



(43) International Publication Date
15 October 2015 (15.10.2015)

- (51) International Patent Classification:
H02G 7/05 (2006.01)
- (21) International Application Number:
PCT/US2015/025276
- (22) International Filing Date:
10 April 2015 (10.04.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/978,716 11 April 2014 (11.04.2014) US
14/489,236 17 September 2014 (17.09.2014) US
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- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,

[Continued on next page]

(54) Title: SIDE-LOADING QUADRANT DEADEND CLAMP ASSEMBLY

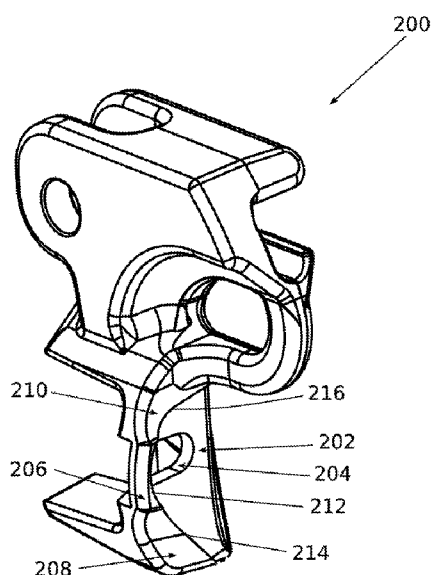


FIG. 30

(57) Abstract: A clamp assembly includes a body member and a keeper. A cable groove is formed in the body member to receive a cable. The keeper has a lower surface to engage the cable received in the cable groove. A threaded fastener connects the keeper to the body member. A recess is formed in the body member to receive a washer on the fastener.



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))

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PATENT APPLICATION
OF
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FOR
SIDE-LOADING QUADRANT DEADEND CLAMP ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to provisional application 61/978,716, filed on April 11, 2014, and U.S. Application 14/489,236, filed on September 17, 2014, the disclosures of which are hereby incorporated by reference in their entirety.

FIELD

[0002] The present invention relates to a clamp assembly for deadending a conductor. More particularly, the present invention relates to a clamp assembly having a biasing member disposed between a keeper and body member of the clamp assembly. Still more particularly, the present invention relates to a clamp assembly in which a conductor is secured between a keeper and body member, and a biasing member is disposed on a fastener securing the keeper to the body member.

BACKGROUND

[0003] Deadend clamps are commonly used to secure a cable under tension, for example, an overhead electrical conductor. The deadend clamp anchors the received cable to a supporting structure, such as a tower or utility pole. The deadend clamp transmits the tension on the cable to the supporting structure.

[0004] Conventional deadend clamps typically include one or more U-bolts to clamp a keeper, which in turn applies a clamping pressure to the conductor, such as

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and washers to insert the conductor, and then the nuts and washers must be reconnected to the U-bolts. That procedure becomes even more difficult when the lineman is working with an energized conductor in the field. Accordingly, a need exists for a clamp assembly that is easily assembled.

[0005] Another disadvantage associated with conventional deadend clamps is the use of non-captive fasteners to secure the keeper to the main body. Non-captive fasteners are prone to loosening, thereby providing a less secure connection between the keeper and the main body. Accordingly, a need exists for a clamp assembly in which the keeper is securely connected to the main body to maintain clamping pressure on the conductor.

[0006] Still another disadvantage associated with conventional deadend clamps is the use of external springs between the keeper and the main body. These springs can become dislodged when tightening the keeper to the main body. Additionally, these springs require the fasteners to be tightened in a specific sequence to prevent damaging the springs, thereby providing an inefficient and time consuming task for the lineman. Accordingly, a need exists for a clamp assembly having an improved biasing member between the keeper and main body.

SUMMARY

[0007] According to an exemplary embodiment, a clamp assembly includes a body member, a cable groove, fastener opening, and recess formed in the body member, and a keeper. The keeper has a lower surface adapted to engage a cable received in the cable groove. The recess at least partially surrounds the fastener opening. The recess is at least partially bordered by a first end wall, a second end wall, and a center wall. The center wall extends across the fastener opening.

[0008] According to another exemplary embodiment, a clamp assembly includes a body member, a cable groove, fastener opening, and recess formed in the body member, and a keeper. The keeper has a lower surface adapted to engage a cable received in the cable groove. The fastener opening has a substantially U-shaped slot.

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The recess at least partially surrounds the fastener opening. The recess is at least partially bordered by a first end wall, a second end wall, and a center wall.

[0009] According to another exemplary embodiment, a clamp assembly includes a body member, a cable groove, fastener opening, and recess formed in the body member, and a keeper. The keeper has a lower surface adapted to engage a cable received in the cable groove. The fastener opening has a substantially U-shaped slot. A fastener extends through the fastener opening connecting the keeper to the body. A biasing member is disposed on the fastener between said keeper and said body member. The recess at least partially surrounds the fastener opening. The recess is at least partially bordered by a first end wall, a second end wall, and a center wall.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above aspects and features of the present invention will be more apparent from the description for exemplary embodiments of the present invention taken with reference to the accompanying drawings, in which:

[0011] FIG. 1 is a front perspective view of a side loading quadrant deadend clamp assembly according to a first exemplary embodiment of the invention;

[0012] FIG. 2 is a rear perspective view of the clamp assembly of FIG. 1;

[0013] FIG. 3 is a side elevational view of the clamp assembly of FIG. 1;

[0014] FIG. 4 is a top plan view of the clamp assembly of FIG. 1;

[0015] FIG. 5 is a top plan view in cross section of the clamp assembly taken along line 5-5 of FIG. 3;

[0016] FIG. 6 is a side elevational in cross section of the clamp assembly taken along line 6-6 of FIG. 4;

[0017] FIG. 7 is a front perspective view of a body member of the clamp assembly of FIG. 1;

[0018] FIG. 8 is a bottom perspective of the body member of FIG. 7;

[0019] FIG. 9 is a side elevational view of the body member of FIG. 7;

[0020] FIG. 10 is a rear elevational view of the body member of FIG. 7;

[0021] FIG. 11 is a front elevational view of the body member of FIG. 7;

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- [0022]** FIG. 12 is a top plan view of the body member of FIG. 7;
- [0023]** FIG. 13 is a bottom plan view of the body member of FIG. 7;
- [0024]** FIG. 14 is a perspective view of a keeper of the clamp assembly of FIG. 1;
- [0025]** FIG. 15 is a side elevational view of the keeper of FIG. 14;
- [0026]** FIG. 16 is a rear elevational view of the keeper of FIG. 14;
- [0027]** FIG. 17 is a side elevational view of the keeper of FIG. 14;
- [0028]** FIG. 18 is a top plan view of the keeper of FIG. 14;
- [0029]** FIG. 19 is a rear elevational view of the clamp assembly of FIG. 1;
- [0030]** FIG. 20 is front perspective view of a side loading quadrant deadend clamp assembly according to a second exemplary embodiment of the invention;
- [0031]** FIG. 21 is a rear perspective view of the clamp assembly of FIG. 20;
- [0032]** FIG. 22 is a side elevational view of the clamp assembly of FIG. 20;
- [0033]** FIG. 23 is an enlarged perspective view of a recessed area in an outer surface of a bottom wall of a pocket of a body of the clamp assembly of FIG. 22;
- [0034]** FIG. 24 is a front perspective view of the clamp assembly of FIG. 20;
- [0035]** FIG. 25 is a front elevational view of a body of the clamp assembly of FIG. 20;
- [0036]** FIG. 26 is a side elevational view of the body of FIG. 25;
- [0037]** FIG. 27 is a front perspective view of the body of FIG. 25;
- [0038]** FIG. 28 is a front elevational view of a biasing member of the clamp assembly of FIG. 20;
- [0039]** FIG. 29 is a perspective view of the biasing member of FIG. 28;
- [0040]** FIG. 30 is front perspective view of a side loading quadrant deadend clamp body according to a third exemplary embodiment of the invention;
- [0041]** FIG. 31 is a front elevational view of the clamp body of FIG. 30;
- [0042]** FIG. 32 is a side elevational view of the clamp body of FIG. 30;
- [0043]** FIG. 33 is a rear elevational view of the clamp body of FIG. 30;
- [0044]** FIG. 34 is a bottom elevational view of the clamp body of FIG. 30;
- [0045]** FIG. 35 is a front perspective view of the clamp body of FIG. 30 with an attached keeper and fastener;

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[0046] FIG. 36 is a left side elevational view of the clamp assembly of FIG. 35;

[0047] FIG. 37 is a bottom elevational view of the clamp assembly of FIG. 35;
and

[0048] FIG. 38 is a right side elevational view of the clamp assembly of FIG. 35.

[0049] Throughout the drawings, like reference numerals will be understood to refer to like parts, components and structures.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0050] As shown in FIGS. 1 – 19, a clamp assembly 11 in accordance with a first exemplary embodiment of the present invention includes a body member 21 and a keeper 31. The body member 21 has a cable groove 71 formed therein to receive a cable 9. The keeper 31 is connected to the body member 21 and has a lower surface 34 adapted to engage the cable 9 received in the cable groove 71. A biasing member 41 is disposed between the keeper 31 and the body member 21.

[0051] The body member 21 includes a clevis bracket 51 having first and second mounting ears 52 and 53, as shown in FIGS. 1 and 2. Openings 54 and 55 in the mounting ears 52 and 53 receive a clevis pin 56. As shown in FIG. 4, the clevis pin 56 has a first end 57 and a second end 58. A head 59 is disposed at the first end 57 of the clevis pin. An opening 60 is formed proximal the second end 58 of the clevis pin 56. The second end 58 of the clevis pin 56 is inserted through the first and second mounting ears 52 and 53. A cotter pin 61 is inserted through the opening 60 in the clevis pin 56, thereby preventing the clevis pin 56 from being removed from the mounting ears 52 and 53. The head 59 of the clevis pin 56 is larger than the openings 54 and 55 in the mounting ears 52 and 53 to limit insertion of the clevis pin through the openings 54 and 55 in the mounting ears. The cotter pin 61 has a head 62 at one end and a raised portion 63 proximal the other end to substantially prevent accidental withdrawal of the cotter pin from the clevis pin opening 60. The head 62 of the cotter pin 61 is larger than the clevis pin opening 60 to limit insertion of the cotter pin. The raised portion 62 of the cotter pin 61 flexes to allow insertion of cotter pin through the clevis pin opening 60, but prevents accidental withdrawal of the cotter pin from the

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clevis pin opening 60. The clevis bracket 51 allows the clamp assembly 11 to be pivotally connected to a supporting structure.

[0052] A cable groove 71 extends from a first end 22 to proximal a second end 23 of the body member 21, as shown in FIG. 2. The cable groove 71 has a 90 degree bend 72 therein, as shown in FIG. 8, to bring the conductor 9 in line with the clevis bracket 51. The cable groove 71 is preferably formed in a side of the body member 21 such that the conductor 9 can be inserted in the cable groove in a radial direction of the conductor, i.e., from the side of the clamp assembly 11. A lip 70 is formed at an outer edge of the cable groove 71, as shown in FIGS. 2 and 8, to substantially prevent the cable 9 from exiting the cable groove 71 before being clamped between the body member 21 and the keeper 31.

[0053] As shown in FIG. 6, a pocket 73 is formed in the body member 21 proximal the first end 22 thereof. The pocket 73 is preferably a substantially U-shaped cavity configured to receive the keeper 31, as shown in FIG. 3. The pocket 73 has opposite side walls 74 and 75 and a bottom wall 76 therebetween. A fastener opening 77 in the bottom wall 76 of the pocket 73 receives a fastener 13 to secure the keeper 31 to the body member 21, as shown in FIG. 6.

[0054] A recessed area 78 is formed on an outer surface 79 of the bottom wall 76 of the pocket 73, as shown in FIG. 6. The recessed area 78 is preferably substantially V-shaped, as shown in FIG. 7. The recessed area 78 receives the washer 16 disposed on the shaft 15 of the fastener, as shown in FIG. 6.

[0055] The keeper 31 is secured to a side of the body member 21 below the clevis bracket 51, as shown in FIG. 2. The keeper 31 has a fastening portion 32 and a cable engaging portion 33, as shown in FIGS. 14 – 18. A cable groove 34 is disposed in the cable engaging portion 33 of the keeper 31, as shown in FIGS. 5 and 16. The keeper cable groove 34 is disposed opposite the body member cable groove 71 to securely retain the cable 9 therebetween when the keeper 31 is secured to the body member 21.

[0056] The fastening portion 32 of the keeper 31 has a fastener bore 35 passing from an inner surface 36 to an outer surface 37 thereof, as shown in FIGS. 5 and 6. A chamber 38 is formed at the end of the bore proximal the outer surface 37 to receive a

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nut 17 disposed on the fastener 13. The chamber 38 is preferably hexagonally shaped to correspond to the outer shape of the nut 17, thereby providing a captive nut that is substantially prevented from rotational movement on the fastener 13.

[0057] An eye 65 in the body member 21 facilitates manipulation of the clamp assembly 11 by a lineman. Preferably, the eye 65 has a substantially oval shape. The cable groove preferably runs between the eye 65 and the mounting ears 52 and 53. Accordingly, the clevis pin 56 does not need to be removed to insert the conductor 9 in the cable groove 71.

[0058] The fastener 13 is inserted through a fastener opening 77 in the bottom wall 76 of the pocket 73 of the body member 21 and is received by a fastener bore 35 in the keeper 31. The fastener 13 has a head 14 and a threaded shaft 15 extending therefrom, as shown in FIGS. 5 and 6. The washer 16 and the nut 17 are disposed on the fastener shaft 13. When assembled, the washer 16 is received in the recess 78 in the body member 21 and the nut 17 is received in the chamber 38 in the fastener portion 32 of the keeper 31.

[0059] The biasing member 41 is disposed on the shaft 15 of the fastener 13, as shown in FIGS. 1 – 3, 5 and 6. The biasing member 41 has a first end 42 that abuts an inner surface 80 of the bottom wall 76, as shown in FIG. 3. A second end 43 of the biasing member 41 abuts the nut 17 received in the chamber 38 of the keeper 31, as shown in FIG. 6. The biasing member 41 is preferably a helical tapered spring in which a diameter at the first end 42 is larger than a diameter at the second end 43.

[0060] The body member 21 is preferably unitarily formed as a single-piece. The body member 21 is preferably made of an aluminum alloy. The keeper 31 is preferably unitarily formed as a single-piece. The keeper 31 is preferably made of an aluminum alloy.

Assembly and Operation

[0061] The deadend clamp assembly 11 is shown assembled in FIGS. 1 – 7. The body member 21 is connected to a support, such as a bracket, and the clevis pin 56 is passed through the mounting ear openings 54 and 55. The cotter pin 61 is then passed

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through the opening 60 in the clevis pin 56 to prevent the cotter pin from being removed from the mounting ears 52 and 53. The clevis pin 56 allows the clamp assembly 11 to pivot with respect to the support, thereby facilitating receiving the cable 9.

[0062] The cable 9 is inserted in the cable groove 71 from a side of the body member (i.e., in a radial direction of the cable). The lip 70, as shown in FIG. 2, prevents the cable 9 from slipping out of the cable groove 71 as the fastener 13 is tightened to draw the keeper 31 closer to the body member 21 to clamp the cable therebetween.

[0063] The washer 16 is disposed on the shaft 15 of fastener 13 such that the washer is received by the recessed area 78 in the body member 21, as shown in FIGS. 5 and 6. To clamp the cable 9 between the body member 21 and the keeper 31, a fastener 13 is inserted through the fastener opening 77 in the body member 21 and through the bore 35 in the keeper 31. The nut 17 is disposed in the chamber 38 of the fastener portion 32 of the keeper 31 and peened in the chamber 38 to substantially prevent upward (axial) movement.

[0064] The biasing member 41 is disposed on the shaft 15 of the fastener 13 such that the biasing member is prevented from being dislodged during tightening. The fastener 13 is tightened, thereby drawing the fastener portion 32 of the keeper 31 into the pocket 73 of the body member 21. The biasing member 41 is compressed as the fastener portion 32 of the keeper 31 is drawn into the pocket 73. Simultaneously, the cable portion 33 of the keeper 31 is drawn toward the retained cable 9 in the cable groove 71. Tightening of the fastener 13 is stopped when the keeper cable groove 34 engages the cable 9, thereby clamping the cable 9 between the keeper 31 and the body member 21. The chamber 38 and the peened nut 17 substantially prevent rotation and movement of the captive nut 17 on the fastener shaft 15, thereby securely retaining the keeper 31 to the body member 21. As shown in FIGS. 3 and 19, the side walls 74 and 75 substantially prevent rotation of the keeper 31 relative to the body member 21 as the keeper 31 is drawn into the pocket 73 of the body member 21.

Second Exemplary Embodiment

[0065] A clamp assembly 111 in accordance with a second exemplary embodiment of the present invention is shown in FIGS. 20 – 29. The clamp assembly 111 of the second exemplary embodiment is substantially similar to the clamp assembly 11 of the first exemplary embodiment shown in FIGS. 1 – 19, such that only features of the second exemplary embodiment different than those of the first exemplary embodiment are described below. Similar reference numbers are used to describe the features of the second exemplary embodiment, except in the 100 series, e.g., “1xx.”

[0066] A recessed area 178 is formed on an outer surface 179 of the bottom wall 176 of the pocket 173, as shown in FIGS. 20 and 23 – 27. The recessed area 178 is preferably substantially V-shaped. The recessed area 178 receives a washer 116 disposed on a shaft 115 of a fastener 113, as shown in FIGS. 22 and 23. The fastener opening 177 has an open portion bounded by two end walls 191 and 192. As shown in FIG. 26, a first height H1 of the first end wall 191 is larger than a second height H2 of the second end wall 192. The washer 116 is captured in the body member 121 by the V-shaped recessed area 178. The first height H1 of the first end wall 191 is larger than the second height H2 of the second end wall 192 to substantially prevent disassembly of the clamp assembly 111 when the distance between a cable groove 171 and a keeper cable groove 134 is at a maximum, such as when inserting or removing a cable 109. The first height H1 of the first end wall 191 prevents the washer 115 and the fastener 113 from slipping out the open end of the fastener opening 177 when moving the keeper 131 away from the cable groove 171.

[0067] The biasing member 141 is preferably a tapered spring, as shown in FIGS. 28 and 29, and is disposed on a shaft 115 of a fastener 113, as shown in FIGS. 20 – 22. The biasing member 141 has a first end 142 that abuts an inner surface 180 of a bottom wall 176 of a pocket 173 in a body member 121 of the clamp assembly 111, as shown in FIG. 22. A second end 143 of the biasing member 141 abuts a nut 117 received in a chamber 138 of a keeper 131 (FIG. 6). The biasing member 141 has a

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diameter D1 at the first end 142 that is larger than a diameter D2 at the second end 143, as shown in FIG. 28.

[0068] The smaller diameter second end 143 of the biasing member 141 facilitates passing the biasing member through the fastener bore 135 in the keeper 131 to engage the nut 117, as shown in FIGS. 20 – 22. The larger diameter first end 142 facilitates engaging the biasing member 141 with the inner surface 180 of the bottom wall 176 without slipping into a fastener opening 177 therein. The tapered biasing member 141 also allows the coils 145 to telescope into one another during compression by the keeper 131, thereby reducing the length of the biasing member 141.

[0069] The first end 142 of the biasing member 141 preferably has two coils 143 and 144 that are substantially planar, i.e., having zero pitch. The two coils 143 and 144 increases the stiffness of the biasing member. The two coils 143 and 144 also substantially eliminate the likelihood of the biasing member 141 becoming stuck in the pitch of the threads of the fastener 113 and caught between the fastener 113 and a fastener bore 135 in the keeper 131 when torque is applied to the fastener 113. The coils 145 of the biasing member 141 are substantially prevented from unraveling when torque is applied to the fastener 113 by the two coils 143 and 144 at the first end 142 of the biasing member 141.

Third Exemplary Embodiment

[0070] FIGS. 30-38 depict a third exemplary embodiment of the clamp assembly 200. The clamp assembly 200 is similar to the clamp assembly 11 of the first exemplary embodiment shown in FIGS. 1 – 19, and the clamp assembly 111 of the second embodiment shown in FIGS. 20-29 such that only certain features of the third exemplary embodiment are described below.

[0071] In the exemplary embodiment, a recessed area 202 is formed on an outer surface of the bottom wall of the pocket. The recessed area 202 has a substantially bulge or nose shape and at least partially-surrounds three sides of a fastener opening 204 that extends inwardly through the recessed area and laterally outwardly from the recessed area. The fastener opening 204 includes a substantially U-shaped portion that

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extends to a region having angled sides 205A, 205B that widen from the U-shaped portion to more easily receive a fastener 228. The recessed area 202 has an open back end and is at least partially bordered by a center wall 206, a first end wall 208, and a second end wall 210. The center wall 206 is positioned substantially in front of the fastener opening 204. The center wall 206 includes a curvilinear inner side surface 212. The first end wall 208 includes an inner side surface 214 that extends from the center wall 206 at an oblique angle. The second end wall 210 includes a curvilinear inner side surface 216 that extends from the center wall 206 at a first portion and a linear inner side surface that is obliquely angled to the center wall 206 at a second portion. As best shown in FIGS. 32 and 36, the center wall 206 has a top edge 218 that extends above the first and second end walls 208, 210. In alternative embodiments, the top edge 218 of the center wall 206 extends above at least one of the first and second end walls. The top edge 218 of the center wall 206 connects to the first and second end walls 208, 210 by a pair of curved transitions 220, 222. The bottom edge 224 of the center wall 206 may be spaced above the plane containing the recessed area 202 so that the center wall 206 is also positioned at least partially over fastener opening 204. This creates a space between the fastener opening 204 and the center wall 206 that allows a complete opening in the lateral direction but helps to retain the fastener 228 and an associated washer 226 in the recessed portion 202 when the clamp 200 is assembled. This helps prevent the fastener 228 from being removed, permitting easier installation, adjustment, and insertion and removal of the cable. The opening also increases the manufacturability of the clamp body 200 and reduces associated costs. In various alternative embodiments, the size, shape, and configuration of the center wall 206, first end wall 208, and second end wall 210 may vary. The recessed area 202 receives a washer 226 disposed on a shaft of a fastener 228, as shown in FIGS. 35-38, and helps prevent the washer 226 and fastener 228 from being dislodged from the clamp assembly 200 when the keeper is tightened or loosened.

[0072] The foregoing detailed description of the certain exemplary embodiments has been provided for the purpose of explaining the principles of the invention and its

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practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use contemplated. This description is not necessarily intended to be exhaustive or to limit the invention to the exemplary embodiments disclosed. Any of the embodiments and/or elements disclosed herein may be combined with one another to form various additional embodiments not specifically disclosed. Accordingly, additional embodiments are possible and are intended to be encompassed within this specification and the scope of the appended claims. The specification describes specific examples to accomplish a more general goal that may be accomplished in another way.

[0073] As used in this application, the terms “front,” “rear,” “upper,” “lower,” “upwardly,” “downwardly,” and other orientational descriptors are intended to facilitate the description of the exemplary embodiments of the present invention, and are not intended to limit the structure of the exemplary embodiments of the present invention to any particular position or orientation. Terms of degree, such as “substantially” or “approximately” are understood by those of ordinary skill to refer to reasonable ranges outside of the given value, for example, general tolerances associated with manufacturing, assembly, and use of the described embodiments.

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WHAT IS CLAIMED:

1. A clamp assembly, comprising:
 - a body member;
 - a cable groove formed in said body member to receive a cable;
 - a keeper having a lower surface adapted to engage the cable received in said cable groove;
 - a fastener opening formed in said body member; and
 - a recess formed in said body member at least partially surrounding said fastener opening, said recess being at least partially bordered by a first end wall, a second end wall, and a center wall extending across said fastener opening.
2. The clamp assembly of claim 1, wherein
 - a fastener connects said keeper to said body member and a biasing member is disposed on said fastener between said keeper and said body member.
3. The clamp assembly of claim 1, wherein
 - said cable groove has a bend of approximately 90 degrees.
4. The clamp assembly of claim 1, wherein
 - said center wall includes a curvilinear inner side surface.
5. The clamp assembly of claim 1, wherein
 - said first end wall includes an inner side surface that extends from the center wall at an oblique angle.
6. The clamp assembly of claim 1, wherein
 - said second end wall includes a curvilinear inner side surface that extends from the center wall at a first portion.

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7. The clamp assembly of claim 6, wherein
said second end wall includes a linear inner side surface that is obliquely
angled to the center wall at a second portion.
8. The clamp assembly of claim 1, wherein
a top edge of said center wall connects to said first end wall by a first curved
transition and to said second end wall by a second curved transition.
9. A clamp assembly, comprising:
a body member;
a cable groove formed in said body member to receive a cable;
a keeper having a lower surface adapted to engage the cable received in said
cable groove;
a fastener opening formed in said body member having a substantially U-
shaped slot; and
a recess in said body member at least partially surrounding said fastener
opening, said recess being at least partially bordered by a first end wall, a
second end wall, and a center wall connecting said first end wall and said
second end wall.
10. The clamp assembly of claim 9, wherein
said cable groove has a bend of approximately 90 degrees.
11. The clamp assembly of claim 9, wherein
a fastener connects said keeper to said body member.
12. The clamp assembly of claim 9, wherein
a top edge of said center wall extends above at least one of the first and second
end walls.

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13. The clamp assembly of claim 9, wherein
a bottom edge of said center wall is spaced above the recessed area.
14. The clamp assembly of claim 9, wherein
said center wall is positioned in front of said U-shaped portion of said fastener opening
15. The clamp assembly of claim 9, wherein
said fastener opening includes a first angled side and a second angled side that
widen the fastener opening from the U-shaped portion.
16. The clamp assembly of claim 9, wherein
said center wall includes a curvilinear inner side surface, said first end wall
includes an inner side surface that extends from the center wall at an
oblique angle, said second end wall includes a curvilinear inner side
surface that extends from the center wall at a first portion, said second end
wall includes a linear inner side surface that is obliquely angled to the
center wall at a second portion.
17. A clamp assembly, comprising:
a body member;
a cable groove formed in said body member to receive a cable;
a keeper having a lower surface adapted to engage the cable received in said
cable groove;
a fastener opening formed in said body member having a substantially U-
shaped slot;
a fastener extending through the fastener opening and connecting said keeper
to said body member;
a biasing member disposed on said fastener between said keeper and said body
member;

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a recess in said body member at least partially surrounding said fastener opening;
first end wall bordering the recess;
a second end wall bordering the recess; and
a center wall connecting said first end wall and said second end wall.

18. The clamp assembly of claim 9, wherein

said cable groove has a bend of approximately 90 degrees.

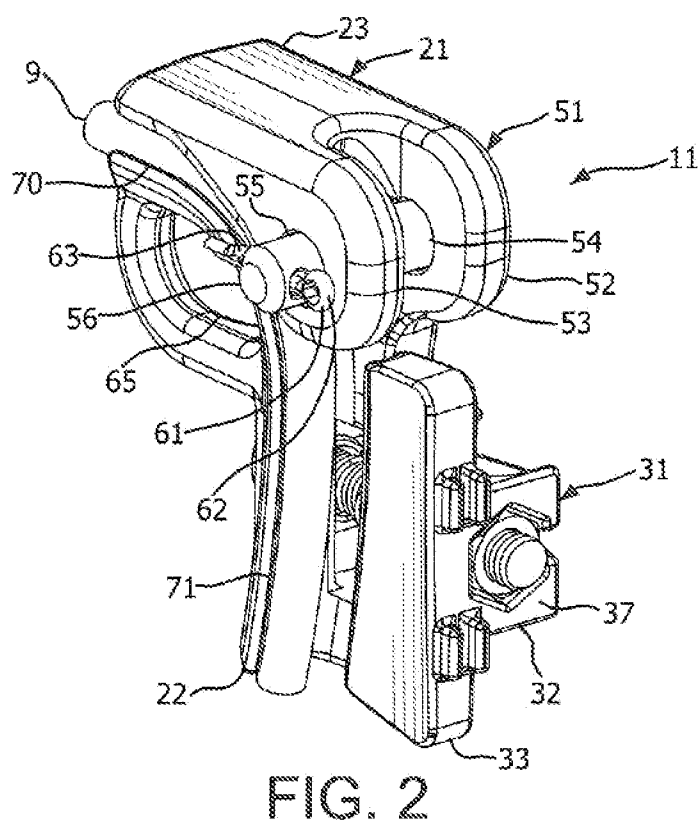
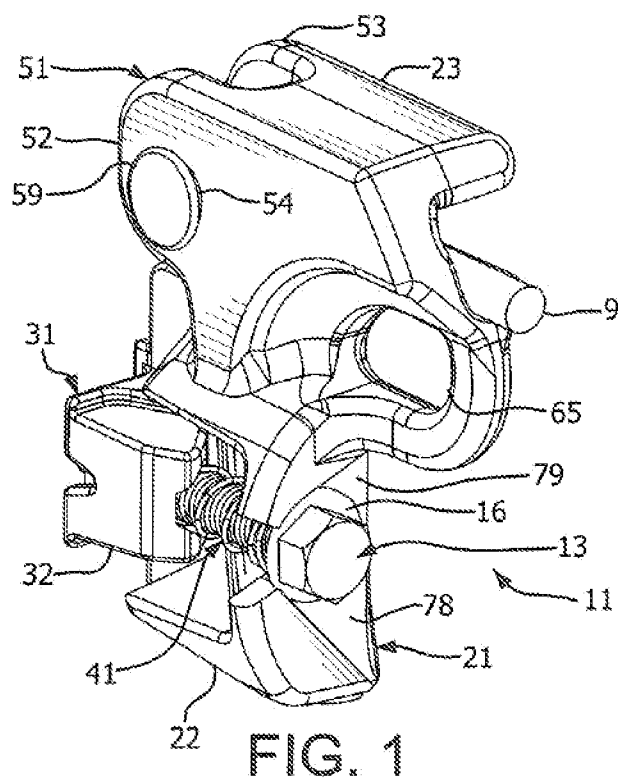
19. The clamp assembly of claim 17, wherein

said center wall includes a curvilinear inner side surface, said first end wall includes an inner side surface that extends from the center wall at an oblique angle, said second end wall includes a curvilinear inner side surface that extends from the center wall at a first portion, said second end wall includes a linear inner side surface that is obliquely angled to the center wall at a second portion.

20. The clamp assembly of claim 19, wherein

a top edge of said center wall extends above at least one of the first and second end walls and a bottom edge of said center wall is spaced above a plane containing the recessed area.

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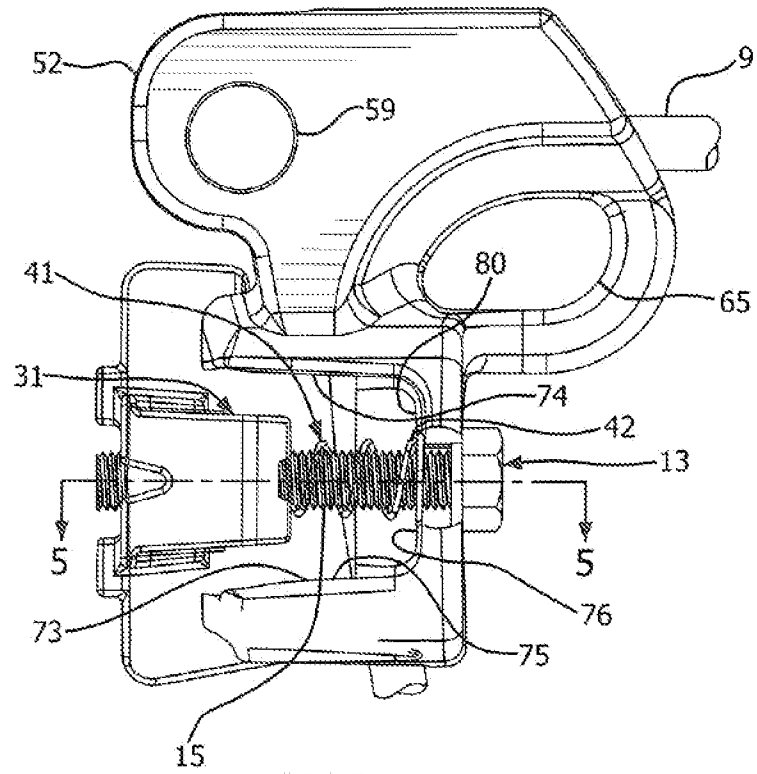


FIG. 3

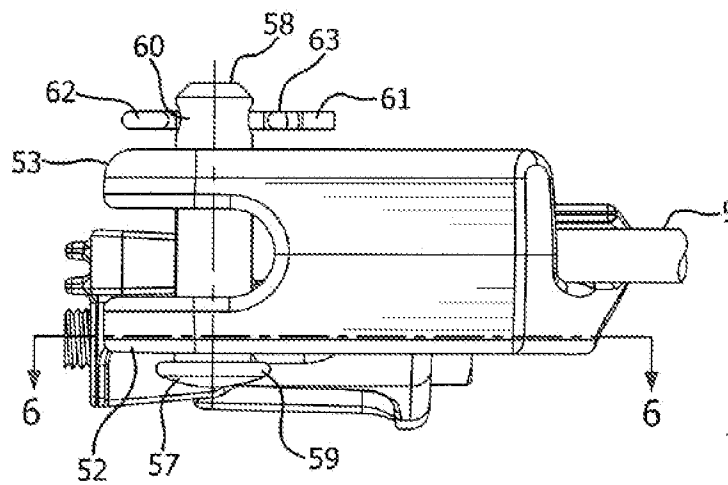


FIG. 4

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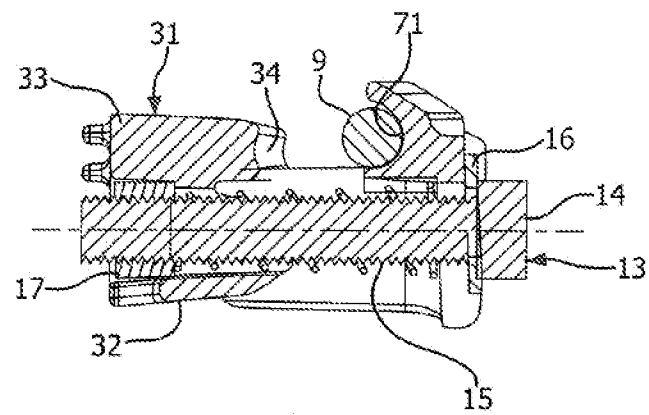


FIG. 5

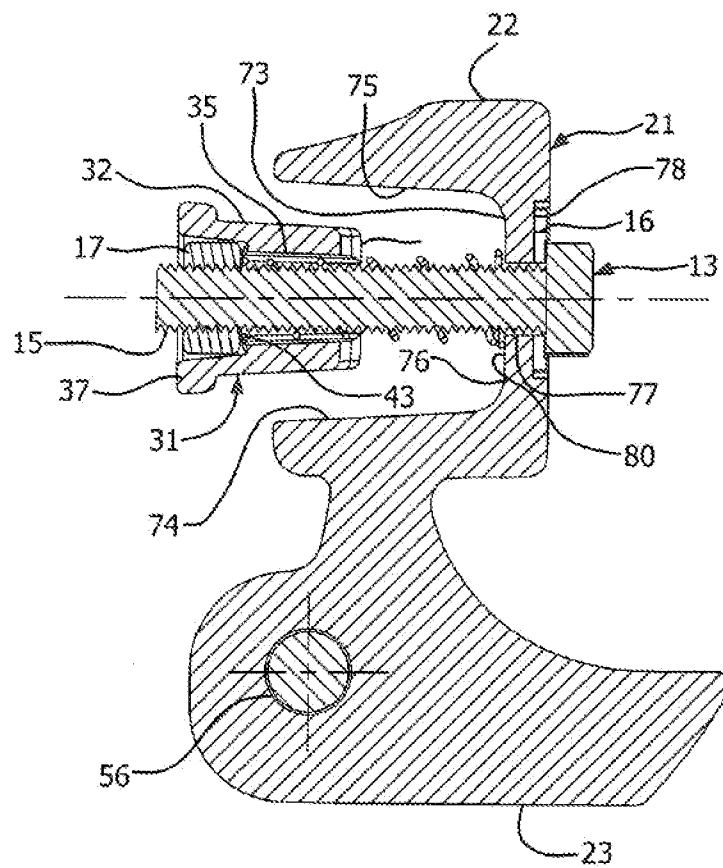


FIG. 6

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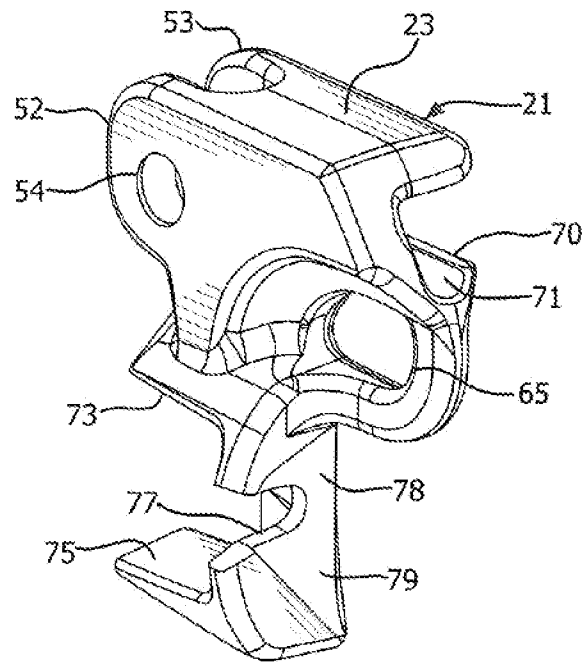


FIG. 7

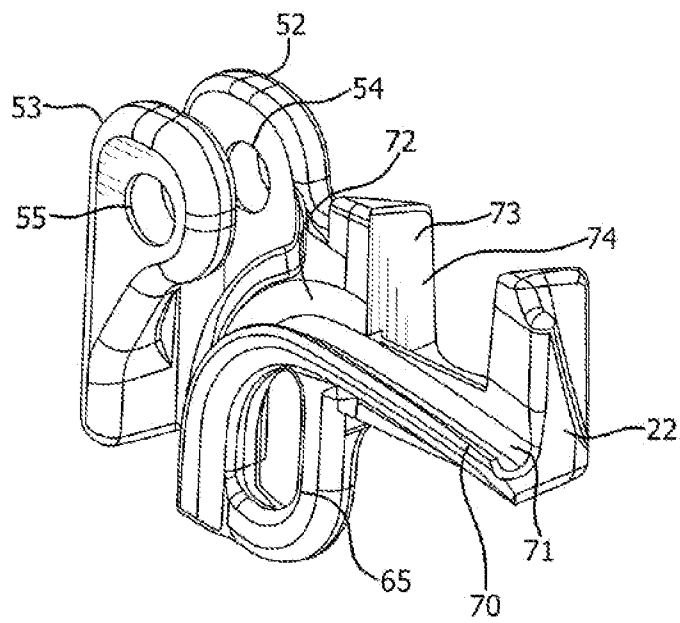


FIG. 8

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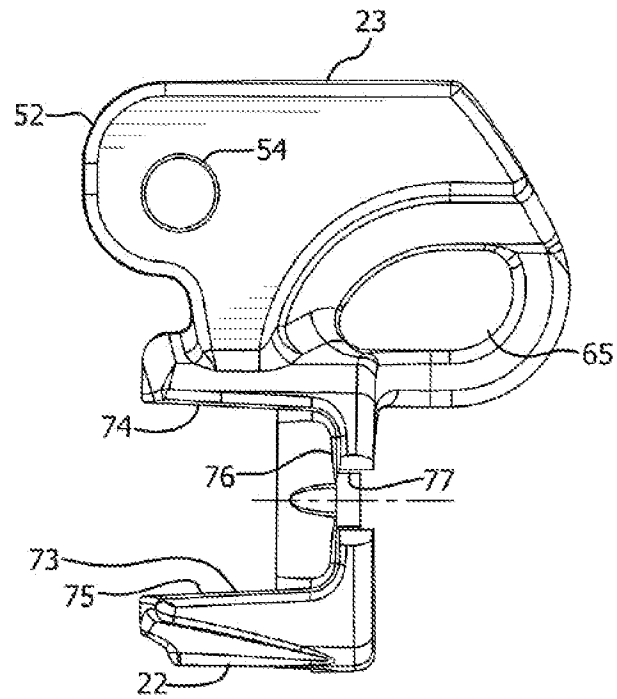


FIG. 9

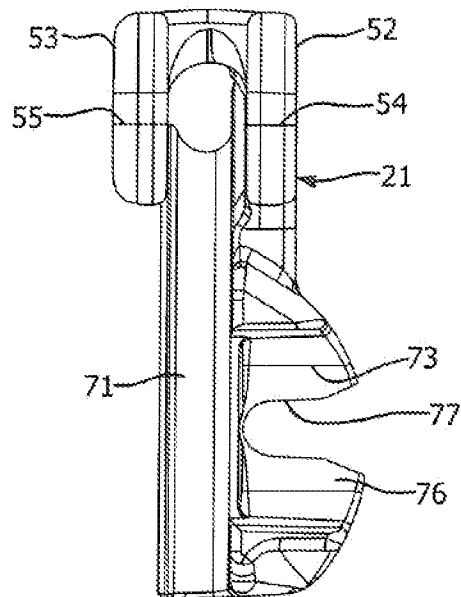


FIG. 10

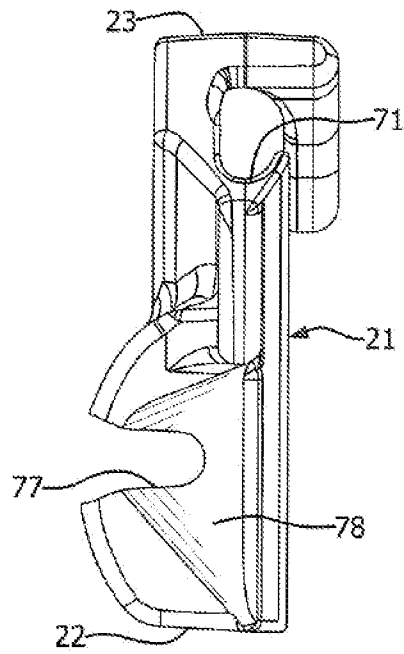


FIG. 11

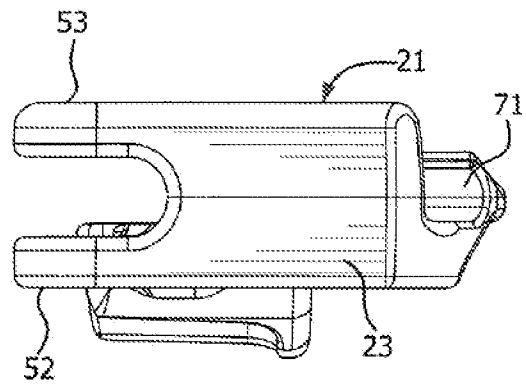


FIG. 12

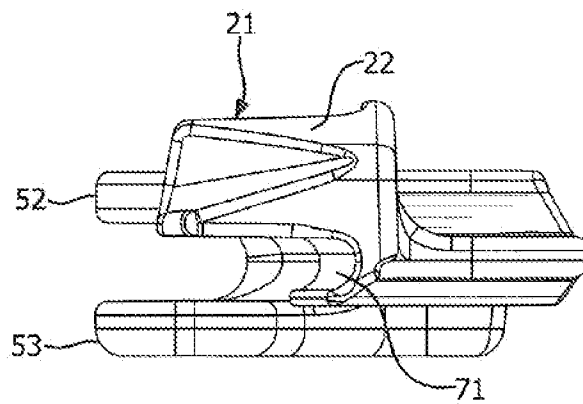


FIG. 13

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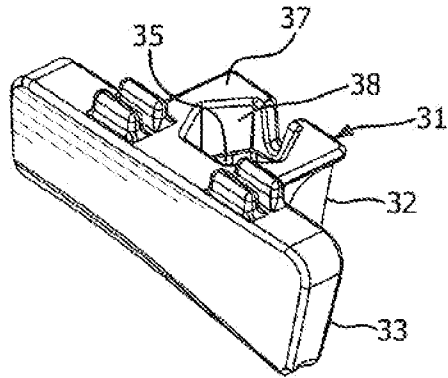


FIG. 14

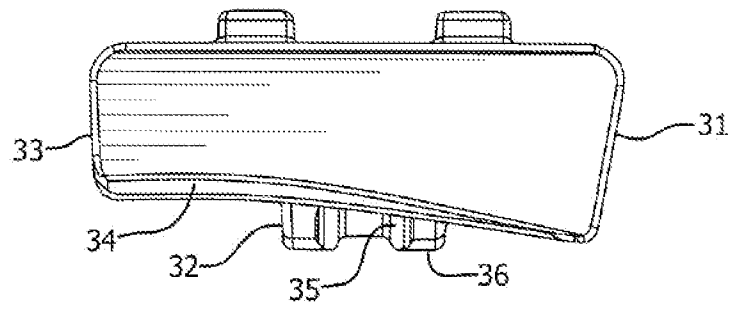


FIG. 15

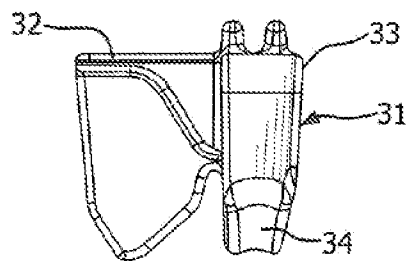


FIG. 16

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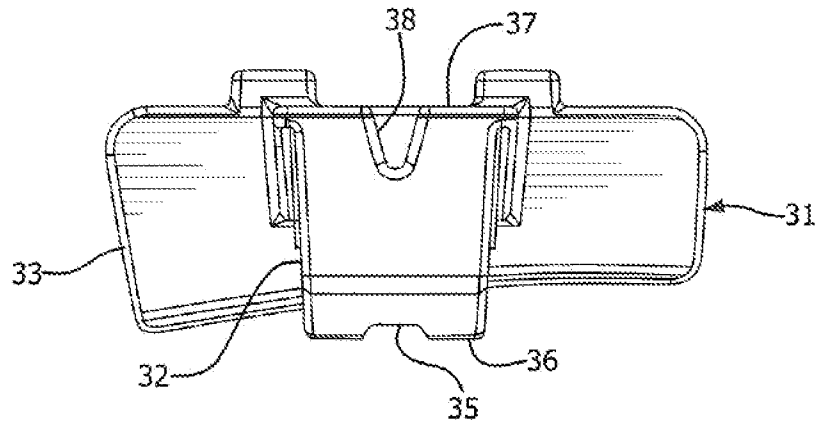


FIG. 17

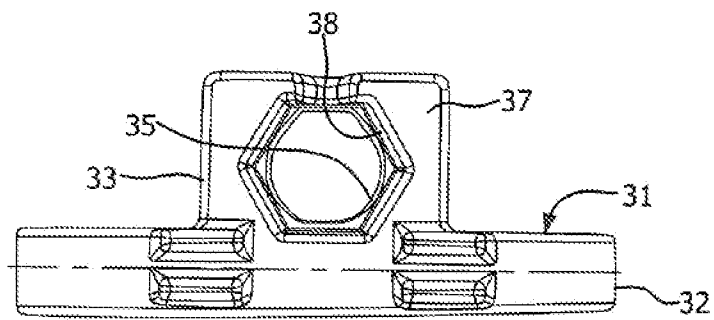


FIG. 18

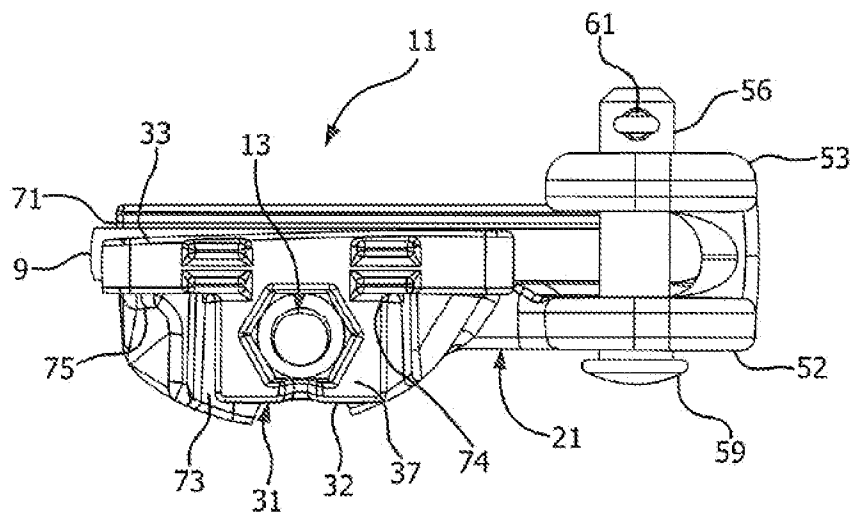


FIG. 19

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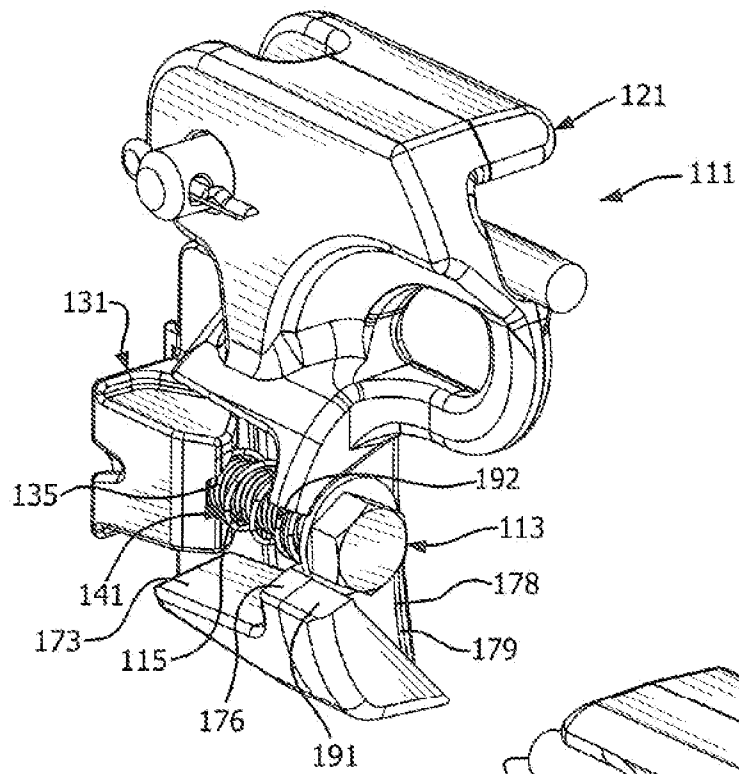


FIG. 20

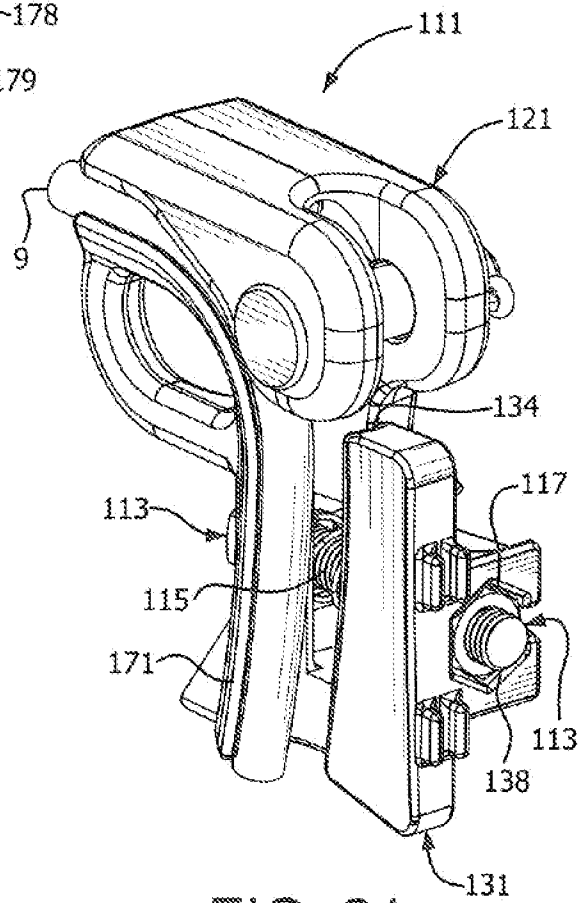


FIG. 21

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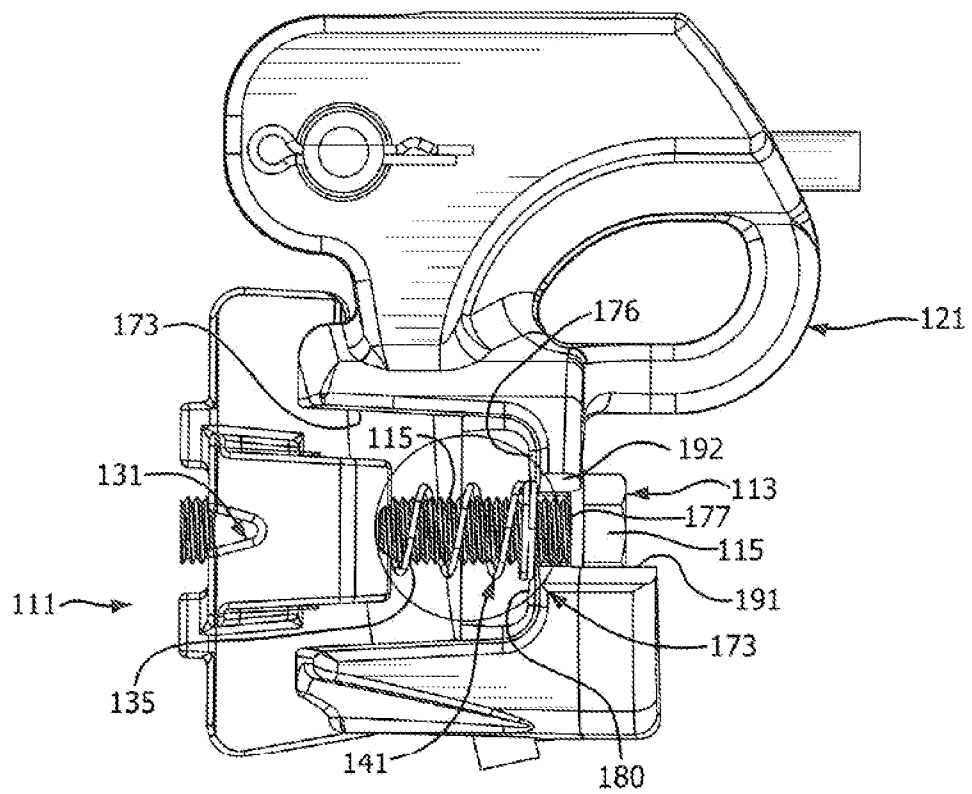


FIG. 22

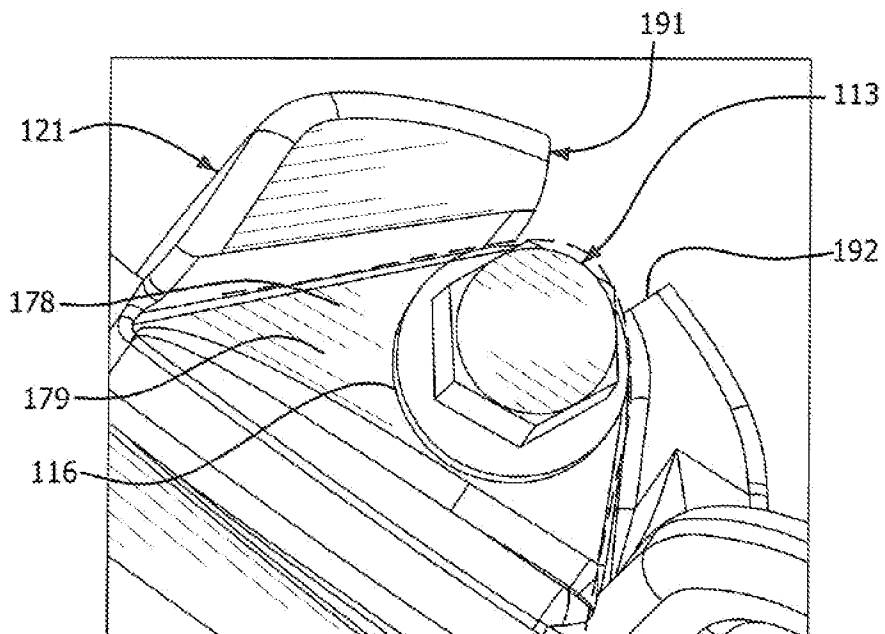


FIG. 23

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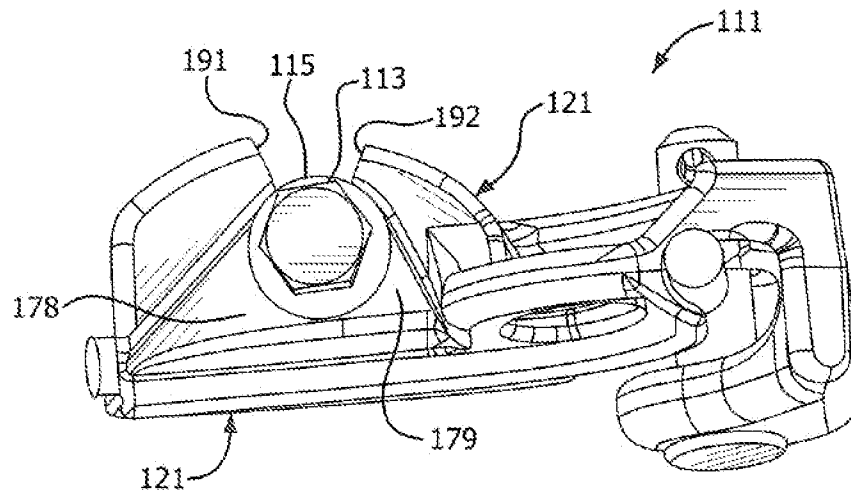


FIG. 24

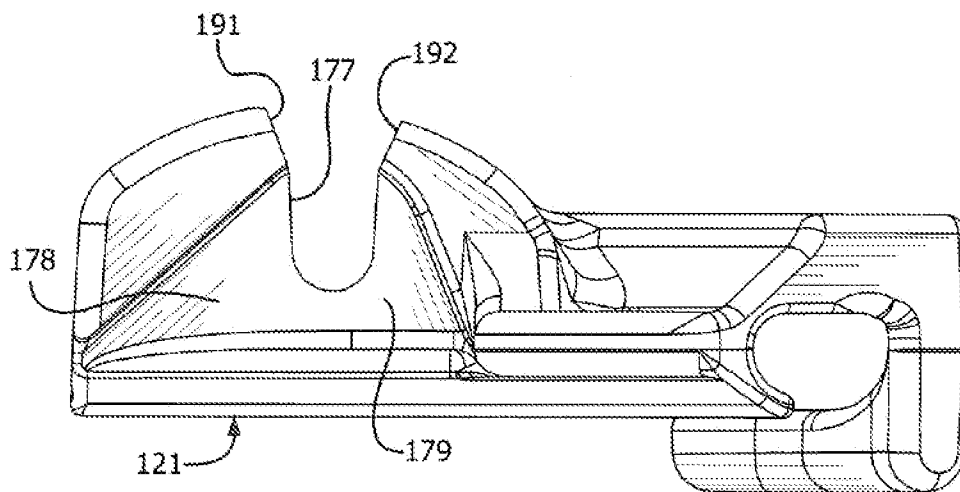
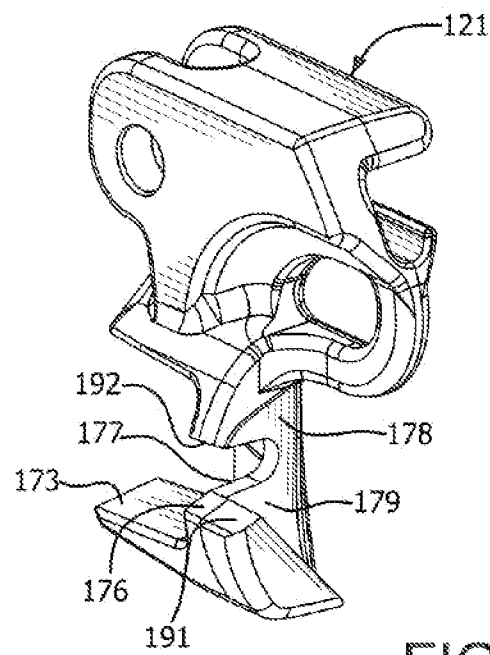
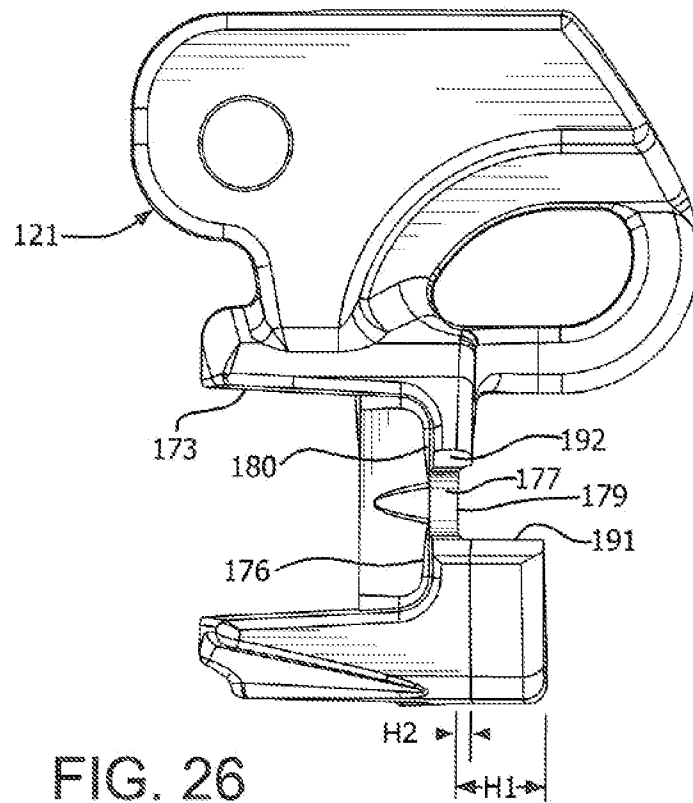


FIG. 25

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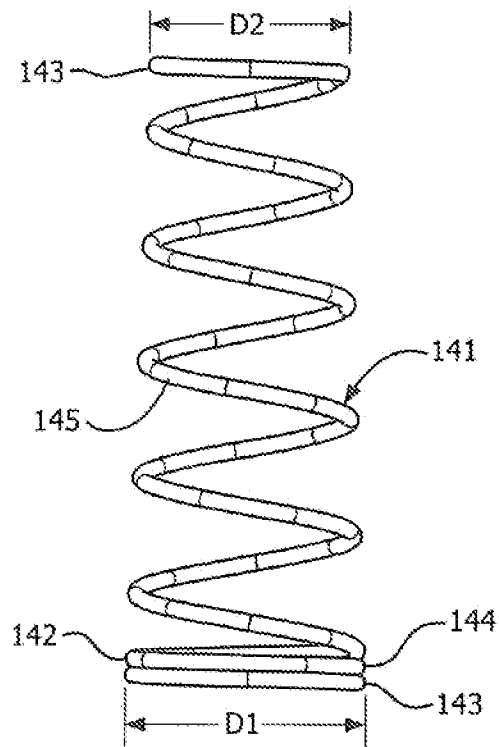


FIG. 28

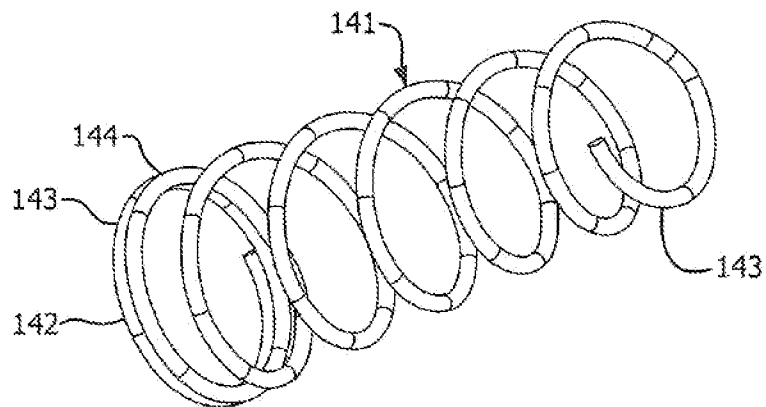


FIG. 29

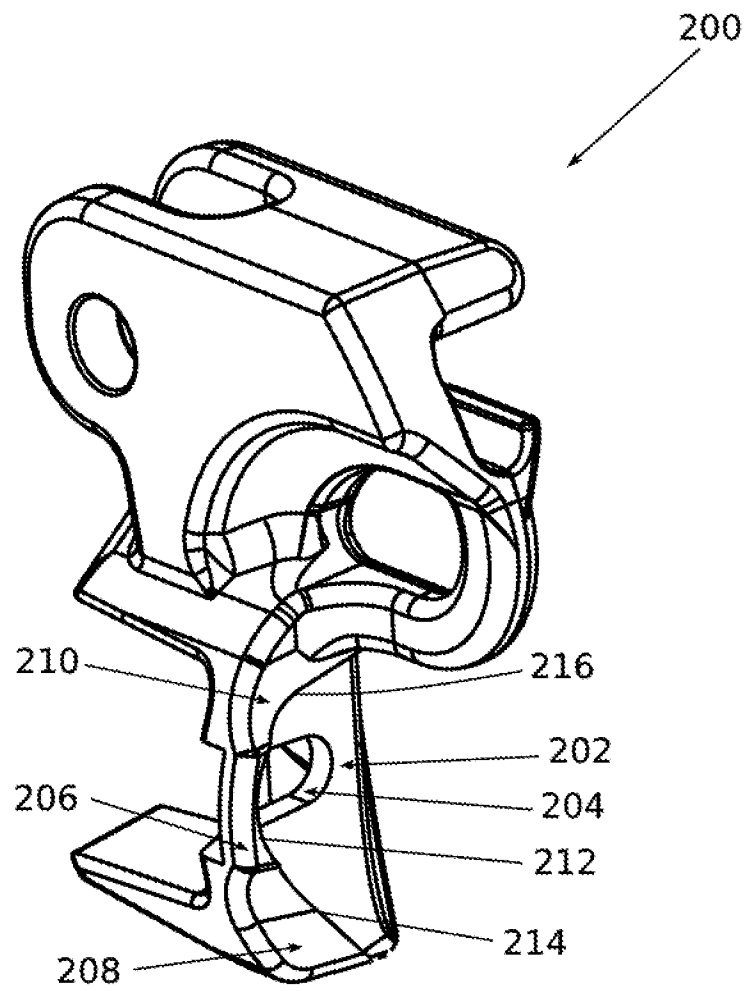


FIG. 30

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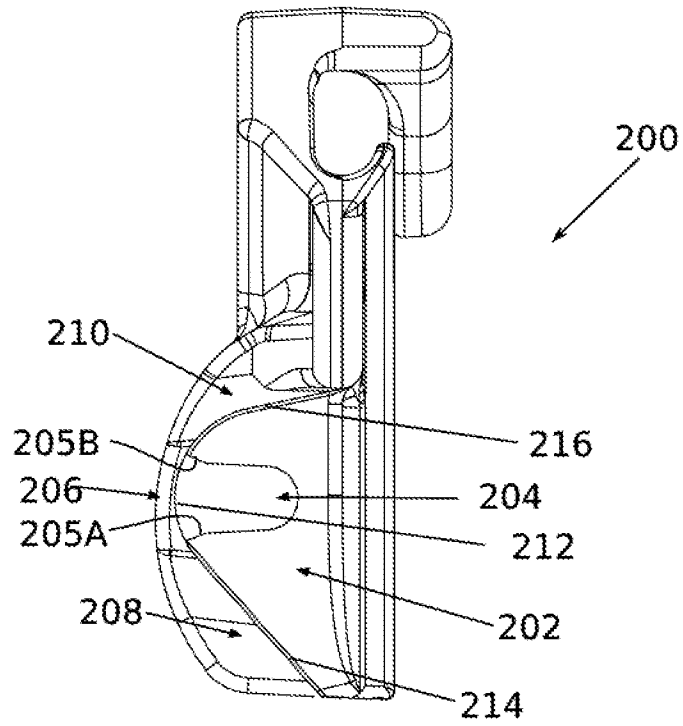


FIG. 31

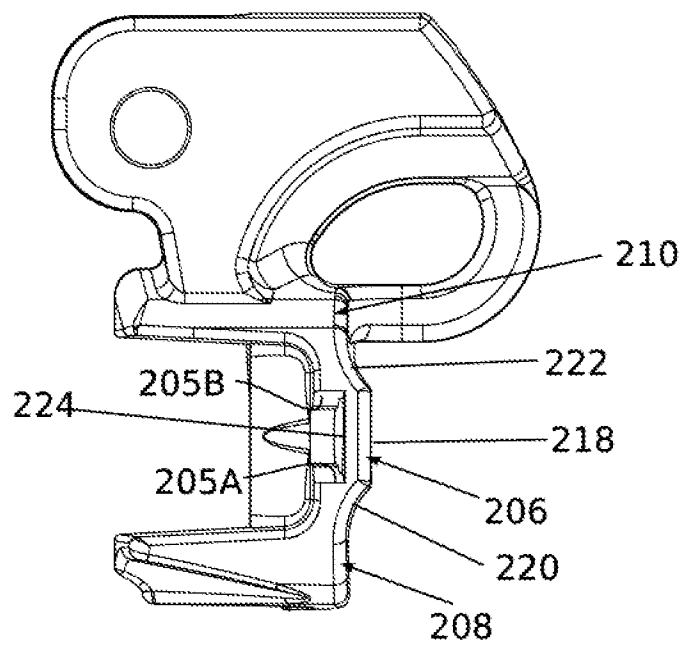


FIG. 32

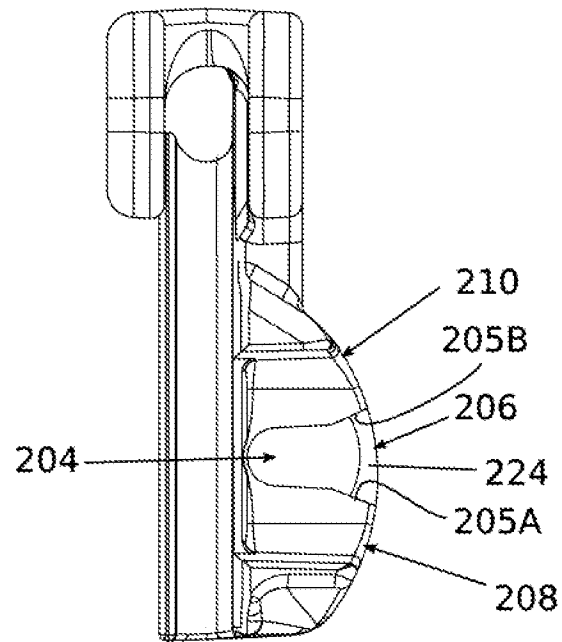


FIG. 33

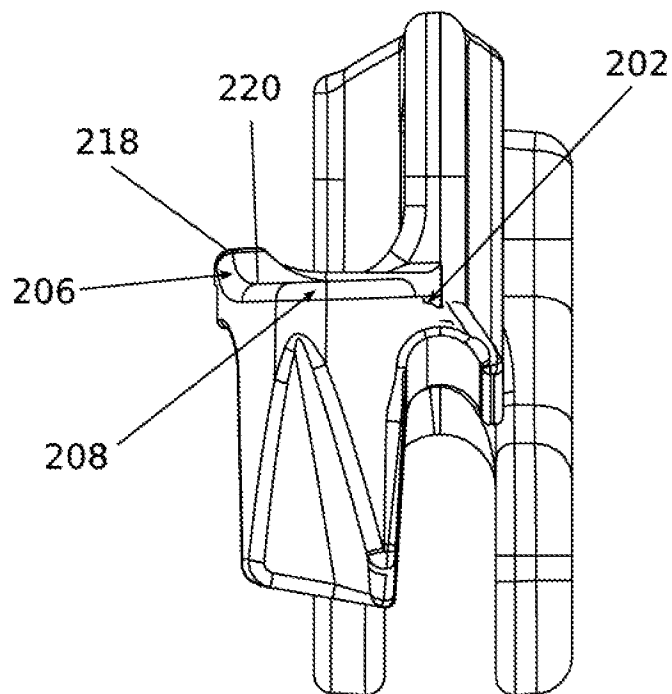


FIG. 34

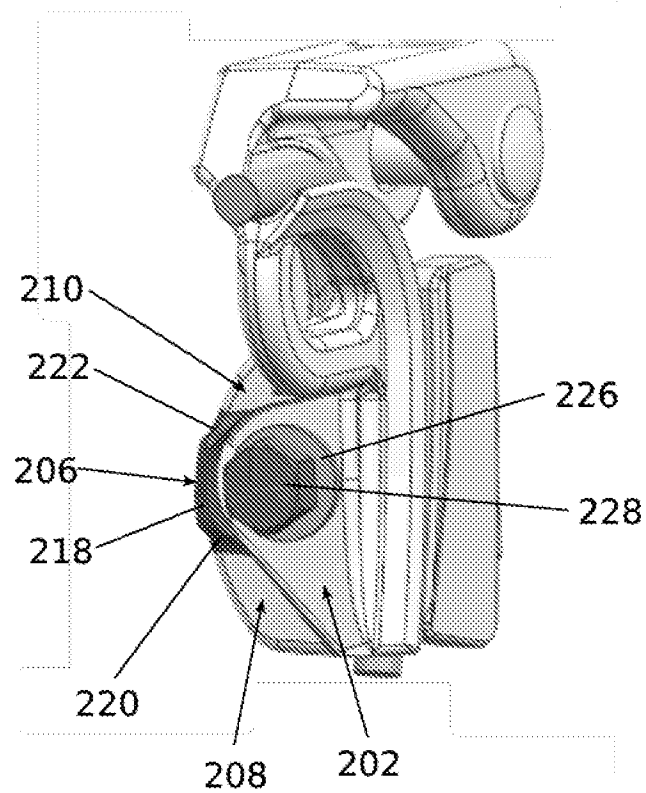


FIG. 35

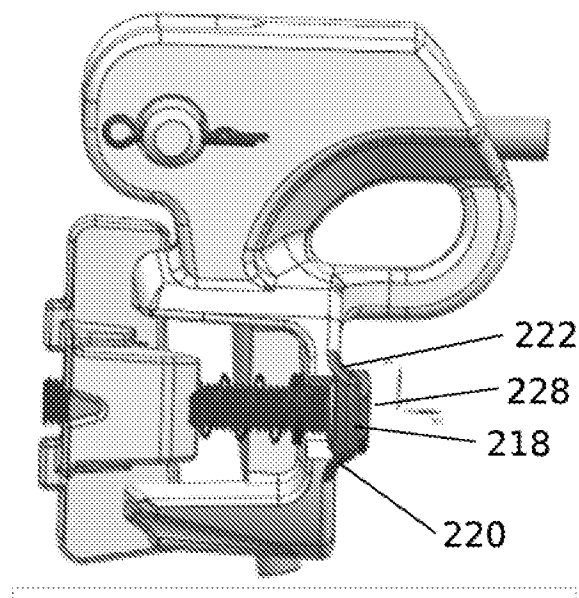


FIG. 36

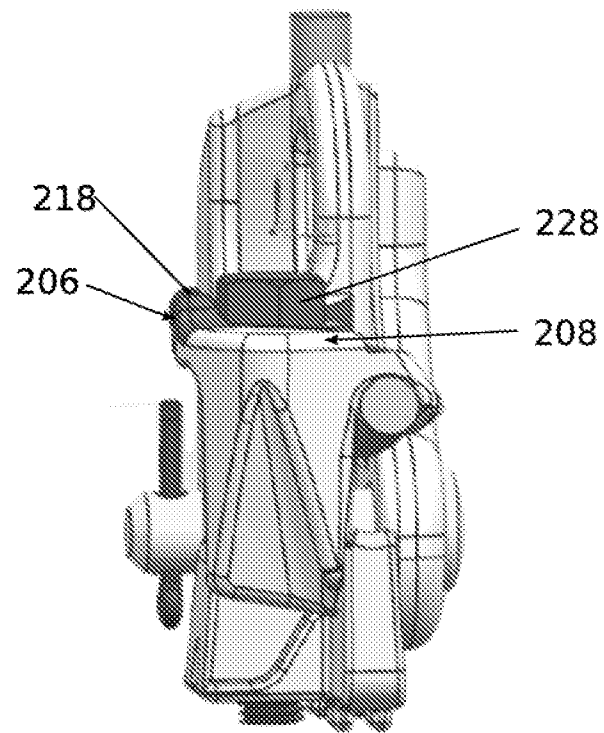


FIG. 37

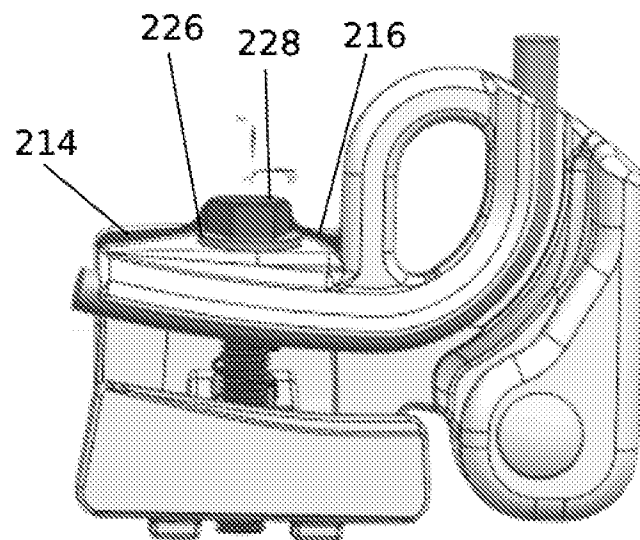


FIG. 38

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/025276

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H02G 7/05 (2015.01)

CPC - H02G 7/056 (2015.05)

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)

IPC(8) - F16G 11/00, 11/06; F16L 3/00; H02G 7/00, 7/05 (2015.01)

CPC - F16G 11/06; F16L 3/1215; G02B 6/48; H02G 7/056 (2015.05) (keyword delimited)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 24/65, 135R, 489, 495; 174/42; 248/63, 74.1, 74.4

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

PatBase, Google Patent, Google

search terms used: clamp, keeper, spring, oblique angle, cable, groove, suspension, side loading, dead end, bolt, curvilinear, u-bolt, obtuse, slot, end wall, angles

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2013/0240685 A1 (HUBBELL INCORPORATED) 19 September 2013 (19.09.2013) entire document	1-20
Y	US 1,793,932 A (HITE) 24 February 1931 (24.02.1931) entire document	1-20
Y	US 2,077,222 A (CREAGER) 13 April 1937 (13.04.1937) entire document	12-14, 20
A	US 2013/0082152 A1 (BUNDREN et al) 04 April 2013 (04.04.2013) entire document	1-20
A	US 2013/0227823 A1 (DIOP et al) 05 September 2013 (05.09.2013) entire document	1-20

☐ Further documents are listed in the continuation of Box C.


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"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

12 June 2015

Date of mailing of the international search report

07 JUL 2015

Name and mailing address of the ISA/US

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P.O. Box 1450, Alexandria, Virginia 22313-1450

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