(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 137 263 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.01.2022 Bulletin 2022/03

(21) Application number: **15785383.9**

(22) Date of filing: **01.05.2015**

(51) International Patent Classification (IPC):
B25F 1/04 *(2006.01)* ***B25B 15/00*** *(2006.01)*
B25B 23/00 *(2006.01)* ***B25F 1/02*** *(2006.01)*
B25G 1/08 *(2006.01)* ***B25B 15/04*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B25B 15/04; B25B 23/0035; B25F 1/04; B25G 1/085

(86) International application number:
PCT/CA2015/000277

(87) International publication number:
WO 2015/164946 (05.11.2015 Gazette 2015/44)

(54) **MULTI-BIT TOOL WITH BI-DIRECTIONAL RATCHET MECHANISM**

WERKZEUG MIT MEHREREN BOHRMEISSELN MIT BIDIREKTIONALEM RATSCHENMECHANISMUS

OUTIL À PLUSIEURS EMBOUTS DOTÉ D'UN MÉCANISME À ROCHET BIDIRECTIONNEL

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

(30) Priority: **01.05.2014 US 201461987159 P**

(43) Date of publication of application:
08.03.2017 Bulletin 2017/10

(73) Proprietor: **Grand, Gérard**
St. Catherines, ON L2T 3N3 (CA)

(72) Inventor: **Grand, Gérard**
St. Catherines, ON L2T 3N3 (CA)

(74) Representative: **Orr, Robert**
Murgitroyd & Company Leeds
Arena Point
Merrion Way
Leeds LS2 8PA (GB)

(56) References cited:
EP-A1- 2 459 349
CA-A1- 2 206 408
CA-A1- 2 334 439
CA-A1- 2 534 756
CA-A1- 2 534 756
CA-A1- 2 537 447
CA-A1- 2 599 549
CA-A1- 2 791 320
GB-A- 856 270
US-A1- 2007 277 654
US-B1- 6 332 384
US-B1- 6 928 908
US-B1- 7 028 593

EP 3 137 263 B1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to multi-bit tools, and more particularly to ratcheting multi-bit tools.

BACKGROUND OF THE INVENTION

[0002] Various types of multi-bit tools, such as screwdrivers, have been widely available to the public for many years. Multi-bit tools provide a convenient means for having various types of working bits readily available for use.

[0003] Earlier types of multi-bit tools have removable and replaceable working bits that are typically are stored in the handle of the driver. The working bits may be manually inserted one at a time, as selected, in an in-use position into a bit chuck at the front of the driver, or alternatively may be inserted into an extension member that is itself inserted into the open front end of the bit chuck.

[0004] For increased convenience in terms of turning of threaded fasteners by a handheld driver, it is known to include a ratchet mechanism in multi-bit tools having removable and replaceable working bits. Typically, the ratchet mechanism is operatively disposed between the bit chuck and the main body of the driver. The rotational direction of ratcheting of the ratchet mechanism is selectable for turning threaded fasteners either clockwise or counter-clockwise.

[0005] For the multi-bit tools having removable and replaceable working bits as described above, the inclusion of a ratchet mechanism is quite straight forward. The longitudinal forces experienced by the driver during use, in reaction to pushing the driver onto a threaded fastener, are simply transmitted through the rachet mechanism to the handle.

[0006] One such prior art ratcheting screw driver having readily removable and replaceable working bits that are inserted into the bit chuck at the open front end and that are storable in the main body is one made by Stanley Works of New Britain, Connecticut, under the name brand HUSKY.

[0007] Another such ratcheting driver is disclosed in the United States Design Patent D562,665, issued February 26, 2008 to Gao, and entitled Ratcheting Screwdriver Assembly.

[0008] Yet another such prior art ratcheting screwdriver is taught in United States Patent 5,806,381, issued September 15, 1998 to Lin, and entitled Ratchet Screw Driver Assembly. The ratchet screwdriver includes a driving stem having a gear rotatably engaged in the bore of a handle and having a free end or engaging with a fastener to be driven. A ratchet mechanism is engaged in the handle and engaged with the gear of the driving stem portion electively driving the driving stem. A barrel is rotatably engaged on the driving stem and removable along the driving stem or engaging around the fastener and for preventing the fastener from being tilted and preventing the fastener from hurting the hand of the user.

[0009] More recent multi-bit tools include a plurality of bit assemblies, typically six bit assemblies, operatively mounted within the main body of the driver. Typically, each bit assembly includes a working bit secured to some type of bit extension, to form an operational mechanism. A manually operable actuation mechanism of some sort, possibly even a spring loaded actuation mechanism, is connected to the bit extension. Each bit assembly is movable singularly, or in other words one at a time, between a retracted position within the main body of the driver and a forwardly extended in-use position whereat a working bit at the front end of bit assembly extends forwardly from the bit chuck of the driver for use.

[0010] Further, each bit assembly, when it is in its forwardly extended in-use position has a rearwardly facing surface that abuts in force transmitting relation against a generally forwardly facing surface that is either on the main body of the driver or on an internal part or portion of the driver, to thereby support the selected bit assembly in place during use.

[0011] The problem with trying to include a ratcheting mechanism in multi-bit tools having a plurality of bit assemblies is not readily apparent. As described above, in such multi-bit tools, when a bit assembly is in a forwardly extended in-use position, the rearwardly directed longitudinal force experienced by the driver during use, in reaction to pushing the driver onto a thread fastener, makes it very difficult to rotate the extended in-use bit assembly with respect to the main body of the driver, in conjunction with the rotation of the bit chuck and the main body with respect to each other. Such transmission of longitudinal forces from the bit chuck to the main body of the driver without passing through the ratchet mechanism is in contrast to the situation of prior art multi-bit tools where the single bit is received into the open front end of the bit chuck, and the rearwardly directed longitudinal forces are received directly by the bit chuck and transmitted to the main body of the driver through the ratchet mechanism. Accordingly, it is very difficult, if not impossible to turn the handle portion of the main body with respect to the bit chuck during use, when permitted by the ratchet mechanism.

[0012] None of these multi-bit tool having a plurality of bit assemblies have a ratcheting function.

[0013] United States patent 6,928,908 discloses a revolving screwdriver comprising a hollow handle with a ratchet device mounted thereon. The ratchet device comprises a seat, a ratchet shaft and a knob. A revolving cylinder is disposed within the hollow handle and includes a plurality of axial, peripheral cartridges. Each peripheral cartridge is capable of receiving a plurality of solid hexagonal shanks having a section of a hexagon. A spring depressible ball in the handle is adapted to enter one of a plurality of recesses of the revolving cylinder for rotationally positioning a desired shank in alignment with the rear end. A push rod is operated via pushing of the cap to readily move the selected solid shank out of the car-

tridge and into the rear end of the hollow ratchet shaft.

[0014] It is an object of the present invention to provide a multi-bit tool having a plurality of reconfigurable bit assemblies that move from a retracted position generally within the main body of the driver and an extended position whereat a selected one of the moving bits of one of the reconfigurable bit assemblies is in a forwardly extended in-use position with the working bit extending forwardly from the bit chuck, and having a ratchet mechanism that permits selection of rotation in a first rotational direction and locking of rotation to preclude rotation in a second rotational direction, and that permits selection of rotation in a second rotational direction and locking of rotation to preclude rotation in a first rotational direction.

[0015] It is an object of the present invention to provide a multi-bit tool having a plurality of reconfigurable bit assemblies that move from a retracted position generally within the main body of the driver and an extended position whereat a selected one of the moving bits of one of the reconfigurable bit assemblies is in a forwardly extended in-use position with the working bit extending forwardly from the bit chuck, and having a bi-directional rotation-locking mechanism that permits selection of rotation in a first rotational direction and locking of rotation to preclude rotation in a second rotational direction, and that permits selection of rotation in a second rotational direction and locking of rotation to preclude rotation in a first rotational direction.

SUMMARY OF THE INVENTION

[0016] In accordance with the present invention, there is provided a multi-bit tool as claimed in claim 1. The multi-bit tool comprises a handle defining a longitudinal axis; a bit chuck having a bit-receiving opening and mounted on the handle for rotation of the bit chuck and the handle with respect to each other, about an axis of rotation; a plurality of working bits operatively retained by the handle for movement between a retracted position whereat the working bit is generally disposed within the handle, and an in-use position whereat the working bit is received in torque transmitting relation by the bit chuck and extends through the bit-receiving opening; means for moving the working bits, as selected, singularly between the retracted position and the in-use position; means for selectively retaining a working bit in the forwardly extended in-use configuration; a bi-directional rotation-locking mechanism operatively interposed between the handle and the bit chuck; a coupler for each working bit, each coupler having a first component operatively connected to the working bit and a second component operatively connected to the means for moving the working bits, and wherein the first component and the second component are connected one to the other for rotational movement one with respect to the other.

[0017] Optional further features of the multi-bit tool are defined in the dependent claims.

[0018] A ratchet sleeve for a multi-bit tool having a plurality of individually selectable working bits is also disclosed, which may form part of the multi-bit tool of claim 1. The ratchet sleeve comprises a main body having an outer handle portion and an inner driver-gripping portion connected one to the other for rotation of the outer handle portion and the inner driver-gripping portion with respect to each other about an axis of rotation; and a bi-directional rotation-locking mechanism operatively interposed between the outer handle portion and the inner driver-gripping portion.

[0019] A bit assembly for use in a multi-bit tool is also disclosed, which may form part of the multi-bit tool of claim 1. The bit assembly comprises a bit holder having a bit-receiving recess; a bit extension attached in angularly variable relation to the bit holder; and a working bit having a front working end and a back end. The working bit is captured at its back end by the bit holder for rotation about the axis of rotation.

[0020] A bit mechanism for use in a multi-bit tool is also disclosed, which may form part of the multi-bit tool of claim 1. The bit mechanism comprises a bit holder having a back end base portion and an annular wall structure extending forwardly from a back end adjacent the back end base portion to a front end, and defines a bit-receiving recess. The annular wall structure defines an axis of rotation. A working bit has a front working end and a back end. The working bit is captured at its back end by the bit holder for rotation about the axis of rotation.

[0021] A bit holder for use with a bit mechanism in a multi-bit tool is also disclosed, which may form part of the multi-bit tool of claim 1. The bit holder comprises a back end base portion and an annular wall structure extending forwardly from a back end adjacent the back end base portion to a front end; and a bit-receiving recess defined by the back end base portion and the annular wall structure; wherein the annular wall structure defines an axis of rotation for a bit inserted therein.

[0022] A bit assembly for use in a multi-bit tool is also disclosed, which may form part of the multi-bit tool of claim 1. The bit assembly comprises a series of parts connected together in torque transmitting relation one to the next, the parts comprising, in seriatim, a handle, a bi-directional rotation-locking mechanism, a bit chuck, a bit holder of a bit assembly, and a selected working bit.

[0023] A bit assembly for use in a multi-bit tool is also disclosed, which may form part of the multi-bit tool of claim 1. The bit assembly comprises a series of parts connected together in torque transmitting relation one to the next, the parts comprising, in seriatim, a handle, a bi-directional rotation-locking mechanism, a bit chuck, a rotational indexing system, a bit holder of a bit assembly, and a selected working bit.

[0024] A multi-bit tool is also disclosed, which does not fall within the scope of the invention as claimed, the tool comprising a handle defining a longitudinal axis; a bit chuck having a bit-receiving opening and mounted on the handle for rotation of the bit chuck and the handle with respect to each other, about an axis of rotation; a

plurality of working bits operatively retained by the handle for movement between a retracted position whereat the working bit is generally disposed within the handle, and an in-use position whereat the working bit is received in torque transmitting relation by the bit chuck and extends through the bit-receiving opening; means for moving the working bits, as selected, singularly between the retracted position and the in-use position; means for selectively retaining a working bit in the forwardly extended in-use configuration; a bi-directional rotation-locking mechanism operatively interposed between the handle and the bit chuck; wherein each of the working bits are part of a corresponding bit assembly; wherein each bit assembly has a bit holder; wherein the working bit is connected to the bit holder for rotational movement one with respect to the other.

[0025] Other advantages, features and characteristics of the present invention, as well as methods of operation and functions of the related elements of the structure, and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following detailed description and the appended claims with reference to the accompanying drawings, the latter of which is briefly described herein below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The novel features which are believed to be characteristic of the multi-bit tool according to the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention. In the accompanying drawings:

Figure 1 is a perspective view from the front of the multi-bit tool according to the present invention, with the bit assembly in its extended in-use position;

Figure 2 is a perspective view from the rear of a front portion of the first embodiment of the multi-bit tool of Figure 1, with the bit assembly in its extended in-use position;

Figure 3 is a perspective view from the front of the first embodiment of the multi-bit tool of Figure 1, but with the bit assembly in its retracted position;

Figure 4 is a perspective view from the side and slightly from the rear of the multi-bit tool of Figure 1, with the bit assembly in its retracted position;

Figure 5 is a cut-away perspective view of the multi-bit tool of Figure 1, with some components removed for the sake of clarity;

Figure 6 is a cut-away perspective view of the multi-bit tool of Figure 1, with one bit assembly in its extended position;

Figure 7 is a cut-away perspective view of the multi-bit tool of Figure 1, but from a more forward angle than Figure 6, with one bit assembly in its extended position;

Figure 8 is a cut-away perspective view of the multi-bit tool of Figure 1, with a portion of one bit assembly shown in its extended position;

Figure 9 is a cut-away perspective view of the multi-bit tool of Figure 1, but shown from a slightly different angle than Figure 8, with a portion of one bit assembly shown in its extended position;

Figure 10 is a cut-away perspective view of the multi-bit tool of Figure 1;

Figure 11 is a cut-away perspective view of the multi-bit tool of Figure 1, but shown from a slightly different angle than Figure 10;

Figure 12 is a cut-away perspective view of the multi-bit tool of Figure 1, and similar to Figure 11 but with a few additional components shown;

Figure 13 is a perspective view from the side and front of the multi-bit tool of Figure 1, with components omitted for the sake of clarity;

Figure 14 is a cut-away perspective view from the front of the bi-directional rotation-locking mechanism of the multi-bit tool of Figure 1;

Figure 15 is a perspective view of the front cone portion of the multi-bit tool of Figure 1, with the "C"-clip partially removed;

Figure 16 is a perspective view of the front cone portion of the multi-bit tool of Figure 1, with the "C"-clip fully removed and the sections of the front cone portion separated one from the other;

Figure 17 is a perspective view of the back portion of a bit assembly;

Figure 18 is a perspective view from the front of the back portion of a bit assembly;

Figure 19 is an exploded side elevational view of the front cone portion of the multi-bit tool of Figure 1, with a bit assembly about to enter the front cone portion;

Figure 20 is a perspective view from the front of a bit assembly;

Figure 21 is a cut-away perspective view from the front of a bit assembly;

Figure 22 is a side elevational view of a bit assembly;

Figure 23 is a side elevational view of a bit assembly, with the removable and replaceable bit just having been removed from the remainder of the bit assembly;

Figure 24 is a side elevational view of a bit assembly, with the removable and replaceable bit removed and shown beside the remainder of the bit assembly;

Figure 25 is a perspective view of a removable and replaceable bit; and,

Figure 26 is a side elevational view of the back portion of a bit assembly.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0027] Reference will now be made to Figures 1 through 27, which show a first embodiment of the multi-bit tool of the present invention. The first embodiment of the present invention provides a multi-bit tool 100. In brief, the multi-bit tool 100 comprises a handle 110, a bit chuck 130, a plurality of working bits 150, with each working bit 150 being part of a corresponding bit assembly 170, means 190 for moving the working bits 150, bi-directional rotation-locking mechanism 220, and a coupler 240.

[0028] The handle 110 has a front end 111 and a back end 112 and defines a longitudinal axis "L" that generally extends the length of the multi-bit tool 100 from the front end 111 to the back end 112. The handle 110 is preferably made from a suitable plastic material and has a substantially hollow interior 114 defined by an inner surface 115. The substantially hollow interior 114 houses various components of the multi-bit tool 100. The outer surface 116 of the handle 110 forms a suitable grip for turning the multi-bit tool 100, or at least the handle 110 portion of the multi-bit tool 100, about the longitudinal axis "L".

[0029] A bit chuck 130 has a dodecagonally (twelve sided) shaped bit-receiving opening 131 and is mounted on the handle 110 at the front end 111 thereof for rotation of the bit chuck 130 and the handle 110 with respect to each other, about an axis of rotation "R". The bit chuck 130 comprises a forward bit chuck portion 132 having a front end 133 and a back end 134 and a rearward bit chuck portion 137 having a front end 138 and a back end 139. The forward bit chuck portion 132 and the rearward bit chuck portion 137 are held together by a large "C"-clip 119 engaged in co-operating annular slots 141a, 141b in the forward bit chuck portion 132 and the rearward bit chuck portion 137, respectively. The forward bit chuck portion 132 is disposed in surrounding relation, adjacent its back end 134, with respect to the front end 138 of the rearward bit chuck portion 137.

[0030] The multi-bit tool 100 further comprises a ball bearing assembly 160 having a first handle member 161 and a second handle member 162. The first handle member 161 is securely connected in torque transmitting relation to the bit chuck 130 by means of threaded fasteners or a suitable adhesive (not specifically shown). The second handle member 162 is securely connected in torque transmitting relation to the handle 110, at the front end 111 of the handle 110. The first handle member 161 and the second handle member 162 are connected one to the other by the ball bearing assembly 160 for rotational movement one with respect to the other about the axis of rotation "R".

[0031] The bit chuck 130 is mounted on the handle 110 for rotation of the bit chuck 130 and the handle 110 with respect to each other, about an axis of rotation "R".

[0032] The multi-bit tool 100 further comprises a bit holder 164 having a bit-receiving recess 165 open to the front end of the bit holder 164 an disposed immediately rearwardly of the bit-receiving opening 131 of the bit chuck 130.

[0033] A bit extension 166 is attached in angularly variable relation to the bit holder 164, so as to extend generally rearwardly from the bit holder 164. In the illustrated embodiment, the bit extension 166 connects to a corresponding actuator mechanism, which is the means 190 for moving the working bits 150, as selected, singularly between said retracted position and said in-use position.

[0034] As can be best seen in Figures 20 through 26, the bit holder 164 comprises a back end base portion 167 and an annular wall structure 168 extending forwardly from a back end 168b adjacent the back end base portion 167 to a front end 168f. The annular wall structure 168 defines the bit-receiving recess 165 and the axis of rotation "R". The annular wall structure 168 should be made from a flexible plastic material. Preferably, the back end base portion 167 and the annular wall structure 168 of the bit holder 164 are integrally formed one with the other.

[0035] The bit holder 164 has an outer surface 116 comprising a plurality of flat surfaces 169 disposed in angled relation one to the next around the perimeter of the bit holder 164. The plurality of flat surfaces 169 are grippable in torque transmitting relation by a co-operating bit chuck 130.

[0036] The annular wall structure 168 comprises a plurality of wall portions 168w extending forwardly from the back end to the front end, and an equal plurality of forwardly extending slots 169s, each slot 169s having a front end and a back end. Adjacent ones of the wall portions 168w have one slot 169s disposed therebetween. Preferably, each of the forwardly extending slots 169s is open at its front end 169f in order to permit the back end of the working bit 150 to more readily slide in and out of the bit holder 164.

[0037] The plurality of working bits 150 are operatively retained by the handle 110, as perhaps can be best seen in Figure 7, for movement between a retracted position and an in-use position. In Figures 3 and 4, the six bit assemblies 170 are in their respective retracted positions. Figures 1, 2 and 6 through 9, one selected bit assembly 170 is in its in-use position. Further, in Figures 1, 2 and 6 through 9, five bit assemblies 170 are in their respective retracted positions. In the in-use position, the working bit 150 is received in torque transmitting relation by the bit chuck 130 and extends through the bit-receiving opening 131 of the bit chuck 130.

[0038] Each of the working bits 150 is part of a corresponding bit assembly 170, and the corresponding plurality of bit assemblies 170 are operatively mounted within the handle 110.

[0039] Each working bit 150 has a front working end 150f and a back end 150b and extends therebetween, and preferably is integrally formed from a single piece of plastic material. The front working end 150f may be any desirable type of bit or blade or the like. The central section of each working bit 150 is hexagonally shaped in cross-section to engage the bit-receiving opening 131 in torque transmitting relation. The working bit 150 has an annular channel 154 disposed adjacent the back end of the working bit 150. A small "C"-clip 155 extends partially through the forward bit chuck portion 132 to engage an annular channel 154 in the working bit 150 in interfering relation with the portion of the bit holder 164 that defines the annular channel 154, to thereby retain the working bit 150 in place until it is specifically pulled out. In this manner, the working bit 150 is captured at its back end by the bit holder 164 for rotation about the axis of rotation "R". Further, it can be seen that each of the working bits 150 is part of a corresponding bit assembly 170, and that the working bit 150 is connected to the bit holder 164, which is also part of the bit assembly 170, for rotational movement one with respect to the other.

[0040] Further, the working bit 150 includes a first portion 173 of an indexing system 172 and the bit holder 164 includes a second portion 174 of the indexing system 172.

[0041] The first portion 173 of the indexing system 172 comprises a plurality of radially projecting teeth 173 on the outer surface of the back end portion 151 of the working bit 150. The radially projecting teeth 173 are elongate front to back and also are aligned along the axis of rotation "R".

[0042] The second portion 174 of the indexing system 172 is retained by the annular wall structure 168 and comprises a plurality of inwardly facing channels 174 shaped, dimensioned and otherwise adapted to engage the radially projecting teeth 173 on the outer surface of the back end portion 151 of the working bit 150. In this manner, the first portion 173 and the second portion 174 of the indexing system 172 co-operate with each other to thereby index the working bit 150 with respect to the bit holder 164 in a plurality of rotational positions about the axis of rotation "R". Each of the inwardly facing channels 174 is aligned along the axis of rotation "R". The number of inwardly facing channels 174 is preferably twice the number of flat surfaces 169 on the outer surface 116 of the bit holder 164. This permits the first portion 173 of the indexing system 172 to be received in the inwardly facing channels 174 every thirty (30) degrees of rotation of the working bit 150 with respect to the bit holder 164.

[0043] The indexing system 172 precludes the working bit 150 from freely turning to any rotational angle within the bit holder 164. Such free rotational turning of the working bit 150 is highly undesirable since the working bit 150 would have trouble rotationally lining up with the dodecagonally (twelve sided) shaped bit-receiving opening 131 in the bit chuck 130. Instead, the twelve positions of the indexing system 172 help rotationally align the working bit 150 with the dodecagonally (twelve sided) shaped bit-receiving opening 131 in bit chuck 130, while allowing the working bit 150 to have some rotational freedom, in case there is rotational mis-alignment with the bit-receiving opening 131.

[0044] There is also means 190 for moving the working bits 150, as selected, singularly between the retracted position and the in-use position. The means 190 for moving the working bits 150 between the retracted position and the in-use position comprises at least one actuator mechanism, and in the first embodiment as illustrated, the at least one actuator mechanism comprise a plurality of actuator mechanisms 190, one for each working bit 150. The overall structure and operation of the actuator mechanism is not germane to this patent document. Any suitable actuator mechanism could be used.

[0045] The multi-bit tool 100 further comprises means 200 for selectively retaining a working bit 150 in the forwardly extended in-use configuration. In the first embodiment as illustrated, the means 200 for selectively retaining a working bit 150 in the forwardly extended in-use configuration comprises a forwardly facing abutment surface 200 on the central post 202 within the handle 110, disposed between the six bit assemblies 150. The forwardly facing abutment surface 200 can alternatively be elsewhere within the handle 110. Alternatively, any other suitable means 200 for selectively retaining a working bit 150 in the forwardly extended in-use configuration can be used.

[0046] The multi-bit tool 100 of the present invention further comprises a bi-directional rotation-locking mechanism 220 operatively interposed between the handle 110 and the bit chuck 130. As can be best seen in Figure 14, the bi-directional rotation-locking mechanism 220 comprises a bi-directional ratchet mechnism 220. The first pawl portion 221 can engage the selector ring 224 to preclude movement of the handle 110 with respect to the bit chuck 130, in the first rotational direction "A". Accordingly, rotation or attempted of the handle 110 about the longitudinal axis "L" by the hand of a user, or by an automatic means in another embodiment, would cause

corresponding rotation of the bit chuck 130 about the longitudinal axis "L", thereby permitting a threaded fastener to be turned. Further, when the working bit 150 is engaged in a fastener and the handle 110 is turned in a second rotational direction "B", the first pawl portion 221 permits movement of the handle 110 with respect to the bit chuck 130, in the second rotational direction "B". Accordingly, such rotation of the handle 110 about the longitudinal axis "L" by the hand of a user, or by an automatic means in another embodiment, would not cause corresponding rotation of the bit chuck 130 about the longitudinal axis "L", thereby precluding a threaded fastener from being turned.

[0047] Further, the second pawl portion 222 can engage the selector ring 224 to preclude movement of the handle 110 with respect to the bit chuck 130, in the second rotational direction "B". Accordingly, rotation or attempted rotation of the handle 110 about the longitudinal axis "L" by the hand of a user, or by an automatic means in another embodiment, would cause corresponding rotation of the bit chuck 130 about the longitudinal axis "L", thereby permitting a threaded fastener to be turned. When the working bit 150 is engaged in a fastener and the handle 110 is turned in a first rotational direction "A", the second pawl portion 222 permits movement of the handle 110 with respect to the bit chuck 130, in the first rotational direction. Accordingly, such rotation of the handle 110 about the longitudinal axis "L" by the hand of a user, or by an automatic means in another embodiment, would not cause corresponding rotation of the bit chuck 130 about the longitudinal axis "L", thereby precluding a threaded fastener from being turned.

[0048] The multi-bit tool 100 further comprises a coupler 240 for each working bit 150. Each coupler 240 has a first component 241 operatively connected to the working bit 150 and a second component 242 operatively connected to the means 190 for moving the working bits 150. The first component 241 and the second component 242 are connected one to the other for rotational movement one with respect to the other. In the first embodiment as illustrated, the first component 241 and the second component 242 are connected one to the other free rotational movement one with respect to the other about the axis of rotation "R". The first component 241 of the coupler 240 comprises a back end portion 151 of the working bit 150. The second component 242 of the coupler 240 comprises the bit holder 164 having a bit-receiving recess 165 and defining the axis of rotation "R". The working bit 150 is captured at the back end portion 151 by the bit holder 164 for rotation about the axis of rotation "R".

[0049] In the first embodiment as illustrated, the coupler 240 comprises a ball and socket joint. Each coupler 240 is part of a corresponding bit assembly 170. As discussed generally above, each bit assembly 170 comprises the working bit 150 and further comprises a bit

[0050] In an alternative embodiment, which is not illustrated, it is contemplated that the coupler 240 could comprise a ball bearing mechanism.

[0051] In another alternative embodiment, which is not illustrated, it is contemplated that there is a first coupler 240 as described above, and that there is also a second coupler 240 disposed between the working bit 150 and the connected bit extension 166.

[0052] In another aspect of the present invention, there is a bit assembly 170 for use in multi-bit tool 100. The bit assembly 170 comprises a series of parts connected together in torque transmitting relation one to the next. These parts comprise, in seriatim, the handle 110, the bi-directional rotation-locking mechanism 220, the bit chuck 130, the bit holder 164 of the bit assembly 170, and the selected working bit 150.

[0053] In another aspect of the present invention, there is bit assembly 170 for use in multi-bit tool 100. The bit assembly 170 comprises a series of parts connected together in torque transmitting relation one to the next. The parts comprise, in seriatim, a handle 110, a bi-directional rotation-locking mechanism 220, a bit chuck 130, a rotational indexing system 172, a bit holder 164 of a bit assembly 170, and a selected working bit 150.

Claims

1. A multi-bit tool (100) comprising:

a handle (110) defining a longitudinal axis (L);
a bit chuck (130) having a bit-receiving opening (131) and mounted on said handle for rotation of said bit chuck and said handle with respect to each other, about an axis of rotation (R);
a plurality of working bits (150) operatively retained by said handle for movement between a retracted position whereat said working bit is generally disposed within said handle, and an in-use position whereat said working bit is received in torque transmitting relation by said bit chuck and extends through said bit-receiving opening;
means (190) for moving said working bits, as selected, singularly between said retracted position and said in-use position;
means (200) for selectively retaining a working bit in said forwardly extended in-use configuration;
a bi-directional rotation-locking mechanism (220) operatively interposed between said handle and said bit chuck;
a coupler (240) for each working bit, each coupler having a first component (241) operatively connected to said working bit and a second component (242) operatively connected to said means for moving said working bits, and wherein said first component and said second component are connected one to the other for rotational movement one with respect to the other.

2. The multi-bit tool (100) of Claim 1, wherein said working bit (150) has a front working end (150f) and a back end (150b), and wherein said second component (242) of said coupler (240) comprises a bit holder (164) having a bit-receiving recess (165) and defining an axis of rotation (R), and wherein said working bit is captured at said back end portion by said bit holder for rotation about said axis of rotation.

3. The multi-bit tool (100) of Claim 1, wherein each of said working bits (150) is part of a corresponding bit assembly (170), and wherein each said coupler (240) is part of said corresponding bit assembly.

4. The multi-bit tool (100) of Claim 1, further comprising a bit holder (164) having a bit-receiving recess (165), a bit extension (166) attached in angularly variable relation to said bit holder, wherein said working bit (150) has a front working end (150f) and a back end (150b), and wherein said working bit is captured at its back end by said bit holder for rotation about said axis of rotation (R).

5. The multi-bit tool (100) of claim 1, wherein said working bit (150) includes a first portion (173) of an indexing system (172) and said bit holder (164) includes a second portion (174) of said indexing system, and wherein said first portion and said second portion of said indexing system co-operate with each other to thereby index said working bit with respect to said bit holder in a plurality of rotational positions about said axis of rotation (R).

6. The multi-bit tool (100) of claim 5, wherein said bit holder (164) comprises a back end base portion (167) and an annular wall structure (168) extending forwardly from a back end (168b) adjacent said back end base portion to a front end (168f), and wherein said annular wall structure defines said bit-receiving recess (165) and said axis of rotation (R).

7. The multi-bit tool (100) of claim 6, wherein said first portion (173) of said indexing system (172) is retained by said annular wall structure (168).

8. The multi-bit tool (100) of claim 7, wherein said annular wall structure (168) is made from a flexible plastic material.

9. The multi-bit tool (100) of claim 8, wherein said annular wall structure (168) comprises a plurality of wall portions (168w) extending forwardly from said back end (168b) to said front end (168f), and an equal plurality of forwardly extending slots (169s), each slot having a front end and a back end, wherein adjacent ones of said wall portions have one slot disposed between them.

10. The multi-bit tool (100) of claim 9, wherein each said forwardly extending slot (169s) is open at its front end.

11. The multi-bit tool (100) of claim 9, wherein said first portion (173) of said indexing system (172) comprises a plurality of inwardly facing channels (174) in said annular wall structure (168) each aligned along said axis of rotation (R), and said second portion (174) of said indexing system (172) comprises a plurality of radially projecting teeth (173) shaped, dimensioned and otherwise adapted to engage said inwardly facing channels in said annular wall structure.

12. The multi-bit tool (100) of claim 1 or 11, wherein:

said working bit (150) has a front working end (150f) and a back end (150b);
said second component (242) of said coupler (240) comprises a bit holder (164) having a bit-receiving recess (165) and defining an axis of rotation (R);
said working bit is captured at said back end portion by said bit holder for rotation about said axis of rotation; and
said bit holder (164) has an outer surface (116) comprising a plurality of flat surfaces (169) disposed in angled relation one to the next around a perimeter of said bit holder, and wherein said plurality of flat surfaces are grippable in torque transmitting relation by the bit chuck (130).

13. The multi-bit tool (100) of claim 12, when dependent on claim 11, wherein the number of inwardly facing channels (174) is twice the number of flat surfaces (169) on said outer surface (116) of said bit holder (164).

Patentansprüche

1. Werkzeug mit mehreren Einsätzen (100), das Folgendes umfasst:

einen Griff (110), der eine Längsachse (L) definiert;
ein Einsatzfutter (130) mit einer Einsatzaufnahmeöffnung (131) und montiert an dem Griff zur Drehung des Einsatzfutters und des Griffs bezüglich zueinander, um eine Drehachse (R);
mehrere Arbeitseinsätze (150), die operativ durch den Griff gehalten werden, zur Bewegung zwischen einer eingezogenen Position, an der der Arbeitseinsatz im Allgemeinen innerhalb des Griffs angeordnet ist, und einer Verwendungsposition, an der der Arbeitseinsatz in einer Drehmoment übertragenden Position durch das

Einsatzfutter aufgenommen ist und sich durch die Einsatzaufnahmeöffnung erstreckt;
Mittel (190) zum Bewegen der Arbeitseinsätze, wie ausgewählt, für sich zwischen der eingezogenen Position und der Verwendungsposition;
Mittel (200) zum gezielten Halten eines Arbeitseinsatzes in der sich nach vorn erstreckenden Verwendungsauslegung;
einen bidirektionalen Drehverriegelungsmechanismus (220), operativ zwischen dem Griff und dem Einsatzfutter angeordnet;
einen Koppler (240) für jeden Arbeitseinsatz, wobei jeder Koppler eine erste Komponente (241), die mit dem Arbeitseinsatz wirkverbunden ist, und eine zweite Komponente (242), die mit den Mitteln zum Bewegen der Arbeitseinsätze wirkverbunden ist, aufweist, und wobei die erste Komponente und die zweite Komponente miteinander verbunden sind zur rotatorischen Bewegung bezüglich zueinander.

2. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 1, wobei der Arbeitseinsatz (150) ein vorderes Arbeitsende (150f) und ein hinteres Ende (150b) aufweist, und wobei die zweite Komponente (242) des Kopplers (240) einen Einsatzhalter (164) umfasst, der eine Einsatzaufnahmevertiefung (165) aufweist und eine Drehachse (R) definiert, und wobei der Arbeitseinsatz an dem hinteren Ende durch den Einsatzhalter erfasst ist zur Drehung um die Drehachse.

3. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 1, wobei jeder der Arbeitseinsätze (150) Teil einer entsprechenden Einsatzanordnung (170) ist und wobei jeder der Koppler (240) Teil der entsprechenden Einsatzanordnung ist.

4. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 1, ferner umfassend einen Einsatzhalter (164) mit einer Einsatzaufnahmevertiefung (165), einer Einsatzverlängerung (166), in winklig veränderbarer Beziehung an dem Einsatzhalter befestigt, wobei der Arbeitseinsatz (150) ein vorderes Arbeitsende (150f) und ein hinteres Ende (150b) aufweist und wobei der Arbeitseinsatz an seinem hinteren Ende durch den Einsatzhalter erfasst ist zur Drehung um die Drehachse (R) .

5. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 1, wobei der Arbeitseinsatz (150) einen ersten Teil (173) eines Indexierungssystems (172) umfasst und der Einsatzhalter (164) einen zweiten Teil (174) des Indexierungssystems umfasst, und wobei der erste Teil und der zweite Teil des Indexierungssystems miteinander zusammenwirken, um so den Arbeitseinsatz bezüglich des Einsatzhalters in mehreren rotatorischen Positionen um die Drehachse (R) zu indexieren.

6. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 5, wobei der Einsatzhalter (164) einen Basisteil des hinteren Endes (167) und eine ringförmige Wandstruktur (168) umfasst, die sich von einem hinteren Ende (168b) angrenzend an den Basisteil des hinteren Endes nach vorn zu einem vorderen Ende (168f) erstreckt, und wobei die ringförmige Wandstruktur die Einsatzaufnahmevertiefung (165) und die Drehachse (R) definiert.

7. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 6, wobei der erste Teil (173) des Indexierungssystems (172) durch die ringförmige Wandstruktur (168) gehalten wird.

8. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 7, wobei die ringförmige Wandstruktur (168) aus einem flexiblen Kunststoffmaterial gefertigt ist.

9. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 8, wobei die ringförmige Wandstruktur (168) mehrere Wandteile (168w), die sich von dem hinteren Ende (168b) nach vorn zu einem vorderen Ende (168f) erstrecken, und eine gleiche Vielzahl von sich nach vorn erstreckenden Schlitzen (169s) umfasst, wobei jeder Schlitz ein vorderes Ende und ein hinteres Ende aufweist, wobei zwischen angrenzenden der Wandteile ein Schlitz angeordnet ist.

10. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 9, wobei jeder der sich nach vorn erstreckenden Schlitze (169s) an seinem vorderen Ende offen ist.

11. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 9, wobei der erste Teil (173) des Indexierungssystems (172) mehrere nach innen zeigende Kanäle (174) in der ringförmigen Wandstruktur (168) umfasst, die jeweils entlang der Drehachse (R) ausgerichtet sind, und wobei der zweite Teil (174) des Indexierungssystems (172) mehrere radial herausragende Zähne (173) umfasst, die geformt, dimensioniert und anderweitig angepasst sind, um in Eingriff mit den nach innen zeigenden Kanälen in der ringförmigen Wandstruktur zu kommen.

12. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 1 oder 11, wobei:

der Arbeitseinsatz (150) ein vorderes Arbeitsende (150f) und ein hinteres Ende (150b) aufweist;
die zweite Komponente (242) des Kopplers (240) einen Einsatzhalter (164) umfasst, der eine Einsatzaufnahmevertiefung (165) aufweist und eine Drehachse (R) definiert;

der Arbeitseinsatz an dem hinteren Ende durch den Einsatzhalter erfasst ist zur Drehung um die Drehachse; und
der Einsatzhalter (164) eine äußere Oberfläche (116) aufweist, die mehrere flache Oberflächen (169) umfasst, die nebeneinander in angewinkelter Beziehung um einen Umfang des Einsatzhalters angeordnet sind, und wobei die mehreren flachen Oberflächen in einer Drehmoment übertragenden Beziehung durch das Einsatzfutter (130) ergreifbar sind.

13. Werkzeug mit mehreren Einsätzen (100) nach Anspruch 12, wenn abhängig von Anspruch 11, wobei die Anzahl von nach innen zeigenden Kanälen (174) zweimal die Anzahl von flachen Oberflächen (169) an der äußeren Oberfläche (116) des Einsatzhalters (164) ist.

Revendications

1. Outil (100) à embouts multiples comportant :

une poignée (110) définissant un axe longitudinal (L) ;
un mandrin (130) d'embout doté d'une ouverture (131) de réception d'embout et monté sur ladite poignée en vue d'une rotation dudit mandrin d'embout et de ladite poignée l'un par rapport à l'autre, autour d'un axe de rotation (R) ;
une pluralité d'embouts (150) de travail retenus fonctionnellement par ladite poignée en vue d'un mouvement entre une position rétractée dans laquelle ledit embout de travail est généralement disposé à l'intérieur de ladite poignée, et une position en cours d'utilisation dans laquelle ledit embout de travail est reçu dans une relation de transmission de couple par ledit mandrin d'embout et s'étend à travers ladite ouverture de réception d'embout ;
un moyen (190) servant à déplacer lesdits embouts de travail, tels que sélectionnés, individuellement entre ladite position rétractée et ladite position en cours d'utilisation ;
un moyen (200) servant à retenir sélectivement un embout de travail dans ladite configuration en cours d'utilisation s'étendant vers l'avant ;
un mécanisme bidirectionnel (220) de verrouillage en rotation interposé fonctionnellement entre ladite poignée et ledit mandrin d'embout ;
un coupleur (240) pour chaque embout de travail, chaque coupleur comprenant un premier composant (241) relié fonctionnellement audit embout de travail et un second composant (242) relié fonctionnellement audit moyen servant à déplacer lesdits embouts de travail, et ledit premier composant et ledit second composant étant reliés l'un à l'autre en vue d'un mouvement de rotation l'un par rapport à l'autre.

2. Outil (100) à embouts multiples selon la revendication 1, ledit embout (150) de travail présentant une extrémité avant (150f) de travail et une extrémité arrière (150b), et ledit second composant (242) dudit coupleur (240) comportant un porte-embout (164) doté d'un évidement (165) de réception d'embout et définissant un axe de rotation (R), et ledit embout de travail étant capturé au niveau de ladite partie d'extrémité arrière par ledit porte-embout en vue d'une rotation autour dudit axe de rotation.

3. Outil (100) à embouts multiples selon la revendication 1, chacun desdits embouts (150) de travail faisant partie d'un ensemble (170) d'embout correspondant, et chacun desdits coupleurs (240) faisant partie dudit ensemble d'embout correspondant.

4. Outil (100) à embouts multiples selon la revendication 1, comportant en outre un porte-embout (164) doté d'un évidement (165) de réception d'embout, un prolongement (166) d'embout lié dans une relation angulairement variable audit porte-embout, ledit embout (150) de travail présentant une extrémité avant (150f) de travail et une extrémité arrière (150b), et ledit embout de travail étant capturé à son extrémité arrière par ledit porte-embout en vue d'une rotation autour dudit axe de rotation (R).

5. Outil (100) à embouts multiples selon la revendication 1, ledit embout (150) de travail comprenant une première partie (173) d'un système (172) d'indexage et ledit porte-embout (164) comprenant une seconde partie (174) dudit système d'indexage, et ladite première partie et ladite seconde partie dudit système d'indexage coopérant entre elles pour indexer ainsi ledit embout de travail par rapport audit porte-embout dans une pluralité de positions angulaires autour dudit axe de rotation (R).

6. Outil (100) à embouts multiples selon la revendication 5, ledit porte-embout (164) comportant une partie (167) de base d'extrémité arrière et une structure (168) de paroi annulaire s'étendant vers l'avant d'une extrémité arrière (168b) adjacente à ladite partie de base d'extrémité arrière jusqu'à une extrémité avant (168f), et ladite structure de paroi annulaire définissant ledit évidement (165) de réception d'embout et ledit axe de rotation (R).

7. Outil (100) à embouts multiples selon la revendication 6, ladite première partie (173) dudit système (172) d'indexage étant retenue par ladite structure (168) de paroi annulaire.

8. Outil (100) à embouts multiples selon la revendica-

tion 7, ladite structure (168) de paroi annulaire étant constituée d'une matière plastique souple.

9. Outil (100) à embouts multiples selon la revendication 8, ladite structure (168) de paroi annulaire comportant une pluralité de parties (168w) de paroi s'étendant vers l'avant de ladite extrémité arrière (168b) à ladite extrémité avant (168f), et une pluralité égale de fentes (169s) s'étendant vers l'avant, chaque fente présentant une extrémité avant et une extrémité arrière, des parties adjacentes parmi lesdites parties de paroi ayant une fente disposées entre elles.

10. Outil (100) à embouts multiples selon la revendication 9, chacune desdites fente (169s) qui s'étendent vers l'avant étant ouverte à son extrémité avant.

11. Outil (100) à embouts multiples selon la revendication 9, ladite première partie (173) dudit système (172) d'indexage comportant une pluralité de rainures (174) orientées vers l'intérieur dans ladite structure (168) de paroi annulaire, chacune alignée suivant ledit axe de rotation (R), et ladite seconde partie (174) dudit système (172) d'indexage comportant une pluralité de dents (173) radialement saillantes profilées, dimensionnées et adaptées autrement pour interagir avec lesdites rainures orientées vers l'intérieur dans ladite structure de paroi annulaire.

12. Outil (100) à embouts multiples selon la revendication 1 ou 11 :

ledit embout (150) de travail présentant une extrémité avant (150f) de travail et une extrémité arrière (150b) ;
ledit second composant (242) dudit coupleur (240) comportant un porte-embout (164) doté d'un évidement (165) de réception d'embout et définissant un axe de rotation (R) ;
ledit embout de travail étant capturé au niveau de ladite partie d'extrémité arrière par ledit porte-embout en vue d'une rotation autour dudit axe de rotation ; et
ledit porte-embout (164) présentant une surface extérieure (116) comportant une pluralité de surfaces plates (169) disposée dans une relation oblique l'une par rapport à la suivante autour d'un périmètre dudit porte-embout, et ladite pluralité de surfaces plates pouvant être serrée dans une relation de transmission de couple par le mandrin (130) d'embout.

13. Outil (100) à embouts multiples selon la revendication 12, lorsqu'elle est dépendante de la revendication 11, le nombre de rainures (174) orientées vers l'intérieur étant le double du nombre de surfaces plates (169) sur ladite surface extérieure (116) dudit porte-embout (164).

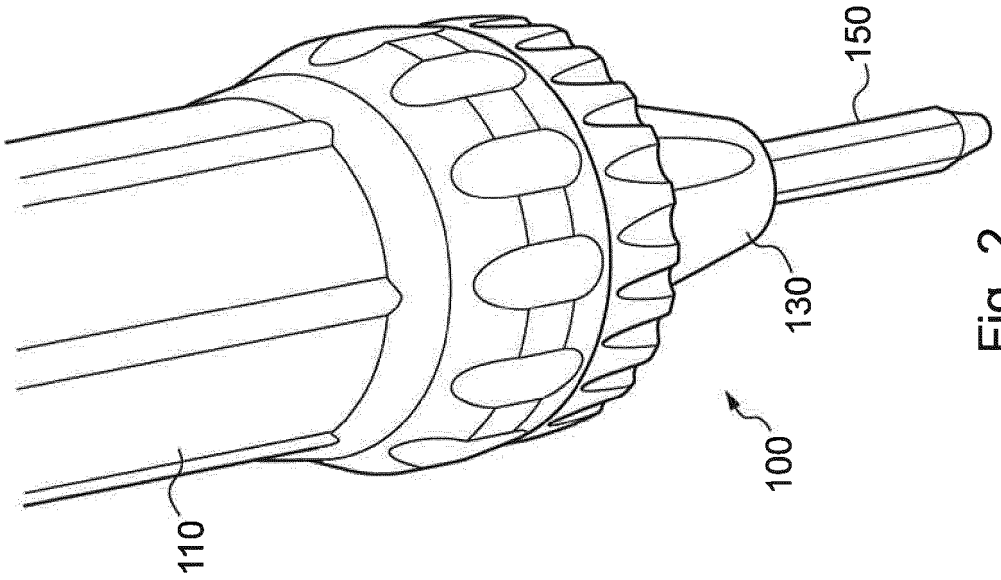

Fig. 2

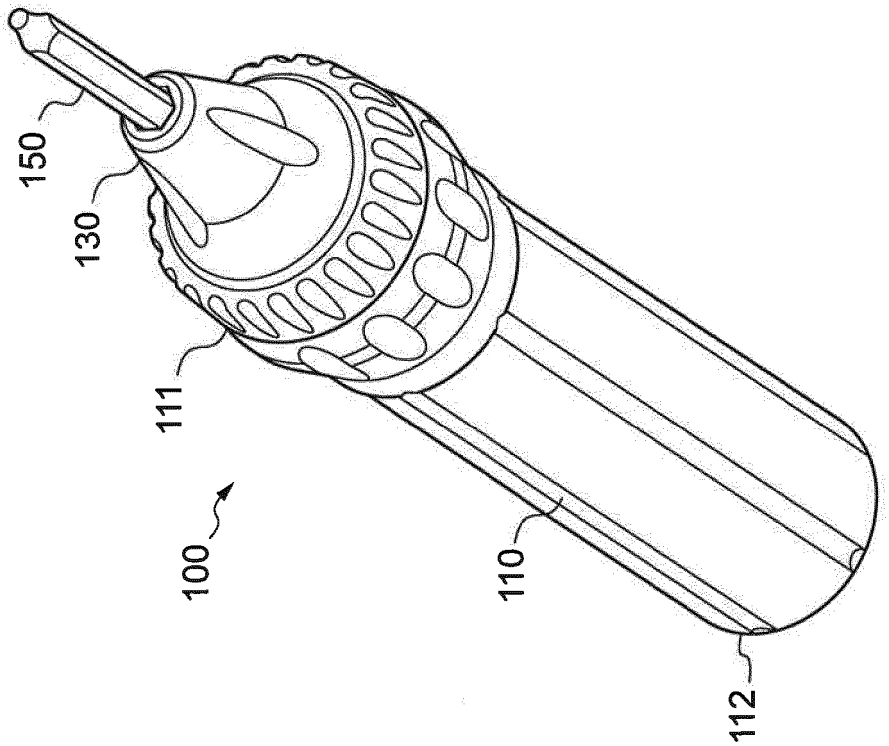

Fig. 1

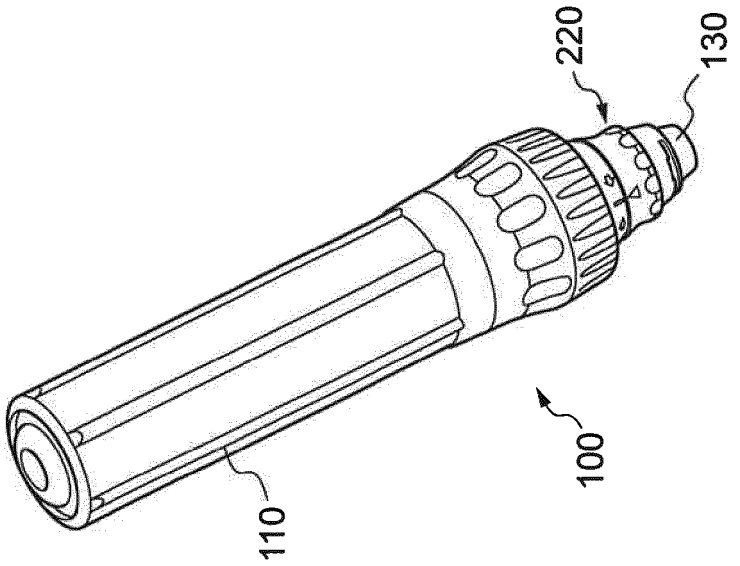

Fig. 4

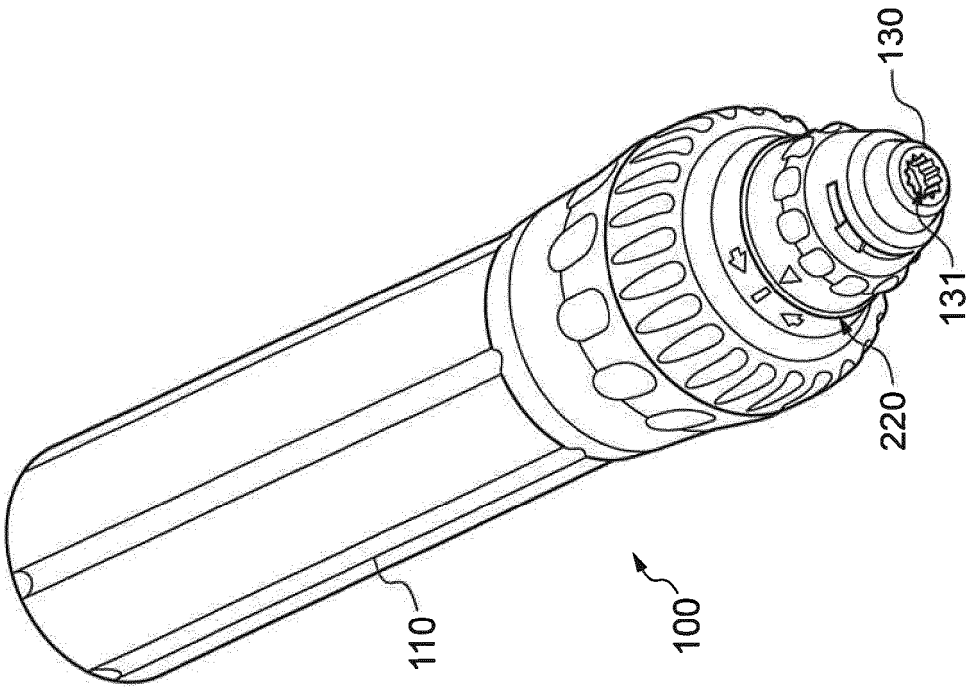

Fig. 3

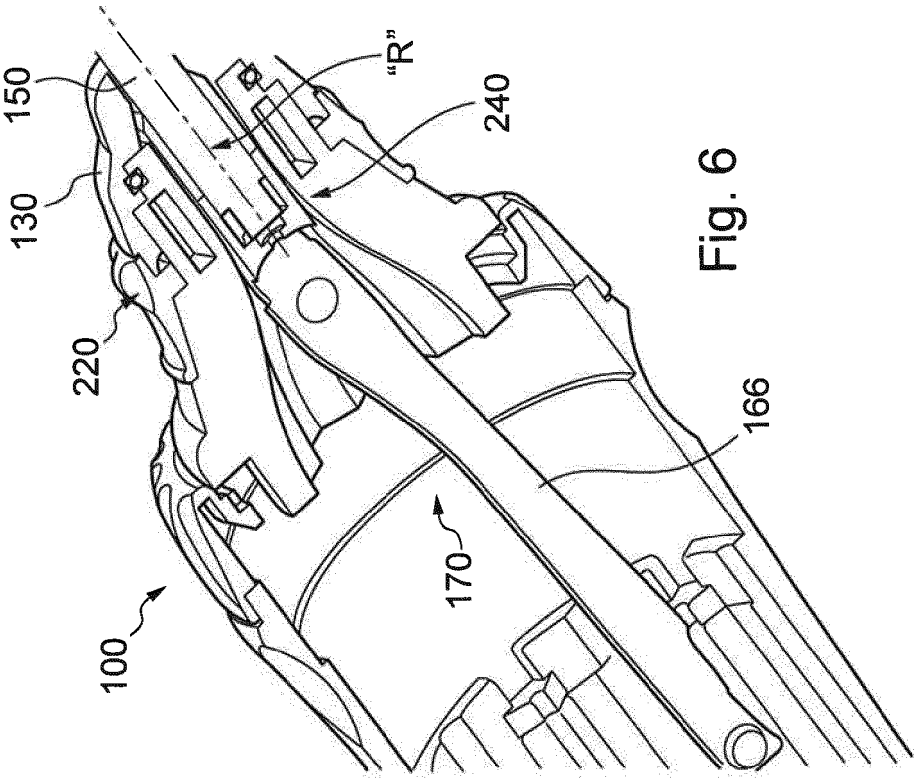

Fig. 6

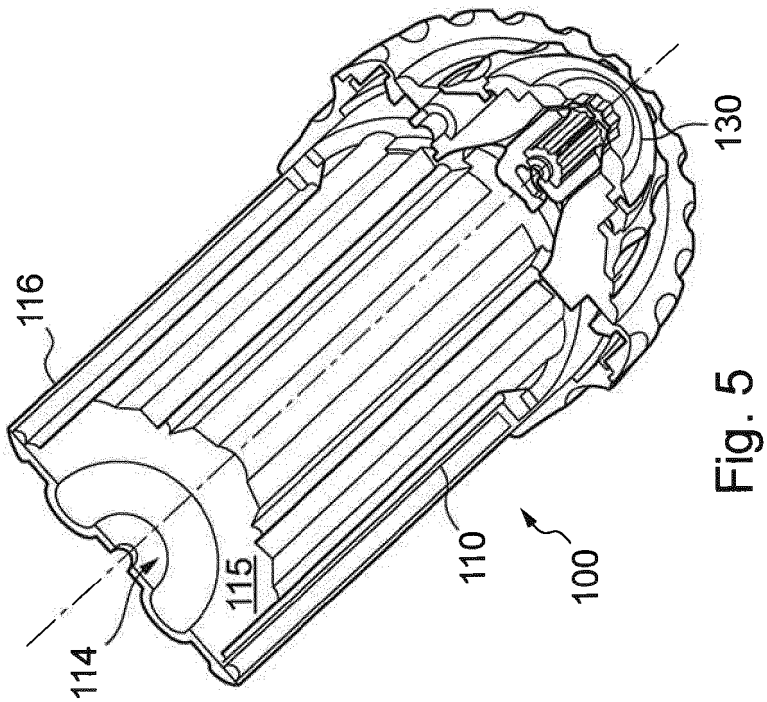

Fig. 5

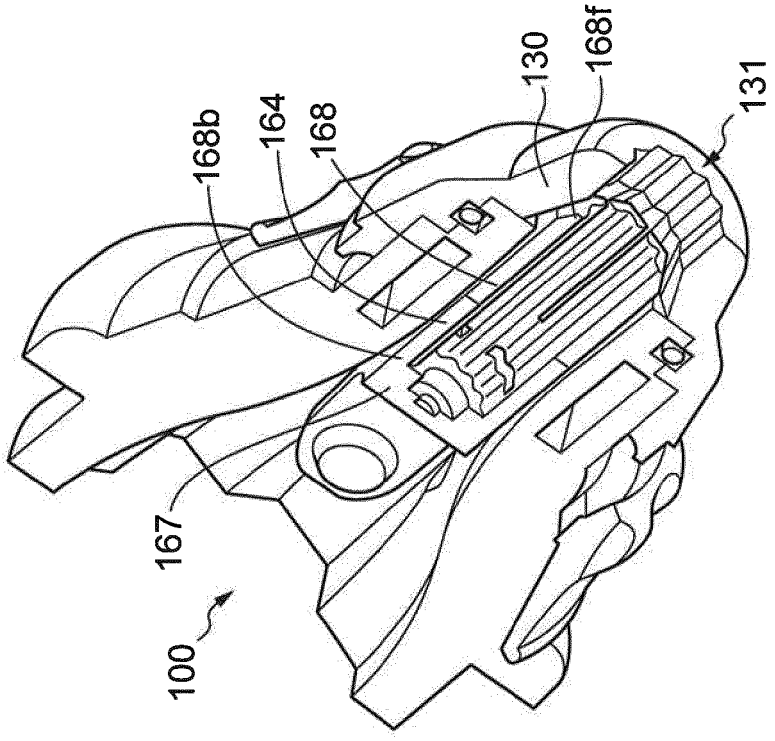
168b
164
168
130
168f
131
167
100

Fig. 8

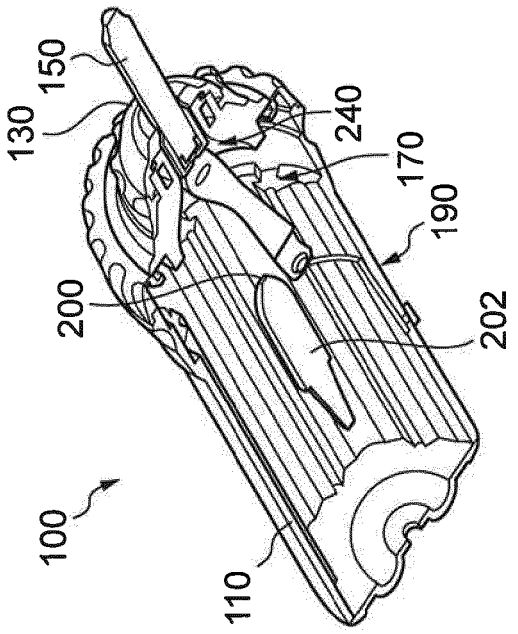
150
130
240
170
190
200
202
100
110

Fig. 7

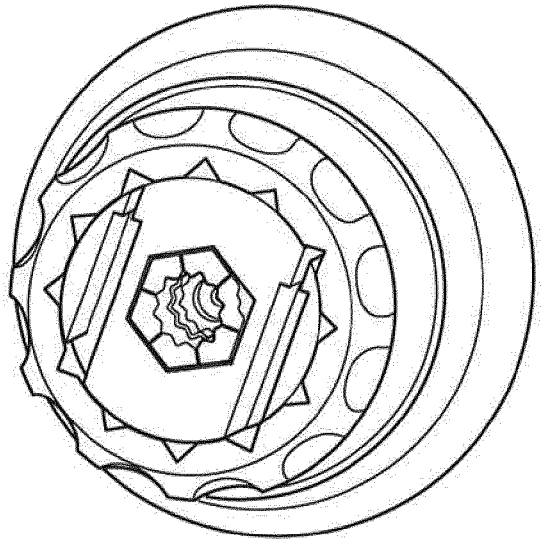

Fig. 10

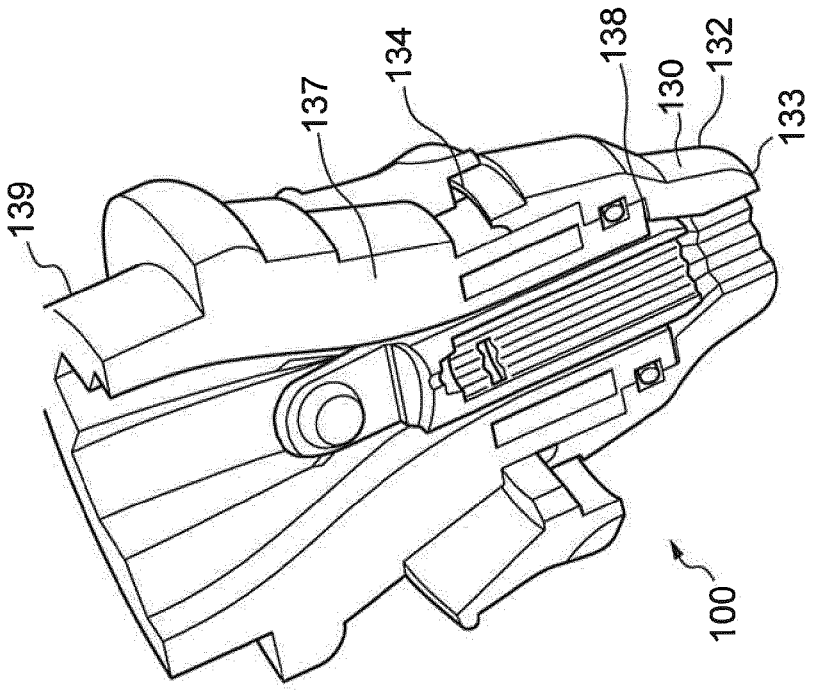

Fig. 9

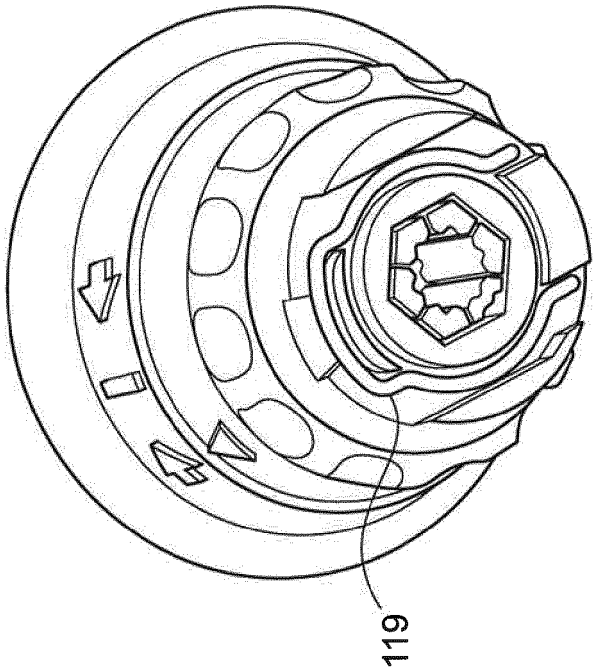

Fig. 12

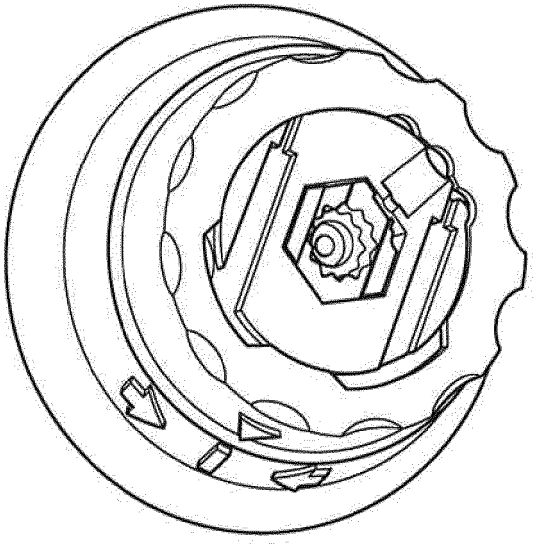

Fig. 11

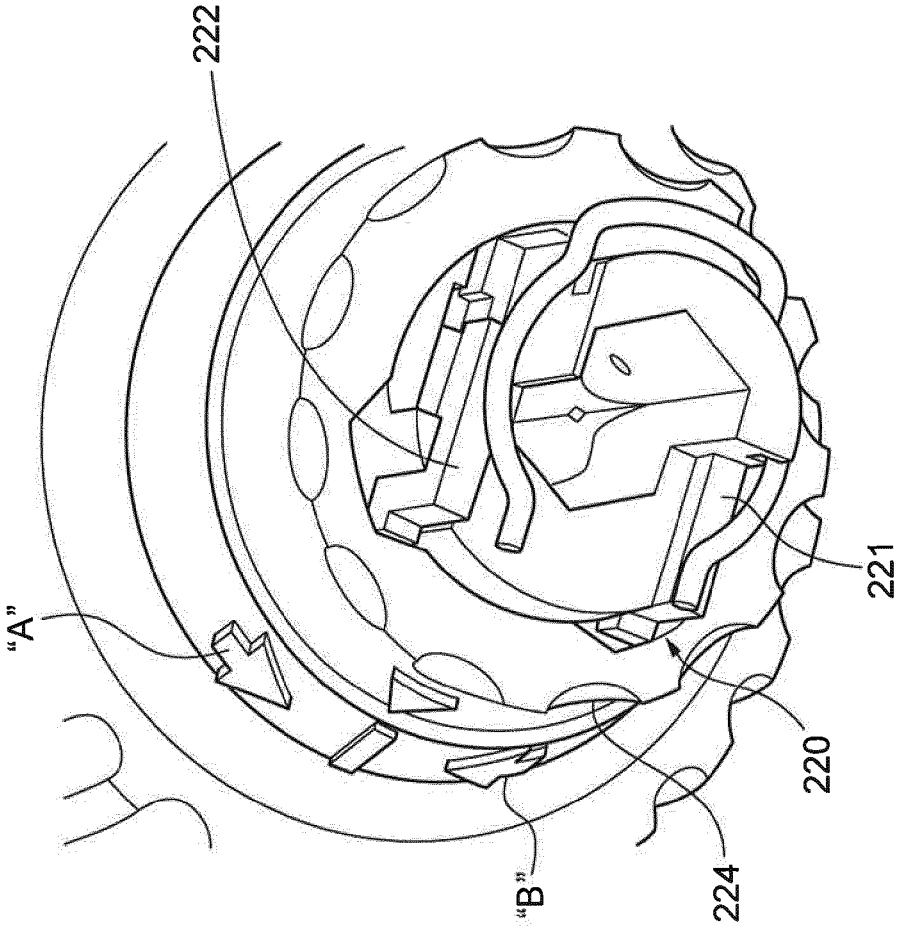

Fig. 14

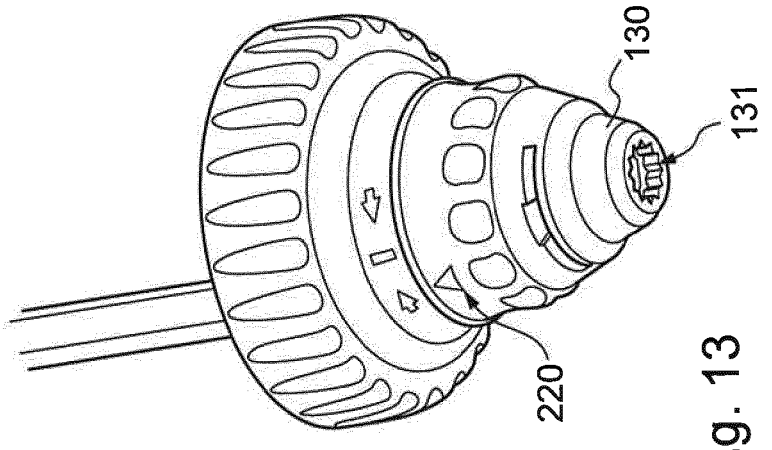

Fig. 13

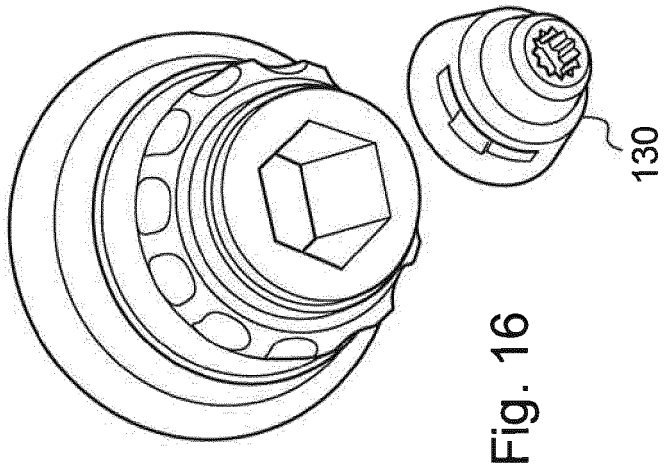

Fig. 16

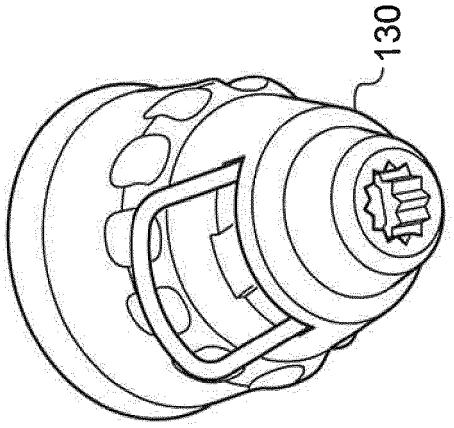

Fig. 15

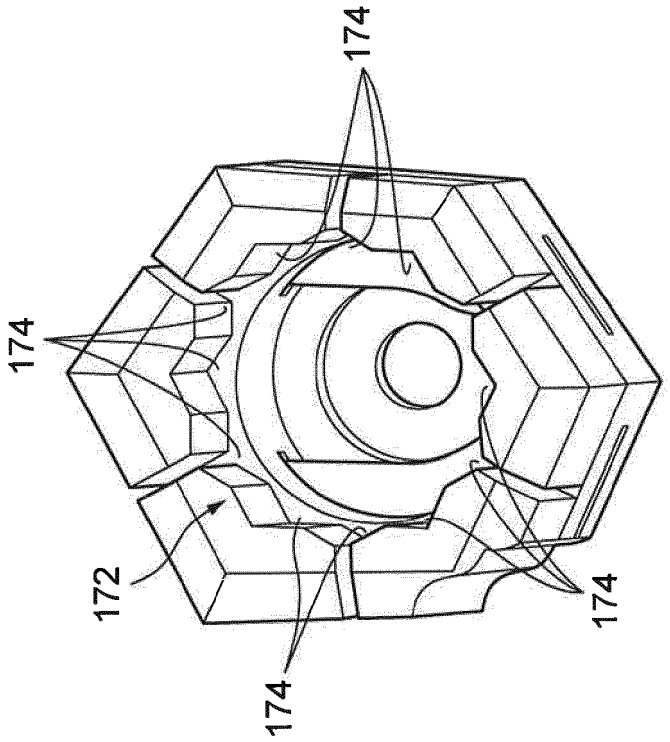

Fig. 18

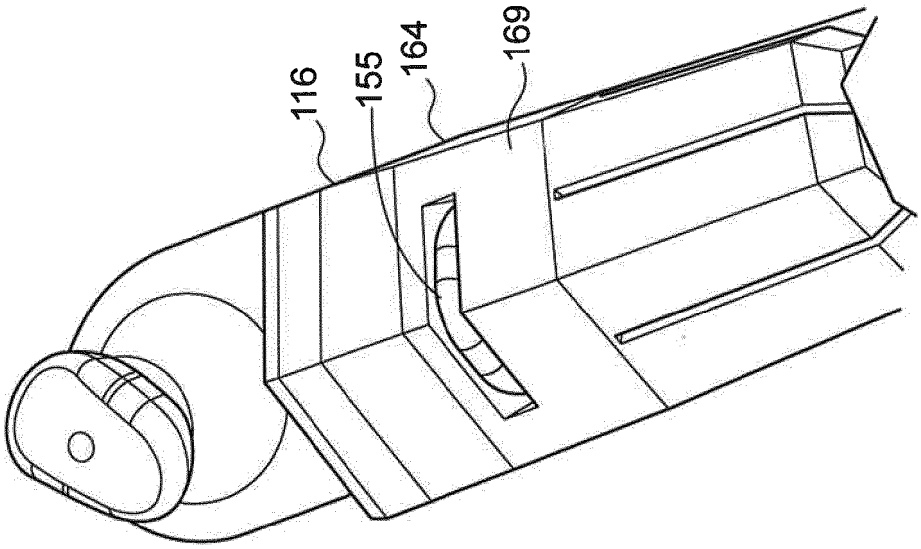

Fig. 17

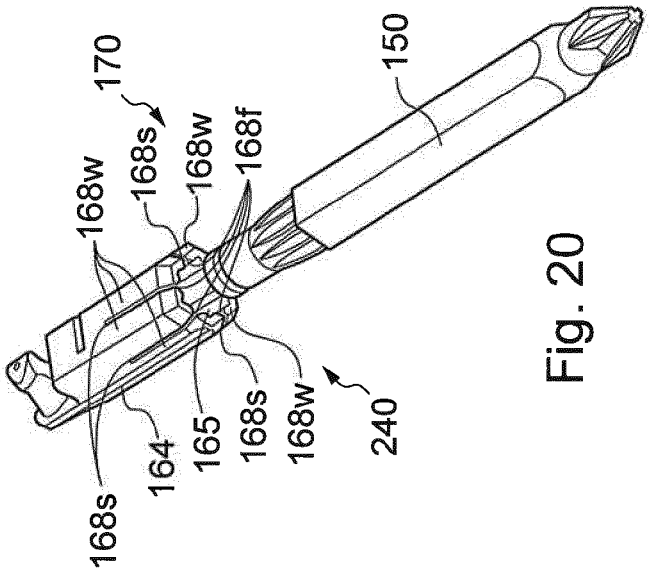

Fig. 20

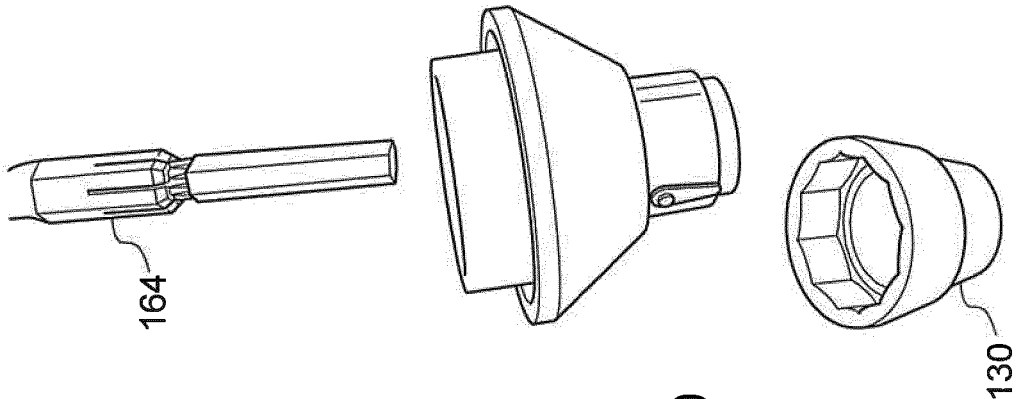

Fig. 19

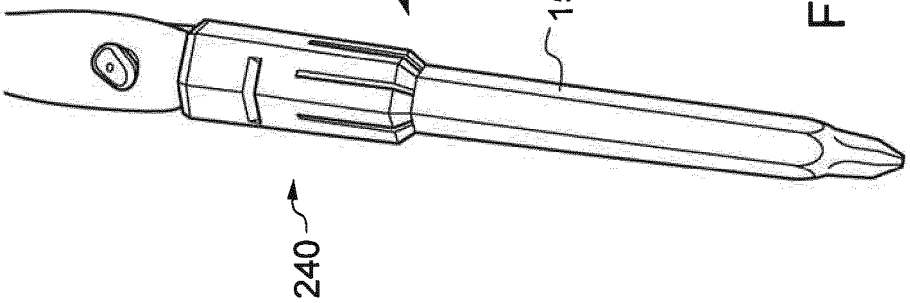

Fig. 22

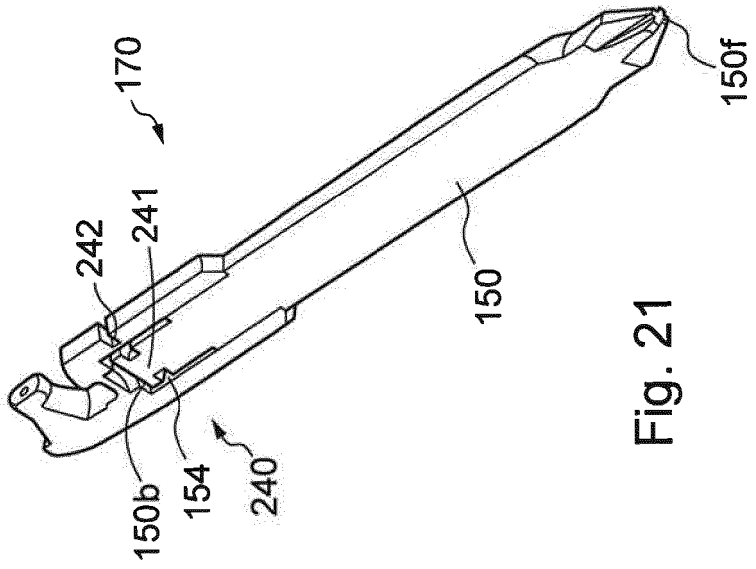

Fig. 21

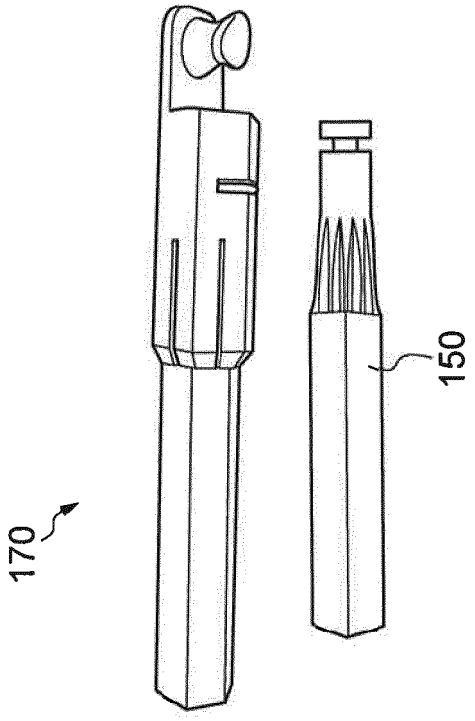

Fig. 24

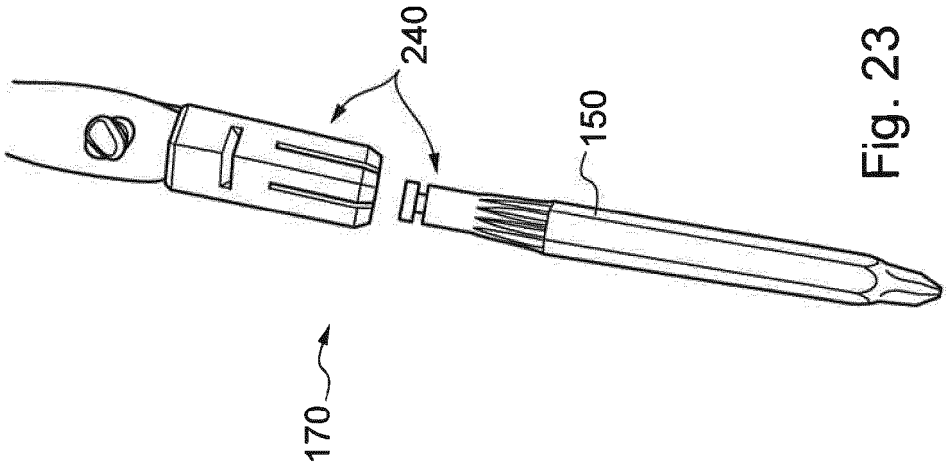

Fig. 23

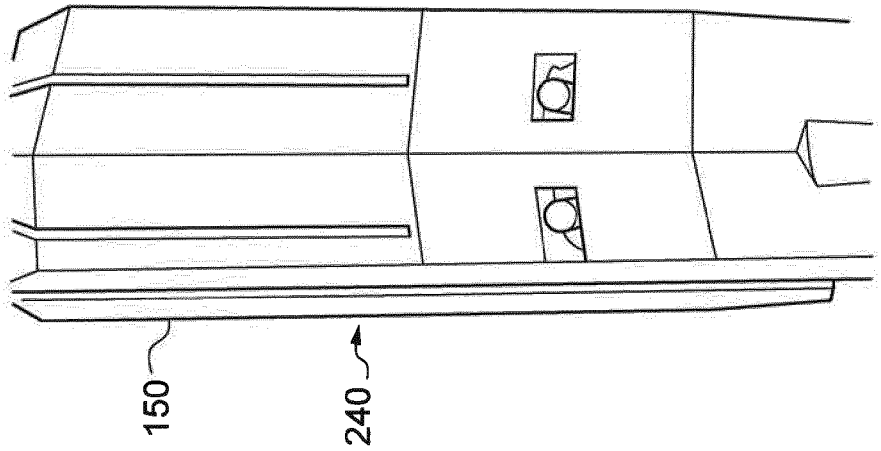

Fig. 26

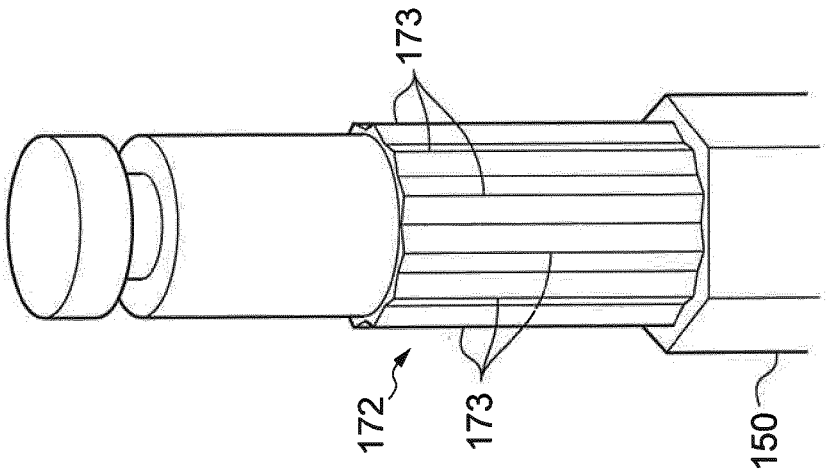

Fig. 25

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US D562665 S, Gao **[0007]**
- US 5806381 A, Lin **[0008]**
- US 6928908 B **[0013]**