



- (51) International Patent Classification:
H02G 3/32 (2006.01) F16B 2/02 (2006.01)
F16L 3/08 (2006.01)
- (21) International Application Number:
PCT/US2017/065801
- (22) International Filing Date:
12 December 2017 (12.12.2017)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
62/437,195 21 December 2016 (21.12.2016) US
62/438,480 23 December 2016 (23.12.2016) US
- (71) Applicant: COMMSCOPE TECHNOLOGIES LLC
[US/US]; 1100 CommScope Place SE, Hickory, North Carolina 28602 (US).
- (72) Inventors: JOSHI, Aviral; 3356 S Emerald Avenue, Chicago, Illinois 60616 (US). VACCARO, Ronald; 343 River Haven Drive, Taylorville, North Carolina 28681 (US). RAJPAL, Taig; 1541 N Bell Avenue, Unit 1, Chicago, Illinois 60622 (US).
- (74) Agent: CANNON, James R.; MYERS BIGEL, P.A., PO Box 37428, Raleigh, North Carolina 27627 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: HANGER FOR MOUNTING MULTIPLE CABLES

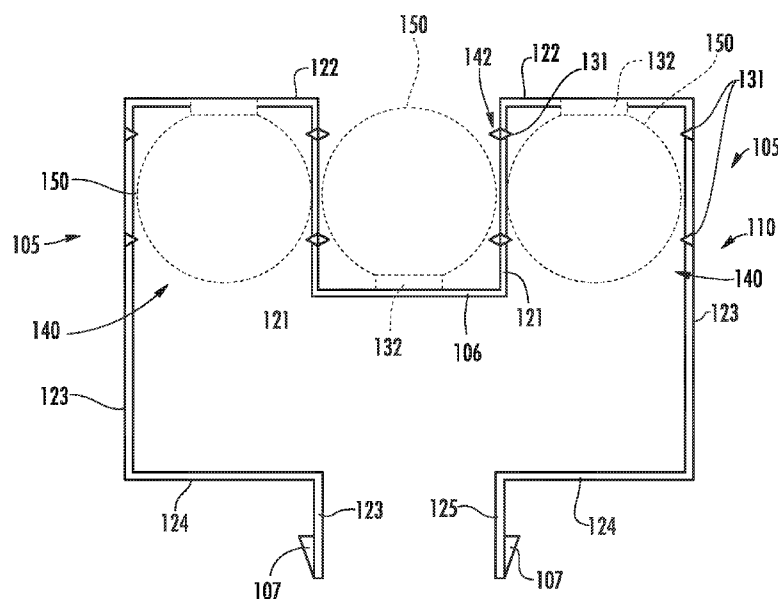


FIG. 5

(57) Abstract: A cable hanger for mounting cables to a mounting structure includes: a base panel; a pair of arms attached to opposite ends of the base panel; and a pair of locking projections, each locking projection being attached adjacent a free end of a respective arm. Each arm is configured to define a respective internal cavity configured to grasp cable. The arms and the base panel combine to define an external cavity for grasping cable. The cable hanger can be deflected from a relaxed state to a deflected state by forcing the locking projections toward each other. In the deflected state the cable hanger may be mounted to a mounting structure, with the arms inserted through a hole in the mounting structure and exerting outward pressure on edges of the hole, and the locking projections maintaining the cable hanger in a mounted position on the mounting structure.



SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

HANGER FOR MOUNTING MULTIPLE CABLES

Related Application

[0001] The present application claims priority from and the benefit of U.S. Provisional Patent Application Nos. 62/438,480, filed December 23, 2016, and 62/437,195, filed December 21, 2016, the disclosures of which are hereby incorporated herein in their entireties.

Field of the Invention

[0002] The present invention relates generally to devices for supporting cables and, in particular, to hangers for securing cables to support structures.

Background of the Invention

[0003] Cable hangers are commonly used to secure cables to structural members of antenna towers and or along tunnel walls. Generally, each cable is attached to a structural member by cable hangers mounted at periodically-spaced attachment points.

[0004] Antenna towers and or tunnels may be crowded due to the large numbers of cables required for signal-carrying. Over time, as systems are added, upgraded and/or expanded, installation of additional cables may be required. To conserve space, it may be desirable for each set of cable hangers to secure more than a single cable. Certain cable hangers have been constructed to secure multiple cables; other cable hangers have a stackable construction that permits multiple cable hangers to be interlocked extending outwardly from each mounting point/structural member. Stacked and multiple-cable-type cable hangers significantly increase the number of cables mountable to a single attachment point.

[0005] One popular stackable cable hanger is discussed in U.S. Patent No. 8,191,836 to Korczak, the disclosure of which is hereby incorporated herein by reference in its entirety. One such cable hanger, designated broadly at **10**, is shown in **FIGS. 1** and **2**. The hanger **10** includes curved arms **5** that extend from a flat base **6**. Locking projections **7** extend from the free ends of the arms **5**. As can be seen in **FIGS. 1** and **2**, the locking projections **7** are inserted into a reinforced hole **8** in a tower structure **4** to mount the hanger **10** thereon. The base **6** of the hanger **10** includes a reinforced hole **9** that can receive the projections of another hanger **10** to mount a second cable.

[0006] As can be best seen in **FIG. 2**, the arms **5** include arcuate sections **14** that together generally define a circle within which a cable can reside. Two cantilevered tabs **12** extend radially inwardly and toward the base **6** at one end of the arcuate sections **14**, and two cantilevered tabs **16** extend radially inwardly and toward the base **6** from the opposite ends of the arcuate sections **14**. The cantilevered tabs **12**, **16** are deployed to deflect radially outwardly when the hanger **10** receives a cable for mounting; this deflection generates a radially inward force from each tab **12**, **16** that grips the jacket of the cable.

[0007] Hangers can be “stacked” onto each other by inserting the locking projections **7** of one hanger into the large hole **9** of the next hanger. One variety of cable hanger of this type is the SNAP-STAK® hanger, available from CommScope, Inc. (Joliet, Illinois).

[0008] The SNAP-STAK® hanger is offered in multiple sizes that correspond to the outer diameters of different cables. This arrangement has been suitable for use with RF coaxial cables, which tend to be manufactured in only a few different outer diameters; however, the arrangement has been less desirable for fiber optic cables, which tend to be manufactured in a much greater variety of diameters. Moreover, fiber optic cables tend to be much heavier than coaxial cables (sometimes as much as three times heavier per unit foot), which induces greater load and stress on the hangers.

[0009] Multiple approaches to addressing this issue are offered in co-assigned and co-pending U.S. Patent Publication No. 2016/0281881 to Vaccaro, the disclosure of which is hereby incorporated herein by reference in full. One cable hanger discussed in this publication is shown in **FIGS. 3** and **4** and designated broadly at **610** therein. The cable hanger **610** is somewhat similar to the cable hanger **10**, inasmuch as it has a base **606**, curved arms **605** and locking

projections 607 that resemble those of the hanger 10 discussed above. However, the cable hanger 610 also has flex members 618 that define chords across the arcuate sections 614 of the arms 605. As can be seen in FIG. 4, cantilevered gripping members 612, 616 extend from the flex members 618 and into the cable-gripping space S within the arms 605. It can also be seen in FIG. 3 that the flex members 618 are tripartite, with two vertically offset horizontal runs 618a, 618c merging with the arcuate sections 614 of the arms 605 and a vertical run 618b extending between the horizontal runs 618a, 618c. The gripping members 612, 616 extend from opposite sides of the vertical run 618b and are vertically offset from each other.

[0010] In use, the cable hanger 610 is employed in the same manner as the cable hanger 10; a cable is inserted into the space S between the arms 605, which are then closed around the cable as the locking projections 607 are inserted into a mounting hole. The cantilevered gripping members 612, 616 can help to grip and to center the cable within the space S. The presence of the flex members 618, which are fixed end beams rather than cantilevered tabs, can provide additional gripping force beyond that of the cable hanger 10.

Summary

[0011] As a first aspect, embodiments of the invention are directed to a cable hanger for mounting cables to a mounting structure. The cable hanger comprises: a base panel; a pair of arms attached to opposite ends of the base panel; and a pair of locking projections, each locking projection being attached adjacent a free end of a respective arm. Each arm is configured to define a respective internal cavity configured to grasp a first cable. The arms and the base panel combine to define an external cavity for grasping a second cable. The cable hanger can be deflected from a relaxed state to a deflected state by forcing the locking projections toward each other. In the deflected state the cable hanger may be mounted to a mounting structure, with the arms inserted through a hole in the mounting structure and exerting outward pressure on edges of the hole, and the locking projections maintaining the cable hanger in a mounted position on the mounting structure.

[0012] As a second aspect, embodiments of the invention are directed to a cable hanger for mounting cables to a mounting structure comprising: a base panel; a pair of arms attached to opposite ends of the base panel; and a pair of locking projections, each locking projection being

attached adjacent a free end of a respective arm. The arms and the base panel define at least one internal cavity and at least one external cavity configured to grasp cables.

[0013] As a third aspect, embodiments of the invention are directed to a cable hanger for mounting cables to a mounting structure comprising: a head portion defining an internal head cavity for mounting a first cable; a pair of arm portions merging with the head portion, each arm portion defining an internal arm cavity for mounting a respective second cable; a pair of locking segments, each locking segment merging with a respective arm portion; and a first pair of gripping members, a first one of the gripping members extending from the head portion, and a second one of the gripping members extending from a first one of the arm portions, the gripping members defining a first external cable mounting location for mounting a third cable. The cable hanger can be deflected from a relaxed state to a deflected state by forcing the locking projections toward each other. In the deflected state the cable hanger may be mounted to a mounting structure, with the arms inserted through a hole in the mounting structure and exerting outward pressure on edges of the hole, and the locking projections maintaining the cable hanger in a mounted position on the mounting structure.

[0014] As a fourth aspect, embodiments of the invention are directed to a cable hanger for mounting cables to a mounting structure comprising: a formed strip, the strip having a periphery, the strip defining a plurality of internal cavities defined by walls configured to receive and grasp first cables, the strip including a pair of locking projections configured to be deflected into a deflected state by forcing the locking projections toward each other, wherein in the deflected state the cable hanger may be mounted to a mounting structure; and at least one pair of gripping members extending from the walls of the strip, the gripping members defining an external cable mounting location configured to receive and grasp a second cable.

Brief Description of the Figures

[0015] FIG. 1 is a perspective view of a prior art cable hanger.

[0016] FIG. 2 is a top view of the prior art cable hanger of FIG. 1.

[0017] FIG. 3 is a perspective view of another prior art cable hanger.

[0018] FIG. 4 is a top view of the cable hanger of FIG. 3.

[0019] FIG. 5 is a top view of a cable hanger capable of mounting multiple cables according to embodiments of the invention.

[0020] FIG. 6 is a top view of two cable hangers of FIG. 5 deployed in a stacked configuration.

[0021] FIG. 7 is a top view of a cable hanger capable of mounting multiple cables according to alternative embodiments of the invention.

[0022] FIG. 8 is a top view of another cable hanger capable of mounting multiple cables according to alternative embodiments of the invention.

[0023] FIG. 9 is a top view of two cable hangers of FIG. 8 deployed in a stacked configuration.

Detailed Description

[0024] The present invention is described with reference to the accompanying drawings, in which certain embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments that are pictured and described herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. It will also be appreciated that the embodiments disclosed herein can be combined in any way and/or combination to provide many additional embodiments.

[0025] Unless otherwise defined, all technical and scientific terms that are used in this disclosure have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. The terminology used in the below description is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used in this disclosure, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that when an element (e.g., a device, circuit, etc.) is referred to as being "attached", "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly attached", "directly connected" or "directly coupled" to another element, there are no intervening elements present.

[0026] Referring now to the drawings, a cable hanger **110** according to embodiments of the invention is shown in **FIG. 5**. The cable hanger **110** has a base panel **106** with two arms **105** extending from opposite ends thereof. Each of the arms **105** is a mirror image of the other arm **105** and includes a plurality of segments. An inboard segment **121** extends rearwardly and generally perpendicularly from the edge of the base panel **106**. A rear segment **122** extends laterally and generally perpendicularly from the rear end of each inboard segment **121**. An outboard segment **123** extends forwardly and generally perpendicularly from the outer end of each rear segment **122**. A forward segment **124** extends inwardly and generally perpendicularly from the forward end of each outboard segment **123**. Finally, a lock segment **125** extends generally perpendicularly and forwardly from the inner end of each forward segment **124**. Locking projections **107** are located on the lock segments **125**. (As used herein, the “forward” or “front” direction is the direction extending from the base panel **106** toward the locking segments **125**. The “rear” direction is the opposite of the front direction. “Lateral” and “outboard” refer to the direction normal to the front and rear directions that extends away from the center of the cable hanger **110** toward the outboard segments **123**, and “inboard” refers to the opposite of the outboard direction).

[0027] This configuration creates cavities in which cables can be mounted. More specifically, the inboard, rear and outboard segments **121**, **122**, **123** create internal lateral cavities **140**, and the base panel **106** and the inboard segments **121** create an external central cavity **142** (as used herein, a cavity is “internal” when it is located within the periphery of the cable hanger **110**, and is “external” when it is located outside the periphery of the cable hanger **110**).

[0028] The cable hanger **110** may include a number of cable gripping features, such as barbs, lances, nubs, teeth, and the like. The cable hanger **110** shown in **FIG. 5** includes barbs **131** that extend from the inboard segments **121** into both the lateral and central cavities **140**, **142**. Also, lances **132** extend from the base panel **106** into the central cavity **142** and from the rear segments **122** into the lateral cavities **140**.

[0029] As is also shown in **FIG. 5**, cables **150** can be mounted within the lateral and central cavities **140**, **142**. It can be seen that a single cable hanger **110** can hold up to three cables **150** at once, which can reduce the number of cable hangers **110** required to mount multiple cables. The barbs **131** and the lances **132** can assist in grasping cables **150** mounted in the cavities **140**, **142**.

As with the cable hangers **10**, **610** discussed above, the cable hanger **110** can be mounted to a mounting structure via the locking projections **107** being deflected toward each other from a relaxed state and being inserted into a hole (typically $\frac{3}{4}$ inch) in a mounting structure in the deflected condition. The arms **105** exert outward pressure on edges of the hole, and the locking projections **107** maintain the cable hanger **110** in a mounted position on the mounting structure.

[0030] Those skilled in this art will appreciate that, although the cavities **140**, **142** are shown as being similar, if not identical, in size, in other embodiments the cable hanger **110** may be configured such that the lateral and central cavities **140**, **142** are of different sizes, or even such that each of the lateral cavities **140** is of a different size. In addition, in some embodiments additional segments may be included in the arms **105** in a “square wave” pattern so that more cables (e.g., five or seven) may be mounted in a single cable hanger.

[0031] Further, the segments may be oriented somewhat different relative to each other. For example, the inboard segments **121** may be disposed at an oblique angle relative to the base panel **106** and the rearward segments **122**. If the inboard segments **121** were angled such that their rearward ends (where they merge with the rear segments **122**) were closer together than their forward ends (where they merge with the base panel **106**), the cavities **140**, **142** created thereby would be trapezoidal in shape, with the open end of the trapezoid being relatively narrow, and thereby would be likely to capture cables more securely. If on the other hand, the inboard segments **121** were angled so that their rearward ends were farther apart than their forward ends, the resulting trapezoidal cavities would have their wider ends open, which may facilitate the entry of cables in the cavities. Other configurations are also possible, including those in which some or all of the segments of the arms **105** are arcuate or curvilinear rather than straight.

[0032] Referring now to **FIG. 6**, two cable hangers **110**, **110'** are shown mounted in a stacked relationship. As can be seen from **FIG. 6**, the locking projections **107'** of the cable hanger **110'** are inserted into holes (not shown) in the inboard segments **121** of the cable hanger **110**. The cable hanger **110** is mounted in a mounting structure **170**. In this manner, additional cables (three additional cables in this instance) can be mounted to the same mounting location on the mounting structure **170** with only a single additional cable hanger.

[0033] Referring now to **FIG. 7**, another embodiment of a cable hanger, designated broadly at **210**, is shown therein. The cable hanger **210** is similar to the cable hanger **110** in general configuration, with a base panel **206**, arms **205** having the same five segments as discussed above, and locking projections **207**. However, the cable hanger **210** also includes two cantilevered gripping tabs **212** that extend from the base panel **206** into the central cavity **242**, and further includes two cantilevered gripping tabs **216, 218** that extend from, respectively, the inboard segment **221** and the outboard segment **223** of each lateral cavity **240**. Barbs **231** also extend into the cavities **240, 242** from the base panel **206** and the rear segments **222**. Thus, cables (not shown in **FIG. 7**) can be mounted within each cavity **240, 242** and held in place by the gripping tabs **212, 216, 218**.

[0034] The gripping tabs **212, 216, 218** may take a variety of configurations. Some potential configurations are shown in U.S. Patent Publication No. 2016/0281881 to Vaccaro and U.S. Patent No. 8,191,836 to Korczak, *supra*. Other configurations are shown in co-assigned U.S. Patent Application No. 15/335,614, filed October 27, 2016, the disclosure of which is hereby incorporated herein in its entirety. More or fewer gripping tabs may be included in other embodiments.

[0035] Referring now to the drawings, a cable hanger **410** according to embodiments of the invention is shown in **FIG. 8**. The cable hanger **410** is generally cruciform in shape, with a head portion **420**, two arm portions **430**, and locking segments **408** on which locking projections **407** or other locking features are located. These are described in greater detail below.

[0036] The head portion **420** includes an end wall **421** and two side walls **422** that merge with the end wall **421**, thereby defining a head cavity **424**. Each of the arm portions **430** includes an end wall **431** and two side walls **432** that merge with the end wall **431**, thereby defining respective arm cavities **434**. As can be seen in **FIG. 5**, one of the side walls **432** of each of the arm portions **430** merges with one of the side walls **422** of the head portion **420**. The other of the side walls **432** of each of the arm portions **430** merges with a respective locking segment **408**.

[0037] It can also be seen in **FIG. 5** that the head portion **420** includes a lance **425** that extends into the head cavity **424** from the end wall **421**, and further includes barbs **426** that extend into the head cavity **424** from the side walls **422**. Similarly, each of the arm portions **430** includes a lance **435** that extends into its arm cavity **434** from the end wall **431** and barbs **436**

that extend into its arm cavity **434** from the side walls **432**. The lances **425**, **435** and barbs **426**, **436** provide gripping features to the cavities **424**, **434**; other gripping features, such as teeth, nubs and the like, may also be employed.

[0038] FIG. 8 also illustrates that a gripping tab **412** extends from each of the side walls **422** of the head portion **420** at an oblique angle (typically about 45 degrees). A gripping tab **416** also extends at an oblique angle (typically about 45 degrees) from each of the side walls **432** of the arm portions **430** that merge with the side walls **422**. Lances **417**, **419** are positioned near the ends of respective gripping tabs **412**, **416**. Each pair of gripping tabs **412**, **416** defines a cable mounting location **413** that is located external of the cable hanger **410**. (As used herein, a cavity or mounting location is “internal” when it is located within the periphery of the cable hanger **410**, and is “external” when it is located outside the periphery of the cable hanger **410**).

[0039] As can be seen in FIG. 8, the head cavity **424** is sized to receive and grasp a cable **450**, which is held in place by the barbs **426** and the lance **425**. Each of the arm cavities **434** is also sized to receive and grasp a cable **452**, which is held in place by the barbs **436** and the lance **435**. Finally, each pair of gripping tabs **412**, **416** can grasp a cable **454** as it is located in a respective cable mounting location **413**. Thus, in the illustrated configuration, the cable hanger **410** can hold up to five separate cables.

[0040] As with the cable hangers **10**, **110**, **210**, **610** discussed above, the cable hanger **410** can be mounted to a mounting structure via the locking projections **407** being deflected toward each other from a relaxed state and being inserted into a hole (typically $\frac{3}{4}$ inch) in a mounting structure in the deflected condition. The locking segments **408** exert outward pressure on edges of the hole, and the locking projections **407** maintain the cable hanger in a mounted position on the mounting structure.

[0041] Those skilled in this art will appreciate that, although the head and arm cavities **424**, **434** are shown as being similar, if not identical, in size, in other embodiments the cable hanger **410** may be configured such that the head and arm cavities **424**, **434** are of different sizes, or even such that each of the arm cavities **434** is of a different size. In addition, in some embodiments arm portions may be included in a “square wave” pattern so that more cables (e.g., five or seven) may be mounted in a single cable hanger.

[0042] Those skilled in this art will also appreciate that the head portion **421** and arm portions **431** may be configured differently. For example, configurations which some or all of the segments of the end and side walls are arcuate or curvilinear rather than straight may be suitable. In addition, the end and side walls may be disposed at oblique angles to one another rather than at generally right angles.

[0043] Like the gripping tabs **212**, **216**, **218** discussed above, the gripping tabs **412**, **416** may take a variety of configurations. Some potential configurations for gripping members are shown in U.S. Patent Publication No. 2016/0281881 to Vaccaro and U.S. Patent No. 8,191,836 to Korczak, *supra*. Other configurations are shown in co-assigned U.S. Patent Application No. 15/335,614, filed October 27, 2016, the disclosure of which is hereby incorporated herein in its entirety. More or fewer gripping tabs may be included in other embodiments.

[0044] Referring now to **FIG. 9**, two cable hangers **410**, **410'** are shown mounted in a stacked relationship. As can be seen from **FIG. 6**, the locking projections **407'** of the cable hanger **410'** are inserted into holes (not shown) in the end wall **421** of the head portion **420** of the cable hanger **410** and can be received in slots or holes (not shown) in the side walls **422** of the head section inboard segments **421** of the cable hanger **410**. The cable hanger **410** is mounted in a mounting structure **470**. In this manner, additional cables (five additional cables in this instance) can be mounted to the same mounting location on the mounting structure **470** with only a single additional cable hanger **410'**.

[0045] The cable hangers **110**, **210**, **410** may be formed of a variety of materials, such as steel and other metals. The cable hangers **110**, **210** may be stamped from a sheet or strip of material, such as steel, and bent by known methods into the configurations shown herein. As such, the cable hangers **110**, **210**, **410** may be monolithic component, such as formed strips of steel or other easily-bent materials.

[0046] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of

this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That Which is Claimed is:

1. A cable hanger for mounting cables to a mounting structure, comprising:
 - a base panel;
 - a pair of arms attached to opposite ends of the base panel; and
 - a pair of locking projections, each locking projection being attached adjacent a free end of a respective arm;wherein each arm is configured to define a respective internal cavity configured to grasp a first cable;
 - wherein the arms and the base panel combine to define an external cavity for grasping a second cable;
 - wherein the cable hanger can be deflected from a relaxed state to a deflected state by forcing the locking projections toward each other;
 - wherein in the deflected state the cable hanger may be mounted to a mounting structure, with the arms inserted through a hole in the mounting structure and exerting outward pressure on edges of the hole, and the locking projections maintaining the cable hanger in a mounted position on the mounting structure.

2. The cable hanger defined in Claim 1, wherein gripping tabs extend into at least one of the external and internal cavities.

3. The cable hanger defined in Claim 1 or Claim 2, further comprising gripping features on the arms.

4. The cable hanger defined in Claim 3, wherein the gripping features are located within the external cavity.

5. The cable hanger defined in Claim 3, wherein the gripping features are located within at least one of the internal cavities.

6. The cable hanger defined in any of Claims 1-5, wherein each of the arms includes an inboard segment attached to the base panel, and wherein the external cavity is defined by the inboard segments and the base panel.

7. The cable hanger defined in Claim 6, wherein each of the arms further includes a rear segment that merges with the inboard segment and an outboard segment that merges with an end of the rearward segment, and wherein the internal cavities are defined by respective inboard, rearward and outboard segments.

8. The cable hanger defined in Claim 7, wherein each of the arms further includes a forward segment that merges with an end of the outboard segment, and a locking segment that merges with an end of the forward segment, the locking projections being mounted on the locking segments.

9. The cable hanger defined in any of Claims 1-8, wherein the cable hanger is formed as a monolithic component.

10. The cable hanger defined in any of Claims 1-9, wherein the cable hanger is formed from a metallic sheet.

11. The cable hanger defined in any of Claims 1-10, in combination with the first cable mounted in the external cavity and the second cable mounted in one of the internal cavities.

12. A cable hanger for mounting cables to a mounting structure, comprising:
a base panel;
a pair of arms attached to opposite ends of the base panel; and
a pair of locking projections, each locking projection being attached adjacent a free end of a respective arm;
wherein the arms and the base panel define at least one internal cavity and at least one external cavity configured to grasp cables.

13. The cable hanger defined in Claim 12, in combination with a first cable mounted in the at least one external cavity and a second cable mounted in one of the at least one internal cavity.

14. A cable hanger for mounting cables to a mounting structure, comprising:
a head portion defining an internal head cavity for mounting a first cable;
a pair of arm portions merging with the head portion, each arm portion defining an internal arm cavity for mounting a respective second cable;
a pair of locking segments, each locking segment merging with a respective arm portion; and
a first pair of gripping members, a first one of the gripping members extending from the head portion, and a second one of the gripping members extending from a first one of the arm portions, the gripping members defining a first external cable mounting location for mounting a third cable;
wherein the cable hanger can be deflected from a relaxed state to a deflected state by forcing the locking projections toward each other; and
wherein in the deflected state the cable hanger may be mounted to a mounting structure, with the arms inserted through a hole in the mounting structure and exerting outward pressure on edges of the hole, and the locking projections maintaining the cable hanger in a mounted position on the mounting structure.

15. The cable hanger defined in Claim 14, further comprising gripping features in the head cavity and/or the arm cavities.

16. The cable hanger defined in Claim 14 or Claim 15, wherein the first gripping member extends from a side wall of the head portion, and the second gripping member extends from a side wall of a first one of the arm portions.

17. The cable hanger defined in Claim 16, wherein the side wall of the first arm portion meets the side wall of the head portion to form a generally right angle.

18. The cable hanger defined in Claim 16, further comprising a second pair of gripping members, a first one of the gripping members of the second pair extending from the head portion, and a second one of the gripping members of the second pair extending from a second one of the arm portions, the gripping members of the second pair defining a second external cable mounting location for mounting a fourth cable.

19. The cable hanger defined in any of Claims 14-18, wherein each of the arm portions comprises an end wall and a pair of side walls, such that the internal arm cavities are generally rectangular.

20. The cable hanger defined in any of Claims 14-19, wherein the head portion comprises an end wall and a pair of side walls, such that the internal head cavity is generally rectangular.

21. The cable hanger defined in any of Claims 14-20, in combination with the first cable mounted in the head cavity, the second cable mounted in one of the arm cavities, and the third cable mounted in the first external mounting location.

22. A cable hanger for mounting cables to a mounting structure, comprising:
a formed strip, the strip having a periphery, the strip defining a plurality of internal cavities defined by walls configured to receive and grasp first cables, the strip including a pair of locking projections configured to be deflected into a deflected state by forcing the locking projections toward each other, wherein in the deflected state the cable hanger may be mounted to a mounting structure; and

at least one pair of gripping members extending from the walls of the strip, the gripping members defining an external cable mounting location configured to receive and grasp a second cable.

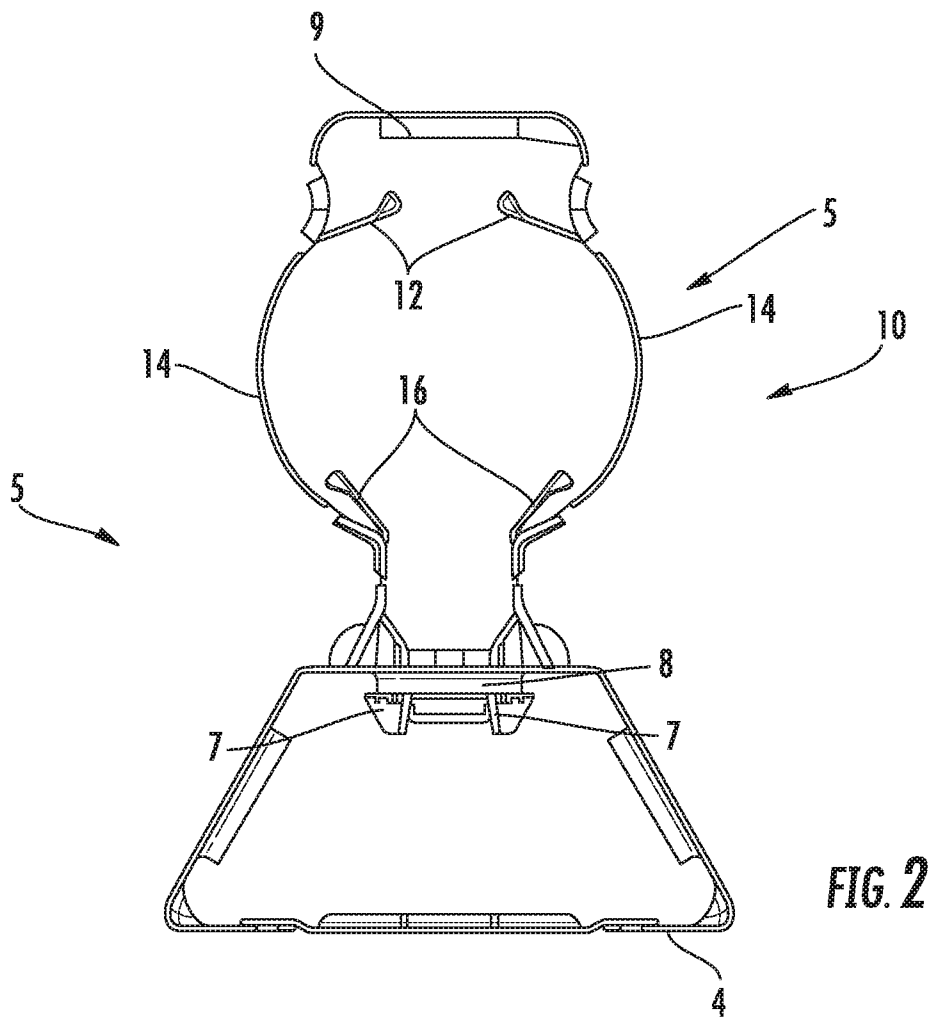
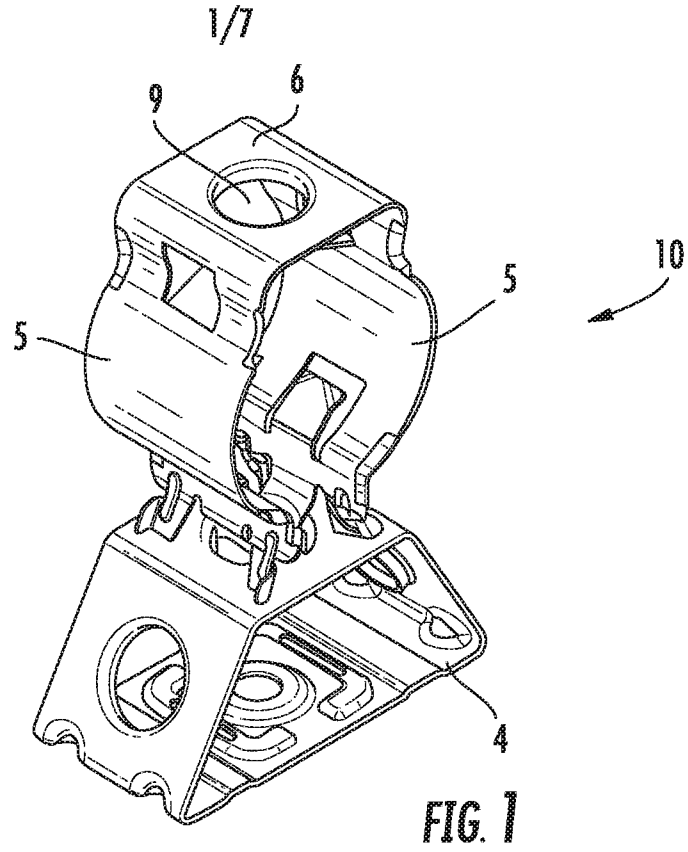
23. The cable hanger defined in Claim 22, further comprising gripping features in the internal cavities and/or on the gripping members.

24. The cable hanger defined in Claim 22 or Claim 23, further comprising a second pair of gripping members extending from the walls of the strip, the second pair of gripping members defining a second external cable mounting location configured to receive and grasp a third cable.

25. The cable hanger defined in Claim 24, wherein the strip includes a head portion defining one of the internal cavities as an internal head cavity and a pair of arm portions merging with the head portion, each arm portion defining one of the internal arm cavities as an internal arm cavity.

26. The cable hanger defined in Claim 25, wherein a first one of the pair of gripping members extends from a side wall of the head portion, and a second one of the second gripping member extends from a side wall of one of the arm portions.

27. The cable hanger defined in any of Claims 22-26, in combination with first cables mounted in the internal cavities and a second cable mounted in the external mounting location.



2/7

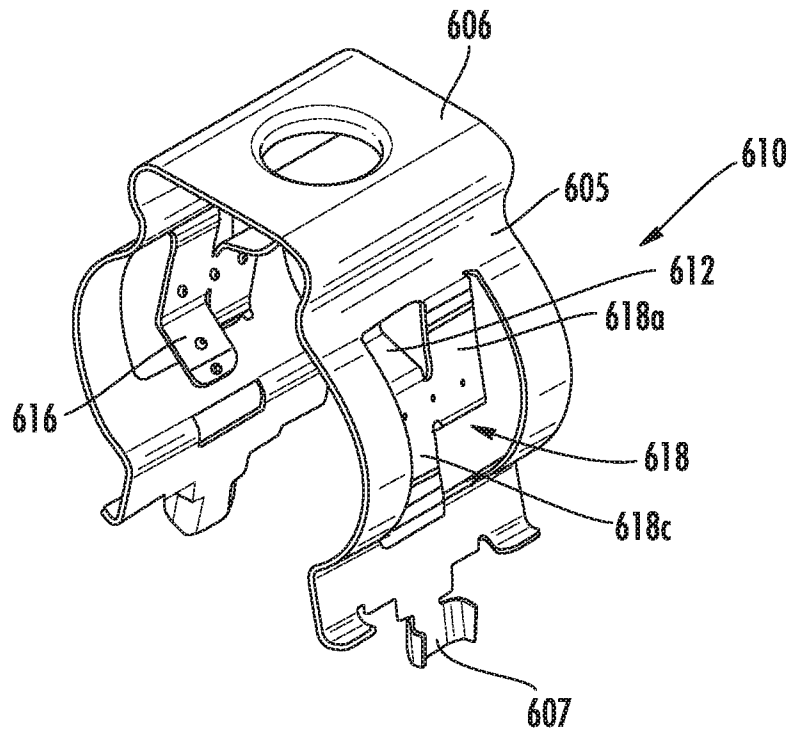


FIG. 3

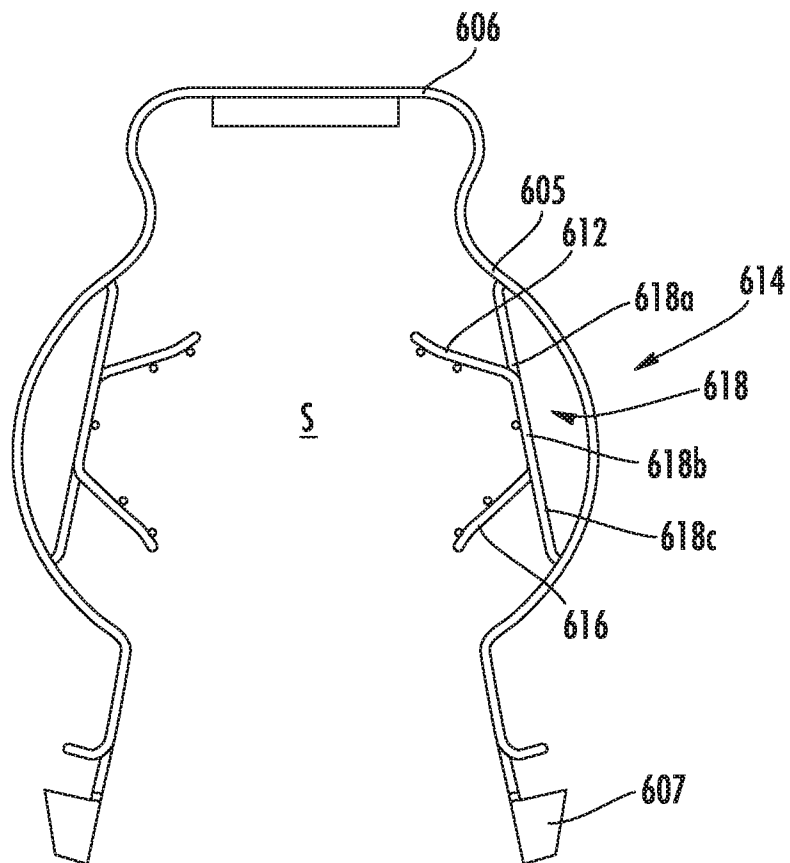


FIG. 4

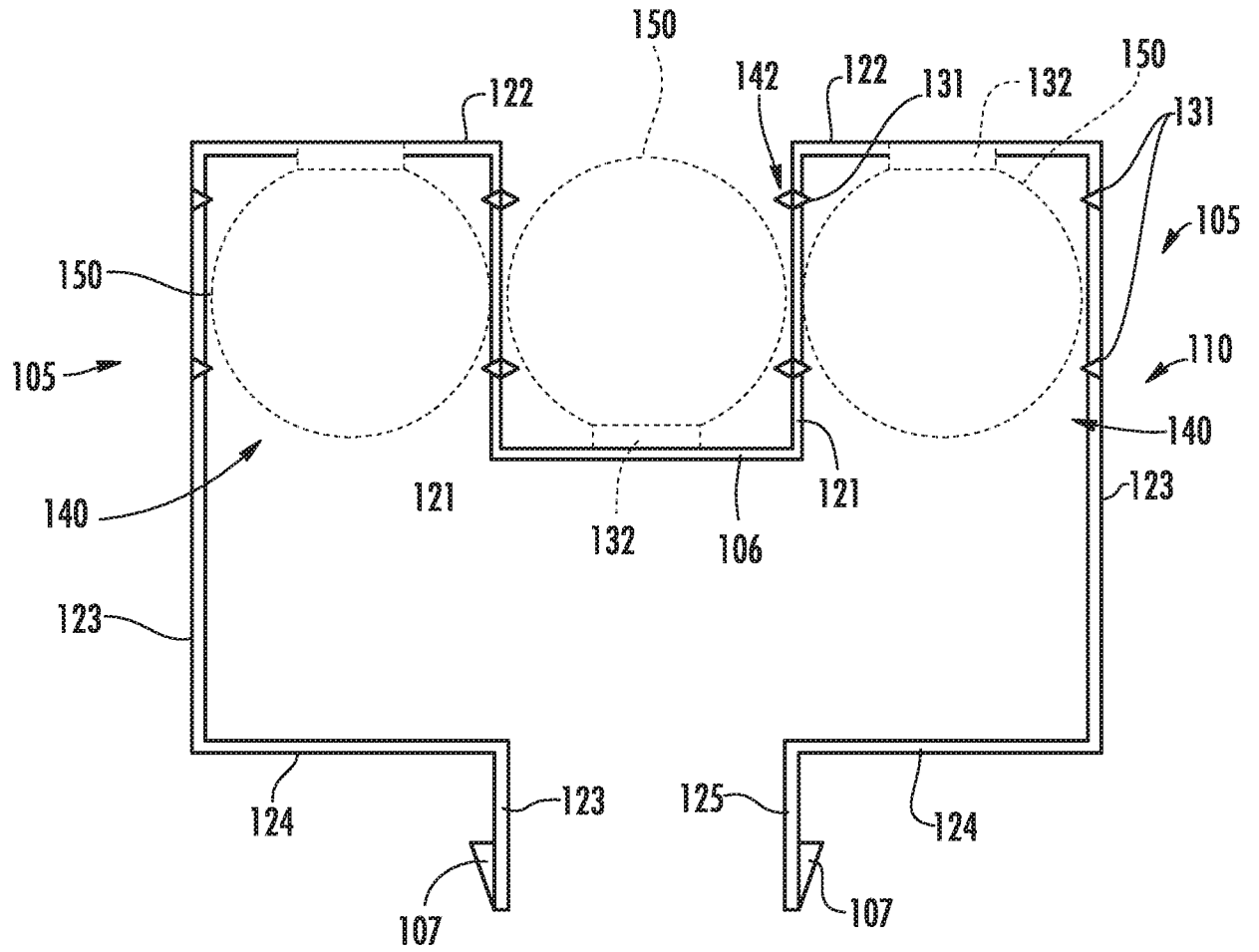


FIG. 5

4/7

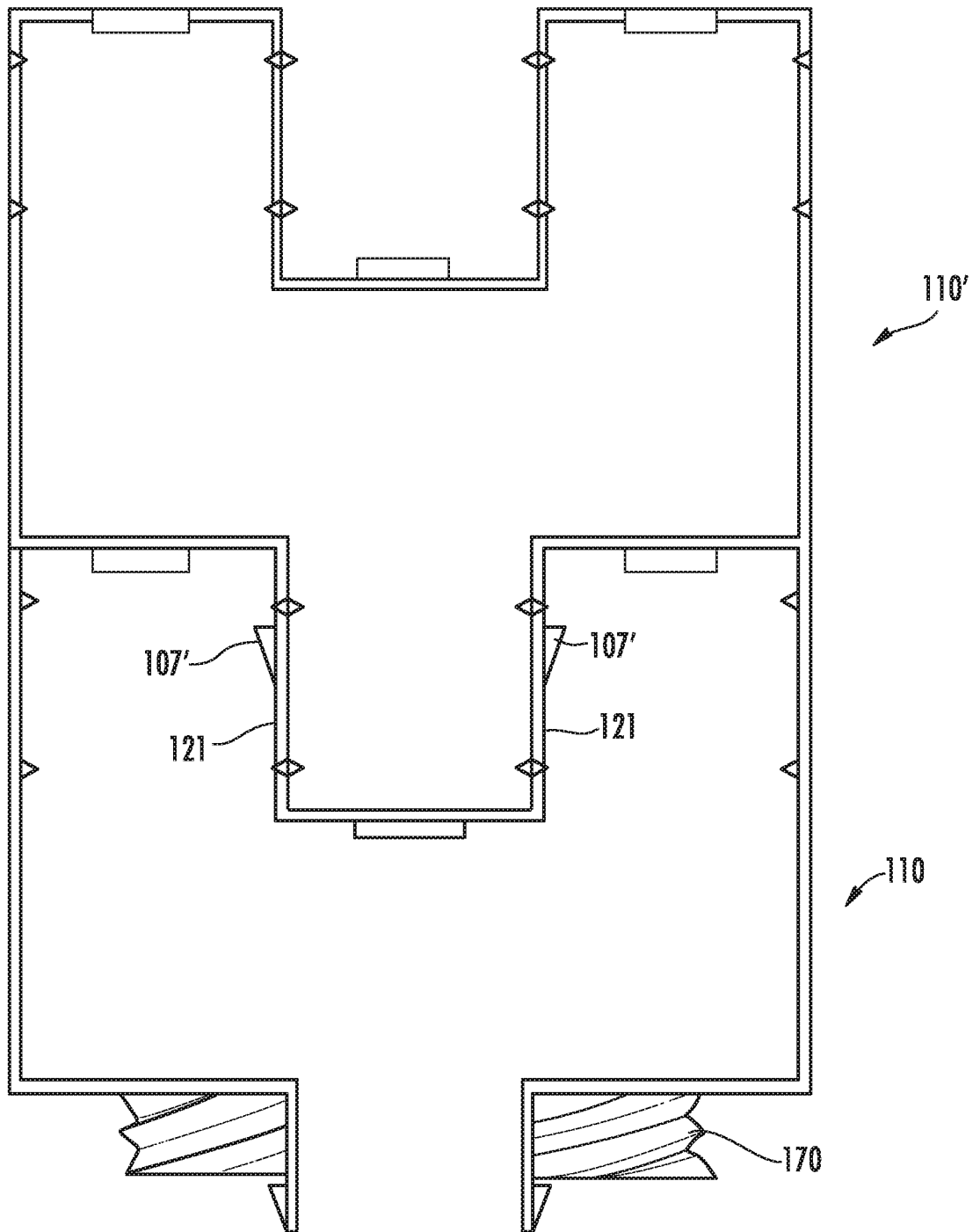


FIG. 6

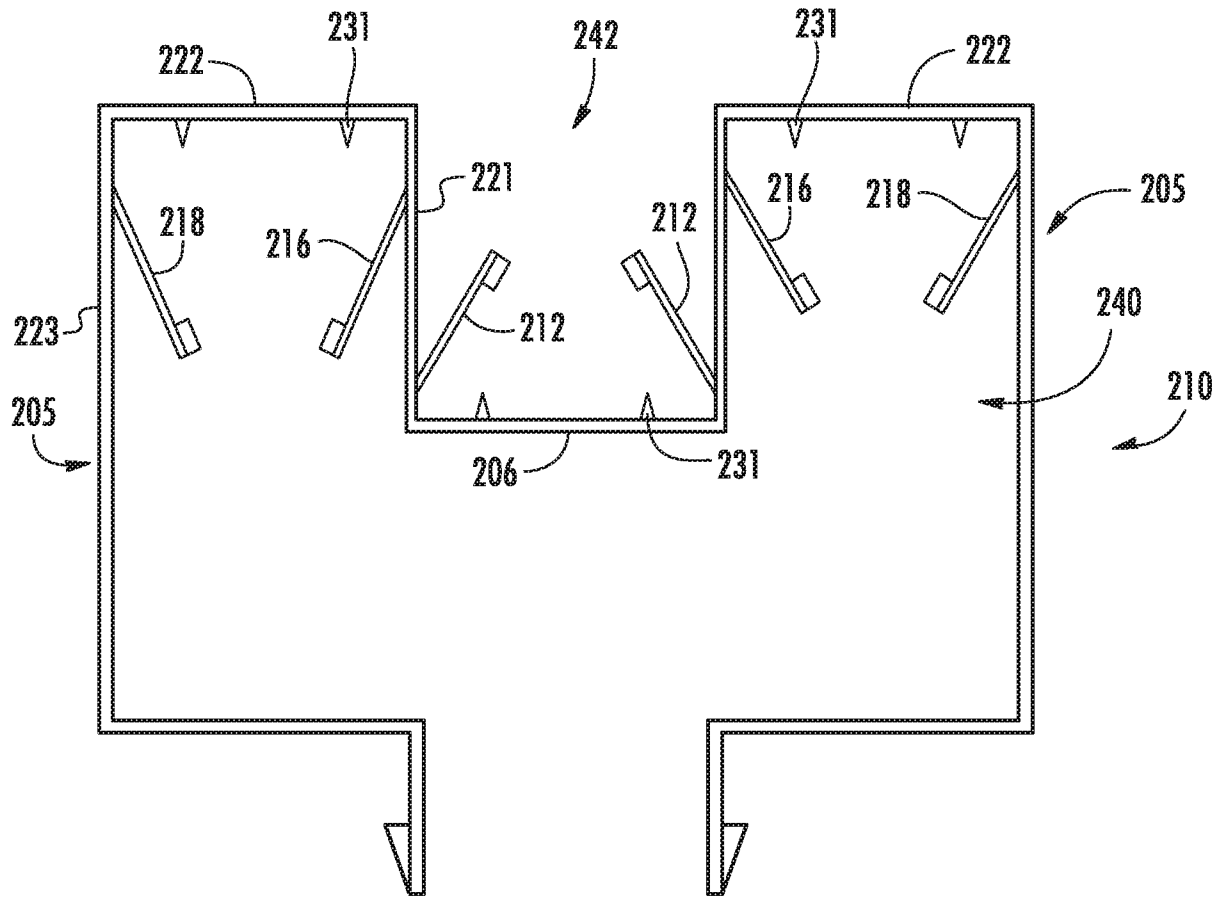


FIG. 7

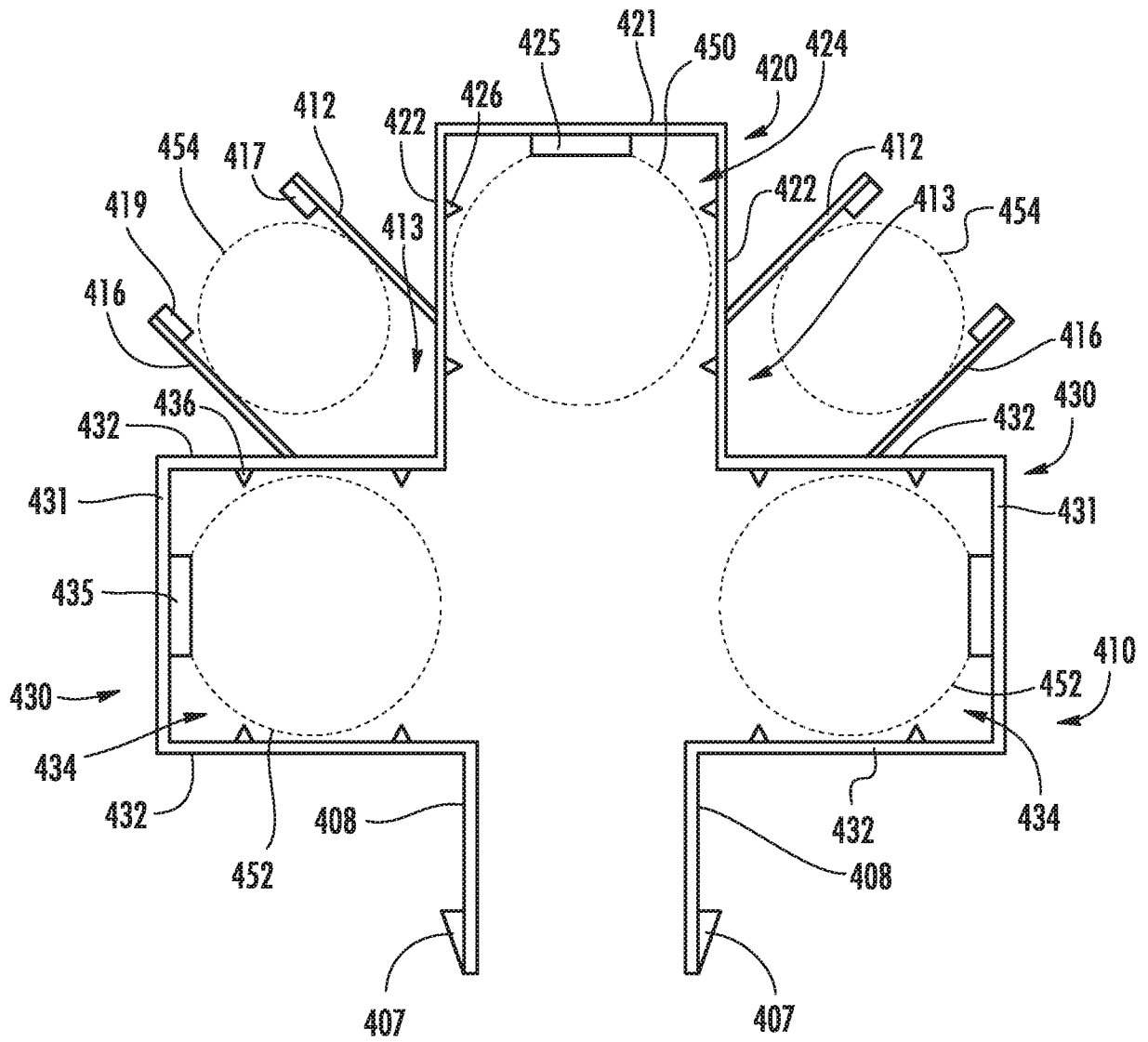


FIG. 8

7/7

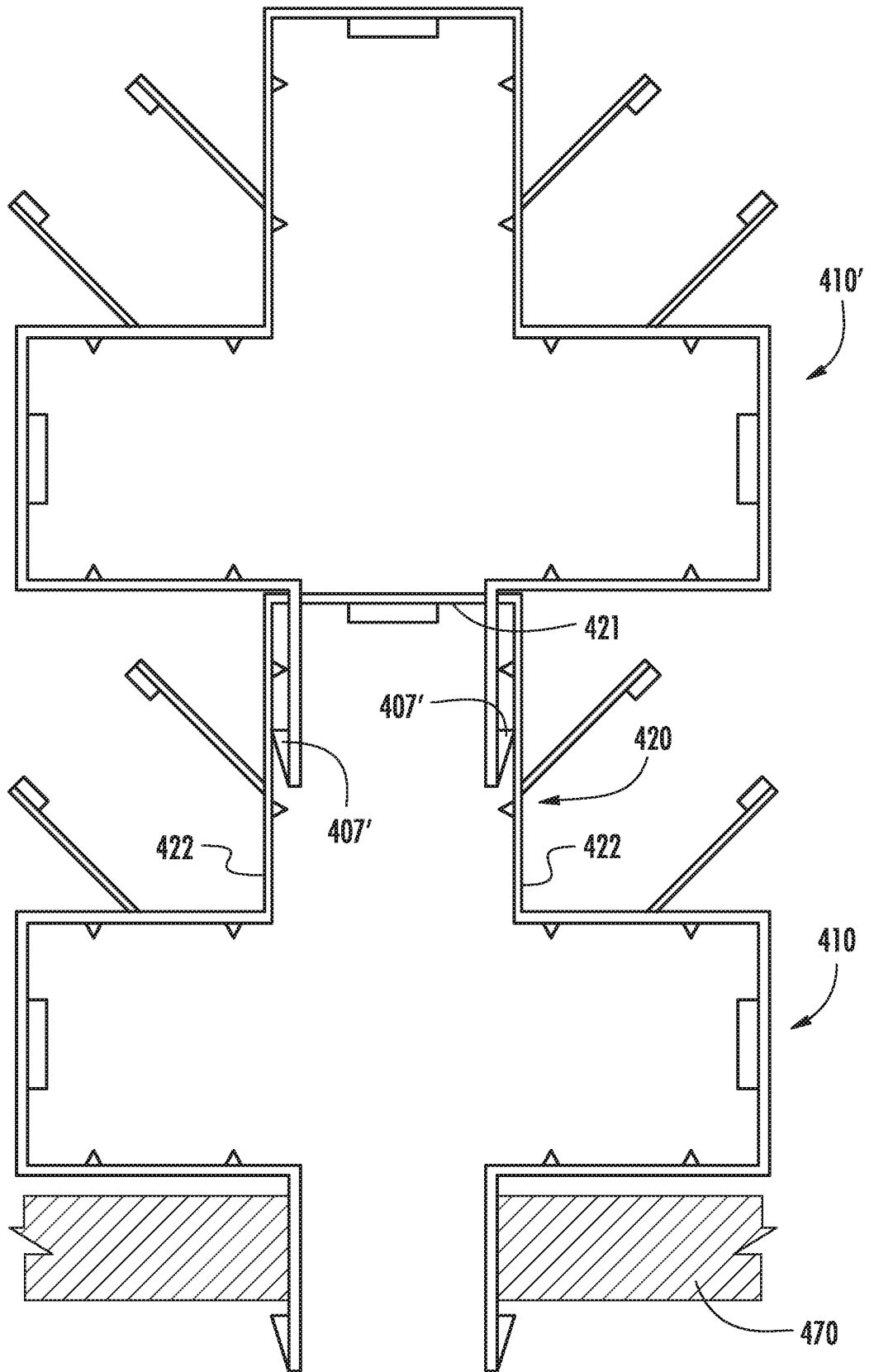


FIG. 9

A. CLASSIFICATION OF SUBJECT MATTER**H02G 3/32(2006.01)i, F16L 3/08(2006.01)i, F16B 2/02(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H02G 3/32; F16L 3/10; H01B 7/00; H04B ; F16L 3/13; F16L 3/22; E04G 21/16; E04B 1/38; F16L 3/08; F16B 2/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: cable hanger, mounting structure, internal cavity, external cavity, locking projections

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011-0226913 A1 (GIORGIO FEIGE) 22 September 2011 See paragraphs 41-53, 64-66; claim 1; and figures 4-9.	1-5, 12-18, 22-26
Y	US 6323430 B1 (MICHAEL SANTOS FINONA) 27 November 2001 See column 2, lines 17-34; claim 4; and figures 1-2, 7.	1-5, 12-18, 22-26
A	US 2016-0281883 A1 (COMMSCOPE TECHNOLOGIES LLC) 29 September 2016 See the entire document.	1-5, 12-18, 22-26
A	WO 02-095956 A2 (ANDREW CORPORATION) 28 November 2002 See the entire document.	1-5, 12-18, 22-26
A	US 2011-0107719 A1 (JON R. KODI) 12 May 2011 See the entire document.	1-5, 12-18, 22-26

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

13 April 2018 (13.04.2018)

Date of mailing of the international search report

13 April 2018 (13.04.2018)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

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

Facsimile No. +82-42-481-8578

Authorized officer

JANG, Gijeong

Telephone No. +82-42-481-8364



Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 7-8
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 7-8 refer to multiple dependent claim, which does not comply with PCT Rule 6.4(a).

3. Claims Nos.: 6, 9-11, 19-21, 27
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/065801

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011-0226913 A1	22/09/2011	CA 2769838 A1 CA 2769838 C EP 2464907 A1 EP 2464907 B1 EP 2940360 A1 ES 2554856 T3 MX 2012001871 A US 2014-0131529 A1 US 8439316 B2 US 9086175 B2 WO 2010-143222 A1	16/12/2010 21/11/2017 20/06/2012 02/09/2015 04/11/2015 23/12/2015 11/04/2012 15/05/2014 14/05/2013 21/07/2015 16/12/2010
US 6323430 B1	27/11/2001	None	
US 2016-0281883 A1	29/09/2016	US 9853434 B2	26/12/2017
WO 02-095956 A2	28/11/2002	AT 495558 T AU 2002-307212 A1 BR 0000046 A BR 0005093 A BR 0005093 B1 CN 100539341 C CN 1196882 C CN 1260605 A CN 1294432 A CN 1520498 A DE 10295371 T5 DE 60013333 T2 EP 1020672 A1 EP 1020672 B1 EP 1096594 A2 EP 1096594 A3 EP 1096594 B1 KR 10-0445855 B1 KR 10-2001-0051299 A TW 550358 B US 2002-0005463 A1 US 2005-0109890 A1 US 6161804 A US 6354543 B1 US 6899305 B2 WO 02-095956 A3	15/01/2011 03/12/2002 29/08/2000 30/10/2001 18/11/2008 09/09/2009 13/04/2005 19/07/2000 09/05/2001 11/08/2004 29/04/2004 17/02/2005 19/07/2000 01/09/2004 02/05/2001 20/11/2002 12/01/2011 30/08/2004 25/06/2001 01/09/2003 17/01/2002 26/05/2005 19/12/2000 12/03/2002 31/05/2005 18/09/2003
US 2011-0107719 A1	12/05/2011	AU 2007-323610 A1 AU 2007-323610 B2 CA 2701308 A1 CA 2701308 C CA 2842484 A1 CA 2842484 C	29/05/2008 19/04/2012 29/05/2008 15/04/2014 29/05/2008 26/04/2016

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/065801

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CN 101588891 A	25/11/2009
		CN 101588891 B	10/04/2013
		CN 102677825 A	19/09/2012
		CN 102677825 B	15/04/2015
		EP 2094434 A2	02/09/2009
		EP 2094434 A4	28/08/2013
		EP 2094434 B1	01/02/2017
		EP 3181287 A1	21/06/2017
		HK 1176099 A1	26/02/2016
		MX 2009005318 A	09/07/2009
		NZ 577877 A	27/04/2012
		NZ 598794 A	27/09/2013
		RU 2009-123475 A	27/12/2010
		RU 2427458 C2	27/08/2011
		US 2008-0115448 A1	22/05/2008
		US 2008-0115449 A1	22/05/2008
		US 2011-0139644 A1	16/06/2011
		US 7891074 B2	22/02/2011
		US 7963392 B2	21/06/2011
		US 8640323 B2	04/02/2014
		US 8955679 B2	17/02/2015
		WO 2008-064307 A2	29/05/2008
		WO 2008-064307 A3	28/08/2008