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(54) Title: COLLAPSIBLE CABLE REEL

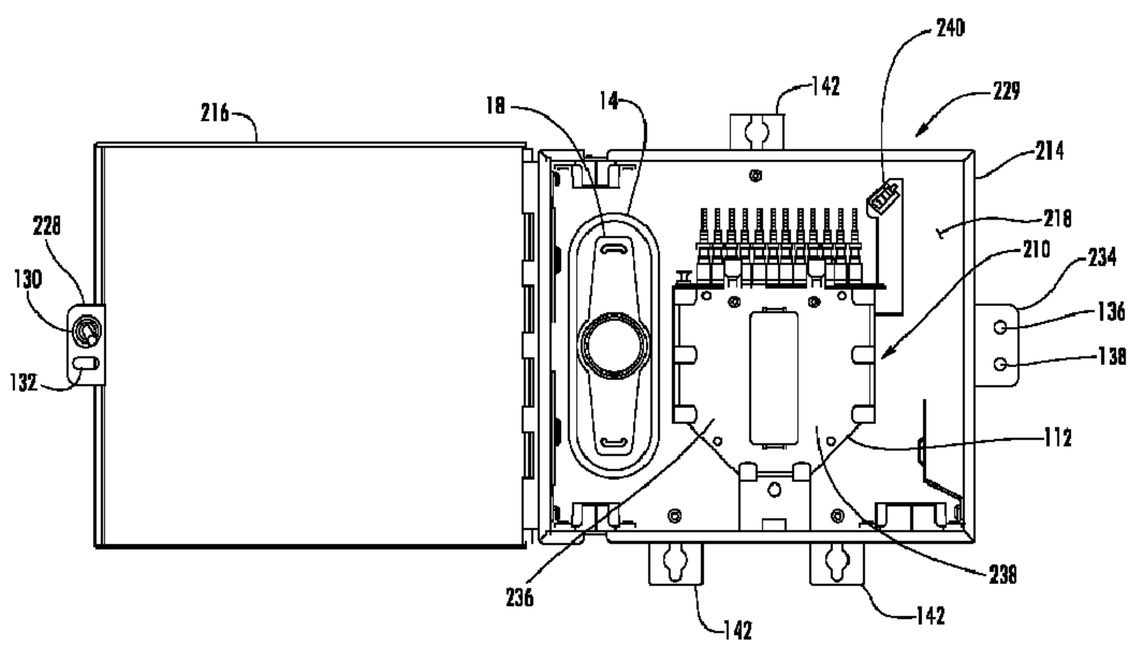

FIG. 14

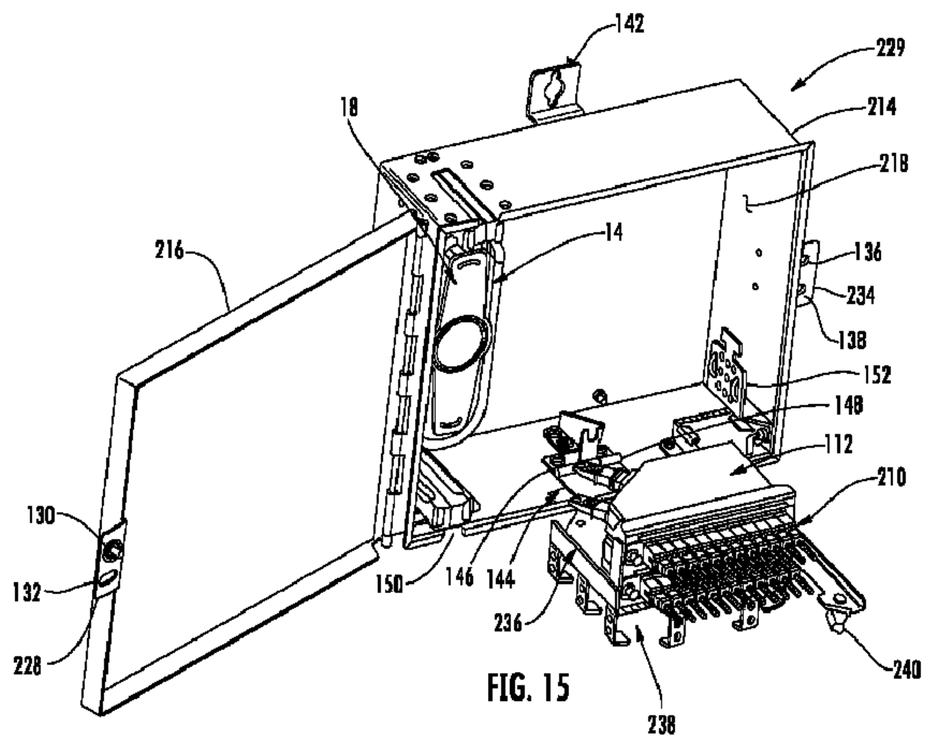

FIG. 15

(57) Abrégé/Abstract:
A collapsible cable reel comprising a frame assembly having with a first end and a second end and at least one cable support is disclosed. A first end assembly releasably connects to the first end of the frame assembly and a second end assembly releasably

CA 2814954 A1 2012/04/26

(21) 2 814 954

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(57) Abrégé(suite)/Abstract(continued):
connects to the second end of the frame assembly. At least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The length of the at least one cable support and the frame assembly are shortenable allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

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(54) Title: COLLAPSIBLE CABLE REEL

(57) Abstract: A collapsible cable reel comprising a frame assembly having with a first end and a second end and at least one cable support is disclosed. A first end assembly releasably connects to the first end of the frame assembly and a second end assembly releasably connects to the second end of the frame assembly. At least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The length of the at least one cable support and the frame assembly are shortenable allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

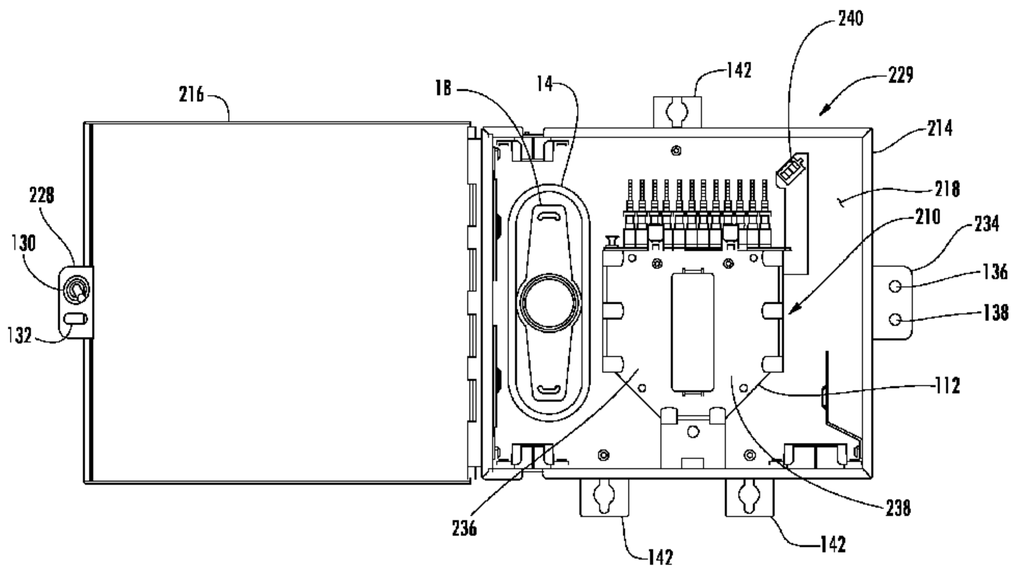

FIG. 14

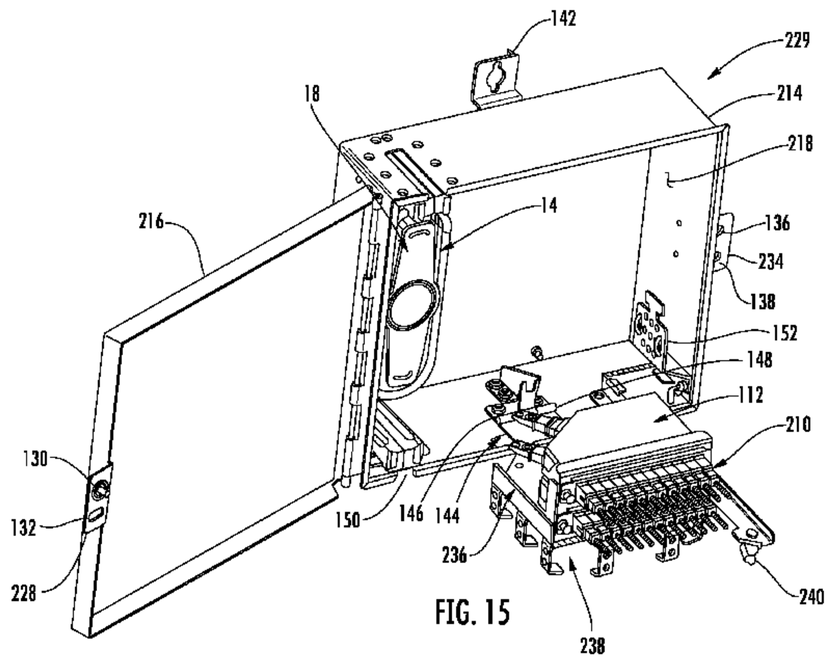

FIG. 15

WO 2012/054450 A2

WO 2012/054450 A2

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

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COLLAPSIBLE CABLE REEL

RELATED APPLICATIONS

[0001] This present application claims the benefit of priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application Serial No. 61/394,663 filed on October 19, 2010 and entitled "Collapsible Cable Reel," which is incorporated herein by reference in its entirety.

[0002] This present application claims the benefit of priority under 35 U.S.C. § 119 to U.S. Provisional Patent Application Serial No. 61/440,220 filed on February 7, 2011 and entitled "Collapsible Cable Reel," which is incorporated herein by reference in its entirety.

BACKGROUND

Field of the Disclosure

[0003] The disclosure relates to a cable reel and particularly a collapsible cable reel for fiber optic cable. The collapsible cable reel can be used to pay out fiber optic cable fiber optic network installations, for example, multiple dwelling unit installations. After a selected length of fiber optic cable is payed out from the collapsible reel, the collapsible reel can be collapsed or reduced in size to a smaller foot print and mounted in an enclosure for use as a slack storage spool.

Technical Background

[0004] In the world of the ever-increasing need for broadband bandwidth optical cables have become the main part of telecommunication networks. Optical cables can transmit voice signals, data signals and video signals for very long distances with very high speed. Developments of optic telecommunication networks allow the connection of the end user directly to the optical fiber. This kind of network technology known as FTTH technology (fiber to the home) requires extending an "all optical" communication network closer to the subscribers. As a result such telecommunication networks include large number distribution points from a distribution cable to an end user or subscriber.

[0005] One of the key parts of the FTTH network is the last mile connection which often is an indoor installation. Different kind of buildings like multiple dwelling units and block of apartments require complicated cabling systems which might mean that there are many separate cables, each one to connect one subscriber. Installation of many cables which provide the connection between a main distribution point (which usually is located in the basement or in another place of the building) and the end user may cause problems with routing through the wall or levels of the building. As a result, such installations consume a lot of time and costs.

SUMMARY

[0006] Embodiments disclosed in the detailed description include a collapsible cable reel. A collapsible cable reel comprising a frame assembly with a first end and a second end and at least one cable support. A first end assembly releasably connects to the first end of the frame assembly and a second end assembly releasably connects to the second end of the frame assembly. The at least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The length of the at least one cable support is shortenable allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

[0007] The first position of the collapsible cable reel may be an uncollapsed state, while the second position of the collapsible cable reel may be a collapsed state. The frame assembly may comprise a center member having a frame hub and an extension member. The center member may be shortenable in length by removing the extension member allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position. Alternatively or additionally, the center member may comprise a telescoping extension member, with the center member being shortenable by reducing the length of the telescoping extension member.

[0008] The frame assembly may comprise at least one frame arm extending radially from the frame hub. The first end assembly may comprise at least one first end

arm extending radially from the first end hub, and the second end assembly may comprise at least one second end arm extending radially from the second end hub. Alternatively or additionally, the frame assembly may comprise a frame disk connected to the frame hub. The first end assembly may comprise a first disk connected to the first end hub, and the second end assembly may comprise a second disk connected to the second end hub.

[0009] The collapsible cable reel may have at least 100 feet of cable wound on it. The cable may be fiber optic cable, such as without limitation, riser cable or drop cable for a multiple dwelling unit. The collapsible cable reel is adapted to store cable slack in at least one of the first position and second position. The collapsible cable reel may be removably mountable in an enclosure, in one or both of the first position and the second position.

[0010] In another embodiment, a method of operating a collapsible cable reel is disclosed. The method may comprise providing a collapsible cable reel having a first end and a second end on which cable is wound. The first end and the second end are separated by a distance. The method may include paying out at least a portion of the cable, retaining remaining slack of the cable not payed out on the collapsible cable reel, and collapsing the collapsible cable reel by reducing the distance between the first end and the second end. The method may also include removably mounting the collapsed collapsible cable reel with the retained remaining slack of the cable in an enclosure. The cable may be fiber optic cable. The fiber optic cable may be riser cable or drop cable, used in a multiple dwelling unit.

[0011] The collapsible cable reel of the method may comprise a frame assembly having with a first end and a second end and at least one cable support, a first end assembly connected to the first end of the frame assembly, and a second end assembly connected to the second end of the frame assembly. At least one cable support may extend from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The method may include shortening at least one cable supports to allow the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

[0012] In another embodiment, a method of operating a collapsible cable reel is disclosed. The method including providing a frame assembly having with a first end and a second end and a plurality of cable supports, a first end assembly connected to the first end of the frame assembly and a second end assembly connected to the second end of the frame assembly. A plurality of cable supports extend from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The length of the plurality of cable supports is shortenable. The method may also include paying out at least a portion of the length of cable, retaining remaining slack of the cable not payed out on the cable supports, and shortening a length of each of the plurality of cable supports allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position. The length of cable wound on the cable supports is at least 100 feet. The cable is fiber optic cable. The fiber optic cable is one of riser cable and drop cable, used in a multiple dwelling unit. The method may also include removably mounting the collapsible cable reel in an enclosure.

[0013] Additional features and advantages will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from that description or recognized by practicing the embodiments as described herein, including the detailed description that follows, the claims, as well as the appended drawings.

[0014] It is to be understood that both the foregoing general description and the following detailed description present embodiments, and are intended to provide an overview or framework for understanding the nature and character of the disclosure. The accompanying drawings are included to provide a further understanding, and are incorporated into and constitute a part of this specification. The drawings illustrate various embodiments, and together with the description serve to explain the principles and operation of the concepts disclosed.

BRIEF DESCRIPTION OF THE FIGURES

[0015] **FIG. 1** is a schematic diagram of a perspective elevation view of a multiple dwelling unit (MDU) with an exemplary fiber optic network installed therein, wherein a riser cable with pre-set tap points extends from a payout reel in a patch panel enclosure located at a lower level to multiple distribution levels;

[0016] **FIG. 2** is a schematic diagram of a perspective elevation view of a MDU with an exemplary fiber optic network installed therein, wherein a riser cable with pre-set tap points extends from a payout reel in a slack enclosure on a distribution level to other distribution levels and to a lower level;

[0017] **FIG. 3** is a schematic diagram of a perspective elevation view of a MDU with an exemplary fiber optic network installed therein, wherein a riser cable with pre-set tap points extends from a payout reel in a FDT on a distribution level to other distribution levels and the lower level;

[0018] **FIG. 4** is a schematic diagram of a perspective elevation view of a MDU with an exemplary fiber optic network installed therein, wherein a plurality of riser cables each extend from a separate payout reel in a patch panel enclosure located at the lower level to one of the distribution levels;

[0019] **FIG. 5** is a schematic diagram of a perspective elevation view of a MDU with an exemplary fiber optic network installed therein, wherein a plurality of riser cables each extend from a separate FDTs each located at one of the distribution levels to the patch panel enclosure located at the lower level;

[0020] **FIG. 6** is a schematic diagram of a bundled drop cable extending from a FDT to a subscriber premises located on a distribution level of the MDU;

[0021] **FIG. 7** is a schematic diagram of an elevation view of an exemplary preconnectorized riser cable installation assembly with a plurality of preconnectorized riser cables being extended from payout reels located at a lower level by a leader with extending features attached to the leader at preset locations;

[0022] **FIG. 7A** is a detail view of an exemplary pull device assembly which may be attached to the end of the riser cable to facilitate extending the riser cable from the payout reel;

[0023] **FIG. 8** is a flowchart illustrating a method of installing a plurality of preconnectorized riser cables from payout reels located at a lower level to FDTs located at distribution levels, according to an exemplary embodiment;

[0024] **FIG. 9** is a schematic diagram of an elevation view of an exemplary preconnectorized riser cable installation assembly with a plurality of preconnectorized risers being extended from payout reels located at distribution levels by a leader with extending features attached to the leader at preset locations;

[0025] **FIG. 10** is a flowchart illustrating a method of installing a plurality of preconnectorized riser cables from payout reels located at distribution levels to a patch panel enclosure located at the lower level, according to an exemplary embodiment;

[0026] **FIG. 11** is a schematic diagram of a front, perspective view of an exemplary local convergence point (LCP) for use with a fiber optic network in a MDU;

[0027] **FIG. 11A** is a schematic diagram of a front, perspective exploded view of the LCP of **FIG. 11** having an interior panel removably mountable in the LCP, wherein the interior panel is configured to support optical fiber in a first section of the LCP;

[0028] **FIG. 11B** is a schematic diagram of a front, perspective exploded view of the LCP of **FIG. 11** having an interior panel removably mountable in the LCP, wherein the interior panel is configured to support optical fiber splitting in the second section of the LCP;

[0029] **FIG. 11C** is a schematic diagram of a front, perspective exploded view of the LCP of **FIG. 11** having an interior panel removably mountable in the LCP, wherein the interior panel is configured to support optical fiber splicing in the second section of the LCP;

[0030] **FIG. 12** is a schematic diagram of front, elevation views of an exemplary patch panel enclosure with a multi-fiber adapter assembly and multiple payout reels removably mounted therein;

[0031] **FIG. 13** is a schematic diagram of a front, perspective view of an exemplary FDT having a module with multi-fiber adapters and single fiber adapters and a payout reel removably mounted therein, wherein the FDT is configured to be mounted in-line with and supported by the conduit carrying the riser cable;

[0032] **FIG. 14** is a schematic diagram of a front, perspective view of an exemplary FDT having a module assembly with multi-fiber adapters and single fiber adapters pivotably mounted therein and a collapsible payout reel removably mounted therein, wherein the FDT is configured to be wall or closet mounted;

[0033] **FIG. 15** is a schematic diagram of the front, perspective view of the FDT of **FIG. 14** with the module assembly pivoted to an open position;

[0034] **FIG. 16** is a schematic diagram of an exploded, perspective view of an exemplary embodiment of the collapsible cable reel in the uncollapsed state;

[0035] **FIG. 17** is a schematic diagram of a partial, exploded view of a first end assembly of the collapsible cable reel of **FIG. 16**;

[0036] **FIG. 18** is a schematic diagram of a partial exploded view of the frame assembly and the second end assembly of the collapsible cable reel of **FIG. 16**;

[0037] **FIG. 19** is a schematic diagram of a detailed, perspective view of the end of a cable support of the collapsible cable reel of **FIG. 16**;

[0038] **FIG. 20** is a schematic diagram of a detailed, perspective view of a snap lock on a first end hub in exploded relationship to the second end of the center member at the extension member of the collapsible cable reel of **FIG. 16**;

[0039] **FIG. 21A i**s a schematic diagram of a detailed, perspective view of a locking tab on a second end arm in exploded relationship to a receiver in a frame arm of the collapsible cable reel of **FIG. 16**;

[0040] **FIG. 21B** is a schematic diagram of a detailed, perspective view of the locking tab releasably attached in the receiver of **FIG. 21A;**

[0041] **FIG. 22** is a schematic, perspective view of the collapsible cable reel of **FIG. 16** in an assembled, uncollapsed state;

[0042] **FIG. 23** is a schematic, perspective view of the collapsible cable reel of **FIG. 16** transitioning from an uncollapsed to a collapsed state;

[0043] **FIG. 24** is a schematic, perspective view of the collapsible cable reel of **FIG. 16** in a collapsed state;

[0044] **FIG. 25** is a schematic diagram of an exploded, perspective view of an exemplary embodiment of the collapsible cable reel in the uncollapsed state;

[0045] **FIG. 26** is a schematic, perspective view of the collapsible cable reel of **FIG. 25** in an assembled, uncollapsed state;

[0046] **FIG. 27** is a schematic, perspective view of the collapsible cable reel of **FIG. 25** transitioning from an uncollapsed to a collapsed state;

[0047] **FIG. 28** is a schematic, perspective view of the collapsible cable reel of **FIG. 25** in a collapsed state; and

[0048] **FIG. 29** is a schematic, perspective view of an embodiment of a frame assembly that can be used with the collapsible cable reel of **FIG. 16** or **FIG. 25**.

DESCRIPTION OF THE DISCLOSURE

[0049] Embodiments disclosed in the detailed description include a fiber optic distribution network for a multi-floor multiple dwelling unit (MDU). The network includes a local convergence point (LCP) which may be located in a lower level of the MDU, for example, the basement. The LCP receives a feeder cable that provides optical communication service to the MDU from a service provider. One or more preconnectorized riser cables having multi-fiber connectors on each end optically connect to the feeder cable through the LCP. The riser cable extends from the LCP to one or more upper distribution levels of the MDU. At the distribution level, the riser cable is received by a network access point. The connection between the riser cable and the subscriber premises may be through tether cables branched off from the riser cable at each distribution level. The tether cables may then be connected to subscriber premises via one or more drop cables at the network access point. Alternatively, or additionally, an individual riser cable may be extended to the distribution level. The network access point may be referred to as a transition box, a fiber distribution terminal (FDT), or patch panel enclosure. As such, reference to a transition box herein shall be understood to mean either or both a FDT or patch panel enclosure.

[0050] The FDT may include one or more multi-fiber-to-multi-fiber adapters to provide for connection of the riser cable to one or more drop cables. The drop cable extends to the subscriber premises at that distribution level to provide optical communication service to the subscriber. Any riser cable slack may be stored in one or more of the FDT or a slack enclosure. Additionally, the riser cable slack may be stored

on the payout reel, with the payout reel removably mounted in the FDT, a patch panel enclosure, or the slack enclosure. The slack storage enclosure and/or transition box may be located at or adjacent to the LCP or at the distribution level.

[0051] The multi-fiber-to-multi-fiber adapters located at the network access point may have dual shutters, one on each end of the adapter. The shutters are adapted to be automatically closed against the end of the adapter when a multi-fiber connector is not inserted in that end of the adapter. In this manner, the shutters may provide sealing of the adapter against the environment, keeping the adapter protected and clean when not in use. The multi-fiber adapter may be keyed up and down to coordinate with the polarity of the multi-fiber connectors. The adapters may be mounted in a cassette which is removably mounted in the network access point. Alternatively, the adapter may be removably mounted to a panel which may be removably mounted in the network access point.

[0052] Further, the FDT, the patch panel enclosure and/or the slack storage enclosure may be located in the stair well of a MDU and provide a termination point for cable pulled or dropped vertically in the MDU. When located in the stairwell the FDT may mounted on, to or in proximity to a conduit, and in such case be referred to as a "Pipe-n-Box" or a "Pencil Box." The FDT may provide a point at which riser cable transitions to one or more drop cables and/or in generally horizontal cable runs. This location also serves as a point at which riser cable slack may be stored. The FDT, the patch panel enclosure and/or the slack storage enclosure may also be located within a telecommunications closet and referred to as a "closet box." The solution may include one or more of the FDTs, the patch panel enclosure and/or the slack storage enclosures in the stairwell, telecommunications closet, and/or by the LCP.

[0053] The FDT, the patch panel enclosure and/or the slack storage enclosure may have an enclosure with pivotable panel having a first side and a second side mounted therein. Fiber optic adapters may mount to the pivotable panel and may be accessed from the first side or the second side by pivoting the pivotable panel.

[0054] A collapsible cable reel may be included. The collapsible cable reel acts as a conventional cable reel for shipping cable to customers and for paying out cable for installation. Additionally, though, the collapsible cable reel may be reduced to a

smaller form factor and mounted in an enclosure, for example, a FDT, the patch panel enclosure and/or the slack storage enclosure, and function as a modular slack storage spool. In this regard, users may pay out or dispensed the cable from the collapsible cable reel to or in a riser, as a riser cable, or at a distribution level as drop cable. Additionally, the riser cable or drop cable may be terminated or connected to each other or connected to a distribution cable extending toward a LCP that provides the optical communication service to the MDU. Cable slack may be stored within the FDT, the patch panel enclosure and/or the slack storage enclosure either in a lower level, for example a basement, in a stairwell or in a telecommunications closet.

[0055] The collapsible cable reel may have a frame assembly with a center member that has removable, telescoping and/or adjustable extension member, and a first end and a second end. A first end assembly may connect to one of the first and second ends and a second end assembly may connect to the other of one of the first and second ends. One or more arms may extend radially from a frame hub, a first end hub, and/or a second end hub. A plurality of cable supports may extend between the frame assembly and the first end assembly. The plurality of cable supports are adapted to support a length of cable wound around the collapsible cable reel. The length of each of the plurality of cable supports is shortenable and/or movable allowing the collapsible cable reel to reduce in length moving the first end assembly toward the second end assembly. In this manner the collapsible cable reel may move from an uncollapsed state toward a collapsed state. The collapsible cable reel is mountable in an enclosure providing cable slack storage.

[0056] In this regard, the figures included herein are organized such that **FIGS. 1-6** illustrate exemplary embodiments of fiber optic networks in an MDU; **FIGS. 7-10** illustrate exemplary embodiments of installed riser cables along with methods for installing the riser cables; **FIGS. 11-11C** illustrate exemplary embodiments of the LCP; **FIG. 12** illustrates an exemplary embodiment of the patch panel enclosure; **FIGS. 13-15** illustrate exemplary embodiments of the FDT; and **FIGS. 16-28** illustrates an exemplary embodiment of the collapsible cable reel.

[0057] Referring now to **FIG. 1**, there is shown a schematic diagram of a perspective elevation view of the MDU **10** with an exemplary fiber optic network **12**

installed therein. A riser cable **14** with pre-set mid-span access points **16** extends from a payout reel **18**. The riser cable **14** pays out from a payout reel **18**. Once the riser cable **14** is paid out from the payout reel **18** to multiple distribution levels **24, 26, 28,** the payout reel **18** is removably mounted in a patch panel enclosure **20**. Although, in **FIG. 1** three higher levels **24, 26, 28** are illustrated, the fiber optic network **12** may have any number of distribution levels. The riser cable **14** is preconnectorized with multi-fiber connectors **30**, **32** at each end of the optical fibers of the riser cable **14**. The patch panel enclosure **20** has a multi-fiber-to-multi-fiber adapter assembly **34** which receives a first multi-fiber connector **30**. A distribution cable **36** preconnectorized with a multi-fiber connector **38**, is received by and connects to the multi-fiber adapter assembly **34** in the patch panel enclosure **20** to establish an optical connection between the riser cable **14** and the distribution cable **36**. The distribution cable **36** routes to a local convergence point (LCP) **40**. The LCP **40** receives a feeder cable **42** which provides optical communication service to the MDU **10** from a service provider.

[0058] During installation, the riser cable **14** pays out from the payout reel **18** such that the riser cable **14** extends generally in an upward direction from the lower level **22** to each ascending distribution level **24, 26, 28** in succession with distribution level **28** being the highest distribution level in the MDU **10**. The mid-span access points **16** are preset such that they are separated by a distance "**X**" along the length of the riser cable **14**. The distance "**X**" is preset at the factory to a certain value depending on the distance between adjoining distribution levels **24**, **26**. As examples, the distance "**X**" may be set at 10 feet, 12 feet, 14 feet, 15 feet, and the like. In this manner, as the riser cable **14** pays out and installed in the MDU **10**, the preset mid-span access points will align, generally with each distribution level **24**, **26** of the MDU **10**. However, the one exception to this may be the highest distribution level **28**, since the end of the riser cable **14** would extend to that level and and would not have a mid-span access point. Any riser cable **14** slack due to the presetting of the distance "**X**" or otherwise, may be stored on the payout reel **18**, in the patch panel enclosure **20** and/or a slack enclosure (not shown in **FIG. 1**). Slack may also be stored loosely at the lower level **22**, in one or more fiber distribution terminals **29** located at one or more of the distribution levels **24, 26, 28**. Additionally, the payout reel **18** may be removably mounted in the slack

housing or may be mounted or located separate from the patch panel enclosure **20** and/or slack enclosure and/or from the FDT **29** at one or more of the distribution levels **24, 26, 28**.

[0059] The riser cable **14** may be any number of optical fibers, as non-limiting examples, 6-216 fibers. At each mid-span access point **16**, certain of the optical fibers may be furcated or separated out from the riser cable **14** in a FDT **29** located at the distribution level **24, 26**. As examples, 6, 8 or 12 fibers may be furcated or separated out from the riser cable **14** and terminated with the second multi-fiber connector **32**. At the highest distribution leval **28**, the optical fibers remaining in the riser cable **14** after furcating out the optical fibers at lower distribution levels **24, 26** are terminated with the second multi-fiber connector **32**. The second multi-fiber connector **32** may be received by a multi-fiber adapter assembly **34** removably mounted in the FDT **29** at the distribution level **24, 26, 28**. Alternatively, instead of the multi-fiber adapter assembly **34**, the second multi-fiber connector may be received by and connected to a connector module (not shown in **FIG. 1**) removably mounted in the FDT **29**.

[0060] A multi-fiber bundled drop cable **44** preconnectorized with a multi-fiber connector **38**, is received by and connects to the multi-fiber adapter assembly **34**, or the connector module, as the case may be, in the FDT **29** located at the distribution level **24, 26, 28**. In this manner an optical connection is established between the riser cable **14** and the multi-fiber bundled drop cable **44**. The multi-fiber bundled drop cable **44** routes to one or more drop boxes **46** associated with subscriber premises **48** located at the distribution level **24, 26, 28**. One or more optical fibers separate from the multi-fiber bundled drop cable **44** at the drop box **46** and extends to the subscriber premises **48**. In this manner, optical communication service is provided to the subscriber premises **48**.

[0061] **FIG. 2** is a schematic diagram of a perspective elevation view the MDU **10** with an exemplary fiber optic network **112** installed therein. The riser cable **14** with pre-set mid-span access points **16** extends from a payout reel **18** in a separate slack enclosure **50** located at the highest distribution level **28** to the other distribution levels **24, 26** and the lower level **22**. The aspects and/or components of the fiber optic network **112** described with respect to **FIG. 1** will not be described again with respect to **FIG. 2**. In **FIG. 2**, after the riser cable **14** is paid out, the payout reel **18** is removably

mounted in the slack enclosure **50** located at the highest level **28** instead of the patch panel enclosure **20**. In this manner, during installation, the riser cable **14** pays out from the payout reel **18** such that the riser cable **14** extends generally in a downward direction from the highest distribution level **28** to each descending distribution level **24, 26** in succession, and to the patch panel enclosure **20**.

[0062] The patch panel enclosure **20** includes a multi-fiber adapter assembly **34** but may not include the payout reel **18** since that is located at the highest distribution level **28** in fiber optic network **112**. However, the multi-fiber-to-multi-fiber adapter assembly **34** in the patch panel enclosure **20** receives the first multi-fiber connector **30** and optically connects it with the with a multi-fiber connector **38** of the distribution cable **36** to establish an optical connection between the riser cable **14** and the distribution cable **36** as described above with respect to **FIG. 1**.

[0063] **FIG. 3** is a schematic diagram of a perspective elevation view of the MDU **10** with an exemplary fiber optic network **212** installed therein. The riser cable **14** with pre-set mid-span access points **16** extends from the payout reel **18** in the FDT **29** located at the highest distribution level **28** to the other distribution levels **24, 26**. The aspects and/or components of the fiber optic network **212** described with respect to **FIG. 1** and/or **FIG. 2** will not be described again with respect to **FIG. 3**. In **FIG. 3**, after the riser cable **14** is paid out, the payout reel **18** is removably mounted in the FDT **29** located at the highest distribution level **28** instead of the slack enclosure **50**, as described with respect to **FIG. 2**. In this way, the slack enclosure **50** is not needed at the highest distribution level **28** conserving space. The paying out and installation of the riser cable **14** may be the same as described with respect to **FIG. 2**.

[0064] **FIG. 4** is a schematic diagram of a perspective elevation view of the MDU **10** with an exemplary fiber optic network **312** installed therein. A plurality of riser cables **14(1), 14(2), 14(3)** each extend from a separate payout reel **18(1), 18(2), 18(3)** in the patch panel enclosure **20** to respective ones of the distribution levels **24, 26, 28**. The aspects and/or components of the fiber optic network 3**12** described with respect to **FIG. 1, FIG. 2** and/or FIG. 3 will not be described again with respect to **FIG. 4**. Each riser cable **14(1), 14(2), 14(3)** pays out from respective payout reels **18(1), 18(2), 18(3)**. After the riser cable **14(1), 14(2), 14(3)** is paid out, the respective payout

reel **18(1), 18(2), 18(3)** is removably mounted in the patch panel enclosure **20**. The riser cables **14(1), 14(2), 14(3)** extend generally in an upward direction from the lower level **22** to separate ascending distribution level **24, 26, 28**. In this manner, a separate riser cable **14** provides optical service to a separate distribution level **24**, **26**, **28**. Each of the riser cables **14(1), 14(2), 14(3)** terminates with respective second multi-fiber connectors **32(1), 32(2), 32(3)** which are received by and connected to the respective multi-fiber adapter assembly **34** in the FDT **29** located at the distribution levels **24**, **26**, **28**. In the patch panel enclosure **20**, the riser cables **14(1), 14(2), 14(3)** extend from each of the payout reels **18(1), 18(2), 18(3)** to the multi-fiber adapter assembly **34** located at the patch panel enclosure **20**. The first multi-fiber connector **30(1), 30(2), 30(3)** of each respective riser cable **14(1), 14(2), 14(3)** is received by and connects to the multi-fiber adapter assembly **34** in the patch panel enclosure **20**. The distribution cable **36** preconnectorized with a multi-fiber connector **38**, is received by and connects to the multi-fiber adapter assembly **34** in the patch panel enclosure **20** to establish an optical connection between the riser cables **14(1), 14(2), 14(3)** and the distribution cable **36**. The distribution cable **36** routes to a local convergence point (LCP) **40**.

[0065] **FIG. 5** is a schematic diagram of a perspective elevation view of the MDU **10** with an exemplary fiber optic network **412** installed therein. The plurality of riser cables **14(1), 14(2), 14(3)** each extend from separate, respective FDTs **29** located at one of the distribution levels **24, 26, 28** to the patch panel enclosure **20**. The aspects and/or components of the fiber optic network **312** described with respect to **FIG. 1**, **FIG. 2**, **FIG. 3** and/or **FIG. 4** will not be described again with respect to **FIG. 5**. Each riser cable **14(1), 14(2), 14(3)** pays out from respective payout reels **18(1), 18(2), 18(3).** After the necessary length of riser cable **14(1), 14(2), 14(3)** is paid out, the payout reel **18(1), 18(2), 18(3)** is removably mounted in separate, respective FDTS **29** located at respective distribution levels **24, 26, 28**. The riser cables **14(1), 14(2), 14(3)** extend generally in a downward direction from the respective FDTs **29** located at respective distribution levels **24, 26, 28** to the lower level **22**. In this manner, a separate riser cable **14** provides optical service to a separate distribution level **24**, **26**, **28**. Each of the riser cables **14(1), 14(2), 14(3)** terminates with respective second multi-fiber connectors **32(1), 32(2), 32(3)** which are received by and connected to the respective multi-fiber

adapter assembly **34** in the FDT **29** located at the distribution levels **24**, **26**, **28**. In the patch panel enclosure **20**, the first multi-fiber connector **30(1), 30(2), 30(3)** of each respective riser cable **14(1), 14(2), 14(3)** is received by and connects to the multi-fiber adapter assembly **34** in the patch panel enclosure **20**. The distribution cable **36** preconnectorized with a multi-fiber connector **38**, is received by and connects to the multi-fiber adapter assembly **34** in the patch panel enclosure **20** to establish an optical connection between the riser cables **14(1), 14(2), 14(3)** and the distribution cable **36**. The distribution cable **36** routes to the LCP **40**.

[0066] Referring now to **FIG. 6**, the portion of the fiber optic networks **12, 112, 212, 312, 412** at the distribution level **24, 26, 28** is illustrated. The multi-fiber bundled drop cable **44** extends from the FDT **29** at the distribution level **24, 26, 28** to drop box **46** associated with the and located at the subscriber premises **48**. The multi-fiber bundled drop cable **44** includes multiple fiber optic cables **52** retained together by one or more helically wrapped external binders **54**. One or more of the multiple fiber optic cables is separated from the multi-fiber bundled drop cable **44** by removing the multiple fiber optic cable from the retainage of the one or more external binders. The separated fiber optic cable **52** may then extend to the subscriber premises **48**.

[0067] **FIG. 7** is a schematic diagram of an elevation view of an exemplary preconnectorized riser installation assembly **56** with a plurality of preconnectorized riser cables **14(1), 14(2), 14(3)** being extended from respective payout reels **18(1), 18(2), 18(3)** located at a lower level **22** by a leader **58** with extending features **60** attached to the leader **58** at preset locations at a distance "**Y**" along the length of the leader **58**. The extending feature **60** may be any type of loop, hook, swivel, or the like, configured to attach to the second multi-fiber connectors **32(1), 32(2), 32(3)**, or to some type of pull device attached to the second multi-fiber connectors **32(1), 32(2), 32(3)** to provide for safely and effectively paying out the riser cables **14(1), 14(2), 14(3)**.

[0068] **FIG. 7A** is a detail view of a pull device assembly **62** which may be attached to the end of the riser cable **14** to facilitate extending the riser cable **14** from the payout reel **18**. The pull device assembly **62** attaches to the riser cable **14** using extending feature 60. The pull device assembly **62** may enclose the second multi-fiber connector **32**, boot of the second multi-fiber connector **32** and a portion of the riser

cable **14**. The pull device assembly **62** has a swivel end **64** and a body **66**. The body **66** may enclose and/or support the second multi-fiber connectors **32**. The swivel end **64** is allowed to rotate freely and independently of the body **66** and, therefore, the second multi-fiber connector **32** and the riser cable **14**. The swivel end **64** comprises a hole through which the extending feature **60** inserts. As the riser cable **14** is pulled through the MDU **10** particularly in conduit using a pull loop **68** attached to the end of the leader **58**, and the extending feature **60** attached to the swivel end **64**, the swivel end **64** it is allowed to independently rotate from the rest of the pull device assembly **62**. This independent rotation eliminates twisting of the riser cable **14** and the second multi-fiber connector **32**. In this manner, as the leader **58** is pulled through the MDU **10** particularly in conduit, the leader **58**, the extending feature **60** and the swivel end **64** reduce or may eliminate any induced additional torsional stresses on the riser cable **14** and/or the second multi-fiber connector **32**.

[0069] Referring again to **FIG. 7**, the distance "**Y**" is preset to a certain value depending on the distance between adjoining distribution levels **24**, **26, 28**. As examples, the distance "**Y**" may be set at 10 feet, 12 feet, 14 feet, 15 feet, and the like. In this manner, as the leader **58** is pulled through the MDU **10**, riser cables **14(1), 14(2), 14(3)** each pays out to a point that will align, generally, with each respective distribution level **24**, **26, 28** of the MDU **10**. Any riser cable **14** slack due to the presetting of the distance "**Y**" or otherwise, may be stored on the respective payout reel **18(1), 18(2), 18(3)** and/or loosely in an patch panel enclosure **20** and/or a slack enclosure (not shown in **FIG. 7**). Additionally, slack may be stored loosely, on the payout reels **18(1), 18(2), 18(3)** and/or the FDT **29** at one or more of the distribution levels **24, 26, 28**. Each second multi-fiber connectors **32(1), 32(2), 32(3)**, may then be connected to the respective multi-fiber adapter assembly **34** removably mounted in the FDT **29** located at the respective distribution level **24**, **26, 28**. Additionally, the first multi-fiber connectors **30(1), 30(2), 30(3)** attached to respective riser cables **14(1), 14(2), 14(3)** may be connected to the respective multi-fiber adapter assembly **34** removably mounted in the patch panel enclosure **20**.

[0070] **FIG. 8** is a flowchart illustrating a method of installing a plurality of preconnectorized riser cables **14(1)**, **14(2)**, **14(3)**, from payout reels **18(1), 18(2), 18(3)**

located at a lower level **22** to FDTs **29** located at upper levels **24, 26, 28** according to an exemplary embodiment. The payout reels **14(1)**, **14(2)**, **14(3)** are positioned in the lower level **22** (**Step 1000**). Optionally, a pull device assembly **62** may be attached to the end of each riser cable **14(1)**, **14(2)**, **14(3)** (**Step 1002**). A leader **58** with extending features **60** located at the pre-set distance "**Y**" along the length of the leader **58** is provided (**Step 1004**). The extending features **60** are attached to the end of each riser cable **14(1)**, **14(2)**, **14(3)**, particularly to each pull device assembly **62** if such is provided (**Step 1006**). A pull rope is attached to the end of the leader **58** through a pull loop **68** (**Step 1008**) and, using the pull rope, the leader **58** is pulled to the distribution levels **24, 26, 28** of the MDU **10** in an ascending order paying out the riser cables **14(1)**, **14(2)**, **14(3)** from the respective payout reels **18(1), 18(2), 18(3)** (**Step 1010**). At each successive distribution level **24, 26, 28** in the ascending order, the leader **58** is accessed and the appropriate riser cable **14(1)**, **14(2)**, **14(3)** for that distribution level **24, 26, 28** is extended. The appropriate riser cable **14(1)**, **14(2)**, **14(3)** is disconnected from the extending feature **60** and the second multi-fiber connector **32(1), 32(2), 32(3)** to the respective multi-fiber adapter assembly **34** in the FDT **29** at the distribution level **24, 26, 28** (**Step 1012**). The first multi-fiber connectors **30(1), 30(2), 30(3)** may be connected to the multi-fiber adapter assembly **34** located in the patch panel enclosure **20** (**Step 1014**). Riser cable **14** slack may be stored in the FDT **29** at the distribution level **24, 26, 28** and/or in the payout reels **18(1), 18(2),18(3)** (**Step 1016**). The payout reels **18(1), 18(2),18(3)** may be removably mounted in the patch panel enclosure **20**.

[0071] **FIG. 9** is a schematic diagram of an elevation view of an exemplary preconnectorized riser installation assembly **70** with a plurality of preconnectorized riser cables **14(1)**, **14(2)**, **14(3)** being extended from payout reels **18(1), 18(2),18(3)** each located at respective distribution levels **24, 26, 28** of the MDU **10** using pull loop **68**. The riser cables **14(1)**, **14(2)**, **14(3)** may be payed out by using a leader **58** with extending features **60** attached to the leader **58** at preset locations at a distance "**Z**" along the length of the leader **58**. The extending feature **60** may be any type of loop, hook, swivel, or the like, configured to attach to the first multi-fiber connectors **30(1), 30(2), 30(3)**, or to some type of pull device attached to the first multi-fiber connectors **30(1), 30(2), 30(3)** to provide for safely and effectively paying out the riser cables

14(1), 14(2), 14(3). The pull device assembly **66** described with respect to **FIG. 7A**, above, may be attached to the end of the riser cables **14(1), 14(2), 14(3)** to facilitate extending the riser cables **14(1), 14(2), 14(3)** from the payout reels **18(1), 18(2),18(3)**.

[0072] The distance "**Z**" is preset to a value, as a nonlimiting example, 6 inches, to allow the leader **58** to be accessed at each succeeding distribution level **24, 26, 28** in descending order to attach extending feature **60** to the particular riser cable **14(1), 14(2), 14(3)**. In other words, the riser cable **14(3)** for the highest distribution level **28** is attached to the leader first. Then the riser cable **14(2)** for then next lower distribution level **26** is attached to the leader **58**. Then the riser cable **14(1)** for the next lower distribution level **24** is attached to the leader **58**. The leader **58** extends to the lower level **22**. Any riser cable **14** slack may be stored on the respective payout reel **18(1), 18(2), 18(3)** and/or loosely in the FDT **29** and/or a slack enclosure (not shown in **FIG. 9**) at the distribution level **24, 26, 28**. Additionally, slack may be stored in the patch panel enclosure **20**. Each second multi-fiber connectors **32(1), 32(2), 32(3)**, may be connected to the respective multi-fiber adapter assembly **34** removably mounted in the FDT **29** located at the respective distribution level **24, 26, 28**. Additionally, the first multi-fiber connectors **30(1), 30(2), 30(3)** attached to respective riser cables **14(1), 14(2), 14(3)** may be connected to the respective multi-fiber adapter assembly **34** removably mounted in the patch panel enclosure **20**.

[0073] **FIG. 10** is a flowchart illustrating a method of installing a plurality of preconnectorized riser cables **14(1), 14(2), 14(3)** from payout reels **18(1), 18(2), 18(3)** located at distribution levels **24, 26, 28** of MDU **10** to the patch panel enclosure **20**, according to an exemplary embodiment. The payout reels **14(1), 14(2), 14(3)** are each positioned at respective distribution levels **24, 26, 28** (**Step 2000**). Optionally, a pull device assembly **62** may be attached to the end of each riser cable **14(1), 14(2), 14(3)** (**Step 2002**). A leader **58** with extending features **60** located at the pre-set distance "**Z**" along the length of the leader **58** is provided (**Step 2004**). A pull rope is attached to the pulling loop **68** at the end of the leader **58** (**Step 2006**). One of the extending features **60**, which may be the first extending feature **60** closest to the pulling loop **68** is attached to the riser cable **14(3)** from the payout reel **18(3)** located at the highest distribution level **28** in the MDU **10** (**Step 2008**). The leader **58** is extended to the next succeeding

distribution level **26, 24** in descending order (**Step 2010**). At the next succeeding distribution level **26, 24,** the leader **58** is accessed and the next extending feature **60** is attached to the end of that riser cable **14(2), 14(3)** (**Step 2012**). The leader **58** is extended to the distribution levels and the riser cable attached in the same manner. The leader **58** is extended to the lower level **22** (**Step 2014**). The riser cables **14(1)**, **14(2)**, **14(3)** are disconnected from the leader **58** and each first multi-fiber connector **30(1), 30(2), 30(3)** is connected to the multi-fiber adapter assembly **34** in the patch panel **20** enclosure (**Step 2016**). Each second multi-fiber connector **32(1), 32(2), 32(3)** is connected to respective multi-fiber adapter assemblies **34** in the FDT **29** located at the distribution levels **24, 26, 28** (**Step 2018**). Riser cable **14** slack may be stored in the FDT **29** at the distribution level **24, 26, 28** and/or in the payout reels **18(1), 18(2),18(3)** (**Step 2020**). The payout reels **18(1), 18(2), 18(3)** may be removably mounted in the FDT **29** . Slack may also be stored in the patch panel enclosure **20**.

[0074] **FIG. 11** is a schematic diagram of a front, perspective view of an exemplary LCP **40** for use with a fiber optic network in a MDU **10**. The LCP **40** comprises an enclosure **72** with a door **74** hingedly attached to the enclosure **72**. The door **74** closes to restrict and/or prohibit access to the interior **76** of the enclosure **72** and the components mounted therein, and opens to allow access to the interior **76** and the components mounted therein. A swingable adapter panel **78** mounts in the interior **76**. The adapter panel **78** has a first side **80** (not visible in **FIG. 11)** and a second side **82** to provide connections of optical fibers **83**, **85** between a feeder side and a distribution side. Pivot points **96** positioned at the top and bottom of the interior **76** allow the adapter panel to swing to provide access to the first side **80** or the second side **82** depending on the positioning of the adapter panel **78**. Additionally, the adapter panel is lockable in one or more positions. The adapter panel **78** splits the interior **76** into a first section **84** and a second section **86**. The LCP **40** is flexible such that either or both the first section **84** or the second section **86** can be configured to support feeder side optical fiber **83** management and/or connections, and/or distribution side optical fiber **85** management and/or connections.

[0075] The adapter panel **78** has a connection field **88** that supports multi-fiber adapters and connections, single fiber adapters and connections as well as pass-through

adapters and connection. In **FIG. 11**, the feeder cable **42** is shown as entering the LCP **40** at the bottom into the first section **84** and connecting to splice trays **92**. A continuing section **42(1)** of the feeder cable **42** extends from the bottom of the second side **86** to further provide optical connection from the service provider to other areas of the MDU **10** and/or to other MDU's and/or facilities. The distribution cable **36** extends from the top of the first section **84**. The distribution cable **36** optically connects to one or more riser cables **14**, which may be through a multi-fiber adapter assembly **34** in a patch panel housing **20**. One or more splitters **94** may also be mounted in the LCP **40** to split the optical signal carried by the feeder cable **42** into multiple optical signals for distribution. Fiber routing guides **98** and fiber management guides **100** may also be mounted in the first section **84** and/or the second section **86**.

[0076] **FIGS. 11A**, **11B** and **11C** are schematic diagrams of front, perspective, exploded views of the LCP **40** illustrating interior panels **102(1), 102(2), 102(3)** which may be used in the LCP **40**. The interior panels **102(1), 102(2), 102(3)** are interchangeable and allow the LCP **40** enclosure **72** to be easily reconfigured at the factory or in the field. This allows the enclosure **72** to be configured and reconfigured to support multiple applications and changing subscriber situations. In this manner, the interior panels **102(1), 102(2), 102(3)** can support, without limitation, fiber splicing, multiple splitter form factors, cable entries and other various modifications or arrangements of the LCP **40**. Additionally, the interior panels **102(1), 102(2), 102(3)** can be installed on the either the first section **84** or second section **86** of the interior **76** using any type of fasteners **104**, such as, without limitation, screws, latches and the like allowing for removable attachment.

[0077] In this regard, **FIG. 11A** illustrates an interior panel **102(1)** removably mountable to the enclosure **72** in the interior **76** in the first section **84** configured to support optical fiber splicing having splice trays **92** and optical fiber management guides **100**. **FIG. 11B** illustrates an interior panel **102(2)** removably mountable to the enclosure **72** in the interior **76** in the second section **86** configured to support optical fiber splitting having splitters **94** and optical fiber management guides **100**. **FIG. 11C** illustrates an interior panel **102(2)** removably mountable to the enclosure **72** in the interior **76** in the second section **86** configured to support optical fiber splicing having

splice trays **92** and optical fiber management guides **100**. Similarly, although not shown, an interior panel **102** removably mountable to the enclosure **72** in the interior **76** in the first section **84** may be configured to support optical fiber splitting having splitters **94** and optical fiber management guides **100**. Additionally or alternatively, the interior panels **102** may be configured to support any type of function or component, as examples, without limitation, furcation devices, ribbon fan-out bodies, wave division multiplexing, coarse wave division multiplexing and others.

[0078] The LCP **40** provides for a smaller form factor while allow a high density of optical fiber connections for distribution of optical service to the MDU **10**. Additionally, the LCP **40** allows for various options for feeder and distribution cables and of multiple splitters including, without limitation, at least five 1X32 splitters. The LCP **40** can also function as a demarcation point providing 1X1 input to output connections.

[0079] **FIG. 12** is a schematic diagram of front, elevation views of an exemplary patch panel enclosure **20** with a multi-fiber adapter assembly **34** and multiple payout reels **18** removably mounted therein. The patch panel enclosure **20** has a door **106** hingedly attached thereto. The door **106** closes to restrict and/or prohibit access to the interior **107** of the patch panel enclosure **20** and the components mounted therein, and opens to allow access to the interior **107** and the components mounted therein. In **FIG. 12**, a multi-fiber adapter assembly **34** and multiple payout reels **18(1), 18(2), 18(3), 18(4)**, are shown mounted in the interior **107**. The riser cables **14(1), 14(2), 14(2), 14(2)** are shown as having been paid out from the payout reels **18(1), 18(2), 18(3), 18(4)** which are now being used to store riser cable **14(1), 14(2), 14(2), 14(2)** slack. In FIG. 12, the payout reels **18(1)**, **18(2)**, **18(3)**, **18(4)** are shown in a collapsed state. The payout reels **18(1), 18(2), 18(3), 18(4)** are shown as being collapsible being collapsed to a smaller form factor allowing for storing in the patch panel enclosure **20**. The first multi-fiber connectors **30(1), 30(2), 30(3), 30(4)** route and connect to one side of the with the multi-fiber adapter assembly **34**. The distribution cable **36** connects to the other end of the multi-fiber adapter assembly **34** and extends from the bottom of the patch panel enclosure **20**. Mounting holes **108** allow the patch panel enclosure **20** to be wall mounted.

[0080] **FIG. 13** is a schematic diagram of a front, perspective view of a FDT **129** having a payout reel **18** and an adapter module assembly **110** with an adapter module **112** and a multi-fiber adapter assembly **34** removably mounted therein. In the embodiment depicted in **FIG. 13**, the FDT **129** is configured to be mounted in-line with and supported by conduit **113** carrying the riser cable **14** and may be mounted at one or more distribution levels **24, 26, 28**. The FDT **129** has an enclosure **114** with a door **116** hingedly attached thereto. The door **116** closes to restrict and/or prohibit access to the interior **118** of the FDT **129** and the components mounted therein, and opens to allow access to the interior **118** and the components mounted therein. In **FIG. 13**, the adapter module assembly **110** is shown mounted to the door **116** in the interior **118**. The adapter module assembly **110** comprises a connector panel **120** to which the adapter module **112** and the multi-fiber adapter assembly **34** attach. The multi-fiber adapter assembly **34** has multi-fiber adapters **122** and multiple single fiber adapters **124**. In this manner, the adapter module assembly **110** can receive and connect the riser cable **14** to drop cables **44** extending to subscriber premises **48** located on the distribution levels **24, 26, 28**.

[0081] Routing guides **126** to route and manage fiber optic cables mount to the door **116** in the interior **118** in addition to the adapter module assembly **110**. The door **116** has a flange **128** having a tool lock mechanism **130** and a pad lock hole **132**. A flange **134** on the enclosure **114** has a tool lock receiver **136** and pad lock hole **138**, which mate with the tool lock mechanism **130** and a pad lock hole **132** when the door **116** is closed to provide for locking the FDT **129**. The riser cable **14** is shown as having been paid out from the payout reel **18** which is now being used to store riser cable **14** slack. The payout reel **18** is shown in the collapsed state in a smaller form factor allowing for storing in the FDT **129**.

[0082] **FIG. 14** is a schematic diagram of a front, perspective view of an exemplary FDT **229** having a payout reel **18** removably mounted therein and an adapter module assembly **210** pivotably mounted therein. The FDT **229** has an enclosure **214** with a door **216** hingedly attached thereto, and may be located at one or more distribution levels **24, 26, 28**. The door **216** closes to restrict and/or prohibit access to the interior **218** of the FDT **229** and the components mounted therein, and opens to

allow access to the interior **218** and the components mounted therein. The adapter module assembly **210** has a cradle **236** adapted to removably hold one or more adapter modules **112**. The cradle **236** has a slack storage area **238** for storing the slack of drop cables **44** extending to subscriber premises **48** located at the distribution level **24, 26, 28**. A routing guide **240** connecting to and extending from the cradle provides for drop cable **44** routing and management in the FDT **229**. One or more mounting ears **142** extend from the enclosure **214** allowing the enclosure **214** to be mounted to a wall, for example in a closet, at the distribution level **24, 26, 28**. The door **216** has a flange **228** having a tool lock mechanism **130** and a pad lock hole **132**. A flange **234** on the enclosure **214** has a tool lock receiver **136** and pad lock hole **138**, which mate with the tool lock mechanism **130** and a pad lock hole **132** when the door **116** is closed to provide for locking the FDT **229**. The riser cable **14** is shown as having been paid out from the payout reel **18** which is now being used to store riser cable **14** slack. The payout reel **18** is shown as being collapsible being collapsed to a smaller form factor allowing for storing in the FDT **229**.

[0083] **FIG. 15** is a schematic diagram of the front, perspective view of the FDT **229** with the adapter module assembly **210** pivoted to an open position. The adapter module assembly **210** has a pivot assembly **144** connected to the bottom of the enclosure **214**. In **FIG. 15,** the pivot assembly **144** is illustrated as a cradle bracket **146** and a cradle hinge **148**. However, the pivot assembly **144** can be any mechanical or structural design that allows the adapter module assembly **210** to pivot. Sealing feature **150** allows the riser cable **14** and drop cables **44** to enter the enclosure **214** while maintaining the FDT **229** in an environmentally sealed condition. One or more strain relief brackets **152** provide strain relief for the riser cable **14** and drop cables **44** in the FDT **229**.

[0084] Referring now to **FIGS. 16** to **28** there is illustrated exemplary embodiments of a collapsible cable reel. The collapsible cable reel comprising a frame assembly with a first end and a second end and at least one cable support. A first end assembly releasably connects to the first end of the frame assembly and a second end assembly releasably connects to the second end of the frame assembly. The at least one cable support extends from the frame assembly to the first end assembly and is adapted

to support a length of cable wound around the collapsible cable reel. The length of the at least one cable support is shortenable allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

[0085] The first position of the collapsible cable reel may be an uncollapsed state, while the second position of the collapsible cable reel may be a collapsed state. The frame assembly may comprise a center member having a frame hub and an extension member. The center member may be shortenable in length by removing the extension member allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position. Alternatively or additionally, the center member may comprise a telescoping extension member, with the center member being shortenable by reducing the length of the telescoping extension member.

[0086] The frame assembly may comprise at least one frame arm extending radially from the frame hub. The first end assembly may comprise at least one first end arm extending radially from the first end hub, and the second end assembly may comprise at least one second end arm extending radially from the second end hub. Alternatively or additionally, the frame assembly may comprise a frame disk connected to the frame hub. The first end assembly may comprise a first disk connected to the first end hub, and the second end assembly may comprise a second disk connected to the second end hub.

[0087] The collapsible cable reel may have at least 100 feet of cable wound on it. The cable may be fiber optic cable, such as without limitation, riser cable or drop cable for a multiple dwelling unit. The collapsible cable reel is adapted to store cable slack in at least one of the first position and second position. The collapsible cable reel may be removably mountable in an enclosure, in one or both of the first position and the second position.

[0088] A method of operating a collapsible cable reel is also disclosed. The method may comprise providing a collapsible cable reel having a first end and a second end on which cable is wound. The first end and the second end separated by a distance, paying out at least a portion of the cable, retaining remaining slack of the cable not

payed out on the collapsible cable reel, and collapsing the collapsible cable reel by reducing the distance between the first end and the second end. The method may also include removably mounting the collapsed collapsible cable reel with the retained remaining slack of the cable in an enclosure. The cable may be fiber optic cable. The fiber optic cable may be riser cable or drop cable, used in a multiple dwelling unit.

[0089] The collapsible cable reel of the method may comprise a frame assembly having with a first end and a second end and at least one cable support, a first end assembly connected to the first end of the frame assembly, and a second end assembly connected to the second end of the frame assembly. At least one cable support may extend from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The method may include shortening at least one cable supports to allow the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

[0090] A method may include providing a frame assembly having with a first end and a second end and a plurality of cable supports, a first end assembly connected to the first end of the frame assembly and a second end assembly connected to the second end of the frame assembly. A plurality of cable supports extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel. The length of the plurality of cable supports is shortenable. The method may also include paying out at least a portion of the length of cable, retaining remaining slack of the cable not payed out on the cable supports, and shortening a length of each of the plurality of cable supports allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position. The length of cable wound on the cable supports is at least 100 feet. The cable is fiber optic cable. The fiber optic cable is one of riser cable and drop cable, used in a multiple dwelling unit. The method may also include removably mounting the collapsible cable reel in an enclosure.

[0091] In this regard, as shown in **FIG. 16**, the collapsible cable reel **18** has a frame assembly **302**, a first end assembly **304** and a second end assembly **306**. The frame assembly **302** has a center member **308**, frame arms **310** and cable supports **312**.

The center member **308** has a frame hub **314** and an extension **316**. The extension **316** has spaced apart extension members **316(1)**, **316(2)**. The extension members **316(1)**, **316(2)** connect to the frame hub **314** by a frame break away feature **318** at a first end **320**. The frame break away feature **318** will be discussed in more detail below. The extension members **316(1)**, **316(2)** may interconnect at a second end **322**. First indentations **324** may be formed in the frame hub **314** at the first end **320** proximate to the frame break away feature **318**. Second indentations **326** may be formed in the extension members **316(1)**, **316(2)** proximate the second end **322**.

[0092] The frame arms **310** connect to and extend radially from frame hub **314**. One or more of the frame arms **310** may have frame arm proximal breakaway features **328**. Additionally, one or more of the frame arms **310** may have frame arm distal break away features **330**. In the embodiment shown in **FIG. 16**, two frame arms **310** may have the frame arm proximal breakaway features **328** and two other frame arms **310** may have the frame arm distal breakaway features **330**. The frame arm proximal break away feature **328** and the frame arm distal break away feature **330** will be discussed in more detail below. Although in **FIG. 16** four frame arms **310** are shown, any number of frame arms **310** may be used.

[0093] Cable supports **312** connect to and extend from the frame arms **310** in a direction generally parallel with the center member **308**. As shown in **FIG. 16**, each cable support **312** may connect to a respective frame arm **310**. One or more of the cable supports **312** may have a support break away feature **332**. In the embodiment shown in **FIG. 16**, two cable supports **312** have the support break away feature **332**. Additionally, as shown in **FIG. 16**, the cable supports **312** having the support break away feature **332** extend from frame arms **310** that have the frame arm distal break away feature **330**. The support break away feature **332** will be discussed in more detail below. Although in **FIG. 16** four cable supports **312** are shown, any number of cable supports **312** may be used.

[0094] Continuing with reference to **FIG. 16**, the first end assembly **304** may have a first end hub **334** and first end arms **336**. The first end arms **336** connect to and radially extend from the first end hub **334**. One or more of the first end arms **336** may have first end arm proximal breakaway features **338**. Additionally, one or more of the

first end arms **336** may have first end arm distal break away features **340**. In the embodiment shown in **FIG. 16**, two first end arms **336** have the first end arm proximal breakaway features **338** and two other fist end arms **336** have the first end arm distal breakaway features **340**. The first end arm proximal break away feature **338** and the first end arm distal break away feature **340** will be discussed in more detail below. Although in **FIG. 16** four first end arms **336** are shown, any number of first end arms **336** may be used.

[0095] Referring now also to **FIG. 17**, each of the first end arms **336** may have support guides **342**. The first end hub **334** may have snap locks **344**. The support guides **342** and the snap locks **344** may be used to releasably connect the frame assembly **302** to the first end assembly **304** in a first position. In this regard, the snap locks **344** have inwardly extending protrusions **345** which snap into the second indentations **326** on the extension members **316(1)**, **316(2)** to releasably retain the first end assembly **304** to the frame assembly **302**.

[0096] With reference again to **FIG. 16**, the second end assembly **306** is shown having a second end hub **346** and second end arms **348**. The second end arms **348** connect to and radially extend from the second end hub **346**. One or more of the second end arms **348** may have second end arm proximal breakaway features **350**. Additionally, one or more of the first end arms **348** may have second end arm distal break away features **352**. In the embodiment shown in **FIGS. 16**, two second end arms **348** may have the second end arm proximal breakaway features **350** and two other second end arms **348** may have the second end arm distal breakaway features **352**. The second end arm proximal break away feature **350** and the second end arm distal break away feature **352** will be discussed in more detail below. Although in **FIG. 16** four second end arms **348** are shown, any number of second end arms **348** may be used.

[0097] Referring now also to **FIG. 18**, support stub **354**, locking tab **356**, guide pin **358** are shown extending from one or more of the second end arms **348**. In **FIG. 18**, two of the second end arms **348** are shown with the support stub **354**, the locking tab **356**, and the guide pin **358**, and two other of the second end arms **348** are shown with only the support stub **354**. The support stub **354,** the locking tab **356**, and the guide pin **358**, are used to releasably connect the second end assembly **306** to the frame assembly

302. In this regard, the support stub **354** inserts into a support guide **342** (not shown) on the frame arm **310**, the guide pin **358** inserts into guide pin aperture **360** on the frame arm **310**, and the locking tab **356** has a hook end **362**. When the locking tab **356** inserts into receiver **364** in the frame arm **310**, the hook end **362** snap locks on to the inside of the frame arm **310** releasably connecting the second end assembly **306** to the frame assembly **302 (see FIGS. 21A** and **21B)**. The second end hub **346** has a beveled edge perimeter **366** which inserts into the frame hub **314** when the second end assembly **306** is releasably connected to the frame assembly **302**.

[0098] Referring now to **FIGS. 19, 20**, **21A** and **21B**, there are shown detail, perspective views of an end section of one of the cable support **312** (**FIG. 19**) one of the snap locks **344 (FIG. 20)** and one of the locking tabs **356**, (**FIGS. 21A** and **21B**). As illustrated in **FIG. 19**, the profile of the cable support **312** is "T" shaped having a support surface **368** and a stiffening rib **370**. The support surface **368** faces radially outwardly and the stiffening rib **370** extends radially inwardly when the cable support **312** is connected between the frame assembly **302** and the first end assembly **304**. In this manner, the support surface **368** is adapted to receive the load of the cable wound on the cable reel **18** and the stiffening rib **370** provides additional strength to the cable support **312** to allow the cable support **312** to support the cable load and minimizing any bowing and/or the risk of unintentional breaking.

[0099] **FIG. 20** illustrates a detail, perspective view of one of the snap locks **344**. The snap lock **344** has a resilient flap **372** with a protrusion **345**. The resilient slap **372** pivots to allow the extension member second end **322** to insert into the first end hub **334**. The resilient flap **372** biases against the extension member second end **322** as the extension member second end **322** moves in the first end hub **334**. The extension member second end **322** moves until the second indentation **326** on the extension member **316** aligns with the protrusion **345**. Upon such alignment, the pressure caused by the biasing of the resilient flap **372** forces or snaps the protrusion **345** into the second indentation **326** releasably locking the extension member **316** to the first end hub **334**. Moving the extension member **316** applies a force to the protrusion **345** causing the resilient flap **372** to pivot away from the extension member **316** thereby releasing the

protrusion **345** from the second indentation **326** allowing the extension member to be removed from or further advanced through the first end hub **334**.

[00100] **FIGS. 21A and 21B** illustrate detail, perspective views of one of the locking tabs **356** on the second end arm **348**. The locking tab **356** has a cantilevered member **374** attached to the second end arm **348** at an attachment end **376** and a hook **378** extending generally perpendicular from a plane of the cantilevered member **374** at the hook end **362**. The hook end **362** inserts through the receiver **364** in the frame arm **310**. As the hook end **362** goes through the receiver **364**, a receiver edge **380** exerts pressure on the hook **378** forcing the cantilevered member **374** to pivot in one direction, designated as **"A"** in **FIG. 21A**. When the hook **378** passes through the receiver **374**, the receiver edge **380** stops exerting the pressure on the hook **378** and the cantilevered member **374** pivots in the other direction, designated as **"B"** in **FIG. 21A**, allowing the hook end **362** to move back towards its initial position. As the hook end **362** moves back towards its initial position, the hook **378** snaps against the receiver edge **380** releasably retaining the second end arm **348** to the frame arm **310** as shown in **FIG. 21B**. Applying pressure to the hook **378** moves the hook end **362** which causes the cantilevered member to pivot in the direction designated as **"A"** and allows the second end arm **348** to be disconnected or released from the frame arm **310**.

[00101] Referring now to **FIG. 22**, there is shown the collapsible cable reel **18** in the assembled, un-collapsed state with a length of cable, in this case, riser cable **14**, wound thereon. However, it should be understood that the any type of cable may be wound on the collapsible cable reel **18**. In operation, the cable may be wound on the collapsible cable reel **18** when the collapsible cable reel is in the assembled, un-collapsed state at the factory and shipped to the installation site. The collapsible cable reel **18** is in the uncollapsed or first position establishing a distance **"D1"** between the frame arms **310** and the first end arms **336**. The distance **"D1"** may be any distance. As a non-limiting example, D1 may be about 10 inches. Also, a distance **"D2"** is established between the second end arms **348** and the frame arms **310** when the second end arms **348** are attached to the frame arms **310**. A portion of the fiber optic cable **14** may be started and stored separately on the support stubs **354** extending between the frame arms **310** and second end arms **348**. The distance **"D2"** may be any distance. As

a non-limiting example D2 may be about ½ inch. When the cable **14** needs to be accessed later, a technician may easily access the cable **14** in the area between the frame arms **310** and second end arms **348** without having to access the cable on the cable supports **312**. At the site the cable may be payed out to install the cable as necessary to facilitate the network installation. Once the required length of cable is payed out, the collapsible cable reel **18** may be collapsed and used to store any remaining slack of cable left wound on the collapsible cable reel **18**.

[00102] In this regard, **FIG. 23** illustrates a perspective view of the collapsible cable reel **18** in the process of being collapsed, or transitioned toward a collapsed state or second position. The first step is to release the snap locks **344** releasably connecting the extension members **316(1)**, **316(2)** to the first end hub **334**. With the extension members **316(1)**, **316(2)** unconnected from the first end hub **334** the first end assembly **304** may then be moved toward the frame arms **310** with the first end hub **334** passing about the extension members **316(1)**, **316(2)**. In **FIG. 23**, the direction of the movement of the first end assembly **304** is indicated by an arrow marked as **"X."** As the first end assembly **304** moves toward the frame arms **310**, the support guides **342** pass about the cable supports **312** with the cable supports **312** being progressively extended past the first end arms **336**. This allows the distance between the first end arms **334** and the frame arms **310** to progressively reduce until the snap locks **344** align with the first indentation **324**. Upon alignment with the first indentations **324**, the protrusions **345** on the snap locks **344** snap into and position in the first indentations **324**. When the protrusions **345** snap into the first indentations **324**, the first end assembly **304** is releasably connected to the frame assembly **302** in a second position. In the second position, the first end arms **336** are separated from the frame arms **310** by a distance "**D3**." The distance **"D3"** may be any distance provided it is less than distance "**D1**." As examples, and depending on the distance **"D1"**, **"D3"** may be anyb distance. As an example, D3 may be about 5 inches.. In the second position when the collapsible cable reel **18** is in the collapsed state, the distance **"D2"** may not change.

[00103] When the collapsible cable reel **18** is in the second position, the second end arms **348(1)**, **348(2)** may be separated from the second end assembly **306** and the second end hub **366** at the second end proximal break-away feature **350** and discarded.

Additionally, a portion of the second end arms **348(3)**, **348(4)** may be separated from the rest of the second end assembly **306** at the second end distal break away feature **352** leaving only a portion of second end arms **384(5)**, **384(6)** (shown on **FIG. 24**). Similarly, the first end arms **336(1)**, **336(2)** may be separated from the first end assembly **304** and the first end hub **334** at the first end proximal break-away feature **338**. The first end arms **336(1)**, **336(2)** may be slid off of the support guides **312** and discarded. Additionally, a portion of the second end arms **336(3)**, **336(4)** may be separated from the rest of the first end assembly **304** at the first end distal break away feature **340** leaving only a portion of first end arms **336(5), 336(6)** (shown on **FIG. 24**).

[00104] Once the first end arms **336** have been separated from the first end assembly **304** and the second end arms **348** have been separated from the second end assembly **306**, the frame arms frame arms **310(1)**, **310(2)** may be separated from the frame assembly **302** and the frame hub **314** at the frame arm proximal break-away feature **328**. The frame arms **310(1)**, **310(2)** and the cable supports **312** extending therefore may then be discarded. The frame arms **310(3)** and **310(4)** may then be separated at the frame arm distal break-away feature **330** leaving only a portion of frame arms **310(5), 310(6)** (shown on **FIG. 24**). The cable supports **312** that extend from frame arms **310(5), 310(6)** may be separated into two segments at the support break-away feature **332**. The segment that extends past the frame arms **310(5), 310(6)** may then be discarded. In this regard, the remaining segments of the two remaining frame arms **310(5), 310(6)** will extend into the support guides **342** in frame arms **310(5), 310(6)** but may not extend past the frame arms **310(5), 310(6)** as shown in **FIG. 24**. Additionally, with the first end hub **334** releasably attached to the frame hub **314** by the snap locks **344** into first indentations **324**, the extension members **316(1)**, **316(2)** may be separated from the frame hub **314** at frame break-away feature **318** and discarded.

[00105] The collapsible cable reel **18** is in the collapsed state, or second position, as shown in **FIG. 24**. In the second position, any remaining cable slack not payed out may be left on the collapsible cable reel **18**. Since in the second position, the collapsible cable reel **18** has a smaller size and, therefore, takes up less space, than the collapsible cable reel **18** in the uncollapsed or first position, the collapsible cable reel **18** may then be conveniently stored. Such storage may include, as non-limiting examples,

being retained on a cable reel caddy, hung on a wall, and/or stored in an enclosure, box or cabinet.

[00106] Referring now to **FIGS. 25-28**, there is shown an embodiment of the collapsible cable reel **18'**. Collapsible cable reel **18'** is similar to collapsible cable reel **18** as shown and described with reference to **FIGS. 16-24**, except that it does not have frame arms **310**, first end arms **336** and second end arms **348**. Instead, the collapsible cable reel **18'**, has a frame assembly **402**, a first end assembly **404**, and a second end assembly **406**. The frame assembly **402** has a frame disk **408** with cable supports **410** extending therefrom. The first end assembly **404** has first disk **412** and the second end assembly **406** has a second disk **414**. In **FIG. 25**, the cable supports **410** are shown as channels or **"C"** shaped instead of the **"T"** shape of cable supports **312** described above with reference to collapsible cable reel **18**. However, the cable supports **312** may be used instead of cable supports **410** with collapsible cable reel **18'**. Further, any type or shape of cable supports may be used with either collapsible cable reel **18** or collapsible cable reel **18'**. The cable supports **410** insert into support guides **426** in a similar manner as cable supports **312** and support guides **342** as described above. The center member **308**, frame hub **314**, extension member **316**, first end hub **334** and second end hub **346** interconnect and function in a similar manner as described above.

[00107] In **FIG. 25**, the frame disk **408**, the first disk **412**, and the second disk **414** have multiple spokes **416**, **418**, **420**, respectively, extending radially outwardly. At least two each of the multiple spokes **416**, **418**, **420** has a break-away feature. As shown in **FIG. 25**, one of the spokes **418** of the first disk **412** has first disk break-away feature **422**. The first disk break-away feature **422** extends around the first end hub **334** and along the sides of the spoke **418** to a point on the spoke **418**. Although not shown in **FIG. 25**, the frame disk **408** and the second disk **414** may have similar break-away features as first disk break-away feature **422**.

[00108] Referring now to **FIG. 26**, there is shown the collapsible cable reel **18'** in the assembled, un-collapsed state with a length of cable, in this case, riser cable **14**, wound thereon. However, it should be understood that the any type of cable may be wound on the collapsible cable reel **18'**. In operation, the cable may be wound on the collapsible cable reel **18'** when the collapsible cable reel is in the assembled, un-

collapsed state at the factory and shipped to the installation site. The collapsible cable reel **18'** is in the uncollapsed or first position establishing a distance **"D1"** between the frame disk **408** and the first disk **412**. The distance **"D1"** may be any distance. As a non-limiting example, D1 may be about 10 inches. Also, a distance **"D2"** is established between the second disk **414** and the frame disk **408** when the second disk **414** is attached to the frame disk **408**. A portion of the fiber optic cable **14** may be started and stored separately on the support stubs **424** extending between the frame disk **408** and second disk **414**. The distance **"D2"** may be any distance. As a non-limiting example, D2 may be about ½ inch. When the cable **14** needs to be accessed later, a technician may easily access the cable **14** in the area between the frame disk **408** and second disk **414** without having to access the cable on the cable supports **410**. At the site the cable may be payed out to install the cable as necessary to facilitate the network installation. Once the required length of cable is payed out, the collapsible cable reel **18'** may be collapsed and used to store any remaining slack of cable left wound on the collapsible cable reel **18'**.

[00109] **FIG. 27** illustrates the collapsible cable reel **18'** being moved from uncollapsed state, or first position, to the collapsed state, or second position. When the collapsible cable reel **18'** is to be placed in the collapsed state or second position, a portion of the process as described above with respect to collapsible cable reel **18**, may be used. In this regard, the first step is to release the snap locks **344** releasably connecting the extension members **316(1)**, **316(2)** to the first end hub **334**. With the extension members **316(1)**, **316(2)** unconnected from the first end hub **334** the first end assembly **404** may then be moved toward the frame disk **408** with the first end hub **334** passing about the extension members **316(1)**, **316(2)**. In **FIG. 27**, the direction of the movement of the first end assembly **404** is indicated by an arrow marked as **"X."** As the first end assembly **404** moves toward the frame disk **408**, the support guides **426** pass about the cable supports **410** with the cable supports **410** being progressively extended past the first disk **412**. This allows the distance between the first disk **412** and the frame disk **408** to progressively reduce until the snap locks **344** align with the first indentation **324**. Upon alignment with the first indentations **324**, the protrusions **345** on the snap locks **344** snap into and position in the first indentations **324**. When the

protrusions **345** snap into the first indentations **324**, the first end assembly **404** is releasably connected to the frame assembly **402** in a second position. In the second position, the first disk **412** is separated from the frame disk **408** by a distance "**D3**." The distance **"D3"** may be any distance provided it is less than distance "**D1**." As examples, and depending on the distance **"D1"**, **"D3"** may be any distance. As a non-limiting example, D3 may be 5 inches. In the second position when the collapsible cable reel **18'** is in the collapsed state, the distance **"D2"** may not change.

[00110] The first disk **412** may then be separated along the first disk break-away feature **422**. This results in the first end assembly **404** having two first end arms **418(1)**, **418(2)** formed from the portion of the spokes **418** remaining after the separation. This may be seen with reference to **FIG. 26**. Similarly, the frame disk **408** and the second disk **414** may also be separated along the similarly arranged break-away features on those disks (not shown). This results in the frame assembly **402** having two frame arms **416(1)**, **416(2)** formed from the portion of the spokes **416** remaining after the separation. Additionally, this results in the second end assembly **406** having two second end arms **420(1)**, **420(2)** formed from the portion of the spokes **420** remaining after the separation. The rest of the frame assembly **402**, first end assembly **404**, and second end assembly **406** may be discarded.

[00111] The cable supports **410** that extend from frame arms **416(1), 416(2)** may be separated into two segments at the support break-away feature **426**. The segment that extends past the first end arms **418(1)**, **418(2)** may then be discarded. In this regard, the remaining segments of the two remaining cable supports **410** will extend into the support guides **426** in the first end arms **418(1)**, **418(2)** but may not extend past the first end arms **418(1)**, **418(2)** as shown in **FIG. 28**. Additionally, with the first end hub **334** releasably attached to the frame hub **314** by the snap locks **344** into first indentations **324**, the extension members **316(1)**, **316(2)** may be separated from the frame hub **314** at frame break-away feature **318** and discarded.

[00112] The collapsible cable reel **18'** is in the collapsed state, or second position, as shown in **FIG. 28**. In the second position, any remaining cable slack not payed out may be left on the collapsible cable reel **18'**. Since in the second position, the collapsible cable reel **18'** has a smaller size and, therefore, takes up less space, than the

collapsible cable reel **18'** in the uncollapsed or first position, the collapsible cable reel **18'** may then be conveniently stored. Such storage may include, as non-limiting examples, being retained on a cable reel caddy, hung on a wall, and/or stored in an enclosure, box or cabinet.

[00113] Referring now to **FIG. 29**, there is shown another embodiment of a frame assembly **428** that may be used with collapsible cable reel **18**, **18'**. Instead of having a center member **308** with an extension member **316**, the frame assembly **428** has a telescoping center member **430**. The telescoping center member **430** has a frame hub **432** attached to frame disk **408**. It should be understood that instead of the frame disk **408**, and although not shown in **FIG 29**, frame arms **310** may extend from frame hub **432** in the same manner as described above. The telescoping center member **430** may have one or more telescoping sections **434** and a telescoping second end **436**. The telescoping second end **436** releasably attaches to the first end hub **334** (not shown) as described above. The telescoping second end **436**, telescoping sections **434** and frame hub **432** may be formed to sequentially friction fit into each other to provide for telescoping function. In this manner, the friction fit retains the telescoping second end **436**, telescoping sections **434** in an extended relationship, telescoped out, when the collapsible cable reel **18**, **18'** is in the uncollapsed state; and allows the telescoping second end **436**, telescoping sections **434** to be sequentially inserted into each other, telescoped in, when the collapsible cable reel **18**, **18'** moves from the uncollapsed state toward, and in the collapsed state, or second position.

[00114] Many modifications and other embodiments set forth herein will come to mind to one skilled in the art to which the embodiments pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the description and claims are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. It is intended that the embodiments cover the modifications and variations of the embodiments provided they come within the scope of the appended claims and their equivalents. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A collapsible cable reel, comprising:

a frame assembly having with a first end and a second end and at least one cable support;

a first end assembly connected to the first end of the frame assembly; and

a second end assembly connected to the second end of the frame assembly,

wherein at least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel, and

wherein the length of the at least one cable supports is shortenable allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

2. The collapsible cable reel of claim 1, wherein in the first position the collapsible cable reel is in an uncollapsed state.

3. The collapsible cable reel of claim 1, wherein in the second position the collapsible cable reel is in a collapsed state.

4. The collapsible cable reel of claim 1, wherein the frame assembly comprises a center member having a frame hub, and wherein the center member is shortenable in length.

5. The collapsible cable reel of claim 4, wherein the center member comprises an extension member, and wherein the center member is shortenable by removing the extension member.

6. The collapsible cable reel of claim 1, wherein the center member comprises a telescoping extension member, and wherein the center member is shortenable by reducing the length of the telescoping extension member.

7. The collapsible cable reel of claim 2, wherein the frame assembly comprises at least one frame arm extending radially from the frame hub.

8. The collapsible cable reel of claim 1, wherein the first end assembly comprises at least one first end arm extending radially from the first end hub.

9. The collapsible cable reel of claim 1, wherein the second end assembly comprises at least one second end arm extending radially from the second end hub.

10. The collapsible cable reel of claim 1, wherein the frame assembly comprises a frame disk connected to the frame hub.

11. The collapsible cable reel of claim 1, wherein the first end assembly comprises a first disk connected to the first end hub.

12. The collapsible cable reel of claim 1, wherein the second end assembly comprises a second disk connected to the second end hub.

13. The collapsible reel of claims 1, wherein the collapsible cable reel is adapted to store cable slack in at least one of the first position and second position.

14. The collapsible cable reel of claim 1, wherein the collapsible cable reel is removably mountable in an enclosure.

15. The collapsible cable reel of claim 1, wherein the collapsible cable reel is removably mountable in an enclosure in one or both of the first position and the second position.

16. A method of operating a collapsible cable reel, comprising;

providing a collapsible cable reel having a first end and a second end on which cable is wound, the collapsible cable reel having a first end and a second end separated by a distance;

paying out at least a portion of the cable;

retaining remaining slack of the cable not payed out on the collapsible cable reel; and

collapsing the collapsible cable reel by reducing the distance between the first end and the second end.

17 The method of claim 14, further comprising, removably mounting the collapsed collapsible cable reel with the retained remaining slack of the cable in an enclosure.

18. The method of claims 14, wherein the cable is fiber optic cable.

19. The method of claim 16, wherein the fiber optic cable is one of riser cable and drop cable, used in a multiple dwelling unit.

20. The method of claim 14, wherein the collapsible cable reel comprises,

a frame assembly having with a first end and a second end and at least one cable support;

a first end assembly connected to the first end of the frame assembly; and

a second end assembly connected to the second end of the frame assembly,

wherein at least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel.

21. The method of claim 18, further comprising, shortening at least one cable supports allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

22. A method of operating a collapsible cable reel, comprising:

providing a frame assembly having with a first end and a second end and a plurality of cable supports, a first end assembly connected to the first end of the frame assembly and a second end assembly connected to the second end of the frame assembly, wherein at least one cable support extends from the frame assembly to the first end assembly and is adapted to support a length of cable wound around the collapsible cable reel, and wherein the length of the at least one cable supports is shortenable;

paying out at least a portion of the length of cable;

retaining remaining slack of the cable not payed out on the cable supports; and

shortening a length of each of the plurality of cable supports allowing the first end assembly to move closer to the second end assembly and the collapsible cable reel to move from a first position to a second position.

23. The method of claim 20, wherein the length of cable wound on the cable supports is at least 100 feet.

24. The method of claims 21, wherein the cable is fiber optic cable.

25. The method of claim 22, wherein in the fiber optic cable is one of riser cable and drop cable, used in a multiple dwelling unit.

26. The method of claim 20, further comprising, removably mounting the collapsible cable reel in an enclosure.

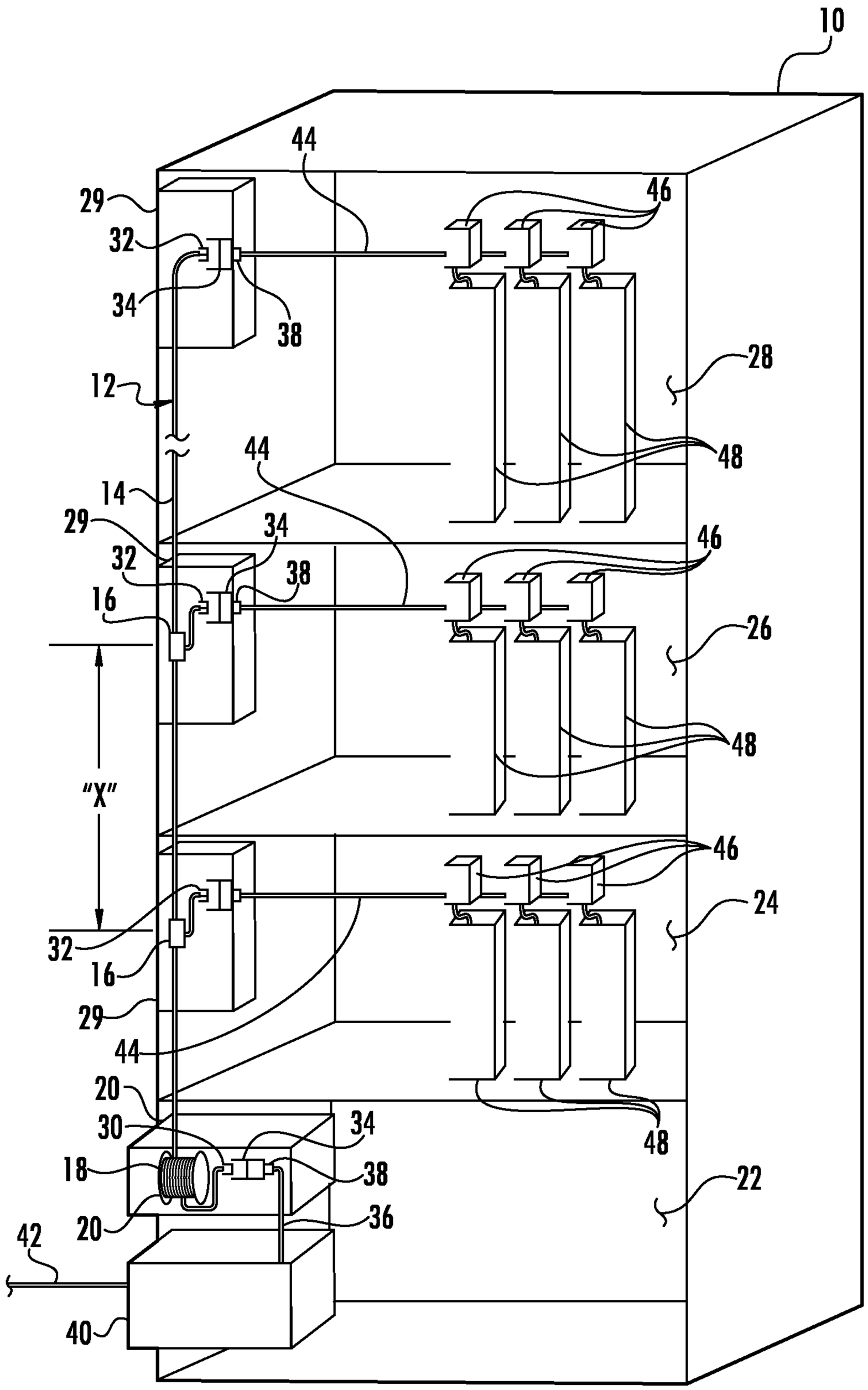
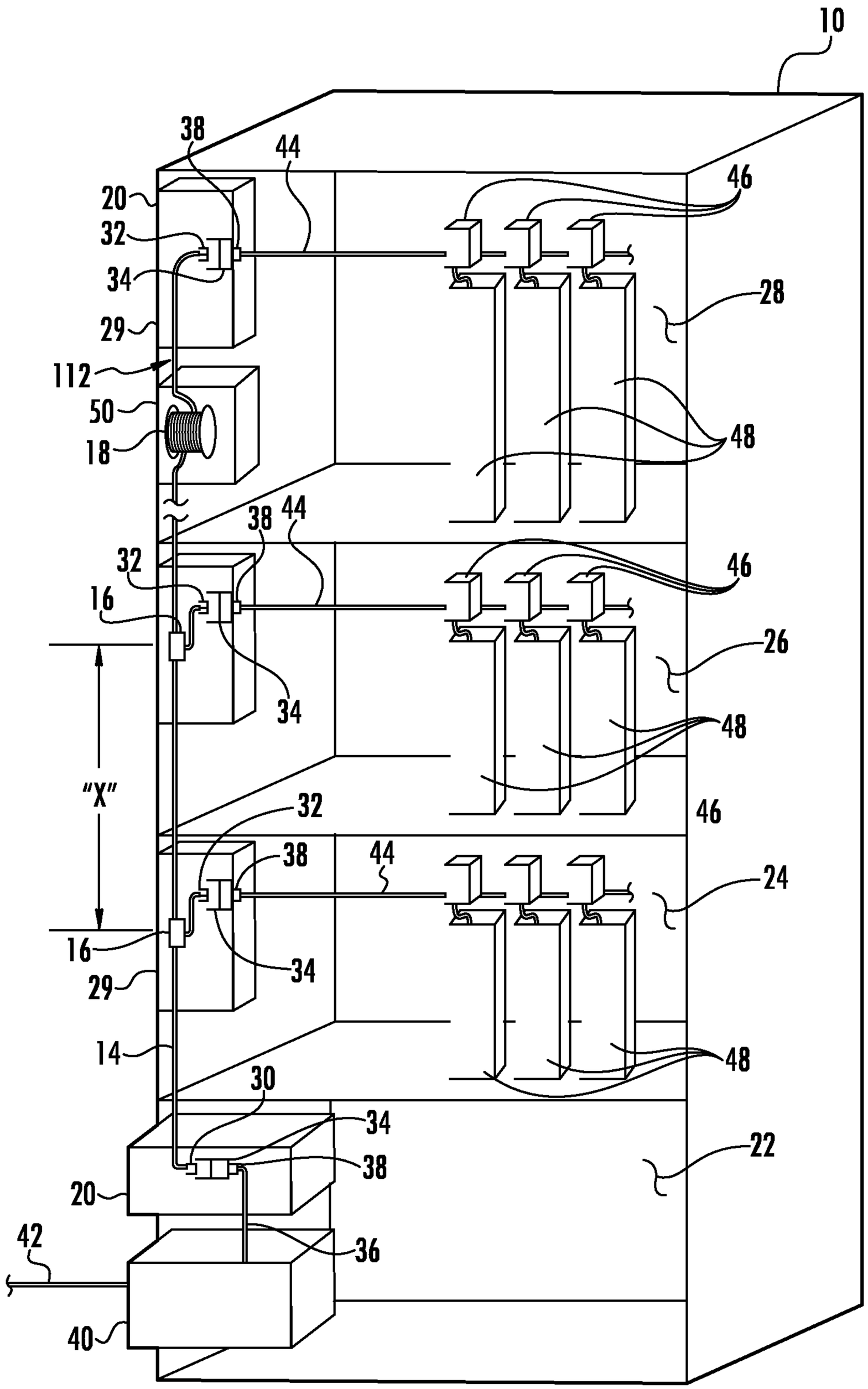


FIG. 1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38
44
46
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29
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112
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48
18
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44
32
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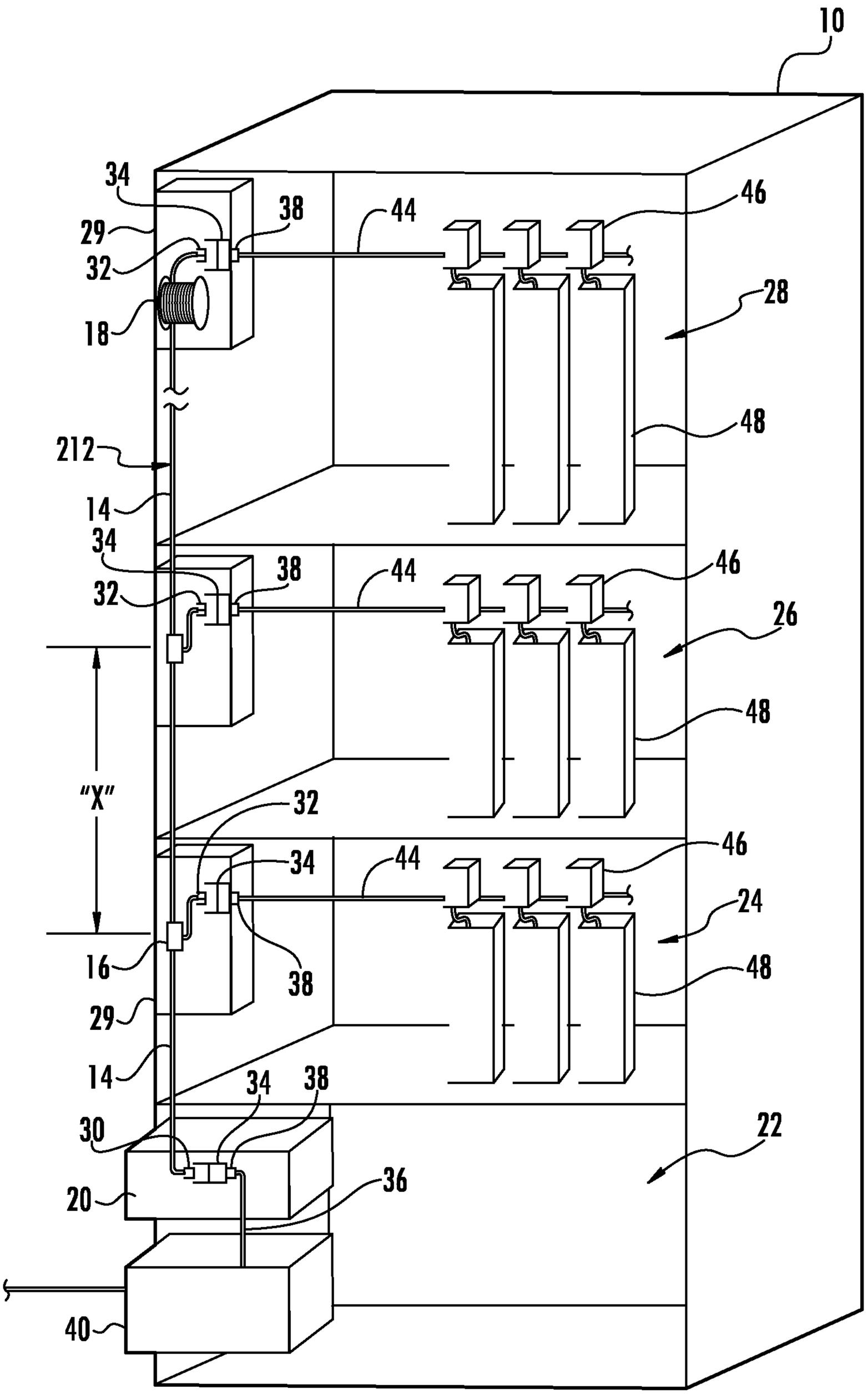
48
"X"
32
46
38
44
24
16
34
29
14
48
30
34
22
38
20
42
36
40

FIG. 2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18
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212
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32
26
48
"X"
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16
38
48
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14
34
38
30
22
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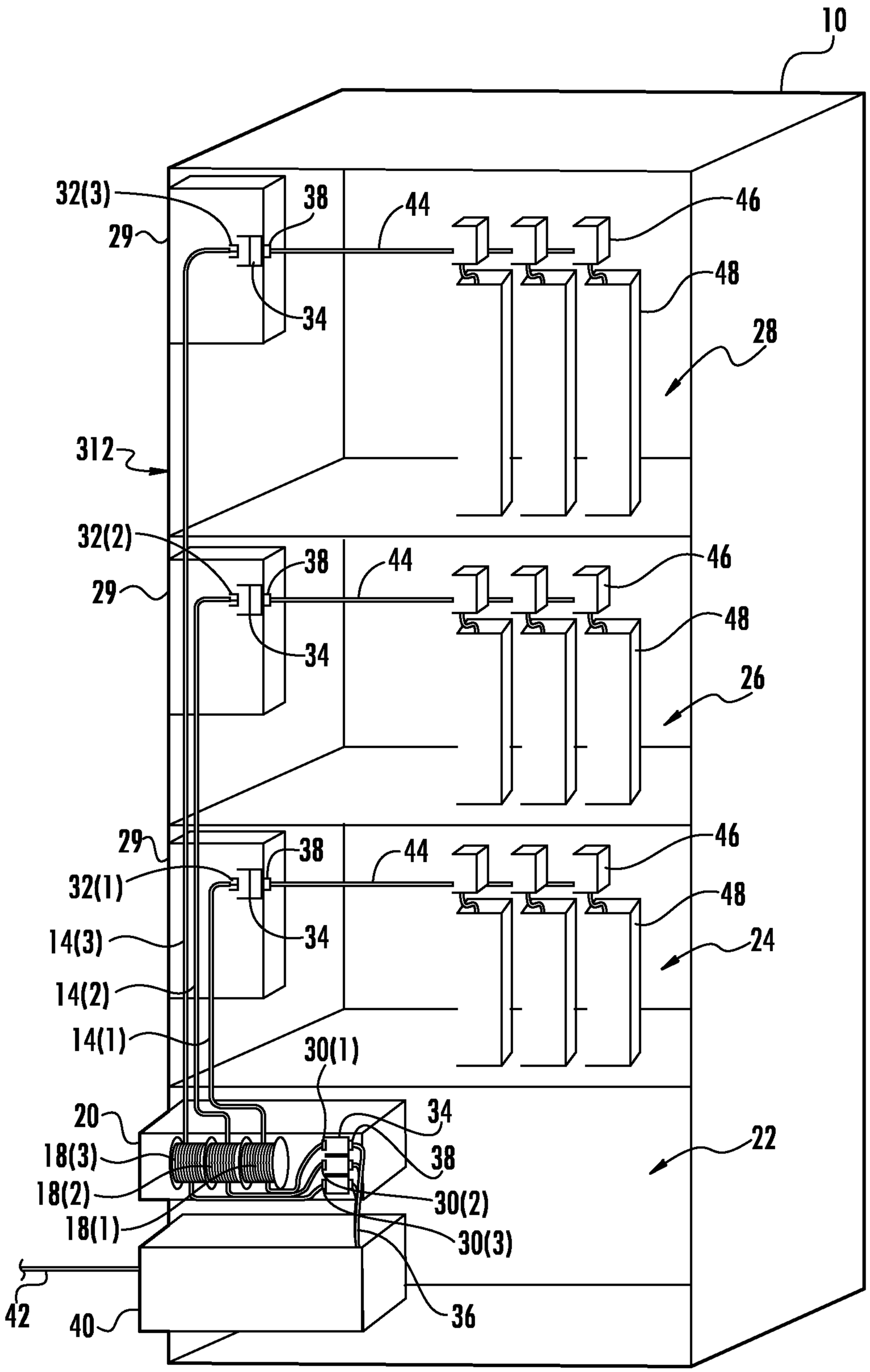
20
40

FIG. 3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14(3)
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14(2)
14(1)
30(1)
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18(3)
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18(2)
30(2)
18(1)
30(3)
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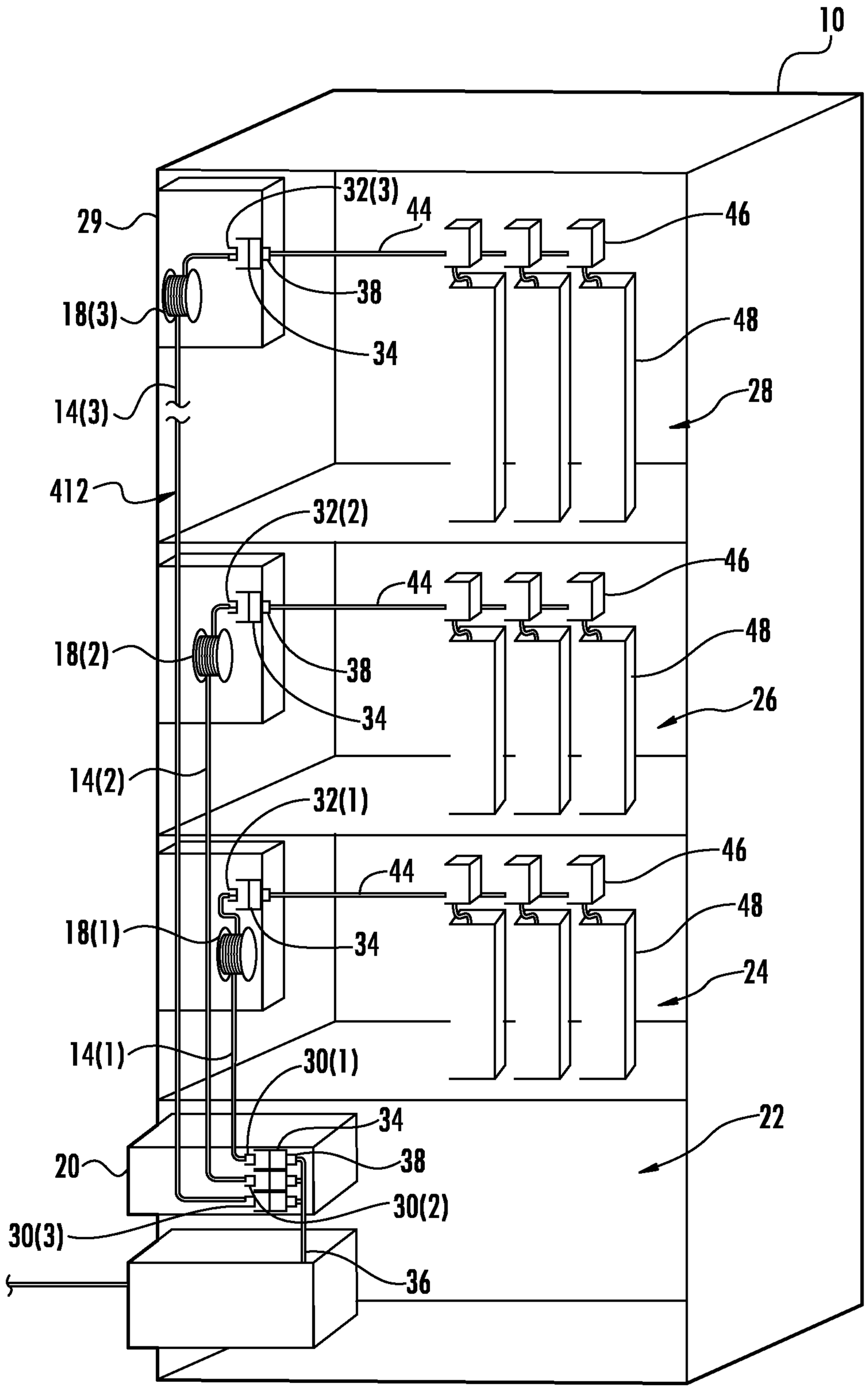
FIG. 4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14(2)
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14(1)
30(1)
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38
30(2)
30(3)
36

FIG. 5

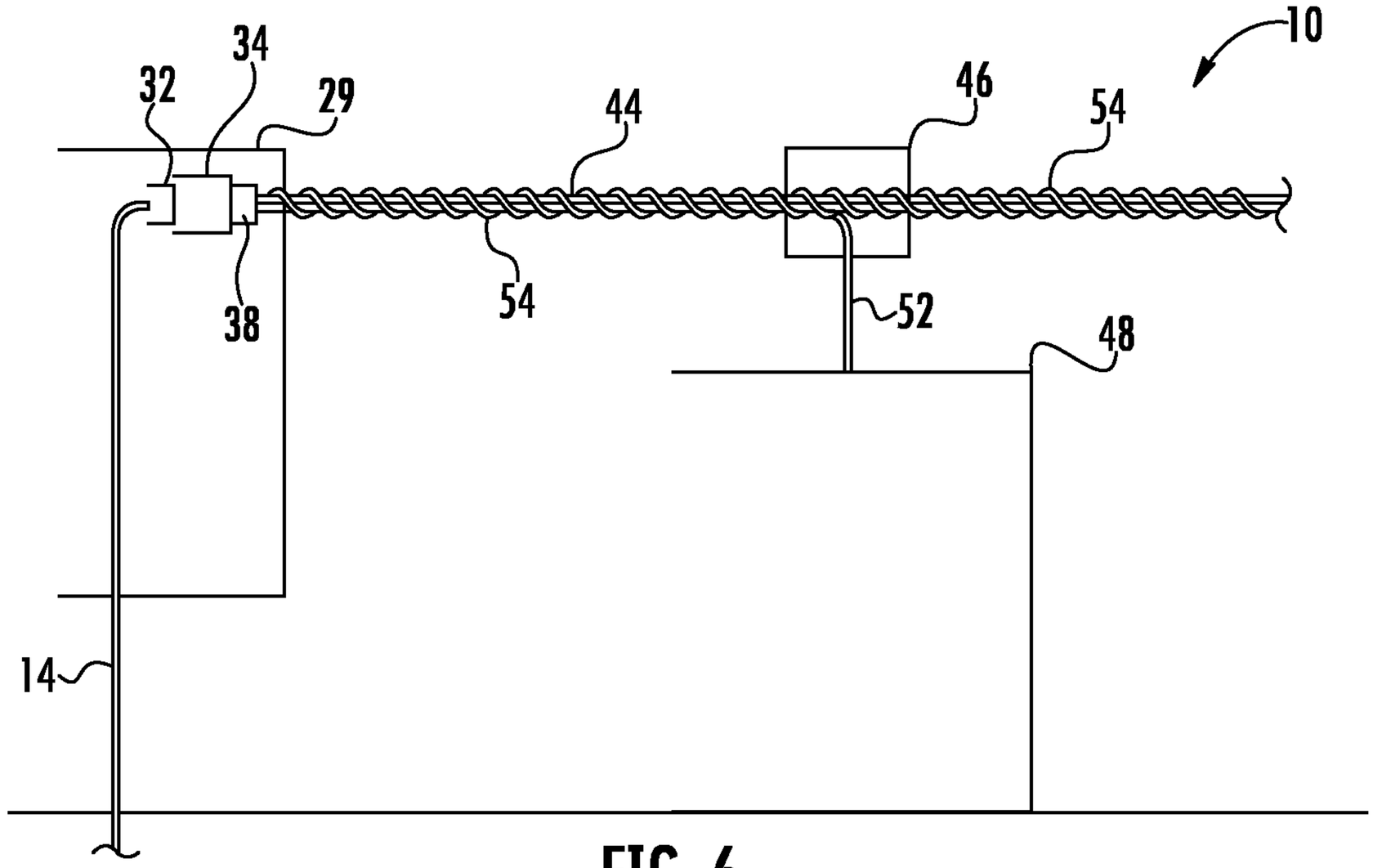
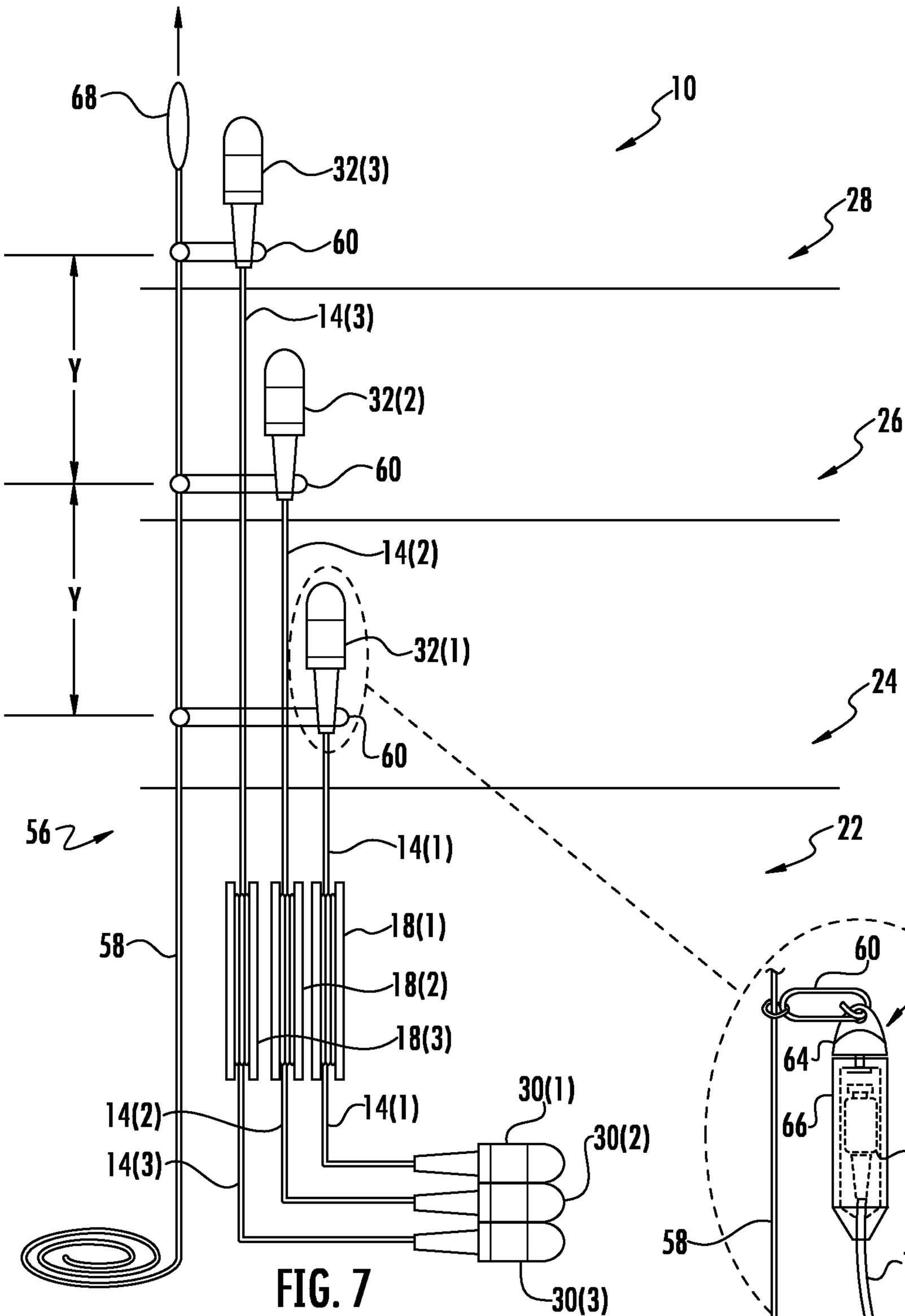


FIG. 6


68
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32(2)
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14(2)
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18(1)
18(2)
18(3)
14(2)
14(1)
30(1)
30(2)
14(3)
30(3)
10
28
26
24
22
60
62
64
66
32
58
14

FIG. 7

FIG. 7A

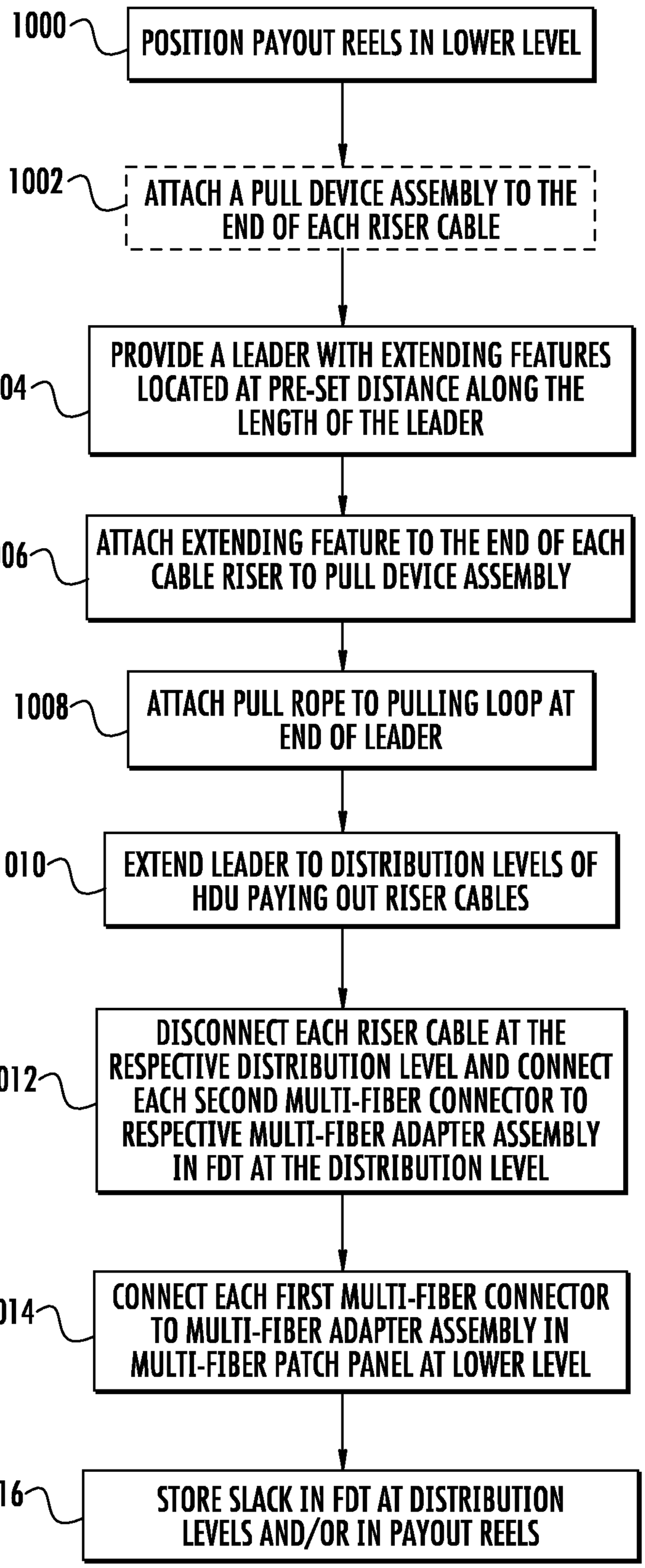
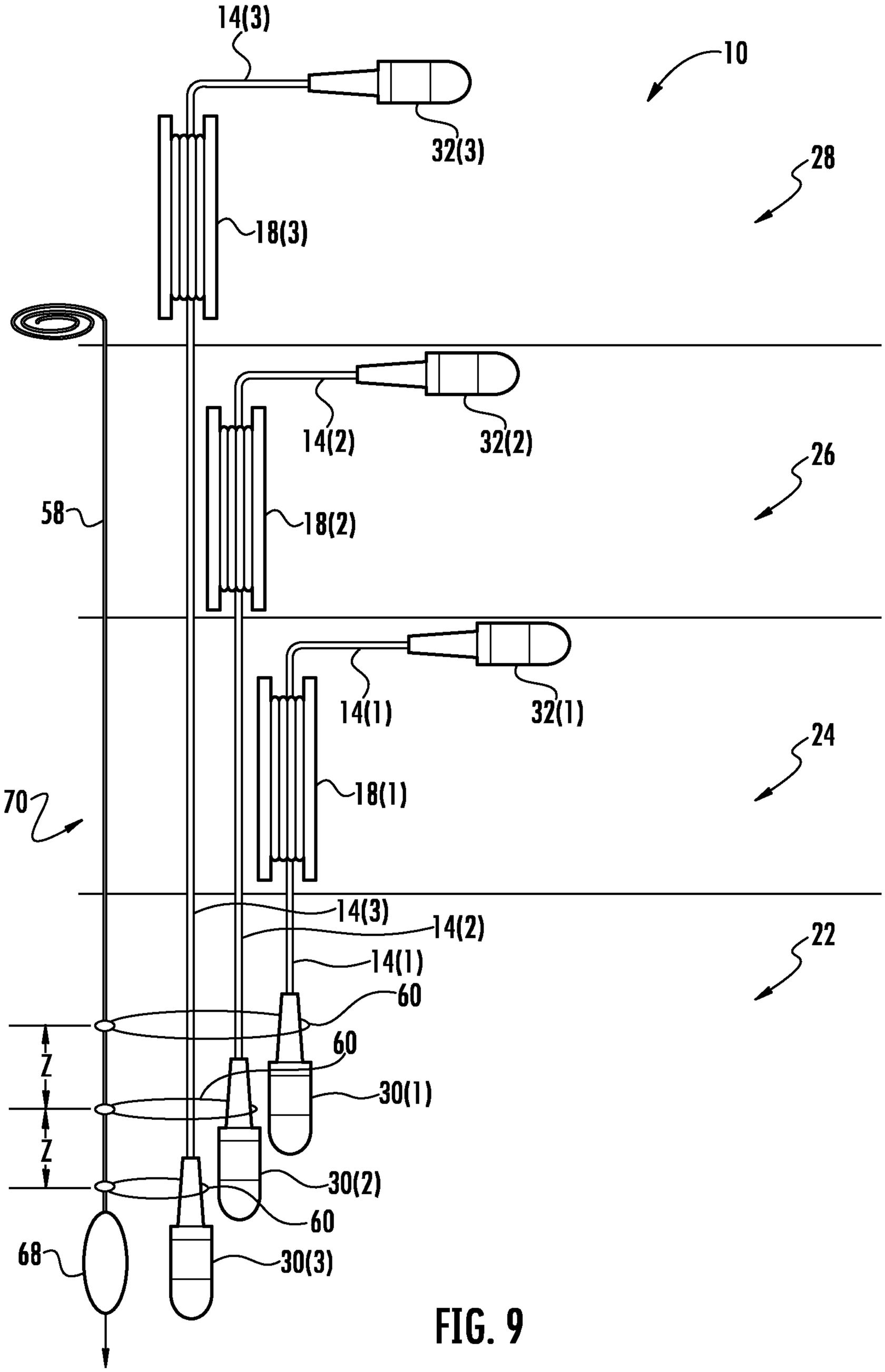

1000
POSITION PAYOUT REELS IN LOWER LEVEL
1002
ATTACH A PULL DEVICE ASSEMBLY TO THE END OF EACH RISER CABLE
1004
PROVIDE A LEADER WITH EXTENDING FEATURES LOCATED AT PRE-SET DISTANCE ALONG THE LENGTH OF THE LEADER
1006
ATTACH EXTENDING FEATURE TO THE END OF EACH CABLE RISER TO PULL DEVICE ASSEMBLY
1008
ATTACH PULL ROPE TO PULLING LOOP AT END OF LEADER
1010
EXTEND LEADER TO DISTRIBUTION LEVELS OF HDU PAYING OUT RISER CABLES
1012
DISCONNECT EACH RISER CABLE AT THE RESPECTIVE DISTRIBUTION LEVEL AND CONNECT EACH SECOND MULTI-FIBER CONNECTOR TO RESPECTIVE MULTI-FIBER ADAPTER ASSEMBLY IN FDT AT THE DISTRIBUTION LEVEL
1014
CONNECT EACH FIRST MULTI-FIBER CONNECTOR TO MULTI-FIBER ADAPTER ASSEMBLY IN MULTI-FIBER PATCH PANEL AT LOWER LEVEL
1016
STORE SLACK IN FDT AT DISTRIBUTION LEVELS AND/OR IN PAYOUT REELS

FIG. 8


14(3)
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32(3)
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14(2)
32(2)
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32(1)
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18(1)
14(3)
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14(1)
22
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Z
30(1)
Z
30(2)
60
68
30(3)

FIG. 9

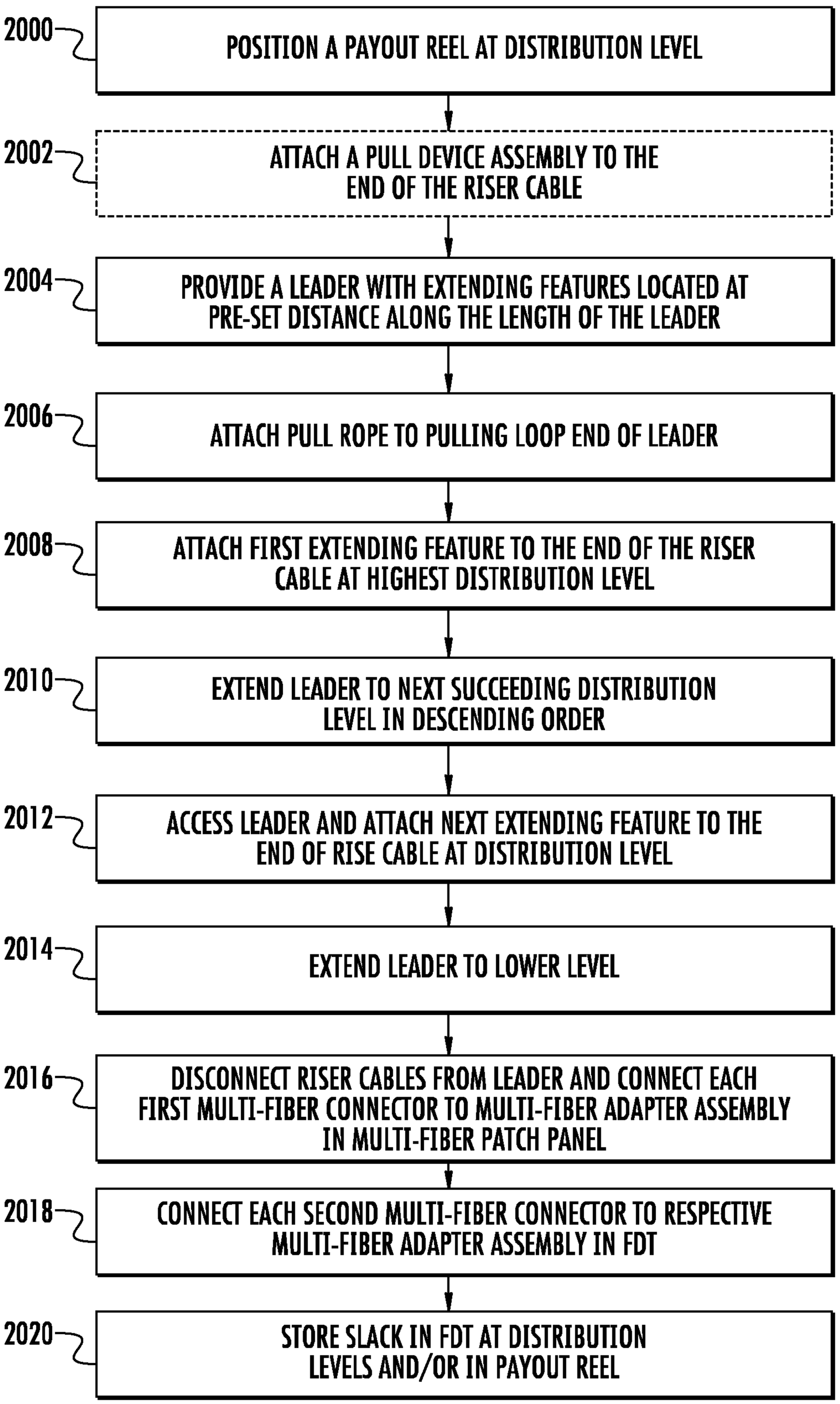
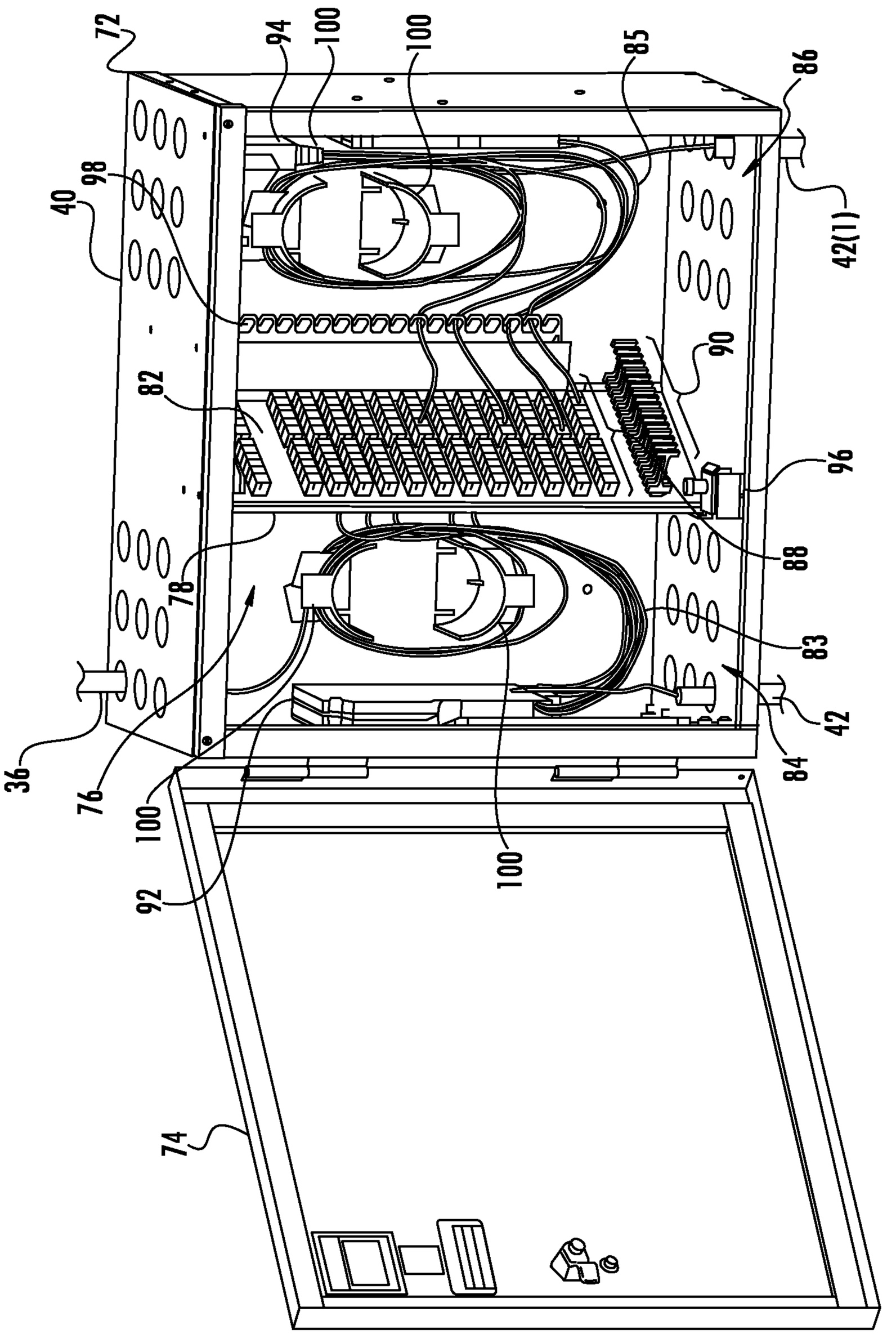

2000
POSITION A PAYOUT REEL AT DISTRIBUTION LEVEL
2002
ATTACH A PULL DEVICE ASSEMBLY TO THE END OF THE RISER CABLE
2004
PROVIDE A LEADER WITH EXTENDING FEATURES LOCATED AT PRE-SET DISTANCE ALONG THE LENGTH OF THE LEADER
2006
ATTACH PULL ROPE TO PULLING LOOP END OF LEADER
2008
ATTACH FIRST EXTENDING FEATURE TO THE END OF THE RISER CABLE AT HIGHEST DISTRIBUTION LEVEL
2010
EXTEND LEADER TO NEXT SUCCEEDING DISTRIBUTION LEVEL IN DESCENDING ORDER
2012
ACCESS LEADER AND ATTACH NEXT EXTENDING FEATURE TO THE END OF RISE CABLE AT DISTRIBUTION LEVEL
2014
EXTEND LEADER TO LOWER LEVEL
2016
DISCONNECT RISER CABLES FROM LEADER AND CONNECT EACH FIRST MULTI-FIBER CONNECTOR TO MULTI-FIBER ADAPTER ASSEMBLY IN MULTI-FIBER PATCH PANEL
2018
CONNECT EACH SECOND MULTI-FIBER CONNECTOR TO RESPECTIVE MULTI-FIBER ADAPTER ASSEMBLY IN FDT
2020
STORE SLACK IN FDT AT DISTRIBUTION LEVELS AND/OR IN PAYOUT REEL

FIG. 10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74

FIG. 11

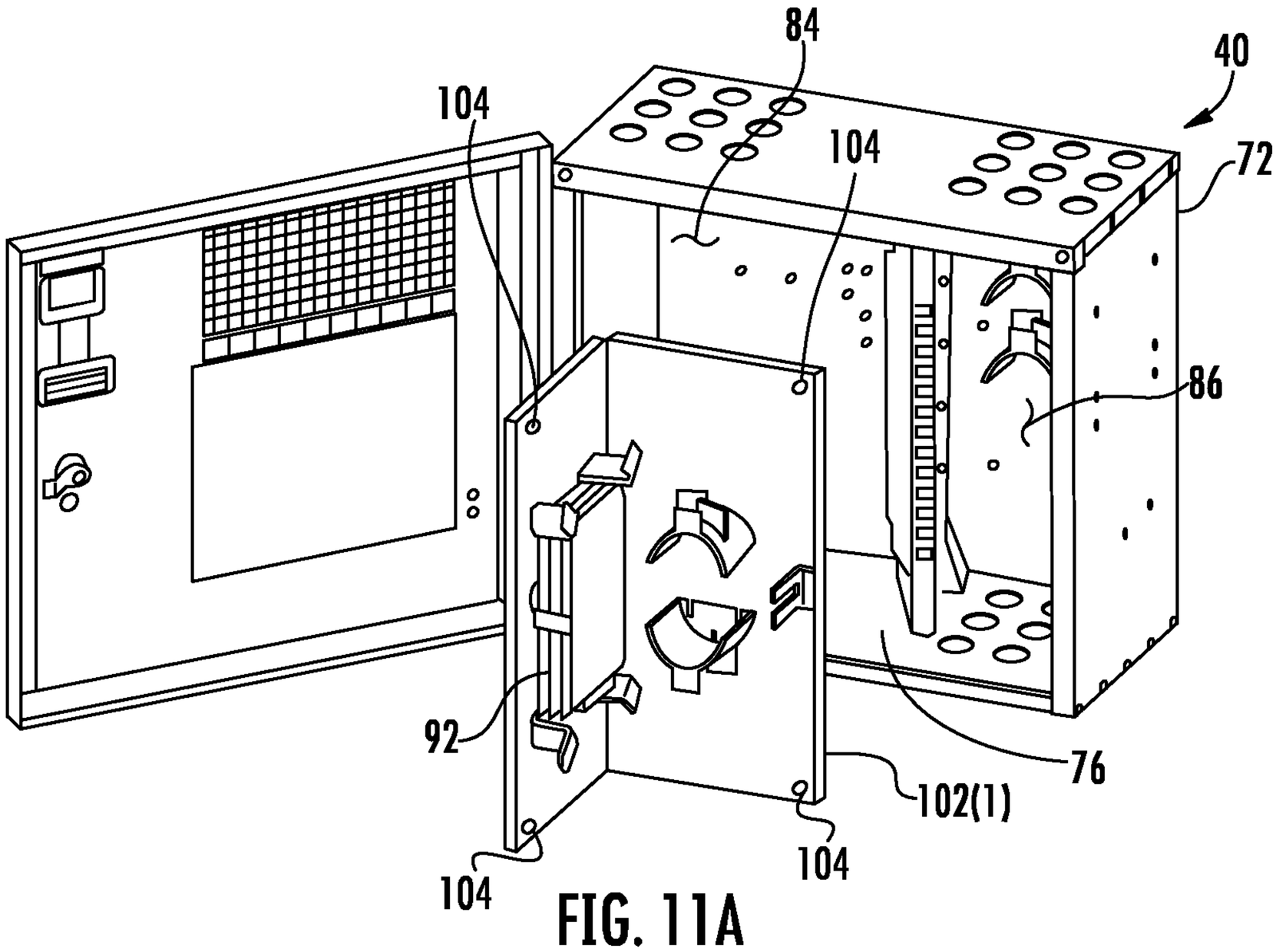


FIG. 11A

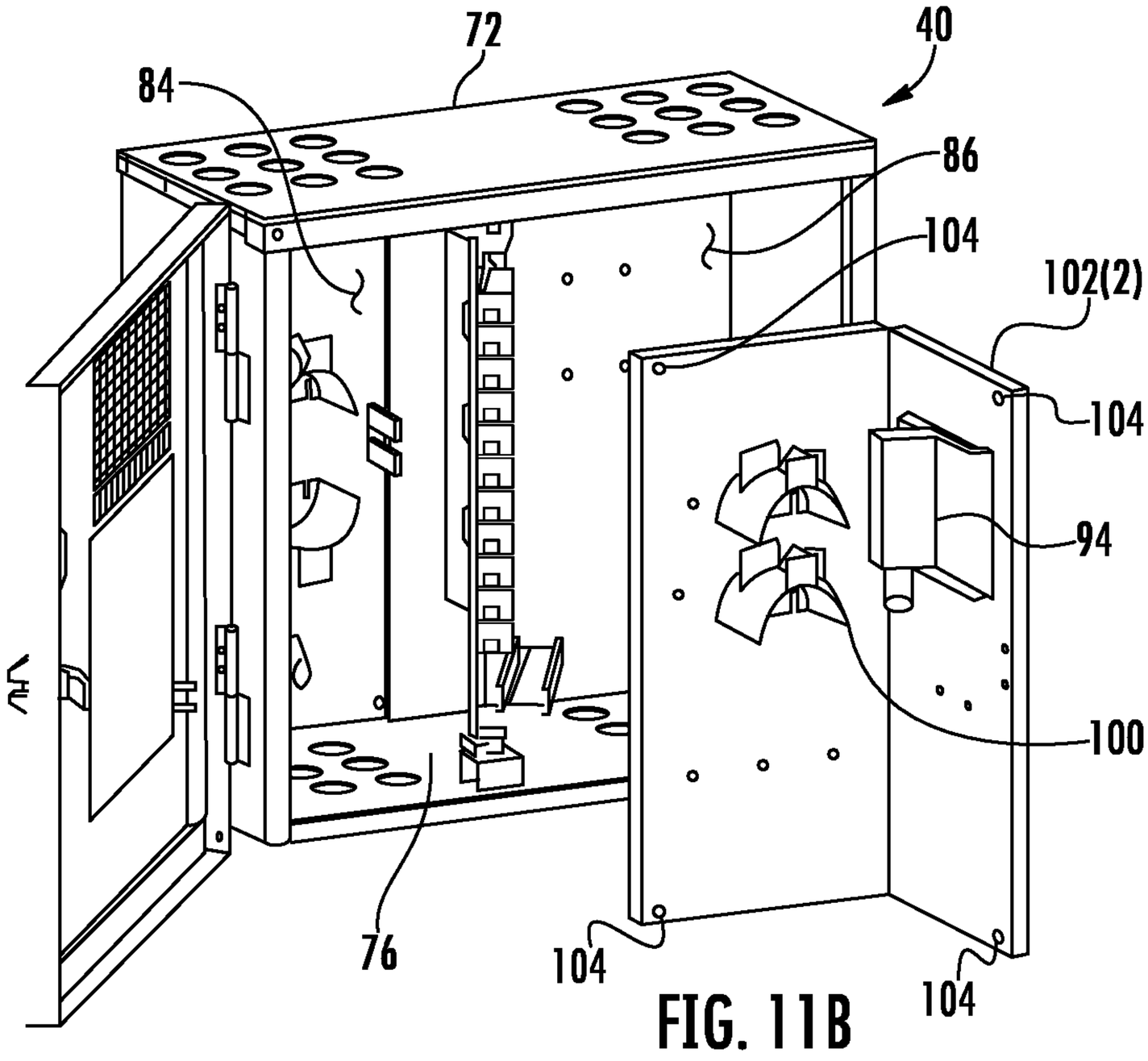


FIG. 11B

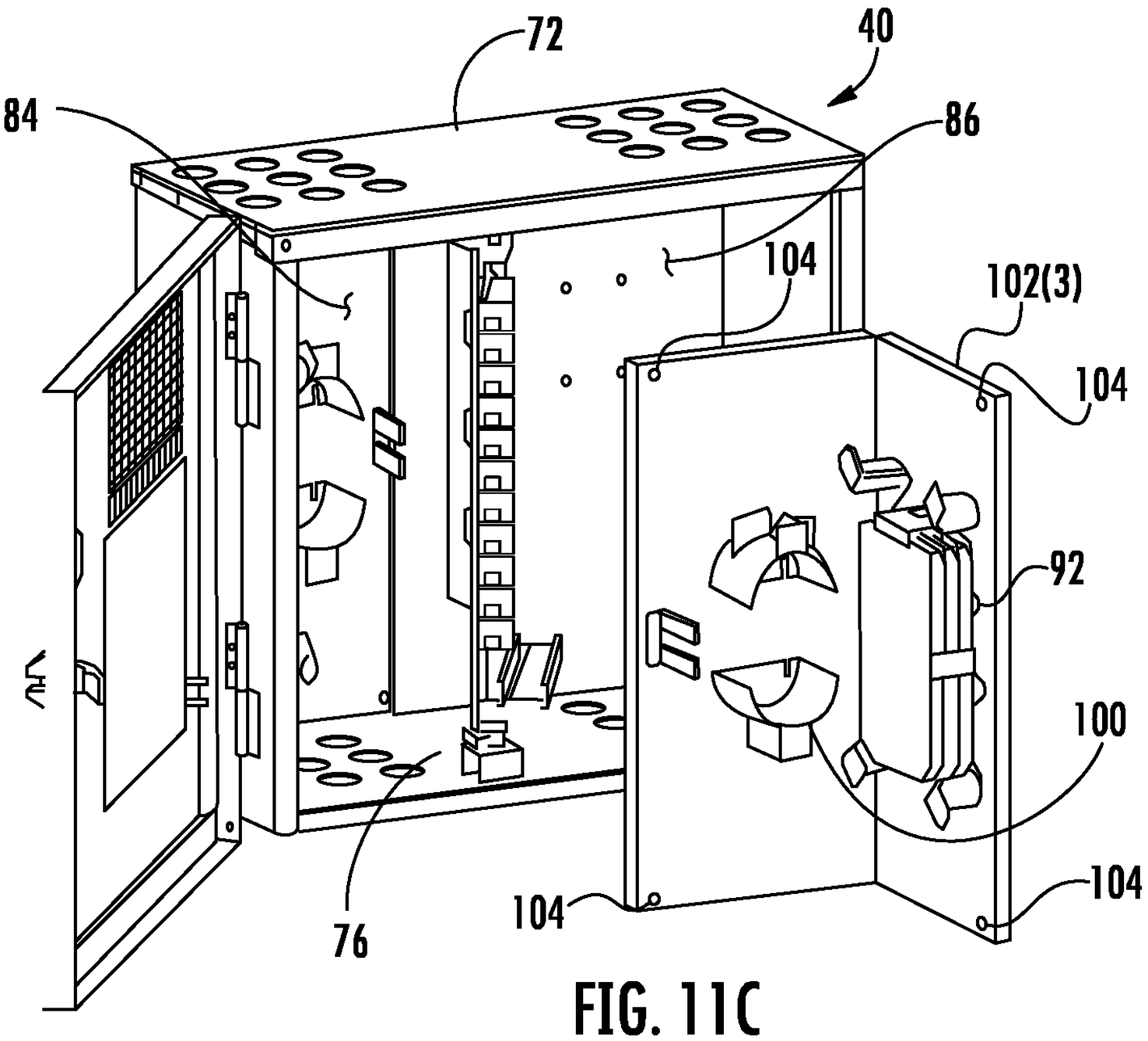
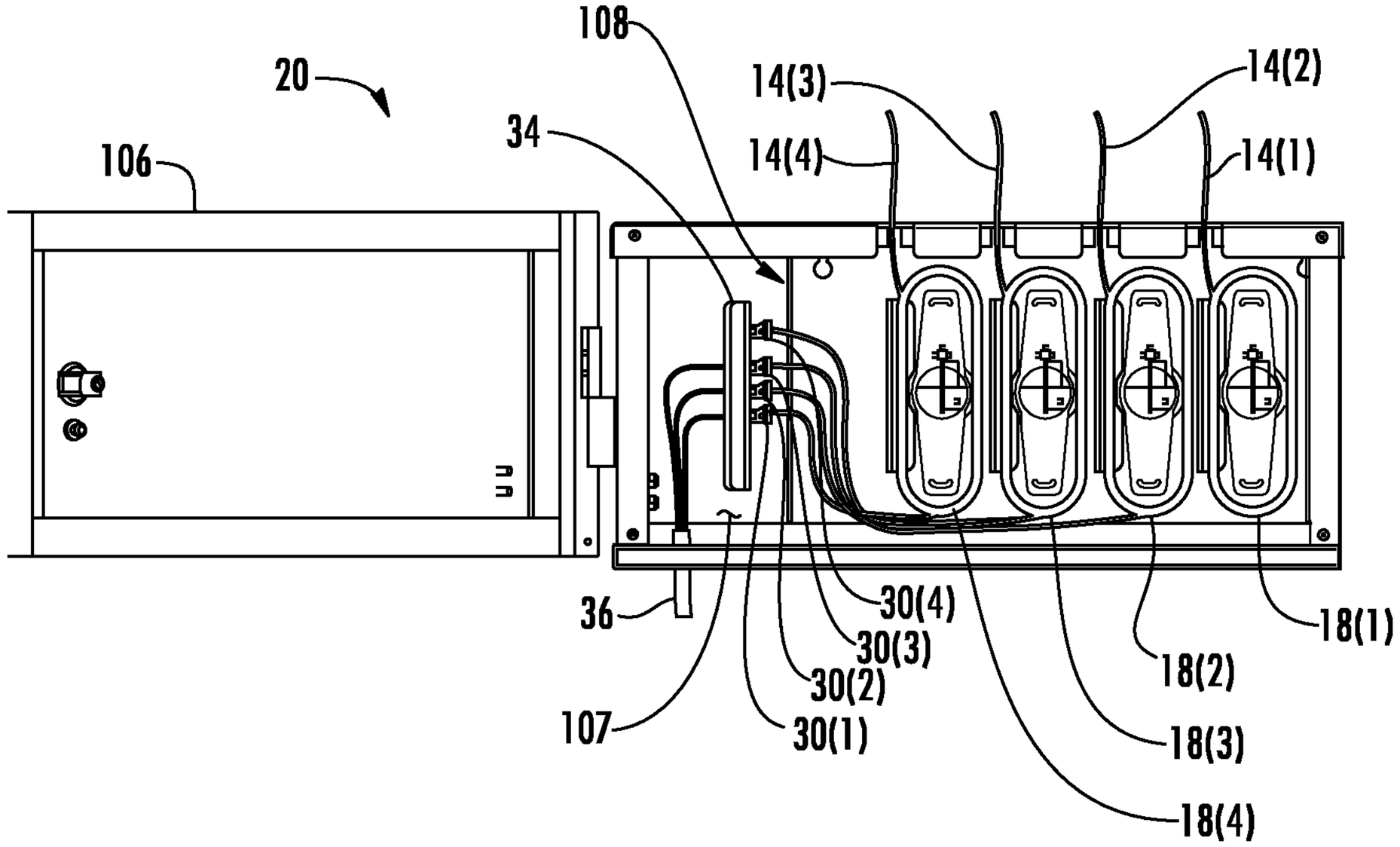


FIG. 11C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14(3)
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18(4)

FIG. 12

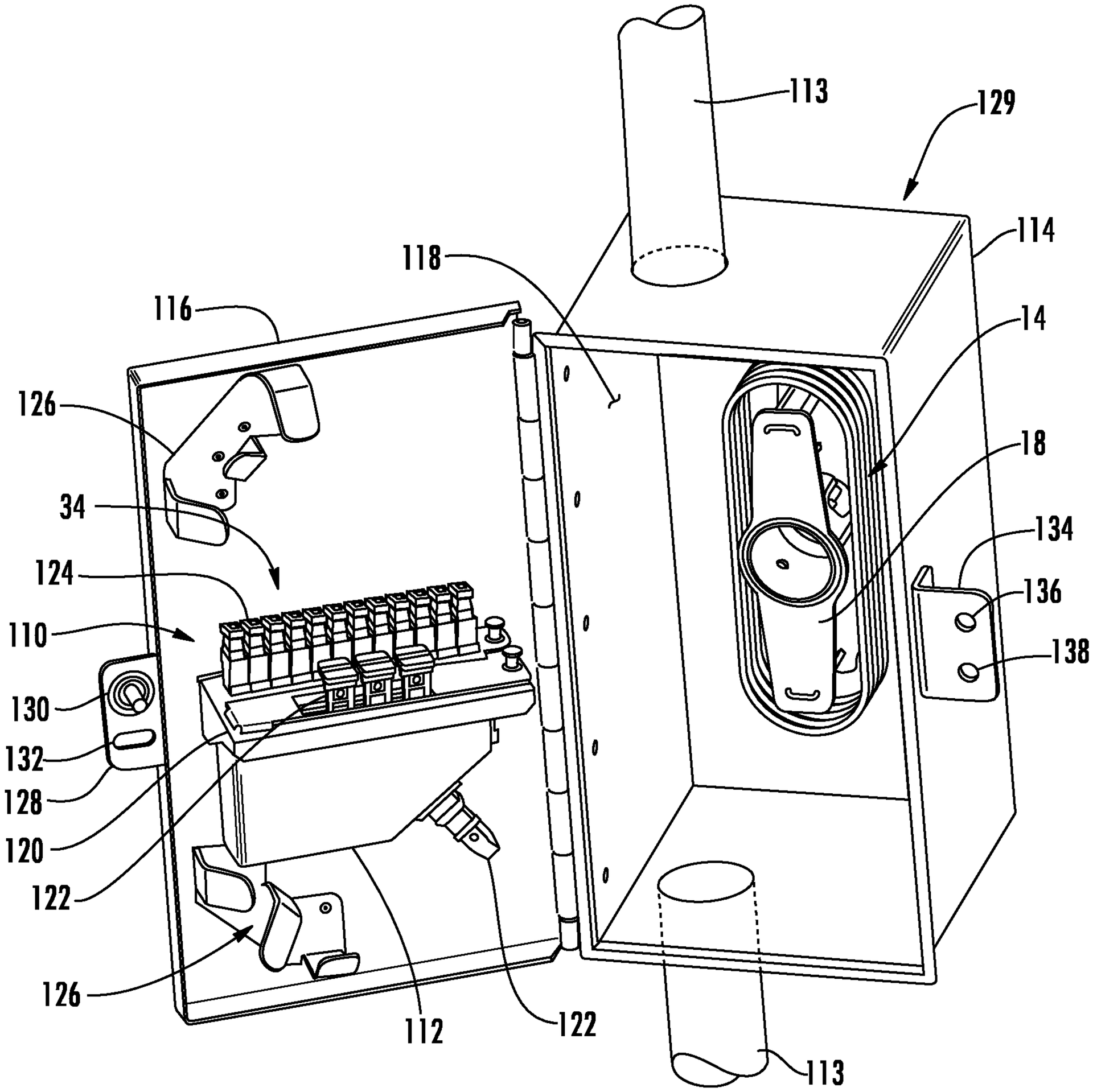
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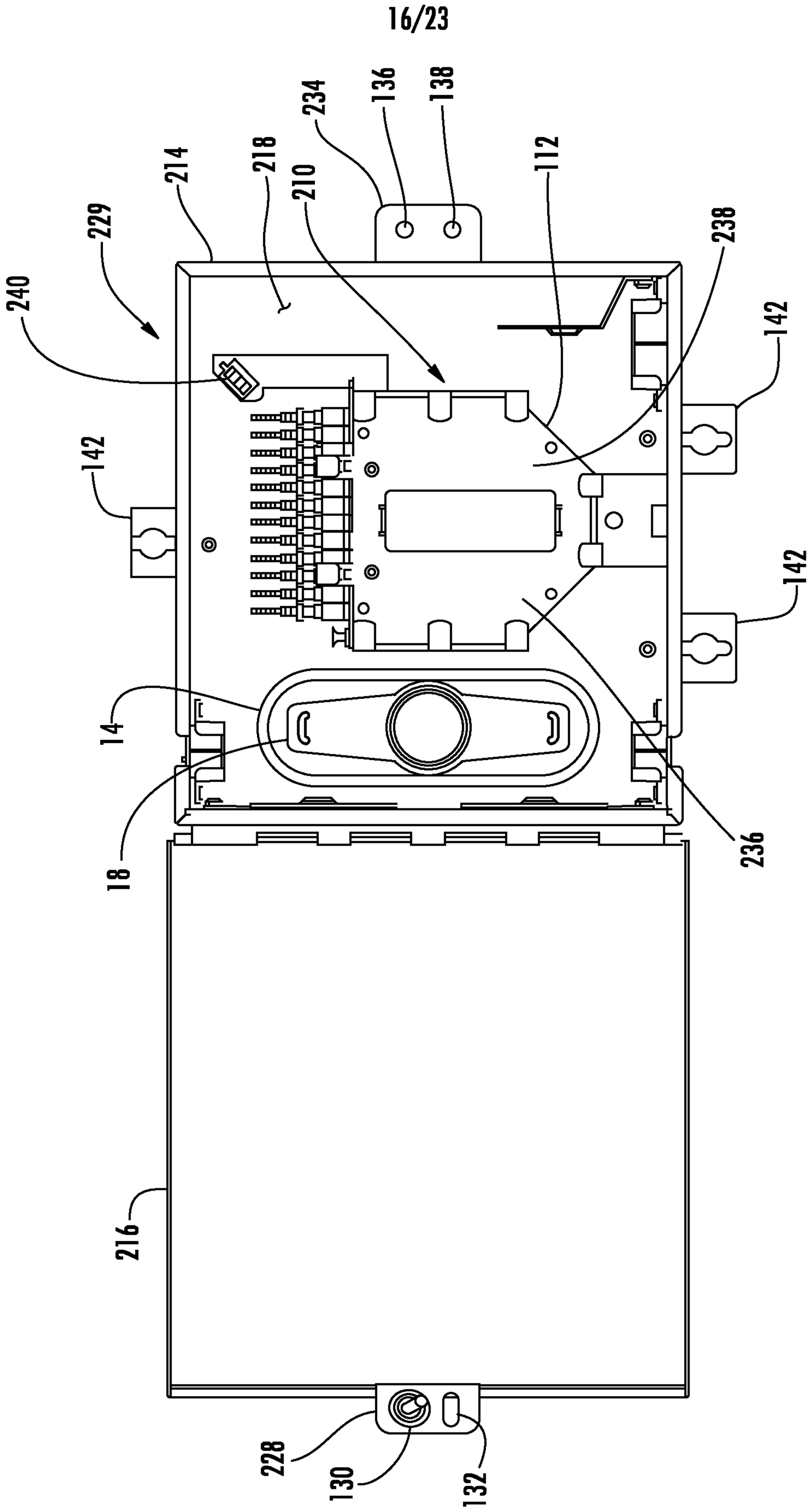
FIG. 13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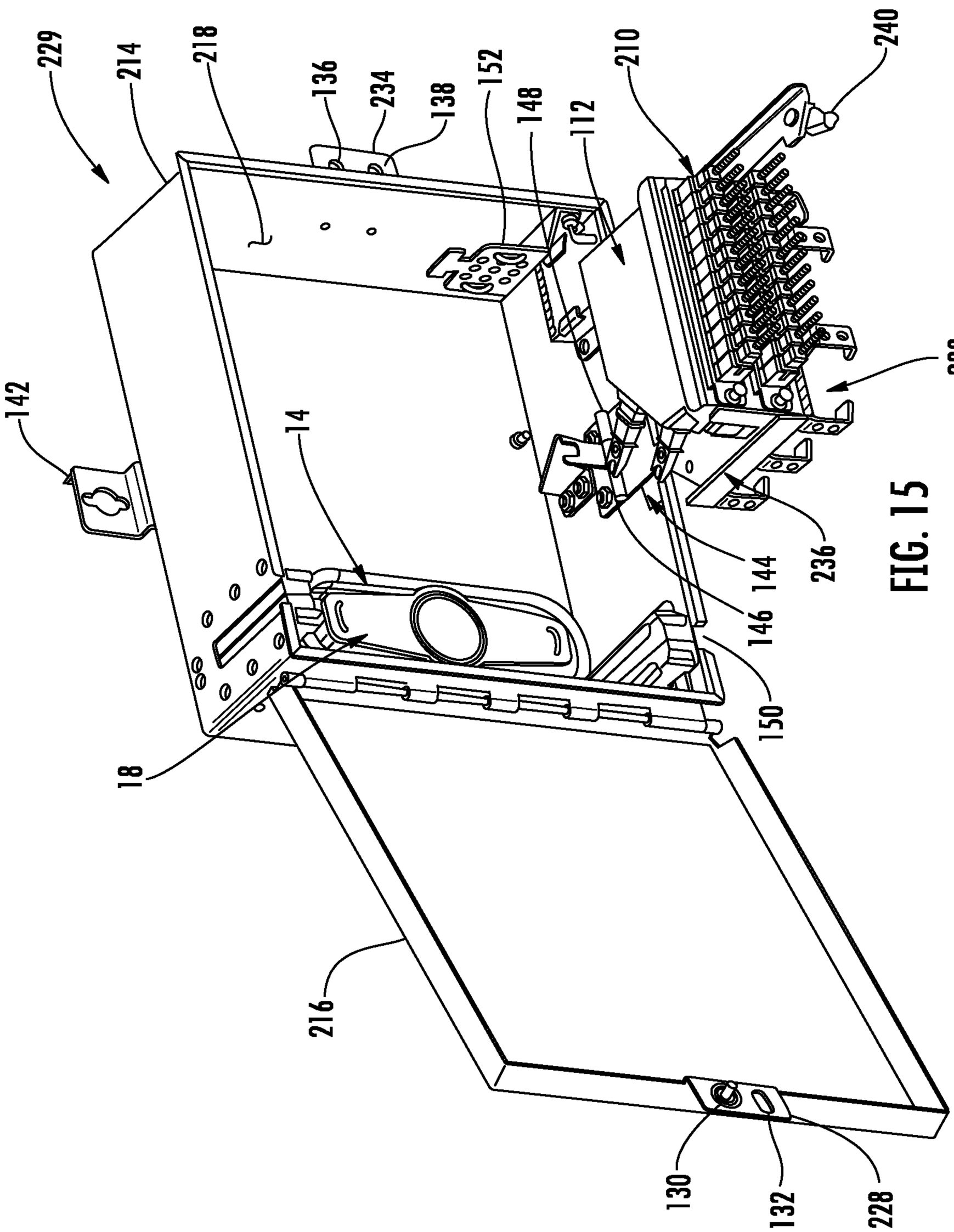
132

FIG. 14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228

FIG. 15

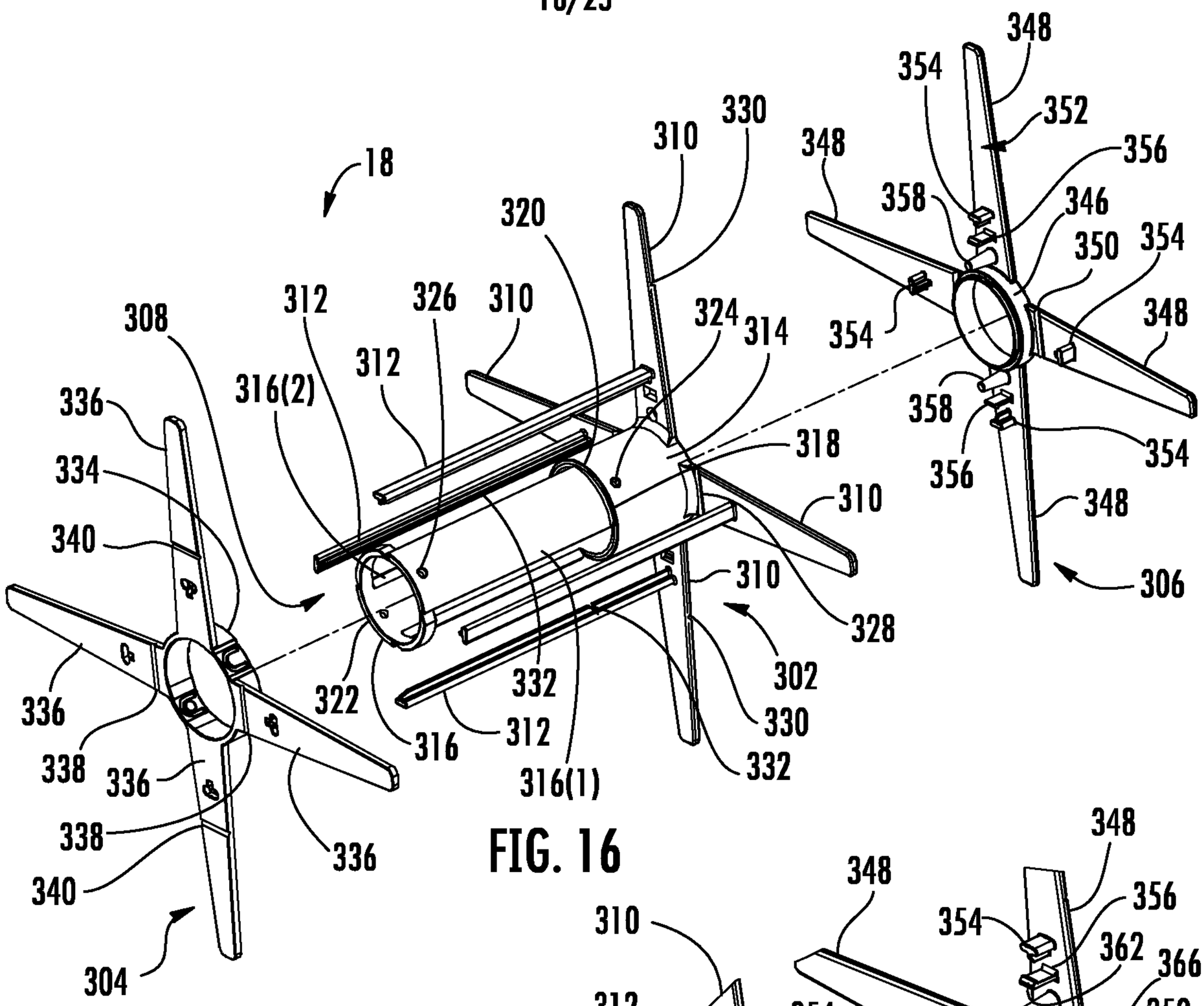


FIG. 16

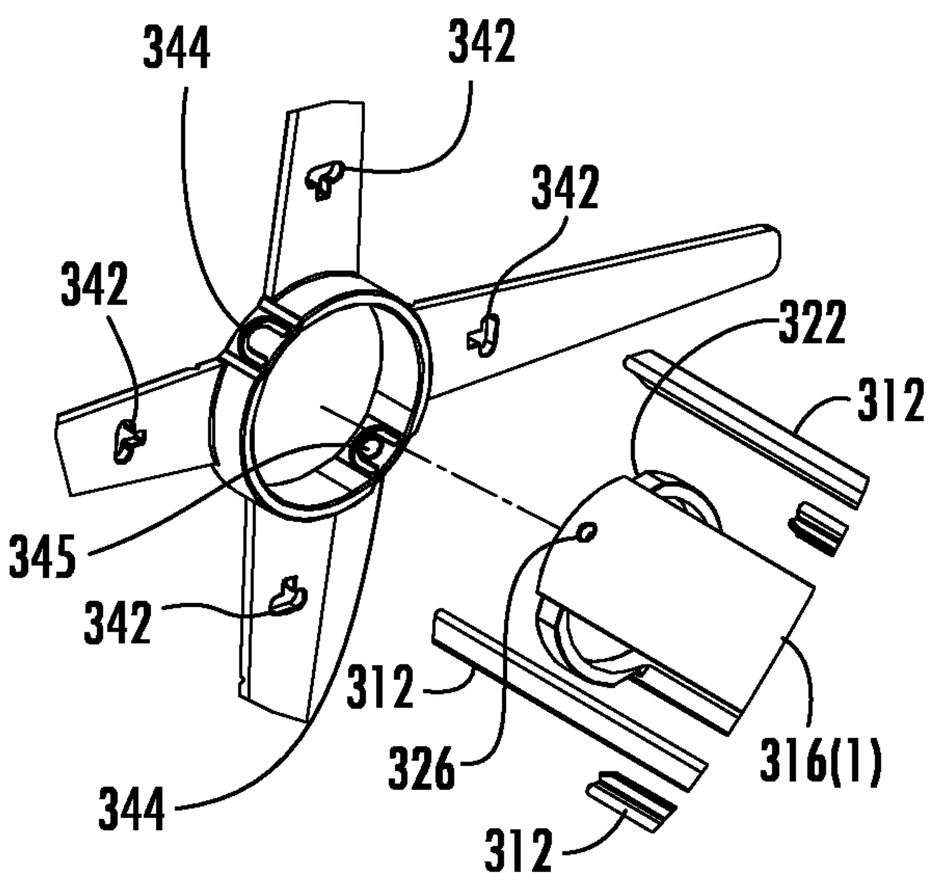


FIG. 17

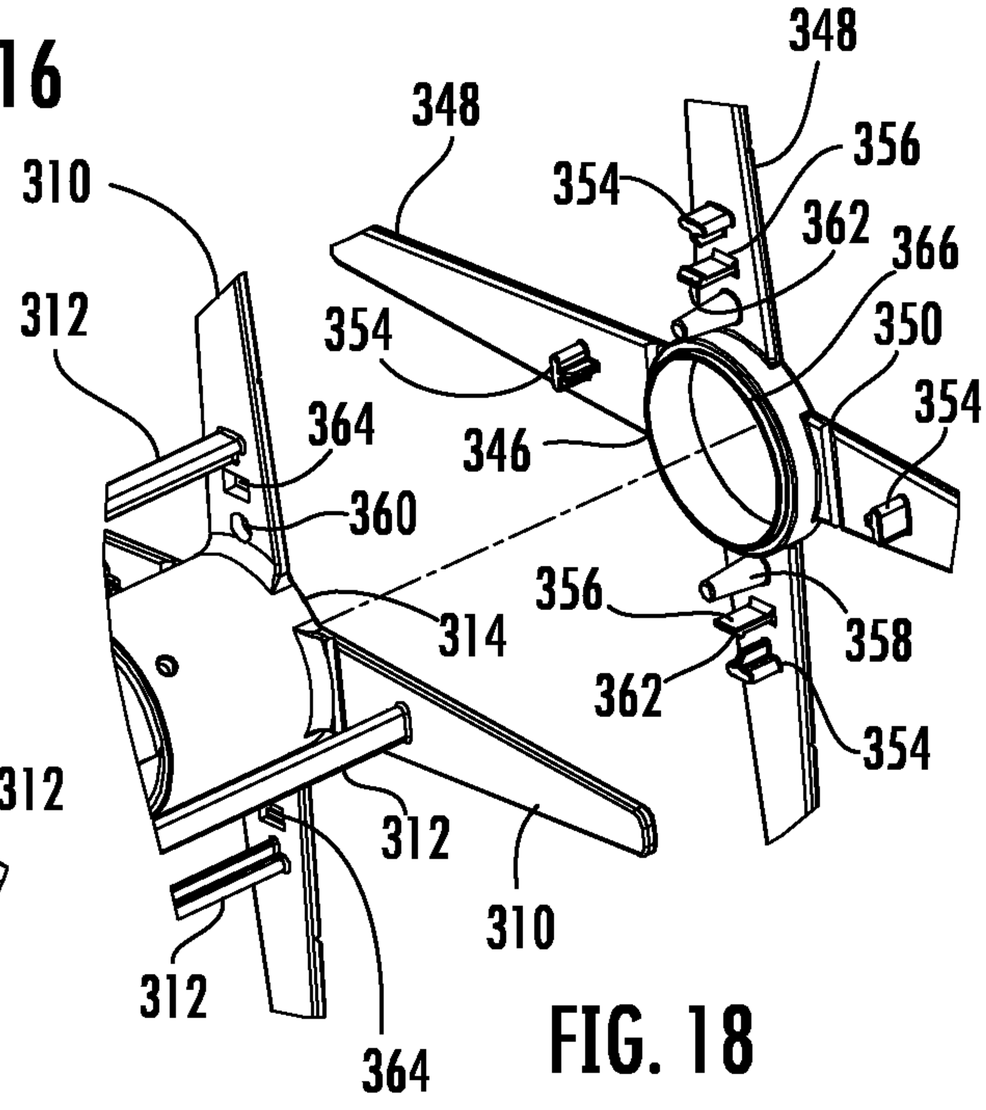


FIG. 18

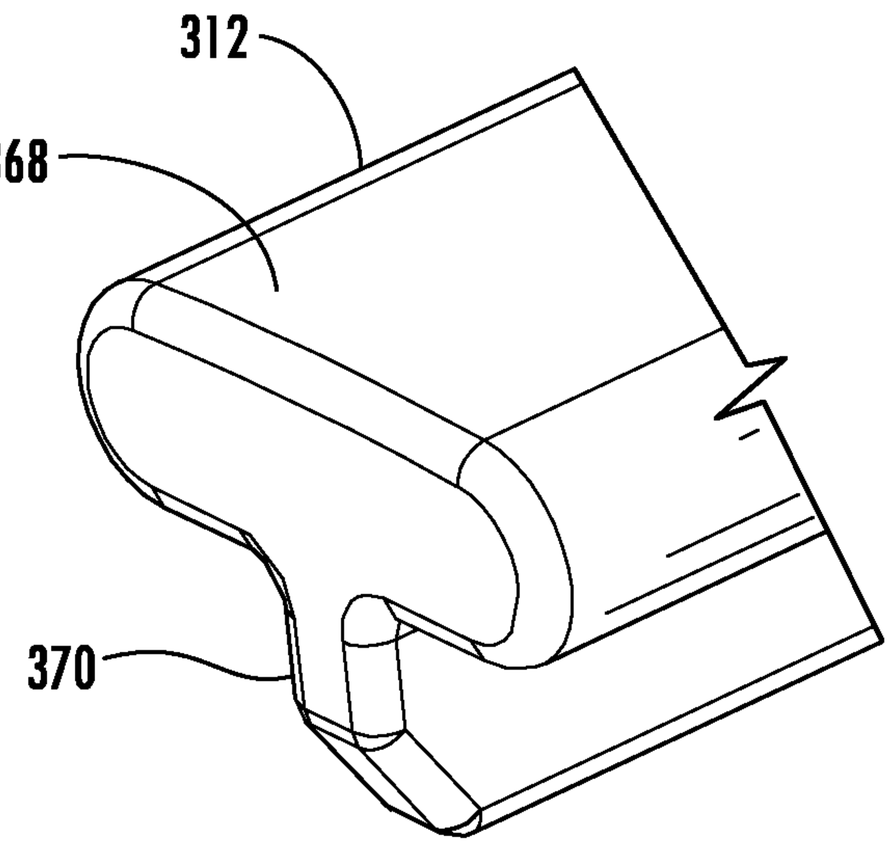


FIG. 19

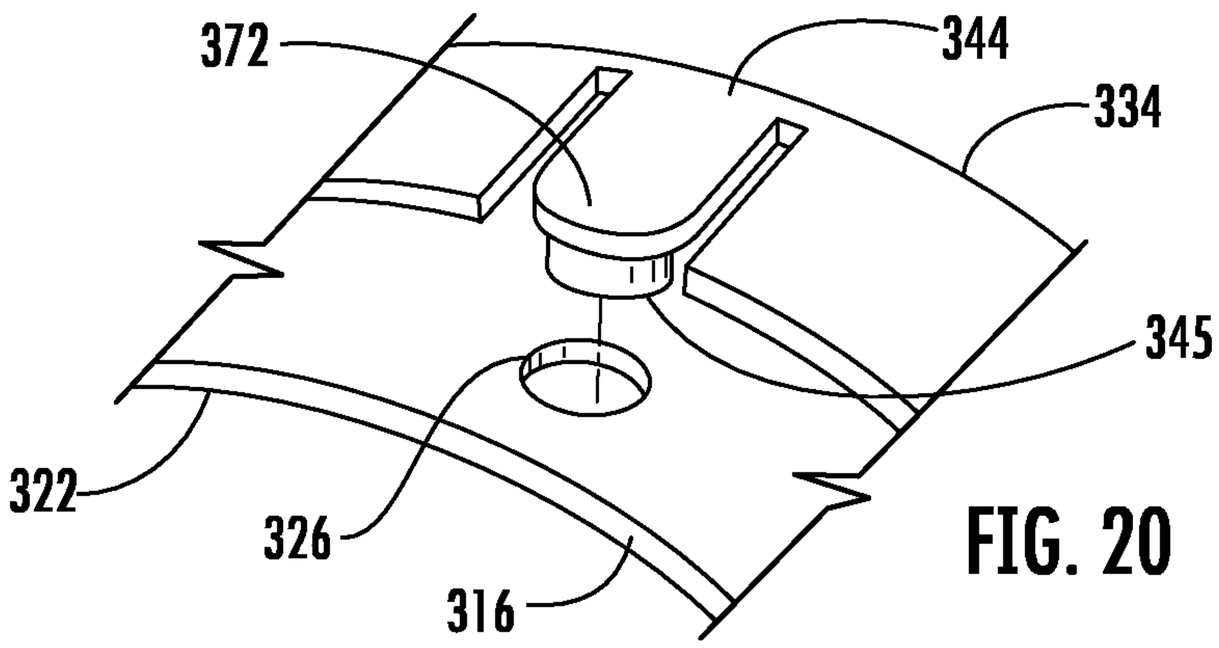


FIG. 20

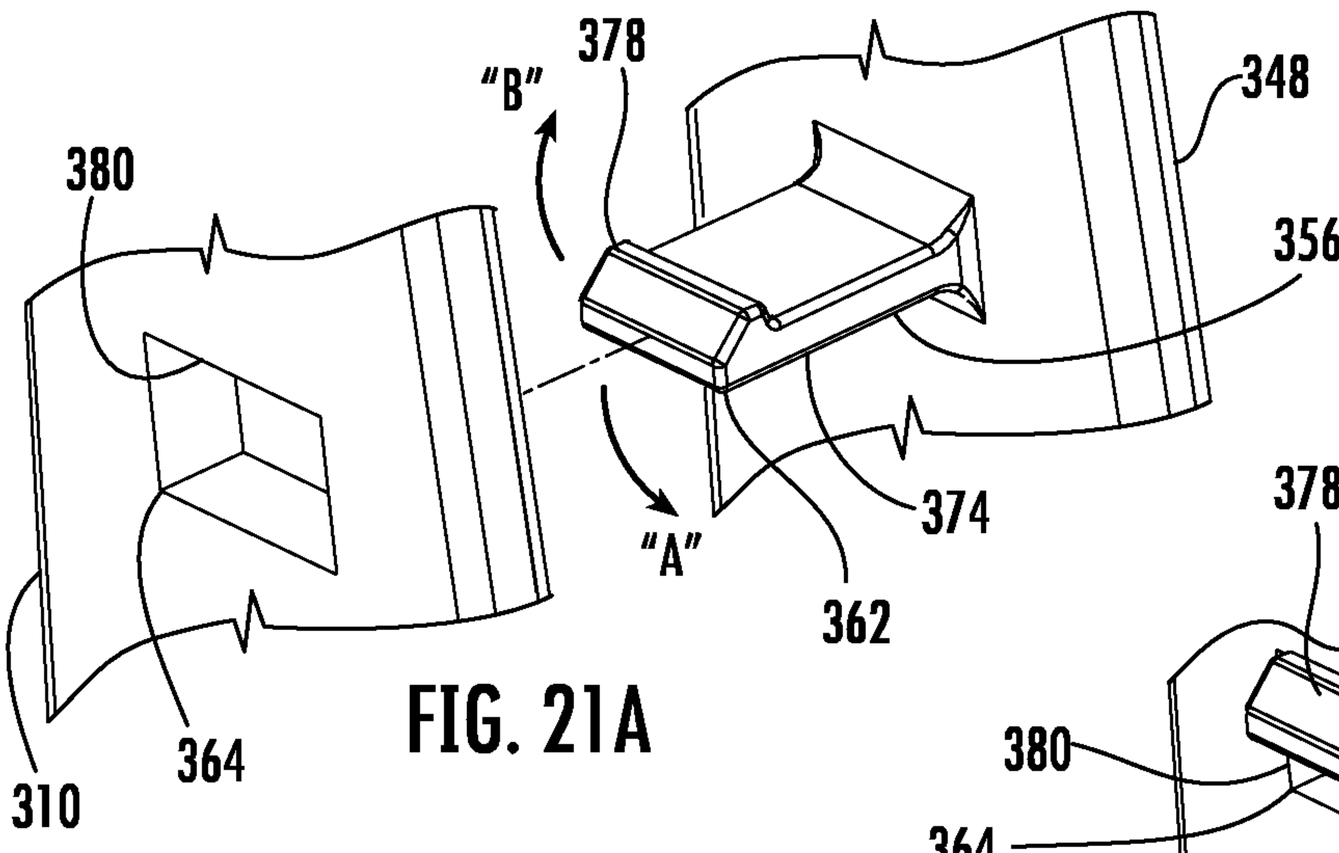


FIG. 21A

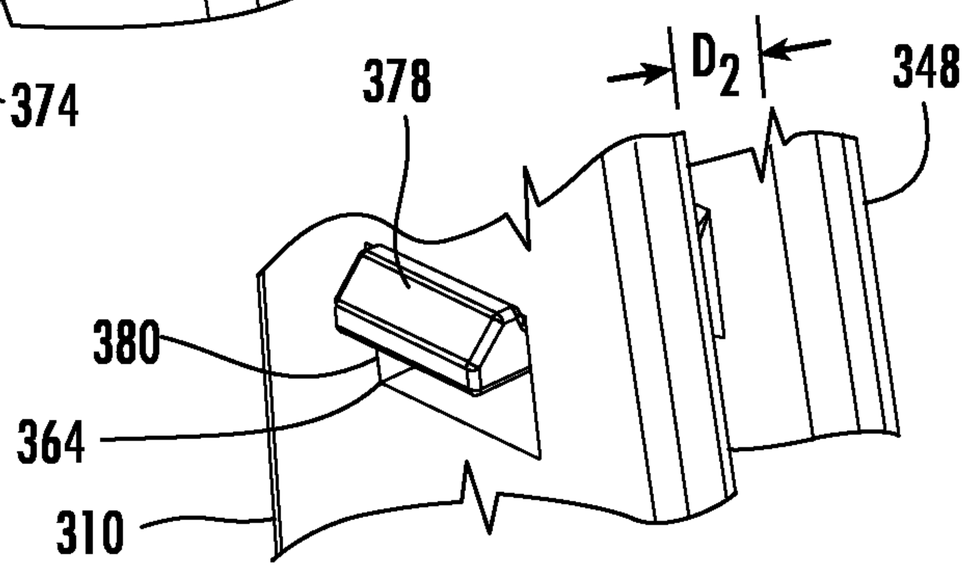
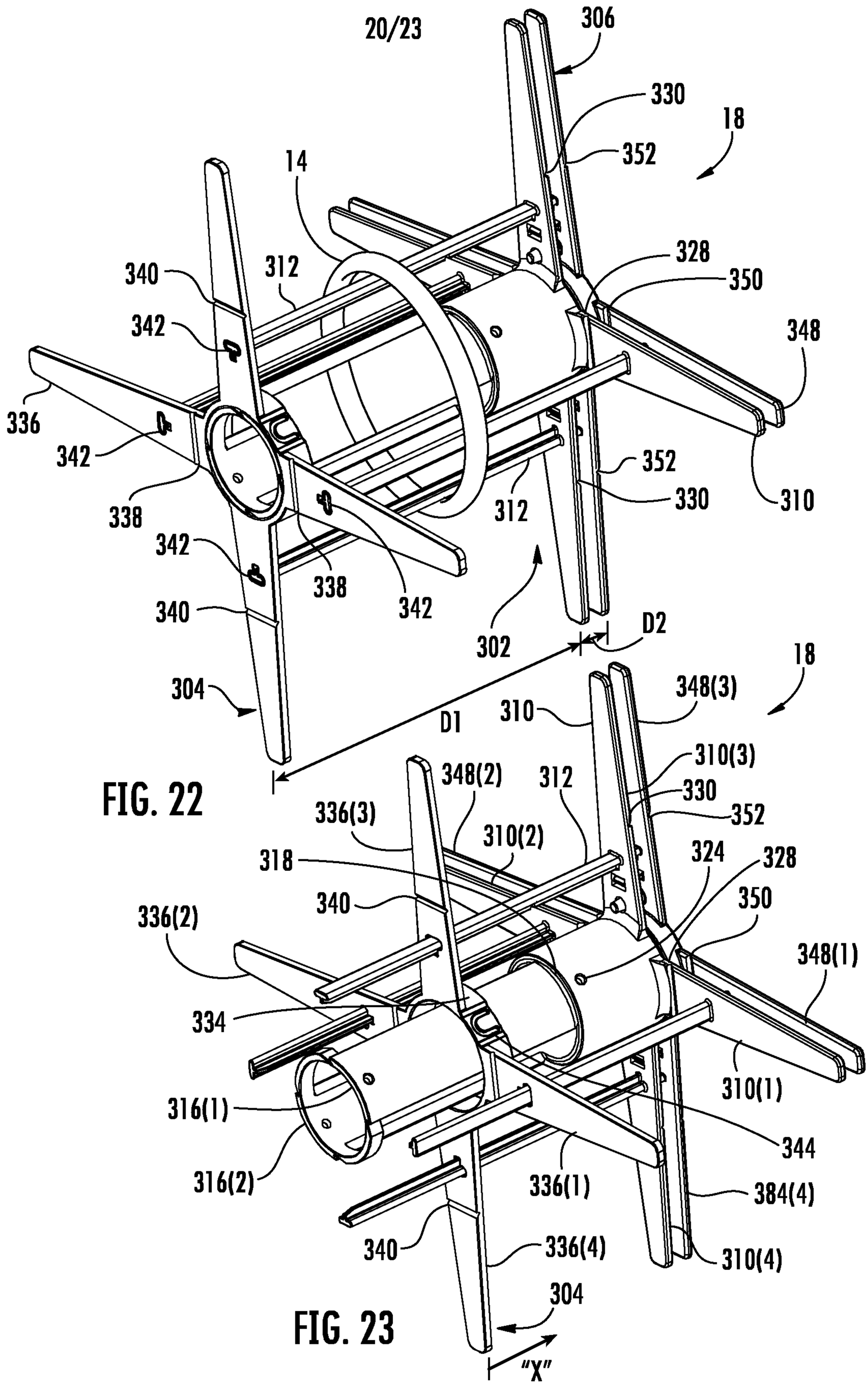


FIG. 21B


20/23
306
330
18
352
14
328
350
340
312
348
342
336
342
352
338
330
310
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342
338
342
340
302
D2
304
D1
18
348(3)
310
310(3)
348(2)
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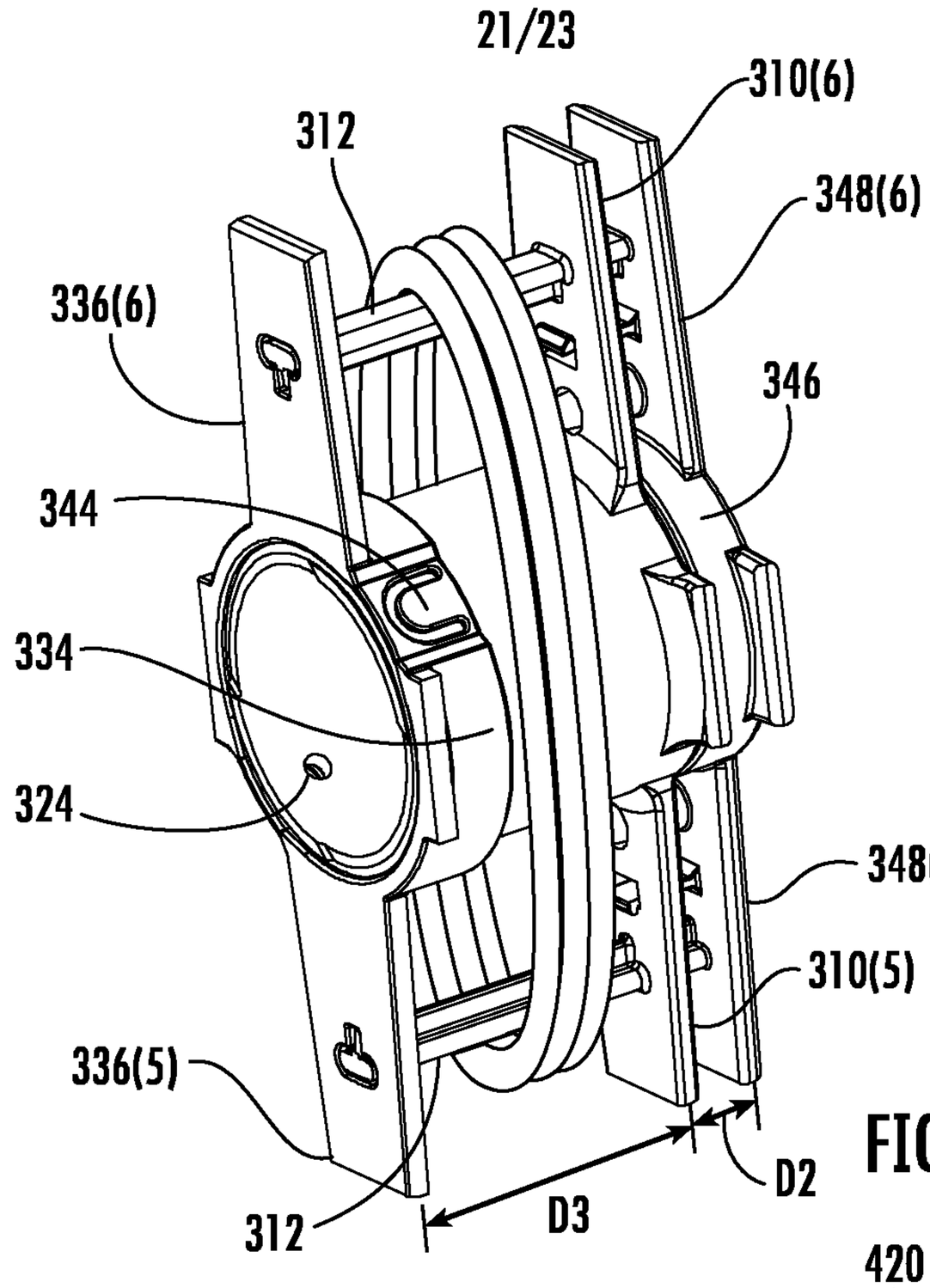
352
336(3)
310(2)
318
324
328
340
350
336(2)
348(1)
334
316(1)
310(1)
344
316(2)
336(1)
384(4)
340
336(4)
310(4)
304
"X"

FIG. 22

FIG. 23


21/23
310(6)
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348(6)
336(6)
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344
334
324
348(5)
310(5)
336(5)
D2
312
D3

FIG. 24

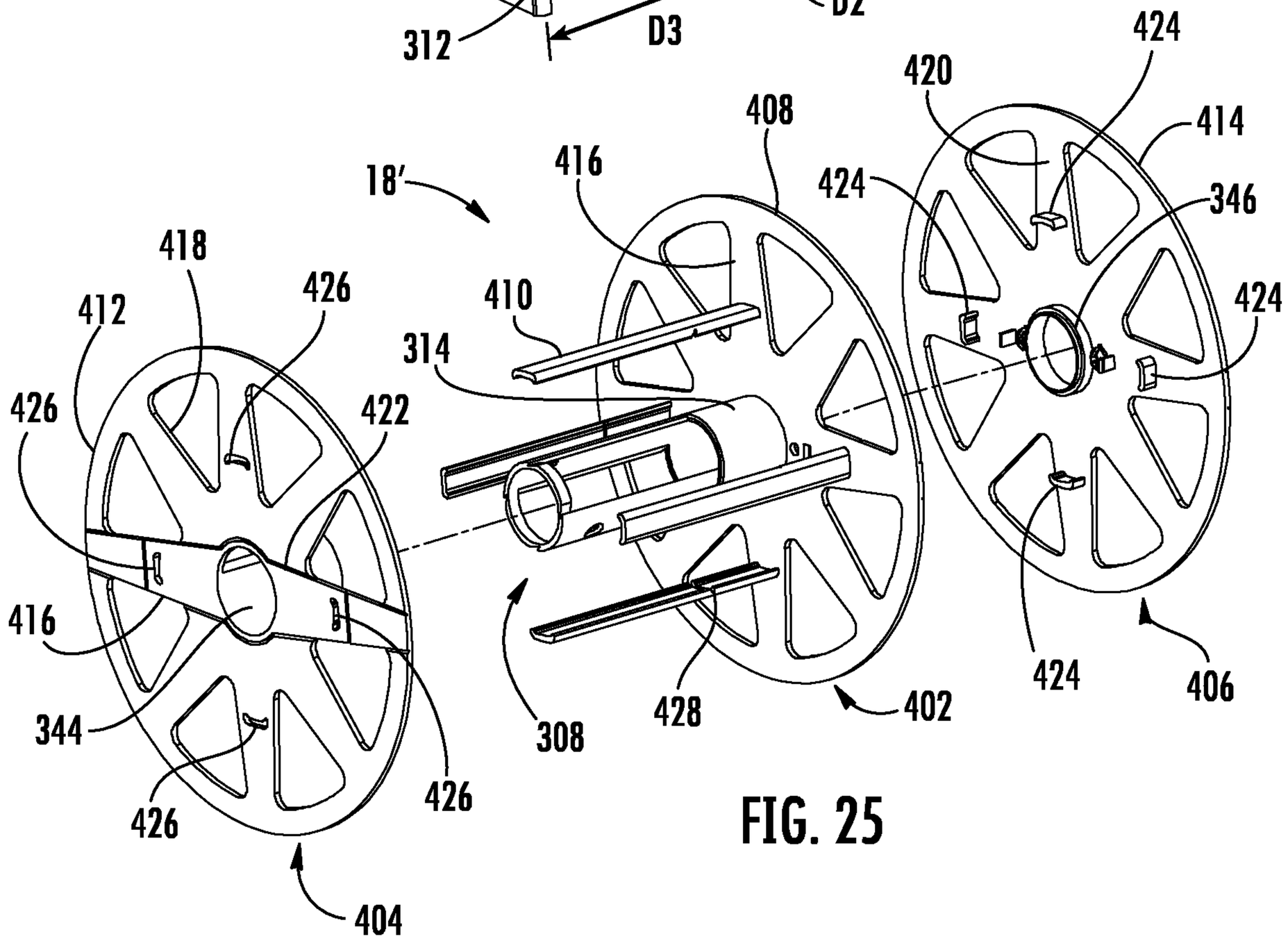
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FIG. 25

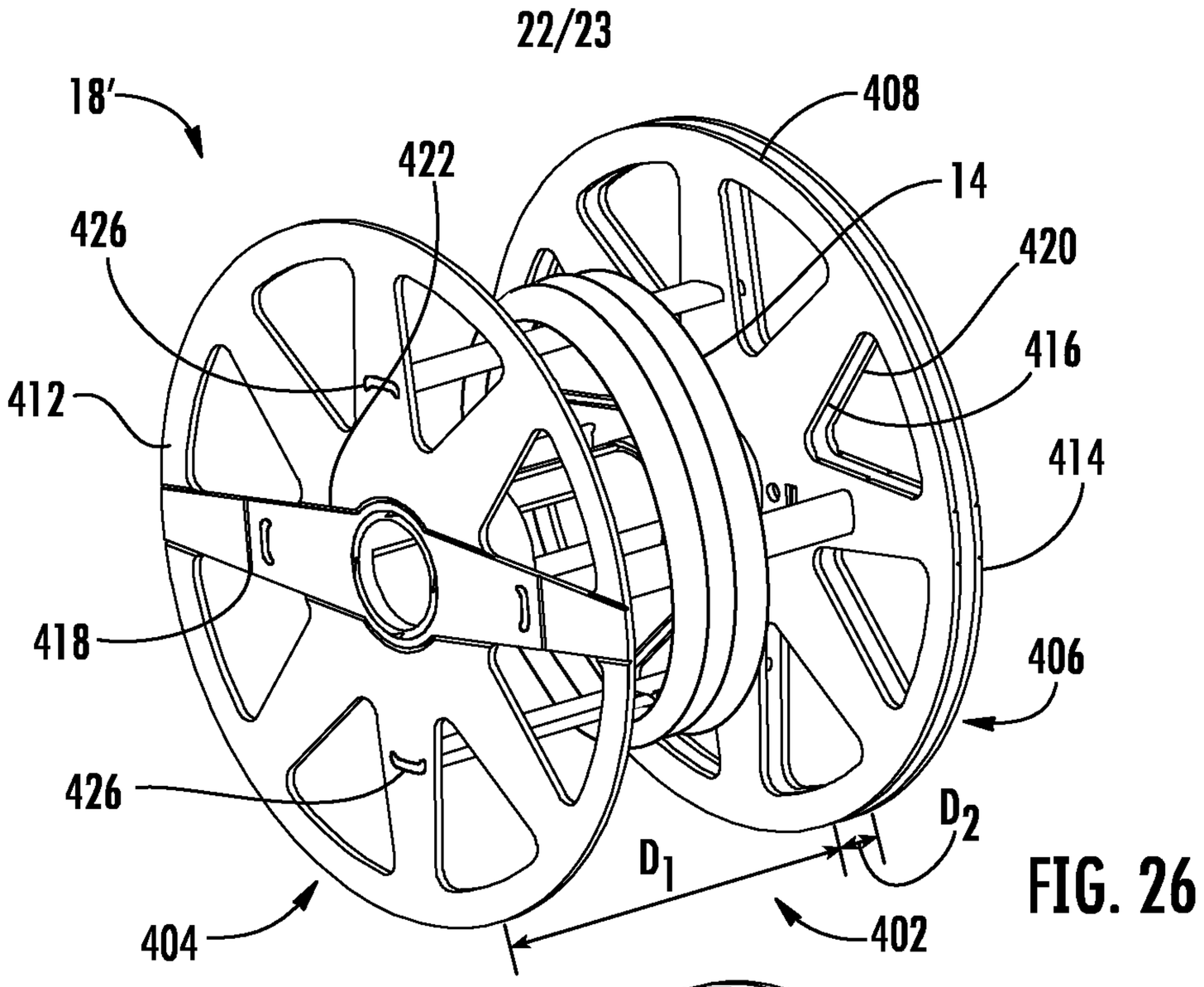

FIG. 26

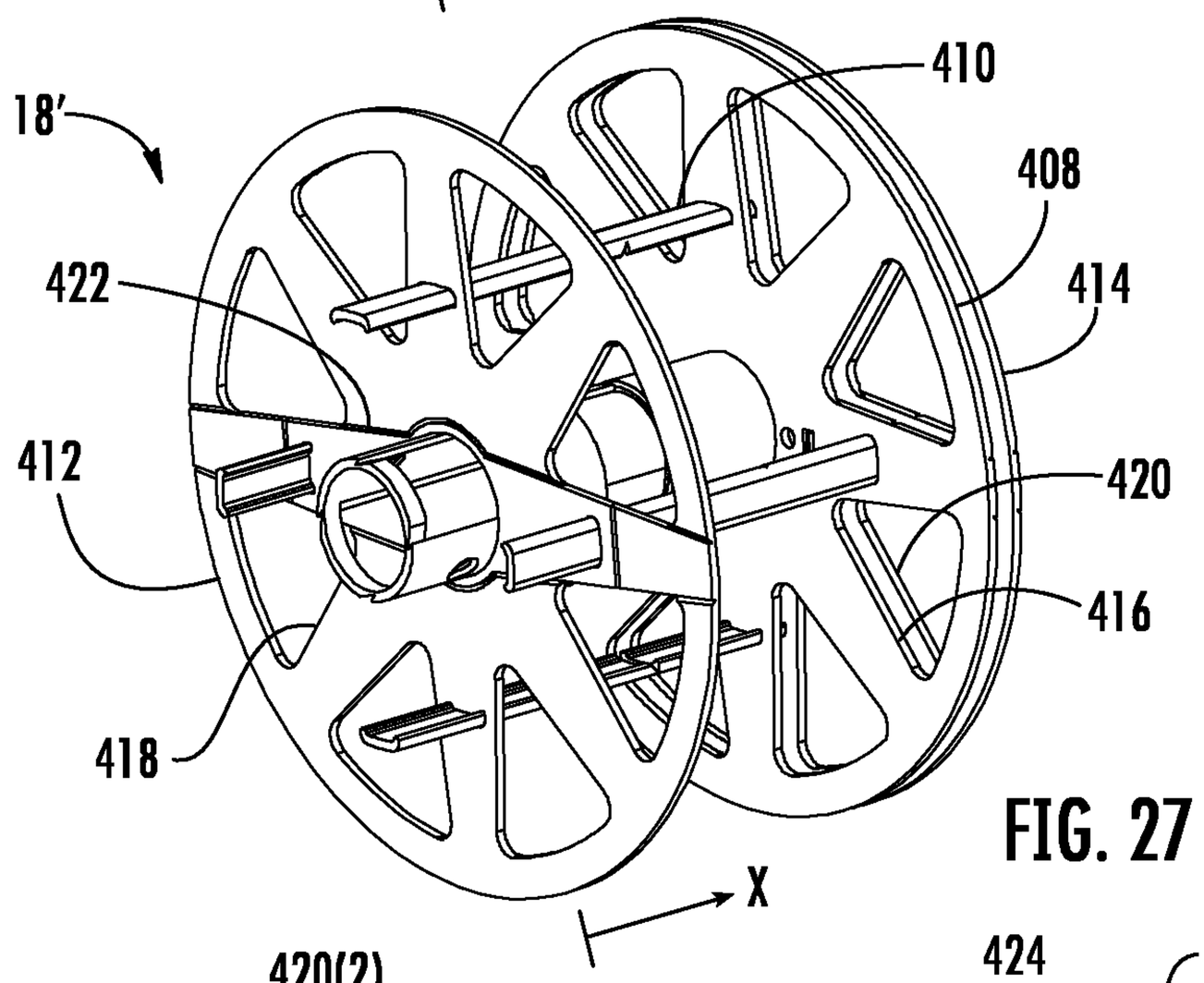

FIG. 27

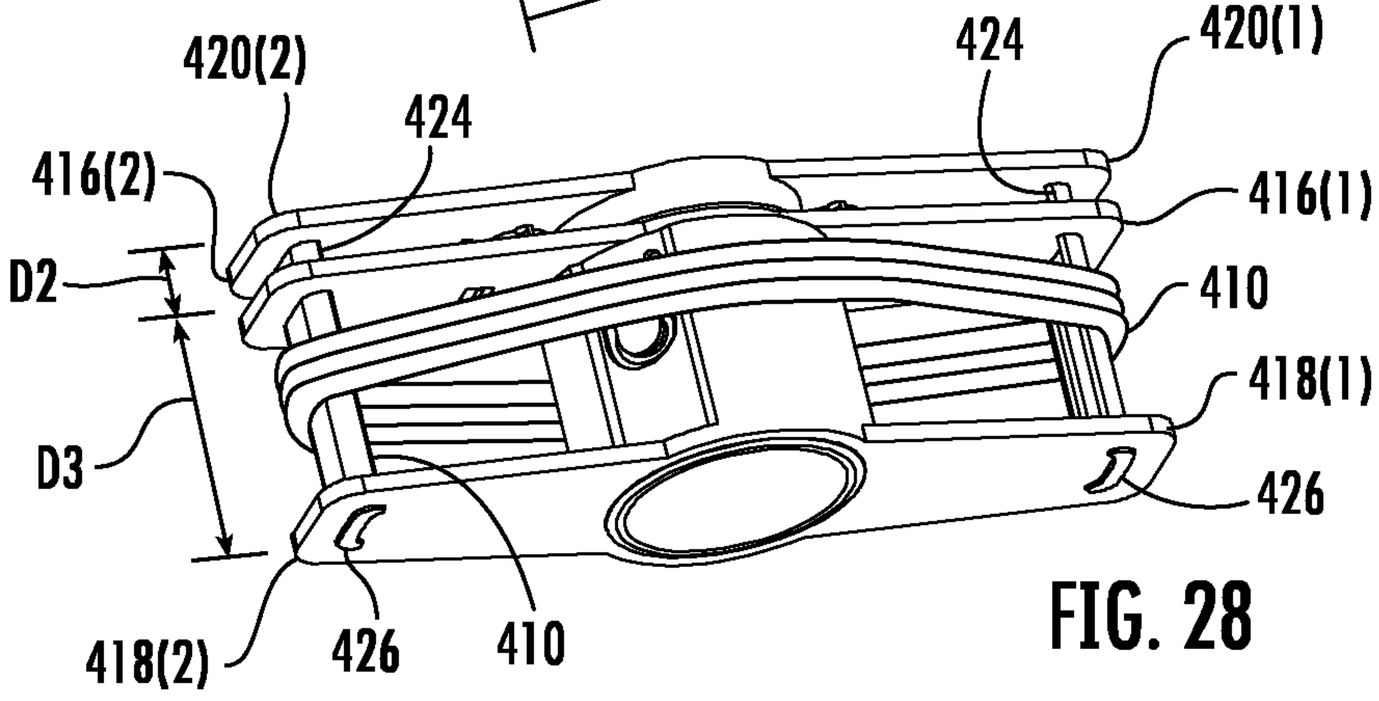

FIG. 28

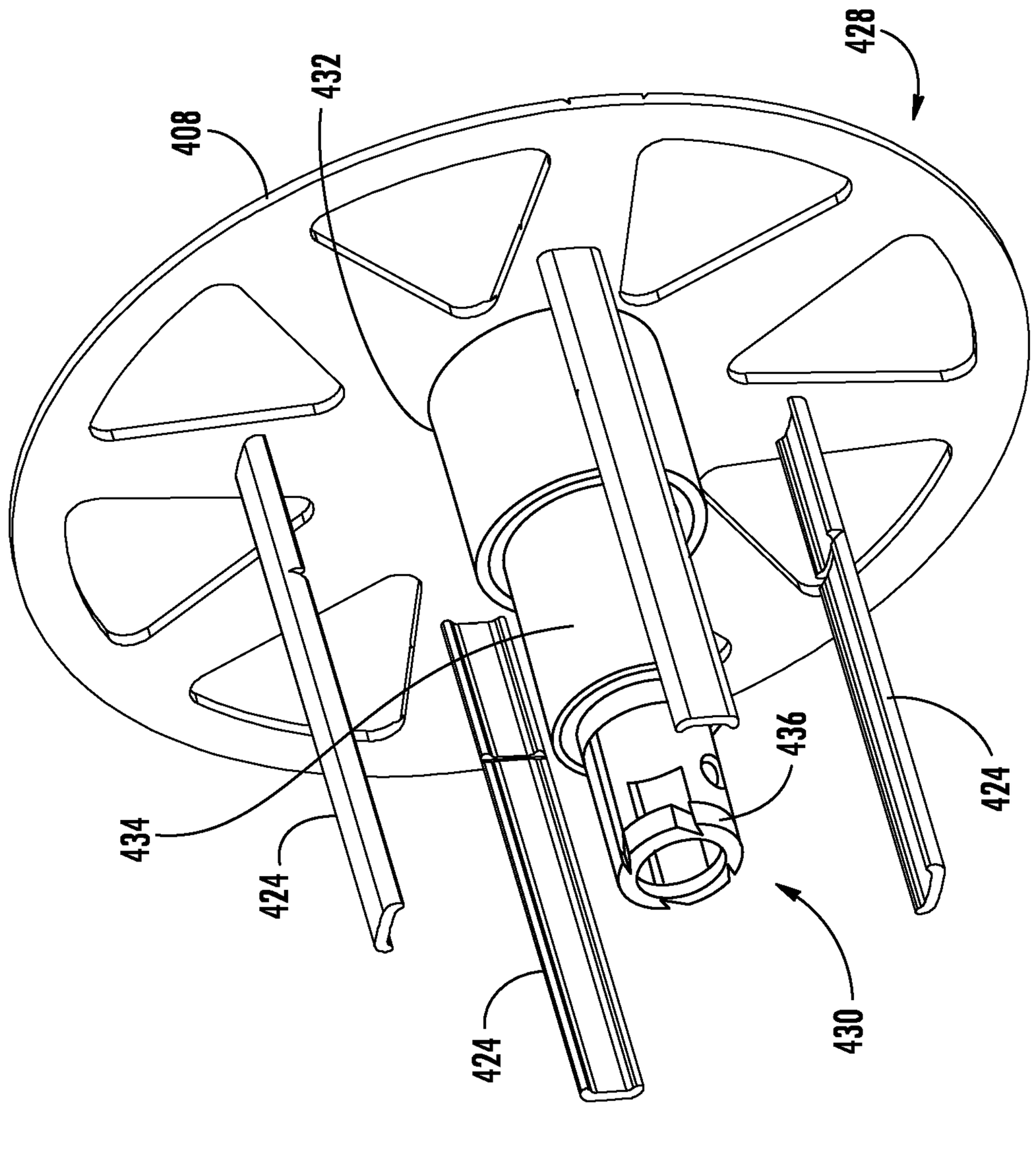

FIG. 29

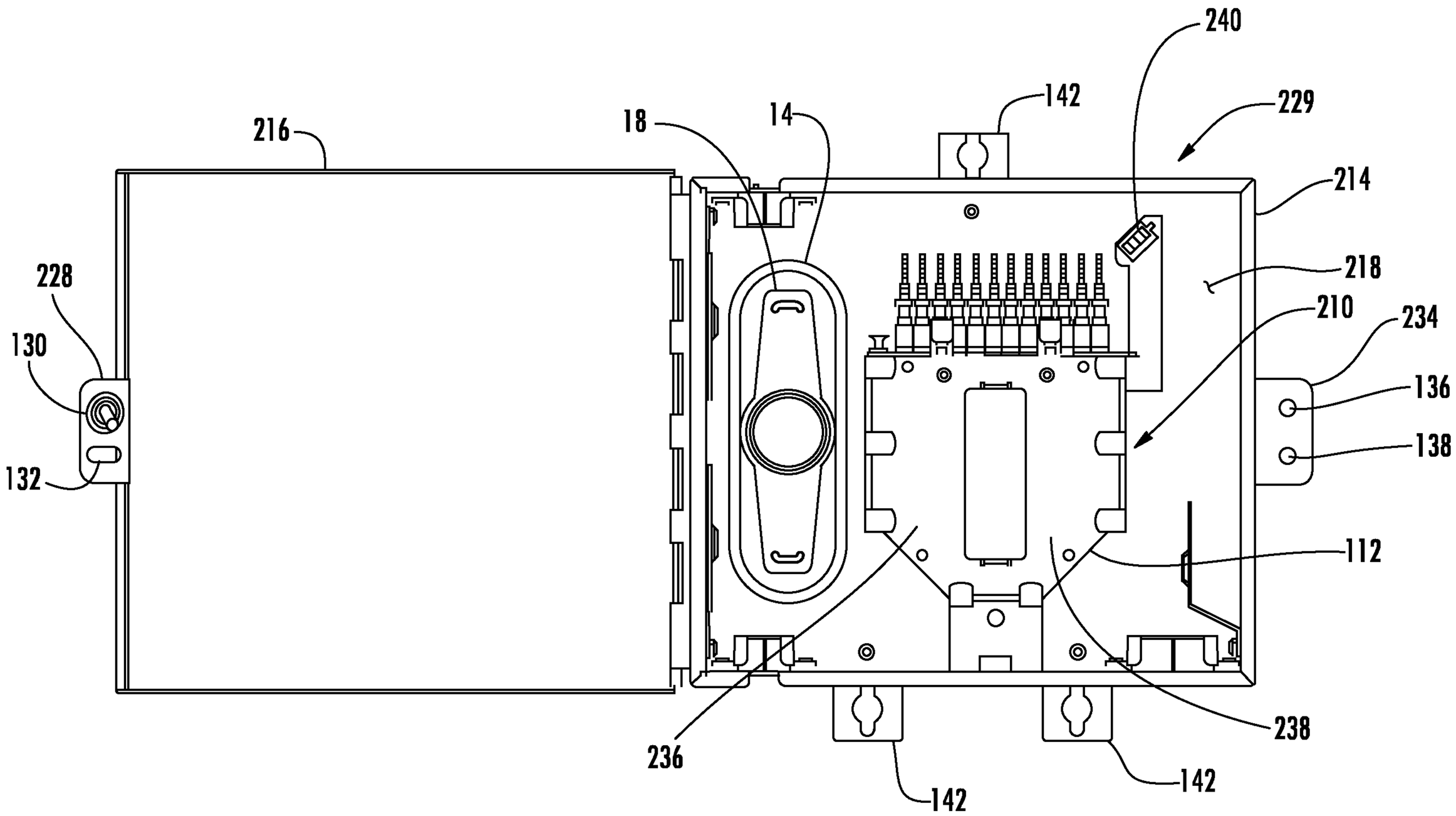
240
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FIG. 14

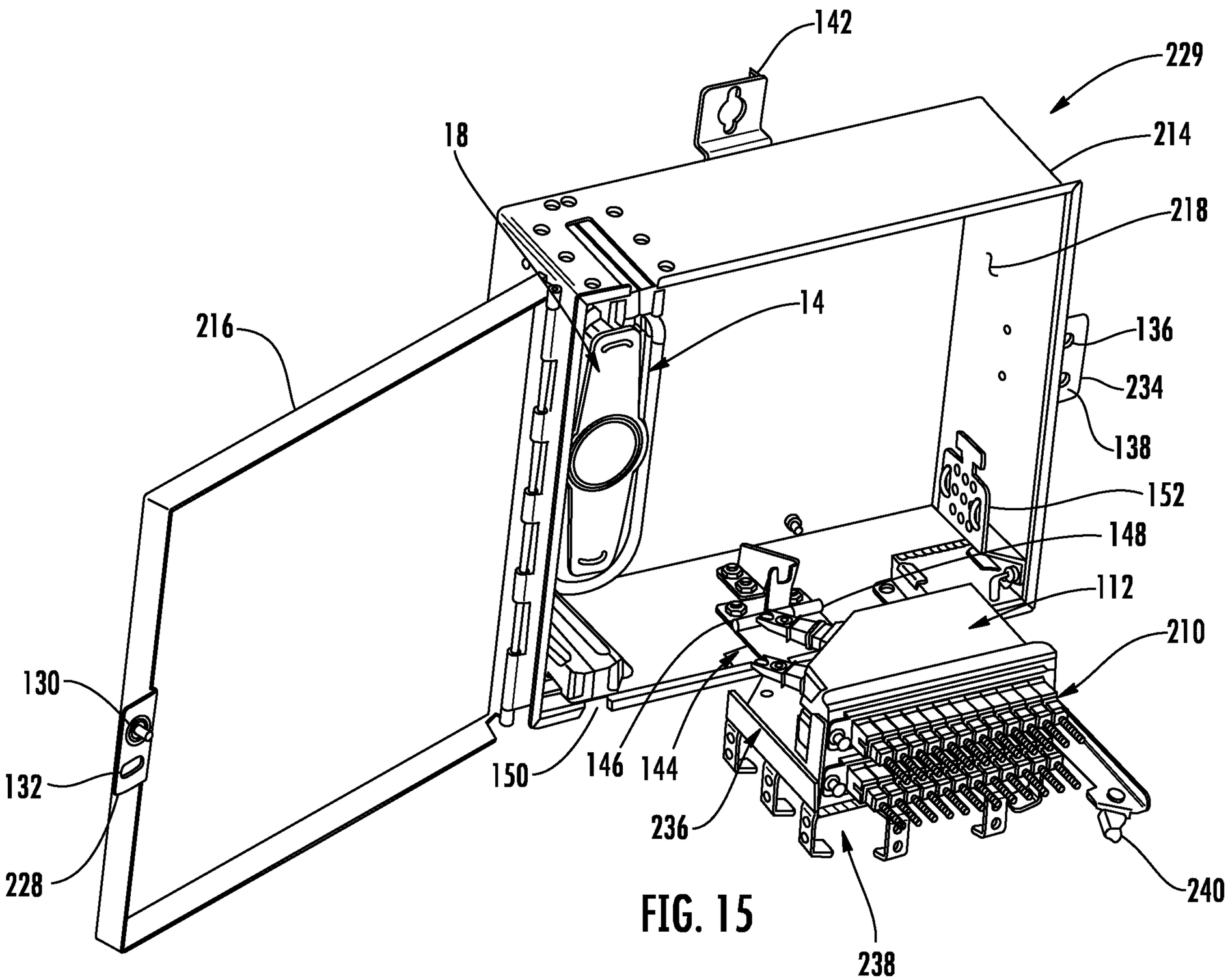
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FIG. 15