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(54) **RATCHET ASSEMBLY FOR PROTECTIVE HEADGEAR**

(57) A ratchet assembly for a head protection device is provided. The ratchet assembly comprises a first cover and a ratchet gear. The first cover defines an aperture and has a locking element disposed along the aperture. The ratchet gear comprises a plurality of ratchet gear teeth, and the locking element is engaged with a ratchet gear tooth of the plurality of ratchet gear teeth of the ratchet

gear to restrict rotation of the ratchet gear in a direction. The ratchet assembly also comprises a knob and a second cover. The knob comprises a plurality of knob gears disposed on the interior of the knob, and the second cover has a protrusion. The knob is coupled to the protrusion of the second cover.

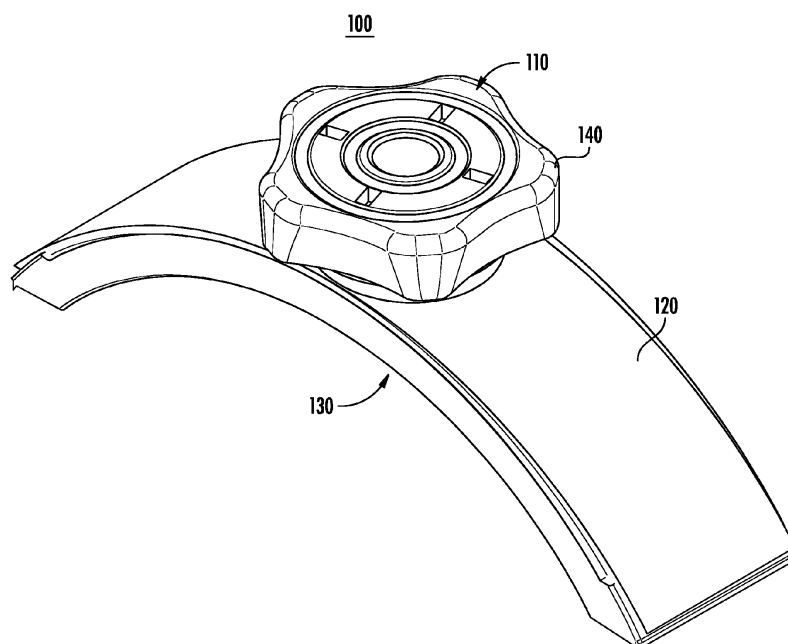


FIG. 1A

Description

TECHNOLOGICAL FIELD

[0001] Example embodiments of the present disclosure relate generally to head protection devices or protective headgears, and more particularly, to a ratchet assembly for head protection devices.

BACKGROUND

[0002] Protective headgears and hard hats are generally worn by users at industrial sites to protect the users from head injuries caused by falling objects or collisions with fixed objects at the sites. The hard hats are provided with a band or strap that is adjustable and is used by the users to wear the hard hat. Such bands are equipped with a buckle or a ratchet mechanism to secure the band around the users' heads. In many situations, due to an impact from a falling object, collision with an object, or use of the band over a prolonged period, the buckle or the ratchet mechanism becomes inefficient and tends to loosen unwantedly.

[0003] The Applicant has identified several technical challenges associated with ratcheting systems used for hard hats. Through applied effort, ingenuity, and innovation, many of these identified challenges have been overcome by developing solutions that are included in embodiments of the present disclosure, many examples of which are described in detail herein.

BRIEF SUMMARY

[0004] The illustrative embodiments of the present disclosure relate to a ratchet assembly for a head protection device. The ratchet assembly includes a first cover and a ratchet gear. The first cover defines an aperture therein and has at least one locking element disposed along the aperture. The at least one locking element is movable from a first position to a second position in a radially outward direction based on an externally applied force. The ratchet gear comprises a plurality of ratchet gear teeth disposed on an outer surface of the ratchet gear. The ratchet gear is disposed within the aperture of the first cover and the at least one locking element of the first cover is engaged with at least one of the plurality of ratchet gear teeth of the ratchet gear. The at least one locking element engages with the at least one of the plurality of ratchet gear teeth, such that the at least one locking element restricts rotation of the ratchet gear in at least one direction and allows rotation of the ratchet gear in another direction. In moving from the first position to the second position, the at least one locking element disengages with the at least one of the plurality of ratchet gear teeth.

[0005] In some embodiments, the ratchet assembly comprises a second cover having a protrusion and the first cover is disposed on the protrusion. The first cover and the second cover in a coupled state define a cavity.

[0006] In some embodiments, the cavity is configured to receive a band comprising a plurality of band teeth.

[0007] In some embodiments, the ratchet gear comprises a plurality of pinion gear teeth. Each of the plurality of pinion gear teeth is engaged with at least one of the plurality of band teeth of the band, such that rotation of the ratchet gear tightens or loosens the band during operation.

[0008] In an example embodiment, the ratchet assembly comprises a knob, wherein the knob comprises a plurality of knob gears disposed on an interior of the knob.

[0009] In some embodiments, the at least one locking element comprises a ratchet lock and an unlocking rib, wherein the ratchet lock comprises a ramped surface and is engaged with the at least one of the plurality of ratchet gear teeth of the ratchet gear. The unlocking rib protrudes outwardly from the first cover.

[0010] In an example embodiment, a ratchet assembly for a head protection device is provided. The ratchet assembly comprises a first cover, a ratchet gear, and a knob. The first cover defines an aperture and comprises at least two locking elements disposed along the aperture. The at least two locking elements are positioned diametrically opposite to each other. Each of the at least two locking elements includes a ratchet lock and an unlocking rib. The ratchet gear comprises a plurality of ratchet gear teeth and the ratchet gear is disposed within the aperture of the first cover. The ratchet lock of each of the at least two locking elements is engaged with at least one of the plurality of ratchet gear teeth of the ratchet gear. The knob is disposed on the ratchet gear. The knob comprises a plurality of knob gears. The unlocking rib of each of the at least two locking elements is engaged with at least one of the plurality of knob gears.

[0011] In an example embodiment, the unlocking rib of each of the at least two locking elements is movable from a first position to a second position in a radially outward direction based on an externally applied force. The externally applied force may be exerted by the at least one of the plurality of knob gears in response to a user rotating the knob in a direction.

[0012] In some embodiments, the ratchet cover further comprises a second cover having a protrusion, and the first cover is disposed on the protrusion of the second cover.

[0013] In an example embodiment, the first cover and the second cover define a cavity to receive a band. In an example embodiment, the band comprises a plurality of band teeth.

[0014] In an example embodiment, the ratchet gear comprises a plurality of pinion gear teeth, and each of the plurality of pinion gear teeth is configured to engage with at least one of the plurality of band teeth of the band.

[0015] In some embodiments, the knob comprises a plurality of engagement protrusions for a user to grip.

[0016] In some embodiments, each of the plurality of ratchet gear teeth comprises a ramped surface, such that a lower portion of the ramped surface of a ratchet gear

tooth abuts a higher portion of the ramped surface of a subsequent ratchet gear tooth.

[0017] In an example embodiment, a head protection device is provided. The head protection device comprises a first cover, a ratchet gear, and a knob. The first cover defines an aperture and has at least one locking element along the aperture. The at least one locking element is movable from a first position to a second position in a radially outward direction based on an externally applied force. The ratchet gear comprises a plurality of ratchet gear teeth disposed on an outer surface of the ratchet gear, wherein the ratchet gear is disposed within the aperture of the first cover. The knob comprises a plurality of knob gears disposed on an interior of the knob. In an example, the knob is disposed on the ratchet gear. The at least one locking element of the first cover is engaged with at least one of the plurality of ratchet gear teeth of the ratchet gear and at least one of the plurality of knob gears of the knob.

[0018] In an example embodiment, the head protection device comprises a second cover having a protrusion, wherein the first cover is disposed on the protrusion.

[0019] In another example embodiment, the at least one locking element comprises a ratchet lock and an unlocking rib. The ratchet lock comprises a ramped surface and is engaged with the at least one of the plurality of ratchet gear teeth of the ratchet gear, and the unlocking rib protrudes outwardly from the first cover.

[0020] In some embodiments, the unlocking rib is engaged with at least one of the plurality of knob gears of the knob.

[0021] In some embodiments, the unlocking rib is engaged with the at least one of the plurality of knob gears such that rotation of the knob in a direction causes the unlocking rib to move to a second position from a first position in a radially outward direction.

[0022] In an example embodiment, each of the plurality of ratchet gear teeth comprises a ramped surface, such that a lower portion of the ramped surface of a ratchet gear tooth abuts a higher portion of the ramped surface of a subsequent ratchet gear tooth.

[0023] In another example embodiment, the knob comprises a plurality of engagement protrusions for a user to grip the knob.

[0024] The above summary is provided merely for purposes of summarizing some example embodiments to provide a basic understanding of some aspects of the disclosure. Accordingly, it will be appreciated that the above-described embodiments are merely examples and should not be construed to narrow the scope or spirit of the disclosure in any way. It will be appreciated that the scope of the disclosure encompasses many potential embodiments in addition to those here summarized, some of which will be further described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The description of the illustrative embodiments

can be read in conjunction with the accompanying figures. It will be appreciated that for simplicity and clarity of illustration, elements illustrated in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to other elements. Embodiments incorporating teachings of the present disclosure are shown and described with respect to the figures presented herein, in which:

FIGS. 1A-1C illustrate various exterior views of a ratchet assembly of a head protection device, in accordance with an example embodiment of the present disclosure;

FIG. 2A is an exploded view of a ratchet assembly for use with a head band, in accordance with an example embodiment of the present disclosure;

FIG. 2B illustrates the placement of a second cover on a head band, in accordance with an example embodiment of the present disclosure;

FIG. 2C is a cut-away side view of a ratchet assembly installed on a head band, in accordance with an example embodiment of the present disclosure;

FIG. 3A illustrates a knob used in a ratchet assembly, in accordance with an example embodiment of the present disclosure;

FIG. 3B illustrates a ratchet gear used in a ratchet assembly, in accordance with an example embodiment of the present disclosure;

FIG. 3C illustrates an engagement between a knob and a ratchet gear of a ratchet assembly, in accordance with an example embodiment of the present disclosure;

FIG. 4A illustrates a first cover of a band housing, in accordance with an example embodiment of the present disclosure;

FIGS. 4B and 4C illustrate the engagement between a ratchet gear and a locking element of a first cover of a ratchet assembly, in accordance with an example embodiment of the present disclosure;

FIG. 5A illustrates a plurality of band teeth of a band, in accordance with an example embodiment of the present disclosure;

FIGS. 5B, 5C, and 5D illustrate the interaction between a pinion gear of a ratchet gear and band teeth of a band, in accordance with an example embodiment of the present disclosure;

FIGS. 6A-6D illustrate various view of a second cover used in a ratchet assembly, in accordance with an example embodiment of the present disclosure; and

FIG. 7 is a flow chart illustrating a method for assembling a band housing, in accordance with an example embodiment of the present disclosure.

DETAILED DESCRIPTION

[0026] Some embodiments of the present disclosure

will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments are shown. Indeed, the disclosure may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. The terms "or" and "optionally" are used herein in both the alternative and conjunctive sense, unless otherwise indicated. The terms "illustrative" and "exemplary" are used to be examples with no indication of quality level. Like numbers refer to like elements throughout.

[0027] The components illustrated in the figures represent components that may or may not be present in various example embodiments described herein such that embodiments may include fewer or more components than those shown in the figures while not departing from the scope of the disclosure.

[0028] Turning now to the drawings, the detailed description set forth below in connection with the appended drawings is intended as a description of various example configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts with like numerals denoting like components throughout the several views. However, it will be apparent to those skilled in the art of the present disclosure that these concepts may be practiced without these specific details.

[0029] In many example industrial working environments, such as mining, tunneling, quarrying, ship building, construction, pharmaceutical environments, heavy engineering industry, power industry, and forestry, risk of head injury to workers is constantly present. In some instances, head injuries are a result of an impact of a falling object or collision with fixed objects at the workplace. Therefore, safety helmets are preferably required to help ensure the safety of workers in dangerous conditions. To this end, some existing safety helmets may not fit the user correctly or consistently, in some examples, but not limited to, during emergency incidents, due to various reasons, including improper placement, unbuckling or loose buckling of a chin strap, a loosened headband and/or the like. Further, even in situations when installed correctly on a user, current safety helmets may involve the use of ratcheting means, which is ineffective. For instance, ratcheting means can loosen during an operation due to a mechanical failure, thereby leading to safety risk. In some examples, such failures may be based on defects, wear and tear, and/or the like.

[0030] Various example embodiments described in the present disclosure relate to a head band and a ratcheting mechanism of the head band to allow for a user to easily tighten the ratcheting mechanism while also resisting loosening of straps of the head band during the operation.

[0031] FIGS. 1A-1C illustrate various exterior views of a ratchet assembly 100 in accordance with an example

embodiment of the present disclosure. As shown, the ratchet assembly 100 may include a knob 110 and a band housing (e.g., a first cover 120 snap-fit to a second cover 130). In various embodiments, the knob 110 may be configured to allow a user to tighten or loosen the ratchet assembly 100. As such, the knob 110 may be shaped such that the user could easily operate the knob 110. In various example embodiments, the knob 110 may have a plurality of engagement protrusions 140 to allow for a user to grip the knob 110. For example, as shown, the knob 110 may have five engagement protrusions 140.

[0032] In various embodiments, the knob 110 is operably coupled with the ratchet gear 170 (shown in FIG. 3A-3C), as discussed in more detail below. In various embodiments, the first cover 120 and the second cover 130 are configured to engage with one another (e.g., via snap-fitting) to form the band housing. In some embodiments, the band housing may define a unitary piece (e.g., the first cover 120 and the second cover 130 may be formed out of a single piece of material). In various embodiments, the band housing (e.g., the first cover 120 and the second cover 130) may define a band cavity therein (e.g., between the first cover 120 and the second cover 130). In various embodiments, the band cavity may be configured to receive a band (e.g., a head band 150), as discussed in more detail (shown in FIG. 2A). For example, two ends of the band 150 may be placed in the band cavity such that the ratchet assembly 100 is configured to loosen and/or tighten the band 150 such that the band 150 may fit snugly with various shaped heads.

[0033] Referring now to FIG. 2A, an exploded view of the ratchet assembly 100 is provided. In some embodiments, the ratchet assembly 100 may be installed on the band 150. As shown in FIG. 2B, the second cover 130 may define a protrusion 210. The protrusion 210 extends outwardly through a plurality of band teeth 220 of the band 150 (e.g., through both band end 150A and head band end 150B). As illustrated in the exploded view of FIG. 2A, as well as the cross-sectional view of FIG. 2C, the first cover 120 may be coupled to the second cover 130, such that the band 150 may be sandwiched therebetween. Said differently, the band 150 may pass through the band cavity defined between the first cover 120 and the second cover 130. Additionally, the ratchet gear 170 may be disposed on the protrusion 210. In various embodiments, the knob 110 may also be disposed on the protrusion 210 and configured to engage with the ratchet gear 170. In various embodiments, the engagement of the knob 110 with the protrusion 210 may secure the knob 110 to the ratchet assembly 100 and cause the ratchet assembly 100 to stay a unitary piece.

[0034] In various embodiments, the ratchet gear 170 may define one or more ratchet gear teeth 320 configured to be received by the band teeth 220 of the band 150. In various embodiments, the band 150 may define two ends 150A, 150B, configured to be received between the band housing (e.g., first cover 120 and second cover 130). As such, as the ratchet gear teeth 320 of the ratchet gear

170 rotates, the two ends 150A, 150B of the head band 150 may be configured to either enlarge or reduce the circumference of the band 150. For example, in an instance in which the ratchet gear 170 rotates clockwise, the amount of overlap between the two ends 150A, 150B may increase. The increase in the overlap causes the band circumference to reduce (e.g., the head band 150 is tightened). In another instance in which the ratchet gear 170 rotates counterclockwise, the overlap of the two ends 150A, 150B of the band 150 may be reduced. Therefore the band circumference may be increased (e.g., the head band 150 is loosened).

[0035] In various embodiments, the first cover 120 may define at least one locking element (e.g., locking elements 410A, 410B) configured to engage with one or more ratchet gear teeth 320 of the first cover 120 of the ratchet gear 170, as discussed with reference to FIG. 4A below. In various embodiments, the rotational movement of the ratchet gear 170 may be restricted in a direction via the engagement of the locking elements 410A, 410B of the first cover 120, and the ratchet gear teeth 320 of the ratchet gear 170. In various embodiments, and as discussed in more detail in reference to FIGS. 3A-3C below, the ratchet gear teeth 320 may be disengaged from the locking elements 410A, 410B of the first cover 120 based on the rotation of the knob 110 due to the interaction between a plurality of knob gears 310 and at least one unlocking rib (e.g., unlocking ribs 440A, 440B) of the locking elements 410A, 410B, as shown in FIGS. 4A-4C.

[0036] FIG. 3A illustrates the knob 110 of the ratchet assembly 100, in accordance with an example embodiment. As shown, the knob 110 includes the plurality of knob gears 310. In various embodiments, each knob gear of the plurality of knob gears 310 may be spaced equally from one another. In some embodiments, the same number of knob gears 310 may be provided as the number of ratchet gear teeth 320 provided on the ratchet gear 170, as shown in FIG. 3B. In various embodiments, the knob 110 may comprise a knob aperture 330 configured to engage with the protrusion 210 of the second cover 130. In various embodiments, the knob 110 may be configured for a user to rotate via engagement protrusions 140, as shown in FIG. 1A. In various embodiments, the number of engagement protrusions 140 provided may be based on the desired gripping characteristics. For example, as shown in FIG. 1A, the knob 110 may have five engagement protrusions 140.

[0037] In various embodiments, the knob 110 is configured with one or more keys 340. For example, in FIG. 3A, the knob 110 is configured with three keys 340A, 340B, and 340C spaced equally from one another. The keys 340 of the knob 110 interact with spacings 350 (shown in FIG. 3B) for coupling the knob 110 to the ratchet gear 170. For example, in an assembled state, the key 340A is disposed within the spacing 350A, the key 340B is within the spacing 350B, and the key 340C is within the spacing 350C. As shown in FIG. 3B, at the center,

the ratchet gear 170 is configured with a ratchet aperture 360. The ratchet aperture 360 allows the receiving of the protrusion 210. The ratchet gear 170 also has a plurality of pinion gear teeth 370. The plurality of pinion gear teeth 370 is aligned along the ratchet aperture 360 and is configured to mate with the plurality of band teeth 220 on the band 150. The plurality of pinion gear teeth 370 is engaged with the plurality of band teeth 220 such that the rotation of the ratchet gear 170 allows movement of the band 150 for tightening or loosening the band 150. Each pinion gear tooth of the plurality of pinion gear teeth 370 is spaced equally from each other.

[0038] FIG. 3C illustrates the engagement between the knob 110 of FIG. 3A and the ratchet gear 170 of FIG. 3B, in accordance with an example embodiment. As shown, the ratchet gear 170 may be disposed under the knob 110. As discussed above, in various embodiments, the knob 110 may have one or more keys 340A-340C that are configured to engage with the ratchet gear 170. In various embodiments, the ratchet gear 170 may be configured to engage with the band housing (e.g., first cover 120 and the second cover 130). In various embodiments, the ratchet gear 170 may be configured with a plurality of ratchet gear teeth 320 and a plurality of pinion gear teeth 370.

[0039] FIG. 4A illustrates the first cover 120 having locking elements 410A, 410B in accordance with an example embodiment. The first cover 120 has an aperture 420 to receive the ratchet gear 170 during assembly of the ratchet assembly 100. The locking elements 410A and 410B are aligned along the aperture 420. In various embodiments, the first cover 120 may have more than two locking elements 410A, 410B. The locking elements 410A and 410B are positioned at diametrically opposite positions along the aperture 420. The locking elements 410A and 410B are configured to engage with at least one of the plurality of ratchet gear teeth 320 of the ratchet gear 170.

[0040] Each locking element 410A and 410B comprises a ratchet lock and an unlocking rib. For example, the locking element 410A comprises ratchet lock 430A and unlocking rib 440A and the locking element 410B comprises ratchet lock 430B and unlocking rib 440B. The ratchet locks 430A and 430B comprise a ramped surface 450 having one lower end and another higher end. The unlocking ribs 440A and 440B protrude outwardly from the first cover 120 and are configured to engage with one of the plurality of knob gears 310 of the knob 110.

[0041] FIGS. 4B-4C illustrate the interaction of the first cover 120 of FIG. 4A and a ratchet gear 170 of the ratchet assembly 100. Each ratchet gear tooth of the plurality of ratchet gear teeth 320 comprises a ramped surface 450 such that the lower portion of the ramped surface 450 of the ratchet gear tooth abuts a higher portion of the ramped surface 450 of the ratchet gear tooth. The ratchet lock 430A, 430B and the ratchet gear tooth are engaged in a manner that the higher portion of the ramped surface 450 of the ratchet lock 430A, 430B engages with the high-

er portion of the ramped surface 450 of a subsequent ratchet gear tooth. In various embodiments, the ratchet gear 170 is configured to rotate in one direction, for example, in a clockwise direction, and is restricted to move in the opposite direction, for example, in a counterclockwise direction when the ratchet locks 430A and 430B are engaged with the ratchet gear teeth 320 of the ratchet gear 170. As shown in FIG. 4B, the higher portion of the ramped surface of the ratchet lock 430A is pushed against the higher portion of the ramped surface of a subsequent ratchet gear tooth to restrict the movement in the counterclockwise direction.

[0042] As discussed above, the restriction of the ratchet gear 170 due to the interaction between the ratchet gear teeth 320 and the ratchet locks 430A and 430B may restrict the movement of the ratchet gear teeth 320 and the plurality of band teeth 220 on the band 150. For example, in an instance in which the ratchet gear 170 is restricted from rotating counterclockwise, the ratchet gear teeth 320 may also be restricted from rotating counterclockwise, such that the band 150 cannot be loosened until tooth protrusion(s) of the ratchet gear teeth 320 are disengaged from the locking elements 410A, 410B (e.g., via a user rotating the knob 110).

[0043] In various embodiments, the ratchet assembly 100 may be configured such that rotation direction of the knob 110 and ratchet gear 170 in which the tooth protrusions of the ratchet gear teeth 320 engage with the locking element 410A, 410B (e.g., the counterclockwise direction) may be the rotational direction for loosening the band 150. In various embodiments, the engagement of the tooth protrusions of the ratchet gear teeth 320 and the locking element 410A, 410B may be configured to be overcome with sufficient rotational force. For example, a user may be able to rotate the knob 110 in the loosening direction (e.g., counterclockwise) with sufficient force to overcome the engagement force between the tooth protrusions of the ratchet gear teeth 320 and the ratchet locks 430A and 430B of the locking elements 410A and 410B, such that the ratchet gear teeth 320 may disengage from the ratchet locks 430A and 430B and rotate to allow the ratchet assembly 100 to loosen the band 150. In various embodiments, the unlocking ribs 440A and 440B interact with the plurality of knob gears 310 such that when the knob 110 is rotated in counterclockwise direction with sufficient force, then the plurality of knob gears 310 exert a force on the unlocking ribs 440A and 440B to bend the unlocking ribs 440A, 440B in a radially outward direction. The bending of the unlocking ribs 440A and 440B in an outward direction disengages the ratchet locks 430A and 430B from the tooth protrusions of the ratchet gear teeth 320.

[0044] In an example embodiment, each locking element 410A and 410B is movable between a first position and a second position. In the first position of the locking element 410A, 410B, the ratchet lock 430A, 430B is engaged with one of the plurality of the ratchet gear teeth 320, such that the ratchet lock 430A, 430B allows rotation

of the ratchet gear 170 in one direction and restricts the rotation in another direction. In an instance, when a user applies a sufficient force to rotate the knob 110 in a counterclockwise direction, the knob gears 310 exert a force on the unlocking rib 440A, 440B in a radially outward direction to move to the second position. In the second position, the ratchet lock 430A, 430B disengages with the at least one ratchet gear tooth of the ratchet gear teeth 320 to allow rotation of the ratchet gear 170 in the counterclockwise direction and loosen the band 150.

[0045] FIG. 5A illustrates the plurality of band teeth 220 on the band 150 in accordance with an example embodiment. As shown in FIG. 5A, the band 150 comprises two bands, 510A and 510B. Each band comprises a plurality of band teeth 220. Each of the band teeth 220 of the bands 510A and 510B is configured to engage with the plurality of pinion gear teeth 370 of the ratchet gear 170 during rotation of the ratchet gear 170 for loosening or tightening of the band 150. The band 150 is inserted within the band housing (e.g., the first cover 120 and the second cover 130). The bands 510A and 510B interact with each other such that when the band 150 is tightened, the overlap between the bands 510A and 510B increases, and when the band 150 is loosened, the extent of overlap between the band 510A and 510B decreases. FIGS. 5B-5D illustrate the interaction of the pinion gear teeth 370 of the ratchet gear 170 and the plurality of band teeth 220 on the band 150, in accordance with an example embodiment. As shown, each pinion gear tooth of the ratchet gear 170 mates with each tooth of the plurality of band teeth 220 when the ratchet gear 170 is rotated in a direction. In various embodiments, when the knob 110 is rotated in the clockwise direction causing the ratchet gear 170 to also rotate in the clockwise direction, the bands 510A and 510B move towards each other, and the overlap increases thereby tightening the band 150. When the ratchet gear 170 is rotated in the counterclockwise direction, the bands 510A and 510B move away from each other in opposite directions to loosen the band 150.

[0046] FIGS. 6A-6D illustrate various views of the second cover 130 used in the ratchet assembly 100 in accordance with an example embodiment. In various embodiments, the second cover 130 may be configured with a curved shape, such as to engage a user's head more effectively and/or comfortably. In various embodiments, the second cover 130 may include a plurality of snap-fits 600 configured to operably couple the first cover 120 with the second cover 130. Additionally, in some embodiments, the second cover 130 may include a plurality of gripping protrusions 610 extending towards the first cover 120 and configured to engage with the band 150 during operation (e.g., to assist in restricting any accidental movement of the bands during operation). In various embodiments, the second cover 130 may include the protrusion 210 configured to extend through the ratchet aperture 360, receive the ratchet gear 170, also secure the knob 110. In various embodiments, the knob 110 may

be configured to snap-fit to the knob engagement protrusion 210, such that the non-rotational movement of the knob 110 is limited. In various embodiments, the band 150 may be configured to receive the protrusion 210, such that the band is held in the band cavity in part due to the protrusion 210. In various embodiments, the second cover 130 may define a surface (FIG. 6C) to engage with a user's head during operation.

[0047] FIG. 7 is a flow chart illustrating the method 700 for assembling the band housing in accordance with an example embodiment of the present disclosure. Referring now to Block 710 of FIG. 7, the method 700 of assembling the band housing may include providing a first cover. The first cover 120 comprises an aperture 420 and at least one locking element 410A, 410B. The at least one locking element 410A, 410B is configured to engage with at least one of a plurality of ratchet gear teeth 320 of a ratchet gear 170 to restrict rotation of the ratchet gear 170 in at least one direction and allow rotation of the ratchet gear 170 in another direction. In an example, the at least one locking element 410A, 410B is configured to move from a first position to a second position to disengage the at least one locking element 410A, 410B with the at least one of the plurality of ratchet gear teeth 320.

[0048] Referring now to Block 720 of FIG. 7, the method includes coupling a second cover to the first cover. For example, the second cover 130 may be coupled to the first cover 120. The second cover 130 has a protrusion 210, wherein the first cover 120 is disposed on the protrusion 210. In an example embodiment, the first cover 120 and the second cover 130 define a cavity to receive a band. The band comprises a plurality of band teeth 220 configured to engage with a plurality of pinion gear teeth 370 of the ratchet gear 170.

[0049] During operation, the knob 110 and the keys 340 of the knob 110 rotate in the clockwise direction causing the ratchet gear 170 to rotate in the clockwise direction. The pinion gear teeth 370 of the ratchet gear 170 cause the band 150 to tighten, at which point, the ratchet gear teeth 320 may engage with the locking element 410A, 410B, such that no unintended counterclockwise rotation may occur with a sufficient force, such that the band 150 is not loosened accidentally during operation. As such, in an instance in which the knob 110 is rotated in the counterclockwise direction with sufficient force, the knob gears 310 cause the unlocking ribs 440A, 440B to bend outwards in a radially outward direction and the ratchet gear teeth 320 disengages with the ratchet lock 430A, 430B to allow the band 150 to loosen. For example, in an instance a user intends to loosen the band 150, the user may turn the knob 110 in the counterclockwise direction until the knob gears 310 engage with the unlocking ribs 440A, 440B and exert the unlocking ribs 440A, 440B to move to the second position, such that the ratchet gear 170 rotates in the counterclockwise direction and the band 150 is loosened.

[0050] It must be noted that, as used in this specification and the appended claims, the singular forms "a,"

"an," and "the" include plural referents unless the content clearly dictates otherwise.

[0051] References within the specification to "one embodiment," "an embodiment," "embodiments," or "one or more embodiments" are intended to indicate that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present disclosure. The appearance of such phrases in various places within the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, various features are described which may be exhibited by some embodiments and not by others. Similarly, various requirements are described, which may be requirements for some embodiments, but not other embodiments.

[0052] It should be noted that, when employed in the present disclosure, the terms "comprises," "comprising," and other derivatives from the root term "comprise" are intended to be openended terms that specify the presence of any stated features, elements, integers, steps, or components, and are not intended to preclude the presence or addition of one or more other features, elements, integers, steps, components, or groups thereof.

[0053] As required, detailed embodiments of the present disclosure are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary, which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present disclosure in virtually any appropriately detailed structure.

[0054] While it is apparent that the illustrative embodiments herein disclosed fulfill the objectives stated above, it will be appreciated that numerous modifications and other embodiments may be devised by one of ordinary skill in the art. Accordingly, it will be understood that the appended claims are intended to cover all such modifications and embodiments, which come within the spirit and scope of the present disclosure. The following statements may be useful for understanding the invention:

S1. A ratchet assembly for a head protection device, the ratchet assembly comprising:

a first cover defining an aperture, wherein the first cover comprises at least one locking element disposed along the aperture; and
a ratchet gear comprising a plurality of ratchet gear teeth disposed on an outer surface of the ratchet gear,
wherein the ratchet gear is disposed within the aperture of the first cover.

S2. The ratchet assembly of statement S1, wherein the at least one locking element is movable from a

first position to a second position in a radially outward direction based on an externally applied force and wherein the at least one locking element of the first cover is engaged with at least one of the plurality of ratchet gear teeth of the ratchet gear.

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S3. The ratchet assembly of statement S2 further comprising a second cover having a protrusion, wherein the first cover is disposed on the protrusion, and wherein the first cover and the second cover define a cavity.

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S4. The ratchet assembly of statement S3, wherein the cavity is configured to receive a band, and wherein the band comprises a plurality of band teeth.

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S5. The ratchet assembly of statement S4, wherein the ratchet gear comprises a plurality of pinion gear teeth, wherein each of the plurality of pinion gear teeth is engaged with at least one of the plurality of band teeth of the band, such that rotation of the ratchet gear tightens or loosens the band during operation.

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S6. The ratchet assembly of any one of statements S2 - S5 further comprising a knob, wherein the knob comprises a plurality of knob gears disposed on an interior of the knob.

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S7. The ratchet assembly of statement S6 wherein the knob is disposed on the ratchet gear.

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S8. The ratchet assembly of any one of statements S2 - S7, wherein the at least one locking element comprises a ratchet lock and an unlocking rib, wherein the ratchet lock comprises a ramped surface and is engaged with the at least one of the plurality of ratchet gear teeth of the ratchet gear, and the unlocking rib protrudes outwardly from the first cover.

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S9. The ratchet assembly of statement S8 wherein the at least one locking element of the first cover is engaged with at least one of the plurality of knob gears of the knob.

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S10. The ratchet assembly of statement S1, wherein the first cover comprises at least two locking elements disposed along the aperture, wherein the at least two locking elements are positioned diametrically opposite to each other, and each of the at least two locking elements comprises a ratchet lock and an unlocking rib and wherein the ratchet gear is disposed within the aperture of the first cover and the ratchet lock of each of the at least two locking elements is engaged with at least one of the plurality of ratchet gear teeth of the ratchet gear.

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S11. The ratchet assembly of statement S10 further

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comprising a knob, disposed on the ratchet gear, the knob comprising a plurality of knob gears, wherein the unlocking rib of each of the at least two locking elements is engaged with at least one of the plurality of knob gears.

S12. The ratchet assembly of statement S11, wherein the unlocking rib of each of the at least two locking elements is movable from a first position to a second position in a radially outward direction based on an externally applied force by the at least one of the plurality of knob gears in response to a user rotating the knob in a direction.

S13. The ratchet assembly of any one of statements S11-S12 further comprising a second cover, the second cover having a protrusion, wherein the first cover is disposed on the protrusion of the second cover and wherein the first cover and the second cover define a cavity configured to receive a band, wherein the band comprises a plurality of band teeth.

S14. The ratchet assembly of statement S13, wherein the ratchet gear comprises a plurality of pinion gear teeth, wherein each of the plurality of pinion gear teeth is configured to engage with at least one of the plurality of band teeth of the band and wherein each of the plurality of ratchet gear teeth comprises a ramped surface, such that a lower portion of the ramped surface of a ratchet gear tooth abuts a higher portion of the ramped surface of a subsequent ratchet gear tooth.

S15. The ratchet assembly of any one of statements S11 - S14, wherein the knob comprises a plurality of engagement protrusions for a user to grip.

Claims

1. A ratchet assembly (100) for a head protection device, wherein the ratchet assembly (100) comprises: a first cover (120) defining an aperture (420), and a ratchet gear (170), wherein the ratchet gear (170) is disposed within the aperture (420) of the first cover (120), **characterized in that** the first cover (120) comprises

at least one locking element (410A) disposed along the aperture (420); and
the ratchet gear comprises
a plurality of ratchet gear teeth (320) disposed on an outer surface of the ratchet gear (170),

wherein the at least one locking element (410A) is movable from a first position to a second position in a radially outward direction based on an externally applied force,

- and
 wherein the at least one locking element (410A) of the first cover (120) is engaged with at least one of the plurality of ratchet gear teeth (320) of the ratchet gear (170) to allow a movement of the ratchet gear (170) in one direction and restrict the movement in other direction.
2. The ratchet assembly (100) of claim 1, further comprising a second cover (130) having a protrusion, wherein the first cover (120) is disposed on the protrusion, and wherein the first cover (120) and the second cover (130) define a cavity.
 3. The ratchet assembly (100) of claim 2, wherein the cavity is configured to receive a band (150), and wherein the band (150) comprises a plurality of band teeth (220).
 4. The ratchet assembly (100) of claim 3, wherein the ratchet gear (170) comprises a plurality of pinion gear teeth (370), wherein each of the plurality of pinion gear teeth (370) is engaged with at least one of the plurality of band teeth (220) of the band (150), such that rotation of the ratchet gear (170) tightens or loosens the band (150) during operation.
 5. The ratchet assembly (100) of any one of claims 1-4 further comprising a knob (110), wherein the knob (110) comprises a plurality of knob gears (310) disposed on an interior of the knob (110).
 6. The ratchet assembly of claim 6 wherein the knob is disposed on the ratchet gear.
 7. The ratchet assembly (100) of any one of claims 1-6, wherein the at least one locking element (410A) comprises a ratchet lock (430A) and an unlocking rib (440B), wherein the ratchet lock (430A) comprises a ramped surface and is engaged with the at least one of the plurality of ratchet gear teeth (320) of the ratchet gear (170), and the unlocking rib (440B) protrudes outwardly from the first cover (120).
 8. The ratchet assembly (100) of claim 7 wherein the at least one locking element (410A) of the first cover (120) is engaged with at least one of the plurality of knob gears (310) of the knob (110).
 9. The ratchet assembly (100) of claim 1, wherein the first cover (120) comprises at least two locking elements (410A,410B) disposed along the aperture (420), wherein the at least two locking elements (410A,410B) are positioned diametrically opposite to each other, and each of the at least two locking elements (410A,410B) comprises a ratchet lock (430A) and an unlocking rib (440B) and wherein the ratchet gear (170) is disposed within the aperture (420) of the first cover (120) and the ratchet lock (430A) of each of the at least two locking elements (410A,410B) is engaged with at least one of the plurality of ratchet gear teeth (320) of the ratchet gear (170).
 10. The ratchet assembly (100) of claim 9 further comprising a knob (110), disposed on the ratchet gear (170), the knob (110) comprising a plurality of knob gears (310), wherein the unlocking rib (440B) of each of the at least two locking elements (410A,410B) is engaged with at least one of the plurality of knob gears (310).
 11. The ratchet assembly (100) of claim 10, wherein the unlocking rib (440B) of each of the at least two locking elements (410A,410B) is movable from a first position to a second position in a radially outward direction based on an externally applied force by the at least one of the plurality of knob gears (310) in response to a user rotating the knob (110) in a direction.
 12. The ratchet assembly (100) of any one of claims 10-11 further comprising a second cover (130), the second cover (130) having a protrusion, wherein the first cover (120) is disposed on the protrusion of the second cover (130) and wherein the first cover (120) and the second cover (130) define a cavity configured to receive a band (150), wherein the band (150) comprises a plurality of band teeth (220).
 13. The ratchet assembly (100) of claim 12, wherein the ratchet gear (170) comprises a plurality of pinion gear teeth (370), wherein each of the plurality of pinion gear teeth (370) is configured to engage with at least one of the plurality of band teeth (220) of the band (150) and wherein each of the plurality of ratchet gear teeth (320) comprises a ramped surface, such that a lower portion of the ramped surface of a ratchet gear tooth abuts a higher portion of the ramped surface of a subsequent ratchet gear tooth.
 14. The ratchet assembly (100) of any one of claims 10-13, wherein the knob (110) comprises a plurality of engagement protrusions for a user to grip.

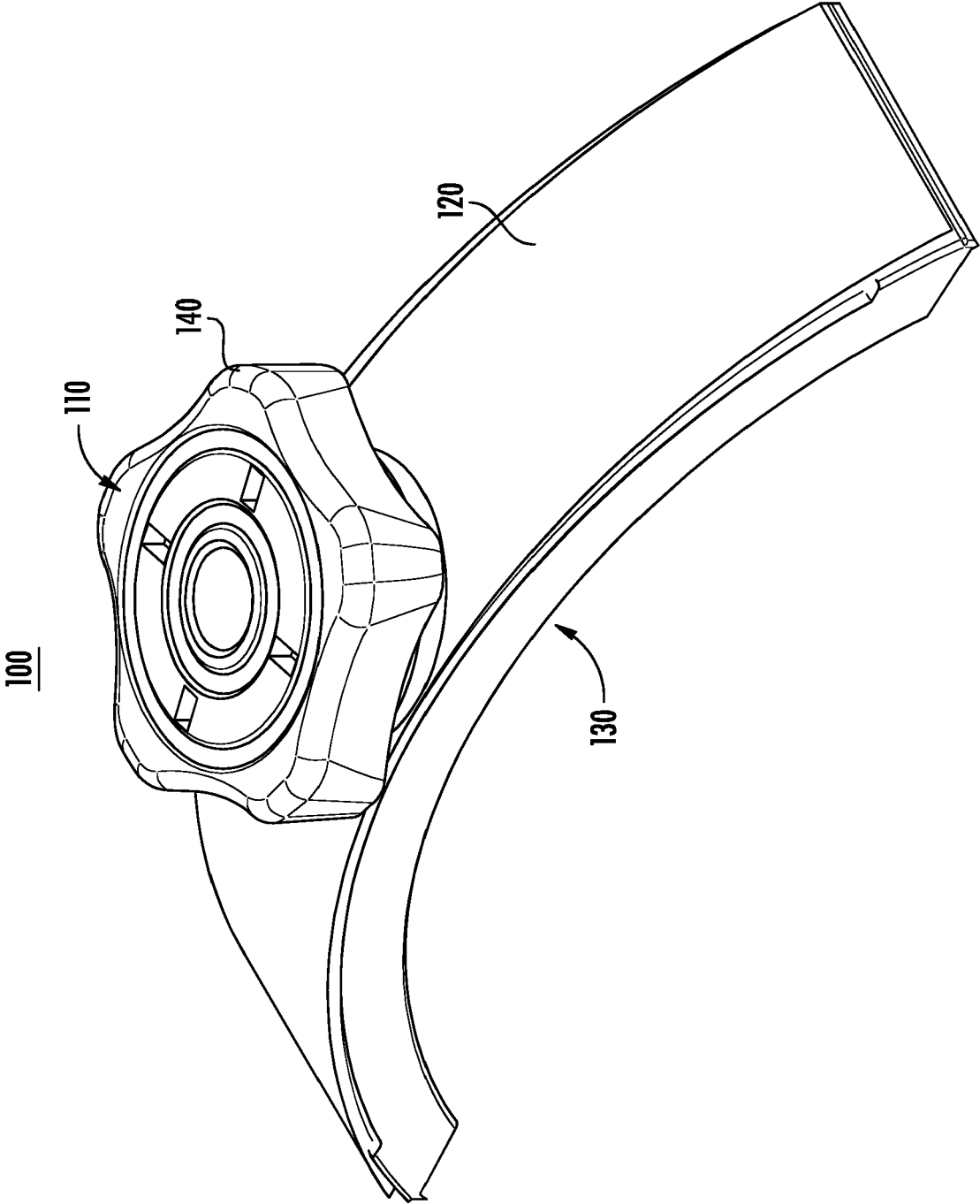


FIG. 1A

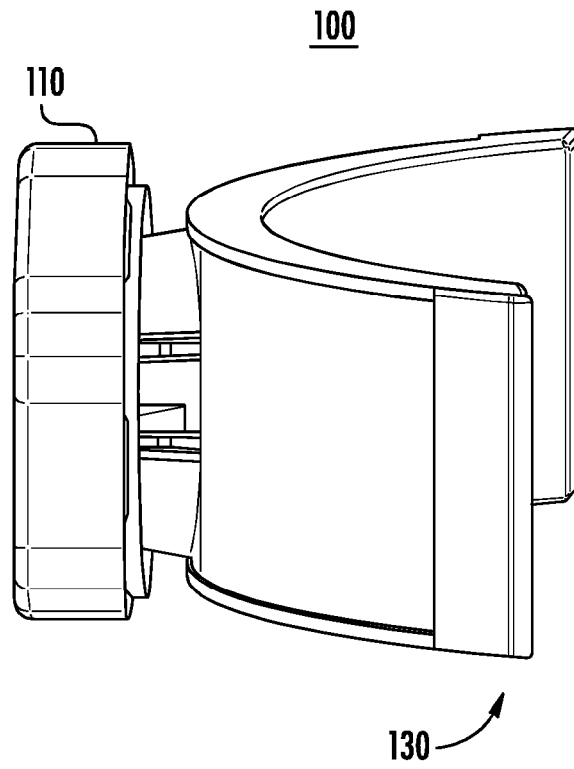


FIG. 1B

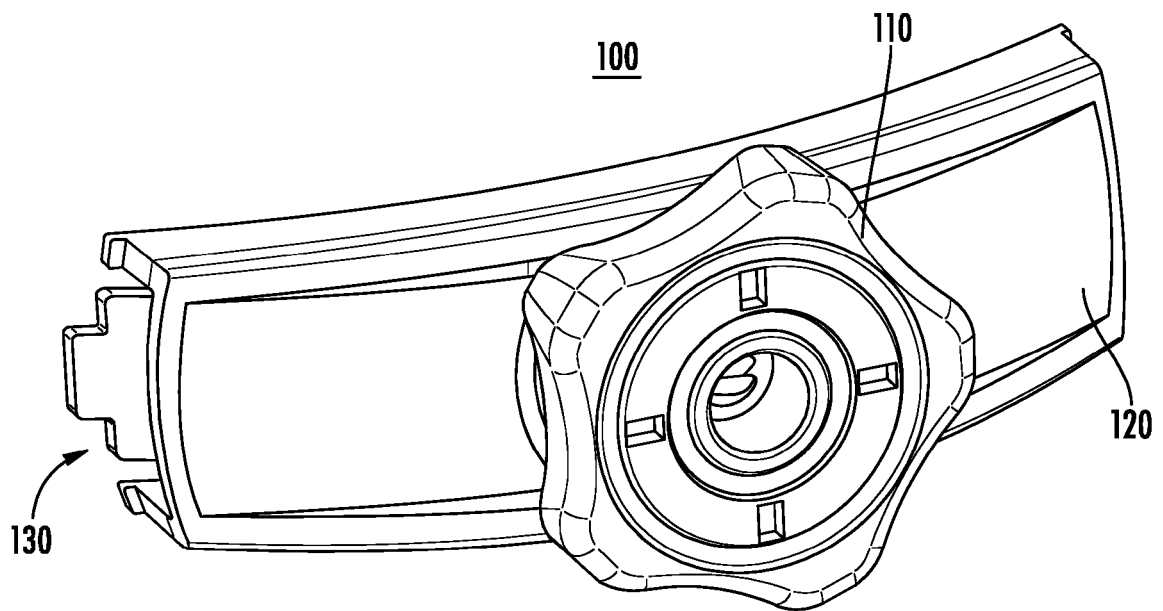


FIG. 1C

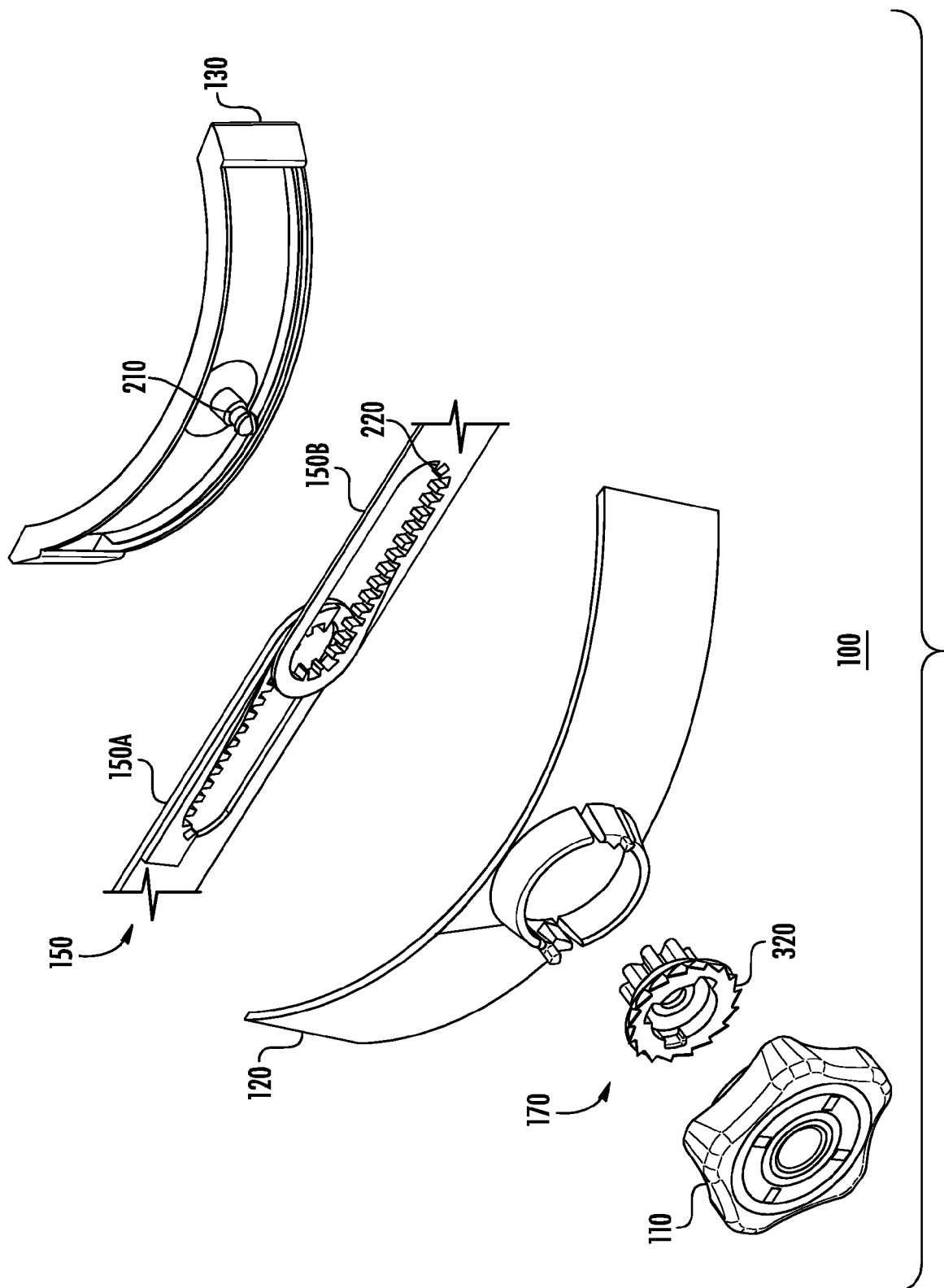


FIG. 2A

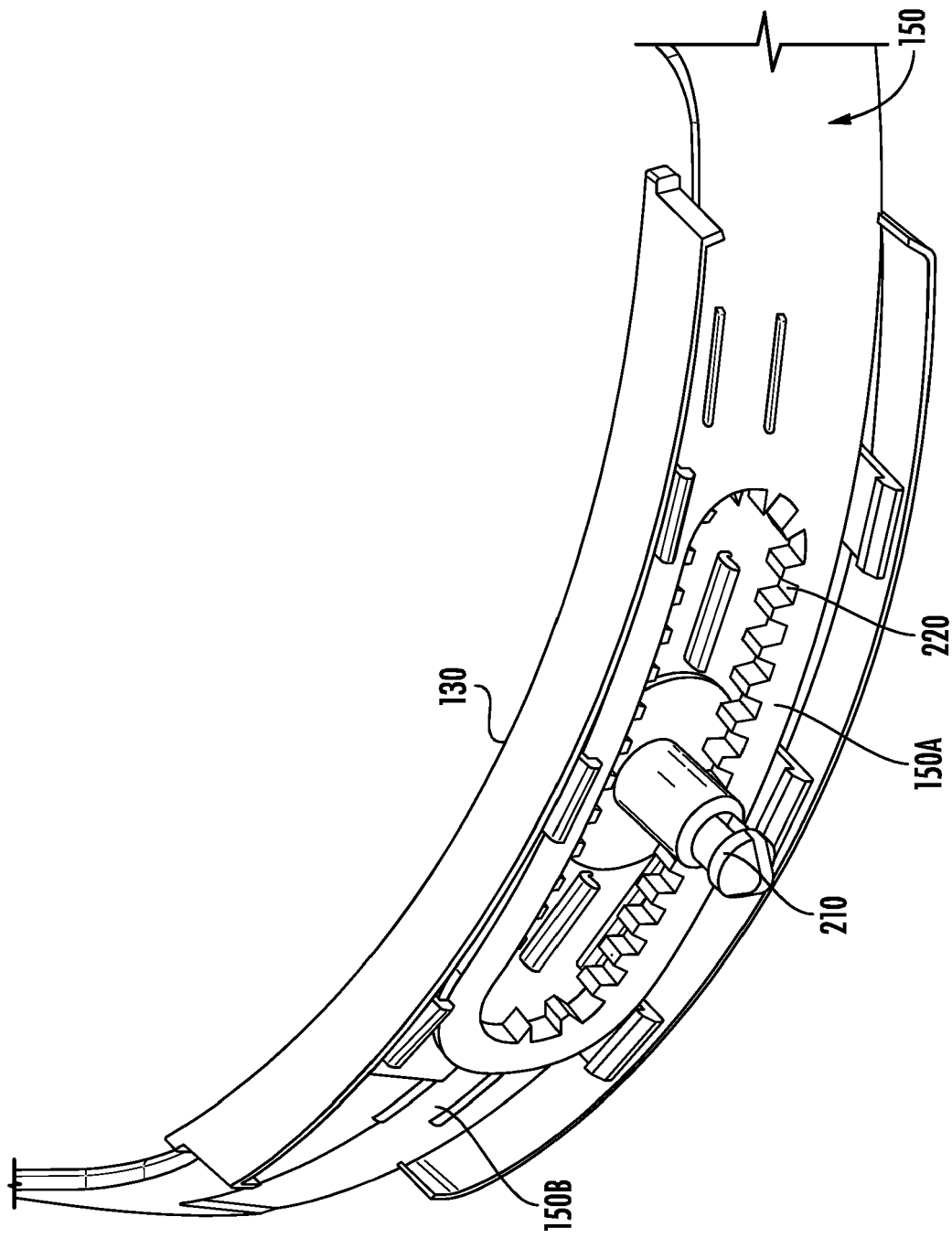


FIG. 2B

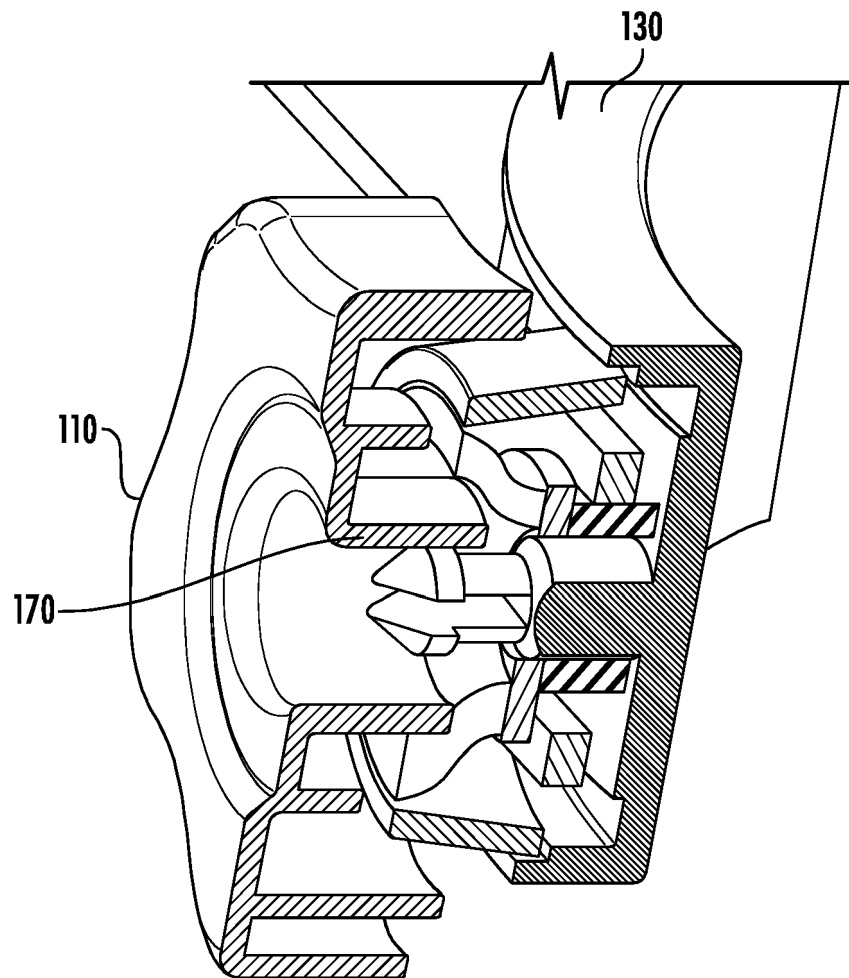


FIG. 2C

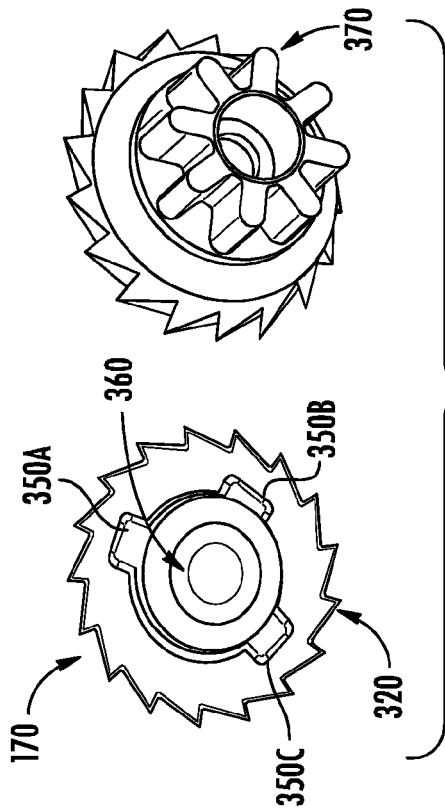


FIG. 3B

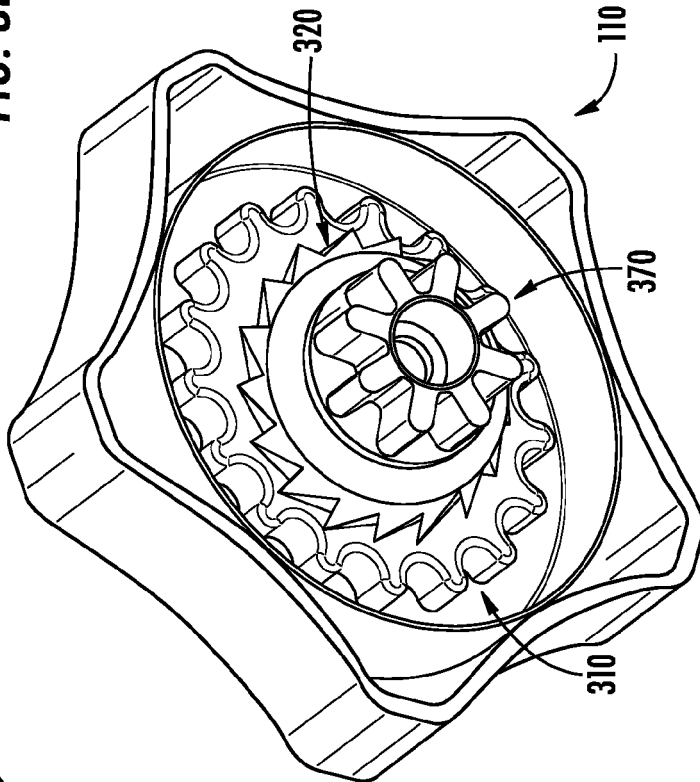


FIG. 3C

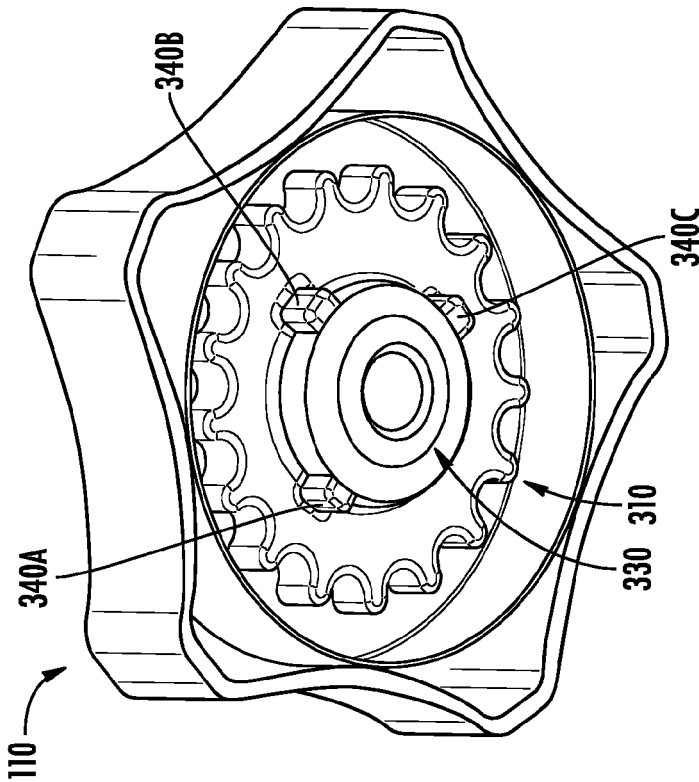


FIG. 3A

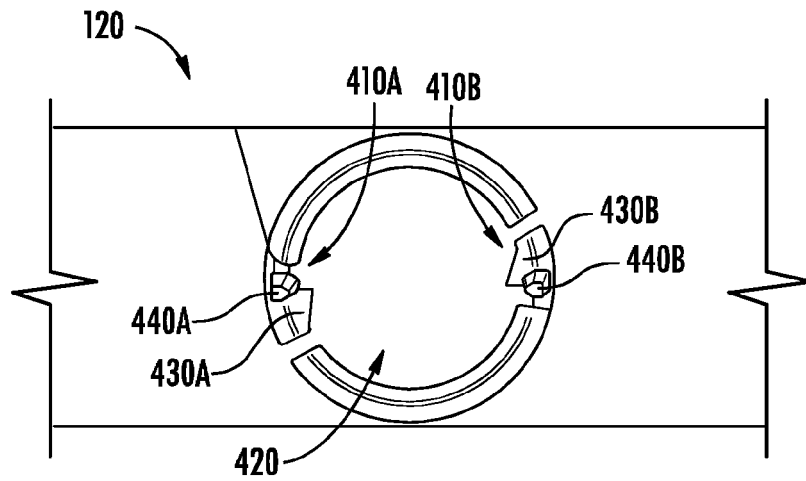


FIG. 4A

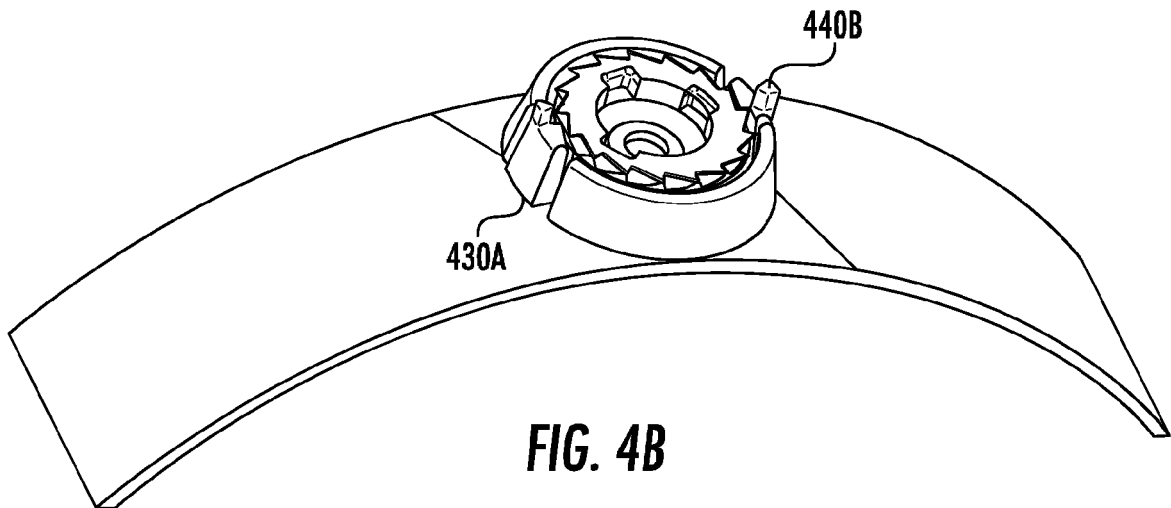


FIG. 4B

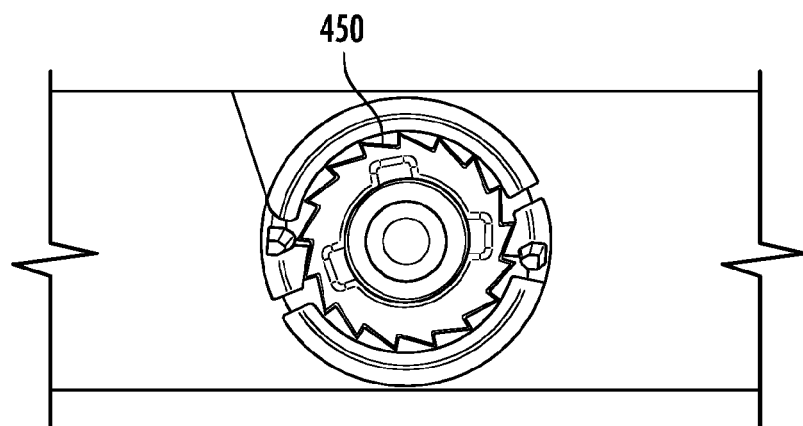
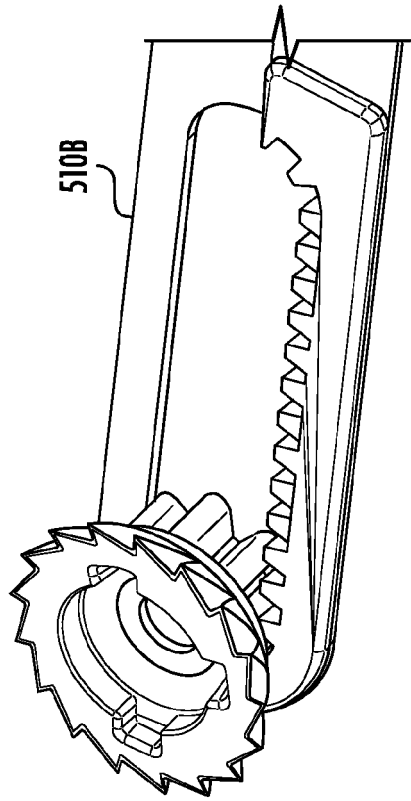
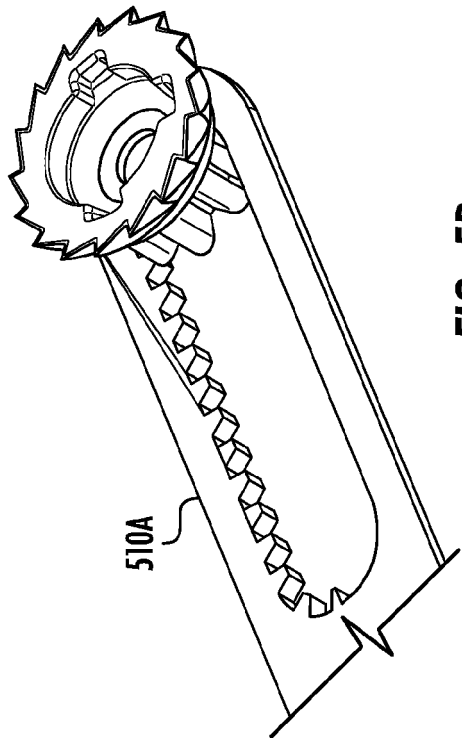
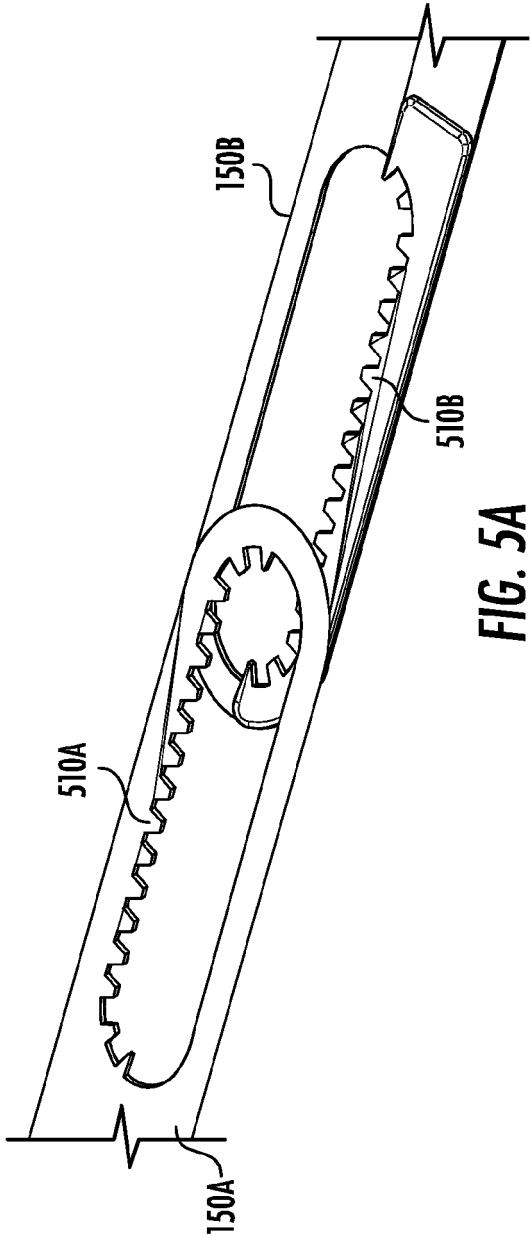


FIG. 4C



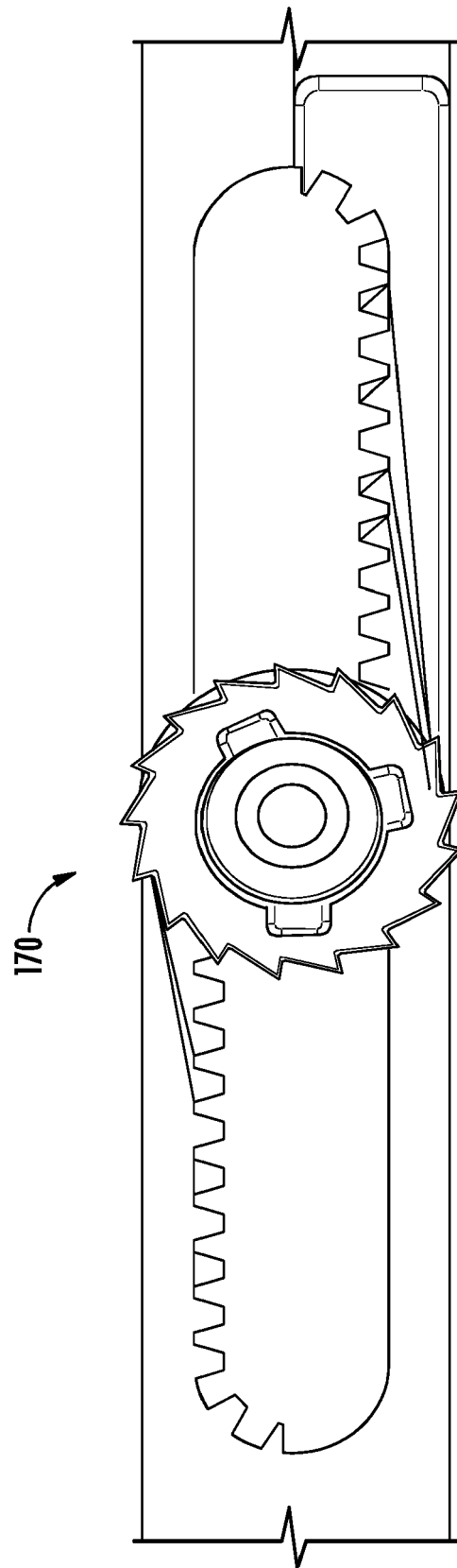


FIG. 5D

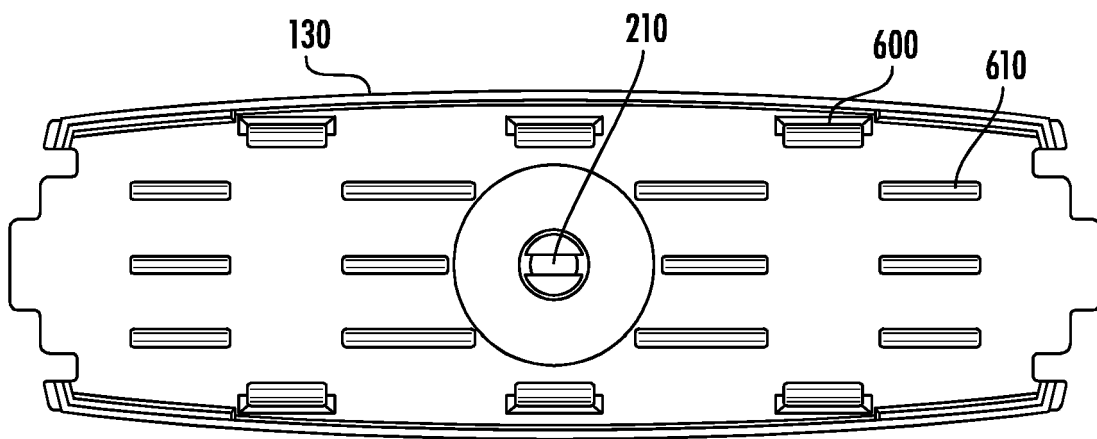


FIG. 6A

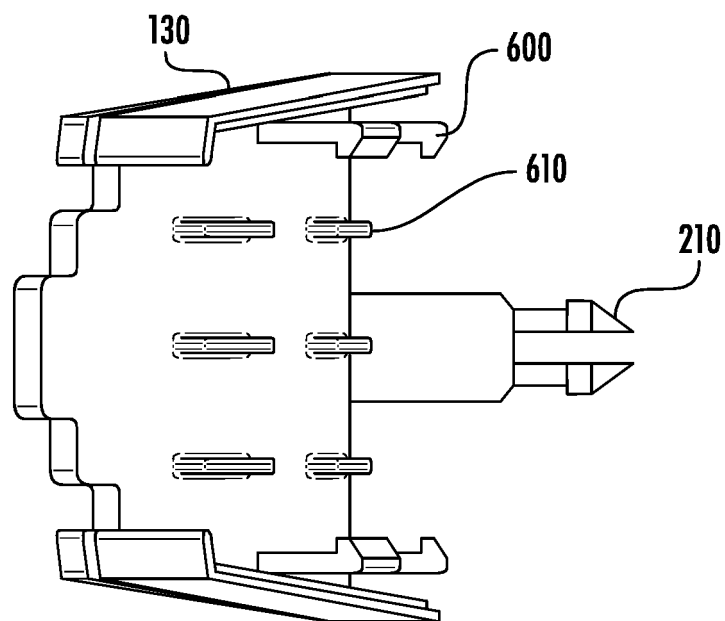


FIG. 6B

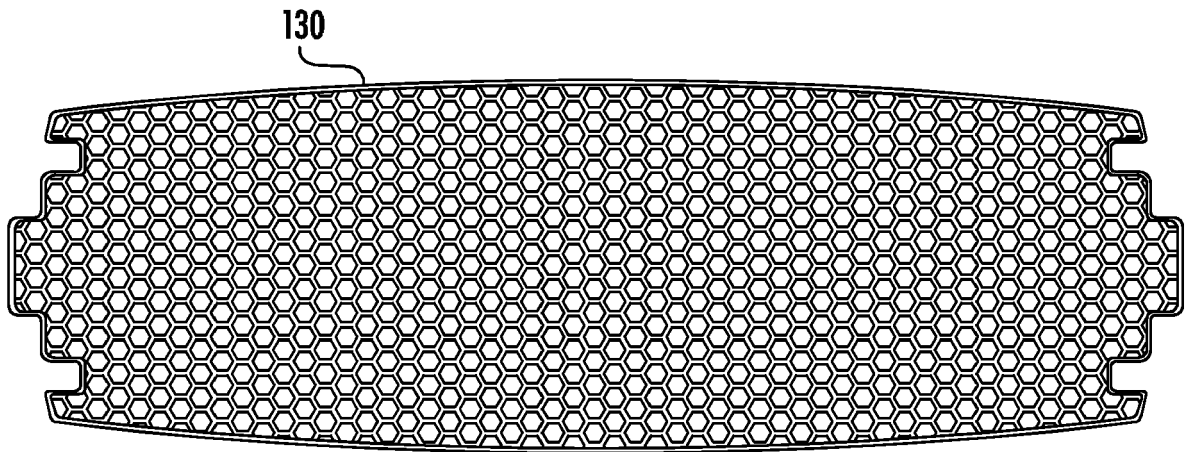


FIG. 6C

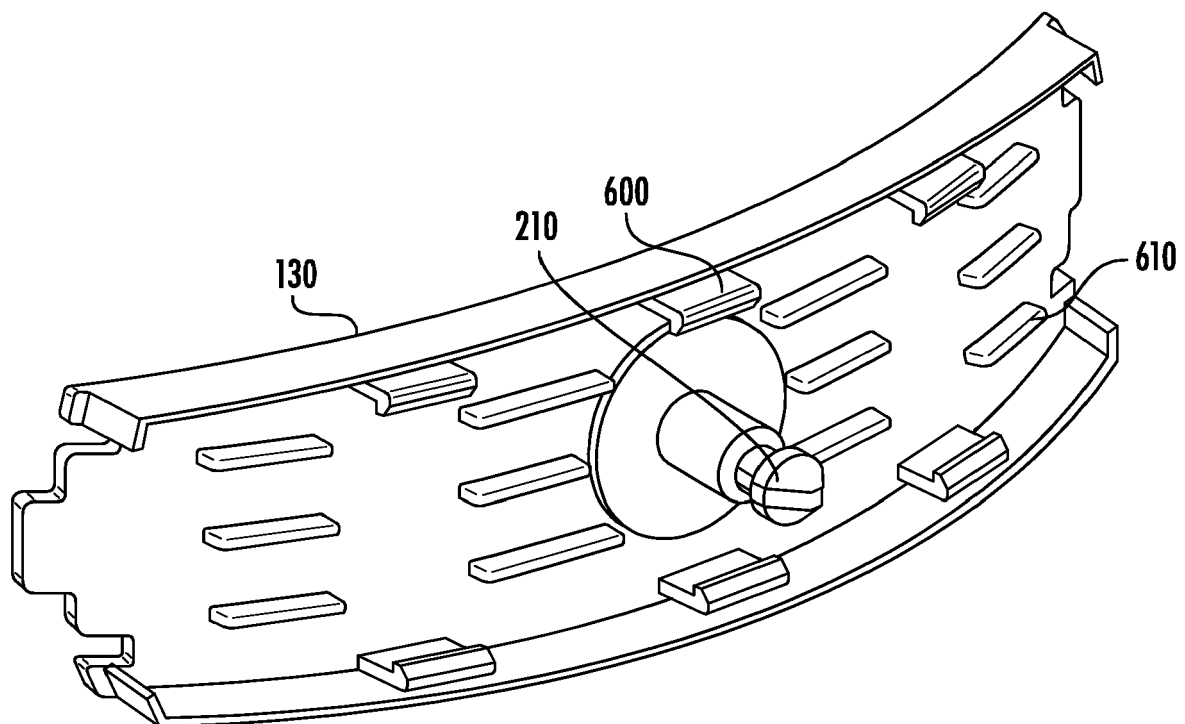


FIG. 6D

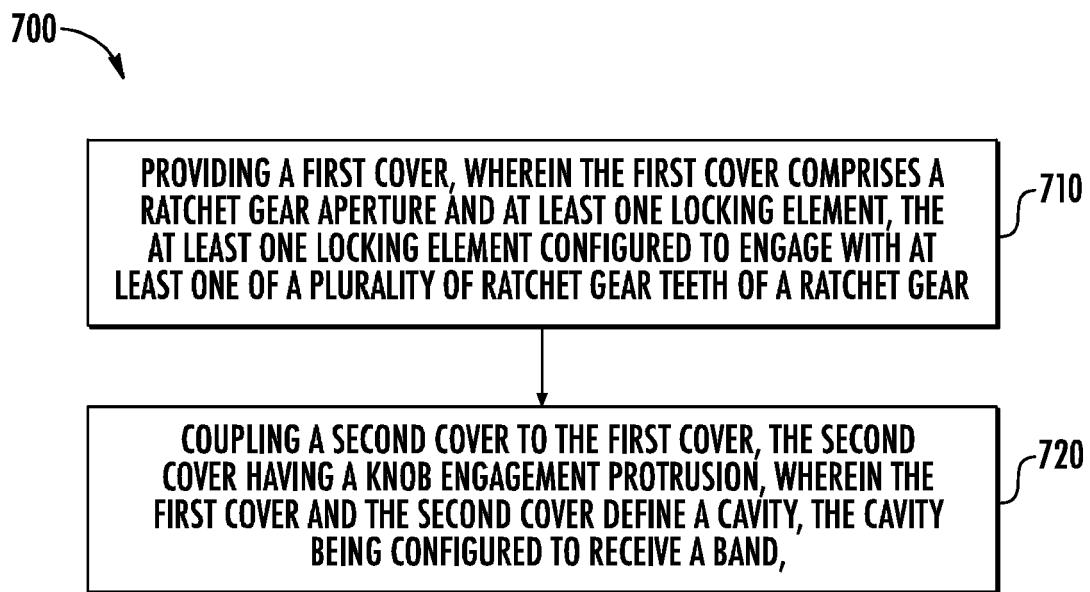


FIG. 7