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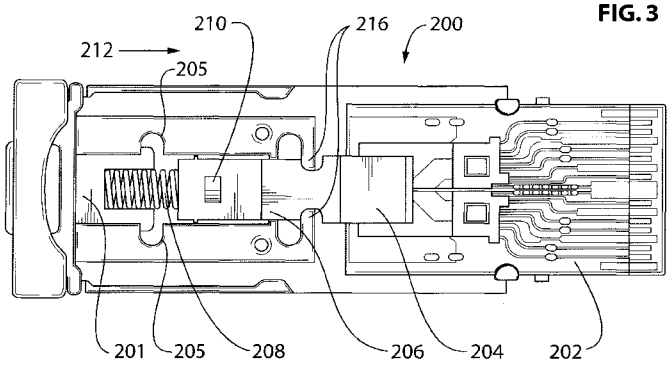
(54) **Title**: OPTICAL SUB-ASSEMBLY WITH STRAIN RELIEF FEATURE

FIG. 3



(57) **Abstract**: The present document describes an optical interconnect module for interfacing optical fibers. The optical interconnect module comprises a casing including a projection and an optical sub-assembly including an interlock portion for receiving the projection of the casing. The optical sub-assembly carries a plurality of optical fibers, and couples face to face with an optical cable assembly for aligning the corresponding fibers together. The optical cable assembly is usually provided in an optical cable connector, along with a spring which compresses when the optical cable connector is inserted in the optical interconnect module. The pressure provided by the spring is transmitted to the optical sub-assembly. The optical sub-assembly applies this pressure to the projection received in the notch thereof for maintaining a tight engagement with the optical cable assembly.

OPTICAL SUB-ASSEMBLY WITH STRAIN RELIEF FEATURE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from US patent application no. 12/958,051 filed on December 1st, 2010.

BACKGROUND

(a) Field

[0002] The subject matter disclosed relates to the field of opto-electrical connection devices. More particularly, it relates to devices for interconnecting optical fibers.

(b) Related Prior Art

[0003] Optical interconnect modules are widely used in the field of optical telecommunication for connecting different optical fibers so that the laser emitted in one fiber is transmitted to the other fiber with the least possible amount of losses in signal strength and light dispersion. Optical interconnect modules comprise a circuit board including an optical connector assembly for processing/converting optical and electric signals.

[0004] Figure 1 is a top plan view of a conventional optical interconnect module **100**.

[0005] An optical interconnect module **100** such as that shown in Figure 1 includes an optical ferrule **102** for coupling with a optical cable assembly provided in the optical cable connector to be inserted in the optical interconnect module **100** (not shown in Figure 1).

[0006] The optical ferrule of the optical cable connector and that of the optical interconnect module **100** constitute a male-female match, whereby the male ferrule such as the ferrule **102** shown in Figure 1 includes at least one male-projection **104** to be received by an opening in the female ferrule in order to align the corresponding optical fibers of the two optical ferrules with each other.

[0007] Figure 2 is an isometric view of a conventional ferrule **106**. In this example, the ferrule **106** is a female ferrule having two openings **108** for receiving the male-

projections **104** of the male-ferrule **102** for aligning the corresponding fibers with each other. Each ferrule includes an opening **110** provided on one side thereof for filling the ferrule with glue after inserting the fibers in a hollow portion of the optical ferrule, so that the fibers remain in place during cutting.

[0008] In order to maintain the two optical ferrules in a tight engagement when an optical cable connector (not shown) is inserted in the optical interconnect module **100**, a positive pressure is applied by the optical cable connector of the optical cable assembly onto the optical ferrule **102** of the optical interconnect module **100**. This pressure is usually provided by a spring which presses onto the ferrule of the optical cable connector to keep the two optical ferrules in tight engagement.

[0009] For instance, in the example of Figure 1, the pressure will be applied on the male-ferrule **102** by the female ferrule of the optical cable connector (which is not shown). In order for the male-ferrule to resist the pressure without being dislocated, and without ruining the fibers **112** and/or the optical connector assembly **114** provided on the circuit board **115**, a member **116** is provided which acts like a bridge between the male ferrule **102** and projections **118** provided in the casing of the optical interconnect module **100**.

[0010] This way, when the female-ferrule is coupled to the male-ferrule **102**, and the spring provides a positive bias toward the circuit board **115** as indicated by arrow **120**, the female ferrule of the an optical cable connector and the male ferrule **102** remain in a tight engagement and the corresponding fibers remain aligned with each other.

[0011] However, this mechanism results in optical interconnect modules having large unused board space **122**, and un-necessarily long fibers **112** which are not suitable for short-reach optical data connectivity.

SUMMARY

[0012] The present document describes an optical interconnect module for interfacing optical fibers. An optical interconnect module in accordance with an embodiment comprises a casing including a projection and an optical sub-assembly including an interlock portion for receiving the projection of the casing. The optical sub-

assembly carries a plurality of optical fibers, and couples face to face with an optical cable assembly for aligning the corresponding fibers together. The optical cable assembly is usually provided in an optical cable connector, along with a spring which compresses when the optical cable connector is inserted in the optical interconnect module. The pressure provided by the spring is transmitted to the optical sub-assembly. The optical sub-assembly applies this pressure to the projection received in the notch thereof for maintaining a tight engagement with the optical cable assembly. With this arrangement it is possible shorten the optical sub-assembly , save circuit board space and reduce the length of the optical fibers, which results in optical interconnect modules which may achieve high speed short-reach optical data connectivity in a small form factor and at low cost.

[0013] According to an aspect, there is provided an optical sub-assembly adapted to interface with an optical cable assembly. The optical sub-assembly is for installation within a casing. The optical sub-assembly comprises optical fibers having an axis and an interlock portion for interaction with the casing, the interaction between the interlock portion and the casing being sufficient to resist a pressure exerted on the optical sub-assembly in a direction corresponding to the axis thereby relieving the strain applied on the optical sub-assembly.

[0014] According to another aspect, there is provided an optical interconnect module for interfacing with an optical cable assembly comprising optical fibers. The optical interconnect module comprising: a casing for receiving the optical cable; and an optical ferrule adapted to interface with the optical cable assembly. The optical sub-assembly comprising optical fibers and an interlock portion for interaction with the casing. The interaction between the interlock portion and the casing being sufficient to resist a pressure exerted on the optical sub assembly by the optical cable assembly thereby relieving the strain applied on the optical sub-assembly while maintaining the optical sub-assembly and the optical cable assembly in a tight engagement.

[0015] Features and advantages of the subject matter hereof will become more apparent in light of the following detailed description of selected embodiments, as illustrated in the accompanying figures. As will be realized, the subject matter disclosed

and claimed is capable of modifications in various respects, all without departing from the scope of the claims. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not as restrictive and the full scope of the subject matter is set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0017] Figure 1 is a top plan view of a conventional optical interconnect module;

[0018] Figure 2 is an isometric view of a conventional optical ferrule;

[0019] Figure 3 is a top plan view of an optical interconnect module connected to an optical cable connector, according to an embodiment; and

[0020] Figure 4 is an isometric view of an optical ferrule in accordance with an embodiment.

[0021] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION

[0022] An embodiment discussed herein describes an optical interconnect module for interfacing optical fibers. An optical interconnect module in accordance with an embodiment comprises a casing including a projection and an optical sub-assembly including a notch for receiving the projection of the casing.

[0023] The optical sub-assembly carries a plurality of optical fibers, and couples face-to-face with an optical cable assembly for aligning the corresponding fibers together. The optical cable assembly is usually provided with an optical cable connector, along with a spring which compresses when the optical cable connector is inserted in the optical interconnect module.

[0024] The pressure provided by the spring is applied to the optical ferrule included in the optical cable assembly. The pressure is transmitted to the optical sub-assembly of the optical interconnect module. The optical sub-assembly applies this

pressure to the projection received in the notch thereof for maintaining a tight engagement with the other optical cable assembly.

[0025] With this arrangement it is possible to position the optical ferrule closer or in contact with the optical connector assembly and save circuit board space and reduce the length of the optical fibers, which results in optical interconnect modules which may achieve high speed short-reach optical data connectivity in a small form factor and at low cost.

[0026] Now referring to the drawings, Figure 3 is a top plan view of an optical interconnect module **200** connected to an optical cable connector **201**, in accordance with an embodiment.

[0027] As shown in the embodiment of Figure 3, the optical interconnect module **200** comprises a circuit board **202** including an optical connector assembly **204** (e.g., a Silicon V-Groove Chip), and an optical ferrule **206**. The optical connector assembly **204** and the optical ferrule **206** form the optical sub-assembly. The optical interconnect module **200** also comprises an opto-electrical conversion device (not shown). The opto-electrical conversion device converts electrical signal to optical signals (e.g., laser diode, VCSEL) in a transmitter application or converts optical signals to electrical signals (e.g., a photo-detector device, photodiode) in a receiver application.

[0028] The optical cable assembly includes an optical cable connector **201**, a spring **208** and a cable optical ferrule **210**. The spring **208** is in direct contact with the cable optical ferrule **210**, for providing positive pressure as indicated by arrow **212** to keep the cable optical ferrule **210** of the optical cable connector **201**, and the optical ferrule **206** of the optical interconnect module **200** in a tight engagement when the optical cable connector **201** is inserted in the optical interconnect module **200**.

[0029] When the optical cable connector **201** is pushed into the optical interconnect module **200**, a pressure is applied on the spring **208** which snaps the optical cable connector **201** in position when it reaches the notches **205** provided in the casing the optical interconnect module **200**. The pressure is transferred from the spring **208** to the cable optical ferrule **210** of the optical cable connector **201** and thereby, to the optical ferrule **206** of the optical interconnect module **200**.

[0030] Figure 4 is an isometric view of an optical ferrule in accordance with an embodiment. According to a general embodiment, the optical ferrule **206** is adapted to interface with an optical cable assembly (not numbered). The optical ferrule **206** is for installation within a casing (not numbered). The optical ferrule **206** comprises a body (not numbered) for carrying optical fibers (not shown) having an axis.

[0031] The body comprises an interlock portion (here represented by notches **214**) for interaction with the casing. The interlock portion could also be embodied in one or more projections which interact with the casing. The interaction between the interlock portion and the casing is sufficient to resist a pressure exerted on the optical ferrule **206** in a direction corresponding to the axis; i.e., direction **212**.

[0032] As shown in Figure 4, the optical ferrule **206** is provided with notches **214** for receiving corresponding projections **216** provided in the casing of the optical interconnect module **200** for applying the pressure of the spring on the projections as shown in Figure 3, in order to prevent the pressure from being transmitted to the optical connector assembly **204** and the circuit board **202**.

[0033] In an embodiment, the optical connector assembly **204** is in direct contact with the optical ferrule **206**, whereby the space **122** between the optical connector assembly **114** and the ferrule **102** of Figure 1 is reduced, and the member **116** is eliminated. Furthermore, the length of the optical fibers needed in the optical interconnect module **200** is less than that used in the conventional optical connector assembly **100** shown in Figure 1.

[0034] The optical interconnect module **200** exemplified in Figure 3 may achieve high speed short-reach optical data connectivity in a small form factor and at low cost.

[0035] The body of the optical ferrule **206** comprises two ends through which the optical fibers respectively enter and exit and wherein the interlock portion is located between the two ends. The ferrule further comprises two opposite sides between the two ends. Each one of the two opposite sides has a notch.

[0036] The optical fibers, for installation a hollow portion of the optical ferrule **206**, each have a flat end. One of the two ends of the optical ferrule **206** comprises a flat

portion. When installed in the optical ferrule **206**, the flat ends of the optical fibers are flush with the flat portion of the optical ferrule **206**.

[0037] According to an embodiment the optical ferrule **206** comprises, at the end of the body comprising the flat portion, holes adapted to receive pins (i.e., a pin and hole combination) for alignment with the cable optical ferrule.

[0038] An optical interconnect module in accordance with the embodiments described herein is ideal for high-speed data communications and computing applications where very short reach bandwidth bottlenecks are incumbent because, the optical interconnect module **200** exemplified above is smaller in size, occupies less board space, and requires fewer components and shorter fibers.

[0039] While preferred embodiments have been described above and illustrated in the accompanying drawings, it will be evident to those skilled in the art that modifications may be made without departing from this disclosure. Such modifications are considered as possible variants comprised in the scope of the disclosure.

CLAIMS:

1. An optical sub-assembly adapted to interface with an optical cable assembly, the optical sub-assembly for installation within a casing, the optical sub-assembly comprising:
optical fibers having an axis;
an interlock portion for interaction with the casing, the interaction between the interlock portion and the casing being sufficient to resist a pressure exerted on the optical sub-assembly in a direction corresponding to the axis thereby relieving the strain applied on the optical sub-assembly.

2. The optical sub-assembly of claim 1, further comprising a body for carrying the optical fibers and for providing a contact with the optical cable assembly.

3. The optical sub-assembly of claim 2, wherein the body comprises two ends through which the optical fibers respectively enter and exit and wherein the interlock portion is located between the two ends.

4. The optical sub-assembly of claim 3, wherein the interlock portion comprises at least two notches.

5. The optical sub-assembly of claim 4, wherein the body comprises two opposite sides between the two ends, each one of the two opposite sides having at least one of the at least two notches.

6. The optical sub-assembly of claim 3, wherein the optical fibers each have a flat end, wherein one of the two ends comprises a flat portion, the flat ends of the optical fibers being flush with the flat portion

7. The optical sub-assembly of claim 6, wherein optical sub-assembly comprises, at the end of the body comprising the flat portion, holes adapted to receive pins for alignment with the optical cable assembly.

8. The optical sub-assembly of claim 2, wherein the body further comprises a hollow portion in which the optical fibers are secured.

9. The optical sub-assembly of claim 1, wherein the interlock portion comprises at least one of a notch and a projection.

10. The optical sub-assembly of claim 1, further comprising an optical connector assembly, which comprises the interlock portion.

11. An optical interconnect module for interfacing with an optical cable assembly comprising optical fibers, the optical interconnect module comprising:
a casing for receiving the optical cable assembly; and
an optical sub-assembly adapted to interface with the optical cable assembly, the optical sub-assembly comprising optical fibers and an interlock portion for interaction with the casing, the interaction between the interlock portion and the casing being sufficient to resist a pressure exerted on the optical sub-assembly by the optical cable assembly thereby relieving the strain applied on the optical sub-assembly while maintaining the optical sub-assembly and the optical cable assembly in a tight engagement.

12. The optical interconnect module of claim 11, wherein the optical sub-assembly and the optical cable assembly comprise a pin and hole combination for aligning the corresponding optical fibers in the optical cable assembly and the optical sub-assembly.

13. The optical interconnect module of claim 11, further comprising an opto-electrical conversion device and an optical connector assembly redirecting light to or from the opto-electrical to the optical fibers.

14. The optical interconnect module of claim 13, wherein the optical sub-assembly is in direct contact with the optical connector assembly.

15. The optical sub-assembly of claim 11, further comprising a body for carrying the optical fibers and for providing a contact with the optical cable assembly.

16. The optical interconnect module of claim 15, wherein the body comprises two ends through which the optical fibers respectively enter and exit and wherein the interlock portion is located between the two ends.

17. The optical interconnect module of claim 16, wherein the interlock portion comprises at least two notches.

18. The optical interconnect module of claim 17, wherein the body comprises two opposite sides between the two ends, each one of the two opposite sides having at least one of the at least two notches.

19. The optical interconnect module of claim 11, wherein the interlock portion comprises at least one of a notch and a projection.

20. The optical interconnect module of claim 11, wherein the optical sub-assembly further comprises an optical connector assembly, which comprises the interlock portion.

PRIOR ART

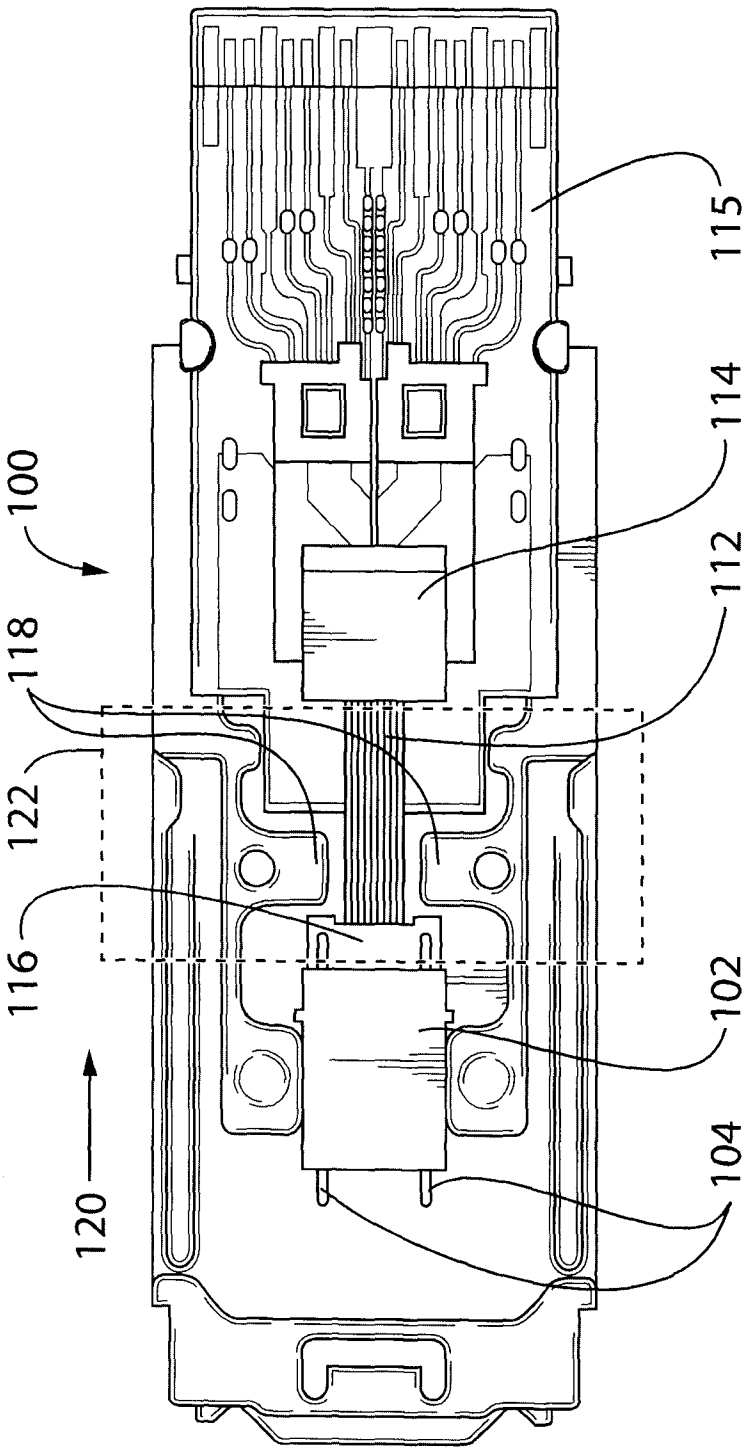


FIG. 1

FIG. 2

PRIOR ART

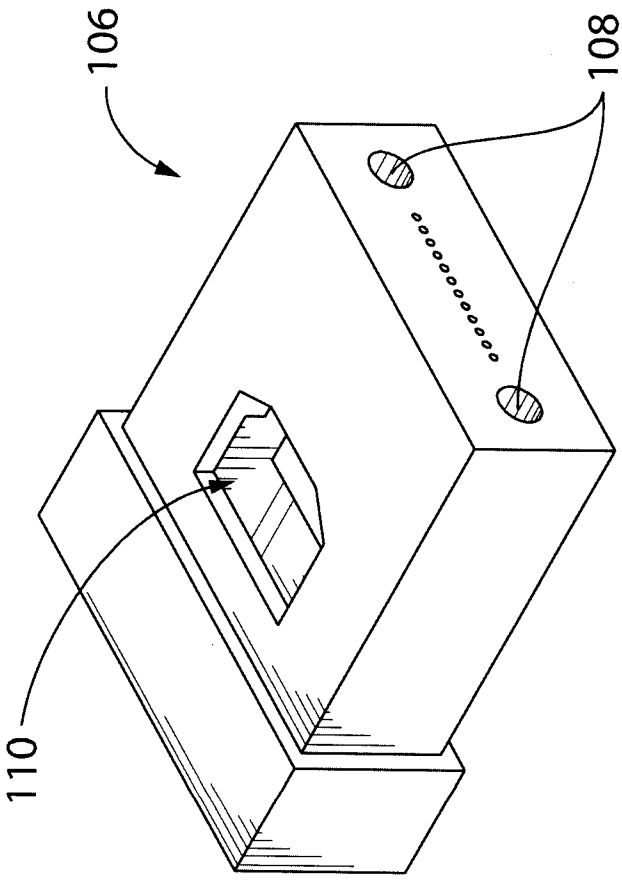


FIG. 3

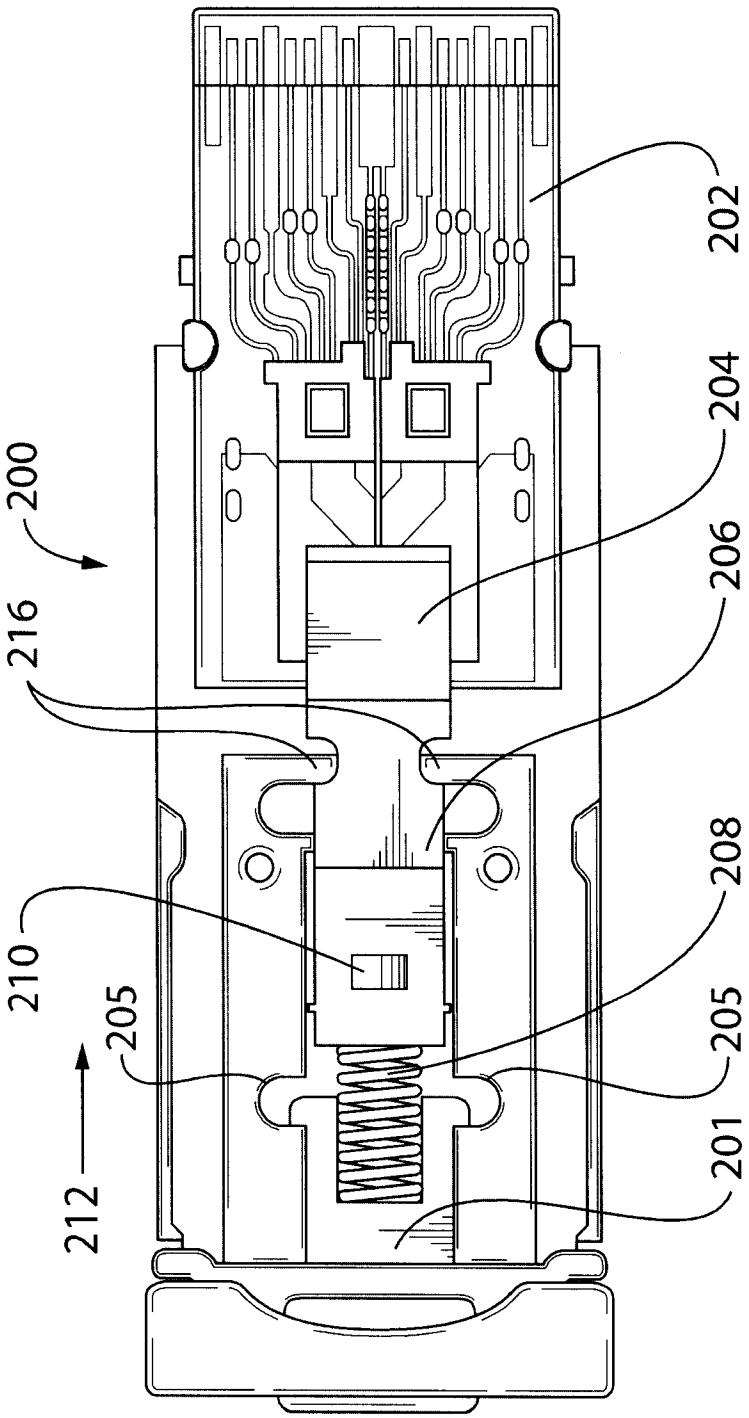
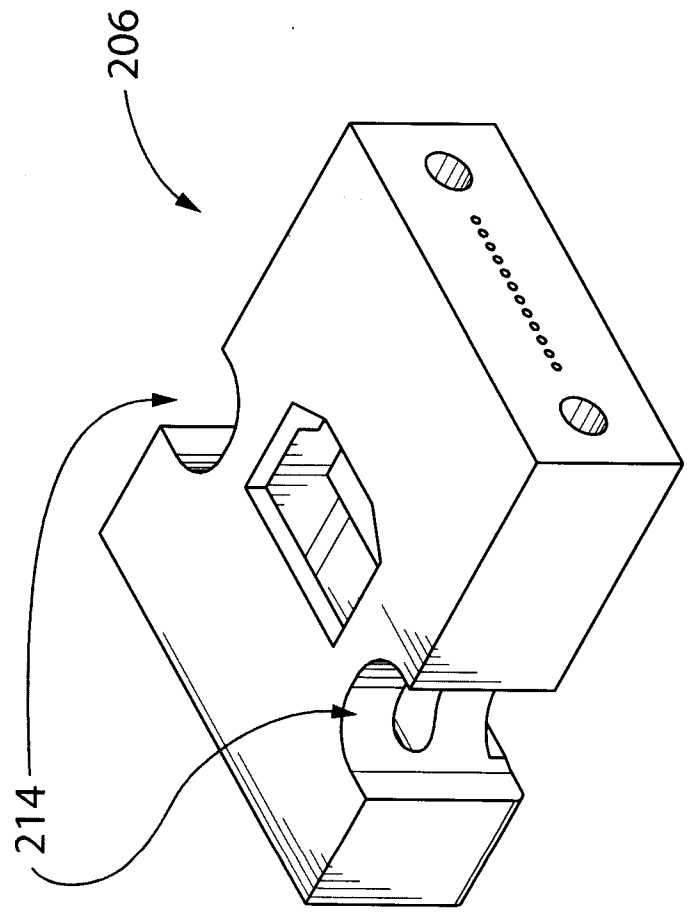


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2011/001333

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***G02B 6/36*** (2006.01)
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)
IPC: ***G02B 6/36*** (2006.01)

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Databases :TotalPatent
Keywords: interconnect, module, ferrule, interlock, spring, pressure, ribbon, assembly, load, notch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,259,856 B1 (SHAHID) 10 July 2001 (10-07-2001) abstract column 1, lines 44-67 column 2, lines 40 - 63 column 3, line 64 - column 4, line 3 column 6, lines 30 - 27 column 9, line 35 - column 11, line 65 figures 1A, 2A, 4A - 6D	1 - 20
A	US 6,974,265 B2 (CHIU et al.) 13 December 2005 (13-12-2005) the entire document	1 - 20

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

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Date of the actual completion of the international search	Date of mailing of the international search report
11 January 2012 (11-01-2012)	27 February 2012 (27-02-2012)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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