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(54) Benævnelse: **Fiberoptisk adapterblok**

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DESCRIPTION

Field

[0001] The present disclosure relates generally to fiber optic telecommunications equipment. More specifically, the present disclosure relates to a fiber optic adapter block designed for high density applications.

Background

[0002] As demand for telecommunications increases, fiber optic networks are being extended in more and more areas. Management of the cables, ease of installation, and ease of accessibility for later management are important concerns. As a result, there is a need for fiber optic devices and methods which address these and other concerns.
Although there are conventional adapter modules containing a plurality of stacked adapters such as that shown in the system of US 2007/036503 A1, such modules are not configured wherein every other adapter is staggered in a front-to-back direction with respect to an adjacent adapter such that front ends of the every other adapter are aligned at a first depth and a front end of the adjacent adapter is at a second depth that is different than the first depth.

Summary

[0003] The present invention relates to a fiber optic telecommunications device. The telecommunications device is a fiber optic adapter block.

[0004] According to one aspect of the disclosure, fiber optic adapters are arranged in a staggered alternating arrangement to facilitate improved connector access. Small form factor connectors particularly benefit from such a construction. Examples include LC and LX.5.

[0005] According to one example embodiment, the adapter block defines a generally one-piece molded body that defines a plurality of integrally formed adapters for optically connecting fiber optic cables terminated with connectors.

[0006] According to another embodiment, the adapter block defines a plurality of adapters provided in a stacked arrangement in a longitudinal direction, such as from a right side to a left side of the adapter block, wherein every other adapter of the block of adapters is staggered in a transverse direction, such as in a front to back direction with respect to an adjacent adapter.

[0007] According to another aspect, the fiber optic adapter block includes at least three fiber

optic adapters provided in a stacked arrangement extending widthwise from a right to left direction on the block, wherein every other adapter of the at least three fiber optic adapters is staggered in a front to back direction with respect to an adjacent adapter such that front ends of the every other adapter of the at least three fiber optic adapters are aligned at a first depth and a front end of the adjacent adapter is at a second depth that is different than the first depth.

[0008] The adapter block can be arranged in a variety of orientations. The adapter block can be incorporated into a variety of telecommunications equipment, including fixtures, panels, frames, drawers, and chassis. The adapter block can be stationarily mounted, or mounted for movement on a pivoting element, and/or on a sliding element.

[0009] A variety of additional inventive aspects will be set forth in the description that follows. The inventive aspects can relate to individual features and combinations of features. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad inventive concepts upon which the embodiments disclosed herein are based.

Brief Description of the Drawings

[0010]

FIG. 1 is a front perspective view of an adapter block having features that are examples of inventive aspects in accordance with the present disclosure;

FIG. 2 is a rear perspective view of the adapter block of FIG. 1;

FIG. 3 is a top view of the adapter block of FIG. 1;

FIG. 4 is a right side view of the adapter block of FIG. 1;

FIG. 5 is a left side view of the adapter block of FIG. 1;

FIG. 6 is a front view of the adapter block of FIG. 1;

FIG. 7 is a rear view of the adapter block of FIG. 1;

FIG. 8 illustrates the front perspective view of the adapter block of FIG. 1 with a number of fiber optic connector mounted thereon;

FIG. 9 is a top view of the adapter block of FIG. 8;

FIG. 10 is a front view of the adapter block of FIG. 8;

FIG. 11 is a cross-sectional view of an example adapter having a media reading interface configured to collect information stored in memory disposed on a fiber optic connector;

FIG. 12 illustrates a technician accessing one of the fiber optic connectors mounted on the adapter block of FIG. 1;

FIG. 13 is a front perspective view of another embodiment of an adapter block having features that are examples of inventive aspects in accordance with the present disclosure;

FIG. 14 is a top view of the adapter block of FIG. 13;

FIG. 15 is a right side view of the adapter block of FIG. 13;

FIG. 16 is a left side view of the adapter block of FIG. 13; and

FIG. 17 is a front view of the adapter block of FIG. 13.

Detailed Description

[0011] Reference will now be made in detail to examples of inventive aspects of the present disclosure which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0012] Referring to FIGS. 1-7, a fiber optic adapter block 10 having features that are examples of inventive aspects in accordance with the present disclosure are illustrated. The fiber optic adapter block 10 defines a front end 12, a rear end 14, a right side 16, a left side 18, a top side 20, and a bottom side 22. In the depicted embodiment, the fiber optic adapter block 10 defines a plurality of fiber optic adapters 24 having an LC footprint that are configured to optically connect a pair of LC style fiber optic connectors 26. In the depicted embodiment, the adapter block 10 defines a generally one-piece unitary molded body 28, wherein the plurality of adapters 24 are integrally formed with the one-piece body 28. According to one example embodiment, the body 28 and the integrally formed adapters 24 may be molded from a polymeric material. In the depicted embodiment, the block 24 defines six LC-type duplex adapters 24 extending widthwise from the right side 16 to the left side 18 of the body 28 for a total of twelve possible connections.

[0013] As will be discussed in further detail below, the adapter block 10 is molded such that every other duplex adapter 24 is staggered in a front to back direction with respect to an adjacent adapter as the adapters 24 extend from the right side 16 to the left side 18 of the block 10. The staggering preferably alternates from the right side to the left side.

[0014] FIGS. 8-10 illustrate the fiber optic adapter block 10 with a number of LC-type fiber optic connectors 26 inserted within the individual adapters 24 of the block 10. LC-type connectors 26 and adapters 24 are generally known in the art. A fiber optic connector 26 having an LC footprint may define a connector body 30 having opposing sidewalls 32, 34, a top wall 36, a bottom wall 38, a front end 40, and a rear end 42. Certain portions of the connector

body 30 may be formed from a molded polymeric material. The connector body 30 normally defines a latch 44 extending from the top wall 36 thereof toward the rear end 42, the latch 44 extending at an acute angle with respect to the top wall 36 of the connector body 30. An LC-type connector 26 may also include a latch trigger 46 that extends from the rear end 42 of the connector body 30 toward the front end 40. The latch trigger 46 also normally extends at an acute angle with respect to the top wall 36. The latch trigger 46 is configured to come into contact with the latch 44 for flexibly moving the latch 44 downwardly.

[0015] When an LC-type fiber optic connector 26 is placed in an adapter 24 for optically coupling light from two optical fibers together, the latch 44 functions to lock the fiber optic connector 26 in place within a cavity 48 of the adapter 24. As is known in the art, the latch 44 normally includes a pair of catches 50, each one extending from a side of the latch 44. Within each adapter cavity 48 is a pair of symmetrically disposed retaining shoulders 52, each formed by a horizontal surface 54 and a vertical surface 56. Please see FIG. 11 for an example of an LC-type fiber optic adapter cavity 48. The horizontal surface 54 of each shoulder 52 is configured to interact with a catch 50 of the latch 44 to deflect the latch 44 downwardly (i.e., toward the central axis of the connector 26). The vertical surface 56 of each shoulder 52 is configured to interact with a vertical surface 58 of a catch 50 to lock the fiber optic connector 26 within the adapter 24.

[0016] During insertion, the interaction between the catches 50 of the latch 44 and the horizontal surfaces 54 of the shoulders 52 cause the latch 44 to move downwardly. The latch 44 springs back (upwardly) after insertion is complete. Thereafter, the vertical surfaces 56 of the shoulders 52 interact with the vertical surfaces 58 on the catches 50 of the latch 44 to lock the connector 26 into the adapter 24.

[0017] Removal of the connector 26 is normally accomplished by manually depressing the latch 44 downwardly and pulling the connector 26 away from the adapter cavity 48. As noted above, the latch trigger 46 may be used to provide greater access the latch 44 and may be configured to come into contact with the latch 44 for flexibly moving the latch 44 downwardly. When the latch trigger 46 is depressed, the interaction between the latch trigger 46 and the latch 44 causes the latch 44 to be pressed in a downward direction, freeing the catch portions 50 of the latch 44 from the vertical surfaces 56 of the shoulders 52 in removing the connector 26.

[0018] Further details relating to LC-type adapters are described in U.S. Patent No. 5,647,043.

[0019] As known, LC-type fiber optic adapters 24 may be provided as duplex adapters wherein each duplex adapter defines a pair of adapter cavities 48 positioned next to one another. Duplex clips may be provided on the connectors 26 for coupling two LC connectors 26 in a side by side configuration. A duplex clip may include a single larger latch trigger that expands over the individual latch triggers 46 of the connectors 26 for removing the two connectors 26 at the same time from a duplex LC adapter 24. An example of a duplex clip is

shown and described in U.S. Patent No. 6,672,898.

[0020] When connectors 26 having an LC footprint are mounted in adapter blocks that provide a high density of connections, a single LC connector 26 that is positioned next to another LC connector 26 or between two other LC connectors 26 may be difficult to access. A technician, when trying to remove a selected LC connector 26, may unintentionally disconnect more than one LC connector 26 at a time. This is a particular problem for rows of three or more connectors 26.

[0021] According to the inventive aspects of the present disclosure, the fiber optic adapter block 10 is molded such that every other adapter 24 (in the depicted embodiment, every other duplex adapter 24) is staggered in a front to back direction with respect to an adjacent adapter 24 as the adapters 24 extend widthwise from the right side 16 to the left side 18 of the block 10. Thus, as shown in FIGS. 1 and 3, the front ends 60 (also the rear ends 62) of the first, the third, and the fifth duplex adapters 24 from the left are aligned at a first depth D_1 along a front to back direction. Similarly, the front ends 60 (also the rear ends 62) of the second, the fourth, and the sixth duplex adapters from the left are aligned at a second depth D_2 along a front to back direction, wherein the second depth D_2 is different than the first depth D_1. According to the depicted embodiment, the second depth D_2 is farther back than the first depth D_1.

[0022] In this manner, a technician experiences reduced interference from adjacent connectors 26 when trying to access a connector 26 that is in the middle of two other connectors 26. According to the depicted embodiment, the adapter block 10 provides space on at least one side of the connector 26 to be removed and the technician can also use portions of the body 28 of the adapter block 10 for support in removing the connector 26. Please refer to FIG. 12 for an illustration of a technician accessing one of the fiber optic connectors 26 mounted to the adapter block 10 of the present disclosure. For example, in the block 10 shown in FIG. 1, if a technician wants to access the leftmost connector 26, the technician has ample room on the left side of the connector for removing the connector 26 by pushing the latch 44 and pulling away from the adapter block 10. The technician may also use the front left corner of the adapter block body 28 for support in removing the connector 26. If the technician wants to access the second connector 26 from the left, the technician has ample room on the right side of the connector for removing the connector 26 since the next adjacent connector 26 to the right is staggered rearwardly and is at a different depth. The technician is also able to use the front right corner of the first duplex adapter 24 for support in applying the pushing and pulling forces on the connector 26. If the technician wants to access the third connector 26 from the left (i.e., the first connector 26 of the second duplex adapter 24 from the left), the technician is able to use the right sidewall 64 of the first duplex adapter 24 from the left to limit interference from the connector 26 to the left of the connector 26 to be removed. The technician can also use the right sidewall 64 or the front right corner of the first duplex adapter 24 from the left for support in pulling the third connector 26. The same process is applicable to the rest of the connectors 26 on the block 10.

[0023] In this manner, when every other duplex adapter 24 is staggered front to back, ease of access to each connector 26 is improved and the unwanted removal of an adjacent connector is reduced. It should be noted that the configuration provided by the adapter block 10 of the present disclosure is different than an adapter block having a stepped configuration, wherein each adapter (or duplex adapter) includes a front end that is positioned at a farther point than the previous adapter in a row of adapters. The adapter block 10 of the present disclosure is able to provide high density, ease of access, and a small footprint for the adapter block, whereas a stepped configuration would either provide for a larger footprint or would require angled mounting of the adapter block to preserve a similar footprint.

[0024] It should be noted that although the depicted adapter block 10 has been described and shown as including six staggered duplex adapters 24, for a total of twelve single adapters 24 and twelve possible connections, the block 10 may include other numbers of adapters 24.

[0025] Although the adapters 24 of the block 10 have been described and shown as being integrally molded with respect to the block body 28, wherein the block 10 defines a unitary one-piece molded body 28, in other embodiments, the individual adapters 24 or the individual duplex adapters 24 may be provided as separable structures, wherein the adapters 24 could be individually mounted in a staggered configuration on a separate support structure. The individual adapters 24 may be permanently fixed to such a support structure (e.g., via ultrasonic welding) or may be mounted so as to be removable from the support structure.

[0026] Although the present disclosure includes the discussion of connectors and adapters having an LC-type footprint, the inventive aspects of the disclosure such as the staggered configuration of the adapters are equally applicable to adapters of other formats such as SC-type or LX.5-type adapters.

[0027] For example, FIGS. 13-17 illustrate a block 110 with adapters 124 having an SC-type footprint, wherein the block 110 includes similar features to that of block 10 in its general configuration. In the depicted embodiment, the adapter block 110 defines a generally one-piece unitary molded body 128, wherein the plurality of adapters 124 are again integrally formed with the one-piece body 128. In the depicted embodiment, the block 110 is shown to be formed from six SC-type adapters.

[0028] It should be noted that the individual adapters 124 forming the staggered configuration of the block 110 may include features found in conventional SC-type adapters. For example, each of the adapters 124 may include internal elements for coupling to SC-type fiber optic connector housings. The internal elements (not shown in the figures) may include a ferrule alignment sleeve and a pair of inner housing halves. As is known for conventional SC type adapters, the pair of inner housing halves may define a sleeve mount, wherein each inner housing half of the sleeve mount includes a pair of latching hooks for latching to an exterior of an SC connector housing and an axial bore for receiving the ferrule alignment sleeve.

[0029] The internal elements may be positioned into an adapter recess of each adapter 124

through an opening at the top sides of the adapters 124. The internal elements may be placed within the adapter recess in a manner similar to that shown in U.S. Patent No. 5,317,663, issued May 20, 1993. Either a single panel 164 may be used to close all of the openings of the adapters 124 or each adapter 124 may include its own panel for closing the individual openings of the adapters 124 to secure the internal elements therewithin.

[0030] In an alternative embodiment, the internal elements may be molded integrally with the body 128 of the adapter block 110 as described in further detail in U.S. Application Publication No. 2010/0054668, filed August 26, 2009.

[0031] It should be noted that the adapter blocks 10/110 of the present disclosure can be configured to be mounted to a variety of different telecommunications equipment or fixtures. The adapter blocks 10/110 may be configured to be movably mounted or fixedly mounted with respect to such equipment or fixtures. The adapter blocks 10/110 may be provided within the telecommunications equipment or fixture as a modular unit that is removable, replaceable, or expandable.

[0032] Further, in accordance with some aspects, one or more of the adapters 24 of the blocks 10/110 may be configured with media reading interfaces or circuitry 70 to collect data or information from one or more fiber optic connectors 26 received within the adapters 24, as described in further detail in U.S. Application Publication No. 2011/0262077, filed February 11, 2011..For example, as shown in FIG. 11 for an LC

[0033] adapter block, one or more of the adapter cavities 28 may be configured to hold one or more media reading interfaces 70 that are configured to engage memory contacts 72 on the fiber optic connectors 26. One or more media reading interfaces 70 may be positioned in the body 28 that defines the adapter block 10. In certain implementations, the body 28 may define slots 74 extending between an exterior of the body and an internal adapter passage or cavity 48 in which the ferrules of the connectors 26 are received.

[0034] Certain types of media reading interfaces 70 include one or more contact members 76 that are positioned in the slots 74. As shown in FIG. 11, a portion of each contact member 76 extends into a respective one of the passages or cavities 48 to engage memory contacts 72 on a fiber optic connector 26. Another portion of each contact member 76 also extends out of the slot 74 to contact a circuit board 80. Telecommunications equipment or fixtures to which the adapter block 10 may be mounted may define conductive paths that are configured to connect the media reading interfaces of the adapter 24 with a master circuit board. The master circuit board may include or connect (e.g., over a network) to a processing unit that is configured to manage physical layer information obtained by the media reading interfaces.

[0035] As noted, example adapters having media reading interfaces and example fiber optic connectors having suitable memory storage and memory contacts are shown in further detail in U.S. Application Publication No. 2011/0262077, filed February 11, 2011.

[0036] Although in the foregoing description, terms such as "top", "bottom", "front", "back", "right", "left", "upper", and "lower were used for ease of description and illustration, no restriction is intended by such use of the terms. The telecommunications devices described herein can be used in any orientation, depending upon the desired application.

[0037] The illustrated embodiment shows the connector axes at 90° to the longitudinal direction (right to left as described). The angle could be turned if desired, such as for cable management.

[0038] Having described the preferred aspects and embodiments of the present invention, modifications and equivalents of the disclosed concepts may readily occur to one skilled in the art. However, it is intended that such modifications and equivalents be included within the scope of the claims which are appended hereto.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US2007036503A1 **[0002]**
- US5647043A **[0018]**
- US6672898B **[0019]**
- US5317663A **[0029]**
- US20100054668A **[0030]**
- US20110262077A **[0032]** **[0035]**

KRAV

1. En fiberoptisk adapterblok (10/110) omfattende:
mindst tre fiberoptiske adaptere (24/124) tilvejebragt i et stablet arrangement strækkende sig i bredden i en længderetning, karakteriseret ved, at enhver anden adapter (24/124) for de mindst tre fiberoptiske adaptere (24/124) er forskudt i en retning fra front til bag, hvad en tilstødende adapter (24/124) angår, så frontenderne (60) for enhver anden adapter (24/124) for de mindst tre fiberoptiske adaptere (24/124) er rettet op ved en første dybde (D1), og en frontende (60) for den tilstødende adapter (24/124) er ved en anden dybde (D2), som er forskellig fra den første dybde (D1).

2. En fiberoptisk adapterblok ifølge krav 1, hvor de bagerste ender (62) for enhver anden adapter (24/124) for de mindst tre fiberoptiske adaptere (24/124) er rettet op ved en tredje dybde, og en bagerste ende (62) for den tilstødende adapter (24/124) er ved en fjerde dybde, som er forskellig fra en tredje dybde.

3. En fiberoptisk adapterblok ifølge krav 1, hvor de mindst tre adaptere (24/124) for den fiberoptiske adapterblok (10/110) er formet i ét med et ensartet støbt legeme (28/128) i en del.

4. En fiberoptisk adapterblok ifølge krav 1, hvor de mindst tre fiberoptiske adaptere (24) er konfigureret til at sammenkoble fiberoptiske stik (26) type LC.

5. En fiberoptisk adapterblok ifølge krav 4, hvor hver fiberoptiske adapter (24) for de mindst tre fiberoptiske adaptere (24) definerer en fiberoptisk adapter (24) type LC duplex for tilvejebringelse af totalt mindst seks forbindelser.

6. En fiberoptisk adapterblok ifølge krav 5, hvor de mindst tre fiberoptiske adaptere (24) omfatter mindst seks fiberoptiske adaptere (24) type LC duplex for tilvejebringelse af totalt mindst tolv forbindelser.

7. En fiberoptisk adapterblok ifølge krav 1, hvor de mindst tre fiberoptiske adaptere (24/124) omfatter mindst seks fiberoptiske adaptere (24/124).

8. En fiberoptisk adapterblok ifølge krav 1, hvor de mindst tre fiberoptiske adaptere (124) er konfigureret til at sammenkoble fiberoptiske stik type SC.

9. En fiberoptisk adapterblok ifølge krav 1, hvor de parallelle adapterakser for de mindst

tre fiberoptiske adaptere (24/124) er lodrette i forhold til en linje defineret langs længderetningen.

DRAWINGS

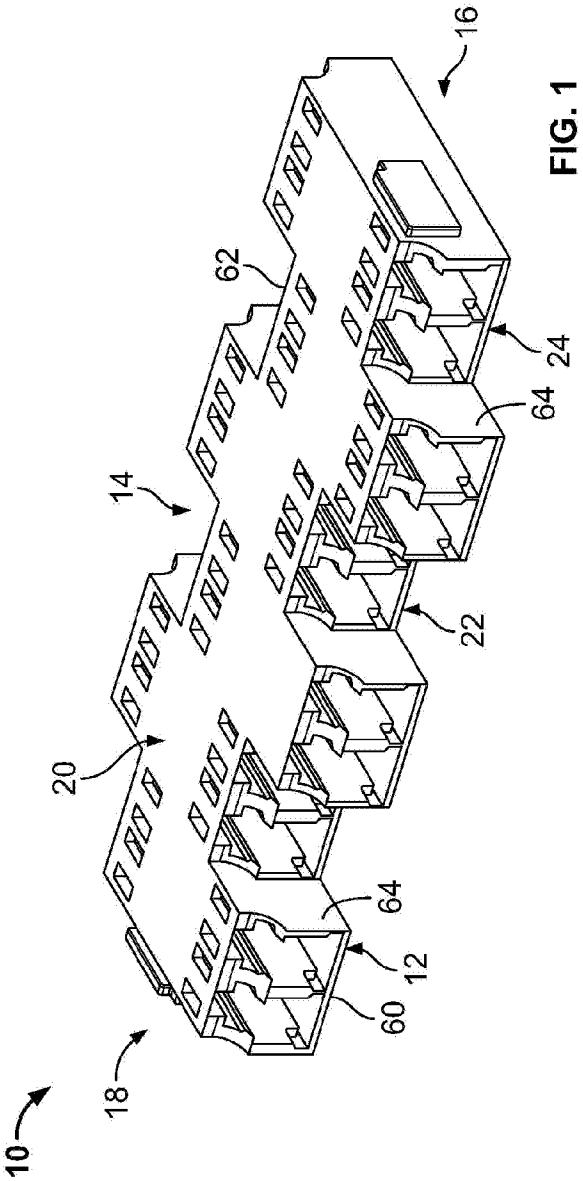


FIG. 1

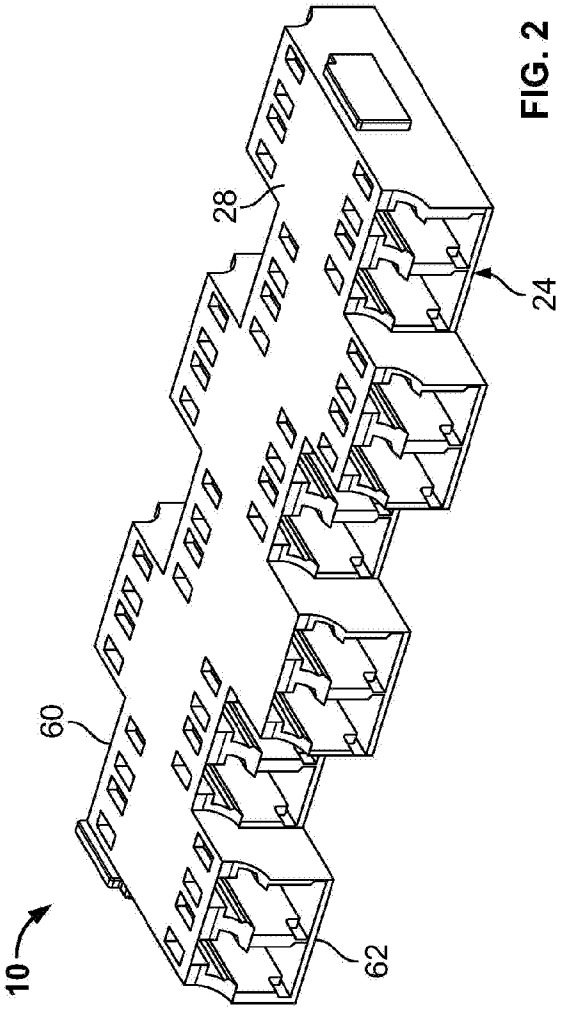


FIG. 2

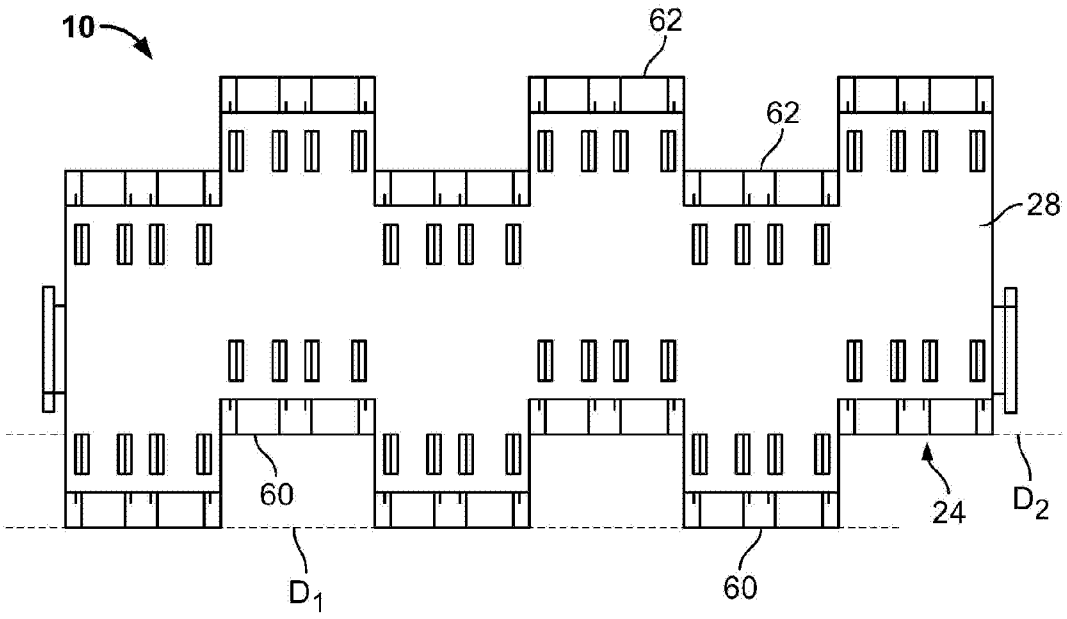


FIG. 3

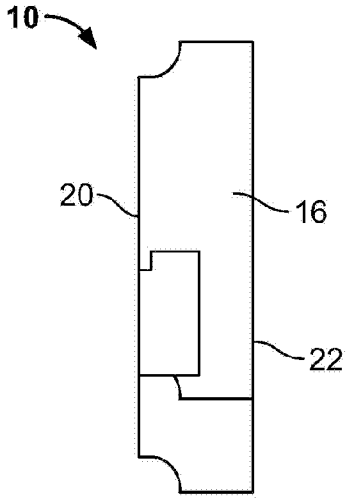


FIG. 4

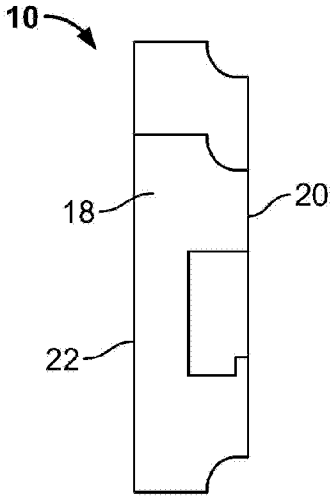


FIG. 5

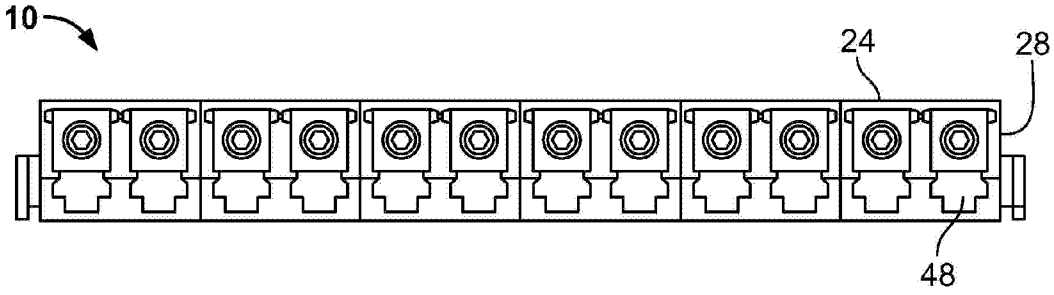


FIG. 6

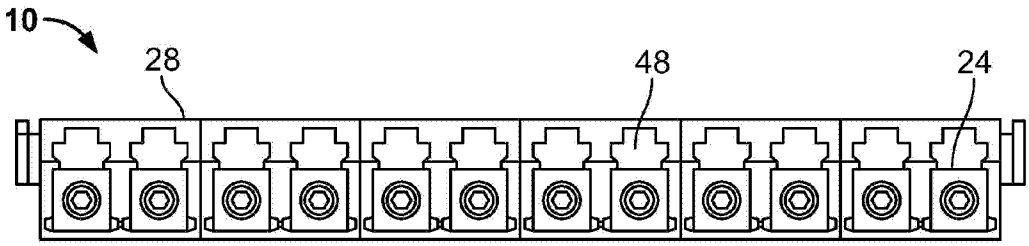


FIG. 7

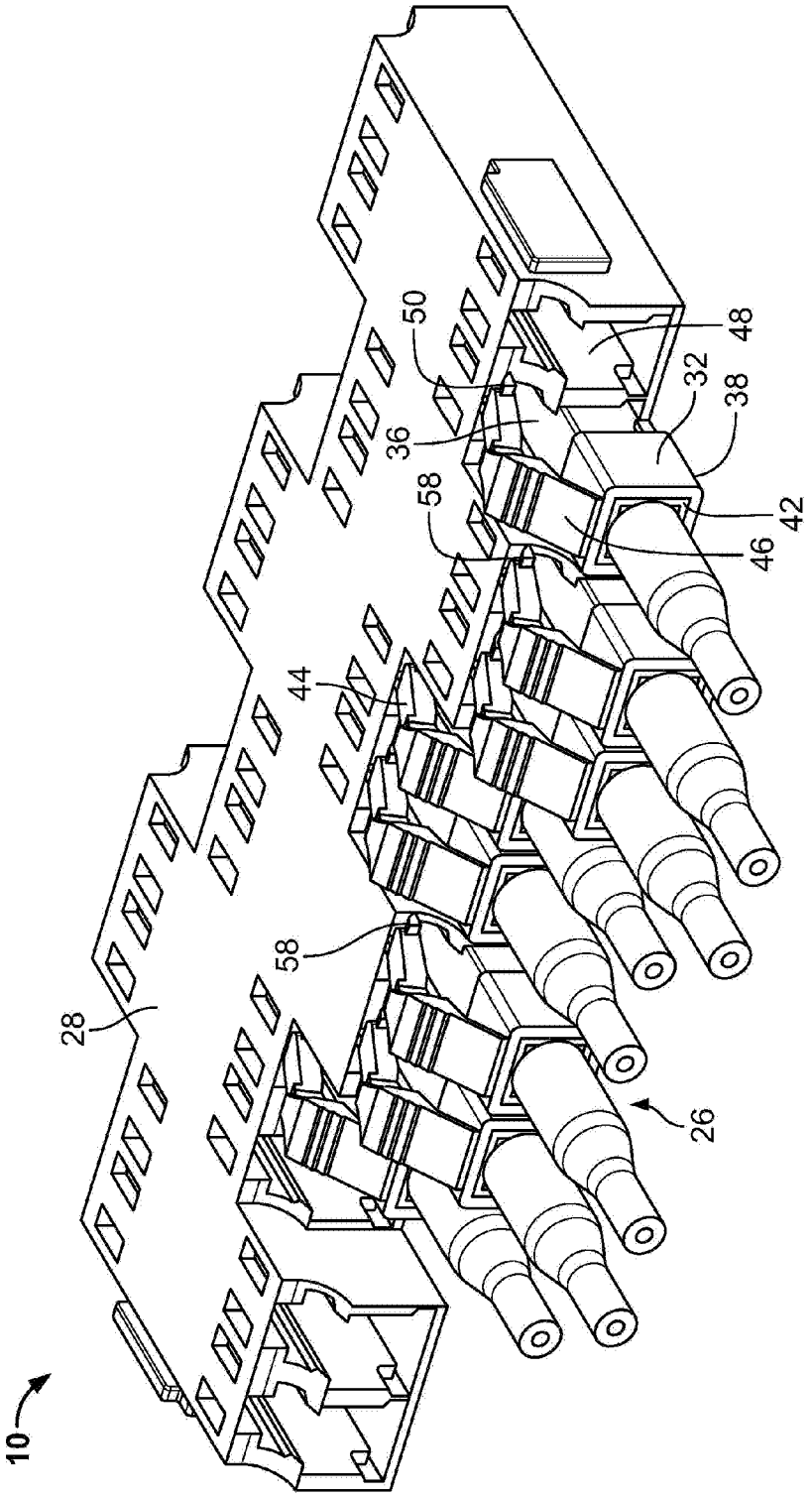


FIG. 8

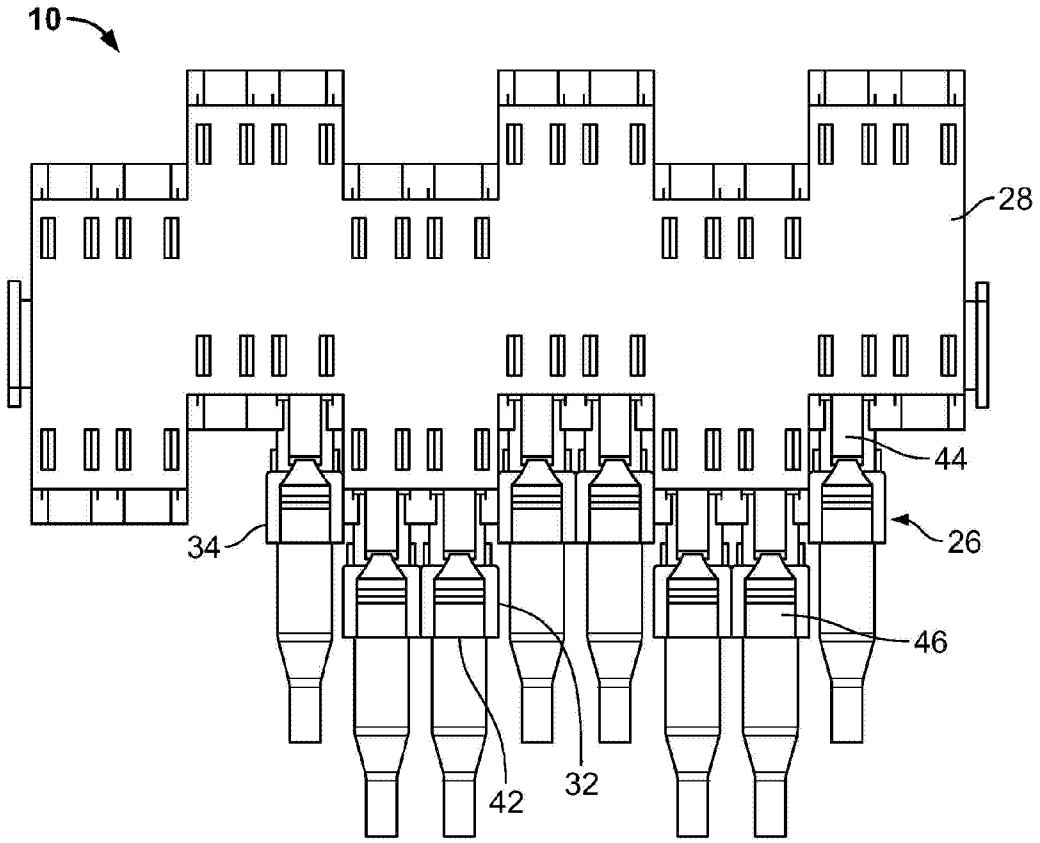


FIG. 9

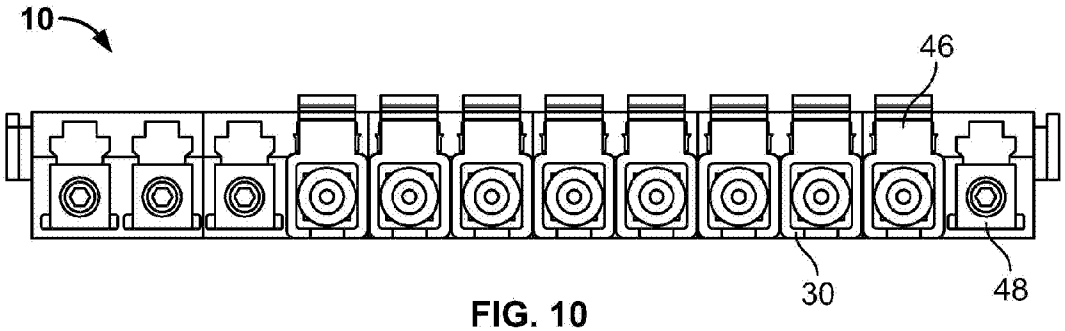


FIG. 10

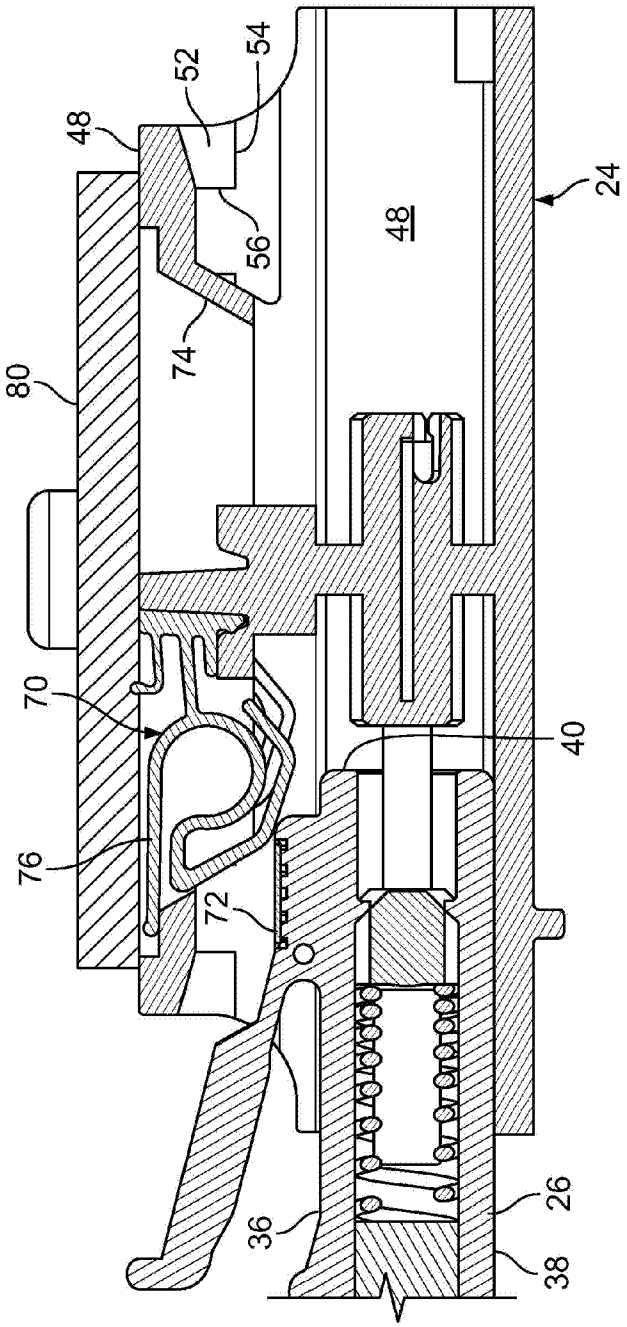


FIG. 11

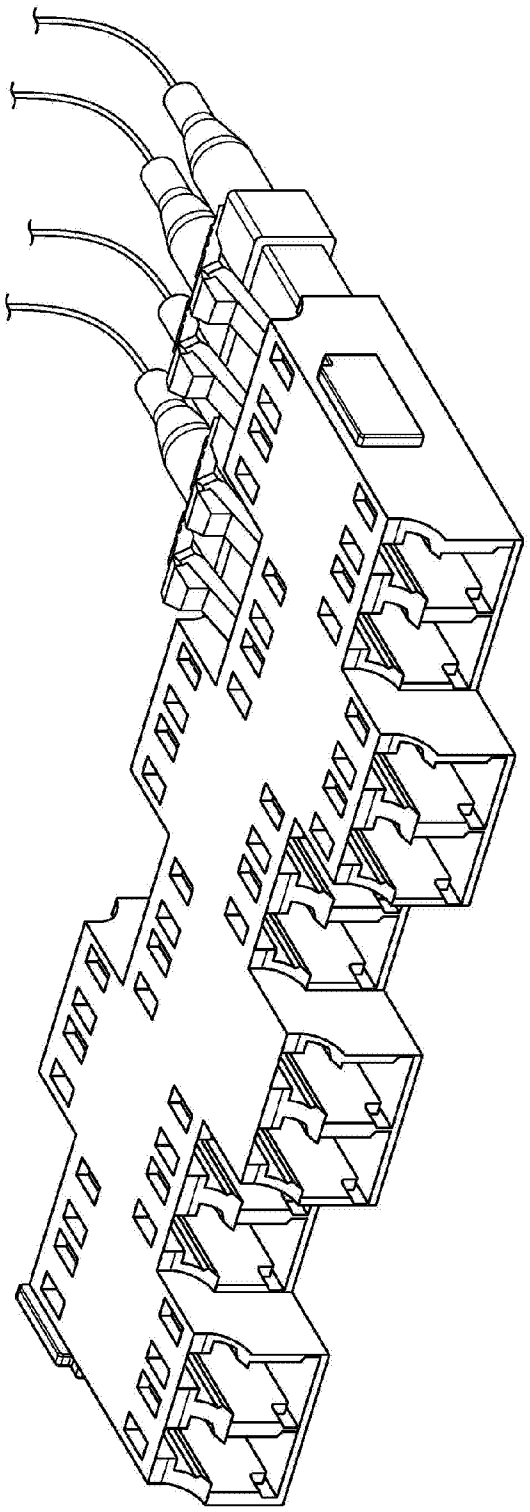


FIG. 12

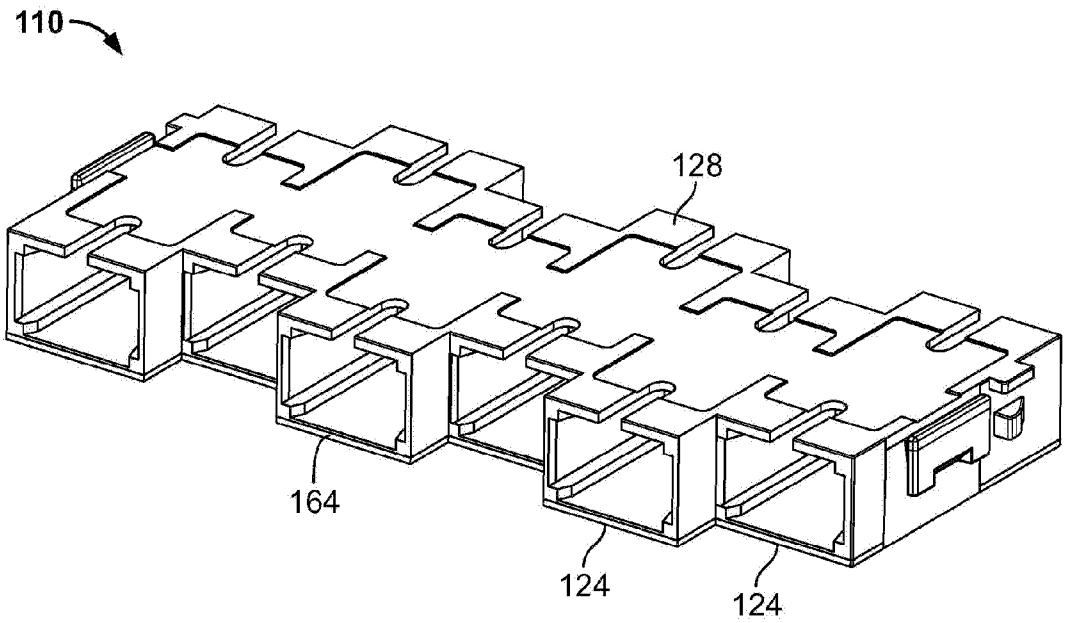


FIG. 13

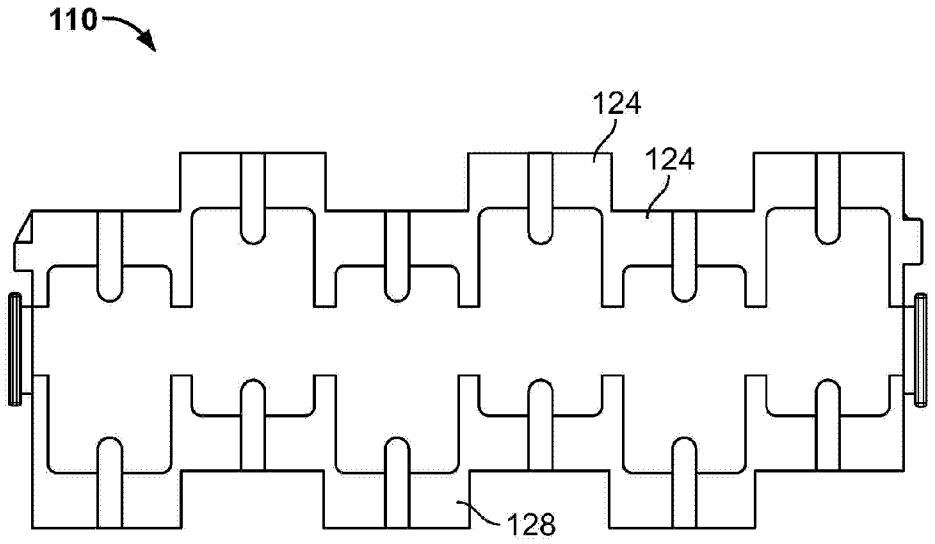


FIG. 14

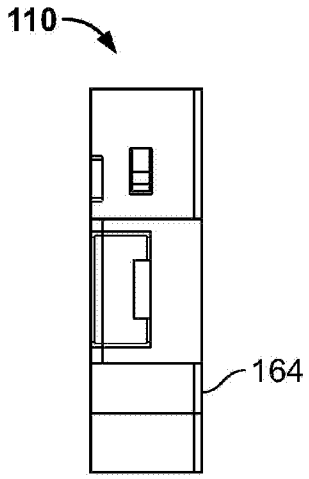


FIG. 15

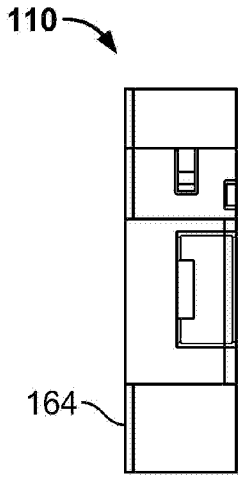


FIG. 16

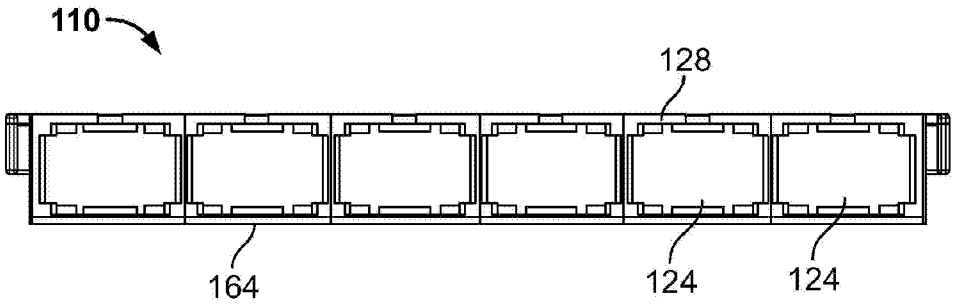


FIG. 17