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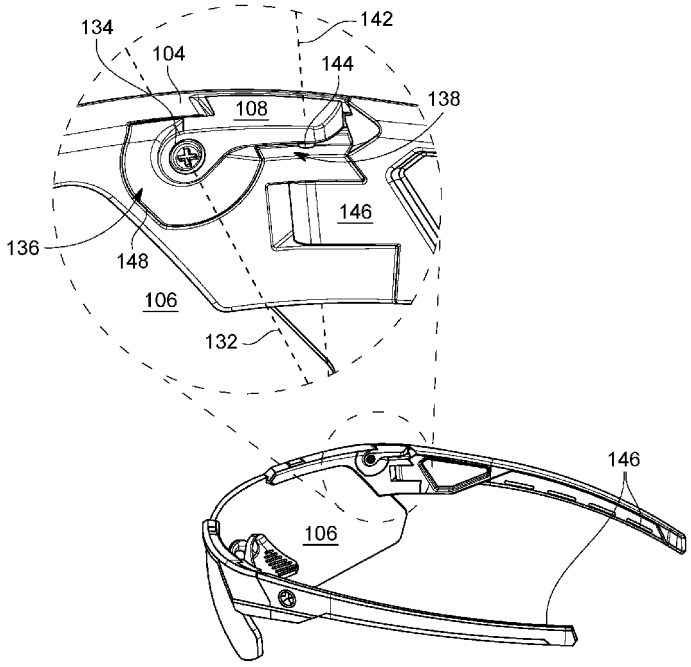

FIG. 1B

(57) Abstract: The present disclosure relates to systems, methods and apparatuses for a lens lock for eyewear comprising an interchangeable lens and a temple having a lens retention mechanism that includes a rotating latch rotatably housed in a curved recess of the temple that is configured to be locked into a closed position via one of a snap or a friction fit with the interchangeable lens.

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TITLE: LENS LOCK FOR INTERCHANGEABLE LENSES

CLAIM OF PRIORITY UNDER 35 U.S.C. §119

[0001] The present Application for Patent claims priority to Provisional Application No. 63/437,912, entitled "Lens Lock for Interchangeable Lenses," filed January 9, 2023 and assigned to the assignee hereof and hereby expressly incorporated by reference herein.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates generally to glasses. In particular, but not by way of limitation, the present disclosure relates to systems, methods and apparatuses for a lens lock for eyewear having interchangeable lenses.

DESCRIPTION OF RELATED ART

[0003] Eyeglass lenses conventionally include lenses that are difficult to remove from the eyeglass frame. As a consequence, users wearing corrective lenses may have multiple pairs of eyeglasses, with each in a different frame. In a sporting context, users may have glasses or goggles for different times of day—those with more or less tinting and reflectivity. However, the darker lenses that were ideal during bright midday sunlight or atop a snowy basin, become less useful and may even obscure a user's view early in the morning or at dusk when much lower light levels exist. Polarized lenses may be well adapted to mitigating glare on the water, snow, or at high altitude, but are not well adapted to internal use or may interfere with viewing of common liquid crystal displays. Those with corrective lenses may carry multiple pairs of glasses and/or goggles with different levels of correction for different use cases.

[0004] While some users may not mind the cost and inconvenience of having to store, transport, and use multiple pairs of eyeglasses mounted in multiple frames, it is at best

an inconvenient and troublesome way to provide proper vision in differing circumstances.

[0005] Interchangeable lens systems have been developed to accommodate these various use cases and allow different lenses to be quickly swapped out of a single frame. Toolless systems typically use a lens retention system including an 'open' and a 'closed' position, where the lenses can be removed in the 'open' position and are locked into place in the 'closed' position such that lens removal is impossible or difficult without damaging the frames and/or lenses. The 'open' position often involves an opening sufficient for the lenses to be inserted or removed without any bending of lens or frame (i.e., zero interference between the lens and frame). However, some systems require some amount of bending of the frame and/or lens to insert or remove the lenses. Either way, a lens retention system that is easy to use and yet retains strong ballistic qualities in use (i.e., lenses that do not become loose or fall out due to vibration, impact, etc.) is desired.

[0006] The system herein disclosed provides a toolless lens retention system that is easy to use and achieves strong ballistic qualities during use.

[0007] It should be noted, the foregoing examples of related art for eyeglass frames and lenses and the like and limitations related therewith are intended to be illustrative and not exclusive, and they do not imply any limitations on the eyeglass frame system described and claimed herein. Various limitations of the related art are already known or will become apparent to those skilled in the art upon a reading and understanding of the specification below and the accompanying drawings.

SUMMARY OF THE DISCLOSURE

[0008] The following presents a simplified summary relating to one or more aspects and/or embodiments disclosed herein. As such, the following summary should not be considered an extensive overview relating to all contemplated aspects and/or embodiments, nor should the following summary be regarded to identify key or critical elements relating to all contemplated aspects and/or embodiments or to delineate the scope associated with any particular aspect and/or embodiment. Accordingly, the following summary has the sole purpose to present certain concepts relating to one or more aspects and/or embodiments relating to the mechanisms disclosed herein in a simplified form to precede the detailed description presented below.

[0009] Some embodiments of the disclosure may be characterized as an eyewear with interchangeable lenses comprising a temple having a lens retention mechanism, an interchangeable lens, and wherein the lens retention mechanism includes a rotating latch rotatably housed in a curved recess of the temple that is configured to be locked into a closed position via one of a snap or a friction fit with the interchangeable lens. In some embodiments, the lens retention mechanism comprises a locking detent. In some embodiments, the rotating latch includes a curved arm that extends in a curved manner from a user extension. In some embodiments, the curved arm is shaped to substantially fit the curved recess in the temple. In many embodiments, the interchangeable lens is configured with a first notch and a second notch, wherein the first notch and the second notch are oriented in substantially opposing directions from one another. The rotating latch is configured to engage with the first notch and the second notch thereby hindering removal of the interchangeable lens. In some embodiments, the curved arm is configured to interface a first side and a second side of the curved recess. In some embodiments, the user extension forms a gap between a bottom of the user extension and the temple. In many embodiments, the user extension is shaped to fit mostly within

a user extension recess in the temple. In some embodiments, the rotating latch comprises a flat to minimize over rotation of the rotating latch toward the closed position. In many embodiments, the curved arm prevents removal of the interchangeable lens from the eyewear when the rotating latch is in the closed position.

[0010] In some embodiments, the rotating latch comprises a hold-closed detent formed from an angled ramp on a periphery of the rotating latch that has a substantially similar radius from a pivot axis as the curved arm. The hold-closed detent can comprise a scallop shaped to substantially engage with the angled ramp, and in some embodiments, the hold-closed detent further comprises a steep face substantially matching an angled face of the angled ramp. The eyewear is configured such that a sufficient backdriving force is needed to rotate the rotating latch out of the closed position.

[0011] In some embodiments, a circular face of the temple is configured to interface with a circular valley on the rotating latch to provide resistance to rotation into an open position. The eyewear can comprise a ledge configured to preclude rotation of the rotating latch past the open position. In some embodiments, the curved arm includes a knob at a distal end of the curved arm and a pinched segment adjacent to the knob, and the knob and the pinched segment are together configured to interface with the second notch to form a friction fit therewith. In some embodiments, the rotating latch is configured to rotate about a latch axis that passes through a fastener, and in some embodiments, the fastener, curved arm and angled ramp are part of a latching assembly having a mostly curved shape and being flush with an inner surface of the temple. In many embodiments, the user extension extends from the latch axis and a hole for the fastener rearward in a curving manner flush with a top of the temple, and wherein the user extension comprises a wider and narrower cross section of the rotating latch.

[0012] Other embodiments of the disclosure may also be characterized as a method of forming an interchangeable lens comprising shaping an interchangeable lens to define a curvature and forming a first notch and a second notch in the interchangeable lens, wherein the first notch and the second notch are oriented in substantially opposing directions from one another. In many embodiments, forming the first notch and the second notch is performed during shaping of the interchangeable lens. In some embodiments, forming the first notch and the second notch includes cutting the first notch and the second notch in the interchangeable lens after shaping the interchangeable lens.

[0013] Other embodiments of the disclosure may also be characterized an interchangeable lens comprising a pane of transparent material and a first curved notch formed along a top portion of the pane and a second curved notch formed along a side portion of the interchangeable lens, wherein the first curved notch and the second curved notch are oriented in substantially opposing directions from one another. In many embodiments, the first curved notch follows a constant radius and the second curved notch follows a constant radius. In various embodiments, the first curved notch is arranged along a clockwise path and the second curved notch is arranged along a counterclockwise path.

[0014] Embodiments of the disclosure additionally relate to an eyewear with interchangeable lenses a first temple having a first lens retention mechanism, a second temple having a second lens retention mechanism, and an interchangeable lens, wherein the first lens retention mechanism includes a first rotating latch rotatably housed in a first curved recess, wherein the second lens retention mechanism includes a second rotating latch rotatably housed in a second curved recess; and wherein the first temple and the second temple are configured to be locked into a closed position via one of a snap or friction

fit with the interchangeable lens. In many embodiments, each of the first lens retention mechanism and the second lens retention mechanism comprises a locking detent. In some embodiments, the first rotating latch includes a first curved arm that extends in a curved manner from a first user extension, and the second rotating latch includes a second curved arm that extends in a curved manner from a second user extension. In some embodiments, the first curved arm is shaped to substantially fit into the first curved recess, and the second curved arm is shaped to substantially fit into the second curved recess.

[0015] In some embodiments, the interchangeable lens is configured with a first top notch and a second top notch and a first side notch and a second side notch, wherein the first top notch and first side notch are oriented in substantially opposing directions from one another and the second top notch and the second side notch are oriented in substantially opposing directions from one another. In many embodiments, the first rotating latch is configured to engage with the first top notch and the first side notch, and wherein the second rotating latch is configured to engage with the second top notch and the second side notch. In some embodiments, the first rotating latch comprises a first hold-closed detent that has a substantially similar radius from a pivot axis as the first curved arm, and wherein the second rotating latch comprises a second hold-closed detent that has a substantially similar radius from a pivot axis as the second curved arm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Various objects and advantages and a more complete understanding of the present disclosure are apparent and more readily appreciated by referring to the following detailed description and to the appended claims when taken in conjunction with the accompanying drawings:

[0017] FIG. 1A is a front view of eyewear in accordance with an embodiment of the present invention;

[0018] FIG. 1B is a close-up view of eyewear in accordance with an embodiment of the present invention;

[0019] FIG. 2 is a closeup of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0020] FIG. 3A is a view of the curved arm of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0021] FIG. 3B is a view of the curved recess of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0022] FIG. 4 is a view of a closed position of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0023] FIG. 5 is an embodiment of an interchangeable lens in accordance with an embodiment of the present invention;

[0024] FIG. 6A is a view of a lens inserted into a temple shown without a rotating latch in accordance with an embodiment of the present invention;

[0025] FIG. 6B is a view of a lens inserted into a temple shown without a rotating latch in accordance with an embodiment of the present invention;

[0026] FIG. 7 is a view of an open position of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0027] FIG. 8 is a view of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0028] FIG. 9 is a view of a lens fitting in a channel in accordance with an embodiment of the present invention;

[0029] FIG. 10 is a close-up of a gap between a bottom of a user extension and a temple in accordance with an embodiment of the present invention;

[0030] FIG. 11A is a view of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0031] FIG. 11B is a view of a locking mechanism of eyewear in accordance with an embodiment of the present invention;

[0032] FIG. 12 is a view of a curved arm partially extending into a channel in accordance with an embodiment of the present invention;

[0033] FIG. 13 is an embodiment of a rotating latch in isolation as viewed from a front of eyewear in accordance with an embodiment of the present invention;

[0034] FIG. 14A is an embodiment of a rotating latch from the back in accordance with an embodiment of the present invention;

[0035] FIG. 14B is an embodiment of a rotating latch from the front in accordance with an embodiment of the present invention; and

[0036] FIG. 15 is a view of the channel without other intervening components in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0037] The present disclosure relates generally to a lens retention system. In particular, but not by way of limitation, the present disclosure relates to systems, methods and apparatuses for a lens retention system having an 'open' and a 'closed' position made possible via rotating toggle having a friction fit or detent to maintain the 'open' position and a detent to maintain the 'closed' position.

[0038] Every pair of glasses or goggles is designed for different ballistic scenarios and test specifications. The impact portion of MIL-SPEC places a higher threshold on ballistic

performance than common reading glasses and sunglasses are subject to, and therefore glasses or goggles designed to this spec should have a greater ability to retain interchangeable lenses when subjected to impact. The current disclosure allows easy toolless interchange of lenses while also passing the MIL-SPEC ballistic impact test using a pair of temples each coupled to a lens and each including a lens retention mechanism formed from a curved recess in the respective temple shaped to rotatably house a rotating latch as well as to allow a portion of the lens to enter the curved recess. The rotating latch is configured to snap into a 'closed' position and rotate into a closed position while rotating through the recess, and latches onto the portion of the lens in the 'closed' position. In other words, the hold open position is made possible via friction between the rotating latch and the temple, while the hold closed position is made possible via (1) a snap fit between the rotating latch and a detent and (2) a snap fit between the rotating latch and the portion of the lens extending into the curved recess. The geometry of the hold closed position is such that downward pressure on the lens (e.g., when accidental dropping or an intentionally attempt to remove the lens occurs) with the rotating latch in the closed position results in increased locking force on the lens.

[0039] For the purposes of this disclosure, a frame can include a temple and an arm where the frame is a multi-part frame as illustrated in the figures. However, a single frame comprising two temples and two arms could also be implemented in a half-frame/rim or full-frame design, though these variations are not illustrated.

[0040] The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[0041] Preliminary note: the flowcharts and block diagrams in the following Figures illustrate the functionality and operation of possible implementations of a lens retention system according to various embodiments of the present disclosure. It should be noted that, in some alternative implementations, the functions noted in each block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved.

[0042] It will be understood that, although the terms first, second, third etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present disclosure.

[0043] Spatially relative terms, such as “beneath,” “below,” “lower,” “under,” “above,” “upper,” and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “below” or “beneath” or “under” other elements or features would then be oriented “above” the other elements or features. Thus, the exemplary terms “below” and “under” can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly. In addition, it will also be understood

that when a layer is referred to as being "between" two layers, it can be the only layer between the two layers, or one or more intervening layers may also be present.

[0044] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items and may be abbreviated as "/".

[0045] It will be understood that when an element or layer is referred to as being "on," "connected to," "coupled to," or "adjacent to" another element or layer, it can be directly on, connected, coupled, or adjacent to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly connected to," "directly coupled to," or "immediately adjacent to" another element or layer, there are no intervening elements or layers present. Likewise, when light is received or provided "from" one element, it can be received or provided directly from that element or from an intervening element. On the other hand, when light is received or provided "directly from" one element, there are no intervening elements present.

[0046] Embodiments of the disclosure are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate

structures) of the disclosure. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the disclosure should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing. Accordingly, the regions illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to limit the scope of the disclosure.

[0047] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and/or the present specification and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0048] FIGs. 1A and 1B show an embodiment of eyewear having a first and a second temple 104, an interchangeable lens 106 and two arms 146. In some embodiments, the first and second temples 104 are coupled to a first and second top frame 160 of the eyewear. In some embodiments, eyewear can comprise a single temple 104, while in other embodiments, eyewear can comprise two temples 104. In some embodiments, the eyewear additionally comprises a nose pad 154.

[0049] In some embodiments, the temples 104, top frame 160, nose pad 154 and/or arms 146 comprise a plastic material, such as acetate. However, temples 104, top frame 160, nose pad 154 and/or arms 146 can comprise any type of plastic. In other embodiments, the temples 104, top frame 160, nose pad 154 and/or arms 146 comprise a metal alloy,

nylon, silicon, rubber or other material or a mixture of different materials (i.e., one element comprises plastic, while another comprises rubber, or portions of one element comprise silicon, while other portions of the element comprise metal).

[0050] In some embodiments the length of the arms can vary 146, but they are generally designed to extend from the frame to the area behind the ears. In various embodiments, the shape of the arms 146 can also differ, with variations ranging from straight and simple to curved or contoured for a more ergonomic fit. In some embodiments, the ends of the arms 146 are the curved to rest behind a user's ears and have smooth, rounded edges to prevent irritation or pressure points. In some embodiments, the ends of the arms 146 are adjustable to accommodate different ear shapes and sizes.

[0051] In some embodiments, the arms 146 are attached to each temple 104 via hinges, allowing them to pivot outward and inward. In some embodiments, the hinges are standard barrel hinges, but in other embodiments, the hinges or more advanced and adjustable types for a customized fit. As described in more detail below, in some embodiments, the eyewear has an arm hinge aperture formed to accept a pin or other elongated member allowing arms 146 of the glasses to rotate relative to the temples.

[0052] The thickness and width of arms 146 can vary based on the frame's design and the intended use of the glasses. In some embodiments, thicker and wider arms146 provide additional stability and support for heavier lenses. In some embodiments, arms 146 are designed to be slightly flexible, allowing them to bend slightly without breaking. This flexibility can enhance durability and comfort, as the arms can better conform to the wearer's head shape.

[0053] In some embodiments, the lens 106 comprises a transparent and/or semi-transparent material that is polarized and/or coated. For example, an anti-reflective coating and/or

UV coating may be added to lens 106. In some embodiments, the lens 106 is made of plastic, while in other embodiments, lens 106 is comprised of glass. In some embodiments, lens 106 is configured with a specific prescriptive view (for example, for a farsighted or a nearsighted user). In some embodiments, lens 106 is coated to enable better night vision. In some embodiments, lens 106 comprises an impact resistant lens, which is harder than lenses used in typical sunglasses and eyeglasses.

[0054] Fig. 2 and the inset of FIG. 1B shows a detailed view of a lens retention mechanism of the temple 104 with a lens 106 locked in place in accordance with various embodiments. As shown, the lens retention mechanism is in the closed position and comprises a rotating latch 108 rotatably housed in a curved recess 110 (illustrated in FIGs. 6A and 6B) in the temple 104. The rotating latch 108 is locked into the closed position (that is, where the latch is substantially planar with a top edge of an arm 146 of the eyewear) via snap fit or friction fit with the lens 106 as well as via a locking detent that is visible in FIGs. 3 and 4. In some embodiments, the rotating latch 108 can include a flat 148 that helps minimize over rotation of the rotating latch 108 toward the 'closed' position.

[0055] In many embodiments, the rotating latch 108 can rotate about a latch axis 132 that passes through a fastener 134. In some embodiments, fastener 134 can be a screw, while in others, it can be a screw with a three-sided or triangular threading profile (for example, like the embodiment illustrated in FIG. 4).

[0056] The lens retention mechanism further comprises a curved arm 112 (shown in FIGS. 3A and 3B). In some embodiments, and as illustrated in FIG. 3A, the curved arm 112 includes a knob 128 at its distal end and a pinched segment 130 adjacent to the knob 128. The knob 128 has a width that is larger than that of the pinched segment 130.

[0057] As used herein, the term "curved" means to have or take a turn, change, or deviation from a straight line or plane surface without sharp breaks or angularity. For example, in some embodiments, an object may be shaped in a curved manner such that the object may be fully circular, semi-circular or having a shape approximate to any other portion of a circle. In other embodiments, the object may have more of an oval-like curve such that it more approximates all or part of an oval.

[0058] Additionally, the rotating latch 108 can include a hold-closed detent formed from an angled ramp 120 on the periphery of the rotating latch 108 that has a similar radius from a pivot axis that the curved arm 112 has. However, in some embodiments, the radius to the angled ramp 120 is less than the radius to the curved arm 112.

[0059] In some embodiments, the hold-closed detent also comprises a scallop 122 in the temple 104 that is better seen in FIG. 3B. In some embodiments, the scallop 122 can pass entirely through a first rear wall of the temple 104 as better seen in FIG. 12, though this aperture is not necessary. Similarly, the curved recess 110 can also pass through the rear wall of the temple 104, allowing the curved arm 112 to interface with both the temple 104 and the lens 106.

[0060] In many embodiments, the scallop 122 is shaped to substantially engage with the angled ramp 120 and includes a steep face 126 substantially matching an angled face 124 of the angled ramp 120, where this angle is such that the rotating latch 108 is not easily moved from the 'closed' to the 'open' position (i.e., an opening threshold of force is applied to force the angled ramp 120 to push past and clear the steep face 126 of the scallop 122), and/or removal of the interchangeable lens 106 is hindered. The angle and height/depth of the angled face 124 can be tailored to different opening thresholds during manufacturing. The steep face 126 can be designed to have the same or a

different angle from that of the angled face 124, for instance, to help adjust the opening threshold. To enhance the feel of opening the rotating latch 108, the angled ramp 120 can interface with a circular face 180 of the temple while rotating. At the same time, or in the alternative, the angled ramp 120 can interface with one or both sides of the curved recess 110.

[0061] FIG. 13 shows an embodiment of a rotating latch 108 in isolation as viewed from the front of the eyewear. As previously described, in some embodiments, the curved arm 112 includes a knob 128 at its distal end and a pinched segment 130 adjacent to the knob 128. FIG. 13 illustrates an embodiment where the width of the pinched segment is stepped narrower than the rest of the curved arm 112 at a first step 131. The pinched segment 130 then extends into the wider knob 128 and a second step 133. While the term "step" or "stepped" is used herein, the pinched segment can taper inwards or outwards at first step 131 and/or second step 133.

[0062] FIG. 5 shows an embodiment of the lens 106 with first and second notches 116 and 118 cut into the lens 106 in substantially opposing directions. In some embodiments, lens 106 only has one notch 116 and/or 118. In other embodiments, lens 106 only has notches 118 and not notches 116. In some embodiments, notches 116 and/or 118 are configured in a curved manner. In some embodiments, notches 116 and/or 118 follow a constant radius. In some embodiments, notch 116 is arranged along a clockwise path (from a front view of the eyewear) and notch 118 is arranged along a counterclockwise path (from a front view of the eyewear).

[0063] Turning back to FIG 3A, the larger knob 128 and the pinched segment 130 are configured together to interface with a notch 118 in the lens 106 to form a snap fit or friction fit therewith. This friction fit not only locks the lens 106 in place but also acts

as a second of two detents for holding the rotating latch 108 in the 'closed' position (the interface between the scallop 122 and the angled ramp 120 being the second).

[0064] With reference to embodiments in FIGs. 11A and 11B, the interaction of rotating latch 108 (including pinched segment 130 and knob 128) with the notch 118 is shown. That is, the shape and angle of pinched segment 130 and knob 128 is configured in a shape similar to that of notch 118, such that knob 128 and all or a portion of pinched segment 130 can fit within notch 118.

[0065] With reference to FIG. 9, in some embodiments, a protrusion 170 in the lens 106 adjacent notch 116 is configured to substantially fit into a groove 165 in a top frame 160. In some embodiments, the underside of top frame 160 comprises a channel 150 shaped to receive the glass of the lens 106 and/or portions of the curved arm 112. For example, FIG. 12 provides a view of an embodiment of the curved arm 112 partially extending into a portion of the channel 150, to further provide a secure fit of lens 106 into frame 160 and the lens retaining mechanism of the eyewear.

[0066] With further reference to FIG. 15, in many embodiments, the channel 150 is shaped with two substantially flat side portions that are sized to overlap a portion of the lens 106. In many embodiments, the channel 150 only overlaps a small portion of the lens.

[0067] Referring back to FIG. 3A, because the knob 128 is positioned just past a bottommost point on the rotating latch 108 (e.g., the '7-o'clock' position) a torque needed to move the rotating latch 108 toward the 'open' position would have to be right and slightly downward in FIG. 3A or left and downward in FIG. 8. Thus, a downward force on the lens 106 would fail to create the torque needed to rotate the rotating latch and in fact would merely increase the locking force. Similarly, while a lateral and downward force might be effective to rotate one of the two rotating latches in embodiments have both a

first and second rotating latch, this force would be directly opposite to that needed to open the second rotating latch and would instead increase the locking force of the second rotating latch. Thus, the use of opposing rotating latches in some embodiments, along with the notches in the lens 106 precludes removal of the lens regardless of the direction of force.

[0068] In some embodiments, the knob 128 includes a flat portion that aligns with the flat 148 in latching assembly 136 (shown in FIG. 2) furthering to help prevent over rotation of the rotating latch 108.

[0069] In accordance with various embodiments, the closed position of the lens retention mechanism is further shown in FIG. 4, with the temple 104 illustrated as transparent so that the rotating latch 108 is visible through the transparent temple 104. The rotating latch 108 includes a curved arm 112 that extends in a curved manner from a user extension 114 that aids a user in accessing the rotating latch 108. The curved arm 112 is shaped to substantially fit the curved recess 110 in the temple 104 (see also FIGs. 3A and 3B for views of the curved arm 112 and the curved recess 110 in isolation). A gap can exist between the curved arm 112 and the curved recess 110 such that the curved arm 112 can rotate into the 'open' position with little resistance when the lens 106 is not locked into place (for example, in the position illustrated in FIG. 7).

[0070] FIGs. 6A and 6B show a lens 106 inserted into the temple without a rotating latch to make the lens more easily visible in this position. The second notch 118 in the lens 106 can be seen to align with and have a similar curvature to the curved recess 110 in the temple 104. It can also be seen that the notch 118 has a smaller width than the curved recess 110, the purpose of this smaller dimension being to create a snap fit with the curved arm 112 of the rotating latch 108 when rotated to the closed position.

[0071] With further reference to an embodiment illustrated in FIG. 7, in order to insert a lens 106 and/or release a lens 106, the rotating latch 108 can be rotated about 30 to 90 degrees from the 'locked' position, but this specific angle is not required. For example, in some embodiments the opening angle is dependent on the location and configuration of the curved recess 110 and the angled ramp 120 and the interplay therebetween.

[0072] With reference to an embodiment illustrated in FIG. 8, beyond the hold-closed detent of the angled ramp 120 and the scallop 122, the curved arm 112 extends sufficiently far into the lens 106 that a sufficient backdriving vector of force (804 in FIG. 8) is needed to rotate the rotating latch 108 out of the 'closed' position. However, most lens impacts cause the lens 106 to expand outward from a center of the lens, a force vector likely in line with vector 806, which is substantially toward a center of rotation and along the radius 802 of the rotating latch 108. As seen, the force commonly exerted by the lens 106 on the curved arm 112 is oblique and approaches 90' from, the direction of force 804 needed to backdrive the rotating latch 108 out of the 'closed' position. Thus, the curved shape of the notch 118 in concert with the shape, dimensions, and angle of the curved arm 112 make it difficult for even strong ballistic impacts to dislodge the lens 106 from the frame.

[0073] At the same time or in the alternative, the curved arm 112 can interface with sides of the curved recess 110 to partially resist rotation of the rotating latch 108. Additionally, or at the same time, the circular face 180 can interface with a circular valley 182 on the rotating latch 108 to provide resistance to rotation into the 'open' position. Any one or more of these frictional interfaces may resist rotation of the rotating latch 108 toward the 'open' position. Finally, ledge 184 may impinge on surface 186 to preclude rotation of the rotating latch 108 past the open position (see FIGs. 3A and 3B).

[0074] In some embodiments, the user extension 114 can extend from the latch axis 132 and a hole for the fastener 134 rearward in a curving manner flush with a top of the temple 104 and can include a wider and narrower cross section than the rest of the rotating latch 108. For example, FIGs. 14A and 14B show an embodiment of a rotating latch 108 from the back and front, respectively that includes a user extension 114 wider cross section towards the rotating latch 108 that narrows as it extends outward from the rotating latch 108. FIG. 14A additionally shows an embodiment where the curvature of the rotating latch 108 is configured to match the curvature of the temple and the curvature of the curved recess in the temple formed for the rotating latch 108. FIG. 14B shows the angled ramp, which may have a shallower angle than the scallop in the temple.

[0075] The user extension 114 can form a gap 138 between a bottom of the user extension 114 and the temple 104 that helps to allow a user's finger to access the user extension 114 and pull upward thereon. FIG. 10 is a close-up of gap 138 between a bottom of a user extension and a temple in accordance with an embodiment of the present invention.

[0076] With reference to FIGs. 3A and 3B, the user extension 114 can be shaped to substantially fit within a user extension recess 140 in the temple 104. The user extension recess 140 may pass over an arm hinge axis 142 passing through an arm hinge aperture 144 formed to accept a pin 152 or other elongated member allowing arms 146 of the glasses to rotate relative to the temples.

[0077] In some embodiments, the eyewear can comprise an RFID (Radio-Frequency Identification) chip in the frame for tracking, authentication, and/or customization. For example, in some embodiments, the RFID chip is embedded in one of the top frame 160, temple 104 and/or arm 146. In addition to the RFID chip, an antenna can be

embedded in the frame, often in close proximity to the RFID chip. In some embodiments, the antenna is created by printing conductive materials onto the frame's surface or embedding conductive wires or traces within the frame material itself. In the case of active RFID chips, a power source (usually a small battery) may also be embedded in the frame to provide power to the chip.

[0078] In various embodiments the RFID chip can be integrated with eyewear systems or applications. For example, in some embodiments, RFID chips can be used to store wearer's prescription information for easy identification and verification. In other embodiments, the RFID chip can be used to track the location of the eyewear. In some embodiments, the RFID chip can be connected to a smartphone or other remote device.

[0079] In some embodiments, one or more cameras are integrated into the eyewear frame. The integrated camera or cameras are configured with electronics to capture images and/or videos, provide image stabilization, exposure control, real-time image enhancement, night vision, augmented reality and/or the like. In some embodiments, the cameras are connected to a processing unit within the frame of the eyewear, which can be a small computer or a specialized camera module. In some embodiments, the image data is transmitted wirelessly from the eyeglasses to a remote device. In some embodiments, this communication is accomplished by various wireless technologies, such as Bluetooth, Wi-Fi, or cellular networks.

[0080] In some embodiments, a method of forming an interchangeable lens 106 is provided. The method comprises choosing a piece or pane of a high-quality optical material, such as polycarbonate, CR-39, or glass, for example. In some embodiments the material is cut and shaped into the desired lens form. This process may involve precision machining, grinding, and polishing to achieve the correct curvature and thickness to

define a curvature. In some embodiments, one or more coatings is applied to one or more surfaces of the lens, such as anti-reflective or UV-blocking coatings. These coatings are applied through techniques such as vapor deposition or dip coating. In some embodiments, if tinted or polarized lenses are desired, these treatments are applied using specialized processes. Tinting may involve immersion in tint baths, while polarization typically involves the insertion of polarizing films.

[0081] As part of the forming step and/or prior to or after such step, a first notch and a second notch are formed in the interchangeable lens. By forming the first and second notches, the notches may be cut out of lens, for example, by precision machining, laser cutting and/or the like. In addition, the lens may be cut to the size and shape of the eyewear. In some embodiments, following the cutting process, the lens may be polished to smoothen any rough edges or surfaces resulting from the cutting process.

[0082] In some embodiments, the first notch and the second notch are formed in a way such that they oriented in substantially opposing directions from one another. For example, in some embodiments, two notches are formed in the top of the lens, wherein each notch is formed to curve in a manner away from a center of the lens (as viewed from a front perspective of the lens).

[0083] In addition and/or optionally, two notches are formed on the sides of the lens, where each side has a notch formed within it. In some embodiments, each side notch is formed with a curvature extending in a direction towards the direction of the top notch. For example, with reference to FIG. 5, the notches 116 and 118 extend towards each other, such that they are oriented in opposite directions from one another. In some embodiments, notches 116 are formed within a top third of the side of the eyewear. In other embodiments, notches 116 are formed within a top half of the side of the eyewear.

In some embodiments, notches 118 are formed with any portion of a top side of the eyewear.

[0084] As used herein, the recitation of "at least one of A, B and C" is intended to mean "either A, B, C or any combination of A, B and C." The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present disclosure. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the disclosure. Thus, the present disclosure is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

1. An eyewear with interchangeable lenses comprising:

a temple having a lens retention mechanism;

an interchangeable lens; and

wherein the lens retention mechanism includes a rotating latch rotatably housed in a curved recess of the temple that is configured to be locked into a closed position via one of a snap or a friction fit with the interchangeable lens.

2. The eyewear of claim 1, wherein the lens retention mechanism comprises a locking detent.

3. The eyewear of claim 1, wherein the rotating latch includes a curved arm that extends in a curved manner from a user extension.

4. The eyewear of claim 3, wherein the curved arm is shaped to substantially fit the curved recess in the temple.

5. The eyewear of claim 3, wherein the interchangeable lens is configured with a first notch and a second notch, wherein the first notch and the second notch are oriented in substantially opposing directions from one another.

6. The eyewear of claim 5, wherein the rotating latch is configured to engage with the first notch and a top frame coupled to the temple is configured to engage with the second notch thereby hindering removal of the interchangeable lens.

7. The eyewear of claim 3, wherein the rotating latch comprises a hold-closed detent formed from an angled ramp on a periphery of the rotating latch that has a substantially similar radius from a pivot axis as the curved arm.

8. The eyewear of claim 7, wherein the hold-closed detent comprises a scallop shaped to substantially engage with the angled ramp.

9. The eyewear of claim 8, wherein the hold-closed detent further comprises a steep face substantially matching an angled face of the angled ramp.

10. The eyewear of claim 1, wherein a sufficient backdriving force is needed to rotate the rotating latch out of the closed position.

11. The eyewear of claim 3, wherein the curved arm is configured to interface a first side and a second side of the curved recess.

12. The eyewear of claim 9, wherein a circular face of the temple is configured to interface with a circular valley on the rotating latch to provide resistance to rotation into an open position.

13. The eyewear of claim 12, further comprising a ledge configured to preclude rotation of the rotating latch past the open position.

14. The eyewear of claim 5, wherein the curved arm includes a knob at a distal end of the curved arm and a pinched segment adjacent to the knob.

15. The eyewear of claim 14, wherein the knob and the pinched segment are together configured to interface with a channel of the temple to form a friction fit therewith.

16. The eyewear of claim 3, wherein the rotating latch is configured to rotate about a latch axis that passes through a fastener.

17. The eyewear of claim 16, wherein the fastener, curved arm and angled ramp are part of a latching assembly having a mostly curved shape and being flush with an inner surface of the temple.

18. The eyewear of claim 16, wherein the user extension extends from the latch axis and a hole for the fastener rearward in a curving manner flush with a top of the temple, and wherein the user extension comprises a wider and narrower cross section of the rotating latch.

19. The eyewear of claim 3, wherein the user extension forms a gap between a bottom of the user extension and the temple.

20. The eyewear of claim 3, wherein the user extension is shaped to fit mostly within a user extension recess in the temple.

21. The eyewear of claim 1, wherein the rotating latch comprises a flat to minimize over rotation of the rotating latch toward the closed position.

22. The eyewear of claim 3, wherein the curved arm prevents removal of the interchangeable lens from the eyewear when the rotating latch is in the closed position.

23. A method of forming an interchangeable lens comprising:

shaping an interchangeable lens to define a curvature; and

forming a first notch and a second notch in the interchangeable lens, wherein the first notch and the second notch are oriented in substantially opposing directions from one another.

24. The method of claim 23, wherein forming the first notch and the second notch is performed during shaping of the interchangeable lens.

25. The method of claim 23, wherein forming the first notch and the second notch includes cutting the first notch and the second notch in the interchangeable lens after shaping the interchangeable lens.

26. An interchangeable lens comprising:

a pane of transparent material; and

a first curved notch formed along a top portion of the pane and a second curved notch formed along a side portion of the interchangeable lens, wherein the first curved notch and the second curved notch are oriented in substantially opposing directions from one another.

27. The interchangeable lens of claim 26, wherein the first curved notch follows a constant radius.

28. The interchangeable lens of claim 27, wherein the second curved notch follows a constant radius.

29. The interchangeable lens of claim 26, wherein the first curved notch is arranged along a clockwise path and the second curved notch is arranged along a counterclockwise path.

30. An eyewear with interchangeable lenses comprising:

a first temple having a first lens retention mechanism;

a second temple having a second lens retention mechanism;

an interchangeable lens;

wherein the first lens retention mechanism includes a first rotating latch rotatably housed in a first curved recess;

wherein the second lens retention mechanism includes a second rotating latch rotatably housed in a second curved recess; and

wherein the first temple and the second temple are configured to be locked into a closed position via one of a snap or friction fit with the interchangeable lens.

31. The eyewear of claim 30, wherein each of the first lens retention mechanism and the second lens retention mechanism comprises a locking detent.

32. The eyewear of claim 30, wherein the first rotating latch includes a first curved arm that extends in a curved manner from a first user extension, and wherein the second rotating latch includes a second curved arm that extends in a curved manner from a second user extension.

33. The eyewear of claim 32, wherein the first curved arm is shaped to substantially fit into the first curved recess, and wherein the second curved arm is shaped to substantially fit into the second curved recess.

34. The eyewear of claim 30, wherein the interchangeable lens is configured with a first top notch and a second top notch and a first side notch and a second side notch, wherein the first top notch and first side notch are oriented in substantially

opposing directions from one another and the second top notch and the second side notch are oriented in substantially opposing directions from one another.

35. The eyewear of claim 34, wherein the first rotating latch is configured to engage with the first top notch, and wherein the second rotating latch is configured to engage with the second top notch.

36. The eyewear of claim 32, wherein the first rotating latch comprises a first hold-closed detent that has a substantially similar radius from a first pivot axis as the first curved arm, and wherein the second rotating latch comprises a second hold-closed detent that has a substantially similar radius from a second pivot axis as the second curved arm.

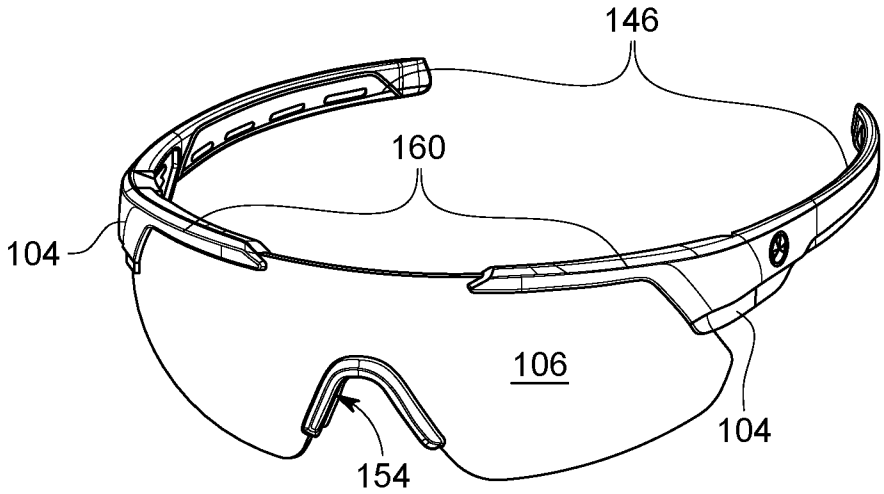
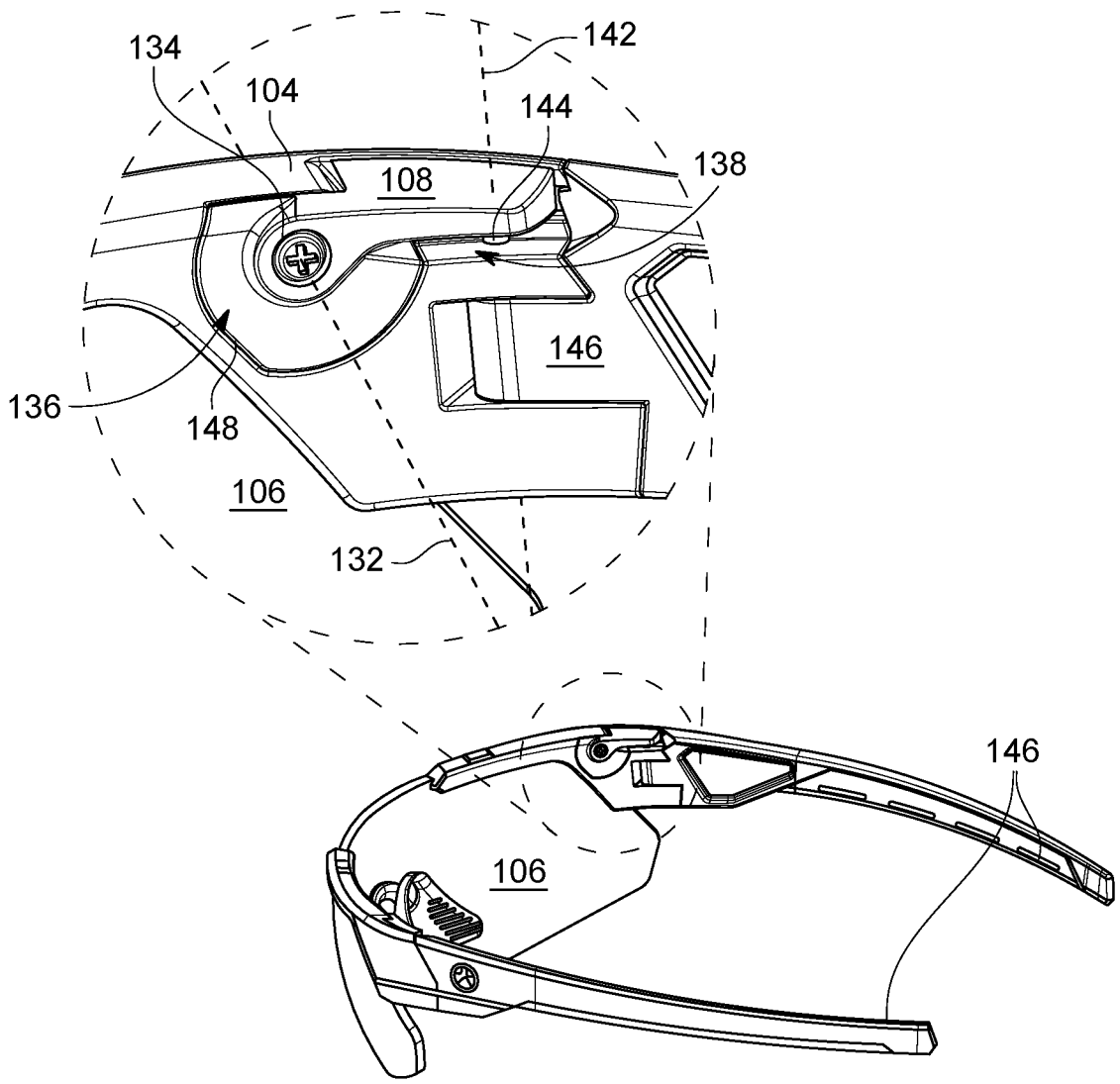

146
160
104
106
104
154

FIG. 1A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146
106

FIG. 1B

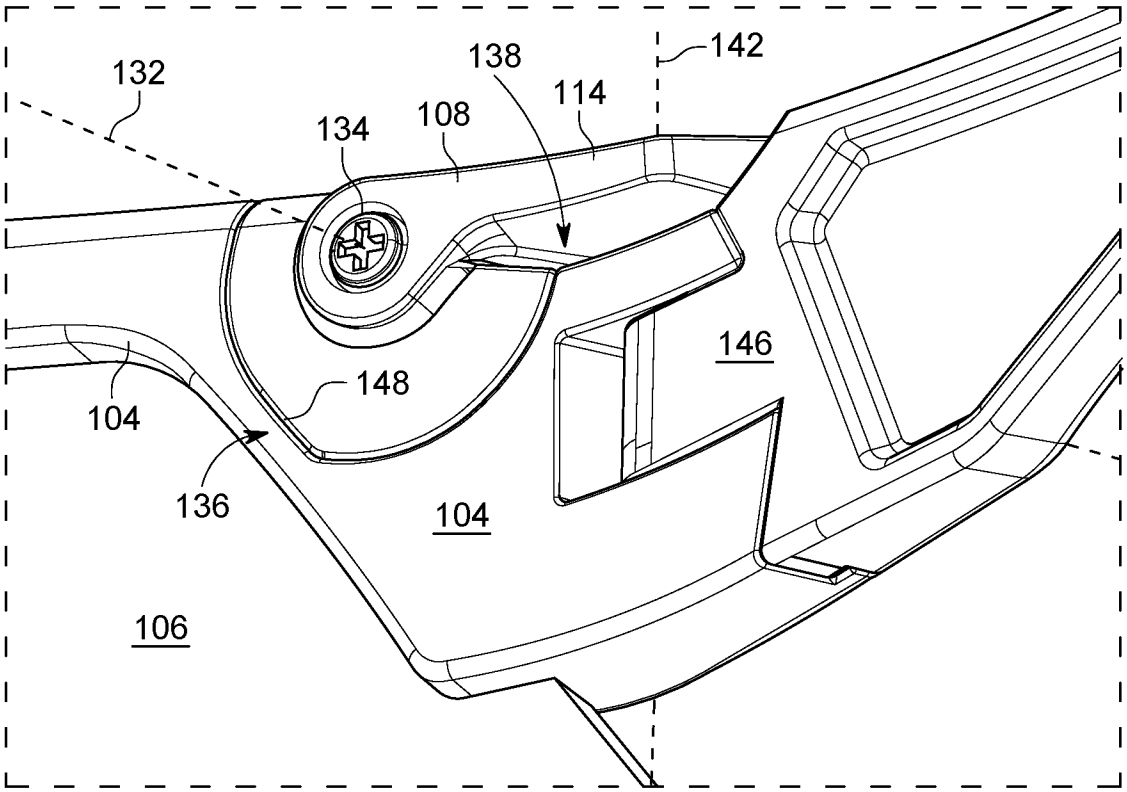
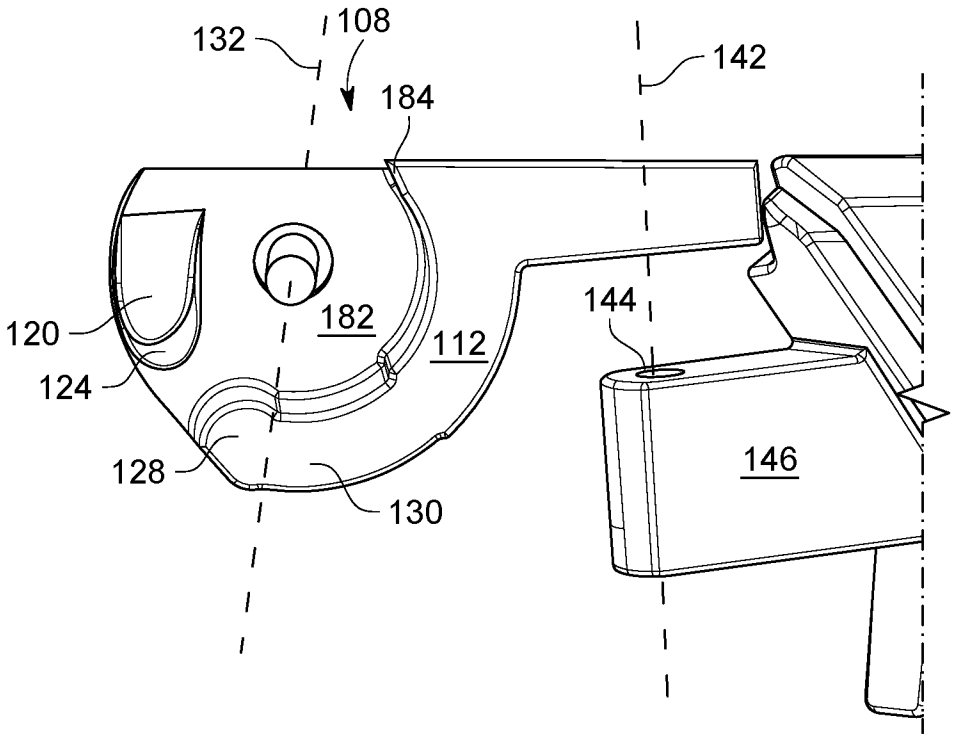


FIG. 2


132
108
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182
112
144
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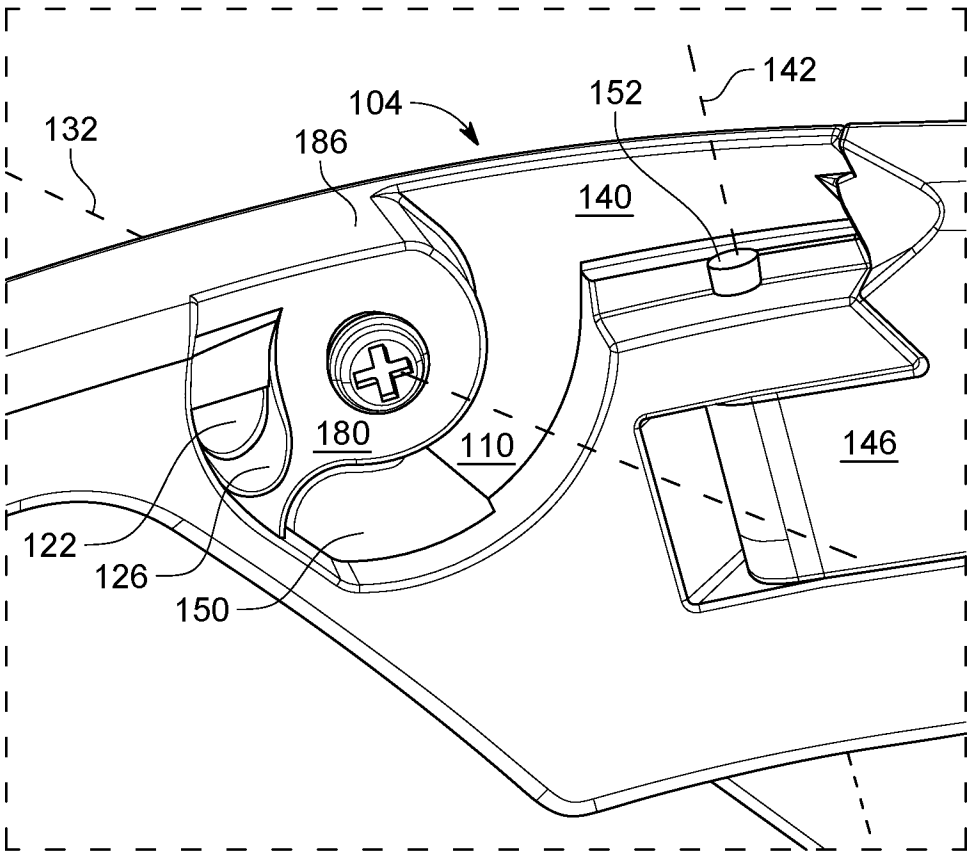
146
128
130

FIG. 3A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132
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140
180
110
146
122
126
150

FIG. 3B

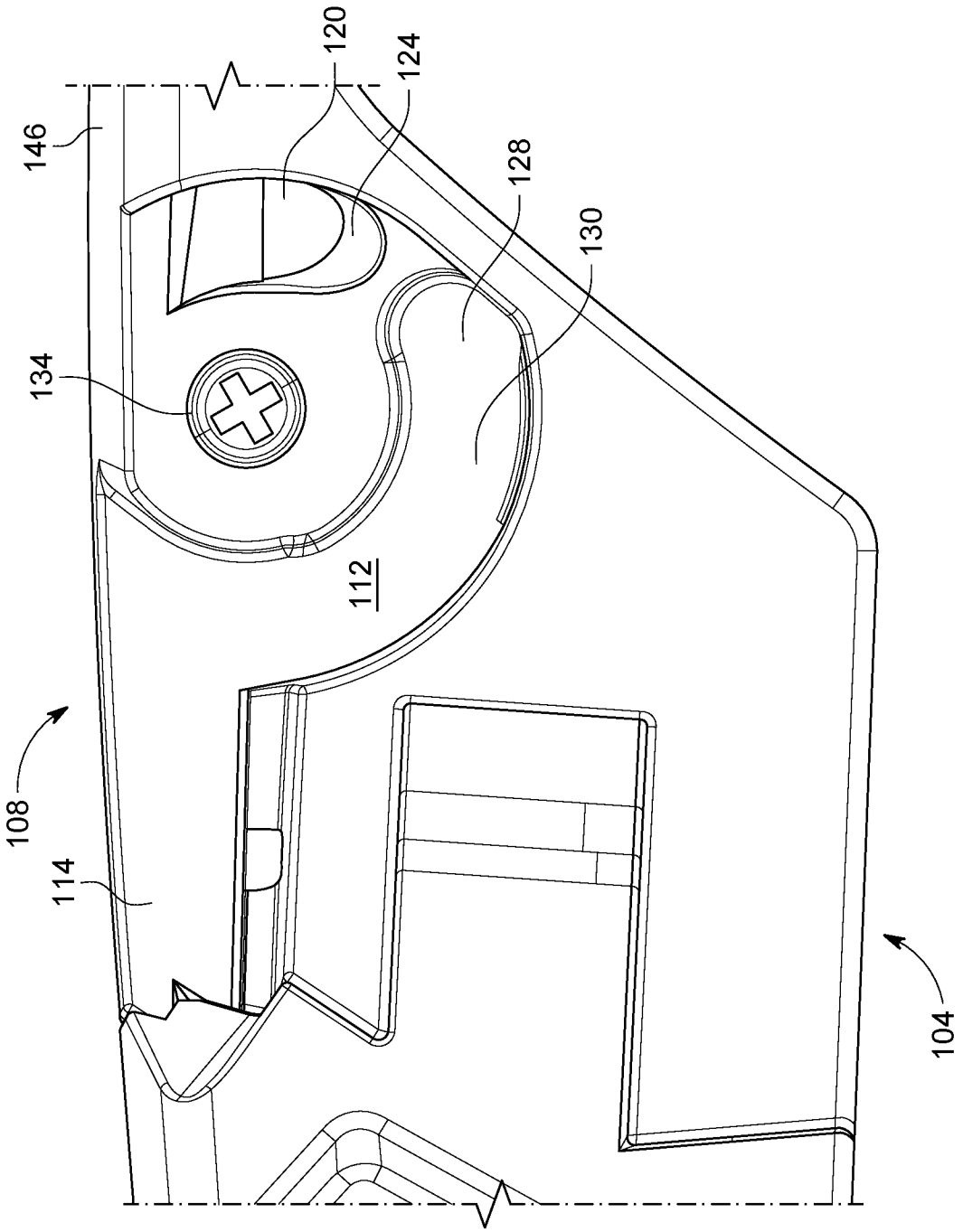

FIG. 4

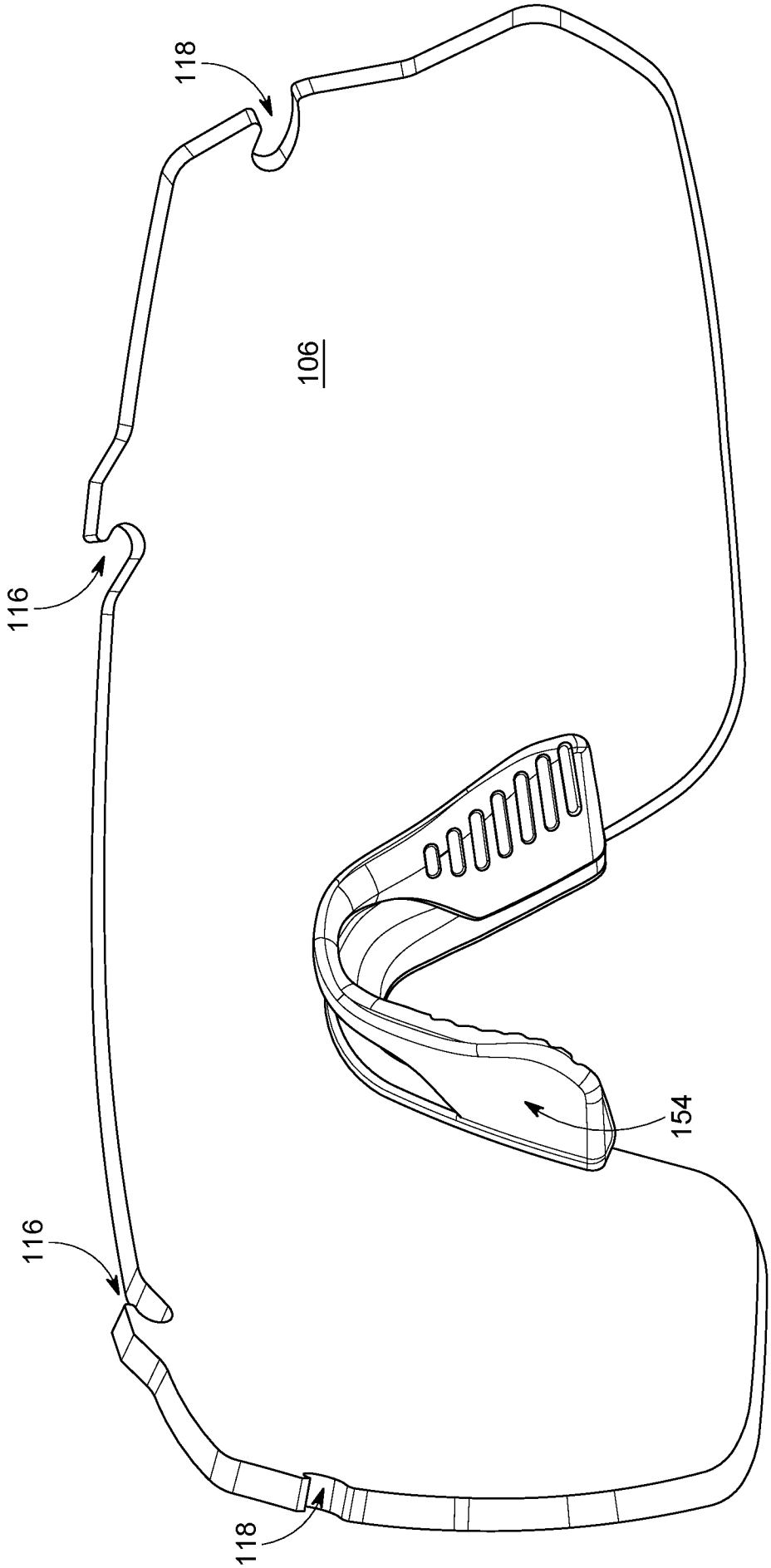

FIG. 5

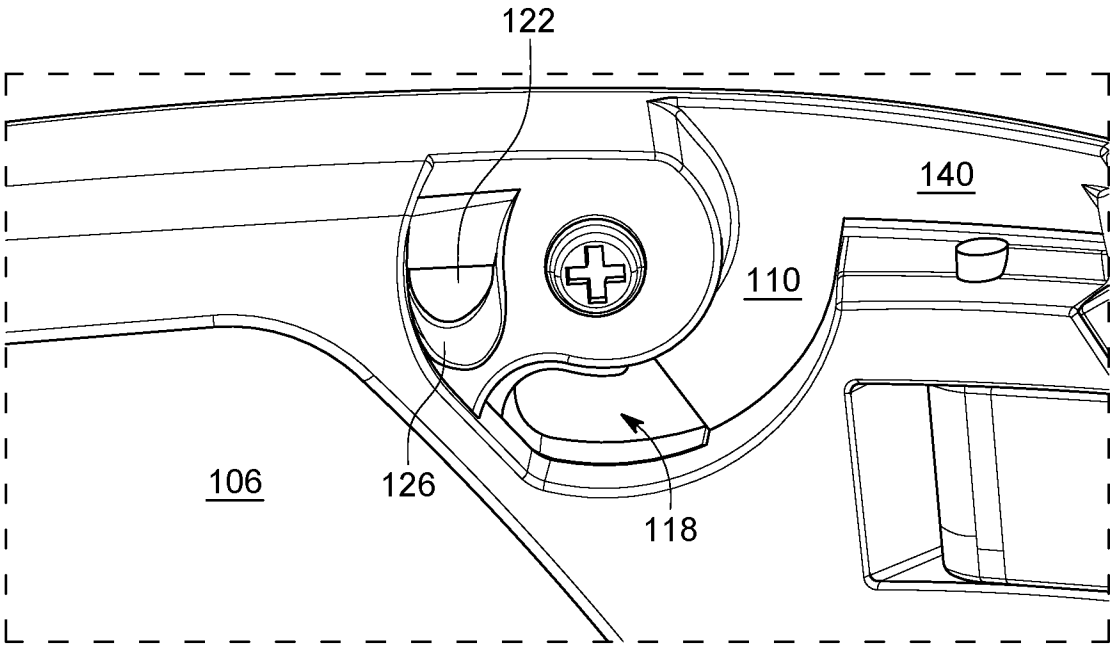

FIG. 6A

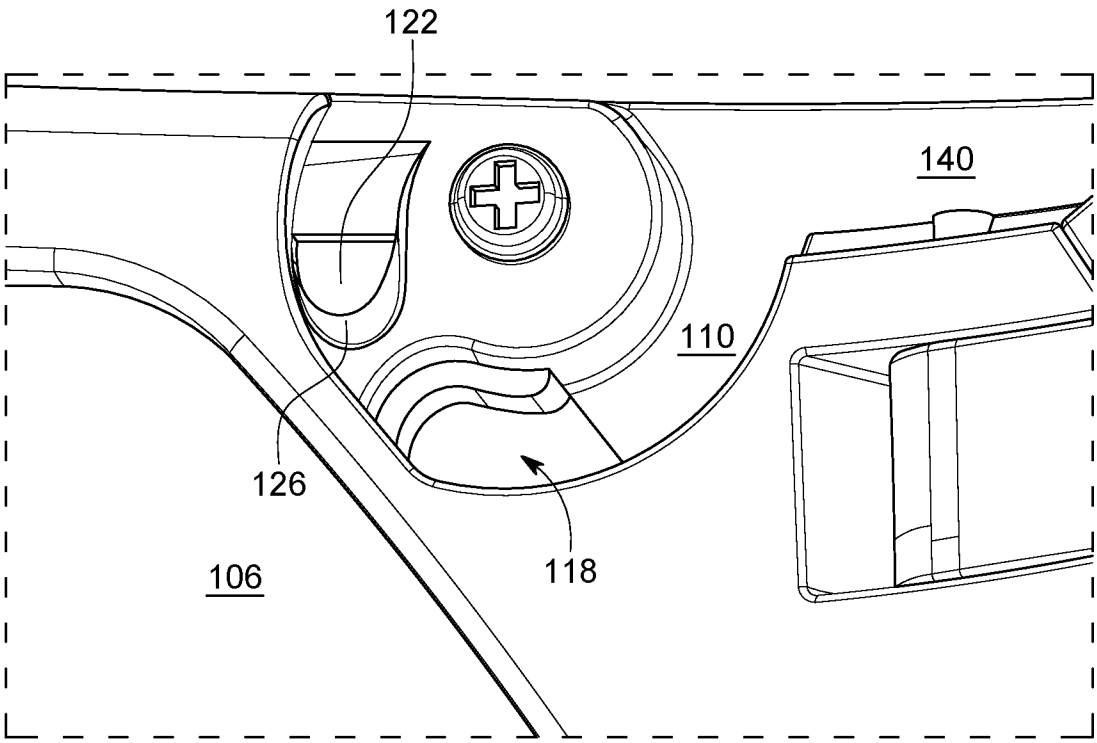

FIG. 6B

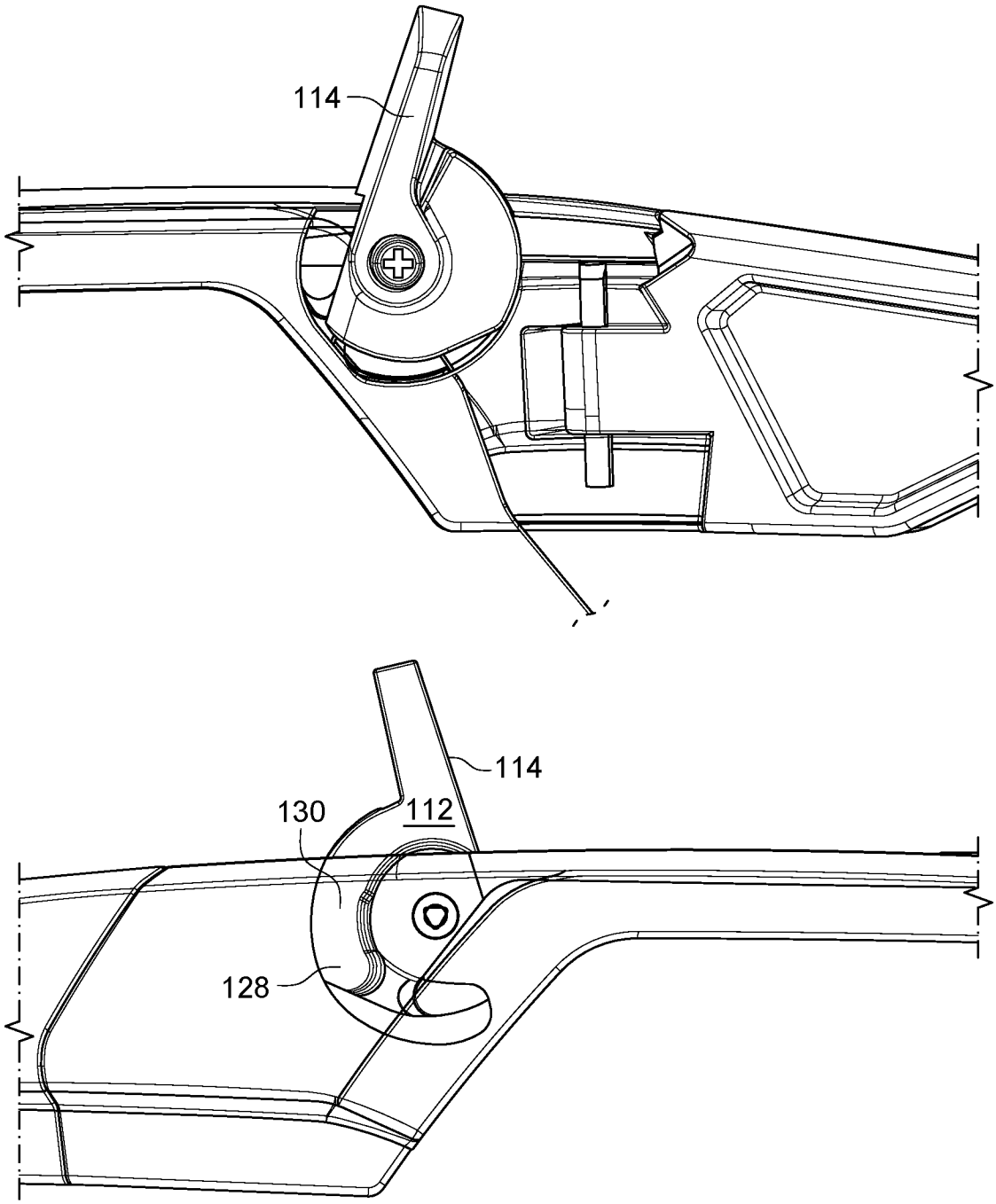

FIG. 7

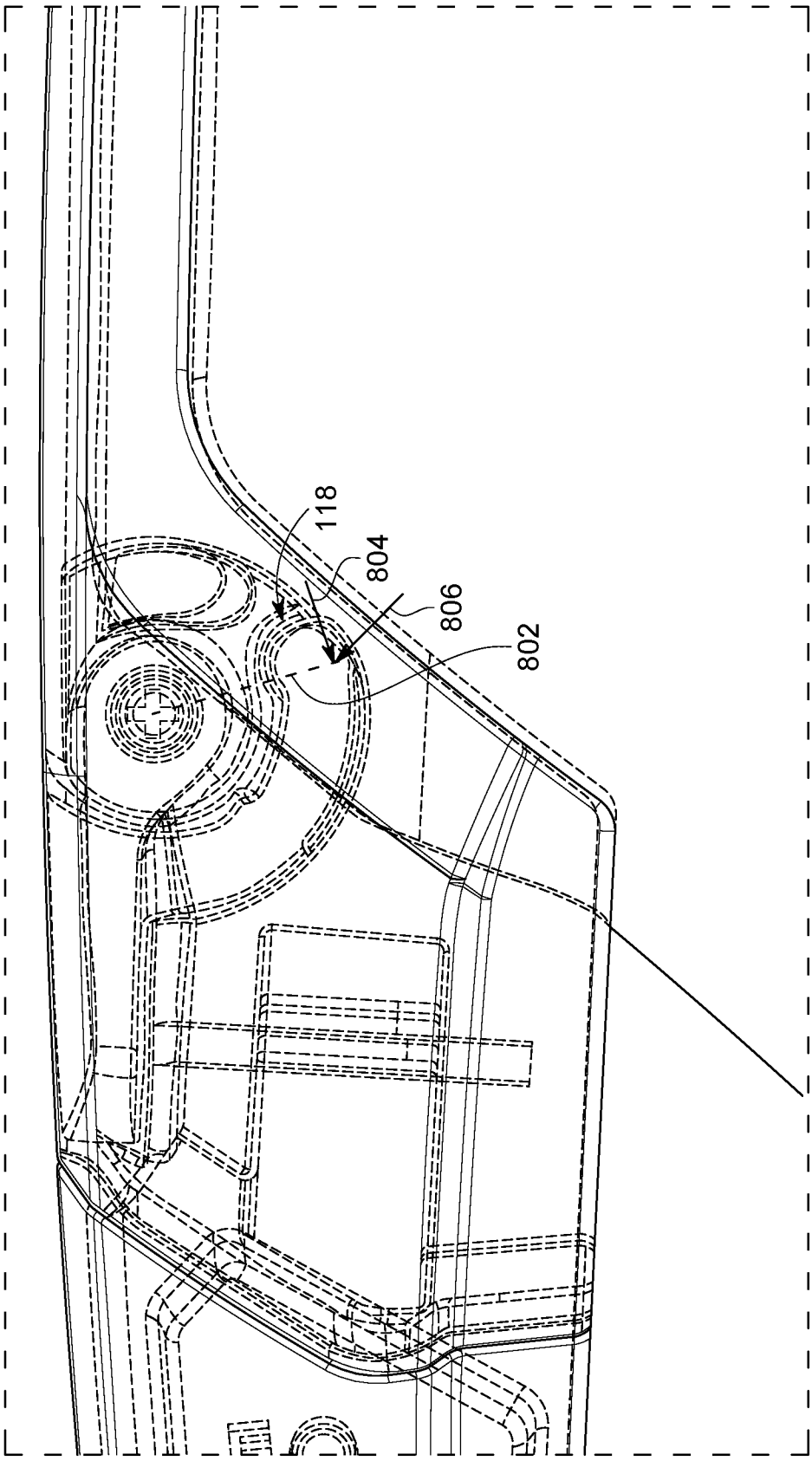

FIG. 8

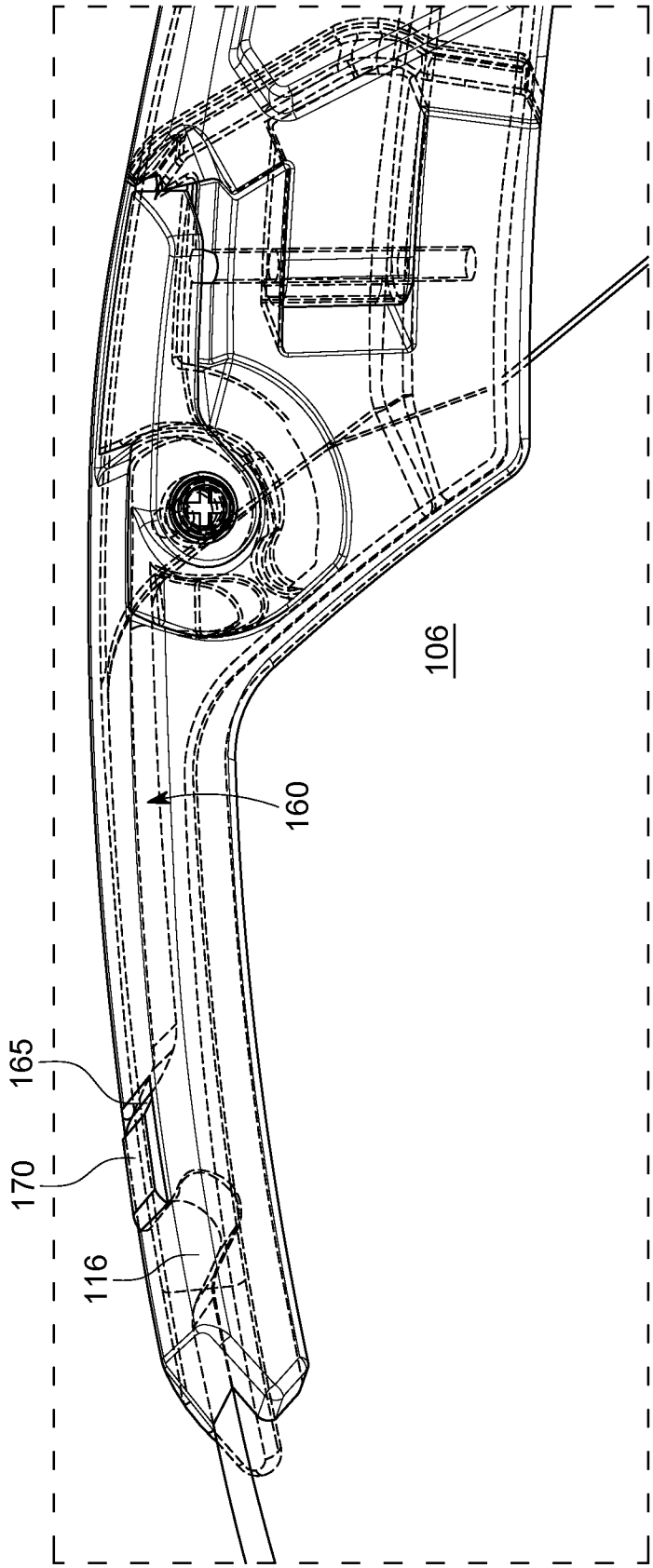

FIG. 9

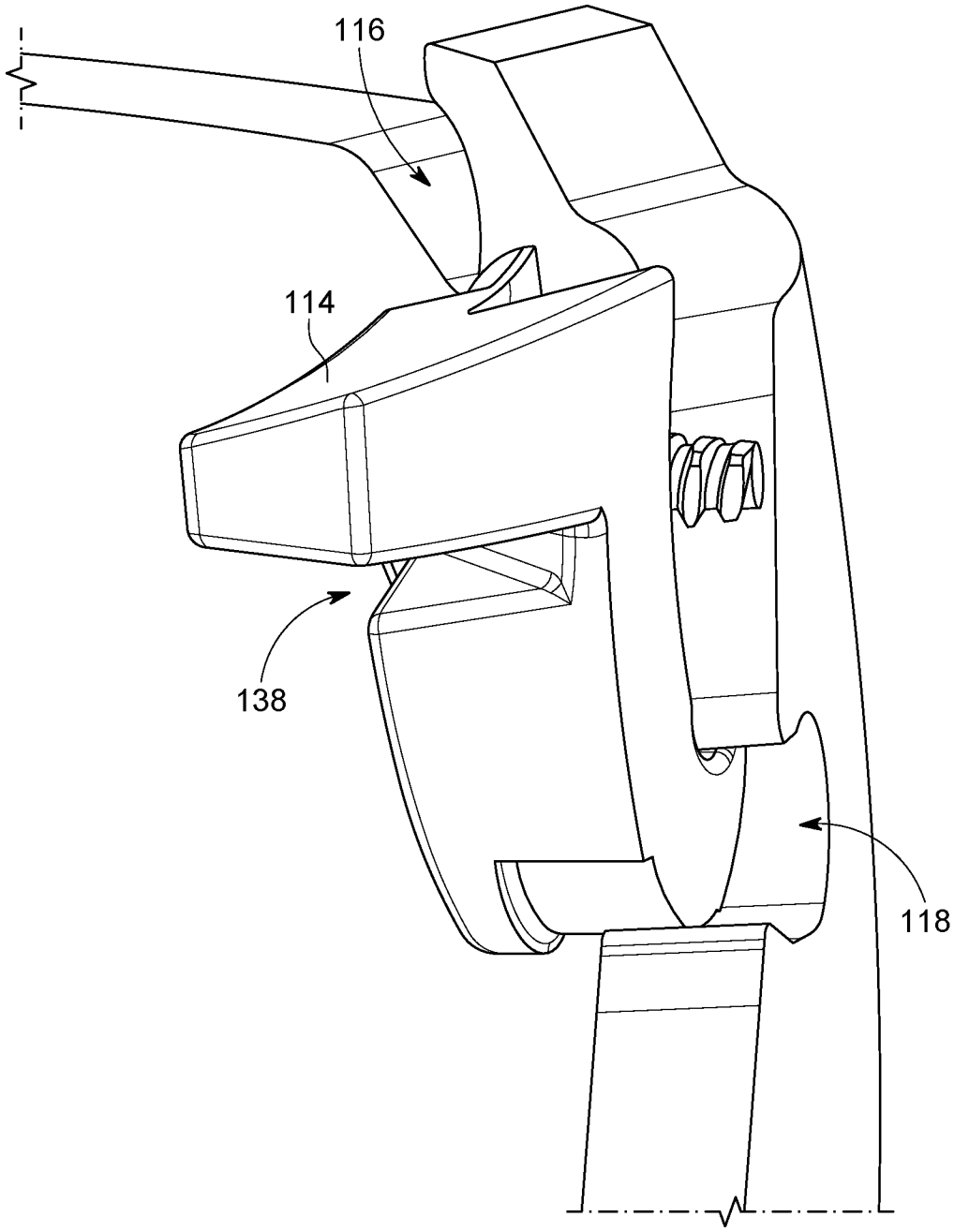

FIG. 10

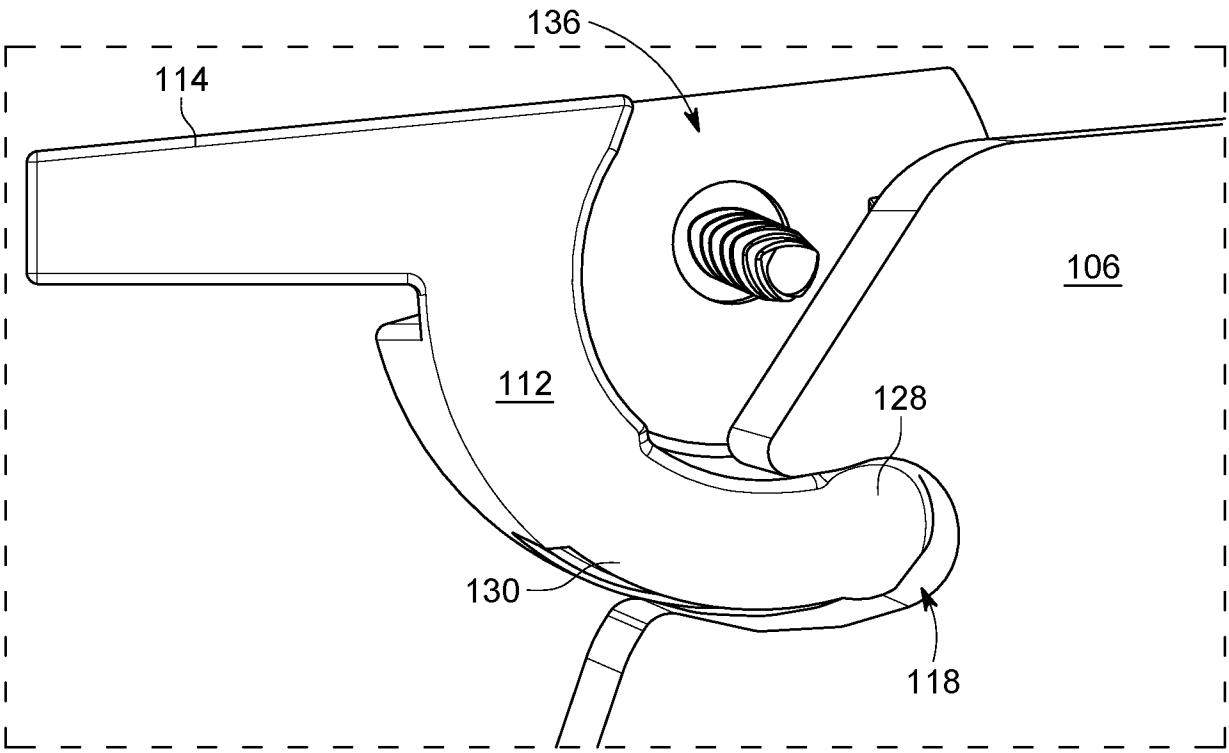

FIG. 11A

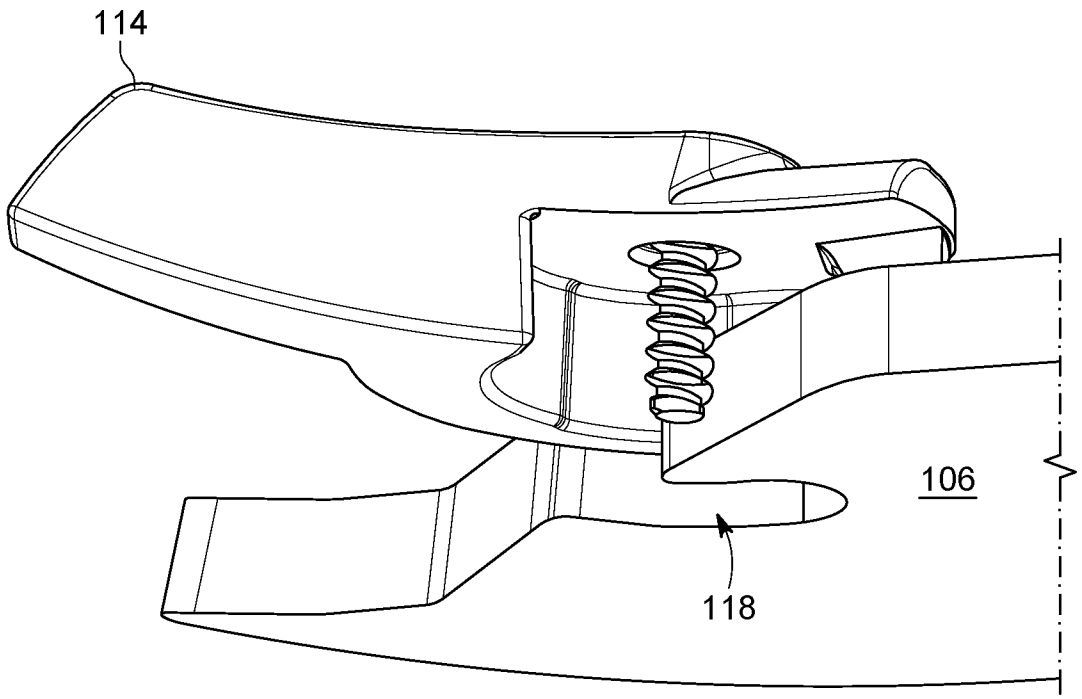

FIG. 11B

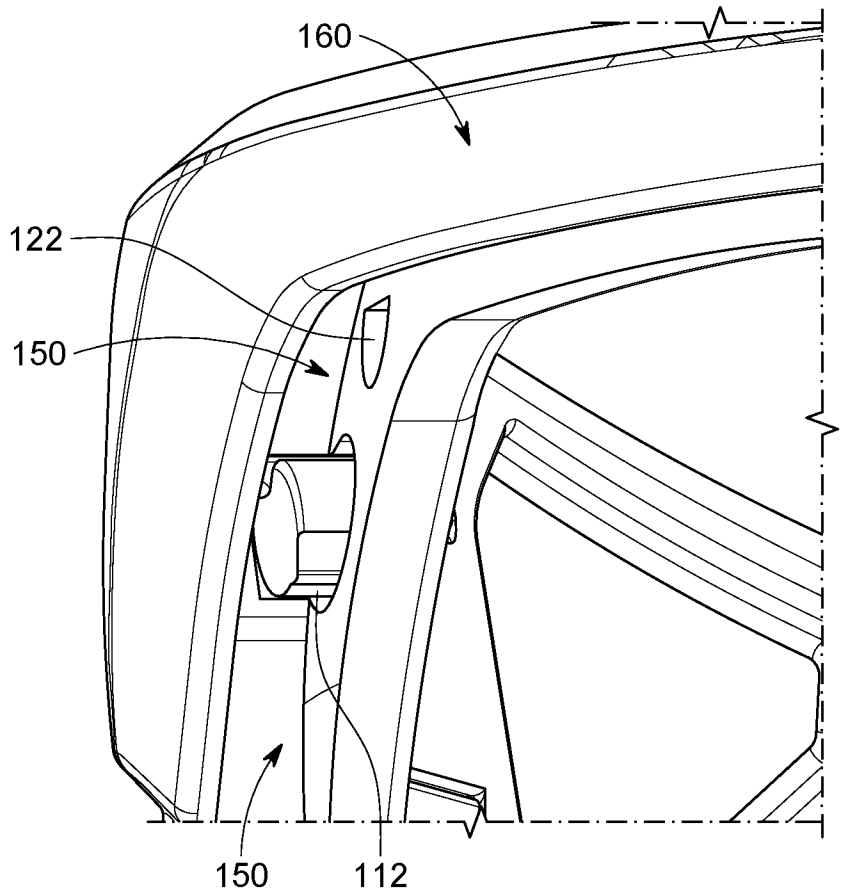

FIG. 12

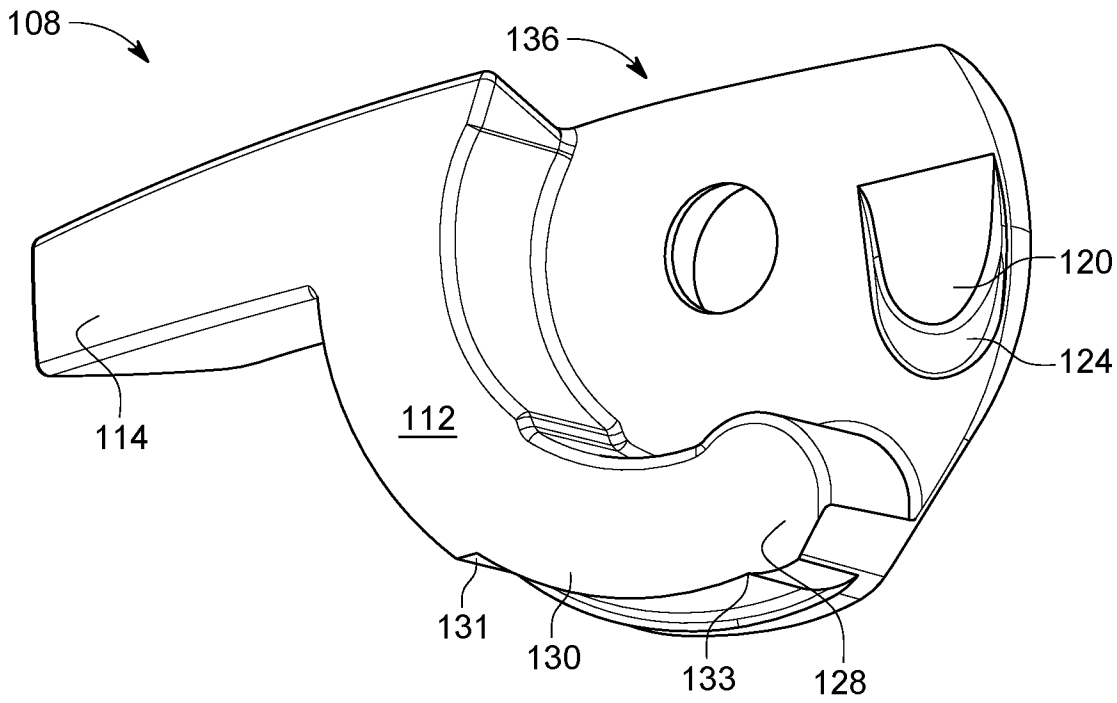

FIG. 13

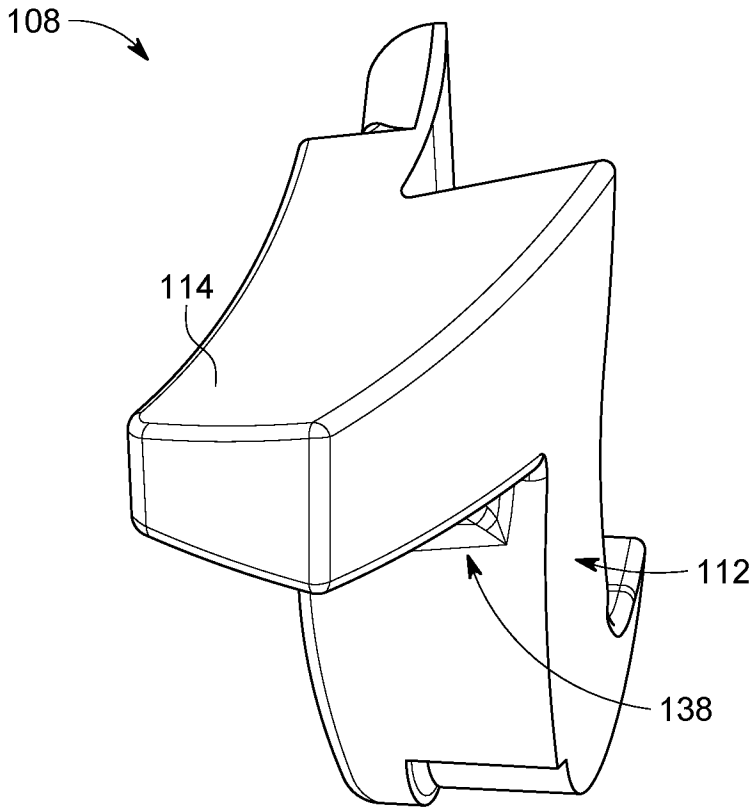

FIG. 14A

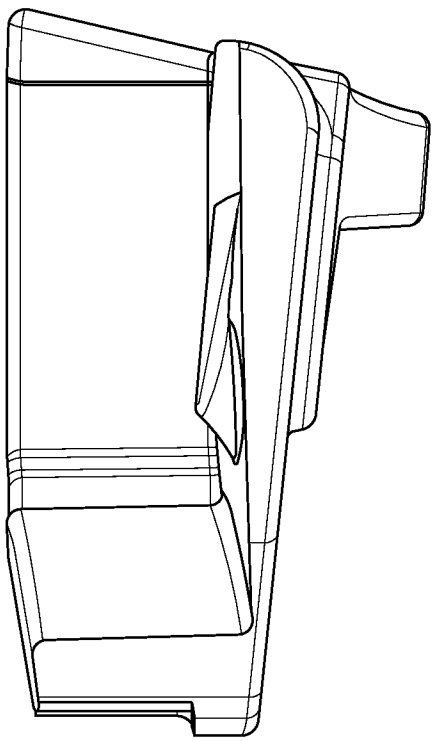

FIG. 14B

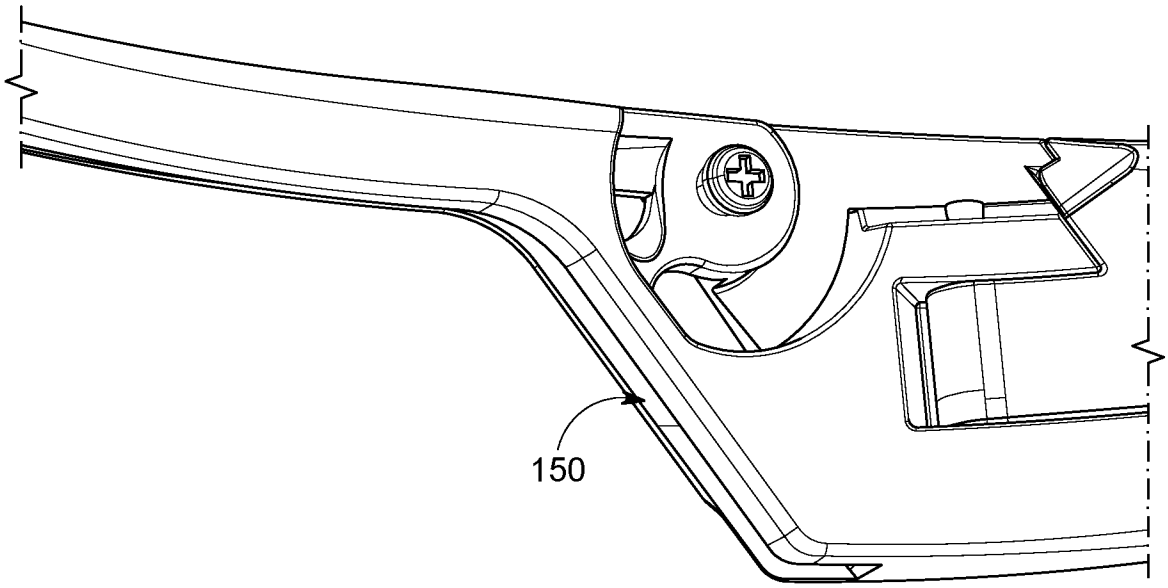

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 24/10652

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. G02C 1/00 (2024.01)
ADD. G02C 1/04, G02C 5/14 (2024.01)

CPC - INV. G02C 1/10

ADD. G02C 2200/08, G02C 1/04, G02C 5/14, G02C 2200/32

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y --- A	US 9,188,792 B2 (Oakley, Inc.) 17 November 2015 (17.11.2015), entire document, especially Fig. 1-13B; col 5, ln 47-63; col 6, ln 27-66; col 8, ln 16; col 9, ln 8-9, 22-31; col 12, ln 15-17	1-5, 10-11, 14-16, 18-22, 30-33 --- 6, 34-35 --- 7-9, 12-13, 17, 36
X	US 2011/0007263 A1 (DiChiara) 13 January 2011 (13.01.2011), entire document, especially Abstract; Fig. 12B; para [0055], [0074], [0090]	23-25
Y	US 10,012,845 B1 (GEM OPTICAL CO., LTD.) 03 July 2018 (03.07.2018), entire document	6, 26-29, 34-35
Y	US 2009/0161062 A1 (KAWANISHI) 25 June 2009 (25.06.2009), entire document, especially Fig. 2; para [0041]-[0042]	26-29
A	US 11,409,129 B2 (Expression Frames LLC) 09 August 2022 (09.08.2022), entire document	7-9, 12-13, 17
A	US 8,316,470 B2 (McNeal et al.) 27 November 2012 (27.11.2012), entire document	1-36

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 April 2024	MAY 21 2024
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300