



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.07.2015 Bulletin 2015/29

(51) Int Cl.:
E06B 9/322 ^(2006.01)
E06B 9/42 ^(2006.01) **E06B 9/78** ^(2006.01)

(21) Application number: **15150510.4**

(22) Date of filing: **08.01.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **08.01.2014 NL 1040592**

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(54) **Operating mechanism for a covering for an architectural opening**

(57) An operating mechanism (122) for a covering for an architectural opening is provided. The operating mechanism may include a housing including a stationary shaft (160), a spool (134) rotatably mounted on the shaft, an operating element (108) secured to the spool, and a slider (148) frictionally engaged with the operating ele-

ment. The slider may be operable to alter a rotational output direction of the operating mechanism based upon a pull direction of the operating element. The slider may move in unison with the operating element within a cavity (250) of the operating mechanism.

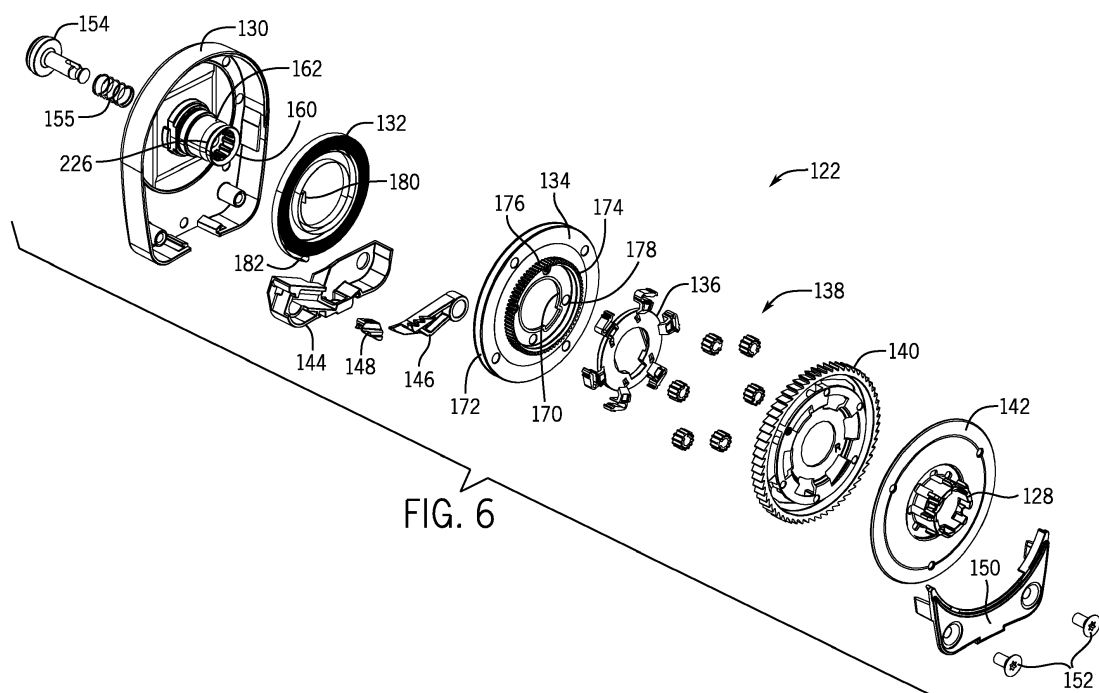


FIG. 6

Description

FIELD

[0001] The present disclosure relates generally to coverings for architectural openings, and more particularly to methods and apparatus for operating a covering for an architectural opening.

BACKGROUND

[0002] Coverings for architectural openings, such as windows, doors, archways, and the like, have taken numerous forms for many years. Some conventional coverings include a retractable shade portion that is movable between an extended position and a retracted position. In the extended position, the shade portion of the covering may be positioned across the opening. In the retracted position, the shade portion of the covering may be positioned adjacent one or more sides of the opening.

[0003] To move the shade portion of the covering between the extended and retracted positions, some coverings include a roller rotatably associated with a fixed end rail of the covering. Rotation of the roller in a first direction retracts the shade portion of the covering to a position adjacent one or more sides of the opening, and rotation of the roller in a second, opposite direction extends the shade portion across the opening. To rotate the roller, and thus move the shade portion of the covering, an operating mechanism may be operably coupled to the roller.

[0004] Some operating mechanisms include an operating element, such as a cord, configured to selectively rotate the roller tube based upon a pull direction of the operating element. For example, pulling the operating element straight downward may rotate the roller in a first direction, whereas pulling the operating element sideways may rotate the roller in an opposite direction. However, if the user changes the pull direction during a pull action (e.g., changing the angle of the operating element from straight downward to sideward or vice versa), the operating mechanism may switch rotation directions of the roller or become jammed, resulting in user frustration and possibly rendering the operating mechanism inoperable.

[0005] The present disclosure is at least partially directed to an operating mechanism that alleviates at least to a certain extent the aforementioned problem, addresses at least to a certain extent difficulties of prior operating mechanisms, and/or generally offers improvements or an alternative to existing operating mechanisms.

[0006] The following is a list of documents that may be related to the present disclosure in that the listed documents include various operating mechanisms: U.S. Patent No. 4646808, U.S. Patent No. 6129131, U.S. Patent No. 7128126, U.S. Patent No. 7380582, U.S. Patent No. 7578334, U.S. Patent No. 8186413, and U.S. Patent Publication No. 20090120593.

SUMMARY

[0007] Examples of the disclosure may include a covering for an architectural opening. The covering may include a roller, a shade, and an operating mechanism. The roller may be rotatable about a longitudinal axis in an extension direction and a retraction direction. The shade may be attached to the roller. The shade may be extended across the architectural opening when the roller rotates in the extension direction, and the shade may be retracted toward one of more sides of the architectural opening when the roller rotates in the retraction direction. The operating mechanism may be operably associated with the roller to rotate the roller in the extension direction or the retraction direction.

[0008] In some examples, the operating mechanism may include a stationary shaft, a spool rotatably mounted on the shaft, an operating element secured to the spool, and a slider frictionally secured to the operating element. The slider may be operable to alter a rotational output direction of the operating mechanism based upon a pull direction of the operating element. The slider may move in unison with the operating element within a cavity of the operating mechanism. The slider may ensure the operating mechanism does not become jammed or frustrated during a pulling action of the operating element, even when an operator changes the angle of the operating element from straight downward to sideward, or vice versa.

[0009] The slider may define an S-shaped passage through which the operating element is routed. The cavity may be defined at least partially by opposing abutment walls. Upon the slider contacting either one of the abutment walls, the operating element may move relative to the slider. A base plate may be attached to the stationary shaft. A lever may be pivotally mounted to the base plate, and the slider may be operable to pivot the lever. The slider may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction. The slider may be adapted to pivot the lever upwardly when the operating element is moved in a second direction that is different than the first direction. A planet holder may be rotatably mounted on the shaft, and the lever may be engageable with the planet holder to restrict rotation of the planet holder relative to the shaft. The lever may include teeth, the planet holder may include teeth, and, upon the slider pivoting the lever toward the planet holder, the teeth of the lever engage the teeth of the planet holder. The teeth of the lever and the teeth of the planet holder may be angled such that the lever remains engaged with the planet holder even when the slider is moved out of contact with the lever.

[0010] A plurality of planet gears may be rotatably mounted to the planet holder. A disc may be mounted onto the shaft and may include an engagement feature adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet holder. The engagement feature

may include an arm having a free end adapted to engage an external tooth of one planet gear of the plurality of planet gears. The disc may include one or more wire springs that engage an outer surface of the shaft to resist rotation of the disc relative to the shaft. The planet holder may include an abutment wall disposed angularly between the engagement feature of the disc and an adjacent planet gear. The lever and the disc may not simultaneously engage the planet holder and the one or more planet gears of the plurality of planet gears, respectively, during a downwardly pull action of the operating element. The spool may include an externally-toothed collar that meshingly engages the plurality of planet gears. The connector may include an internally-toothed ring gear that meshingly engages the plurality of planet gears. An axially-extending flange may be disposed outwardly of the shaft, and the flange may define a centrally-located, downwardly-opening through-hole that provides a central exit position for the operating element. A cord guide may be inset interiorly of the flange and formed of a harder material than the flange to resist wear from the operating element. A power spring may be operatively attached to the spool to wrap the operating element around the spool.

[0011] In some examples, the operating mechanism may include a housing including a stationary shaft, a spool rotatably mounted on the shaft, an operating element secured to the spool, a planet carrier rotatably mounted on the shaft and rotationally coupled to the spool, a lever pivotally mounted to the housing and engageable with the planet carrier to restrict rotation of the planet carrier relative to the shaft, and a lever actuator secured to the operating element and engageable with the lever to pivot the lever into engagement with the planet carrier. Once the lever is engaged with the planet carrier, the lever remains in engagement with the planet carrier even when the lever actuator is moved out of engagement with the lever. The engagement of the lever with the planet carrier may ensure the operating mechanism does not become jammed or frustrated during a pulling action of the operating element, even when an operator changes the angle of the operating cord from straight downward to sideward, as the lever remains in engagement with the planet carrier even when the lever actuator is moved out of engagement with the lever.

[0012] The planet carrier may include a plurality of external teeth, the lever may include one or more external teeth, and, upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever may engage the teeth of the planet carrier. The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet holder even when the lever actuator is disengaged from the lever. A plurality of planet gears may be rotatably supported by the planet carrier. A disc may be mounted onto the shaft and adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet carrier. The disc may include an arm having a free end adapted to engage an external

tooth of one planet gear of the plurality of planet gears. The planet carrier may include an abutment wall disposed angularly between the arm of the disc and an angularly-adjacent planet gear. The disc may include one or more wire springs that engage an outer surface of the shaft to resist rotation of the disc relative to the shaft. The operating mechanism may be configured such that the lever does not engage the planet carrier at the same time the disc engages the one or more planet gears of the plurality of planet gears. The spool may include external teeth that meshingly engage the plurality of planet gears. A connector may include an internally-toothed ring gear that meshingly engages the plurality of planet gears.

[0013] The housing may include a base plate and an axially-extending flange disposed outwardly of the shaft, and the flange may define a centrally-located, downwardly-opening through-hole that provides a central exit position for the operating element. A cord guide may be attached to the base plate and disposed inwardly of the flange. The cord guide may be formed of a harder material than the housing to resist wear from the operating element. The cord guide may define a cavity that receives the lever actuator and is larger than the lever actuator to permit movement of the lever actuator within the cavity. The cavity may be defined at least partially by opposing abutment walls. The operating element and the lever actuator may move together in unison when the lever actuator is not in contact with either one of the abutment walls. The operating element may move relative to the lever actuator when the lever actuator contacts either one of the abutment walls. The lever actuator may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction. The lever actuator may be adapted to pivot the lever toward the planet carrier when the operating element is moved in a second direction that is different than the first direction. A power spring may be operatively attached to the spool to wrap the operating element around the spool.

[0014] In some examples, the operating mechanism may include a stationary shaft, an externally-toothed collar rotatably mounted on the shaft, a planet carrier rotatably mounted on the shaft, an internally-toothed ring gear rotatably mounted on the shaft, a plurality of planet gears rotatably mounted to the planet carrier, a disc mounted on the shaft and adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet carrier, and a pivotable lever engageable with the planet carrier to restrict rotation of the planet carrier relative to the shaft. The plurality of planet gears disposed radially between, and meshingly engaged with, the collar and the ring gear. The operating mechanism may be configured such that the disc does not engage the one or more planet gears of the plurality of planet gears when the lever is engaged with the planet carrier. The disc may ensure the operating mechanism consistently rotates an output shaft of the operating mechanism in a common direction in response

to a specific pull action.

[0015] The disc may include an arm having a free end that is engageable with a planet gear of the plurality of planet gears. The planet carrier may include an abutment wall disposed angularly between the arm of the disc and an angularly-adjacent planet gear of the plurality of planet gears. The disc may include one or more wire springs that engage the shaft to resist rotation of the disc relative to the shaft.

[0016] The operating mechanism may include a spool rotatable in unison with the collar, an operating element secured to the spool, and a lever actuator secured to the operating element and engageable with the lever to pivot the lever into engagement with the planet carrier. The lever may include teeth, the planet carrier may include teeth, and, upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever engage the teeth of the planet carrier. The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet carrier even when the lever actuator is moved out of contact with the lever. The lever actuator may be frictionally secured to the operating element such that the lever actuator moves in unison with the operating element until the lever actuator contacts an abutment wall of the operating mechanism. The lever actuator may define an S-shaped slit through which the operating element is routed. A base plate may be attached to the shaft and a flange may extend axially from a periphery of the base plate. The flange may be disposed outwardly of the shaft. The flange may define a centrally-located, downwardly-opening through-hole that provides a central exit position for the operating element. A cord guide may be inset interiorly of the flange and may be formed of a harder material than the flange to resist wear from the operating element. A power spring may be operatively attached to the spool to wrap the operating element around the spool.

[0017] In some examples, the operating mechanism may include a stationary shaft, an externally-toothed collar rotatably mounted on the shaft, a planet carrier rotatably mounted on the shaft, an internally-toothed ring gear rotatably mounted on the shaft, planet gears rotatably mounted to the planet carrier, the planet gears disposed radially between, and meshingly engaged with, the collar and the ring gear, and a disc mounted on the shaft and adapted to engage one or more of the planet gears to restrict rotation of the planet gears relative to the planet carrier. The disc may ensure the operating mechanism consistently rotates an output shaft of the operating mechanism in a common direction in response to a specific pull action.

[0018] The disc may be biased to resist rotation of the disc relative to the shaft to maintain engagement of the disc with the one or more planet gears. The disc may include one or more wire springs that engage an outer surface of the shaft to resist rotation of the disc relative to the shaft. The one or more wire springs may include end portions that are attached to a body of the disc and

an intermediate portion that extends as a chord of an arcuate inner surface of the disc. The one or more springs may include a pair of wire springs that diametrically oppose one another about a longitudinal axis of the disc.

5 The pair of wire springs may act on opposing sides of the shaft to restrict the disc from rotating about the shaft. The disc may include an arm having a free end adapted to engage one of the planet gears. The planet carrier may include an abutment wall disposed angularly between the arm and one of the planet gears.

10 **[0019]** A pivotable lever may be engageable with the planet carrier to restrict rotation of the planet carrier. The operating mechanism may be configured such that the lever does not engage the planet carrier at the same time the disc engages the one or more planet gears. An operating element may be rotationally coupled to the collar, and a lever actuator may be frictionally secured to the operating element. The lever actuator may be operable to pivot the lever based upon a pull direction of the operating element. The lever actuator may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction. The lever actuator may be adapted to pivot the lever into engagement with the planet carrier when the operating element is moved in a second direction that is different than the first direction. The lever actuator may move in unison with the operating element within a cavity of the operating mechanism. The cavity may be defined at least partially by opposing abutment walls, and, upon the lever actuator contacting either one of the abutment walls, the operating element may move relative to the lever actuator.

25 **[0020]** The planet carrier may include a plurality of external teeth, the lever may include one or more external teeth, and, upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever may engage the teeth of the planet carrier. The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet carrier even when the lever actuator is disengaged from the lever.

30 **[0021]** In some examples, a method of operating a covering for an architectural opening is provided. The method may include pivoting a lever into engagement with a planet carrier by pulling an operating element downwardly in a first direction to raise a shade portion of the covering, and, after engagement of the lever with the planet carrier, continuing to pull the operating element downwardly but in a second direction that is different than the first direction to continue to raise the shade portion of the covering without interrupting the motion of the covering.

35 **[0022]** The method may further include moving a slider beneath the lever by pulling the operating element downwardly in the first direction. The method may further include moving the slider out of contact with the lever by pulling the operating element downwardly in the second direction. The method may further include maintaining the lever in engagement with the planet carrier after the slider is moved out of contact with the lever by providing

the lever and planet carrier with angled teeth that prevent the lever from pivoting away from the planet carrier. The method may further include sliding the operating element within an internal passage of the slider by continuing to pull the operating element downwardly after engagement of the lever with the planet carrier. The method may further include after reaching a desired position of the shade portion of the covering, allowing retraction of the operating element, and subsequent to the retraction of the operating element, pulling the operating element downwardly in the second direction to lower the shade portion without pivoting the lever into engagement with the planet carrier. The method may further include restricting rotation of a plurality of planet gears relative to the planet carrier during the lowering of the shade portion. The method may further include ensuring the lever does not engage the planet carrier during restriction of the rotation of a plurality of planet gears relative to the planet carrier.

[0023] This summary of the disclosure is given to aid understanding, and one of skill in the art will understand that each of the various aspects and features of the disclosure may advantageously be used separately in some instances, or in combination with other aspects and features of the disclosure in other instances. Accordingly, while the disclosure is presented in terms of examples, it should be appreciated that individual aspects of any example can be claimed separately or in combination with aspects and features of that example or any other example.

[0024] This summary is neither intended nor should it be construed as being representative of the full extent and scope of the present disclosure. The present disclosure is set forth in various levels of detail in this application and no limitation as to the scope of the claimed subject matter is intended by either the inclusion or non-inclusion of elements, components, or the like in this summary.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate examples of the disclosure and, together with the general description given above and the detailed description given below, serve to explain the principles of these examples.

FIG. 1 is an isometric view of a covering for an architectural opening in which an operating element is being pulled vertically downward to raise or retract a shade portion of the covering.

FIG. 2 is an isometric view of a covering for an architectural opening in which an operating element is being reeled in or retracted while a shade portion of the covering remains in a stationary position.

FIG. 3 is an isometric view of a covering for an architectural opening in which an operating element is being pulled diagonally or laterally downward to extend or lower a shade portion of the covering.

FIG. 4 is a lengthwise cross-section taken along line 4-4 of FIG. 2.

FIG. 5 is a front isometric view of an example operating mechanism.

FIG. 6 is a partially-exploded, front isometric view of the operating mechanism of FIG. 5.

FIG. 7 is a partially-exploded, rear isometric view of the operating mechanism of FIG. 5.

FIG. 8 is a front elevation view of a housing of the operating mechanism of FIG. 5.

FIG. 9 is a front, isometric view of a blocking disc of the operating mechanism of FIG. 5.

FIG. 10 is a rear elevation view of the blocking disc of FIG. 9.

FIG. 11 is a front elevation view of a planet holder of the operating mechanism of FIG. 5.

FIG. 12 is a rear elevation view of the planet holder of FIG. 11.

FIG. 13 is a front elevation view of a connector of the operating mechanism of FIG. 5.

FIG. 14 is a rear elevation view of the connector of FIG. 13.

FIG. 15 is a front isometric view of a cord guide of the operating mechanism of FIG. 5.

FIG. 16 is a front elevation view of the cord guide of FIG. 15.

FIG. 17 is a front isometric view of a control lever of the operating mechanism of FIG. 5.

FIG. 18 is a rear isometric view of the control lever of FIG. 17.

FIG. 19 is a front isometric view of a lever actuator arranged on an operating element of the operating mechanism of FIG. 5.

FIG. 20 is a cross-sectional view of the lever actuator and operating element of FIG. 19 taken along line 20-20 of FIG. 19.

FIG. 21 is a front elevation view of the operating mechanism of FIG. 5.

FIG. 22 is a side elevation view of the operating mechanism of FIG. 5.

FIG. 23 is a cross-section view of the operating mechanism of FIG. 5 taken along line 23-23 of FIG. 22.

FIG. 24 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 21 with the lever actuator of FIG. 19 in a first position within the cord guide of FIG. 15 in which the lever actuator is laterally aligned with the control lever of FIG. 17.

FIG. 25 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 21 with the lever actuator of FIG. 19 in a second position within the cord guide of FIG. 15 in which the lever actuator is laterally offset from the control lever of FIG. 17.

FIG. 26 is a cross-section view of the operating mechanism of FIG. 5 taken along line 26-26 of FIG. 22.

FIG. 27 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 22 and illustrates the motion of the lever actuator of FIG. 19 and the lever of FIG. 17 when the operating element is pulled downwardly as shown in FIG. 1.

FIG. 28 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 22 and illustrates the rotational motion of a sun gear, planet gears, and a ring gear when the operating element is pulled downwardly after engagement of the lever of FIG. 17 with the planet holder of FIG. 11. FIG. 29 is a cross-section view of the operating mechanism of FIG. 5 taken along line 29-29 of FIG. 28.

FIG. 30 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 22 and illustrates the rotational motion of a sun gear, a planet holder, a ring gear, and a planet-gear-engagement member when the operating element is pulled downwardly as shown in FIG. 3.

FIG. 31 is a cross-section view of the operating mechanism of FIG. 5 taken along line 24-24 of FIG. 22 and illustrates the rotational motion of a sun gear, a planet holder, and a planet-gear-engagement member when the operating element is being retracted as shown in FIG. 2.

FIG. 32 is a cross-section view of the operating mechanism of FIG. 5 taken along line 32-32 of FIG. 21.

DETAILED DESCRIPTION

[0026] The present disclosure provides an operating mechanism for a covering for an architectural opening. The operating mechanism may be a self-contained module associated with an end of a roller. The operating mechanism may utilize a single operating element, such as a cord or ball chain, and may convert linear motion of the operating element into rotational motion for rotating the roller, resulting in retraction or extension of a shade portion of the covering depending upon a pull direction of the operating element. A pull force imparted on the operating element in a first pull direction may cause the roller to rotate in a first direction, and a pull force imparted on the operating element in a second pull direction may cause the roller to rotate in a second direction. In some implementations, a downward motion of the operating element retracts the shade portion of the covering toward one or more sides of the architectural opening, while a lateral or transverse motion of the operating element across a face of the shade portion of the covering extends the shade portion across the architectural opening.

[0027] The operating mechanism may include a lever that is operated by a lever actuator to change the output direction of the operating mechanism. The lever actuator may move in unison (e.g., laterally and longitudinally) with an operating element through friction. The friction may be created by routing the operating element through

an S-shaped slit in the lever actuator. Pulling the operating element straight downward may cause the lever actuator to contact the lever and move the lever into engagement with a member of a planetary gear set, resulting in rotation of a roller in a first direction. Pulling the operating element sideways may cause the lever actuator to slide alongside the lever without actuating the lever, resulting in rotation of the roller in a second, opposite direction.

[0028] During a downward pulling action, an operator may change the angle of the operating element from straight downward to sideward, or vice versa, without jamming the operating mechanism or frustrating the operation of the covering, such as switching rotation directions of a roller of the covering, due at least in part to the design of the lever and the lever actuator. When an operator pulls the operating element downwardly in a first direction (such as straight downward) a short distance, such as less than one centimeter, the lever actuator may move the lever into engagement with a member of the planetary gear set, resulting in rotation of the roller in a first rotational direction. Upon engagement of the lever with the member of the planetary gear set, the operator may continue to pull the operating element downwardly in a vertical, substantially vertical, sideward, or any other downwardly direction without affecting the rotation direction of an output shaft of the operating mechanism. In some implementations, the member of the planetary gear and the lever include corresponding teeth that are engaged with one another upon actuation of the lever by the lever actuator. The teeth of the lever and of the member of the planetary gear set may be angled such that the lever remains engaged with the member of the planetary gear set even when the lever actuator is disengaged from the lever.

[0029] When an operator pulls the operating element downwardly in a second direction (such as diagonally or laterally) a short distance, such as less than one centimeter, the lever actuator may be moved alongside the lever without actuating the lever, resulting in rotation of the roller in a second rotational direction that is opposite the first rotational direction. Once the lever actuator is positioned alongside the lever, the operator may continue to pull the operating element downwardly in a vertical, substantially vertical, sideward, or any other downwardly direction without affecting the rotation direction of an output shaft of the operating mechanism. In some implementations, the lever actuator may not be able to actuate the lever into engagement with the member of the planetary gear set when the lever actuator is positioned alongside the lever. When the lever actuator is positioned alongside the lever and the lever is in a disengaged position, a disc of the operating mechanism may engage a member of the planetary gear set to ensure the operating mechanism rotates the roller in the second rotational direction. In some implementations, the lever and the disc are not simultaneously engaged with different members of the planetary gear set, which may result in jamming of the

operating mechanism.

[0030] Referring to FIGS. 1 through 3, a covering 100 for an architectural opening is provided. The covering 100 may include a head rail 102, a shade portion 104 extending from the head rail 102, and a ballast bar 106 extending horizontally along a lower edge of the shade portion 104 to maintain the shade portion 104 in a taut condition. The head rail 102 may include two opposing end caps 106, which may enclose the ends of the head rail 102 to provide a finished appearance. The shade portion 104 may be formed as a single panel, which may be constructed of continuous lengths of material or may be constructed of strips of material attached or joined together in an edge-to-edge, overlapping, or other suitable relationship. The shade portion 104 may be constructed of substantially any type of material. For example, the shade portion 104 may be constructed from natural and/or synthetic materials, including fabrics, polymers, and/or other suitable materials. Fabric materials may include woven, non-woven, knits, or other suitable fabric types.

[0031] To retract or lift the shade portion 104, an operator may pull downward on an operating element 108 with vertical or substantially vertical, reciprocating or repeating strokes. As shown in FIG. 1, upon downward movement of the operating element 108 (represented by the arrow 110), the shade portion 104 may be retracted, raised, or lifted (represented by the arrow 112). Upon reaching the bottom of the downward stroke of the operating element 108, an operator may release or resistively raise the operating element 108 and the operating element 108 may be automatically retracted or reeled in (represented by the arrow 114 in FIG. 2) for repeated actuation. As the operating element 108 is retracted, a brake element or mechanism (such as one or more wrap springs) operatively associated with the roller 120 may maintain or hold the shade portion 104 in its newly raised position. Once the operating element 108 is retracted a distance above the bottom of the stroke, an operator may pull downward on the operating element 108 in a second stroke to further retract the shade portion 104. This reciprocating process may be repeated until the shade portion 104 is retracted to a desired position.

[0032] To extend or lower the shade portion 104, an operator may pull the operating element 108 in a diagonal or lateral direction across the face of the shade portion 104. As shown in FIG. 3, upon diagonal or lateral movement of the operating element 108 (represented by the arrow 116), the shade portion 104 may be extended or lowered (represented by the arrow 118). Upon reaching the bottom of the downward stroke of the operating element 108, an operator may release or resistively raise the operating element 108 and the operating element 108 may be automatically retracted or reeled in (represented by the arrow 114 in FIG. 2) for repeated actuation. As the operating element 108 is retracted, a brake element or mechanism operatively associated with the roller 120 may maintain or hold the shade portion 104 in its

newly lowered position. Once the operating element 108 is retracted a distance above the bottom of the stroke, an operator may pull diagonally or laterally on the operating element 108 in a second stroke to further lower the shade portion 104. This reciprocating process may be repeated until the shade portion 104 is lowered to a desired position.

[0033] The vertical stroke of the operating element 108 may vary in different implementations of the operating mechanism. Additionally or alternatively, the ratio of the retraction of the shade portion 104 to the stroke of the operating element 108 may vary depending on the specific implementation of the operating mechanism. The operating element 108 may be a cord, ball chain, or other suitable device. The operating element 108 may have a tassel coupled to a free end of the operating element 108 to facilitate grasping of the operating element 108.

[0034] FIG. 4 is a lengthwise cross-section taken along line 4-4 of FIG. 2 and illustrates a roller 120 concealed within the head rail 102. The roller 120 may be formed in various shapes, including a tube such as the approximately cylindrical tube as shown in FIG. 4. The roller 120 may extend between the opposing end caps 106 and may be rotatably coupled to the head rail 102.

[0035] Referring still to FIG. 4, the shade portion 104 may be attached to a roller 120 so that rotational movement of the roller 120 about a longitudinally-extending axis moves the shade portion 104 between extended and retracted positions. The vertical or substantially vertical downward movement of the operating element 108 (see FIG. 1) may rotate the roller 120 in a first rotational direction to retract the shade portion 104 to a position adjacent one or more sides of an associated architectural opening. The diagonal or lateral downward movement of the operating element 108 (see FIG. 3) may rotate the roller 120 in a second, opposite rotational direction to extend the shade portion 104 across the opening. The shade portion 104 may be wrappable about the roller 120, as shown in FIG. 4, so that the shade portion 104 wraps around or unwraps from the roller 120 depending upon the rotation direction of the roller 120. In these implementations, the covering 100 may be referred to as a roller blind or shade. In some implementations, the shade portion 104 is wrapped about or unwrapped from a rear side of the roller 120, with the rear side of the roller 120 positioned intermediate the front side of the roller 120 and a street side of an associated architectural opening.

[0036] To actuate movement of the roller 120, and thus the shade portion 104 of the covering 100, an operating mechanism 122 may be operably associated with an end 124 of the roller 120. An output assembly 126 may be operatively engaged with an output shaft 128 of the operating mechanism 122 to transfer rotation of the output shaft 128 to the roller 120. The output assembly 126 may include a brake element or mechanism to maintain the shade portion 104 of the covering in a desired position. The brake element may inhibit or prevent the shade portion 104 of the covering 100 from extending across the

architectural opening during retraction of the operating element 108 into the operating mechanism 122.

[0037] FIG. 5 is an isometric view of the operating mechanism 122. The operating mechanism 122 may receive an input force from an operator via the operating element 108 and may deliver an output force to the roller 120 via the output shaft 128. The operating mechanism 122 may convert a downward pull motion of the operating element 108 into a rotational motion of the output shaft 128, thereby allowing an operator of the covering 100 to rotate the roller 120, and thus move the shade portion 104, by manipulating the operating element 108. The operating mechanism 122 may be assembled as a single, modular unit that couples to one end of the head rail 102 and supports an associated end 124 of the roller 120. The operating mechanism 122 may be pre-assembled and thus simplify on-site assembly of the covering 100. The operating mechanism 122 may be referred to as an operating module, system, or unit.

[0038] FIGS. 6 and 7 are exploded, isometric views of the operating mechanism 122. The operating mechanism 122 may include a housing 130, a clock or power spring 132, a spring housing or spool 134, a spider or blocking disc 136, a set of planet gears 138, a planet carrier or planet holder 140, a connector 142, a support element or cord guide 144, a shift arm or control lever 146, a lever actuator, slider, or wedge 148, a cover plate 150, one or more fasteners 152, a safety plug 154, and a spring 155. Although not depicted in FIGS. 6 and 7, the operating mechanism 122 may include the operating element 108. The spool 134, the disc 136, the planet holder 140, and the connector 142 may be aligned along a common axis, which may be co-axial with a central axis of the roller 120.

[0039] Referring to FIGS. 6 through 8, the housing 130 may provide a foundation for the remaining components of the operating mechanism 122. The housing 130 may include a base plate 156, a flange 158 extending axially from a periphery of the base plate 156, and an axially-extending stub shaft 160 located inwardly of the periphery of the base plate 156 and of the axially-extending flange 158. The stub shaft 160 may be stationary during operation of the operating mechanism 122. With reference to FIG. 8, the stub shaft 160 may include a tiered or cascading outer surface 162. A first tier 162a may define the largest outer diameter of the outer surface 162 and may support the spool 134. A transverse chord or cut may be formed in the first tier 162a to define an anchor 164. A second tier 162b of the outer surface 162 may have a smaller outer diameter than the first tier 162a. The second tier 162b may support the disc 136. A third tier 162c of the outer surface 162 may have a smaller diameter than the second tier 162b. The third tier 162c may support the planet holder 140. A fourth tier 162d of the outer surface 162 may have a smaller diameter than the third tier 162c. The fourth tier 162d may support the connector 142.

[0040] With continued reference to FIG. 8, the housing

130 may include a pair of bosses 166a, 166b attached to and protruding axially from the base plate 156. The bosses 166a, 166b may be located below the stub shaft 160 and spaced laterally apart from one another so as to be symmetrically positioned about a vertical plane that bisects the housing 130. The bosses 166a, 166b may be internally threaded. Opposing end portions of the flange 158 may extend beneath the bosses 166a, 166b and define a downwardly-opening mouth 168 disposed beneath the stub shaft 160 and equidistant between the bosses 166a, 166b.

[0041] Referring to FIGS. 6 and 7, the spool 134 may convert a pull force applied to the operating element 108 to a rotational force. The spool 134 may be rotatably mounted onto the stub shaft 160 of the housing 130. The spool 134 may include an arcuate inner surface 170 with corresponding dimensions to the first tier 162a of the outer surface 162 of the stub shaft 160 such that the inner surface 170 rotatably bears against the first tier 162a when the spool 134 is mounted onto the stub shaft 160.

[0042] The spool 134 may define an annular groove 172 configured to receive the operating element 108. Although not depicted in FIGS. 6 and 7, the operating element 108 may be wound around the spool 134 and disposed within the groove 172, which may be formed to receive various lengths of the operating element 108. To couple the operating element 108 to the spool 134, one end of the operating element 108 may be routed through a slot formed in a side wall that defines the groove 172 and knotted or otherwise secured to the spool 134. The opposing end of the operating element 108 may be disposed beneath the operating mechanism 122 for manipulation by an operator.

[0043] The spool 134, as shown in FIG. 6, may include an annular collar 174 extending axially from a front face of the spool 134. The collar 174 may include external teeth 176 and a cylindrical or substantially cylindrical inner surface 178. The inner surface 178 may be spaced radially outward of the second tier 162b of the stub shaft 160 of the housing 130 and define an annular space therebetween. As shown in FIG. 7, a rear face of the spool 134 may define a cavity to receive the power spring 132.

[0044] The power spring 132, as shown in FIGS. 6 and 7, may be configured to provide a retraction force to the operating element. The power spring 132 may be contained between the base plate 156 of the housing 130 and the spool 134 when the operating mechanism 122 is assembled. The power spring 132 may include a number of windings extending between an inner end portion 180 and an outer end portion 182. The inner and outer end portions 180, 182 each may be folded over to form an inner and outer hook, respectively, so that when the operating mechanism 122 is assembled, the inner end portion 180 engages the anchor 164 of the housing 130 and the outer end portion 182 engages an anchor 184 of the spool 134. In this configuration, when viewing the stub shaft 160 of the housing 130, a counterclockwise rotation of the spool 134 relative to the housing 130 ra-

dially contracts the windings of the power spring 132 to create a clockwise biasing force, resulting in a spool retraction force. The operating element 108, the power spring 132, and the spool 134 may form a drive mechanism of the operating mechanism 122.

[0045] Referring to FIGS. 6, 7, 9, and 10, the blocking disc 136 may be configured to restrict or prevent spinning of the planet gears 138 about their respective rotation axes. The spool 134, the planet holder 140, and the connector 142 may rotate in unison about the stub shaft 160 of the housing 130 when the disc 136 is engaged with one or more planet gears 138. The disc 136 may be rotatably mounted onto the stub shaft 160 of the housing 130. The disc 136 may include a ring-shaped body 186 having an arcuate inner surface 188 and an arcuate outer surface 190. The arcuate inner surface 188 may rotatably bear against the second tier 162b of the stub shaft 160 when the disc 136 is mounted onto the shaft 160. The arcuate outer surface 190, which may be cylindrical, may rotatably bear against the inner surface 178 of the collar 174 of the spool 134 when the disc 136 is mounted onto the stub shaft 160.

[0046] The blocking disc 136 may include a rotation-resistance feature 192 that resists rotation of the disc 136 about the stub shaft 160 until a sufficient rotational force is applied to the disc 136. Referring to FIG. 10, the disc 136 may include one or more resilient rods or wire springs 194a, 194b that frictionally engages the outer surface 162 of the stub shaft 160. The one or more wire springs 194a, 194b may include opposing end portions that are attached to the body 186 of the disc 136 and an intermediate portion that extends as a chord of the arcuate inner surface 188 of the disc 136. As shown in FIG. 10, the disc 136 may include a pair of wire springs 194a, 194b that diametrically oppose one another about a longitudinal axis of the disc 136. The wire springs 194a, 194b may act on opposing sides of the stub shaft 160 of the housing 130 to restrict or prevent the disc 136 from rotating too easily about the shaft 160, which may dislodge arms of the disc 136 from a locking position with the planet gears 138. In some implementations, more or less than two wire springs may be provided. For example, one wire spring may be provided. Alternatively, the disc 136 may be snugly fit onto the stub shaft 160 and/or include a friction-enhanced surface to increase the coefficient of friction between the disc 136 and the stub shaft 160, thereby resisting rotation of the disc 136 about the shaft 160.

[0047] The blocking disc 136 may include an engagement feature 196 that engages the planet gears 138, the connector 142, or both to restrict or prevent rotation or spinning of the planet gears 138 relative to the planet holder 140. Referring to FIGS. 9 and 10, the disc 136 may include one or more arms 198 disposed radially outward of the outer surface 190 of the body 186 of the disc 136 and defining an annular space between the one or more arms 198 and the outer surface 190. The annular space may be configured to receive the annular collar

174 of the spool 134. Each arm 198 may be disposed in a tangential orientation relative to the outer surface 190 and may include an angled free end 200 adapted to engage the external teeth 201 of a planet gear 138. The free end 200 of each arm 198 may be disposed radially outwardly of the spinning axes of the planet gears 138. An outer surface of each arm 198 may include one or more external teeth 202 adapted to engage an internal tooth of the connector 142. Each arm 198 may include a shoulder 204 at an opposing end of the arm 198 relative to the free end 200. The shoulder 204 may function as a living hinge and permit movement of the free end 200 of the arm 198 in an arcuate path.

[0048] Referring to FIGS. 6, 7, 11, and 12, the planet holder 140 may be rotationally mounted onto the stub shaft 160 of the housing 130. The planet holder 140 may include an arcuate inner surface 206 with corresponding dimensions to the third tier 162c of the outer surface 162 of the stub shaft 160. The inner surface 206 of the planet holder 140 may rotatably bear against the third tier 162c when the planet holder 140 is mounted onto the stub shaft 160. The planet holder 140 may include a plurality of axially-extending pins 208 disposed at a common radius from and angularly spaced about a longitudinal axis of the planet holder 140. The pins 208 may serve as central axles of the planet gears 138 and may support the planet gears 138.

[0049] The planet holder 140 may include an abutment feature to engage and rotationally drive the blocking disc 136 about the stub shaft 160 of the housing 130 when the spool 134 is retracting or reeling in the operating element 108. The planet holder 140 may include an abutment wall 210 disposed angularly adjacent each pin 208. The abutment walls 210 may be angularly spaced from the pins 208 by a distance that is larger than the radius of the planet gears 138 so as to not interfere with the rotation of the planet gears 138 about the pins 208. During retraction of the operating element 108 about the spool 134, the abutment walls 210 may contact the shoulders 204 of the arms 198 of the blocking disc 136 and rotationally drive the blocking disc 136 about the stub shaft 160 of the housing 130.

[0050] The planet holder 140 may include an external engagement feature 212 to restrict or prevent the planet holder 140 from rotating about the stub shaft 160 of the housing 130. As shown in FIGS. 11 and 12, the planet holder 140 may include an annular sleeve 214 disposed radially outwardly of the pins 208. The annular sleeve 214 may define an annular space 218 between an arcuate inner surface 216 of the sleeve 214 and the pins 208. The sleeve 214 may include external teeth 220 extending circumferentially around the sleeve 214.

[0051] Referring to FIGS. 6, 7, 13, and 14, the connector 142 may transfer the rotational movement of the operating mechanism 122 to the roller 120. The connector 142 may be rotationally mounted onto the stub shaft 160 of the housing 130. The connector 142 may include an arcuate inner surface 222 with corresponding dimen-

sions to the fourth tier 162d of the outer surface 162 of the stub shaft 160. The inner surface 222 may rotatably bear against the fourth tier 162c when the connector 142 is mounted onto the stub shaft 160. The connector 142 may include one or more protrusions 224 extending radially inwardly from the inner surface 222. The protrusions 224 may be disposed within an annular groove 226 formed in the fourth tier 162c of the stub shaft 160 to axially secure the connector 142 to the housing 130, thereby axially securing the spool 134, the blocking disc 136, and the planet holder 140 to the stub shaft 160 of the housing 130.

[0052] The connector 142 may meshingly engage the planet gears 138 to transfer rotation between the planet holder 140 and the connector 142. The connector 142 may include an axially-extending ring gear 228 having internal teeth 230 and an arcuate outer surface 232. The internal teeth 230 of ring gear 228 may meshingly engage the external teeth 220 of the planet gears 138. The ring gear 228 may be disposed in the annular space 218 defined by the planet holder 140.

[0053] The connector 142 may be engaged with the output assembly 126 to transfer rotation between the operating mechanism 122 and the roller 120. The connector 142 may include an axially-extending output shaft 128. The output shaft 128 may include axially-extending, radially-projecting ribs 234 that engage corresponding features of the output assembly 126 so that the output shaft 128 and the corresponding features of the output assembly 126 rotate in unison with one another.

[0054] Referring to FIGS. 6 and 7, the safety plug 154 may be disposed within an inner bore of the stub shaft 160 of the housing 130. A head portion of the safety plug 154 may abut against a shoulder of the inner bore of the stub shaft 160 to axially locate the safety plug 154 within the inner bore. A shaft portion of the safety plug 154 may extend axially from the head portion and may be at least partially disposed radially inwardly of the output shaft 128 of the connector 142. The shaft portion of the safety plug 154 may define a transverse passage configured to interface with a locking member, which may be associated with the output assembly 126. The helical spring 155 may be disposed about the shaft portion of the safety plug 154 and located between the head portion of the safety plug 154 and an inner wall of the housing 130.

[0055] Referring to FIGS. 6, 7, 15, and 16, the cord guide 144 may be secured to a lower portion of the housing 130. The cord guide 144 may include a base plate 236 and a flange 238 extending axially from a periphery of the base plate 236. The base plate 236 may define a pair of apertures 240 that receive the bosses 166a, 166b to locate the cord guide 144 relative to the housing 130. An outer surface of the flange 238 of the cord guide 144 may abut against an inner surface of the flange 158 of the housing 130.

[0056] The cord guide 144 may include a first inclined wall 242 that extends from a lower abutment wall 244 and terminates at the aperture 240 that receives the boss

266a. The lower abutment wall 244 may be disposed adjacent a centrally-located through-hole 246 configured to receive operating element 108. A second inclined wall 248 may be spaced above the first inclined wall 242 and may extend parallel or substantially parallel to the first inclined wall 242 to at least partially define a first cavity 250 adapted to receive the lever actuator 148. The cord guide 144 may define a second cavity 252 adapted to receive the control lever 146. The first and second cavities 250, 252 may be disposed on opposing sides of the centrally-located through-hole 246.

[0057] The centrally-located through-hole 246 may provide a central exit position of the operating element 108 in the operating mechanism 122. As such, the operating mechanism 122 may be easily interchanged between a left hand side and a right hand side of the covering 100. Many of the components of the operating mechanism 122 may be left and right hand compatible, thereby allowing a left and right hand version to be realized with a minimum number of different parts. For example, in some examples, separate left and right hand versions of the blocking disc 136, the planet holder 140 (to reverse the orientation of the external teeth 220), the control lever 146 (to reverse the orientation of the teeth), and the cord guide 144 are provided.

[0058] The cord guide 144 may be formed as a separate part from the housing 130 so that the cord guide 144 may be made of different material than the housing 130. The cord guide 144 may be made from a harder plastic material than the housing 130 to minimize friction between the cord guide 144 and the operating element 108. The harder plastic material may be more wear resistant than the housing 130 and may resist wear at the entry and exit of the operating element 108 into and from the cord guide 144, where a sharp bend (which may be about 90 degrees) may cause strong contact forces between the operating element 108 and the cord guide 144.

[0059] Referring to FIGS. 6, 7, 17, and 18, the control lever 146 may be configured to engage the planet holder 140 to restrict or prevent rotation of the planet holder 140 about the stub shaft 160 of the housing 130. The control lever 146 may include an axially-extending collar 254 and a lateral extension 256 extending laterally from an outer surface of the collar 254. The collar 254 may be cylindrical and may define an inner bore adapted to receive one of the bosses 166b of the housing 130. The lateral extension 256 may extend from the collar 254 at a transverse angle relative to a longitudinal axis of the collar. The lateral extension 256 may include a contact surface 258 defined along a lower edge of the lateral extension 256. The contact surface 258 may include a first contact surface 158a configured to interface with the lever actuator 148 and a second contact surface 158b configured to interface with the cord guide 144. The lateral extension 256 may include a series of teeth 260 defined along an upper edge of the lateral extension 256. The teeth 260 may be configured to meshingly engage the external teeth 220 of the planet holder 140 to prevent or restrict rotation of the planet

holder 140 upon engagement with the control lever 146.

[0060] Referring to FIGS. 6, 7, 19, and 20, the lever actuator 148 may be configured to pivot the control lever 146 about the boss 166b to engage the teeth 260 of the control lever 146 with the teeth 220 of the planet holder 140. The lever actuator 148 may include opposing first and second end faces 262, 264 extending laterally between upper and lower contact surfaces 266, 268. The lever actuator 148 may include a cam surface 265 extending at an angle between the upper contact surface 268 and the second end face 264. The lever actuator 148 may define a slit or passage 270 disposed between the upper and lower contact surface 266, 268. The slit or passage 270 may open through the first and second end faces 262, 264. The passage 270 may accommodate the operating element 108. The passage 270 may be S-shaped such that two or more internal surfaces 272 contact opposing sides of the operating element 108 to frictionally secure the lever actuator 148 onto the operating element 108.

[0061] Referring to FIGS. 5, 6, and 7, the cover plate 150 may be secured to the housing 130 to enclose the first and second cavities 250, 253 of the cord guide 144. The cover plate 150 may abut against a lower portion of the peripheral flange 158 of the housing 130 and may define apertures that are alignable with the bosses 166 of the housing 130. The cover plate 150 may be removably secured to the housing 130 with fasteners 152 that extend through the apertures of the cover plate 150 and engage the bosses 166.

[0062] Referring to FIG. 23, a cross section of the operating mechanism 122 taken along line 23-23 of FIG. 22 is provided. As shown in FIG. 23, the control lever 146 may be disposed within the second cavity 250 of the cord guide 144. The control lever 146 may be pivotally mounted to the housing 130. As shown in FIG. 23, the collar 254 of the control lever 146 may be mounted onto the boss 166b of the housing 130 such that an inner surface of the collar 254 rotatably bears against an outer surface of the boss 166b. The lateral extension 256 of the control lever 146 may extend beneath the annular sleeve 214 of the planet holder 140 and may be directed toward the lever actuator 148. A distal tip of the first contact surface 258a of the lateral extension 256 may confront a cam surface 265 of the lever actuator 148. The weight of the lateral extension 256 may pivot the control lever 146 about the boss 166b until the second contact surface 158b abuts against the flange 238 of the cord guide 144. In this disengaged position, the teeth 260 of the control lever 146 may be spaced radially outwardly of the teeth 220 of the planet holder 140 so as to not interfere with the rotation of the planet holder 140.

[0063] Referring still to FIG. 23, the slider or lever actuator 148 may be slidably disposed within the first cavity 250 of the cord guide 144. The height of the lever actuator 148 (defined by the distance between the upper and lower contact surfaces 266, 268) may be substantially congruent with the height of the first cavity 250 (defined by

the distance between the first and second inclined walls 242, 248). The length of the lever actuator 148 (defined by the distance between the first and second end faces 262, 264) may be smaller than the length of the first cavity 250 (defined by the distance between the lower and upper abutment walls 244, 274) so that the lever actuator 148 is moveable within the first cavity 250 in a longitudinal direction of the operating element 108. The width of the lever actuator 148 may be smaller than the width of the first cavity 250 (defined by the distance between the base plate 236 of the cord guide 144 and the cover plate 150) so that the lever actuator 148 is moveable within the first cavity 250 in a transverse direction relative to the longitudinal direction of the operating element 108.

[0064] Referring to FIGS. 24 and 25, cross-section views of the operating mechanism 122 are provided with the lever actuator 148 in different lateral positions within the cord guide 144. As shown in FIGS. 24 and 25, the lever 146 may occupy only a portion of the width of the cavity 250. Referring to FIG. 24, the lever actuator 148 is laterally aligned with the control lever 146 such that the cam surface 265 of the lever actuator 148 confronts a tip of the first contact surface 258a of the lever 146 (see FIG. 23). To maintain the lever actuator 148 in the lateral position depicted in FIG. 24, an operator may pull the operating element 108 downwardly in a vertical or substantially vertical direction (see FIG. 1). In this alignment, when an operator pulls the operating element 108 downwardly in the vertical or substantially vertical direction, the lever actuator 148 moves in unison with the operating element 108 due to the frictional engagement of the lever actuator 148 to the operating element 108. The lever actuator 148 may slide downwardly along the first and second inclined walls 242, 248 of the cord guide 144 until the first end face 262 of the lever actuator 148 abuts against the lower abutment wall 244 of the cord guide 144, at which point the operating element 108 slides within the passage 270 of the lever actuator 148. As the lever actuator 148 is pulled downwardly along the first inclined wall 242, the first contact surface 258a of the control lever 146 may ride upwardly along the cam surface 265 of the lever actuator 148 until the teeth 260 of the control lever 146 engage the teeth 220 of the planet holder 140.

[0065] Upon engagement of the teeth 260 of the control lever 146 with the teeth 220 of the planet holder 140, an operator may move the operating element 108 in a sideways direction (see FIG. 3) during the downward motion of the operating element 108 without affecting the engagement of the lever 146 and the planet holder 140. That is, the control lever 146 may remain in engagement with the planet holder 140 regardless of whether the lever actuator 148 remains in contact with the control lever 146. The angle of the teeth 220, 260 of the planet holder 140 and the lever 146, respectively, may ensure that once engaged with one another, the lever 146 does not dislodge from the planet holder 140 due to gravity, even when the lever 146 is no longer blocked from pivoting downwardly by the lever actuator 148, thereby facilitating

smooth, reliable, and/or robust operation of the operating mechanism 122 during a continuous downward pull motion, without inadvertent switching of the rotation direction or jamming of the operating mechanism 122.

[0066] Upon the operator of the operating mechanism 122 releasing or resistively raising the operating element 108 (see FIG. 2), the rotationally-biased spool 134 may reel in or retract the operating element 108. During the retraction of the operating element 108, the lever actuator 148 may move in unison with the operating element 108 due to the frictional engagement of the lever actuator 148 to the operating element 108. The lever actuator 148 may slide upwardly along the first and second inclined walls 242, 248 of the cord guide 144 until the second end face 264 of the lever actuator 148 abuts against the upper abutment wall 274 of the cord guide 144, at which point the operating element 108 slides within the passage 270 of the lever actuator 148. As the lever actuator 148 is pulled upwardly within the first cavity 250 of the cord guide 144, the planet holder 140 rotates in a retraction direction and allows the teeth 260 of the control lever 146 to disengage from the teeth 220 of the planet holder 140, thereby permitting the control lever 146 to pivot downwardly about the boss 166b so that the control lever 146 does not interfere with continued rotation of the planet holder 140. During the disengagement of the teeth 260 of the control lever 146 and the teeth 220 of the planet holder 140, the lever actuator 148 may move in unison with the operating element 108 within the first cavity 150 and thus may be moved to a position within the cavity 150 that does not obstruct the downwardly pivoting motion of the control lever 146.

[0067] Referring to FIG. 25, the lever actuator 148 is laterally offset from the control lever 146. To locate the lever actuator 148 in the position depicted in FIG. 25, an operator may pull the operating element 108 sideways (see FIG. 3) to move the operating element 108 laterally within the through-hole 246 of the cord guide 144 and thus move the operating element 108 laterally within the first cavity 250 of the cord guide 144. As the lever actuator 148 moves in unison with the operating element 108 due to the frictional engagement of the lever actuator 148 to the operating element 108, the lateral movement of the operating element 108 within the first cavity 250 may laterally offset the lever actuator 148 from the lever 146. Once in the offset position, the lever actuator 148 may be pulled downwardly within the first cavity 250 of the cord guide 144 alongside the control lever 146, thereby bypassing the control lever 146 without pivoting the control lever 146 into engagement with the planet holder 140. The lever actuator 148 may move in unison with the operating element 108 until the first end face 262 of the lever actuator 148 abuts against the lower abutment wall 244 of the cord guide 144, at which point the operating element 108 slides within the passage 270 of the lever actuator 148. Once positioned alongside the lever 146, the lever actuator 148 may not be able to pivot the lever 146 into engagement with the planet holder 140. As such,

the operator may continue to pull the operating element downwardly in a vertical, substantially vertical, sideward, or any other downwardly direction without affecting the rotation direction of the output shaft 128 of the operating mechanism 122.

[0068] Upon the operator of the operating mechanism 122 releasing or resistively raising the operating element 108 (see FIG. 2), the rotationally-biased spool 134 may reel in or retract the operating element 108. During the retraction of the operating element 108, the lever actuator 148 may move in tandem with the operating element 108 due to the frictional engagement of the lever actuator 148 to the operating element 108. The lever actuator 148 may slide upwardly along the first and second inclined walls 242, 248 of the cord guide 144 until the second end face 264 of the lever actuator 148 abuts against the upper abutment wall 274 of the cord guide 144, at which point the operating element 108 slides within the passage 270 of the lever actuator 148. As the lever actuator 148 is pulled upwardly within the first cavity 250 of the cord guide 144, the lever actuator 148 moves alongside the control lever 146.

[0069] Referring back to FIG. 23, the planet gears 138 may be disposed radially between the annular collar 174 of the spool 134 and the ring gear 228 of the connector 142. The planet gears 138 may be angularly arranged around a periphery of the collar 174 of the spool 134 and may meshingly engage the external teeth 176 of the collar 174. The planet gears 138 may be angularly arranged within the ring gear 228 of the connector 142 and may meshingly engage the internal teeth 230 of the ring gear 228.

[0070] Referring still to FIG. 23, the arms 198 of the blocking disc 136 may be disposed radially between the annular collar 174 of the spool 134 and the ring gear 228 of the connector 142. The arms 198 of the blocking disc 136 may be disposed angularly between adjacent planet gears 138. The abutment walls 210 of the planet holder 140 may be disposed angularly between the shoulders 204 of the arms 198 and the planet gears 138. With reference to FIG. 26, the wire springs 194a, 194b of the blocking disc 136 may tangentially engage the outer surface 162 of the stub shaft 160 of the housing 130 and resist rotation of the blocking disc 136 about the stub shaft 160.

[0071] Referring to FIGS. 27 and 28, when an operator pulls the operating element 108 downwardly in the vertical or substantially vertical direction (see FIG. 1), the lever actuator 148 may move downwardly within the first cavity 150 (as indicated by arrow 276 in FIG. 27). The lever actuator 148 may pivot the control lever 146 upwardly toward the planet holder 140 (as indicated by arrow 278 in FIG. 27) to engage the teeth 260 of the lever 146 with the teeth 220 of the planet holder 140 (see FIG. 28). FIG. 29 illustrates the lateral positioning of the lever 146 and the lever actuator 148 within the first cavity 250 when the lever 146 is engaged with the planet holder 140 as shown in FIG. 28.

[0072] Referring to FIG. 28, the downward motion of the operating element 108 in the vertical or substantially vertical direction (as indicated by arrow 110 in FIGS. 1 and 28) rotates the spool 134, and thus the external teeth 176 of the collar 174, in a first direction (as indicated by arrow 280 in FIG. 28). As the planet holder 140 is rotationally locked by the control lever 146, the rotation of the collar 174 about the stub shaft 160 causes the planet gears 138 to rotate in an opposite direction relative to the collar 174 (as indicated by arrow 282 in FIG. 28), which in turn causes the ring gear 228 of the connector 142 to rotate in an opposite direction relative to the collar 174 of the spool 134 (as indicated by arrow 284 in FIG. 28). Thus, when the operator pulls the operating element 108 downwardly in the vertical or substantially vertical direction (see FIG. 1), the output shaft 128 of the connector 142 may rotate in an opposite direction relative to the spool 134, which may result in retraction of the shade portion 104 of the covering 100 (see FIG. 1). During the downward extension of the operating element 108 in the vertical or substantially vertical direction, the blocking disc 136 may remain stationary or substantially stationary relative to the stub shaft 160 of the housing 130 due to the frictional resistance imparted by the wire springs 194a, 194b on the outer surface 162 of the stub shaft 160 (see FIG. 26).

[0073] Referring to FIGS. 27 and 30, when an operator pulls the operating element 108 downwardly in the diagonal or lateral direction (see FIG. 3), the lever actuator 148 may move downwardly within the first cavity 150 (as indicated by arrow 276 in FIG. 27), but the lever actuator 148 may be disposed alongside the control lever 146. In this position, the lever actuator 148 does not pivot the control lever 146. FIG. 25 illustrates the lever actuator 148 positioned laterally of the lever 146 within the first cavity 250 when the lever 146 is not engaged with the planet holder 140 as shown in FIG. 30.

[0074] Referring to FIG. 30, the downward motion of the operating element 108 in the diagonal or lateral direction (as indicated by arrow 116 in FIGS. 3 and 30) rotates the spool 134, and thus the external teeth 176 of the collar 174, in a first direction (as indicated by arrow 288 in FIG. 30). As the planet holder 140 is free to rotate about the stub shaft 160 of the housing 130, and friction between the planet gears 138 and the respective teeth 176, 230 of the spool 134 and the ring gear 228 may resist rotation of the planet gears 138 about the pins 208 of the planet holder 140, the rotation of the collar 174 about the stub shaft 160 may not rotate the planet gears 138 about the pins 208 but rather may cause the planet holder 140 and the ring gear 228 to rotate in the same direction as the collar 174 (as indicated by arrows 290, 292 in FIG. 30). Thus, when the operator pulls the operating element 108 downwardly in the diagonal or lateral direction (see FIG. 3), the output shaft 128 of the connector 142 may rotate in the same direction as the spool 134, which may result in extension of the shade portion 104 of the covering 100 (see FIG. 3).

[0075] With continued reference to FIG. 30, during the downward extension of the operating element 108 in the diagonal or lateral direction, the blocking disc 136 may engage the planet gears 138 to ensure the spool 134, the planet holder 140, and the connector 142 rotate in the same direction. Upon moving the operating element 108 downwardly in the diagonal or lateral direction (see FIG. 3), the spool 134, the planet holder 140, and the connector 142 may initially rotate relative to the blocking disc 136 such that the planet gears 138 move toward the free ends 200 of the arms 198 of the disc 136. Upon sufficient movement of the planet gears 138 toward the arms 198, the free ends 200 of the arms 198 may engage the externally-toothed planet gears 138 to lock the rotation of the planet gears 138 about the pins 208 of the planet holder 140. Once engaged with the planet gears 138, the arms 198 of the blocking disc 136 may resiliently flex radially outwardly such that the external tooth 202 of the arms 198 may engage the internal teeth 230 of the ring gear 228 to further lock the rotation of the ring gear 228 to the planet holder 140. After engagement of the arms 198 with the planet gears 138, the ring gear 228, or both, the blocking disc 136 may rotate in unison with the spool 134, the planet holder 140, and the connector 142 (as indicated by arrow 294 in FIG. 30).

[0076] Referring to FIGS. 28, 30, and 31, upon the operator of the operating mechanism 122 releasing or resistively raising the operating element 108 (see FIG. 2), the lever actuator 148 may move upwardly within the first cavity 150 (as indicated by arrow 296 in FIG. 31) and the spool 134 may be drivingly rotated by the power spring 132 to retract the operating element 108 (as indicated by arrow 298 in FIG. 31). In situations where the releasing or resistively raising of the operating element 108 is subsequent to a downwardly motion of the operating element 108 in a vertical or substantially vertical direction (see FIGS. 1 and 28), the control lever 146 may pivot downwardly away from the external teeth 220 of the planet holder 140 (as indicated by arrow 300 in FIG. 31) so that the teeth 260 of the lever 146 disengage from the teeth 220 of the planet holder 140. In situations where the releasing or resistively raising of the operating element 108 is subsequent to a downwardly motion of the operating element 108 in a diagonal or lateral direction (see FIGS. 3 and 30), the control lever 146 may remain seated against the flange 238 of the cord guide 144.

[0077] With continued reference to FIGS. 28, 30, and 31, rotation of the spool 134, and thus of the external teeth 176 of the collar 174, in an operating-element-retraction direction (as indicated by arrow 298 in FIG. 31) may cause the planet holder 140 and the connector 142 to rotate in unison with the spool 134, since the planet holder 140 may be free to rotate about the stub shaft 160 of the housing 130 (due to the lever 146 being disengaged from the external teeth 220 of the planet holder 140) and friction between the planet gears 138 and the respective teeth 176, 230 of the spool 134 and the ring gear 228 may resist or restrict rotation of the planet gears

138 about the pins 208 of the planet holder 140. The rotation of the planet holder 140 is indicated by the arrow 302 in FIG. 31.

[0078] Alternatively, in implementations where a braking element or mechanism holds the shade portion 104 of the covering in position during retraction of the operating element 108, the connector 142 may be restricted from rotating during the retraction of the operating element 108. In these implementations, the ring gear 228 may be rotationally locked and thus the planet gears 138 may orbit about the externally-toothed collar 176 in a common rotation direction with the spool 134, thereby rotating the planet holder 140 in the same direction as the spool 134 (as indicated by arrow 302 in FIG. 31). Thus, the operating mechanism 122 may reel in or retract the operating element 108 regardless of whether the output shaft 128 of the connector 142 (and thus the ring gear 228) is rotationally locked. During the retraction of the operating element 108, the abutment walls 210 of the planet holder 140 may contact the shoulders 204 of the arms 198 of the blocking disc 136 and rotationally drive the blocking disc 136 about the stub shaft 160 of the housing 130 (as indicated by arrow 304 in FIG. 31).

[0079] The operating mechanism 122 may be configured such that the teeth 260 of the control lever 146 and the arms 198 of the blocking disc 136 are not simultaneously in contact with the teeth 220 of the planet holder 140 and the planet gears 138, respectively, during a downwardly pull motion of the operating element 108, which may cause the mechanism to jam. In some implementations, the contact zone between the lever actuator 148 and the lever 146 has additional length, the angle of the teeth 220, 260 of the planet holder 140 and the lever 146, respectively, is small (the teeth 220, 260 may be very slanted), or both to prevent the simultaneous engagement of the teeth 260 of the control lever 146 and the arms 198 of the blocking disc 136 with the teeth 220 of the planet holder 140 and the planet gears 138, respectively, during a downwardly pull motion of the operating element 108. In some implementations, when the lever actuator 148 is pulled upwardly within the first cavity 250 to disengage the lever actuator 148 from the lever 146, the planet gears 138 may begin to rotate away from the blocking disc 136 before the lever actuator 148 disengages from the lever 146.

[0080] With reference to FIG. 23, when the operating mechanism 122 is assembled, the collar 174 of the spool 134, the planet gears 138, the planet holder 140, and the ring gear 228 of the connector 142 may form a planetary gear set or gear reduction unit, which may reduce the amount of force required to retract or raise the shade portion 104. In some implementations, the gear ratio of the planetary gear set is about 1.3. The relatively low gear ratio (1.3) in these implementations may facilitate the left and right hand side compatibility of the operating mechanism 122. In alternative implementations, the gear ratio may be altered depending on the weight of the shade portion 104 of the covering 100 and the desired input

force to raise the shade portion 104. In some implementations, the gear ratio of the operating mechanism 122 may be increased for heavier shade portions 104 or decreased for lighter-weight shade portions 104. As depicted, in some implementations, the operating mechanism 122 does not use a cord pulley to space the operating element 108 away from the shade portion 104 of the covering.

[0081] The foregoing description has broad application. For example, the example operating mechanism may be used with any type of shade, including, but not limited to, roller and stackable shades. Furthermore, the example operating module or system may be used in association with either end of a head rail. Accordingly, the discussion of any embodiment is meant only to be explanatory and is not intended to suggest that the scope of the disclosure, including the claims, is limited to these examples. In other words, while illustrative embodiments of the disclosure have been described in detail herein, it is to be understood that the inventive concepts may be otherwise variously embodied and employed, and that the appended claims are intended to be construed to include such variations, except as limited by the prior art. The foregoing discussion has been presented for purposes of illustration and description and is not intended to limit the disclosure to the form or forms disclosed herein. For example, various features of the disclosure are grouped together in one or more aspects, embodiments, or configurations for the purpose of streamlining the disclosure. However, it should be understood that various features of the certain aspects, embodiments, or configurations of the disclosure may be combined in alternate aspects, embodiments, or configurations. Moreover, the following claims are hereby incorporated into this Detailed Description by this reference, with each claim standing on its own as a separate embodiment of the present disclosure.

[0082] All directional references (e.g., proximal, distal, upper, lower, upward, downward, left, right, lateral, longitudinal, front, back, top, bottom, above, below, vertical, horizontal, radial, axial, clockwise, and counterclockwise) are only used for identification purposes to aid the reader's understanding of the present disclosure, and do not create limitations, particularly as to the position, orientation, or use of this disclosure. Connection references (e.g., attached, coupled, connected, and joined) are to be construed broadly and may include intermediate members between a collection of elements and relative movement between elements unless otherwise indicated. As such, connection references do not necessarily infer that two elements are directly connected and in fixed relation to each other. Identification references (e.g., primary, secondary, first, second, third, fourth, etc.) are not intended to connote importance or priority, but are used to distinguish one feature from another. The drawings are for purposes of illustration only and the dimensions, positions, order and relative sizes reflected in the drawings attached hereto may vary.

[0083] According to the present invention, there is provided an operating mechanism (122) for an architectural covering, comprising:

a stationary shaft (160);
a spool (134) rotatably mounted on the shaft;
an operating element (108) secured to the spool; and
a slider (148) frictionally secured to the operating element and operable to alter a rotational output direction of the operating mechanism based upon a pull direction of the operating element, wherein the slider moves in unison with the operating element within a cavity (250) of the operating mechanism.

[0084] The slider may define an S-shaped passage (270) through which the operating element is routed.

[0085] The cavity may be defined at least partially by opposing abutment walls (244,274); and upon the slider contacting either one of the abutment walls, the operating element moves relative to the slider.

[0086] The operating mechanism may further comprise: a base plate (156) attached to the stationary shaft; and a lever (146) pivotally mounted to the base plate, and wherein the slider is operable to pivot the lever.

[0087] The slider may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction.

[0088] The slider may be adapted to pivot the lever upwardly when the operating element is moved in a second direction that is different than the first direction.

[0089] The operating mechanism may further comprise a planet holder (140) rotatably mounted on the shaft, and wherein the lever may be engageable with the planet holder to restrict rotation of the planet holder relative to the shaft.

[0090] The lever may include teeth (260).

[0091] The planet holder may include teeth (220).

[0092] Upon the slider pivoting the lever toward the planet holder, the teeth of the lever may engage the teeth of the planet holder.

[0093] The teeth of the lever and the teeth of the planet holder may be angled such that the lever remains engaged with the planet holder even when the slider is moved out of contact with the lever.

[0094] The operating mechanism may further comprise a plurality of planet gears (138) rotatably mounted to the planet holder.

[0095] The operating mechanism may further comprise a disc (136) mounted onto the shaft and include an engagement feature (196) adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet holder.

[0096] The engagement feature may comprise an arm (198) having a free end (200) adapted to engage an external tooth (201) of one planet gear of the plurality of planet gears.

[0097] The disc may include one or more wire springs (194a, 194b) that engage an outer surface (162) of the

shaft to resist rotation of the disc relative to the shaft.

[0098] The planet holder may include an abutment wall (210) disposed angularly between the engagement feature of the disc and an adjacent planet gear.

[0099] The lever and the disc optionally do not simultaneously engage the planet holder and the one or more planet gears of the plurality of planet gears, respectively, during a downwardly motion of the operating element.

[0100] The spool may include an externally-toothed collar (174) that meshingly engages the plurality of planet gears.

[0101] The operating mechanism may further comprise a connector (142) including an internally-toothed ring gear (228) that meshingly engages the plurality of planet gears.

[0102] The operating mechanism may further comprise an axially-extending flange (158) disposed outwardly of the shaft, and wherein the flange defines a centrally-located, downwardly-opening through-hole (246) that provides a central exit position for the operating element.

[0103] The operating mechanism may further comprise a cord guide (144) inset interiorly of the flange and formed of a harder material than the flange to resist wear from the operating element.

[0104] The operating mechanism may further comprise a power spring (132) operatively attached to the spool to wrap the operating element around the spool.

[0105] According to the present invention, there may be provided a covering for an architectural opening, comprising:

a roller rotatable about a longitudinal axis in an extension direction and a retraction direction;

a shade attached to the roller, wherein the shade is extended across the architectural opening when the roller rotates in the extension direction, and wherein the shade is retracted toward one of more sides of the architectural opening when the roller rotates in the retraction direction; and

the operating mechanism as claimed in any preceding claim, wherein the operating mechanism is operably associated with the roller to rotate the roller in the extension direction or the retraction direction.

[0106] According to the present invention, there may be provided an operating mechanism (122) for an architectural covering, comprising:

a housing (130) including a stationary shaft (160);
a spool (134) rotatably mounted on the shaft;
an operating element (108) secured to the spool;
a planet carrier (140) rotatably mounted on the shaft and rotationally coupled to the spool;
a lever (146) pivotally mounted to the housing and engageable with the planet carrier to restrict rotation of the planet carrier relative to the shaft; and
a lever actuator (148) secured to the operating ele-

ment and engageable with the lever to pivot the lever into engagement with the planet carrier, wherein once the lever is engaged with the planet carrier, the lever remains in engagement with the planet carrier even when the lever actuator is moved out of engagement with the lever.

[0107] The planet carrier may include a plurality of external teeth (220).

[0108] The lever may include one or more external teeth (220).

[0109] Upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever may engage the teeth of the planet carrier.

[0110] The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet holder even when the lever actuator is disengaged from the lever.

[0111] The operating mechanism may further comprise a plurality of planet gears (138) rotatably supported by the planet carrier.

[0112] The operating mechanism may further comprise a disc (136) mounted onto the shaft and adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet carrier.

[0113] The disc may include an arm (198) having a free end (200) adapted to engage an external tooth (201) of one planet gear of the plurality of planet gears.

[0114] The planet carrier may include an abutment wall (210) disposed angularly between the arm of the disc and an angularly-adjacent planet gear.

[0115] The disc may include one or more wire springs (194a, 194b) that engage an outer surface (162) of the shaft to resist rotation of the disc relative to the shaft.

[0116] The operating mechanism may be configured such that the lever does not engage the planet carrier at the same time the disc engages the one or more planet gears of the plurality of planet gears during a downwardly motion of the operating element.

[0117] The spool may include external teeth (176) that meshingly engage the plurality of planet gears.

[0118] The operating mechanism may further comprise a connector (142) including an internally-toothed ring gear (228) that meshingly engages the plurality of planet gears.

[0119] The housing may include a base plate (156) and an axially-extending flange (158) disposed outwardly of the shaft, and wherein the flange may define a centrally-located, downwardly-opening through-hole (246) that provides a central exit position for the operating element.

[0120] The operating mechanism may further comprise a cord guide (144) attached to the base plate and disposed inwardly of the flange, wherein the cord guide is formed of a harder material than the housing to resist wear from the operating element.

[0121] The cord guide may define a cavity (250) that receives the lever actuator and is larger than the lever

actuator to permit movement of the lever actuator within the cavity.

[0122] The cavity may be defined at least partially by opposing abutment walls (244,274); the operating element and the lever actuator move together in unison when the lever actuator is not in contact with either one of the abutment walls; and the operating element moves relative to the lever actuator when the lever actuator contacts either one of the abutment walls.

[0123] The lever actuator may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction.

[0124] The lever actuator may be adapted to pivot the lever toward the planet carrier when the operating element is moved in a second direction that is different than the first direction.

[0125] The operating mechanism may further comprise a power spring (132) operatively attached to the spool to wrap the operating element around the spool.

[0126] According to the present invention, there may be provided a covering for an architectural opening, comprising:

a roller rotatable about a longitudinal axis in an extension direction and a retraction direction;

a shade attached to the roller, wherein the shade is extended across the architectural opening when the roller rotates in the extension direction, and wherein the shade is retracted toward one of more sides of the architectural opening when the roller rotates in the retraction direction; and

the operating mechanism as claimed in any one of claims 22-39, wherein the operating mechanism is operably associated with the roller to rotate the roller in the extension direction or the retraction direction.

[0127] According to the present invention, there may be provided an operating mechanism (122) for an architectural covering, comprising:

a stationary shaft (160);

an externally-toothed collar (174) rotatably mounted on the shaft;

a planet carrier (140) rotatably mounted on the shaft; an internally-toothed ring gear (228) rotatably mounted on the shaft;

a plurality of planet gears (138) rotatably mounted to the planet carrier, the plurality of planet gears disposed radially between, and meshingly engaged with, the collar and the ring gear;

a disc (136) mounted on the shaft and adapted to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet carrier; and

a pivotable lever (146) engageable with the planet carrier to restrict rotation of the planet carrier relative to the shaft, wherein the operating mechanism is configured such that the disc does not engage the

one or more planet gears of the plurality of planet gears when the lever is engaged with the planet carrier.

[0128] The disc may include an arm (198) having a free end (200) that is engageable with a planet gear of the plurality of planet gears. 5

[0129] The planet carrier may include an abutment wall (210) disposed angularly between the arm of the disc and an angularly-adjacent planet gear of the plurality of planet gears. 10

[0130] The disc may include one or more wire springs (194a, 194b) that engage the shaft to resist rotation of the disc relative to the shaft.

[0131] The operating mechanism may further comprise: 15

a spool (134) rotatable in unison with the collar; an operating element (108) secured to the spool; and a lever actuator (148) secured to the operating element and engageable with the lever to pivot the lever into engagement with the planet carrier. 20

[0132] The lever may include teeth (260).

[0133] The planet carrier may include teeth (220). 25

[0134] Upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever may engage the teeth of the planet carrier.

[0135] The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet carrier even when the lever actuator is moved out of contact with the lever. 30

[0136] The lever actuator may be frictionally secured to the operating element such that the lever actuator moves in unison with the operating element until the lever actuator contacts an abutment wall (244,274) of the operating mechanism. 35

[0137] The lever actuator may define an S-shaped slit (270) through which the operating element is routed.

[0138] The operating mechanism may further comprise a base plate (156) attached to the shaft and a flange (158) extending axially from a periphery of the base plate and disposed outwardly of the shaft, wherein the flange may define a centrally-located, downwardly-opening through-hole (246) that provides a central exit position for the operating element. 40

[0139] The operating mechanism may further comprise a cord guide (144) inset interiorly of the flange and formed of a harder material than the flange to resist wear from the operating element.

[0140] The operating mechanism may further comprise a power spring (132) operatively attached to the spool to wrap the operating element around the spool. 45

[0141] According to the present invention, there may be provided a covering for an architectural opening, comprising: 55

a roller rotatable about a longitudinal axis in an ex-

tension direction and a retraction direction;

a shade attached to the roller, wherein the shade is extended across the architectural opening when the roller rotates in the extension direction, and wherein the shade is retracted toward one or more sides of the architectural opening when the roller rotates in the retraction direction; and

the operating mechanism as claimed in any one of claims 41-52, wherein the operating mechanism is operably associated with the roller to rotate the roller in the extension direction or the retraction direction.

[0142] According to the present invention, there may be provided an operating mechanism (122) for an architectural covering, comprising:

a stationary shaft (160);

an externally-toothed collar (174) rotatably mounted on the shaft;

a planet carrier (140) rotatably mounted on the shaft; an internally-toothed ring gear (228) rotatably mounted on the shaft;

planet gears (138) rotatably mounted to the planet carrier, the planet gears disposed radially between, and meshingly engaged with, the collar and the ring gear; and

a disc (136) mounted on the shaft and adapted to engage one or more of the planet gears to restrict rotation of the planet gears relative to the planet carrier. 50

[0143] The disc may be biased to resist rotation of the disc relative to the shaft to maintain engagement of the disc with the one or more planet gears.

[0144] The disc may include one or more wire springs (194a, 194b) that engage an outer surface (162) of the shaft to resist rotation of the disc relative to the shaft. 55

[0145] The one or more wire springs may include end portions that are attached to a body (186) of the disc and an intermediate portion that extends as a chord of an arcuate inner surface (188) of the disc.

[0146] The one or more springs may comprise a pair of wire springs (194a, 194b) that diametrically oppose one another about a longitudinal axis of the disc.

[0147] The pair of wire springs may act on opposing sides of the shaft to restrict the disc from rotating about the shaft.

[0148] The disc may include an arm (198) having a free end (200) adapted to engage one of the planet gears.

[0149] The planet carrier may include an abutment wall (210) disposed angularly between the arm and one of the planet gears.

[0150] The operating mechanism may further comprise a pivotable lever that is engageable with the planet carrier to restrict rotation of the planet carrier.

[0151] The operating mechanism may be configured such that the lever does not engage the planet carrier at the same time the disc engages the one or more planet

gears.

[0152] The operating mechanism may further comprising:

an operating element (108) rotationally coupled to the collar; and
a lever actuator (148) frictionally secured to the operating element, wherein the lever actuator is operable to pivot the lever based upon a pull direction of the operating element.

[0153] The lever actuator may be adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction.

[0154] The lever actuator may be adapted to pivot the lever into engagement with the planet carrier when the operating element is moved in a second direction that is different than the first direction.

[0155] The lever actuator may move in unison with the operating element within a cavity (250) of the operating mechanism.

[0156] The cavity may be defined at least partially by opposing abutment walls (244,274); and

upon the lever actuator contacting either one of the abutment walls, the operating element may move relative to the lever actuator.

[0157] The planet carrier may include a plurality of external teeth (220). The lever may include one or more external teeth (220).

[0158] Upon the lever actuator pivoting the lever toward the planet carrier, the teeth of the lever may engage the teeth of the planet carrier.

[0159] The teeth of the lever and the teeth of the planet carrier may be angled such that the lever remains engaged with the planet carrier even when the lever actuator is disengaged from the lever.

[0160] According to the present invention, there is provided a covering for an architectural opening, comprising:

a roller rotatable about a longitudinal axis in an extension direction and a retraction direction;
a shade attached to the roller, wherein the shade is extended across the architectural opening when the roller rotates in the extension direction, and wherein the shade is retracted toward one of more sides of the architectural opening when the roller rotates in the retraction direction; and
the operating mechanism as claimed in any one of claims 54-70, wherein the operating mechanism is operably associated with the roller to rotate the roller in the extension direction or the retraction direction.

[0161] According to the present invention, there is provided a method of operating a covering (100) for an architectural opening, comprising:

pivoting a lever (146) into engagement with a planet carrier (140) by pulling an operating element (108) downwardly in a first direction (110) to raise a shade portion (104) of the covering;

after engagement of the lever with the planet carrier, continuing to pull the operating element downwardly but in a second direction (116) that is different than the first direction to continue to raise the shade portion of the covering without interrupting the motion of the covering.

[0162] The method may further comprise moving a slider (148) beneath the lever by pulling the operating element downwardly in the first direction.

[0163] The method may further comprise moving the slider out of contact with the lever by pulling the operating element downwardly in the second direction.

[0164] The method may further comprise maintaining the lever in engagement with the planet carrier after the slider is moved out of contact with the lever by providing the lever and planet carrier with angled teeth (260,220) that prevent the lever from pivoting away from the planet carrier.

[0165] The method may further comprise sliding the operating element within an internal passage (270) of the slider by continuing to pull the operating element downwardly after engagement of the lever with the planet carrier.

[0166] The method may further comprising:

after reaching a desired position of the shade portion of the covering, allowing retraction of the operating element; and

subsequent to the retraction of the operating element, pulling the operating element downwardly in the second direction to lower the shade portion without pivoting the lever into engagement with the planet carrier.

[0167] The method may further comprise restricting rotation of a plurality of planet gears (138) relative to the planet carrier during the lowering of the shade portion.

[0168] The method may further comprise ensuring the lever does not engage the planet carrier during restriction of the rotation of a plurality of planet gears relative to the planet carrier.

Claims

1. An operating mechanism (122) for an architectural covering, comprising:

a stationary shaft (160);
a spool (134) rotatably mounted on the shaft;
an operating element (108) secured to the spool;
and
a slider (148) frictionally engaged with the oper-

- ating element and operable to alter a rotational output direction of the operating mechanism based upon a pull direction of the operating element, wherein the slider moves in unison with the operating element within a cavity (250) of the operating mechanism. 5
2. The operating mechanism as claimed in claim 1, wherein the slider defines an S-shaped passage (270) through which the operating element is routed. 10
 3. The operating mechanism as claimed in claims 1 or 2, wherein: the cavity is defined at least partially by opposing abutment walls (244,274); and upon the slider contacting either one of the abutment walls, the operating element moves relative to the slider. 15
 4. The operating mechanism as claimed in claims 1, 2, or 3, further comprising: 20
 - a base plate (156) attached to the stationary shaft; and
 - a lever (146) pivotally mounted to the base plate, and 25
 - wherein the slider is operable to pivot the lever, and wherein optionally the slider is adapted to slide alongside the lever without pivoting the lever when the operating element is moved in a first direction, and wherein optionally the slider 30
 - is adapted to pivot the lever upwardly when the operating element is moved in a second direction that is different than the first direction.
 5. The operating mechanism as claimed in claims 4, further comprising a planet holder (140) rotatably mounted on the shaft, and wherein the lever is engageable with the planet holder to restrict rotation of the planet holder relative to the shaft, and wherein optionally: 35
 - the lever includes teeth (260);
 - the planet holder includes teeth (220); and
 - upon the slider pivoting the lever toward the planet holder, the teeth of the lever engage the teeth of the planet holder, and wherein optionally 40
 - the teeth of the lever and the teeth of the planet holder are angled such that the lever remains engaged with the planet holder even when the slider is moved out of contact with the lever. 45
 6. The operating mechanism as claimed in claim 5, further comprising a plurality of planet gears (138) rotatably mounted to the planet holder. 50
 7. The operating mechanism as claimed in claim 6, further comprising a disc (136) mounted onto the shaft and including an engagement feature (196) adapted 55
 - to engage one or more of the plurality of planet gears to restrict rotation of the plurality of planet gears relative to the planet holder, and wherein optionally the engagement feature comprises an arm (198) having a free end (200) adapted to engage an external tooth (201) of one planet gear of the plurality of planet gears.
 8. The operating mechanism as claimed in claim 7, wherein the disc includes one or more wire springs (194a, 194b) that engage an outer surface (162) of the shaft to resist rotation of the disc relative to the shaft.
 9. The operating mechanism as claimed in claims 7 or 8, wherein the planet holder includes an abutment wall (210) disposed angularly between the engagement feature of the disc and an adjacent planet gear.
 10. The operating mechanism as claimed in any one of claims 7-9, wherein the lever and the disc do not simultaneously engage the planet holder and the one or more planet gears of the plurality of planet gears, respectively, during a downwardly motion of the operating element.
 11. The operating mechanism as claimed in any one of claims 6-10, wherein the spool includes an external-toothed collar (174) that meshingly engages the plurality of planet gears.
 12. The operating mechanism as claimed in any one of claims 6-11, further comprising a connector (142) including an internally-toothed ring gear (228) that meshingly engages the plurality of planet gears.
 13. The operating mechanism as claimed in any preceding claim, further comprising an axially-extending flange (158) disposed outwardly of the shaft, and wherein the flange defines a centrally-located, downwardly-opening through-hole (246) that provides a central exit position for the operating element, and optionally, further comprising a cord guide (144) inset interiorly of the flange and formed of a harder material than the flange to resist wear from the operating element.
 14. The operating mechanism as claimed in any preceding claim, further comprising a power spring (132) operatively attached to the spool to wrap the operating element around the spool.
 15. A covering for an architectural opening, comprising:
 - a roller rotatable about a longitudinal axis in an extension direction and a retraction direction;
 - a shade attached to the roller, wherein the shade is extended across the architectural opening

when the roller rotates in the extension direction,
and wherein the shade is retracted toward one
of more sides of the architectural opening when
the roller rotates in the retraction direction; and
the operating mechanism as claimed in any pre-
ceding claim, wherein the operating mechanism
is operably associated with the roller to rotate
the roller in the extension direction or the retrac-
tion direction.

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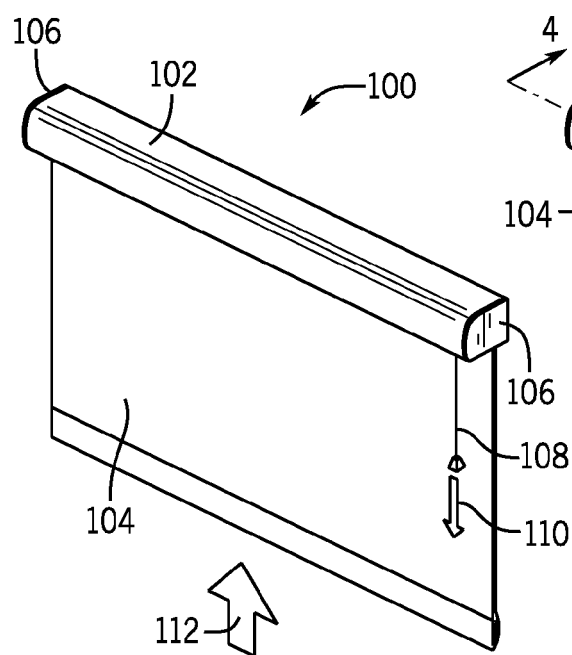


FIG. 1

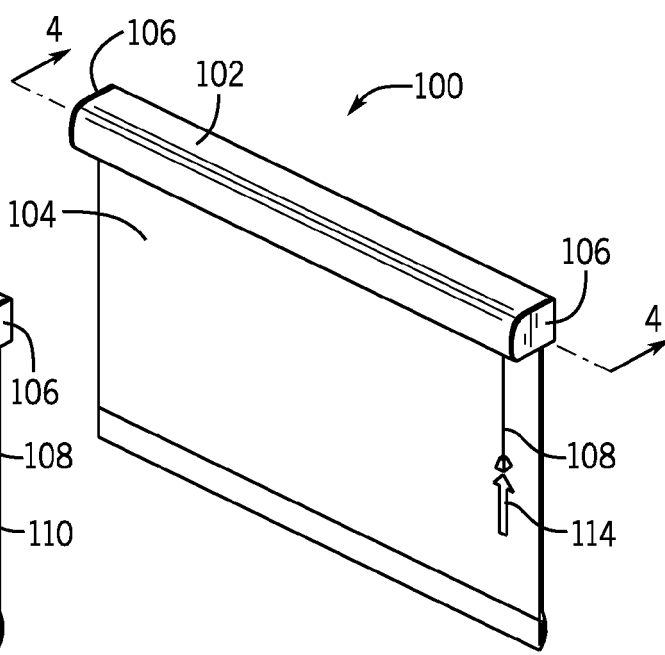


FIG. 2

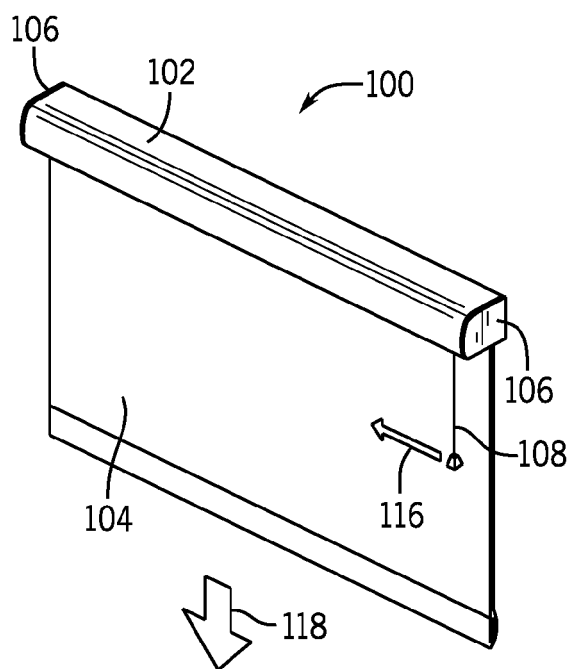


FIG. 3

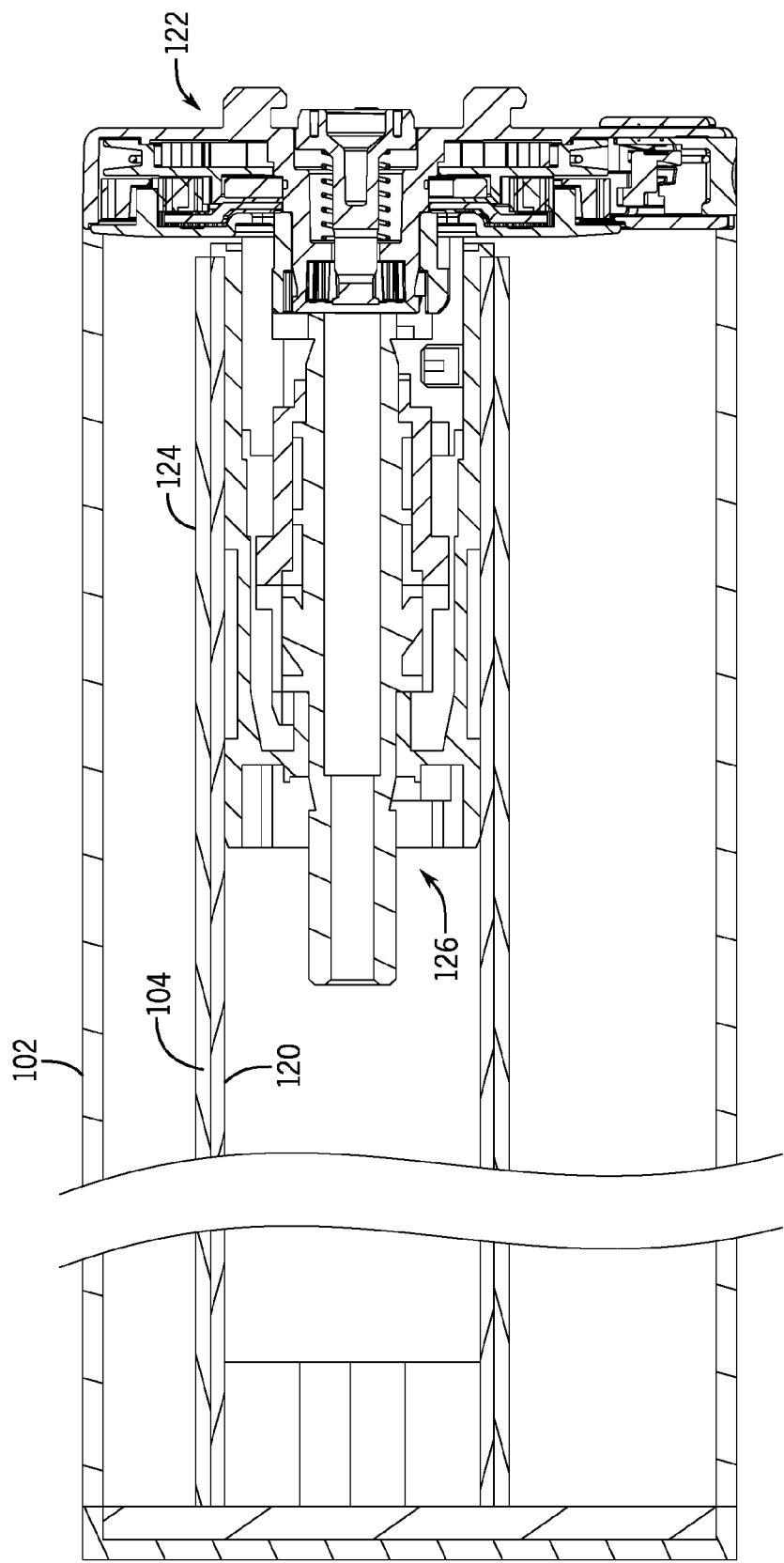
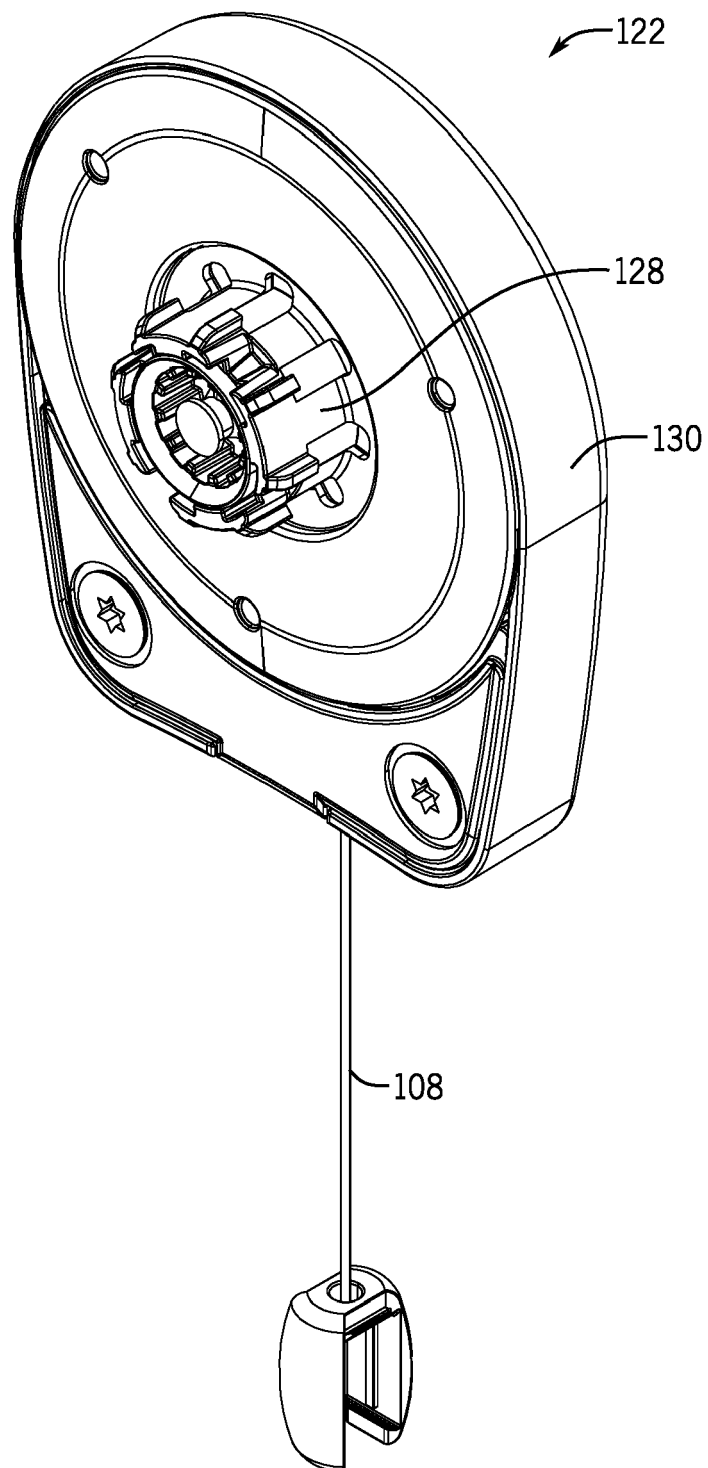


FIG. 4

FIG. 5



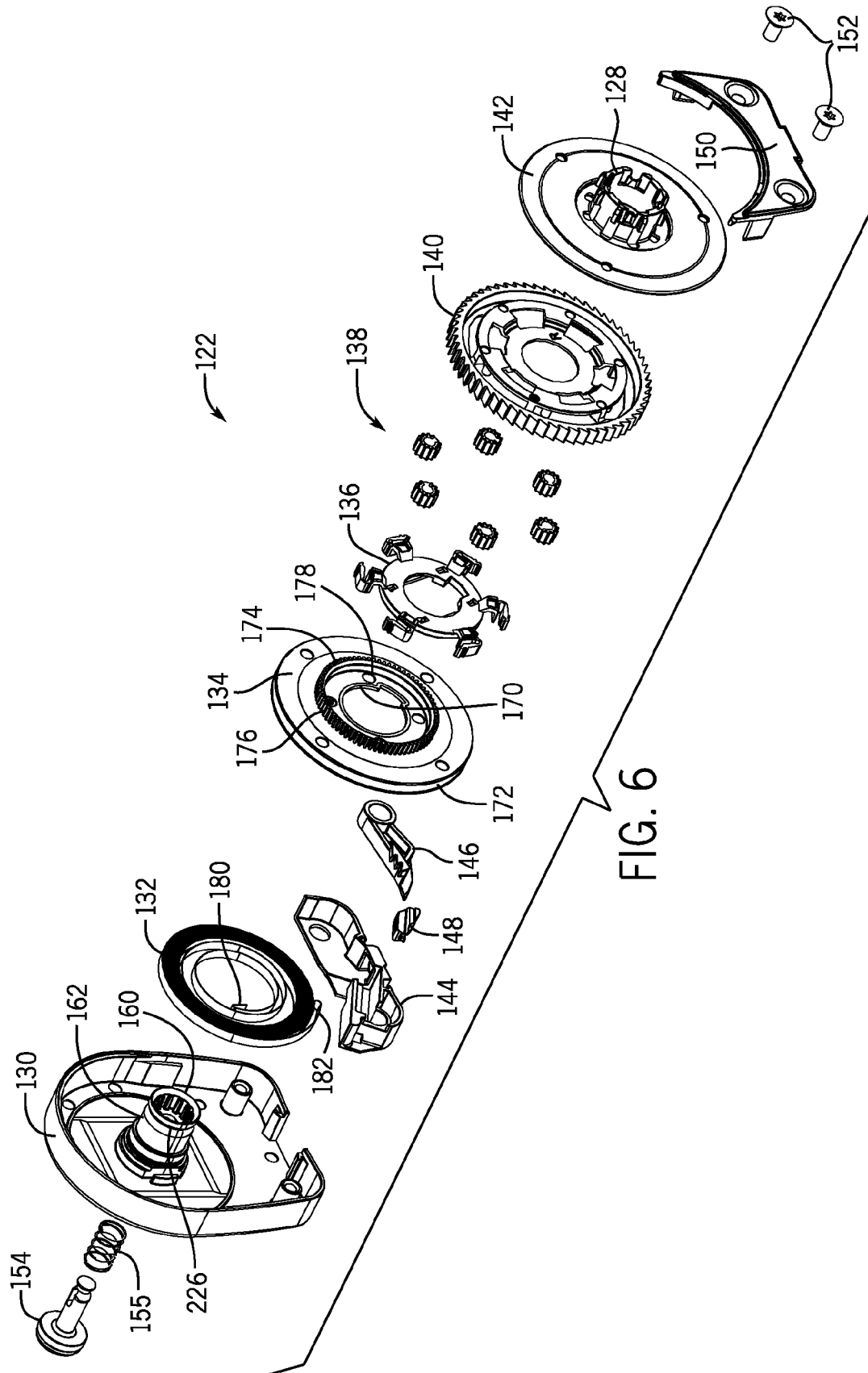


FIG. 6

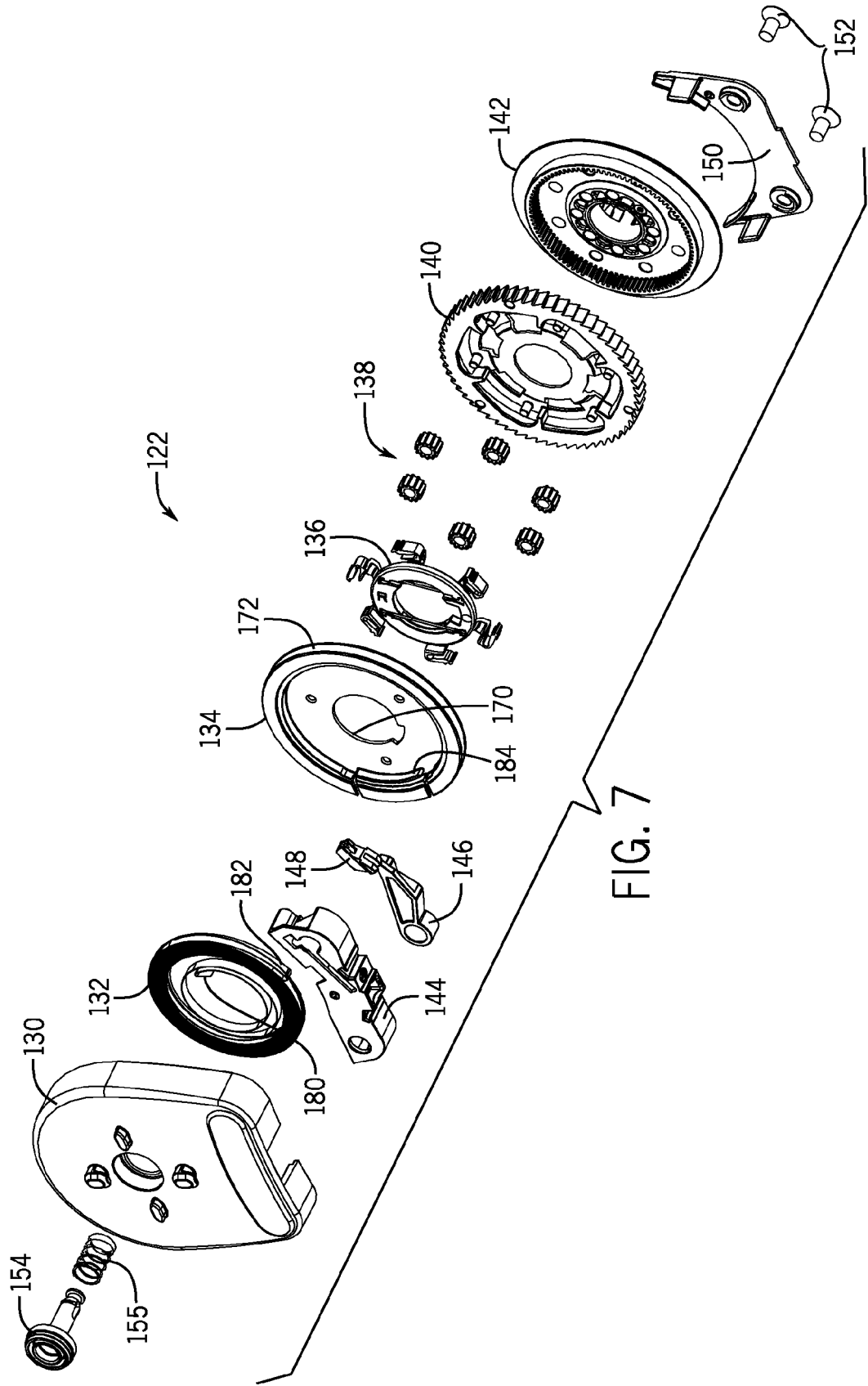


FIG. 7

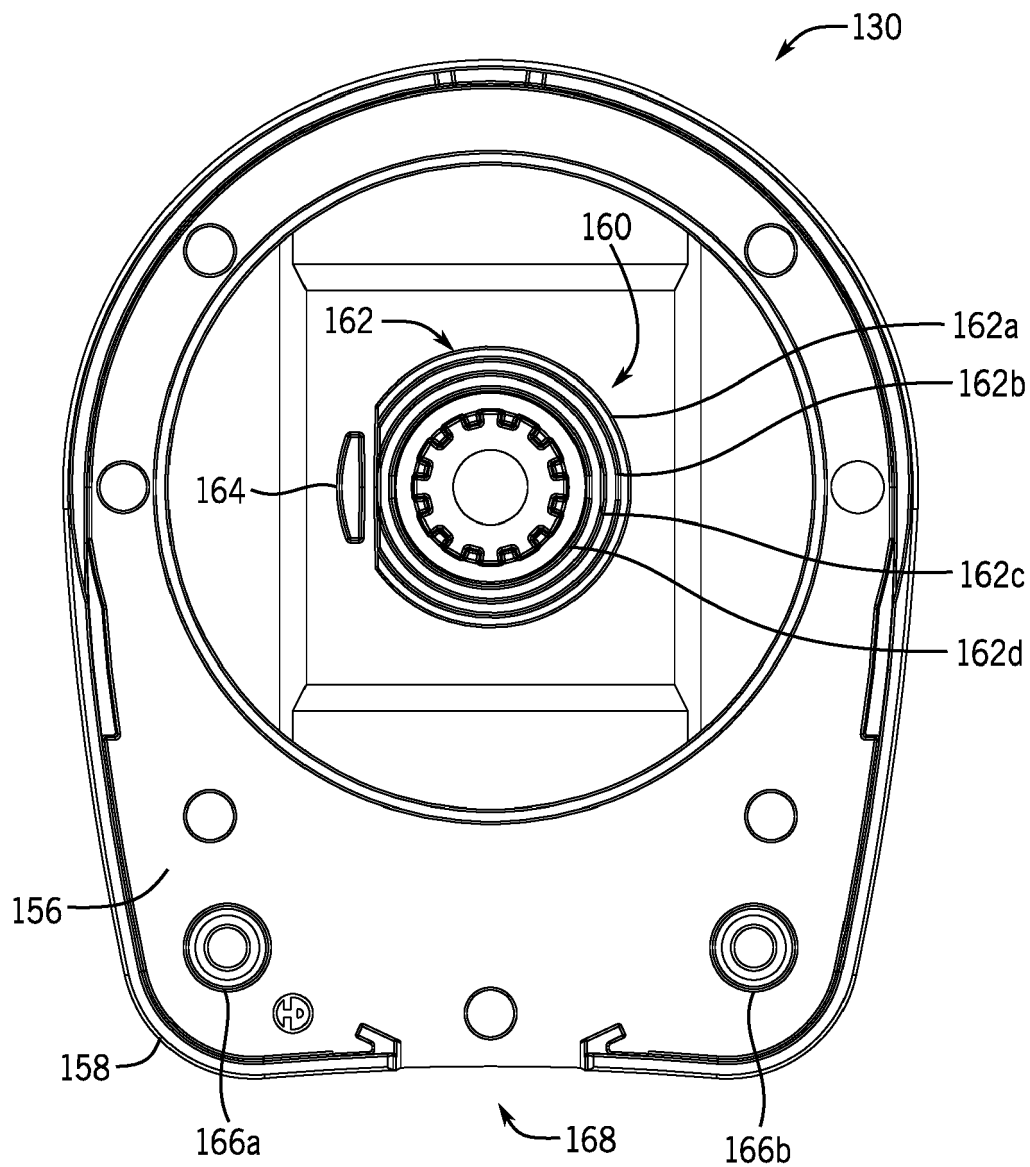


FIG. 8

FIG. 9

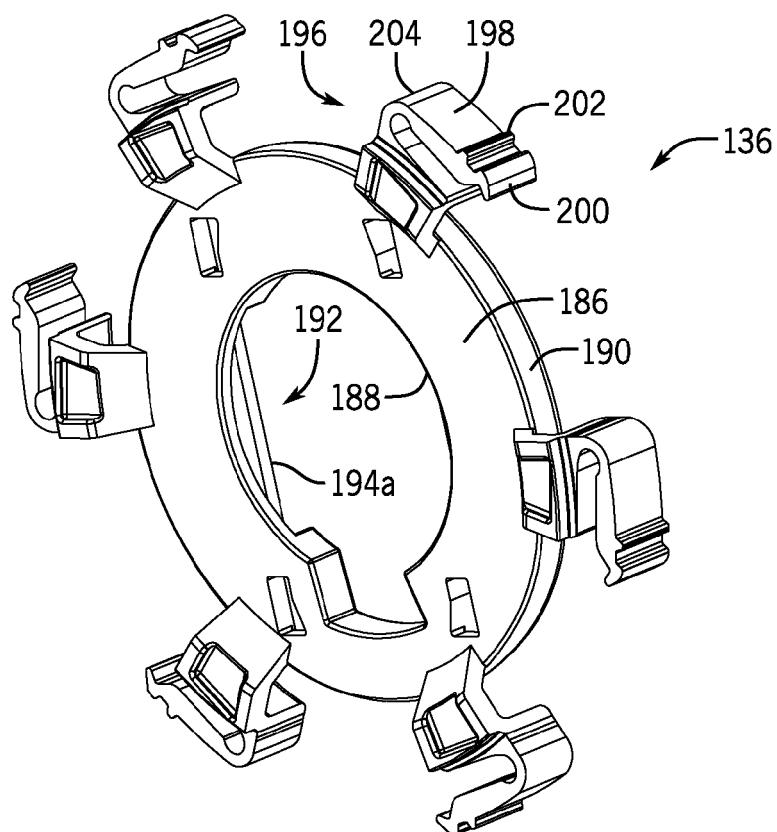


FIG. 10

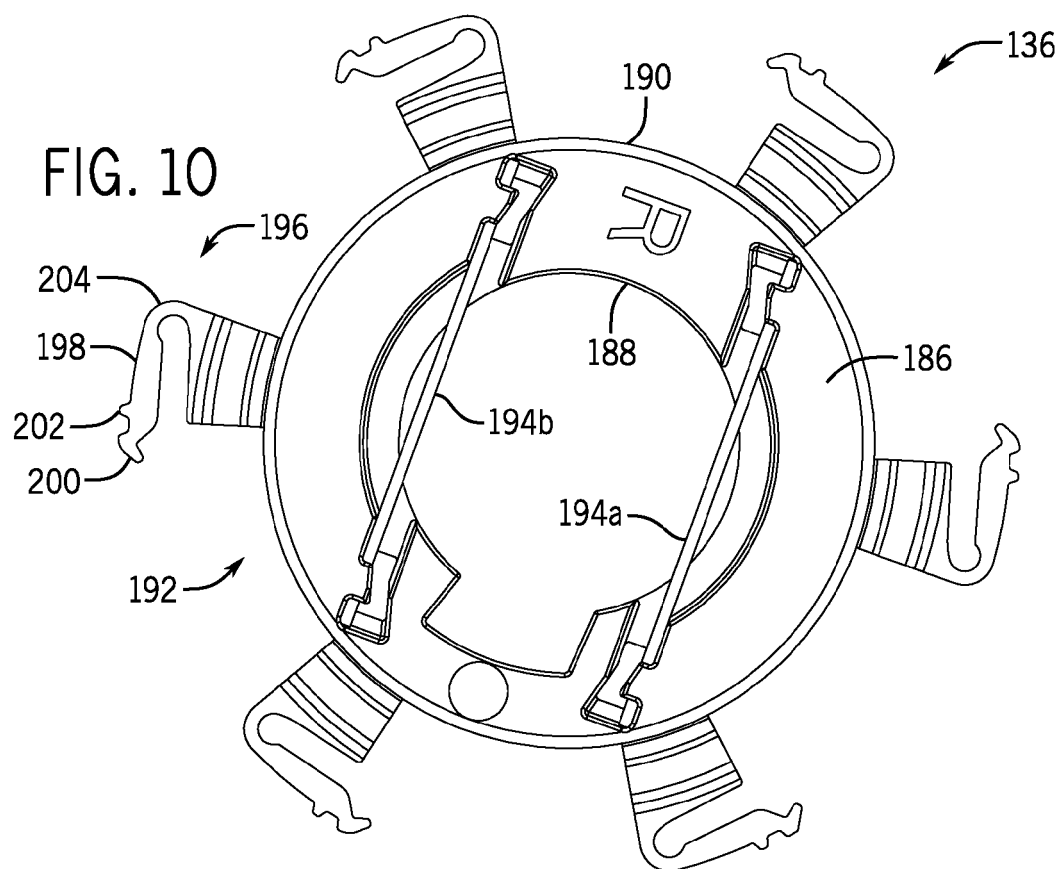


FIG. 11

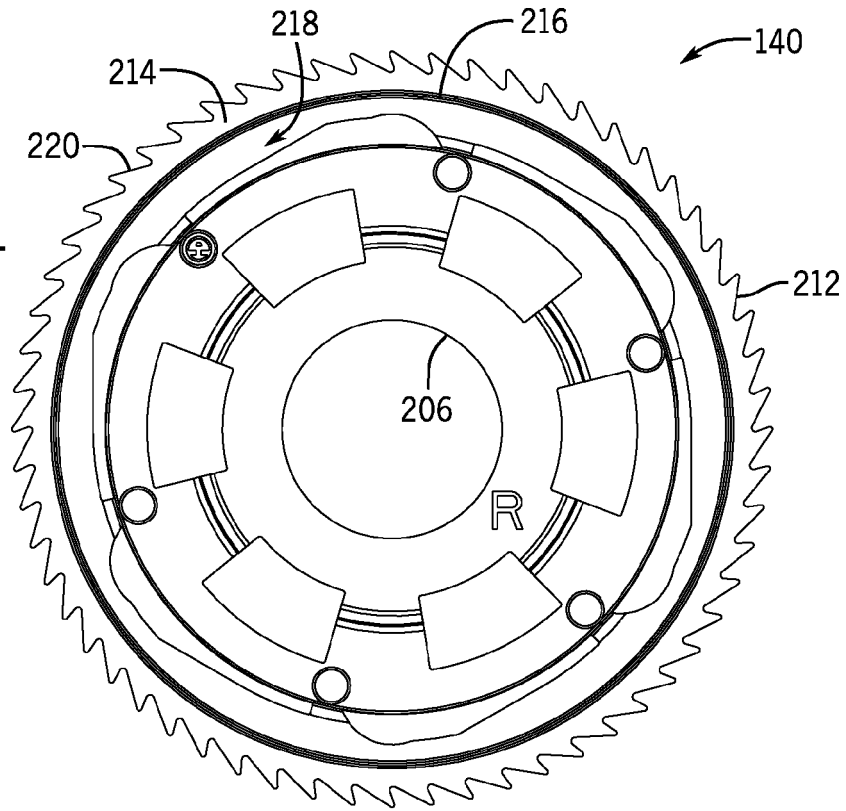


FIG. 12

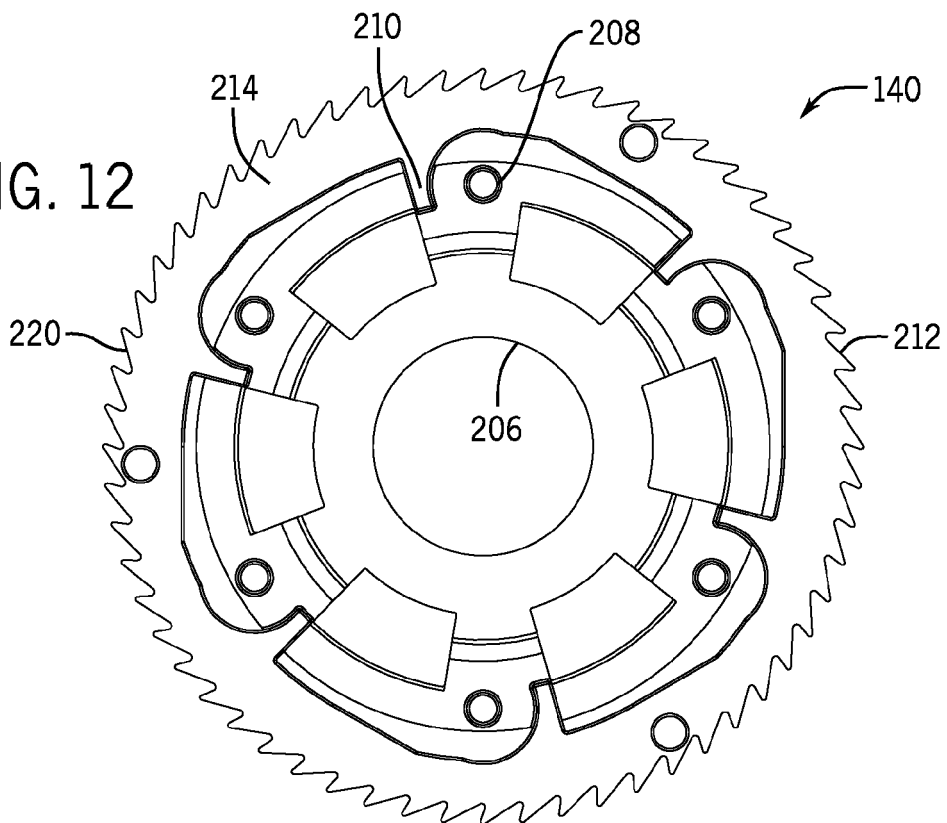


FIG. 13

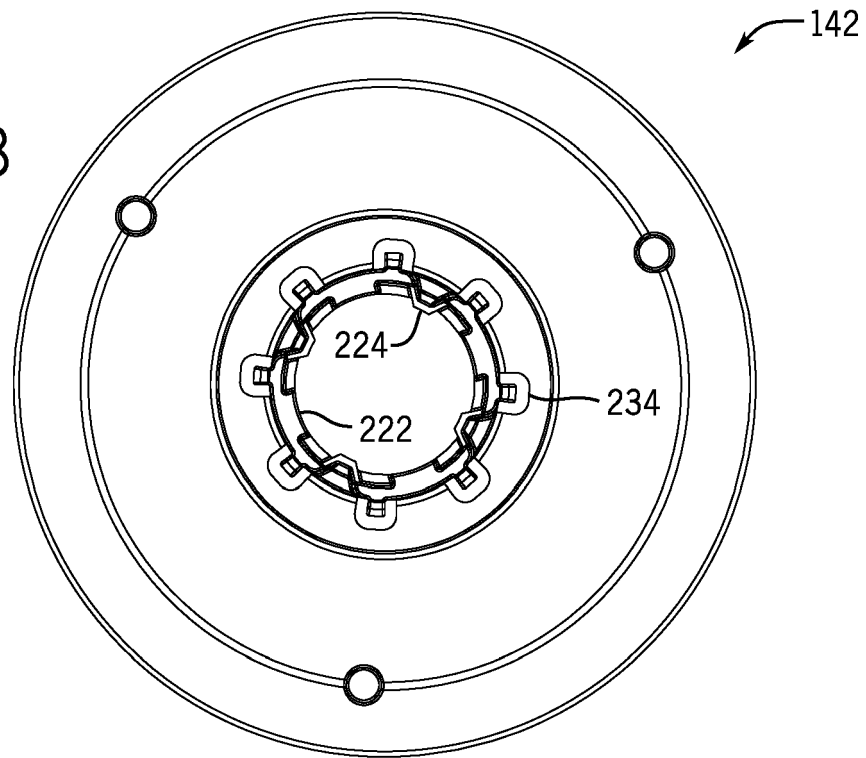
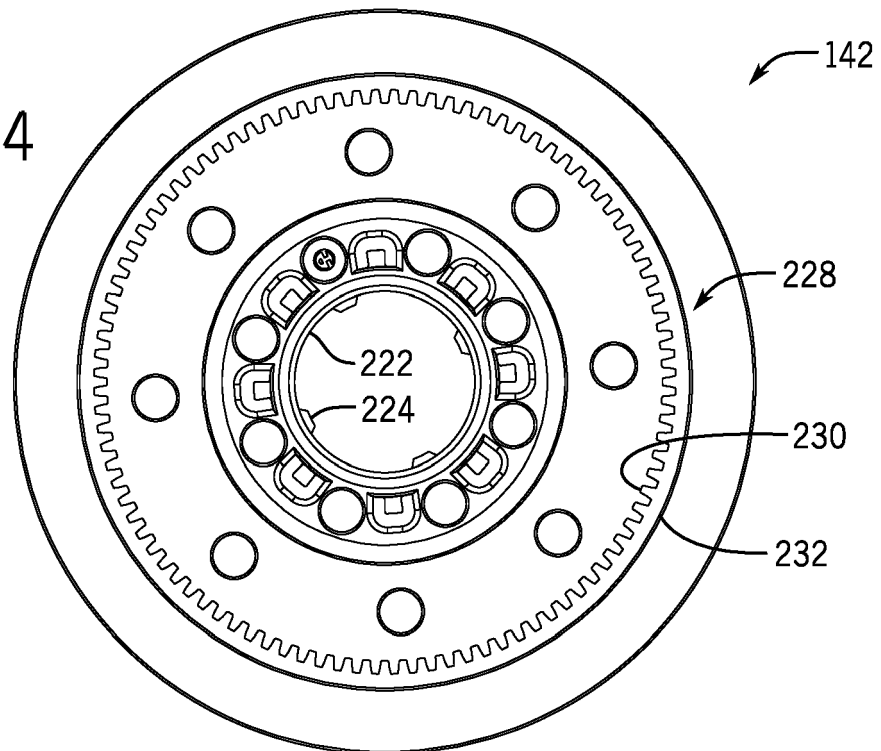
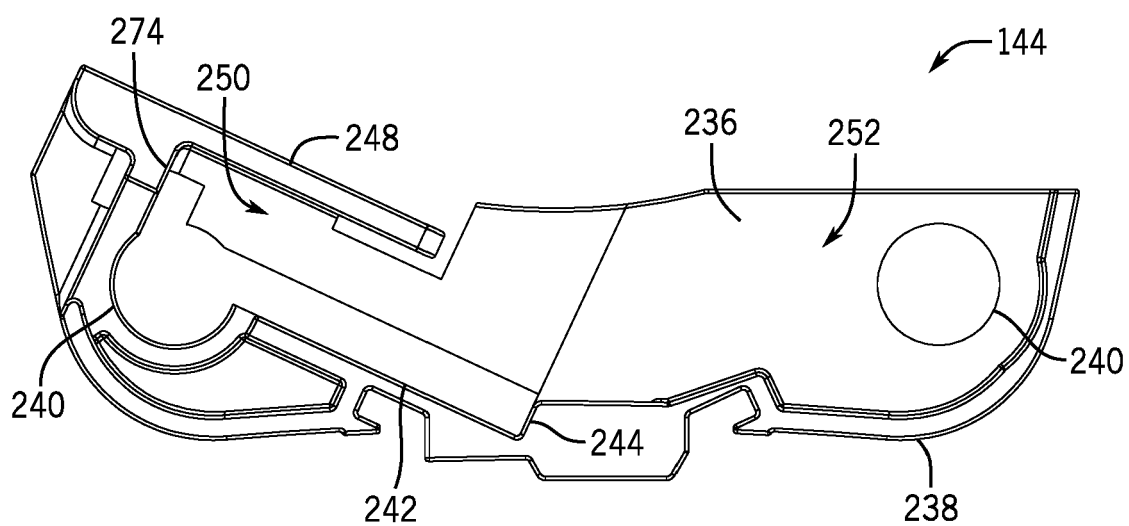
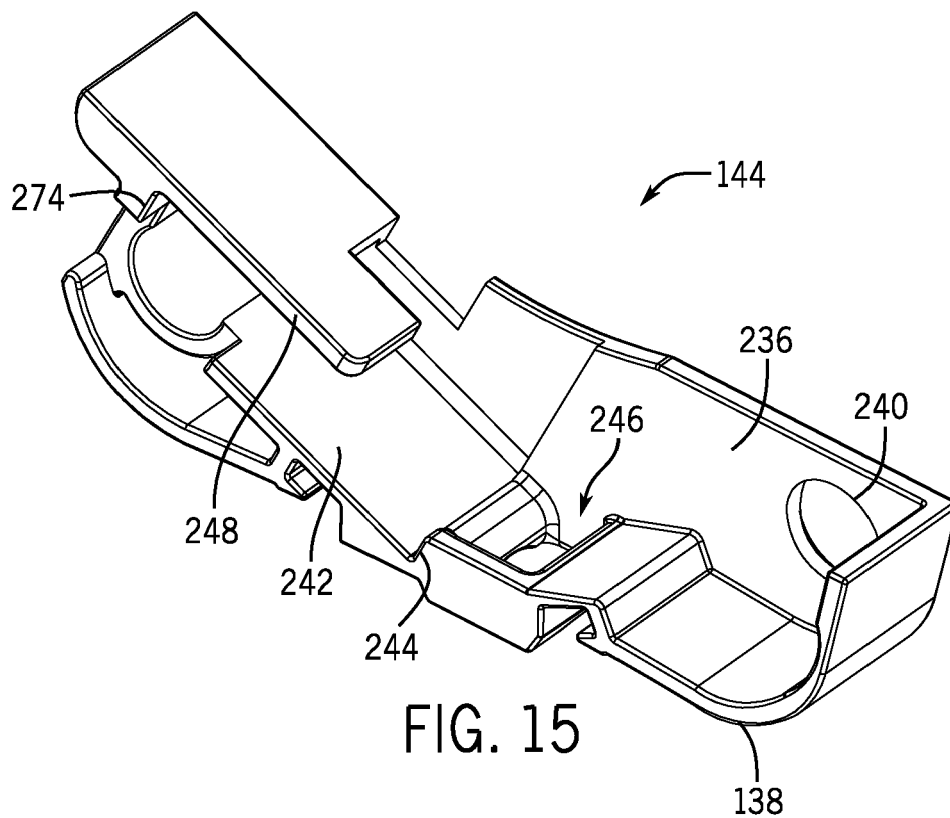
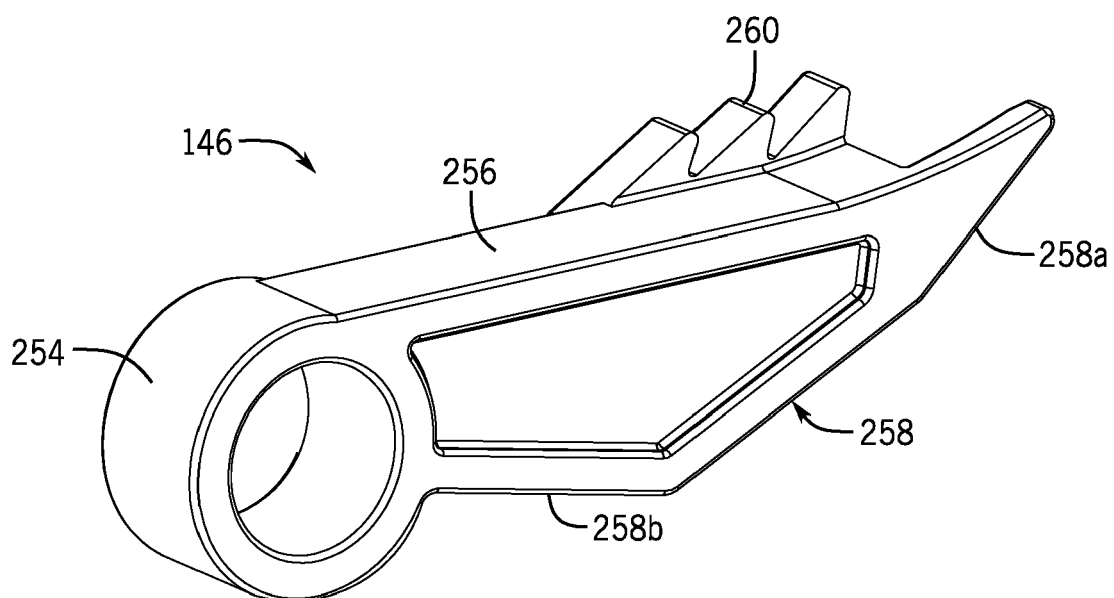
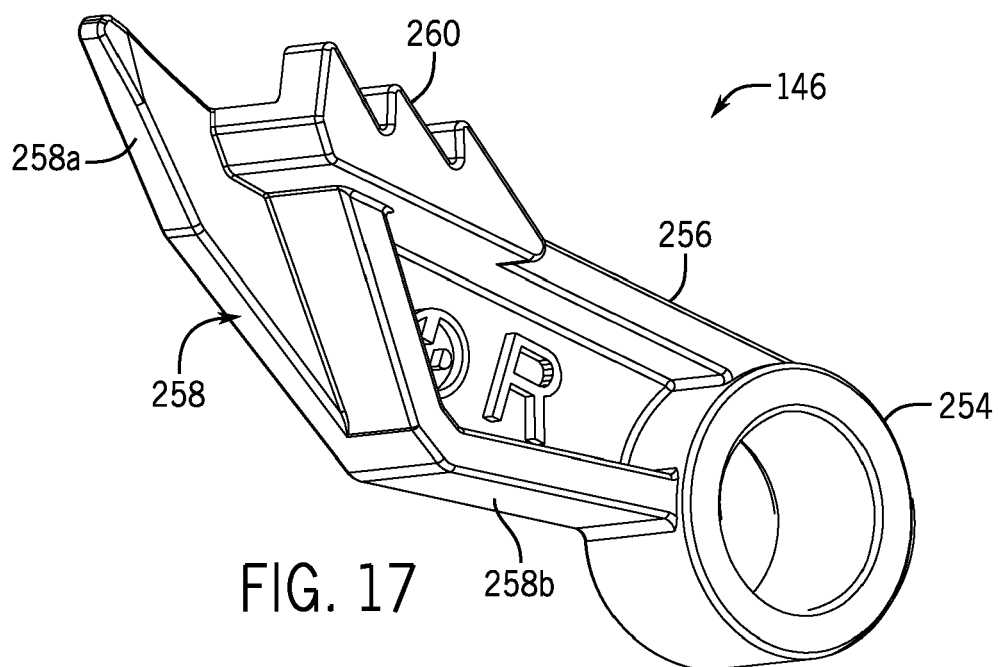


FIG. 14







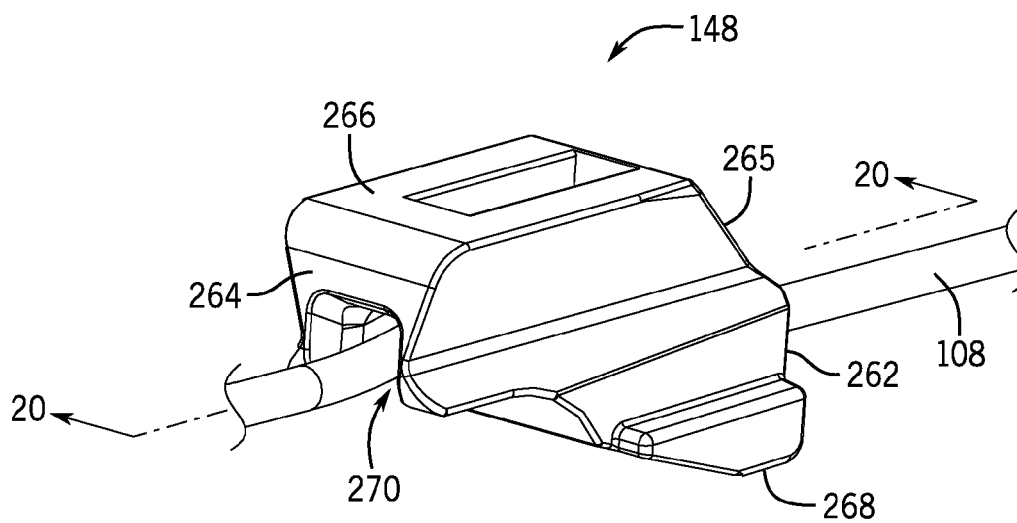


FIG. 19

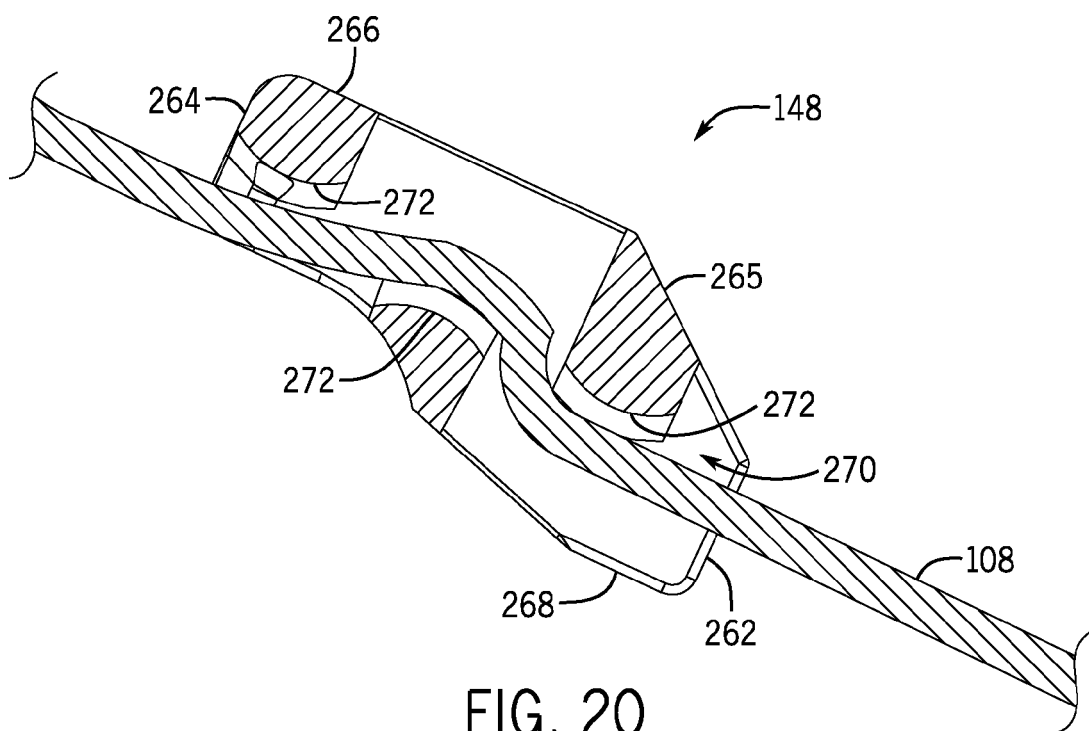
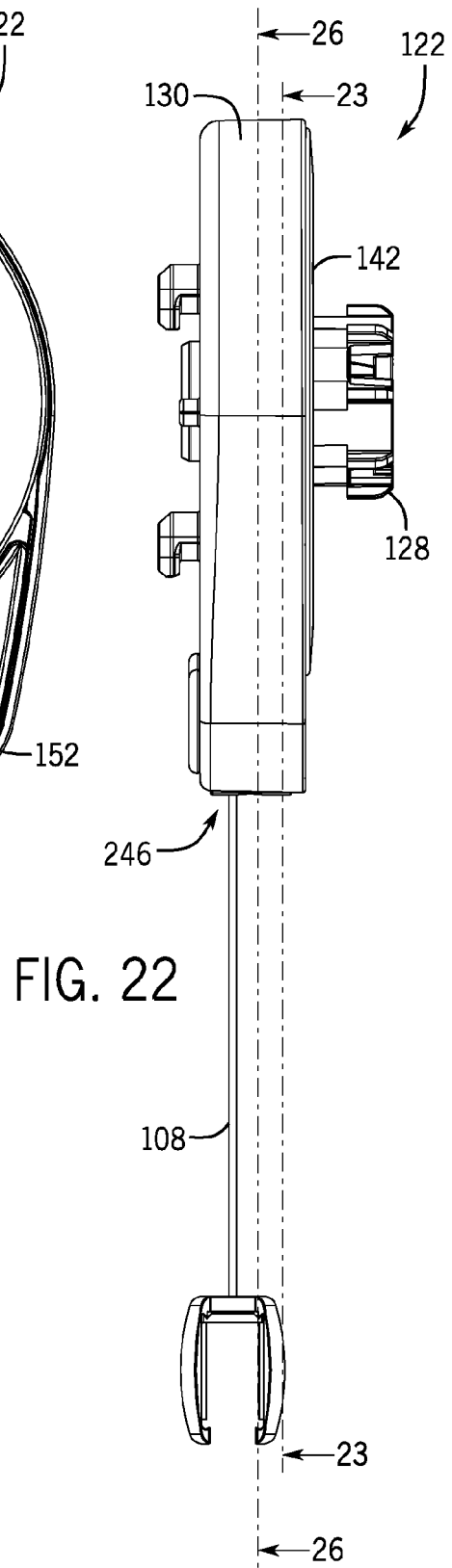
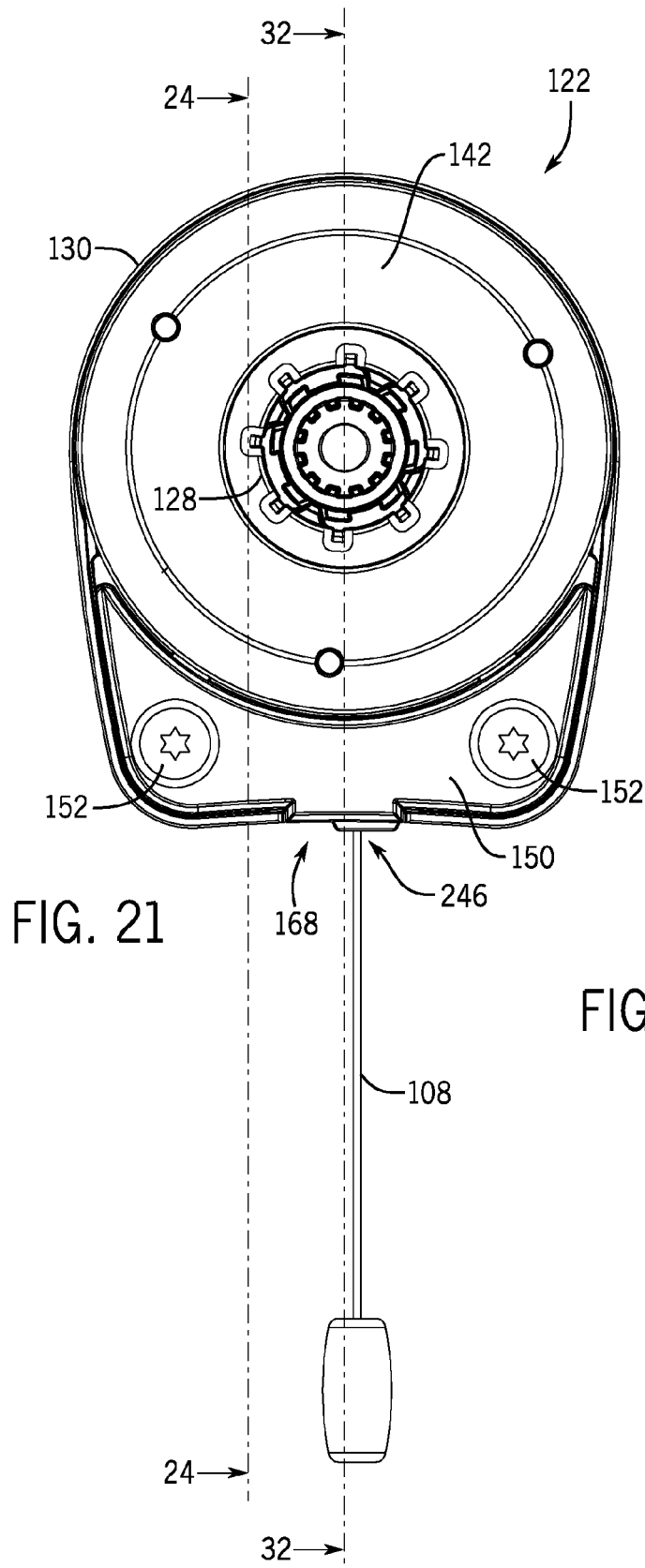


FIG. 20



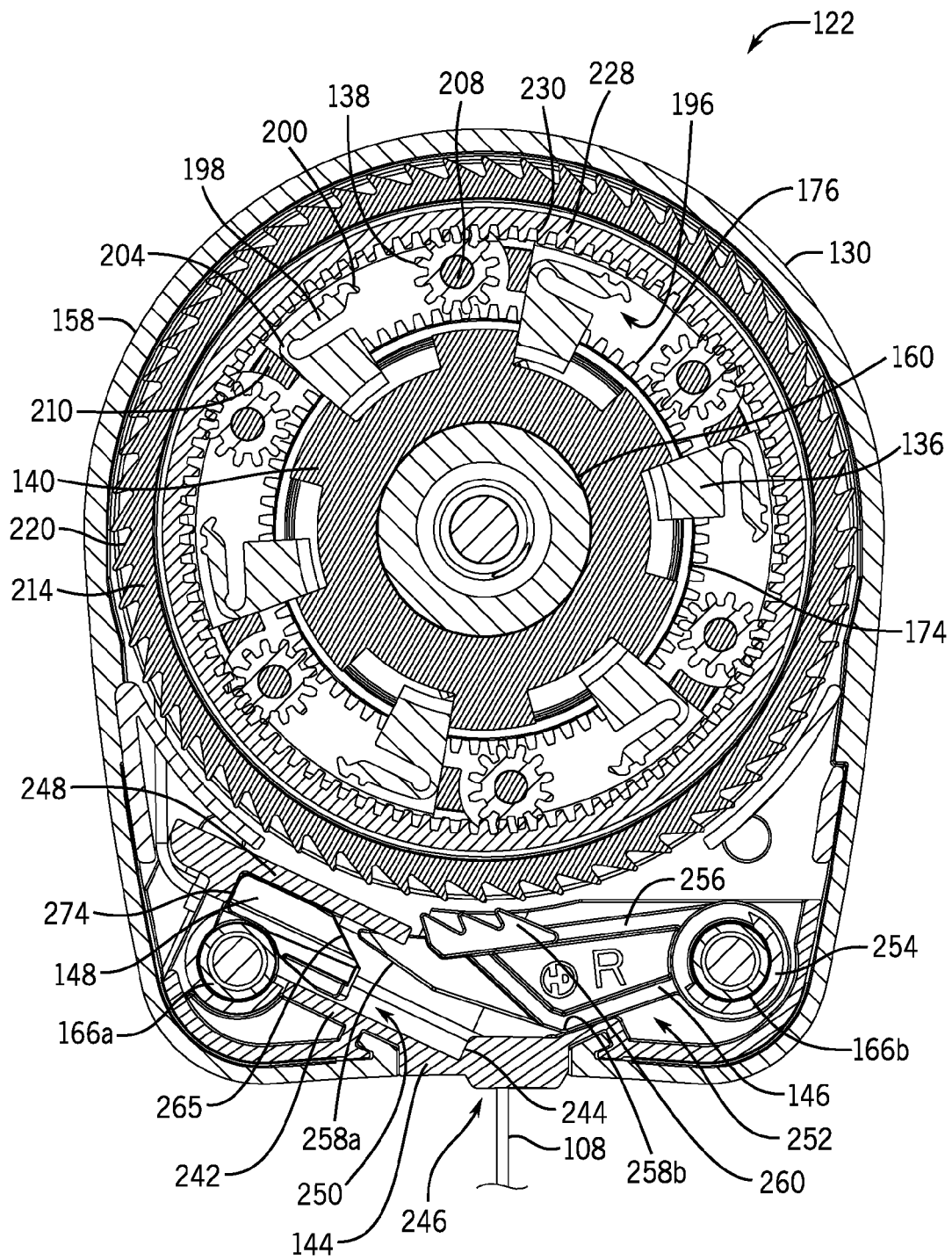
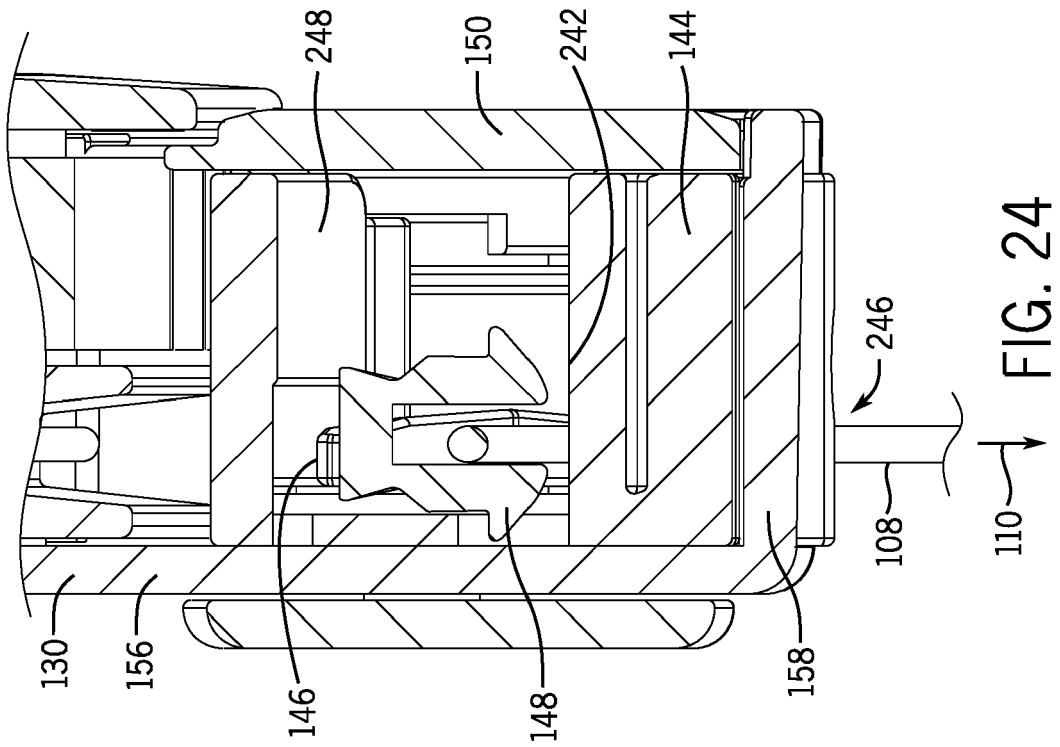
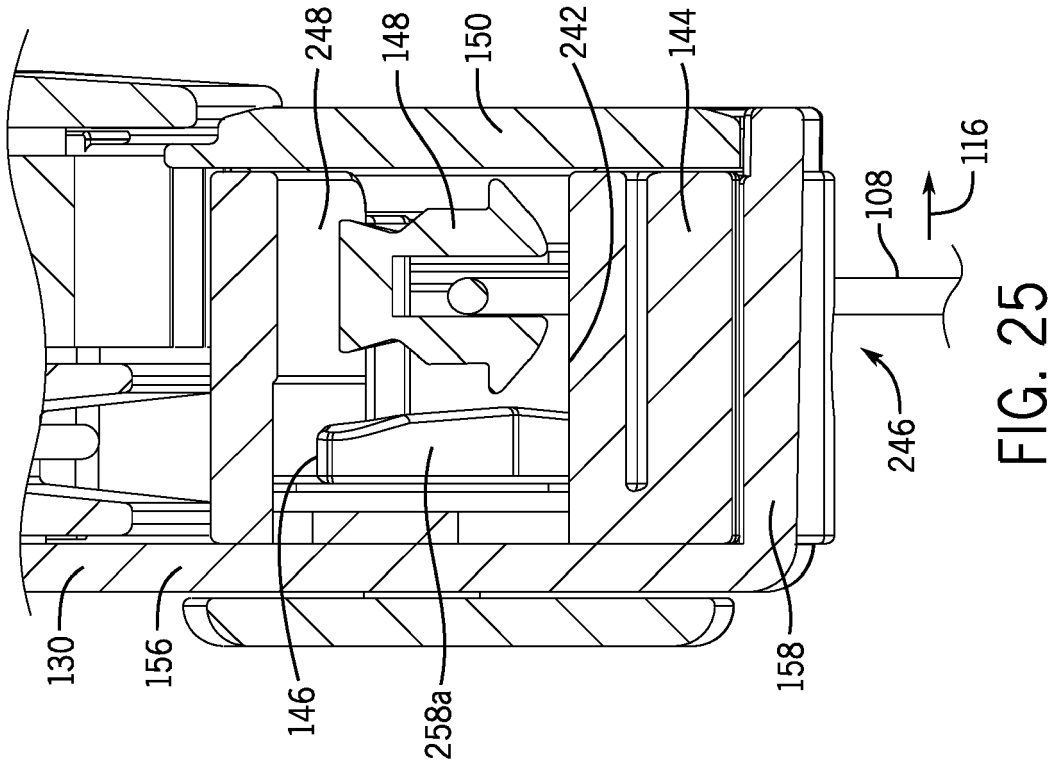


FIG. 23



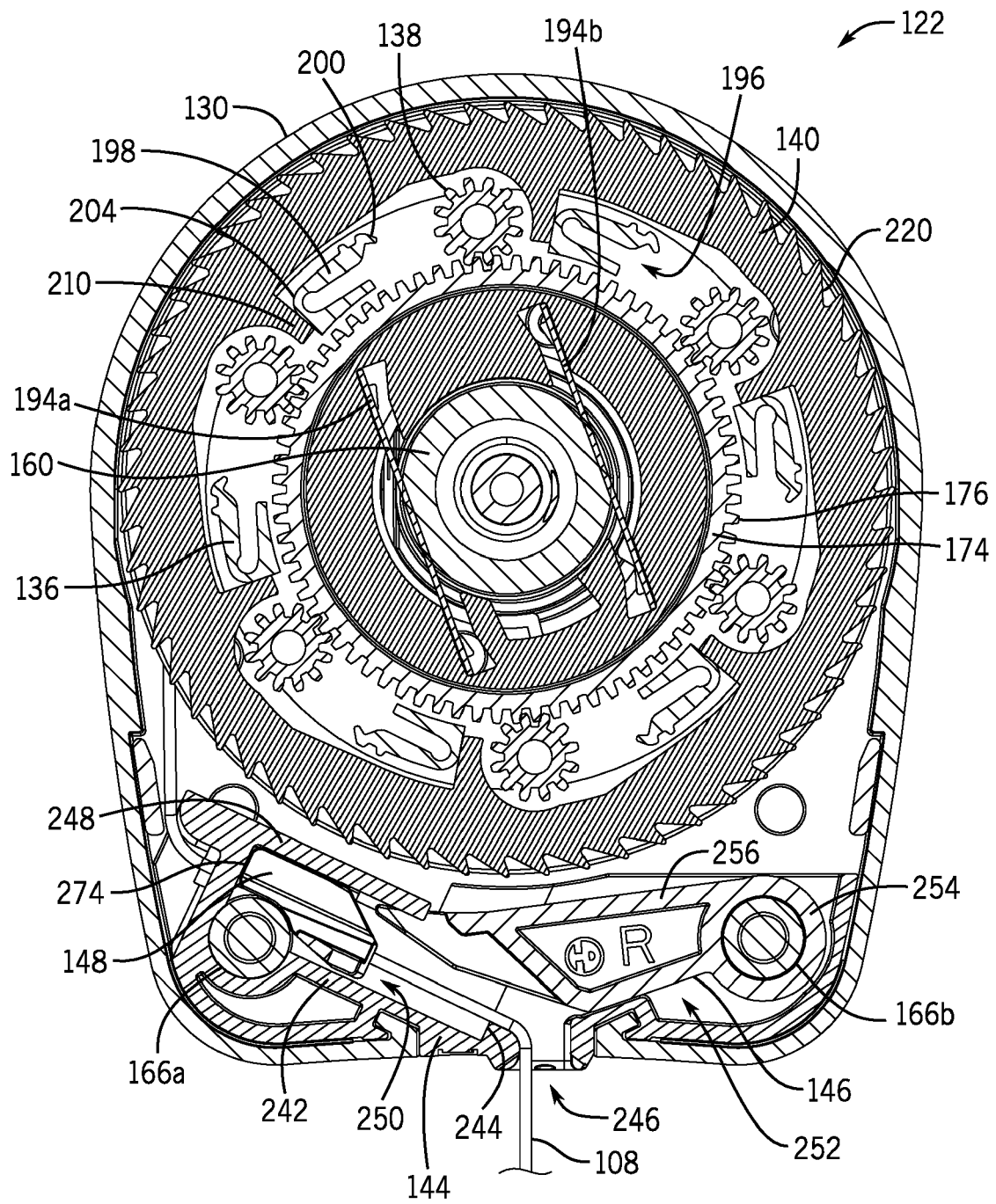


FIG. 26

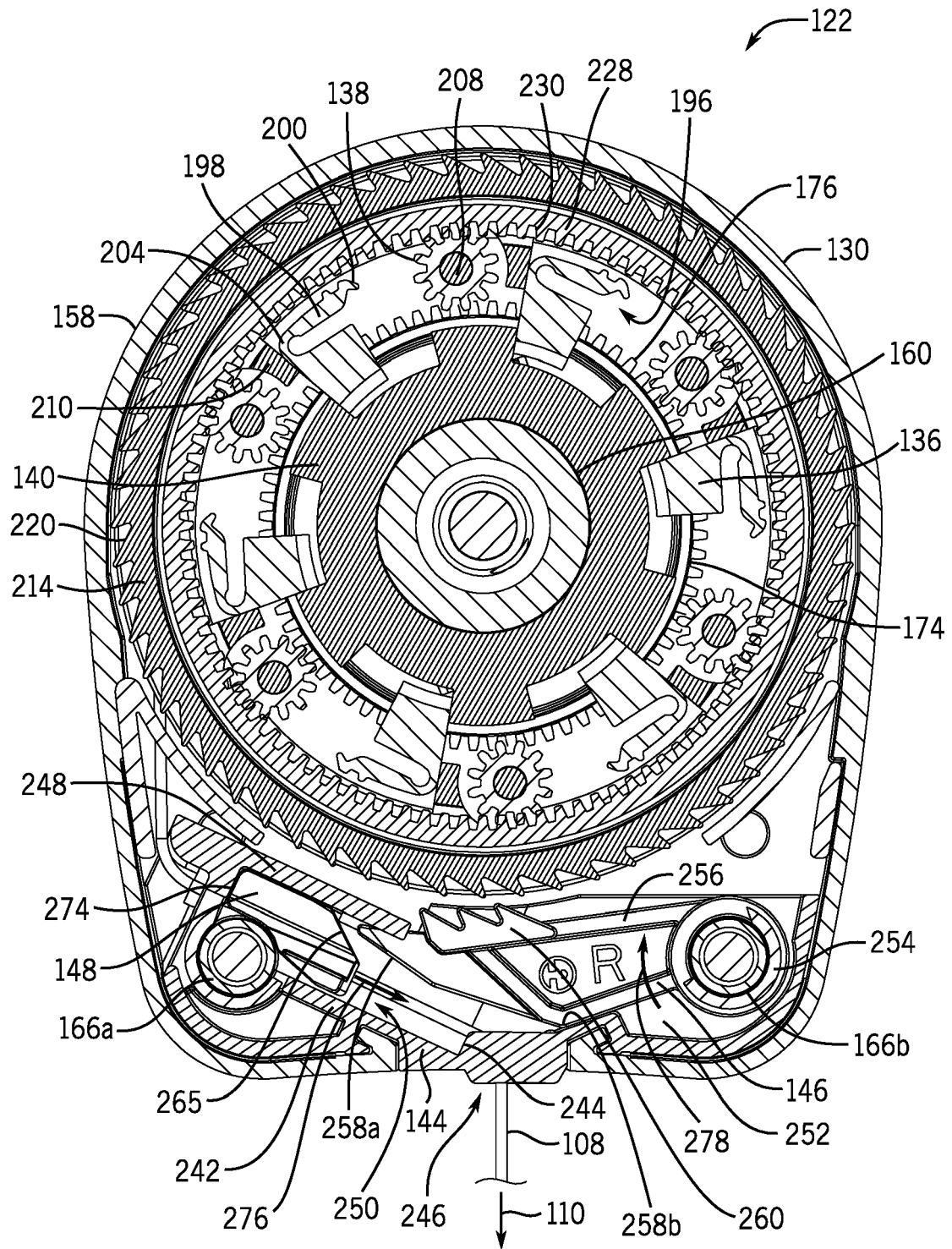


FIG. 27

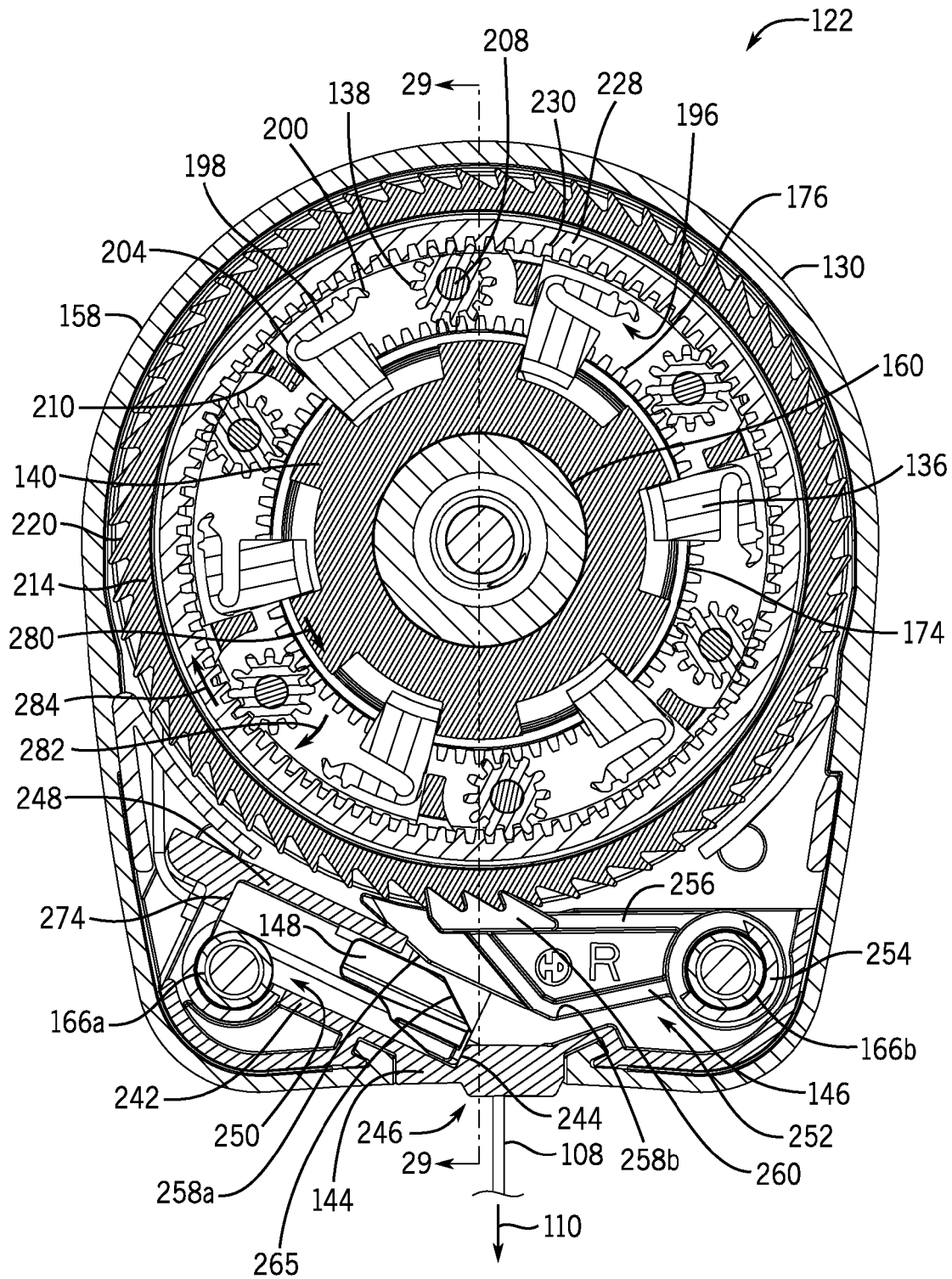


FIG. 28

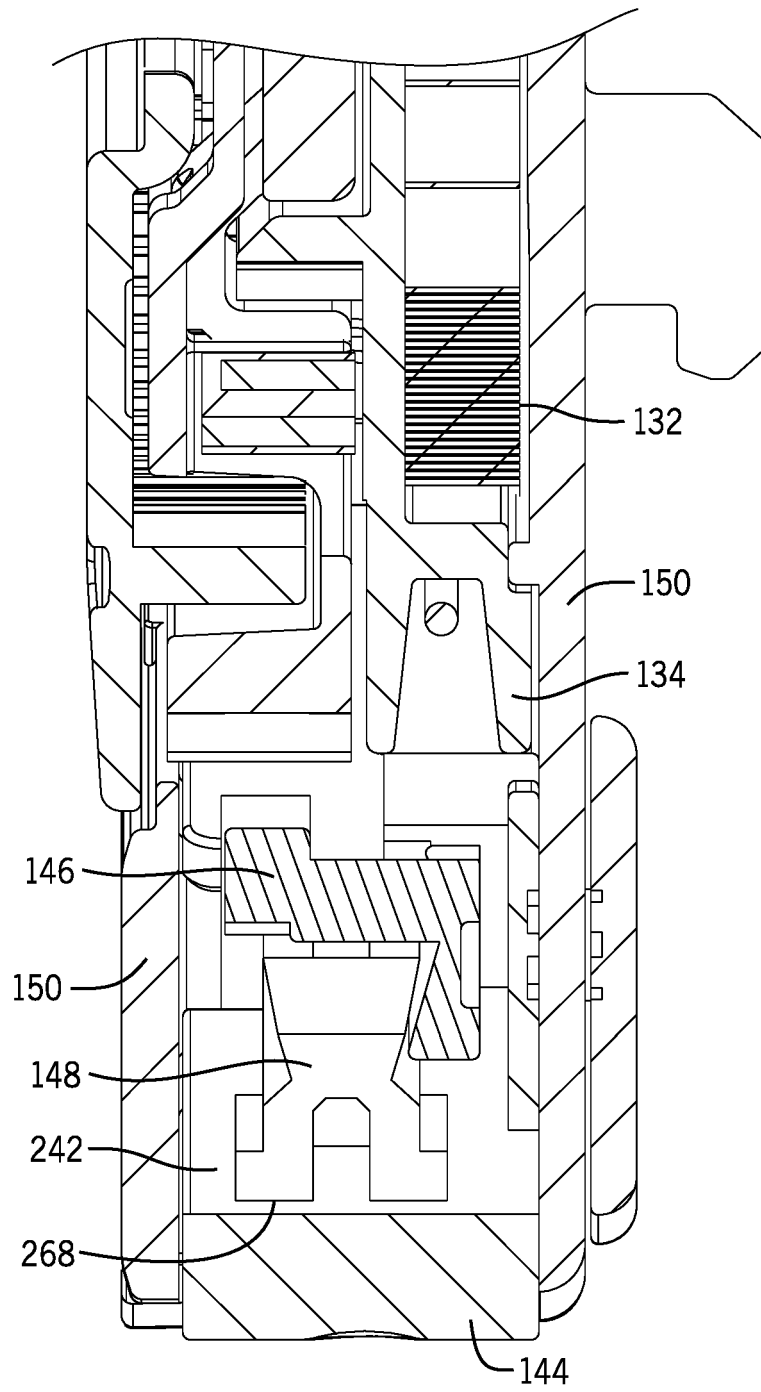


FIG. 29

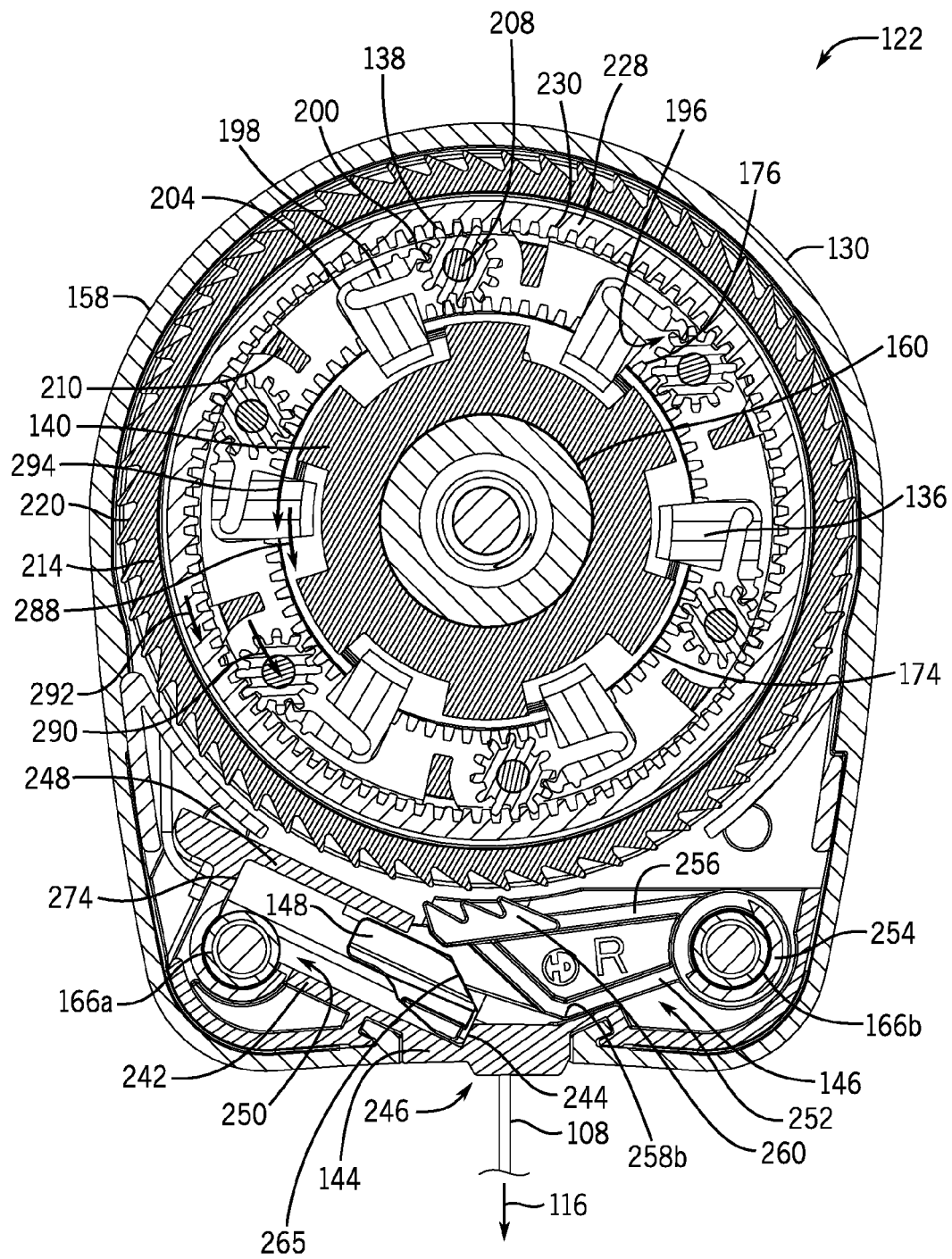


FIG. 30

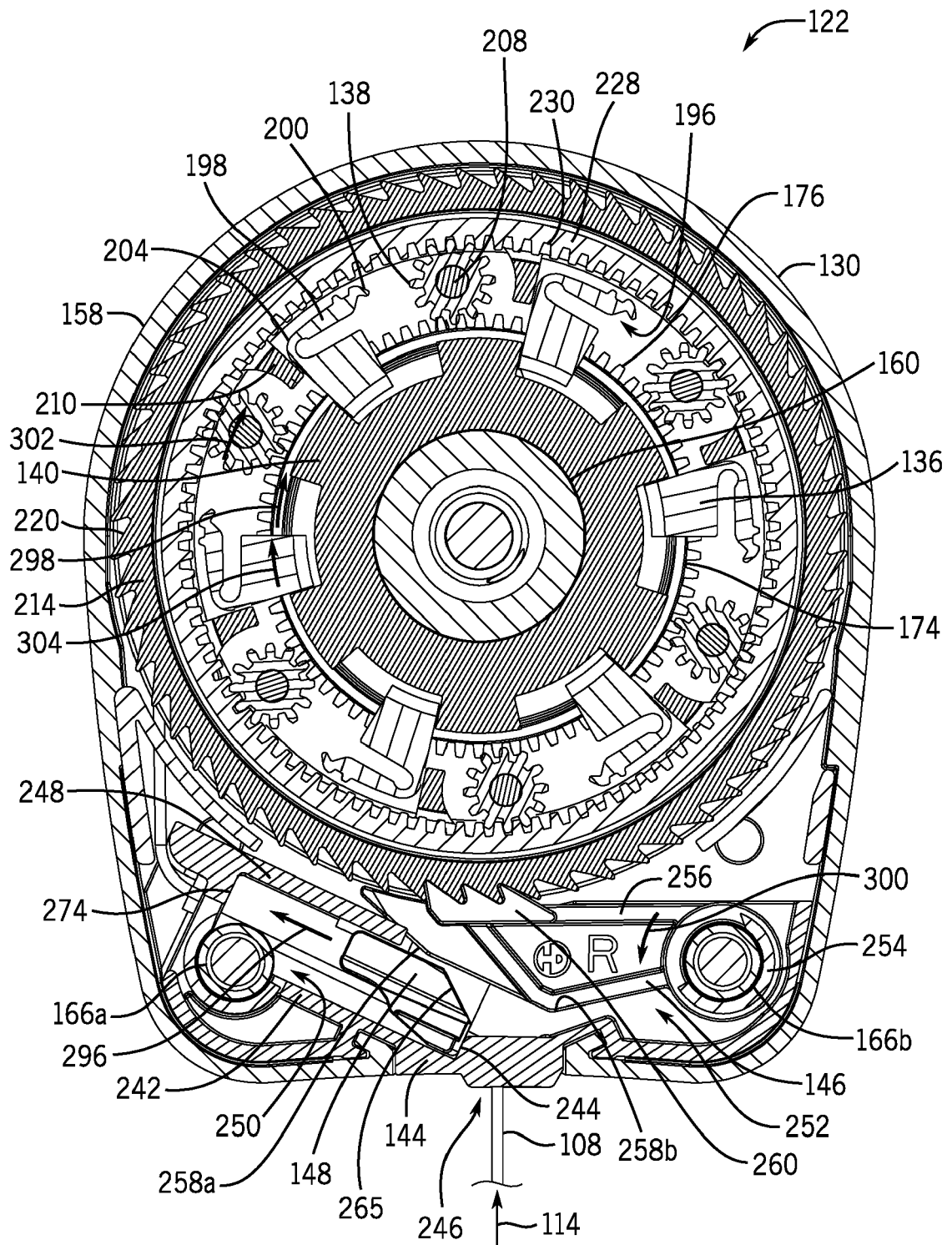


FIG. 31

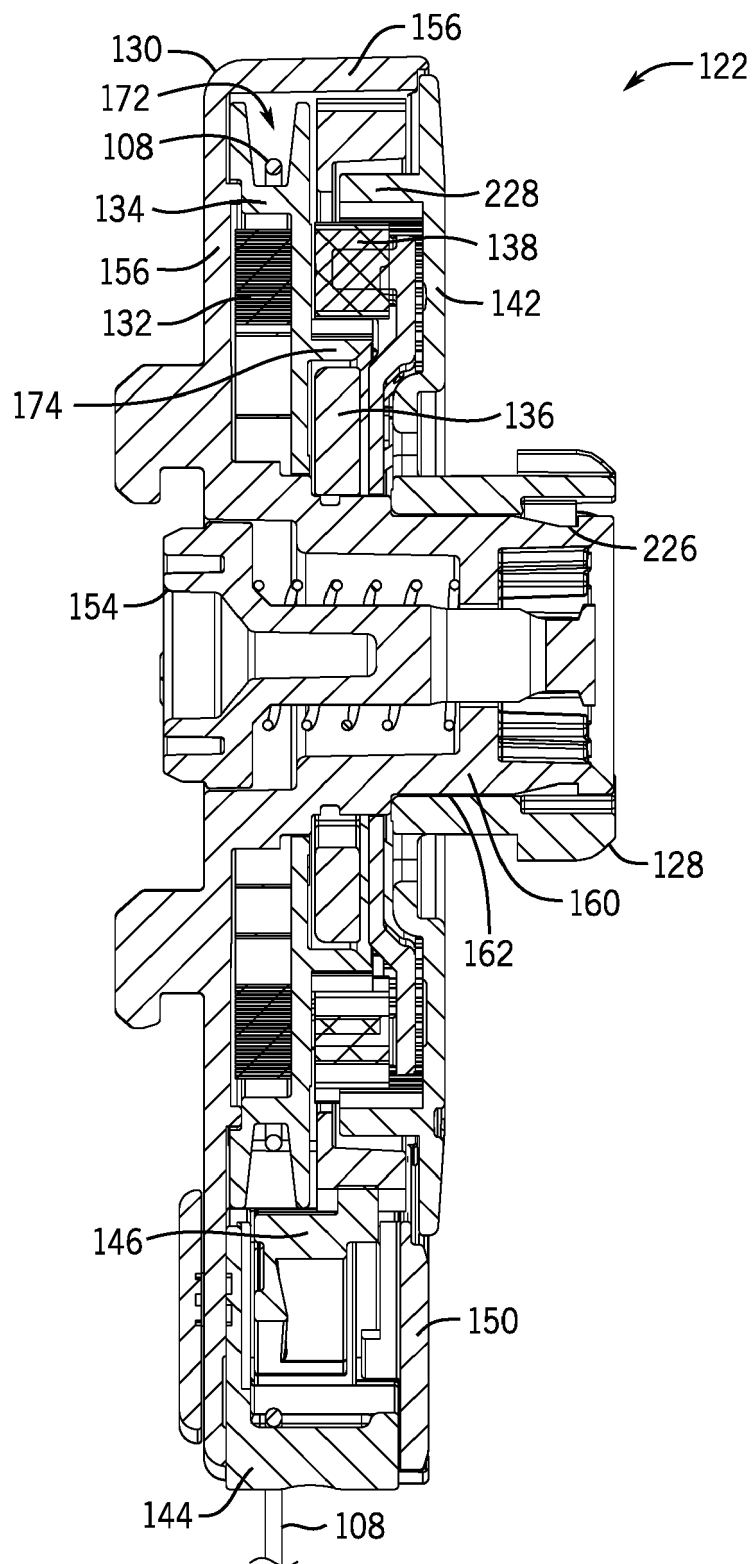


FIG. 32



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