US 20110015634A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2011/0015634 A1

(43) Pub. Date: Jan. 20, 2011

Smith et al.

(54) MODULAR REAMING SYSTEM FOR FEMORAL REVISION

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(21) Appl. No.: **12/502,833**

(22) Filed: **Jul. 14, 2009**

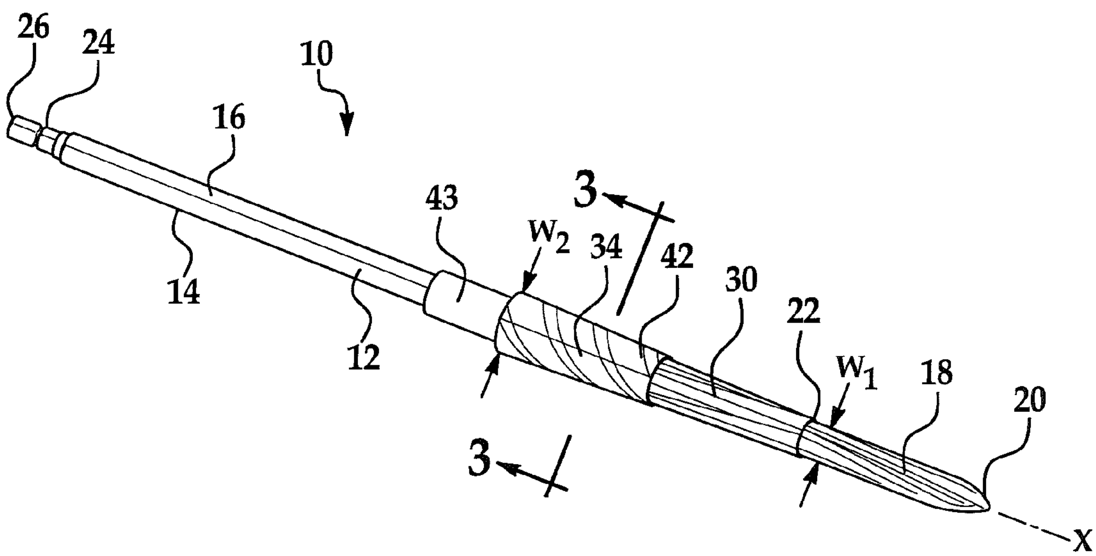
Publication Classification

(51) Int. Cl.
A61B 17/00 (2006.01)

(52) U.S. Cl. 606/80

(57) ABSTRACT

A modular reaming system for reaming a plurality of pockets in an anatomical feature extends along a longitudinal axis. The system includes a first reamer in a first position on the longitudinal axis, and the first reamer reams a first pocket in the anatomical feature. The system further includes a second reamer that is removably coupled to the first reamer in a second position on the longitudinal axis. The second reamer reams a second pocket in the anatomical feature. The second reamer is keyed against rotation relative to the first reamer to ream the first and second pockets substantially simultaneously.



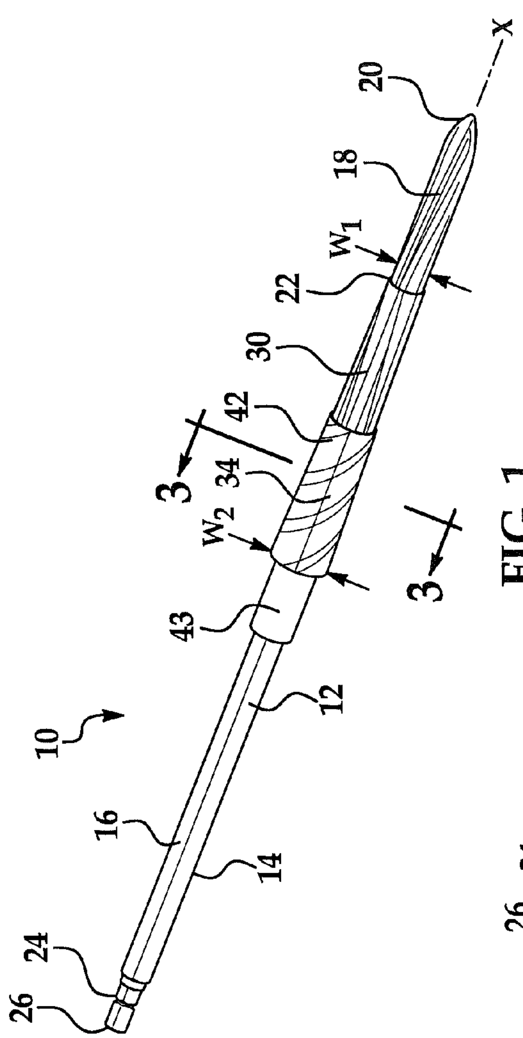
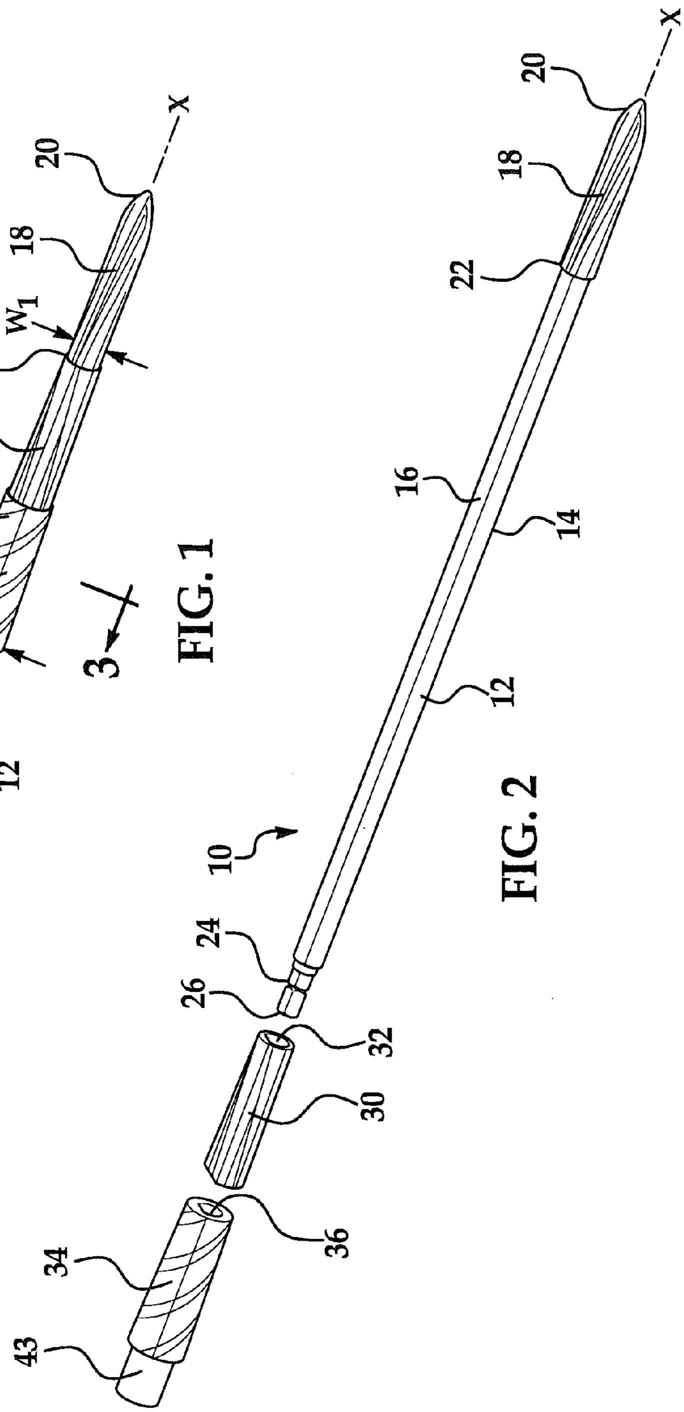

X
20
18
W1
22
30
42
3
34
W2
3
43
12
10
16
14
24
26

FIG. 1


X
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18
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16
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32
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36
34
43

FIG. 2

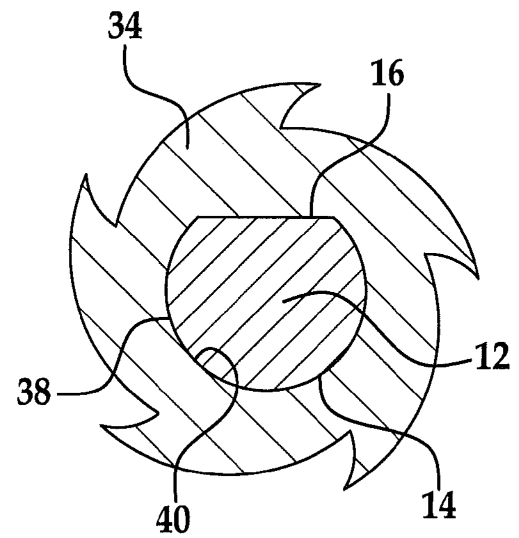


FIG. 3

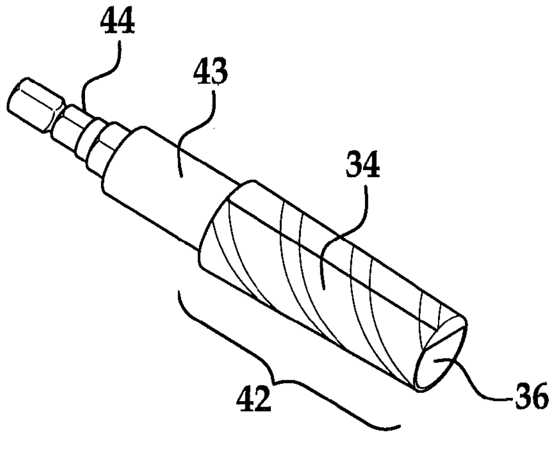


FIG. 4

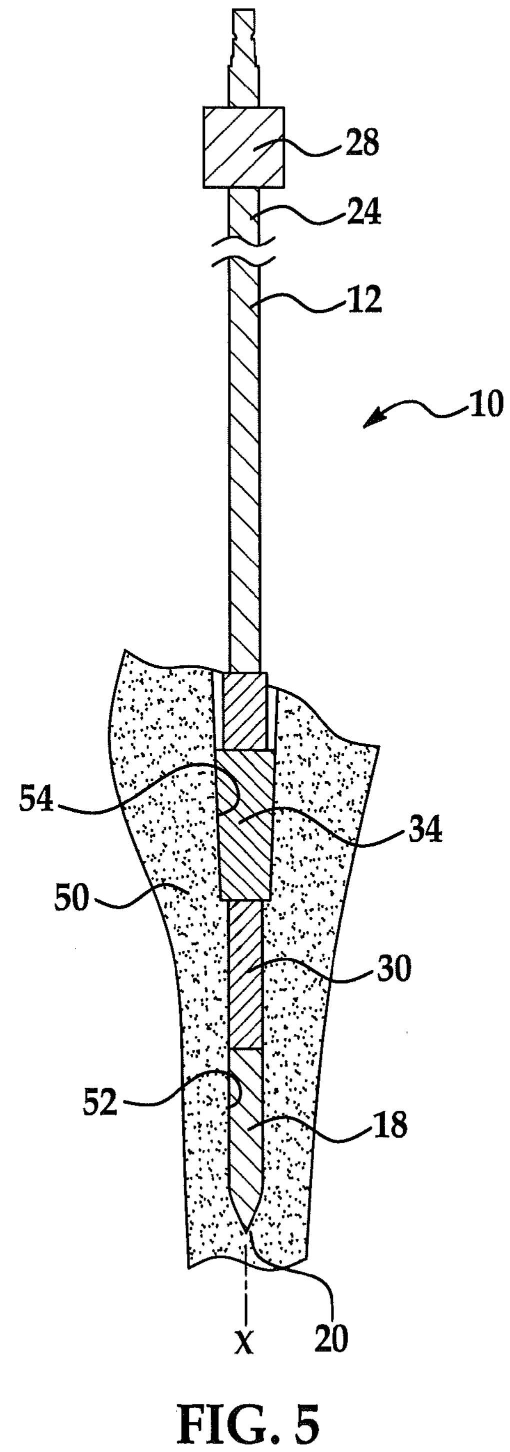
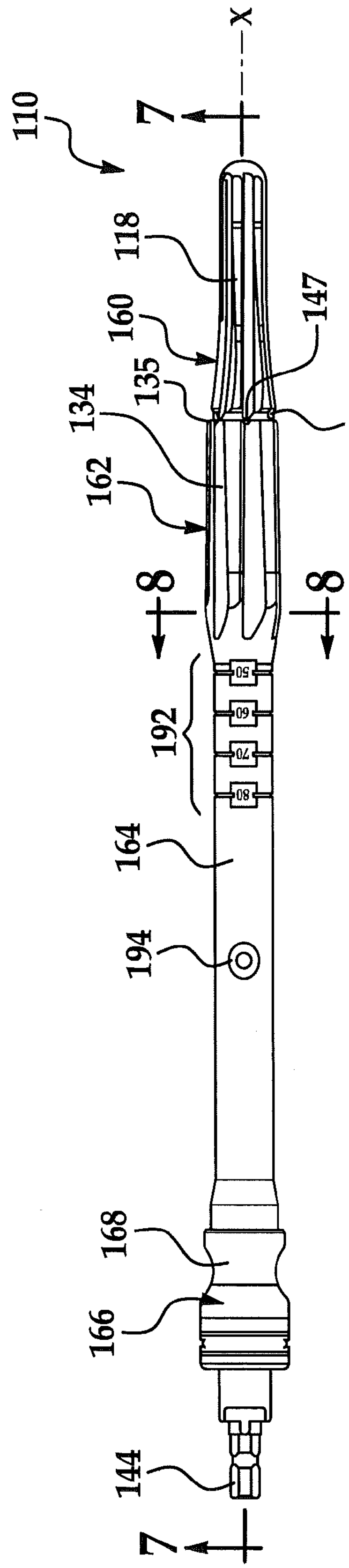


FIG. 5


X
7
110
118
147
160
135
134
137
162
8
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50
60
70
80
192
164
194
168
166
144
7

FIG. 6

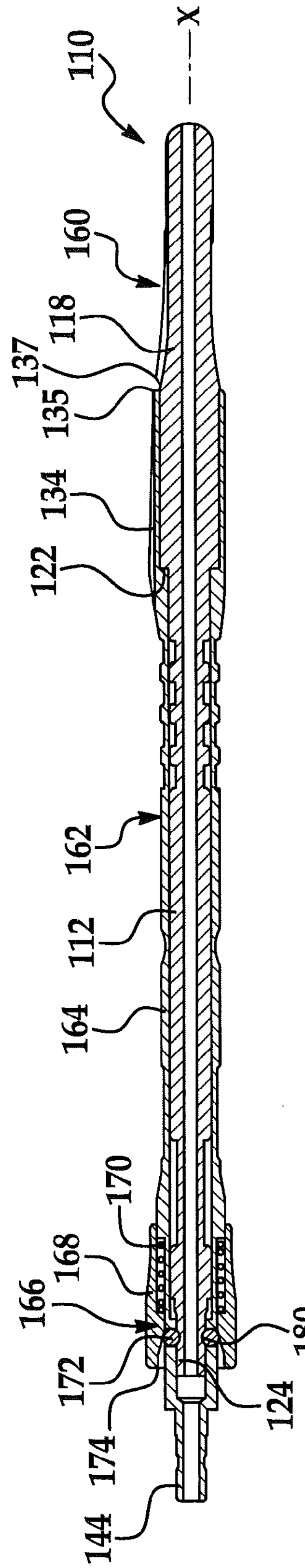

X
110
160
118
137
135
134
122
162
112
164
170
168
166
172
174
180
124
144

FIG. 7

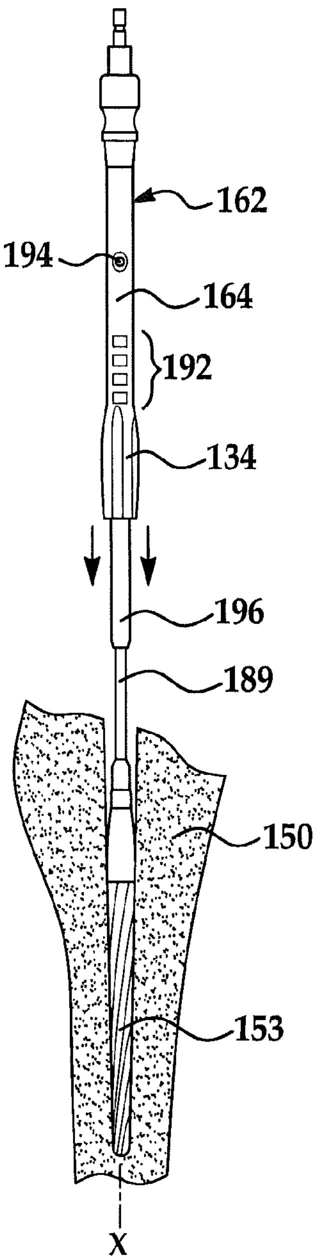


FIG. 9

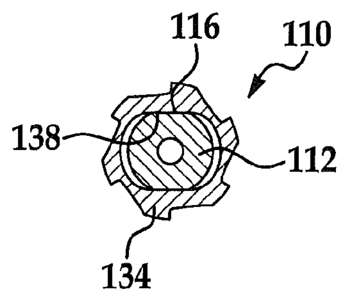


FIG. 8

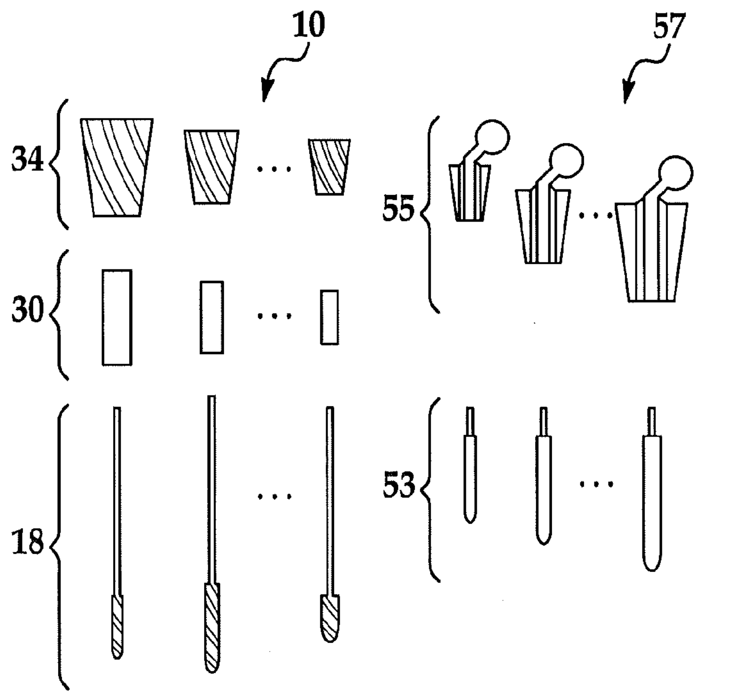
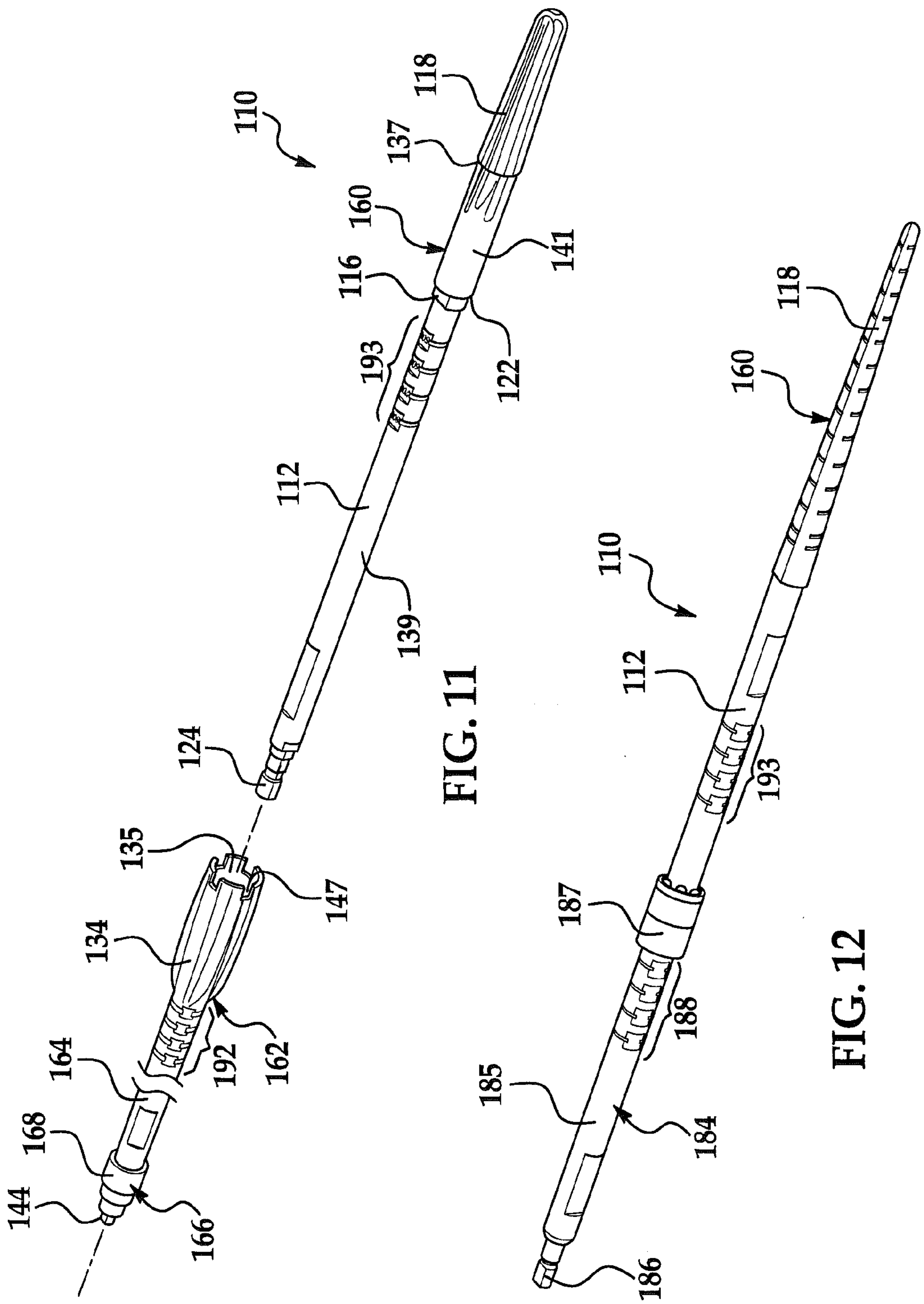


FIG. 10


110
118
137
160
141
116
122
193
112
139
124
135
147
134
162
192
164
168
144
166
118
160
110
112
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187
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184
186

FIG. 11

FIG. 12

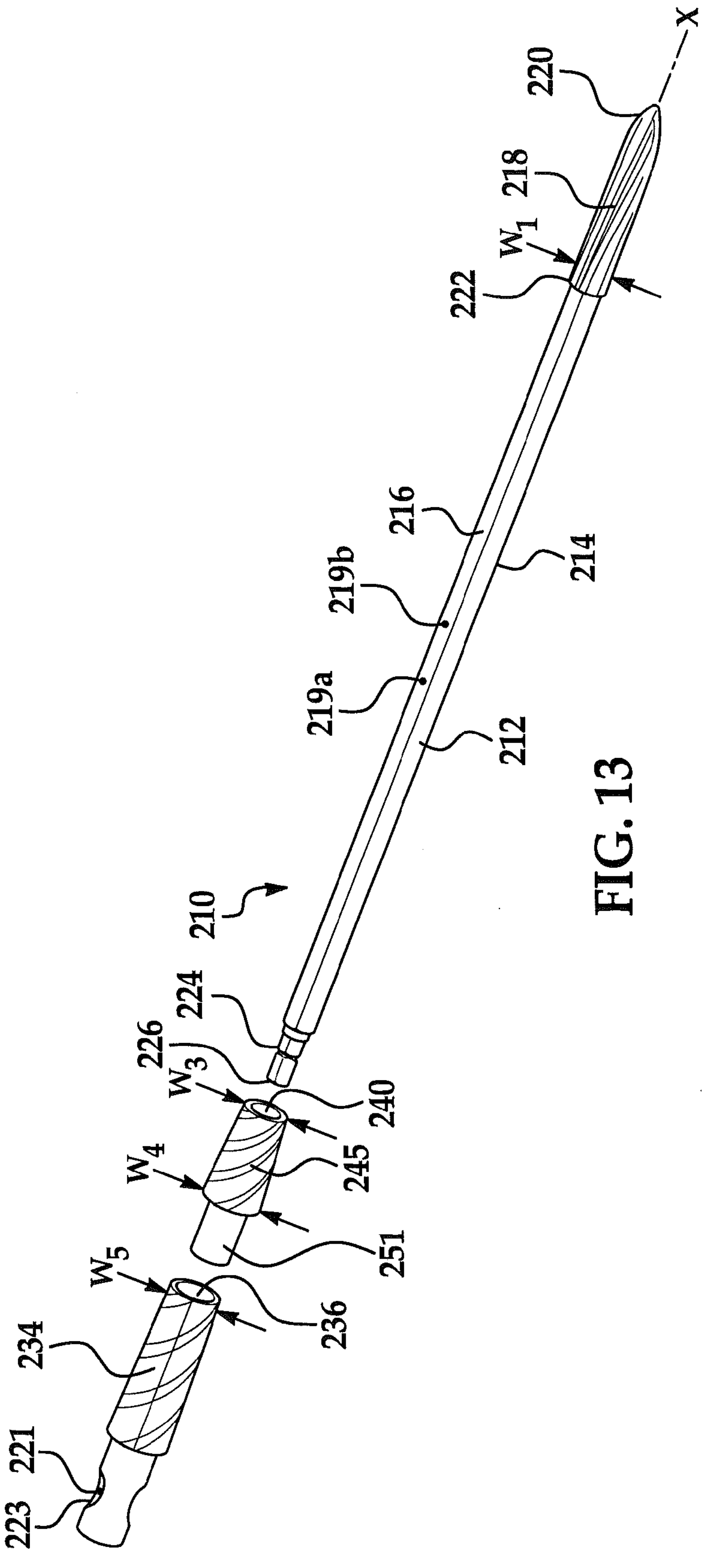
X
220
218
W_1
222
216
214
219b
219a
212
210
224
226
W_3
240
245
W_4
251
W_5
236
234
221
223

FIG. 13

MODULAR REAMING SYSTEM FOR FEMORAL REVISION

FIELD

[0001] The following relates to a reaming tool and, more specifically, relates to a modular reaming system for a femoral revision procedure.

BACKGROUND

[0002] The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

[0003] Prosthetic joints can reduce pain due to arthritis, deterioration, deformation, and the like. Prosthetic hip joints often include a femoral component that is fixed to the patient's femur and an acetabular cup that is fixed within the patient's pelvis. More specifically, the femoral component can include a stem that extends into the patient's resected femur and a rounded head that is received within the acetabular cup. The head can articulate within the cup so as to moveably couple the femoral component within the acetabular cup.

[0004] Typically, a superior portion of the femur is partially reamed to create a reamed opening that receives the femoral component of the prosthetic hip joint. In some cases, multiple reamers of varying widths are used at different portions of the femur such that the resultant reamed opening varies in width and to match the geometry of the femoral component of the prosthetic joint. As such, the reaming process ensures that the femoral component properly fits within and fixes to the femur.

[0005] Although reaming systems have been adequate for their intended purposes, these systems can be improved. For instance, reaming processes can be time consuming and inconvenient, especially if multiple reamers are needed for reaming different portions of the femur.

SUMMARY

[0006] A modular reaming system is disclosed for reaming a plurality of pockets in an anatomical feature. The system extends along a longitudinal axis. The system also includes a first reamer in a first position on the longitudinal axis, and the first reamer reams a first pocket in the anatomical feature. The system further includes a second reamer that is removably coupled to the first reamer in a second position on the longitudinal axis. The second reamer reams a second pocket in the anatomical feature. The second reamer is keyed against rotation relative to the first reamer to ream the first and second pockets substantially simultaneously.

[0007] In another aspect, a modular reaming system is disclosed that includes a first drive coupler, a second drive coupler, and a first reamer driven in rotation by the first drive coupler. The system also includes a second reamer driven in rotation by the second drive coupler or driven in rotation by the first drive coupler.

[0008] In addition, a method of reaming a femur is disclosed that includes removably coupling a proximal reamer to a shaft fixed to a distal reamer. The method further includes retaining the proximal reamer against rotation relative to the distal reamer. Also, the method includes rotating the shaft in a single direction to substantially simultaneously ream a proximal pocket in the femur with the proximal reamer and a distal pocket in the femur with the distal reamer.

[0009] Moreover, a reaming system is disclosed that reams a femur for implantation of a femoral component of a prosthetic joint. The reaming system includes a distal member extending along a longitudinal axis. The distal member includes a first shaft, a distal reamer, and a first drive coupler. The distal reamer and the first drive coupler are fixed to opposite ends of the first shaft. The distal reamer reams a distal pocket in the femur, and the first shaft includes a first flat surface. The system further includes a proximal member including a second shaft, a proximal reamer, and a second drive coupler. The proximal reamer and the second drive coupler are fixed to opposite ends of the second shaft. The proximal reamer reams a proximal pocket in the femur, and the second shaft includes a second flat surface. The proximal member removably receives the first drive coupler and the first shaft to removably couple the proximal and distal members. The distal reamer extends out of the proximal member, and the first flat surface mates with the second flat surface to couple the distal member and the proximal member against rotation relative to each other to ream the first and second pockets substantially simultaneously. Furthermore, the system includes a retention member that limits movement of the proximal member axially relative to the distal member.

[0010] In still another aspect, a modular reaming system for reaming a plurality of pockets in an anatomical feature is disclosed. The modular reaming system includes a longitudinal axis and a first reamer in a first position on the longitudinal axis. The first reamer reams a first pocket in the anatomical feature. The system further includes a second reamer that is removably coupled to the first reamer in a second position on the longitudinal axis. The second reamer reams a second pocket in the anatomical feature. Moreover, the system includes a means for coupling the second reamer against rotation relative to the first reamer to ream the first and second pockets substantially simultaneously.

[0011] Still further, a modular reaming system for reaming a plurality of pockets in an anatomical feature is disclosed. The modular reaming system includes a longitudinal axis and a first member with a first reamer that reams a first pocket in the anatomical feature. The first member includes a first surface. The system further includes a second member with a second reamer that reams a second pocket in the anatomical feature. The second reamer is removably coupled to the first member. The second member includes a second surface that is complementary to the first surface so that rotation of one of the first and second members about the longitudinal axis causes rotation of the other of the first and second members for substantially simultaneous formation of the first and second pockets.

[0012] Further areas of applicability will become apparent from the description provided herein. It should be understood that the description and specific examples are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0013] The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

[0014] FIG. **1** is an isometric view of an exemplary embodiment of a reaming system according to various teachings of the present disclosure;

[0015] FIG. **2** is an exploded isometric view of the reaming system of FIG. **1** ;

[0016] FIG. **3** is a sectional view of the reaming system taken along the line **3-3** of FIG. **1**;

[0017] FIG. **4** is an isometric view of the reaming system of FIG. **1** in a different configuration;

[0018] FIG. **5** is a sectional view of the reaming system of FIG. **1** shown during a reaming procedure;

[0019] FIG. **6** is a side view of a reaming system according to another exemplary embodiment;

[0020] FIG. **7** is a sectional view of the reaming system taken along the line **7-7** of FIG. **6**;

[0021] FIG. **8** is a sectional view of the reaming system taken along the line **8-8** of FIG. **6**;

[0022] FIG. **9** is a side view of a portion of the reaming system of FIG. **6** shown during use;

[0023] FIG. **10** is a view of a modular reaming system or kit shown in association with a corresponding modular prosthetic implant system;

[0024] FIG. **11** is a perspective, exploded view of the reaming system of FIG. **6**;

[0025] FIG. **12** is a perspective view of the reaming system of FIG. **6** shown with an extension member; and

[0026] FIG. **13** is an exploded isometric view of a reaming system according to another exemplary embodiment.

DETAILED DESCRIPTION

[0027] The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features. Moreover, while the reaming system described herein is described in relation to reaming an intramedullary (IM) canal of a femur, the reaming system can be used in any other area of a patient as well.

[0028] Referring initially to FIGS. **1** and **2**, a reaming system **10** is illustrated according to various exemplary embodiments of the present disclosure. The reaming system **10** can include a shaft **12**. The shaft **12** can be elongate and can have a substantially straight longitudinal axis X. Furthermore, the shaft **12** can have a rounded portion **14** and a flat surface **16** as shown in the sectional view of FIG. **3**. More specifically, the shaft **12** can be partially circular in cross section due to the rounded portion **14**, and the flat surface **16** can be included on a chord of the cross section. The rounded portion **14** and the flat surface **16** can both extend along the majority of the shaft **12** in a direction substantially parallel to the longitudinal axis X. Also, the flat surface **16** can be located on only a portion of the shaft **12**.

[0029] The system **10** can also include a first reamer **18**. The first reamer **18** can be disposed at a first (distal) end **20** of the shaft **12**. The first reamer **18** can be substantially cylindrical with a pointed end and can be fluted so as to perform reaming operations, for instance, in bone or other suitable materials. The first reamer **18** can be fluted in either the left-hand or right-hand direction about the axis X. In some embodiments, the first reamer **18** is integrally coupled to the shaft **12** so as to be monolithic; however, the first reamer **18** can be removably coupled to the shaft **12** in some embodiments. The shaft **12** can also include a shoulder **22** adjacent the first reamer **18**. As shown, the shoulder **22** can be generally wider than surrounding portions of the shaft **12**.

[0030] The shaft **12** can also include a first drive coupler **24**. The first drive coupler **24** can be coupled to the shaft **12** at a second (proximal) end **26** thereof. The drive coupler **24** can include any suitable features for removably coupling the shaft **12** to a driving device **28** (FIG. **5**). The driving device **28** can be a motor powered by electricity, pneumatics, hydraulics, etc. The driving device **28** can also be powered by manual input. As such, the driving device **28** can drivingly rotate the shaft **12** about the axis X.

[0031] As shown in FIGS. **1** and **2**, the system **10** can further include one or more modular spacers **30**. Each spacer **30** can be tubular in shape and can have a width (i.e., diameter) substantially equal to that of the first reamer **18**. The spacer **30** can include grooves so that, during reaming operation, materials removed by the first reamer **18** can move along the axis X and pass the spacer **30**. The spacer **30** can also include an aperture **32**, such as a through-hole that extends therethrough. In the embodiment shown, the aperture **32** can slideably receive the second end **26** of the shaft **12** and can slide generally parallel to the axis X on the shaft **12**. As will be described, the aperture **32** can be shaped so as to be keyed against rotation about the axis X relative to the shaft **12**. As the spacer **30** slides toward the first reamer **18**, the spacer can eventually abut the shoulder **22** of the shaft **12**. As such, the shoulder **22** can limit movement of the spacer **30** along the axis X in a direction generally toward the first reamer **18**. The system **10** can also include a separate retention member, such as a biased detent pin or other quick-connect coupling (not shown), that limits movement of spacer **30** along the axis X in a direction generally away from the first reamer **18**. As will be described, the spacer **30** maintains the first reamer **18** a predetermined distance away from other components of the system **10**, and this predetermined distance can be varied on a patient-by-patient basis by interchanging the spacer **30** with another.

[0032] Furthermore, the system **10** can additionally include a second reamer **34**. The second reamer **34** can be generally tubular in shape and can be fluted in order to remove and reduce material during reaming operations. The second reamer **34** can be fluted in either the left-hand or right-hand direction about the axis X; however, it will be appreciated that the second reamer **34** is fluted in the same direction as the first reamer **18**. Also, the second reamer **34** can include an aperture **36**, such as a through-hole, that extends therethrough. The aperture **36** can include a rounded portion **40** and a flat surface **38** as shown in FIG. **3**. The aperture **36** can slideably receive the shaft **12** in order to couple the second reamer **34** to the shaft **12**. More specifically, the flat surface **38** of the second reamer **34** can mate with the flat surface **16** of the shaft **12**, and the rounded portion **40** of the second reamer **34** can mate with the rounded portion **14** of the shaft **12** such that the second reamer **34** continuously extends about and surrounds the shaft **12** as shown in FIG. **3**. Accordingly, the second reamer **34** can be substantially locked against rotation about the axis X (i.e., keyed to the shaft **12**). However, it will be appreciated that the reaming system **10** can include any suitable anti-rotation component for coupling the second reamer **34** against rotation relative to the axis X of the shaft **12**. It will also be appreciated that the spacer **30** can be similarly locked against rotation relative to the shaft **12**.

[0033] The second reamer **34** can slide from the second end **26** generally parallel to the axis X toward the spacer **30** and the first reamer **18**. Also, the second reamer **34** can abut against the spacer **30** such that the spacer **30** limits movement of the second reamer **34** and maintains a predetermined amount of space between the first and second reamers **18**, **34**. The system **10** can also include a separate retention member, such as a biased detent pin or other quick-connect coupling (not shown), that limits movement of spacer **30** along the axis X in a direction generally away from the first reamer **18**.

[0034] Furthermore, in some embodiments, the system **10** can be used without the spacer **30** such that the second reamer **34** abuts directly against the shoulder **22** when coupled to the shaft **12**. Moreover, in some embodiments, the system **10** can include a plurality of second reamers **34** and/or a plurality of spacers **30**, which are each coupled to the shaft **12** at a respective location along the axis X.

[0035] As shown in FIG. **1**, the first reamer **18** can have a maximum width W_1 (diameter) that is less than a maximum width W_2 (diameter) of the second reamer **34**. More specifically, the first reamer **18** can be at least partially tapered and can have a maximum width W_1 adjacent the shoulder **22**. Likewise, the second reamer **34** can include a tapered portion **42** and an axially straight portion **43**. The second reamer **34** can have a maximum width W_2 at the intersection between the tapered portion **42** and the axially straight portion **43**. As will be discussed, the different widths W_1, W_2 and lengths of the first and second reamers **18**, **34** can be adapted such that the system **10** can ream pockets (e.g., bores) that substantially match the geometry of an associated prosthetic device (FIG. **10**) intended for implantation.

[0036] It will be appreciated that when the second reamer **34** is coupled to the shaft **12**, the second reamer **34** can be driven in rotation about the axis X simultaneously with the first reamer **18**. More specifically, the first drive coupler **24** can be coupled to the driving device **28** (FIG. **5**), and the shaft **12** can be drivingly rotated about the axis X. This, in turn, simultaneously rotates both the first and second reamers **18**, **34** in the same direction about the axis X. Accordingly, as shown in FIG. **5**, the first reamer **18** can be used to create a reamed distal pocket **52** (i.e., distal bore) in a femur **50** when the driving device **28** rotates the shaft **12**. Also, because the second reamer **34** rotates with the first reamer **18** and because the second reamer **34** is fluted in the same direction as the first reamer **18**, the second reamer **34** can simultaneously create a reamed proximal pocket **54** (i.e., proximal bore) that is in communication with the distal pocket **52** in the femur **50**. It will be appreciated that the distal and proximal pockets **52**, **54** can provide an intramedullary canal for a femoral portion of a prosthetic device (FIG. **10**). The distal and proximal pockets **52**, **54** can be concentric. The spacer **30** can maintain the predetermined distance between the first and second reamers **18**, **34** and, thus, ensure that the distal and proximal pockets **52**, **54** are at a predetermined distance away from each other. Accordingly, the pockets **52**, **54** can be created in a convenient, accurate, and time-efficient manner.

[0037] Furthermore, as shown in FIG. **10**, the system **10** can be a modular kit that includes a plurality of different first reamers **18**, spacers **30**, and second reamers **34**. The reamers **18**, **34** can vary by length, width, fluting pattern, material or in any other suitable fashion. Also, the spacers **30** can vary by length, width, material, or in any other suitable fashion. Thus, the medical professional can pick and choose from among the first reamers **18**, the spacers **30**, and the second reamers **34** for performing a reaming operation that substantially matches the geometry of the prosthetic that will be implanted.

[0038] Once the distal and proximal pockets **52**, **54** are formed, one or more prosthetic members **53**, **55** (FIG. **10**) can be implanted within the femur **50**. For instance, in some embodiments, a distal prosthetic member **53** can be implanted within the distal pocket **52**, and a proximal prosthetic member **55** can engage the distal prosthetic member **53** and be implanted within the proximal pocket **54**.

[0039] As shown in FIG. **10**, the prosthetic members **53**, **55** can be part of modular prosthetic system **57**. The system **57** can include a plurality of distal prosthetic members **53** (i.e., stems), each having different geometries (e.g., different lengths, widths, etc.). The system **57** can further include a plurality of proximal prosthetic members **55** (i.e., bodies), each having different geometries (e.g., different lengths, widths, etc.). Each distal prosthetic member **53** can engage and fix to each of the proximal prosthetic members **55**, for instance, by a Morse taper-type coupling. Thus, the surgeon can select and customize a distal prosthetic member **53** and a proximal prosthetic member **55** on a patient-by-patient basis. For instance, the system **57** can incorporate components from the commercially available ARCOS system, available from Biomet, Inc. of Warsaw, Ind.

[0040] Also, as shown in FIG. **10**, the reaming system **10** can be directly associated geometrically with the modular prosthetic system **57**. For instance, the system **10** can include a plurality of first reamers **18** of different geometries (e.g., different lengths, widths, etc.), and each first reamer **18** can have a geometry that substantially matches one of the distal prosthetic members **53**. Likewise, the system **10** can include a plurality of second reamers **34** of different geometries, and each second reamer **34** can have a geometry that substantially matches one of the proximal prosthetic members **55**. Furthermore, the system **10** can include a plurality of spacers **30** of different lengths, each corresponding to the assembled distance between the distal and proximal prosthetic members **53**, **55**. Thus, once the surgeon has selected the distal and proximal prosthetic members **53**, **55** that will be implanted, the surgeon can use the corresponding first reamer **18**, spacer **30**, and second reamer **34** to ream the femur **50**. Because the first reamer **18**, spacer **30**, and second reamer **34** match the prosthetic members **53**, **55** geometrically, and because the first reamer **18**, spacer **30**, and second reamer **34** are engaged together during reaming, the reamed pockets **52**, **54** (FIG. **5**) can be very accurately formed simultaneously. As such, the system **10** ensures that the prosthetic members **53**, **55** can fit securely within the femur **50**.

[0041] Also, as shown in FIG. **4**, the second reamer **34** can be alternatively and removably coupled to a second drive coupler **44**. For instance, the second reamer **34** can be removably coupled to the second drive coupler **44** via a biased detent pin (not shown) or in any other suitable fashion. Also, the second drive coupler **44** can be included on a shaft that slidably receives the second reamer **34**. Accordingly, the second reamer **34** can be drivingly coupled to the driving device **28** separate from the first reamer **18** when necessary. For instance, if the distal prosthetic member **53** (FIG. **10**) is already inserted into the distal pocket **52** (FIG. **5**), and the proximal pocket **54** needs to be widened, the second reamer **34** can be coupled to the second drive coupler **44** and drivingly attached to the driving device **28** to widen the proximal pocket **54**. In some embodiments, the aperture **36** of the second reamer **34** can be wide enough such that the second reamer **34** can fit partially over and rotate relative to the distal prosthetic member **53** in order to ream out the proximal pocket **54**. Thus, the surgeon conveniently has the option to create the pockets **52**, **54** simultaneously or in separate steps.

[0042] Accordingly, the system **10** allows the medical professional to ream pockets **52**, **54** within a femur **50** or other anatomical feature of a patient with a single modular system in one step. It will be appreciated that the reamers **18**, **34** can be arranged on the shaft **12** to match the geometry of modular prosthetic members **53**, **55**. The reamers **18**, **34** can also be used separately to ream the pockets **52**, **54** in separate steps. Accordingly, the system **10** can be very convenient and time-efficient for the medical professional when reaming the femur **50** or other suitable anatomical feature. Also, the system **10** can be varied according to the patient's anatomy, according to the prosthetic members **53**, **55**, and the like for added convenience. Moreover, the system **10** can ream the pockets **52**, **54** very accurately so that the prosthesis is more likely to properly fit within the femur **50**.

[0043] Referring now to FIGS. **6**, **7**, **8**, and **11** another exemplary embodiment of the system **110** is illustrated. Components that correspond to those of FIGS. **1-5** are indicated by corresponding reference numerals, increased by **100**.

[0044] As shown, the system **110** can include a first member **160** and a second member **162**. The first member **160** can include a first shaft **112** (FIG. **7**) with a first reamer **118** (e.g., a distal reamer) and a first drive coupler **124** (FIG. **7**) fixed at opposite ends. The second member **162** can also include a second shaft **164** with a second reamer **134** (e.g., a proximal reamer) and a second drive coupler **144** fixed at opposite ends.

[0045] The first reamer **118** can be elongate and fluted. As shown in FIGS. **6**, **7**, and **11**, the first reamer **11 8** can have a slight taper such that the width (i.e., diameter) increases along the axis X toward the first shaft **112**. Moreover, the first reamer **118** can include a shoulder **137**.

[0046] The first shaft **112** can be elongate and can include a first portion **139** and a second portion **141**. The first and second portions **139**,**141** can be substantially cylindrical, and the second portion **141** can be wider (i.e., can have a larger diameter) than the first portion **139**. The second portion **141** can be disposed between the first reamer **118** and the first portion **139** of the shaft **112**.

[0047] Also, the second reamer **134** can be elongate and fluted and can be tapered. The second reamer **134** can also include a leading end **135** that is beveled so as to improve reaming operations.

[0048] In some embodiments, the second member **162** can include depth indicators **192** (FIGS. **6** and **11**). Likewise, the first member **112** can include depth indicators **193** (FIG. **11**). The depth indicators **192**, **193** can be of any suitable type, such as inscribed gradations with numbers. The depth indicators **192**, **193** can be used to visually indicate the depth of the respective member **112**, **162** as the member **112**,**162** performs reaming operations.

[0049] The first member **160** can be removably coupled to the second member **162**. For instance, the second member **162** can be hollow so as to slidably receive the first drive coupler **124** and the first shaft **112**, and such that the first and second members **160**, **162** are coaxial as shown in FIG. **7**. As shown in FIG. **7**, the first member **160** substantially fills and mates with the second member **162**. When coupled, the first reamer **118** extends out from the second member **162** and is disposed at a distance axially away from the second reamer **134**. Also, as shown in FIGS. **6** and **7**, the leading end **135** of the second reamer **134** can be disposed directly adjacent the shoulder **137** of the first reamer **118** when the first and second members **160**, **162** are coupled. The leading end **135** of the second reamer **134** can additionally include teeth **147** (FIGS. **6** and **11**) that increase the cutting ability of the second reamer **134**.

[0050] Also, as shown in FIGS. **8** and **11**, the first shaft **112** can include a plurality of first flat surfaces **116**, and as shown in FIG. **8**, the second shaft **164** can include a plurality of second flat surfaces **138**. For instance, as shown in FIGS. **8** and **11**, the first shaft **112** can include two first flat surfaces **116** that are disposed symmetrically on opposite sides of the axis X, between the first and second portions **139**, **141** of the first shaft **112**. The second shaft **164** can include two corresponding second flat surfaces **138** that are disposed symmetrically on opposite sides of the axis X. The flat surfaces **116**, **138** can abuttingly mate to couple the first and second members **160**,**162** against rotation about the axis X relative to each other.

[0051] Moreover, the first shaft **112** can additionally include a shoulder **122** (FIGS. **7** and **11**). The shoulder **122** can be included between the first and second portions **139**,**141** of the first shaft **112**. As shown in FIG. **7**, the second member **162** can abut against the shoulder **122** to limit movement of the second reamer **134** axially toward the first reamer **118**.

[0052] Furthermore, in some embodiments, the second member **162** can include a retention member **166** (FIG. **7**) that limits movement of the second reamer **134** away from the first reamer **118**. The retention member **166** can be a quick-connect coupling of a known type. More specifically, the retention member **166** can be operably supported on the second member **162**, and the retention member **166** can include a sleeve **168**, a biasing member **170**, and a bearing **172** (FIG. **7**). The sleeve **168** can be ring-shaped and can be slidably received on the second shaft **164** to slide axially on the second shaft **164**. The biasing member **170** can be of any suitable type, such as a coiled spring and can be received on the second shaft **164**. The bearing **172** can be of any suitable type, such as a plurality of ball bearings that are spaced evenly around the second shaft **164** and that are biased radially outward from the axis X. The biasing member **170** can bias the sleeve **168** toward the second drive coupler **144**. Also, the sleeve **168** can include a ramp **174**.

[0053] As the sleeve **168** moves away from the second reamer **134**, the ramp **174** cams the bearing **172** toward the axis X and into a groove **180** formed on the first shaft **11 2** of the first member **160**. As such, the first member **160** is limited against movement in a direction parallel to the axis X relative to the second member **162**. Furthermore, as the sleeve **168** moves toward the second reamer **134**, the bearing **172** is able to bias away from the axis X and out of the groove **180**, thereby releasing the first member **160** from the second member **162**.

[0054] Accordingly, the retention member **166** conveniently couples and de-couples the first and second members **160**, **162**. It will be appreciated that the retention member **166** can be used to limit movement of the second member **162** in both axial directions relative to the first member **160**.

[0055] Thus, the first and second members **160**, **162** can be axially and rotatably fixed, and the system **110** can be used to simultaneously ream a plurality of regions of a femur **50**, similar to the embodiment of FIG. **5**. It will be appreciated that a spacer **30** of the type shown in FIGS. **1-5** can be included between the first and second reamers **118**, **134** to maintain a predetermined axial distance between the first and second reamers **118**,**134**.

[0056] Also, the first and second members **160**,**162** can be used separately to individually ream corresponding portions of the femur **50** as discussed above. For instance, the first member **160** can be used separate from the second member **162** to perform distal reaming of a femur. Next, as shown in FIG. **9**, the second member **162** can be used after a distal prosthetic member **153** has been implanted in the femur **150**.

More specifically, an alignment rod **189** can be removably coupled to the distal prosthetic member **153**, and the second member **162** can slide over and receive the alignment rod **189**. The alignment rod **189** ensures that the second member **162** is aligned substantially coaxially relative to the distal prosthetic member **153**; however, the second member **162** remains free to move axially and rotate about the axis X relative to the alignment rod **189**. Then, the second member **162** can be used to proximally ream the femur **150** and create space for implantation of the proximal prosthetic member (not shown).

[0057] Also, the second member **162** can include an opening **194**, and the alignment rod **189** can include a visual indicator **196** that appears within the opening **194** when the second member **162** is at a predetermined depth within the femur **150**. Accordingly, the second member **162** can ream the femur **150** very accurately, even when separate from the first member **160**.

[0058] In addition, as shown in FIG. **12**, the system **110** can include an extension member **184**. The extension member **184** can be used for reaming with the first member **160** separate from the second member **162**. The extension member **184** can be elongate and axially straight. The extension member **184** can include a shaft **185** with a third drive coupler **186** and a retention member **187** on opposite ends. The retention member **187** can be of a quick-connect type, similar to the retention member **166** described above and shown in FIGS. **6**, **7**, and **11**. The shaft **185** can also include depth indicators **188**, such as inscribed gradations with numbers.

[0059] As shown in FIG. **12**, the retention member **187** can couple to the first member **160** in a manner similar to the retention member **166** described above. Also, the third drive coupler **186** can couple to a driving device **28** of the type described above and shown schematically in FIG. **5**. Thus, the extension member **184** can be removably coupled to the first member to effectively extend the reach of the first member **160** during distal reaming. As such, the first member **160** can be used to ream relatively deeply within the femur **150**.

[0060] It will be appreciated that the system **110** can include a plurality of extension members **184** of different axial lengths. As such, the surgeon can select an extension member **184** to perform distal reaming to a predetermined depth, corresponding to the length of the selected extension member **184**.

[0061] Now referring to FIG. **13**, another exemplary embodiment of the system **210** is illustrated. Components that correspond to those of FIGS. **1-5** are indicated by corresponding reference numerals, increased by 200.

[0062] The system **210** can include a shaft **212** having a first reamer **218** fixed at one end and a drive coupler **224** fixed at an opposite end. The shaft **212** can be substantially similar to the shaft **12** of the embodiments of FIGS. **1** and **2**, except the shaft **212** can include at least one detent button **219***a*, **219***b*. In some embodiments, the shaft **212** can include a plurality of detent buttons **219***a*, **219***b* that are spaced apart along the longitudinal axis X. It will be appreciated that the detent buttons **219***a*, **219***b* can be moveable and biased away from the axis X. It will also be appreciated that the shaft **212** can include quick-connect couplings other than the detent buttons **219***a*, **219***b* without departing from the scope of the present disclosure.

[0063] The system **210** can also include a second reamer **234**. The second reamer **234** can be substantially similar to the second reamer **34** of the embodiments of FIGS. **1** and **2**, except the second reamer **234** can include an aperture **221**. The aperture **221** can receive one of the detent buttons **219***a*, **219***b* when positioned on the shaft **212** to fix the second reamer **234** in a longitudinal position on the shaft **212** as will be discussed in greater detail below. The second reamer **234** can also include a recess **223** that surrounds the aperture **221** that provides a comfortable surface for the user to depress the detent button **219***a*, **219***b* to remove the second reamer **234** from the shaft **212** as will be discussed in greater detail below.

[0064] Furthermore, the system **210** can include a third reamer **245**. The third reamer **245** can be tapered so as to have a distal width W3 that is substantially equal to the proximal width W1 of the first reamer **218** and to have a proximal width W4 that is substantially equal to the distal width W5 of the second reamer **234**. The third reamer **245** can also include an aperture **240**, such as a through hole, that receives the shaft **212**. Furthermore, a shaft portion **251** can be fixed on a proximal end of the third reamer **245**. The shaft portion **251** can be keyed to the shaft **212** like the embodiments discussed above to inhibit relative rotation of the shaft **212** and third reamer **245**. Furthermore, the third reamer **245** can be fluted in the same direction as the first and second reamers **212**, **234**.

[0065] To assemble the system **210**, the third reamer **245** can slide longitudinally along the axis X from the proximal end **226** of the shaft **212** toward the first reamer **218**. Then, the second reamer **234** can slide longitudinally along the axis X from the proximal end **226** of the shaft **212** toward the first reamer **218** such that the third reamer **245** is disposed between the first and second reamers **218**, **234**. The aperture **221** of the second reamer **234** can receive one of the detent buttons **219***a*, **219***b* to fix the second reamer **234** in an axial position on the shaft **212**. The first and second reamer **212**, **234** can each abut the third reamer **245** and fix the third reamer **245** in an axial position on the shaft **212** as well. Furthermore, in some embodiments, the third reamer **245** can include an aperture for receiving one of the detent buttons **219***a*, **219***b* to fix the third reamer **245** axially.

[0066] Then, the first, second, and third reamers **212**, **234**, **245** can be used to simultaneously form respective pockets within the anatomy of the patient. Like the embodiments discussed above, it will be appreciated that the reamers **212**, **234**, **245** can be sized according to the prosthesis so that the prosthesis can fit into and fixedly engage the anatomy. Next, to disassemble the system **210**, the user presses the detent button **219***a*, **219***b* toward the axis X, and the user slides the second and third reamers **234**, **245** away from the first reamer **212**.

[0067] Accordingly, it will be appreciated that the system **210** can be assembled and disassembled quickly and conveniently. Also, it will be appreciated that the third reamer **245** can be optionally used. For instance, the second reamer **234** can be coupled to the shaft **212** independent of the third reamer **245** and fixed in an axial position relative to the shaft **212** by one of the detent buttons **219***a*, **219***b*. The detent buttons **219***a*, **219***b* can be positioned along the axis X at predetermined intervals according to the geometry of the prosthesis (not shown). Thus, the system **210** can provide substantial versatility.

[0068] Moreover, the foregoing discussion discloses and describes merely exemplary embodiments of the present disclosure. One skilled in the art will readily recognize from such discussion, and from the accompanying drawings and claims, that various changes, modifications and variations may be made therein without departing from the spirit and scope of the disclosure as defined in the following claims. For instance, the sequence of the blocks of the method described herein can be changed without departing from the scope of the present disclosure.

What is claimed is:

1. A modular reaming system for reaming a plurality of pockets in an anatomical feature, the modular reaming system extending along a longitudinal axis, the modular reaming system comprising:

a first reamer in a first position on the longitudinal axis, the first reamer reaming a first pocket in the anatomical feature;

a second reamer that is removably coupled to the first reamer in a second position on the longitudinal axis, the second reamer reaming a second pocket in the anatomical feature, the second reamer keyed against rotation relative to the first reamer to ream the first and second pockets substantially simultaneously.

2. The modular reaming system of claim **1**, further comprising a shaft that is fixedly coupled to the first reamer, the shaft being received by the second reamer to removably couple the second reamer to the first reamer.

3. The modular reaming system of claim **2**, wherein the shaft includes a shoulder that limits movement of the second reamer along the longitudinal axis.

4. The modular reaming system of claim **2**, wherein the first reamer has a maximum width that is less than a maximum width of the second reamer, wherein the first reamer is disposed at a distal end of the shaft, and wherein the second reamer is disposed between the distal end and a proximal end of the shaft.

5. The modular reaming system of claim **2**, wherein the shaft includes at least one biased detent button that is removably received by an aperture of the second reamer, the biased detent button removably fixing the second reamer in the second position.

6. The modular reaming system of claim **1**, further comprising a spacer that is disposed between the first reamer and the second reamer and that maintains an amount of space between the first and second reamers.

7. The modular reaming system of claim **1**, further comprising a third reamer that is disposed between the first reamer and the second reamer at a third position on the longitudinal axis, the third reamer reaming a third pocket, the third reamer keyed against rotation relative to the first reamer to ream the first, second, and third pockets substantially simultaneously.

8. The modular reaming system of claim **1**, further comprising a first surface that is fixed relative to the first reamer and a corresponding second surface that is fixed relative to the second reamer, the second surface mating with the first surface to key the second reamer against rotation relative to the first reamer.

9. The modular reaming system of claim **8**, wherein the first and second surfaces are flat.

10. The modular reaming system of claim **1**, further comprising a drive coupler that is coupled to the first and second reamers to drivingly rotate the first and second reamers in a same direction about the longitudinal axis to ream the first and second pockets substantially simultaneously while rotating in the same direction.

11. The modular reaming system of claim **10**, further comprising a first drive coupler that is fixedly coupled to the first reamer and a second drive coupler that is fixedly coupled to the second reamer, the second reamer receiving the first drive coupler.

12. The modular reaming system of claim **1**, wherein the first reamer is fluted in a first direction about the longitudinal axis, and the second reamer is fluted in the first direction about the longitudinal axis to ream the first and second pockets substantially simultaneously.

13. The modular reaming system of claim **1**, further comprising a retention member that limits movement of the second reamer axially away from the first reamer along the longitudinal axis.

14. The modular reaming system of claim **1**, further comprising a first shaft fixed to an end of the first reamer and a second shaft fixed to an end of the second reamer, the second shaft and the second reamer receiving the first shaft to removably couple the first and second reamers.

15. The modular reaming system of claim **1**, wherein the first reamer performs distal reaming in a femur of a patient, and wherein the second reamer simultaneously performs proximal reaming in the femur of the patient.

16. A modular reaming system comprising:

a first drive coupler;

a second drive coupler;

a first reamer driven in rotation by the first drive coupler; and

a second reamer driven in rotation by the second drive coupler or driven in rotation by the first drive coupler.

17. The modular reaming system of claim **16**, wherein the first and second reamers are keyed against rotation relative to each other.

18. The modular reaming system of claim **16**, further comprising a shaft, the first reamer fixed to a distal end of the shaft, the first drive coupler fixed to a proximal end of the shaft, the second reamer receiving the shaft to couple to the shaft.

19. The modular reaming system of claim **18**, wherein the second reamer slideably receives the shaft.

20. The modular reaming system of claim **16**, further comprising a first shaft and a second shaft, the first shaft including the first reamer on a distal end of the first shaft and the first drive coupler on a proximal end of the first shaft, the second shaft including the second reamer on a distal end of the second shaft and the second drive coupler on a proximal end of the second shaft, the first reamer and the first shaft receiving the second drive coupler and the second shaft.

21. The modular reaming system of claim **16**, wherein one of the first and second reamers performs distal reaming in a femur of a patient, and the other of the first and second reamers performs proximal reaming in the femur of the patient.

22. The modular reaming system of claim **16**, further comprising an extension member that is removably coupled to the second reamer, the extension member including a third drive coupler.

23. A method of reaming a femur comprising:

removably coupling a proximal reamer to a shaft fixed to a distal reamer and retaining the proximal reamer against rotation relative to the distal reamer;

rotating the shaft in a single direction to substantially simultaneously ream a proximal pocket in the femur with the proximal reamer and a distal pocket in the femur with the distal reamer.

24. The method of claim **23**, wherein removably coupling the proximal reamer to the shaft comprises sliding the proximal reamer onto the shaft toward the distal reamer.

25. The method of claim **24**, further comprising retaining the proximal reamer in a fixed axial position on the shaft.

26. The method of claim **23**, further comprising visually indicating a depth of the proximal and distal reamers in the femur.

27. The method of claim **23**, further comprising removably coupling an intermediate reamer to the shaft between the proximal and distal reamers and rotating the shaft in the single direction to substantially simultaneously ream the proximal pocket with the proximal reamer, the distal pocket with the distal reamer, and an intermediate pocket with the intermediate reamer.

28. A reaming system that reams a femur for implantation of a femoral component of a prosthetic joint, the reaming system comprising:

a distal member extending along a longitudinal axis, the distal member including a first shaft, a distal reamer, and a first drive coupler, the distal reamer and the first drive coupler fixed to opposite ends of the first shaft, the distal reamer reaming a distal pocket in the femur, the first shaft including a first flat surface;

a proximal member including a second shaft, a proximal reamer, and a second drive coupler, the proximal reamer and the second drive coupler fixed to opposite ends of the second shaft, the proximal reamer reaming a proximal pocket in the femur, the second shaft including a second flat surface, the proximal member removably receiving the first drive coupler and the first shaft to removably couple the proximal and distal members, the distal reamer extending out of the proximal member, the first flat surface mating with the second flat surface to couple the distal member and the proximal member against rotation relative to each other to ream the first and second pockets substantially simultaneously; and

a retention member that limits movement of the proximal member axially relative to the distal member.

29. A modular reaming system for reaming a plurality of pockets in an anatomical feature, the modular reaming system including a longitudinal axis, the modular reaming system comprising:

a first reamer in a first position on the longitudinal axis, the first reamer reaming a first pocket in the anatomical feature;

a second reamer that is removably coupled to the first reamer in a second position on the longitudinal axis, the second reamer reaming a second pocket in the anatomical feature; and

a means for coupling the second reamer against rotation relative to the first reamer to ream the first and second pockets substantially simultaneously.

30. A modular reaming system for reaming a plurality of pockets in an anatomical feature, the modular reaming system including a longitudinal axis, the modular reaming system comprising:

a first member with a first reamer that reams a first pocket in the anatomical feature, the first member including a first surface;

a second member with a second reamer that reams a second pocket in the anatomical feature, the second reamer being removably coupled to the first member, the second member including a second surface that is complementary to the first surface so that rotation of one of the first and second members about the longitudinal axis causes rotation of the other of the first and second members for substantially simultaneous formation of the first and second pockets.

31. The modular reaming system of claim **30**, wherein the first surface is flat, and the second surface is flat.

32. The modular reaming system of claim **30**, wherein the first member includes a shaft, wherein the first reamer is fixed to the shaft, and wherein the second member axially receives the shaft to removably couple the first and second members.

33. The modular reaming system of claim **32**, wherein the first member slidably receives the shaft to removably couple the first and second members.

34. The modular reaming system of claim **30**, wherein the first member includes a first shaft, wherein the first reamer is fixed to a distal end of the first shaft, wherein a first drive coupler is fixed to a proximal end of the first shaft, wherein the second member includes a second shaft, wherein the second reamer is fixed to a distal end of the second shaft, wherein a second drive coupler is fixed to a proximal end of the second shaft, and wherein the second reamer receives the first drive coupler and the first shaft to removably couple the first and second members.

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