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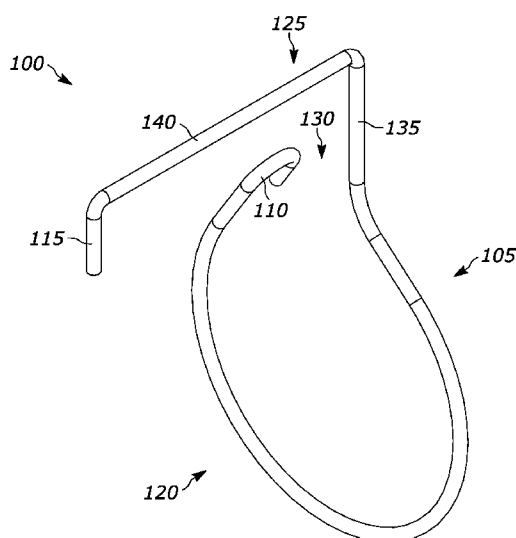


FIG. 1

(57) Abstract: A cable hanger includes a first end and a first section that extends from the first end. The first section includes a curved shape with an open perimeter. The cable hanger also includes a second section that extends from the first section. The second section includes a first portion and a second portion oriented perpendicular to the first portion. The cable hanger also includes a second end coupled to the second section. The second end is oriented perpendicularly with respect to the second portion. The second end has a width that can permit installation into the mounting structure without having to disassemble the mounting structure.



## Cable Hanger

### **Cross-Reference to Related Application:**

**[0001]** This application claims the benefit of U.S. Provisional Application No. 63/596,352, filed November 6, 2023, the entire contents are incorporated herein by reference in its entirety.

### **Field:**

**[0002]** The present disclosure relates to a cable hanger. More particularly, the present disclosure relates to a cable hanger sized to permit assembly without fully disassembling a system.

### **Background:**

**[0003]** Solar panel systems are installed with a mounting structure to support the various panels and other components. Electrical cables are also installed between the various panels and other components. Cable hangers for supporting these electrical cables were initially assembled with the system, and thus were mounted before assembly was complete.

**[0004]** Changing requirements for these cable hangers has necessitated the original hangers be replaced and new hangers be installed. However, this has proved challenging since the solar panel systems have already been assembled and are in use in the field. Current solutions require the system to be disconnected and disassembled to fit a new cable hanger. For example, current hangers may be shaped to receive a cotter pin. This shape may not be able to fit within the solar panel system unless the entire system is fully disassembled. The need therefore exists for a cable hanger than can be retrofitted into the existing solar panel system to permit easier installation.

**Summary:**

**[0005]** Various examples of the present disclosure can overcome various of the aforementioned and other disadvantages associated with known retrofitting cable hangers and offer new advantages as well.

**[0006]** According to one aspect of various examples of the present disclosure there is provided a cable hanger with a body that has a width that can permit insertion through a gap of a pre-assembled mounting structure.

**[0007]** According to one aspect of various examples of the present disclosure there is provided a cable hanger that is at least partially covered with a coating.

**[0008]** In some aspects, the coating reduces frictional wear from the cables contacting the cable hanger and/or the coating is insulative.

**[0009]** According to another aspect of various examples of the present disclosure, there is provided a cable hanger having a first end and a second end selectively connected to one another to form a closed perimeter for retaining cables.

**[0010]** According to another aspect of various examples of the present disclosure, there is provided a cable hanger having a first section for supporting at least one cable and a second portion. The second portion is disposed at least partially in a different plane than the first portion. The second portion having a width sized to fit within a preassembled mounting structure.

**[0011]** According to another aspect of various examples of the present disclosure, there is provided a cable hanger for being retrofitted to a mounting structure. The cable hanger includes a first portion that extends from a first end. The first portion has a rounded shape that can support a cable. The cable hanger also includes a second portion that extends between the first portion and a second end. The second portion has a first linear section and a second linear section angled relative to the first linear section. The second end is a linear section oriented perpendicularly with respect to the second linear end. A width of the second end can fit within a space of the mounting structure to permit retrofitting into a fully assembled mounting structure.

**[0012]** According to another aspect of various examples of the present disclosure, there is provided a cable hanger for being retrofitted to a mounting structure. The cable hanger includes a first end and a first section that extends from the first end. The first

section includes a curved shape with an open perimeter. The cable hanger also includes a second section that extends from the first section. The second section includes a first portion and a second portion oriented perpendicular to the first portion. The cable hanger also includes a second end coupled to the second section. The second end is oriented perpendicularly with respect to the second portion. The second end has a width that can permit installation into the mounting structure without having to disassemble the mounting structure.

**[0013]** According to another aspect of various examples of the present disclosure, there is provided a cable hanger for being retrofitted to a mounting structure. The cable hanger includes a first end and a first section that extends from the first end. The first section includes a curved shape with an open perimeter. The cable hanger also includes a second section that extends from the first section. The second section includes a first portion, a second portion inclined relative to the first portion, and a third portion disposed between the second portion and a second end. The third portion is oriented obliquely with respect to the second portion. The second end is oriented perpendicularly with respect to the third portion. The second end has a width that can permit installation into the mounting structure without having to disassemble the mounting structure.

**[0014]** According to another aspect of various examples of the present disclosure, there is provided a method of installing a cable hanger to a pre-assembled mounting structure.

**[0015]** According to another aspect of various examples of the present disclosure, there is provided a method for coating a cable hanger.

**[0016]** In some aspects, the coating reduces frictional wear from the cables contacting the cable hanger and/or the coating is insulative

**[0017]** According to another aspect of various examples of the present disclosure, there is provided a method for installing a cable hanger in a pre-assembled mounting structure, the method comprising: selecting a cable hanger from a plurality of cable hangers, the cable hanger having a first end and a second end spaced apart from the first end; positioning the second end proximate to a gap in the mounting structure, wherein a maximum width of the second end is less than a width of the gap; pivoting the cable hanger about a first axis and extending the second end through the gap; pivoting the

cable hanger about a second axis substantially perpendicular to the first axis to couple the second end to the mounting structure.

**[0018]** According to another aspect of various examples of the present disclosure, there is provided a method for installing a cable hanger in a pre-assembled mounting structure, the method includes selecting a cable hanger. The cable hanger has a first end and a second end spaced apart from the first end. The cable hanger also has a first section extending from the first end. The first section includes a curved shape with an open perimeter. The cable hanger also has a second section extending from the first section. The second section includes a first portion, a second portion oriented perpendicular to the first portion, and a third portion disposed between the second portion and the second end. The third portion is oriented obliquely with respect to the second portion. The method also includes positioning the second end proximate to a gap in the mounting structure, wherein a maximum width of the second end is less than a width of the gap. The method further includes pivoting the cable hanger about a first axis and extending the second end through the gap. Additionally, the method includes translating the third portion through the gap so that it extends toward the first end. Finally, the method includes securing the first end to the second end to form a closed perimeter.

**[0019]** The disclosure herein should become evident to a person of ordinary skill in the art given the following enabling description and drawings. The drawings are for illustration purposes only and are not drawn to scale unless otherwise indicated. The drawings are not intended to limit the scope of the disclosure. The following enabling disclosure is directed to one of ordinary skill in the art and presupposes that those aspects within the ability of the ordinarily skilled artisan are understood and appreciated.

#### **Brief Description of the Drawings:**

**[0020]** Various aspects and advantageous features of the present disclosure will become more apparent to those of ordinary skill when described in the detailed description of preferred examples and reference to the accompany drawing wherein:

**[0021]** FIG. 1 shows a perspective view of a cable hanger according to a first example.

**[0022]** FIG. 1A shows a perspective view of the cable hanger of FIG. 1 including a coating.

- [0023]** FIG. 2 shows a front view of the cable hanger of FIG. 1.
- [0024]** FIG. 3 shows a side view of the cable hanger of FIG. 1.
- [0025]** FIG. 4 shows a rear view of the cable hanger of FIG. 1.
- [0026]** FIG. 5 shows a perspective view of a cable hanger according to a second example.
- [0027]** FIG. 5A shows a perspective view of the cable hanger of FIG. 5 including a coating.
- [0028]** FIG. 6 shows a front view of the cable hanger of FIG. 5.
- [0029]** FIG. 7 shows a side view of the cable hanger of FIG. 5.
- [0030]** FIG. 8 shows a rear view of the cable hanger of FIG. 5.
- [0031]** FIG. 9 shows a perspective view of a cable hanger according to a third example.
- [0032]** FIG. 9A shows a perspective view of the cable hanger of FIG. 9 including a coating.
- [0033]** FIG. 10 shows a first side view of the cable hanger of FIG. 9.
- [0034]** FIG. 11 shows a second side view of the cable hanger of FIG. 9.
- [0035]** FIG. 12 shows a front view of the cable hanger of FIG. 9.
- [0036]** FIG. 13 shows a top view of the cable hanger of FIG. 9.
- [0037]** FIG. 14 shows a first step in installing the cable hanger of FIG. 1.
- [0038]** FIG. 15 shows a second step in installing the cable hanger of FIG. 1.
- [0039]** FIG. 16 shows a third step in installing the cable hanger of FIG. 1.
- [0040]** FIG. 17 shows a fourth step in installing the cable hanger of FIG. 1.
- [0041]** FIG. 18 shows a first step in installing the cable hanger of FIG. 5.
- [0042]** FIG. 19 shows a second step in installing the cable hanger of FIG. 5.
- [0043]** FIG. 20 shows a third step in installing the cable hanger of FIG. 5.
- [0044]** FIG. 21 shows a fourth step in installing the cable hanger of FIG. 5.
- [0045]** FIG. 22 shows a first step in installing the cable hanger of FIG. 9.
- [0046]** FIG. 23 shows a second step in installing the cable hanger of FIG. 9.
- [0047]** FIG. 24 shows a third step in installing the cable hanger of FIG. 9.
- [0048]** FIG. 25 shows a fourth step in installing the cable hanger of FIG. 9.

**Detailed Description:**

**[0049]** A cable hanger may be used to support cables (e.g., electrical conductors) above the ground and across a pre-determined span. The cable hanger may be constructed from an at least partially rigid material to support a weight of the cables and limit movement of the cable hanger.

**[0050]** FIGS. 1 to 4 illustrate a first cable hanger 100 that can be used to support one or more electrical conductors (not shown). The illustrated cable hanger 100 may be constructed as a unitary piece, although in other examples, two or more sections may be connected together. The hanger 100 may be constructed from an at least partially rigid material (e.g., metal, plastic, etc.).

**[0051]** The cable hanger 100 includes a body 105 having a first end 110 and a second end 115. The first and second ends 110, 115 may be disposed at opposite ends of the body 105, although the first and second ends 110, 115 may not be diametrically opposed. In other words, the body 105 may be shaped so that the first end 110 is closer to the second end 115 than to other portions of the body 105.

**[0052]** In some forms, the first end 110 may be curved and include a substantial U-shape. For example, the first end 110 may be shaped like a hook. In other examples, the first end 110 may include another shape (e.g., a V-shape, an L-shape, etc.).

**[0053]** In some forms, the second end 115 may include a different shape than the first end 110. For example, the illustrated second end 115 may include a substantially L-shaped section. In other words, the second end 115 may be formed substantially at a right angle.

**[0054]** The cable hanger 100 may include a first section 120 and a second section 125 disposed between the first end 110 and the second end 115. The first section 120 may be disposed adjacent to the first end 110 and the second section 125 may be disposed adjacent to the second end 115. The first section 120 and the second section 125 may also be disposed adjacent to one another.

**[0055]** As shown in FIG. 3, the first section 120 may include a substantially curved shape. For example, the first section 120 may be C-shaped or substantially O-shaped. In other words, the first section 120 may not form a closed perimeter. A gap 130 may be

formed between the first end 110 and a junction between the first and second sections 120, 125.

**[0056]** As shown in FIGS. 2 and 4, the second section 125 may extend from the first section 120. The second section 125 may be substantially L-shaped. For example, the second section 125 includes a first portion 135 and a second portion 140 that are formed at substantial right angles. Although in other examples, the first and second portions 135, 140 may be formed at different angles with respect to one another.

**[0057]** In some forms, the second portion 140 extends between the first portion 135 and the second end 115. The illustrated second end 115 may be substantially parallel to the first portion 135 and may extend in the same direction as the first portion 135. For example, the second section 125 and the second end 115 may combine to form a substantially U-shaped structure.

**[0058]** In certain forms, the second portion 140 may have a length that is greater than a length of either the first portion 135 or the second end 115. For example, the first portion 135 may be longer than the second end 115 but shorter than the second portion 140. The total length of the second portion 140 may be greater than a combined length of the second end 115 and the first portion 135. However, other examples of the cable hanger 100 may be sized differently (e.g., the second portion 140 may have a shorter length than either the first portion 135 or the second end 115).

**[0059]** In certain forms, the first section 120 and the second section 125 may be disposed in different planes. For example, the first section 120 may be disposed in a first plane (e.g., entirely within the first plane). The second section 125 may be disposed at least partially in a second plane that intersects the first plane. The second plane may be oriented substantially perpendicularly with respect to the first plane, although other orientations may be used (e.g., obliquely oriented).

**[0060]** In one form, the first portion 135 of the second section 125 may extend from the first section 120 and may be positioned in both the first plane and the second plane. The second portion 140, which may be oriented perpendicularly to the first portion 135, may be disposed in the second plane. The second portion 140 may therefore extend away from the first section 120.



**[0061]** In one form, the first end 110 may be disposed at least partially in a different plane than the first section 120. For example, the first end 110 may extend at least partially in a direction opposite to the second portion 140 and may be situated at least partially on the second plane. The curved shaped of the first end 110 may orient the first end 110 so that it intersects with the second plane but does not lie entirely within the second plane.

**[0062]** In one form, the second end 115 may be disposed in the second plane with the first and second portions 135, 140. Because the second end 115 and the first portion 135 are substantially parallel to one another, they may be both disposed on the second plane. The second end 115 may also be disposed on a third plane that is parallel to the first plane because of being spaced apart from the first portion 135 by the second portion 140.

**[0063]** In some forms, the first portion 135 of the second section 125 may extend from the first section 120 at a position offset from a center of the first section 120. As illustrated in FIG. 3, an axis extending through a center of shape formed by the first section 120 is substantially parallel to, but offset from, the first portion 135.

**[0064]** As shown in FIG. 1A, at least a portion of the first cable hanger 100 may include a coating 150. The coating 150 may be an insulative material (e.g., vinyl). As described below, the coating 150 may be applied to portions of the body 105 where cables could rest in order to reduce wear to the insulation of the cables (e.g., along the first section 120). In other examples, the entire cable hanger 100 may be coated. The coating 150 may be substantially thin so that the thickness of the body 105 without coating similar to the thickness of the body 105 with coating 150. In other examples, a sleeve may replace the coating 150, which may be slid onto the first section 120. The sleeve may be fixed to the body 105 (e.g., using an adhesive, a heat seal, etc.).

**[0065]** FIGS. 5 to 8 illustrate a second cable hanger 200 that can be used to support one or more electrical conductors (not shown). The second cable hanger 200 may be substantially similar to the first cable hanger 100 and only some similarities and differences may be described below. Similar elements include the same reference number plus "100".

**[0066]** The illustrated cable hanger 200 may be constructed as a unitary piece, although in other examples, two or more sections may be connected together. The

hanger 100 may be constructed from an at least partially rigid material (e.g., metal, plastic, etc.).

**[0067]** The cable hanger 200 includes a body 205 having a first end 210 and a second end 215. The first and second ends 210, 215 may be disposed at opposite ends of the body 205, although the first and second ends 210, 215 may not be diametrically opposed. In other words, the body 205 may be shaped so that the first end 210 is closer to the second end 215 than to other portions of the body 205.

**[0068]** In some forms, the first end 210 may be curved and include a substantial U-shape. For example, the first end 210 may be shaped like a hook. In other examples, the first end 210 may include another shape (e.g., a V-shape, an L-shape, etc.).

**[0069]** In some forms, the second end 215 may include a different shape than the first end 210. For example, the illustrated second end 215 may include a substantially L-shaped section. In other words, the second end 215 may be formed substantially perpendicularly. Unlike the second end 115 in the first cable hanger 100, the second end 215 in the second cable hanger 200 may be curved (e.g., include a larger radius of curvature). Although the second end 115 of the first cable hanger 100 may also include a curve, the smaller radius of curvature in the first cable hanger 100 may more closely replicate a right angle, and the second end 215 of the second cable hanger 200 may be more curved.

**[0070]** The cable hanger 200 may include a first section 220 and a second section 225 disposed between the first end 210 and the second end 215. The first section 220 may be disposed adjacent to the first end 210 and the second section 225 may be disposed adjacent to the second end 215. The first section 220 and the second section 225 may also be disposed adjacent to one another.

**[0071]** As shown in FIG. 7, the first section 220 may include a substantially curved shape. For example, the first section 220 may be C-shaped or substantially O-shaped. In other words, the first section 220 may not form a closed perimeter. A gap 230 may be formed between the first end 210 and a junction between the first and second sections 220, 225.

**[0072]** As shown in FIGS. 6 and 8, the second section 225 may extend from the first section 220. The second section 225 may be substantially L-shaped. For example, the

second section 225 includes a first portion 235 and a second portion 240 that are formed at substantial right angles. Although in other examples, the first and second portions 235, 240 may be formed at different angles with respect to one another.

**[0073]** In some forms, the second portion 240 extends between the first portion 235 and the second end 215. The illustrated second end 215 may be substantially parallel to the first portion 235 and may extend in the same direction as the first portion 235. For example, the second section 225 and the second end 215 may combine to form a substantially U-shaped structure.

**[0074]** In certain forms, the substantially U-shaped structure formed between the second end 215 and the first portion 235 of the second cable hanger 200 may be different than the substantially U-shaped structure formed between the second end 115 and the first portion 135 first cable hanger 100. For example, the second cable hanger 200 may include a different transition between the first portion 235 and the second portion 240 as compared to between the second portion 240 and the second end 215. As described above, the second end 215 may include a larger radius of curvature than the transition between the first and second portions 235, 240.

**[0075]** In certain forms, the second portion 240 may have a length that is greater than a length of either the first portion 235 or the second end 215. For example, the first portion 235 may be longer than the second end 215 but shorter than the second portion 240. The total length of the second portion 240 may be greater than a combined length of the second end 215 and the first portion 235. However, other examples of the cable hanger 200 may be sized differently (e.g., the second portion 240 may have a shorter length than either the first portion 235 or the second end 215).

**[0076]** In one form, a distance between the first portion 235 and the second end 215 in the second cable hanger 200 may be the same as a distance between the first portion 135 and the second end 115 in the first cable hanger 100. In this situation, the second portion 240 of the second cable hanger 200 may be shorter than the second portion 140 of the first cable hanger 100 because the larger radius of curvature of the second end 215 provides the additional length.

**[0077]** In one form, a distance between the first portion 235 and the second end 215 in the second cable hanger 200 may be greater than a distance between the first portion

135 and the second end 115 in the first cable hanger 100. In this situation, the second portion 240 of the second cable hanger 200 may be the same length as the second portion 140 of the first cable hanger 100. The larger radius of the second end 215 may extend the overall length of the second section 225.

**[0078]** In certain forms, the first section 220 and the second section 225 may be disposed in different planes. For example, the first section 220 may be disposed in a first plane (e.g., entirely within the first plane). The second section 225 may be disposed at least partially in a second plane that intersects the first plane. The second plane may be oriented substantially perpendicularly with respect to the first plane, although other orientations may be used (e.g., obliquely oriented).

**[0079]** In one form, the first portion 235 of the second section 225 may extend from the first section 220 and may be position in both the first plane and the second plane. The second portion 240, which may be oriented perpendicularly to the first portion 235, may be disposed in the second plane. The second portion 240 may therefore extend away from the first section 220.

**[0080]** In one form, the first end 210 may be disposed at least partially in a different plane than the first section 220. For example, the first end 210 may extend at least partially in a direction opposite to the second portion 240 and may be situated at least partially on the second plane. The curved shaped of the first end 210 may orient the first end 210 so that it intersects with the second plane but does not lie entirely within the second plane.

**[0081]** In one form, the second end 215 may be disposed in the second plane with the first and second portions 235, 240. Because the second end 215 and the first portion 235 are substantially parallel to one another, they may be both disposed on the second plane. The second end 215 may also be disposed on a third plane that is parallel to the first plane because of being spaced apart from the first portion 235 by the second portion 240.

**[0082]** In some forms, the first portion 235 of the second section 225 may extend from the first section 220 at a position offset from a center of the first section 220. As illustrated in FIG. 7, an axis extending through a center of shape formed by the first section 220 is substantially parallel to, but offset from, the first portion 235.

**[0083]** As shown in FIG. 5A, at least a portion of the second cable hanger 200 may include a coating 250. The coating 250 may be an insulative material (e.g., vinyl). As described below, the coating 250 may be applied to portions of the body 205 where cables could rest in order to reduce wear to the insulation of the cables (e.g., along the first section 220). In other examples, the entire cable hanger 200 may be coated. The coating 250 may be substantially thin so that the thickness of the body 205 without coating is substantially similar to the thickness of the body 205 with coating. In other examples, a sleeve may replace the coating 250, which may be slid onto the first section 220. The sleeve may be fixed to the body 205 (e.g., using an adhesive, a heat seal, etc.).

**[0084]** FIGS. 9 to 13 illustrate a third cable hanger 300 that can be used to support one or more electrical conductors (not shown). The third cable hanger 300 may be substantially similar to the first cable hanger 100 and only some similarities and differences may be described below. Similar elements include the same reference number plus “200”.

**[0085]** The illustrated cable hanger 300 may be constructed as a unitary piece, although in other examples, two or more sections may be connected together. The hanger 300 may be constructed from an at least partially rigid material (e.g., metal, plastic, etc.).

**[0086]** The cable hanger 300 includes a body 305 having a first end 310 and a second end 315. The first and second ends 310, 315 may be disposed at opposite ends of the body 305, although the first and second ends 310, 315 may not be diametrically opposed. In other words, the body 305 may be shaped so that the first end 310 is closer to the second end 315 than to other portions of the body 305.

**[0087]** In some forms, the first end 310 may be curved and include a substantial U-shape. For example, the first end 310 may be shaped like a hook. In other examples, the first end 310 may include another shape (e.g., a V-shape, an L-shape, etc.).

**[0088]** In some forms, the second end 315 may include a different shape than the first end 310. For example, the illustrated second end 115 may include a substantially L-shaped section. In other words, the second end 315 may be formed substantially at a right angle.

**[0089]** The cable hanger 300 may include a first section 320 and a second section 325 disposed between the first end 310 and the second end 315. The first section 320 may be disposed adjacent to the first end 310 and the second section 325 may be disposed adjacent to the second end 315. The first section 320 and the second section 325 may also be disposed adjacent to one another.

**[0090]** As shown in FIGS. 9 to 11, the first section 320 may include a substantially curved shape. For example, the first section 320 may be C-shaped or substantially O-shaped. In other words, the first section 320 may not form a closed perimeter. A gap 330 may be formed between the first end 310 and a junction between the first and second sections 320, 325.

**[0091]** As shown in FIGS. 9 to 12, the second section 325 may extend from the first section 320. The second section 325 may be at least partially L-shaped. For example, the second section 325 includes a first portion 335 and a second portion 340 that are formed at substantial right angles. Although in other examples, the first and second portions 335, 340 may be formed at different angles with respect to one another.

**[0092]** As shown in FIG. 13, the second section 325 of the third cable hanger 300 may further include a third portion 343 that extends from the second portion 340. For example, the second portion 340 may be formed between the first and third portions 335, 343. The third portion 343 may be formed on a substantially common plane as the second portion 340 but may be obliquely formed relative to the second portion 340.

**[0093]** In certain forms, the second portion 340 may be angled to extend at least partially away from the first end 310. For example, the second portion 340 may extend out of plane with the first section 320 and the second portion 340 does not extend directly toward the first end 310. The third portion 343 may be angled relative to the second portion 340 and may form a substantially concave shape with respect to the first end 310. In the illustrated example, the third portion 343 may extend at least partially back toward the first end 310 (e.g., a slope of the third portion 343 may be less than a slope of the second portion 340 as viewed in FIG. 13).

**[0094]** In some forms, the third portion 343 extends between the second portion 340 and the second end 315. The illustrated second end 315 may be substantially parallel to the first portion 335. As shown in FIGS. 9 and 10, the second end 315 may extend in the

opposite direction as the as the first portion 335. For example, the second section 325 and the second end 315 may combine to form a substantially Z-shaped or N-shaped structure (e.g., as viewed in FIG. 10).

**[0095]** In certain forms, the second portion 340 and the third portion 343 may have a combined length that is greater than a length of either the first portion 335 or the second end 315. For example, the first portion 335 may be longer than the second end 315 but shorter than the second portion 340. The total length of the second portion 340 and the third portion 343 may be greater than a combined length of the second end 315 and the first portion 335. However, other examples of the cable hanger 300 may be sized differently (e.g., the combined length of the second portion 340 and the third portion 343 may have a shorter length than either the first portion 335 or the second end 315).

**[0096]** In one form, the second portion 340 and the third portion 343 may be approximately the same length. However, in other examples, the second portion 340 may be longer or shorter than the third portion 343.

**[0097]** In one form, the first portion 335 may be approximately the same length as the second portion 340 and/or the third portion 343. However, in other examples, the first portion 335 may be longer or shorter than at least one of the second portion 340 or the third portion 343.

**[0098]** In certain forms, the first section 320 and the second section 325 may be disposed in different planes. For example, the first section 320 may be disposed in a first plane (e.g., entirely within the first plane). The second section 325 may be disposed at least partially in a second plane that intersects the first plane. The second plane may be oriented substantially perpendicularly with respect to the first plane, although other orientations may be used (e.g., obliquely oriented).

**[0099]** In one form, the first portion 335 of the second section 325 may extend from the first section 320 and may be position in the first plane. The second portion 340, which may be oriented perpendicularly to the first portion 335, may be disposed in the second plane. The second portion 340 may therefore extend away from the first section 320. The third section 343, although oriented obliquely with respect to the second section 340, the third section 343 may be situation on the second plane.

**[0100]** In one form, the second portion 340, oriented on the second plane, may be oriented obliquely with respect to the first plane. This may be illustrated in FIG. 13 where the second portion 340 is oriented obliquely with respect to the first section 320.

**[0101]** In one form, the first end 310 may be disposed at least partially in a different plane than the first section 320. For example, the first end 310 may extend at least partially in a direction opposite to the second portion 340 and may be situated at least partially on the first plane.

**[0102]** In one form, the second end 315 may not be disposed in the second plane with the second and third portions 340, 343. The second end 315 may extend out of the second plane in an opposite direction as the first portion 335.

**[0103]** In some forms, the first portion 335 of the second section 325 may extend from the first section 320 at a position offset from a center of the first section 320. As illustrated in FIGS. 9 and 10, an axis extending through a center of shape formed by the first section 320 is substantially parallel to, but offset from, the first portion 335.

**[0104]** As shown in FIG. 9A, at least a portion of the third cable hanger 300 may include a coating 350. The coating 350 may be an insulative material (e.g., vinyl). As described below, the coating 350 may be applied to portions of the body 305 where cables could rest in order to reduce wear to the insulation of the cables (e.g., along the first section 320). In other examples, the entire cable hanger 300 may be coated. The coating 350 may be substantially thin so that the thickness of the body 305 without coating is substantially similar to the thickness of the body 305 with coating. In other examples, a sleeve may replace the coating 350, which may be slid onto the first section 320. The sleeve may be fixed to the body 305 (e.g., using an adhesive, a heat seal, etc.).

**[0105]** Any of the cable hangers 100, 200, 300 may be used with a support structure 500. The support structure 500 may be a support structure for a solar panel system, although the cable hangers 100, 200, 300 may be used with any support structure. For example, FIG. 14 illustrates a support structure having a first brace 505 and a second brace 510. The first and second braces 505, 510 may be connected by a support 515 which may space the first brace 505 from the second brace 510. A bracket 520 may be disposed between the first and second braces 505, 510. A gap 525 may also exist between the bracket 520 and the support 515.



**[0106]** With continued reference to FIG. 14, the support structure 500 may be assembled before a cable hanger 100, 200, 300 is connected. The cable hanger 100, 200, 300 is therefore sized and shaped to connect to the support structure 500 without having to disassemble the support structure 500. In other words, the cable hanger 100, 200, 300 may be configured to retrofit to an existing support structure 500 (e.g., solar panel support structure)

**[0107]** To assemble the first cable hanger 100, the second section 125 may be positioned so that it contacts or is in close proximity to the first brace 505. Specifically, the second section 125 may be positioned so that the second end 115 is positioned proximate to the gap 525 between the bracket 520 and the support 515. In this orientation, the second portion 140 of the second section 125 may at least partially contact a surface of the first brace 505. The first section 120 may be spaced apart from the first brace 505 to avoid interference.

**[0108]** The width of the second end 115 (or the cable hanger 100 as a whole) may be less than the width of the gap 525. This may enable at least a portion of the cable hanger 100 to be received within the gap 525.

**[0109]** In the illustrated example, the first portion 135 of the second section 125 may be spaced apart from the surface of the first brace 505 because of the orientation of the first cable hanger 100. However, other orientations of the first cable hanger 100 may permit contact between the first brace 505 and the first portion 135.

**[0110]** As shown in FIG. 15, the first cable hanger 100 may be pivoted about the support 515 so that the first section 120 moves from one side of the support 515 to the other side of the support 515. For example, the second end 115 may hook around the support 515 to at least partially retain the position of the first cable hanger 100 during the pivoting movement. By this pivoting movement, the second end 115 may move into the gap 525 and be at least partially positioned between the bracket 520 and the support 515.

**[0111]** As shown in FIG. 16, the first cable hanger 100 may pivot until the second portion 140 is substantially parallel with an edge of the bracket 520. The second portion 140 may also be in contact with the surface of the first brace 105.

**[0112]** In this position, the above described second plane may be parallel to or coplanar with the surface of the first brace 505. The first plane may be perpendicular to the edge of the bracket 520.

**[0113]** In some forms, the cable hanger 100 may be at least partially positioned through the gap 525. For example, the second end 115 may be moved entirely through the gap 525 so that the second portion 140 is received within the gap 525. The width of the second section 140 may also be less than a width of the gap 525 to permit movement between the brace 520 and the support 515.

**[0114]** As shown in FIG. 17, the cable hanger 100 may continue to move through the gap 525 until the first portion 135 contacts an edge of the first brace 505. This contact provides a stop surface to limit further translational movement of the cable hanger 100 through the gap 525 (e.g., which may space the first section 120 apart from the first brace 505). In this position, the second end 115 may extend beyond an opposite edge of the first brace 505. The cable hanger 100 may be rotated (e.g., 90 degrees shown) so that the second end 115 contacts (or is in close proximity to) the opposite edge of the first brace 505.

**[0115]** In this position, the first brace 505 may be retained between the first portion 135 and the second end 115. The length of the second portion 140 may be approximately the width of the first brace 505 to permit the first portion 135 and the second end 115 to be disposed on either side. This may limit translational movement of the cable hanger 100 through the gap 525 in this in-use position. The second portion 140 resting against the upper surface of the first brace 505 may also limit translational movement toward the ground (e.g., support the cable hanger 100, and any supported cables, against the force of gravity).

**[0116]** Once in the in-use position of FIG. 17, the first section 120 may be oriented so that the gap 130 is positioned at a superior end. Cables (not shown) may be fit through the gap 130 and positioned against the inner perimeter of the first section 120. Contact between the second portion 140 and the first brace 505 may support the weight of the cables. Additionally, the material of the first cable hanger 100 may resist deformation as a result of supporting the cables and may provide further support.

**[0117]** As described above in FIG. 1A, some forms of the cable hanger 100 may include a coating 150 (e.g., an insulative coating). For example, at least the first section 120 of the cable hanger 100 may be coated with a material to minimize wear between the cables and the cable hanger 100. In other examples, the entire cable hanger 100 (including the first section 120) may be coated.

**[0118]** Because the first section 120 may not be inserted through the gap 525, the width added by the coating 150 may not substantially impair the installation of the cable hanger 100.

**[0119]** As shown in FIGS. 18 to 21, the second cable hanger 200 may be installed in substantially the same way as the first cable hanger 100. The specific installation process is therefore not repeated for the sake of brevity.

**[0120]** As described in FIG. 5, the second end 215 of the second cable hanger 200 may be more rounded than the second end 115 of the first cable hanger 100. This more rounded end may enable smooth insertion through the gap 525 (e.g., FIGS. 18 to 20) and may interface with a first brace 505 having a rounded edge. A user may therefore select between the first cable hanger 100 and the second cable hanger 200 based in part on the shape of the first brace 505.

**[0121]** Some forms of the second cable hanger 200 may include a coating 250 on at least a portion of the body 205 (see e.g., FIG. 5A). For example, the coating 250 may be applied to the first section 220 (e.g., where the cables contact the body 205). In other examples, the coating 250 may be applied to the entire surface of the body 205. Because the installation process is similar with the cable hanger 100, the coating 250 on the first section 220 may not substantially impair the installation of the cable hanger 200.

**[0122]** As shown in FIGS. 22 to 25, the third cable hanger 300 may be installed in a similar way as the first cable hanger 100 and the second cable hanger 200. Only some similarities and differences are described below.

**[0123]** To assemble the third cable hanger 300, the second section 325 may be positioned so that it contacts or is in close proximity to the first brace 505. Specifically, the second section 325 may be positioned so that the second end 315 is positioned proximate to the gap 525 between the bracket 520 and the support 515.

**[0124]** For example, the third cable hanger 300 may be positioned so that the transition between the second end 315 and the third portion 343 is disposed against the upper surface of the first brace 505. The second and third portions 340, 343 may therefore extend away from the upper surface of the first brace 505.

**[0125]** The width of the second end 315 (or the cable hanger 300 as a whole) may be less than the width of the gap 525. This may enable at least a portion of the cable hanger 300 to be received within the gap 525.

**[0126]** As shown in FIG. 23, the third cable hanger 300 may be pivoted toward the first brace 505 so that the second and third portions 340, 343 move toward the upper surface of the first brace 505. As part of this movement, the cable hanger 300 may translate so that the second end 315 moves at least partially through the gap 525 (e.g., the illustrated second end 315 moves entirely through the gap 525 and at least a portion of the third portion 343 moves through the gap 525).

**[0127]** In some forms, this movement illustrated between FIGS. 22 and 23 causes the first section 320 to move from being superior to the first brace 505 to at least partially inferior to the first brace 505. More particularly, the orientation of the gap 330 changes from facing the first brace 505 to facing the second brace 510.

**[0128]** In this position, the above described second plane may be parallel to or coplanar with the surface of the first brace 505. The first plane may be perpendicular to the edge of the bracket 520.

**[0129]** As shown in FIG. 24, the cable hanger 300 may continue to move through the gap 525 until the first portion 335 contacts an edge of the first brace 505. This contact provides a stop surface to limit further translational movement of the cable hanger 300 through the gap 525 (e.g., which may space the first section 320 apart from the first brace 505). In this position, the second end 315 may extend beyond an opposite edge of the first brace 505.

**[0130]** In some forms, a transition between the second and third portions 340, 343 may be disposed proximate to the support 515. The oblique inclination between the second and third portions 340, 343 may permit the third portion 343 to extend toward the first end 310.

**[0131]** Once in the in-use position of FIG. 24, the first section 320 may be oriented so that the gap 330 is positioned at a superior end. Cables (not shown) may be fit through the gap 330 and positioned against the inner perimeter of the first section 320. Contact between the second and third portions 340, 343 and the first brace 505 may support the weight of the cables. Additionally, the material of the third cable hanger 300 may resist deformation as a result of supporting the cables and may provide further support.

**[0132]** Some forms of the third cable hanger 300 may include a coating 350 on at least a portion of the body 305 (see e.g., FIG. 9A). For example, the coating 350 may be applied to the first section 320 (e.g., where the cables contact the body 305). In other examples, the coating 350 may be applied to the entire surface of the body 305. The coating 350 may not substantially impair the installation of the cable hanger 300.

**[0133]** Once the cables are supported by the first section 320, the first end 310 may be moved toward the second end 320. As shown in FIG. 25, the hook of the first end 310 may pass over the third portion 343 proximate to the second end 315. A resilient material of the cable hanger 300 may bias the cable hanger 300 to its original position (see e.g., FIG. 9) and may therefore lock the first end 310 to the second end 315. This position may form a substantially closed perimeter and may therefore limit the removal of the cables from the cable hanger 300.

**[0134]** In this position, the first brace 505 may be retained between the first portion 135 and the first section 320 via its connection to the third portion 343 by the first end 310. A length between the second end 315 and the transition between the first and second portions 335, 340 may be approximately the width of the first brace 505 to permit the first portion 335 and the second end 315 to be disposed on either side. This may limit translational movement of the cable hanger 100 through the gap 525 in this in-use position. The second and third portions 340, 343 resting against the upper surface of the first brace 505 may also limit translational movement toward the ground (e.g., support the cable hanger 300, and any supported cables, against the force of gravity).

**[0135]** One of ordinary skill will appreciate that the exact dimensions and materials are not critical to the disclosure and all suitable variations should be deemed to be within the scope of the disclosure if deemed suitable for carrying out the objects of the disclosure.

**[0136]** One of ordinary skill in the art will also readily appreciate that it is well within the ability of the ordinarily skilled artisan to modify one or more of the constituent parts for carrying out the various examples of the disclosure. Once armed with the present specification, routine experimentation is all that is needed to determine adjustments and modifications that will carry out the present disclosure.

**[0137]** The above examples are for illustrative purposes and are not intended to limit the scope of the disclosure or the adaptation of the features described herein. Those skilled in the art will also appreciate that various adaptations and modifications of the above-described preferred examples can be configured without departing from the scope and spirit of the disclosure. Therefore, it is to be understood that, within the scope of the appended claims, the disclosure may be practiced other than as specifically described.

## CLAIMS

What is claimed is:

1. A method for installing a cable hanger in a pre-assembled mounting structure, the method comprising:
  - selecting a cable hanger from a plurality of cable hangers, the cable hanger having a first end and a second end spaced apart from the first end;
  - positioning the second end proximate to a gap in the mounting structure, wherein a maximum width of the second end is less than a width of the gap;
  - pivoting the cable hanger about a first axis and extending the second end through the gap;
  - pivoting the cable hanger about a second axis substantially perpendicular to the first axis to couple the second end to the mounting structure.
2. The method of claim 1, wherein the cable hanger includes a first section coupled to the first end and a second section coupled to the second end, and wherein the cable hanger is formed as a unitary piece.
3. The method of claim 2, wherein the first section is disposed in a first plane and the second section is disposed at least partially in a second plane oriented perpendicular to the first plane.
4. The method of claim 2, wherein the second end is perpendicular with respect to the second portion.
5. The method of claim 1, further comprising translating the second portion through the gap after pivoting the cable hanger about the first axis.
6. The method of claim 1, further comprising applying a coating to at least a portion of the cable hanger, the coating is configured to reduce fictional wear.
7. A cable hanger for being retrofitted to a mounting structure, the cable hanger comprising:
  - a first portion extending from a first end, the first portion having a rounded shape configured to support a cable;

a second portion extending between the first portion and a second end, the second portion having a first linear section and a second linear section angled relative to the first linear section;

wherein the second end is a linear section oriented perpendicularly with respect to the second linear end;

wherein a width of the second end is configured to fit within a space of the mounting structure to permit retrofitting into a fully assembled mounting structure.

8. The cable hanger of claim 7, wherein the first linear section and the second linear section are oriented perpendicularly with respect to one another.

9. The cable hanger of claim 8, wherein the second end and the first linear section are parallel to one another.

10. The cable hanger of claim 7, wherein a curved transition extends between the second end and the second linear section.

11. The cable hanger of claim 7, wherein the first end includes a hook, and wherein the hook is configured to selectively connect to the second end.

12. The cable hanger of claim 7, wherein at least a portion of the first portion includes a coating configured to reduce frictional wear.

13. A cable hanger for being retrofitted to a mounting structure, the cable hanger comprising:

a first end;

a first section extending from the first end, wherein the first section includes a curved shape with an open perimeter;

a second section extending from the first section, the second section including a first portion and a second portion oriented perpendicular to the first portion;

a second end coupled to the second section, the second end oriented perpendicularly with respect to the second portion;

wherein the second end has a width configured to permit installation into the mounting structure without having to disassemble the mounting structure.

14. The cable hanger of claim 13, wherein the second end is parallel to the first portion.



15. The cable hanger of claim 14, wherein the second end extends in the opposite direction from the first portion.
16. The cable hanger of claim 13, wherein the second section further includes a third portion disposed between the second portion and the second end, wherein the third portion is oriented obliquely with respect to the second portion.
17. The cable hanger of claim 13, wherein the first section is disposed in a first plane and the second section is disposed at least partially in a second plane oriented perpendicular with respect to the first plane.
18. The cable hanger of claim 13, wherein at least a portion of the first section includes a coating configured to reduce frictional wear.
19. A method for installing a cable hanger in a pre-assembled mounting structure, the method comprising:
- selecting a cable hanger including,
    - a first end and a second end spaced apart from the first end,
    - a first section extending from the first end, wherein the first section includes a curved shape with an open perimeter;
    - a second section extending from the first section, the second section including a first portion, a second portion oriented perpendicular to the first portion, and a third portion disposed between the second portion and the second end, wherein the third portion is oriented obliquely with respect to the second portion;
  - positioning the second end proximate to a gap in the mounting structure, wherein a maximum width of the second end is less than a width of the gap;
  - pivoting the cable hanger about a first axis and extending the second end through the gap;
  - translating the third portion through the gap so that it extends toward the first end; and
  - securing the first end to the second end to form a closed perimeter.
20. The method of claim 19, wherein the cable hanger is formed as a unitary piece.
21. The method of claim 19, wherein the first section is disposed in a first plane and the second section is disposed at least partially in a second plane oriented perpendicular to the first plane.

22. The method of claim 19, wherein the second end is perpendicular with respect to the third portion.
23. The method of claim 19, further comprising applying a coating to at least a portion of the cable hanger, the coating is configured to reduce frictional wear.
24. A cable hanger for being retrofitted to a mounting structure, the cable hanger comprising:
- a first end;
  - a first section extending from the first end, wherein the first section includes a curved shape with an open perimeter; and
  - a second section extending from the first section, the second section including a first portion, a second portion inclined relative to the first portion, and a third portion disposed between the second portion and a second end, wherein the third portion is oriented obliquely with respect to the second portion;
- wherein the second end is oriented perpendicularly with respect to the third portion; and
- wherein the second end has a width configured to permit installation into the mounting structure without having to disassemble the mounting structure.
25. The cable hanger of claim 24, wherein the second end is parallel to the first portion.
26. The cable hanger of claim 25, wherein the second end extends in the opposite direction from the first portion.
27. The cable hanger of claim 24, wherein the first section is disposed in a first plane and the second section is disposed at least partially in a second plane oriented perpendicular with respect to the first plane.
28. The cable hanger of claim 24, wherein at least a portion of the first section includes a coating configured to reduce frictional wear.
29. The cable hanger of claim 24, wherein the first end includes a hook, wherein the hook is configured to removably contact the third portion proximate to the second end to form a closed perimeter.

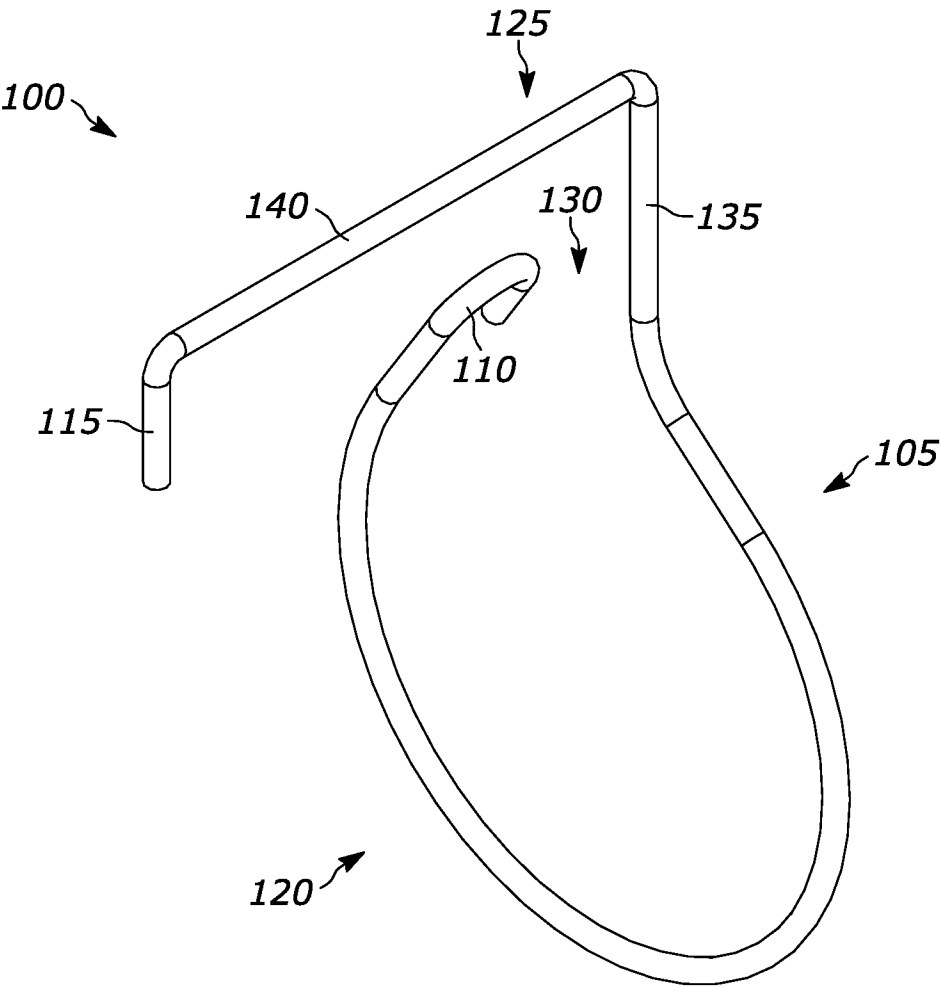


FIG. 1

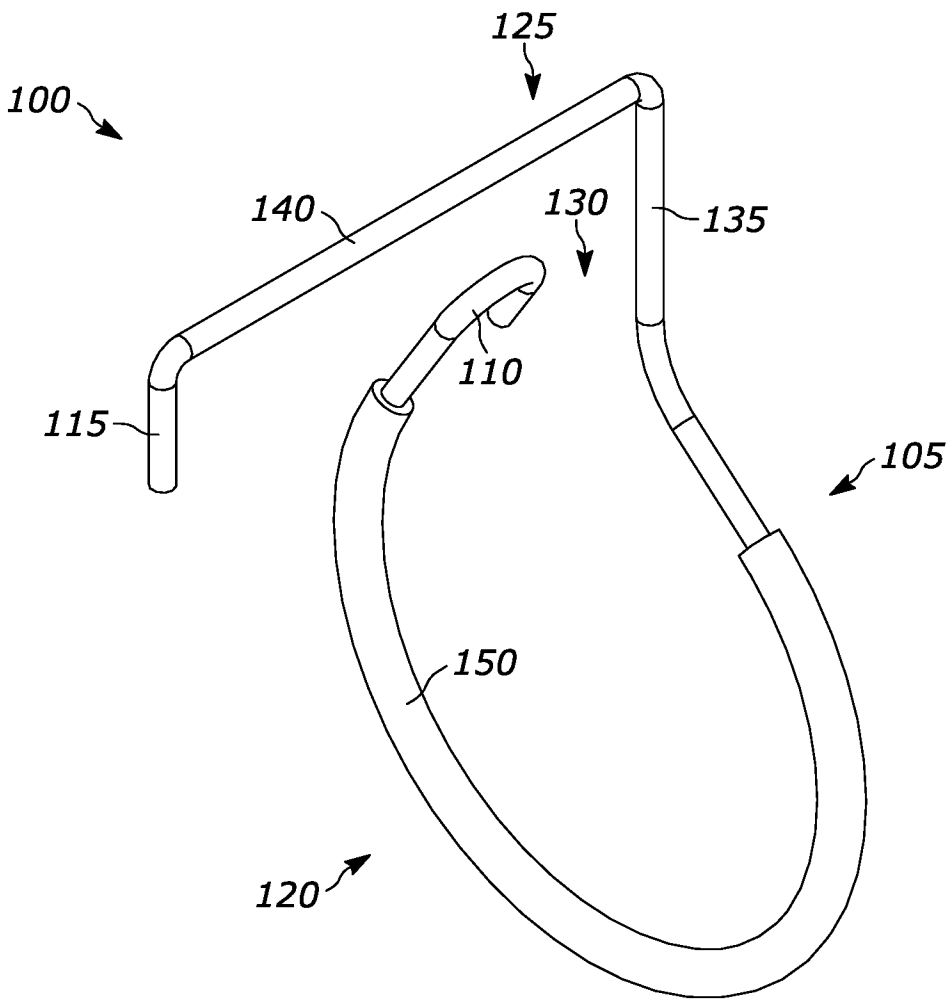


FIG. 1A

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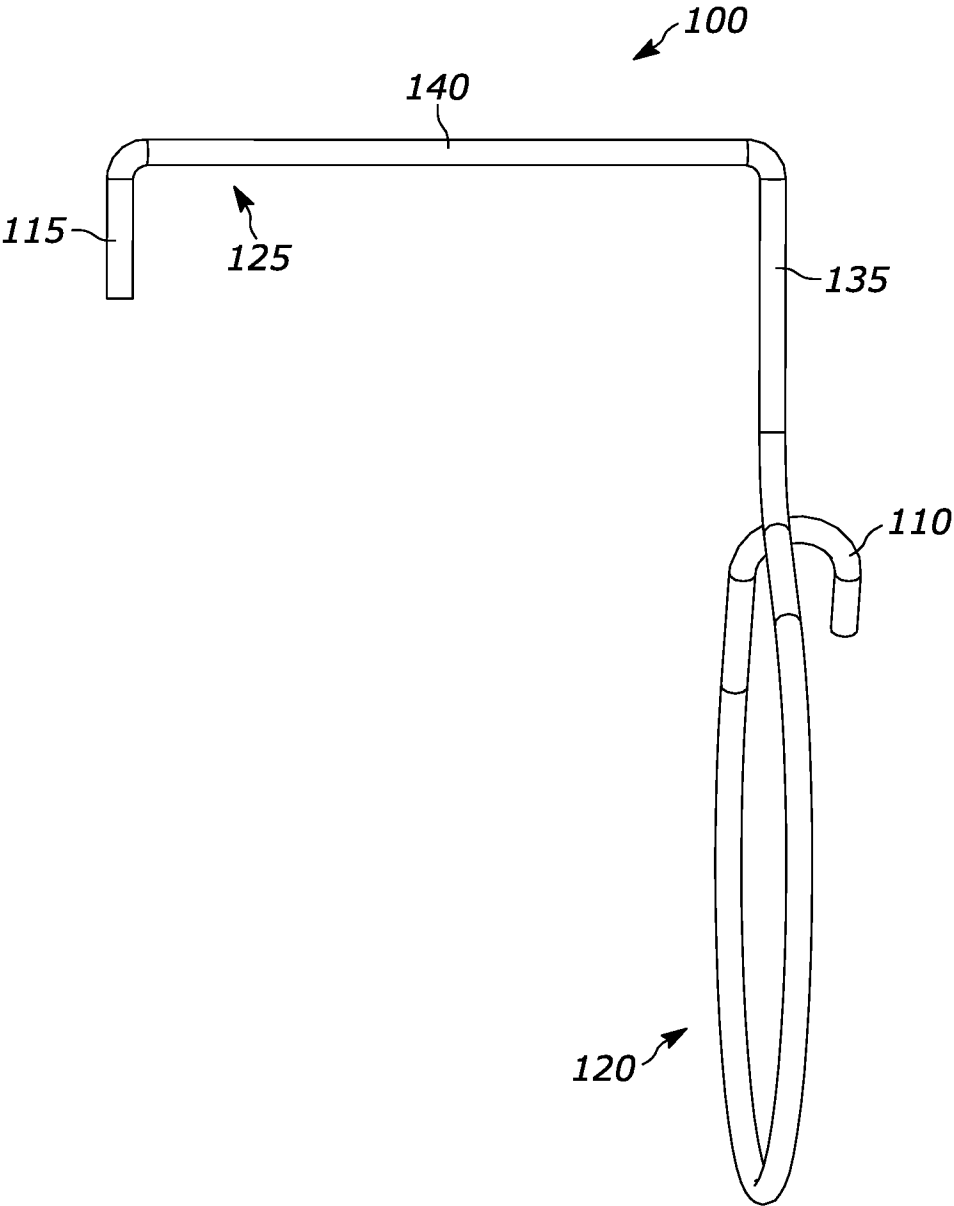


FIG. 2

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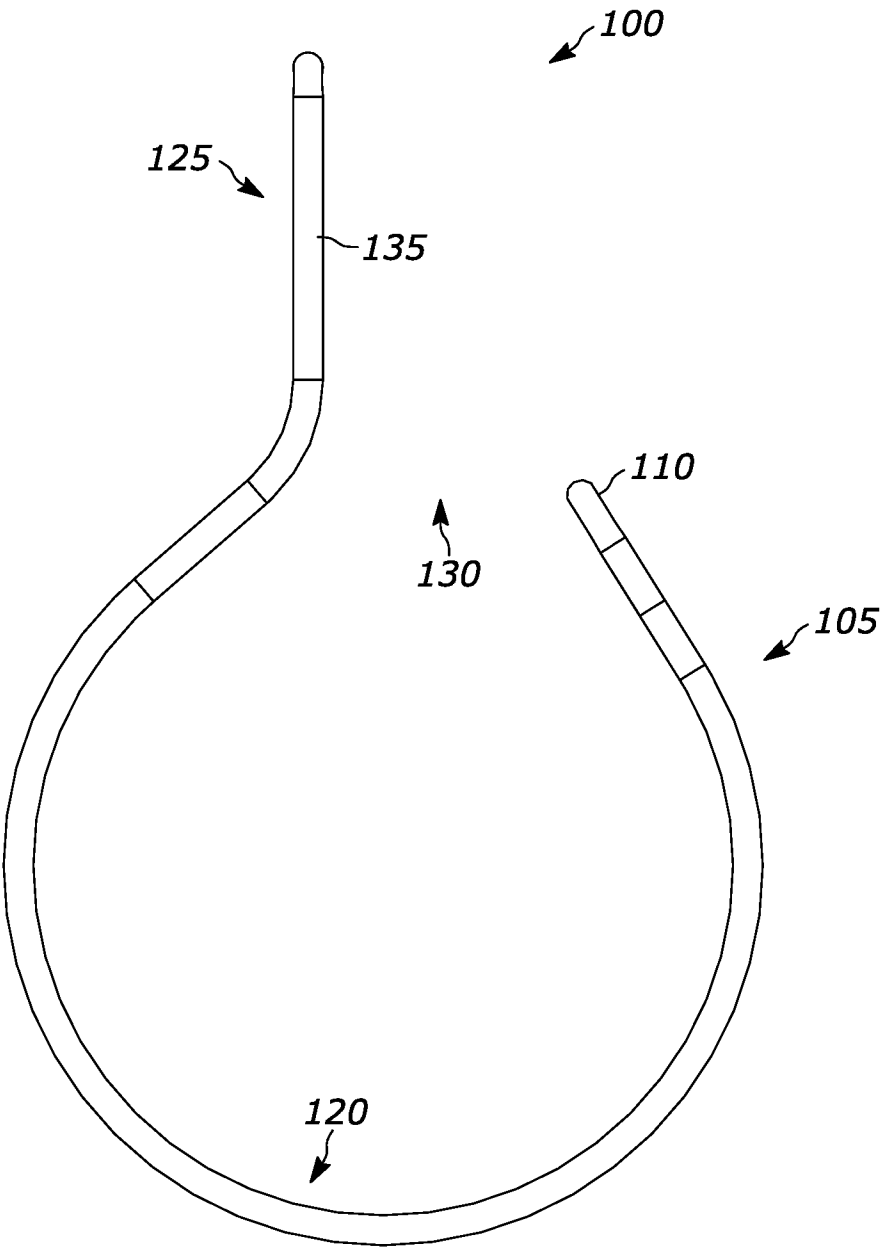


FIG. 3

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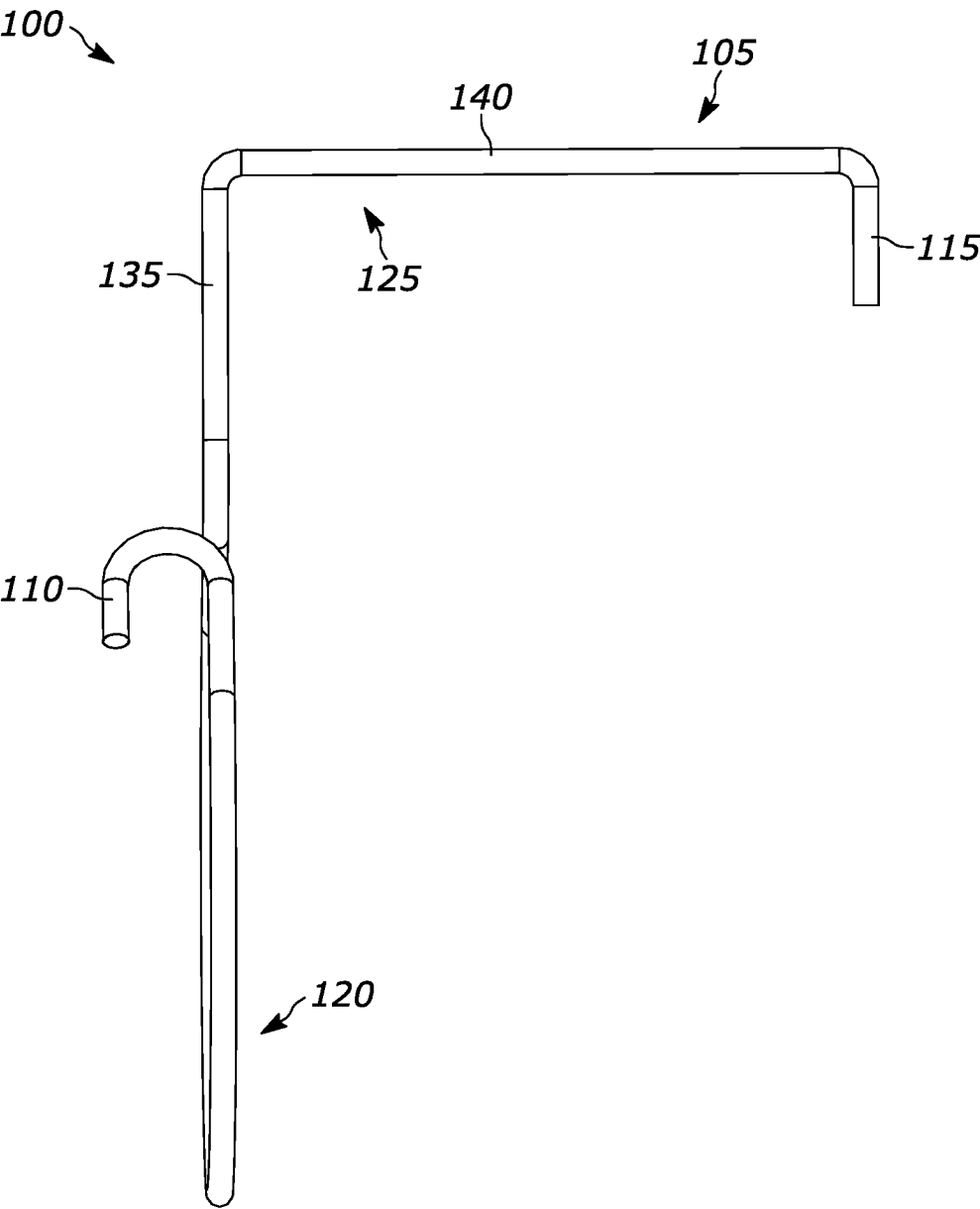


FIG. 4

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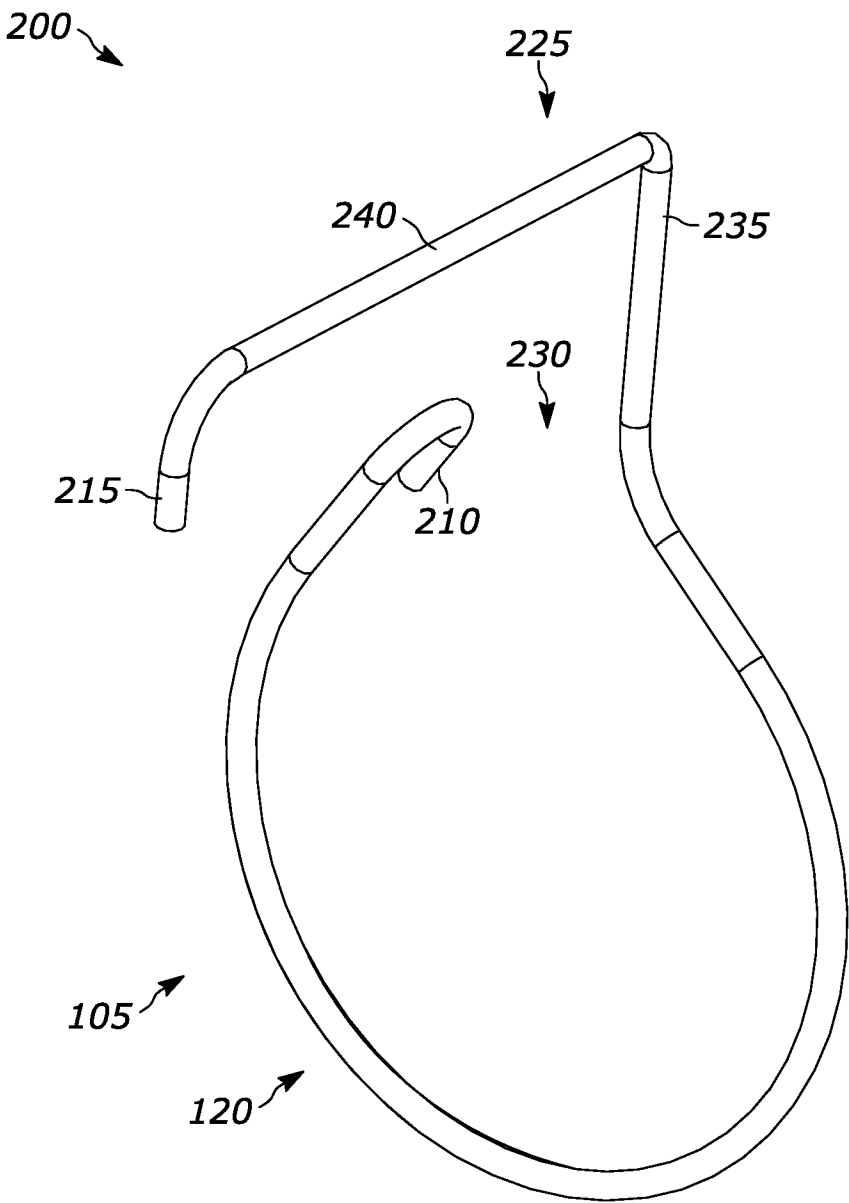


FIG. 5



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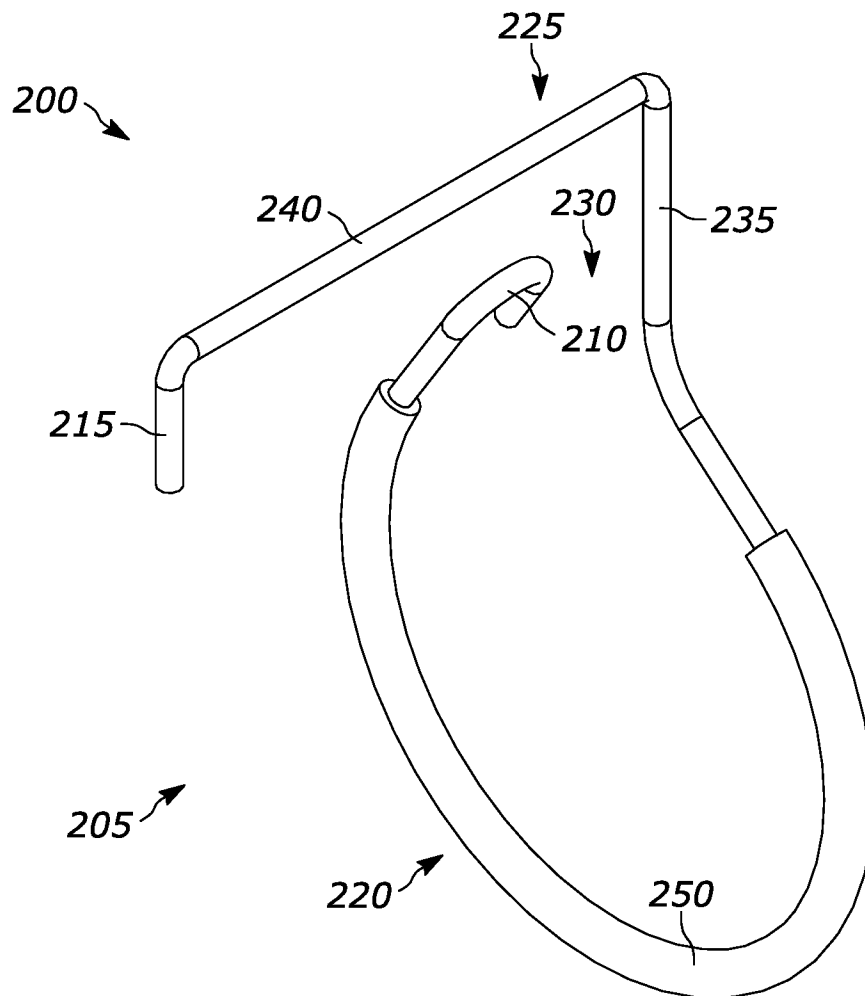


FIG. 5A

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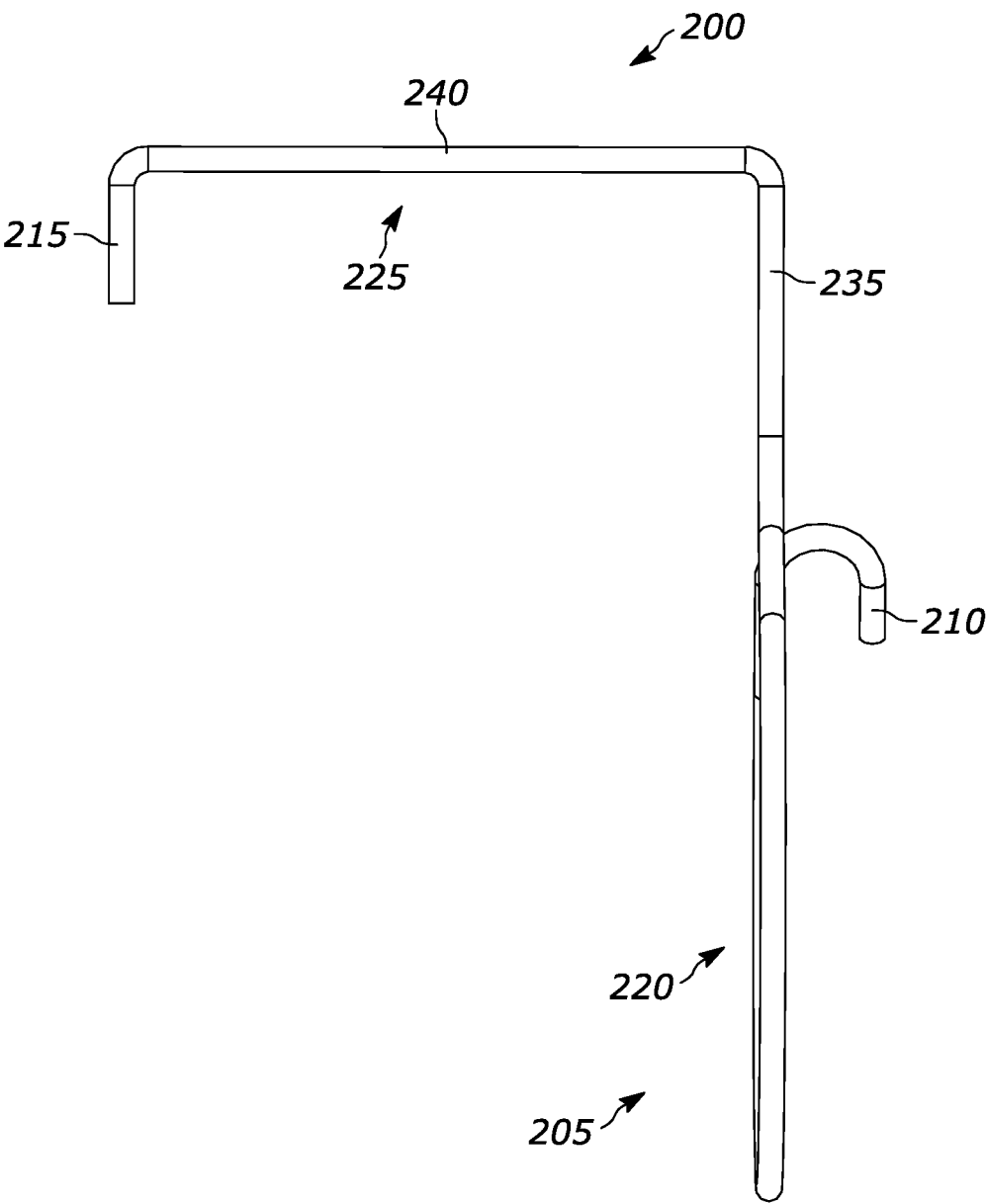


FIG. 6

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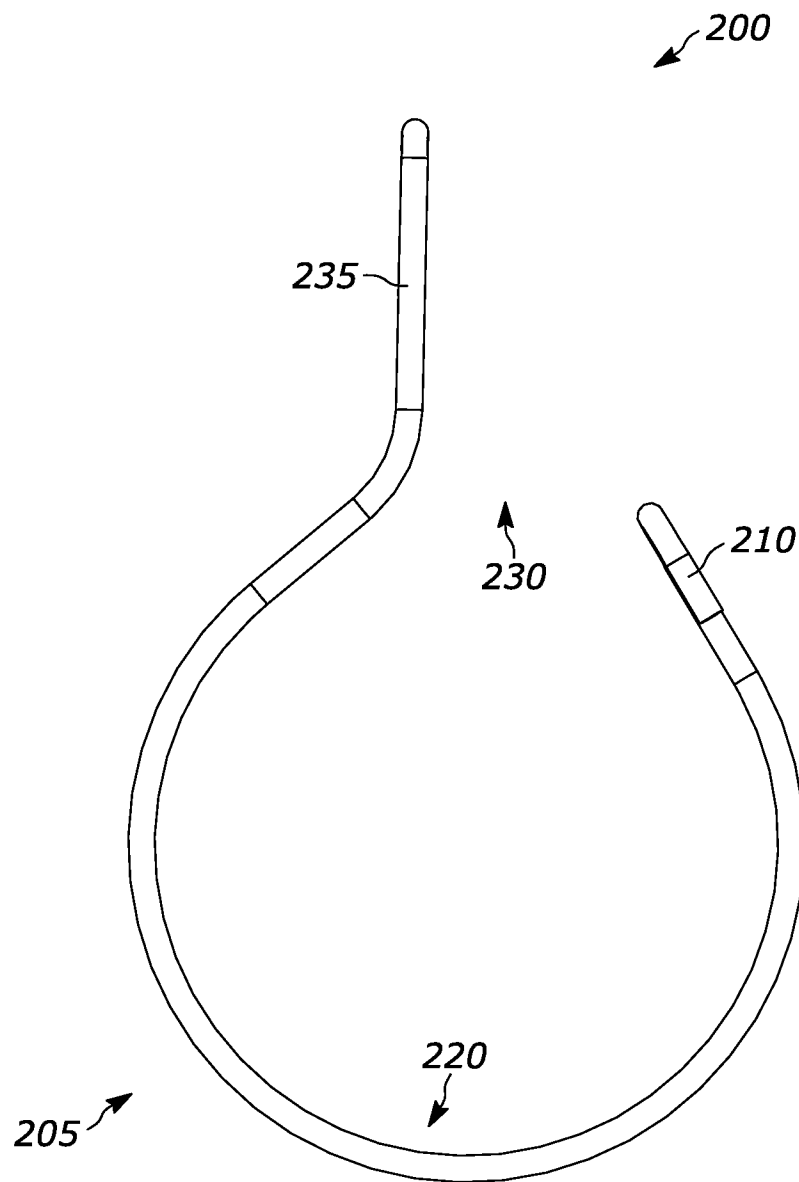


FIG. 7

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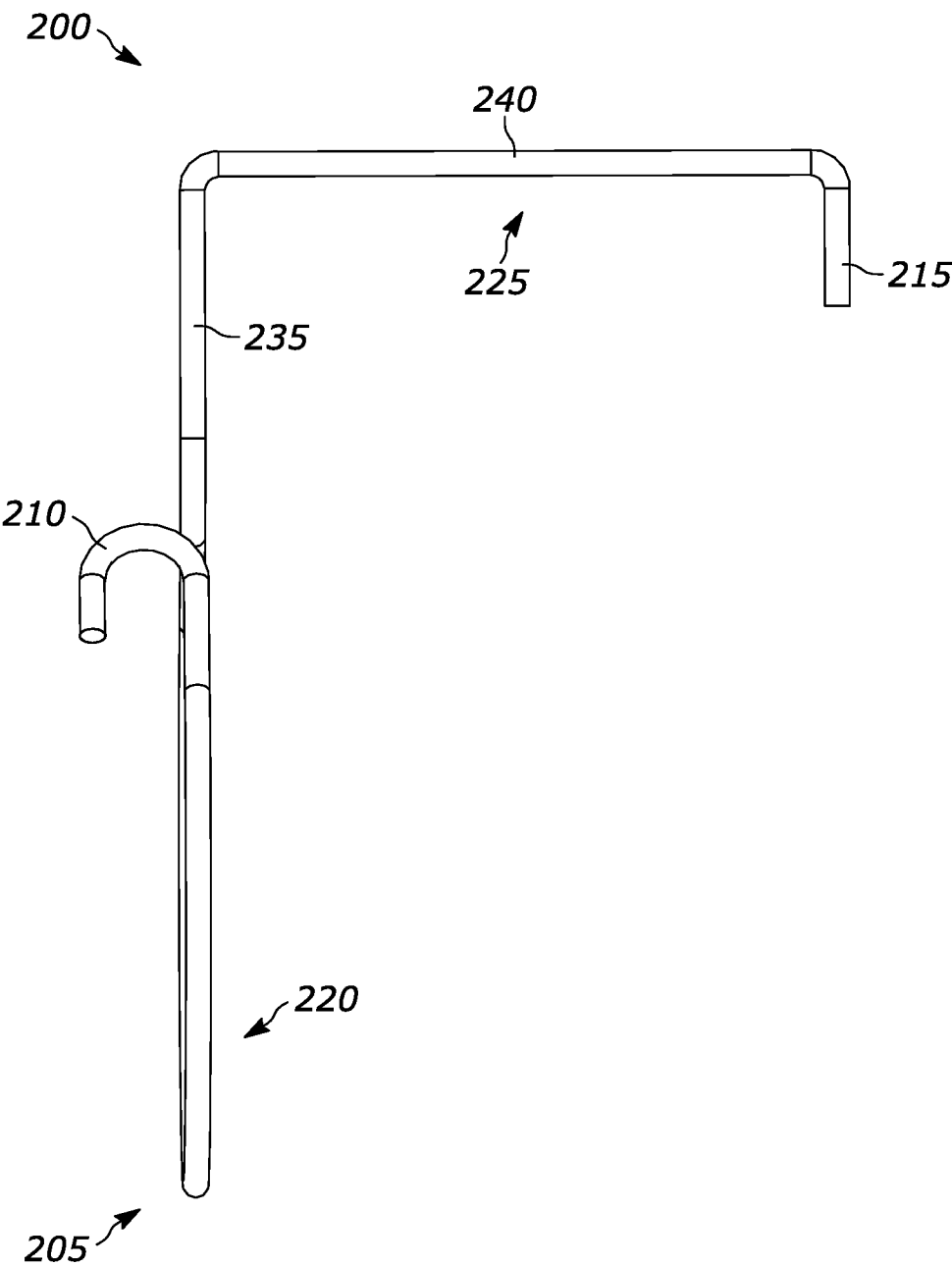


FIG. 8

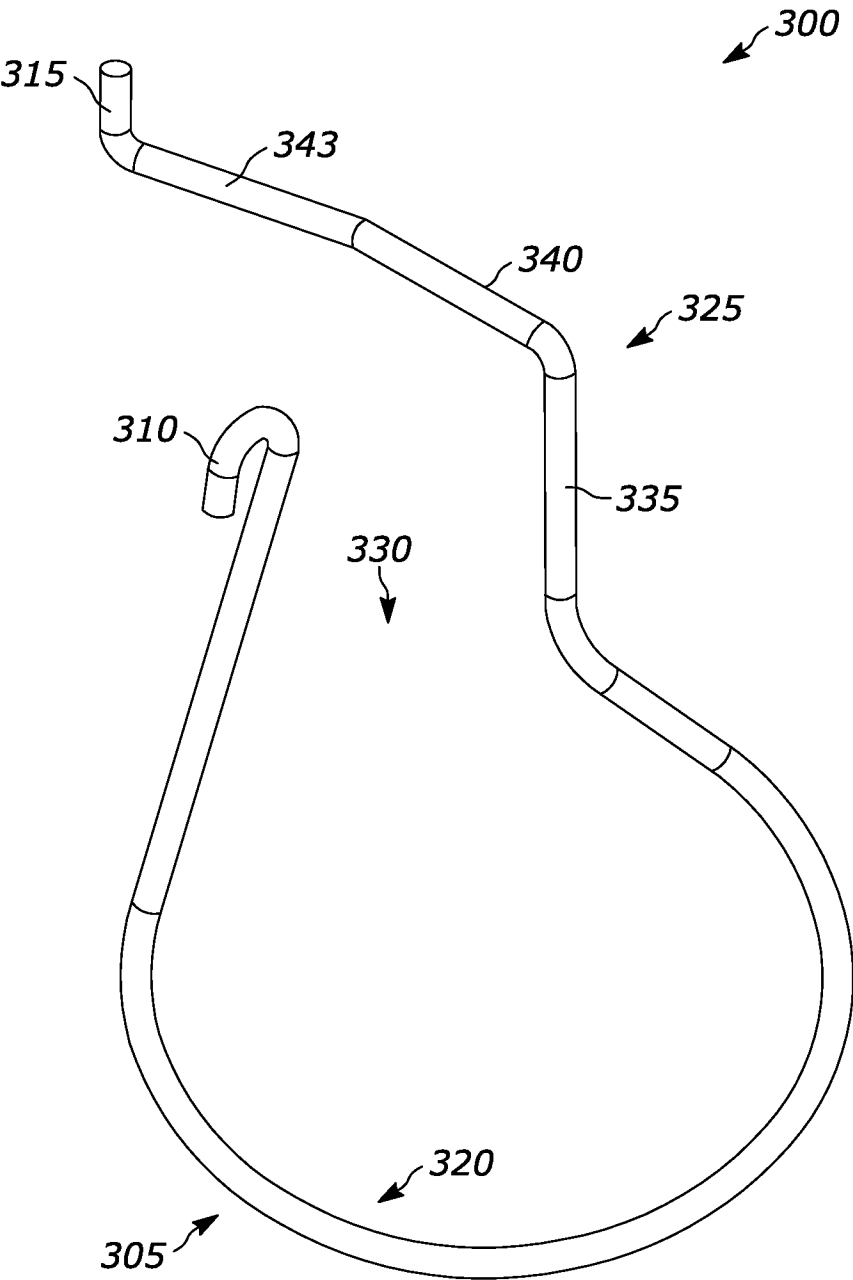


FIG. 9

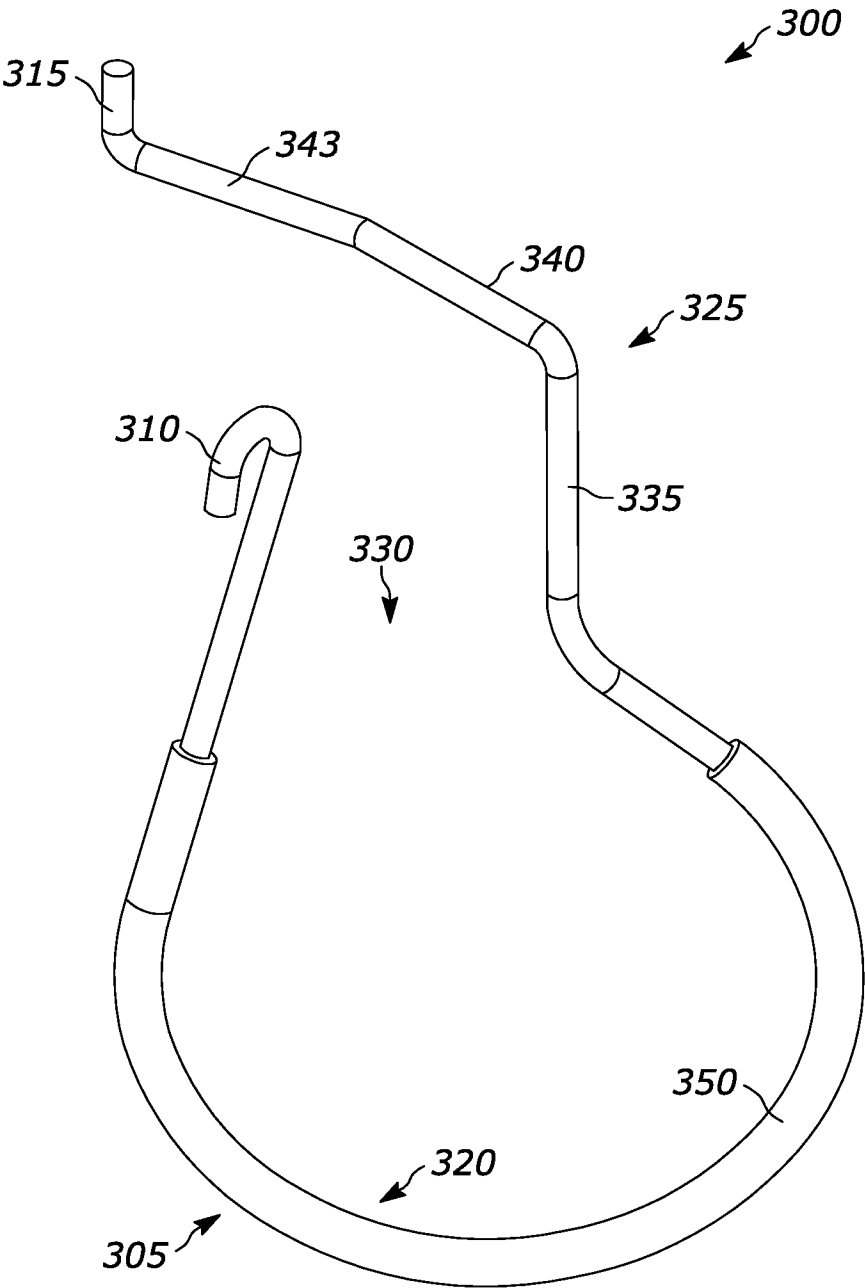


FIG. 9A

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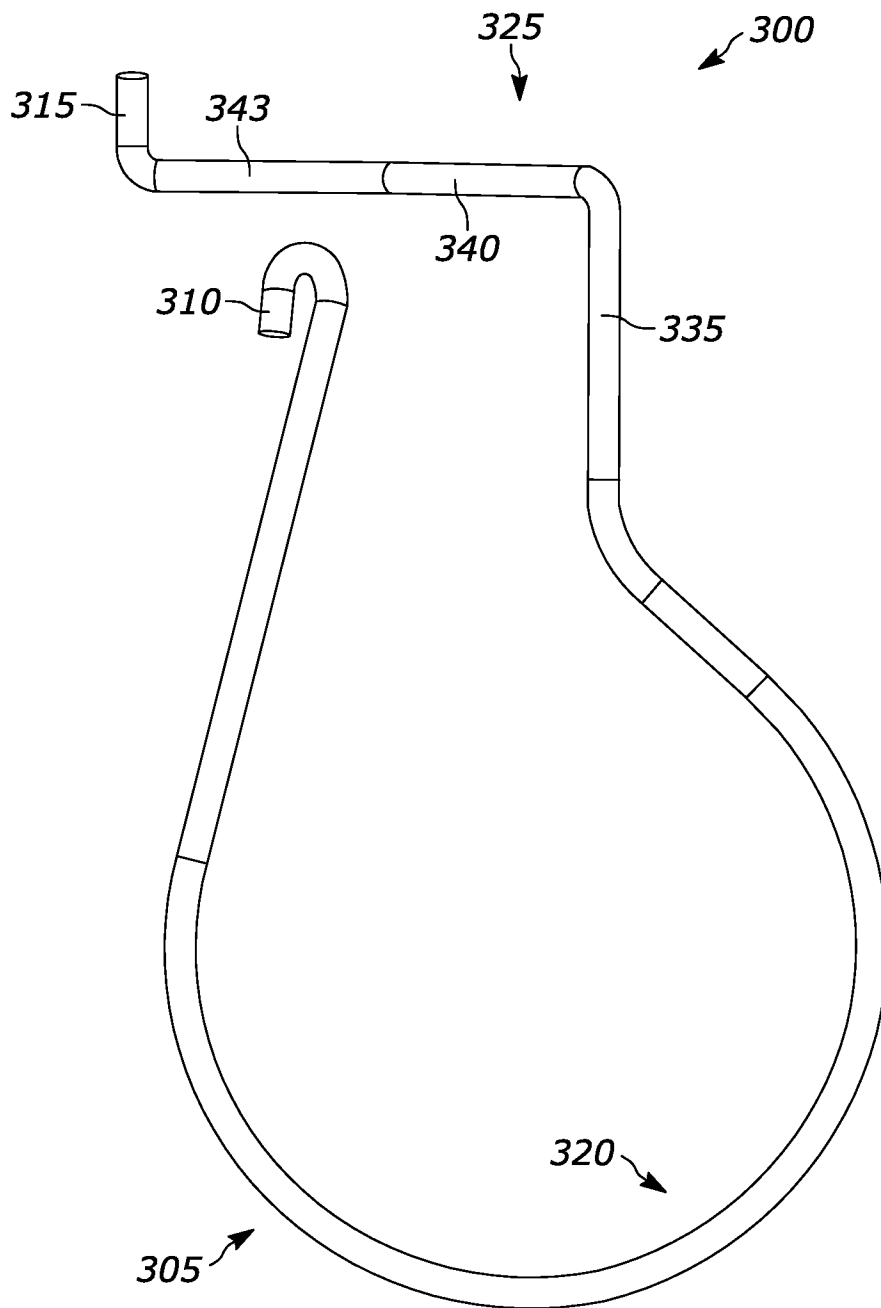


FIG. 10

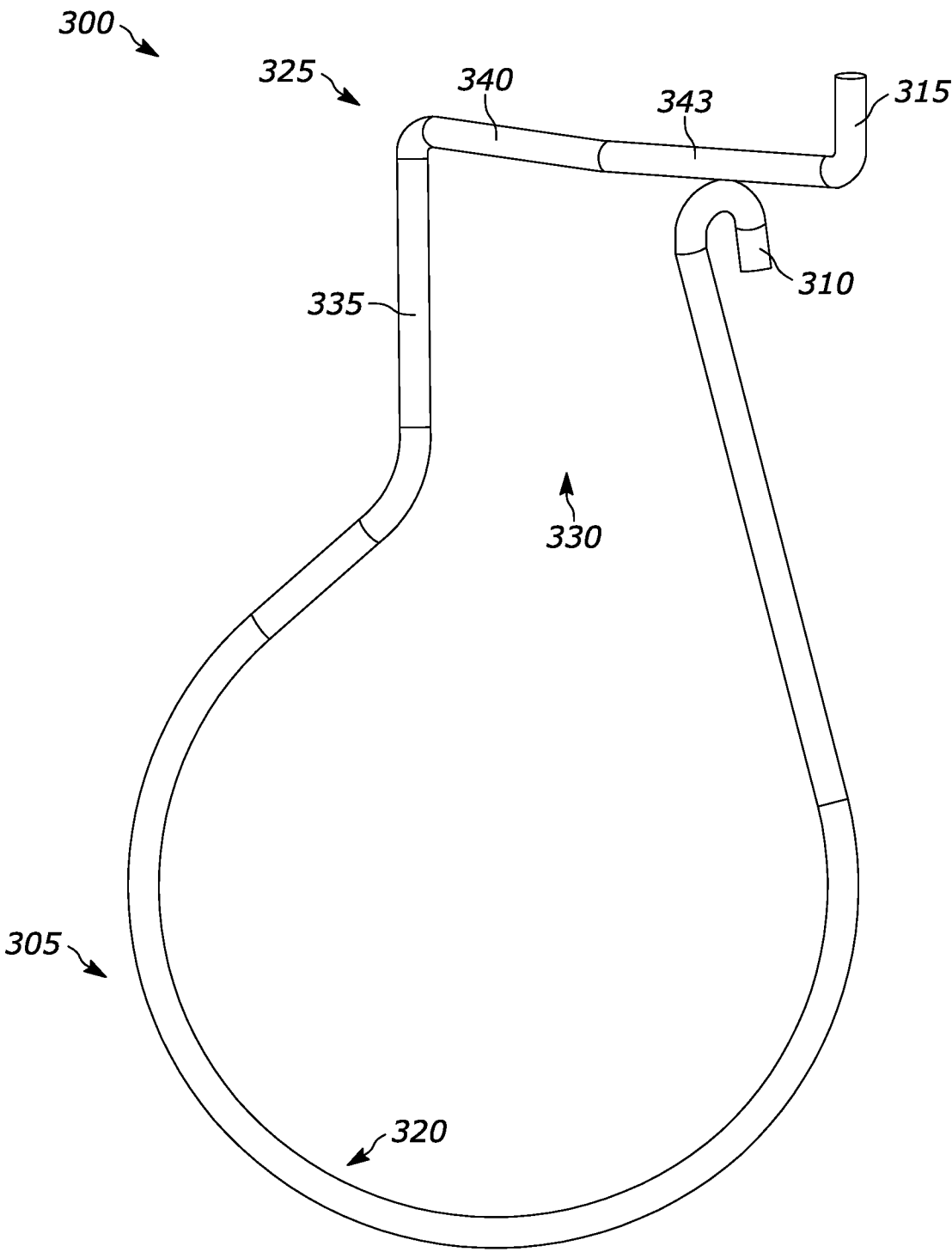


FIG. 11



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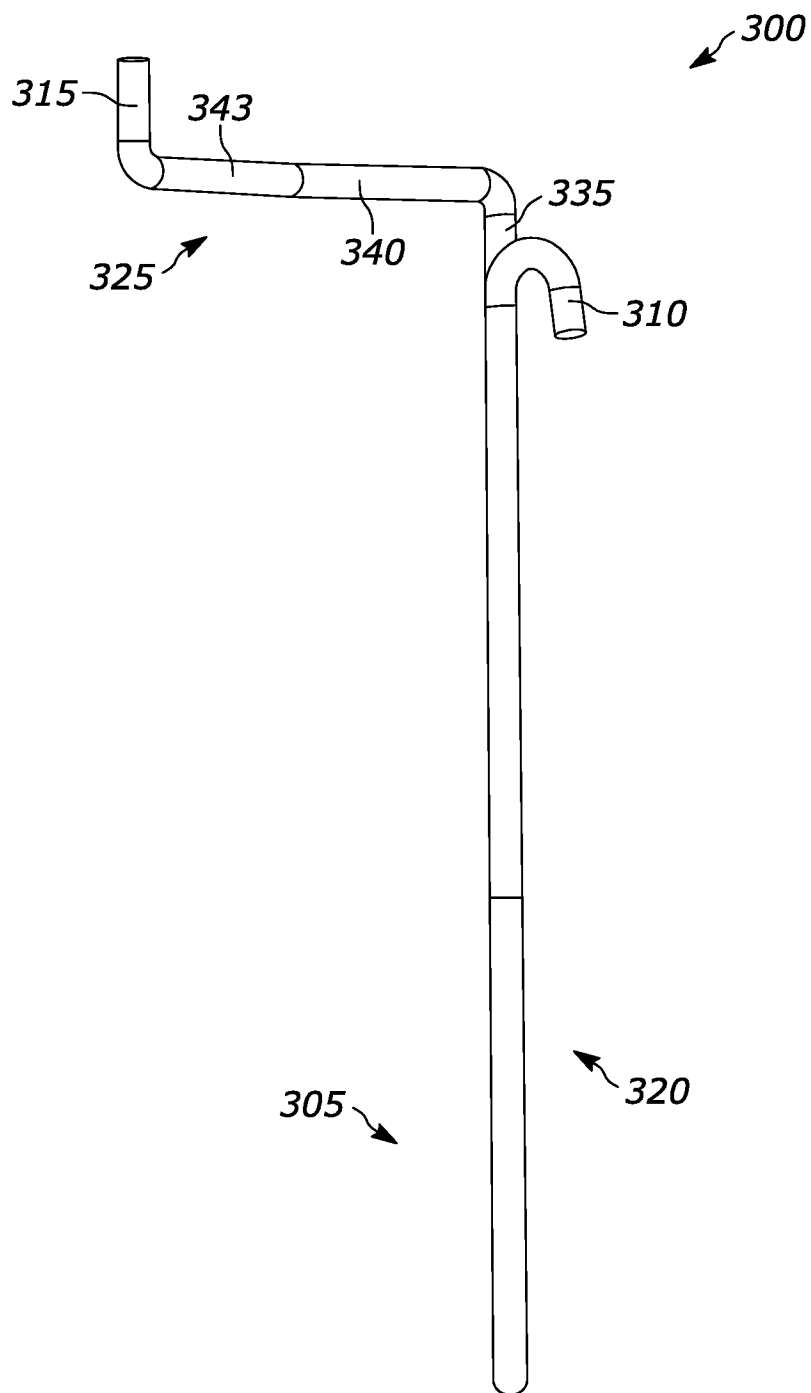


FIG. 12

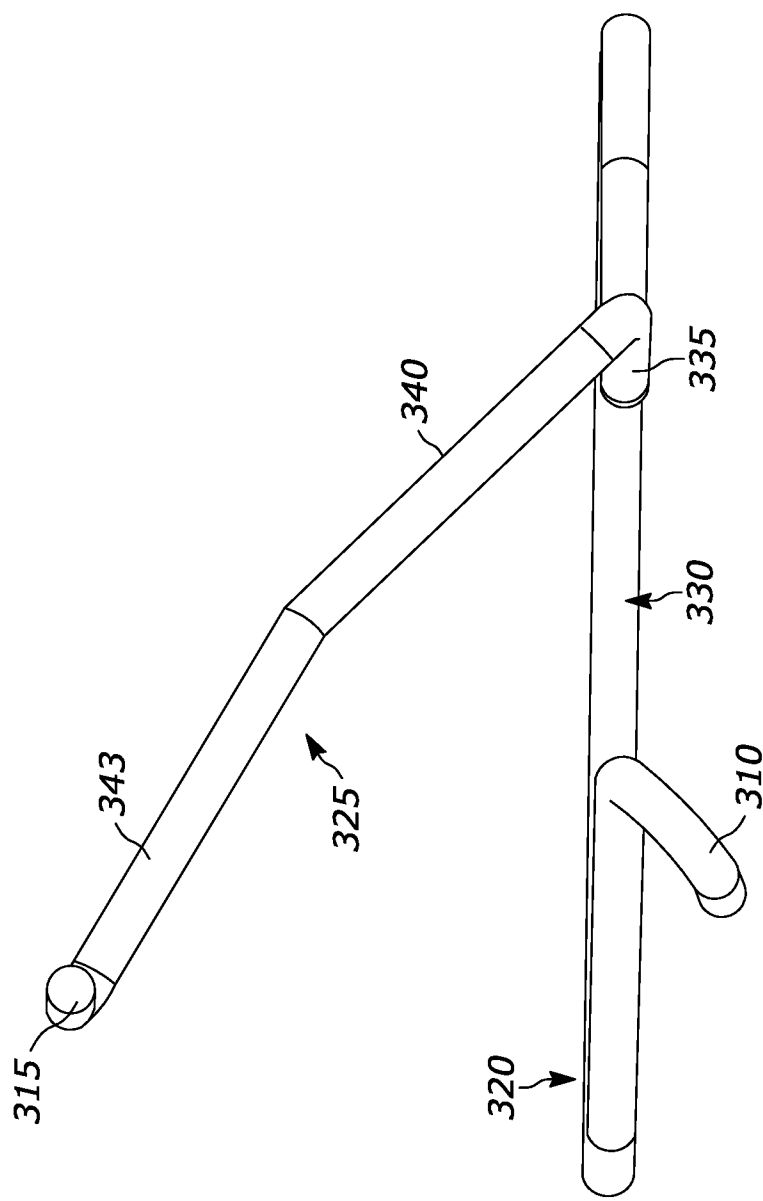


FIG. 13

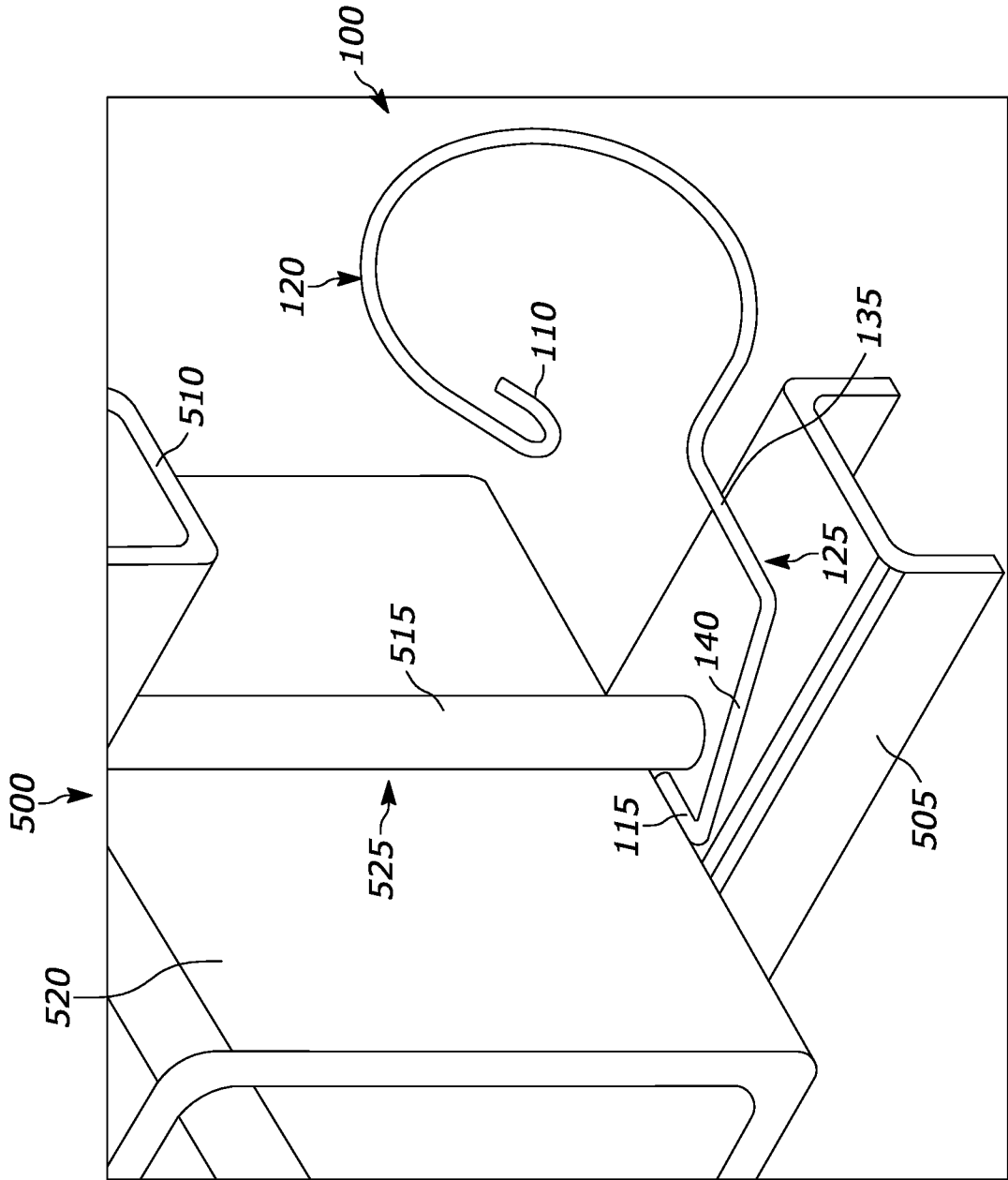


FIG. 14

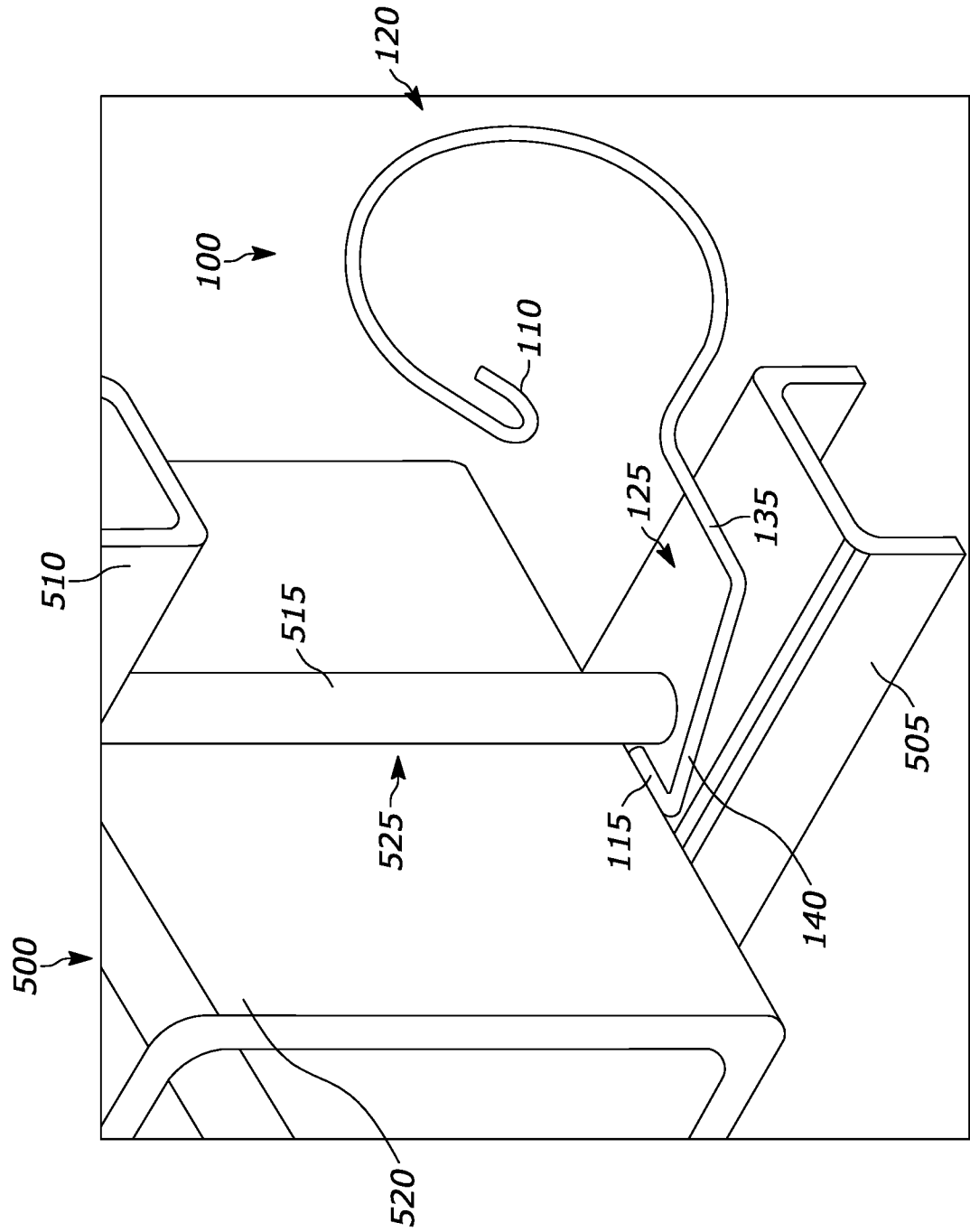


FIG. 15

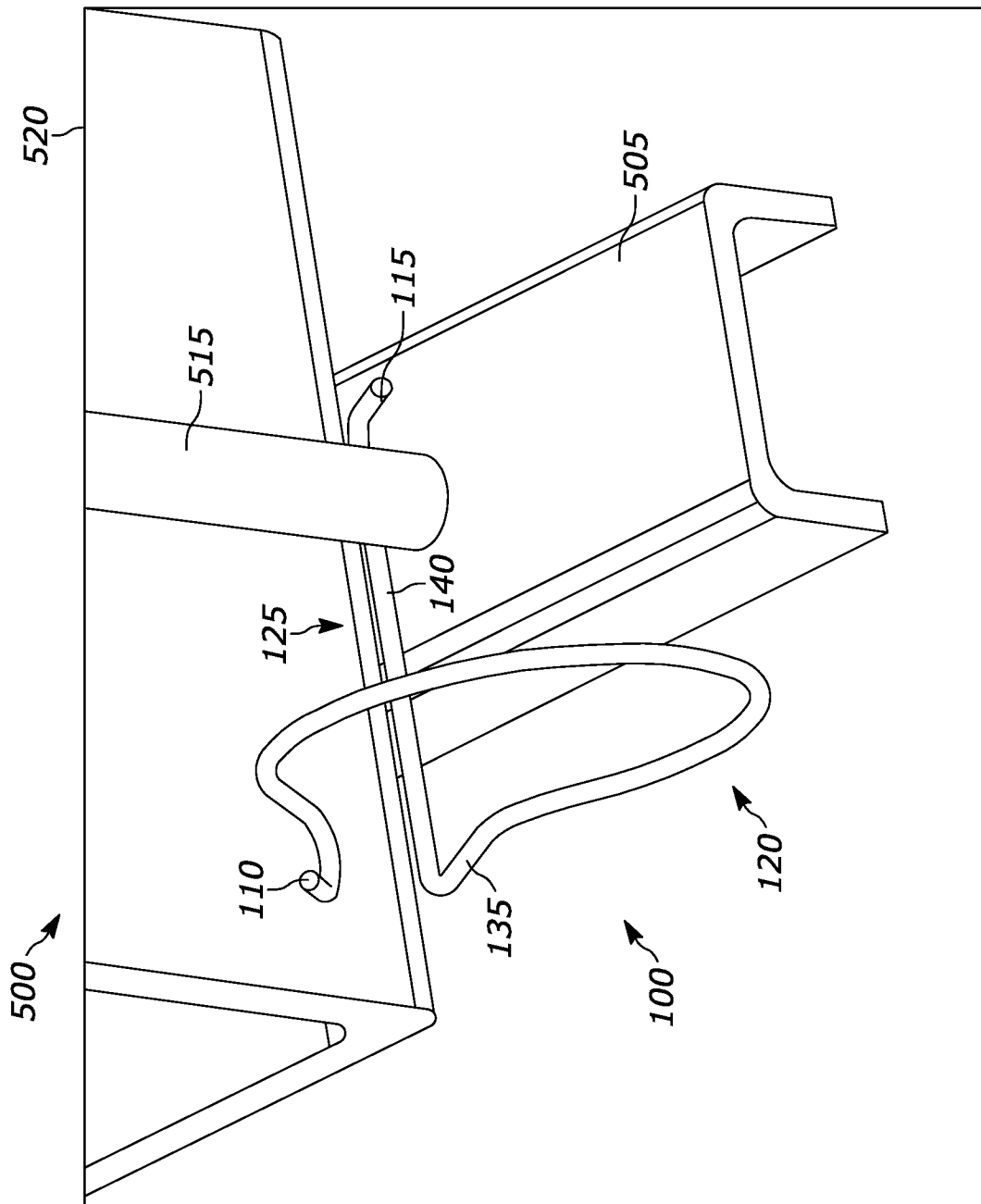


FIG. 16

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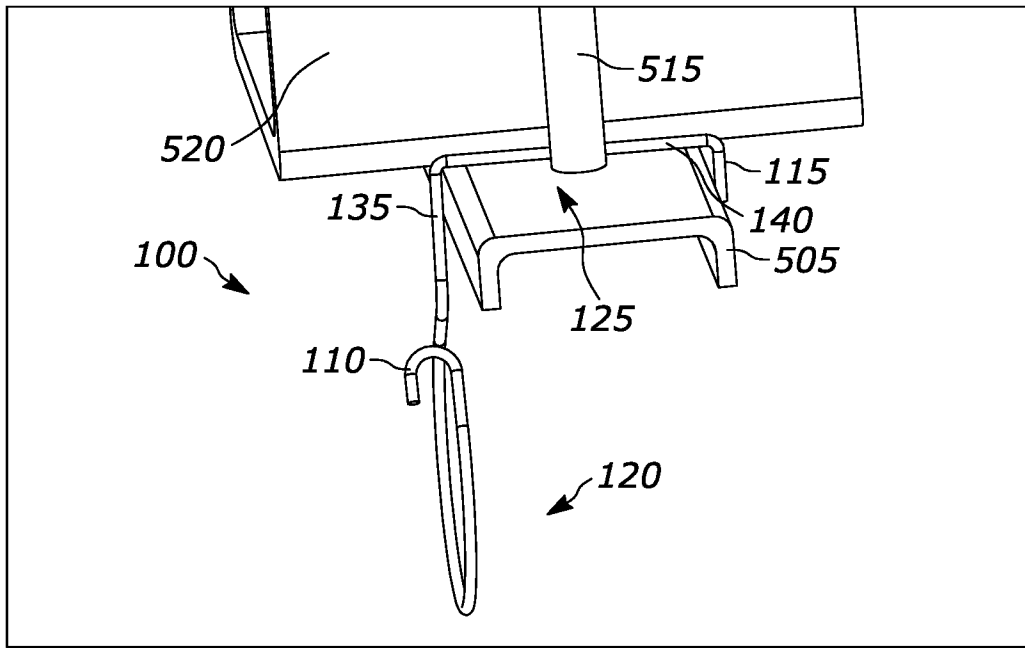


FIG. 17

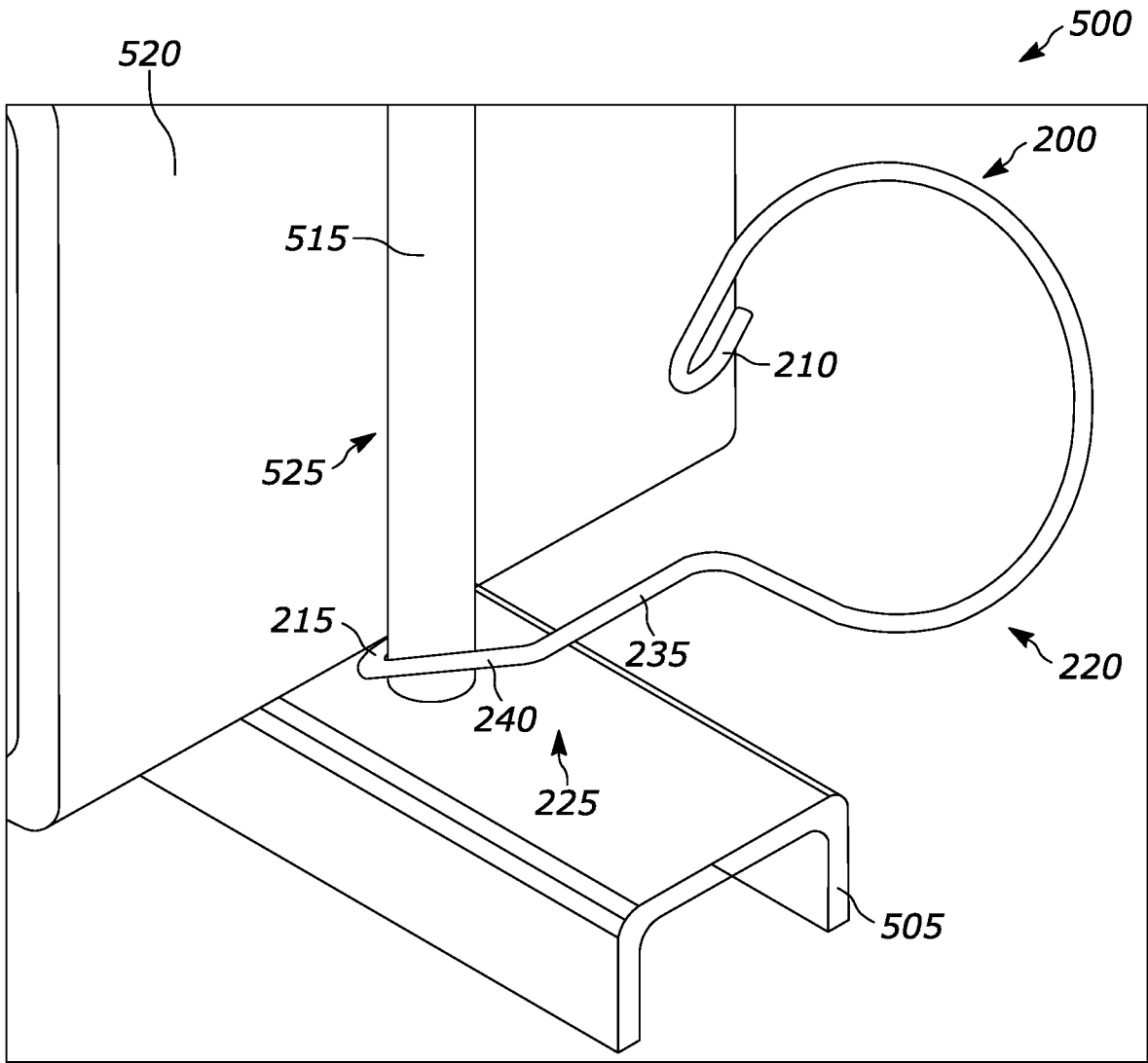


FIG. 18

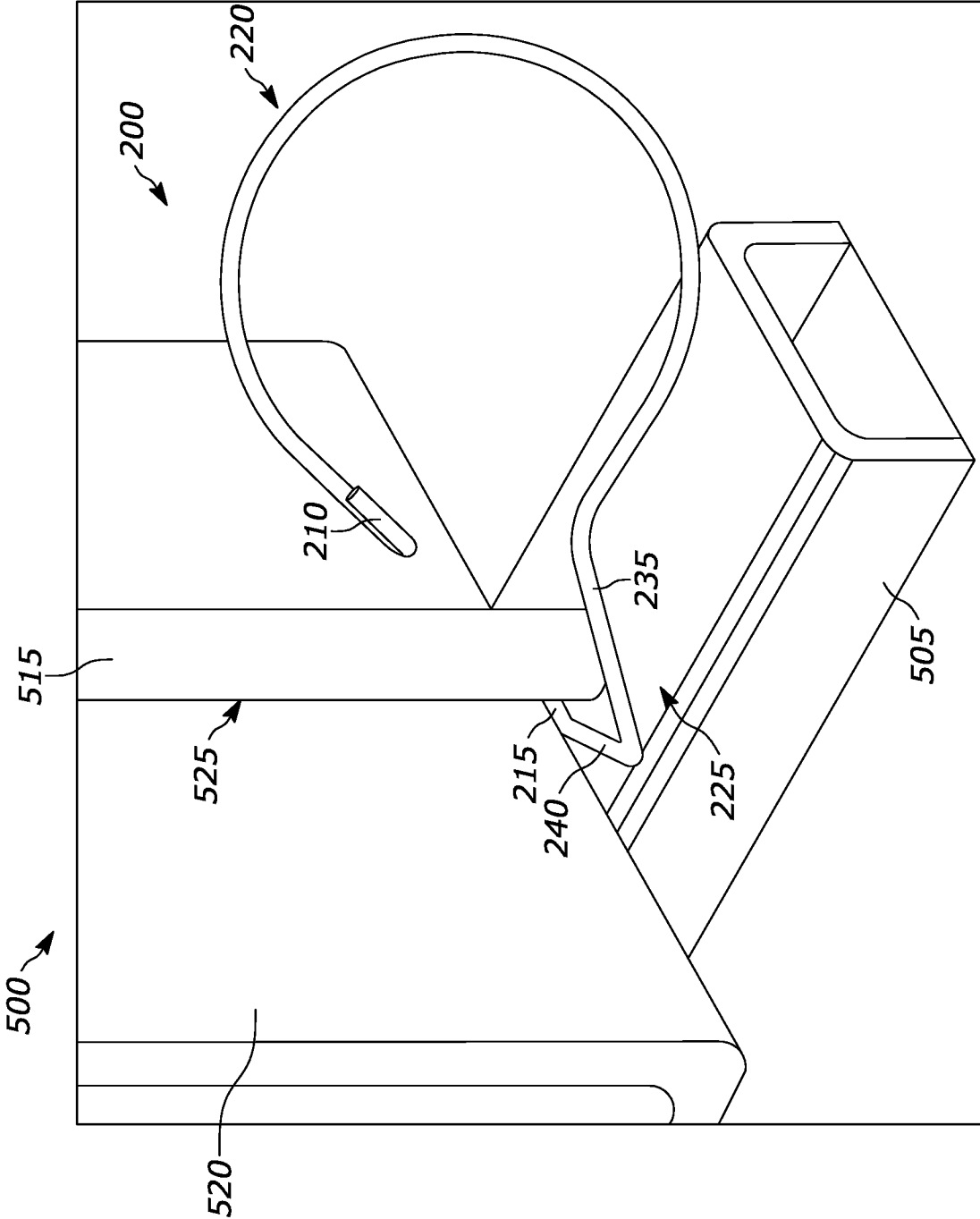


FIG. 19



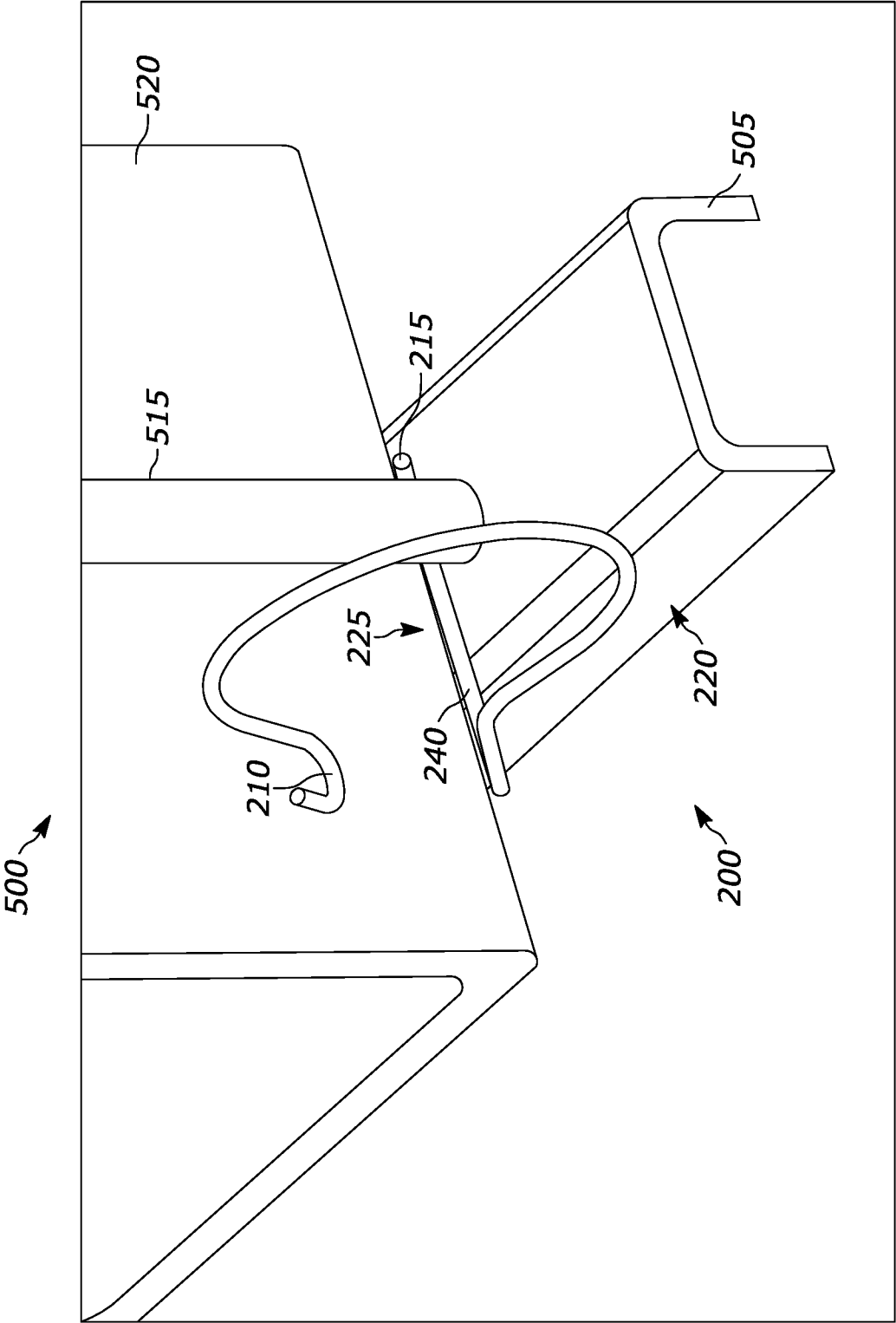


FIG. 20

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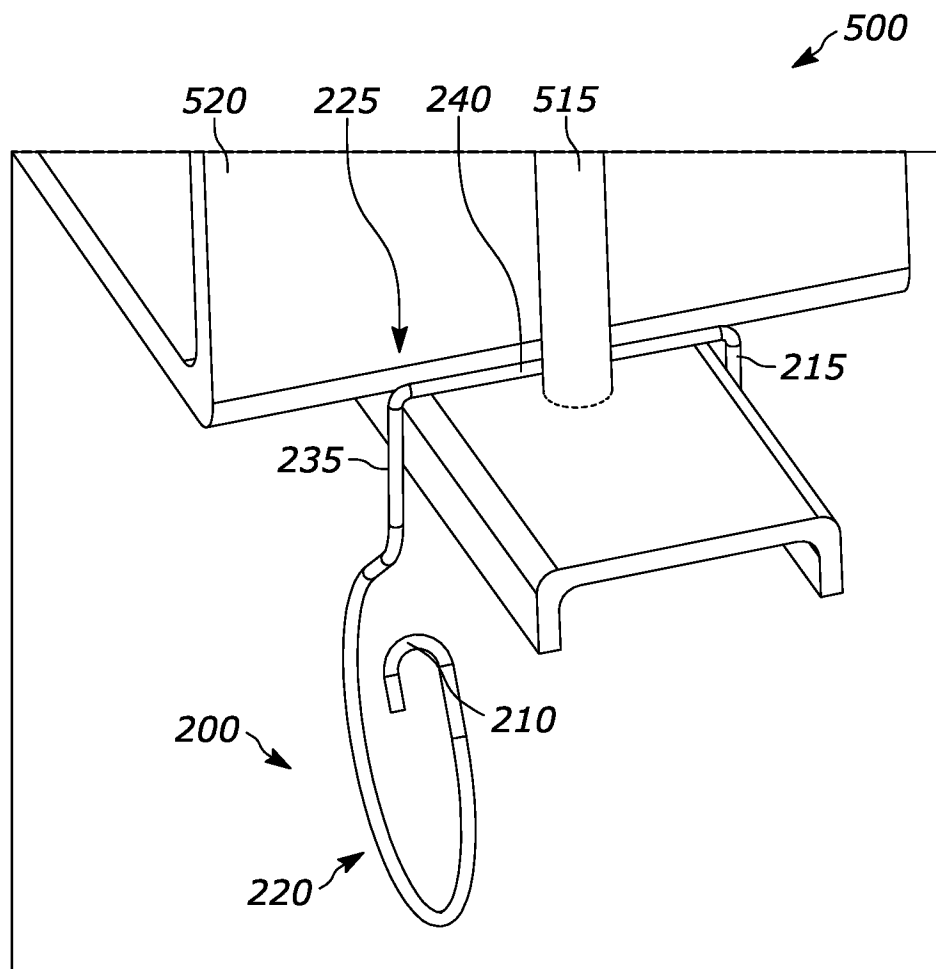


FIG. 21

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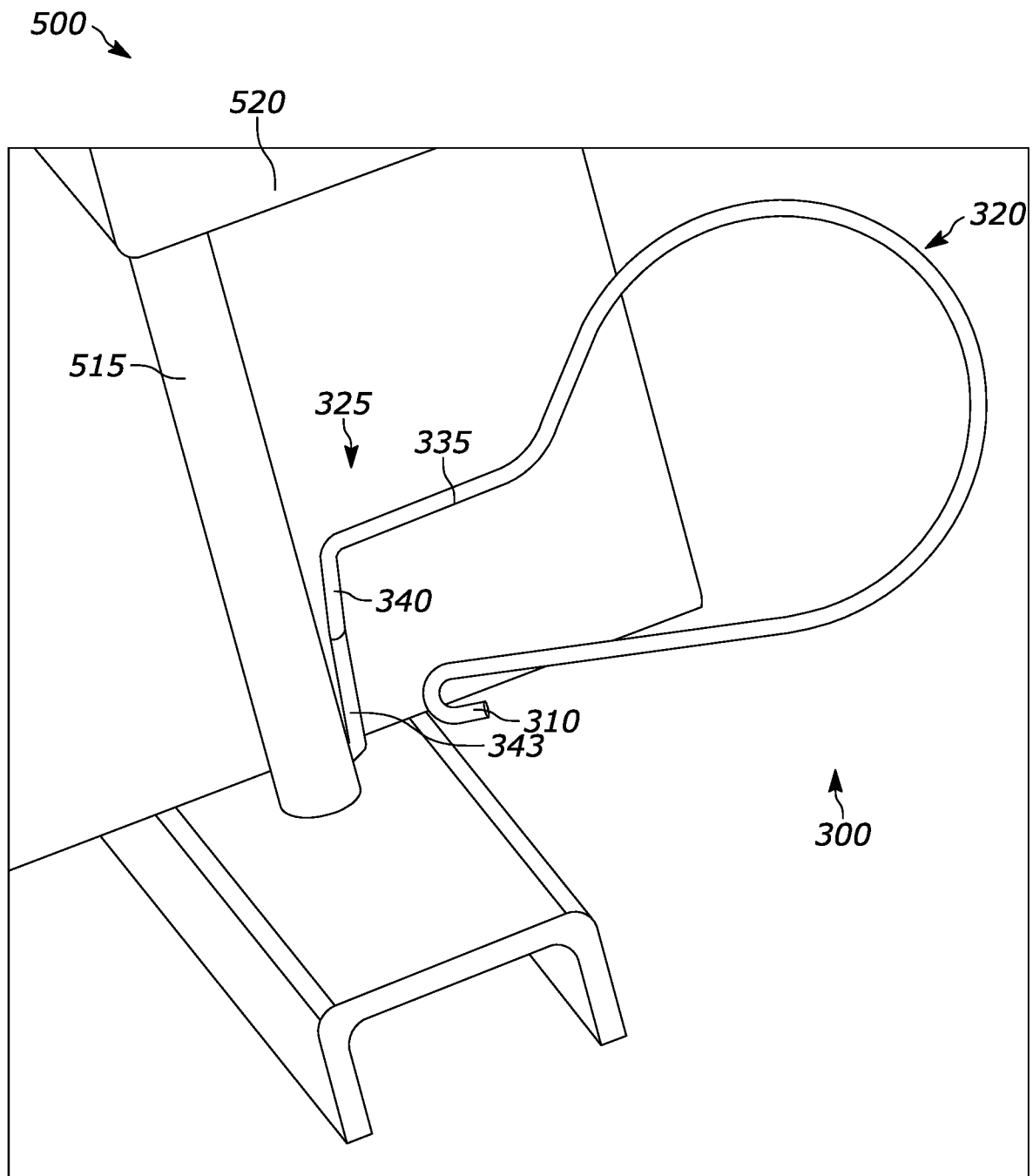


FIG. 22

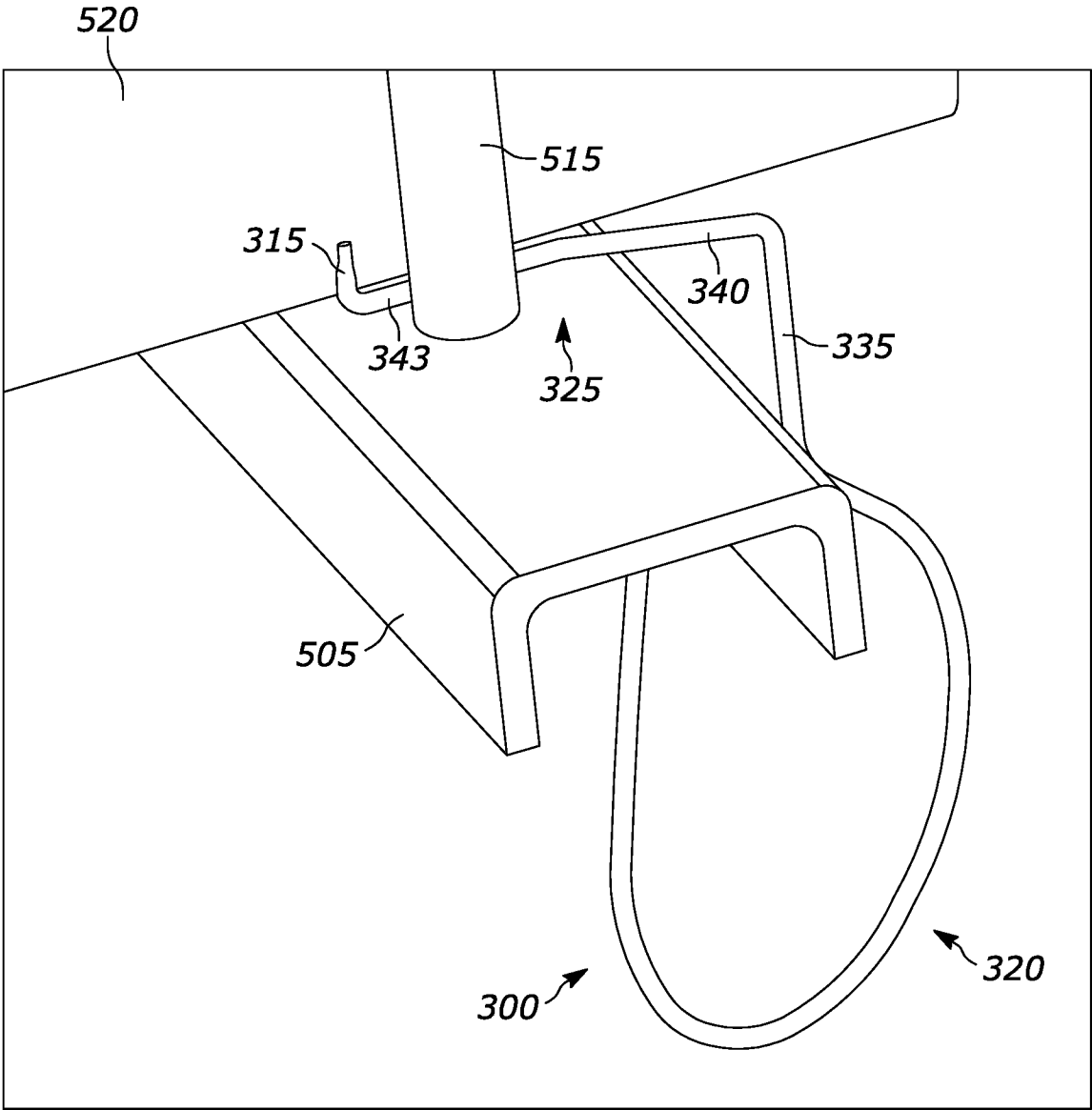


FIG. 23

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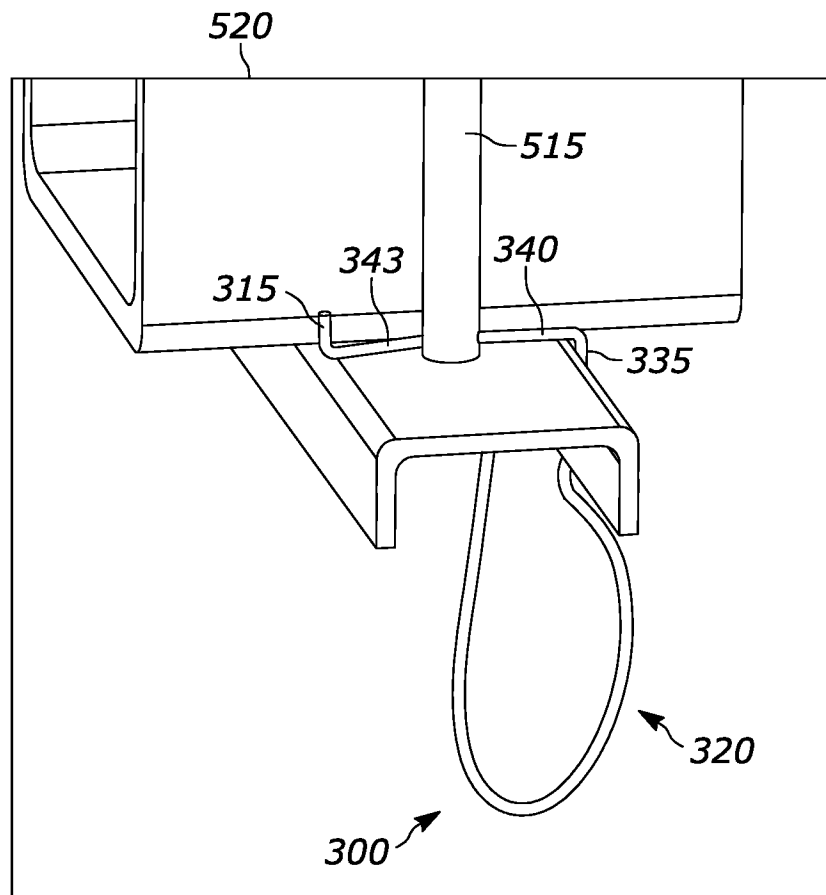


FIG. 24

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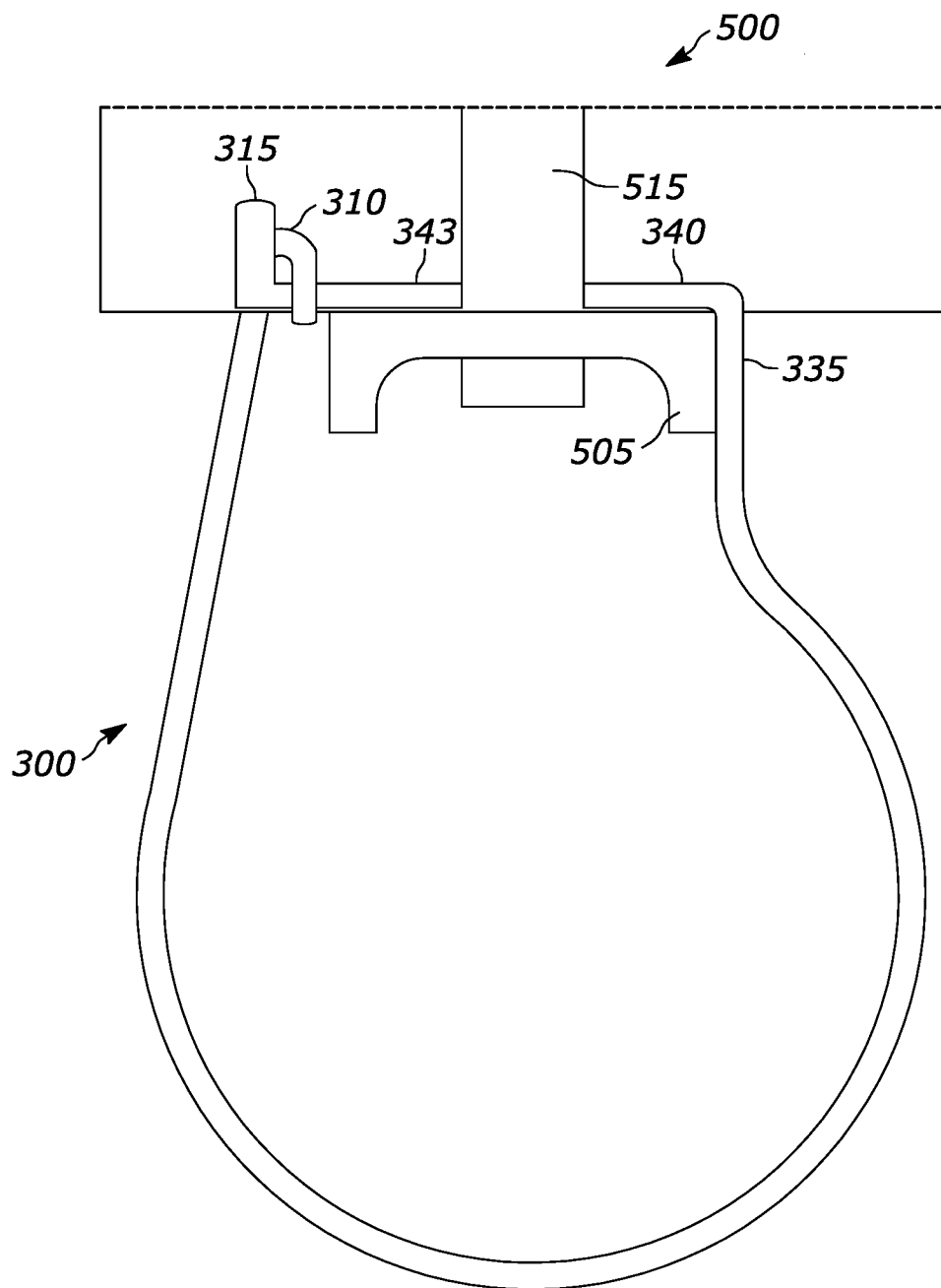


FIG. 25

**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:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I: Claims 1-6 directed to a method comprising: pivoting a cable hanger about a second axis to couple a second end to a mounting structure.

Group II: Claim 7-18 directed to a second portion having a first linear section and a second linear section, and wherein the second end is a linear section oriented perpendicularly with respect to the second linear portion.

Group III: Claim 19-23 directed to a method comprising: translating a third portion through a gap so that it extends toward the first end; and securing a first end to a second end to form a closed perimeter.

Group IV: Claim 24-30 directed to a second portion inclined relative to the first portion; and a third portion oriented obliquely with respect to the second portion.

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 additional fees, this Authority did not invite payment of 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.: **1-6**

**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

International application No.

PCT/US2024/054536

**A. CLASSIFICATION OF SUBJECT MATTER**IPC: *F16L 3/06* (2025.01); *F16L 3/23* (2025.01); *H02G 3/30* (2025.01); *H02G 3/32* (2025.01)CPC: *F16L 3/06*; *F16L 3/23*; *H02G 3/30*; *H02G 3/32*

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)

See Search History Document

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

See Search History Document

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

See Search History Document

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                 | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2022/0038046 A1 (Cambria County Association for the Blind & Handicapped) 03 February 2022 (03.02.2022)<br>para [0097], fig 1, 3 | 1-6                   |
| A         | US 2023/0141833 A1 (Affordable Wire Management, LLC) 11 May 2023 (11.05.2023)<br>entire document                                   | 1-6                   |
| A         | US 2016/0258554 A1 (Ripoll Agullo et al.) 08 September 2016 (08.09.2016)<br>entire document                                        | 1-6                   |
| A         | US 2018/0347727 A1 (Hubbell Incorporated) 06 December 2018 (06.12.2018)<br>entire document                                         | 1-6                   |



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

“D” document cited by the applicant in the international application

“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

06 February 2025 (06.02.2025)

Date of mailing of the international search report

24 March 2025 (24.03.2025)

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