



(51) International Patent Classification:

G02B 27/01 (2006.01)

(21) International Application Number:

PCT/US2019/028477

(22) International Filing Date:

22 April 2019 (22.04.2019)

(25) Filing Language:

English

(26) Publication Language:

English

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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to the identity of the inventor (Rule 4.17(i))

Published:

— with international search report (Art. 21(3))

(54) Title: ARM MECHANISMS ROTATABLY COUPLED TO HUBS

(57) Abstract: An example hinge system may include a hub, an arm mechanism rotatably coupled to the hub, and a plurality of detents coupled to the hub. The arm mechanism may include a first arm and a second arm slideably coupled to the first arm. The first arm is rotatable when the second arm is in a first position and the first arm is rotatably retrainable when the second arm is in a second position. An example head-mounted display (HMD) is also described. The HMD includes a head strap and a viewer. The viewer is slidable from a retracted position to a protracted position, rotatable with respect to the strap when the viewer is in the protracted position, and lockable at an angular orientation with respect to the strap when the viewer is in the retracted position.



WO 2020/219005 A1

ARM MECHANISMS ROTATABLY COUPLED TO HUBS

BACKGROUND

[0001] Electronic devices designed as a form factor to be worn are increasingly common. Wearable electronic devices are used in many industries including fitness and virtual reality (VR). Such devices are capable of enhancing an experience with electronic information and/or sensory-excitation during activity while worn.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0002]** Figure 1 is a block diagram depicting an example hinge system.
- [0003]** Figure 2 is a block diagram depicting an example wearable device.
- [0004]** Figure 3 is a block diagram depicting an example head-mountable display (HMD) system.
- [0005]** Figure 4 is an isometric view of an example HMD system.
- [0006]** Figures 5-7 are side views of an example HMD system in various states.
- [0007]** Figure 8 is an exploded view of example components of an example hinge system.
- [0008]** Figures 9-12 are side views of example components of an example hinge system of an example HMD system in various states.
- [0009]** Figures 13-16 depict components of an example hinge system of an example HMD system including example adjustment mechanisms.

DETAILED DESCRIPTION

[0010] In the following description and figures, some example implementations of hinge systems, wearable devices, and head-mountable display (HMD) systems are described. Electronic devices may include circuitry, a combination of circuitry and executable instructions, a housing to contain the

circuitry, and other functional physical parts to accomplish function. Wearable devices may include such components, including components to allow the device to be worn. For example, the wearable devices may include components that provide adjustability or otherwise adaptable to different body size, body shapes, and/or user preferences.

[0011] Various examples described below relate to rotatability of arm mechanisms via a hinge system. In general, the arm mechanism is rotatable when the arm is moved into a protracted orientation and is restrained from rotational movement when in a retracted orientation. In this manner, the HMD system may have lockable positions of the viewer based on the lockable angular orientations of the arm mechanism coupled to the viewer, for example. One such lockable position of the HMD system may be substantially above the eyeline to allow the viewer of the HMD to be sustained in a standby orientation when not in use.

[0012] Figure 1 is a block diagram depicting an example hinge system 102. Referring to Figure 1, the hinge system 102 generally includes a hub 104, a pivot 106, an arm mechanism 110, and a plurality of detents 122 and 124. In general, the arm mechanism 110 is coupled to the hub 104 and rotatable around the pivot 106 when a structure of the arm mechanism (e.g., second arm 114 of Figure 1) is in an unlock position (e.g., protracted away from the hub 104) and restrained in an orientation based on the plurality of detents (e.g., 122 and 124 of Figure 1) when in the structure of the arm mechanism 10 is in a lock position (e.g., retracted towards the hub 104). In this manner, the hinge system 102 utilizes a slide-and-rotation to move the arm mechanism 110 and slides back into a lock position to be restrained at an angular orientation with respect to the pivot 106.

[0013] The hub 104 of Figure 1 is coupled to the pivot 106 and the arm mechanism 110 is rotatably coupled to the hub 104. The pivot 106 may be a pin or other circular structure and may be located at the center of the hub 110 or located off-center with respect to the shape of the hub 110. In some example, the arm mechanism 110 may rotate around a pivot 106 that is physically separate from the location of the hub, such that the hub 104 and pivot 106 are spaced apart. The rotation about the pivot 106 may be centric or eccentric with respect to the center of the hub 104.

[0014] The arm mechanism 110 of Figure 1 includes a first arm 112 and a second arm 114. In an example, the first arm 112 of the arm mechanism 110 is

rotatably coupled to the pivot 106 and the second arm 114 is slideably coupled to the first arm 112, such that the second arm 114 is positionable in a first position with respect to the first arm 112 and a second position with respect to the first arm 112. For example, the first arm 112 may include a guide wall to interface with a guide post of the second arm 114 to allow for translational movement of the second arm 114 as guided by the guide post along the guide channel. In some examples, the arm mechanism 110 may include a bias member, such as a bias member that applies a bias force on the second arm 114 towards the pivot 106 and/or the first arm 112. Example bias members include a spring, a piston, a pump, a gear, a motor, and the like, as well as a combination thereof.

[0015] The plurality of detents 122 and 124 are coupled to the hub 104. The plurality of detents 122 and 124 correspond to sustainable orientations of the arm mechanism 110 with respect to rotation about the pivot 106. A detent, as used herein, may be any appropriate protrusion or aperture compatible with interfacing with a component of the hinge system 102. The plurality of detents represents sustainable orientations of the arm mechanism 110. For example, one detent may represent an orientation of the arm mechanism 110 sustainable in a view orientation towards the eyes of a user while a second detent may represent a standby orientation towards the forehead of the user.

[0016] The first arm 112 is rotatable based on the plurality of detents. For example, the first arm 112 may be rotatable when the second arm is in a first position (e.g., an unlock position extended away from the pivot 106) and the first arm 112 may be rotatably restrainable when the second arm is in a lock position. The first arm 112 is rotatable among the orientations corresponding to the plurality of detents when the second arm is in the first position and the first arm 112 may be rotatably lockable at a particular orientation corresponding to a particular detent of the plurality of detents when the second arm is in a second position (e.g., a lock position protracted towards the pivot 106). In this manner, the arm mechanism 110 may be rotatable when pulled away from the plurality of detents and restrained when interfaced with (e.g., inserted into) one of the plurality of detents. As used herein, the various forms of restrain may include to fasten, to lock, to secure, to constrain, to confine, to bind, to guide, to usher, to mechanically connect, to sustain, or to otherwise maintain in a state hindered from relative rotational movement of a substantial degree.

[0017] In some examples, the hinge system 102 may include other supportive structures. For example, a guide wall may be coupled to the hub 104 to act as a stop, such that the guide wall may hinder rotation of the arm mechanism 110 past about the range of the plurality of detents. For example, the first arm 112 may be rotatable among the orientations corresponding to the plurality of detents (e.g., 122, 124) when the second arm 114 is in the first position, however, the guide wall may still hinder rotation past a particular angle.

[0018] Figure 2 is a block diagram depicting an example wearable device 201. Referring to Figure 2, the wearable device 201 generally includes a strap 230, a hub 204, an extendable arm 210, and a plurality of detents (e.g., 222 and 224). The strap 230 may be made of plastic, metal, textile, or some combination thereof that may be flexible to allow the wearable device 201 to attach to a body member of a user, such as a head or a wrist.

[0019] The arm mechanism 210 is extendable between various lengths. The extendable arm mechanism 210 is coupled to the strap at a hub to allow for rotation when the arm mechanism 210 is extended and to hinder rotation when the arm mechanism 210 is contracted.

[0020] The rotatability of the arm mechanism 210 may depend on the arm mechanism's position with respect to the plurality of detents coupled to the hub 204. For example, the plurality of detents may correspond to sustainable rotational orientations of the extendable arm mechanism 210 where the arm mechanism 210 may be locked into an angular orientation when interfaced with one of the plurality of detents and may be unlocked for rotation when not interfaced with one of the plurality of detents, such as the extendable arm mechanism 210 being rotatable among the plurality of detents when the arm mechanism is in a protracted orientation.

[0021] The plurality of detents (e.g., 222 and 224) may be formed of physical structures on the hub to complement a structure of the arm mechanism 210. For example, the plurality of detents may include a guide wall (e.g., guide walls 226 and 228) to confine the extendable arm mechanism from rotation when the extendable arm mechanism 210 is in a retracted position. In this manner, the extendable arm mechanism 210 may couple to the first detent 222 or the second detent 224.

[0022] Figure 3 is a block diagram depicting an example head-mounted display (HMD) system 300. Referring to Figure 3, the HMD system 300 generally

includes a head strap 330, a hub 304 coupled to the head strap 330, a slidable arm mechanism 310 coupled to the hub 304, and a viewer 340 coupled to the slidable arm mechanism 310.

[0023] The slidable arm mechanism 310 may assist adjustment of the position of the viewer 340. For example, the slidable arm mechanism 310 may rotatably coupled to the hub 304 at a first end of the slidable arm mechanism 310 and the viewer 340 coupled to the slidable arm mechanism 310 at a second end of the slidable arm mechanism 310 to allow the viewer 340 to rotate between a view position in front of a user's eyeline and a standby position over the user's forehead. The slidable arm mechanism 310 may be slidable by at least a portion being able to change distance with respect to the hub 304. For example, the slidable arm mechanism 310 may be extendable or protractible with respect to the hub 304.

[0024] The viewer 340 may be adjustable into various orientations. For example, the viewer 340 may be slidable (e.g., via the slideability of the slidable arm mechanism 310), rotatable (e.g., via the rotatable coupling of the slidable arm mechanism 310 to the hub 304), and lockable (e.g., via a plurality of detents coupled to the hub). The viewer 340 may be slidable from a retracted position (e.g., a position biased towards the hub 304) to a protracted position (e.g., a position farther away from the hub 304 with respect to the retracted, resting, or default distance of the viewer 340 from the hub 304). The viewer 340 may be rotatable with respect to the head strap 330 when the viewer 340 is in the protracted position. The viewer 340 may freely rotate or biasedly rotate, except when coupled to a detent, for example. The viewer 340 may be lockable at an angular orientation with respect to the head strap 330 when the viewer 340 is in the retracted position.

[0025] Figure 4 is an isometric view of an example HMD system 400. The HMD 400 includes a head strap 430, a hinge system 402 on the left side and right side of the head strap 430, and a viewer 440. The viewer 440 may include a plurality of displays (e.g., a display for each eye) and a face gasket 442. The viewer 440 may also include electronics and/or circuitry (such as a processor and control program to operate the plurality of displays) and a housing surrounding the electronics and/or circuitry.

[0026] The multiple hinge systems 402 support and sustain the viewer 440 via arm mechanisms 410. The arm mechanism 410 may include a slidable arm 414 that

is able to be positioned in multiple states with the respect to the hub 404. The slidable arm 414 of the arm mechanism 410 may be covered by arm cover 432.

[0027] Figures 5-7 are side views of an example HMD system 400 in various states. Referring to Figure 5, the HMD system 400 is in a view state with the viewer 440 generally located in the eyeline of the user 90 with the face gasket 442 in contact with the face of the user 90. The viewer 440 may be biased towards the face of the user 90, such as via a bias mechanism within the arm mechanism 410 to maintain the arm 414 biased towards the hub 404 to maintain the face gasket 442 in contact with the user's face at the eyeline.

[0028] Referring to Figure 6, the HMD system 400 is in a rotatable state with the viewer 440 at a distance from the hub 404 that is greater than the distance of the viewer from the hub 404 with respect to the view state of Figure 5. For example, the bias force of a bias mechanism of the arm mechanism 410 may be overcome with a force 461 to slide the arm 414 away from the hub 404, such as depicted in Figure 6 with more of the arm 414 exposed outside of the cover 432.

[0029] Referring to Figure 7, the HMD system 400 is in a standby position. The HMD system 400 is able to rotate in the direction 463 with respect to the hub 404 while the viewer 440 is extended via the slidable arm mechanism 410. In this manner, the face gasket 442 of the viewer 440 may rotated and moved towards the level of the head strap 430 on the user's head or even above the head strap 430 with respect to the user's head. In this manner, the viewer 440 may be lockable into a view orientation below the head strap 430 when worn on the head of a user 90, and lockable into a standby orientation above the head strap 430 when maintained in the same position on the user's head. Indeed, the viewer 440 may rotate towards stops (e.g., guide walls) to limit rotation of the slidable arm mechanism 410 within about 60 degrees of rotation from the view position to the standby position. The arm mechanism 414 may be exposed to the same degree as that with respect to the view state or in a different amount with respect to the view state of Figure 5 or rotatable state of Figure 6.

[0030] Figure 8 is an exploded view of example components of an example hinge system 402. The hinge system 402 generally includes a first hub 404, a first arm 412, a second arm 414 coupled to a second hub 408, a third arm 418, and a cover 432.

[0031] The arm 414 is coupled to a viewer 440 at a hub 408. The arm 414 may interface with the arm 412. For example, the arm 414 may include a contour or wall to form a shell in which the arm 412 may fit. In the example of Figure 8, the arm 412 may include a guide post 476 (e.g., guide wall) that fits within a guide channel 478 formed by the arm 414, such that translational movement of the arm 414 is guided by the guide post 476 along the guide channel 478.

[0032] The arm 412 and the arm 414 are coupled together with a bias member 416, such as a spring. Figure 8 depicts a plurality of springs that couple to protrusions 472 extending from arm 412 and coupled to protrusions 474 of arm 414. The springs 416 bias the arm 414 towards the head 460 of the arm 412, where the head 460 couples to the hub 404 via the hub cap 462. The arms 412 and 414 may be assisted in maintaining coupling in the view state using magnets 434. The magnets 434 may apply an attractive or resistive force to assist slideability of the arm mechanism 410 and/or resist slideability of the arm mechanism 410. For example, a user may need to overcome the magnetic force with an initial resistance greater than used to continue sliding the arm 414 to a protracted position and the magnetic force may assist pulling arm 414 into a retracted resting position when released by the user.

[0033] The hub cap 462 may couple the head 460 of the arm 412 to the hub 404 to allow the arm 412 to rotate with respect to the hub 404. For example, the hub cap 462 may be coupled at pivot point 454 to allow the head 460 of the arm 412 to rotate around the pivot point 454.

[0034] The head 460 may include a feature to limit or facilitate rotation of the arm 412. For example, the head 460 may include a notch 452 to stop rotation of the arm 412 past a relative angle with respect to the hub 404.

[0035] The hub cap 462 includes features to sustain the arm mechanism 410 in a position or limit rotation of the arm mechanism 410 with respect to the hub 404. For example, the hub cap 462 may include a stop 450 to hinder rotation past an angular orientation with respect to the hub 404. In this manner, the stop 450 may be coupled to the hub 404 to act as a guide wall to hinder rotation of the arm mechanism 410 past a range of the plurality of detents 422 and 424, and thereby, for example, limit the degree of free rotation of the arm mechanism 410. In other examples, the stop and notch interface may be swapped, such as placing the stop on the hub 404 or the head 460 and the notch on the hub cap 462.

[0036] The hub cap 462 may include a plurality of detents, such as detents 422 and 424, which, in the example of Figure 8, represent fixable locations and orientations of the arm mechanism 410 with respect to the hub 404. The arm 418 is coupleable to arm 414 at fastening holes 464. The arm 418 includes an end with a contour feature that is complementary to the shape of the detents. In the examples of Figures 8-12, the arm 418 includes a nose 428 that complements the indents formed by walls of the detents 422 and 424. More details regarding interface states of the arm 418 and plurality of detents are provided with respect to the descriptions of Figures 9-12.

[0037] Figures 9-12 are side views of example components of an example hinge system 402 of an example HMD system 400 in various states. Referring to Figure 9, the example hinge system 402 generally includes a first hub 404, an arm mechanism 410, and a second hub 408. The hub 404 is coupled to a strap 430 and the hub 408 is coupled to a viewer 440. The cover 432 is noted in dotted lines as well as the outline of components of the arm mechanism 410 to show relationships of the components of the arm mechanism 410.

[0038] The first hub 404 includes a structure with contour elements forming a plurality of detents 422 and 424. For example, the plurality of detents may be apertures defined by a perimeter of the hub, each aperture having a shape complementary to a shape of a protrusion of the extendable arm mechanism. For another example, the hub may have a plurality of detents coupled to it where the plurality of detents is a plurality of indentations or protrusions defined by perimeter contour of the hub 404 (e.g., walls shaped on the hub cap 462). Referring to Figures 9-12, the arm 418 of the arm mechanism 410 includes a nose 428 that fits within the shape of the detents 422 and 424. The detents 422 and 424 may be different shapes. For example, an end of the detent 422 may be a distance D1 from the center 454 of the hub 404 where an end of the detent 424 may be at a different distance D2 from the center 454 of the hub 404 (e.g., D1 may be greater than D2 or D2 may be greater than D1). Indeed, each of the plurality of detents may be different sizes and/or located at different radial distances from the pivot such that the arm 418 (and thereby, the arm 414 and the entire arm mechanism 410) is lockable or otherwise retrainable at different radial distances from the pivot based on the shape, location, and/or orientation of the plurality of detents.

[0039] In the example of Figure 9, the bias members (e.g., springs 416) may maintain force on the arm 418, via the coupling of arms 412 and 414), to keep the nose 428 of the arm 418 substantially within the detent 422. The bias mechanism may maintain the viewer 440 in the retracted position (e.g., bias the viewer 440 towards the user's head). This state of the arm mechanism 410 depicted in Figure 9 may be a view orientation corresponding to a mode for viewing and operating the HMD at the user's eyeline.

[0040] The bias mechanism may place force on the arm mechanism 410 towards a pivot point, such as a center of the hub and the plurality of detents may be at different locations with respect to the diameter of the hub 404 and in such locations that are axially aligned with the center of the hub 404. In this manner, the bias force may maintain wherein the bias mechanism includes a bias force to place a protrusion of the slidable arm mechanism into a subset of the plurality of the detents, and, for example, may maintain force to place the nose 428 of the arm 418 into one of the plurality of detents.

[0041] Referring to Figure 10, the hinge system may include features such as a notch 452 to limit rotation of the arm when in contact with stop 450. Magnets 434 are depicted at a location to assist sustaining the bias mechanism and/or the arm mechanism in the angular orientation. The slidable arm mechanism 410 is not rotatable when the bias mechanism maintains the slidable arm mechanism 410 in at least one of the plurality of detents. The slidable arm mechanism 410 is rotatable when the bias force is overcome to slide the slidable arm mechanism 410 out of the plurality of detents (e.g., past the perimeter of the hub 404).

[0042] Referring to Figure 11, the force of the bias mechanism (e.g., the force of the springs 416) may be overcome to allow the nose 428 of the arm 418 to exit the detent 422. The slidable arm mechanism 410 may appear to extend the arm 414 to a greater degree past the cover 432 with respect to the view orientation depicted in Figure 9. With the nose 428 pulled completely external to the perimeter of the hub 404 (e.g., fully exited out of the detent 422), the arm mechanism 410 is able to rotate past the detent 422 of the hub cap 404 affixed to the strap 430. The arm mechanism 410 may rotated towards the detent 424, for example.

[0043] Referring to Figure 12, with the arm mechanism 410 rotated towards the detent 424 and released, the bias member places a force on the arm mechanism 410, such as a bias force on the arm 414 and/or arm 418 via coupling of the bias

member, and applies the force on the arm mechanism 410 to bias the nose 428 of the arm 418 into a position corresponding to the detent 424 (e.g., sustained within the boundaries of the detent 424). A stop, such as stop 450, may be used as a guide to ensure the maximum range of rotation is not exceeded and/or guide the nose 428 of the arm to a detent, such as a last detent in a range of the plurality of detents.

[0044] The location and/or shape of the detents 422 and 424 may allow for different distances of the viewer 440 from the hub 404 at the different securely retractable positions of the arm mechanism 410. For example, the distance D1 may be smaller than the distance D2 and, thereby, the arm 414 may assist the viewer 440 coupled to the hub 408 on the end of the arm 414 opposite the nose 428 of the arm 418 to be positioned at a distance farther away from the hub 404 when compared to the position and distance of the viewer 440 when the nose 428 is located within the detent 422. The viewer 440 may be located at a distance with respect to a pivot at the center 454 of the hub 404. For example, the viewer 440 is located a distance from the center 454 of a length of the arm mechanism 410 minus D1 in Figure 9 and may be a distance from the center 454 of a length of the arm mechanism 410 plus D2 in the example state of Figure 12. In those examples, the radial difference between the states of the viewer 440 from the pivot in the examples of Figures 9 and 12 is equal to D1 plus D2. In some examples, the location and/or shape of the detents, such as in the example of Figures 9-12, allow the hinge system 402 to be compact by placing the detent 422 sufficiently across the diameter of the hub 404 to allow the nose 428 of the arm mechanism 410 to significantly overlap the diameter of the hub 404 (e.g., greater than the radius of the hub 404) and to be extended by placing the detent 424 in a location not crossing the center 454 and closer to the hub perimeter (e.g., less than the radius of the hub 404). In this manner, the viewer 440 may be located farther away from the strap 430 in the standby mode when compared to the location of the viewer 440 in the view mode. This may also, for example, compensate for any differences in head size to allow for comfortable operation in standby and view modes as well as avoid any unintentional contact with hair or other objects. A strap protrusion or extension may also be formed on the strap to act as a protective cover for the components of the viewer 440 and avoid such contact, for example. A strap extension is discussed further with respect to Figures 13-16.

[0045] Figures 13-16 depict components of an example hinge system 502 of an example HMD system 500 including example adjustment mechanisms 538 and 580. Referring to Figure 13, the HMD system 500 generally includes a strap 530, a viewer 540, a hinge system 502, a hub adjuster 538, and a viewer adjuster 580.

[0046] The hinge system 502 includes a hub 504 with a plurality of detents (e.g., 524) coupled to the hub 504 and an arm mechanism 510. The arm mechanism 510 includes a first arm 512, a second arm 514, and a spring 516 coupled to arms 512 and 514. The arm mechanism 510 is slidable to remove from coupling with a detent, rotatable to move the arm mechanism 510 to a different detent, and lockable into the other, different detent when the bias force from the spring 516 is applied (without additional forces applied). A first stop 550 and second stop 552 are coupled to the hub 504 to hinder the arm mechanism 510 from rotating past the range of the plurality of detents on the cam 562 of the hub 504.

[0047] Referring to Figure 14, the example HMD system 500 is depicted from a side view with the viewer 540 in a view position. In the view position, the nose 528 of the arm 514 is in contact with a guide wall of the cam 562 forming the detent 522. The head strap 430 may include a strap extension 536, which is discussed in more detail with respect to Figure 16.

[0048] The viewer adjuster 580 is coupled to the viewer 540. In general, the viewer adjuster 580 is a mechanism to allow the viewer 540 to be angularly adjusted with respect of the arm mechanism 510. In this manner, the viewer 540 may be rotatably orientable in the directions of 563 or 565 to adjust the angle of the viewer 540 with respect to the user's face, such as the user's eyeline. The viewer adjuster 580 includes a cam support 586, a tabbed selector 582, and a plurality of detents 584 to lock the viewer 540 into angular orientations of the viewer 540 with respect to the slidable arm 510. The tabbed selector 582 is coupled to the arm 514 and coupleable to the cam support 586 via the plurality of detents 584. For example, the tabbed selector 582 may be aligned with a detent 584 and when interfaced with the detent 584, the tabbed selector 582 maintains an angular orientation of the cam support 586 with respect to the arm 514. The tabbed selector 582 may change interface among the plurality of detents 584. For example, to increase or decrease the angle of the viewer 540 with respect to the arm mechanism 510, the tabbed selector 582 may be removed from interfacing with the current detent 584 and

moved to interface with an adjacent detent 584. This may be in the direction of arrows 567 or 569 depicted in Figure 16.

[0049] The hub adjuster 538 is coupled to the hub 504, via the cam 562, for example. In general, the hub adjuster 538 adjusts an orientation of the hub 504 with respect to the strap 530 and/or adjust an orientation of the plurality of detents (e.g., 522 and 524) on the cam 562 with respect to the strap 530. Indeed, the hub adjuster 538 includes a cam support 568 with a plurality of detents 558 to lock the cam 562 into angular orientations of the hub 504 with respect to head strap 530. The hub adjuster 538 includes a lock interface, such as tabbed selector 548 and detents 558. The lock interface includes a plurality of interface points to maintain an angular orientation of the plurality of detents about a pivot of the hub 504 with respect to the strap 530. For example, to increase or decrease the angle of the cam 562 with respect to the head strap 530 (e.g., via the cam support 568), the tabbed selector 548 may be removed from interfacing with the current detent 558 and moved to interface with an adjacent detent 558. The cam support 568 may be affixed to the head strap 530 and the cam 562 may be affixed to the hub 504, where the cam 562 and the cam support 568 are rotatable with respect to each other to adjust the angular relationship between the head strap 530 and the arm mechanism 510.

[0050] Figure 15 is a cut-away view of a tabbed selector 548 interfaced with a cam support 586. The cam support 586 includes a detent, such as an indentation 558. The tabbed selector 548 includes a protrusion 588 that fits within, or is otherwise complementary to, the indentation of the detent 558 to sustain the tabbed selector 548 connected to the cam support 562. The tabbed selector 548 may be made of a flexible material to allow the tabbed selector 548 to be flexed away from the cam support 586, such as to rotate the cam support and interface with a different detent when the tabbed selector is released and flexed back into a normal state. A flexed state of the tabbed selector 548 is shown in dotted lines for comparison.

[0051] Referring to Figure 16, the example HMD system 500 is depicted in a side view with the viewer 540 at a standby position. In the standby position, the nose 528 coupled to arm 514 is in contact with a guide wall of the cam 562 forming the detent 524. The viewer 540 is nearer the head strap 530 in the standby position when compared to the view position. For example, the viewer 540 may be moved towards the strap extension 536 coupled to the head strap 530. The strap extension

536 may protect the components of the viewer 540, such as the displays and/or face gasket, from unintentional contact, such as by hair on the user's head.

[0052] As discussed herein, the stops 550 and 552 may represent rotational bounds of the hinge system 502. Such range of bounds may be about 60 degrees. The strap extension 536 may cover the user's head equal to or greater than 60 degrees from the view position and/or eyeline of the user. For example, the viewer 540 may be rotatable from a position corresponding to the location of the strap extension 536 when the slidable arm mechanism is placed in a standby position corresponding to the upper limit of the 60 degrees of rotation to a position below the head strap when the slidable arm mechanism is placed in a view position corresponding to the lower limit of the 60 degrees of rotation.

[0053] By using an adjustable hinge system as discussed herein, a user of an HMD system may, for example, quickly move the viewer from the view position to a standby position by a pull-and-rotate maneuver to allow for completing tasks with the viewer outside of the eyeline (or otherwise unobstructed from completing the tasks), release the viewer to allow the bias member to maintain the viewer in the standby position comfortably resting at or above the head strap, and quickly move the viewer back to the view position, using a similar pull-and-rotate maneuver, to begin their virtual reality session again.

[0054] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the elements of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or elements are mutually exclusive.

[0055] The terms "include," "have," and variations thereof, as used herein, mean the same as the term "comprise" or appropriate variation thereof. Furthermore, the term "based on," as used herein, means "based at least in part on." Thus, a feature that is described as based on some stimulus may be based only on the stimulus or a combination of stimuli including the stimulus. Furthermore, the use of the words "first," "second," or related terms in the claims are not used to limit the claim elements to an order or location, but are merely used to distinguish separate claim elements.

[0056] The present description has been shown and described with reference to the foregoing examples. It is understood, however, that other forms, details, and

examples may be made without departing from the spirit and scope of the following claims.

CLAIMS

What is claimed is:

1. A hinge system comprising:
 - a pivot;
 - a hub coupled to the pivot;
 - an arm mechanism rotatably coupled to the hub, including:
 - a first arm rotatably coupled to the pivot; and
 - a second arm slideably coupled to the first arm, the second arm positionable in a first position with respect to the first arm and a second position with respect to the first arm; and
 - a plurality of detents coupled to the hub, the plurality of detents corresponding to sustainable orientations of the first arm with respect to rotation about the pivot, wherein:
 - the first arm is rotatable when the second arm is in the first position; and
 - the first arm is rotatably restrainable when the second arm is in the second position.
2. The hinge system of claim 1, wherein:
 - each of the plurality of detents are located at different radial distances from the pivot;
 - each of the plurality of detents are different sizes; and
 - the second arm is lockable at different radial distances from the pivot based on the plurality of detents.
3. The hinge system of claim 1, comprising:
 - a bias member coupled to the second arm, the bias member to bias the second arm into the second position.
4. The hinge system of claim 3, wherein:
 - the bias member is a spring;
 - the first arm includes a guide channel;
 - the second arm includes a guide post; and

translational movement of the second arm is guided by the guide post along the guide channel and biased towards the pivot by the spring.

5. The hinge system of claim 4, further comprising:

a guide wall coupled to the hub, the guide wall to hinder rotation of the first arm past a range of the plurality of detents.

6. A wearable device:

a strap;

an extendable arm mechanism rotatably coupled to the strap at a hub; and

a plurality of detents coupled to the hub, the plurality of detents corresponding to sustainable rotational orientations of the extendable arm mechanism,

wherein:

the extendable arm mechanism is rotatable among the plurality of detents when in a protracted position, and

the plurality of detents include a guide wall to confine the extendable arm mechanism from rotation when the extendable arm mechanism is in a retracted position.

7. The wearable device of claim 6, wherein:

the plurality of detents are apertures defined by a perimeter of the hub, each aperture having a shape complementary to a shape of a protrusion of the extendable arm mechanism.

8. The wearable device of claim 6, further comprising:

a hub adjuster coupled to the hub, the hub adjuster to adjust an orientation of the hub with respect to the strap and the plurality of detents with respect to the strap.

9. The wearable device of claim 6, wherein:

the hub adjuster includes a lock interface, the lock interface including a plurality of interface points to maintain an angular orientation of the plurality of detents about a pivot of the hub with respect to the strap.

10. A head-mounted display system comprising:
- a head strap;
 - a hub coupled to the head strap;
 - a slidable arm mechanism rotatably coupled to the hub at a first end of the slidable arm mechanism; and
 - a viewer coupled to the slidable arm mechanism at a second end of the slidable arm mechanism, the viewer being:
 - slidable from a retracted position towards the hub to a protracted position position away from the hub,
 - rotatable with respect to the head strap when the viewer is in the protracted position, and
 - lockable at an angular orientation with respect to the head strap when the viewer is in the retracted position.
11. The head-mounted display system of claim 10, further comprising:
- a bias mechanism to maintain the viewer in the retracted position; and
 - a first plurality of detents coupled to the hub, the plurality of detents being a plurality of indentations defined by perimeter contour of the hub,
- wherein the bias mechanism includes a bias force to place a protrusion of the slidable arm mechanism into a subset of the plurality of the detents,
- and the slidable arm is rotatable when the bias force is overcome to slide the slidable arm mechanism out of the plurality of detents and not rotatable when the bias mechanism maintains the slidable arm mechanism in the plurality of detents.
12. The head-mounted display system of claim 10, wherein:
- the viewer includes a plurality of displays and a face gasket,
 - the viewer is lockable into a view orientation below the head strap when worn,
- and
- the viewer is lockable into a standby orientation above the head strap when worn.
13. The head-mounted display system of claim 12, further comprising:

a viewer adjuster coupled to the viewer, the viewer adjuster including a cam and a second plurality of detents to lock the viewer into angular orientations of the viewer with respect to the slidable arm.

14. The head-mounted display system of claim 13, further comprising:

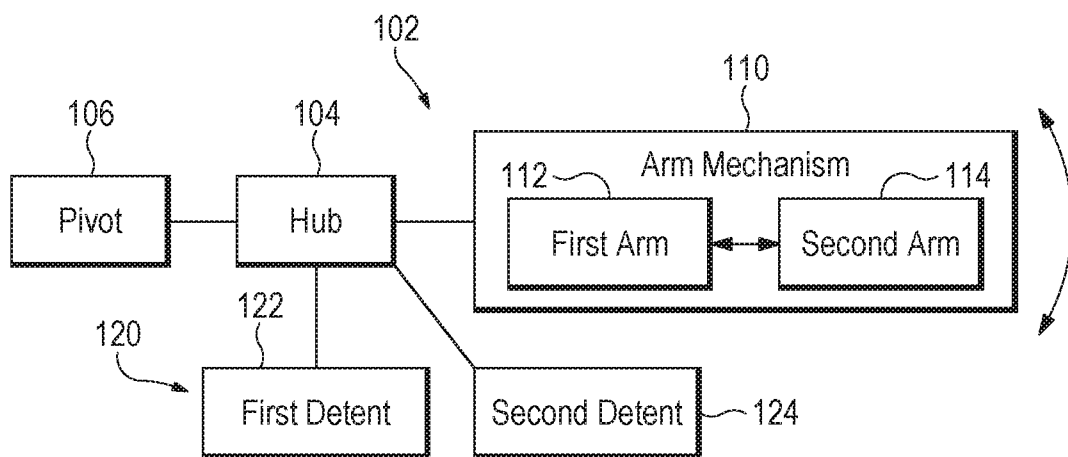
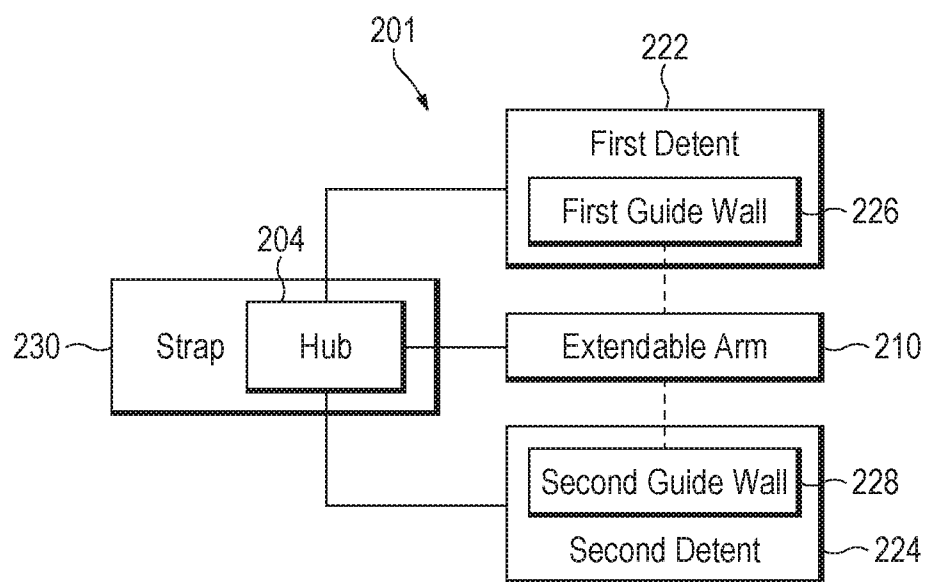
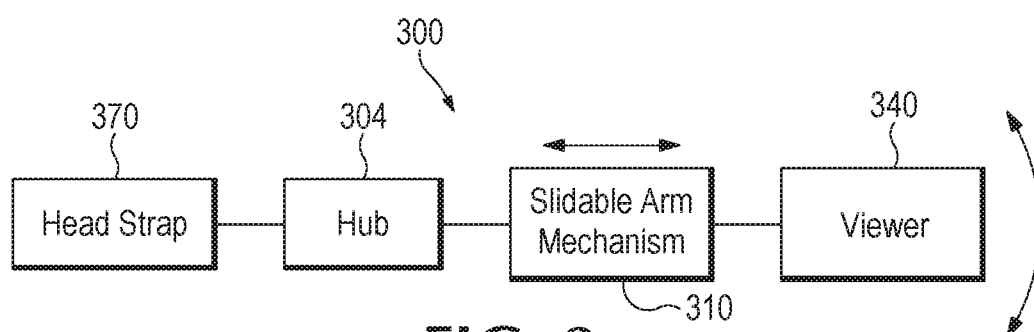
a hub adjuster coupled to the hub, the hub adjuster including a third plurality of detents to lock the hub into angular orientations of the hub with respect to head strap.

15. The head-mounted display system of claim 14, further comprising:

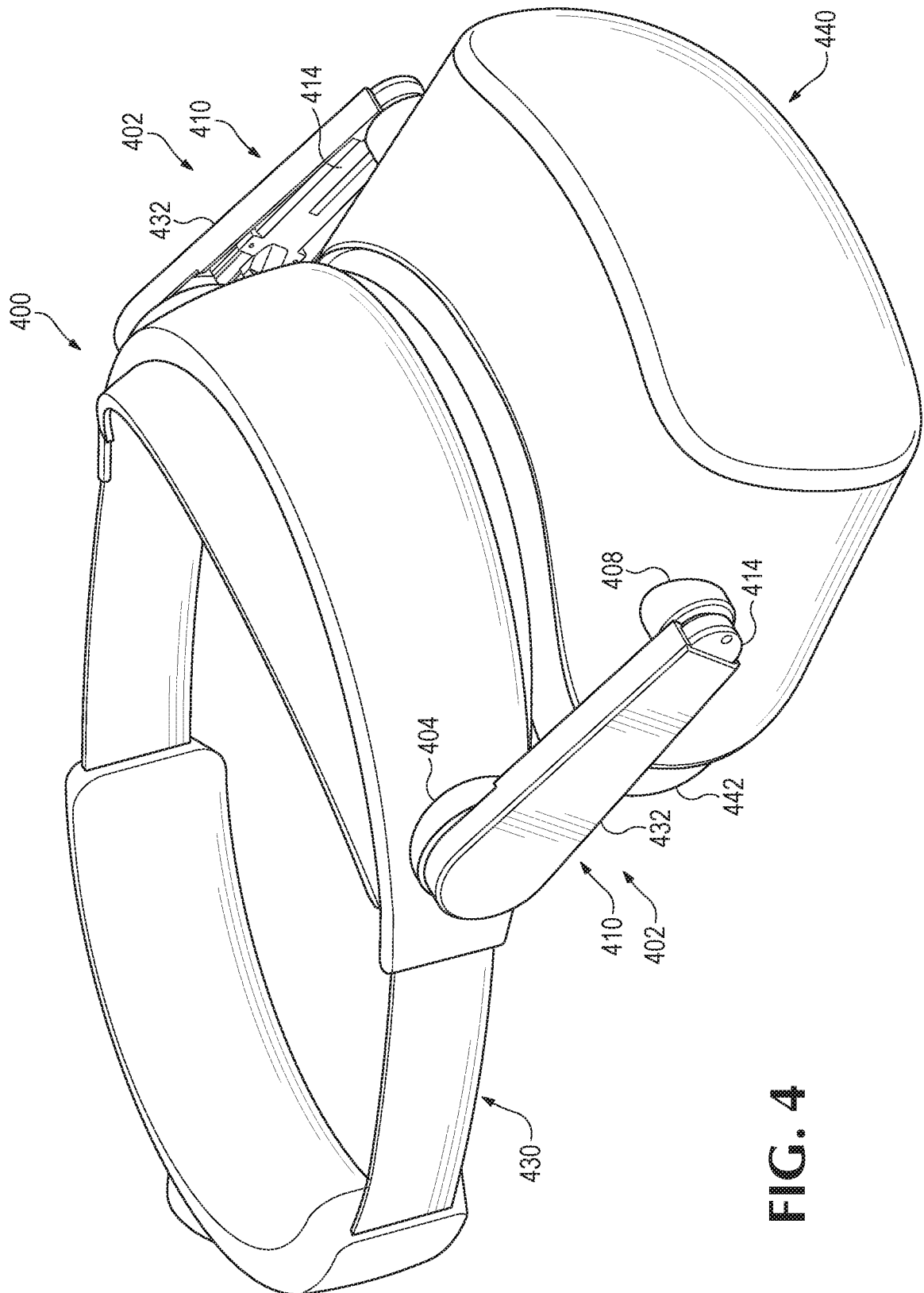
a plurality of guide walls to limit rotation of the slidable arm mechanism within about 60 degrees of rotation; and

a strap extension coupled to the head strap, the viewer rotatable from a position corresponding to the location of the strap extension when the slidable arm mechanism is placed in a standby position corresponding to the upper limit of the 60 degrees of rotation to a position below the head strap when the slidable arm mechanism is placed in a view position corresponding to the lower limit of the 60 degrees of rotation.

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**FIG. 1****FIG. 2****FIG. 3**

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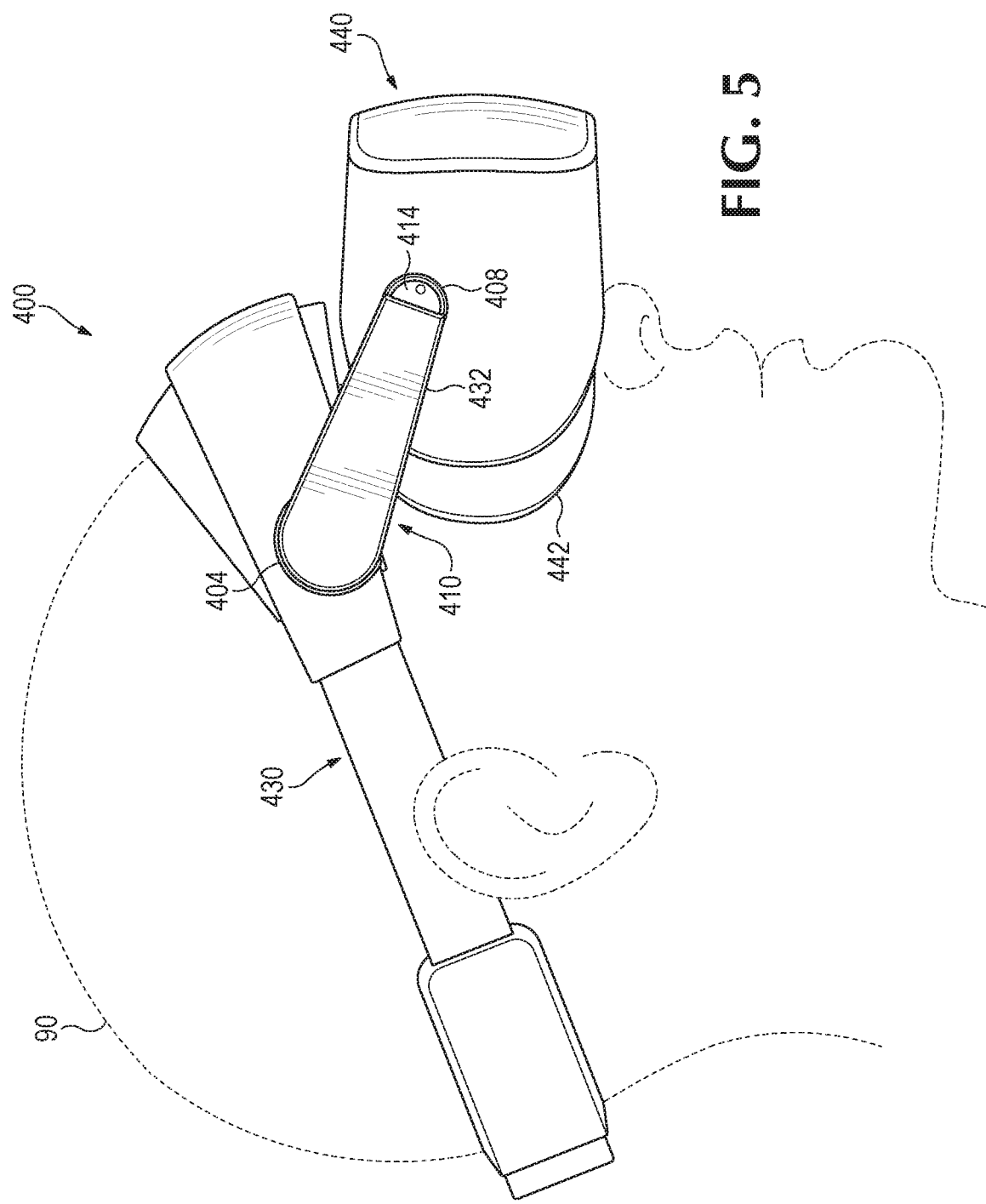
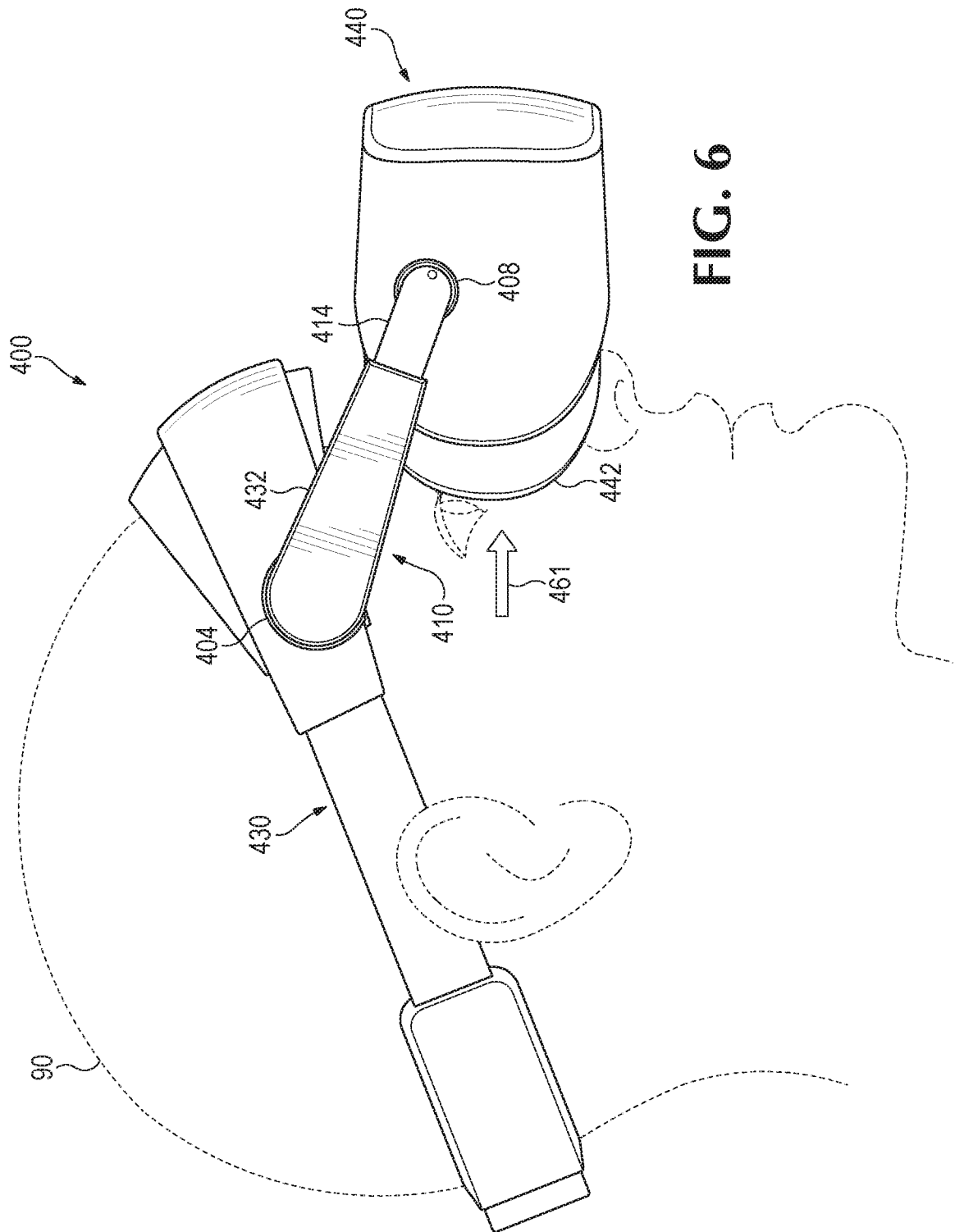
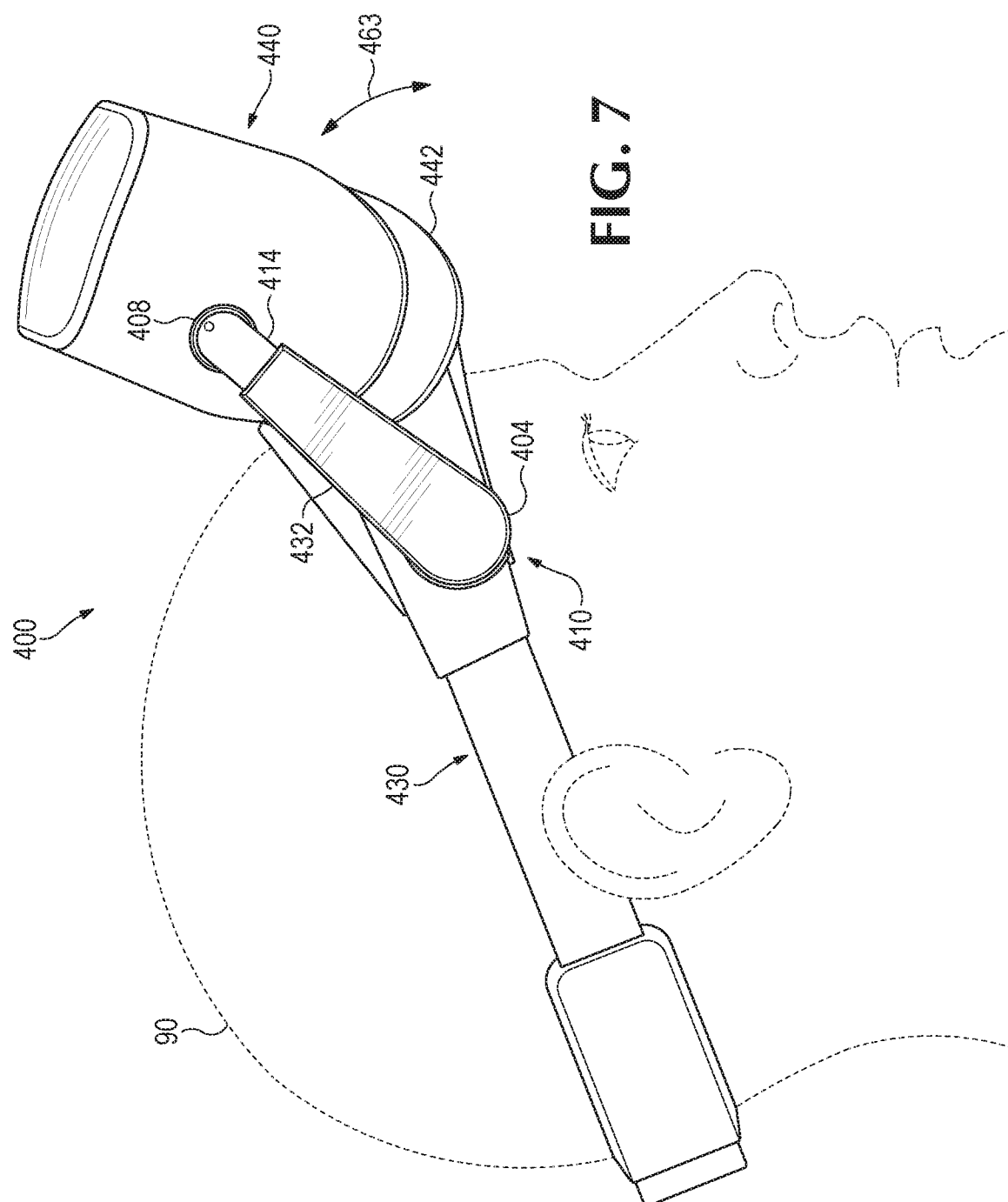


FIG. 5

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FILE

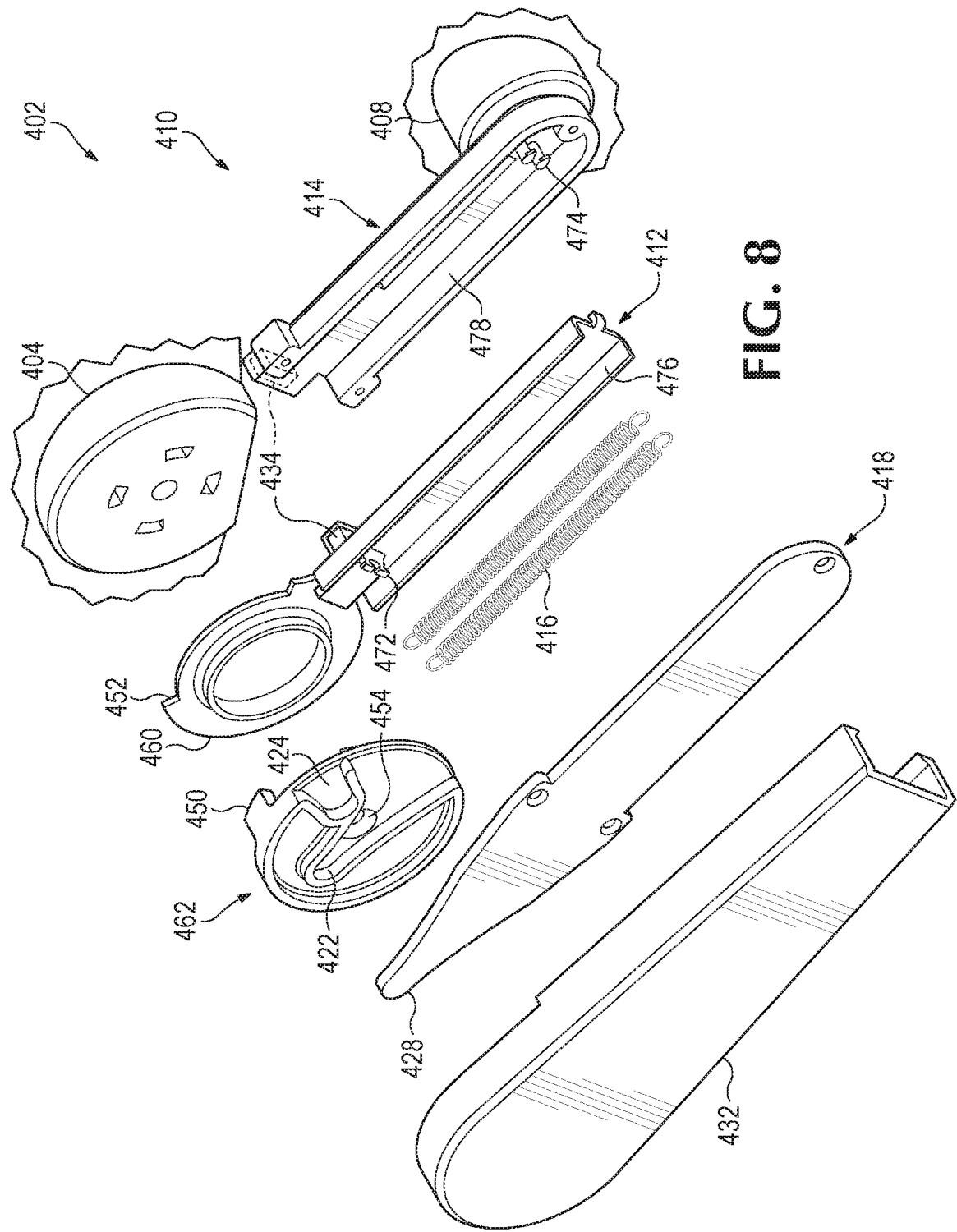


FIG. 8

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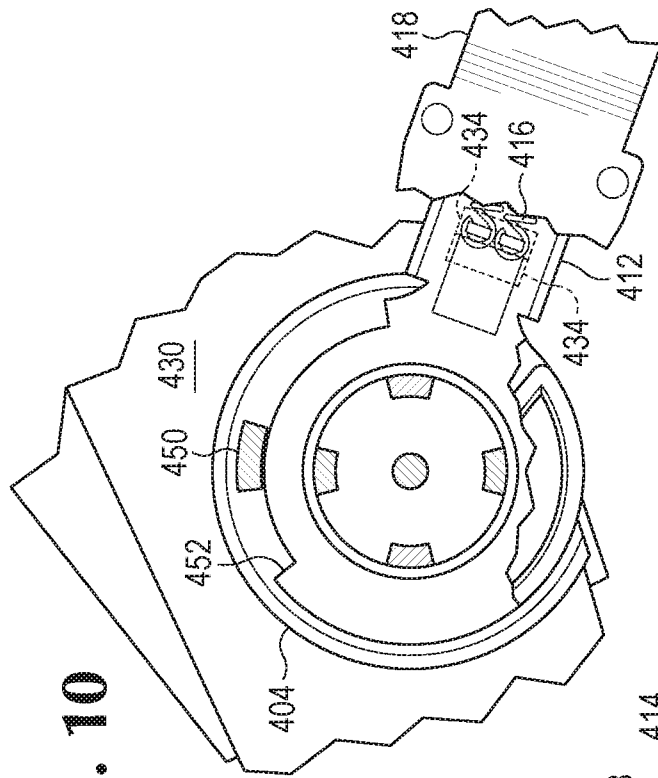


FIG. 10

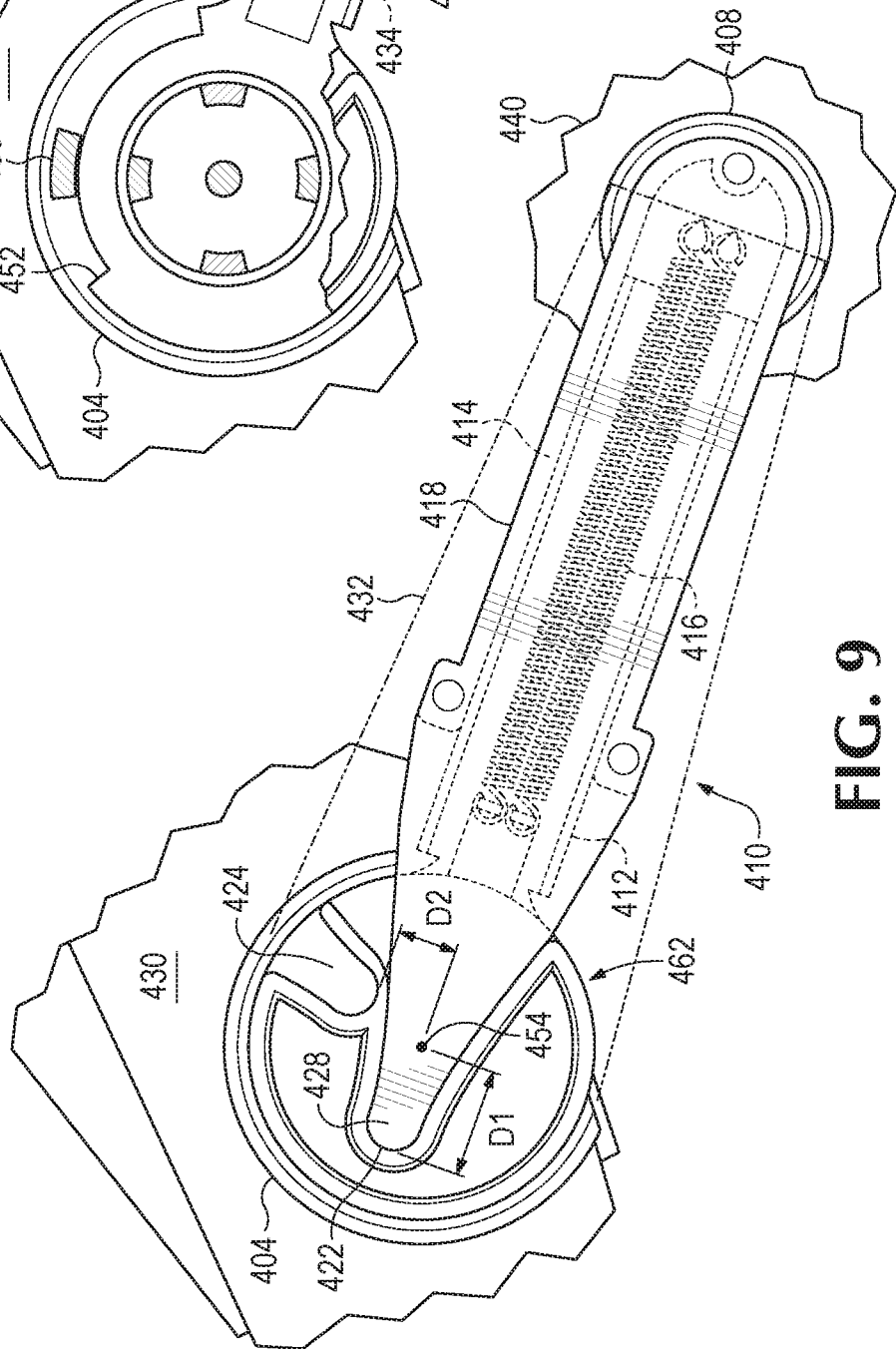


FIG. 9

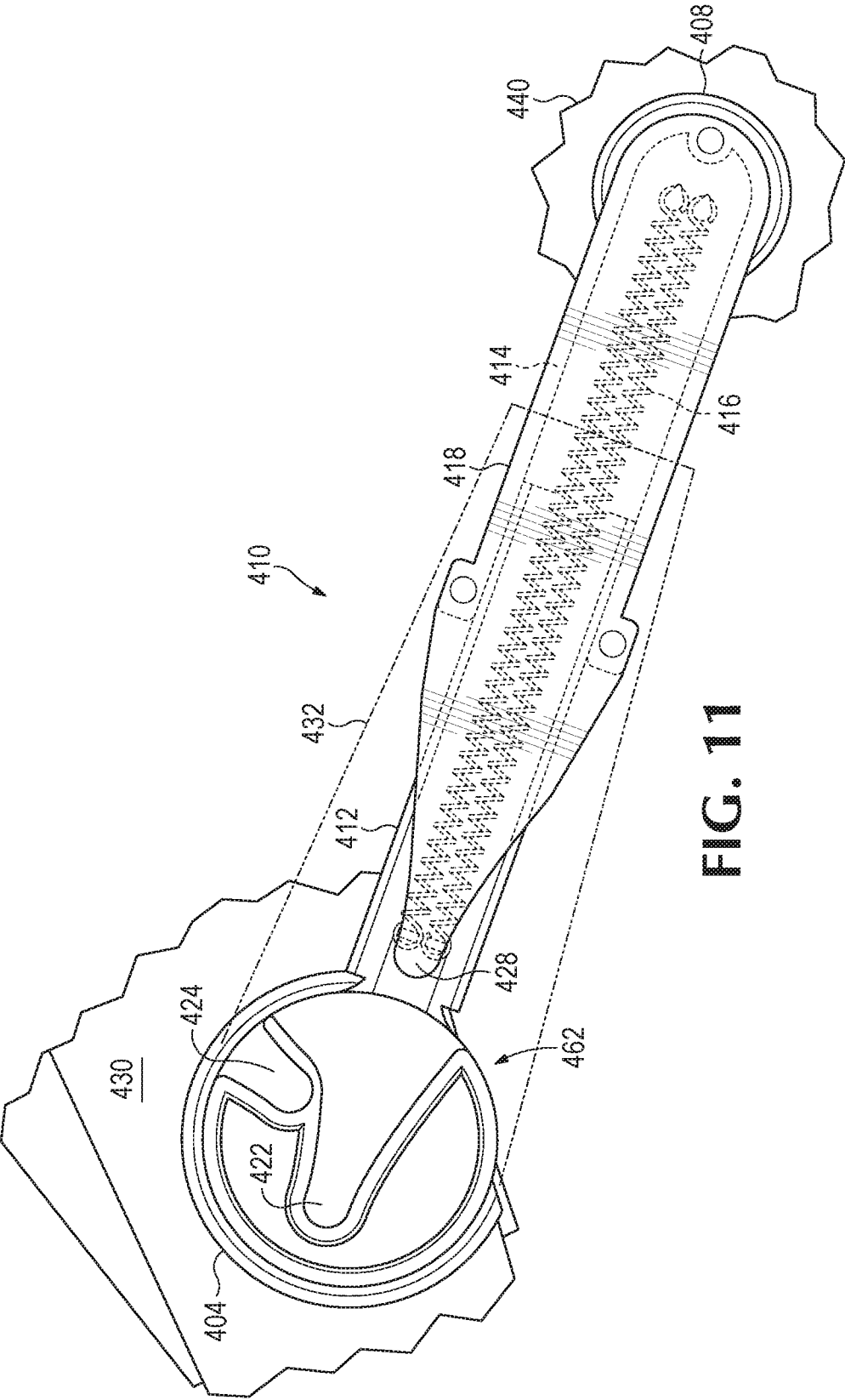
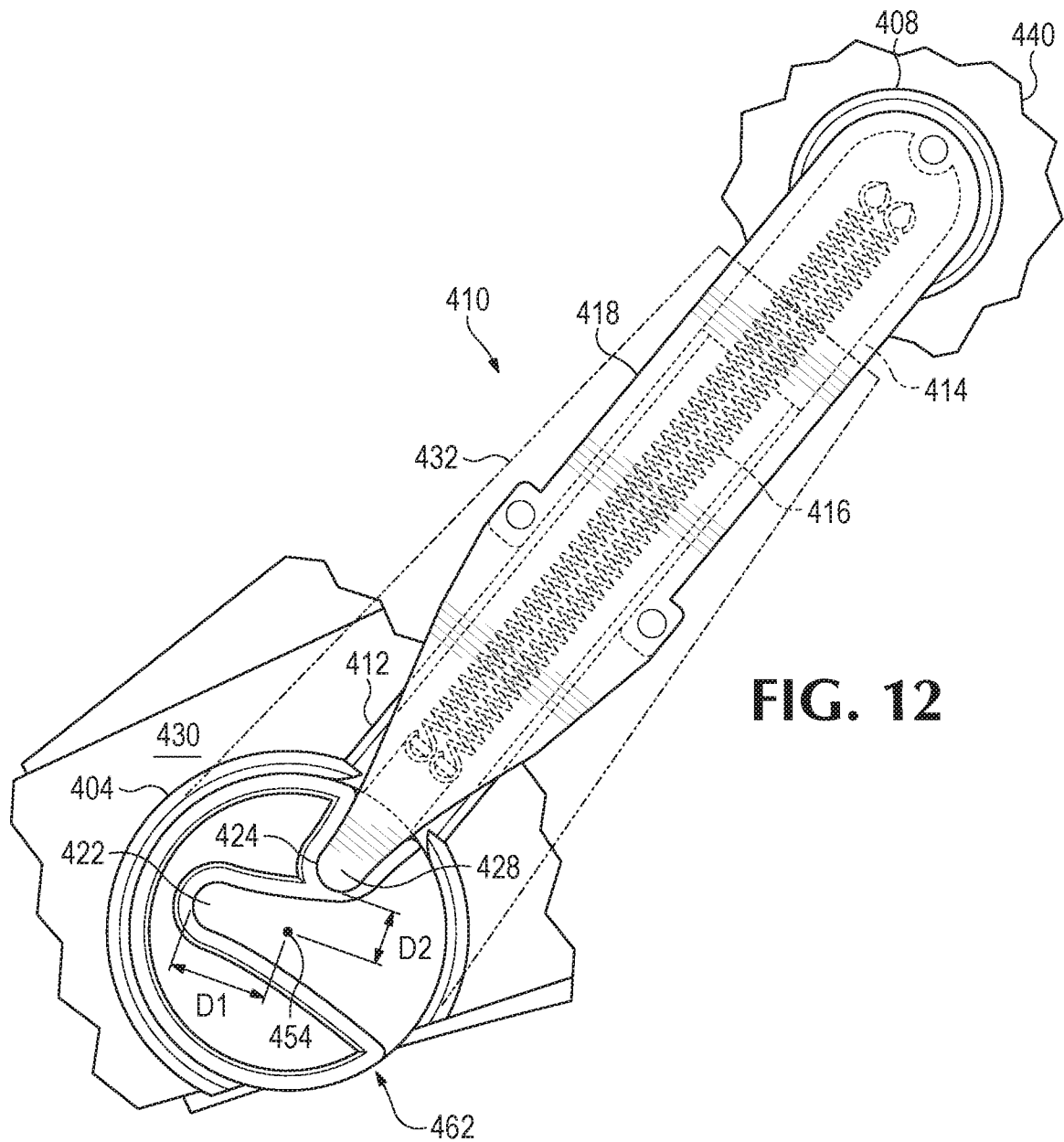
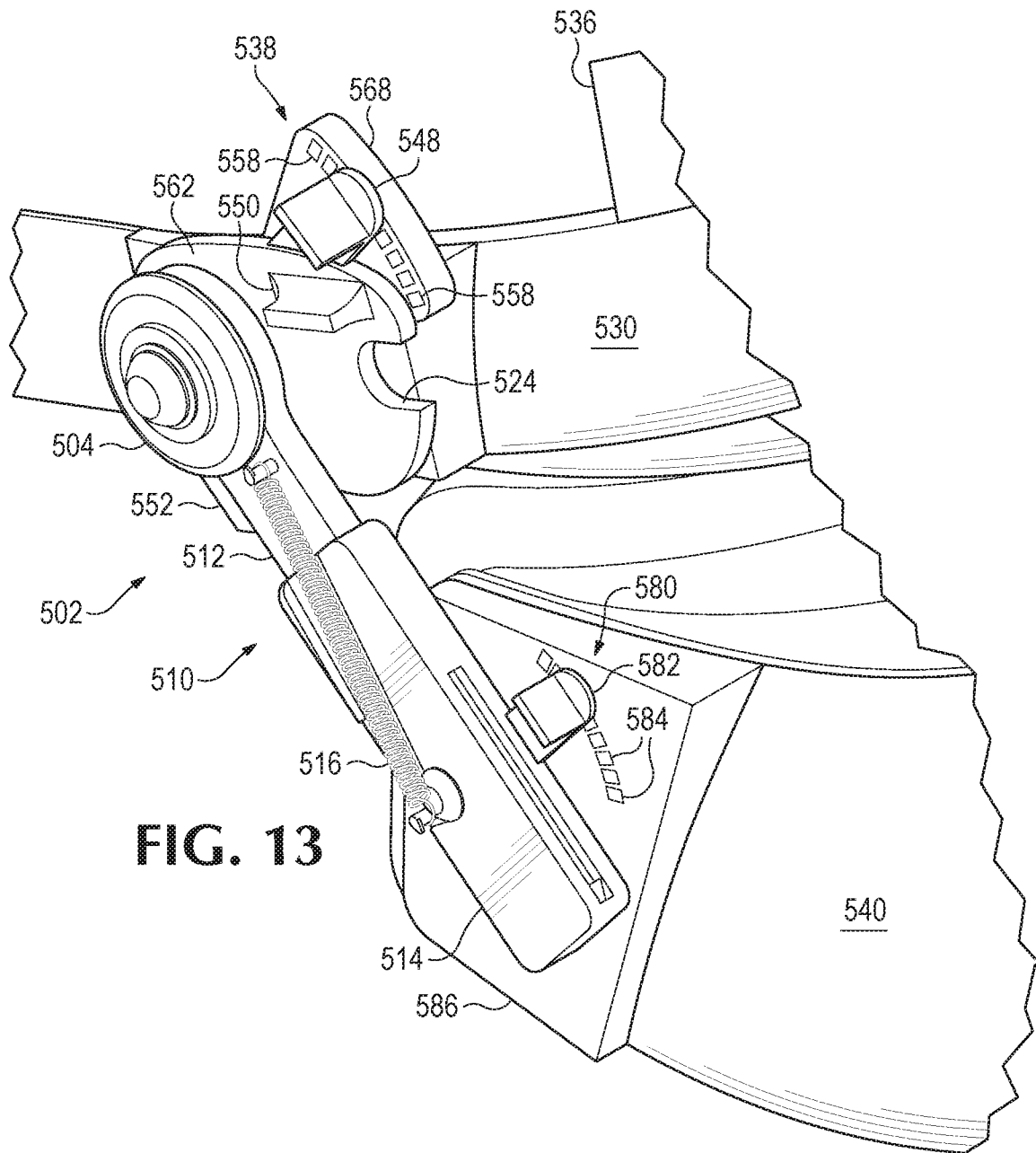


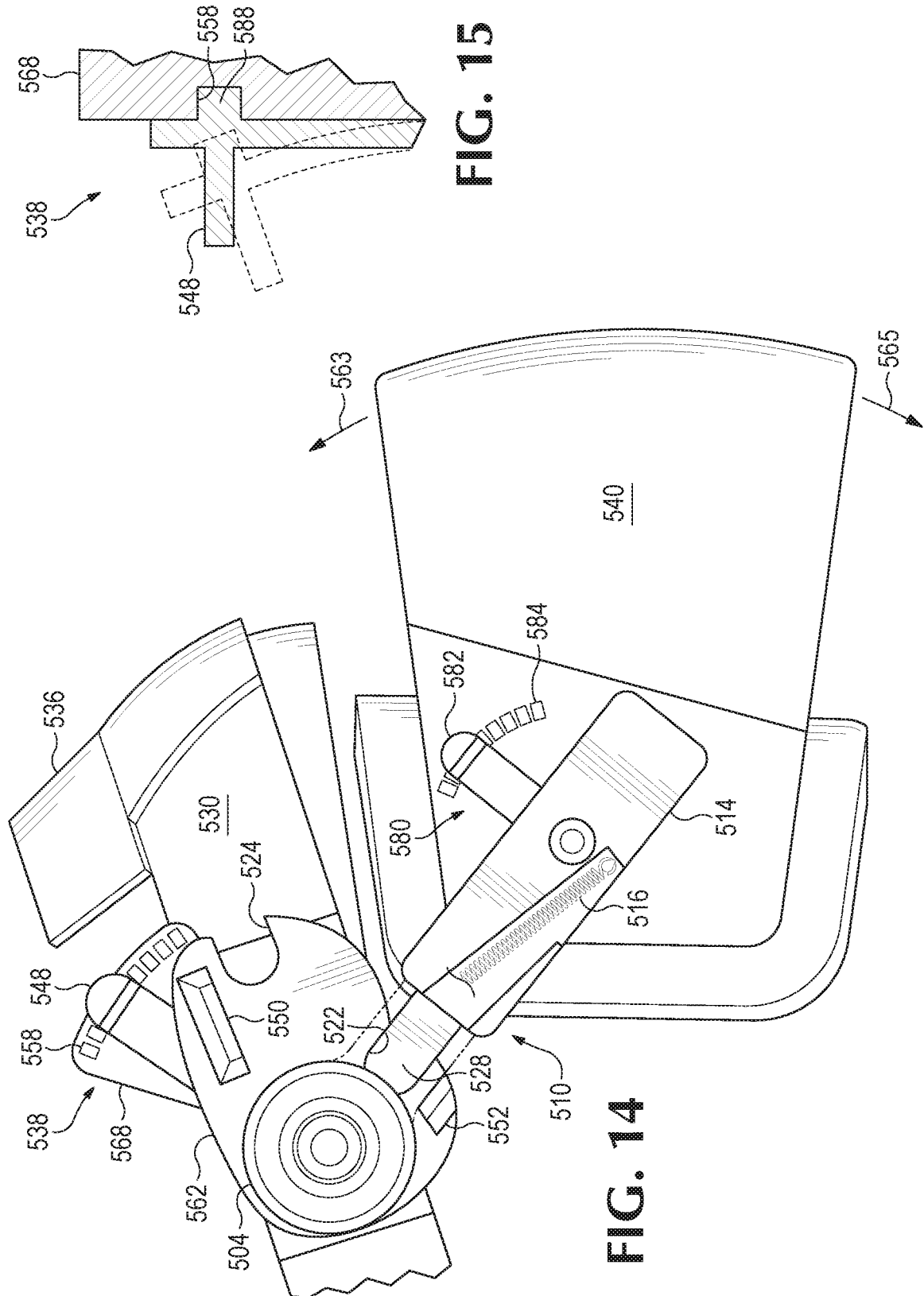
FIG. 11

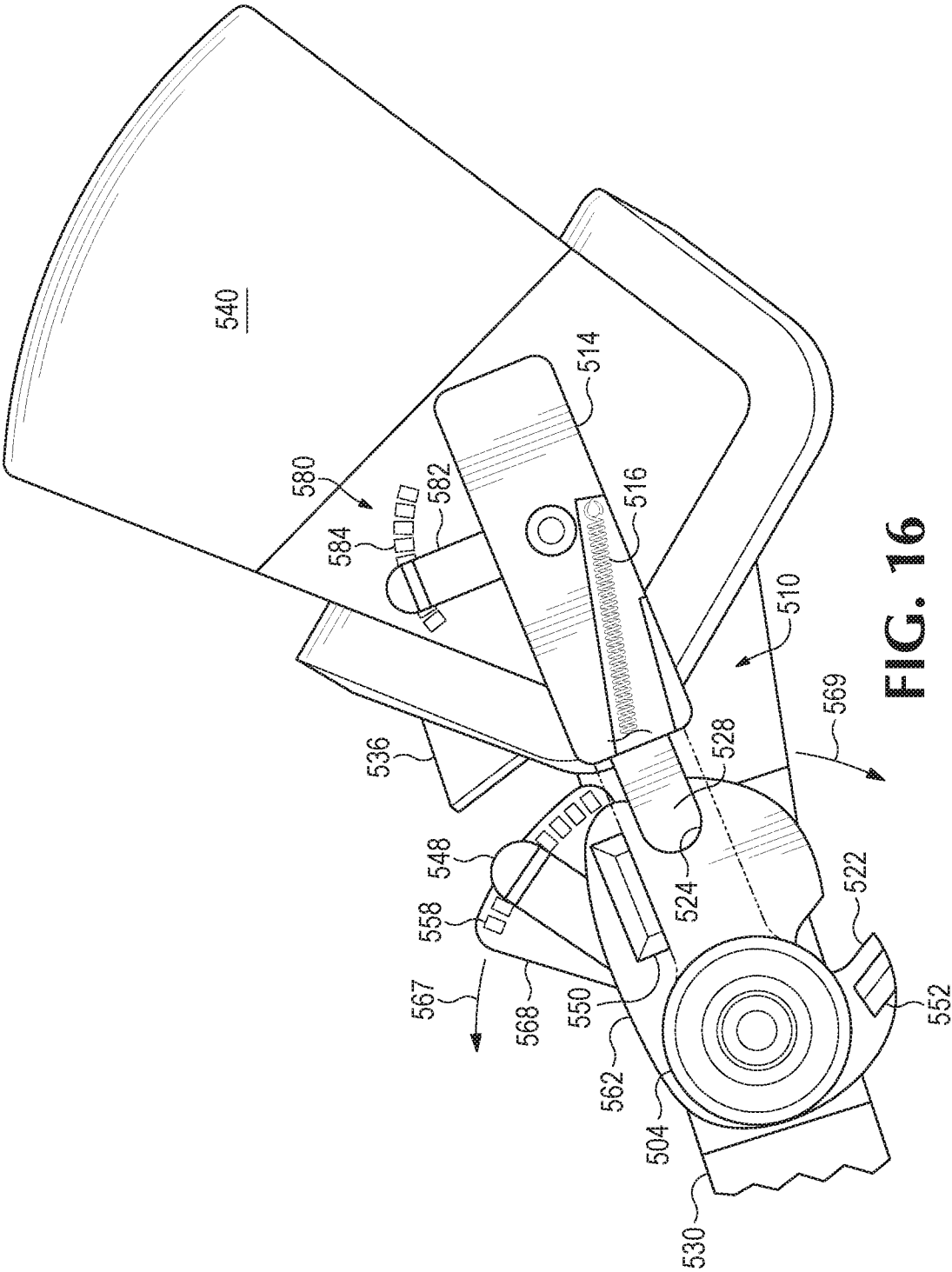
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/028477

A. CLASSIFICATION OF SUBJECT MATTER <i>G02B 27/01 (2006.01)</i> 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) G02C 3/00, 5/00-22, 9/00-04, 11/00, G03B 5/00-08, A42B 3/00, 3/04, 3/08, 3/10, 3/12, 3/14, 3/32, A63B 23/00, 69/00, G09B 9/00, G02B 27/01 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE, Information Retrieval System of FIPS		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2000/055673 A1 (COLORADO MICRODISPLAY, INC.) 21.09.2000, pages 1, 2, page 4, paragraphs 2-4, page 5, paragraphs 2-4, page 7, paragraphs 5-6; p.8, p.12, paragraphs 5-6, claims, figures 1, 3-5, 14, 15	10
A		1-9, 11-15
X	WO 2000/055672 A1 (COLORADO MICRODISPLAY, INC.) 21.09.2000, pages 1, 2, page 4, paragraphs 2-5, page 5, paragraphs 2-4, page 7, paragraphs 4-5, page 8, paragraphs 1-4, page 12, paragraphs 4-5, figures 1, 3-5, 14, 15	10
A	WO 1995/011473 A1 (KOPIN CORPORATION) 27.04.1995	1-15
A	US 6369952 B1 (RICHARD DENNIS RALLISON et al) 09.04.2002	1-15
A	US 9575319 B2 (ION VIRTUAL TECHNOLOGY CORPORATION) 21.02.2017	1-15
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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“E”	earlier document but published on or after the international filing date	“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
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“O”	document referring to an oral disclosure, use, exhibition or other means	“&” document member of the same patent family
“P”	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search		Date of mailing of the international search report
13 January 2020 (13.01.2020)		16 January 2020 (16.01.2020)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer S. Omarova Telephone No. (499) 240-25-91