

VISUAL IDENTIFICATION SYSTEM FOR TELECOMMUNICATIONS
CONNECTION PORTS

Field

5 This disclosure pertains to the telecommunications (e.g., fiber optic) industry. More particularly, this disclosure pertains to high density distribution devices used in the telecommunications industry and a visual identification system that can be used to identify individual connection locations or ports such as adapters in the devices.

Background

10 Fiber optic connectivity and service is being extended to more and more customers, both commercial and residential. With the increase in use of fiber optic cables in the telecommunications industry, it is desirable to provide devices with increased density. By density, it is meant the number of locations per unit volume or unit area for
15 providing connection on a particular fiber optic device.

 An example of a high density fiber optic device may be a high density fiber distribution frame or chassis that may include a number of trays or modules housing optical distribution/signal-splitting equipment, wherein the trays may be individually pulled out for accessing the internal components. The trays may define connection
20 locations or ports such as fiber optic adapters for establishing connection to the optical devices contained therein.

 With the increased density of fiber optic connections in telecommunications devices, quick identification of the individual connection ports, e.g., for service or for other purposes, presents a challenge, especially in low-light
25 environments. A system for quick identification of the individual ports in a high density distribution environment is desirable.

Summary

30 The present disclosure relates to high density fiber optic distribution devices that utilize an identification system for visually identifying the individual connection locations or ports such as adapters for connection, repair, etc.

According to one inventive aspect, a telecommunications device includes a frame or chassis, a plurality of connection locations, wherein the connection locations form horizontal rows of connection locations along the frame or chassis and also form vertical columns of connection locations on the frame or chassis, a first light emitting device associated with each horizontal row of connection locations so as to identify a particular row when lit, and a second light emitting device associated with each column of connection locations so as to identify an entire particular column when lit.

According to another inventive aspect, a telecommunications device includes a frame and a plurality of trays slidably mounted to the frame. The trays are slidable between a closed position and an open position with respect to the frame, wherein the trays are mounted in a stacked arrangement in the vertical direction. A plurality of connection locations associated with each tray form a horizontal row of connection locations along each tray. The connections locations of all of the trays also form a plurality of vertical columns of connection locations with the trays mounted to the frame. A light emitting device is associated with each tray so as to identify a particular tray when lit. A light emitting device is also associated with each column of connection locations so as to identify an entire particular column when lit.

A method of visually identifying one particular connection location on a tray of a plurality of trays slidably mounted on a telecommunications frame, wherein the trays are mounted in a stacked arrangement in a vertical direction and each tray defines a plurality of connection locations forming a horizontal row of connection locations along each tray, the connections locations of all of the trays also forming a plurality of vertical columns of connection locations with the trays mounted to the frame is disclosed. The method comprises using a first light emitting device associated with each tray so as to identify a particular tray when lit, using a second light emitting device associated with each column of connection locations so as to identify an entire particular column when lit, and lighting the first and second light emitting devices such that the combination of the first and second light emitting devices provides a visual identification of the one particular connection location.

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.

5 Brief Description of the Drawings

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

FIG. 1 is a diagrammatic view illustrating a fiber optic high density distribution frame/chassis with pull-out trays that includes a visual connection port identification system having features that are examples of inventive aspects in accordance with the principles of the present disclosure;

FIG. 2 is a front perspective view of a portion of the distribution
15 frame/chassis of FIG. 1 that illustrates a number of different embodiments of the visual
connection port identification system that can be used with the distribution frame/chassis;

FIG. 3 illustrates a front view of a portion of the distribution frame/chassis of FIGS. 1-2, wherein two of the embodiments of the visual connection port identification system are illustrated in further detail; and

FIG. 4 illustrates a close-up view showing a connection location or port in the form of a fiber optic adapter being identified using one of the embodiments of the visual identification system of FIGS. 1-3.

Detailed Description

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

FIGS. 1-4 generally illustrate a visual identification system 10 that can be
30 used for identifying connection locations or ports 12 in a telecommunications high
density distribution environment. In FIGS. 1-4, the visual identification system 10 is

diagrammatically depicted as being part of a high density distribution frame or chassis 14 that includes a number of pull-out trays 16 housing optical distribution/signal-splitting equipment. The trays 16 may be individually selectively slid out for accessing the internal components or connections 12. The trays 16 of the chassis/frame 14 may define connection ports 12 such as fiber optic adapters 18 for establishing service connectivity to the optical devices contained therein. It should be understood that the type of distribution frame 14 depicted in FIGS. 1-4 is simply one example device, environment, or application in which the visual identification system 10 of the present disclosure may be used. The visual identification system 10, which will be described in further detail below, may be used on any chassis or frame that may include multiple connection locations or ports such as adapters in a matrix type layout. A number of examples of high density chassis or frames that include pull-out trays or modules with fiber optic adapters that may utilize the identification system 10 of the present disclosure are illustrated and described in U.S. Provisional Application Ser. No. 61/650,772, filed on May 23, 2012, the entire disclosure of which is incorporated herein by reference.

Still referring to FIGS. 1-4, the frame/chassis 14 defines a right side 20, a left side 22, a top end 24, a bottom end 26, a front side 28 and a rear side 30. It should be noted that even though the frame is referred to herein as a “chassis”, a frame may also include multiple “chassis” that are on the “frame” in a stacked arrangement.

The frame/chassis 14 includes the multiple slidable trays or modules 16 that are configured to house fiber optic distribution equipment. Each tray 16 may define the multiple connection locations or ports 12 at the front side 28 of the chassis 14. In the depicted embodiment, the connection locations or ports 12 are defined by fiber optic adapter openings that are configured to receive mating fiber optic connectors 32 (see FIG. 4). The adapters 18 may be of different formats including LC, SC, MPO, etc.

The frame 14 may define a top panel 34 extending across the top end 24 of the frame 14, a bottom panel 36 extending across the bottom end 26 of the frame 14. A right support member 38 extends vertically at the right side 20 of the frame 14 and a left support member 40 extends vertically at the left side 22 of the frame 14. In the depicted embodiment, a central divider 42 cooperates with the right support member 38 to slidably

support the trays 16 at the right side 20 of the frame 14 and cooperates with the left support member 40 to slidably support the trays 16 on the left side 22 of the frame 14.

The visual identification system 10 of the present disclosure provides a cost-effective and simplified way to quickly identify a given adapter port 18, for connectivity, repair service, etc.

Still referring to FIGS. 1-4, the visual identification system 10 is achieved by using an X-Y matrix of light emitting devices 44 (e.g., light emitting diodes - LED's) (or other visual indicators) placed on the frame 14 in combination with a light control system. The LED's 44 may be mounted to portions of the frame via printed circuit boards 46 (PCB's). The light control system may form part of a larger network or connectivity database and may be operated remotely. The light control system may utilize a database to identify the port 12 of interest and provide the power to the corresponding LED's 44 in the X-Y matrix via the PCB's 46. The LED's aligned along the plurality of Y-axes may be referred to as first LED's 44a and the LED's aligned along a plurality of X-axes may be referred to as second LED's 44b.

The general positioning of the LED matrix is illustrated in FIG. 1. In the depicted embodiment, each tray 16 includes an associated first LED 44a that is vertically aligned with the tray 16, wherein the first LED's 44a are mounted adjacent the left support member 40 for the left trays 16 and mounted adjacent the right support member 38 for the right trays 16. Each adapter 18 also includes an associated second LED 44b that is horizontally aligned with the given adapter 18, wherein the second LED's 44b are mounted both at the top and bottom panels 34, 36 of the frame 16. As will be described in further detail below, the second LED's 44b for the adapters 18 are mounted both at the top and bottom panels 34, 36 of the frame 16 so that a service technician that may have access from only the top or the bottom of the frame 16 can still visually identify the adapters 18.

In the given embodiment, for a double sided, twelve-tray high frame or chassis utilizing twenty-four adapter ports per tray, there would be a total of one hundred twenty LED's 44 utilized if the first LED's 44a are provided adjacent the right and left support members 38, 40. As an alternative to having the tray LED's 44a on the ends of the trays 16, the first LED's 44a may be positioned on the center divider 42, utilizing one

column of first LED's 44a for both the right and left trays 16. As noted, the horizontal row of second LED's 44b at the top and the bottom of the frame 14 are positioned to indicate the port 12 when viewed from above or below. Having the second LED's 44b both on the top and the bottom of the frame 16 may be helpful depending upon the position of the frame 16 or the accessibility by the service technician.

The present disclosure contemplates a number of different concepts or embodiments to control the light from the LED's 44 to give an accurate indication of which port 12 is being identified.

One embodiment includes, positioned on the tray doors 48 (adhered, clipped or molded), aligned with the second LED's 44b, light pipes 50 to focus and direct the light to form a controlled spot 52 on an indication target 54 (one per port 12) on the top and bottom sides of the tray 16 that correspond to the adapter port 12. As shown, each adapter port 12 at the front of the tray 16 may include a corresponding target area 54 and an indicator line 56 that extends from that target area 54 to the port 12 itself. A focusing element 58 (e.g., a lens) and maybe a shutter may be used for initial control of the light emitted from the second LED's 44b. In using such a method, when the port 12 that needs to be accessed is determined, the control system will illuminate the first LED 44a for the desired tray 16 to indicate to the service technician which tray 16 should be slidably pulled out. The second LEDs 44b on the top and bottom panels 34, 36 of the frame 16 are lit up by the control system to hit the light target 54 to indicate the desired adapter port 12. The indicator line 56 simply provides a visual element for the service technician to follow from the light target 54 to the front of the frame 16 to the port 12. In certain embodiments, the indicator line 54 may include light reflecting properties also.

For the first embodiment discussed above, light pipes 50 used may be produced by cutting to length and hand polishing the faces. According to one embodiment, the diameter for the light pipes 50 is around 3.85mm. According to another embodiment, the diameter for the light pipes 50 is around 2.75mm. For the depicted framework, twelve pieces of around 12 to 13mm in length light pipes 50 may be assembled in a column with a 1mm gap therebetween for a clearance for the tray sliding operation. High brightness LED's 44 are placed in line above and below the ports 12. A controlled light spot 52 (see FIG. 4) is then produced at the opposite end of to the LED

44. It should be noted that the brightness may be reduced due to light being lost at every air gap, however, still achieving the desired illumination after the twelve light pipes 50. The target spot 52 will tend to be brighter for the trays 16 nearer the light source.

A second embodiment of the visual indication system 10 includes,
5 positioned on the tray doors 48 (adhered, clipped or molded), aligned with the second LED's 44b, tubes 60 with inner reflective surfaces 62 that are configured to direct the light to form a controlled spot 52 on an indication target 54 (one per port 12) on the top or the bottom of the tray 16 that corresponds to the adapter port 12. A focusing element 58 (e.g., a lens) and maybe a shutter may be used for initial control of the light emitted
10 from the second LED's 44b.

For the second embodiment, tubes 60 with an outside diameter of around 6.35mm and an internal diameter of around 4.45mm can be used with lengths of around 13mm. For the depicted framework, twelve of these tubes 60 can be placed with a 1 mm gap therebetween for the clearance for the tray sliding operation. As noted above, a lens
15 58 (to collimate the light) and a shutter (to constrain unwanted dispersion of the light) may be used to focus the light down the tubes 60, as shown in detail in FIG. 3. This method can produce a bright controlled spot 52 (shown in FIGS. 2 and 4), with near no loss of intensity, regardless of twelve-tray distance, six-tray distance, or two-tray distance setups.

20 Another embodiment relates to the use of lines 64 (printed or molded on the tray doors 48) that are aligned with the second LED's 44b and the indication targets 54 (one per port 12) for the corresponding adapters 18. In this embodiment, the service technician can identify the lit second LED 44b and visually follow the indicator lines 64 on the tray front faces to the targets 54. The three embodiments discussed above are
25 diagrammatically all illustrated on the same frame 16 in FIG. 2.

Another possible embodiment would involve using a collimated light source (e.g., a laser or a similar source) to directly shine a controlled spot of light onto the indication target 54 (one per port) for the corresponding adapter port 12.

As noted above, in usage, the first and second LED's 44 are illuminated as
30 part of a work order to indicate required work to be carried out on a port 12 in terms of a patch to be made/unmade or an error or repair situation. A first LED 44a, in the vertical

column indicates which tray 16 the port 12 is located on and needs to be pulled out, and one set of second LED's 44b in the horizontal row (top and bottom) indicates the port's horizontal position on that tray 16. When the tray 16 is pulled out, the collimated light lands on the target area 54 corresponding to the adapter. The indicator line 56 that
5 extends from the target area 54 to the port 12 itself can then be visually followed to identify the individual port 12 that requires attention.

The visual indication system 10 of the present disclosure provides a substantially reduced component count, control complexity and assembly costs while maintaining individual illumination/identification/indication of the individual ports 12.

10 Normally, to individually identify trays and ports for a five hundred seventy six-port frame 16, such as the one illustrated in FIG. 1, would require six hundred LED's 44 (or other visual indicators), twenty-four for the trays 16 and five hundred seventy six for each port 12. The present system has the ability to reduce this count down to one hundred twenty (or one hundred eight if vertical tray indication is on the center
15 divider), twenty-four (or twelve) for the trays 16 and ninety-six for port indication, thus reducing the cost of components, control complexity and assembly costs while maintaining individual illumination/identification/indication of an individual port 12.

FIG. 4 illustrates a representative target indicator or area 54 on an adapter tray 16 with the indicating light spot 52 illuminating the target area 54. According to one
20 embodiment, the light source is a high intensity Kingbright hyper red (635nm InGaAlP) led 44 (typically 900mcd).

If multiple chassis are provided on a given frame in a stacked arrangement, each chassis may also include a separate third LED for identifying the separate chassis itself. However, with each of the trays 16 being illuminated either from
25 the right side, the left side or the center divider, there might not be a need for a separate chassis identifier for vertically stacked chassis.

The above specification, examples, and data provide a description of the manufacture and use of the disclosure. Many embodiments of the inventive aspects can be made without departing from the spirit and scope of the disclosure.

Number	Part Names
10	visual identification system
12	port
14	frame
16	trays
18	adapters
24	top end
26	bottom end
32	mating fiber optic connectors
34	top panel
36	bottom panel
38	right support member
40	left support member
42	center divider
44	led
44a	first led
44b	associated second led
46	printed circuit boards
48	tray doors
50	light pipes
52	controlled spot
54	target area
56	indicator line
58	focusing element
60	tubes
62	inner reflective surfaces
64	indicator lines

WHAT IS CLAIMED IS:

1. A telecommunications device comprising:
 - a frame (14);
 - a plurality of trays (16) slidably mounted to the frame (14), the trays (16) slidable between a closed position and an open position with respect to the frame (14), the trays (16) mounted in a stacked arrangement in a vertical direction;
 - a plurality of connection locations (18) associated with each tray (16), the connection locations (18) forming a horizontal row of connection locations (18) along each tray (16), the connections locations (18) of all of the trays (16) also forming a plurality of vertical columns of connection locations (18) with the trays (16) mounted to the frame (14);
 - a first light emitting device (44a) associated with each tray (16) so as to identify a particular tray (16) when lit; and
 - a second light emitting device (44b) associated with each column of connection locations (18) so as to identify an entire particular column when lit.
2. A telecommunications device according to claim 1, wherein the light emitting devices (44) are light emitting diodes (LED's).
3. A telecommunications device according to claim 1, wherein the connection locations (18) are defined by fiber optic adapters.
4. A telecommunications device according to claim 1, wherein the frame (14) includes twelve slidable trays (16) and each tray (16) includes twenty-four connection locations (18).
5. A telecommunications device according to claim 4, wherein the frame (14) includes a first set of twelve slidable trays (16) and a second set of twelve slidable trays (16), the first and second sets of slidable trays (16) mounted in a side-by-side configuration separated by a divider (42) of the frame (14).

6. A telecommunications device according to claim 1, wherein the trays (16) house fiber optic equipment and the connections locations (18) are defined by fiber optic adapters for connection to the fiber optic equipment with fiber optic connectors (32).
7. A telecommunications device according to claim 1, further comprising two second light emitting devices (44b) associated with each column of connection locations (18) so as to identify an entire particular column when either is lit, one of the second light emitting devices (44b) being located at a top end (24) of the frame (14) and the other of the second light emitting devices (44b) being located at a bottom end (26) of the frame (14), the two second light emitting devices (44b) horizontally aligned on the frame (14).
8. A telecommunications device according to claim 1, wherein each tray (16) includes a light pipe (50) aligned with the second light emitting device (44b) so as to relay the light along the entire column of connection locations (18) so as to identify the entire particular column.
9. A telecommunications device according to claim 1, wherein each tray (16) includes a tube (60) with an inner reflective surface (62) aligned with the second light emitting device (44b) so as to relay the light along the entire column of connection locations (18) so as to identify the entire particular column.
10. A telecommunications device according to claim 1, wherein each tray (16) includes a visual indicator line (64) aligned with the second light emitting device (44b) so as to visually relay the light along the entire column of connection locations (18) so as to identify the entire particular column.
11. A method of visually identifying one particular connection location (18) on a tray (16) of a plurality of trays (16) slidably mounted on a telecommunications frame (14), wherein the trays (16) are mounted in a stacked arrangement in a vertical direction and each tray (16) defines a plurality of connection locations (18)

forming a horizontal row of connection locations (18) along each tray (16), the connections locations (18) of all of the trays (16) also forming a plurality of vertical columns of connection locations (18) with the trays (16) mounted to the frame (14), the method comprising:

- using a first light emitting device (44a) associated with each tray (16) so as to identify a particular tray (16) when lit;
- using a second light emitting device (44b) associated with each column of connection locations (18) so as to identify an entire particular column when lit; and
- lighting the first and second light emitting devices (44a, 44b) such that the combination of the first and second light emitting devices (44a, 44b) provides a visual identification of the one particular connection location (18).

12. A method according to claim 11, wherein the light emitting devices (44) are light emitting diodes (LED's).
13. A method according to claim 11, wherein the connection locations (18) are defined by fiber optic adapters.
14. A method according to claim 11, further comprising using two second light emitting devices (44b) associated with each column of connection locations (18) so as to identify an entire particular column when either is lit, one of the second light emitting devices (44b) being located at a top end (24) of the frame (14) and the other of the second light emitting devices (44b) being located at a bottom end (26) of the frame (14), the two second light emitting devices (44b) horizontally aligned on the frame (14).
15. A method according to claim 11, further comprising using a light pipe (50) on each tray (16), the light pipe (50) aligned with the second light emitting device (44b) so as to relay the light along the entire column of connection locations (18) so as to identify the entire particular column.

16. A method according to claim 11, further comprising using a tube (60) with an inner reflective surface (62) on each tray (16), the tube (60) aligned with the second light emitting device (44b) so as to relay the light along the entire column of connection locations (18) so as to identify the entire particular column.
17. A method according to claim 11, further comprising using a visual indicator line (56) on each tray (16), the visual indicator line (56) aligned with the second light emitting device (44b) so as to visually relay the light along the entire column of connection locations (18) so as to identify the entire particular column.
18. A telecommunications device comprising:
 - a frame (14);
 - a plurality of connection locations (18), the connection locations (18) forming horizontal rows of connection locations (18) along the frame (14) and also forming vertical columns of connection locations (18) on the frame (14);
 - a first light emitting device (44a) associated with each horizontal row of connection locations (18) so as to identify a particular row when lit; and
 - a second light emitting device (44b) associated with each column of connection locations (18) so as to identify an entire particular column when lit.
19. A telecommunications device according to claim 18, wherein the light emitting devices (44) are light emitting diodes (LED's).
20. A telecommunications device according to claim 18, wherein the connection locations (18) are defined by fiber optic adapters.

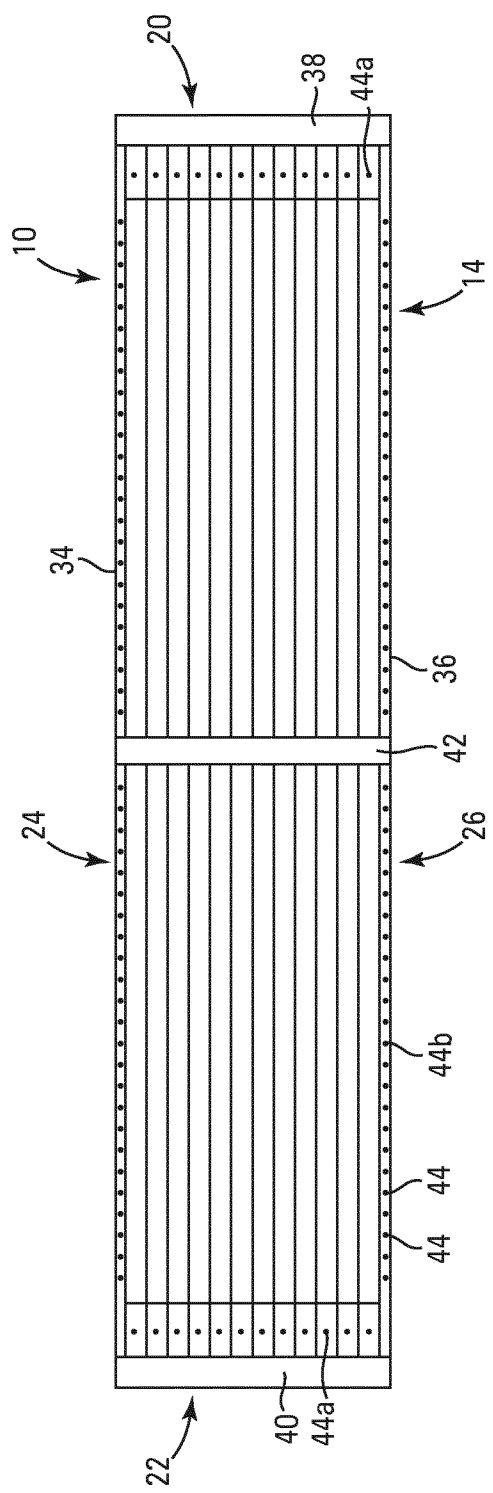
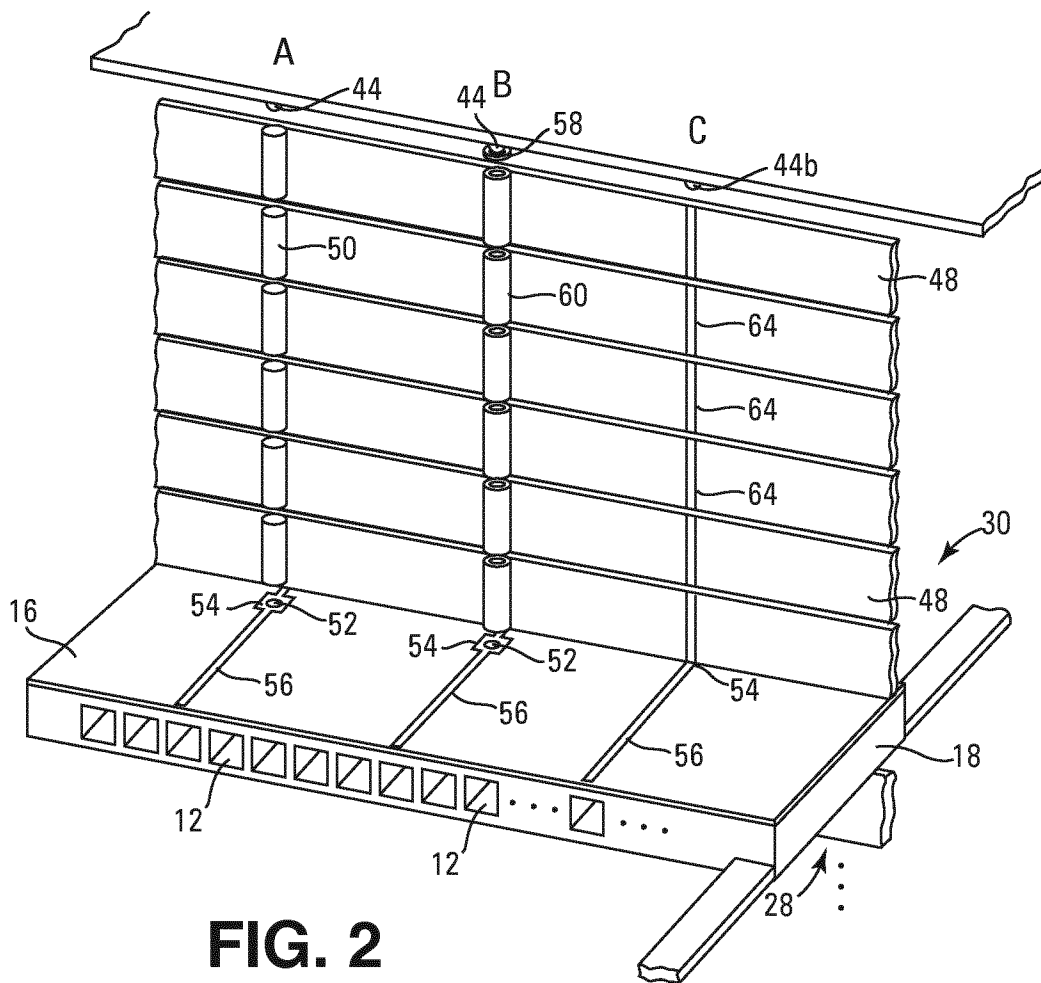


FIG. 1

**FIG. 2**

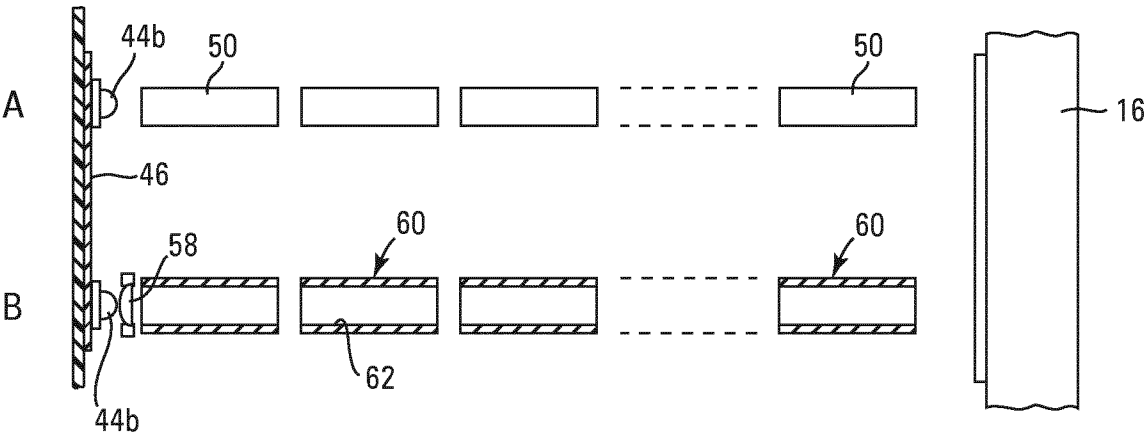


FIG. 3

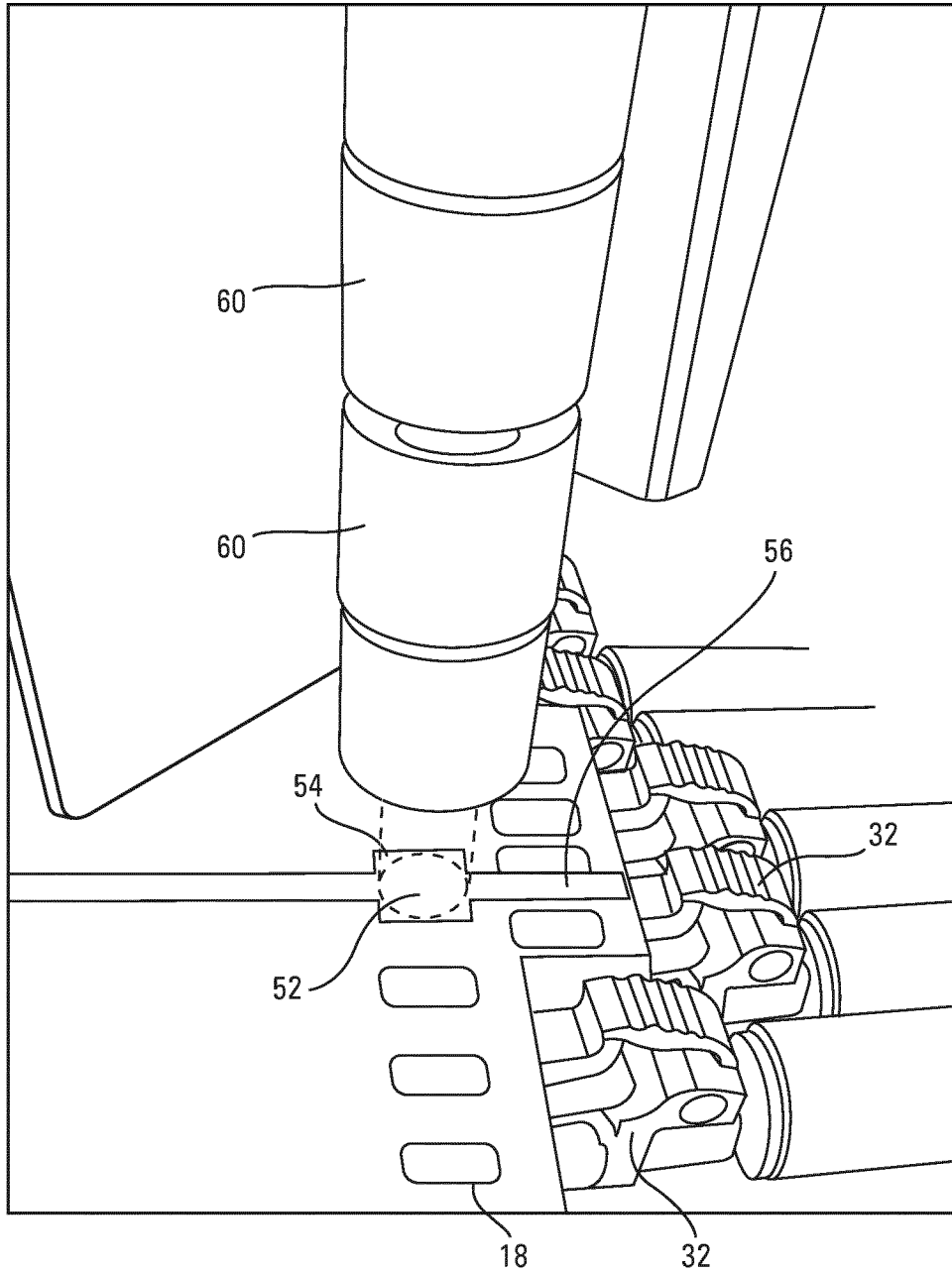


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/064522

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B6/44
ADD.

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 H04Q

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/064526 A1 (SMITH W E [US] ET AL SMITH W ERIC [US] ET AL) 23 March 2006 (2006-03-23)	18-20
Y	figure 2 paragraphs [0017], [0023] - [0034] -----	1-17
Y	US 5 265 187 A (MORIN JOSEPH O R [CA] ET AL) 23 November 1993 (1993-11-23) column 3, lines 31-60; figures 1,4,6 column 4, lines 50-53 column 5, line 38 - line 67 column 7, line 25 - line 58 -----	1-17
Y	US 6 256 445 B1 (JENNINGS MARK R [US] ET AL) 3 July 2001 (2001-07-03) abstract; figures 2,4 column 3, line 18 - column 4, line 16 column 4, line 51 - line 57 -----	8,9,15, 16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 October 2013

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/064522

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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