



- (51) **International Patent Classification:**
G02B 6/54 (2006.01) **G02B 6/36** (2006.01)
- (21) **International Application Number:**
PCT/US2016/023366
- (22) **International Filing Date:**
21 March 2016 (21.03.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
62/137,005 23 March 2015 (23.03.2015) US
- (71) **Applicant:** **COMMSCOPE TECHNOLOGIES LLC**
[US/US]; 1100 CommScope Place SE, Hickory, North
Carolina 28602 (US).
- (72) **Inventors:** **CAMPBELL, Brent**; 4724 14th Ave S, Min-
neapolis, Minnesota 55407 (US). **WENTWORTH, Mi-
chael J.**; 15191 Blakeley Trail, Belle Plaine, Minnesota
56011 (US). **PFARR, John T.**; 235 Regency Road, Le
Sueur, Minnesota 56058 (US).
- (74) **Agent:** **BRUESS, Steven C.**; Merchant & Gould P.C.,
P.O. Box 2903, Minneapolis, Minnesota 55402-0903 (US).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SH, SI, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

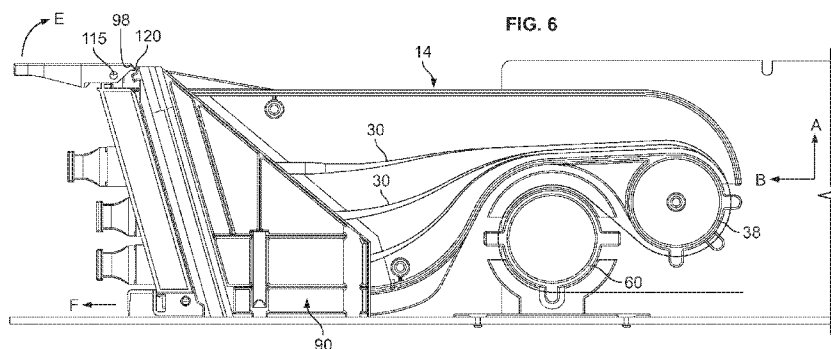
Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

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

- (54) Title:** FIBER OPTIC MODULE AND CHASSIS WITH CABLE SLACK MANAGEMENT



- (57) Abstract:** A telecommunications system includes a telecommunications fixture including a fixture spool and at least one telecommunications module mounted to the telecommunications fixture. The telecommunications module is slidably movable between a retracted position and an extended position with respect to the telecommunications fixture. The telecommunications module includes a module spool that moves with the telecommunications module, wherein the module spool moves toward and away from the fixture spool as the telecommunications module slides with respect to telecommunications fixture. A cable that extends from the telecommunications fixture to the slidable telecommunications module is at least partially wrapped around both the fixture spool and the module spool when the module is in the retracted position.

**FIBER OPTIC MODULE AND CHASSIS WITH CABLE SLACK
MANAGEMENT**

5 **Cross Reference to Related Application**

This application is being filed on March 21, 2016 as a PCT International Patent Application and claims the benefit of U.S. Patent Application Serial No. 62/137,005, filed on March 23, 2015, the disclosure of which is incorporated herein by reference in its entirety.

10 **Field**

The present disclosure relates to apparatus and methods for termination and storage of optical fiber cables, such as distribution cables.

Background

15 With respect to termination and storage of optical fibers including distribution fibers, various concerns exist. One concern is providing high density to minimize needed space. In the case of telecommunications enclosures, a reduced size for the enclosures and the internal structures is preferred.

20 A further concern related to termination and storage of optical fiber cables is the ease of access to the cables and the terminations. Such ease of use is desired during assembly, during installation in the field, and later when changes or modifications to the system are desired requiring adding or removing terminations, or when cleaning and checking the terminations.

25 A further concern in the area of termination and storage/management of optical fiber cables includes protecting the optical fiber from damage from excess bending below the minimum bend radius of the cable. Such protection of the fibers is desired during assembly and installation, and later when individual terminations and cables are accessed for cleaning or modification.

Further improvements in these areas are desired.

Summary

The present disclosure relates to a telecommunications system, a fiber optic based system according to one aspect, that includes a chassis and at least one movable module, wherein both the chassis and the module include cable slack storage/ management features for managing fiber optic cables associated with the system. The system includes a chassis and a plurality of movable modules mounted therein, wherein the chassis and the modules include features that cooperate to manage the slack for cabling between the chassis and the modules as the modules move between an extended position and a retracted position.

According to an aspect of the disclosure, the telecommunications system includes a telecommunications fixture including a fixture spool and at least one telecommunications module mounted to the telecommunications fixture. The telecommunications module is slidably movable between a retracted position and an extended position with respect to the telecommunications fixture. The telecommunications module includes a module spool that moves with the telecommunications module, wherein the module spool moves toward and away from the fixture spool as the telecommunications module slides with respect to the telecommunications fixture. A cable that extends from the telecommunications fixture to the slidable telecommunications module is at least partially wrapped around both the fixture spool and the module spool when the module is in the retracted position.

According to a further aspect of the disclosure, the telecommunications system includes a telecommunications fixture including a fixture spool and at least one telecommunications module mounted to the telecommunications fixture, the telecommunications module slidably movable between a retracted position and an extended position with respect to the telecommunications fixture. The telecommunications module includes a module spool that moves with the telecommunications module, wherein when the telecommunications module is moved from the retracted position to the extended position, the module spool moves away from the fixture spool along a first direction and toward the fixture spool along a second direction that is orthogonal to the first direction.

According to yet another aspect, the disclosure is directed to a method of managing a cable extending between a telecommunications fixture and a telecommunications module slidably mounted on the telecommunications fixture, the method comprising moving the telecommunications module from an extended position to

a retracted position with respect to the telecommunications fixture and at least partially wrapping the cable around both a spool of the telecommunications fixture and a spool of the telecommunications module automatically by moving the telecommunications module from the extended position to the retracted position, wherein the spool of the telecommunications module moves toward the spool of the telecommunications fixture along at least a first direction.

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

FIG. 1 is a front perspective view of a fiber optic telecommunications system including a telecommunications chassis and a plurality of slidable distribution modules mounted therein, the system having inventive aspects in accordance with the present disclosure;

FIG. 2 is a partially exploded view of the system of FIG. 1;

FIG. 3 illustrates a further exploded view of the system of FIGS. 1-2 with the distribution modules removed from the telecommunications chassis;

FIG. 4 is a close-up view illustrating one of the modules of FIG. 1 in a retracted position;

FIG. 5 illustrates the module of FIG. 4 in an extended position;

FIG. 6 is a top view illustrating one of the modules of FIG. 1 in a retracted position, with a cover of the module removed to show the internal features thereof including the cabling therein;

FIG. 6A illustrates the module of FIG. 6 with one of the mounting walls removed to show further details of the internal features of the module;

FIG. 7 illustrates the module of FIG. 6A in an extended position;

FIG. 8 is another perspective view illustrating one of the modules of FIG. 1 in an extended position, with the cover of the module removed to show the internal features thereof;

FIG. 9 is a perspective view of one of the mounting walls used for slidably mounting the modules of FIG. 1 into the chassis of FIG. 1;

FIG. 10 is a top view of the wall of FIG. 9; and

FIG. 11 is a cross-sectional view taken along line 11-11 of FIG. 10.

Detailed Description

Referring now to FIGS. 1-11, a telecommunications system 10 (e.g., a fiber
5 optic based system according to one embodiment) with cable slack management/storage
features is illustrated. The fiber optic system 10 includes a telecommunications
chassis/frame 12 that houses a plurality of slidably mounted distribution modules 14.

Referring to FIGS. 1-3, the chassis 12 defines a front side 16, a rear side 18,
a right side 20, a left side 22, a top side 24, and a bottom side 26. The fibers carried by a
10 distribution cable 28 coming from the rear side 18 of the chassis 12 are relayed as ribbon
cables 30 (illustrated in FIGS. 6-8) to each of the modules 14 mounted within the chassis
12. In the depicted example, the ribbon cables 30 are shown as being terminated with
MPO style connectors 32 that are mounted to MPO style adapters 33 positioned at the
front of the distribution modules 14.

As shown, the right side 20 of the chassis 12 is defined by a vertical right
15 wall 34. The right side 20 of the chassis 12 is provided as a closed side. The left side 22
of the chassis 12 is provided as an open side, and the modules 14 are configured to slide
generally in a direction from the closed right side 20 toward and through the open left side
22.

As will be described in further detail, within an interior 36 of the chassis
20 12, the right wall 34 includes a plurality of chassis spools 38 mounted thereon. The
chassis spools 38 are mounted in a stacked arrangement extending from the top side 24 to
the bottom side 26 of the chassis 12. Each chassis spool 38, as will be discussed,
cooperates with a slidable distribution module 14 for managing the cable slack associated
25 with each module 14.

For providing slidable movement to the modules 14, the chassis 12 includes
a plurality of walls 90 mounted on the right wall 34. The walls 90 are provided in a
stacked arrangement from the top side 24 to the bottom side 26. The walls 90 are mounted
parallel to each other. As shown, each module 14 uses two of the walls 90 for slidable
30 support.

FIGS. 9-11 illustrate one of the walls 90 of the chassis in isolation. As
shown, each wall 90 mounts to the right wall 34 of the chassis 12 along a lower edge 112,
such as with fasteners into holes 113. The wall 90 defines opposite facing linear grooves

214 which are configured to slidably receive mating structures of the modules 14 mounted thereto.

Now referring to FIGS. 4-8, one of the modules 14 is shown in closer detail. Each module 14 includes a module housing 40 defined by a main housing portion 42 and a removable cover 44 that is attached to the main housing portion 42 for covering an interior 46 of the module 14. The main housing portion 42 defines a bottom wall 48 of the module housing 40, and the cover 44 defines a top wall 50 of the module housing 40. The main housing portion 42 also defines a curved rear wall 52 for relaying fibers in and out of the module housing 40 without violating minimum bend radius requirements. As will be described in further detail, a curved notch 54 is defined by a right wall 56 of the main housing portion 42 (and also by the cover 44), where the curved notch 54 is configured to accommodate the chassis spool 38 when the module 14 is in the retracted position.

The module housing 40 defines an adapter block 100 at a front end 58 and a module spool 60 at a rear end 62 of the module 14. The adapter block 100, as shown, is provided as an integral part of the module housing 40 in the depicted embodiment. In other embodiments, the adapter block 100 may be provided as a removable part of the module 14 that can be removed and replaced with similar blocks or blocks having different adapter formats. Also, the adapter block 100 may be provided with adapters that are integrally formed with the block 100 or may include individually removable adapters.

The module spool 60 at the rear end 62 of the module 14 cooperates with one of the chassis spools 38 provided within the chassis 12 for managing the cabling extending into the module 14, as will be discussed in further detail below.

FIG. 4 illustrates the module 14 in a retracted position, and FIG. 5 illustrates the module 14 in an extended position. FIG. 6 illustrates the module 14 with the cover 44 of the module 14 removed to show the internal features thereof, including the cabling 30 therein, and FIG. 6A illustrates the module 14 with one of the mounting walls 90 removed to show further details of the internal features of the module 14. FIG. 7 illustrates the module of FIG. 6A in an extended position.

Still referring to FIGS. 4-8, the slidable interaction of the modules 14 with the walls 90 of the chassis 12 is provided by the adapter block 100 that is located at the front end 58 of the module 14. The adapter block 100 defines guides 108 formed as rails for slidably mating with grooves 214 of two opposed walls 90. As noted above, the adapter block 100 may include openings 102 for receiving individual adapters 33. In other

embodiments, the main adapter bodies may be formed as integral parts of the block 100, wherein the block 100 just receives internal ferrule alignment features. In FIGS. 6A, 7, and 8, MPO type adapters 33 are shown. The front ends 64 of the adapters 33 are provided with dust caps 66 when the modules 14 are not being actively used. In the example shown, four openings 102 are provided for each adapter block 100 for receiving four MPO type adapters 33. The MPO adapters 33 snap into the openings 102. Even though each module 14 is shown with four MPO type adapters 33 that can mate MPO connectors 32, other numbers are possible. For example, in certain embodiments, the modules 14 may be twice as wide providing twice the capacity shown in the Figures, or each MPO connector 32 may be terminated to two ribbon cables 30, providing twice the distribution.

Still referring to FIGS. 4-8, the adapter block 100 includes a pivoting handle 114 which pivots about hinge 115 in the direction of an arrow E as specifically shown in FIGS. 6 and 6A. A tip 98 of the handle 114 engages an end 120 of wall 90 to lift the adapter block 100 (and the entire module) to allow the movement to start from a retracted position to an extended position. A slide handle or clip 122 provided at the opposite end of the row of adapters is configured to engage an edge 116 of the wall 90. A corner 124 of the clip 122 engages first notch 94 defined on the edge 116 to retain module 14 in the retracted position. The handle 114, when pivoted to engage the wall 90 and lift the adapter block 100, moves the corner 124 out of first notch 94 to allow movement to the extended position through a pulling motion by the user. The corner 124 of the clip 122 falls into a second notch 96 defined on the edge 116 when the module 14 is in the fully extended position. The interaction of the clip 122 and the second notch 96 keeps the module 14 from sliding off of the wall 90. Slide handle/clip 122 is spring loaded to resist movement of a handle portion 126 of the clip 122 in the direction of arrow F as shown in FIGS. 6 and 6A. The slide handle/clip 122 can then be moved manually to allow module 14 to be fully separated from the wall 90 if desired. In this manner, any of the modules 14 may be fully removed from the chassis 12 such as for repair or replacement of the adapters 33.

As shown in FIG. 7, axis G defines the line of travel and presents each of the MPO adapters 33 in a staggered arrangement relative to a transverse direction H. It should be noted that, although the depicted example of the distribution module 14 follows an angled (acute angle) travel path with respect to the right wall 34 of the chassis 12, the

inventive features are fully applicable to modules 14 that can slidably move perpendicular/transverse to the right wall 34.

Adapter blocks similar to those shown in the present disclosure are described and shown in further detail, including the slidable operation thereof, in U.S.

5 Patent Nos. 5,497,444 and 6,591,051, the entire disclosures of which are incorporated herein by reference.

Now referring specifically to FIGS. 6, 6A, 7, and 8, for managing the cables leading from the rear side 18 of the chassis 12 toward the adapter block 100 located at the front ends 58 of the modules 14, as noted above, each module 14 includes a module
10 spool 60. The module spool 60, in the depicted embodiment, is formed as an integral part of the module main housing portion 42. The module spool 60 moves along with the slidable module 14 and cooperates with the fixed chassis spool 38 in managing the cabling.

When the module 14 is in a retracted position, as shown in FIGS. 6 and 6A,
15 the module spool 60 is generally horizontally aligned with the chassis spool 38. The module housing 40 includes the curved notch 54 configured to accommodate the chassis spool 38 when the module 14 is in the retracted position. When the module 14 is moved to an extended position, due to the angled movement of the module 14 with respect to the right wall 34 of the chassis 12, the module spool 60 moves away from the chassis spool 38
20 in a direction extending from the right side 20 to the left side 22 (i.e., first direction A), but also moves toward the chassis spool 38 when viewed along a rear to front direction (i.e., second direction B) of the chassis 12.

Both the chassis spool 38 and the module spool 60 include cable retention fingers 68 for retaining the cables 30 around the spools 38, 60. As a cable 30 extends
25 from the rear side 18 of the chassis 12 toward the modules 14, the cable 30 is initially passed around the chassis spool 38 between the right wall 34 of the chassis 12 and the chassis spool 38. The cable 30 is then wound around the chassis spool 38 toward the rear and then around the module spool 60. As the cable 30 is wound around the module spool 60, the cable 30 enters the interior 46 of the module 14 through an opening 70 located at
30 the rear end 62 of the module 14 that is adjacent the module spool 60. From the opening 70, the cable 30 is led to the adapter block 100 adjacent the front end 58 of the module 14. The cable 30, which is terminated with a fiber optic connector 32 (e.g., an MPO type connector in the depicted example) is mated to one of the adapters 33 of the adapter block 100.

In the embodiment of the module 14 shown, the adapter block 100 provides the capacity for four adapters 33 even though three are shown as being used.

The spools 38, 60 of the chassis 12 and the module 14 are sized (in diameter) and positioned such that, even when the module 14 is at its fully extended position, the length of cable 30 that has been wound around both of the spools 38, 60 is not pulled or tensioned in a manner where stress is applied to the optical fibers. As shown, when the module 14 is moved between the retracted and extended positions, the length of fiber that is between the rear end 62 of the module 14 (at the rearmost part of the module spool 60) and the forwardmost part of the chassis spool 38 moves between a taut configuration and a coiled configuration. This length of fiber is managed and remains unstressed as the module 14 moves between extended and retracted positions.

The MPO connectors 32 at the front end 58 of the module 14 may be oriented in the MPO adapters 33 such that the flat profile of the ribbon cables 30 are positioned horizontally against the bottom wall 48 of the module housing 40. The module interior 46 provides enough space where the ribbon cables 30 can be twisted approximately 90 degrees from the flat profile extending along the bottom wall 48 of the module housing 40 toward the flat profile being parallel to the curved rear wall 52 of the module housing 40. In this manner, a plurality of ribbon cables 30 can exit through the opening 70 at the rear end 62 of the module 14 and be wound around both the module spool 60 and the chassis spool 38.

The chassis 12 depicted in FIGS. 1-3 is a 432-fiber chassis, with twelve sliding fiber optic modules 14, each module 14 including three MPO adapter ports, each adapter port mating an MPO connector 32 that is carrying twelve fibers. The fiber counts can be varied depending upon the desired density. In addition, even though the depicted embodiment of the telecommunications system 10 is shown with MPO format connectors 32 and adapters 33, other format types such as SC, LC, and FC can be used. Furthermore, even though the telecommunications system 10 of the present disclosure has been discussed and illustrated as a fiber optic based system since the features thereof are advantageous to managing fibers that are subject to minimum bend radius requirements and pull-stress limitations, the features may be applicable to other types of telecommunications systems such as electrical or hybrid systems, where cable management is essential.

Although in the foregoing description, terms such as “top,” “bottom,” “front,” “back,” “right,” “left,” “upper,” and “lower” may have been used for ease of

description and illustration, no restriction is intended by such use of the terms. The devices described herein can be used in any orientation, depending upon the desired application.

5 Having described the preferred aspects and embodiments of the present disclosure, 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.

CLAIMS:

1. A telecommunications system comprising:
a telecommunications fixture including a fixture spool;
at least one telecommunications module mounted to the telecommunications fixture, the telecommunications module slidably movable between a retracted position and an extended position with respect to the telecommunications fixture, the telecommunications module including a module spool that moves with the telecommunications module, wherein the module spool moves toward and away from the fixture spool as the telecommunications module slides with respect to telecommunications fixture, wherein a cable that extends from the telecommunications fixture to the slidable telecommunications module is at least partially wrapped around both the fixture spool and the module spool when the module is in the retracted position.
2. A telecommunications system according to claim 1, further comprising a plurality of the telecommunications modules mounted to the telecommunications fixture.
3. A telecommunications system according to claim 1, wherein the telecommunications module slides at a non-perpendicular angle with respect to a portion of the telecommunications fixture.
4. A telecommunications system according to claim 1, wherein the telecommunications module is a fiber optic module for relaying fiber optic signals.
5. A telecommunications system according to claim 4, wherein the fiber optic module defines fiber optic adapter ports for receiving fiber optic connectors terminated to cables coming from the telecommunications fixture.
6. A telecommunications system according to claim 5, wherein the fiber optic adapter ports are MPO format.
7. A telecommunications system according to claim 1, wherein the telecommunications module includes a latch for unlatching the telecommunications module to allow for slidable movement with respect to the telecommunications fixture.

8. A telecommunications system comprising:
a telecommunications fixture including a fixture spool;
at least one telecommunications module mounted to the telecommunications fixture, the telecommunications module slidably movable between a retracted position and an extended position with respect to the telecommunications fixture, the telecommunications module including a module spool that moves with the telecommunications module, wherein when the telecommunications module is moved from the retracted position to the extended position, the module spool moves away from the fixture spool along a first direction and toward the fixture spool along a second direction that is orthogonal to the first direction.
9. A telecommunications system according to claim 8, wherein the module spool moves toward the fixture spool along the first direction and away from the fixture spool along the second direction when the telecommunications module is moved from the extended to the retracted position.
10. A telecommunications system according to claim 8, wherein the fixture spool and the module spool are generally aligned along the second direction when the telecommunications module is in the retracted position.
11. A telecommunications system according to claim 8, further comprising a plurality of the telecommunications modules mounted to the telecommunications fixture.
12. A telecommunications system according to claim 8, wherein the telecommunications module slides at a non-perpendicular angle with respect to a portion of the telecommunications fixture.
13. A telecommunications system according to claim 8, wherein the telecommunications module is a fiber optic module for relaying fiber optic signals.
14. A telecommunications system according to claim 13, wherein the fiber optic module defines fiber optic adapter ports for receiving fiber optic connectors terminated to cables coming from the telecommunications fixture.

15. A telecommunications system according to claim 14, wherein the fiber optic adapter ports are MPO format.
16. A telecommunications system according to claim 8, wherein the telecommunications module includes a latch for unlatching the telecommunications module to allow for slidable movement with respect to the telecommunications fixture.
17. A method of managing a cable extending between a telecommunications fixture and a telecommunications module slidably mounted on the telecommunications fixture, the method comprising:
- moving the telecommunications module from an extended position to a retracted position with respect to the telecommunications fixture; and
 - at least partially wrapping the cable around both a spool of the telecommunications fixture and a spool of the telecommunications module automatically by moving the telecommunications module from the extended position to the retracted position, wherein the spool of the telecommunications module moves toward the spool of the telecommunications fixture along at least a first direction.
18. A method according to claim 17, further comprising moving the spool of the telecommunications fixture and the spool of the telecommunications module away from each other along at least the first direction when moving the module from the retracted position to the extended position.
19. A method according to claim 17, further comprising sliding the telecommunications module at a non-perpendicular angle with respect to a portion of the telecommunications fixture such that the telecommunications module moves in two different directions that are orthogonal to each other.
20. A method according to claim 17, further comprising pivoting a latch handle to unlatch the telecommunications module for slidable movement with respect to the telecommunications fixture.

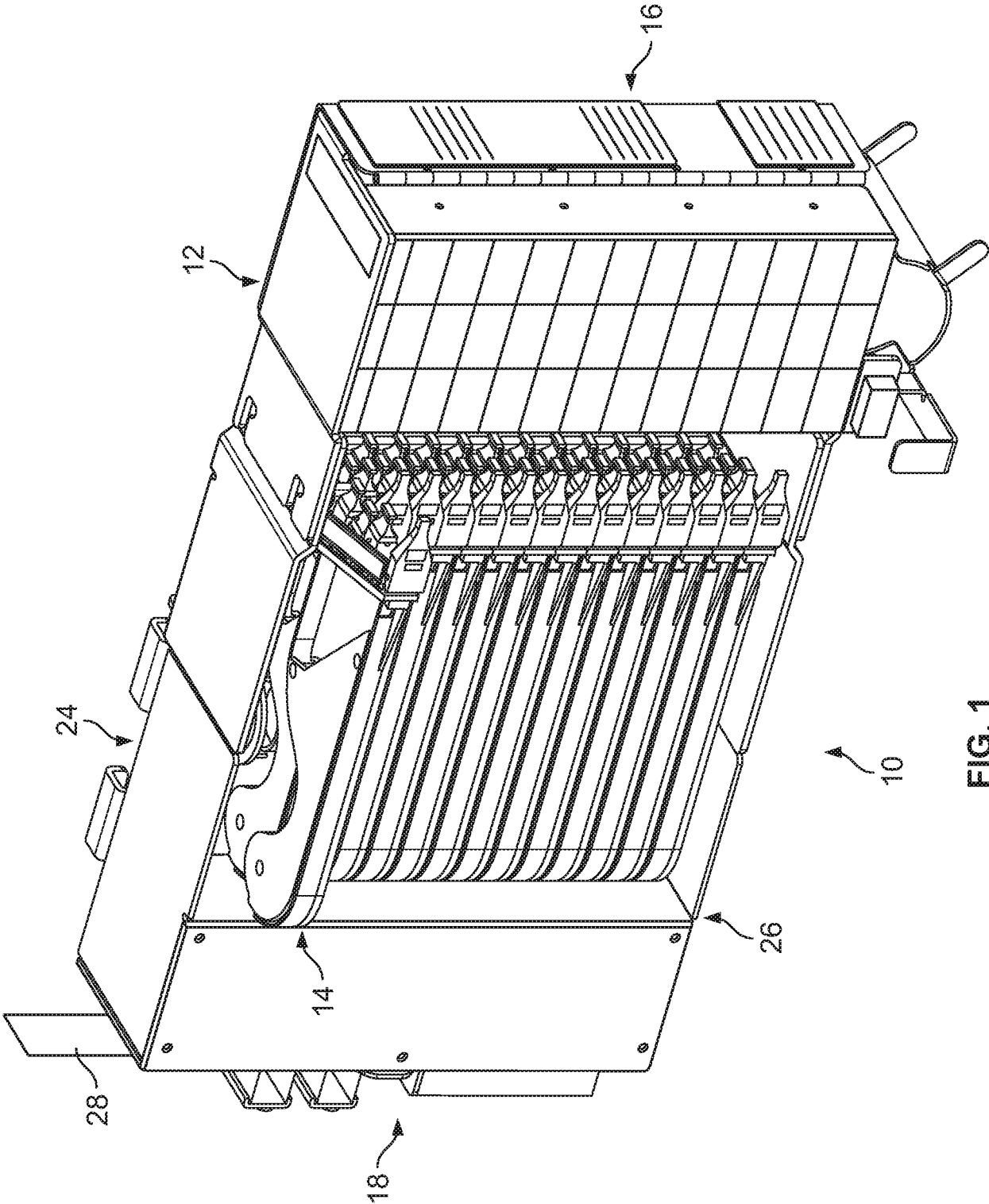


FIG. 1

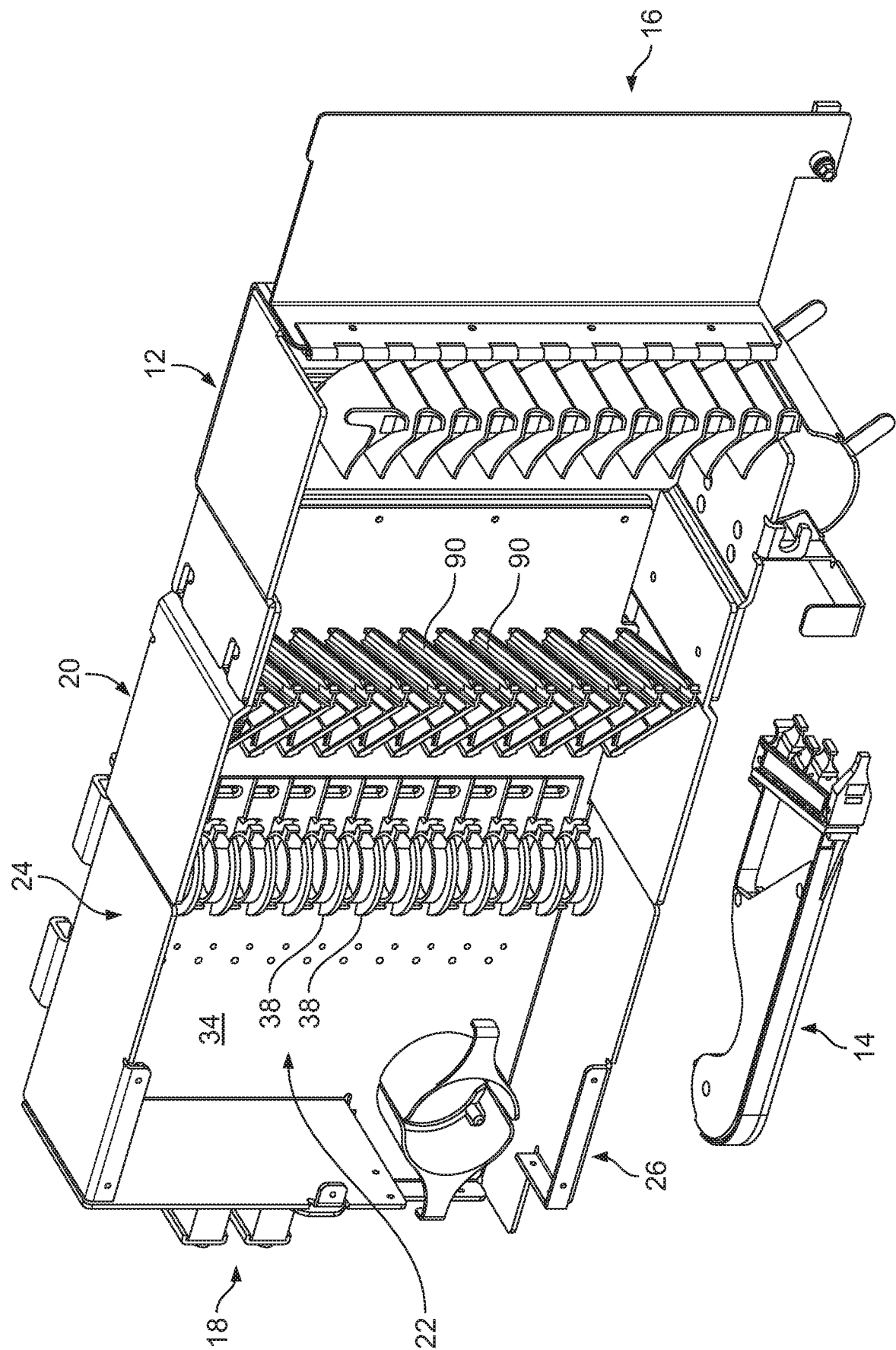


FIG. 2

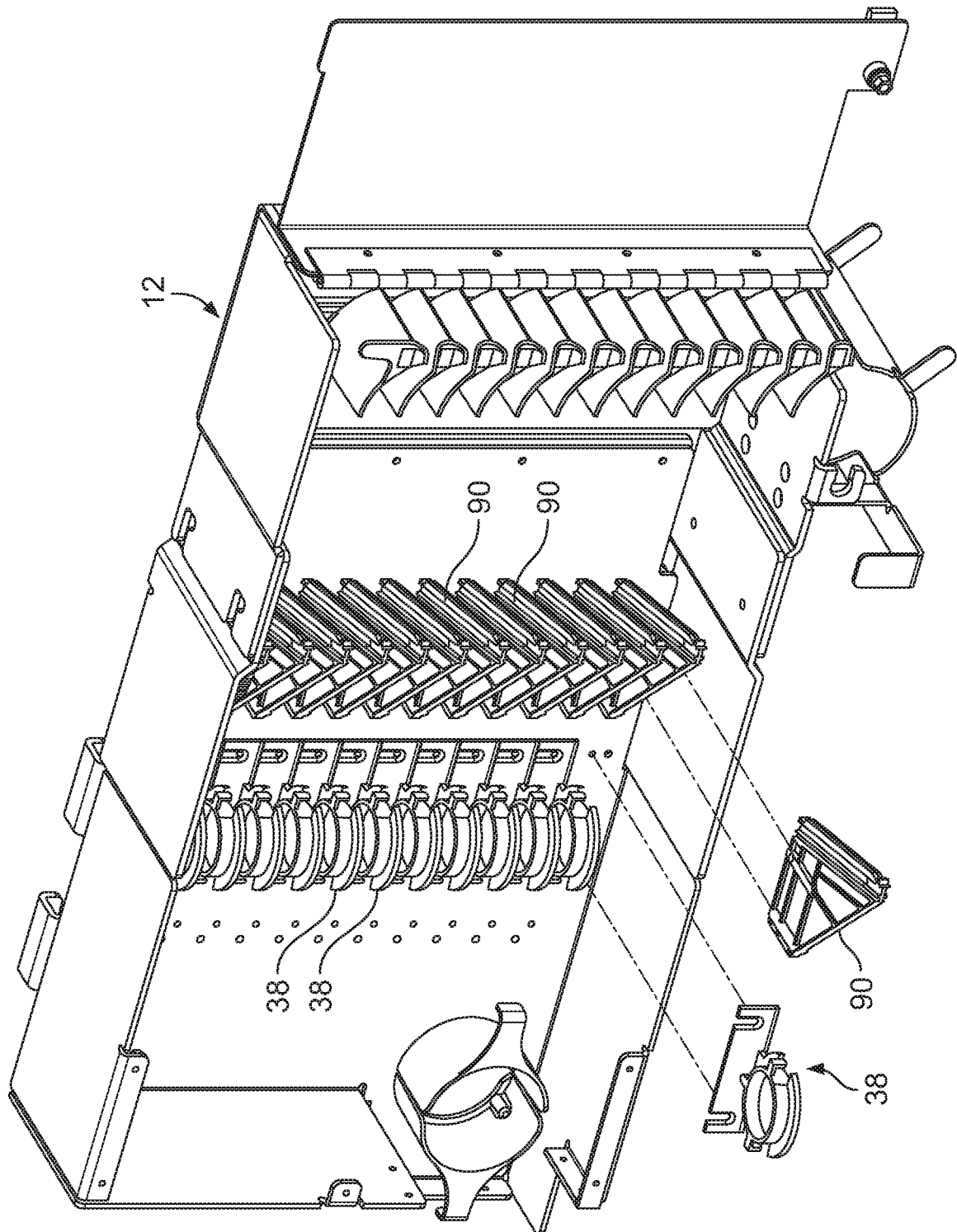


FIG. 3

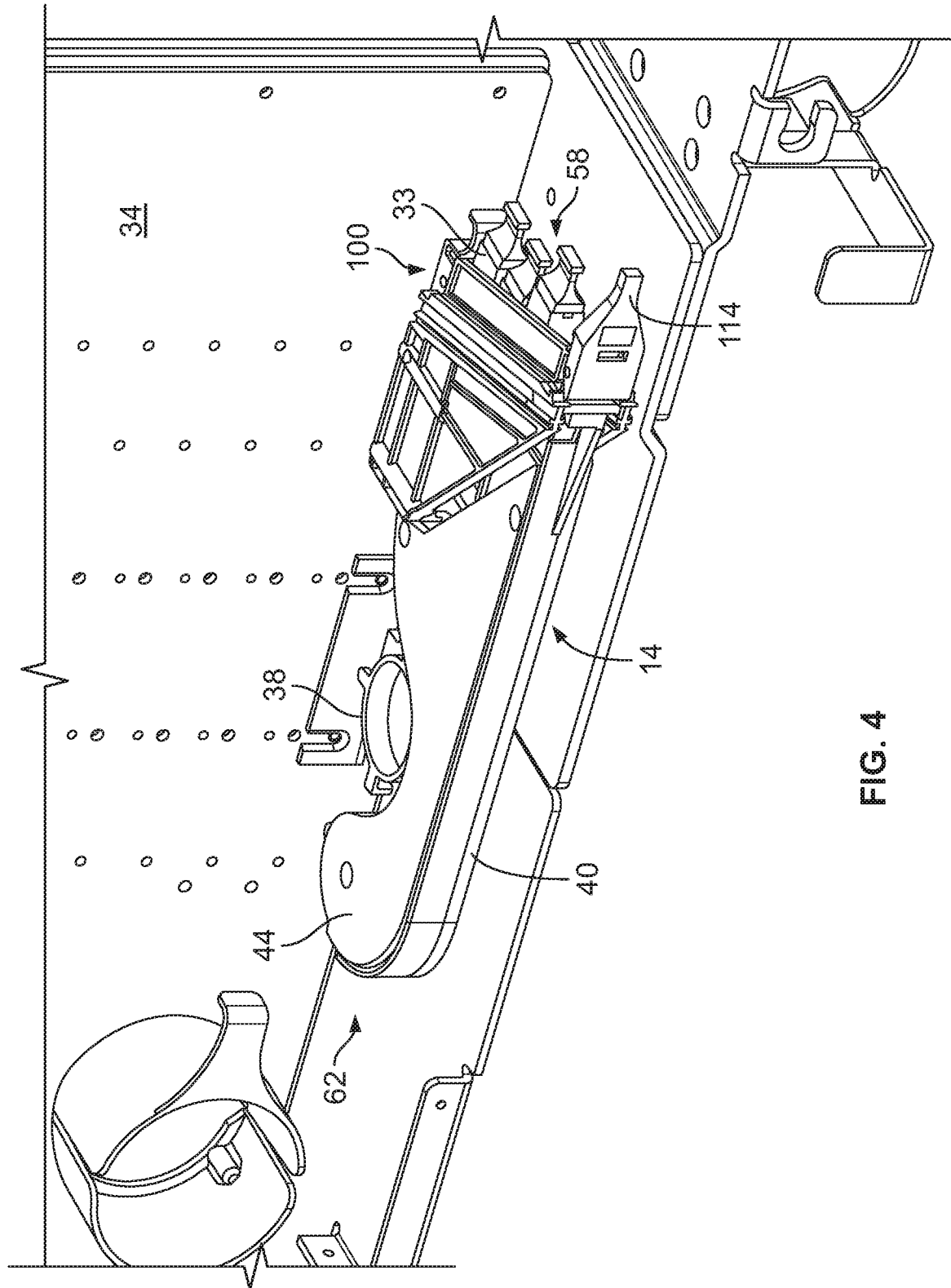


FIG. 4

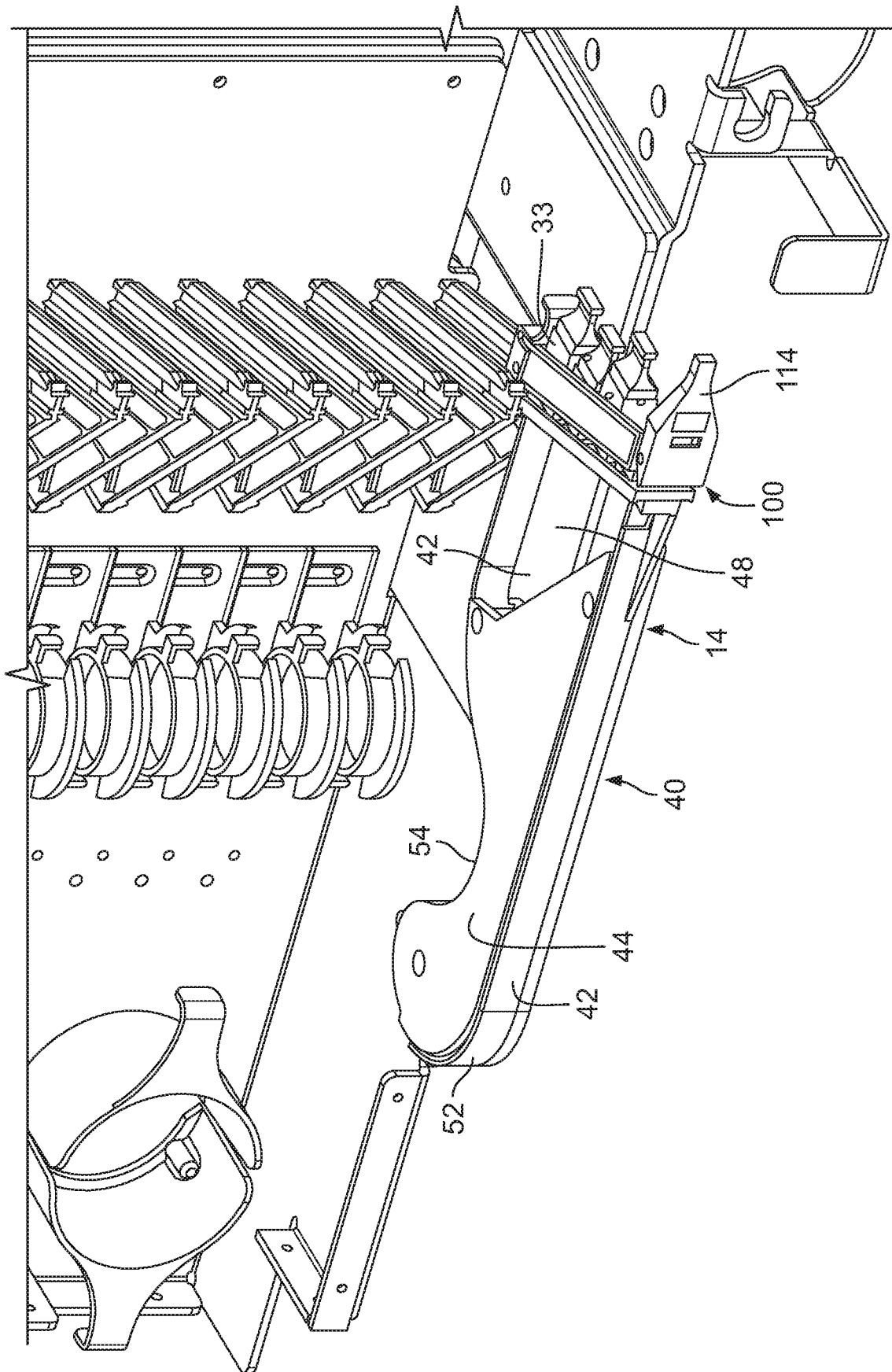


FIG. 5

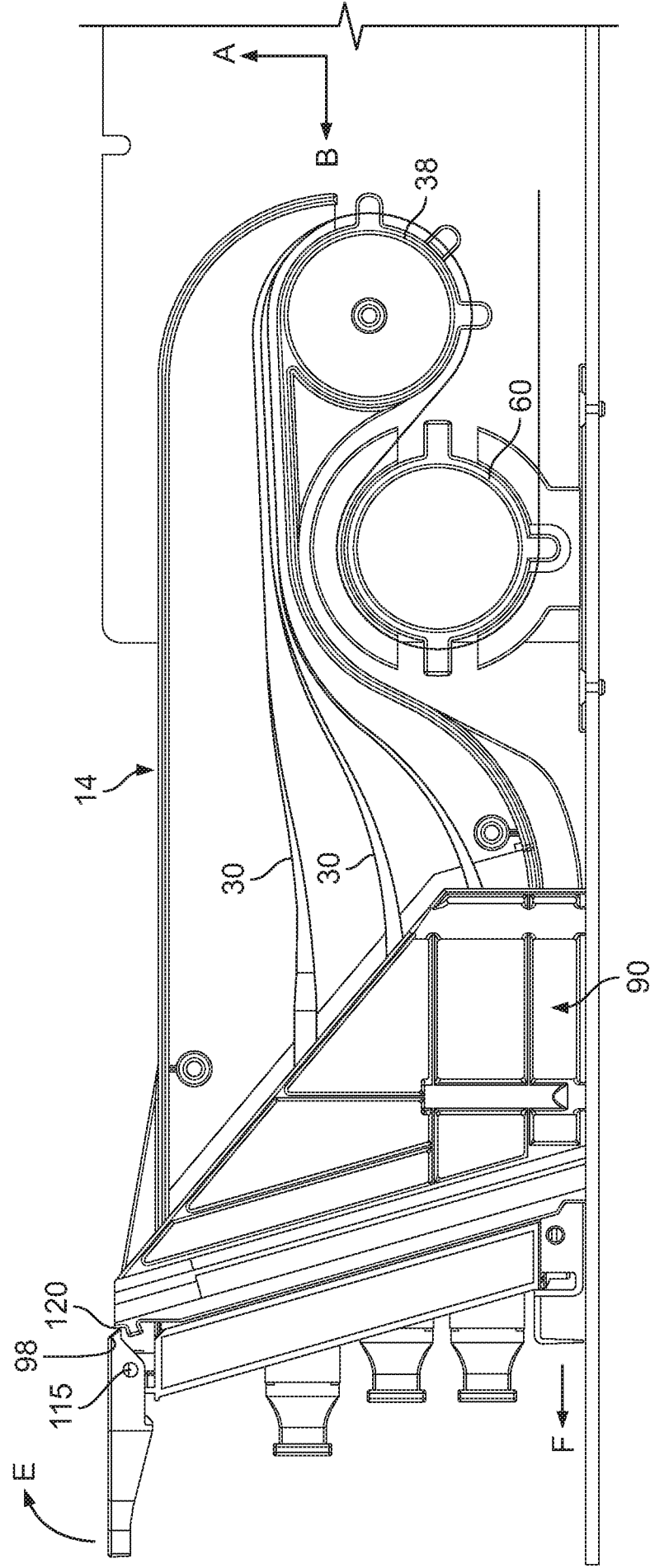


FIG. 6

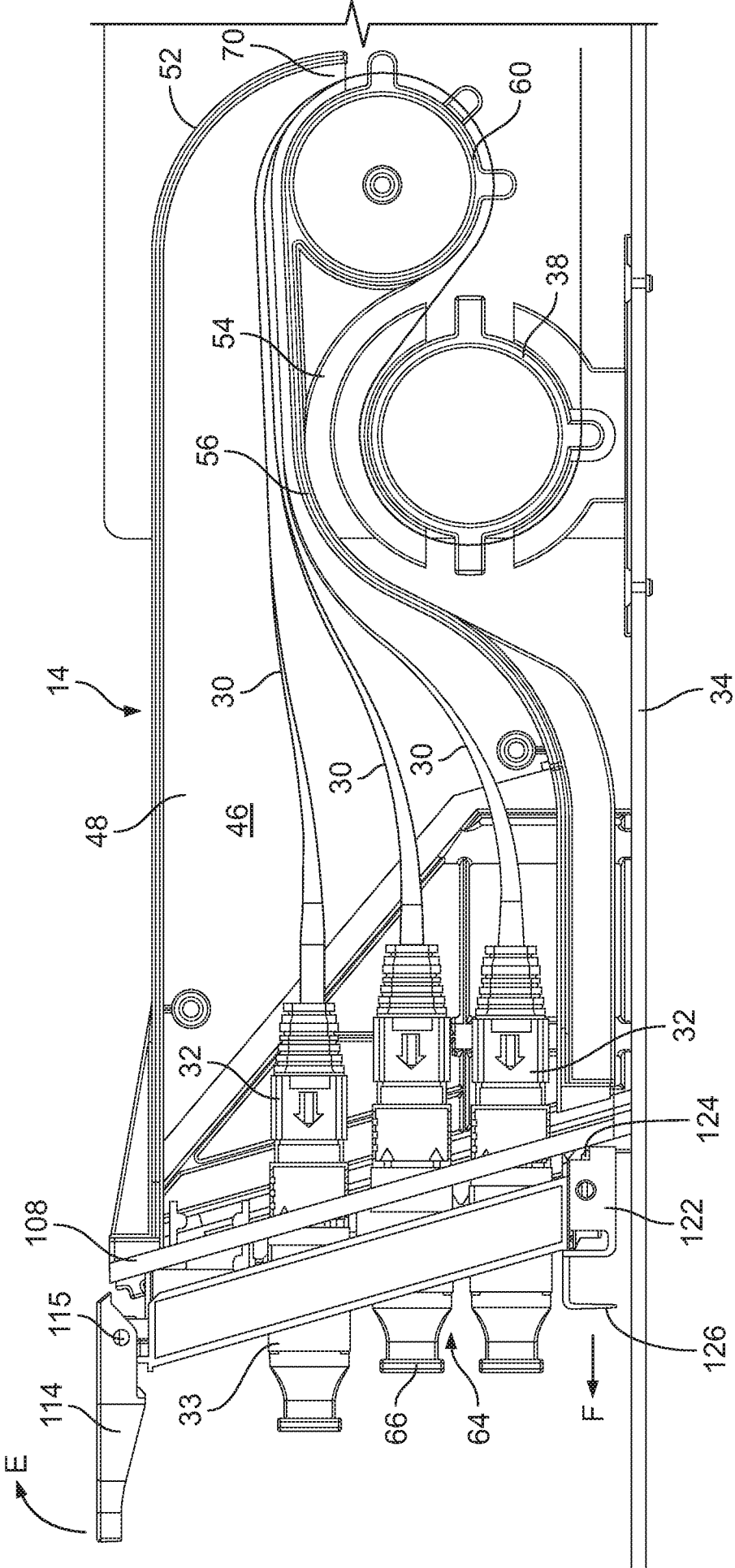
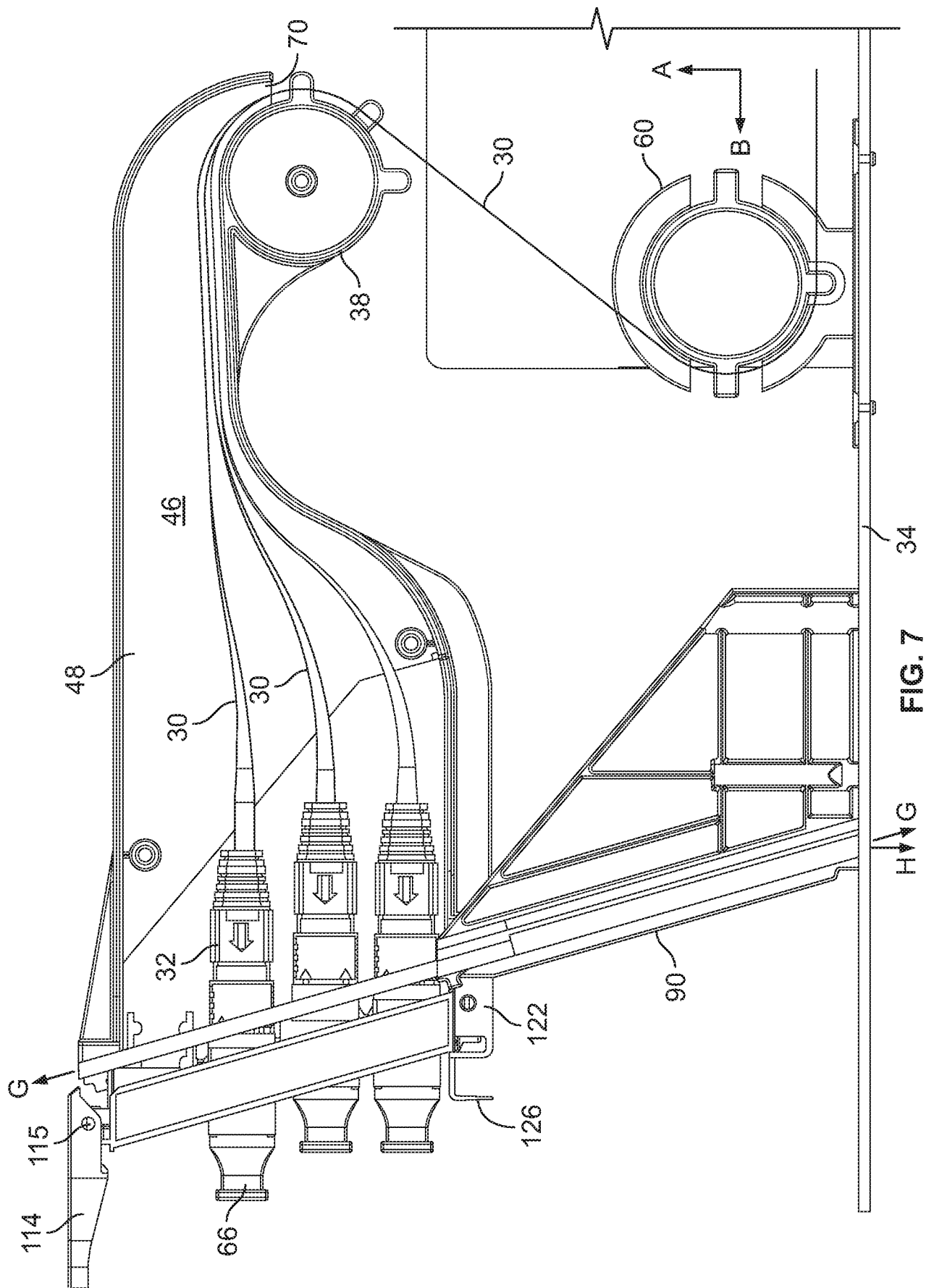


FIG. 6A



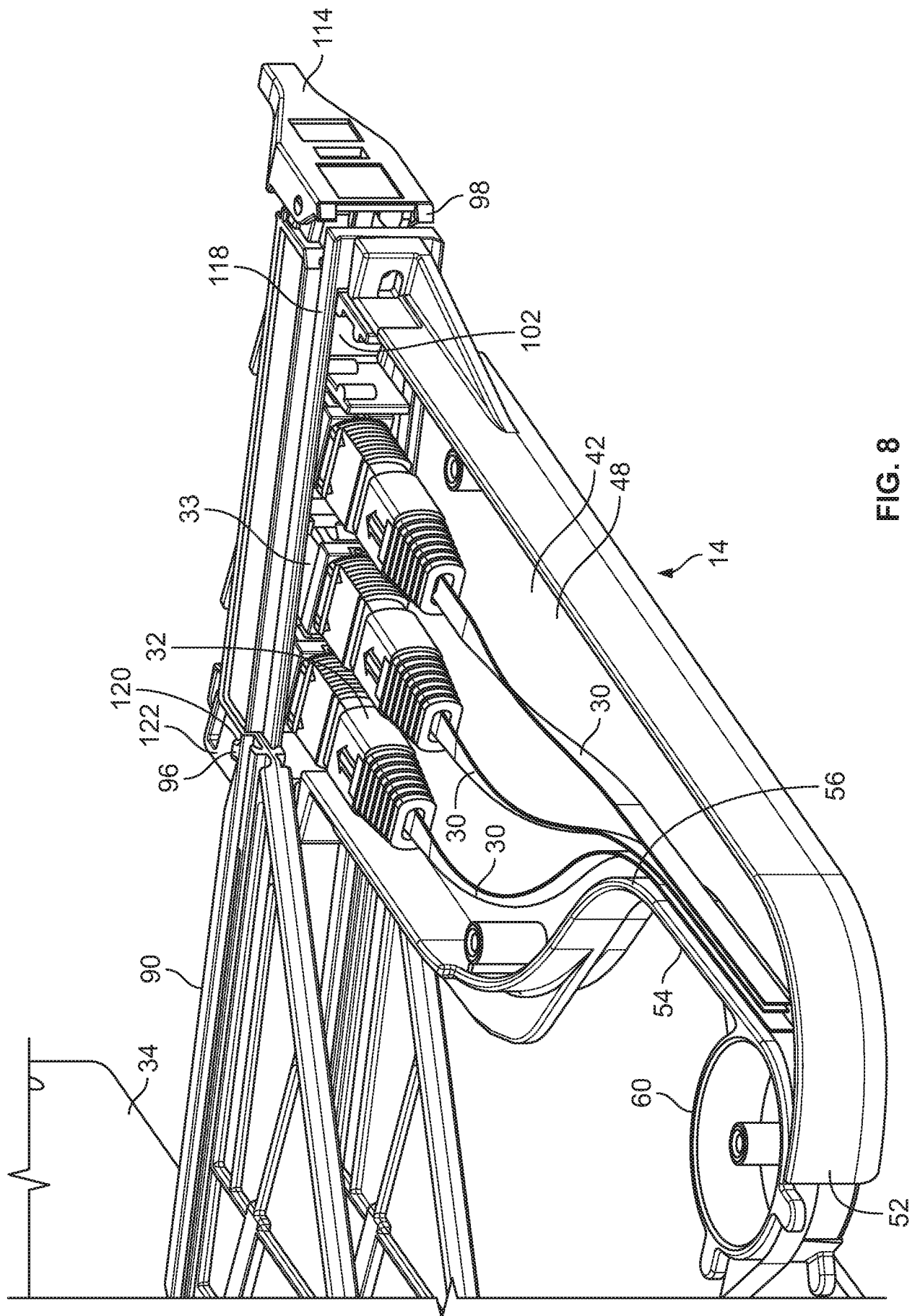


FIG. 8

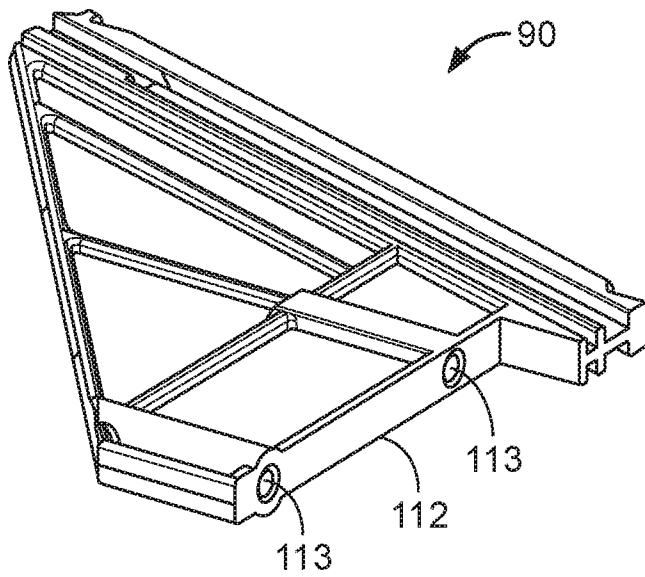


FIG. 9

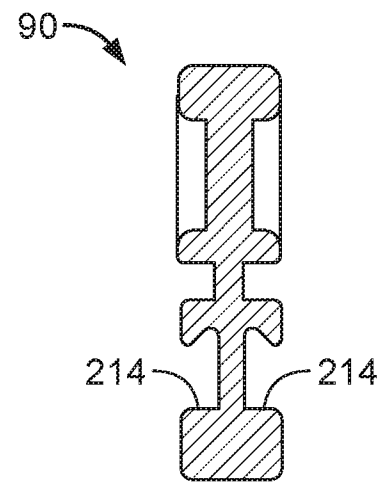


FIG. 11

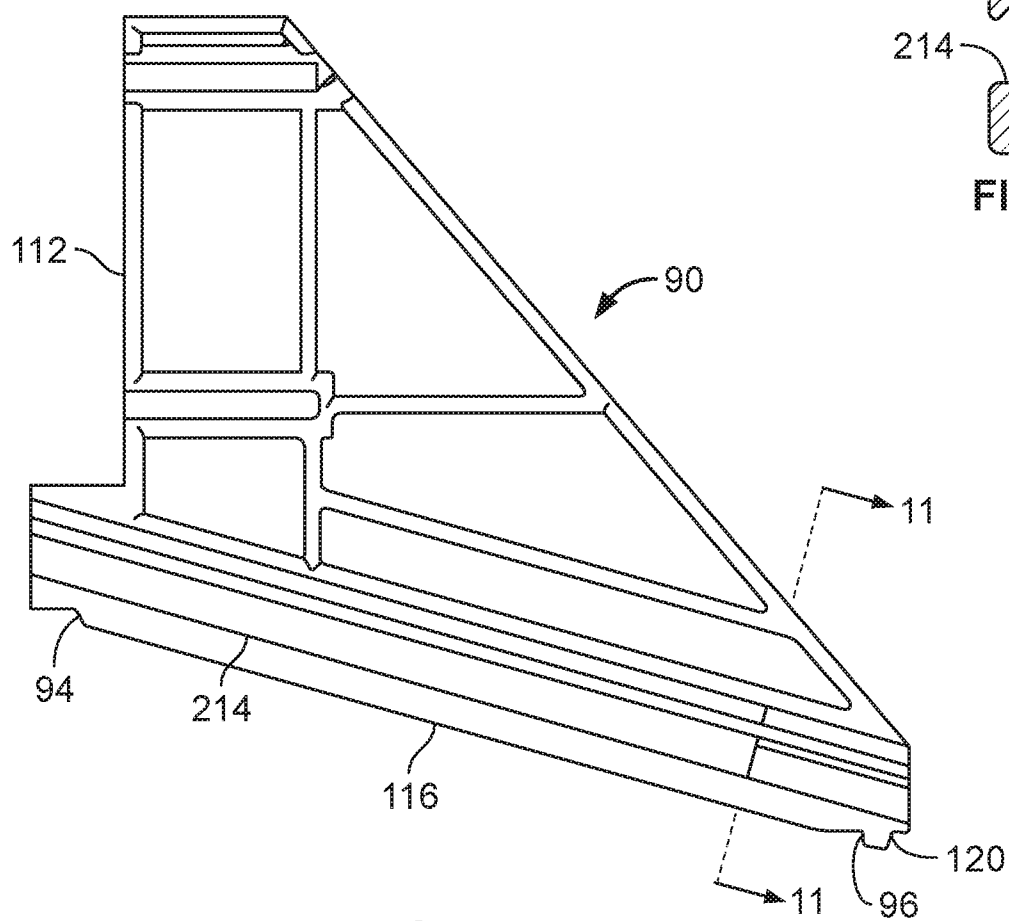


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/023366**A. CLASSIFICATION OF SUBJECT MATTER****G02B 6/54(2006.01)i, G02B 6/36(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 6/54; G02B 6/24; G02B 6/00; G02B 6/44; G02B 6/36

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) & Keywords: optical fiber, slide, spool, retract, extend

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013-0089298 A1 (HOLMBERG et al.) 11 April 2013 See paragraphs [0037]-[0044] and figures 1A-8.	1-20
A	US 2010-0310224 A1 (KOWALCZYK et al.) 09 December 2010 See paragraphs [0027]-[0036] and figures 2-4.	1-20
A	US 5544273 A (HARRISON) 06 August 1996 See column 2, line 36 - column 3, line 43 and figures 1-6.	1-20
A	JP 2006-201662 A (SUMITOMO ELECTRIC IND., LTD.) 03 August 2006 See paragraphs [0009]-[0028] and figures 1(A)-7.	1-20
A	JP 2003-029054 A (NEC CORP.) 29 January 2003 See paragraphs [0021]-[0036] and figures 1-6(c).	1-20



Further documents are listed in the continuation of Box C.



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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

20 June 2016 (20.06.2016)

Date of mailing of the international search report

21 June 2016 (21.06.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

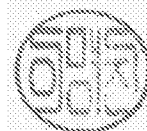
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

LEE, Myung Jin

Telephone No. +82-42-481-8474



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/023366

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013-0089298 A1	11/04/2013	US 9170391 B2	27/10/2015
US 2010-0310224 A1	09/12/2010	AR 067819 A1	21/10/2009
		AU 2008-311242 A1	16/04/2009
		BR PI0815601 A2	03/03/2015
		CN 101802672 A	11/08/2010
		CN 101802672 B	02/01/2013
		CN 102937735 A	20/02/2013
		DK 2618195 T3	18/01/2016
		EP 2176696 A1	21/04/2010
		EP 2176696 B1	23/04/2014
		EP 2618195 A2	24/07/2013
		EP 2618195 A3	07/08/2013
		EP 2618195 B1	07/10/2015
		EP 2963469 A1	06/01/2016
		ES 2482996 T3	05/08/2014
		ES 2558172 T3	02/02/2016
		HK 1146747 A1	13/09/2013
		HR P20151415 T1	29/01/2016
		MX 2010001388 A	31/03/2010
		TW 200931092 A	16/07/2009
		TW I452372 B	11/09/2014
		US 2009-0074370 A1	19/03/2009
		US 2011-0158599 A1	30/06/2011
		US 2012-0328257 A1	27/12/2012
		US 2014-0010513 A1	09/01/2014
		US 2014-0105558 A1	17/04/2014
		US 2015-0177472 A1	25/06/2015
		US 7756379 B2	13/07/2010
		US 7894701 B2	22/02/2011
		US 8189984 B2	29/05/2012
		US 8494333 B2	23/07/2013
		US 8705929 B2	22/04/2014
		US 8891931 B2	18/11/2014
		US 9223104 B2	29/12/2015
		US 9261666 B2	16/02/2016
		WO 2009-048680 A1	16/04/2009
		WO 2009-048680 A9	11/06/2009
US 5544273 A	06/08/1996	None	
JP 2006-201662 A	03/08/2006	CN 100516949 C	22/07/2009
		CN 101107549 A	16/01/2008
		US 2008-0118207 A1	22/05/2008
		WO 2006-078007 A1	27/07/2006
JP 2003-029054 A	29/01/2003	JP 3778021 B2	24/05/2006