US011346098B2

(12) **United States Patent**
Krondorfer et al.

(10) **Patent No.: US 11,346,098 B2**
(45) **Date of Patent: May 31, 2022**

(54) **EXTENDABLE TOILET AUGER**

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(73) Assignee: **Ridge Tool Company**, Elyria, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 355 days.

(21) Appl. No.: **16/708,510**

(22) Filed: **Dec. 10, 2019**

(65) **Prior Publication Data**

US 2020/0190786 A1 Jun. 18, 2020

Related U.S. Application Data

(60) Provisional application No. 62/778,359, filed on Dec. 12, 2018.

(51) **Int. Cl.**

E03F 9/00	(2006.01)
E03C 1/302	(2006.01)
B08B 9/045	(2006.01)

(52) **U.S. Cl.**

CPC ***E03F 9/005*** (2013.01); ***B08B 9/045*** (2013.01); ***E03C 1/302*** (2013.01); *B08B 2209/04* (2013.01)

(58) **Field of Classification Search**

CPC E03F 9/005; B08B 9/045; B08B 2209/04; E03C 1/302

See application file for complete search history.

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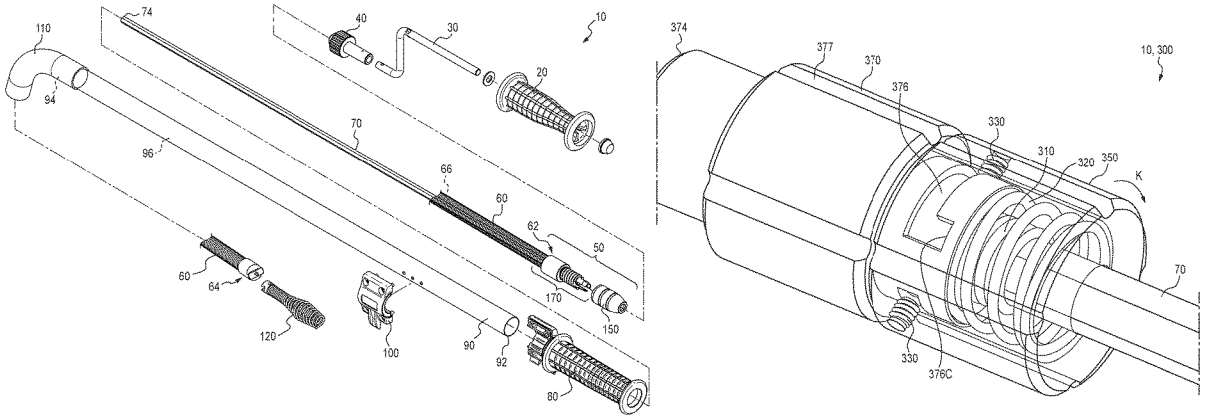
Primary Examiner — Weilun Lo

(74) *Attorney, Agent, or Firm* — Mark E. Bandy; Rankin, Hill & Clark LLP

(57) **ABSTRACT**

Augers that utilize a drain cleaning cable which can be rotated and selectively extended or retracted from the auger are described. The augers utilize coupling assemblies that enable easy coupling or decoupling between the drain cleaning cable and a torque transmission shaft of the auger.

19 Claims, 23 Drawing Sheets



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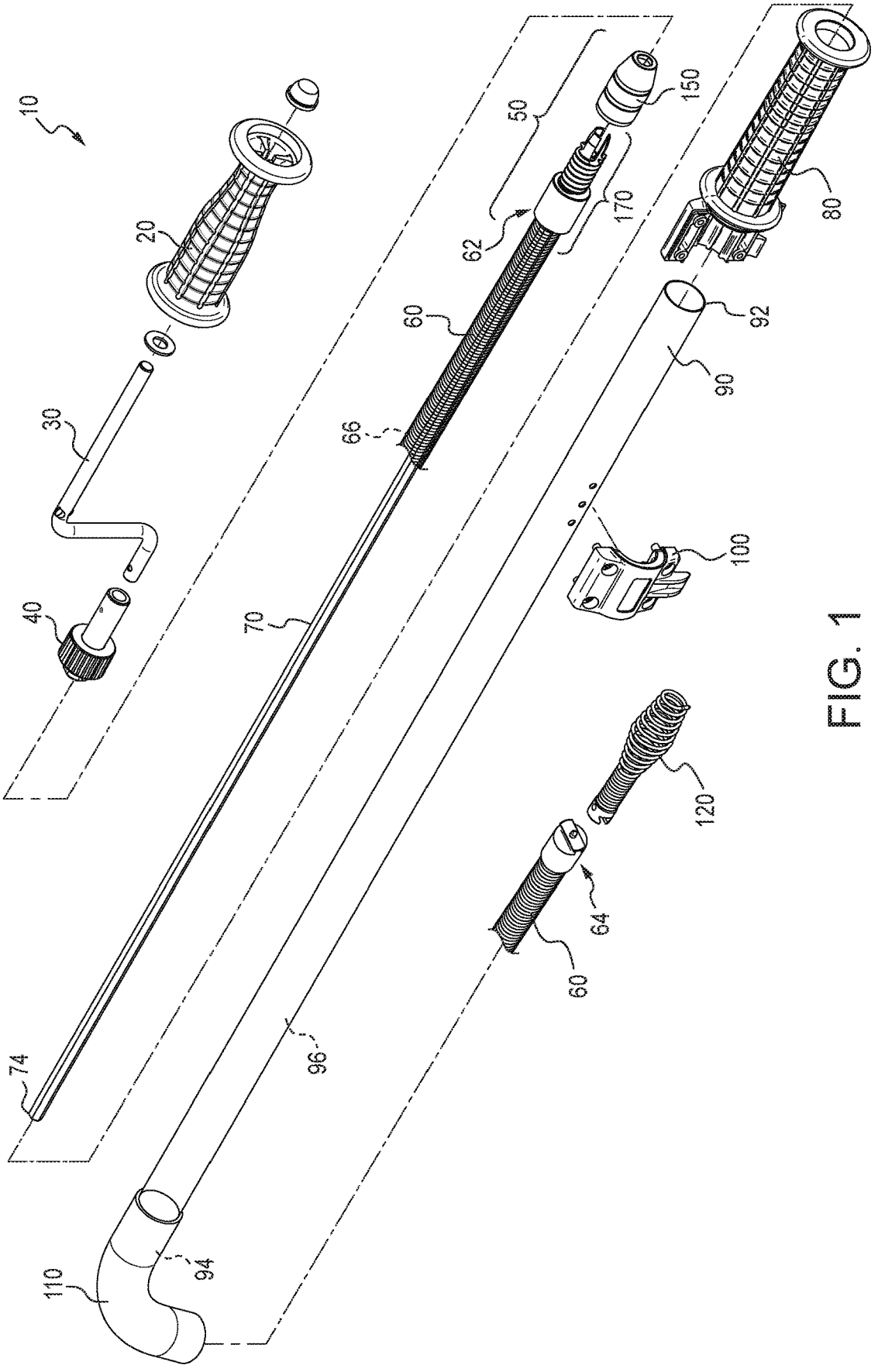

FIG. 1

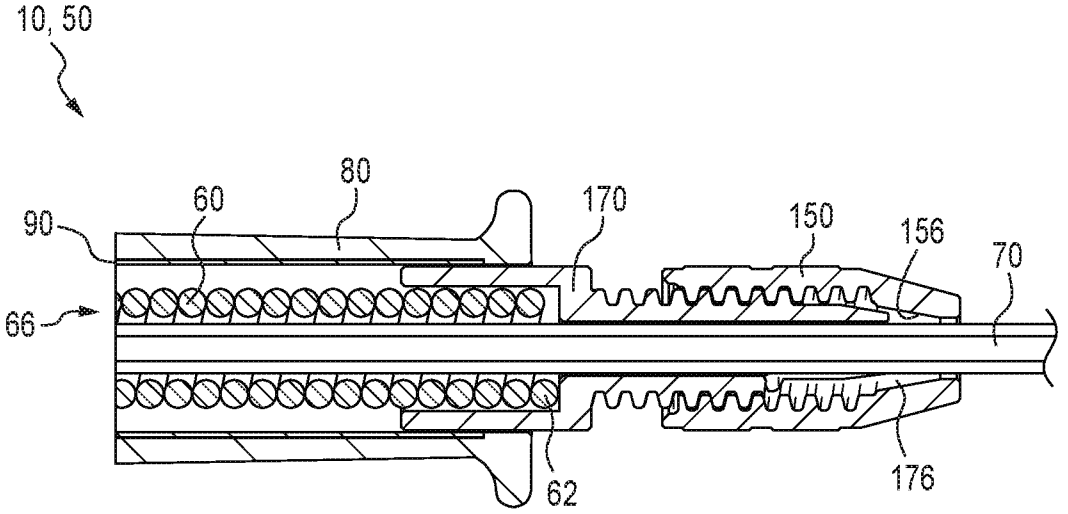
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FIG. 2

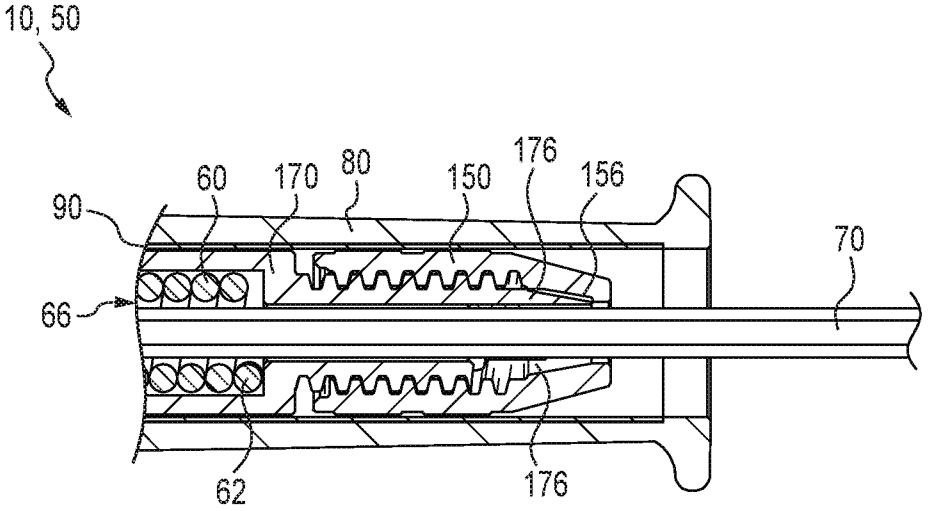
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FIG. 3

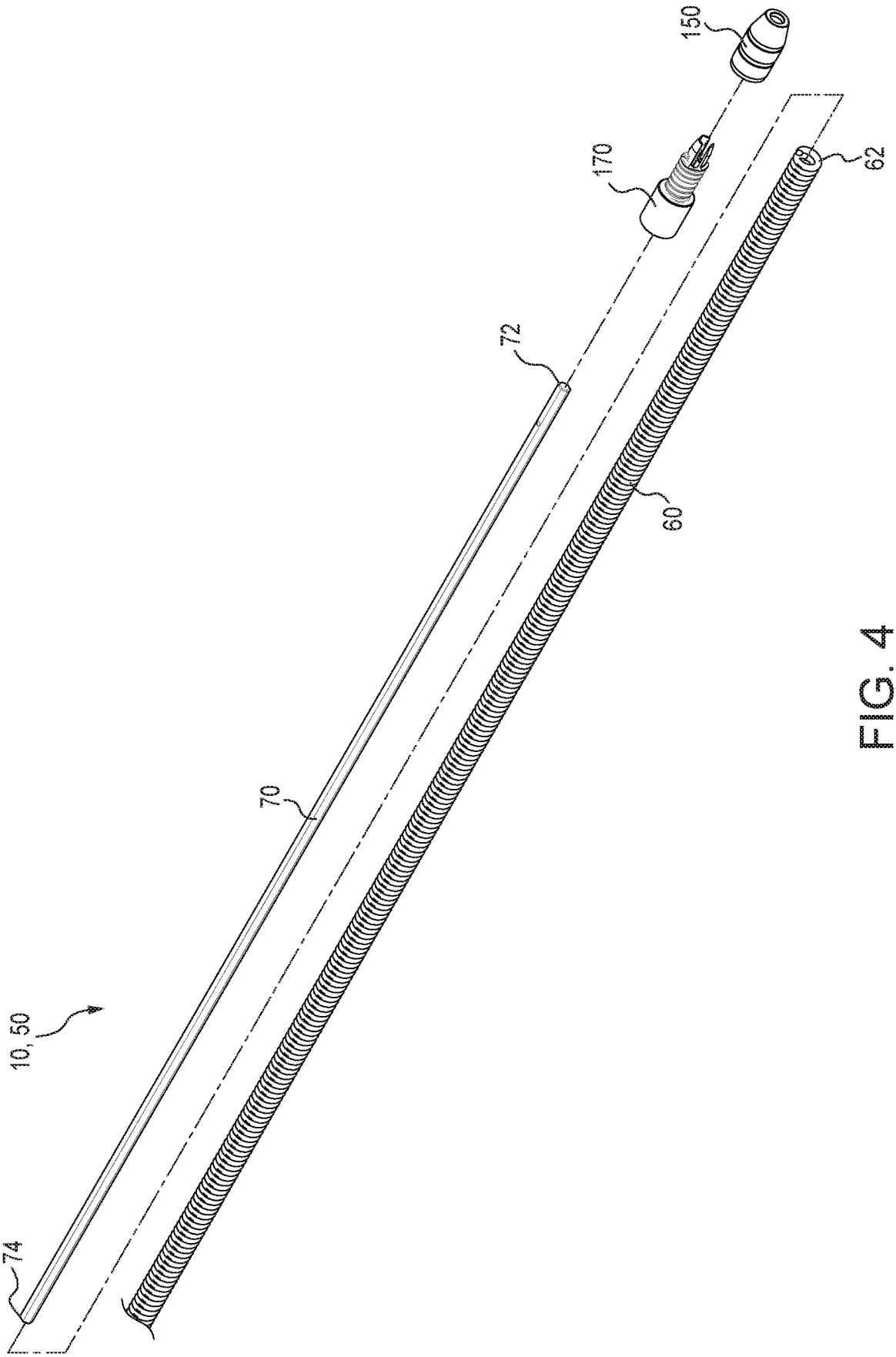


FIG. 4

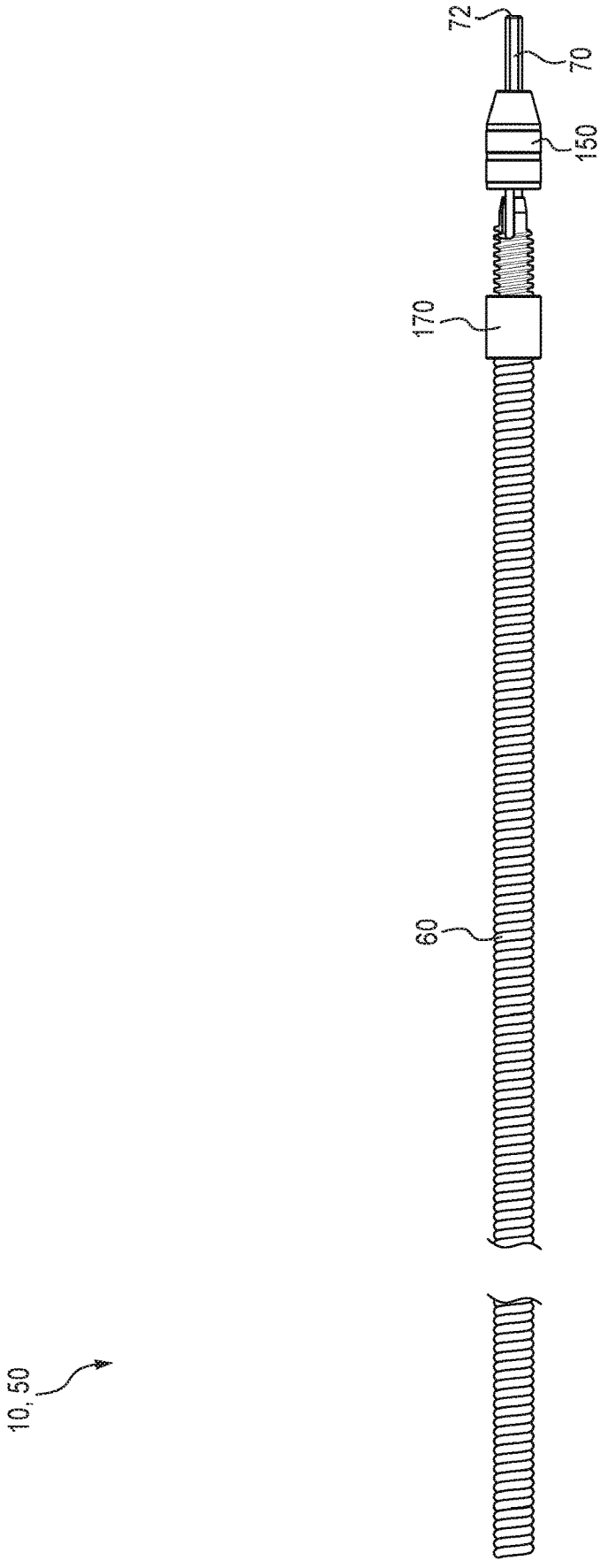


FIG. 5

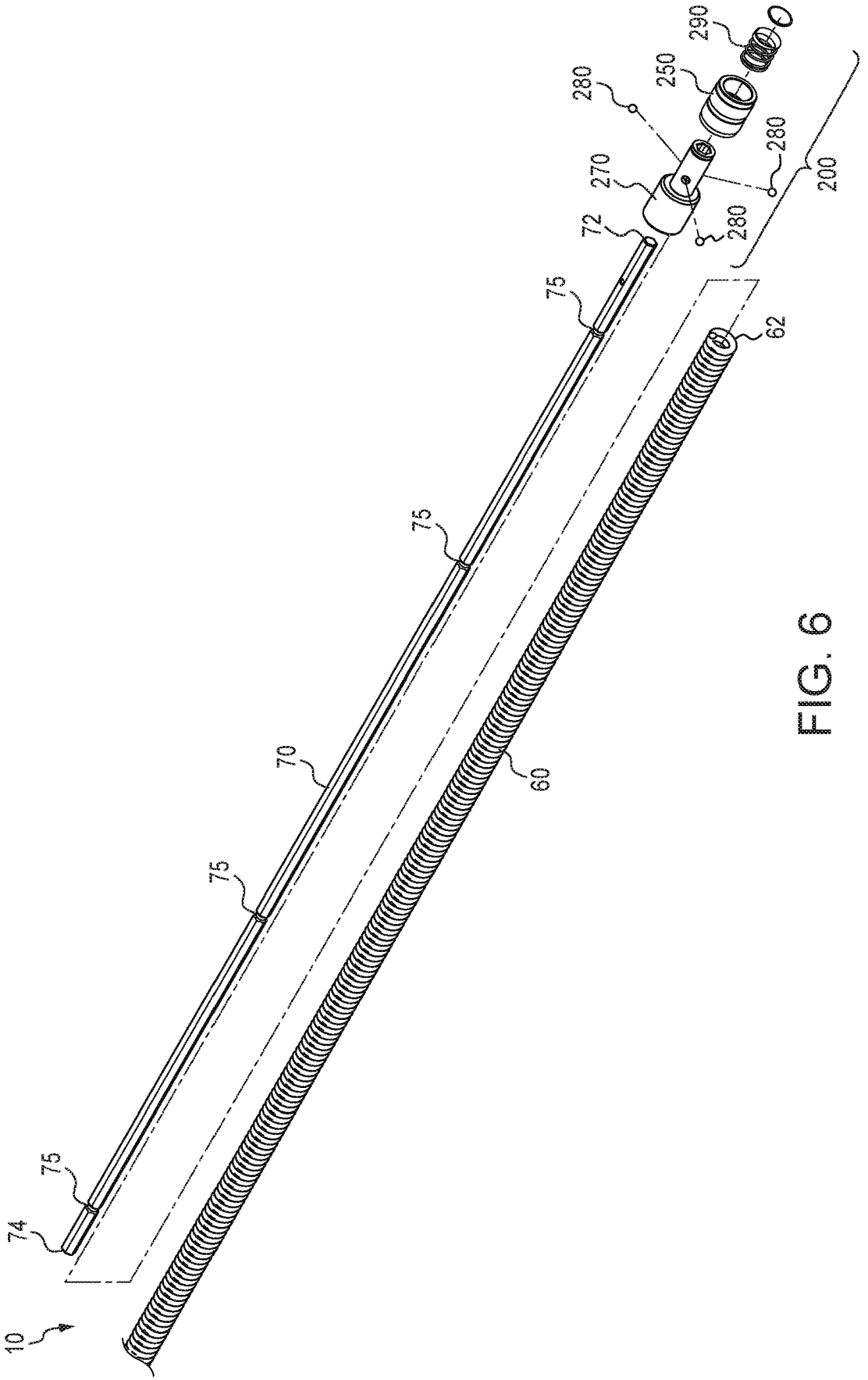
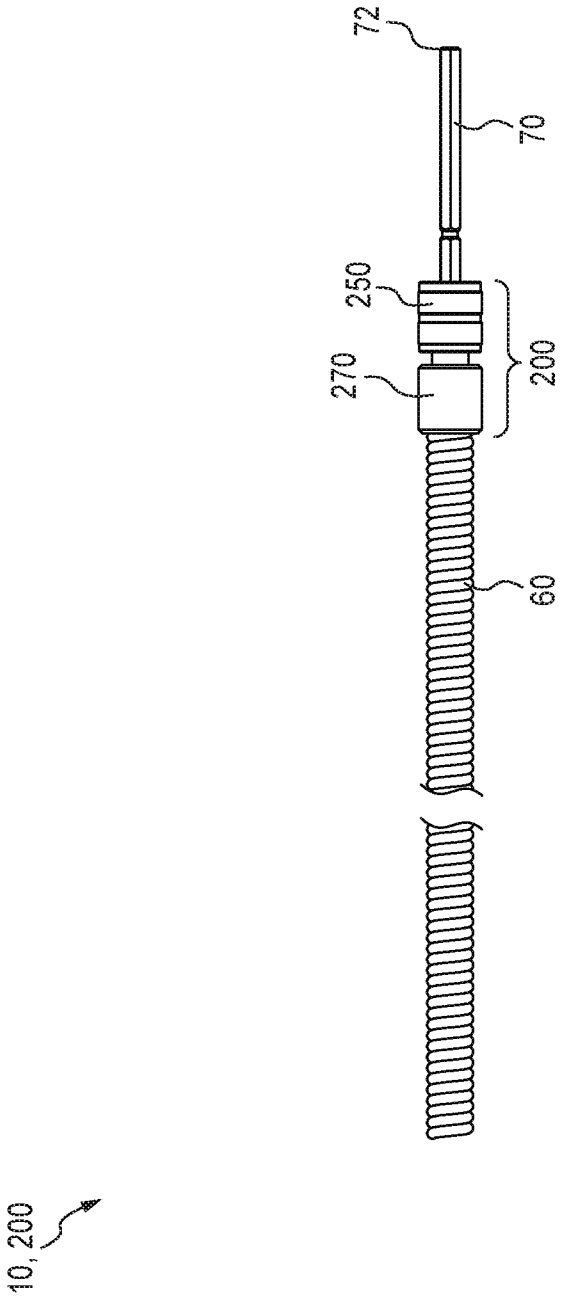


FIG. 6



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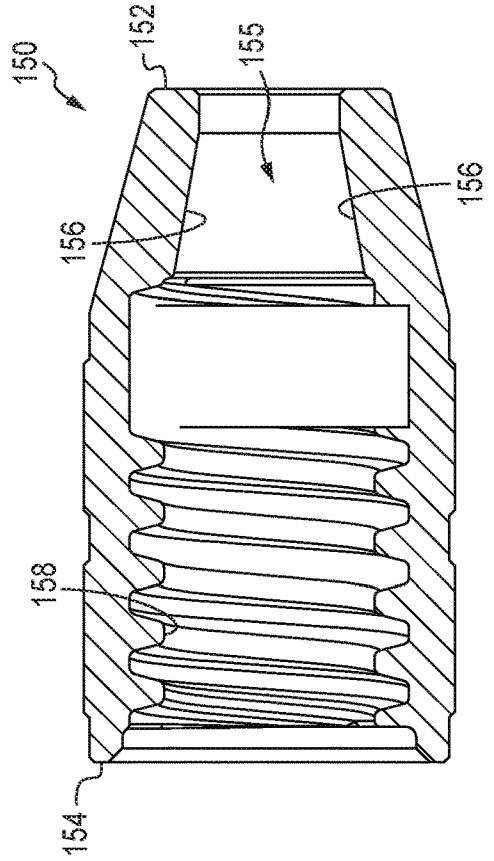
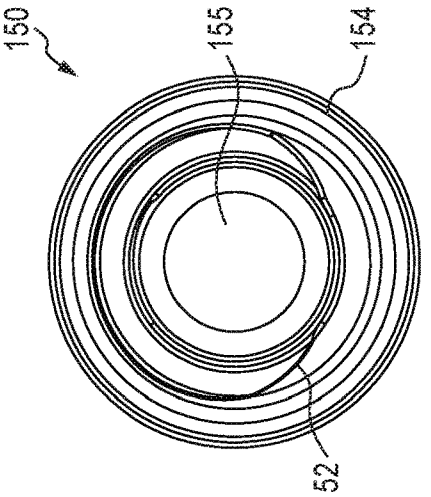


FIG. 10



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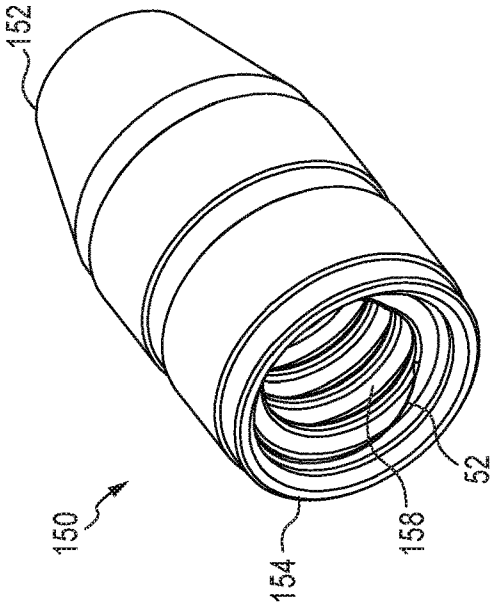

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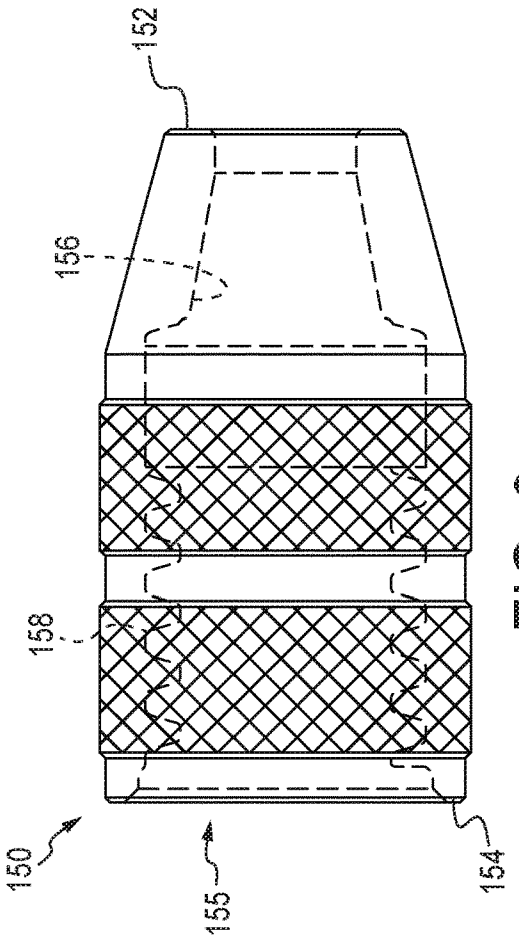

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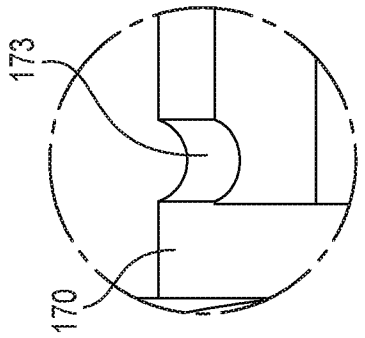

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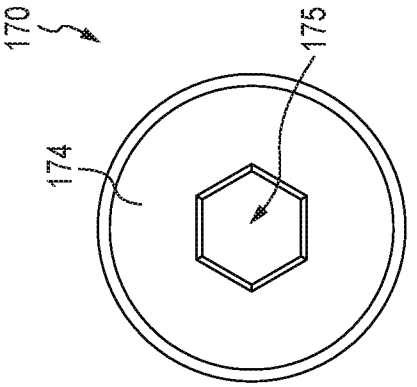

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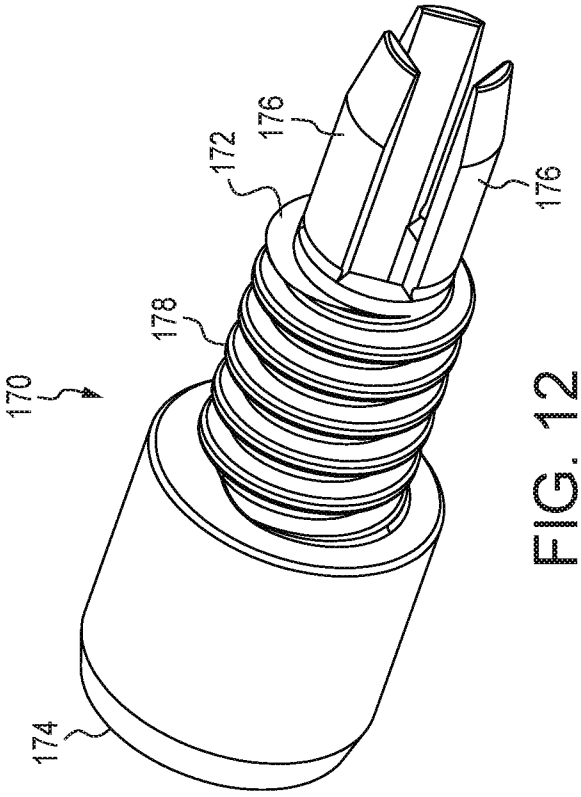
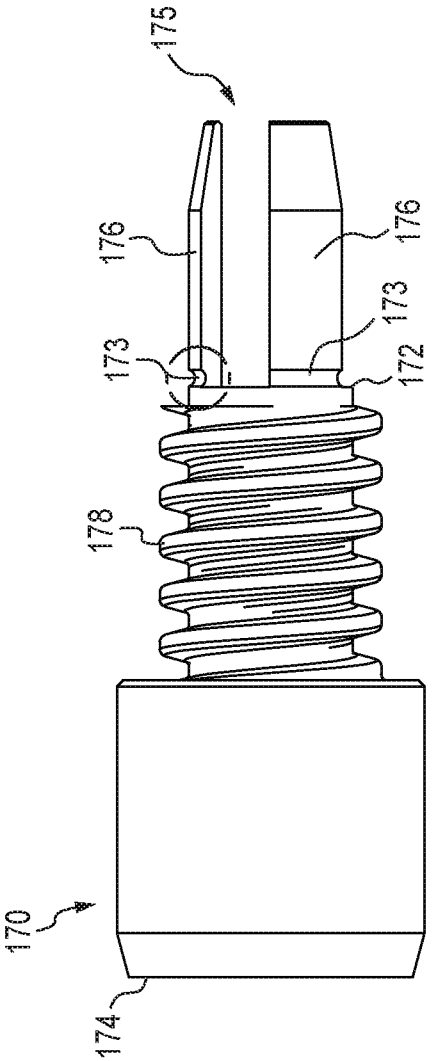


FIG. 12



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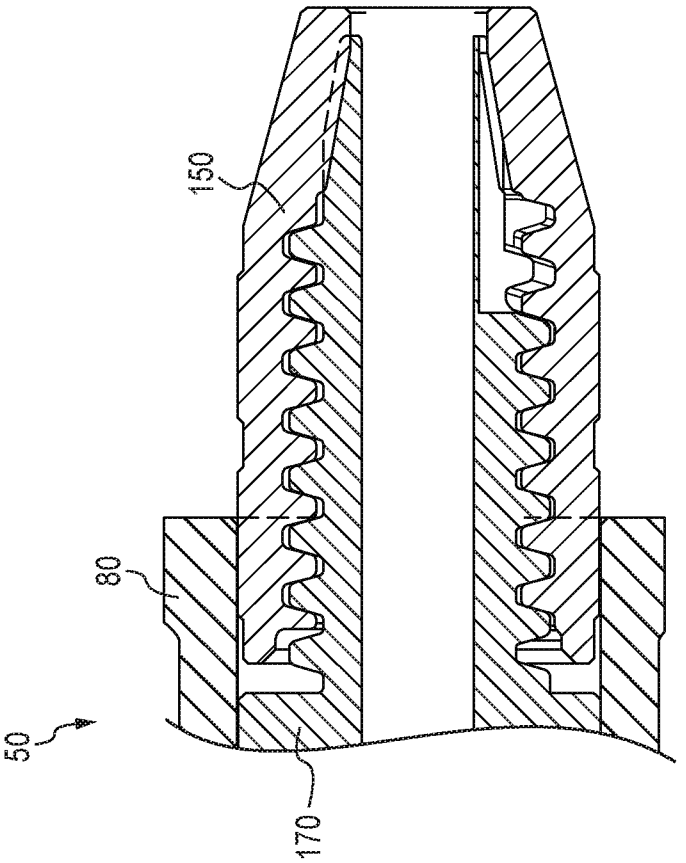

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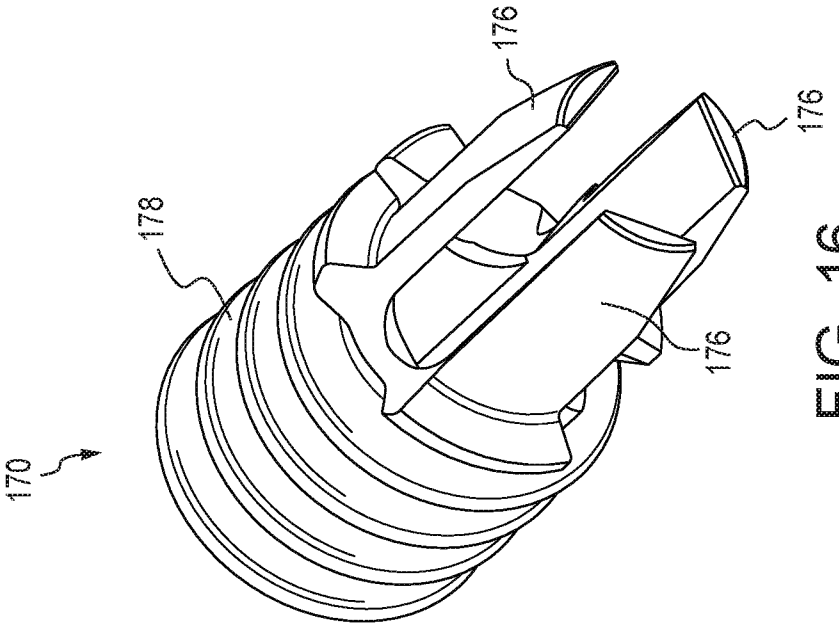

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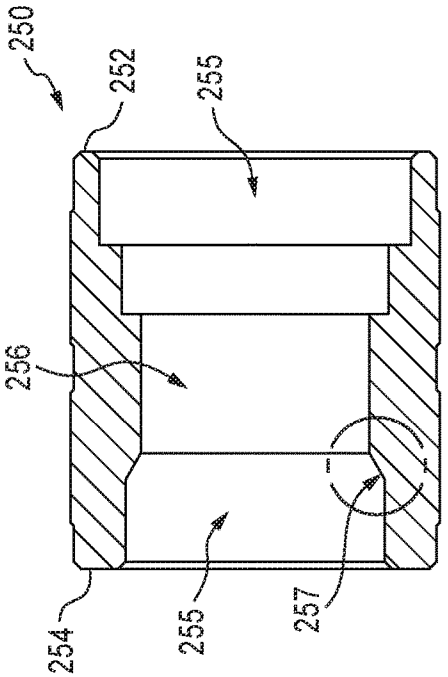

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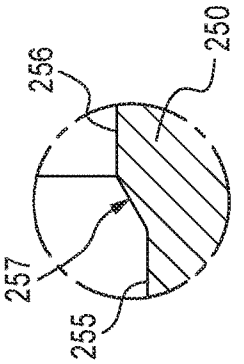

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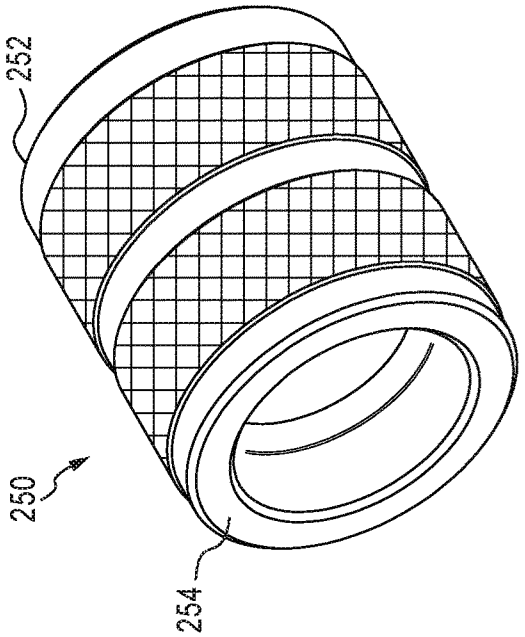

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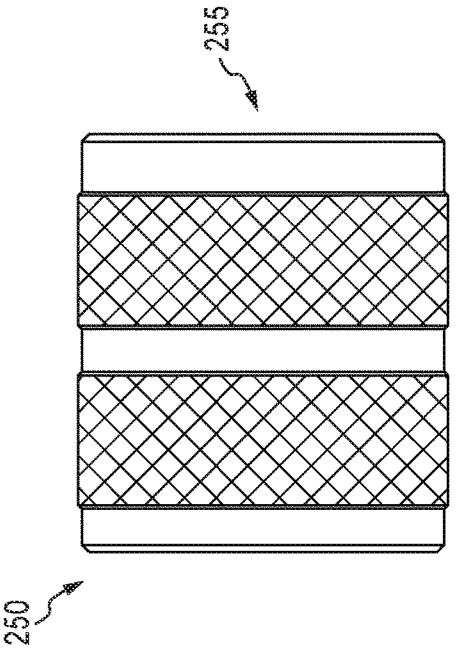

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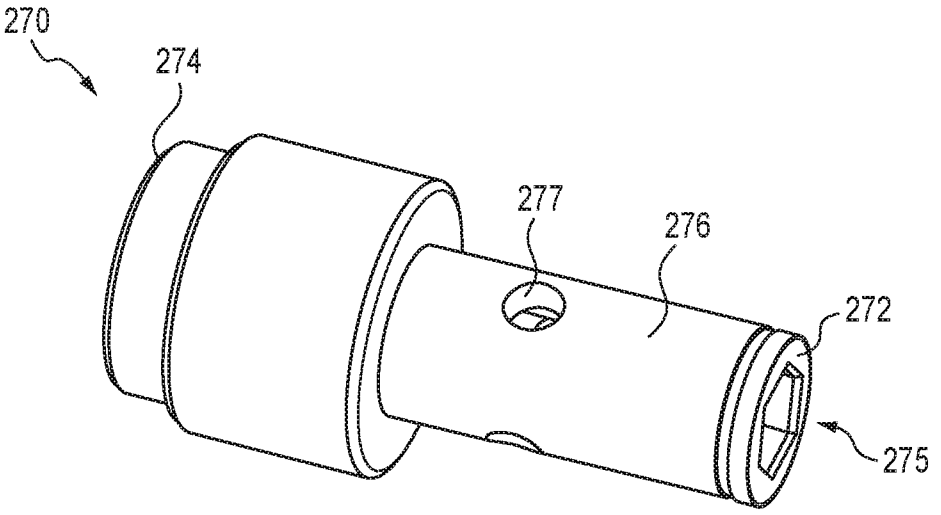

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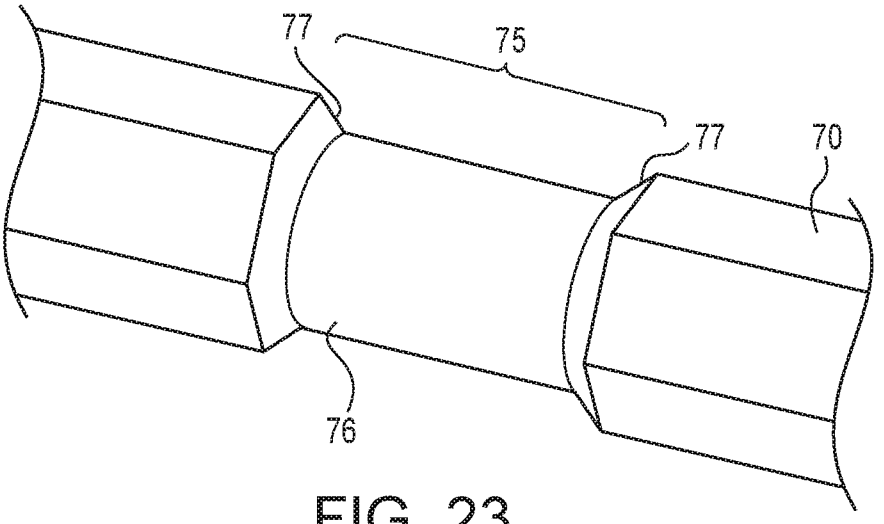

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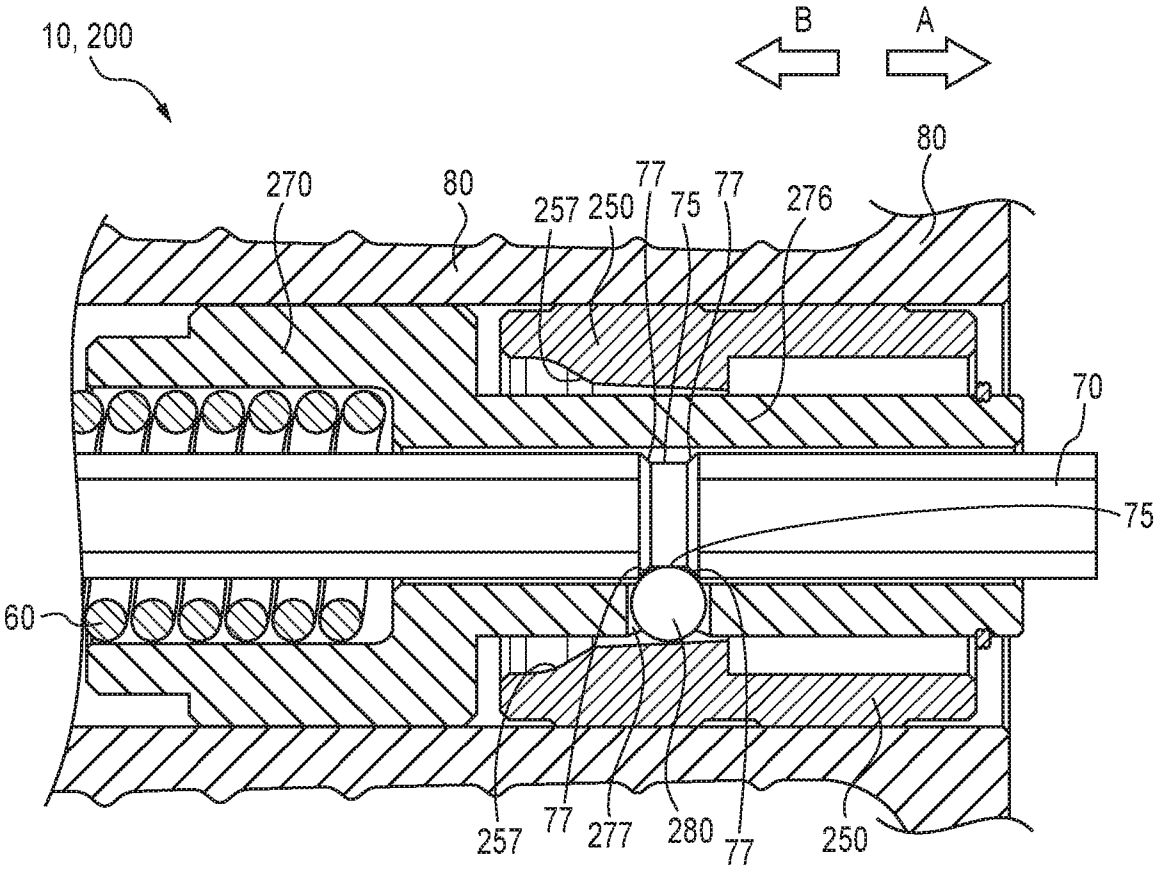

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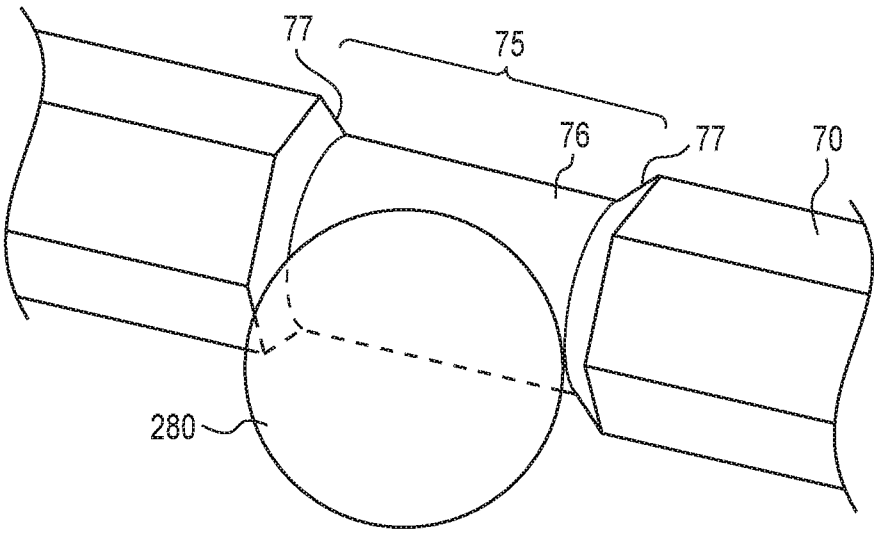
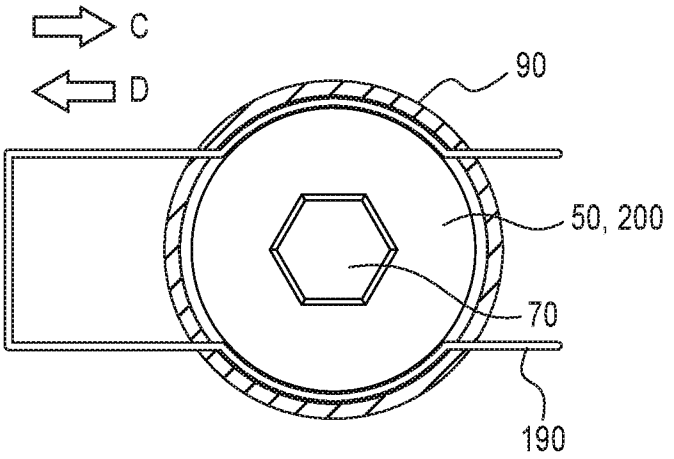


FIG. 24A



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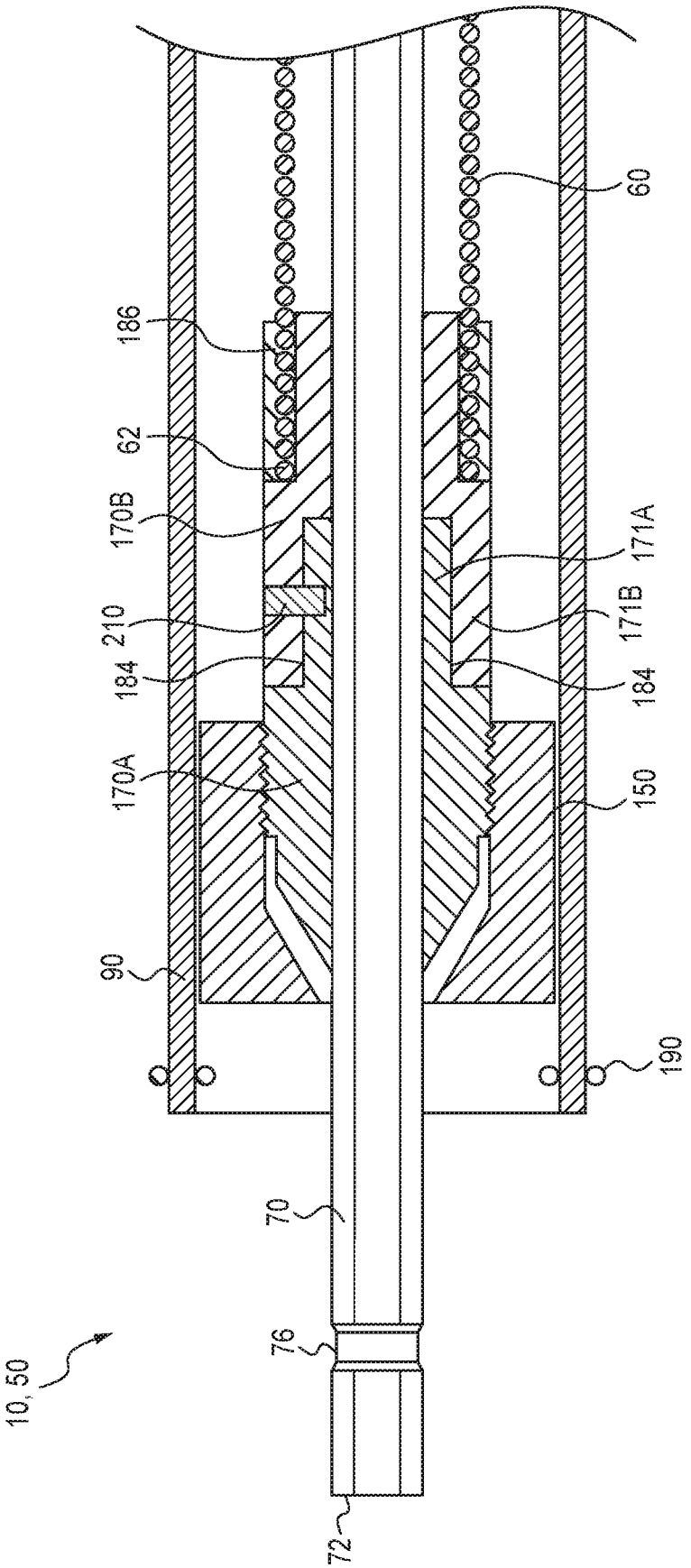
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FIG. 26

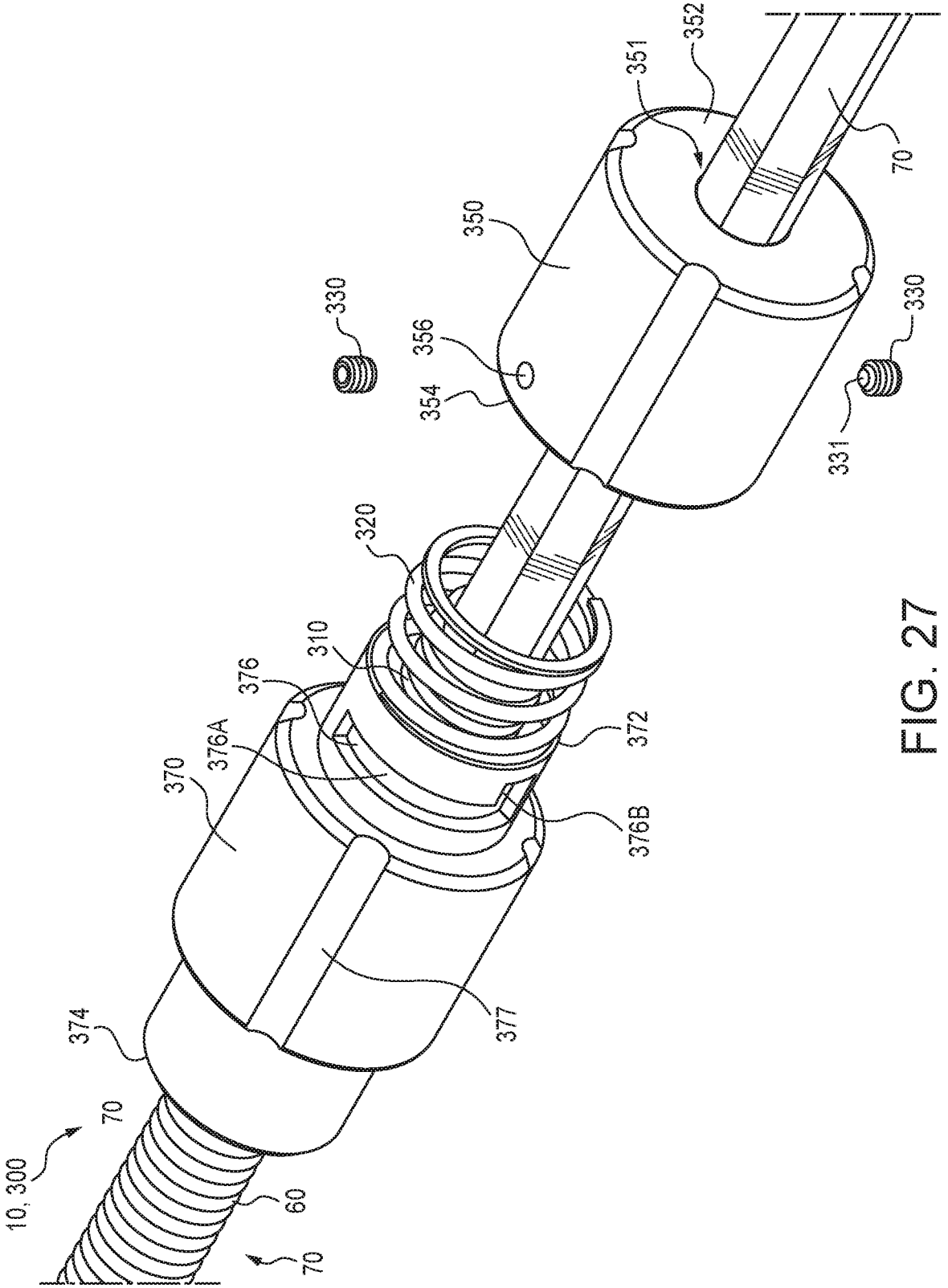
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FIG. 27

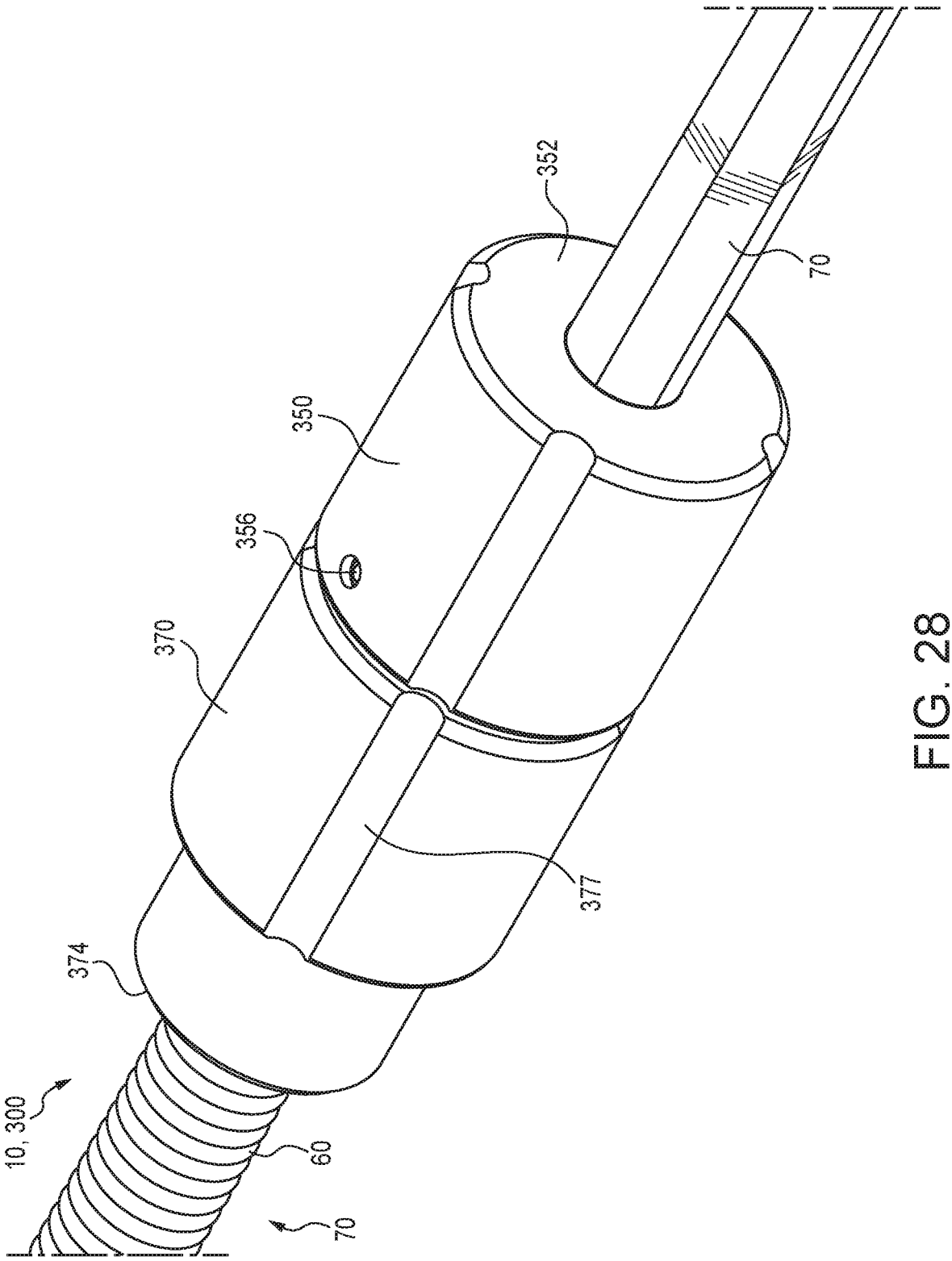

FIG. 28

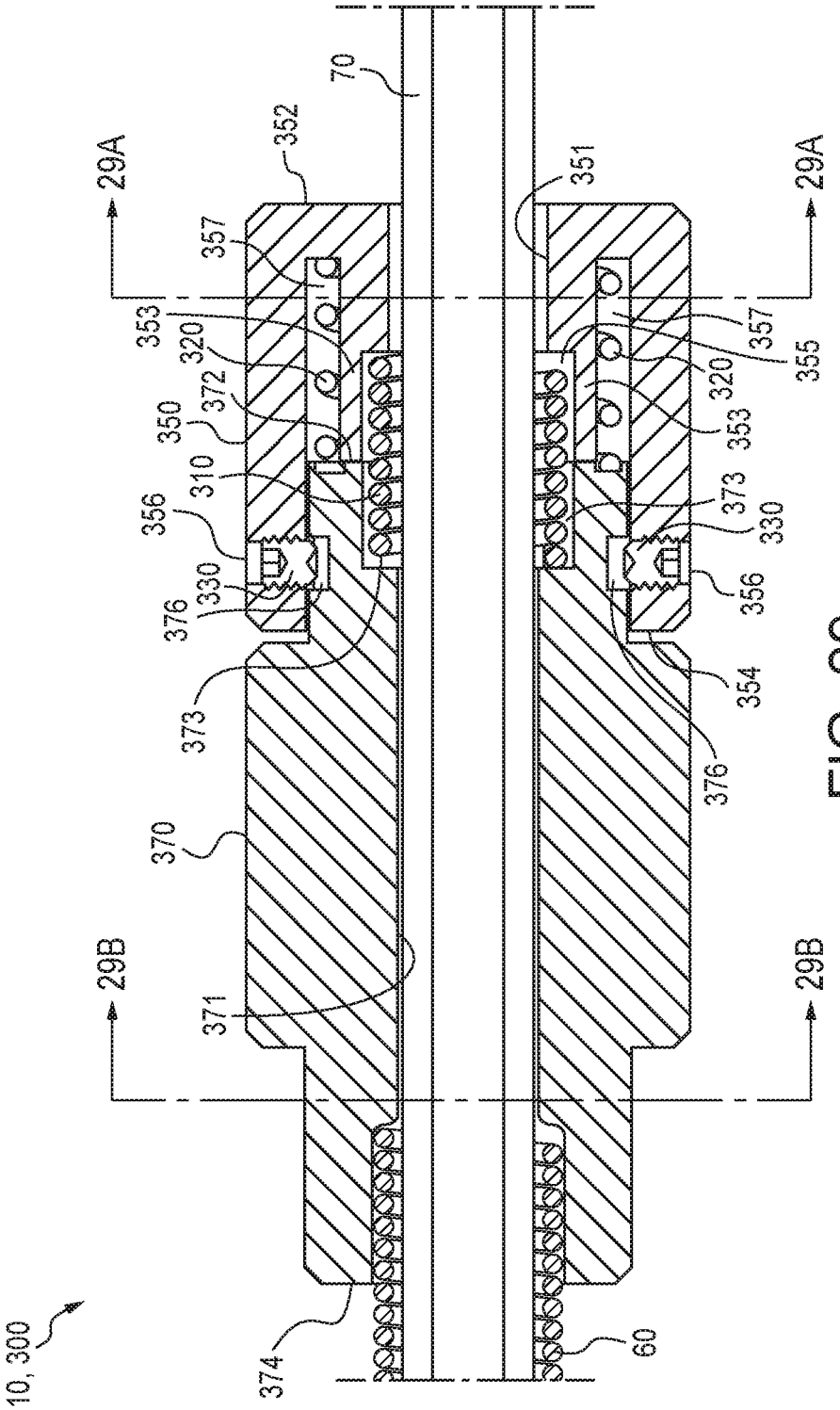
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FIG. 29

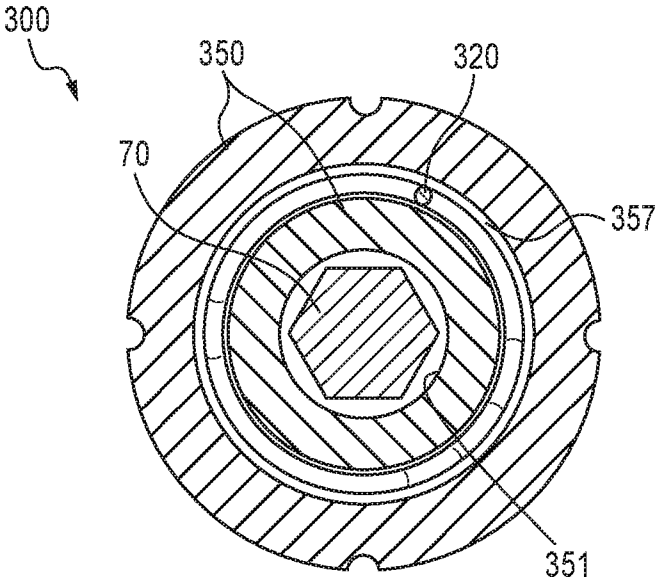
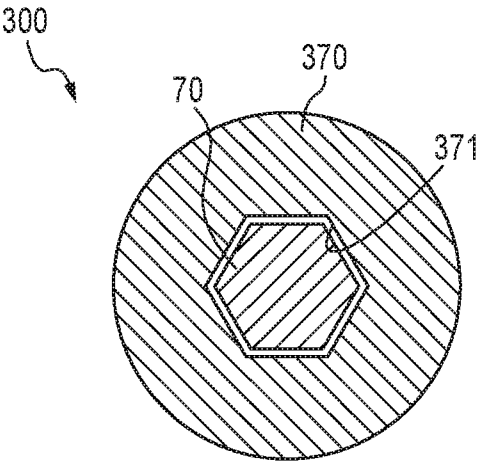


FIG. 29A



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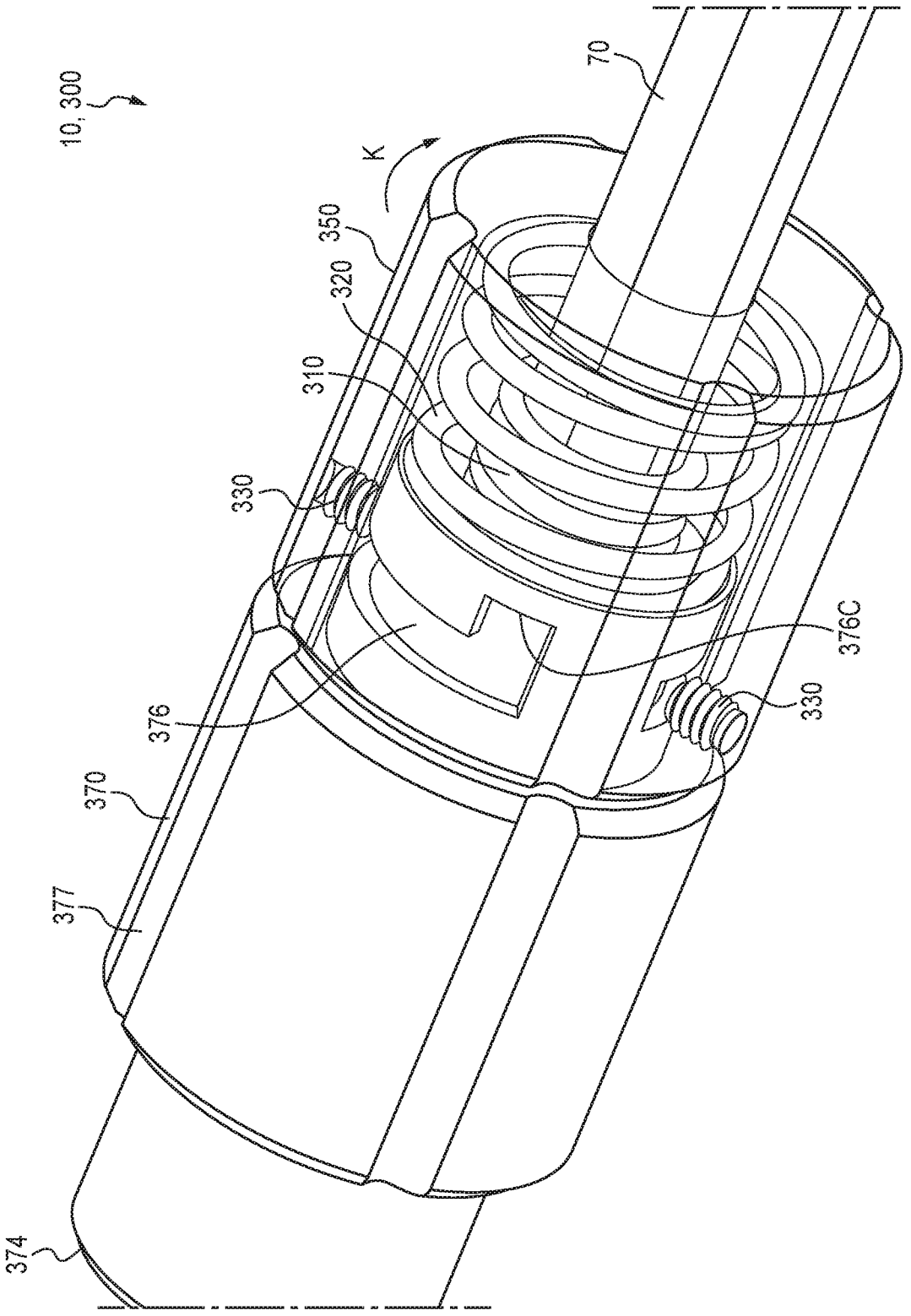

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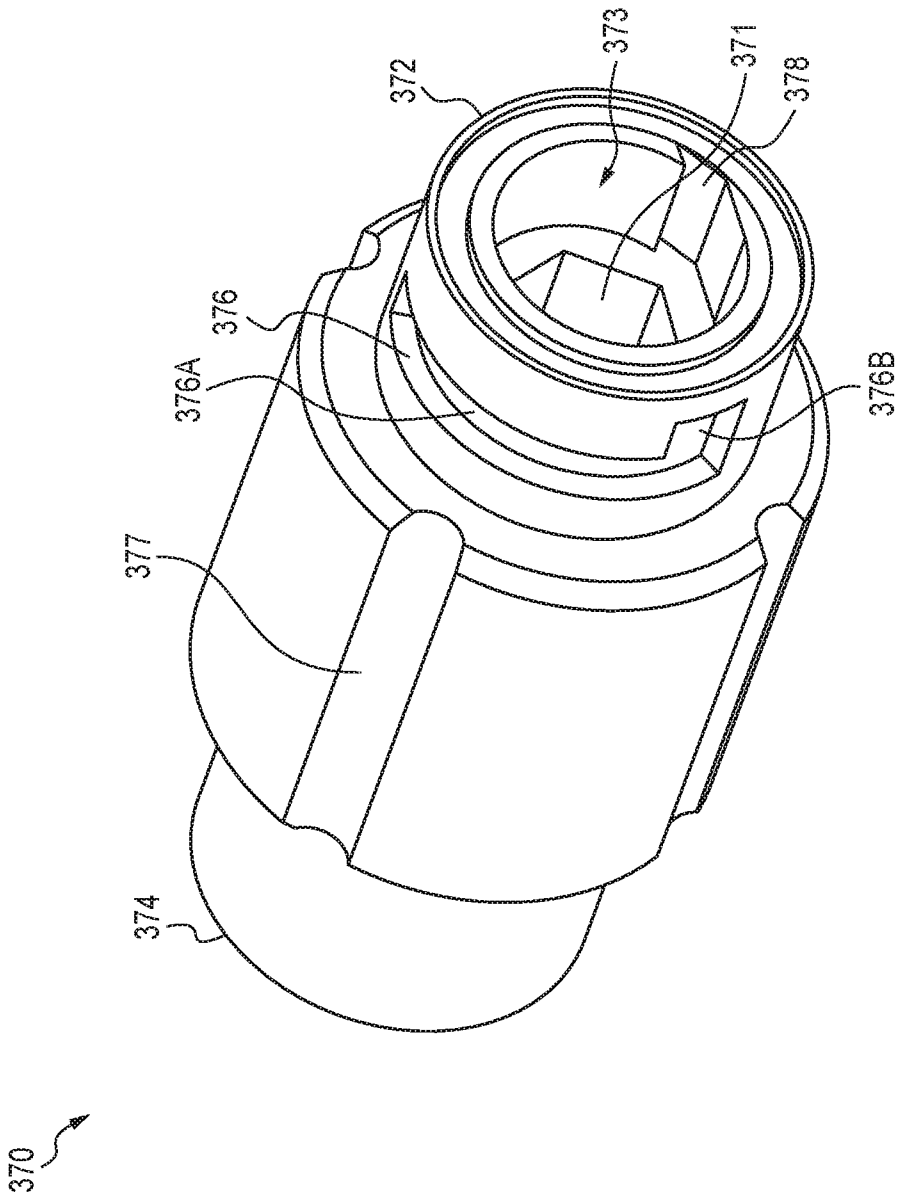

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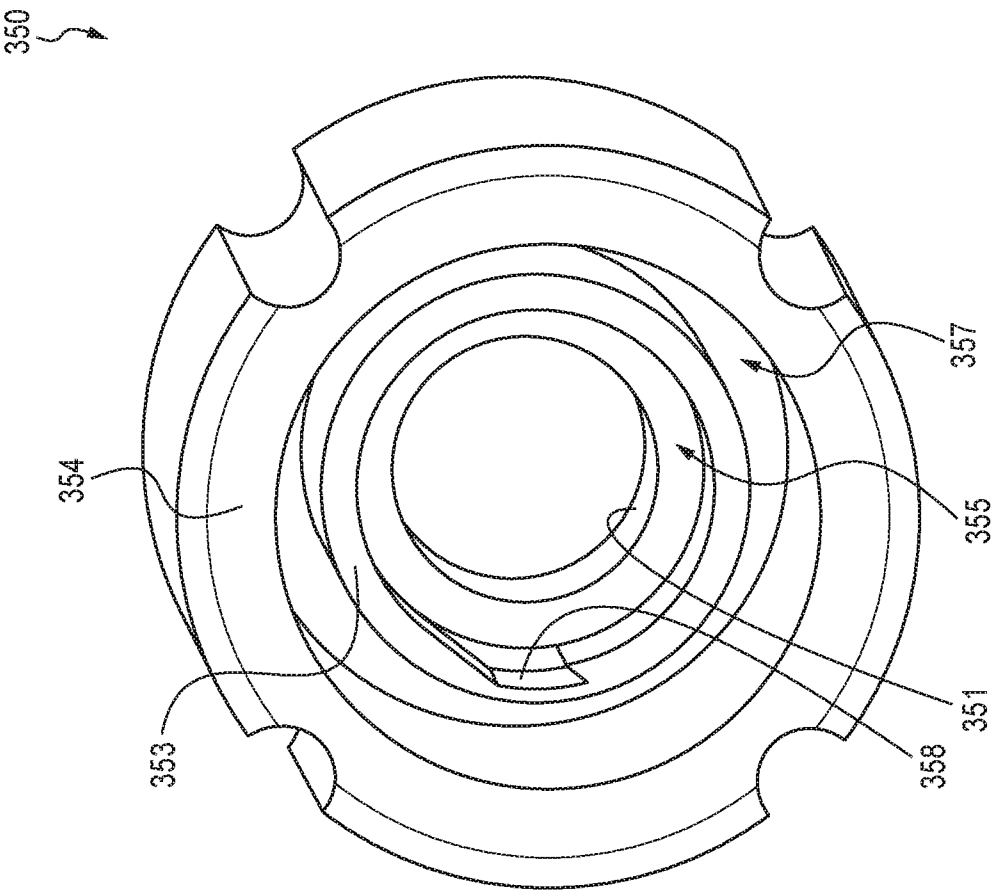

FIG. 32

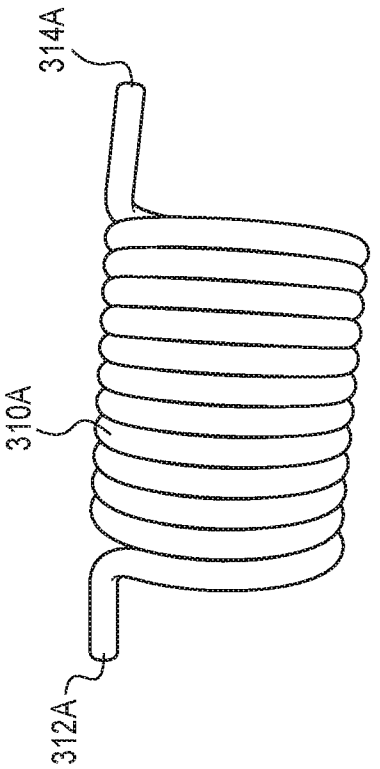

FIG. 34

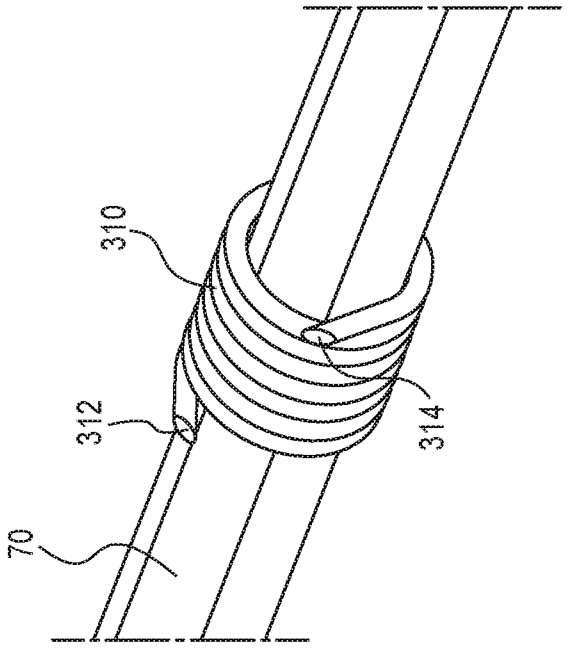

FIG. 33

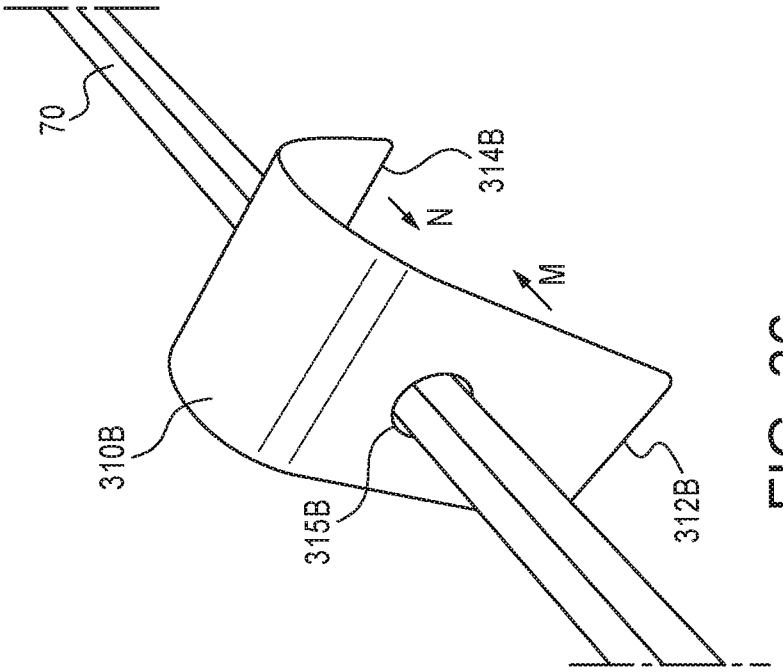

FIG. 36

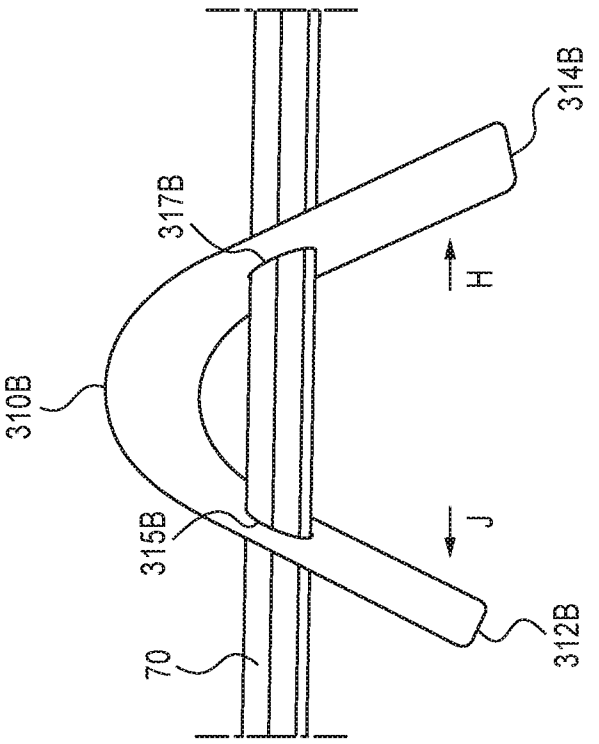

FIG. 35

EXTENDABLE TOILET AUGER

FIELD

The present subject matter relates to augers and plumbing tools for clearing stoppages or clogs in waste pipes and particularly those leading from sinks, urinals, and toilets. More particularly, the present subject matter relates to coupling assemblies used in augers for transferring rotary motion to a drain cleaning cable and enabling extension of the cable in a convenient and intuitive manner.

BACKGROUND

Many known augers utilize an arrangement of two concentrically arranged tubes. An outer tube serves as a guide tube, and an inner tube serves as a handle extension. A cable header slides inside the inner tube between various positions. Because of this arrangement, the cable header is generally not accessible to the user. Because the cable header is not accessible, adjustment of the length of cable extending from the auger in many applications is difficult and not readily intuitive for the occasional user and cumbersome overall.

Specifically, in many known augers, a user extends or pushes the drain cleaning cable further into a drain or other region by extending the telescopic handle portion of the auger. This is typically performed by pushing a detent button and pulling the telescopic handle portion from the remaining portion of the auger to increase the overall length of the auger. Once lengthened, the auger end and drain cleaning cable extending therefrom are pushed further into the drain. In order to retract the cable back into the telescopic housing, the user holds or grasps the cable, presses the detent, and slides the telescopic tube back over the cable. This procedure is not intuitive and frequently requires the user to contact dirty water or debris from the drain. Accordingly, a need remains for an improved auger assembly and method of use.

SUMMARY

The difficulties and drawbacks associated with previous approaches are addressed in the present subject matter as follows.

In one aspect, the present subject matter provides a toilet auger having an extendable drain cleaning cable. The auger comprises an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing. The auger also comprises a drain cleaning cable at least partially disposed in the housing. The cable defines a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the cable. The auger also comprises a coupling assembly engaged with the proximal end of the drain cleaning cable. And, the auger comprises a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable. The torque transmission shaft defines a proximal end and an opposite distal end. The coupling assembly enables selective engagement between the torque transmission shaft and the cable. The coupling assembly is sized and configured to be slidably positionable within the hollow interior of the housing.

In another aspect, the present subject matter provides a coupling assembly for selectively engaging and disengaging a torque transmission shaft and a drain cleaning cable. The coupling assembly comprises a threaded coupler having a proximal end, an opposite distal end, and a passage extending therethrough between the proximal end and the distal end. The threaded coupler includes (i) a plurality of axially extending fingers projecting from the proximal end of the threaded coupler, and (ii) a threaded engagement region defined along an outer surface of the threaded coupler. The coupling assembly also comprises a grip nut having a proximal end, an opposite distal end, and a passage extending therethrough between the proximal end and the distal end. The grip nut includes a threaded engagement region defined along an inner surface of the passage in the grip nut. The passage defined in the grip nut is sized and shaped to receive the proximal end of the threaded coupler and the threaded engagement regions of the threaded coupler and the grip nut are configured to threadedly engage each other.

In yet another aspect, the present subject matter provides a coupling assembly for selectively engaging and disengaging a torque transmission shaft and a drain cleaning cable in which the torque transmission shaft defines a plurality of retention depressions along a length portion of the shaft. The coupling assembly comprises a quick release sleeve defining a proximal end, a distal end, and a passage extending between the proximal end and the distal end. The quick release sleeve also includes an interior region of reduced span, and an interior ramp wall extending between the passage and the interior region of reduced span. The coupling assembly also includes a quick release coupling defining a proximal end, an opposite distal end, and a passage extending between the proximal end and the distal end. The quick release coupling also includes a spindle sized and shaped to be received within the passage of the quick release sleeve, the spindle defining at least one ball capture region. The coupling assembly also includes at least one ball sized and shaped to be received in the ball capture region defined in the spindle and also in the retention depressions defined in the torque transmission shaft.

In another aspect, the present subject matter provides a coupling assembly for selectively engaging and disengaging a torque transmission shaft and a drain cleaning cable. The coupling assembly comprises a torsion lock body defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and a locking groove region. The coupling assembly also comprises a torsion lock sleeve defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and at least one aperture providing access to an interior region of the torsion lock sleeve. The interior region is accessible from the distal end of the sleeve. The proximal end of the torsion lock body is positioned within the interior region of the torsion lock sleeve such that the locking groove region is disposed under and aligned with the aperture defined in the torsion lock sleeve.

In still another aspect, the present subject matter provides a method of clearing blockage in a drain. The method comprises providing an auger having an extendable drain cleaning cable, the auger including (i) an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing, (ii) a drain cleaning cable at least partially disposed in the housing, the cable defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the cable, (iii) a coupling assembly engaged with the proximal end of the drain cleaning cable, (iv) a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable, the torque transmission shaft defining

a proximal end and an opposite distal end, and (v) an auger tool affixed to the distal end of the drain cleaning cable. The coupling assembly enables selective engagement between the torque transmission shaft and the cable. The coupling assembly is sized and configured to be slidably positionable within the hollow interior of the housing. The method also comprises positioning the auger in a drain to be cleared or unblocked. The method also comprises applying rotational motion to the proximal end of the torque transmission shaft which thereby imparts rotational motion to the coupling assembly, the drain cleaning cable, the distal end of the drain cleaning cable, and the auger tool.

In yet another aspect, the present subject matter provides a method of selectively engaging and disengaging a torque transmission shaft with a drain cleaning cable of an auger. The method comprises providing an auger including (i) an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing, (ii) a drain cleaning cable at least partially disposed in the housing, the cable defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the cable, (iii) a coupling assembly engaged with the proximal end of the drain cleaning cable, and (iv) a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable, the torque transmission shaft defining a proximal end and an opposite distal end. The coupling assembly enables selective engagement between the torque transmission shaft and the cable. The coupling assembly is sized and configured to be slidably positionable within the hollow interior of the housing. The method also comprises displacing the coupling assembly beyond the proximal end of the auger housing to thereby expose and make accessible the coupling assembly to a user. The method further comprises actuating the coupling assembly to thereby disengage the torque transmission shaft from the drain cleaning cable. The method additionally comprises axially displacing the torque transmission shaft relative to the drain cleaning cable. And, the method also comprises actuating the coupling assembly to thereby engage the torque transmission shaft to the drain cleaning cable.

In still another aspect, the present subject matter provides a toilet auger having an extendable drain cleaning cable. The auger comprises an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing. The auger also comprises a drain cleaning cable at least partially disposed in the housing. The cable defines a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the cable. The auger further comprises a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable. The torque transmission shaft defines a proximal end and an opposite distal end. The torque transmission shaft is slidably disposed within the hollow interior of the drain cleaning cable and can be extended from the proximal end of the drain cleaning cable.

In yet another aspect, the present subject matter provides a threaded coupler for use in a coupling assembly for selectively engaging and disengaging a torque transmission shaft and a drain cleaning cable. The threaded coupler has a proximal end, an opposite distal end, and a passage extending therethrough between the proximal end and the distal end. The threaded coupler includes (i) a plurality of axially extending fingers projecting from the proximal end of the threaded coupler, and (ii) a threaded engagement region defined along an outer surface of the threaded coupler. At least one of the axially extending fingers includes a region of reduced cross sectional area.

As will be realized, the subject matter described herein is capable of other and different embodiments and its several details are capable of modifications in various respects, all without departing from the claimed subject matter. Accordingly, the drawings and description are to be regarded as illustrative and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partially exploded assembly view of an embodiment of an extendable toilet auger in accordance with the present subject matter.

FIG. **2** is a schematic cross sectional view of an embodiment of a coupling assembly of the auger of FIG. **1** in an idle condition in which cable movement is unlocked.

FIG. **3** is a schematic cross sectional view of the coupling assembly depicted in FIGS. **1** and **2** in a working condition in which cable movement is locked.

FIG. **4** is a further exploded assembly view of the coupling assembly of the auger of FIG. **1**.

FIG. **5** is a partially assembled view of the coupling assembly depicted FIG. **4**.

FIG. **6** is an alternate embodiment of a quick change coupling assembly shown in an exploded assembly view in accordance with the present subject matter.

FIG. **7** is a partially assembled view of the quick change coupling assembly of FIG. **6**.

FIGS. **8-11** illustrate a grip nut used in the coupling assembly detailed in FIGS. **4-5**.

FIGS. **12-15** illustrate a threaded coupler used in the coupling assembly detailed in FIGS. **4-5**.

FIG. **16** is a partial perspective detail view of the threaded coupler shown in FIGS. **12-15**.

FIG. **17** is a partial cross sectional view showing engagement between the grip nut and the threaded coupler of the coupling assembly detailed in FIGS. **4-5** and **8-16**.

FIGS. **18-21** illustrate a quick release sleeve used in the quick change coupling assembly of FIGS. **6-7**.

FIG. **22** is a perspective detail view of a quick release coupling used in the quick change coupling assembly of FIGS. **6-7**.

FIG. **23** is a partial perspective detail view of a retention depression in a torque transmission shaft used in association with the quick change coupling assembly of FIGS. **6-7**.

FIG. **24** is a partial cross sectional view of the quick change coupling assembly of FIGS. **6-7**.

FIG. **24**A is a detailed partial perspective view illustrating the retention depression in the torque transmission shaft and a locking ball positioned in the depression.

FIG. **25** is a schematic cross sectional view of a portion of an auger illustrating a stop component and positioning of the stop.

FIG. **26** is a schematic cross sectional view of a portion of another embodiment of an auger coupling assembly illustrating additional details and aspects of the present subject matter.

FIGS. **27-30** and **29**A-**29**B are schematic views of another embodiment of an auger coupling assembly in accordance with the present subject matter.

FIG. **31** is a schematic perspective view of a torsion lock body used in the coupling assembly shown in FIGS. **27-30**.

FIG. **32** is a schematic interior end view of a torsion lock sleeve used in the coupling assembly shown in FIGS. **27-30**.

FIGS. **33-34** are schematic views of representative versions of torsion springs used in the coupling assembly shown in FIGS. **27-30**.

FIGS. **35-36** are schematic views of another version of a spring component that could be used in association with the coupling assembly shown in FIGS. **27-30**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present subject matter relates to coupling assemblies used in extendable toilet augers that enable a torque transmission shaft to be easily disengaged and re-engaged with a drain cleaning cable (or component thereof) to allow extension and/or retraction of the cable relative to the auger. The present subject matter also relates to augers utilizing the coupling assemblies.

In many of the descriptions herein, the terms "distal" and "proximal" are used to refer to particular regions, ends, or portions of components and/or assemblies. These terms as used herein are with respect to positioning of the auger and its components during typical use by a user. That is during use, the proximal region, end or portion of a component is closer to the user as compared to the corresponding distal region, end or portion of that component. And similarly, the distal region, end or portion of a component is farther from the user as compared to the corresponding proximal region, end or portion of that component.

Generally, the augers include a guide tube, outer tube or housing; a flexible drain cleaning cable also referred to in the industry as a "snake;" a cable header which is an end portion of the cable or a component attached to an end of the cable; a coupling assembly attached to the cable header; and a centrally disposed torque transmission shaft, which at least partially is disposed within the cable. The auger also includes engagement provisions for delivering rotary power to the torque transmission shaft such as a manually powered handle or crank, or power engagement assemblies for engaging a power tool such as a handheld drill or the like. Although the description herein is primarily with regard to augers utilizing manually powered handles or cranks, it will be understood that the present subject matter is not limited to such and includes augers driven by electrically powered motors such as in handheld drills.

The coupling assembly serves to connect the drain cleaning cable or snake, to the torque transmission shaft (engaged with a crank handle or other power delivering means) to thereby provide torque transmission from the crank handle to the drain cleaning cable.

To adjust the length of the drain cleaning cable (relative to a distal end of the auger), the user pulls the torque transmission shaft and coupling assembly engaged therewith out of the housing toward the user and past the proximal end of the housing to expose the coupling assembly. The user then disengages a coupling component of the coupling assembly to release the torque transmission shaft from the drain cleaning cable. The user then re-positions the torque transmission shaft relative to the cable. The user then engages the coupling again. The user can now push the cable header along the length of the guide tube and the cable attached to the cable header down the drain, while rotating the cable with the crank handle.

When retracting the cable, the user pulls up the torque transmission shaft toward the user until the coupling becomes accessible. After disengaging the coupling, the user can push the torque transmission shaft inside the cable for storage and re-engaging the coupling.

Typically, the cable header is a proximal end portion of the drain cleaning cable that engages a coupling component of the coupling assembly. In many versions, the cable header threadedly engages an axially extending stem portion of the coupling component such as described in U.S. Pat. No. 4,364,140 herein incorporated by reference. Specifically, the stem portion includes helical groove(s) to mate with the helical coils of the drain cleaning cable. A crimp ring as described in greater detail herein can be used to secure or further secure an end of the cable to the coupling component. However, the present subject matter includes a wide array of engagement provisions to attach a proximal end of the drain cleaning cable to the coupling component.

In a first embodiment, the coupling assembly includes a grip nut and a threaded coupler that provides a friction fit between the torque transmission shaft and the cable header in the axial connection. The torque is transferred through the form fit between the torque transmission shaft which typically exhibits a hexagonal cross sectional shape and the threaded coupler thereby transferring torque from the torque transmission shaft to the drain cleaning cable. In many versions, the torque transmission shaft may have a variety of cross sectional shape(s) such as a n-sided polygon in which n is within a range of from 3 to about 8 or more. For a torque transmission shaft having a hexagonal cross sectional shape, n is equal to 6. It is also contemplated that the torque transmission shaft could exhibit a circular cross sectional shape or a non-circular cross sectional shape.

The threaded coupler can be provided as one or more separate part(s) or can alternatively be integrated with the end of the cable header. In many embodiments, a proximal end of the torque transmission shaft includes a "power groove" connection by which the shaft can be easily connected to an electrically powered drill or other rotary power source. Alternatively or in addition, a crank handle can be provided, that can be connected to the torque transmitting shaft. The advantage of this embodiment in which the coupling assembly utilizes a grip nut and a threaded coupler is that the length position of the cable and torque transmission shaft can be adjusted to near infinitely small increments.

In another embodiment, the coupling is in the form of a quick change coupling and includes a quick release sleeve and a quick release coupling. The quick release coupling includes at least one engagement or locking ball that is engagingly received in peripheral grooves or recessed regions on the torque transmission shaft. In a locked position, the quick release sleeve prevents the ball(s) from moving out of the peripheral grooves. A spring or other member can be used to bias the quick release sleeve to the locked position. When the user moves the sleeve to an unlocked position, the ball(s) can move radially out of the grooves, and the torque transmission shaft can be moved axially relative to the cable header and cable. If used, a torque transmission shaft having a multi-sided polygon cross sectional geometry allows for torque transfer from the crank handle to the cable header independently of whether the quick change coupling is in a locked or unlocked position.

In certain embodiments, the auger and/or coupling assemblies may optionally include a stop. If a stop is provided, there should be an option to override this stop to allow the cable header to be pulled out of the guide tube, typically toward the user. This is typically required to completely retract the distal end of the cable into the guide tube when the guide tube is inserted into the toilet bowl at the beginning of the cleaning operation. One possible way to provide this

stop cost efficiently, is by use of wire form as described in greater detail herein. Additional details and aspects of stops are provided herein.

In contrast to known devices, augers of the present subject matter utilize an inverted configuration. That is, instead of a tubular handle extension that houses the cable header, the torque transmission shaft is at least partially stored or otherwise disposed inside the drain cleaning cable. The cable header becomes accessible and the adjustment becomes more intuitive. Significantly, the inconvenient ball detents as used in certain previously known augers that penetrate the handle tube from the inside out are no longer required. Depending on the choice of the coupling assembly, the handle length and the length of the cable that can be fed out into the drain, can be adjusted in increments depending on the number of grooves in the torque transmission shaft or infinitely with a threaded coupler as previously noted. These and other aspects are described in greater detail herein.

FIGS. **1-5** illustrate a toilet auger **10** and components thereof in accordance with the present subject matter. The auger **10** comprises a crank handle **20**, a crank **30**, and a crank clamp **40**. The crank clamp **40** engages the crank **30** and the crank handle **20** to a proximal end **72** (FIG. **4**) of a torque transmission shaft **70**, preferably hexagonal in cross section, and referred to herein as hex shaft **70**, as described in greater detail herein. The auger **10** also comprises a coupling assembly **50** which in this particular embodiment includes a grip nut **150** and a threaded coupler **170** described in greater detail herein. The auger **10** thus comprises a drain cleaning cable **60**, the torque transmission shaft **70**, a housing handle **80**, a housing **90**, and a clamp handle **100**. The auger typically also comprises a tube sleeve **110**, and one or more augers **120** or other tools affixed to the drain cleaning cable **60**.

Specifically, referring to FIG. **1**, the drain cleaning cable **60** defines a proximal end **62**, an opposite distal end **64**, and a generally hollow interior **66** extending between the ends **62**, **64**. The coupling assembly **50** and its components, e.g., the grip nut **150** and the threaded coupler **170** also define passage(s) extending through the components. The torque transmission shaft **70** defines a proximal end **72** (see FIGS. **4** and **5**) and an opposite distal end **74**. The torque transmission shaft **70** is disposed within at least a portion of the hollow interior **66** of the drain cleaning cable **60**, and the passage(s) of the coupling components.

The collection of the torque transmission shaft **70**, the drain cleaning cable **60**, and the coupling assembly **50** is disposed and more particularly slidingly disposed within a hollow interior **96** of the housing **90**. The hollow interior **96** of the housing extends between a proximal end **92** and an opposite distal end **94** of the housing **90**.

Although the housing **90** of the auger **10** is illustrated as a hollow tube or cylinder, it will be understood that the present subject matter is not limited to such and includes other shapes and configurations for the housing **90**.

As will be understood, the coupling assembly **50** enables a user to selectively affix the cable header, i.e., the proximal end **62**, and the drain cleaning cable **60** to a desired location along the length of the torque transmission shaft **70**. The coupling assembly **50** also enables a user to selectively decouple a previously affixed cable **60** from the torque transmission shaft **70**. Upon affixing the cable **60** to the torque transmission shaft **70**, extension or retraction of the torque transmission shaft **70**, results in a corresponding linear displacement of the cable **60**. And, rotation of the torque transmission shaft **70** results in corresponding rotation of the cable **60**. Upon decoupling the cable **60** from the torque transmission shaft **70**, the cable **60** can be axially moved independently of the torque transmission shaft **70**, and vice versa. In many versions, upon such decoupling, rotation of the torque transmission shaft **70** still results in corresponding rotation of the cable **60**. However, the present subject matter includes configurations in which upon decoupling, rotary motion of the torque transmission shaft **70** does not result in rotary motion of the drain cleaning cable **60**.

FIG. **2** illustrates the coupling assembly **50** in an idle condition in which the drain cleaning cable **60** is decoupled from the torque transmission shaft **70**. And FIG. **3** illustrates the coupling assembly **50** in a working condition in which the drain cleaning cable **60** is affixed or coupled to the torque transmission shaft **70**. In order to couple or affix the cable **60** and shaft **70** together as shown in FIG. **3**, the grip nut **150** is threadedly engaged with the threaded coupler **170** from an initially threaded position as depicted in FIG. **2**, to a fully engaged threaded position as shown in FIG. **3**. As the grip nut **150** is linearly and axially displaced toward the threaded coupler **170**, an interior wall **156** of the grip nut **150** urges axially extending fingers **176** of the threaded coupler **170** into contact and engagement with the torque transmission shaft **70** to thereby provide frictional engagement between the shaft **70** and the threaded coupler **170**.

FIG. **4** is an exploded view of the grip nut **150**, the threaded coupler **170**, the torque transmission shaft **70**, and the drain cleaning cable **60**. FIG. **5** illustrates these components in an assembled state. It will be seen that the torque transmission shaft **70** extends through passages and/or interiors of the drain cleaning cable **60**, the grip nut **150**, and the threaded coupler **170**.

FIGS. **8-11** illustrate in greater detail the grip nut **150** of the coupling assembly **50**. The grip nut **150** defines a proximal end **152**, an opposite distal end **154**, and an interior passage **155** extending between the ends **152**, **154**. Defined along at least a portion of the passage **155** and adjacent the distal end **154** is a threaded engagement region **158**. And, also defined along at least a portion of the passage **155** and adjacent the proximal end **152** is a region of tapering internal engagement wall(s) **156**. As shown in FIGS. **9** and **10**, the wall(s) **156** taper or transition to a reduced span or opening of the passage **155** as the wall(s) **156** extend toward the proximal end **152** of the grip nut **150**.

FIGS. **12-16** illustrate in greater detail the threaded coupler **170** of the coupling assembly **50**. The threaded coupler **170** defines a proximal end **172**, an opposite distal end **174**, and an interior passage **175** extending between the ends **172**, **174**. The threaded coupler **170** also includes one or more, and typically a plurality of, axially extending fingers **176** projecting from the proximal end **172** of the coupler **170**. In certain versions of the threaded coupler **170**, one or more recessed regions or regions of reduced cross sectional area **173** can be provided to increase flexibility of the fingers **176**. The term "region of reduced cross sectional area" refers to a region of the fingers having a reduced width and/or thickness which results in reduced bending stiffness of that finger. The region of reduced cross sectional area can be provided by removing material from the finger(s) of interest along peripheral or exterior portion(s) or by forming holes, apertures, or recesses within the finger(s) of interest. The cross sectional shape of the passage **175** at least at the distal end **174** of the threaded coupler generally corresponds to the cross sectional shape of the torque transmission shaft **70**. Thus, for a shaft **70** having a hexagonal cross sectional shape, the passage **175** exhibits a hexagonal cross sectional shape, sized to accommodate and receive the shaft **70**. FIG. **15** illustrates the passage **175** exhibiting such a cross sec-

tional shape. The threaded coupler **170** also includes a threaded engagement region **178** defined along an outer surface of the coupler **170**. The threaded engagement regions of the threaded coupler and the grip nut, i.e., region **158** of the grip nut **150** and region **178** of the threaded coupler **170**, are configured, i.e., sized and shaped, to threadedly engage each other.

FIG. **17** illustrates threaded engagement between the grip nut **150** and the threaded coupler **170** in the coupling assembly **50**.

The coupling assembly **50** may also utilize one or more biasing members such as spring(s) **52**. The biasing members or spring(s) **52** may serve to promote engagement or disengagement between the grip nut **150** and the threaded coupler **170**. A representative example of a spring biasing member **52** is depicted in FIGS. **8** and **11**. The spring **52** is positioned within the threaded engagement region **158** of the grip nut **150** and urges disengagement of the threaded engagement region **178** of the threaded coupler **170**.

The auger **10** may utilize a quick change coupling assembly **200** instead of the coupling assembly **50** described herein. The coupling assembly **200** and its components are illustrated in FIGS. **6-7** and **18-24**.

Referring to FIGS. **6** and **7**, the quick change coupling assembly **200** includes a quick release sleeve **250**, a quick release coupling **270**, and one or more locking balls **280**. If the auger **10** utilizes the quick change coupling assembly **200**, the torque transmission shaft **70** defines a plurality of retention depressions **75** along at least a portion of the length of the shaft **70**. In many versions, the retention depressions **75** are equally spaced apart. However, the present subject matter includes versions in which the retention depressions are spaced apart unequally from one another. Typically, the plurality of retention depressions includes a total of from 2 to 12 or more, and in many versions a total of 4 retention depressions. The quick change coupling assembly **200** may additionally comprise one or more biasing members **290**. The biasing members serve to bias the quick release sleeve **250** to a position relative to the coupling **270** as described in greater detail herein.

FIGS. **18-21** illustrate a quick release sleeve **250** of the coupling assembly **200**. The quick release sleeve **250** defines a proximal end **252**, an opposite distal end **254**, and a passage **255** extending between the ends **252**, **254**. The quick release sleeve **250** also includes an interior region of reduced span **256**. And, the quick release sleeve **250** includes a tapered wall region or ramp **257** extending between the passage **255** adjacent the distal end **254** and the region of reduced span **256**. FIGS. **20** and **21** illustrate in greater detail a representative ramp or wall region **257**. As explained in greater detail herein, the ramp **257** serves to urge the one or more locking ball(s) **280** radially inward as the quick release sleeve **250** is positioned over a retention depression **75** defined in the torque transmission shaft **70**.

FIG. **22** illustrates a quick release coupling **270** used in the quick change coupling **200**. The coupling **270** defines a proximal end **272**, an opposite distal end **274**, and a passage **275** extending between the ends **272**, **274**. The coupling **270** also includes a spindle **276** which typically exhibits a cross sectional span or diameter that is sized and shaped to be received within the passage **255** and the interior region of reduced span **256** of the quick release sleeve **250**. Defined along an outer surface of the spindle **276** is at least one and typically a plurality of ball capture regions **277**.

FIG. **23** is a detailed view of a retention depression **75** defined or otherwise formed in the torque transmission shaft **70**. In certain versions, the retention depression **75** includes a circumferential groove **76** extending about the periphery of the shaft **70** and having a cross sectional diameter that is less than the minimum cross sectional span of the shaft **70** as measured at another location devoid of a retention depression **75**. The retention depression **75** can also include a sloping transition wall **77** or a pair of such walls opposing each other, extending between the groove **76** and an outer surface of the torque transmission shaft **70**. The width of the groove **76** and/or distance between the sloping transition walls **77** is sufficient to receive a locking ball **280**.

FIG. **24** is a schematic cross sectional view of the quick change coupling assembly **200** utilized in an auger **10**. The coupling assembly **200** is shown disposed within the housing handle **80** of the auger and depicted in a working or locked position in which the drain cleaning cable **60** is coupled to, or engaged with, the torque transmission shaft **70**. The torque transmission shaft **70** extends through passages in the coupling **270**, the sleeve **250**, and the cable **60**. In this locked position, the one or more locking ball(s) **280** are disposed in a corresponding retention depression(s) **75** in the shaft **70**. The ball(s) are held in the depression **75** by the quick release sleeve **250** positioned over the ball(s) **280**. In order to unlock or decouple the assembly **200**, the sleeve **250** is linearly displaced away from the coupling **270**, which in the FIG. **24** is movement of the sleeve **250** in the direction of arrow A. As noted, the coupling assembly may additionally comprise one or more biasing members **290** (shown in FIG. **6**). If used, the biasing members **290** bias the sleeve **250** toward a locked direction, which in FIG. **24** is shown as displacement in the direction of arrow B. FIG. **24**A is a detailed partial perspective view illustrating a locking ball **280** positioned in the retention depression **75**.

A wide array of drain cleaning cables can be used in association with the augers and coupling assemblies described herein. The cables typically are in the form of a flexible, helically wound wire or metal member. The drain cleaning cable typically has a length of 3 feet or 6 feet, or a length within a range of from 3 to 6 feet. However, the present subject matter includes the use of cables having lengths less than 3 feet or greater than 6 feet.

As previously noted, in certain versions, the augers may include a power groove connection by which the torque transmission shaft can be readily affixed or otherwise engaged with an electrically powered drill. A power groove can be provided by forming or otherwise providing a recessed region within the torque transmission shaft at or near the proximal end of the shaft. The recessed region can be in the form of a retention depression similar to for example, the retention depression **75** described herein, which is adjacent the proximal end **72** of the torque transmission shaft **70**. Preferably, the power groove is located within about 0.5 to about 2 inches of the proximal end **72** of the shaft **70**. In order to affix or engage a powered drill to the power groove, the crank clamp **40** (see FIG. **1**) is loosened to thereby enable separation of the crank clamp **40**, the crank **30**, and the crank handle **20** from the proximal end **72** of the shaft **70** (see FIG. **4** for example). The drill or other rotary power source can then be affixed or engaged with the proximal end **72** of the shaft **70**.

As previously noted, in certain versions of the augers, a stop is provided to prevent the cable header from inadvertently being displaced out of the guide tube or housing and particularly, beyond the proximal end of the guide tube. Thus, the stop serves to retain the cable header and the coupling assembly within the interior of the housing. In many versions, the stop is a component or assembly generally disposed between the proximal end of the housing and

the coupling assembly. The stop is typically selectively positionable between a first position in which the stop prevents displacement or movement of the coupling assembly beyond the proximal end of the housing, and a second position in which the stop allows displacement of the coupling assembly beyond or past the proximal end of the housing, to thereby expose and make accessible the coupling assembly to the user.

The stop can be provided in a wide variety of forms and configurations so long as the stop enables selective displacement of the cable header and coupling assembly out of and/or beyond the proximal end of the guide tube. A representative stop which can be selectively positioned in the auger to prevent or allow displacement of the cable header and coupling assembly out of the guide tube or housing, is shown in FIG. **25**. That figure illustrates a cross sectional view of the housing **90** and the proximal end of the coupling assembly **50**, **200**, and torque transmission shaft **70** disposed within the housing **90**. A stop **190** is provided which upon insertion into the hollow interior of the housing **90** (in the direction of arrow C) and between (i) the proximal end of a component of the coupling assembly **50**, **200**, and (ii) the proximal end of the housing **90**, precludes displacement of the coupling assembly **50**, **200** beyond the stop **190** and thus prevents the coupling assembly from moving beyond the proximal end of the housing **90**. The stop **190** can be placed in an unlocked position by removal or separation of the stop **190** from the guide tube **90** by pulling the stop **190** in the direction of arrow D in FIG. **25**. Upon sufficient positioning or removal of the stop **190** relative to the interior of the housing **90**, the coupling assembly **50**, **200** may then be permitted to move beyond the proximal end and out of the interior of the housing **90**.

FIG. **26** is a schematic cross sectional view of a portion of another embodiment of an auger **10** having a hybrid cable header assembly. In this version, a modified coupling assembly **50** is depicted that is disposed in a housing **90** and that includes a grip nut **150** that is selectively engageable with a modified threaded coupler **170** as previously described herein. The modified coupler **170** includes a proximal portion **170**A and a distal portion **170**B. The grip nut **150** and modified coupler **170** each define a hollow passage extending through each component in like fashion as previously described passages **155** and **175**. The torque transmission shaft **70** extends through the grip nut **150**, the modified coupler **170**, and the drain cleaning cable **60**. The torque transmission shaft may include a power groove **76** as previously described adjacent the proximal end **72** of the shaft **70**.

Referring further to FIG. **26**, the proximal portion **170**A of the modified coupler **170** is formed from a material different than the material of the distal portion **1706**. In many applications, the material of the proximal portion **170**A is a material that is less costly and/or that can be more easily shaped or formed than the material of the distal portion **1706**. Nonlimiting examples of material for the proximal portion **170**A include polymeric materials that can be injection molded. In many applications, the distal portion **1706** is formed from one or more metals such as steel for example.

The proximal portion **170**A and the distal portion **1706** of the modified coupler **170** can be affixed to one another in a variety of techniques. In the version depicted in FIG. **26**, the assembly includes one or more pin(s) **210** that extend through or into male and female regions of both of the proximal portion **170**A and the distal portion **170**B. The pin(s) **210** secure and affix the portions **170**A and **170**B together and particularly in an axial direction. In the particular version of FIG. **26**, the proximal portion **170**A of the coupler **170** includes a male portion depicted as **171**A and the distal portion **170**B includes a female portion **171**B. The female portion **171**B is sized and shaped to receive the male portion **171**A. Preferably, the interfacing surfaces of these male and female components shown as interface **184**, exhibit non-circular cross sections and in many applications, have a cross section in the shape of an n-sided polygon. This mating configuration promotes torque transfer from the distal portion **170**B to the proximal portion **170**A. The present subject matter also includes reversal of the male and female portions such that the distal portion **170**B can include the male portion, and the proximal portion **170**A can include the female portion.

The hybrid cable header assembly illustrated in FIG. **26** may also include a crimp ring **186** that servers to engage the proximal end **62** and adjacent region of the drain cleaning cable **60** to the distal portion **170**B of the modified coupler **170**.

The present subject matter also includes hybrid cable header assemblies using a modified version of the quick release coupling **270**. Thus, in these versions, the coupling **270** includes a proximal portion and a distal portion, in which these portions are formed from differing materials and are coupled together by one or more pins.

FIG. **26** also schematically illustrates the previously described stop **190** which can for example be in the form of a wire member.

In yet another embodiment of the present subject matter, an auger coupling assembly **300** is provided. The coupling assembly **300** is configured for use with a torque transmission shaft **70** and/or in association with a toilet auger as previously described. Referring to FIGS. **27-32**, the assembly **300** comprises a torsion lock body **370** and a torsion lock sleeve **350**. To move coupling assembly **300**, a user would rotate lock sleeve **350** relative to lock body **370**, about a longitudinal axis defined by the hex shaft **70** (FIG. **28**), and slide assembly **300** to the left or right (FIG. **29**). FIG. **29**A is a cross section of the coupling assembly **300** and torque transmission shaft **70** of FIG. **29**, taken across section line **29**A. FIG. **29**B is a cross section of the coupling assembly **300** and torque transmission shaft **70** of FIG. **29**, taken across section line **29**B. The assembly **300** also comprises a plurality of biasing members, typically a primary spring and a secondary spring. In the embodiment shown in FIGS. **27-32**, the coupling assembly **300** comprises a primary torsion spring **310** and a secondary compression spring **320**. Torsional spring **310** is preferably axially disposed within compression spring **320**, as shown in FIGS. **29** and **30**. Torsional spring **310** includes integral end portions **312** and **314**, as shown in FIG. **33**. When in its normal "relaxed state," the torsional spring **310** bites down on the axially disposed longitudinal edges of hexagonally-shaped torque transmission shaft **70**, which essentially "fixes" torsion lock body **370** axially along the length of hex shaft **70**. To release torsional spring **310** from the hexagonally-shaped torque-transmission shaft **70**, for moving the coupling assembly **300** along the length of hex shaft **70**, a user can increase an inner diameter of torsional spring **310**, by rotating end portion **314** counterclockwise relative to end portion **312** (FIG. **33**). Torsion lock sleeve **350** (FIG. **30**) defines retaining structure, such as capture structure **358** (FIG. **32**), which is configured to engage and retain one of the end portions **312** and **314** of the torsional spring **310**, and the torsion lock body **370** (FIG. **31**) similarly defines retaining structure, such as capture structure **378**, which is similarly configured

to engage and retain the other one of the end portions **312** and **314** of the torsional spring **310**. Thus, when the user lets go of the lock sleeve **350**, the "relaxed state" of the torsional spring **310** causes the lock sleeve **350** to tighten onto the hex shaft **70**. In many versions of the assembly **300**, the primary spring **310** is at least partially disposed within an interior region of the secondary spring **320**. The coupling assembly **300** may also comprise one or more fasteners or securing elements **330**.

The torsion lock body **370** defines an interior passage **371** sized and shaped to slidably receive the torque transmission shaft **70**. Interior passage **371**, shown as a hexagonal bore, snuggly receives the hexagonally-shaped torque transmission shaft **70** and transfers torque from hex shaft **70** to the coupling assembly **300**. Typically, the passage **371** is sized and shaped to allow the lock body **370** to be axially moved with respect to the shaft **70**, however not allow rotational movement of the lock body **370** relative to the shaft **70**. The torsion lock body **370** defines a proximal end **372** and an opposite distal end **374**. As will be understood, a drain cleaning cable **60** is affixed or otherwise secured to the lock body **370** typically at the distal end **374** of the lock body **370**. The torsion lock body **370** also defines a recessed receiving region **373** for accommodating at least a portion of the primary spring **310**. In many versions, the receiving region **373** is cylindrically shaped, however, the present subject matter includes other shapes for this region and is not limited to a cylindrical shape. The torsion lock body **370** also defines a locking groove region shown as channel **376**. The locking groove region **376** in FIG. **30** receives the securing element (s) **330** (FIG. **29**) as described in greater detail herein. The locking groove region **376** includes a circumferentially extending portion **376**A (FIG. **27**) and an axially extending portion or pocket **376**B (FIG. **27**), terminating with end portion **376**C, shown in FIG. **30**. The torsion lock body **370** may optionally include one or more slots, ridges, or other regions generally designated as **377** along an exterior surface of the lock body **370** for promotion of gripping or handling by a user.

The torsion lock sleeve **350** defines a proximal end **352** and a distal end **354**. The lock sleeve **350** also defines an interior passage **351** extending between the ends **352**, **354** and which is sized and shaped to slidably and rotatably receive the torque transmission shaft **70**. Typically, the passage **351** is sized and shaped to allow the sleeve **350** to be axially moved and rotated about the shaft **70**. The torsion lock sleeve **550** also defines one or more apertures **356** for receiving the securing element(s) **330**. In many versions, the aperture(s) **356** and the securing element(s) **330** include threads and so the securing element(s) **330** can be threadedly engaged in the aperture(s) **356**. The aperture(s) **356** provide access to an interior region of the torsion lock sleeve **350**. That interior region is accessible from the distal end **354** of the sleeve **350**.

The torsion lock sleeve **350** includes an interior circumferential wall **353** that separates a generally cylindrical inner receiving region **355** from an outer annular receiving region **357**. The inner region **355** is configured to receive the primary spring **310**. The outer region **357** is configured to receive the secondary spring **320**. In many versions, the lock sleeve **350** includes one or more capture structures **358** within the inner receiving region **355**. The capture structure **358** is configured to engage an end of the primary spring **310** which as noted is typically a torsion spring.

The torsion lock body **370** and the torsion lock sleeve **350** are adapted to engage each other. In this configuration, the interior passage **371** of the lock body **370** is aligned and generally co-extensive with the interior passage **351** of the lock sleeve **350**. As will be understood, the torque transmission shaft **70** extends through the passages **371** and **351**. Specifically, a portion and typically a proximal end portion **372** of the torsion lock body **370** is sized for positioning within the torsion lock sleeve **350** and typically within a distal end portion **354** of the sleeve **350**. The receiving region **373** of the torsion lock body **370** may also include a capture structure **378** which is configured to engage an end of the primary spring **310**. The locking groove region **376** is located along the torsion lock body **370** at a location such that upon engagement between the lock body **370** and the lock sleeve **350**, the locking groove region **376** is aligned or disposed underneath the aperture(s) **356** defined in the lock sleeve **350**. This arrangement enables an inner face **331** of a securing element **330** to be positioned within the locking groove region **376** of the torsion lock body **370**. In many versions, the diameter or interior span of the receiving region **373** of the torsion lock body **370** is the same or substantially so as the diameter or interior span of the inner receiving region **355** of the torsion lock sleeve **350**. As noted, upon assembly and incorporation of the primary torsion spring **310** within the regions **373** and **355**, one end of the torsion spring **310** engages the capture structure **378** of the torsion lock body **370**, and another end of the torsion spring **310** engages the capture structure **358** of the torsion lock sleeve **350**. In addition, upon assembly of the components, the proximal end **372** of the torsion lock body **370** is directed toward and in close proximity with the interior circumferential wall **353** of the torsion lock sleeve **350**. Upon such assembly, the secondary compression spring **320** is disposed and enclosed within the outer receiving region **357** of the torsion lock sleeve **350**. FIG. **34** depicts an alternate, additional embodiment of torsional spring **310**A having end portions **312**A and **314**A. To slide torsional spring **310**A longitudinally along the length of hexagonally-shaped shaft **70**, a user can increase the inner diameter of spring **310**A by rotating end portion **314**A clockwise about the longitudinal axis of hex shaft **70** relative to end portion **312**A. As discussed above, one of the end portions **312**A and **314**A of torsional spring **310**A would engage capture structure **358** of torsion lock sleeve **350** (or a suitable aperture defined by sleeve **350**), while the other one of the end portions **312**A and **314**A of torsional spring **310**A would engage capture structure **378** of torsion lock body **370** (or a suitable aperture defined by lock body **370**), so that the torsional spring **310**A is able to return to its normal "relaxed" state and cause securing elements **330** (FIG. **30**) to move within channel **376** and stop in pocket **376**B (FIG. **27**), after the user releases hold of torsion lock sleeve **350** relative to torsion lock body **370**.

The coupling assembly **300** provides an axially releasable engagement between the assembly **300** and the torque transmission shaft **70**. That is, upon engagement of the lock body **370** with the lock sleeve **350** and incorporation of the primary and secondary springs **310**, **320** therebetween, the coupling assembly **300** can be selectively affixed at a desired location along the shaft **70** by rotating the sleeve **350** relative to the lock body **370**. In this locked state, the securing element(s) **330** are at least partially disposed in the locking groove region **376** and specifically, the axially extending portion **376**B. The secondary spring **320** promotes retainment of this locked state by urging the sleeve **350** and specifically the securing element(s) **330** toward an end **376**C of the locking groove region **376**, as shown in FIG. **30**. A user wishing to unlock the coupling assembly **300** urges the sleeve **350** toward the body **370**, against the biasing force of

the secondary spring **320**, thereby moving the securing element(s) **330** away from the end **376**C of the locking groove region **376**; and then rotating the sleeve **350** in the direction of arrow K relative to the shaft **70** and body **370**. Rotation of the sleeve **350** in the direction of arrow K results in loosening and expansion of the primary spring **310** from the shaft **70**, thereby allowing axial movement of the sleeve **350** and the body **370** relative to the shaft **70**.

FIG. **33** illustrates a primary spring **310** in the form of a torsion spring disposed about a torque transmission shaft **70**. The primary spring **310** defines a first end **312** and a second end **314**. As will be understood, upon incorporation in the coupling assembly **300**, the first end **312** is positioned adjacent the stop structure **378** of the torsion lock body **370** and the second end **314** is positioned adjacent the stop structure **358** of the torsion sleeve **350**. The ends **312**, **314** can be shaped or configured according to the stop structures or other components of the body **370** and/or sleeve **350**. The present subject matter includes a wide array of variations of the springs and components. For example, FIG. **34** depicts a variant primary spring **310**A having flat or blunt ends **312**A and **314**A.

In operation, coupling assembly or mechanism **300** (FIG. **28**) is capable of freely sliding along the length of torque-transmission shaft **70** until a user causes the coupling assembly or mechanism **300** to be fixed to a desired position along the length of torque-transmission shaft **70**. While the preferred embodiment of the torque-transmission shaft **70** is illustrated in, e.g., FIGS. **29**A and **29**B, as hexagonal in cross section, it can be appreciated that a polygonal-sided torque-transmission shaft, that is, a shaft that is "n"-sided in cross section, where "n" is, e.g., 3-8, would be functionally and operationally equivalent to illustrated shaft **70**. The coupling assembly or mechanism **300** includes a torsion spring **310** (FIG. **29**) which encircles a portion of the external surface of the elongated torque-transmission shaft **70**. Coupling assembly or mechanism **300** also includes a compression spring **320** (FIGS. **27** and **29**) encircling a portion of the torsion spring **310**. Coupling assembly or mechanism **300** further includes a torsion lock sleeve **350** which defines an inner pocket or inner receiving region **355** (FIGS. **29** and **32**) into which one end portion of torsion spring **310** is disposed, and an outer pocket or outer receiving region **357** (FIGS. **29** and **32**) within which compression spring **320** is entirely contained. Coupling assembly or mechanism **300** additionally includes a torsion lock body **370**. Torsion lock body **370** defines yet another pocket or receiving region **373** (FIGS. **29** and **31**) into which the opposite end portion of the torsion spring **310** is disposed. The torsion spring **310** (FIG. **33**) is dimensioned relative to the elongated hexagonal-shaped torque-transmission shaft **70** for the purpose of affixing the mechanism **300** along the length of hex shaft **70**. In addition, torsion spring **310** is made of a material or materials suitable for enabling the torsion spring **310** to be firmly frictionally-affixed to a portion of the external surface of hex shaft **70** whenever torsion spring **310** is in its normally-"closed" or so-called "relaxed" state. When the torsion spring **310** is in its "relaxed" state, its coiled structure is tightly wrapped around a portion of the elongated torque-transmission shaft **70** (FIG. **33**) and frictionally-affixed thereto. To enable a user to operate the coupling assembly or mechanism **300**, one of the end portions **312** or **314** of the torsion spring **310** (FIG. **33**) is disposed into the inner pocket or receiving region **355** of torsion sleeve **350** and is securely frictionally held there by capture structure **358** (FIG. **32**), while the other end portion **312** or **314** of the torsion spring **310** (FIG. **33**) is disposed into the other pocket or receiving region **373** defined by torsion lock body **370** and is securely frictionally held there by capture structure **378** (FIG. **31**). To enable a user to slide the mechanism **300** (FIG. **28**) along the length of shaft **70**, the torsion lock body **370** features an interior passage **371**, depicted (e.g., in FIGS. **29**B and **31**) as a hexagonal through-bore that snuggly axially receives hexagonally-shaped torque transmission shaft **70** (FIGS. **27-30**). Interior passage **371** (FIG. **29**B) also serves to "tie" torsion lock body **370** to torque-transmission shaft **70**, so that when the user rotates lock body **370** about the longitudinal axis of shaft **70**, shaft **70** is rotated about its longitudinal axis as well, which transfers torque from lock body **370** to hexagonal shaft **70**. Torsion lock body **370** also defines a locking groove region **376** which includes a circumferentially-extending portion **376**A and an axially-extending portion or pocket **376**B, shown in FIG. **27**, for rotating one of the torsion lock sleeve **350** and lock body **370** relative to the other about the longitudinal axis of torque-transmission shaft **70**, which enables a user either to affix mechanism **300** to or release mechanism **300** from shaft **70**. Torsion lock sleeve **350** includes securing elements **330** (FIG. **30**), which have an end portion **331** (FIG. **27**) configured for insertion into locking groove region **376**, shown in FIGS. **29** and **30**. When the components of the mechanism **300** (FIG. **28**) described above are assembled, compression spring **320** in outer pocket or receiving region **357** (FIG. **29**) of torsion sleeve **350** is compressed. To release the mechanism **300** from hex shaft **70**, one end portion **312** or **314** of the torsion spring **310** is caused by a user to rotate (e.g., counterclockwise in FIG. **33**) relative to the other (end portion **312** or **314** of torsion spring **310**) about the longitudinal axis of the hex shaft **70**, which "opens" spring **310** and releases the tight grip that spring **310** has on hex shaft **70**. To operate mechanism **300**, a user must rotate one of torsion lock sleeve **350** and torsion lock body **370** (FIG. **28**) relative to the other about the longitudinal axis of hex shaft **70**. This will cause the end portion **331** (FIG. **27**) of a securing element **330** to be moved within locking groove region **376**. When the end portion **331** of a securing element **330** arrives at axially-extending portion or pocket **376**B (FIG. **27**), the compressive-force in compression spring **320** causes the end portion **331** of securing element **330** to abut end portion **376**C (FIG. **30**) of groove **376**. This increases the gap between lock sleeve **350** and lock body **370** along the longitudinal axis of shaft **70**. In a preferred embodiment of mechanism **300**, lock sleeve **350** and lock body **370** are spaced about 2 millimeters apart when mechanism **300** is "fixed" to shaft **70** (FIG. **28**) and are spaced about 4 millimeters apart when the mechanism **300** is free to move along the length of shaft **70**. Torsion spring **310**, when relaxed, tightly grips hex shaft **70**. As a result, a user must rotate one of torsion lock sleeve **350** and torsion lock body **370** relative to the other about a longitudinal axis defined by hex shaft **70**, to force torsion spring **310** to "open," releasing its "grip" on hex shaft **70** and allowing a user to freely move the mechanism described above longitudinally along shaft **70**.

FIGS. **35** and **36** schematically illustrate another version of biasing component(s) that could be utilized or incorporated in a coupling assembly in an auger as described herein. In this version, a biasing component **310**B is provided which defines opposite ends **312**B and **314**B and two apertures **315**B and **317**B. The biasing component **310**B is positioned at a desired location on a torque transmission shaft **70** by bending or otherwise positioning the component **310**B so that the apertures **315**B and **317**B are aligned and the shaft **70** extends therethrough. The material of the component **310**B is such that the component adopts a relatively flat

shape at rest and must be urged to the shape as shown in FIG. **36** by applying force to the ends **312**B and **314**B. Specifically, end **312**B is urged in the direction of arrow M toward end **314**B; and end **314**B is urged in the direction of arrow N toward end **312**B. Upon force removal, the elastic or resilient behavior of the material of the component **310**B results in releasable retention or securement of the component **310**B to the shaft **70**. That is, due to the noted material behavior, the end **312**B is urged outward in the direction of arrow J in FIG. **35**, and the end **314**B is urged outward in the direction of arrow H. Nonlimiting examples of suitable materials for the biasing component **310**B include but are not limited to steel, stainless steel, and various metal alloys known for deformable and elastic properties.

The present subject matter also provides methods of clearing blockage(s) in drains. The methods involve providing an auger as described herein. The methods also include positioning the auger in a drain to be cleared or unblocked. Specifically, this typically includes inserting the auger tool attached to the distal end of the drain cleaning cable, into the drain until the auger tool contacts the blockage. The user applies rotational motion to the torque transmission shaft. As previously described, the rotational motion can be applied manually such as by movement of a crank or other handle, or by application of a powered source of rotary motion. Rotation of the torque transmission shaft results in rotating of the coupling assembly, the drain cleaning cable, and the auger tool attached to the distal end of the drain cleaning cable. The method of use may also include the user urging the auger tool further into the drain. Typically, this is accompanied by continuous or intermittent rotary motion of the drain cleaning cable and auger tool attached thereto.

It may be necessary or desirable to further extend the drain cleaning cable from the distal end of the auger housing. In accordance with the present subject matter, this procedure is as follows. The user moves or otherwise displaces the coupling assembly beyond or past the proximal end of the auger housing. This typically involves pulling the coupling assembly out of the auger housing to thereby expose and make accessible the coupling assembly to the user. The user then adjusts or otherwise actuates the coupling assembly to decouple or disengage the torque transmission shaft from the drain cleaning cable. When utilizing the previously described coupling assembly **50**, the user unscrews the grip nut **150** from the threaded coupler **170** so that the torque transmission shaft **70** may axially move past the fingers **176** of the coupler **170**. When utilizing the previously described quick change coupling assembly **200**, the user axially moves the quick release sleeve **250** away from the quick release coupling **270** to thereby expose the one or more locking ball(s) positioned in corresponding ball capture regions **277**. Upon sufficient axial movement of the sleeve **250**, the ball(s) may then disengage from their former position(s) in retention depression(s) **75** of the torque transmission shaft **70**. This in turn enables axial movement of the torque transmission shaft relative to the drain cleaning cable. When using the previously described coupling assembly **300**, the user urges the sleeve **350** toward the lock body **370**, and then rotates the sleeve **350** relative to the shaft **70** and lock body **370** to loosen the primary spring **310** out of frictional engagement with the shaft **70**. This enables axial movement of the shaft **70** relative to the drain cleaning cable.

After desired positioning of the drain cleaning cable relative to the torque transmission shaft, the coupling assembly is actuated to thereby couple or engage the torque transmission shaft to the drain cleaning cable. This locks or secures the components together so that the user can push or otherwise displace the torque transmission shaft and urge the coupling assembly back into the hollow interior of the auger housing. Such movement also causes extension of the distal end of the cable housing and auger tool attached thereto, relative to the distal end of the auger housing. As will be appreciated, this enables the user to urge the auger tool further into the drain to clear blockages.

Many other benefits will no doubt become apparent from future application and development of this technology.

All patents, applications, standards, and articles noted herein are hereby incorporated by reference in their entirety.

The present subject matter includes all operable combinations of features and aspects described herein. Thus, for example if one feature is described and/or illustrated in association with an embodiment and another feature is described and/or illustrated in association with another embodiment, it will be understood that the present subject matter includes embodiments having a combination of these features.

As described hereinabove, the present subject matter solves many problems associated with previous strategies, systems and/or devices. However, it will be appreciated that various changes in the details, materials and arrangements of components, which have been herein described and illustrated in order to explain the nature of the present subject matter, may be made by those skilled in the art without departing from the principle and scope of the claimed subject matter, as expressed in the appended claims.

What is claimed is:

1. A toilet auger having an extendable drain cleaning cable, the auger comprising:

an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing;

a drain cleaning cable at least partially disposed in the housing, the cable defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the cable;

a coupling assembly engaged with the proximal end of the drain cleaning cable, the coupling assembly including a torsion lock body defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and a locking groove region, the locking groove region including a circumferentially extending portion and an axially extending portion;

a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable, the torque transmission shaft defining a proximal end and an opposite distal end;

wherein the coupling assembly enables selective engagement between the torque transmission shaft and the cable, the coupling assembly sized and configured to be slidably positionable within the hollow interior of the housing;

a torsion lock sleeve defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and at least one aperture providing access to an interior region of the torsion lock sleeve, the interior region accessible from the distal end of the sleeve;

wherein the proximal end of the torsion lock body is positioned within the interior region of the torsion lock sleeve such that the locking groove region is disposed under and aligned with the aperture defined in the torsion lock sleeve.

2. The toilet auger of claim 1 wherein the coupling assembly further includes:

a securing element releasably disposed in the aperture defined in the torsion lock sleeve.

3. The toilet auger of claim 2 wherein an inner face of the securing element is disposed in the locking groove region of the torsion lock body.

4. The toilet auger of claim 1 wherein the coupling assembly further includes:

a primary biasing member disposed between the torsion lock body and the torsion lock sleeve.

5. The toilet auger of claim 4 wherein the primary biasing member is a torsion spring.

6. The toilet auger of claim 4 wherein the coupling assembly further includes: a secondary biasing member disposed between the torsion lock body and the torsion lock sleeve.

7. The toilet auger of claim 6 wherein the secondary biasing member is a compression spring.

8. The toilet auger of claim 6 wherein the primary biasing member is at least partially disposed within the secondary biasing member.

9. A coupling assembly for selectively engaging and disengaging a torque transmission shaft and a drain cleaning cable, the coupling assembly comprising:

a torsion lock body defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and a locking groove region, the locking groove region including a circumferentially extending portion and an axially extending portion;

a torsion lock sleeve defining a proximal end, a distal end, an interior passage extending between the proximal and distal ends, and at least one aperture providing access to an interior region of the torsion lock sleeve, the interior region accessible from the distal end of the sleeve;

wherein the proximal end of the torsion lock body is positioned within the interior region of the torsion lock sleeve such that the locking groove region is disposed under and aligned with the aperture defined in the torsion lock sleeve.

10. The coupling assembly of claim 9 wherein the coupling assembly further includes:

a securing element releasably disposed in the aperture defined in the torsion lock sleeve.

11. The coupling assembly of claim 10 wherein an inner face of the securing element is disposed in the locking groove region of the torsion lock body.

12. The coupling assembly of claimed 9 wherein the coupling assembly further includes:

a primary biasing member disposed between the torsion lock body and the torsion lock sleeve.

13. The coupling assembly of claim 12 wherein the primary biasing member is a torsion spring.

14. The coupling assembly of claim 12 wherein the coupling assembly further includes:

a secondary biasing member disposed between the torsion lock body and the torsion lock sleeve.

15. The coupling assembly of claim 14 wherein the secondary biasing member is a compression spring.

16. The coupling assembly of claim 14 wherein the primary biasing member is at least partially disposed within the secondary biasing member.

17. A toilet auger having an extendable drain cleaning cable, the auger comprising:

an auger housing defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal end and the distal end of the housing;

a drain cleaning cable at least partially disposed in the housing, the cable defining a proximal end, an opposite distal end, and a hollow interior extending between the proximal and the distal end of the cable;

a torque transmission shaft at least partially disposed in the hollow interior of the drain cleaning cable, the torque transmission shaft defining a proximal end and an opposite distal end;

wherein the torque transmission shaft is slidably disposed within the hollow interior of the drain cleaning cable and can be axially moved relative to the drain cleaning cable.

18. The toilet auger of claim 17 further comprising;

a coupling assembly engaged with the proximal end of the drain cleaning cable.

19. The toilet auger of claim 17 wherein the torque transmission shaft has a cross sectional shape in the form of a polygon with n sides.

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