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(12) **United States Patent**
Sollami

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(54) **BIT HOLDER**

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(21) Appl. No.: **15/928,269**

(22) Filed: **Mar. 22, 2018**

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/512,581, filed on Oct. 13, 2014, now Pat. No. 10,072,501, which is a continuation-in-part of application No. 12/870,289, filed on Aug. 27, 2010, now Pat. No. 8,622,482, application No. 15/928,269, filed on Mar. 22, 2018, which is a continuation-in-part of application No. 15/708,292, filed on Sep. 19, 2017, which is a continuation of application No. 14/628,482, filed on Feb. 23, 2015, now Pat. No. 9,879,531, application No. 15/928,269, filed on Mar. 22, 2018, which is a continuation-in-part of application No. 14/959,551, filed on Dec. 4, 2015, application No. 15/928,269, filed on Mar. 22, 2018, which is a continuation-in-part of application No. 15/699,504, filed on Sep. 8, 2017, which is a continuation-in-part of application No. 14/959,551, filed on Dec. 4, 2015, application No. 15/928,269, filed on Mar. 22, 2018, which is a continuation-in-part of application No. 14/690,679, filed on Apr. 20, 2015.

(60) Provisional application No. 61/891,683, filed on Oct. 16, 2013, provisional application No. 61/944,646, filed on Feb. 26, 2014, provisional application No.

(Continued)

(51) **Int. Cl.**

E21C 35/19 (2006.01)

E21C 35/18 (2006.01)

E21C 35/197 (2006.01)

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

CPC **E21C 35/18** (2013.01); **E21C 35/197** (2013.01); **E21C 35/19** (2013.01); **E21C 2035/1826** (2013.01)

(58) **Field of Classification Search**

CPC E21C 35/18; E21C 35/183; E21C 35/187; E21C 35/19; E21C 35/1933; E21C 35/1936; E21C 35/193; E21C 35/197; E21C 2035/191

USPC 299/79.1, 81.1, 81.3, 102-111, 113
See application file for complete search history.

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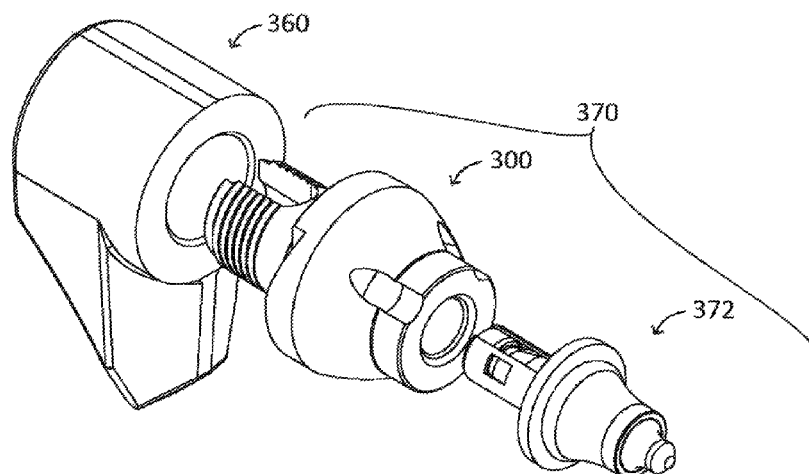
Primary Examiner — Sunil Singh

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Rockman Videbeck & O'Connor

(57) **ABSTRACT**

A unitary bit/holder and/or a bit holder including a body portion and a shank. The body portion and the shank being coaxial and including a bore extending from a forward end of the body portion to the distal end of the shank. The shank further including a segment adjacent a distal end of the shank that includes a plurality of ribs and at least one notch or relief zone between each rib in the plurality of ribs.

17 Claims, 22 Drawing Sheets



Related U.S. Application Data

62/100,764, filed on Jan. 7, 2015, provisional application No. 61/983,291, filed on Apr. 23, 2014.

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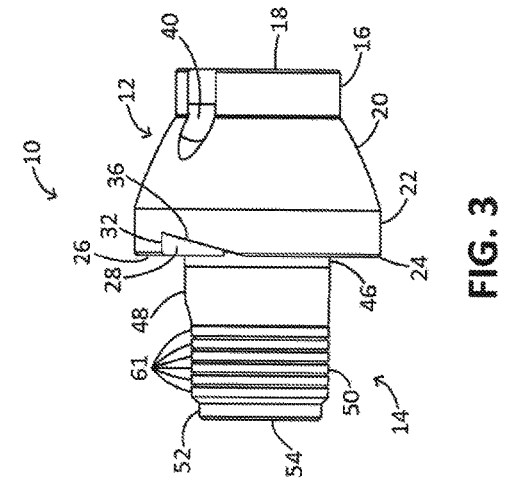
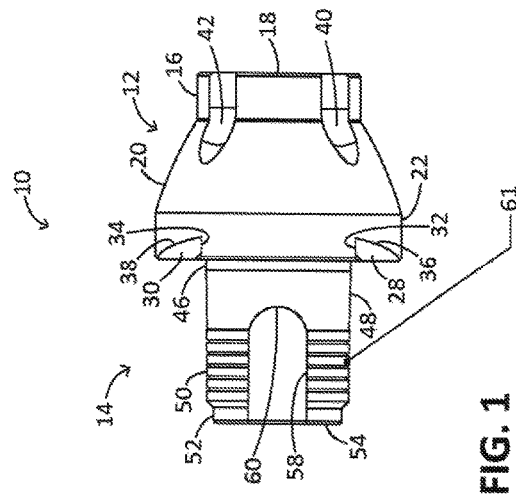
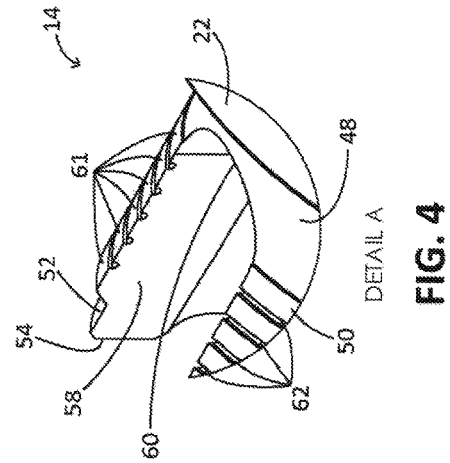
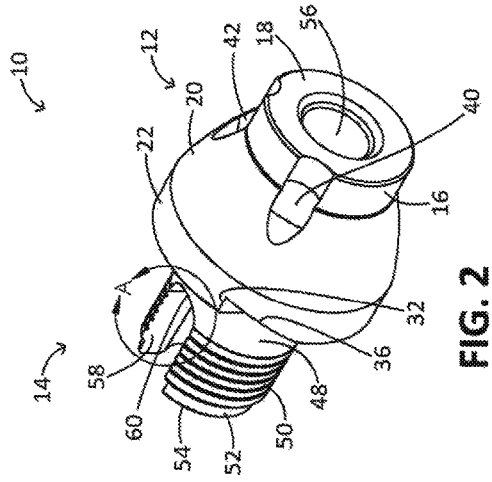
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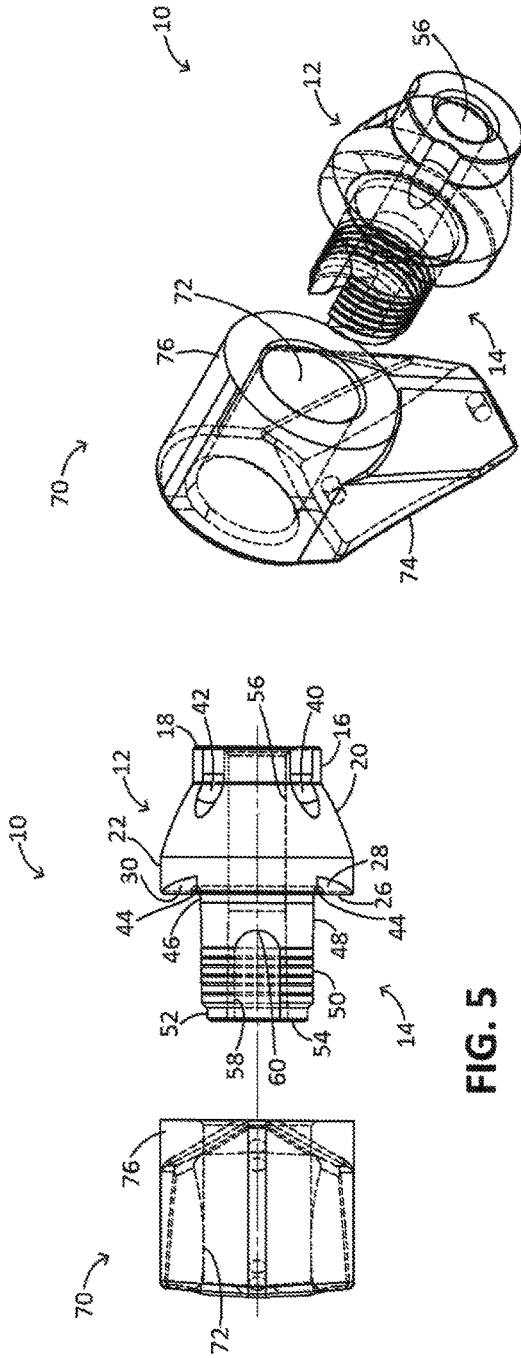


FIG. 5

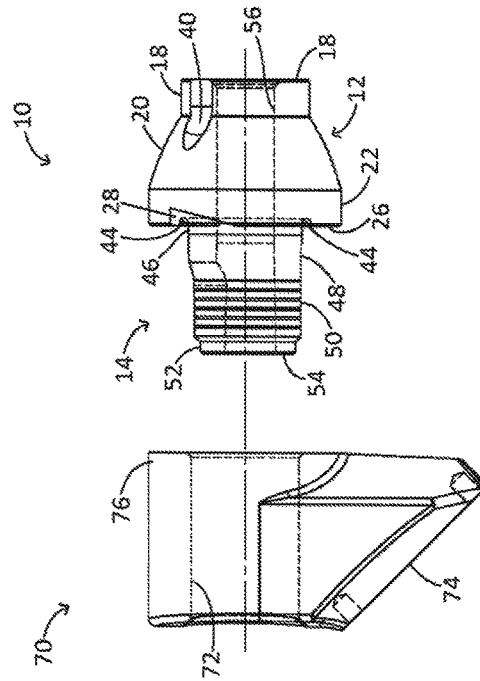


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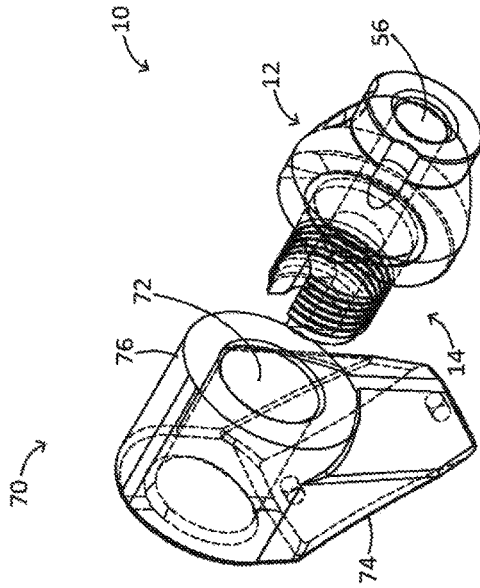


FIG. 7

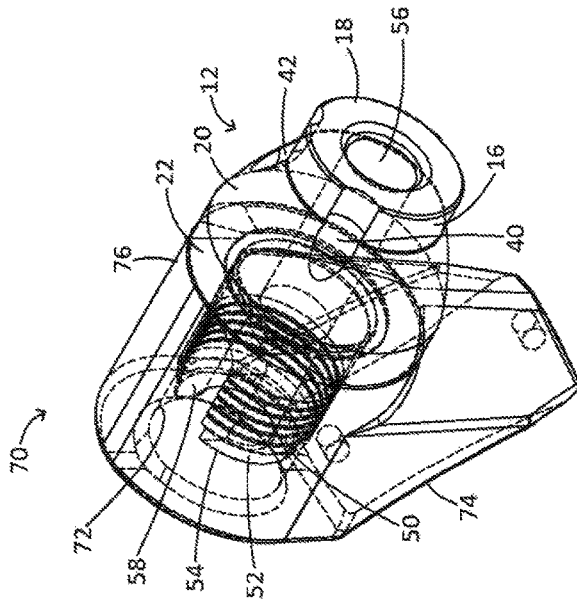


FIG. 8

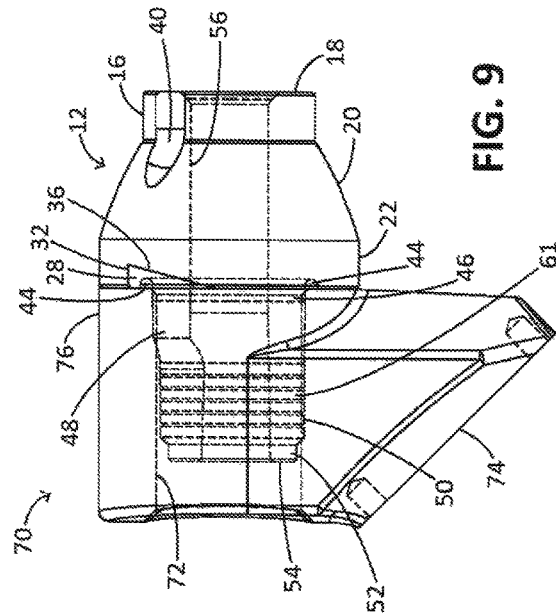


FIG. 9

FIG. 10

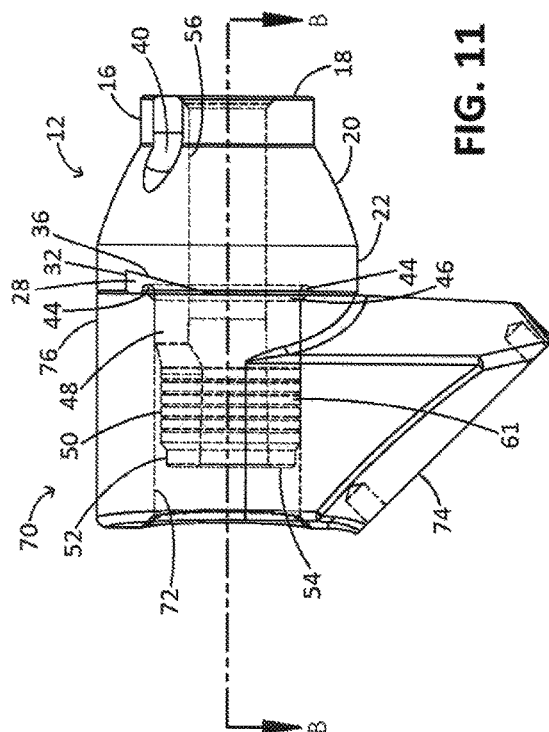


FIG. 11

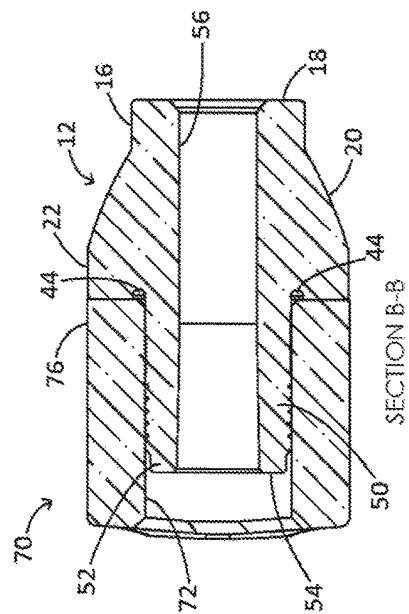


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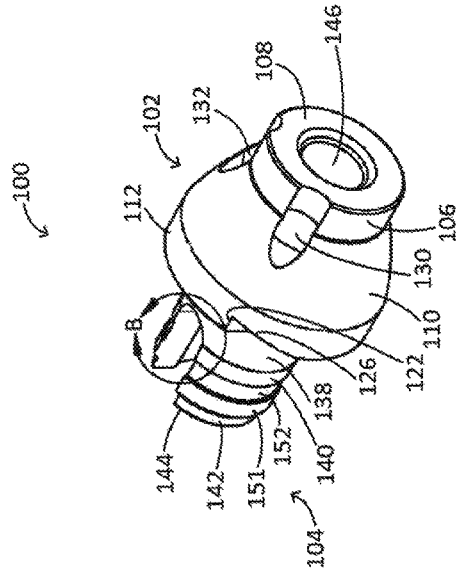


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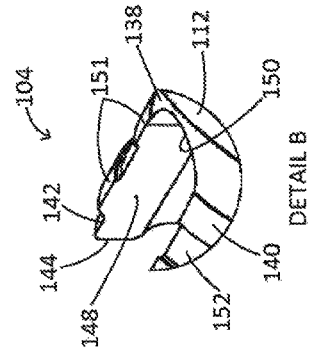


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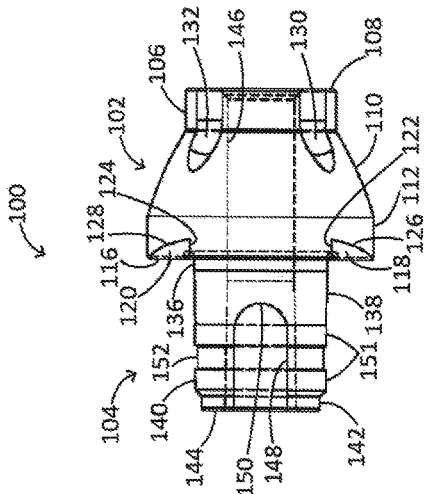


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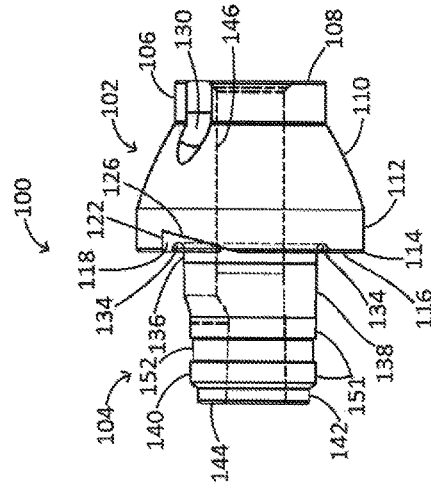


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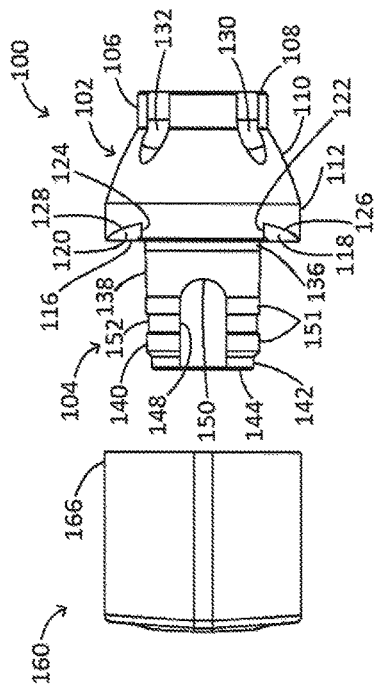


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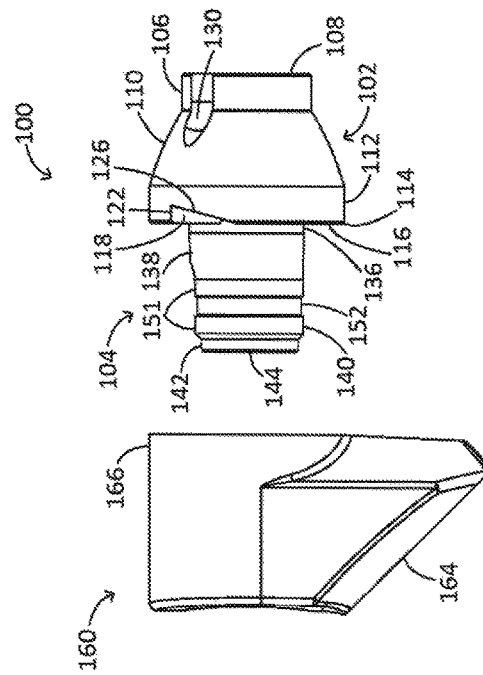


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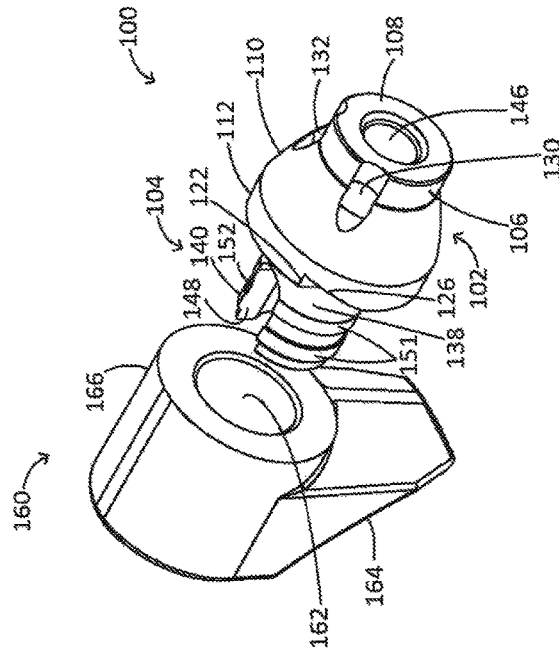


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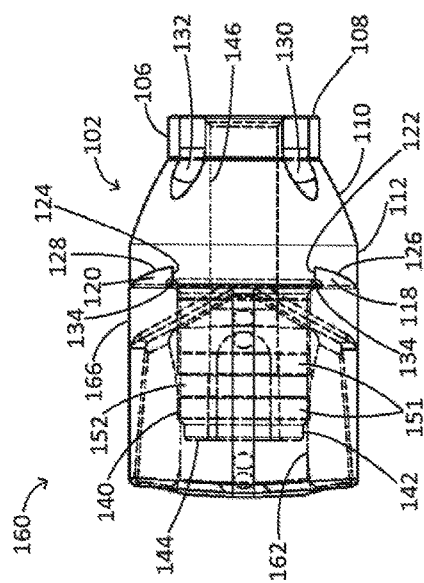


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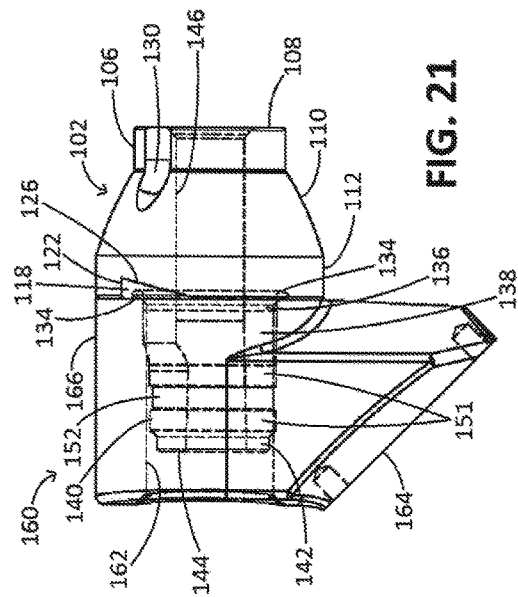


Fig. 21

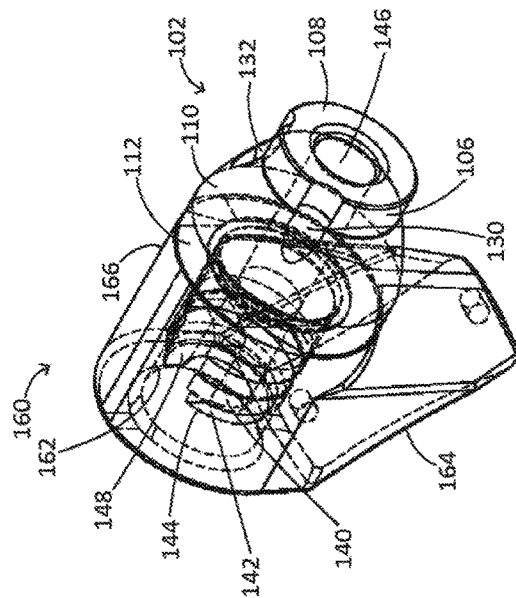


FIG. 22

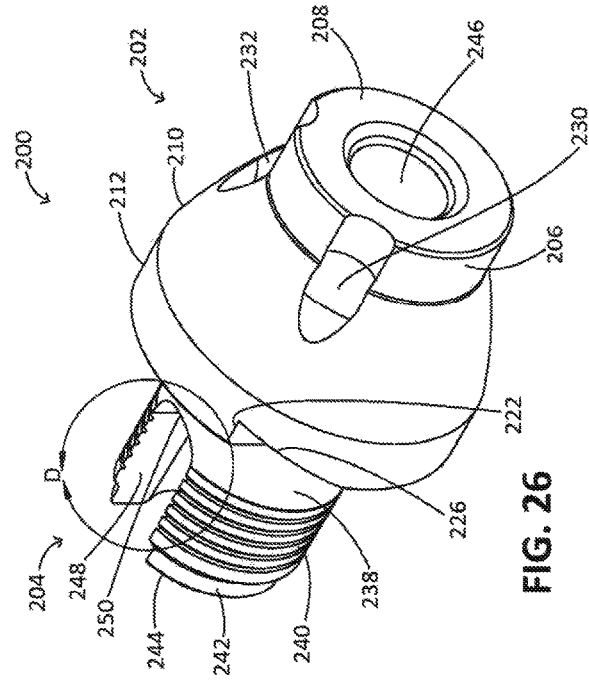


FIG. 26

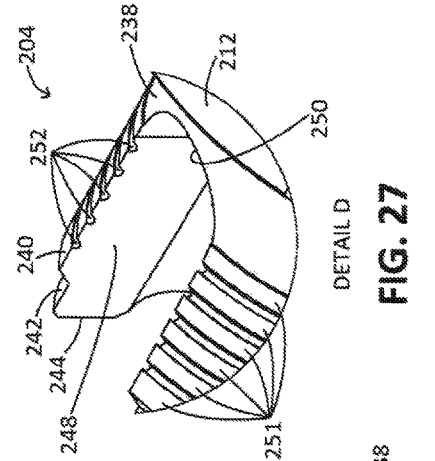


FIG. 27

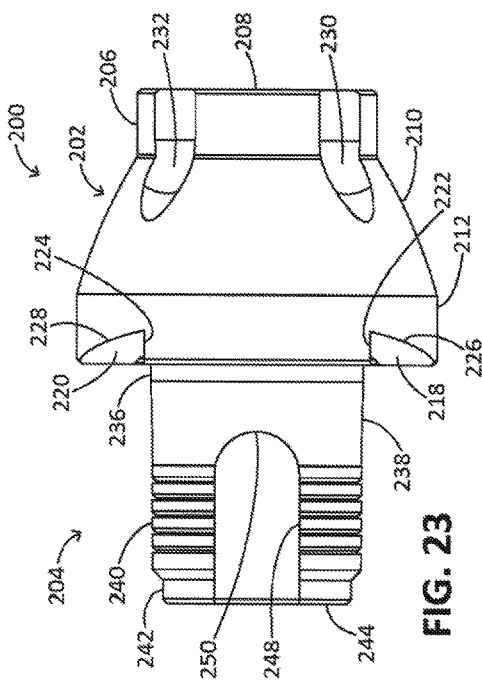


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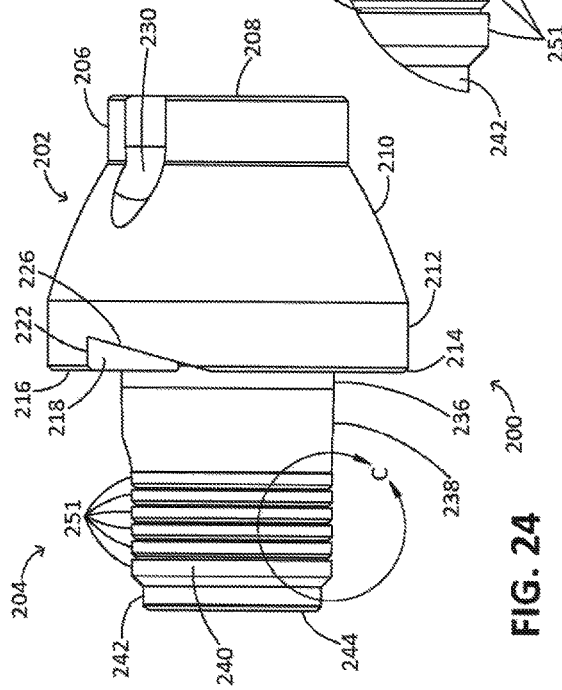


FIG. 24

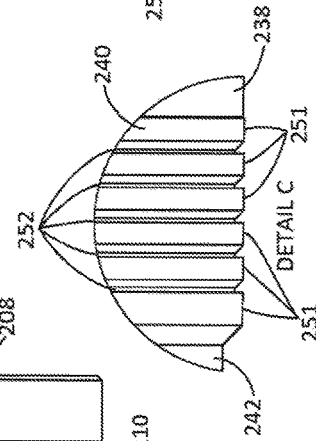


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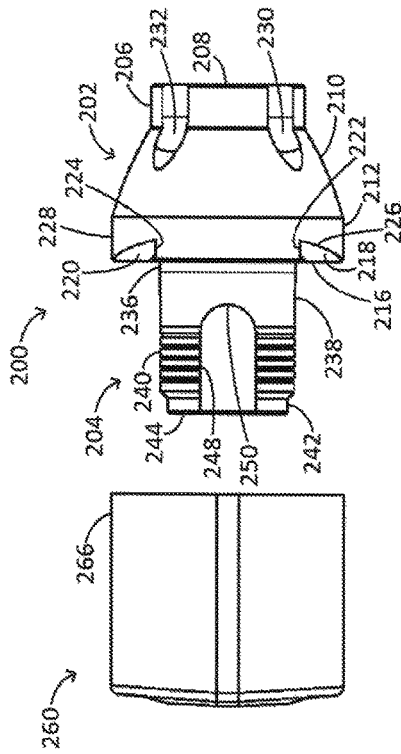


FIG. 28

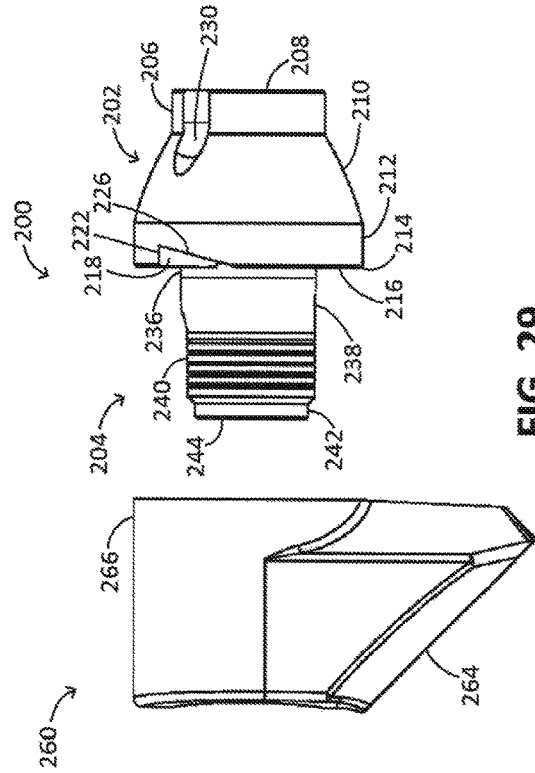


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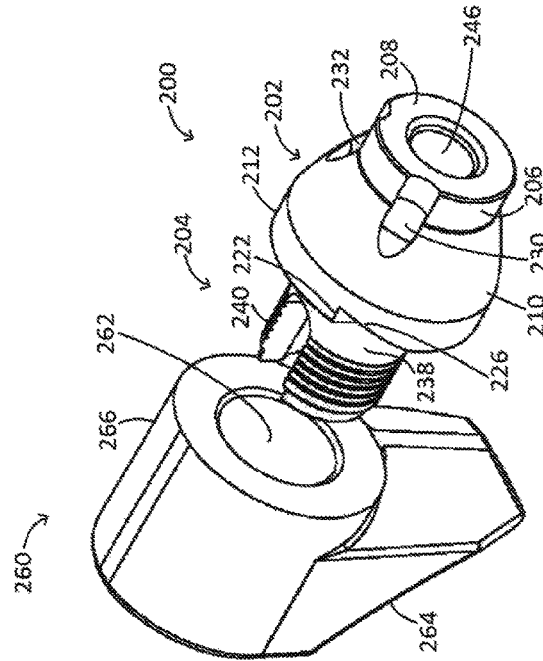


FIG. 30

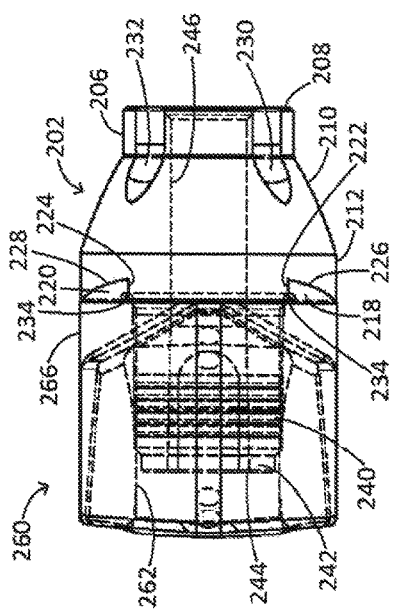


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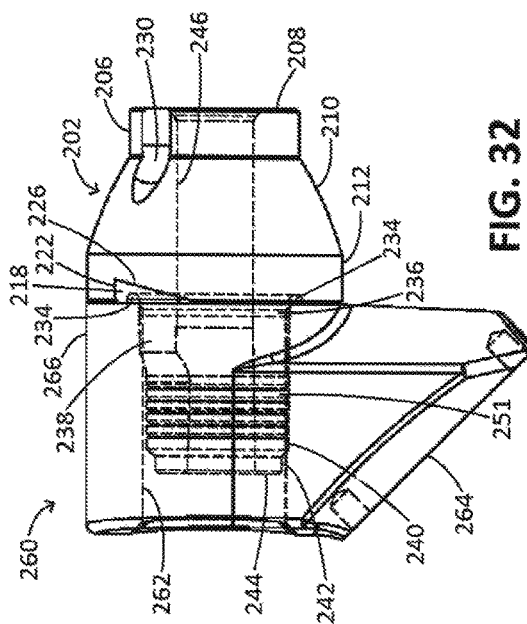


FIG. 32

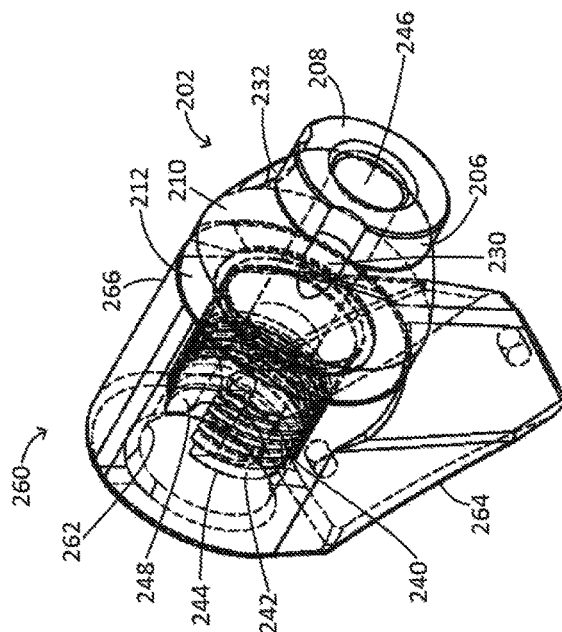
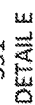
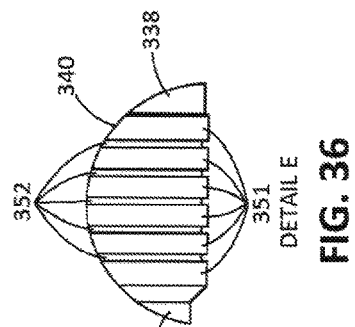
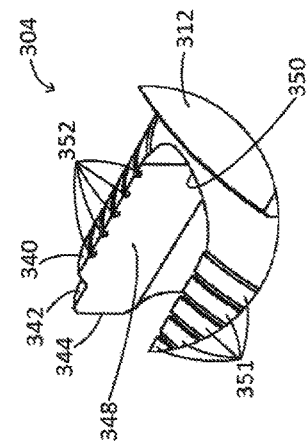
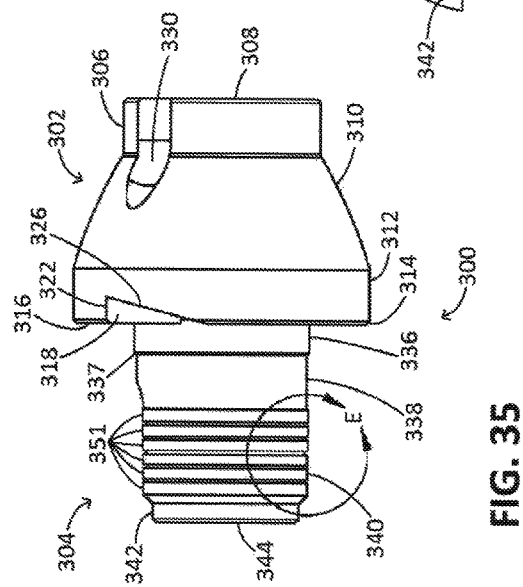
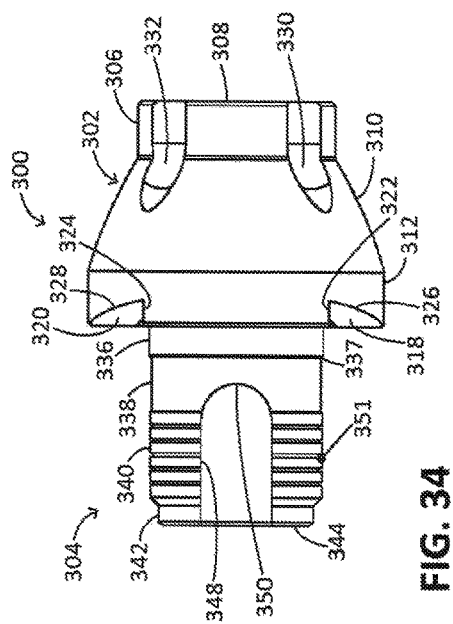
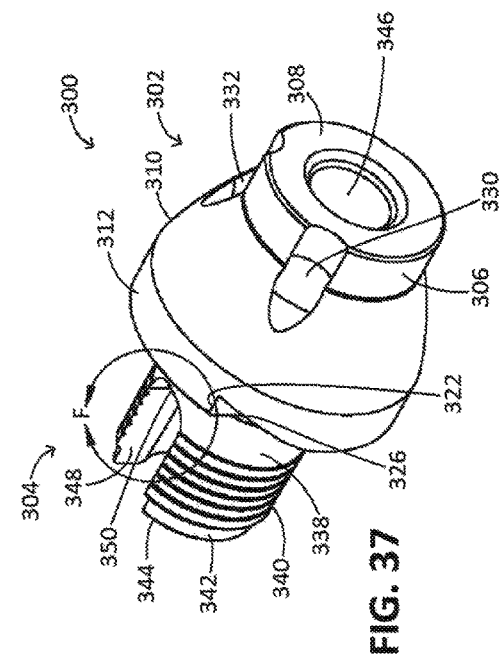


FIG. 33



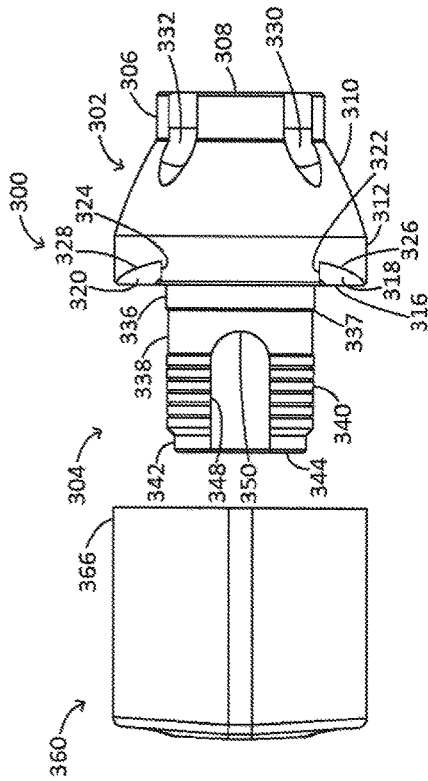


FIG. 39

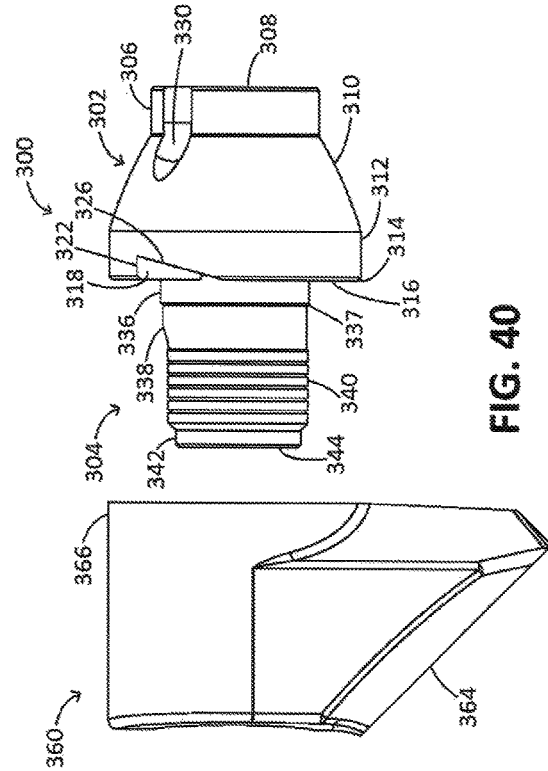


FIG. 40

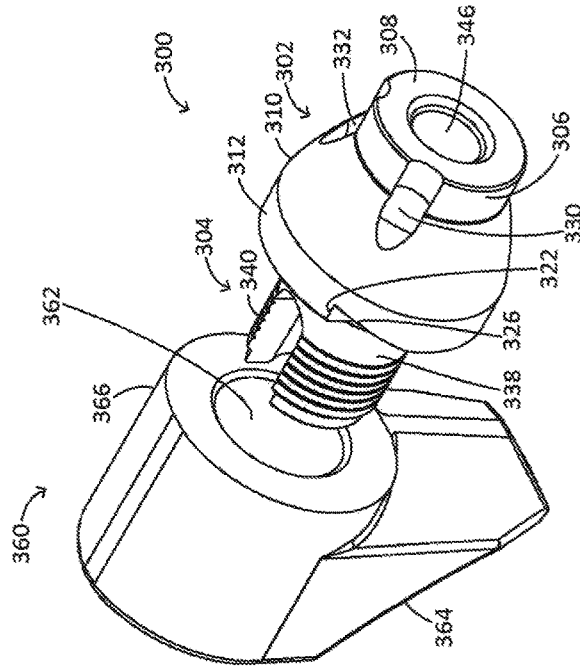


FIG. 41

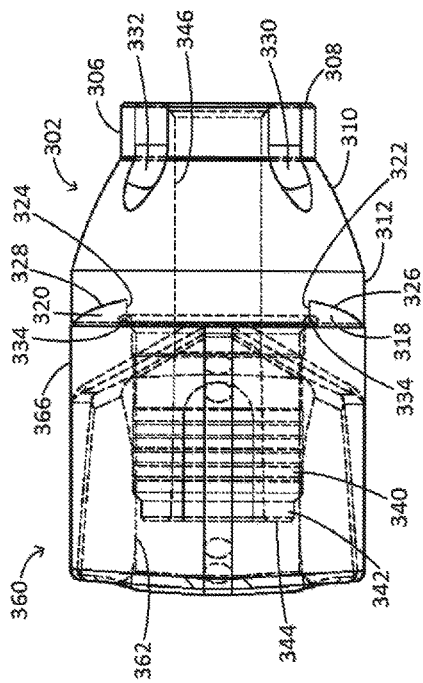


FIG. 42

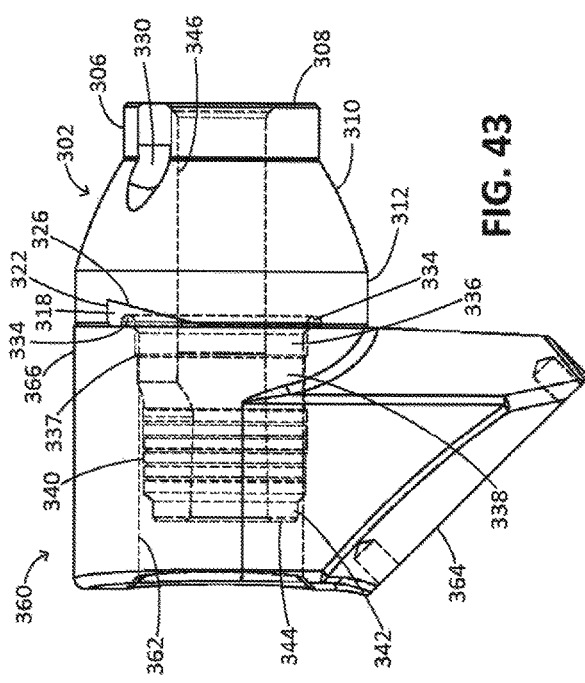


FIG. 43

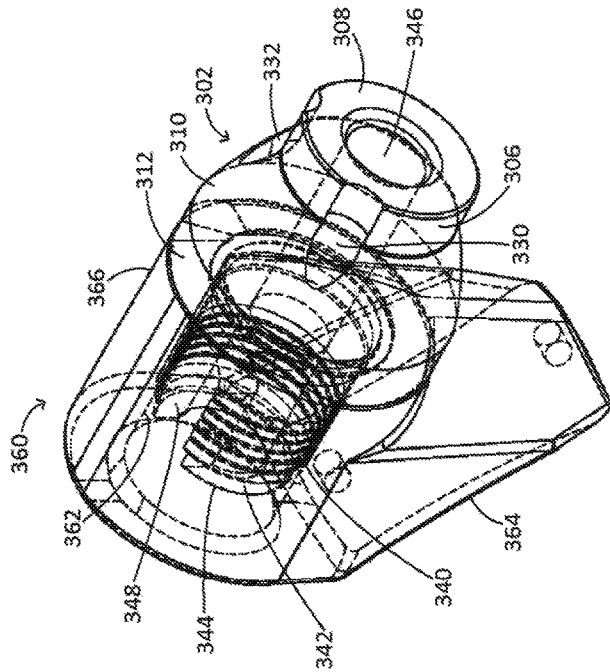
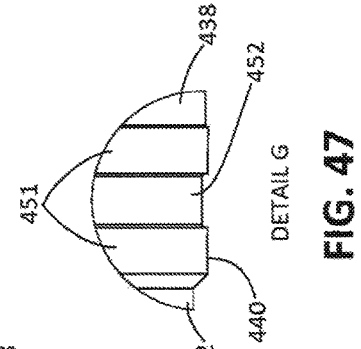
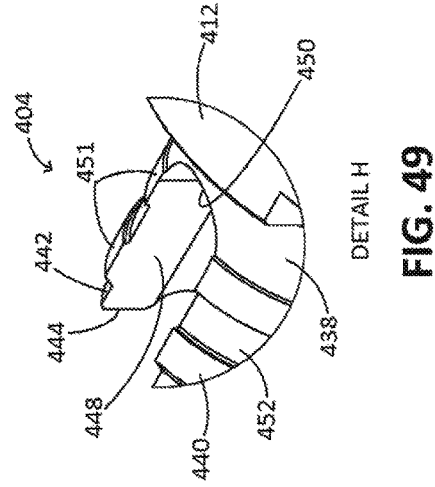
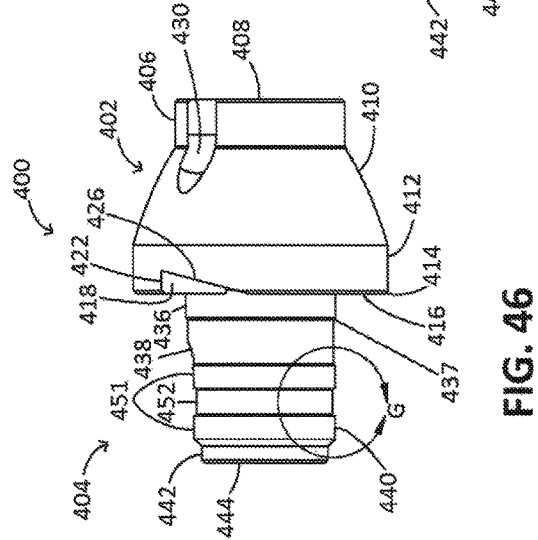
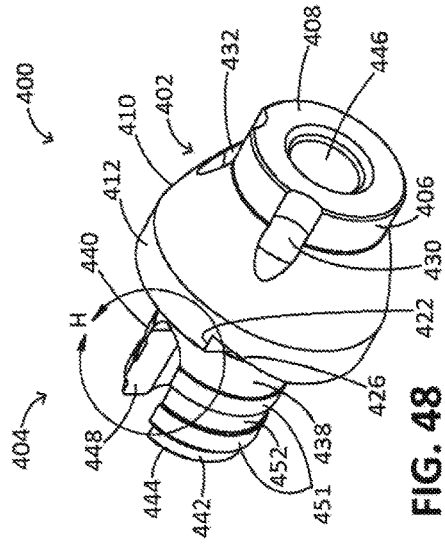
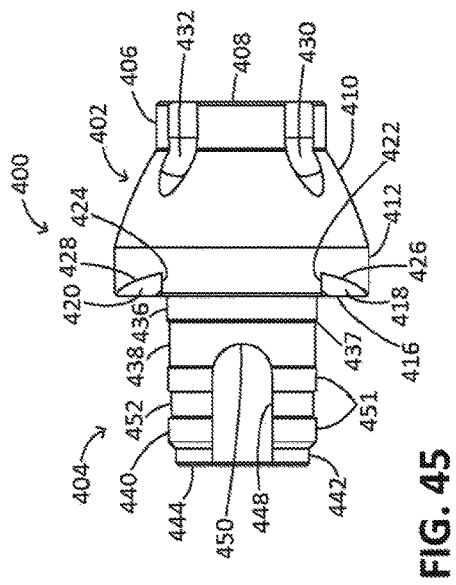


FIG. 44



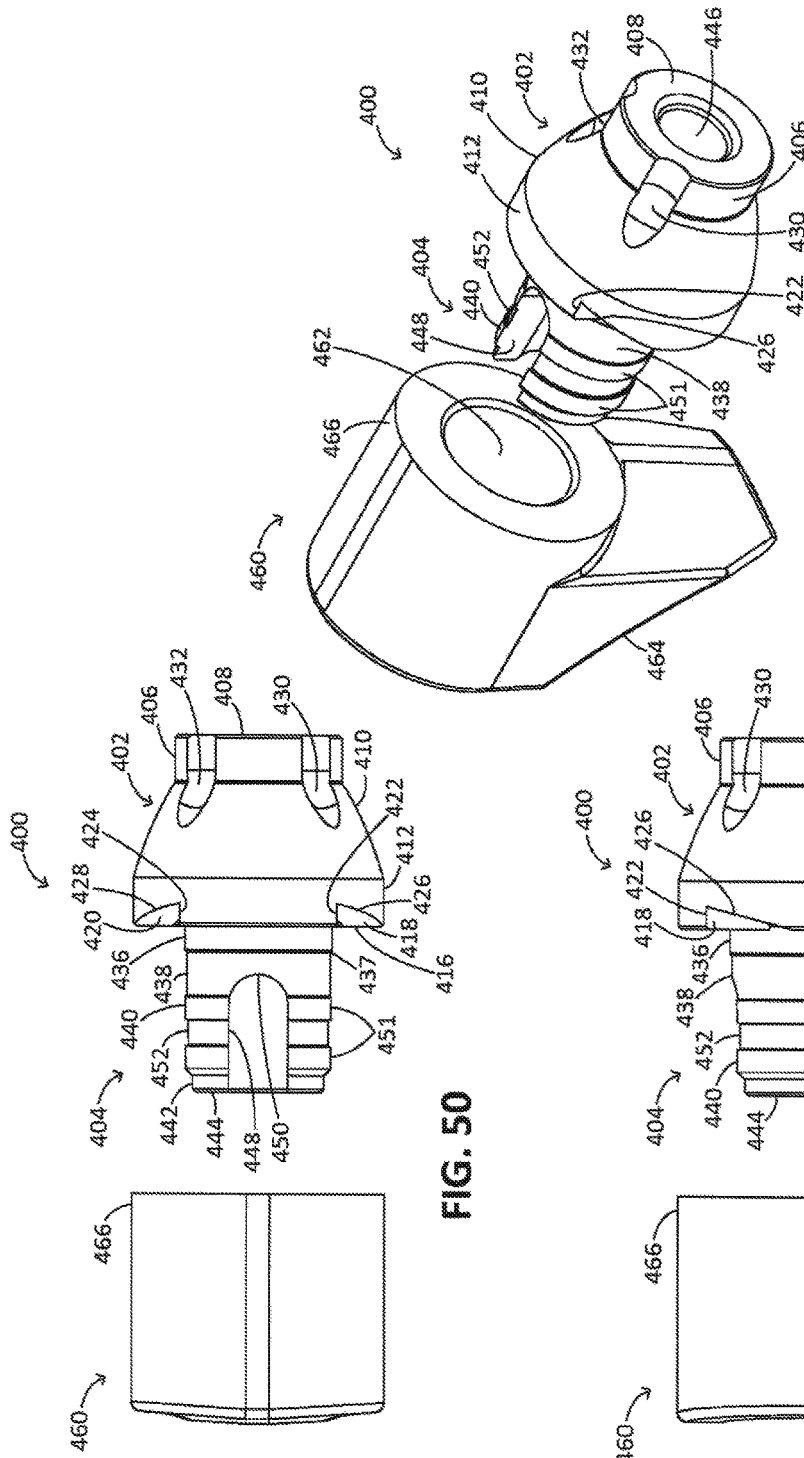


FIG. 50

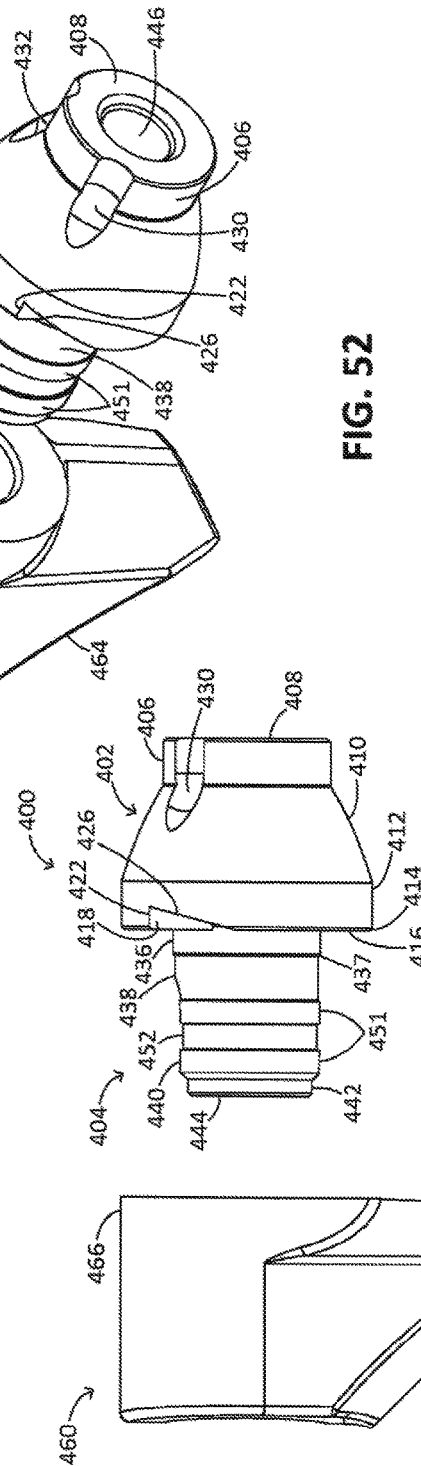
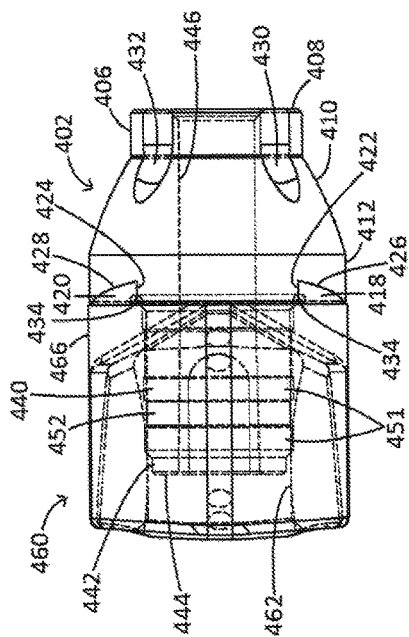
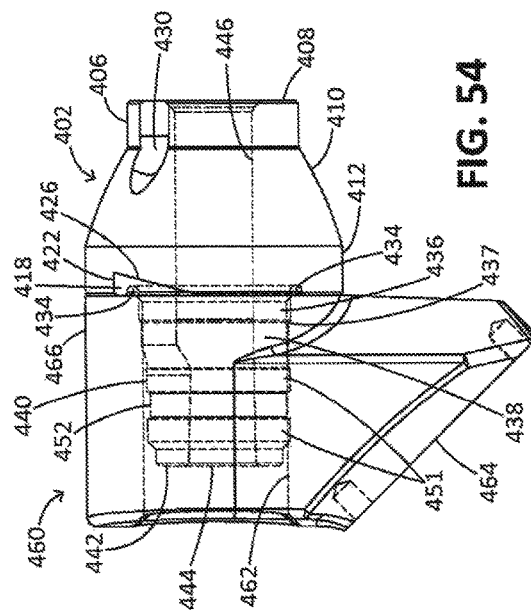


FIG. 51

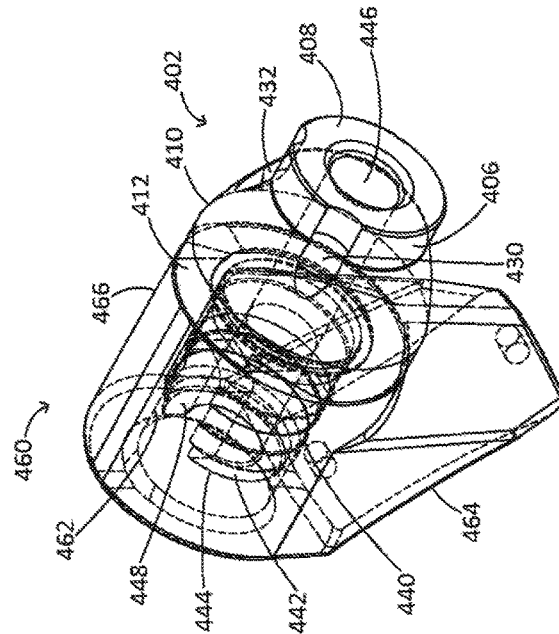
FIG. 52



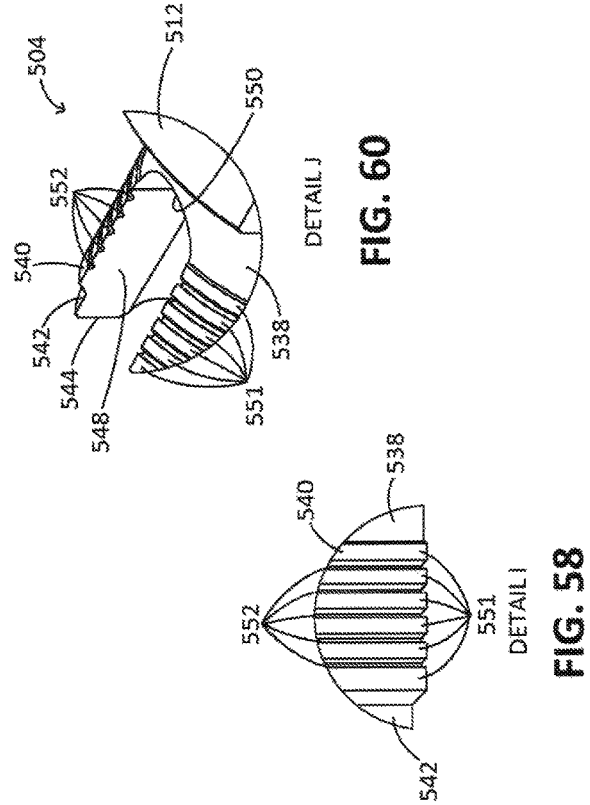
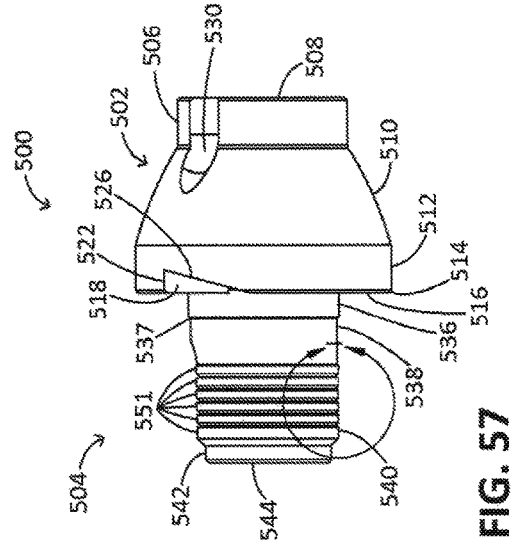
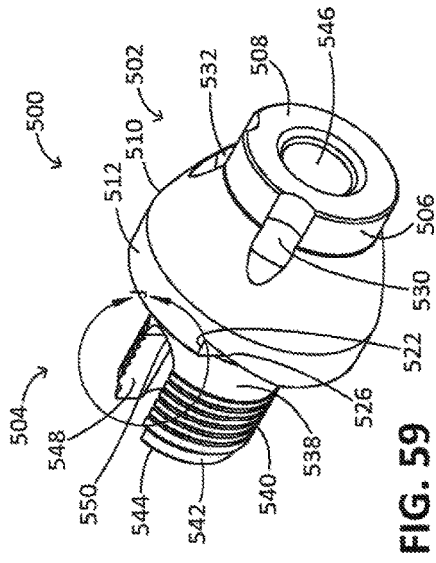
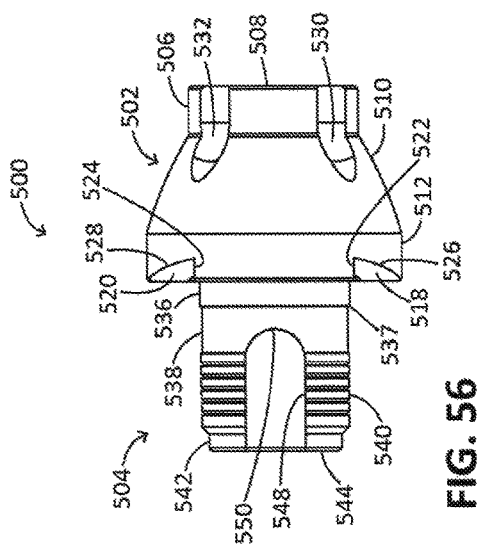
35
G*

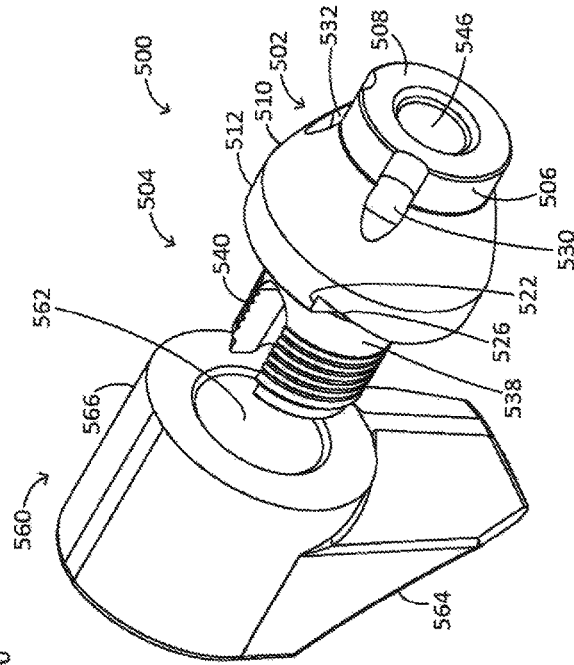
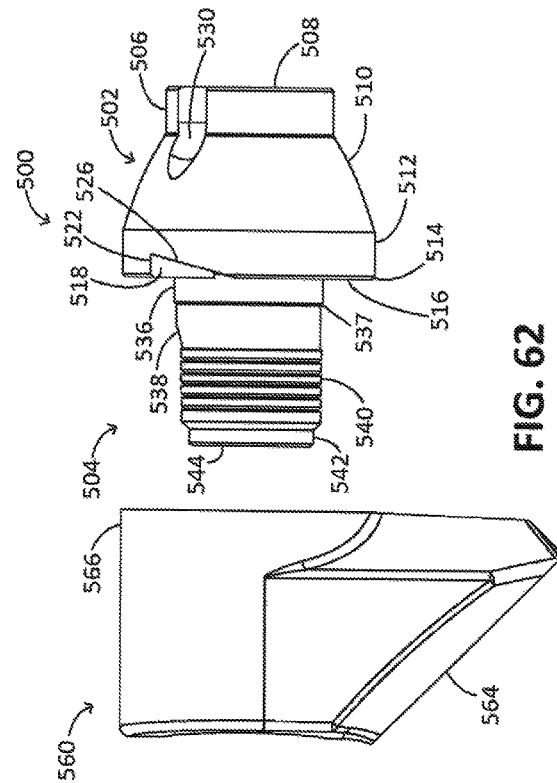
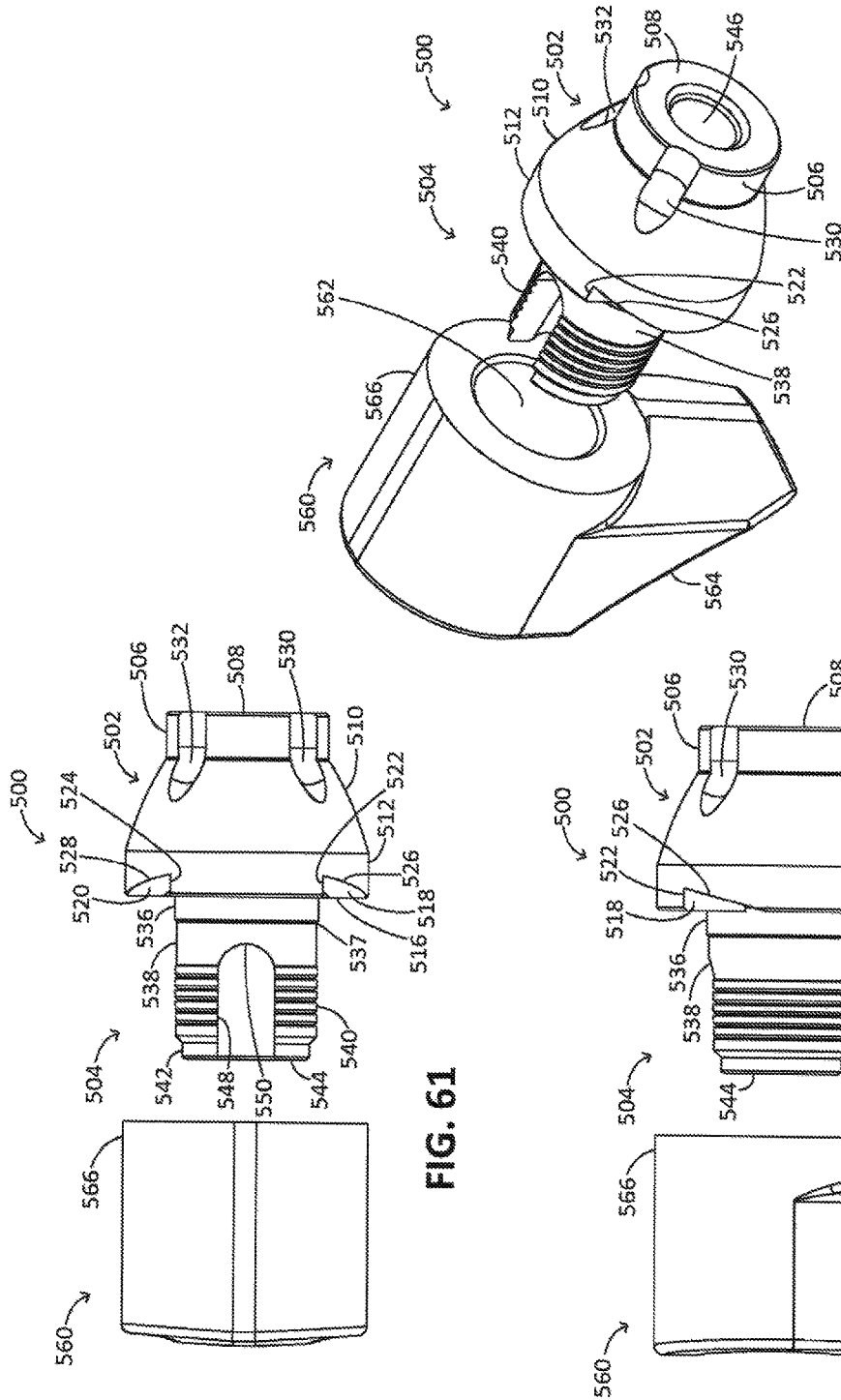


54
G.
E.



55
55
G.
L





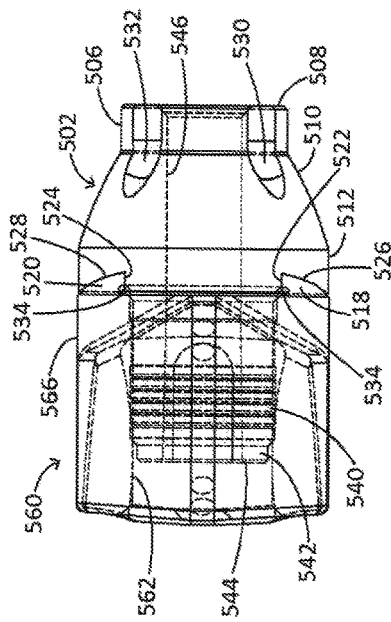


FIG. 64

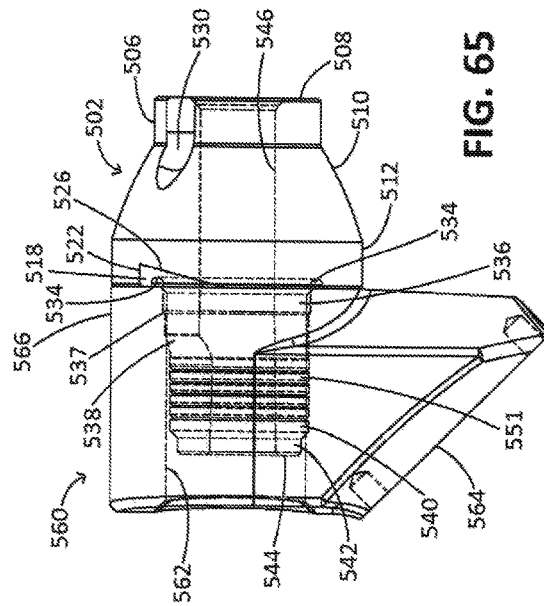


FIG. 65

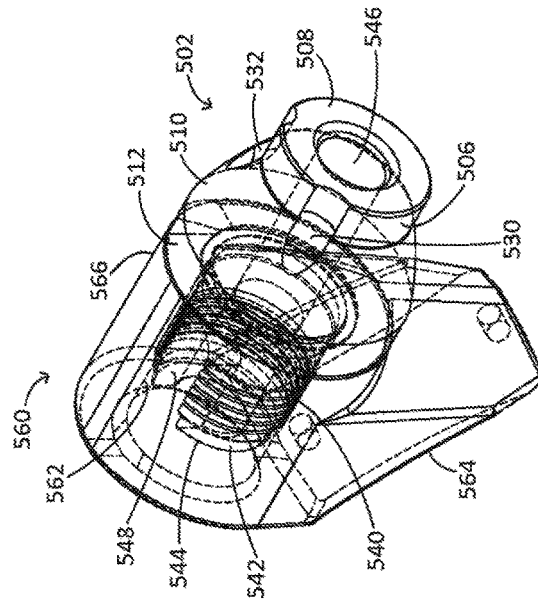


FIG. 66

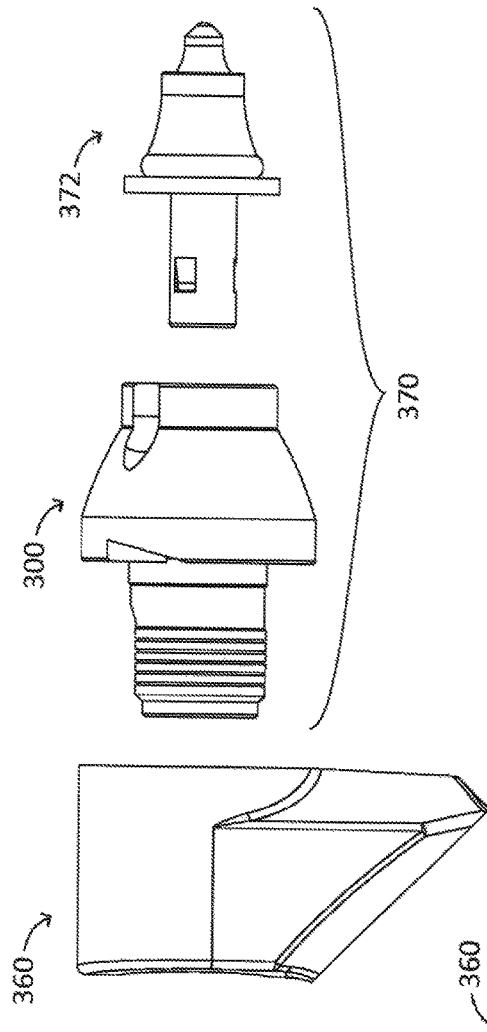


FIG. 67

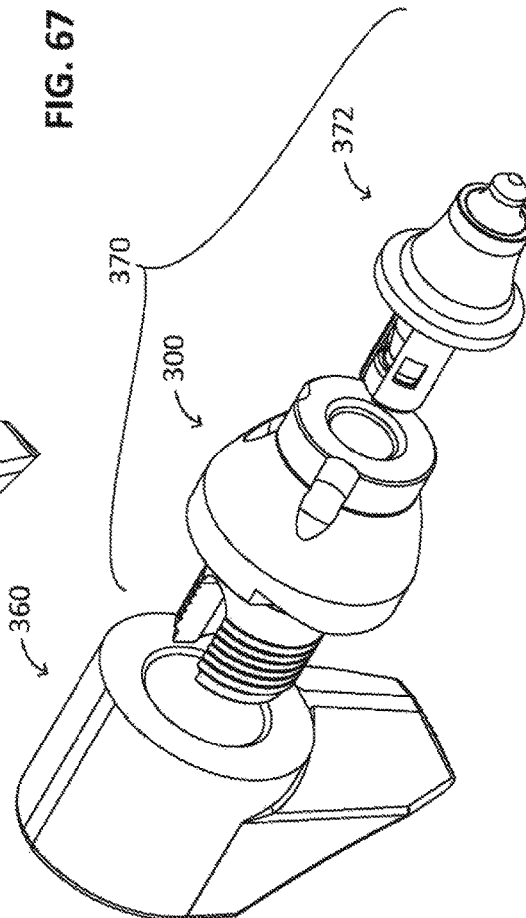


FIG. 68

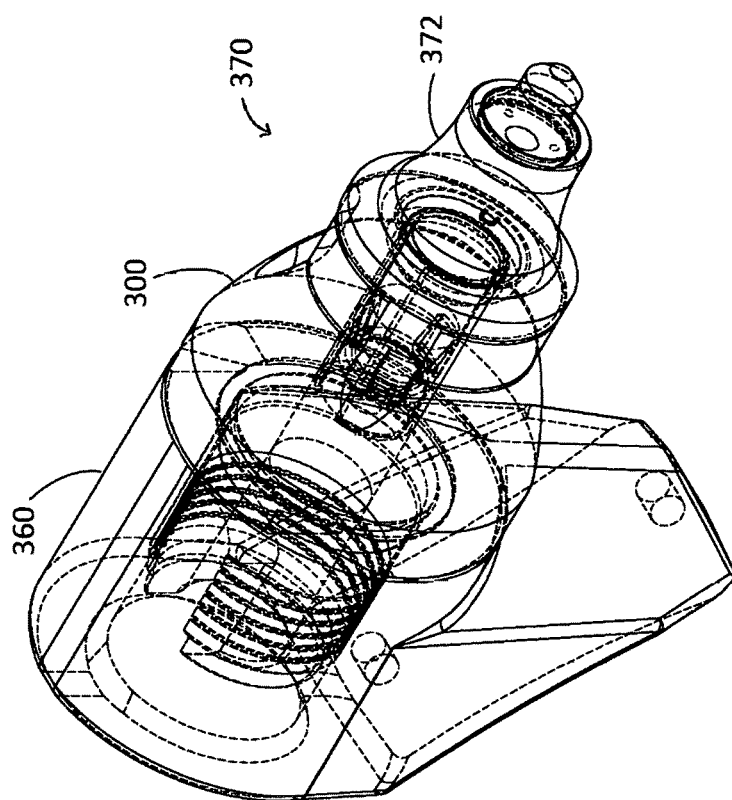


FIG. 69

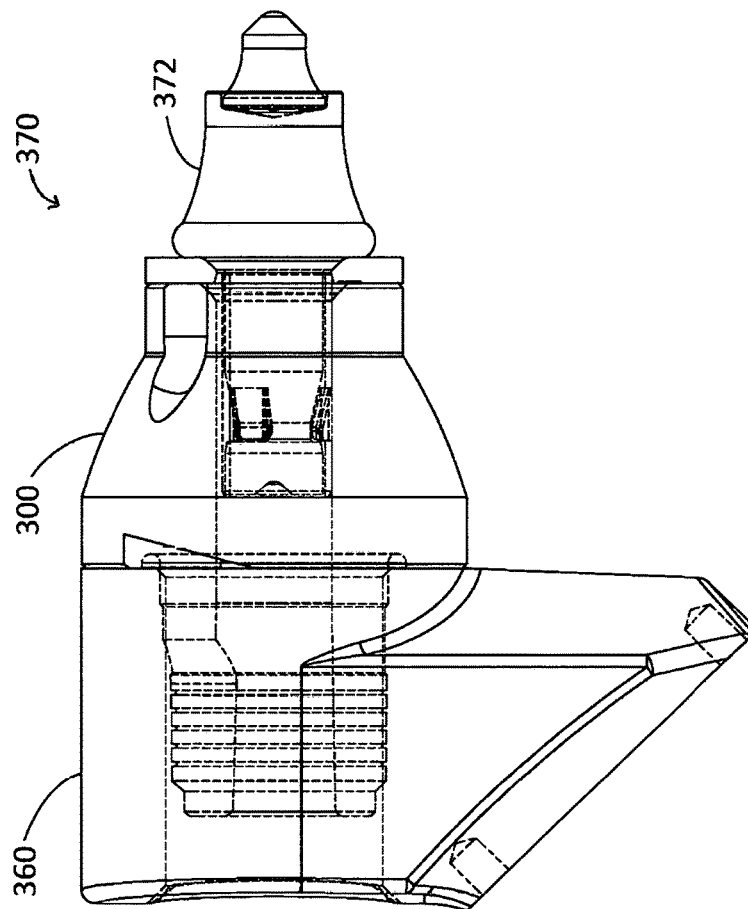


FIG. 70

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BIT HOLDER**CROSS-REFERENCE TO RELATED APPLICATION(S)**

This application claims priority to and is a continuation-in-part of U.S. Provisional Application No. 61/891,683, filed Oct. 16, 2013, claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 12/870,289, filed Aug. 27, 2010, now U.S. Pat. No. 8,622,482, issued Jan. 7, 2014, claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 14/512,581, filed Oct. 13, 2014, claims priority to and is a continuation-in-part of U.S. Provisional Application No. 61/944,646, filed Feb. 26, 2014, claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 14/628,482, filed Feb. 23, 2015, now U.S. Pat. No. 9,879,531, issued Jan. 30, 2018, claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 15/708,292, filed Sep. 19, 2017, claims priority to and is a continuation-in-part of U.S. Provisional Application No. 62/100,764, filed Jan. 7, 2015, claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 14/959,551, filed Dec. 4, 2015, claims priority to and is a continuation-in-part to U.S. Provisional Application No. 61/983,291, filed Apr. 23, 2014, claims priority to and is a continuation-in-part to U.S. Non-Provisional application Ser. No. 14/690,679, filed Apr. 20, 2015, and claims priority to and is a continuation-in-part of U.S. Non-provisional application Ser. No. 15/699,504, filed Sep. 8, 2017, to the extent allowed by law and the contents of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

This disclosure relates to bit assemblies for road milling, mining, and trenching equipment, and more particularly, to a bit holder for use road milling, mining, and trenching machines.

BACKGROUND

Road milling, mining, and trenching equipment utilizes bits traditionally set in a bit assembly having a bit holder and/or a bit holder block. In one embodiment, the bit is retained by the bit holder and the bit holder is retained in the bit holder block. In another embodiment a unitary bit/holder is retained in the bit holder block. A plurality of the bit assemblies are mounted on the outside of a rotatable drum in staggered positions, typically in a V-shaped or spiral configuration, in an effort to create the smoothest road milling. The combinations of bit assemblies have been utilized to remove material from the terra firma, such as degrading the surface of the earth, minerals, cement, concrete, macadam or asphalt pavement. Individual bits, bit holders, and bit holder blocks may wear down or break over time due to the harsh road degrading environment. Additionally, the bit holder or the unitary bit/holder may be ejected out of the bit holder block bore due to the harsh road degrading environment. A need has developed to provide a bit holder and/or a unitary bit/holder that makes a sufficient radial connection with the bit holder block bore to prevent the bit holder and/or unitary bit/holder from being ejected out of the bit holder block bore during harsh operations. Additionally, to provide greater radial force, a shank of the bit holder and/or unitary bit/holder comprises notches and/or

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relief zones adapted to reduce surface contact between the shank of the bit holder, and/or unitary bit/holder, and the bit holder block bore.

SUMMARY

This disclosure relates generally to bit assemblies for road milling, mining, and trenching equipment. One implementation of the teachings herein is a bit holder that includes a body having a bottom; and a generally cylindrical shank depending axially from the bottom of the body, the shank including a segment adjacent a distal end of the shank, the segment including a plurality of ribs.

In another implementation of the teachings herein is a combination for a bit assembly that includes one of a unitary bit/holder and a bit holder comprising: a forward body portion having a bottom; and a generally cylindrical hollow shank depending axially from the bottom of the forward body portion, the shank comprising: a segment adjacent a distal end of the shank, the segment comprising a plurality of ribs; and a base block comprising a bore adapted to make an interference contact with at least the segment of the shank, the plurality of ribs adapted to reduce a surface contact between the segment and a complementary portion of the bore of the base block and to provide a more evenly distributed and more highly concentrated force per segment.

These and other aspects of the present disclosure are disclosed in the following detailed description of the embodiments, the appended claims and the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

The various features, advantages, and other uses of the apparatus will become more apparent by referring to the following detailed description and drawings, wherein like reference numerals refer to like parts throughout the several views. It is emphasized that, according to common practice, the various features of the drawings are not to-scale. On the contrary, the dimensions of the various features are arbitrarily expanded or reduced for clarity.

FIG. 1 is a top elevation view of a first embodiment of a bit holder in accordance with implementations of this disclosure;

FIG. 2 is a side perspective view of the first embodiment of the bit holder in accordance with implementations of this disclosure;

FIG. 3 is a side elevation view of the first embodiment of the holder in accordance with implementations of this disclosure;

FIG. 4 is a detail perspective view of Detail A of the first illustrated embodiment of the bit holder of FIG. 2 in accordance with implementations of this disclosure;

FIG. 5 is an exploded top elevation view of the first embodiment of the bit holder and a bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 6 is an exploded side elevation view of the first embodiment of the bit holder and the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 7 is an exploded side perspective view of the first embodiment of the bit holder and the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 8 is a top elevation view of the first embodiment of the bit holder assembled with the bit holder block, showing

FIG. 26 is a side perspective view of the third illustrated embodiment of the bit holder in accordance with implementations of this disclosure;

FIG. 46 is a side elevation view of the fifth illustrated embodiment of the bit holder in accordance with implementations of this disclosure;

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FIG. 47 is a detail elevation view of Detail G of the fifth illustrated embodiment of the bit holder of FIG. 46 in accordance with implementations of this disclosure;

FIG. 48 is a side perspective view of the fifth illustrated embodiment of the bit holder in accordance with implementations of this disclosure;

FIG. 49 is a detail perspective view of Detail H of the fifth illustrated embodiment of the bit holder of FIG. 48 in accordance with implementations of this disclosure;

FIG. 50 is an exploded top elevation view of the fifth illustrated embodiment of the bit holder and a bit holder block in accordance with implementations of this disclosure;

FIG. 51 is an exploded side elevation view of the fifth illustrated embodiment of the bit holder and the bit holder block in accordance with implementations of this disclosure;

FIG. 52 is an exploded side perspective view of the fifth illustrated embodiment of the bit holder and the bit holder block in accordance with implementations of this disclosure;

FIG. 53 is a top elevation view of the fifth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 54 is a side elevation view of the fifth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 55 is a side perspective view of the fifth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 56 is a top elevation view of a sixth illustrated embodiment of a bit holder in accordance with implementations of this disclosure;

FIG. 57 is a side elevation view of the sixth illustrated embodiment of the bit holder in accordance with implementations of this disclosure;

FIG. 58 is a detail elevation view of Detail I of the sixth illustrated embodiment of the bit holder of FIG. 57 in accordance with implementations of this disclosure;

FIG. 59 is a side perspective view of the sixth illustrated embodiment of the bit holder in accordance with implementations of this disclosure;

FIG. 60 is a detail perspective view of Detail J of the sixth illustrated embodiment of the bit holder of FIG. 59 in accordance with implementations of this disclosure;

FIG. 61 is an exploded top elevation view of the sixth illustrated embodiment of the bit holder and a bit holder block in accordance with implementations of this disclosure;

FIG. 62 is an exploded side elevation view of the sixth illustrated embodiment of the bit holder and the bit holder block in accordance with implementations of this disclosure;

FIG. 63 is an exploded side perspective view of the sixth illustrated embodiment of the bit holder and the bit holder block in accordance with implementations of this disclosure;

FIG. 64 is a top elevation view of the sixth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 65 is a side elevation view of the sixth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

FIG. 66 is a side perspective view of the sixth illustrated embodiment of the bit holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure;

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FIG. 67 is an exploded side elevation view of the fourth illustrated embodiment of the bit holder and a first illustrated embodiment of the unitary bit/holder, shown with a bit holder block and a bit, in accordance with implementations of this disclosure;

FIG. 68 is an exploded perspective view of the fourth illustrated embodiment of the bit holder and the first illustrated embodiment of the unitary bit/holder, shown with the bit holder block and the bit, in accordance with implementations of this disclosure;

FIG. 69 is a side perspective view of the fourth illustrated embodiment of the bit holder assembled with the bit into the first illustrated embodiment of the unitary bit/holder and the first illustrated embodiment of the unitary bit/holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure; and

FIG. 70 is a side elevation view of the fourth illustrated embodiment of the bit holder assembled with the bit into the first illustrated embodiment of the unitary bit/holder and the first illustrated embodiment of the unitary bit/holder assembled with the bit holder block, showing invisible internal elements in dotted lines, in accordance with implementations of this disclosure.

DETAILED DESCRIPTION

Road milling, mining, and trenching equipment utilizes bits traditionally set in a bit assembly having a bit holder and/or a bit holder block. In one embodiment, the bit is retained by the bit holder and the bit holder is retained in the bit holder block. In another embodiment a unitary bit/holder is retained in the bit holder block, hereinafter referred to as a base block. A plurality of the bit assemblies are mounted on the outside of a rotatable drum in staggered positions, typically in a V-shaped or spiral configuration, in an effort to create the smoothest road milling. The combinations of bit assemblies have been utilized to remove material from the terra firma, such as degrading the surface of the earth, minerals, cement, concrete, macadam or asphalt pavement. Individual bits, unitary bit/holders, bit holders, and base blocks may wear down or break over time due to the harsh road degrading environment. Additionally, the bit holder or the unitary bit/holder may be ejected out of the base block bore due to the harsh road degrading environment. A need has developed to provide a bit holder and/or a unitary bit/holder that makes a sufficient radial connection with the base block bore to prevent the bit holder and/or unitary bit/holder from being ejected out of the base block bore during harsh operations. Additionally, to provide greater radial force, a shank of the bit holder and/or unitary bit/holder comprises ribs, notches and/or relief zones adapted to reduce surface contact between the shank of the bit holder, and/or unitary bit/holder, and the base block bore.

Referring to FIGS. 1-12, a first embodiment of a bit holder 10 comprises a bit holder body 12 and a shank 14 axially depending from the bottom of the bit holder body 12. The bit holder body 12 is generally annular in shape and comprises an annular or generally cylindrical upper body portion 16 axially extending from a top surface 18, such as a flat annular top surface in this first illustrated embodiment. Subjacent the upper body portion 16 is a middle portion 20 that extends axially and radially outwardly to a radially extending generally cylindrical tire portion 22. The middle portion 20, in this illustrated embodiment, has an arcuate

shape. In other embodiments, the middle portion 20 can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion 22 is a tapered portion 24 (FIG. 3) that ends in a flange 26 (FIGS. 3, 5, and 6), such as a flat annular flange, of the bit holder body 12. The tire portion 22 includes at least a pair of tapered cutouts 28, 30 (FIGS. 1, 5, and 8), or wedge-shaped undercuts to provide access and leverage for a tool to extract the bit holder 10 from a base block 70 (FIGS. 5-12). The tapered cutouts 28, 30 are formed into the tire portion 22 and extend from the flange 26 subjacent to the tire portion 22. The tapered cutouts 28, 30 include a pair of parallel flat vertical inner surfaces 32, 34 (FIGS. 1 and 8), respectively, and a pair of flat tapered top surfaces 36, 38 (FIGS. 1 and 8), respectively. The outer edge of the flat tapered top surfaces 36, 38 is each arcuate in shape to follow the periphery of the tire portion 22. An interior border of each tapered cutout 28, 30 does not extend to a plane through the centerline of the bit holder 10 in this illustrated embodiment. A pair of notches 40, 42 (FIGS. 1, 2, 5, and 8) are formed into the bit holder body 12 and extend from the flat annular top surface 18 through the upper body portion 16 and the middle portion 20, terminating at a point within the middle portion 20. The notches 40, 42 provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body 12.

A generally rounded annular or generally cylindrical undercut 44 (FIGS. 5, 6, 8, 9, 11, and 12) extends from the tire portion 22 to a generally cylindrical or annular first segment 46 of the shank 14. The shank 14 axially depends from the flange 26 of the bit holder body 12. The bit holder body 12 and the shank 14 are axially aligned about a bit holder bore 56 (FIGS. 2, 7, and 10-12) that extends from the flat annular top surface 18 of the bit holder body 12 to a distal end 54 of the shank 14. The first segment 46 of the shank 14 axially extends from the flange 26 to a second segment 48 that is subjacent to the first segment 46. The second segment 48 can have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment 46 or towards the distal end 54 of the shank 14. A slot 58 extends from an upper termination 60 to the distal end 54 of the shank 14. Subjacent the second segment 48 is a third segment 50 that axially extends to a decreased diameter fourth segment 52 adjacent the distal end 54 of the shank 14. The fourth segment 52 is generally C-shaped when viewed from the distal end 54.

In this first illustrated embodiment, the third segment 50 of the shank 14 includes a plurality of ribs 61 and a plurality of notches or relief zones 62, shown in detail in FIG. 4, which are U-shaped in this first illustrated embodiment, located between each rib in the plurality of ribs 61. The plurality of ribs 61 and the plurality of notches or relief zones 62, in this exemplary implementation, are disposed solely on an outer surface of the third segment 50 of the shank 14. The plurality of notches 62 provide reduced surface contact between the third segment 50 and a complementary portion of a bore 72 (FIG. 7) of the base block 70, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without a plurality of notches or relief zones. The base block 70 comprises a base 74 and receiving portion 76, as shown in FIGS. 6 and 7. The base 74 can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion 76 includes the base block bore 72 that is symmetrical with the shank 14 along a

centerline. When assembled, after insertion of the shank 14 into the bore 72, the shank 14 of the bit holder 10 forms an interference fit with the bore 72 of the base block 70.

Referring to FIGS. 13-22, a second embodiment of a bit holder 100 comprises a bit holder body 102 and a shank 104 substantially the same as the bit holder 10 of the first embodiment. The bit holder body 102 is generally annular in shape and comprises an annular or generally cylindrical upper body portion 106 axially extending from a top surface 108, such as a flat annular top surface in this second illustrated embodiment. Subjacent the upper body portion 106 is a middle portion 110 that extends axially and radially outwardly to a radially extending generally cylindrical tire portion 112. The middle portion 110, in this illustrated embodiment, has an arcuate shape. In other embodiments, the middle portion 110 can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion 112 is a tapered portion 114 (FIGS. 14 and 18) that ends in a flange 116 (FIGS. 13, 14, 17, and 18), such as a flat annular flange, of the bit holder body 102. The tire portion 112 includes at least a pair of tapered cutouts 118, 120 (FIGS. 13, 17, and 20), or wedge-shaped undercuts, to provide access and leverage for a tool to extract the bit holder 100 from a base block 160 (FIGS. 17-22). The tapered cutouts 118, 120 are formed into the tire portion 112 and extend from the flange 116 subjacent to the tire portion 112. The tapered cutouts 118, 120 include a pair of parallel flat vertical inner surfaces 122, 124 (FIGS. 13, 17, and 20), respectively, and a pair of flat tapered top surfaces 126, 128 (FIGS. 13, 17, and 20), respectively. The outer edge of the flat tapered top surfaces 126, 128 is each arcuate in shape to follow the periphery of the tire portion 112. An interior border of each tapered cutout 118, 120 does not extend to a plane through the centerline of the bit holder 100 in this illustrated embodiment. A pair of notches 130, 132 (FIGS. 13, 15, 17, 19, and 20) are formed into the bit holder body 102 and extend from the flat annular top surface 108 through the upper body portion 106 and the middle portion 110, terminating at a point within the middle portion 110. The notches 130, 132 provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body 102.

A generally rounded annular or generally cylindrical undercut 134 (FIGS. 14 and 20) extends from the tire portion 112 to a generally cylindrical or annular first segment 136 of the shank 104. The shank 104 axially depends from the flange 116 of the bit holder body 102. The bit holder body 102 and the shank 104 are axially aligned about a bit holder bore 146 (FIGS. 13-15 and 19-22) that extends from the flat annular top surface 108 of the bit holder body 102 to a distal end 144 of the shank 104. The first segment 136 of the shank 104 axially extends from the flange 116 to a second segment 138 that is subjacent to the first segment 136. The second segment 138 can have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment 136 or towards the distal end 144 of the shank 104. A slot 148 extends from an upper termination 150 to the distal end 144 of the shank 104. Subjacent the second segment 138 is a third segment 140 that axially extends to a decreased diameter fourth segment 142 adjacent the distal end 144 of the shank 104. The fourth segment 142 is generally C-shaped when viewed from the distal end 144.

In this second illustrated embodiment, the third segment 140 of the shank 104 includes a plurality of ribs 151 and at least one notch or relief zone 152, shown in detail in FIG. 16, between each rib in the plurality of ribs 151. The plurality of ribs 151 and the at least one notches or relief zone 152, in this exemplary implementation, are disposed solely on an

outer surface of the third segment **140** of the shank **104**. The at least one notch or relief zone **152** provides reduced surface contact between the third segment **140** and a complementary portion of a bore **162** (FIG. **19**) of the base block **160**, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without at least one notch or relief zone. The base block **160** comprises a base **164** and receiving portion **166**, as shown in FIGS. **18** and **19**. The base **164** can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion **166** includes the base block bore **162** that is symmetrical with the shank **104** along a centerline. When assembled, after insertion of the shank **104** into the bore **162**, the shank **104** of the bit holder **100** forms an interference fit with the bore **162** of the base block **160**.

Referring to FIGS. **23-33**, a third embodiment of a bit holder **200** comprises a bit holder body **202** and a shank **204** substantially the same as the bit holder **10** of the first embodiment. The bit holder body **202** is generally annular in shape and comprises an annular or generally cylindrical upper body portion **206** axially extending from a top surface **208**, such as a flat annular top surface in this third illustrated embodiment. Subjacent the upper body portion **206** is a middle portion **210** that extends axially and radially outwardly to a radially extending generally cylindrical tire portion **212**. The middle portion **210**, in this illustrated embodiment, has an arcuate shape. In other embodiments, the middle portion **210** can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion **212** is a tapered portion **214** (FIGS. **24** and **29**) that ends in a flange **216** (FIGS. **24** and **29**), such as a flat annular flange, of the bit holder body **202**. The tire portion **212** includes at least a pair of tapered cutouts **218**, **220** (FIGS. **23**, **28**, and **31**), or wedge-shaped undercuts, to provide access and leverage for a tool to extract the bit holder **200** from a base block **260** (FIGS. **28-33**). The tapered cutouts **218**, **220** are formed into the tire portion **212** and extend from the flange **216** subjacent to the tire portion **212**. The tapered cutouts **218**, **220** include a pair of parallel flat vertical inner surfaces **222**, **224** (FIGS. **23**, **28**, and **31**), respectively, and a pair of flat tapered top surfaces **226**, **228** (FIGS. **23**, **28**, and **31**), respectively. The outer edge of the flat tapered top surfaces **226**, **228** is each arcuate in shape to follow the periphery of the tire portion **212**. An interior border of each tapered cutout **218**, **220** does not extend to a plane through the centerline of the bit holder **200** in this illustrated embodiment. A pair of notches **230**, **232** (FIGS. **23**, **26**, **28**, **30**, and **31**) are formed into the bit holder body **202** and extend from the flat annular top surface **208** through the upper body portion **206** and the middle portion **210**, terminating at a point within the middle portion **210**. The notches **230**, **232** provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body **202**.

A generally rounded annular or generally cylindrical undercut **234** (FIGS. **31** and **32**) extends from the tire portion **212** to a generally cylindrical or annular first segment **236** of the shank **204**. The shank **204** axially depends from the flange **216** of the bit holder body **202**. The bit holder body **202** and the shank **204** are axially aligned about a bit holder bore **246** (FIGS. **26** and **30-33**) that extends from the flat annular top surface **208** of the bit holder body **202** to a distal end **244** of the shank **204**. The first segment **236** of the shank **204** axially extends from the flange **216** to a second segment **238** that is subjacent to the first segment **236**. The second

segment **238** can have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment **236** or towards the distal end **244** of the shank **204**. A slot **248** extends from an upper termination **250** to the distal end **244** of the shank **204**. Subjacent the second segment **238** is a third segment **240** that axially extends to a decreased diameter fourth segment **242** adjacent the distal end **244** of the shank **204**. The fourth segment **242** is generally C-shaped when viewed from the distal end **244**.

In this third illustrated embodiment, the third segment **240** of the shank **204** includes a plurality of ribs **251** and a plurality of notches or relief zones **252**, shown in detail in FIGS. **25** and **27**, between each rib in the plurality of ribs **251**. The plurality of ribs **251** and the plurality of notches or relief zones **252**, in this exemplary implementation, are disposed solely on an outer surface of the third segment **240** of the shank **204**. The edges or sides of each rib in the plurality of ribs **251** are disposed at an acute angle, in this embodiment, to a plane through the centerline of the bit holder **200**. In other embodiments the edges or sides of each rib in the plurality of ribs **251** can be disposed at an obtuse angle to or perpendicular to a plane through the centerline of the bit holder **200**. The plurality of notches **252** provide reduced surface contact between the third segment **240** and a complementary portion of a bore **262** (FIG. **30**) of the base block **260**, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without at least one notch or relief zone. The base block **260** comprises a base **264** and receiving portion **266**, as shown in FIGS. **29** and **30**. The base **264** can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion **266** includes the base block bore **262** that is symmetrical with the shank **204** along a centerline. When assembled, after insertion of the shank **204** into the bore **262**, the shank **204** of the bit holder **200** forms an interference fit with the bore **262** of the base block **260**.

Referring to FIGS. **34-44**, a fourth embodiment of a bit holder **300** comprises a bit holder body **302** and a shank **304** axially depending from the bottom of the bit holder body **302**. The bit holder body **302** is generally annular in shape and comprises an annular or generally cylindrical upper body portion **306** axially extending from a top surface **308**, such as a flat annular top surface in this fourth illustrated embodiment. Subjacent the upper body portion **306** is a middle portion **310** that extends axially and radially outwardly to a radially extending generally cylindrical tire portion **312**. The middle portion **310**, in this illustrated embodiment, has an arcuate shape. In other embodiments, the middle portion **310** can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion **312** is a tapered portion **314** (FIGS. **35** and **40**) that ends in a flange **316** (FIGS. **35**, **39**, and **40**), such as a flat annular flange, of the bit holder body **302**. The tire portion **312** includes at least a pair of tapered cutouts **318**, **320** (FIGS. **34**, **39**, and **42**), or wedge-shaped undercuts to provide access and leverage for a tool to extract the bit holder **300** from a base block **360** (FIGS. **39-44**). The tapered cutouts **318**, **320** are formed into the tire portion **312** and extend from the flange **316** subjacent to the tire portion **312**. The tapered cutouts **318**, **320** include a pair of parallel flat vertical inner surfaces **322**, **324** (FIGS. **34**, **39**, and **42**), respectively, and a pair of flat tapered top surfaces **326**, **328** (FIGS. **34**, **39**, and **42**), respectively. The outer edge of the flat tapered top surfaces **326**, **328** is each arcuate in shape to

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follow the periphery of the tire portion 312. An interior border of each tapered cutout 318, 320 does not extend to a plane through the centerline of the bit holder 300 in this illustrated embodiment. A pair of notches 330, 332 (FIGS. 34, 39, 41, and 42) are formed into the bit holder body 302 and extend from the flat annular top surface 308 through the upper body portion 306 and the middle portion 310, terminating at a point within the middle portion 310. The notches 330, 332 provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body 302.

A generally rounded annular or generally cylindrical undercut 334 (FIGS. 42 and 43) extends from the tire portion 312 to a generally cylindrical or annular increased diameter first segment 336 of the shank 304. The shank 304 axially depends from the flange 316 of the bit holder body 302. The bit holder body 302 and the shank 304 are axially aligned about a bit holder bore 346 (FIGS. 37 and 41-44) that extends from the flat annular top surface 308 of the bit holder body 302 to a distal end 344 of the shank 304. The first segment 336 of the shank 304 axially extends from the flange 316 to a shoulder 337 that is subjacent to the first segment 336. A decreased diameter second segment 338, subjacent the shoulder 337, axially extends to an increased diameter third segment 340. The second segment 338 can have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment 336 or towards the distal end 344 of the shank 304. A slot 348 extends from an upper termination 350 to the distal end 344 of the shank 304. A decreased diameter fourth segment 342 axially extends from the third segment 340 to a location adjacent the distal end 344 of the shank 304. The fourth segment 342 is generally C-shaped when viewed from the distal end 344.

In this fourth illustrated embodiment, the third segment 340 of the shank 304 includes a plurality of ribs 351 and a plurality of notches or relief zones 352, shown in detail in FIGS. 36 and 38, which are U-shaped in this fourth illustrated embodiment, located between each rib in the plurality of ribs 351. The plurality of ribs 351 and the plurality of notches or relief zones 352, in this exemplary implementation, are disposed solely on an outer surface of the third segment 340 of the shank 304. The plurality of notches 352 provide reduced surface contact between the third segment 340 and a complementary portion of a bore 362 (FIG. 41) of the base block 360, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without a plurality of notches or relief zones. The base block 360 comprises a base 364 and receiving portion 366, as shown in FIGS. 40 and 41. The base 364 can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion 366 includes the base block bore 362 that is symmetrical with the shank 304 along a centerline. When assembled, after insertion of the shank 304 into the bore 362, the shank 304 of the bit holder 300 forms an interference fit with the bore 362 of the base block 360.

Bits and their respective bit holders may be combined into a unitary structure. A first illustrated embodiment of a unitary bit/holder 370, shown in FIGS. 67-70, comprises the fourth illustrated embodiment of the bit holder 300 and a bit 372 which are assembled together into a unitary structure to form the unitary bit/holder 370. In other embodiments, the unitary bit/holder 370 may comprise the first illustrated embodiment of the bit holder 10, the second illustrated embodiment of the bit holder 100, the third illustrated embodiment of the bit holder 200, the fifth illustrated

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embodiment of the bit holder 400, or the sixth illustrated embodiment of the bit holder 500 assembled together with the bit 372 to form the unitary structure of the into a unitary bit/holder. All these members are brazed in their respective recesses to form a generally unitary bit/holder that fits in a bit holder block bore. The unitary bit/holder 370 of this first illustrated embodiment is then assembled into the base block 360, which comprises insertion of the shank 304 into the bore 362 of the base block 360, forming an interference fit between the shank 304 of the bit holder 300 and the bore 362 of the base block 360. In other embodiments, the unitary bit/holder may be assembled into the base block 70, base block 160, base block 260, base block 460, or base block 560.

Referring to FIGS. 45-55, a fifth embodiment of a bit holder 400 comprises a bit holder body 402 and a shank 404 substantially the same as the bit holder 300 of the fourth embodiment. The bit holder body 402 is generally annular in shape and comprises an annular or generally cylindrical upper body portion 406 axially extending from a top surface 408, such as a flat annular top surface in this fifth illustrated embodiment. Subjacent the upper body portion 406 is a middle portion 410 that extends axially and radially outwardly to a radially extending generally cylindrical tire portion 412. The middle portion 410, in this illustrated embodiment, has an arcuate shape. In other embodiments, the middle portion 410 can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion 412 is a tapered portion 414 (FIGS. 46 and 51) that ends in a flange 416 (FIGS. 45, 46, 50, and 51), such as a flat annular flange, of the bit holder body 402. The tire portion 412 includes at least a pair of tapered cutouts 418, 420 (FIGS. 45, 50, and 53), or wedge-shaped undercuts to provide access and leverage for a tool to extract the bit holder 400 from a base block 460 (FIGS. 50-55). The tapered cutouts 418, 420 are formed into the tire portion 412 and extend from the flange 416 subjacent to the tire portion 412. The tapered cutouts 418, 420 include a pair of parallel flat vertical inner surfaces 422, 424 (FIGS. 45, 50, and 53), respectively, and a pair of flat tapered top surfaces 426, 428 (FIGS. 45, 50, and 53), respectively. The outer edge of the flat tapered top surfaces 426, 428 is each arcuate in shape to follow the periphery of the tire portion 412. An interior border of each tapered cutout 418, 420 does not extend to a plane through the centerline of the bit holder 400 in this illustrated embodiment. A pair of notches 430, 432 (FIGS. 45, 48, 50, 52, 53, and 55) are formed into the bit holder body 402 and extend from the flat annular top surface 408 through the upper body portion 406 and the middle portion 410, terminating at a point within the middle portion 410. The notches 430, 432 provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body 402.

A generally rounded annular or generally cylindrical undercut 434 (FIGS. 53 and 54) extends from the tire portion 412 to a generally cylindrical or annular increased diameter first segment 436 of the shank 404. The shank 404 axially depends from the flange 416 of the bit holder body 402. The bit holder body 402 and the shank 404 are axially aligned about a bit holder bore 446 (FIGS. 48 and 52-55) that extends from the flat annular top surface 408 of the bit holder body 402 to a distal end 444 of the shank 404. The first segment 436 of the shank 404 axially extends from the flange 416 to a shoulder 437 that is subjacent to the first segment 436. A decreased diameter second segment 438, subjacent the shoulder 437, axially extends to an increased diameter third segment 440. The second segment 438 can

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have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment 436 or towards the distal end 444 of the shank 404. A slot 448 extends from an upper termination 450 to the distal end 444 of the shank 404. A decreased diameter fourth segment 442 axially extends from the third segment 440 to a location adjacent the distal end 444 of the shank 404. The fourth segment 442 is generally C-shaped when viewed from the distal end 444.

In this fifth illustrated embodiment, the third segment 440 of the shank 404 includes a plurality of ribs 451 and at least one notch or relief zone 452, shown in detail in FIGS. 47 and 49, between each rib in the plurality of ribs 451. The plurality of ribs 451 and the at least one notches or relief zone 452, in this exemplary implementation, are disposed solely on an outer surface of the third segment 440 of the shank 404. The at least one notch or relief zone 452 provides reduced surface contact between the third segment 440 and a complementary portion of a bore 462 (FIG. 52) of the base block 460, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without a plurality of notches or relief zones. The base block 460 comprises a base 464 and receiving portion 466, as shown in FIGS. 51 and 52. The base 464 can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion 466 includes the base block bore 462 that is symmetrical with the shank 404 along a centerline. When assembled, after insertion of the shank 404 into the bore 462, the shank 404 of the bit holder 400 forms an interference fit with the bore 462 of the base block 460.

Referring to FIGS. 56-66, a sixth embodiment of a bit holder 500 comprises a bit holder body 502 and a shank 504 substantially the same as the bit holder 300 of the fourth embodiment. The bit holder body 502 is generally annular in shape and comprises an annular or generally cylindrical upper body portion 506 axially extending from a top surface 508, such as a flat annular top surface in this sixth illustrated embodiment. Subjacent the upper body portion 506 is a middle portion 510 that extends axially and radially outwardly to a radially extending generally cylindrical tire portion 512. The middle portion 510, in this illustrated embodiment, has an arcuate shape. In other embodiments, the middle portion 510 can have a frustoconical shape, a convex shape, a concave shape, or an arcuate shape.

Adjacent the tire portion 512 is a tapered portion 514 (FIGS. 57 and 62) that ends in a flange 516 (FIGS. 57, 61, and 62), such as a flat annular flange, of the bit holder body 502. The tire portion 512 includes at least a pair of tapered cutouts 518, 520 (FIGS. 56, 61, and 64), or wedge-shaped undercuts to provide access and leverage for a tool to extract the bit holder 500 from a base block 560 (FIGS. 61-66). The tapered cutouts 518, 520 are formed into the tire portion 512 and extend from the flange 516 subjacent to the tire portion 512. The tapered cutouts 518, 520 include a pair of parallel flat vertical inner surfaces 522, 524 (FIGS. 56, 61, and 64), respectively, and a pair of flat tapered top surfaces 526, 528 (FIGS. 56, 61, and 64), respectively. The outer edge of the flat tapered top surfaces 526, 528 is each arcuate in shape to follow the periphery of the tire portion 512. An interior border of each tapered cutout 518, 520 does not extend to a plane through the centerline of the bit holder 500 in this illustrated embodiment. A pair of notches 530, 532 (FIGS. 56, 59, 61, 63, 64, and 66) are formed into the bit holder body 502 and extend from the flat annular top surface 508 through the upper body portion 506 and the middle portion

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510, terminating at a point within the middle portion 510. The notches 530, 532 provide access and leverage for a tool to extract, or knock out, a bit from the bit holder body 502.

A generally rounded annular or generally cylindrical undercut 534 (FIGS. 64 and 65) extends from the tire portion 512 to a generally cylindrical or annular increased diameter first segment 536 of the shank 504. The shank 504 axially depends from the flange 516 of the bit holder body 502. The bit holder body 502 and the shank 504 are axially aligned about a bit holder bore 546 (FIGS. 59 and 63-66) that extends from the flat annular top surface 508 of the bit holder body 502 to a distal end 544 of the shank 504. The first segment 536 of the shank 504 axially extends from the flange 516 to a shoulder 537 that is subjacent to the first segment 536. A decreased diameter second segment 538, subjacent the shoulder 537, axially extends to an increased diameter third segment 540. The second segment 538 can have a generally cylindrical shape, an arcuate shape, or can be tapered towards the first segment 536 or towards the distal end 544 of the shank 504. A slot 548 extends from an upper termination 550 to the distal end 544 of the shank 504. A decreased diameter fourth segment 542 axially extends from the third segment 540 to a location adjacent the distal end 544 of the shank 504. The fourth segment 542 is generally C-shaped when viewed from the distal end 544.

In this sixth illustrated embodiment, the third segment 540 of the shank 504 includes a plurality of ribs 551 and a plurality of notches or relief zones 552, shown in detail in FIGS. 58 and 60, between each rib in the plurality of ribs 551. The plurality of ribs 551 and the plurality of notches or relief zones 552, in this exemplary implementation, are disposed solely on an outer surface of the third segment 540 of the shank 504. The edges or sides of each rib in the plurality of ribs 551 are disposed at an acute angle, in this embodiment, to a plane through the centerline of the bit holder 500. In other embodiments the edges or sides of each rib in the plurality of ribs 551 can be disposed at an obtuse angle to or perpendicular to a plane through the centerline of the bit holder 500. The plurality of notches 552 provide reduced surface contact between the third segment 540 and a complementary portion of a bore 562 (FIG. 63) of the base block 560, which yields a more evenly distributed and more highly concentrated force per segment when compared to a bit holder having a shank with a segment with no material removed, i.e., without a plurality of notches or relief zones. The base block 560 comprises a base 564 and receiving portion 566, as shown in FIGS. 62 and 63. The base 564 can be flat or slightly concave to fit a drum or additional mounting plates on which a singular or a plurality of base blocks can be mounted. The receiving portion 566 includes the base block bore 562 that is symmetrical with the shank 504 along a centerline. When assembled, after insertion of the shank 504 into the bore 562, the shank 504 of the bit holder 500 forms an interference fit with the bore 562 of the base block 560.

As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or". That is, unless specified otherwise, or clear from context, "X includes A or B" is intended to mean any of the natural inclusive permutations. That is, if X includes A; X includes B; or X includes both A and B, then "X includes A or B" is satisfied under any of the foregoing instances. In addition, "X includes at least one of A and B" is intended to mean any of the natural inclusive permutations. That is, if X includes A; X includes B; or X includes both A and B, then "X includes at least one of A and B" is satisfied under any of the foregoing instances. The articles "a" and "an" as used in this

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application and the appended claims should generally be construed to mean “one or more” unless specified otherwise or clear from context to be directed to a singular form. Moreover, use of the term “an implementation” or “one implementation” throughout is not intended to mean the same embodiment, aspect or implementation unless described as such.

While the present disclosure has been described in connection with certain embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims, which scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures as is permitted under the law.

What is claimed is:

1. A bit holder comprising:
 - a forward body portion having a bottom;
 - a generally cylindrical hollow shank depending axially from the bottom of the forward body portion, the shank comprising:
 - a first segment adjacent a distal end of the shank, the first segment comprising a plurality of ribs solely around a first outer surface of the first segment;
 - a slot axially extending from the distal end of the shank to a slot termination disposed in a second segment adjacent the first segment, the second segment comprising a smooth second outer surface, a first diameter of the first segment subjacent the second segment greater than a second diameter of the second segment; and
 - a bore axially extending from a forward end of the forward body portion to the distal end of the shank, a portion of the bore internally adjacent the first segment, the portion including a smooth surface.
2. The bit holder of claim 1, further comprising:
 - at least one notch disposed between each rib of the plurality of ribs.
3. The bit holder of claim 2, wherein the at least one notch is U-shaped.
4. The bit holder of claim 2, wherein the at least one notch includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right angle to a plane through a centerline of the bit holder.
5. The bit holder of claim 1, wherein each rib in the plurality of ribs includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right angle to a plane through a centerline of the bit holder.
6. The bit holder of claim 1, wherein the plurality of ribs is adapted to reduce a surface contact between the segment and a complementary portion of a bore of a base block and to provide a more evenly distributed and more highly concentrated force per segment.
7. A unitary bit/holder comprising:
 - a forward body portion having a bottom;
 - a generally cylindrical hollow shank depending axially from the bottom of the forward body portion, the shank comprising:
 - a first segment adjacent a distal end of the shank, the first segment comprising a plurality of ribs solely around a first outer surface of the first segment;
 - a slot axially extending from the distal end of the shank to a slot termination disposed in a second segment adjacent the first segment, the second segment comprising a smooth second outer surface, a first diam-

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- eter of the first segment subjacent the second segment greater than a second diameter of the second segment; and
 - a bore axially extending from a forward end of the forward body portion to the distal end of the shank, a portion of the bore internally adjacent the first segment, the portion including a smooth surface.
8. The unitary bit/holder of claim 7, further comprising:
 - at least one notch disposed between each rib of the plurality of ribs.
 9. The unitary bit/holder of claim 8, wherein the at least one notch is U-shaped.
 10. The unitary bit/holder of claim 8, wherein the at least one notch includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right angle to a plane through a centerline of the unitary bit/holder.
 11. The unitary bit/holder of claim 7, wherein each rib in the plurality of ribs includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right angle to a plane through a centerline of the unitary bit/holder.
 12. The unitary bit/holder of claim 7, wherein the plurality of ribs is adapted to reduce a surface contact between the segment and a complementary portion of a bore of a base block and to provide a more evenly distributed and more highly concentrated force per segment.
 13. A combination for a bit assembly comprising:
 - one of a unitary bit/holder and a bit holder comprising:
 - a forward body portion having a bottom;
 - a generally cylindrical hollow shank depending axially from the bottom of the forward body portion, the shank comprising:
 - a first segment adjacent a distal end of the shank, the first segment comprising a plurality of ribs solely around a first outer surface of the first segment;
 - a slot axially extending from the distal end of the shank to a slot termination disposed in a second segment adjacent the first segment, the second segment comprising a smooth second outer surface, a first diameter of the first segment subjacent the second segment greater than a second diameter of the second segment;
 - a shank bore axially extending from a forward end of the forward body portion to the distal end of the shank, a portion of the shank bore internally adjacent the first segment, the portion including a smooth surface; and
 - a base block comprising a base block bore adapted to make an interference contact with at least the first segment of the shank, the plurality of ribs adapted to reduce a surface contact between the first segment and a complementary portion of the base block bore of the base block and to provide a more evenly distributed and more highly concentrated force per segment.
 14. The combination of claim 13, further comprising:
 - at least one notch disposed between each rib of the plurality of ribs.
 15. The combination of claim 14, wherein the at least one notch is U-shaped.
 16. The combination of claim 14, wherein the at least one notch includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right angle to a plane through a centerline of at least one of the unitary bit/holder and the bit holder.
 17. The combination of claim 13, wherein each rib in the plurality of ribs includes a pair of sides, each side disposed at at least one of an acute angle, an obtuse angle, and a right

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angle to a plane through a centerline of at least one of the
unitary bit/holder and the bit holder.

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