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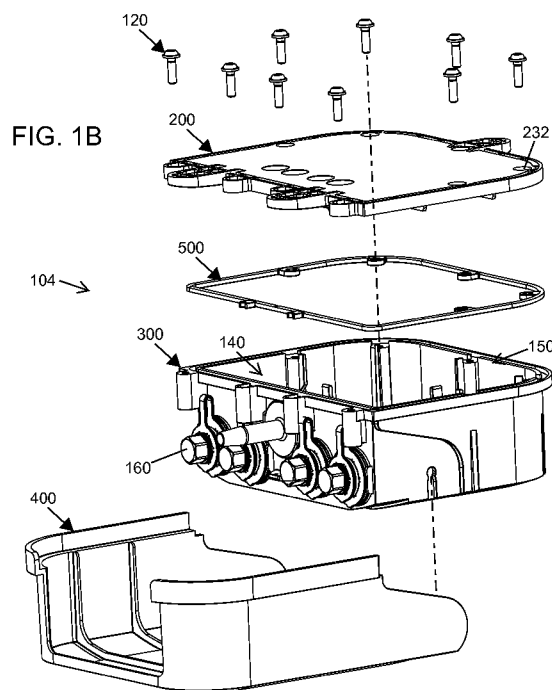
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- (54) Title: ENCLOSURE SEAL WITH PRESSURE RELIEF



(57) Abstract: A seal (500) is adapted for use with telecommunications enclosures (100). The seal (500) provides a pressure relief function to relieve excess pressure from an interior (140) of the enclosure (100). In certain embodiments, the seal (500) may reduce fatigue stress and thereby reduce or eliminate fatigue failure in the telecommunications enclosure (100) by relieving pressure within the interior (140) of the enclosure (100).

ENCLOSURE SEAL WITH PRESSURE RELIEF

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to U.S. Patent Application Serial No. 61/949,693 filed on March 7, 2014, the disclosure of which is incorporated herein by
5 reference in its entirety.

FIELD OF THE INVENTION

[0002] The present disclosure relates to enclosures (e.g., hardened enclosures) that may be opened for servicing components housed within an interior of the enclosure.

10 BACKGROUND

[0003] Enclosures may be provided at various points of a telecommunications network. The enclosures may house various telecommunications components. The enclosures may be used to terminate fiberoptic cables routed to the enclosures. The enclosures may be ruggedized to withstand outdoor environments and protect the
15 telecommunications components within an interior of the enclosure from rain, sunlight, dust, rodents, and various other hazards that may be present in such outdoor environments. The enclosures may also be used in indoor environments.

[0004] To gain access to service the telecommunications components and/or to reconnect and/or interconnect the various telecommunications cables terminated within the
20 enclosure, the enclosures may be openable and thereby expose the interior of the enclosure. When opened, a technician may gain access to the interior of the enclosure and thereby perform desired operations to the telecommunications components and/or the telecommunications cable interconnections. In outdoor and/or other environments, the enclosures may be provided with a seal or seals that seal joints of the enclosure. The
25 joints between various pieces of the enclosure may facilitate repeated openings and closings of the enclosure.

[0005] In certain environments with substantial changes in temperature and/or barometric or ambient pressure, differential pressure may develop within the enclosure with respect to the ambient environment. Such differential pressure, especially when
30 cyclical, may lead to structural failure of the enclosure. Elevated pressure within the

interior of the enclosure may undesirably affect the telecommunications components therein as they may be sensitive to increased pressure. Methods of relieving pressure from the interior of the enclosure may therefore be desired.

SUMMARY

- 5 [0006] The present disclosure relates to a seal adapted for use with telecommunications enclosures. The seal provides a pressure relief function to relieve excess pressure from an interior of the enclosure. In certain embodiments, the seal may reduce fatigue stress and thereby reduce or eliminate fatigue failure in the telecommunications enclosure by relieving pressure within the interior of the enclosure.
- 10 [0007] A variety of additional aspects will be set forth in the description that follows. These aspects can relate to individual features and to combinations of features. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad concepts upon which the embodiments disclosed herein are based.

15 BRIEF DESCRIPTION OF THE DRAWINGS

- [0008] Figure 1A is a perspective view of an enclosure according to the principles of the present disclosure;
- [0009] Figure 1B is the perspective view of Figure 1A, but exploded thereby revealing a seal adapted to provide a pressure relief function according to the principles of
- 20 the present disclosure;
- [0010] Figure 2 is another exploded perspective view of the enclosure of Figure 1A with the seal of Figure 1B;
- [0011] Figure 3 is an enlarged portion of Figure 2, as called out at Figure 2;
- [0012] Figure 4 is an enlarged portion of Figure 3, as called out at Figure 3;
- 25 [0013] Figure 5 is an enlarged portion of Figure 3, as called out at Figure 3;
- [0014] Figure 6 is an enlarged portion of Figure 2, as called out at Figure 2;
- [0015] Figure 7 is still another exploded perspective view of the enclosure of Figure 1A with the seal of Figure 1B;
- [0016] Figure 8 is an enlarged portion of Figure 7, as called out at Figure 7;
- 30 [0017] Figure 9 is an enlarged portion of Figure 8, as called out at Figure 8;
- [0018] Figure 10 is an enlarged portion of Figure 8, as called out at Figure 8;

[0019] Figure 11 is the perspective view of Figure 7, but non-exploded and enlarged;

[0020] Figure 12 is an elevation view of a cover of the enclosure of Figure 1A;

[0021] Figure 13 is an elevation view of the seal of Figure 1B;

[0022] Figure 14 is an enlarged partial cross-sectional elevation view of the cover of
5 Figure 12, as called out at Figure 12;

[0023] Figure 15 is an enlarged partial cross-sectional elevation view of the cover of
Figure 12, as called out at Figure 12;

[0024] Figure 16 is an enlarged partial cross-sectional elevation view of the seal of
Figure 1B, as called out at Figure 13;

10 [0025] Figure 17 is an enlarged partial perspective cutaway view of the seal of Figure
1B similar to the enlarged partial cross-sectional view of Figure 16 with a cutaway plane
of Figure 17 coinciding with a cross-sectional plane of Figure 16, but with the cutaway
plane of Figure 17 tilted relative to a viewing direction of Figure 17;

[0026] Figure 18 is an enlarged partial cross-sectional elevation view of the seal of
15 Figure 1B, as called out at Figure 13;

[0027] Figure 19 is an enlarged portion of Figure 13, as called out at Figure 13;

[0028] Figure 20 is a perspective view of another enclosure according to the
principles of the present disclosure;

[0029] Figure 21 is another perspective view of the enclosure of Figure 20;

20 [0030] Figure 22 is the perspective view of Figure 21, but exploded thereby revealing
another seal adapted to provide a pressure relief function according to the principles of the
present disclosure;

[0031] Figure 23 is an enlarged portion of Figure 22, as called out at Figure 22;

[0032] Figure 24 is the perspective view of Figure 20, but exploded thereby revealing
25 the seal of Figure 22;

[0033] Figure 25 is an enlarged portion of Figure 24, as called out at Figure 24;

[0034] Figure 26 is the exploded perspective view of Figure 24, but with the seal of
Figure 22 separately exploded;

[0035] Figure 27 is an enlarged portion of Figure 26, as called out at Figure 26;

30 [0036] Figure 28 is an enlarged portion of Figure 26, as called out at Figure 26;

[0037] Figure 29 is a partial perspective cutaway view of the enclosure of Figure 20,
but with a shroud removed;

[0038] Figure 30 is an enlarged portion of Figure 29, as called out at Figure 29;

[0039] Figure 31 is an enlarged portion of Figure 29, as called out at Figure 29;

[0040] Figure 32 is a plan view of the seal of Figure 22;

[0041] Figure 33 is an enlarged portion of Figure 32, as called out at Figure 32;

[0042] Figure 34 is an exploded perspective view of still another enclosure with still another seal adapted to provide a pressure relief function according to the principles of the present disclosure;

[0043] Figure 35 is an enlarged portion of Figure 34, as called out at Figure 34;

[0044] Figure 36 is the exploded perspective view of Figure 34, but with a base of the enclosure removed and with the seal of Figure 34 separately exploded;

[0045] Figure 37 is an enlarged portion of Figure 36, as called out at Figure 36;

10 [0046] Figure 38 is an enlarged portion of Figure 36, as called out at Figure 36;

[0047] Figure 39 is a partial elevation view of the seal of Figure 34;

[0048] Figure 40 is an enlarged portion of Figure 39, as called out at Figure 39;

[0049] Figure 41 is a cross-sectional view of the seal of Figure 34, as called out at Figure 39;

15 [0050] Figure 42 is an enlarged portion of Figure 41, as called out at Figure 41;

[0051] Figure 43 is an end view of the seal of Figure 34;

[0052] Figure 44 is an enlarged portion of Figure 43, as called out at Figure 43;

[0053] Figure 45 is another partial elevation view of the seal of Figure 34 that is opposite the partial elevation view of Figure 39; and

20 [0054] Figure 46 is an enlarged partial cross-sectional elevation view of the seal of Figure 34, as called out at Figure 45.

DETAILED DESCRIPTION

[0055] According to the principles of the present disclosure, a seal that seals two pieces of a telecommunications enclosure provides a pressure relief function. Such telecommunications enclosures are often used in outdoor environments and experience cyclical changes in ambient temperature, ambient pressure, sunlight exposure, humidity, and/or other environmental factors. As such enclosures are typically watertight; such ambient cyclical variations may lead to cyclical pressure variations within the enclosure if no pressure relief function is provided. The cyclical pressure variations may be harmful to telecommunications components positioned within the enclosure. Such cyclical pressure variations may also induce cyclical stress on the enclosure. The cyclical stress on the enclosure may lead to fatigue failure and produce cracks on the enclosure and/or produce

other failures of the enclosure. In addition to the cyclical pressure variations, the telecommunications enclosures may also experience one-time pressure events that may be vented by the pressure relief function of the seal.

[0056] Environments where such telecommunications enclosures are installed may include ambient temperatures that range from -40 degrees Celsius to +65 degrees Celsius. Such enclosures may be expected to perform with differential pressures from 10 to 20 kPa. Such enclosures may further be expected to be submersible beneath water at a depth of one meter, two meters, and/or up to five meters. The water pressure (i.e., water head) may be cyclical.

[0057] Such telecommunications enclosures may be expected to withstand standardized performance tests. For example, a performance standard known in the industry as IP65/IP67 may require subjecting the enclosure to a series of tests. Meeting or exceeding such standardized performance criteria may be required for the enclosure to be selected for use in a given telecommunications network. Other test standards may include IEC 61300-2-38 Method A, IEC 609529, and IEC 61300-2-23 Method 2.

[0058] According to the principles of the present disclosure, a seal with a blow-off point may be used to seal two pieces of the enclosure at a performance level that satisfies one or more of the above performance standards and allows for pressure relief of the enclosure at the blow-off point when a predetermined positive differential pressure within the enclosure exists. By using the seal with the pressure relief function, a separate pressure relief valve for the enclosure may not be needed. By avoiding a separate pressure relief valve, the enclosure may be reduced in cost, reduced in weight, reduced in size, and/or reduced in complexity (i.e., increased in reliability).

[0059] In certain embodiments, the seal and the enclosure are designed together to facilitate the pressure relief function of the seal. In other embodiments, the seal may include a pressure relief function and may be retrofitted into existing enclosures and provide the pressure relief function to the existing enclosures.

[0060] Turning now to the Figures, three example embodiments of sealing systems for telecommunications enclosures are provided. In particular, Figures 1A-19 illustrate an enclosure 100 with a seal 500 that provides a pressure relief function. Figures 20-33 illustrate an enclosure 1100 with a seal 1500 that provides a pressure relief function. And, Figures 34-46 illustrate an enclosure 2100 with a seal 2500 that provides a pressure relief function.

[0061] In each of the illustrated embodiments, the enclosures 100, 1100, 2100 include two or more pieces that are substantially rigid in comparison with the seal 500, 1500, 2500. In particular, the pressure relief function is triggered by internal pressure inducing deformation on the seal 500, 1500, 2500, and seal deformation results in a controlled release of pressure from within the enclosure 100, 1100, 2100. In certain embodiments, external pressure may induce deformation on the seal 500, 1500, 2500, and seal deformation results in a controlled intake of pressure to within the enclosure 100, 1100, 2100. In the depicted embodiments, any deformation that may occur on the pieces of the enclosure 100, 1100, 2100 are substantially lower in magnitude compared with the deformation at the seal 500, 1500, 2500.

[0062] In the example embodiments, the enclosure 100, 1100, 2100 is designed to compress the seal 500, 1500, 2500 upon configuring the enclosure 100, 1100, 2100 to a closed configuration 102, 1102. In certain embodiments, the seal 500, 1500, 2500 is nominally 2.5 millimeters across sealing surfaces in an uncompressed state. Upon installing the seal 500, 1500, 2500 into the enclosure 100, 1100, 2100 and assembling the enclosure 100, 1100, 2100 to the closed configuration 102, 1102, the seal 500, 1500, 2500 may be nominally compressed to 2 millimeters across the sealing surfaces. The compression from 2.5 millimeters to 2 millimeters is nominally a 25% compression.

[0063] In certain embodiments, compression stresses within the seal 500, 1500, 2500 are non-uniform. However, compressing the seal 500, 1500, 2500 from 2.5 millimeters to 2 millimeters produces a 25% bulk compression amount. At a given cross-section, the bulk compression amount determines a resulting shape of the seal 500, 1500, 2500 and an amount of sealing contact pressure that the seal 500, 1500, 2500 produces against corresponding sealing areas of the enclosure 100, 1100, 2100. In certain embodiments, a deformation to stress relationship within the seal 500, 1500, 2500 may be linear or non-linear. The deformation characteristics may be elastic, hyperelastic, viscoelastic, plastic, and/or thermal elastic. The bulk compression amount results in a preloading of the seal 500, 1500, 2500 against the sealed pieces of the enclosure 100, 1100, 2100. The preloading of the seal 500, 1500, 2500 may aid in the sealing function of the seal 500, 1500, 2500 as any fluid attempting to leak across the seal 500, 1500, 2500 would first need to overcome this preload.

[0064] According to the principles of the present disclosure, the seal 500, 1500, 2500 include a pressure relief portion 540, 1540, 2540. In the depicted examples, the pressure relief portion 540, 1540, 2540 includes a pressure relieving feature 542, 1542, 2542 (i.e., a

pressure relief feature). As depicted, the pressure relieving feature 542, 1542, 2542 includes a reduced amount of material in at least one direction compared with neighboring portions of the seal 500, 1500, 2500. As depicted, the pressure relief portion 540, 1540, 2540 is relatively small in size compared to an elongate portion 520, 1520, 2520 of the seal 500, 1500, 2500.

[0065] As depicted, the seal 500, 1500, 2500 extend around a loop. In other embodiments, the seal may extend from a first end to a second end. In the depicted embodiments, the elongate portion 520, 1520, 2520 extends substantially around a perimeter of the seal 500, 1500, 2500. The elongate portion 520, 1520, 2520 joins to the pressure relief portion 540, 1540, 2540 on both sides of the pressure relief portion 540, 1540, 2540. The perimeter of the seal 500, 1500, 2500 is substantially occupied by the elongate portion 520, 1520, 2520 (e.g., over 95% of a length of the perimeter). However, the pressure relief portion 540, 1540, 2540 occupies a portion of the perimeter. In the depicted embodiments, the elongate portion 520, 1520, 2520 and the pressure relief portions 540, 1540, 2540 are made of a single continuous piece of material (e.g., rubber, silicone rubber, etc.). The seal 500, 1500, 2500 is monolithic in the depicted embodiments. In other embodiments, the seal may have joints, the elongate portion may include a different material from the pressure relief portion, and/or the seal may not be continuous. In the depicted embodiments, the elongate portion 520, 1520, 2520 includes a substantially constant cross-section 522. In the depicted embodiments, the seals 500, 1500, 2500 are substantially planar seals (i.e., substantially lay along a plane). In the depicted embodiments, the seals 500, 2500 include substantially planar sealing surfaces. In certain embodiments, the seal may be non-planar and/or may seal non-planar sealing surfaces to each other.

[0066] In the depicted embodiments, the elongate portion 520, 1520, 2520 substantially achieves a first bulk compression amount when the seal 500, 1500, 2500 is installed within the enclosure 100, 1100, 2100 and the enclosure 100, 1100, 2100 is at the closed configuration 102, 1102. In the depicted embodiments, the pressure relief portion 540, 1540, 2540 experiences a second bulk compression amount when the enclosure 100, 1100, 2100 is at the closed configuration 102, 1102. In the depicted embodiments, the second bulk compression amount is less than the first bulk compression amount. By having a lower bulk compression amount at the pressure relief portion 540, 1540, 2540, the pressure relieving feature 542, 1542, 2542 is more easily displaced out of sealing contact with the sealed pieces of the enclosure 100, 1100, 2100 than the elongate portion

520, 1520, 2520. However, when no pressure differential exists or when a pressure differential lower than a predetermined amount exists, the pressure relieving feature 542, 1542, 2542 and the remainder of the pressure relief portion 540, 1540, 2540 make sealing contact with both sealed pieces of the enclosure 100, 1100, 2100.

5 [0067] As depicted, the pressure relieving feature 542, 1542, 2542 includes a divot, a notch, a groove, etc. that would not provide sealing action in an undeformed position. However, the second bulk compression amount is sufficient to compress material neighboring the pressure relieving feature 542, 1542, 2542 and thereby provide a continuous sealing contact from the elongate portion 520, 1520, 2520 and across the
10 pressure relief portion 540, 1540, 2540. As depicted, the seal 500, 1500, 2500 includes a single pressure relief portion 540, 1540, 2540. In other embodiments, the seal may have multiple pressure relief portions.

[0068] Turning now to Figures 1A-19, the enclosure 100 will be described in detail. The enclosure 100 provides an enclosed volume 140 when configured in the closed
15 configuration 102. The enclosed volume 140 may provide shelter for various telecommunications components. To access the enclosed volume 140, a cover 300 (i.e., a second enclosure member) of the enclosure 100 may be separated from a base 200 (i.e., a first enclosure member) of the enclosure 100. As depicted, a majority of the enclosed volume 140 is included within the cover 300. In other embodiments, some or all of the
20 enclosed volume 140 may reside in the base 200.

[0069] By separating the cover 300 from the base 200, the enclosed volume 140 may be accessed through an access opening 150. With the cover 300 separated from the base 200, the enclosure 100 is at an open configuration 104. In the depicted embodiment, a set of fasteners 120 are used to secure the enclosure 100 at the closed configuration 102. The
25 fasteners 120 may be removed and thereby allow the enclosure 100 to be configured to the open configuration 104. In addition to the access opening 150, one or more entrance/exit locations 160 may be provided. As depicted, the entrance/exit locations 160 are substantially smaller than the access opening 150 but are useful to route fiberoptic cables into the enclosure 100. The fiberoptic cables may be terminated and/or interconnected
30 with various fiberoptic cables within the enclosed volume 140.

[0070] The base 200 includes a mounting side 202 (see Figure 2), an interior side 204 (see Figure 7), a first end 206 (i.e., a first side, a first edge), a second edge 208, a third edge 210, and a fourth edge 212. As depicted, four corners 214 are positioned around the base 200. In particular a rounded corner 214r is included at the intersection of the first end

206 and the third edge 210. Likewise, a rounded corner 214r is included between the first end 206 and the fourth edge 212. A square corner 214s is included between the second edge 208 and the third edge 210. Likewise, a square corner 214s is included between the second edge 208 and the fourth edge 212.

5 **[0071]** The base 200 may further include a set of mounting tabs 220 that each include a mounting hole 222. The mounting tabs 220 and the mounting holes 222 may be used to secure the base 200 to a mounting location (e.g., a wall, a pole, etc.). The base 200 may further include a set of attachment tabs 230 each with an attachment hole 232. The attachment holes 232 may be included on the base 200 without an attachment tab 230.

10 The set of fasteners 120 may be positioned within the attachment holes 232. As depicted, the attachment holes 232 are counter bored thereby allowing the mounting side 202 of the base 200 to be positioned against the mounting location without heads of the fasteners 120 protruding from the mounting side 202.

[0072] The cover 300 includes an outside 302 (see Figure 7), an interior side 304 (see
15 Figure 6), a first end 306 (i.e., a first side, a first edge), a second edge 308, a third edge 310, and a fourth edge 312. As depicted, four corners 314 are positioned around the cover 300. In particular a rounded corner 314r is included at the intersection of the first end 306 and the third edge 310. Likewise, a rounded corner 314r is included between the first end 306 and the fourth edge 312. A square corner 314s is included between the second edge
20 308 and the third edge 310. Likewise, a square corner 314s is included between the second edge 308 and the fourth edge 312. The cover 300 further includes a series of attachment bosses 330 each with an attachment hole 332. As depicted, the attachment holes 332 are threaded and adapted to receive threads of the fasteners 120. In other
25 embodiments, the cover 300 may include through holes rather than the attachment holes 332, and the base 200 may include threaded holes rather than the attachment through holes 232.

[0073] As depicted, the cover 300 includes a groove 350. The groove 350 is adapted to hold a substantial portion of the seal 500. However, a portion of the seal 500 may protrude beyond the groove 350, when un-deformed, thereby allowing sealing contact to
30 be made with a sealing surface 250 of the base 200. The groove 350 may be wider than the seal 500 in its uncompressed state thereby allowing lateral swelling of the seal 500 to occur when the seal 500 is compressed (upon the enclosure 100 being configured at the closed configuration 102). A sealing surface 351 is included at a bottom of the groove 350 and makes sealing contact with the seal 500.

[0074] As depicted, the groove 350 may include a series of notches 352. As depicted, the notches 352 may lead to the attachment bosses 330. Certain of the notches 352 may be positioned inwardly toward the enclosed volume 140 (which substantially resides within the cover 300). Certain other of the notches 352 may extend outwardly to attachment
5 bosses 330 of the cover 300.

[0075] Turning now to Figures 3-5, the seal 500 includes a base side 502 (i.e., a first sealing side, a first sealing surface, etc.), a cover side 504 (i.e., a second sealing side, a second sealing surface, etc.), a first end 506 (i.e., a first edge), a second edge 508, a third edge 510, and a fourth edge 512. As depicted, four corners 514 are positioned around the
10 seal 500. In particular a rounded corner 514r is included at the intersection of the first end 506 and the third edge 510. Likewise, a rounded corner 514r is included between the first end 506 and the fourth edge 512. A square corner 514s is included between the second edge 508 and the third edge 510. Likewise, a square corner 514s is included between the second edge 508 and the fourth edge 512. As illustrated at Figures 4 and 5, the seal 500
15 further includes an outside 516 and an inside 518. The outside 516 generally faces away from the enclosed volume 140. As depicted, a shape of the seal 500 generally matches a shape of the groove 350 of the cover 300. In such embodiments, the seal 500 is preferably installed with an orientation of the seal 500 matching an orientation of the groove 350.

[0076] The seal 500 further includes attachment bosses 530. Certain of the
20 attachment bosses 530, 530h also include attachment holes 532. The attachment bosses 530h and the attachment holes 532 correspond with the attachment bosses 330 and the attachment holes 332 and further correspond with the attachment tabs 230 and the attachment holes 232. The fasteners 120 may be inserted through the attachment holes 532 when the enclosure 100 is at the closed configuration 102. As depicted, the
25 attachment bosses 530 may include the attachment bosses 530h with holes (e.g., the attachment holes 532) and also include a certain set of attachment bosses 530s without holes.

[0077] As depicted, the pressure relief portion 540 fits within the groove 350 of the cover 300. Walls of the groove 350 adjoin the pressure relief portion 540 and the notches
30 352 are spaced away from the pressure relief portion 540 at a distance. As depicted, the pressure relief portion 540 is at a bottom of the enclosed volume 140 when the enclosure 100 is normally oriented. A shroud 400 further covers the second edge 308 of the cover 300. The pressure relief portion 540 is positioned at the second edge 308 of the cover 300 and the second edge 208 of the base 200. By including the shroud 400 to shield the

portion of the seal 500 including the pressure relief portion 540, and by positioning the pressure relief portion 540 at the bottom of the enclosed volume 140, the pressure relief portion 540 is less likely to draw in outside material other than air when a negative pressure inside the enclosed volume 140 draws in air through the pressure relieving feature

5 542.

[0078] In certain embodiments, the pressure relief portion 540 is adapted to both relieve positive pressure within the enclosed volume 140 by expelling air through the pressure relief feature 542 and is also adapted to relieve negative pressure within the enclosed volume 140 by drawing in air through the pressure relief feature 542. In other
10 embodiments, the pressure relief feature 542 only allows air to be relieved from the enclosed volume 140 to the outside environment. The differential pressure to activate the pressure relief function of the pressure relieving feature 542 may be predetermined. In particular, a differential pressure to expel air from the enclosed volume 140 may be a predetermined value. The differential pressure required to draw air into the enclosed
15 volume 140 may be a second predetermined differential pressure. The first and second predetermined differential pressures may be different from each other.

[0079] The pressure relieving feature 542 may be triangular in shape as illustrated at Figure 19. The triangular shape may be surrounded by fillets and/or radii to provide a smooth transition from the elongate portion 520 to the pressure relief portion 540. By
20 including the triangular shape at the pressure relieving feature 542, deformation that occurs on the pressure relief portion 540 may bunch up material at a vertex 544 of the pressure relieving feature 542 and thereby provide additional resistance for fluid flowing from the vertex 544 toward the enclosed volume 140 in comparison with fluid flowing from the enclosed volume 140 and through a base 546 of the triangle to the vertex 544. In
25 the depicted embodiment, the pressure relieving feature 542 may be created by removing material from the elongate portion 520.

[0080] The seal 500 of the enclosure 100 includes sealing surfaces 502 and 504 positioned at parallel planes opposite each other about the seal 500. In particular, the base sealing side 502 of the seal 500 is positioned opposite the cover sealing side 504 of the
30 seal 500. The base sealing side 502 contacts the sealing surfaces 250 of the base 200, and the cover sealing side 504 contacts the sealing surfaces 351 of the cover 300. The sealing surfaces 250, 351, 502, 504 of the base 200, the cover 300, and the seal 500, respectively, are each substantially planar.

[0081] Turning now to Figures 20-33, the enclosure 1100 will be described in detail. The enclosure 1100 is similar to the enclosure 100 but includes an enclosed volume 1140 at a base 1200 and includes entrance/exit locations 1160 at a cover 1300. In contrast to the seal 500 and the enclosure 100, the seal 1500 of the enclosure 1100 includes an inner
5 sealing surface 1504 that seals against a bottom 1351 of a groove 1350 of the cover 1300, and an outer sealing surface 1502 that seals against a sealing surface 1250 of the base 1200 (see Figures 29-32). The sealing surfaces 1250, 1351, 1502, 1504 of the base 1200, the cover 1300, and the seal 1500, respectively, each form a loop. An access opening 1150 (see Figure 22) to the enclosed volume 1140 may be included on the base 1200. The
10 access opening 1150 may be penetrated by portions of the cover 1300 when the enclosure 1100 is at the closed configuration 1102. The cover 1300, and telecommunications components mounted thereon, may be withdrawn from the enclosed volume 1140 through the access opening 1150 when the enclosure 1100 is moved to an open configuration 1104.

[0082] The seal 1500 also includes the elongate portion 1520 that extends
15 substantially around a perimeter of the seal 1500. The pressure relief portion 1540 is also included along the perimeter of the seal 1500. The seal 1500 may have a circular cross-section. The circular cross-section may allow the seal 1500 to be placed within the groove 1350 at any position along the perimeter and at any rotational position about a center-curve of the seal 1500. The pressure relieving portion 1540 may thus be positioned
20 anywhere along the perimeter of the seal 1500. However, as depicted, placing the pressure relief portion 1540 at a back surface of the enclosure 1100 may limit direct exposure of the pressure relief portion 1540 to the harshest exposure of the outside environment. A shroud 1400 may further protect the pressure relief portion 1540 from direct exposure to the environment.

[0083] Turning now to Figures 34-46, the enclosure 2100 will be described in detail. The enclosure 2100 is similar to the enclosure 100, and the seal 2500 is similar to the seal 500 except for the differences described below.

[0084] A pressure relief portion 2540 of the seal 2500 is included on a tab 2560 that extends inwardly toward and/or to an enclosed volume 2140 (see Figures 34 and 35). The
30 pressure relief portion 2540 and the pressure relieving feature 2542 (see Figure 40) may be substantially larger than the pressure relief portion 540 and the pressure relieving feature 542, respectively. A vertex 2544 and a base 2546 of the pressure relieving feature 2542 may be further separated from each other, may have a higher pressure holding capacity, and/or may have a higher accuracy in achieving the predetermined pressure relieve points.

A notch 2356 (i.e., a channel) is included on a groove 2350 of a cover 2300 to accommodate the tab 2560. Figure 34 illustrates the enclosure 2100 in an open configuration 2104.

[0085] Various modifications and alterations of this disclosure will become apparent to those skilled in the art without departing from the scope and spirit of this disclosure, and it should be understood that the scope of this disclosure is not to be unduly limited to the illustrative embodiments set forth herein.

PARTS LIST

	[0086]	100	telecommunications enclosure
10	[0087]	102	closed configuration
	[0088]	104	open configuration
	[0089]	120	fastener
	[0090]	140	enclosed volume
	[0091]	150	access opening
15	[0092]	160	entrance/exit locations
	[0093]	200	base
	[0094]	202	mounting side
	[0095]	204	interior side
	[0096]	206	first edge
20	[0097]	208	second edge
	[0098]	210	third edge
	[0099]	212	fourth edge
	[0100]	214	corners
	[0101]	214r	rounded corner
25	[0102]	214s	square corner
	[0103]	220	mounting tab
	[0104]	222	mounting hole
	[0105]	230	attachment tab
	[0106]	232	attachment hole
30	[0107]	250	sealing surface
	[0108]	300	cover
	[0109]	302	outside

	[0110]	304	interior side
	[0111]	306	first edge
	[0112]	308	second edge
	[0113]	310	third edge
5	[0114]	312	fourth edge
	[0115]	314	corners
	[0116]	314r	rounded corner
	[0117]	314s	square corner
	[0118]	330	attachment boss
10	[0119]	332	attachment hole
	[0120]	350	groove
	[0121]	351	sealing surface
	[0122]	352	notch
	[0123]	400	shroud
15	[0124]	500	seal
	[0125]	502	sealing surface
	[0126]	504	sealing surface
	[0127]	506	first edge
	[0128]	508	second edge
20	[0129]	510	third edge
	[0130]	512	fourth edge
	[0131]	514	corner
	[0132]	514r	rounded corner
	[0133]	514s	square corner
25	[0134]	516	outside
	[0135]	518	inside
	[0136]	520	elongate portion
	[0137]	522	cross-section
	[0138]	530	attachment boss
30	[0139]	530h	attachment boss
	[0140]	530s	attachment boss
	[0141]	532	attachment hole
	[0142]	540	pressure relief portion
	[0143]	542	pressure relieving feature

	[0144]	544	vertex
	[0145]	546	base
	[0146]	1100	enclosure
	[0147]	1102	closed configuration
5	[0148]	1104	open configuration
	[0149]	1140	enclosed volume
	[0150]	1150	access opening
	[0151]	1160	entrance/exit location
	[0152]	1200	base
10	[0153]	1250	sealing surface
	[0154]	1300	cover
	[0155]	1350	groove
	[0156]	1351	sealing surfaces
	[0157]	1400	shroud
15	[0158]	1500	seal
	[0159]	1502	outer sealing surface
	[0160]	1504	inner sealing surface
	[0161]	1520	elongate portion
	[0162]	1540	pressure relief portion
20	[0163]	1542	pressure relieving feature
	[0164]	2100	enclosure
	[0165]	2104	open configuration
	[0166]	2140	enclosed volume
	[0167]	2300	cover
25	[0168]	2350	groove
	[0169]	2356	notch
	[0170]	2500	seal
	[0171]	2520	elongate portion
	[0172]	2540	pressure relief portion
30	[0173]	2542	pressure relieving feature
	[0174]	2544	vertex
	[0175]	2546	base
	[0176]	2560	tab

WHAT IS CLAIMED IS:

1. A seal (500, 1500, 2500) for sealing a first member (200) of an enclosure (100) to a second member (300) of the enclosure (100) when the enclosure (100) is at a closed configuration (102) that defines an enclosed volume (140), the seal (500) permitting separation of the first member (200) and the second member (300) when the enclosure (100) is configured at an open configuration (104), the seal (500) comprising:
 - an elongate portion (520) along which a substantially constant cross-section (522) is defined;
 - a first contact area (502) extending along the elongate portion (520), the first contact area (502) adapted to sealingly engage the first member (200) along the elongate portion (520) when the enclosure (100) is at the closed configuration (102);
 - a second contact area (504) extending along the elongate portion (520), the second contact area (504) adapted to sealingly engage the second member (300) along the elongate portion (520) when the enclosure (100) is at the closed configuration (102); and
 - a pressure relief portion (540) at which a pressure relieving feature (542) is defined;wherein the elongate portion (520) is adapted to compress a first bulk compression amount when the enclosure (100) is at the closed configuration (102);
 - wherein the pressure relief portion (540) is adapted to compress a second bulk compression amount when the enclosure (100) is at the closed configuration (102); and
 - wherein the second bulk compression amount is less than the first bulk compression amount.
2. The seal (500, 1500, 2500) of claim 1, wherein the first contact area (502) is adapted to extend substantially along a plane when the enclosure (100) is at the closed configuration (102).
3. The seal (500, 1500, 2500) of claims 1 or 2, wherein the pressure relief portion (540) includes a cross-section with a tab portion (2560) that extends beyond the substantially constant cross-section of the elongate portion (520) in a direction transverse to the elongate portion (520).
4. The seal (500, 1500, 2500) of any of claims 1-3, wherein the pressure relief portion (540) includes a recess (542) that is recessed inwardly from the first contact area (502).

5. The seal (500, 1500, 2500) of claim 4, wherein the recess (542) is a variably sized recess that increases in size toward a side (518) of the seal (500) that is adapted to be positioned adjacent the enclosed volume (140) when the seal (500) is installed in the enclosure (100).

6. The seal (500, 1500, 2500) of claim 5, wherein the variably sized recess (542) is a substantially triangular recess.

7. The seal (500, 1500, 2500) of any of claims 1-6, further comprising an enclosure (100) including two members (200, 300) which are sealed to one another before and/or after the pressure relief portion (540) relieves a pressure condition within the enclosure (100).

8. A seal (500, 1500, 2500) for sealing a first member (200) of an enclosure (100) to a second member (300) of the enclosure (100) when the enclosure (100) is at a closed configuration (102) that defines an enclosed volume (140), the seal (500) permitting separation of the first member (200) and the second member (300) when the enclosure (100) is configured at an open configuration (104), the seal (500) comprising:

an elongate portion (520) along which a substantially constant cross-section (522) is defined;

a first contact area (502) extending along the elongate portion (520), the first contact area (502) adapted to sealingly engage the first member (200) along the elongate portion (520) when the enclosure (100) is at the closed configuration (102);

a second contact area (504) extending along the elongate portion (520), the second contact area (504) adapted to sealingly engage the second member (300) along the elongate portion (520) when the enclosure (100) is at the closed configuration (102); and

a pressure relief portion (540) at which a pressure relieving feature (542) is defined, wherein the pressure relieving feature includes a recess.

9. The seal (500, 1500, 2500) of claim 8, wherein the first contact area (502) is adapted to extend substantially along a plane when the enclosure (100) is at the closed configuration (102).

10. The seal (500, 1500, 2500) of claims 8 or 9, wherein the pressure relief portion (540) includes a cross-section with a tab portion (2560) that extends beyond the substantially constant cross-section of the elongate portion (520) in a direction transverse to the elongate portion (520).
11. The seal (500, 1500, 2500) of any of claims 8-10, wherein the pressure relief portion (540) includes a recess (542) that is recessed inwardly from the first contact area (502).
12. The seal (500, 1500, 2500) of claim 11, wherein the recess (542) is a variably sized recess that increases in size toward a side (518) of the seal (500) that is adapted to be positioned adjacent the enclosed volume (140) when the seal (500) is installed in the enclosure (100).
13. The seal (500, 1500, 2500) of claim 12, wherein the variably sized recess (542) is a substantially triangular recess.
14. The seal (500, 1500, 2500) of any of claims 8-13, further comprising an enclosure (100) including two members (200, 300) which are sealed to one another before and/or after the pressure relief portion (540) relieves a pressure condition within the enclosure (100).
15. A method for sealing a first member (200) of an enclosure (100) to a second member (300) of the enclosure (100) when the enclosure (100) is at a closed configuration (102) that defines an enclosed volume (140), the seal (500, 1500, 2500) permitting separation of the first member (200) and the second member (300) when the enclosure (100) is configured at an open configuration (104), comprising:
- providing a seal (500, 1500, 2500) as in any of claims 1-14;
 - providing an over-pressure situation in the sealed enclosure (100);
 - relieving the over-pressure situation through a pressure relief portion (540) at which a pressure relieving feature (542) is defined in the seal (500, 1500, 2500);
 - resealing the enclosure (100) with the seal (500, 1500, 2500).

FIG. 1A

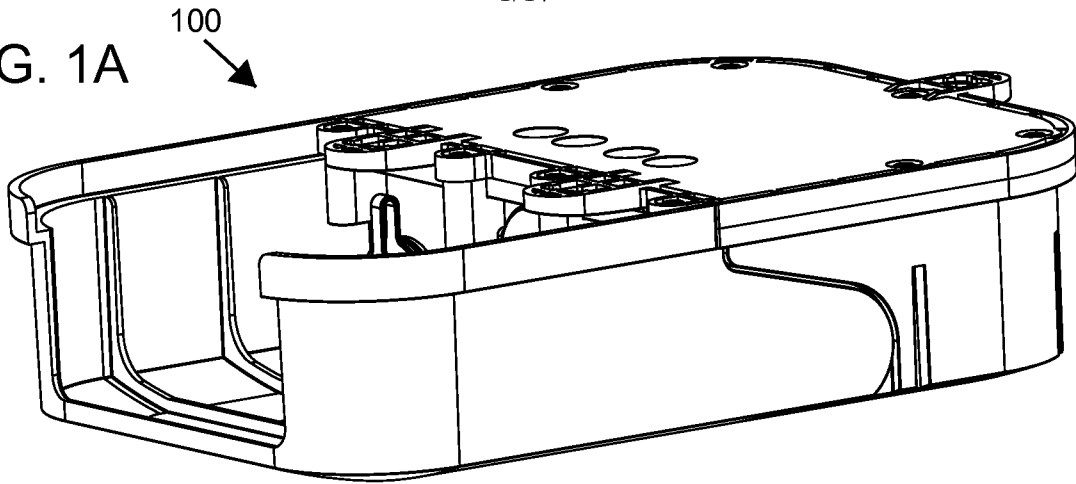
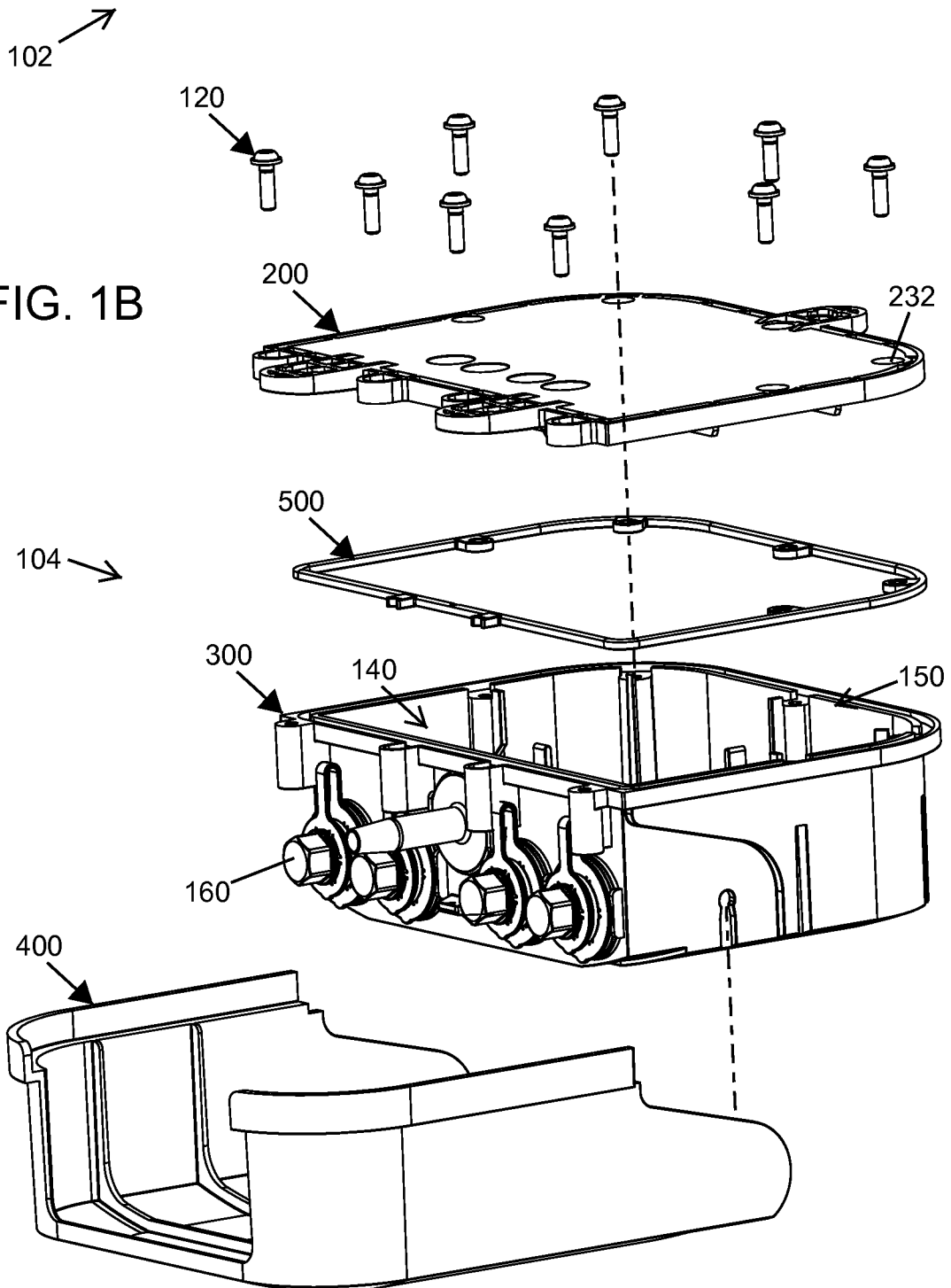
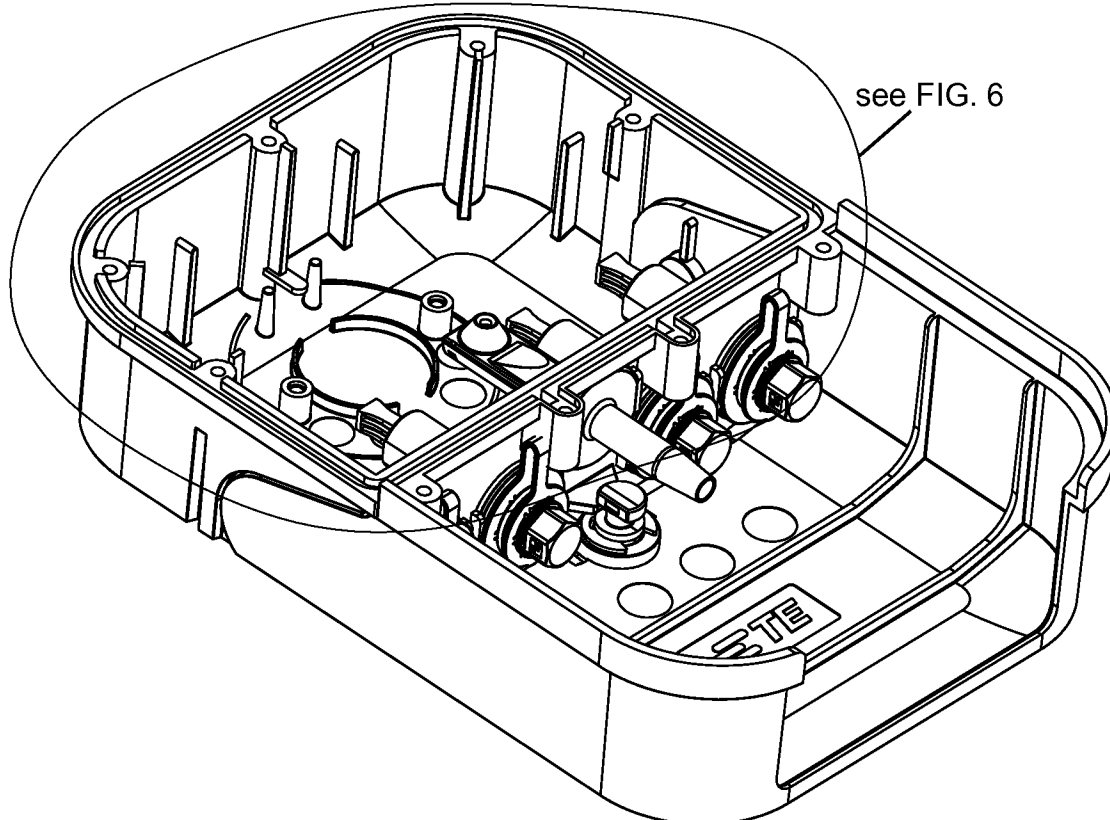
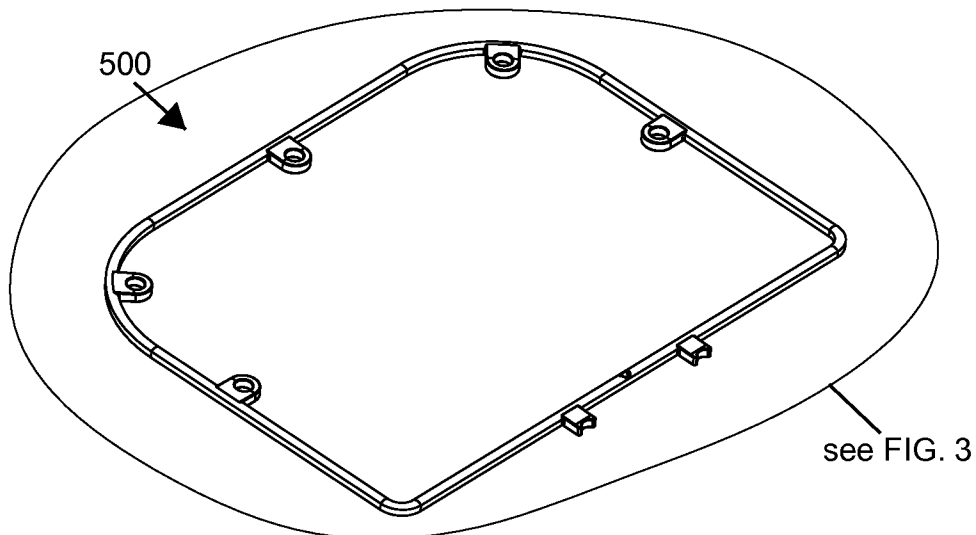
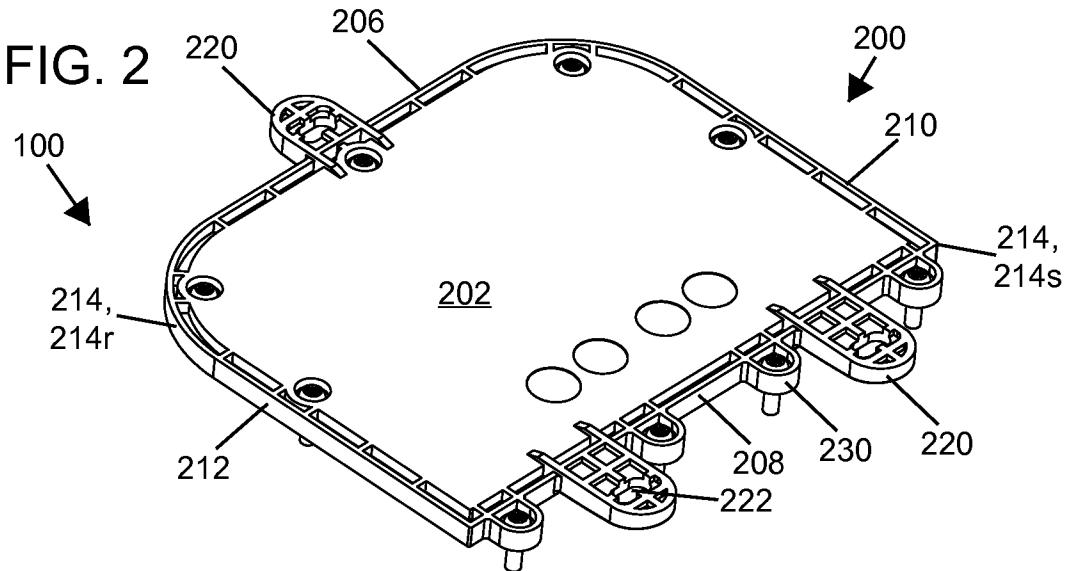


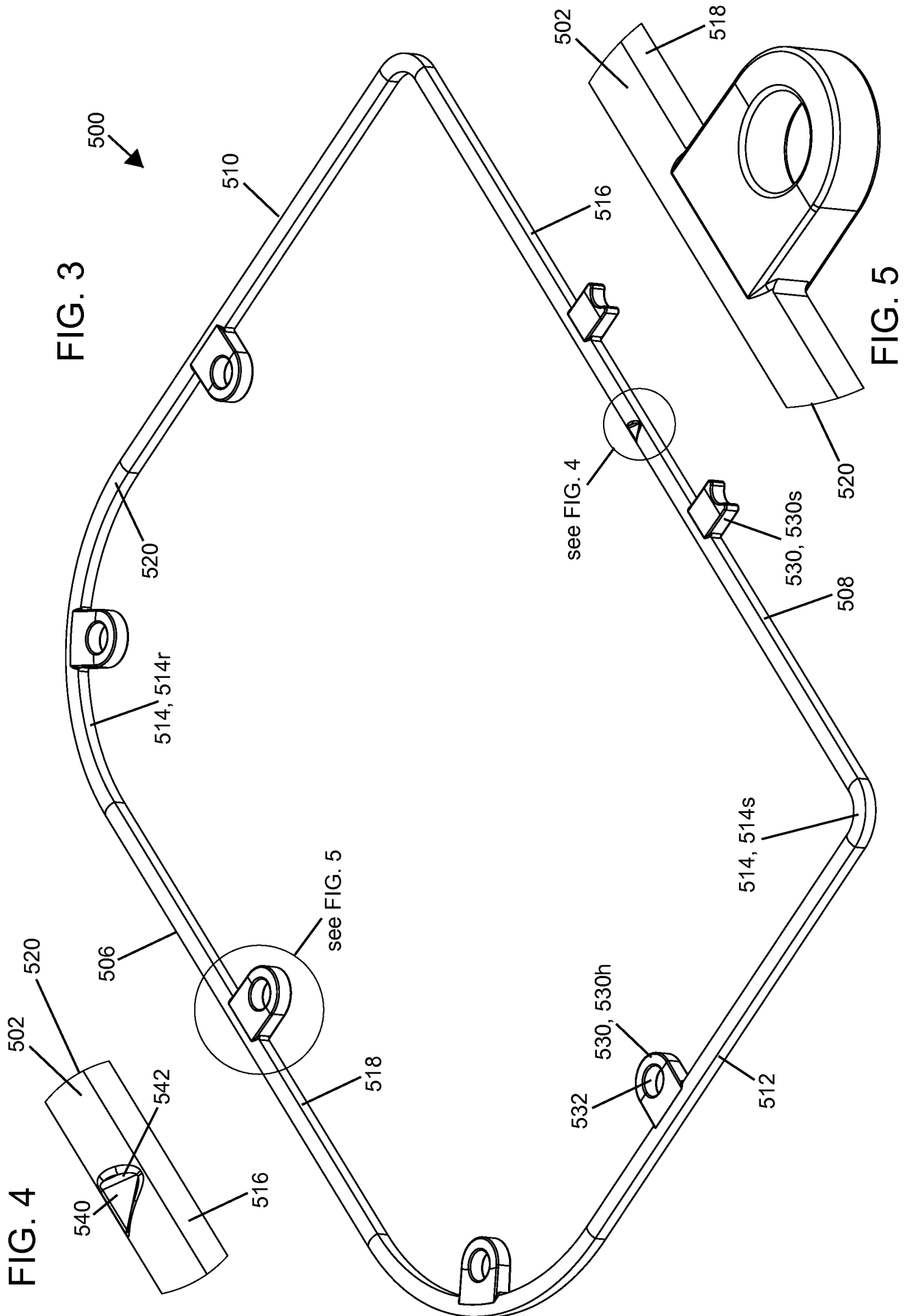
FIG. 1B



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FIG. 2





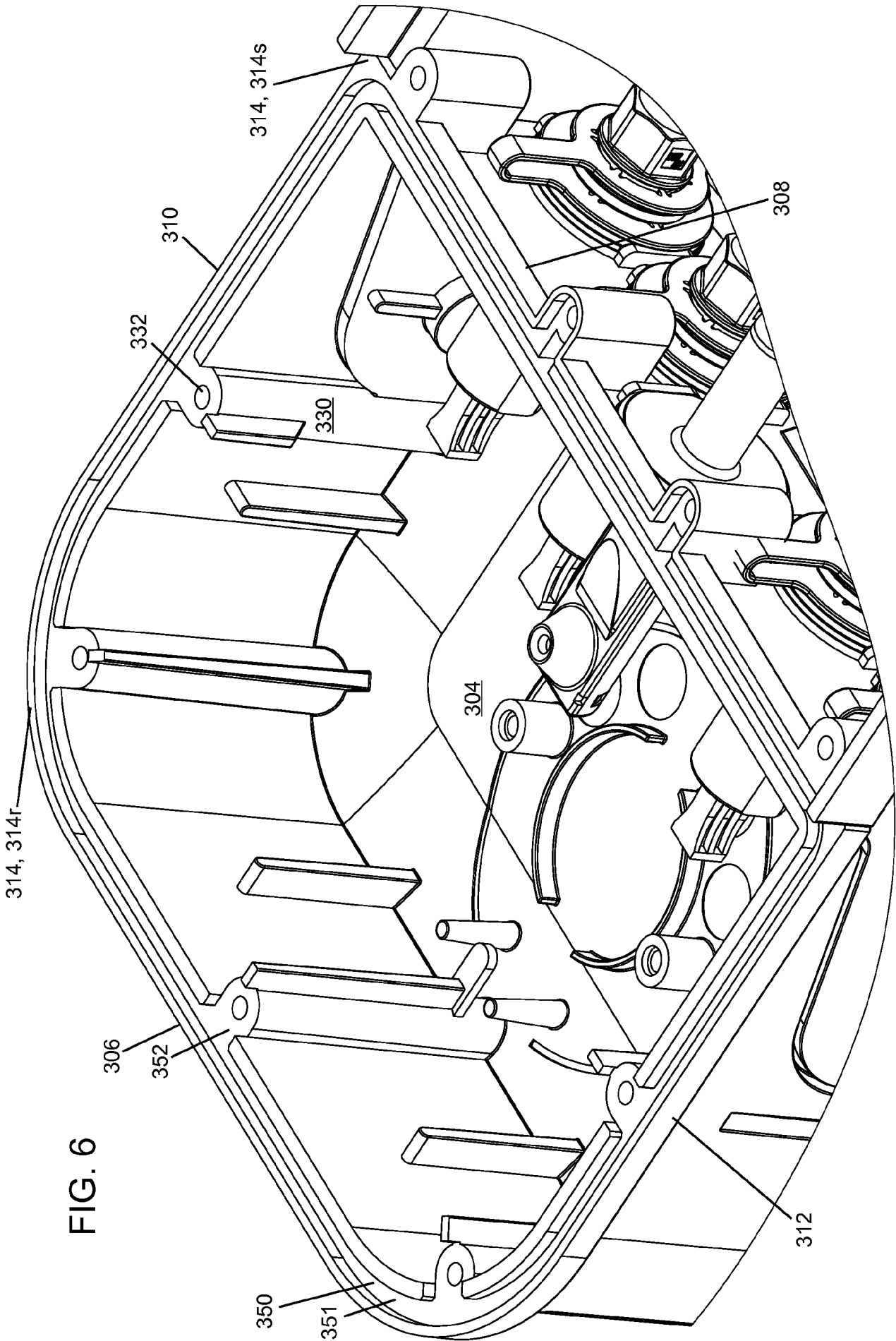
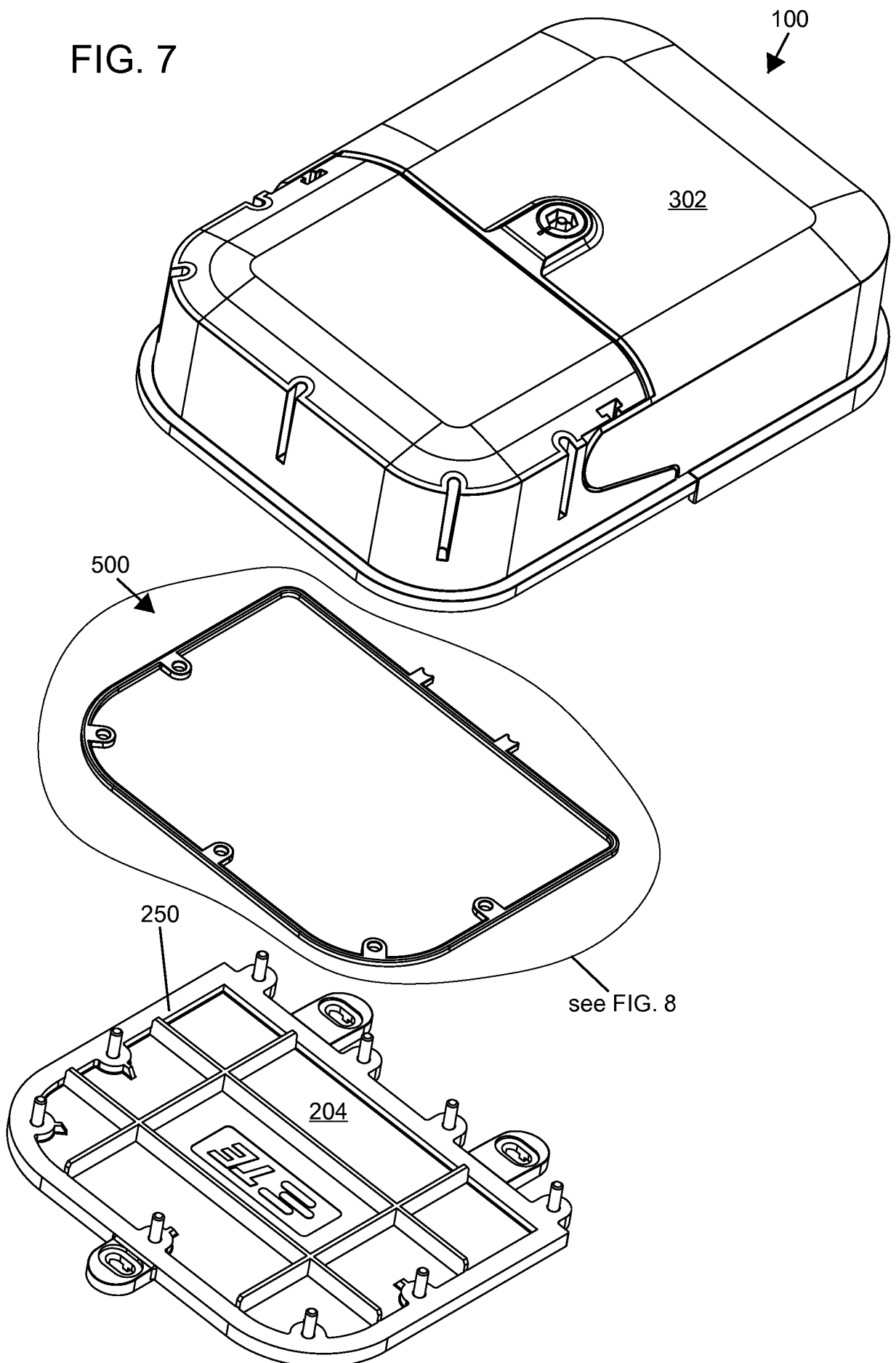
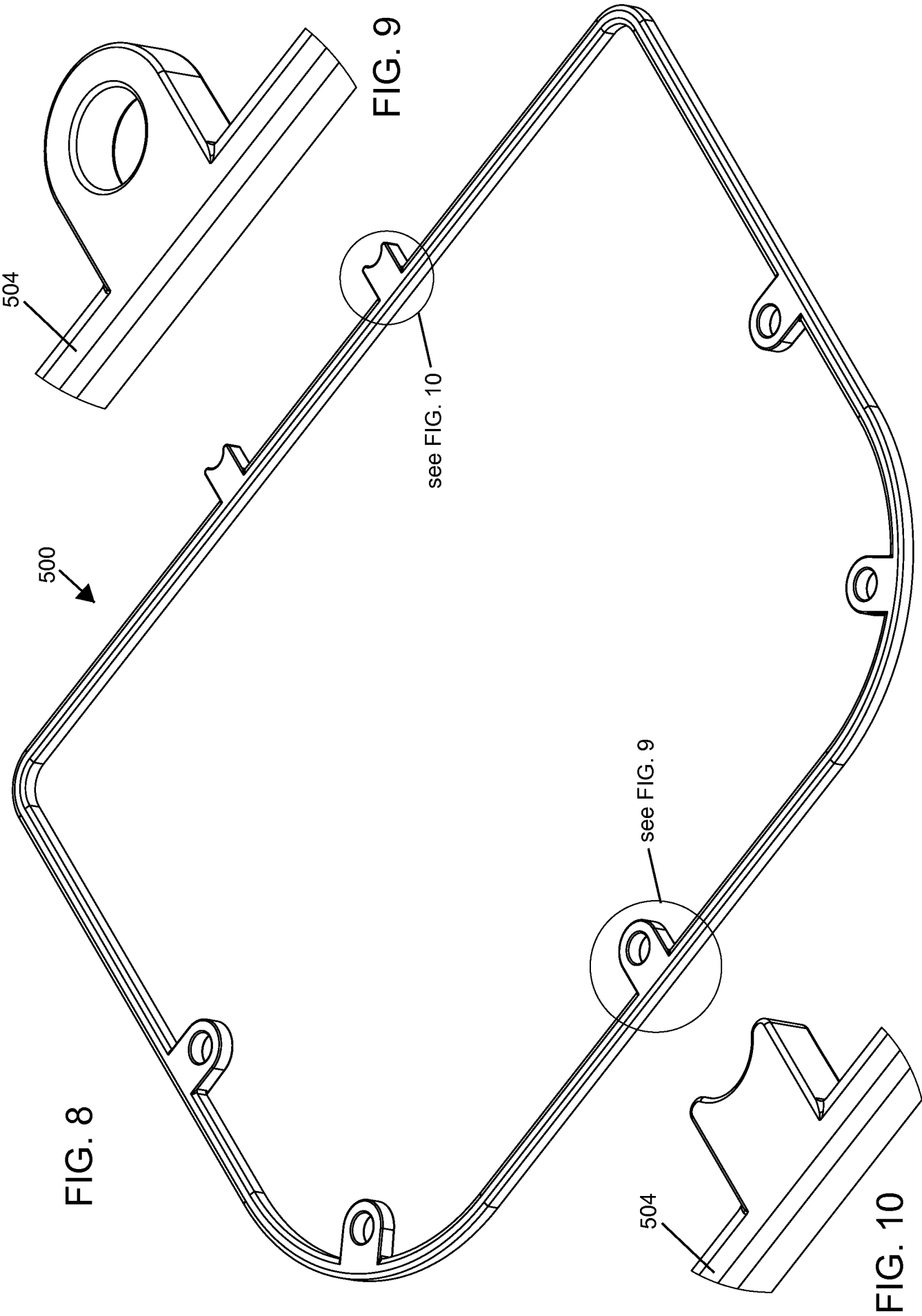


FIG. 7





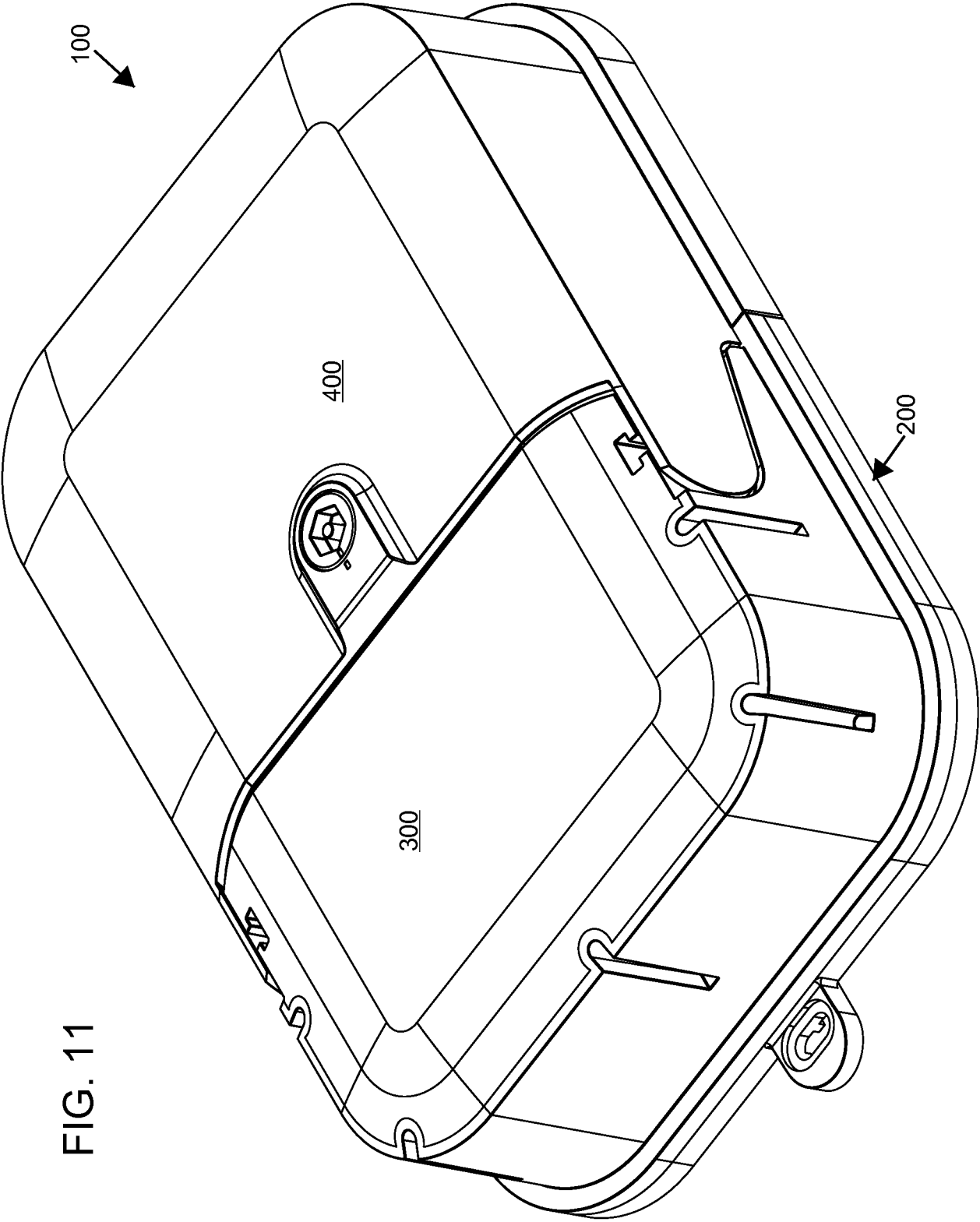


FIG. 11

FIG. 12

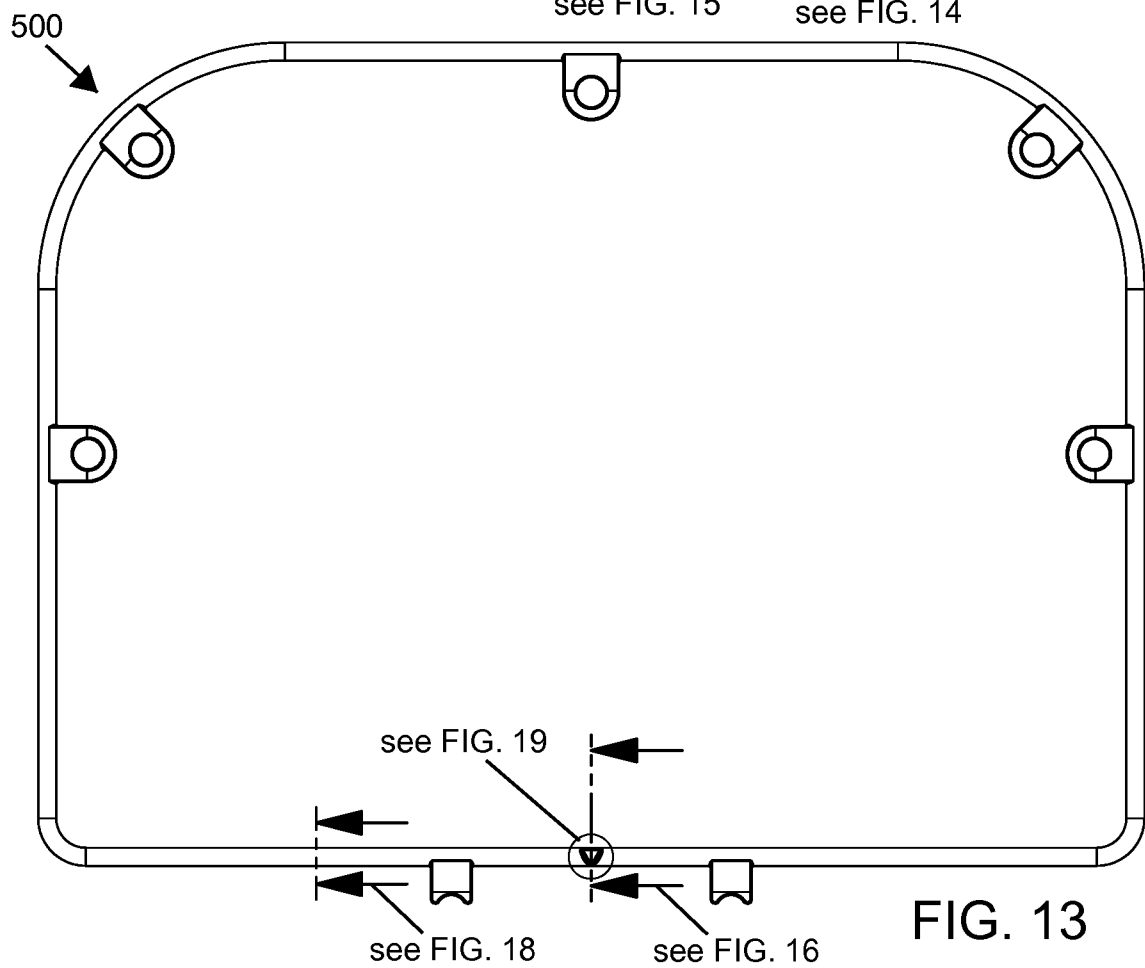
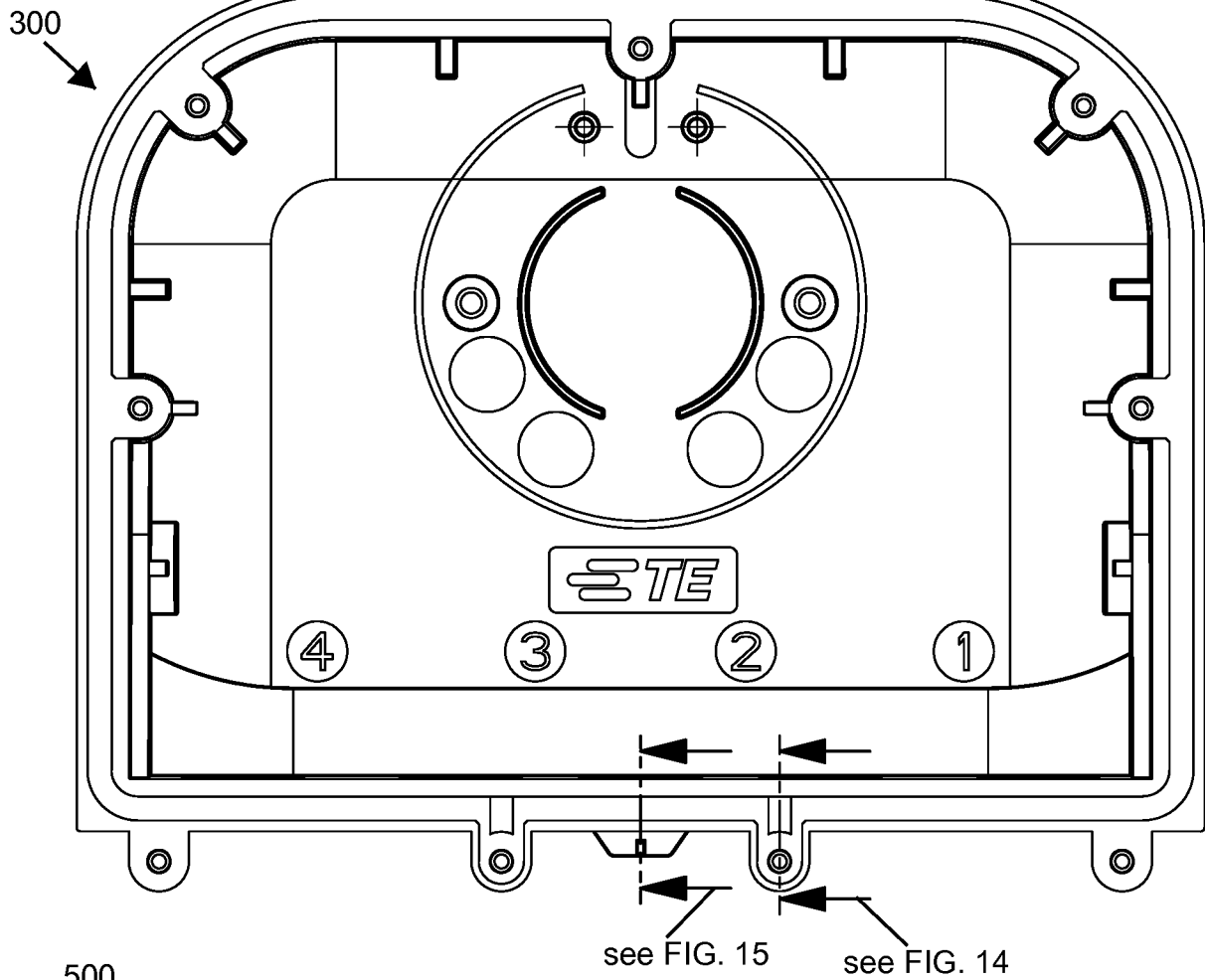


FIG. 13

FIG. 14

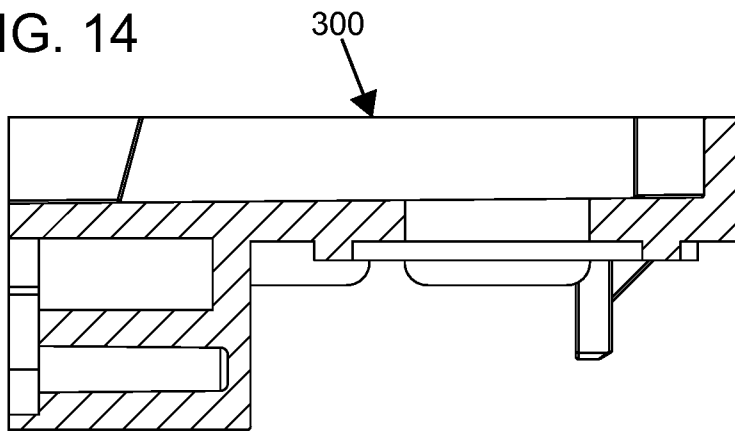


FIG. 18

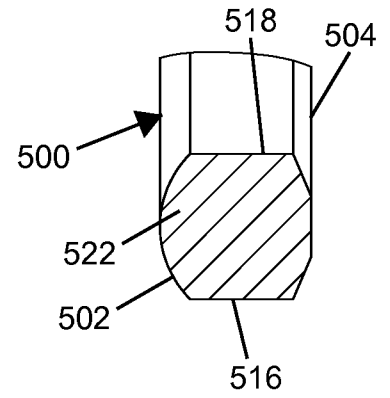


FIG. 16

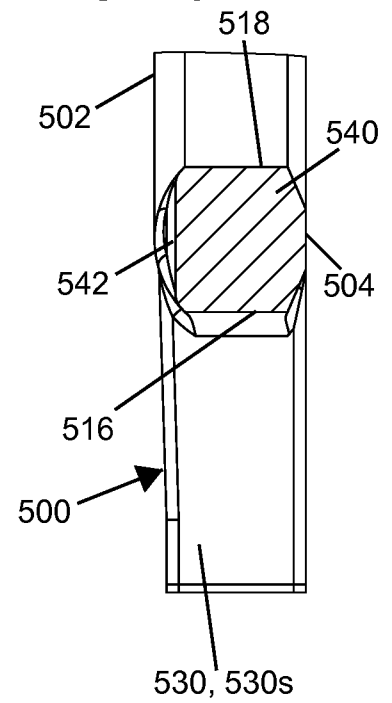


FIG. 15

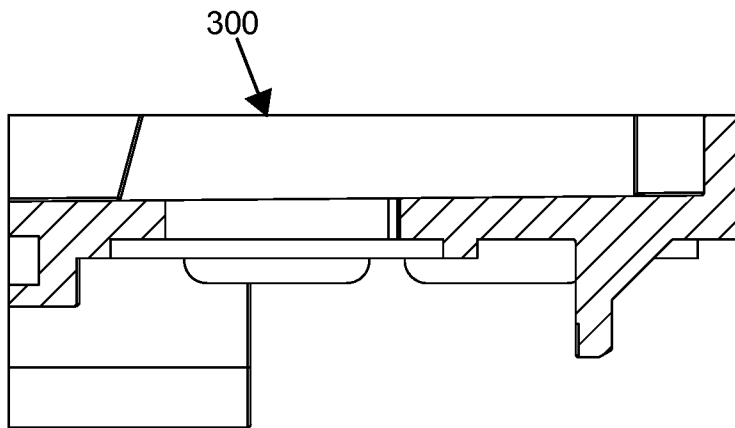


FIG. 19

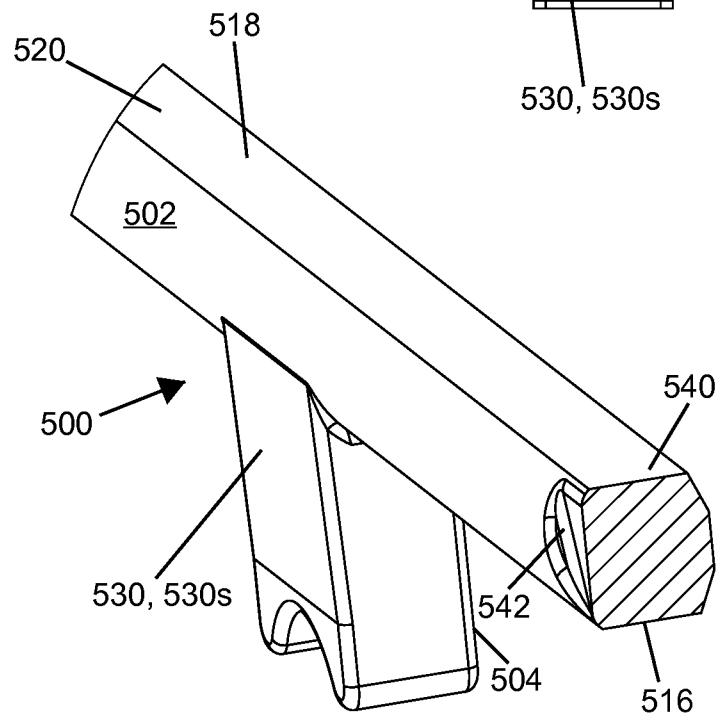
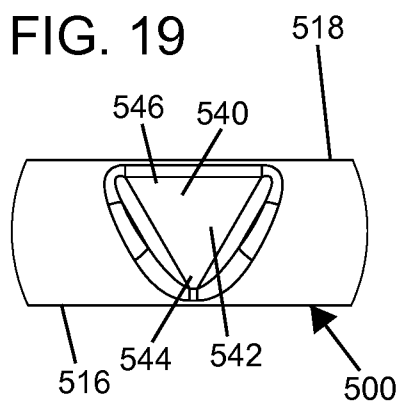


FIG. 17

FIG. 21

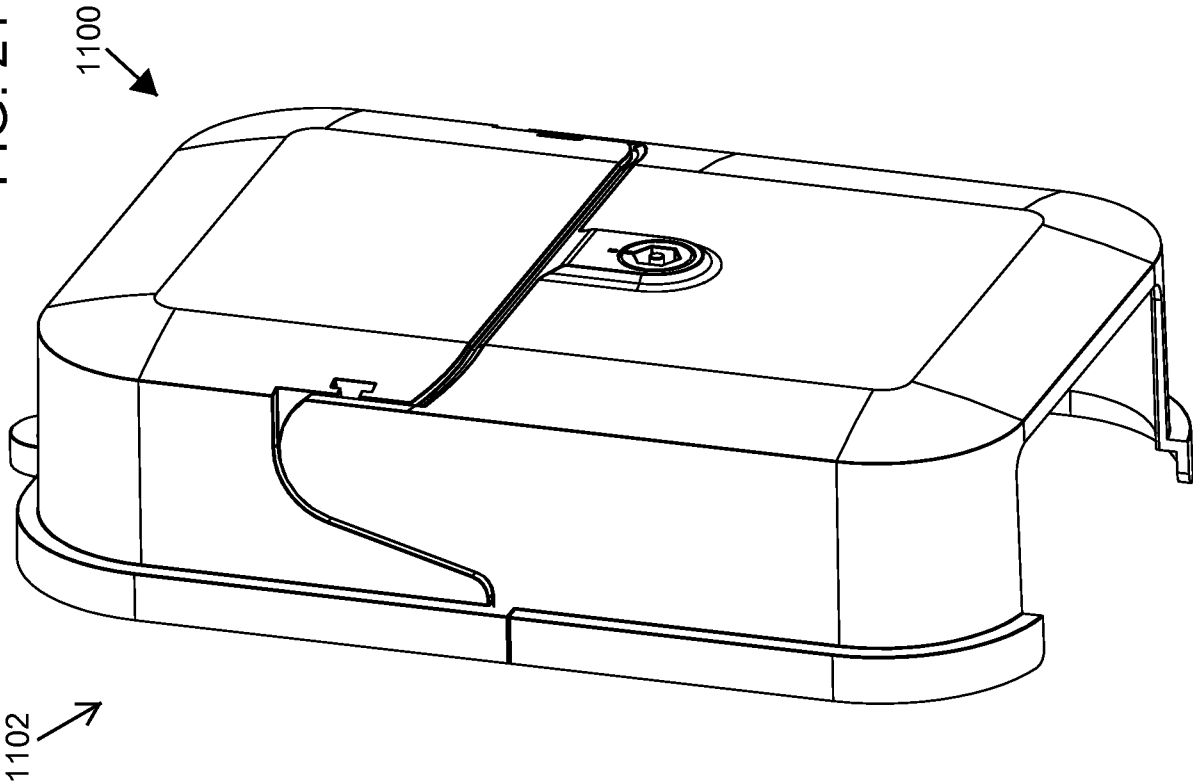


FIG. 20

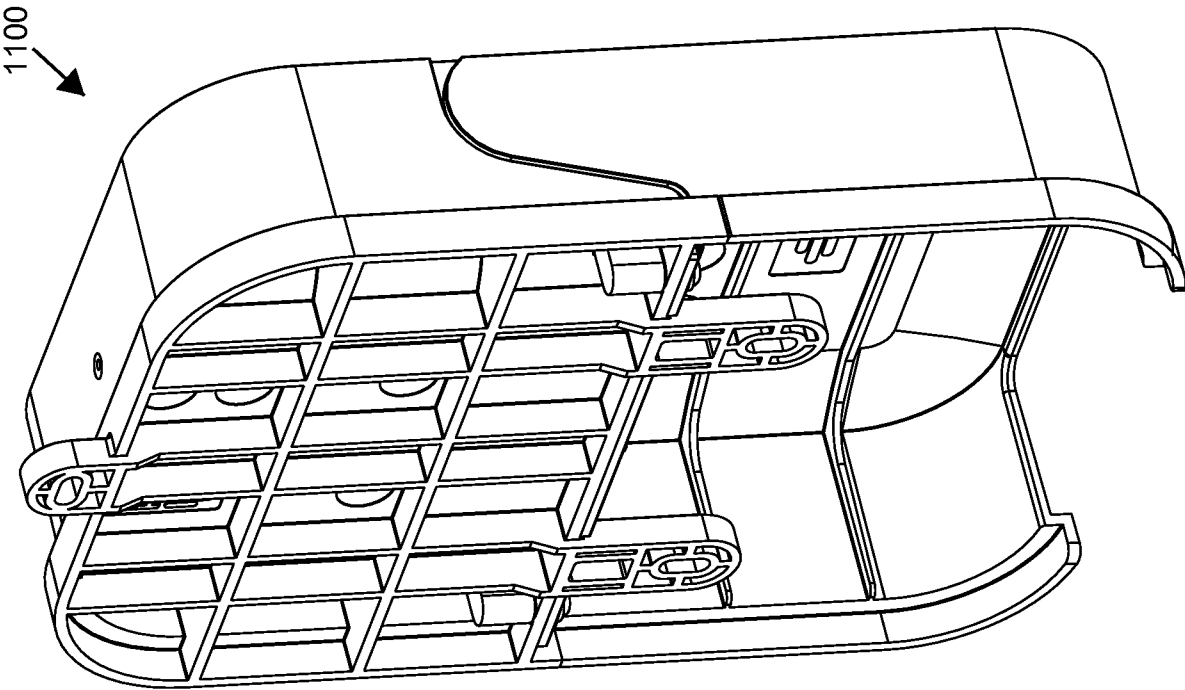


FIG. 22

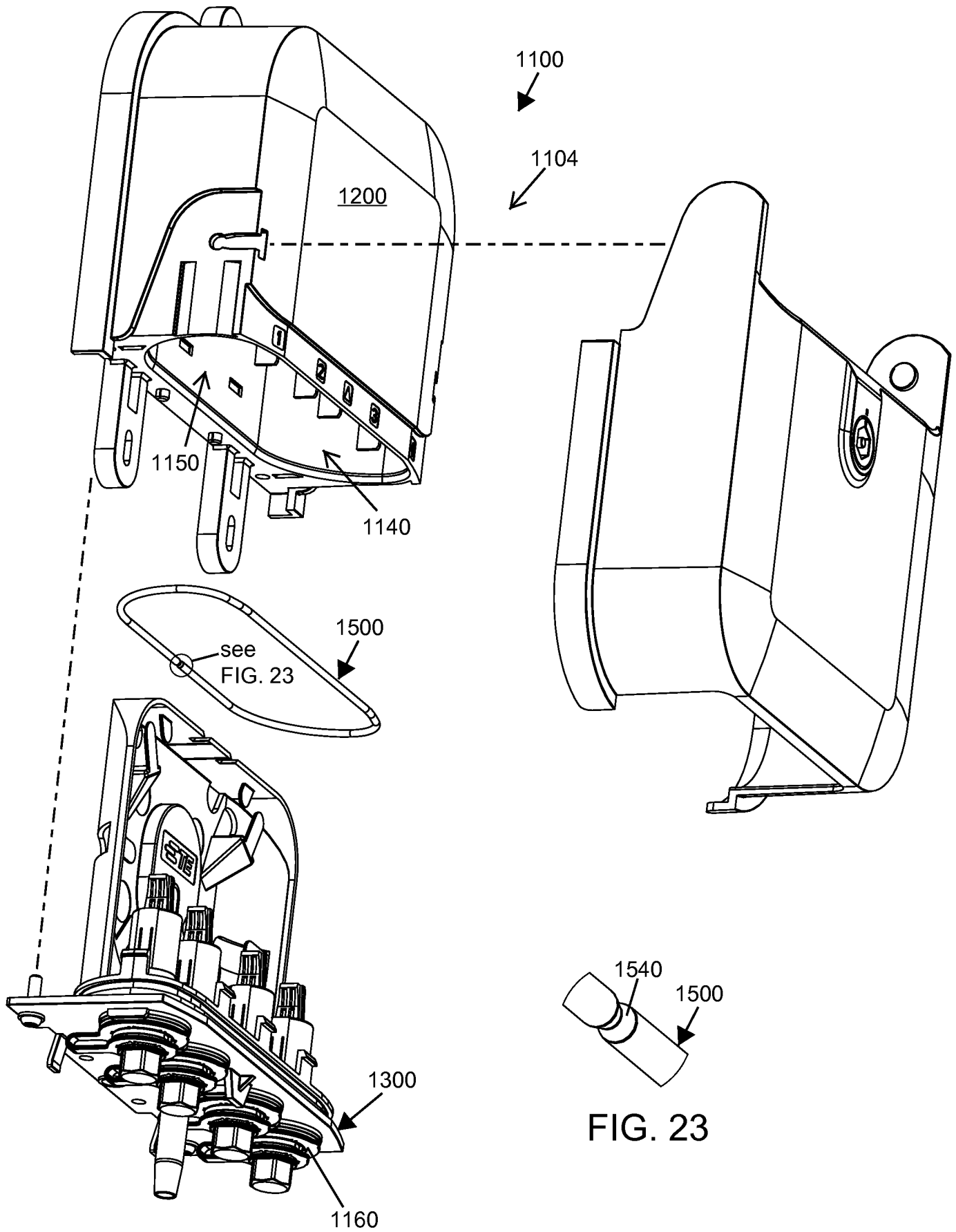


FIG. 23

FIG. 24

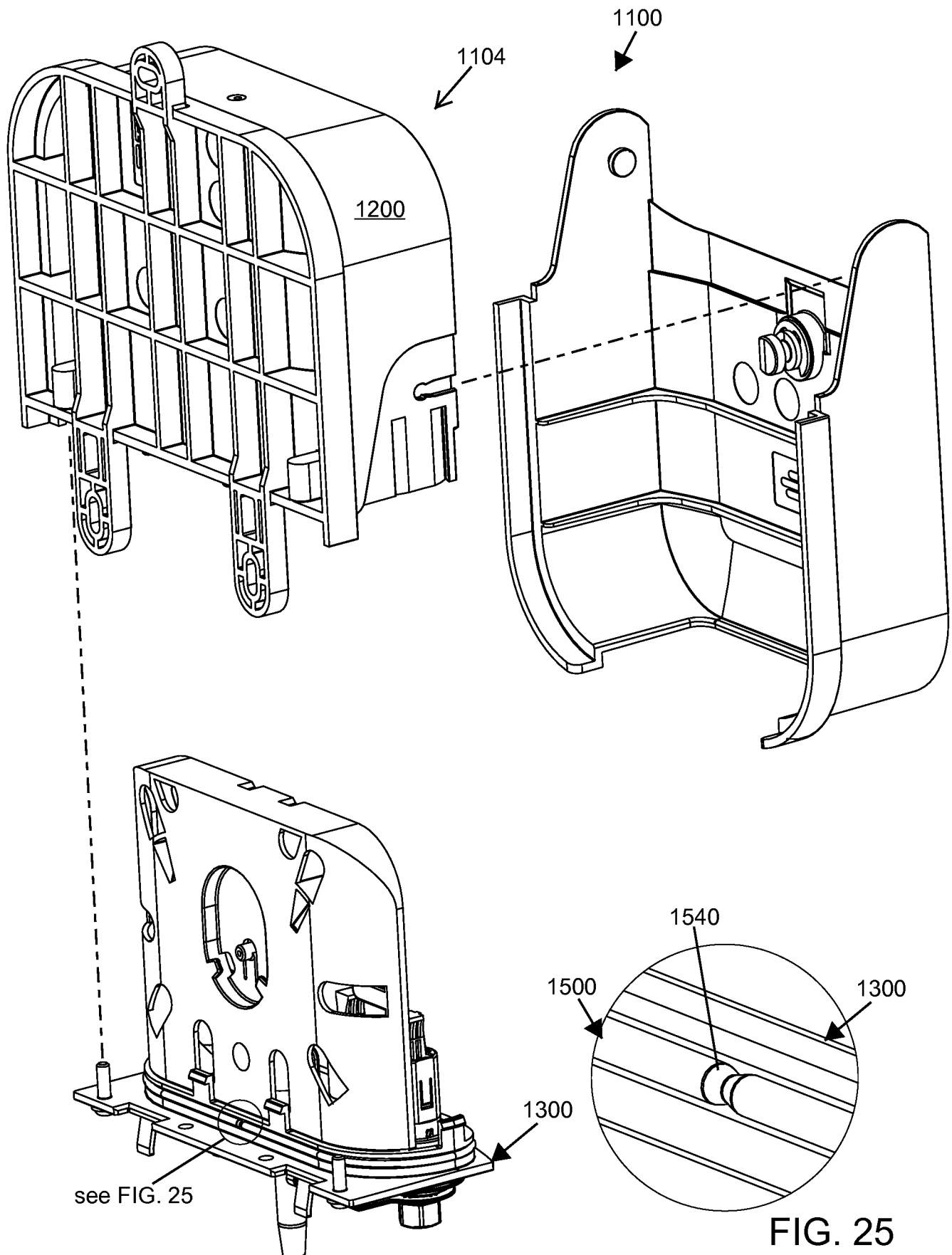


FIG. 25

FIG. 26

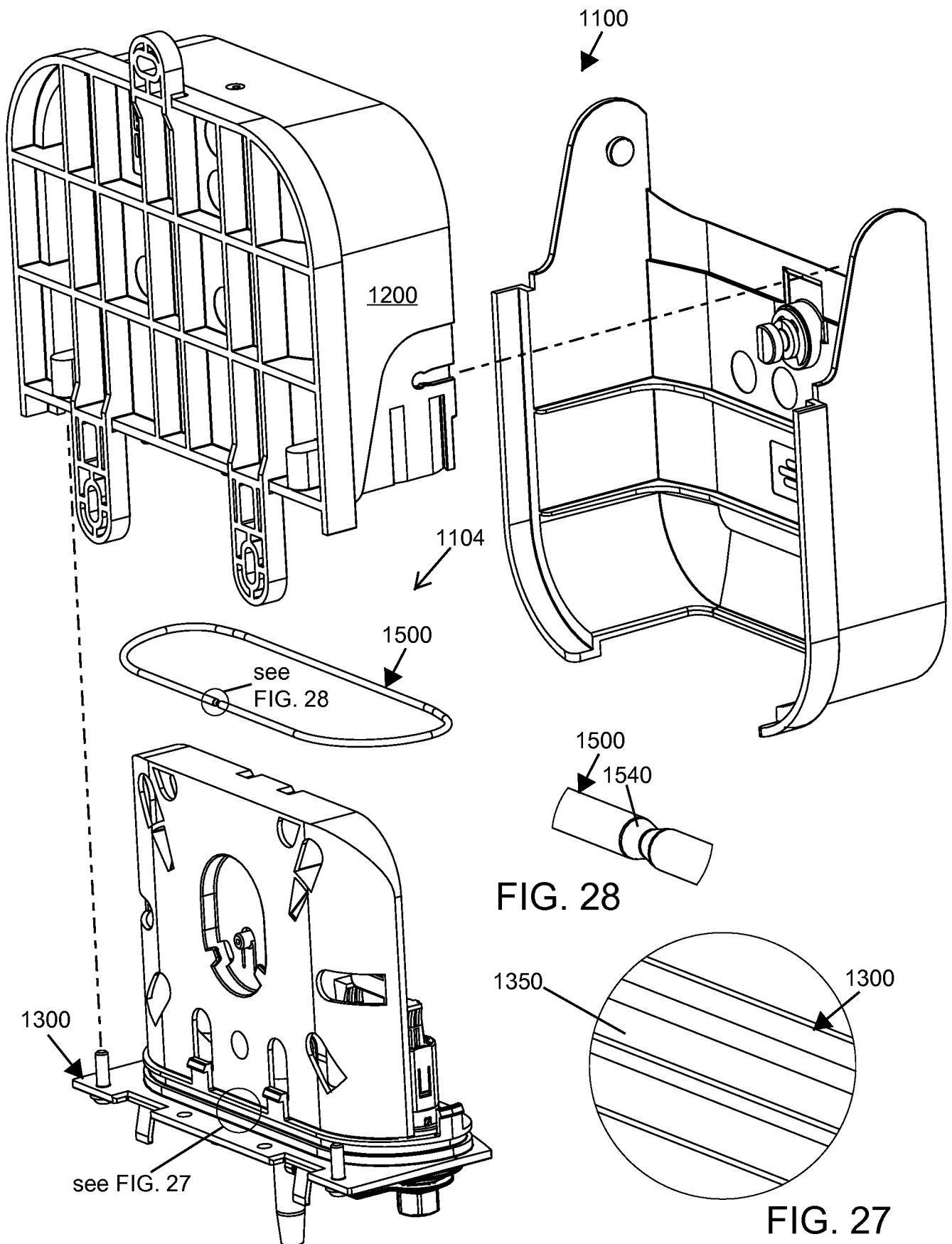


FIG. 29

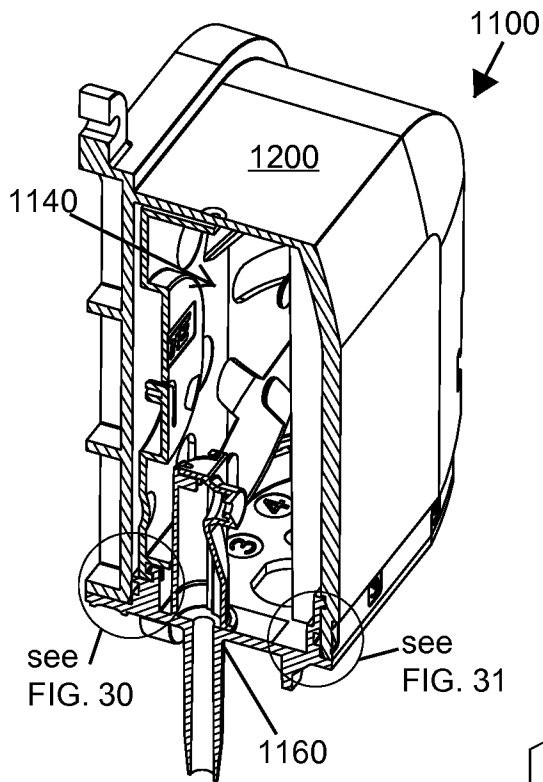


FIG. 30

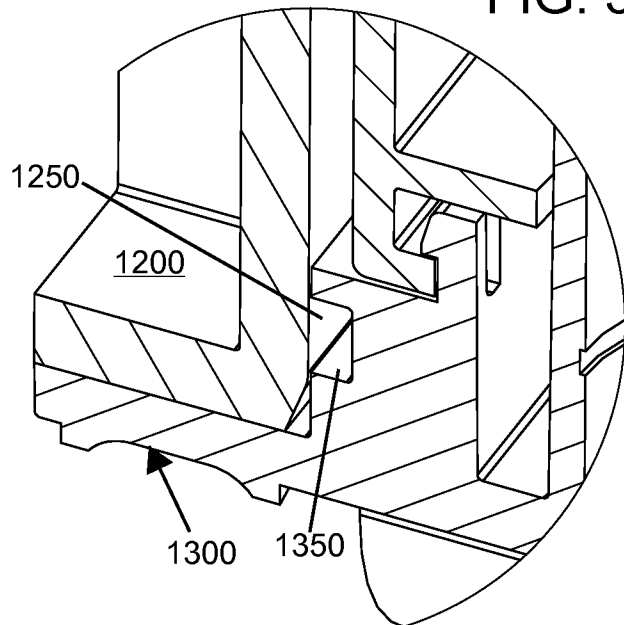
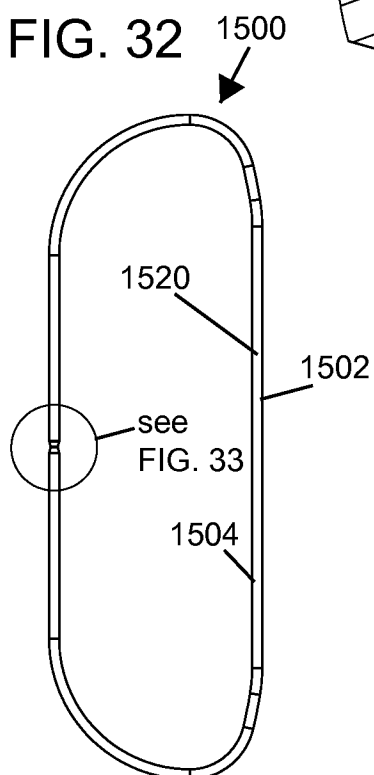


FIG. 32



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FIG. 31

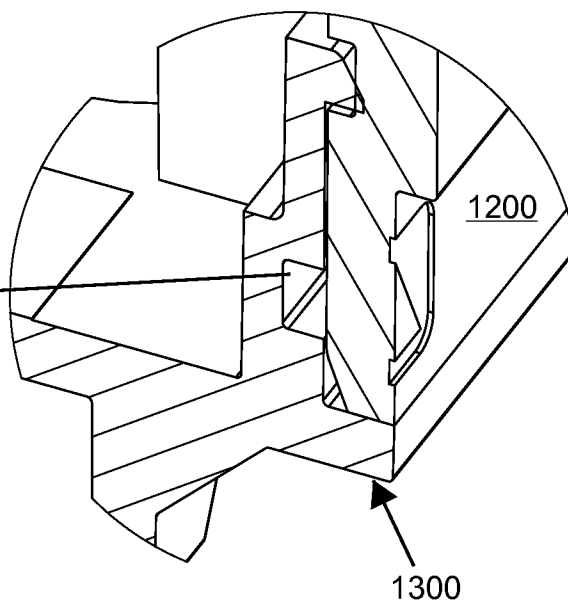


FIG. 33

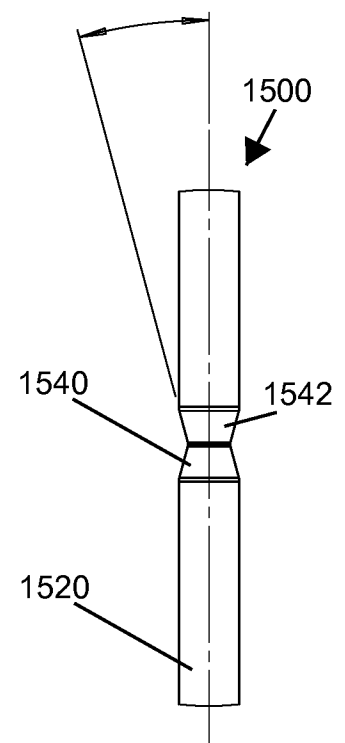


FIG. 34

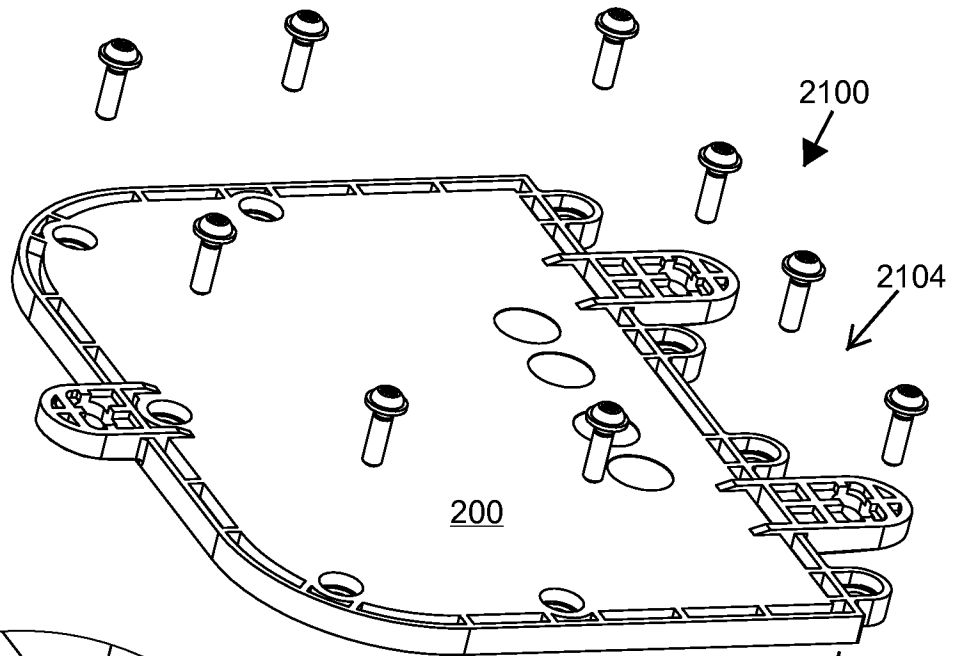


FIG. 35

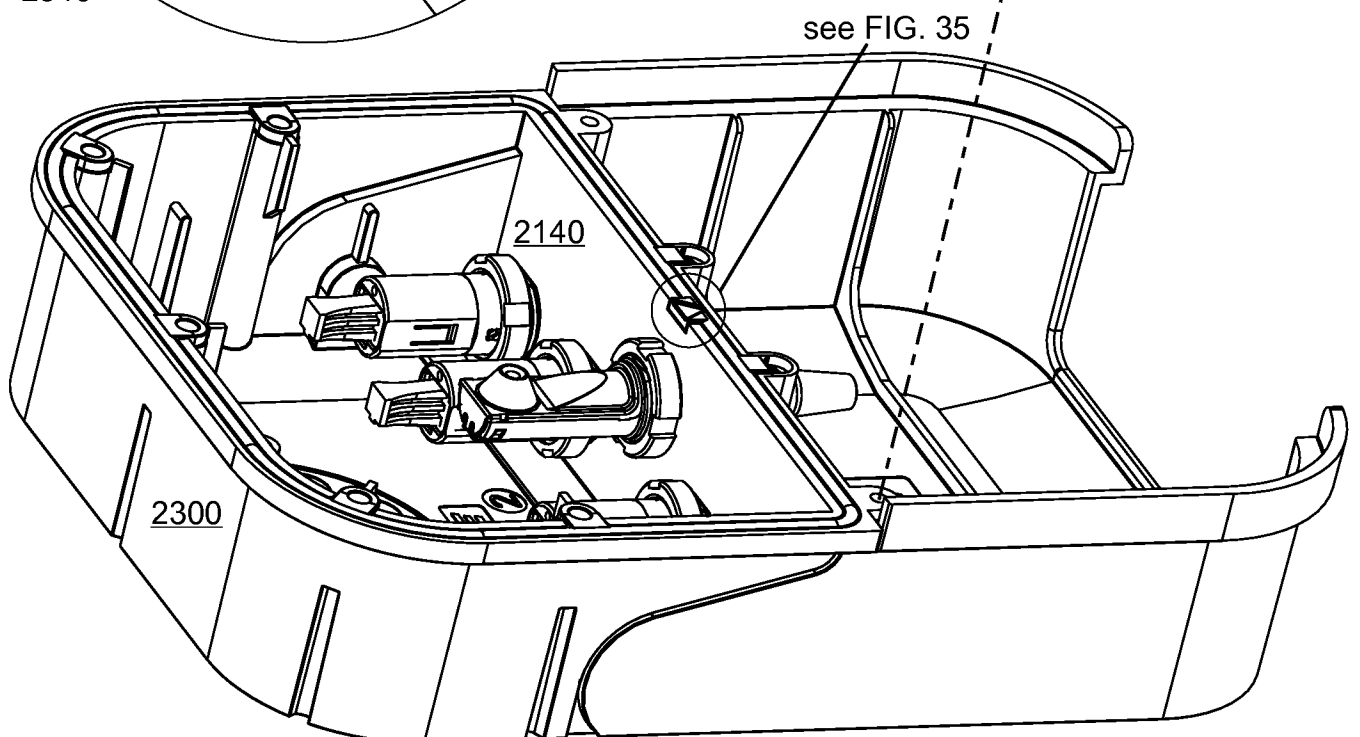
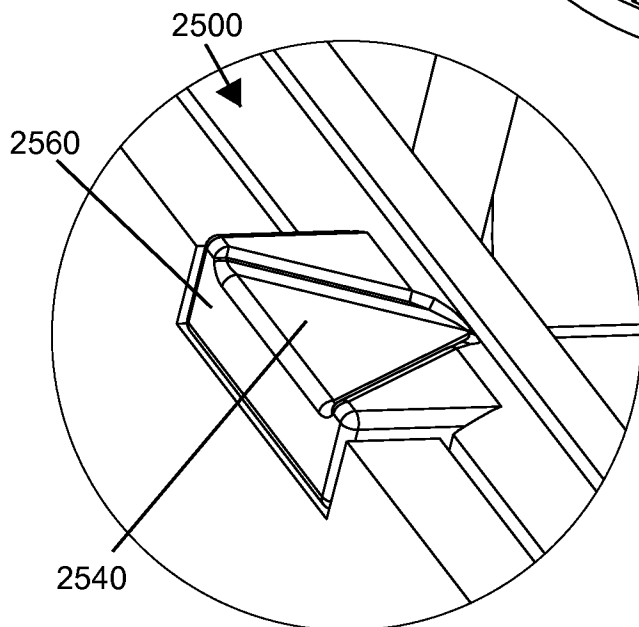


FIG. 37

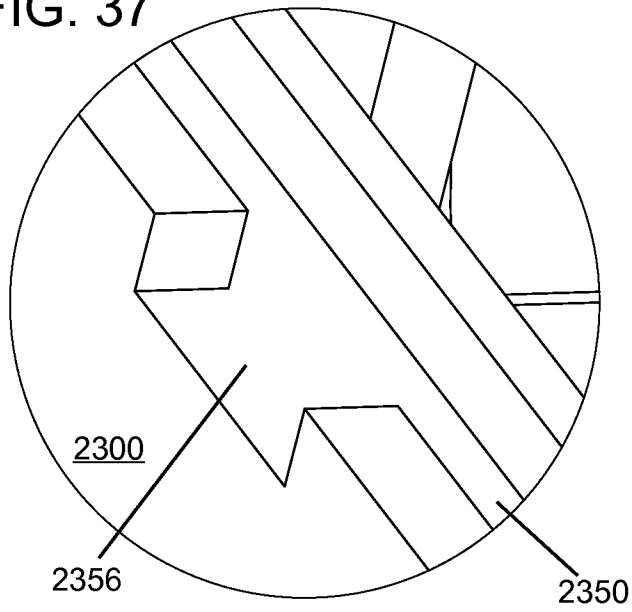


FIG. 38

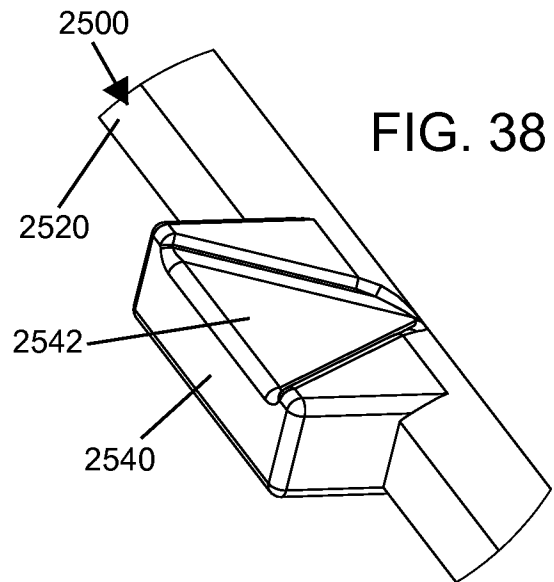
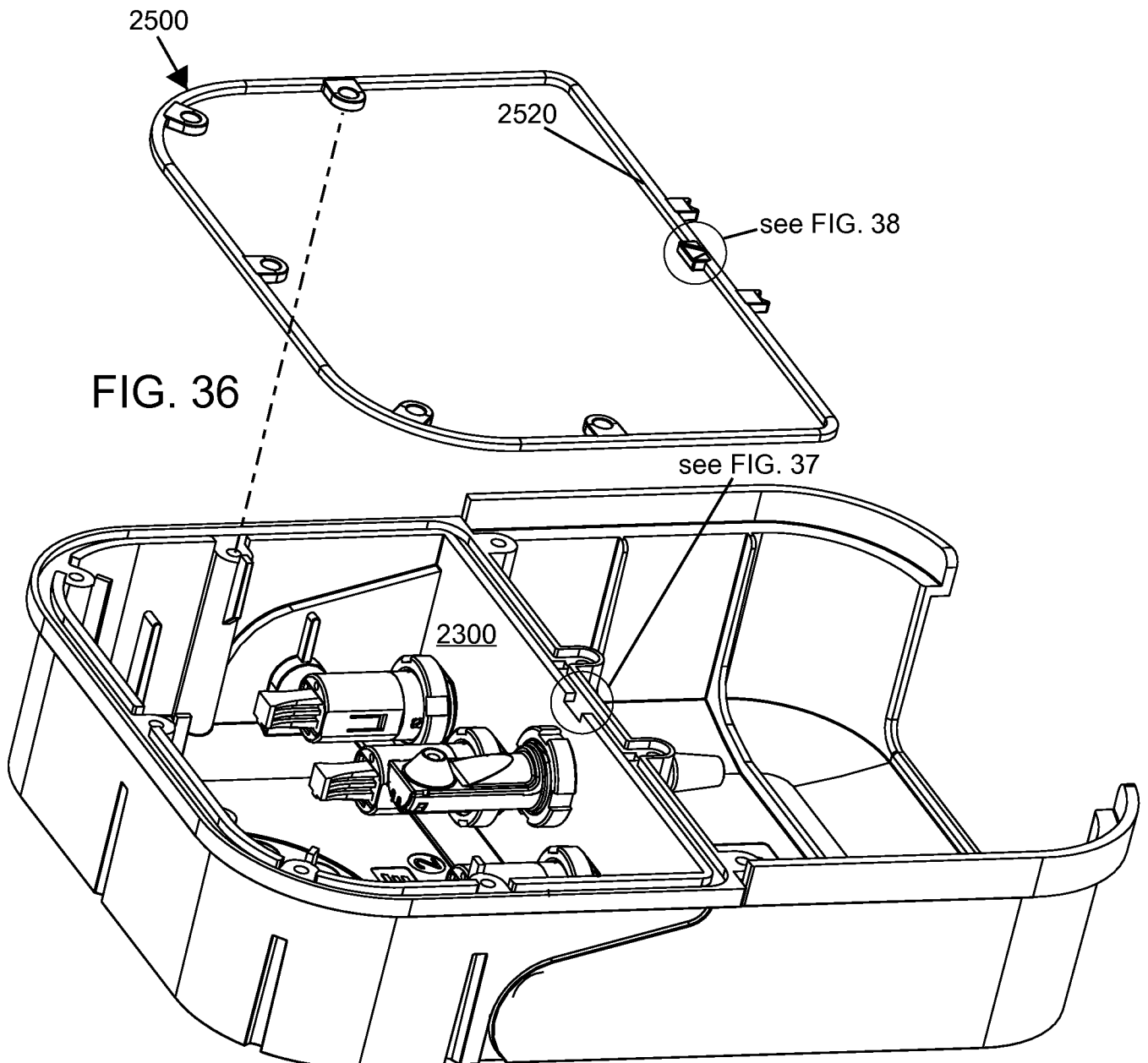
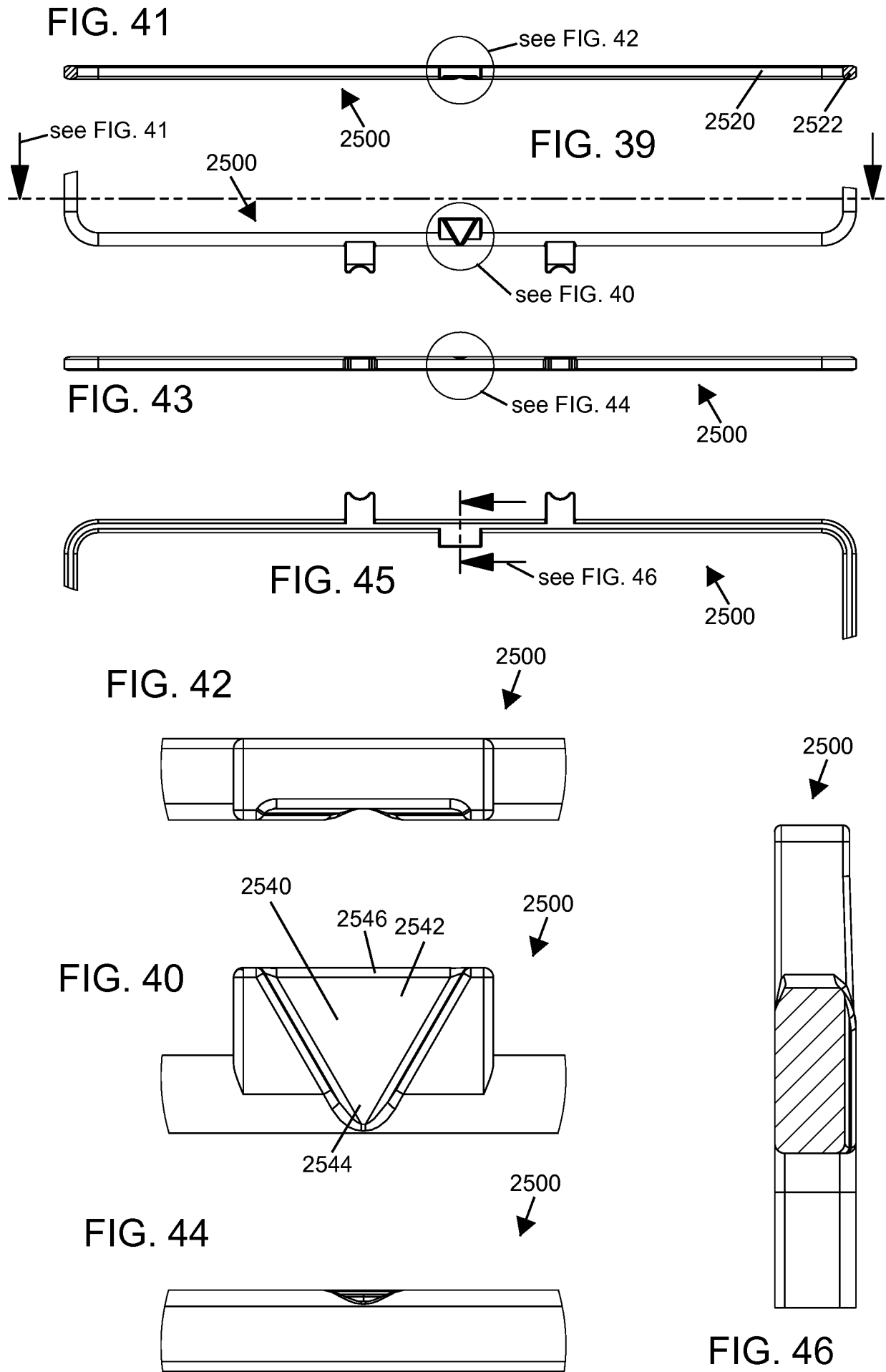


FIG. 36





INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/054090

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B6/44
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G02B H02G F25D B62D H01L H05K

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/014491 A1 (MACAULEY ANDREW S [GB] ET AL) 18 January 2007 (2007-01-18) abstract; figure 2	1-14
X	US 2010/193280 A1 (BAREISS MARTIN [DE] ET AL) 5 August 2010 (2010-08-05) abstract; figure 2 paragraph [0024]	1,2,4,8, 9,11
X	US 5 992 638 A (GREGERSON BARRY [US] ET AL) 30 November 1999 (1999-11-30) abstract; figures 10,11 column 5, lines 60-65	1-4, 7-12,15



Further documents are listed in the continuation of Box C.



See patent family annex.

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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

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"&" document member of the same patent family

Date of the actual completion of the international search

5 May 2015

Date of mailing of the international search report

13/05/2015

Name and mailing address of the ISA/

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NL - 2280 HV Rijswijk
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Fax: (+31-70) 340-3016

Authorized officer

Elflein, Wilhelm

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/054090

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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