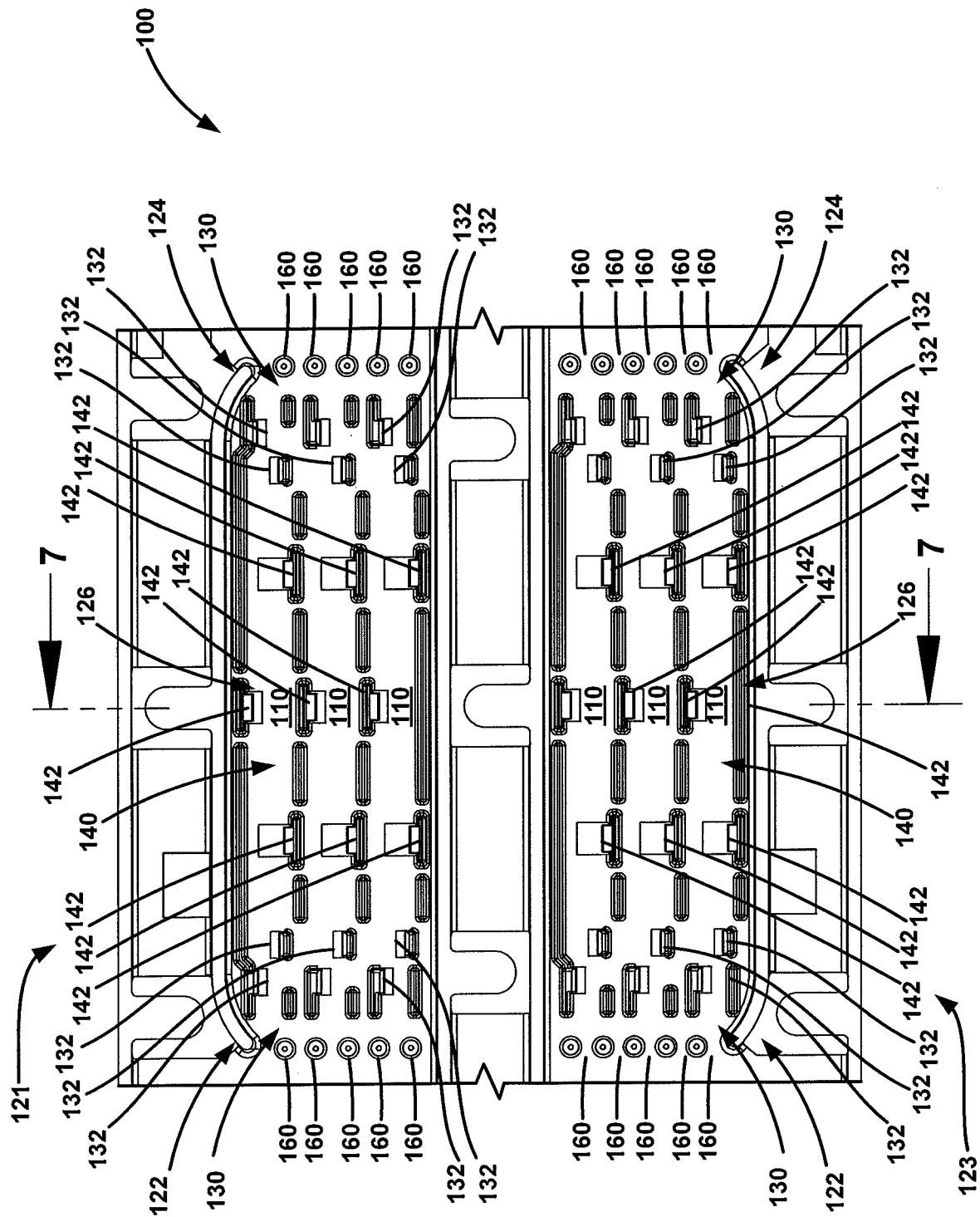
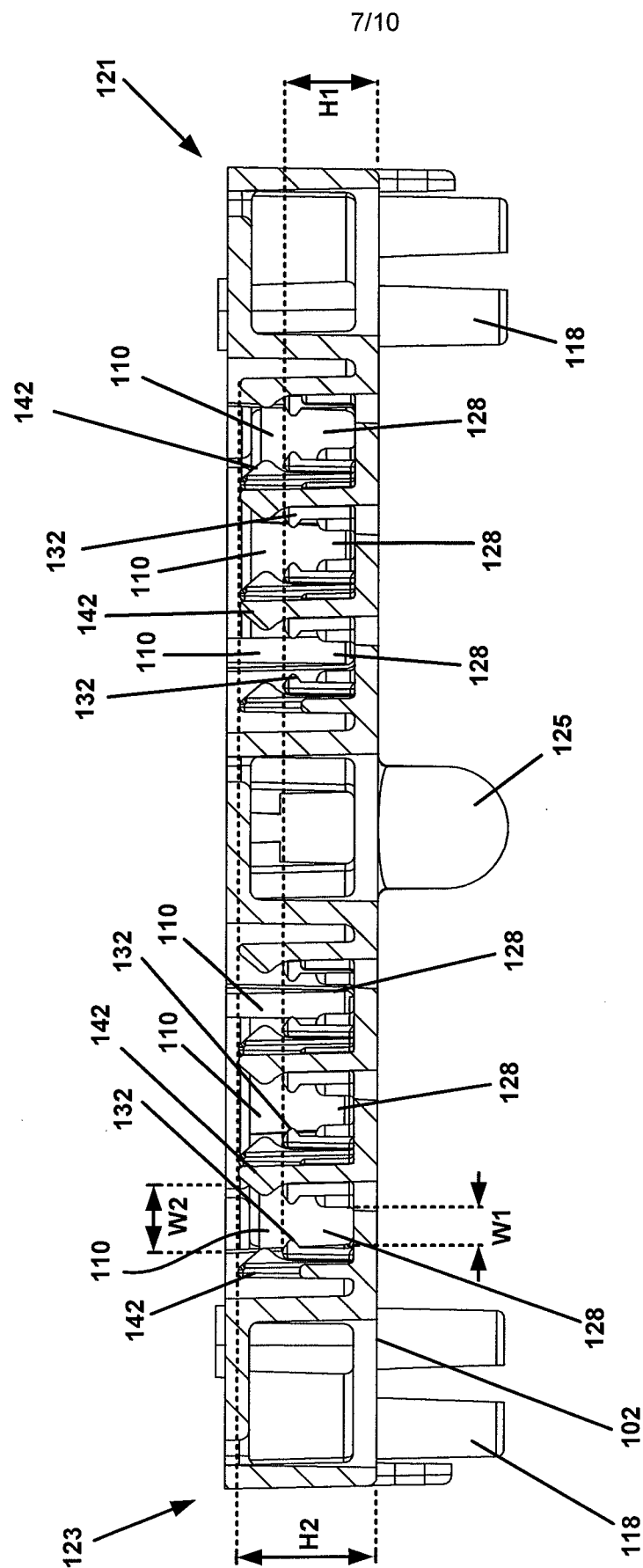
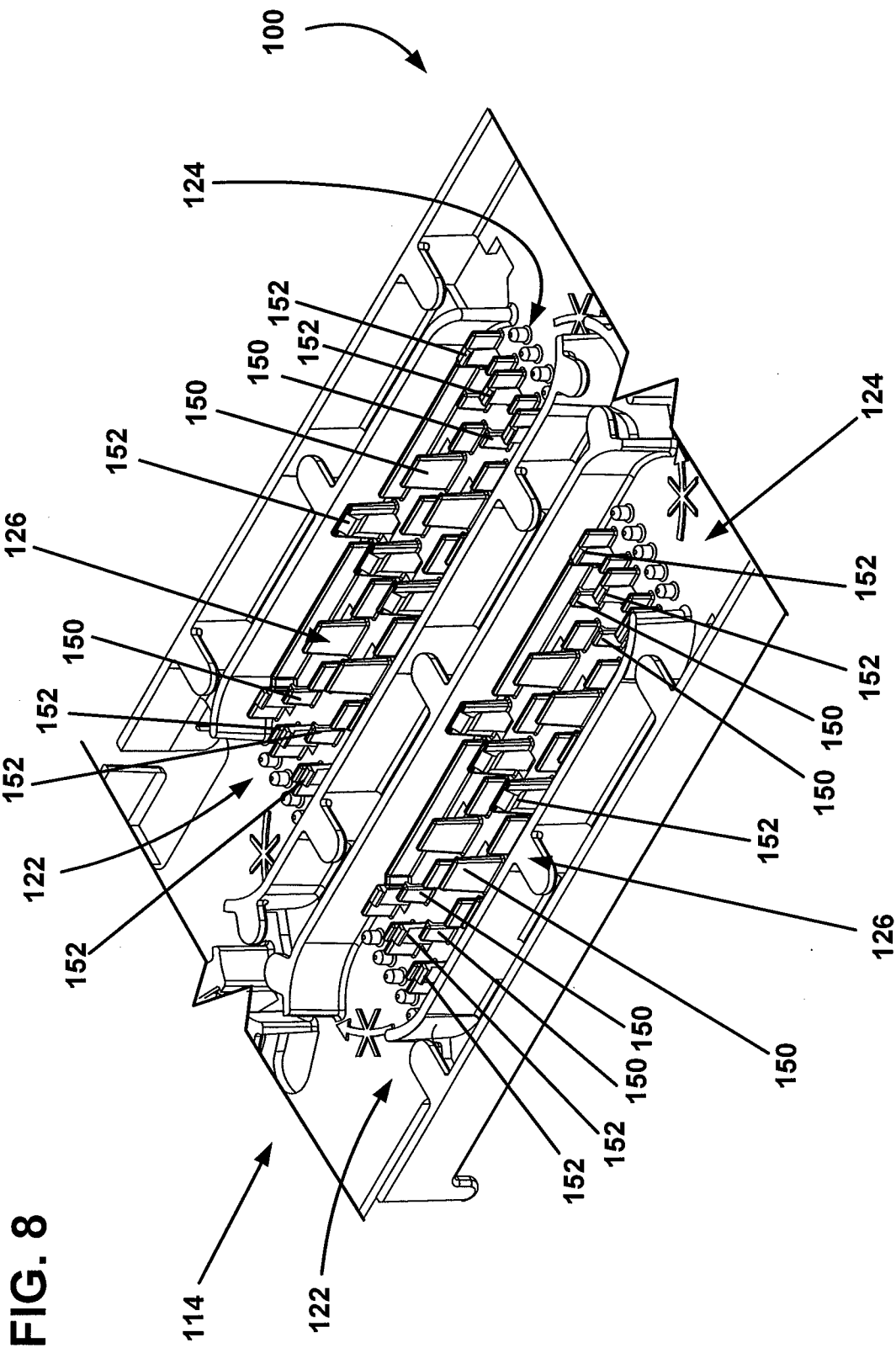


FIG. 6



**FIG. 7**





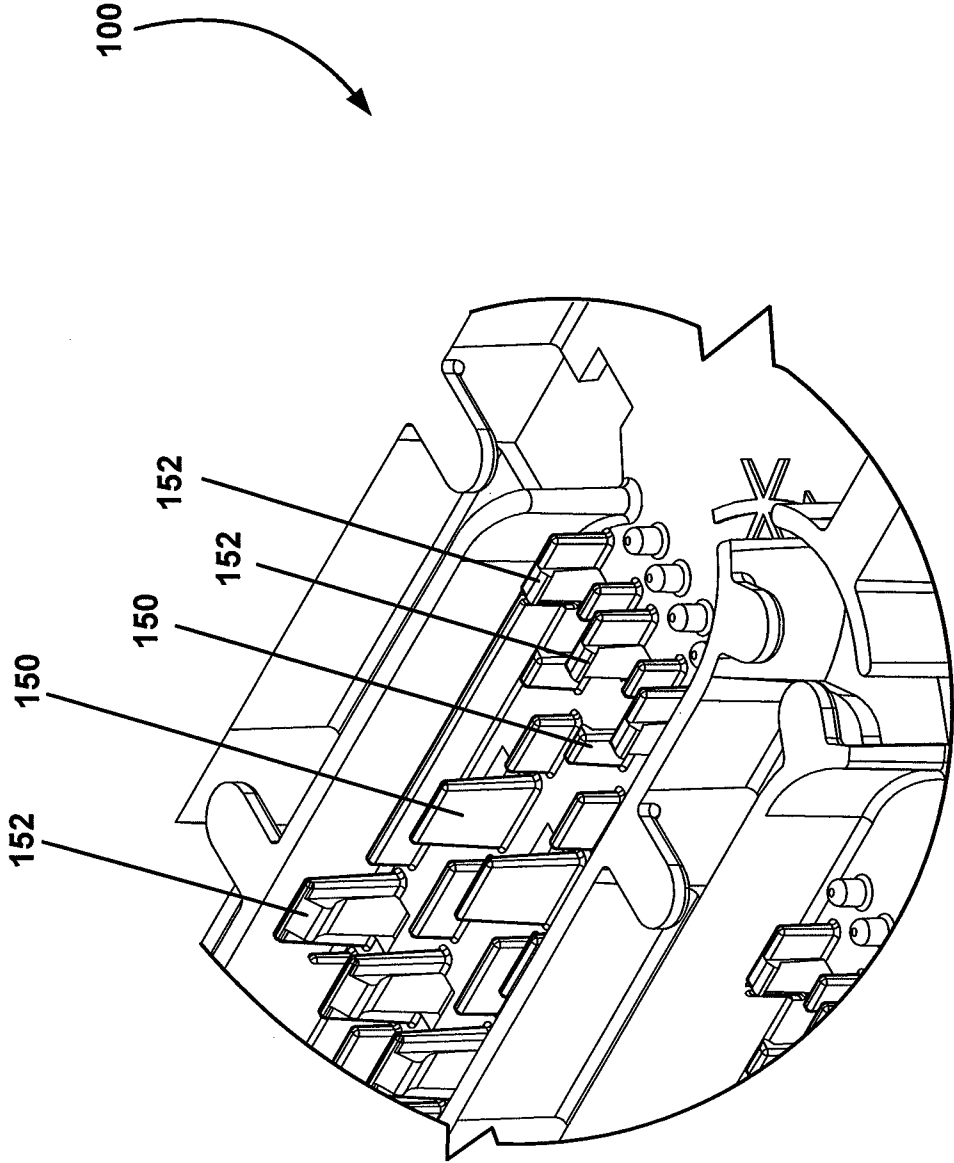
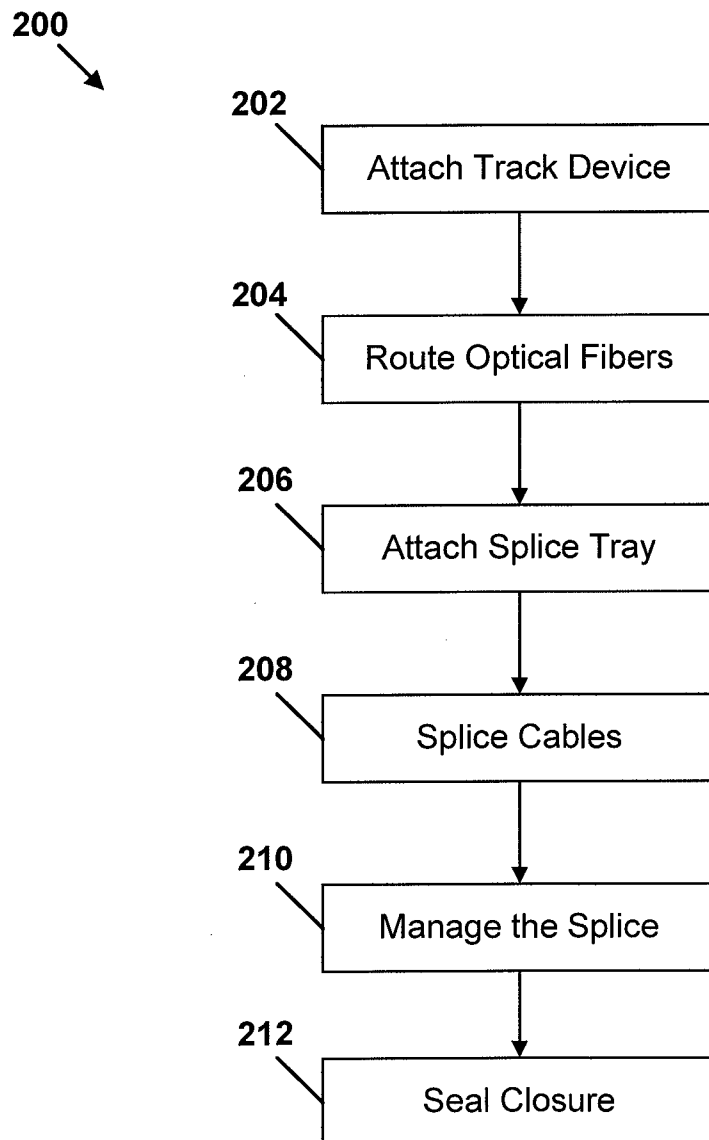


FIG. 9

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**FIG. 10**

**A. CLASSIFICATION OF SUBJECT MATTER****G02B 6/44(2006.01)i**

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 6/44; G02B 6/255; G02B 6/36; G02B 6/38

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: splice tray, second, different, structure

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                   | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | WO 96-38752 A1 (THE WHITAKER CORPORATION) 05 December 1996<br>page 6, lines 13-15, page 7, line 34 - page 8, line 31 and figures 7-9 | 18, 19                |
| Y         |                                                                                                                                      | 1-17, 20-22           |
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| A         | US 4840449 A (SHAHRYAR GHANDEHARIZADEH) 20 June 1989<br>claim 1 and figures 2-3                                                      | 1-22                  |
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

25 June 2020 (25.06.2020)

Date of mailing of the international search report

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International Application Division

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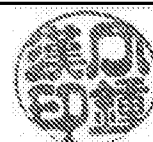


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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2020/020460**

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