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(54) **RATCHETING TOOL WITH CLUTCH**

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CPC B25B 21/004; B25B 23/141; B25F 5/001
See application file for complete search history.

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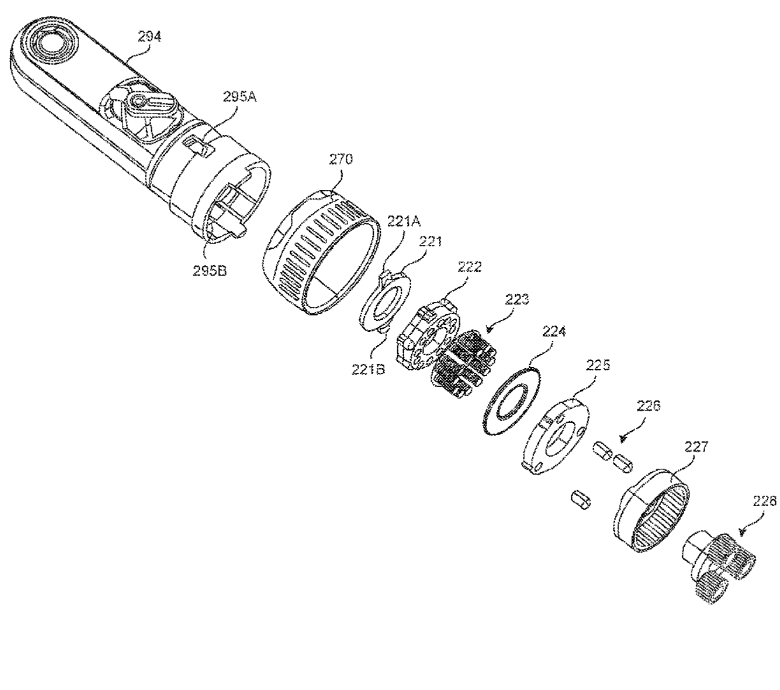
(57) **ABSTRACT**

A ratcheting tool may include a motor coupled to an output drive mechanism by a clutch assembly. A torque selector may be rotatably coupled to a housing of the tool, to provide for selection of a maximum output torque. The clutch assembly may selectively disengage the motor and the output drive mechanism, or slip, in response to detection of an output torque level, or resistance torque, that is greater than or equal to the selected maximum output torque level.

34 Claims, 16 Drawing Sheets



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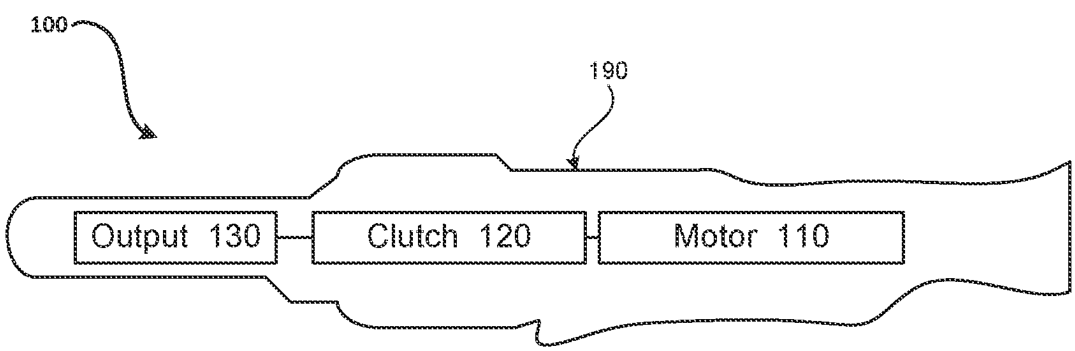


FIG. 1

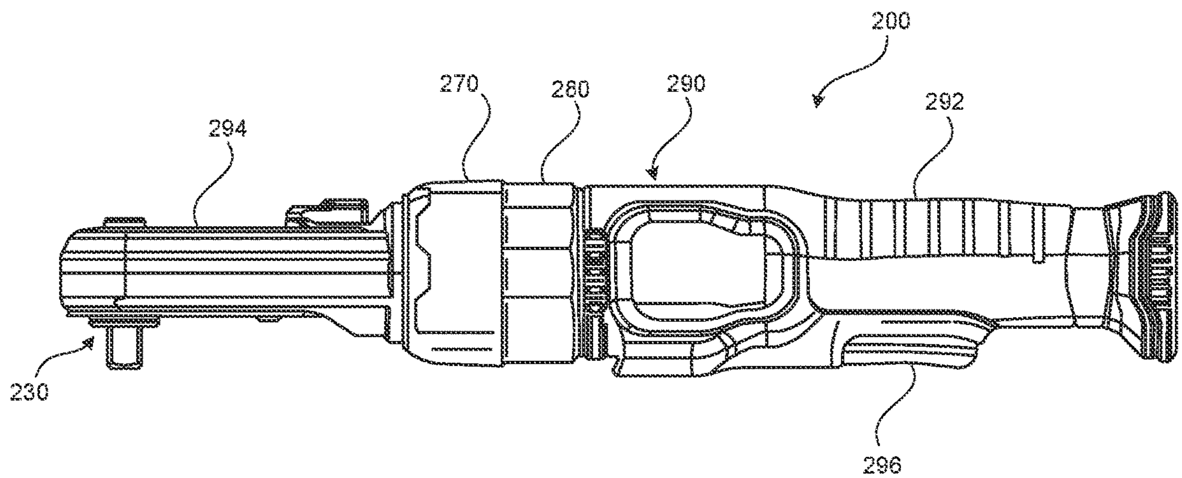


FIG. 2

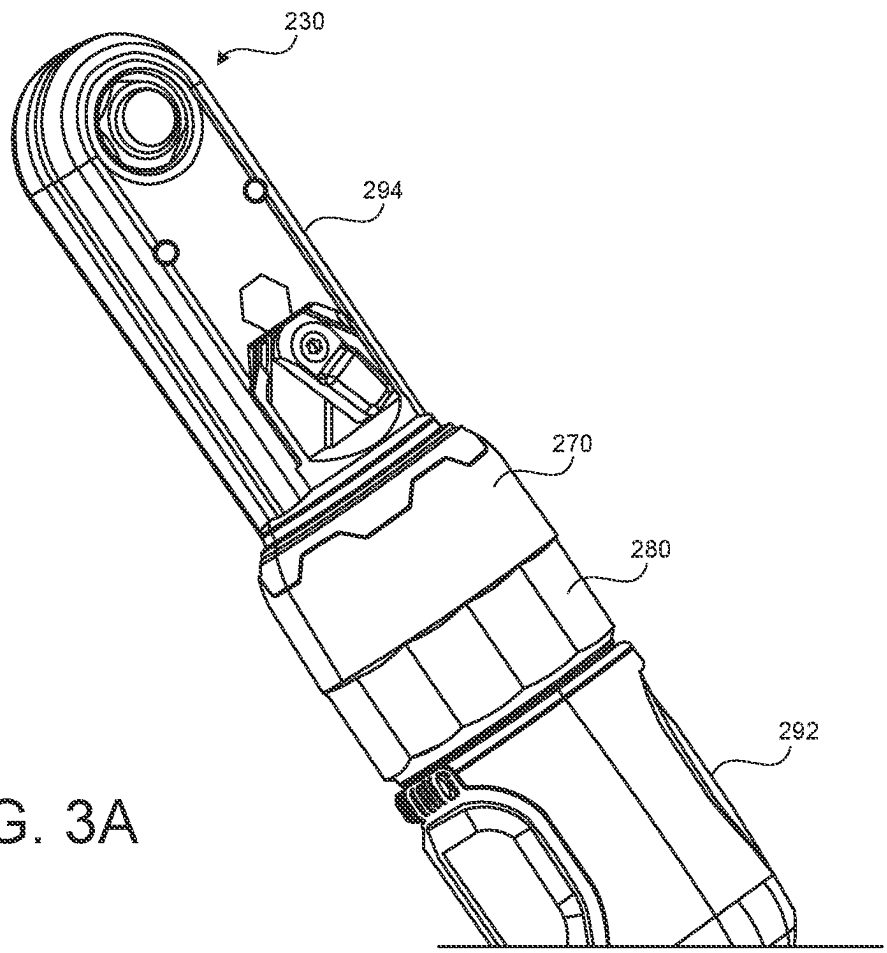
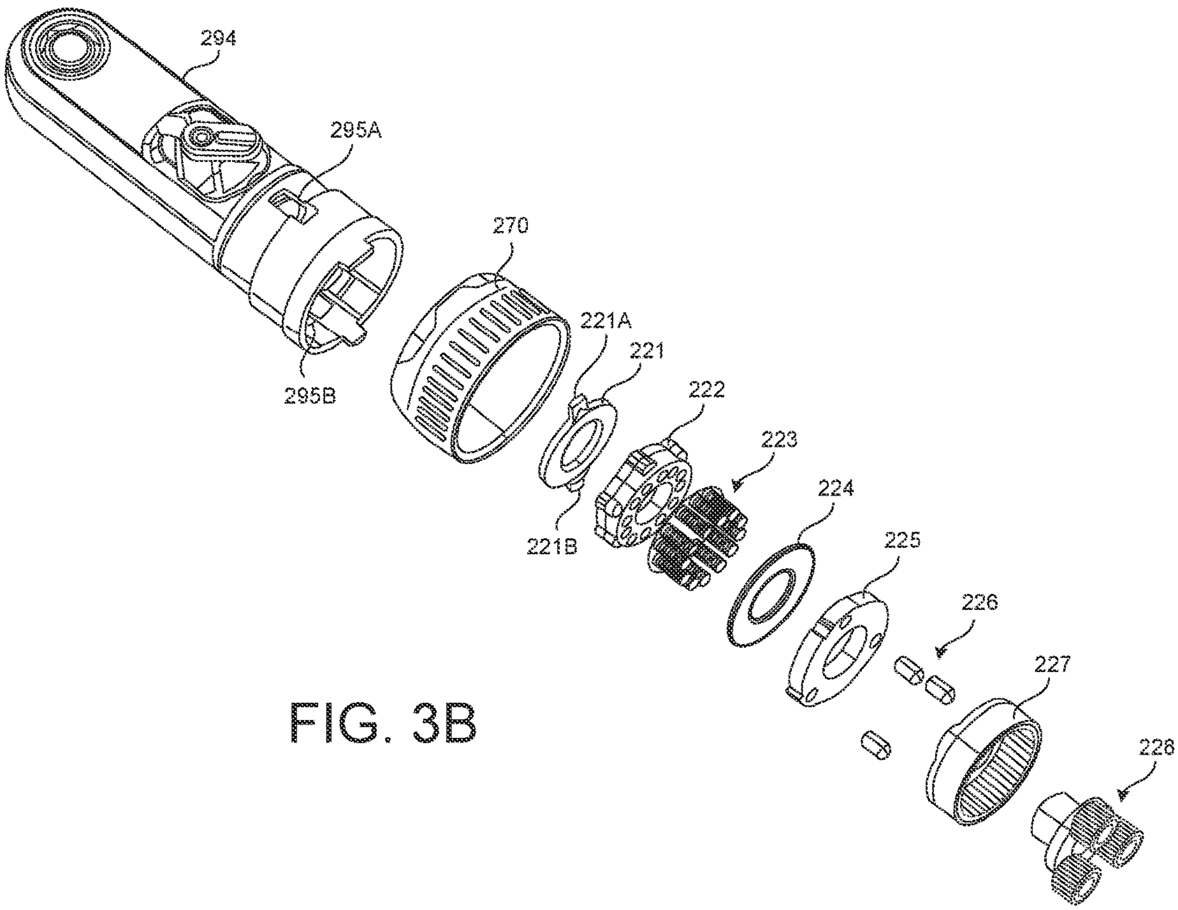


FIG. 3A



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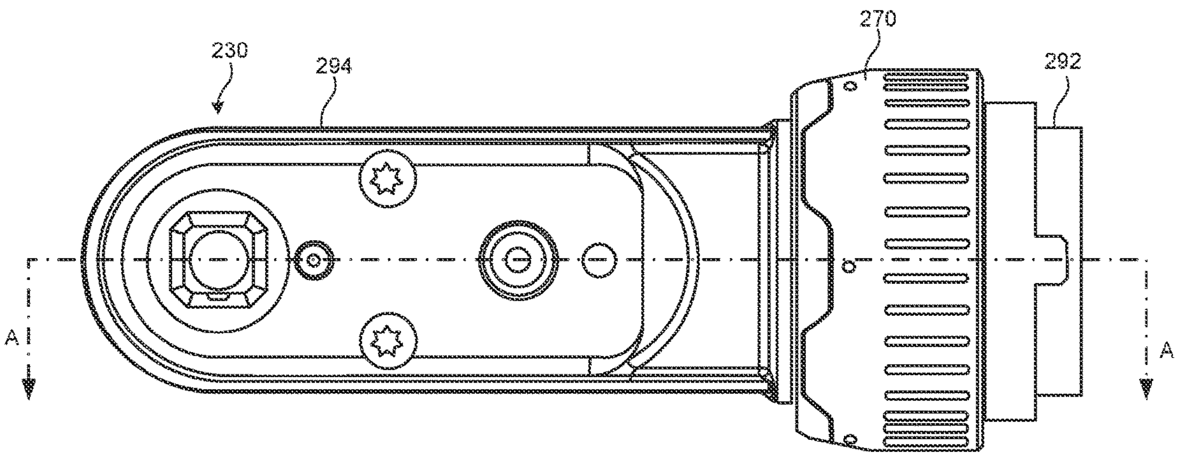
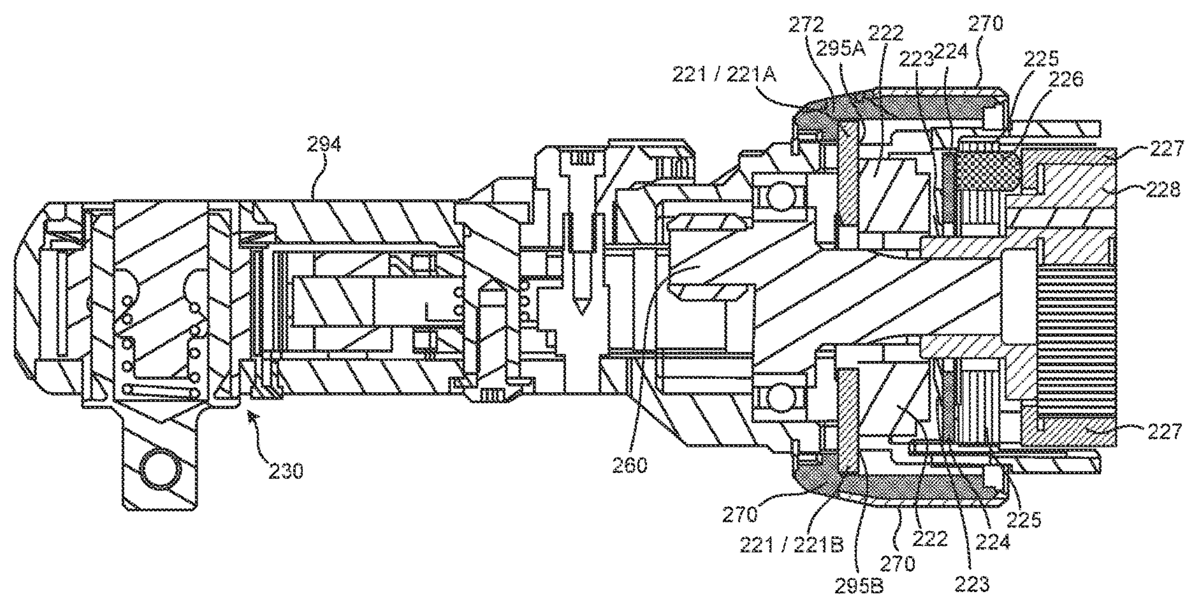


FIG. 4A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295B
223

FIG. 4B

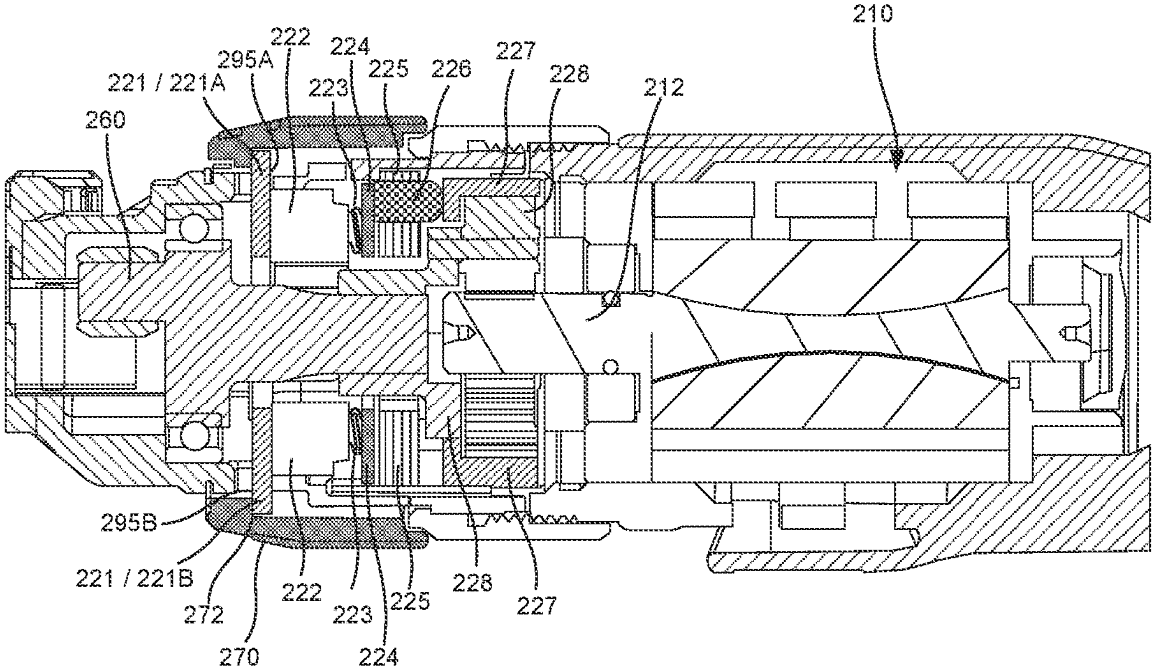
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FIG. 5

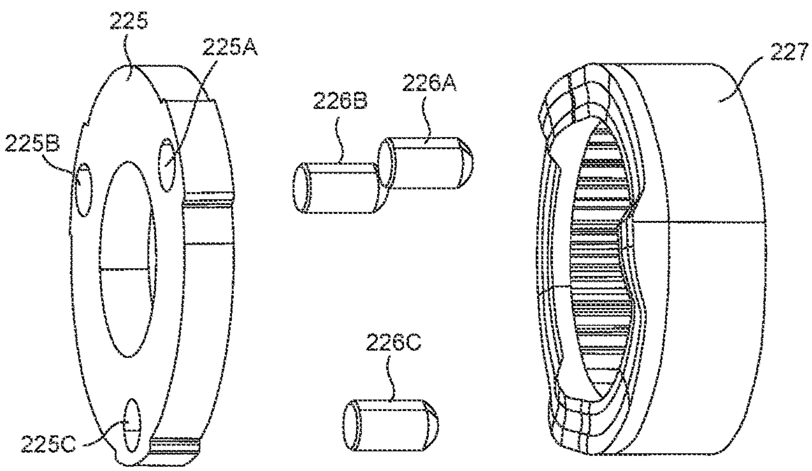
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FIG. 6A

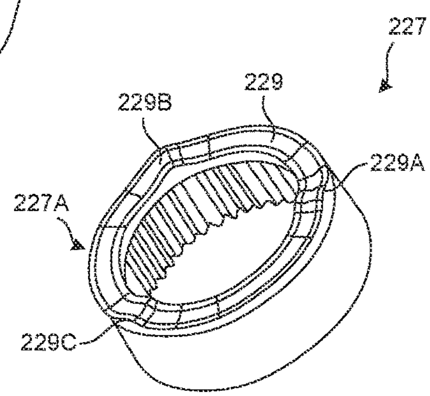
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FIG. 6B

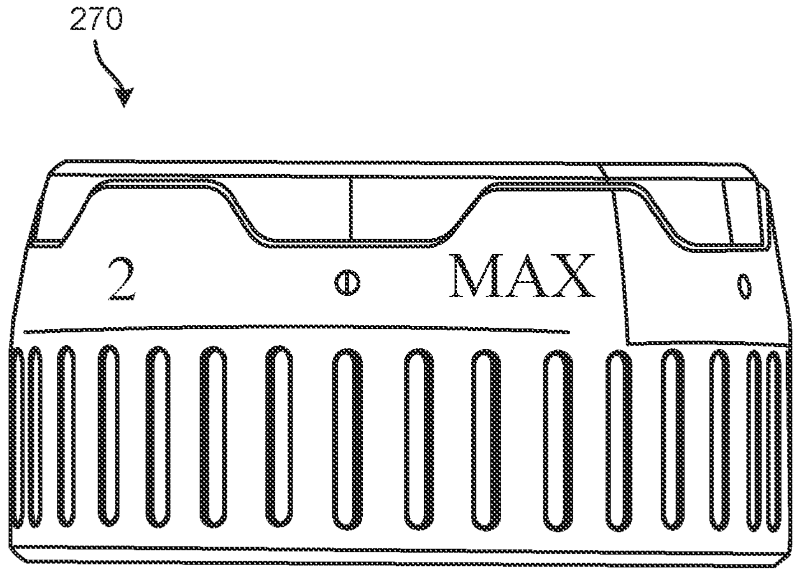

FIG. 7A

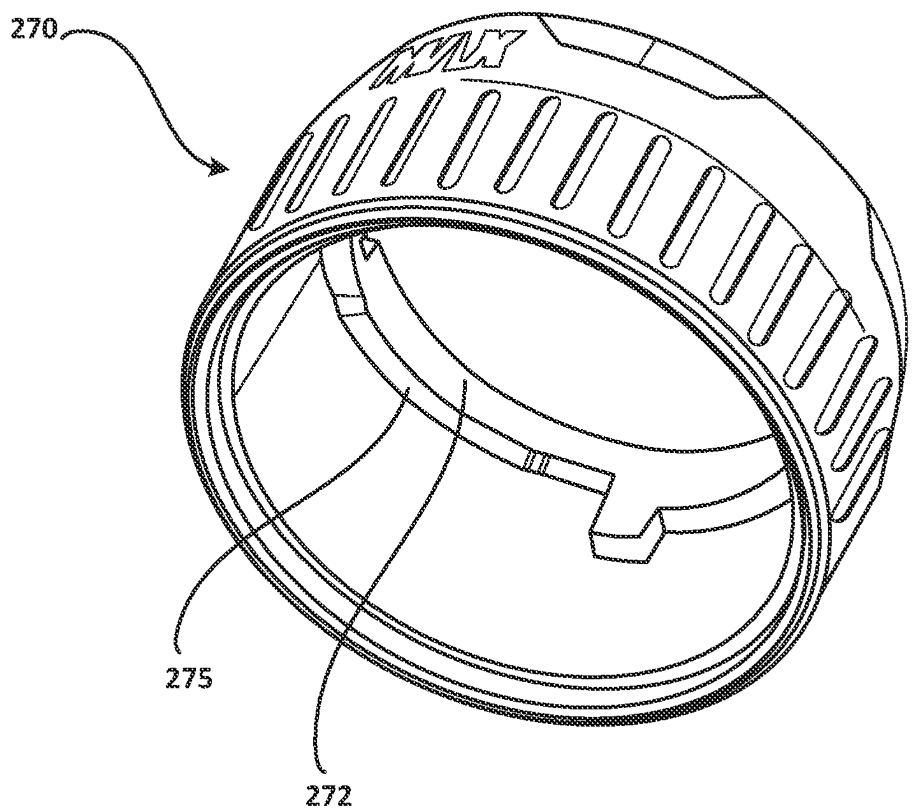

FIG. 7B

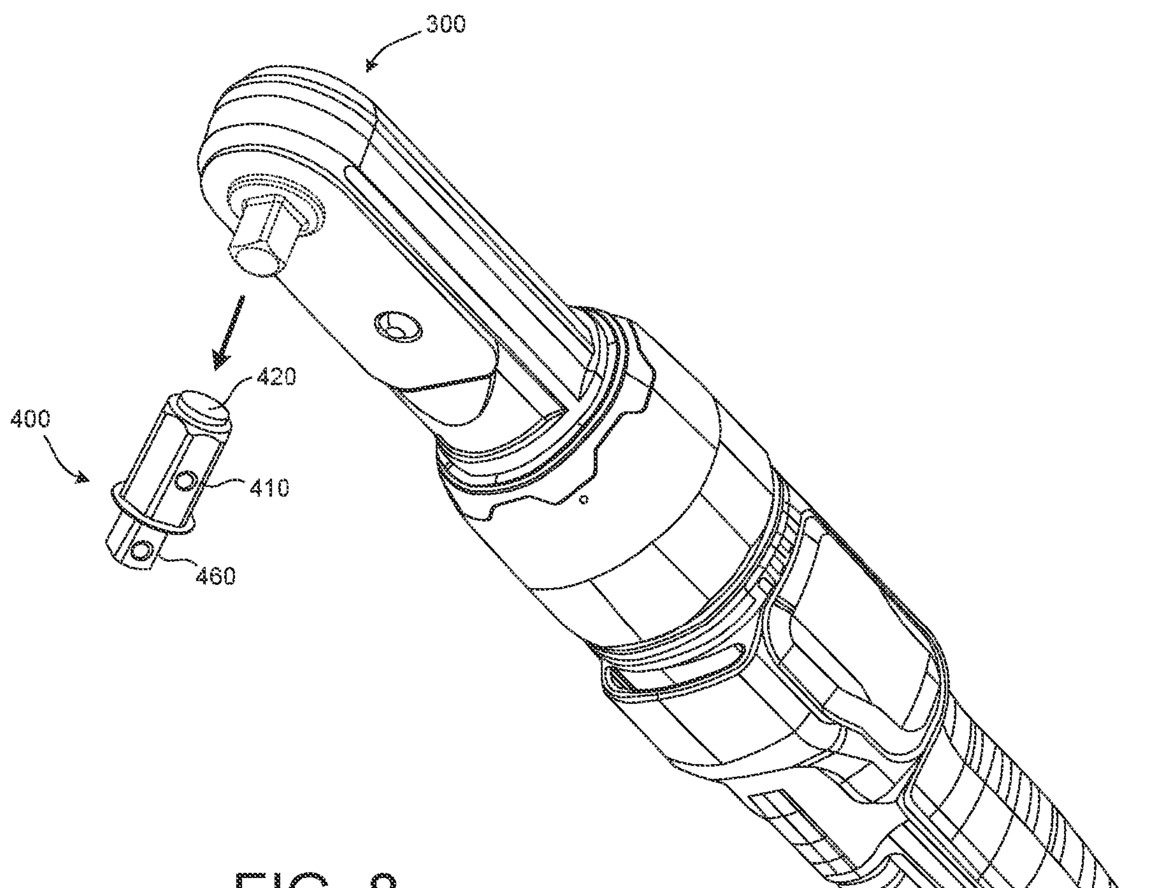

FIG. 8

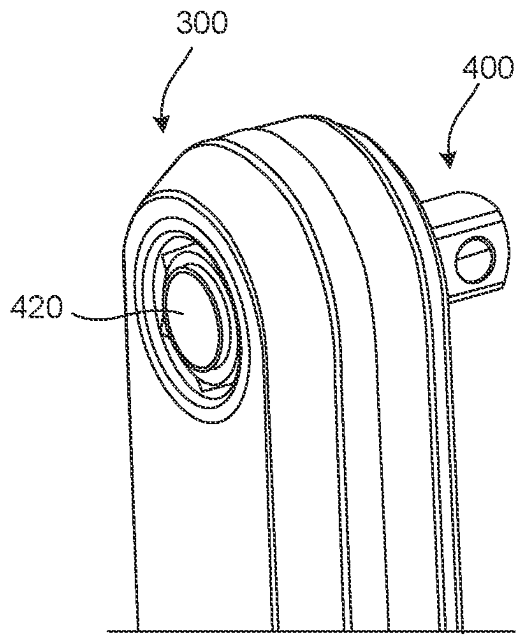

FIG. 9A

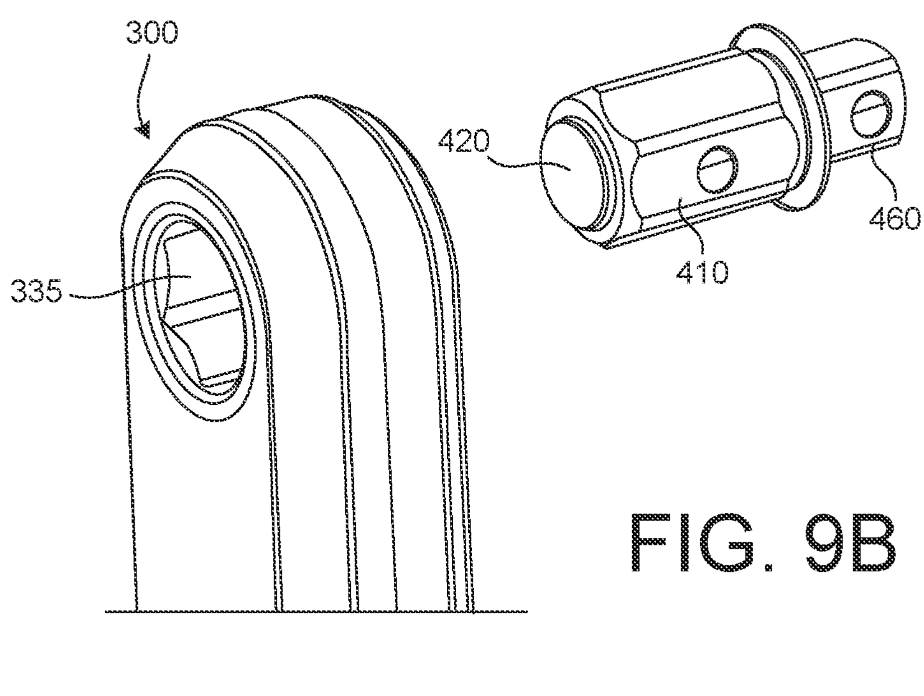

FIG. 9B

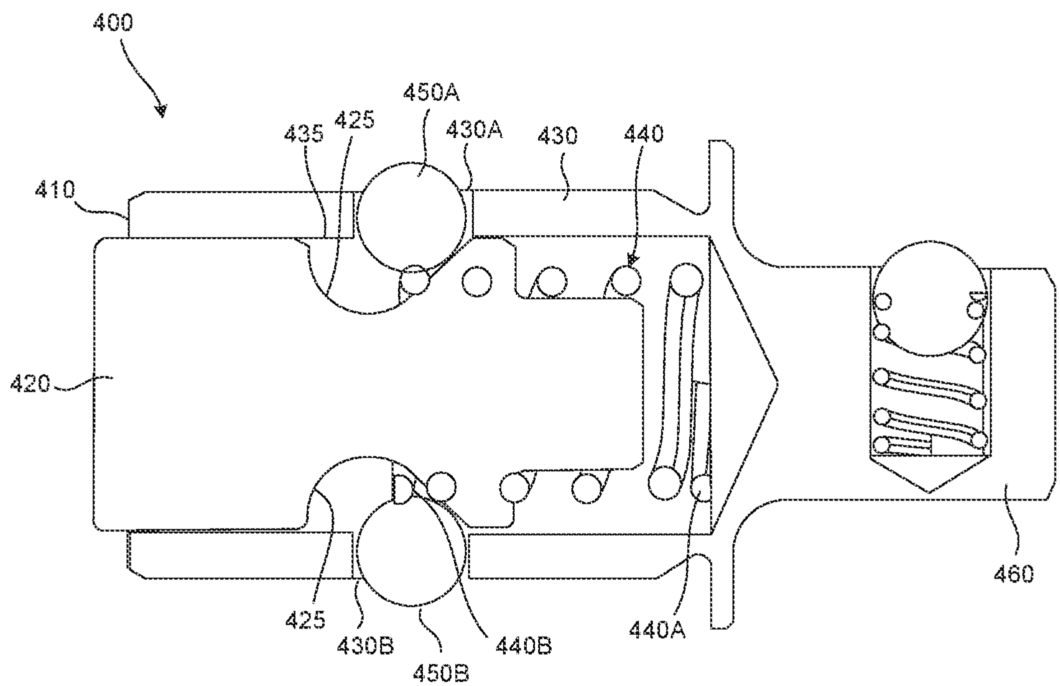
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FIG. 10

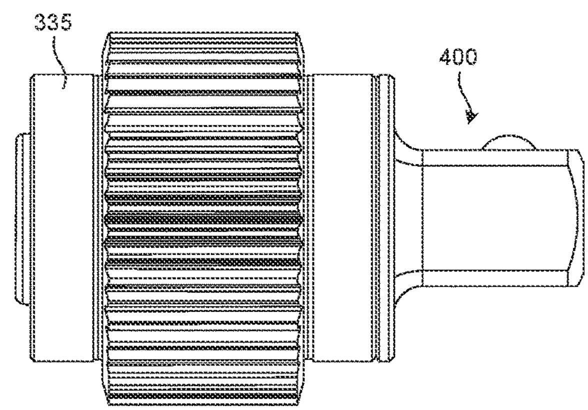

FIG. 11A

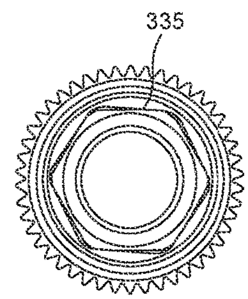

FIG. 11B

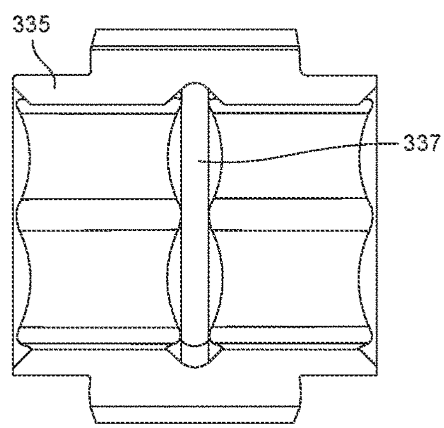

FIG. 11C

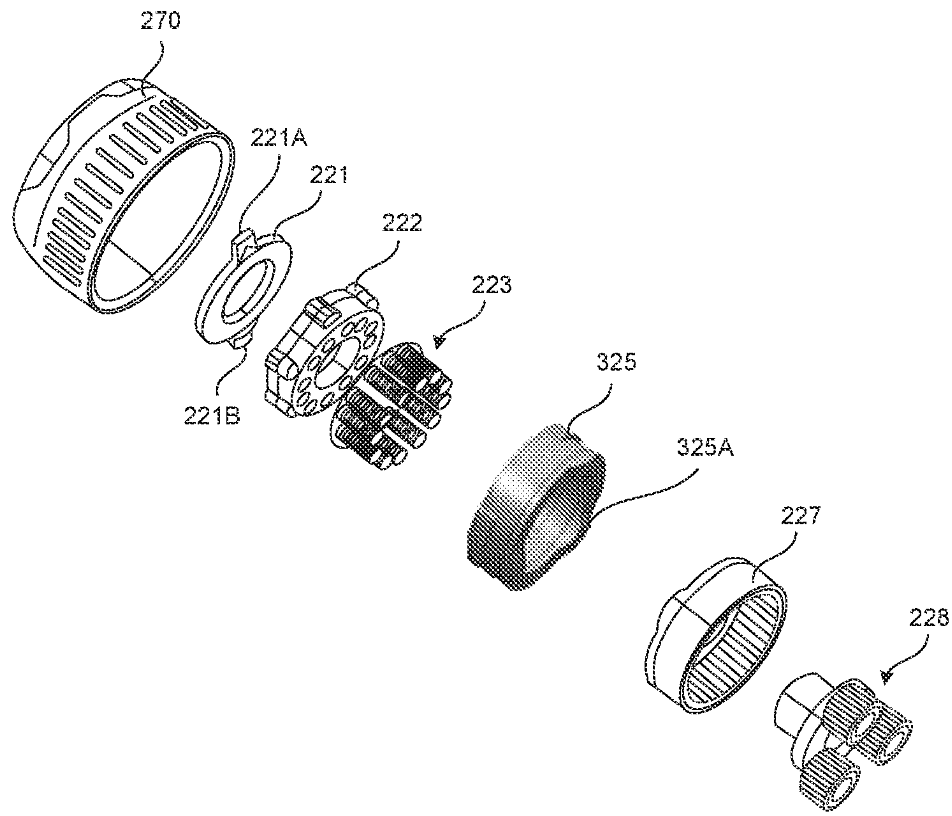

FIG. 12A

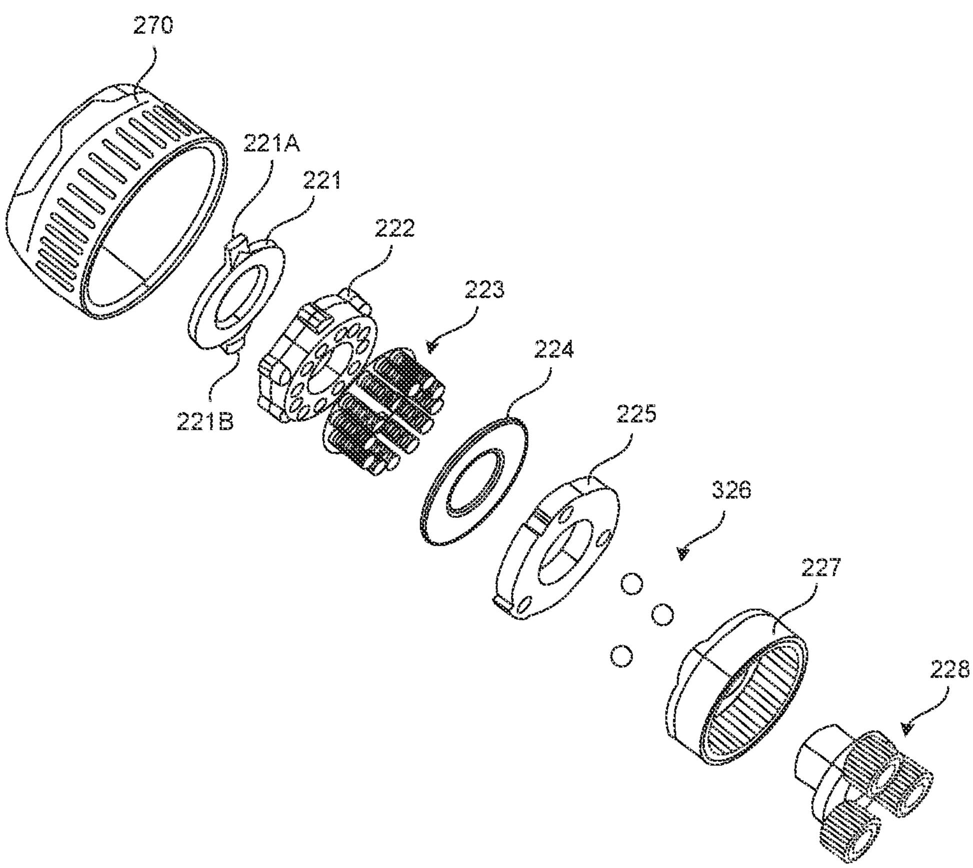

FIG. 12B

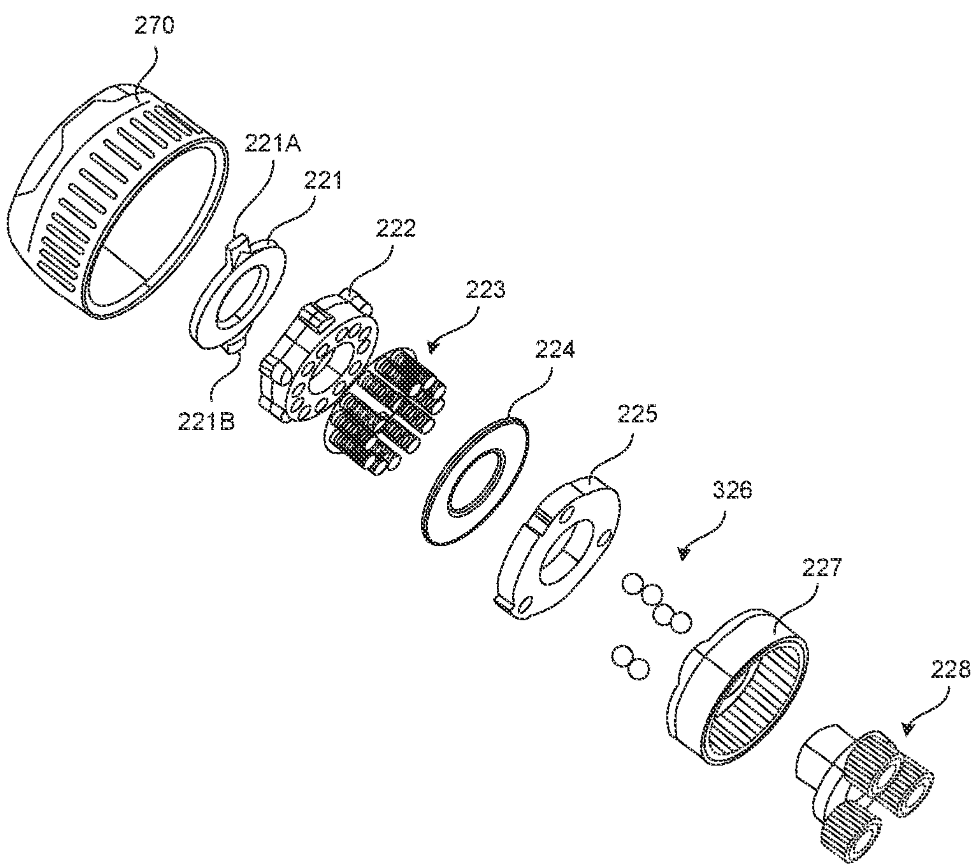

FIG. 12C

RATCHETING TOOL WITH CLUTCH

FIELD

This document relates, generally, to a ratcheting tool, and in particular, to a ratcheting tool having a torque limiting clutch.

BACKGROUND

A ratcheting tool, or ratchet, may include a head portion that can engage a work piece (for example, a fastener), and a handle portion extending from the head portion for manipulation by a user. Rotation of the ratcheting tool in a first direction (i.e., rotation of the handle portion about the head portion), may cause a corresponding rotation of the work piece engaged with the head portion (for example, a tightening or a loosening of a fastener). Rotation of the ratcheting tool in a second direction (opposite the first direction) may allow the handle portion of the ratcheting tool to be repositioned, while the head portion remains stationary, to provide for additional rotation in the first direction (and corresponding additional tightening or loosening of the fastener). This ratcheting action may provide for relatively rapid tightening or loosening of a fastener while the tool remains engaged with the fastener. Some ratcheting tools may be relatively simple hand tools, while some ratcheting tools may be operated in both a power driven mode and a manual mode. Effective control of a maximum amount of torque output by the ratcheting tool and/or applied to the work piece/fastener may simplify use of the tool, may protect the work piece/fastener from damage, and may enhance the utility of the tool.

Users face many problems or hinderances in the use of common powered ratchets. One problem is that a user may receive a reactionary force or kickback from the tool that can cause harm to the user. Another issue that users face in using powered ratchets is the necessity to use and/or purchase different tools or different ratchets to perform a job. Another problem users face is the necessity to purchase an entirely new ratchet or service the existing ratchet when a drive head is damaged. Therefore, a need exists for a ratchet tool with a torque limiting clutch.

SUMMARY

In one aspect, A ratchet may include a housing, a motor in the housing, an output drive mechanism coupled to the housing, a torque selector coupled to the housing, the torque selector including a collar rotatably coupled to the housing, wherein the collar is rotatable to a plurality of positions corresponding to a plurality of torque settings, so as to provide for selection of a maximum output torque of the ratchet, and a clutch assembly selectively coupling the motor and the output drive mechanism

In another aspect, a ratchet tool may include a housing, a motor in the housing, an output drive mechanism coupled to the housing, and a clutch assembly selectively coupling the motor and the output drive mechanism. The clutch assembly may include a planetary gear set coupled to an output shaft of the motor, a ring gear having an inner circumferential surface configured to selectively engage the planetary gear set, a pin cage having a plurality of openings formed therein, a clutch washer, a plurality of clutch pins respectively received in the plurality of openings in the pin cage, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with an axial end portion of the ring gear, a spring cage having a plurality of recesses formed in a first side thereof, a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer, and a pressing plate positioned proximate a second side of the spring cage.

In another aspect, a ratchet tool with clutch may include a housing, a motor in the housing, n output drive mechanism coupled to the housing, a torque selector coupled to the housing, the torque selector including a collar rotatably coupled to the housing, wherein the collar is rotatable to a plurality of positions corresponding to a plurality of torque settings, so as to provide for selection of a maximum output torque of the ratchet tool, and a clutch assembly selectively coupling the motor and the output drive mechanism. The clutch assembly may include a planetary gear set coupled to an output shaft of the motor, a ring gear having an inner circumferential surface configured to selectively engage the planetary gear set, a pin cage having a plurality of openings formed therein, a clutch washer, a plurality of clutch pins respectively received in the plurality of openings in the pin cage, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with an axial end portion of the ring gear, a spring cage having a plurality of recesses formed in a first side thereof, a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer, and a pressing plate positioned proximate a second side of the spring cage.

In another aspect, a ratchet tool with limiting clutch may include a housing, a motor in the housing, an output drive mechanism coupled to the housing, and a clutch assembly selectively coupling the motor and the output drive mechanism. The clutch assembly may include a planetary gear set coupled to an output shaft of the motor, a ring gear having an inner circumferential surface configured to selectively engage the planetary gear set, a pin cage, a clutch washer, a clutch interface coupled to the pin cage, wherein the pin cage having a end thereof in contact with a first side of the clutch washer, and the clutch interface having an end in contact with an axial end portion of the ring gear, a spring cage having a plurality of recesses formed in a first side thereof, a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer, and a pressing plate positioned proximate a second side of the spring cage.

This implementation of the invention, in particular, may be desired because it reduces the amount of reactionary force to a user and thus reduces the risk of harm to a user because the detection of maximum force can release the engagement of the motor and the output mechanism. This implementation of the invention may also be desired, in particular, because the coupling portion as configured to be removably coupled provides the user the ability to switch out one tool interface for another tool interface, thereby providing a user with options for different head assemblies and creating a plurality of different tools for many different jobs. Thus, to a relatively large extent, the interchangeable functionality of the drive assembly permits a user to forgo hauling multiple heavy tools and instead grants a user the ability to carry smaller tool heads for use with one main tool to perform different jobs.

The terminology used herein is for the purpose of describing implementations or embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms, "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the root terms "can", "include", "can include", "may", and/or "have", when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of at least one other feature, step, operation, element, component, and/or groups thereof.

As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article, or apparatus that comprises a list of features is not necessarily limited only to those features but may include other features not expressly listed or inherent to such process, method, article, or apparatus.

For definitional purposes and as used herein "connected" or "attached" includes operation or physical, whether direct or indirect, affixed or coupled, as for example, a connection of the clutch assembly **220** to an input shaft **260**, or crank shaft **260**. Thus, unless specified, "connected" or "attached" is intended to embrace any operationally functional connection.

As used herein "substantially," "generally," "slightly" and other words of degree are relative modifiers intended to indicate permissible variation from the characteristic so modified. It is not intended to be limited to the absolute value or characteristic which it modifies but rather possessing more of the physical or functional characteristic than its opposite, and preferably, approaching or approximating such a physical or functional characteristic.

The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following descriptions of embodiments of the invention taken in conjunction with the accompanying drawings:

FIG. **1** is a schematic view of an exemplary tool, in accordance with implementations described herein.

FIG. **2** is a side view of an exemplary ratcheting tool, in accordance with implementations described herein.

FIG. **3**A is a perspective view of a ratchet head portion of the exemplary ratcheting tool shown in FIG. **2**, and FIG. **3**B is an exploded perspective view of the ratchet head portion of the exemplary ratcheting tool shown in FIG. **3**A, in accordance with implementations described herein.

FIG. **4**A is a top view of the ratchet head portion of the exemplary ratcheting tool shown in FIG. **2**, and FIG. **4**B is a cross-sectional view of the ratchet head portion of the exemplary ratcheting tool, taken along line A-A of FIG. **4**A, in accordance with implementations described herein.

FIG. **5** is a cross sectional view of the exemplary ratcheting tool, in accordance with implementations described herein.

FIGS. **6**A and **6**B illustrate a pin cage and a ring gear of an exemplary clutch assembly of the exemplary ratcheting tool, in accordance with implementations described herein.

FIGS. **7**A and **7**B illustrate a torque selector of the exemplary ratcheting tool, in accordance with implementations described herein.

FIGS. **8**, **9**A and **9**B illustrate an exemplary ratcheting tool including a removable square drive assembly, in accordance with implementations described herein.

FIG. **10** is a cross-sectional view of the exemplary square drive assembly shown in FIGS. **8**, **9**A and **9**B.

FIG. **11**A is a side view of the exemplary square drive assembly, FIG. **11**B is a front view of an exemplary output spindle of a ratcheting tool, and FIG. **11**C is a partial view of an inner peripheral portion of the exemplary output spindle, in accordance with implementations described herein.

FIGS. **12**A, **12**B, and **12**C are partial, exploded perspective views of the ratchet head portion of the exemplary ratcheting tool shown in FIG. **3**A, in accordance with alternate implementations described herein.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate embodiments of the present invention, and such exemplifications are not to be construed as limiting the scope of the present invention in any manner.

DETAILED DESCRIPTION

A schematic view of an exemplary power driven tool **100**, such as, for example, a power driven ratcheting tool **100**, is shown in FIG. **1**. The exemplary ratcheting tool **100** illustrated in FIG. **1** is a powered ratcheting tool **100** which may be operated in a power driven mode, and in a manual mode. The exemplary tool **100** includes a motor **110** selectively engaged with an output mechanism **130** by a clutching mechanism **120**. The motor **110**, the clutching mechanism **120** and a portion of the output mechanism **130** may be received in and/or coupled to a housing **190**. In some implementations, the motor **110** may be an electric motor that receives power from, for example, a power storage device (such as, for example, a battery), an external electrical power source, and the like. In some implementations, the motor **110** may be an air driven, or pneumatic motor, that is powered by compressed air introduced into the housing **190** from an external compressed air source. Other types of motors, and other sources of power, may provide for power driven operation of the tool **100**. The clutching mechanism **120** may include, for example, a slip clutch, that can selectively engage and disengage the motor **110** and the output mechanism **130**, based on, for example, a selected, or set, maximum output torque level for the output mechanism **130** for a particular application.

FIG. **2** illustrates an exemplary ratcheting tool **200**, in accordance with implementations described herein. Components of the tool **200** may be received in a housing **290** including a handle housing **292**, which may be grasped by a user, and a ratchet head housing **294**, in which components of an output mechanism **230** may be received in and/or coupled to the ratchet head housing **294**. The handle housing **292**, or motor housing **292**, and the ratchet head housing **294** may be coupled, for example threadably coupled, by a coupler **280**. A trigger **296** may be selectively actuated by the user, to selectively apply power to a motor **210** (see FIG. **5**) received in the housing **290**. A torque selector **270**, or collar **270** may be movably coupled on the housing **290**. Manipulation of the torque selector **270**, or collar **270** may allow a user to select a maximum output torque level to be transmitted to/by the output mechanism **230**. For example, in some implementations, a clutching mechanism (not shown in FIG. **2**) received in the housing **290** may disengage a motor (not shown in FIG. **2**) from driving components of the output mechanism **230**, so that the torque level output at the output mechanism **230** does not exceed the maximum output torque level selected by the user through manipulation of the torque selector **270**, or collar **270**. In alternate implementations, the torque selector can be embodied as releasable or push buttons, catches, and switch mechanisms.

FIG. **3**A is a perspective view of a ratchet head portion of the ratcheting tool **200** shown in FIG. **2**, and FIG. **3**B is an exploded perspective view of the ratchet head portion of the ratcheting tool **200** shown in FIG. **3**A, including an exploded perspective view of an exemplary clutch assembly **220** received in the ratchet head housing **294**, in accordance with implementations described herein. The exemplary clutch assembly **220** provides one example of a clutch assembly, and in particular, a slip clutch assembly, which may be incorporated into the exemplary ratcheting tool **200** to provide for output torque control of the tool **200**. Other arrangements and/or combinations of components of this type of slip clutch assembly may also be considered or adapted for operation of the ratcheting tool **200**. FIG. **4**A is a top view of the ratchet head portion of the ratcheting tool **200**, and FIG. **4**B is a cross-sectional view of the ratchet head portion of the ratcheting tool **200** taken along line A-A of FIG. **4**A, in accordance with implementations described herein.?

As shown in FIGS. **3**B and **4**B, the exemplary clutch assembly **220** may include a pressing plate **221**. A first arm **221**A and a second arm **221**B of pressing plate **221** may each extend radially outward from respective outer circumferential portion of the pressing plate **221**. The first arm **221**A and the second arm **221**B may be positioned substantially diametrically opposite each other with respect to the pressing plate **221**. When installed in the housing **290**, the first arm **221**A may extend through a first slot **295**A formed in the ratchet head housing **294**, and the second arm **221**B may extend through a second slot **295**B formed in the ratchet head housing **294**. A plurality of clutch springs **223** may each have a first end thereof retained in a corresponding recess defined in a spring cage **222**, and a second end thereof positioned adjacent to, or against, or in contact with, a first side of a clutch washer **224**. The plurality of clutch springs **223** may be compressed in the axial direction, and released in the axial direction, in response to axial movement of other components of the clutch assembly **220**. The plurality of clutch springs, in accordance with implementations described herein, may include one or more springs configured for compression or release in an axial compression, and in some implementations, the plurality of clutch springs may include one or more springs having a different size (for example, interface size) for use with a spring cage having corresponding recesses for use with the plurality of clutch springs.

A plurality of clutch pins **226** may be positioned between the clutch washer **224** and a corresponding axial end portion of a ring gear **227**. Each of the plurality of clutch pins **226** may extend through a corresponding opening in a pin cage **225**, such that the clutch pins **226** are axially movable in the openings in the pin cage **225**. A first end of each of the clutch pins **226** may be positioned adjacent to, or against, or contacting, a second side of the clutch washer **224** so that the clutch washer **224** is positioned between the plurality of clutch springs **223** and the plurality of clutch pins **226**. A second end of each of the clutch pins **226** may be positioned adjacent to, or against, or contacting, the corresponding axial end portion of the ring gear **227**. As the plurality of clutch pins **226** are axially movable in the openings in the pin cage **225**, compression and/or release of the compression of the plurality of clutch springs **223**, and axial movement of the clutch washer **224** in response to the compression/release of the clutch springs **223**, may cause corresponding axial movement of the clutch pins **226** positioned against the axial end portion of the ring gear **227**.

A planetary gear set **228** may be selectively engaged with an inner circumferential surface of the ring gear **227**. The planetary gear set **228** may be coupled to a shaft of the motor **210**. The planetary gear set **228** may be driven in response to a force transmitted thereto from the motor **210** via the motor shaft, to selectively transfer power from the motor **210** to the output mechanism **230**, based on an engagement state provided by the clutch assembly **220**. Some embodiments of the clutch assembly **220** may include the pressing plate **221**, the spring cage **222**, the plurality of clutch springs **223**, the clutch washer **224**, the pin cage **225**, the plurality of clutch pins **226** and the ring gear **227** but may include fewer or more components to provide output torque control of the tool **200**. Operation of the clutch assembly **220**, and corresponding engagement and/or disengagement of the motor **210** and the output mechanism **230**, will be discussed in more detail below.

FIG. **5** is a partial cross-sectional view of the exemplary ratcheting tool **200**, illustrating a connection of the motor **210** to the clutch assembly **220**, and a connection of the clutch assembly **220** to an input shaft **260**, or crank shaft **260**, for driving the output mechanism **230**, in accordance with implementations described herein. In the example implementation shown in FIG. **5**, the motor **210** is an air driven motor, simply for purposes of discussion and illustration. The principles to be described herein may be applied in power driven ratcheting tools including other types of motors, driven by other sources/types of power, for example the ratcheting tool **200** can be a cordless power driven ratcheting tool where the motor **210** supplied power by an interchangeable battery.

In operating the exemplary power driven ratcheting tool **200** in the power driven mode, power may be transmitted from the motor **210** (via the motor shaft **212**) to the planetary gear set **228**, and on to the input shaft **260**, or crank shaft **260**. The crank shaft **260** may in turn transmit power to the output mechanism **230**, for operation of ratcheting components of the output mechanism **230**. In particular, in the power driven mode, power is transmitted from the motor **210** to the output mechanism **230** in this manner in a condition in which the ring gear **227** is rotationally locked, or essentially restricted from rotation. In a condition in which the ring gear **227** slips, or is allowed to rotate, power output by the motor **210** is not transmitted to the output mechanism **230**. That is, in the condition in which the ring gear **227** slips, the planetary gear set **228** may continue to rotate in response to power transmitted thereto from the motor **210**; however, due to the slippage, or rotation of the ring gear **227**, that power will no longer be transmitted through the crank shaft **260** to the ratcheting components of the output mechanism **230**. The torque level at which the ring gear **227** transitions from a fixed, or rotationally locked, or non-rotating state, to the slipped, or rotationally unlocked, or rotating state, may be controlled by the clutch assembly **220**, based on the maximum output torque level set, or selected through manipulation of the collar **270**.

FIG. **6**A is an exploded view of the pin cage **225**, the plurality of clutch pins **226**, and the ring gear **227**, and FIG. **6**B is a perspective view of the ring gear **227**. The exemplary implementation illustrated in FIG. **6**A includes three clutch pins **226** (**226**A, **226**B and **226**C) and three openings **225**A, **225**B and **225**C in the pin cage **225**, in which the clutch pins **226**A, **226**B and **226**C are respectively received. A number and/or an arrangement of the clutch pins **226** and the corresponding openings in the pin cage **225** may vary based on a particular combination of components. The clutch pins **226** are illustrated in this embodiments as pins but may be any As noted above, the clutch pins **226** may be axially movable in the openings in the pin cage **225**, based on a compressed/neutral state of the clutch springs **223** and a corresponding axial position of the clutch washer against the first end portion of the clutch pins **226**. In this implementation, the pin cage **225** is contained within the housing and allows an outer diameter ratchet head which allows the ratcheting tool to handle a higher load or torque.

As noted above, the second end portions of the clutch pins **226** may be positioned adjacent to, or in contact with, the axial end portion **227**A of the ring gear **227**. The axial end portion **227**A of the ring gear **227** may be contoured, defining a ramped surface **229** including one or more ramps on the axial end portion **227**A of the ring gear **227**. In the example implementation illustrated in FIGS. **6**A and **6**B, the ramped surface **229** includes ramps **229**A, **229**B and **229**C (which may correspond, for example, to the clutch pins **226**A, **226**B and **226**C). A number, a contour, a placement, and the like of the ramps formed on the ramped surface **229** of the ring gear **227** may vary based on a particular combination of components.

The second end portions of the clutch pins **226** may engage, or contact, the axial end portion **227**A of the ring gear **227**, moving, or sliding along the ramp surface **229** of the ring gear **227**. The clutch pins **226** and the ramped surface **229** are pressed against each other by a force applied by the clutch springs **223**. The magnitude of the force applied by the clutch springs **223**, causing the clutch pins **226** to move axially, may vary based on an amount of compression of the clutch springs **223**. As the output torque level increases, an output torque level greater than a set threshold (corresponding, for example, to the maximum output torque level set or selected through manipulation of the collar **270**) will cause the springs to compress, and cause the clutch pins **226** riding in the ramped surface **229** to jump, or ride over, the ramps **229**A, **229**B, **229**C, causing the ring gear **227**, and the clutch assembly **220**, to slip or rotate. That is, as an amount of detected amount of output torque, and in particular, detected resistance torque, increases, the clutch pins **226** move along the ramped surface **229**, and up the ramps **229**A, **229**B, **229**C. Due to the geometry of the ramps **229**A, **229**B, **229**C, movement of the clutch pins **226** up the ramps in this manner causes the clutch pins **226** to move axially, toward the clutch washer **224**, thus moving the clutch washer **224** axially and compressing the clutch springs **223**. In response to detection of a torque level exceeding the maximum output torque level (set, for example through manipulation of the collar **270**), the clutch pins **226** will move, or travel, or jump over the ramps, disengaging the ring gear **227** and causing the ring gear **227**, and the clutch assembly **220**, to slip. In this slipped condition, the ring gear **227** will continue to rotate, or slip, while the trigger **296** is depressed and the motor **210** is generating power, but torque will not be transmitted to the crank shaft **232**.

One type of clutch setting can limit the torque transmitted from the motor **210** to the output mechanism **230**. The amount of compression of the clutch springs **223**, affecting the positioning and movement of the clutch pins **226** along the ramped surface **229**, may vary based on an amount of output torque, and in particular, resistance torque, detected, affecting the axial position of the pressing plate **221**. The axial position of the pressing plate **221** may vary based on contact, or interface, or engagement of the pressing plate **221**, and in particular, the first and second arms **221**A and **221**B of the pressing plate **221**, with an interior geometry of the collar **270**. As the collar **270** is manipulated into a physical position corresponding to the selected maximum output torque level, this interaction, or engagement, between the pressing plate **221** (i.e. the first and second arms **221**A, **221**B of the pressing plate **221**) and the interior geometry of the collar **270** may affect the torque level which causes the ring gear **227**, and the clutch assembly **220**, to slip or rotate. This interface, or interaction, will be described in more detail with respect to FIGS. **7**A-**7**B.

A second clutch type of setting may not limit the amount of the torque transmitted from the motor **210** to the output mechanism **230**. The clutch collar **270** has a setting where it positions the clamping plate **221** and spring cage **222** axially toward the clutch washer **224**, pins **226**, and ring gear **227**, in such a way as to prevent the pins **226** from axially moving out of the way of the ring gear ramp **229**B. The pins **226** are limited axially by the position of the spring cage **222**, and therefore prevent the ring gear **227** from slipping or rotating even though high torsional loading may be experienced at the output of the ratchet mechanism. In this implementation, based on the clutch setting, the power from the motor is not disengaged from the output mechanism and there may be a hard stop that prevents the ring gear from every spinning. It is a mechanical locking that prevents the ring gear from ever slipping.

In some implementations, the torque level at which the ring gear **227** slips may be further affected by the coefficient of friction between the clutch pins **226** and the ramped surface **229** of the ring gear **227**, the contour, or angle of the ramps formed on the ramped surface **229**, the magnitude of the force applied to the clutch pins **226** by the compression of the clutch springs **223**, and other such factors.

FIG. **7**A is a side view of the collar **270** of the exemplary ratcheting tool **200**, and FIG. **7**B is a perspective view of the collar **270**, illustrating some of the interior geometry of the collar **270**. As described above, referring back to FIG. **4**B, the first arm **221**A of the pressing plate **221** extends through the first slot **295**A in the ratchet head housing **294**, and the second arm **221**B of the pressing plate **221** extends through the second slot **295**B in the ratchet head housing **294**. Distal end portions of the first and second arms **221**A, **221**B may engage with a protruded portion **272**, or step portion **272**, of the interior of the collar **270**. The engagement of the first and second arms **221**A, **221**B with the step portion **272** of the interior of the collar **270** may support an axial position of the pressing plate **221**, and/or set the axial position of the pressing plate **221**.

As shown in FIG. **7**B, the step portion **272** of the interior of the collar **270** may include a contoured, or ramped surface **275**. An arrangement of the contouring, or ramping, of the ramped surface **275** along the inner circumferential portion of the collar **270** may correspond to a plurality of different maximum output torque level settings arranged along the outer circumferential portion of the collar **270**. The first and second arms **221**A, **221**B of the pressing plate **221** may engage the ramped surface **275** of the step portion **272** of the collar **270**. In particular, the interface, or contact between, or engagement of, the first and second arms **221**A, **221**B with a portion of the ramped surface **275** (based on the rotational position of the collar **270** and corresponding maximum output torque setting) will affect an axial position of the pressing plate **221**, based on the contouring of the ramped surface **275**. In some implementations, the first and second arms **221**A, **221**B may be received in detents in the ramped surface **275** of the stepped portion **272** of the collar **270**, to provide a measure of feedback to the user when rotating the collar **270** to select a particular maximum output torque level. The axial position of the pressing plate **221** will in turn affect the amount of compression of the clutch springs **223**. The amount of compression of the clutch springs **223** will, as described above, affect the reactionary torque level causing the ring gear **227** to slips as described above.

That is, as the collar **270** is rotated, the first and second arms **221**A, **221**B of the pressing plate **221** move along the ramped surface **275** on the inner circumferential portion of the collar **270**. The geometry, or contouring, or ramping of the ramped surface **275** causes the pressing plate **221** to move axially (for example, to the left or to the right in the example orientation shown in FIG. **4**B). For example, if the contouring of the ramped surface **275** were to cause the pressing plate **221** to move in a direction to compress (or further compress, or essentially fully compress) the clutch springs **223**, the additional force exerted on the clutch pins **226** may impede the movement of the clutch pins **226** up and over the ramps on the ramped surface **229** of the ring gear **227**. This may reflect, for example, a maximum setting for the allowable output torque level. Similarly, if the contouring of the ramped surface **275** were to cause the pressing plate **221** to move in a direction to release compression of the clutch springs **223** (for example, to the left, in the example orientation shown in FIG. **4**B), the lesser force exerted on the clutch pins **226** may impede the movement of the clutch pins **226** up and over the ramps on the ramped surface **229** of the ring gear **227** until the output torque level (detected resistance torque) reaches the maximum output torque level selected based on the rotational position of the collar **270**. In this situation, at the point at which the output torque level is greater than or equal to the selected maximum output torque level, the clutch pins **226** may ride up and over the ramps of the ramped surface **229** of the ring gear **227**, allowing the ring gear **227** to slip so that torque is not transmitted to the output mechanism **230**.

As noted above, in some implementations, the exemplary power driven ratcheting tool **200** may be operated in a power driven mode, and in a manual mode (in which power is not transmitted from the motor **210** to the output mechanism **230** to implement a power ratcheting function). In some situations, a user may wish to operate the ratcheting tool in the manual mode, to allow for manual, or hand tightening of a work piece/fastener. This may also provide an advantage in protecting bits and fasteners from over stripping by the power driven ratcheting tool. In the exemplary power driven ratcheting tool **200**, in accordance with implementations described herein, the clutch assembly **220** is substantially entirely contained within the confines of the ratchet head housing **294**. The structural integrity of the ratchet head housing **294**, and containment of the clutch assembly **220** within the confines of the ratchet head housing **294**, may allow manual torque to be transferred, through the ratchet head housing **294**, to, for example, a square drive or square drive assembly of the output mechanism **230**, while still allowing the slip clutch assembly **220** to operate, and slip at a selected maximum output torque level as described above. This may allow the power driven ratcheting tool, in accordance with implementations described herein, to be effectively operated in the manual mode.

As previously noted, the exemplary implementation described above includes a pressing plate **221** having two arms **221**A, **221**B extending radially therefrom, at diametrically opposed positions, for ease of discussion and illustration. In some implementations, the pressing plate **221** may include more, or fewer arms extending radially outward from therefrom, and/or arranged at different positions on the pressing plate **221**. Similarly, the exemplary implementation described above includes a plurality of clutch springs **223** received in the spring cage **222**. In some implementations, the clutch assembly **220** may include more, or fewer, clutch springs **223** and/or a different arrangement of clutch springs **223** than illustrated. Further, the exemplary implementation described above includes three clutch pins **226**A, **226**B, **226**C interacting with three ramps **229**A, **229**B, **229**C on the ramped surface **229** of the ring gear **227**, for ease of discussion and illustration. In some implementations, the clutch assembly **220** may include more, or fewer clutch pins **226** and/or more or fewer ramps formed on the ramped surface **229** of the ring gear **227**.

The exemplary implementation described above includes the pressing plate **221** and the spring cage **222** as separate components, simply for ease of discussion and illustration. In some implementations, the pressing plate **221** and the spring cage **222** may be formed as a single unit, or integrally formed. Similarly, the exemplary implementation described above includes the clutch washer **224** and the pin cage **225** as separate components, simply for ease of discussion and illustration. In some implementations, the clutch washer **224** and the pin cage **225** may be formed as a single unit, or integrally formed.

A ratcheting tool, in accordance with implementations described herein, may include a square drive assembly that interfaces with a work piece/fastener to transmit force (for example, rotational, or ratcheting force). In some implementations, a first square drive assembly may be removed from the ratcheting tool and replaced with a second square drive assembly having a different size (for example, interface size) than the first square drive assembly. The ability to interchange square drive assemblies having different interface sizes, without the use of an adapter, may reduce overall size, and may render the ratcheting tool usable in smaller spaces, and for more applications, thus enhancing utility and functionality of the tool. In other implementations, a first square drive assembly may be removed from the ratcheting tool and replaced with a different drive assembly having a different size (for example, a drive assembly with a screwdriver head) than the first square drive assembly. The ability to interchange drive assemblies having different interfaces, without use of an adapter, may render the ratcheting tool usable in smaller spaces, and for more applications, thus enhancing utility and functionality of the tool. Utility and functionality may be further enhanced by a simplified mechanism to release a square drive assembly from the tool, and to securely couple the drive assembly to the tool.

A removable square drive assembly, in accordance with implementations described herein, may be used with a power driven ratcheting tool such as the power driven ratcheting tool **200** described above, which is operable in both a power driven mode and a manual mode, or with a fully manually operated ratcheting tool. A ratcheting tool **300** including a removable square drive assembly **400**, in accordance with implementations described herein, is shown in FIGS. **8**, **9**A and **9**B. FIG. **10** is a cross-sectional view of the exemplary square drive assembly **400** shown in FIGS. **8-9**B. FIG. **11**A is a side view of the square drive assembly **400** installed in an output spindle **335** of the exemplary ratcheting tool **300**, with a housing portion thereof removed. FIG. **11**B is a front view of the exemplary output spindle **335**, and FIG. **11**C is a partial view of an inner peripheral portion of the exemplary output spindle **335**.

In some implementations, the square drive assembly **400** may include a retention portion **410**, or coupling portion **410**, and a working portion **460**, or tool interface portion **460**. The coupling portion **410** may be removably coupled in an output spindle **335** of the ratcheting tool **300**. A release mechanism, in the form of a button **420** in this example implementation, may be movably received in a recess **435** defined in a portion of a housing **430** of the square drive assembly **400** corresponding to the coupling portion **410**. A ramped pocket **425** may be defined in the button **420**, for example, in an outer circumferential portion of the button **420**. A button spring **440** may have a first end **440**A positioned at a first end of the recess **435**, and a second end **440**B fixed to the button **420**. A pair of balls **450** (**450**A, **450**B) may be positioned at corresponding openings **430**A, **430**B in the housing **430**. As the coupling portion **410** of the square drive assembly **400** is inserted into the output spindle **335** of the tool **300**, the button spring **440** may exert a force on the button **420**. The surface of the ramped pocket **425** of the button **420** may transfer the force exerted by the button spring **440** radially, to the pair of balls **450**A, **450**B. This force transferred to the pair of balls **450**A, **450**B urge the balls **450**A, **450**B outward through the openings **430**A, **430**B, so that the balls **450**A, **450**B may engage with, or lock into, a groove **337** defined in the output spindle **335**, thus locking the square drive assembly **400** in the output spindle **335** of the tool **300**. The square drive assembly **400** may be released from the output spindle **335** by depressing the button **420** while pushing or pulling the square drive assembly **400** from the tool **300**. Depression of the button **420** compresses the button spring **440**, allowing the balls **450**A, **450**B to disengage the groove **337** in the output spindle **335** and drop into the button ramp pocket **425**.

A removable square drive assembly, in accordance with implementations described herein, may allow a user to select a square drive tool that matches a desired interface such as, for example, a socket and the like, without the user of an adapter, thus enhancing utility and functionality to the user. A removable square drive assembly, in accordance with implementations described herein, may allow for easy replacement of a damaged square drive tool, which may be designed to preferentially fail under high loading before other, more expensive and difficult to replace internal parts of the tool, allowing for faster and less costly servicing of the tool. A removable square drive assembly, in accordance with implementations described herein, may be coupled to the ratcheting tool at approximately 180 degrees with respect to a triggering/operation mechanism of the tool, allowing for use of the tool in a relatively small, confined space having limited access, further enhancing utility and functionality.

FIGS. **12**A, **12**B and **12**C illustrate alternate implementations of the pin cage **225** and a ring gear engagement element, such as the plurality of clutch pins **226**, interacting with the ring gear **227**. FIG. **12**A illustrates a clutch ramp profile or interface **325** including a ramped surface **325**A located on an axial end of clutch ramp profile **325** that operates in sliding contact with the ring gear **227**. The opposite axial end of clutch ramp profile **325** interfaces with a plurality of clutch springs **223** that press the clutch ramp profile **325** against the ramped surface **229** of the ring gear **227**. A plurality of tabs or slots located radially on the body of the clutch ramp profile **325** interface with ratchet head housing **294**, allowing axial movement of clutch ramp profile or interface **325**, but prohibiting rotation along any of its axes. In this implementation, the second end portions of the clutch ramp profile **325-2** may engage, or contact, the axial end portion of the ring gear **227**, moving, or sliding along the ramp surface **229** of the ring gear **227**. The clutch ramp profile or interface **325** and the ramped surface **229** are pressed against each other by a force applied by the clutch springs **223**. The magnitude of the force applied by the clutch springs **223**, pressing the clutch ramp profile **325** axially against the ramped surface **229**, may vary based on an amount of compression of the clutch springs **223**. As the output torque level increases, an output torque level exceeding the set maximum output torque level will cause the springs to compress, and cause the clutch ramp profile **325** riding in the ramped surface **229** to jump, or ride over, the ramps **229**A, **229**B, **229**C, allowing the ring gear **227**, and the clutch assembly **220**, to slip. That is, as a detected amount of output torque, and in particular, detected resistance torque, increases, the ramped surface **225**A of clutch ramp profile **325** move along the ramped surface **229**, and up the ramps **229**A, **229**B, **229**C. Due to the geometry of the ramps **229**A, **229**B, **229**C, movement of the clutch ramped surface **325-2**A up the ramps in this manner causes the clutch ramped profile to move axially, toward the spring cage **222**, thus compressing the clutch springs **223**. In response to detection of an output torque level that exceeds the set maximum output torque level, the clutch ramped surface **225-2**A will move, or travel, or jump over the ramps, disengaging the ring gear **227** and allowing the ring gear **227**, and the clutch assembly **220**, to slip. In this slipped condition, the ring gear **227** will continue to rotate, or slip, while the trigger **296** is depressed and the motor **210** is generating power, but torque will not be transmitted to the output shaft.

FIGS. **12**B and **12**C illustrate a clutch assembly with a plurality clutch balls **326**. FIGS. **12**B and **12**C illustrate a pin cage **225** with a plurality clutch balls **326**. A functional clutch system can be achieved with a plurality of clutch balls in different formations, (e.g. double stack formation of FIG. **12**C or single stack formation of FIG. **12**B). The plurality of clutch balls **326** may engage, or contact, the axial end portion of the ring gear **227**, moving, rolling, or sliding along the ramp surface **229** of the ring gear **227**. The clutch balls **326** and the ramped surface **229** are pressed against each other by a force applied by the clutch springs **223**. The magnitude of the force applied by the clutch springs **223**, pressing the clutch balls **326** axially against the ramped surface **229**, may vary based on an amount of compression of the clutch springs **223**. An output torque level exceeding the set maximum output torque level will cause the springs to compress, and cause the clutch balls **326** riding in the ramped surface **229** to jump, or ride over, the ramps **229**A, **229**B, **229**C, allowing the ring gear **227**, and the clutch assembly **220**, to slip. That is, as an amount of detected output torque, and in particular, detected resistance torque, increases, the clutch balls **326** move along the ramped surface **229**, and up the ramps **229**A, **229**B, **229**C. Due to the geometry of the ramps **229**A, **229**B, **229**C, movement of the clutch balls **326** up the ramps in this manner causes the clutch balls **326** to move axially, toward the clutch washer **224**, thus moving the clutch washer **224** axially and compressing the clutch springs **223**. In response to detection of a high enough torque level, the clutch balls **326** will move, or travel, or jump over the ramps, disengaging the ring gear

227 and allowing the ring gear **227**, and the clutch assembly **220**, to slip. In this slipped condition, the ring gear **227** will continue to rotate, or slip, while the trigger **296** is depressed and the motor **210** is generating power, but torque will not be transmitted to the output shaft.

While certain features of the described implementations have been illustrated as described herein, many modifications, substitutions, changes and equivalents will now occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the scope of the implementations. It should be understood that they have been presented by way of example only, not limitation, and various changes in form and details may be made. Any portion of the apparatus and/or methods described herein may be combined in any combination, except mutually exclusive combinations. The implementations described can include various combinations and/or sub-combinations of the functions, components and/or features of the different implementations described.

What is claimed is:

1. A ratchet, comprising:
- a housing;
- a motor in the housing;
- an output drive mechanism coupled to the housing;
- a torque selector coupled to the housing, the torque selector being rotatably coupled to the housing, wherein the torque selector is rotatable to a plurality of positions corresponding to a plurality of torque settings, so as to provide for selection of a maximum output torque of the ratchet; and
- a clutch assembly, wherein the clutch assembly comprises:
  - a planetary gear set coupled to an output shaft of the motor;
  - a ring gear having a ramped surface on an axial end portion thereof, a plurality of ramps defined along the ramped surface, and an inner circumferential surface configured to selectively engage the planetary gear set;
  - a pin cage having a plurality of openings formed therein;
  - a clutch washer;
  - a plurality of clutch pins respectively received in the plurality of openings in the pin cage for contact with the plurality of ramps, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with the axial end portion of the ring gear for movement guided by the ramped surface;
  - a spring cage having a plurality of recesses formed in a first side thereof;
  - a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer in a manner that positions the clutch washer between the plurality of springs and the plurality of clutch pins; and
  - a pressing plate positioned proximate a second side of the spring cage, and is selectively coupled to the motor and the output drive mechanism.

2. The ratchet of claim **1**, wherein the torque selector includes:
- a stepped portion extending circumferentially along an inner circumferential surface of the torque selector; and
- a ramped surface arranged along the stepped portion, a contour of the ramped surface of the torque selector including a plurality of ramps respectively corresponding to the plurality of torque settings.

3. The ratchet of claim **2**, wherein the pressing plate includes at least one arm extending radially outward from a peripheral portion of the pressing plate, wherein the at least one arm is configured to engage the ramped surface of the torque selector, and wherein an axial position of the pressing plate is based on the contour of the ramped surface of the torque selector at a rotational position of the torque selector relative to the housing.

4. The ratchet of claim **1**, wherein the plurality of clutch springs exert an axial force on the clutch washer that presses the plurality of clutch pins into engagement with the ramped surface on the axial end portion of the ring gear which permits the transmission of the power of the motor to the output drive mechanism.

5. The ratchet of claim **4**, wherein a magnitude of the force exerted by the plurality of clutch springs on the clutch washer, and on the plurality of clutch pins on the ramped surface of the ring gear, is based on an axial position of the pressing plate.

6. The ratchet of claim **4**, wherein an axial position of the pressing plate is based on engagement of at least one radial arm of the pressing plate with a ramped surface of an inner circumferential portion of the torque selector, and
- wherein an axial force exerted by the plurality of clutch springs on the plurality of pins and engagement of the pins with the ramped surface on the axial end portion of the ring gear is based on the axial position of the pressing plate.

7. The ratchet of claim **6**, wherein:
- in response to detection of an output torque that is less than or equal to the selected maximum output torque, a magnitude of the axial force exerted by the plurality of clutch springs on the plurality of clutch pins maintains the engagement of the plurality of pins in the ramped surface on the axial end portion of the ring gear so as to maintain engagement of the motor and the output drive mechanism, and
- in response to detection of an output torque that is greater than the selected maximum output torque, a magnitude of the axial force exerted by the plurality of clutch springs on the plurality of clutch pins releases allows the plurality of pins to move over the plurality of ramps arranged along the ramped surface on the axial end portion of the ring gear, and releases engagement of the motor and the output drive mechanism.

8. The ratchet of claim **7**, wherein:
- in response to the detection of the output torque that is less than or equal to the selected maximum output torque, the ring gear remains fixed and in an engaged state with the planetary gear set, and
- in response to the detection of the output torque that is greater than the selected maximum output torque, the ring gear is rotatable.

9. The ratchet of claim **1**, wherein:
- the plurality of clutch pins are arranged circumferentially with respect to the pin cage and the ring gear, and are oriented in parallel to each other, and the plurality of clutch pins are movably received in the plurality of openings in the pin cage, and
- the plurality of springs are arranged circumferentially with respect to the spring cage and oriented in parallel to each other.

10. The ratchet of claim 9, wherein the ring gear, the pin cage, the spring cage and the pressing plate are each arranged along a longitudinal axis defined by the output shaft of the motor and an input shaft of the output drive mechanism.

11. The ratchet of claim 1, wherein:

each of the plurality of torque settings corresponds to a respective maximum output torque level of the output drive mechanism, and

wherein the clutch is configured to disengage the coupling of the motor and the output drive mechanism in response to detection of an output torque level that is greater than or equal to the maximum output torque level corresponding to the selected torque setting.

12. The ratchet of claim 1, wherein the ratchet is operable in in a power driven mode in which power is selectively transmitted from the motor to the output drive mechanism via the clutch assembly, and in a manual mode in which the motor and the output drive mechanism are disengaged.

13. The ratchet of claim 1, wherein the motor is at least one of an electric motor or a motor that is air driven.

14. The ratchet of claim 1, further comprising a square drive assembly removably coupled to the output drive mechanism, the square drive assembly including:

a coupling portion configured to be removably coupled in an output spindle of a ratchet head portion of the ratchet;

a tool interface portion coupled to the coupling portion;

a recess defined in an end portion of a housing of the coupling portion;

a button movably installed in the recess;

a spring coupled to the button;

a pocket defined in an outer surface of the button;

at least one ball movably received in the pocket; and

at least one opening formed in the housing, at a position corresponding to the at least one ball.

15. The ratchet of claim 14, wherein:

a first end of the spring is coupled to a distal end of the recess, and a second end of the spring is coupled to the button, and

the pocket extends circumferentially along an outer peripheral surface of the button.

16. The ratchet of claim 15, wherein, in a released state of the button, a force exerted by the spring on the button urges the at least one ball into the at least one opening.

17. The ratchet of claim 16, wherein, with the button in the released state and the coupling portion of the square drive assembly inserted in the output spindle of the ratchet, the at least one ball is configured to engage a recess formed in the output spindle so as to lock the square drive assembly into the output spindle of the ratchet.

18. The ratchet of claim 17, wherein, in a depressed state of the button, the at least one ball is released into the pocket and is disengaged from the recess formed in the output spindle, so as to release the square drive assembly from the output spindle of the ratchet.

19. A ratchet tool, comprising:

a housing;

a motor in the housing;

an output drive mechanism coupled to the housing;

a torque selector coupled to the housing, the torque selector being operatively coupled to the housing, wherein the torque selector is actuated to a plurality of positions corresponding to a plurality of torque settings, so as to provide for selection of a maximum output torque of the ratchet tool; and

a clutch assembly selectively coupling the motor and the output drive mechanism, wherein the clutch assembly comprises:

a planetary gear set coupled to an output shaft of the motor;

a ring gear having a ramped surface on an axial end portion thereof, a plurality of ramps defined along the ramped surface, and an inner circumferential surface configured to selectively engage the planetary gear set;

a pin cage having a plurality of openings formed therein;

a clutch washer;

a plurality of clutch pins respectively received in the plurality of openings in the pin cage for contact with the plurality of ramps, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with the axial end portion of the ring gear for movement guided by the ramped surface;

a spring cage having a plurality of recesses formed in a first side thereof;

a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer in a manner that positions the clutch washer between the plurality of springs and the plurality of clutch pins; and

a pressing plate positioned proximate a second side of the spring cage.

20. The ratchet tool of claim 19, wherein the pressing plate includes at least one arm extending radially outward from a peripheral portion of the pressing plate, wherein the at least one arm is configured to engage the ramped surface of the torque selector, and wherein an axial position of the pressing plate is based on the contour of the ramped surface of the torque selector at a rotational position of the torque selector relative to the housing.

21. The ratchet tool of claim 19, wherein the plurality of clutch springs exert an axial force on the clutch washer that presses the plurality of clutch pins into engagement with the ramped surface on the axial end portion of the ring gear which permits the transmission of the power of the motor to the output drive mechanism.

22. The ratchet tool of claim 21, wherein a magnitude of the force exerted by the plurality of clutch springs on the clutch washer, and on the plurality of clutch pins on the ramped surface of the ring gear, is based on an axial position of the pressing plate.

23. The ratchet tool of claim 22, wherein an axial position of the pressing plate is based on engagement of at least one radial arm of the pressing plate with a ramped surface of an inner circumferential portion of the torque selector, and

wherein an axial force exerted by the plurality of clutch springs on the plurality of pins and engagement of the pins with the ramped surface on the axial end portion of the ring gear is based on the axial position of the pressing plate.

24. The ratchet tool of claim 19, wherein the ratchet is operable in in a power driven mode in which power is selectively transmitted from the motor to the output drive mechanism via the clutch assembly, and in a manual mode in which the motor and the output drive mechanism are disengaged.

25. The ratchet of claim 19, further comprising a square drive assembly removably coupled to the output drive mechanism, the square drive assembly including:

a coupling portion configured to be removably coupled in an output spindle of a ratchet head portion of the ratchet;

a tool interface portion coupled to the coupling portion;

a recess defined in an end portion of a housing of the coupling portion;

a button movably installed in the recess;

a spring coupled to the button;

a pocket defined in an outer surface of the button;

at least one ball movably received in the pocket; and

at least one opening formed in the housing, at a position corresponding to the at least one ball.

26. The ratchet tool of claim 25, wherein, exertion of force on the button in a released or depressed state, permits the at least one ball movably installed in the recess, movement alternately in and out of the recess defined in the end portion of a housing of the coupling portion.

27. A ratchet tool with clutch, further comprising:

a housing;

a motor in the housing;

an output drive mechanism coupled to the housing, the output drive mechanism operatively connected to a drive assembly, the drive assembly including a coupling portion and a tool interface portion wherein the drive assembly is removably coupled in the output drive mechanism that is coupled to the housing;

a torque selector coupled to the housing, the torque selector being rotatably coupled to the housing, wherein the torque selector is rotatable to a plurality of positions corresponding to a plurality of torque settings, so as to provide for selection of a maximum output torque of the ratchet tool; and

a clutch assembly selectively coupling the motor and the output drive mechanism, wherein the clutch assembly comprises:

a planetary gear set coupled to an output shaft of the motor;

a ring gear having a ramped surface on an axial end portion thereof, a plurality of ramps defined along the ramped surface, and an inner circumferential surface configured to selectively engage the planetary gear set;

a pin cage having a plurality of openings formed therein;

a clutch washer;

a plurality of clutch pins respectively received in the plurality of openings in the pin cage for contact with the plurality of ramps, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with the axial end portion of the ring gear for movement guided by the ramped surface;

a spring cage having a plurality of recesses formed in a first side thereof;

a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer in a manner that positions the clutch washer between the plurality of springs and the plurality of clutch pins; and

a pressing plate positioned proximate a second side of the spring cage.

28. The ratchet tool with clutch of claim 27, wherein the torque selector includes:

a stepped portion extending circumferentially along an inner circumferential surface of the torque selector; and

a ramped surface arranged along the stepped portion, a contour of the ramped surface of the torque selector including a plurality of ramps respectively corresponding to the plurality of torque settings.

29. The ratchet tool with clutch of claim 28, wherein the plurality of clutch springs exert an axial force on the clutch washer that presses the plurality of clutch pins into engagement with the ramped surface on the axial end portion of the ring gear which permits the transmission of the power of the motor to the output drive mechanism.

30. The ratchet tool with clutch of claim 28, wherein an axial position of the pressing plate is based on engagement of at least one radial arm of the pressing plate with a ramped surface of an inner circumferential portion of the torque selector, and

wherein an axial force exerted by the plurality of clutch springs on the plurality of pins and engagement of the pins with the ramped surface on the axial end portion of the ring gear is based on the axial position of the pressing plate.

31. The ratchet tool with clutch of claim 30, wherein:

in response to detection of an output torque that is less than or equal to the selected maximum output torque, a magnitude of the axial force exerted by the plurality of clutch springs on the plurality of clutch pins maintains the engagement of the plurality of pins in the ramped surface on the axial end portion of the ring gear so as to maintain engagement of the motor and the output drive mechanism, and

in response to detection of an output torque that is greater than the selected maximum output torque, a magnitude of the axial force exerted by the plurality of clutch springs on the plurality of clutch pins releases allows the plurality of pins to move over the plurality of ramps arranged along the ramped surface on the axial end portion of the ring gear, and releases engagement of the motor and the output drive mechanism.

32. The ratchet tool with clutch of claim 31, wherein:

in response to the detection of the output torque that is less than or equal to the selected maximum output torque, the ring gear remains fixed and in an engaged state with the planetary gear set, and

in response to the detection of the output torque that is greater than the selected maximum output torque, the ring gear is rotatable.

33. The ratchet tool with clutch of claim 27, wherein:

each of the plurality of torque settings corresponds to a respective maximum output torque level of the output drive mechanism, and

wherein the clutch is configured to disengage the coupling of the motor and the output drive mechanism in response to detection of an output torque level that is greater than or equal to the maximum output torque level corresponding to the selected torque setting.

34. A ratchet tool with limiting clutch, comprising:

a housing;

a motor in the housing;

an output drive mechanism coupled to the housing, the output drive mechanism operatively connected to a drive assembly, the drive assembly including a coupling portion and a tool interface portion wherein the drive assembly is removably coupled in the output drive mechanism that is coupled to the housing; and a clutch assembly selectively coupling the motor and the output drive mechanism, wherein the clutch assembly comprises:

a planetary gear set coupled to an output shaft of the motor;

a ring gear having a ramped surface on an axial end portion thereof, a plurality of ramps defined along the ramped surface, and an inner circumferential surface configured to selectively engage the planetary gear set;

a pin cage having a plurality of openings formed therein;

a clutch washer;

a plurality of clutch pins respectively received in the plurality of openings in the pin cage for contact with the plurality of ramps, each of the plurality of clutch pins having a first end thereof in contact with a first side of the clutch washer, and a second end thereof in contact with the axial end portion of the ring gear for movement guided by the ramped surface;

a spring cage having a plurality of recesses formed in a first side thereof;

a plurality of springs each having a first end thereof received in a respective recess of the plurality of recesses in the spring cage, and a second end thereof in contact with a second side of the clutch washer in a manner that positions the clutch washer between the plurality of springs and the plurality of clutch pins; and

a pressing plate positioned proximate a second side of the spring cage.

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