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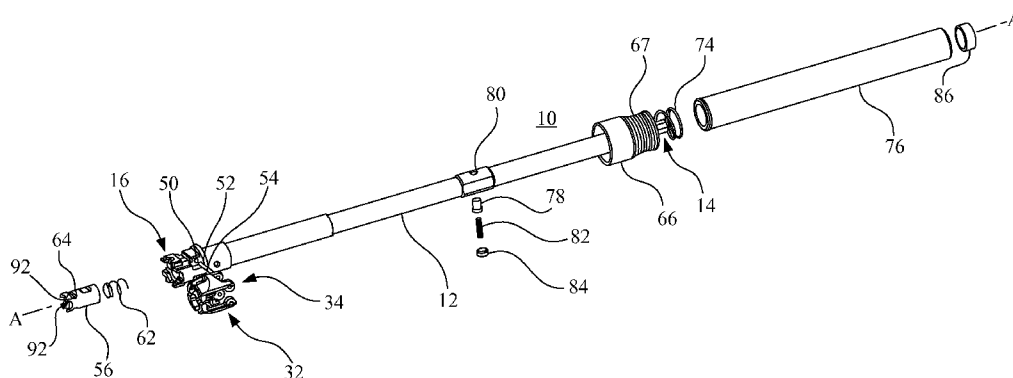


Fig. 1

(57) Abstract: The disclosure illustrates a dual driver for surgical reamers in which either of a crossbridge and crossbar style reamers are axially inserted in the distal end of a central shaft for the reamer driver. A pair of L shaped grips are adapted to connect and disconnect the different style of reamers by the movement of an external sleeve biased towards the connection position. Movement of the sleeve away from the distal end allows an internal plunger to cam the grips to an open position and urge the appropriate reamer from the tool driver directly in an axial direction.

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DUAL REAMER DRIVER

[0001] This is a non-provisional application based upon U.S. provisional patent application serial no. 60/973,919, entitled "AUTOMATIC DUAL CONNECTION REAMER DRIVE", filed September 20, 2007, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

[0002] The present invention relates to orthopedic surgical reamers and more specifically to drivers for such tools.

[0003] In the field of orthopaedic surgery, it is often necessary to remove bone material to enable implantation of prosthesis to repair joints in the human body. Patella cutters and acetabular reamer cups and glenoid reamers are surgical tools which are used in surgery for the insertion of artificial joints. Acetabular reamer cups are used to cut hemispherical cavities in pelvis bones for the insertion of artificial hip joints. Patella cutters are used to shape the underside of the patella or knee cap during knee replacement surgery. Glenoid reamers are used to cut hemispherical cavities in shoulder bones for the insertion of artificial shoulder joints. Patella cutters have a complex arrangement of precisely shaped cutting edges arranged around an axis of rotation for cutting the patella. Acetabular reamer cups and glenoid reamers have a complex arrangement of cutting edges arranged on a spherical surface around the axis of rotation of the cup.

[0004] A number of tools have been developed for this purpose and include reamers having generally semi-hemispherical configuration with cutting elements on them so that a corresponding semi-hemispherical hollow can be formed in the bone material for providing a foundation for the repair of the joint.

[0005] There are two major driver styles in the field, one of which is for the Othy style manufactured by Symmetry Medical, Inc. and the other style manufactured by Precimed SA of L'Echelette, Switzerland. Although these both have semi-hemispherical cutting heads,

they have different interfaces between driving tools with which they are associated. The Othy style has a crossbridge element. This element is a bar extending between the circumference of the hemisphere and having a circular expanded section in the middle. Numerous arrangements are available for securing this device as exemplified by U.S. Patent 6,854,742. Alternatively, the Precimed reamer has a crossbar shape in which two circular cross section bars intersect at the center and extend to the walls of the hemisphere. An example of a driver for this type is found in US patent 5,658,290 in which a bayonet interconnection is provided between the reamer and the driver.

[0006] Typically, surgeons use specialized drivers for each of the reamers. The drivers connect to a source of power and have appropriate handles for guiding the operation of the reamer by a surgeon. If a surgeon has one of the adaptors, it is difficult to utilize the other type of reamer since it requires a specialized driver for that reamer. It has been proposed in U.S. Patent 7,115,119 to provide a dual adapter that accommodates both the Othy and the Precimed reamers. However, this style of dual reamer requires a bayonet interconnection in which the assemblies are inserted axially and then a rotational movement, in accordance with a bayonet connection, is provided to lock the elements in place. This type of action slows the process of utilizing a new reamer because of the additional movement, But, more than that, the release of the device, after it has been in the surgical environment, is more difficult because it requires holding the reamer to reverse the rotational movement and then axial movement to finally free the reamer.

[0007] What is needed in the art, therefore, is a tool driver for surgical reamers that enables rapid and immediate connection and disconnection of the reamers.

SUMMARY OF THE INVENTION

[0008] In one form, the invention is a tool driver for multiple styles of surgical reamers. The driver includes a central shaft rotatable about a longitudinal axis and having a proximal driven end and a distal end. A reamer receiver is carried by the distal end of the shaft and the

receiver has axially facing sets of recesses for receiving at least two different styles of surgical reamers. A gripping device is provided for releasably holding the surgical reamer assemblies in place, the releasable holding device permitting axial removal of the different styles of surgical reamers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

[0010] Fig. 1 is an exploded perspective view of a tool driver in accordance with the present invention;

[0011] Fig. 2 is a longitudinal section view of the tool driver shown in Fig. 1;

[0012] Fig. 3 is an expanded detailed view of a portion of the tool driver in Fig. 1 and 2 taken in the same plane as Fig. 2;

[0013] Fig. 4 is an enlarged detailed view of a portion of the tool driver shown in Fig. 2 taken on a plane at 90 degrees to the plane of Fig. 2;

[0014] Fig. 5 is a side view of an element of the tool driver shown in Figs. 1-4; and

[0015] Fig. 6 is a top view of the element shown in Fig. 5.

[0016] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one embodiment of the invention and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Fig. 1 shows an exploded view of a reamer driver 10 in accordance with the present invention. Reamer driver 10 has a central shaft 12 rotatable about a longitudinal axis A at an

RPM that is appropriate for removal of material during a surgical procedure. Shaft 12 has a proximal end 14 with an interface having an appropriate to receive a power element to produce the correct torque and RPM to perform the surgical removal of material.

[0018] Central shaft 12 has a distal end 16 for receiving one of a plurality of different styles of surgical reamers. As shown particularly in Figs. 3 and 4, distal end 16 has a plurality of recesses integrally formed with the end of shaft 12. It should be apparent, however, to those skilled in the art that the recesses may be formed in a separate element that is affixed to the end of shaft 12. A pair of recesses 18 are semicircular in cross section as shown in Fig. 3. Recesses 18 are formed in portions of the distal end 16 offset from the central axis A and permit movement directly in an axial direction as shown in Fig. 3. Figure 4 shows a pair of recesses 20 including a base 22 and a shoulder 24 connecting to sidewalls 26. Recesses 20 are positioned at 90 degrees relative to recesses 18.

[0019] As stated previously there are two major styles of reamers in the surgical field, one of which is a crossbar and the other of which is a cross bridge. The crossbar interface is illustrated by dashed lines 28, shown in Fig 3 and Figure 4. It is to be noted that the base of semicircular recess 18 and recess base 22 are in the same plane so that the interface for the crossbar reamer 28 is positioned in a common plane to stabilize it. The other surgical reamer is an Othy cross bridge reamer having a circular center and two radially extending bars illustrated by dashed line 30. The crossbridge reamer 30 rests on the shoulder 24. The cross bridge reamer is also moveable into and out of the recesses 20 in an axial direction as illustrated in Fig. 4.

[0020] The different styles of reamers 28 and 30 are retained within the recesses 18 and 24 by grips 32 and 34 shown in Figs. 2 and 3 and in detail in Figs. 5 and 6. The grips 32 and 34 are identical so that reference characters used in Figs. 5 and 6 are applicable for both grips. Grips 32-34 comprise base elements 36 and 37 having a central aligned holes 40 to provide a pivotal mounting on central shaft 12. Bases 36 extend to integral gripping elements 38

having an L-shaped extension 41 so that the grips 32-34 form an L-shape with a pivotal mounting at one end of the L. The extension 41 has a gripping surface 42 with a contour that provides a negative angle with respect to the center of bore 40 so as to accommodate varying thicknesses of reamers. Generally speaking the surface 44 has approximately a 4 degree angle with respect to a plane at right angles to a line extending through bore 40. An intermediate section 46 has a camming surface 48 projecting downward as shown in Figs. 5 and 6 to interact with elements of the reamer driver 10 disclosed below.

[0021] The grips 32 and 34 are pivotally connected to shaft 12 at surfaces 50 with a through hole 52 by a pin 54 extending through bore 40 and through hole 52. Thus, the grips 32 and 34 are mounted so as to grip or release the respective reamers 28 and 30 in an axial direction. Fig. 2 shows the grips 32 and 34 in the retention position.

[0022] Grips 32 and 34 are biased to the open position permitting removal of the reamers 28 or 30. As shown in Figs 1 and 2, this is done by a central plunger 56 received in an axial bore 58 of central shaft 12. Plunger 56 is retained within the bore 58 by a removable ring 60 and is biased towards the left by a spring 62 retained within bore 58. Plunger 56 has a shoulder 64 that acts as a camming surface for the corresponding camming surface 48 on grips 32-34 so as to displace them in a radially outward direction upon axial movement of plunger 56 towards the distal end of shaft 12. Thus, in the absence of any restraining element, the grips 32 and 34 are urged to their open position.

[0023] The grips 32-34 are urged to the closed position illustrated in Fig. 2 by a sleeve 66 telescoped over shaft 12. Sleeve 66 has an inwardly facing shoulder 68 which abuts a corresponding outwardly facing shoulder 70 on shaft 12 to limit the left most position of sleeve 66. Sleeve 66 has a suitable serrated gripping surface 67 to enable manual manipulation. Sleeve 66 is urged to the leftmost position by a spring 74 retained over shaft 12 and abutting a protective sleeve 76, also telescoped over shaft 12.

[0024] Protective sleeve 76 is retained on shaft 12 by a pin 78 received in a cross bore 80 of shaft 12 and yieldably urged to the position shown in Fig. 2 by a spring 82. An appropriate cap 84 retains spring 82 within the bore 80. A retention sleeve 86 is appropriately affixed to the proximal end 14 of shaft 12 so as to limit the rightmost movement of protective sleeve 76.

[0025] In order to facilitate cleaning of the reamer driver, radial passages 88 are provided from recess 58 to the exterior and a central passage 90 is provided in plunger 56. In addition, plunger 56 has cross semicircular recesses 92 at 90 degrees to one another to abut the crossbars of reamer style 28 so as to further stabilize it.

[0026] The reamer driver 10 is operated by pulling sleeve 66 to the right as viewed in Fig. 2 so as to free the grips 32 and 34 and permit the spring 62 to displace the plunger 56 axially so that shoulder 64 urges the camming surface 48 radially outward. The arc of movement is sufficient to permit the surfaces 42 of grips 32-34 to provide axial clearance permitting removal or installation of the reamer driver styles 28 and 30 in an axial direction only. While the sleeve 66 is retracted, either reamer driver style 28 or 30 is axially inserted into the appropriate recesses and the plunger 56 is displaced to the right as shown in Fig. 2. In the case of reamer style 28, the semicircular recesses 92 embrace the crossbars so as to stabilize the reamer. In the case of reamer style 30, the end of plunger 56 abuts the undersurface of the crossbridge reamer 30. The displacement of the plunger 56 to the right permits the grips 32 and 34 to be acted on by sleeve 66 as urged by spring 74. This action holds the drivers in place for a surgical procedure. When the surgical procedure is completed, the sleeve 66 is simply displaced axially to the right as shown in Fig. 2 and the plunger 56 automatically urges either driver style from the driver assembly, thus eliminating multiple movements during a surgical procedure.

[0027] In addition to providing a simplified axial movement for connection and removal, the displacement of pin 78 permits the protective sleeve 76 to be moved to the right against

retention sleeve 86, thus allowing total expansion of the grips 32 and 34 for cleaning. The radial passages provided in plunger 66 and in the sidewall of recess 58 also facilitate the cleaning of the assembly.

[0028] The angle provided on surface 44 of grip 32-34 enables the retention of a range of thicknesses for the reamers 28 and 30.

[0029] While this invention has been described with respect to at least one embodiment, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

WHAT IS CLAIMED IS:

1. A tool driver for multiple styles of surgical reamers, said driver comprising:
 - a central shaft rotatable about a longitudinal axis and having a proximal driver end and a distal end;
 - a reamer receiver carried by the distal end of said shaft, said reamer receiver having axially facing sets of recesses for receiving at least two different styles of surgical reamers
 - a gripping device for releasably holding said surgical reamer assemblies in place, said releasable holding device permitting direct axial removal and installation of the different styles of surgical reamers.

2. The tool driver as claimed in claim 1 wherein said gripping device has an L-shaped configuration with at least one leg capturing the style of reamer and holding it in place in said recesses.

3. The tool driver as claimed in claim 1 wherein said gripping devices are urged towards an open position and releasably held in place.

4. The tool driver as claimed in claim 3 wherein said gripping device has an L-shape pivotally connected to said shaft and said tool driver further comprises a sleeve displaceable to hold said L-shaped device in place.

5. The tool driver as claimed in claim 4 wherein said sleeve is yieldably urged in a direction to hold the L-shaped gripping device in place.

6. The tool driver as claimed in claim 5 wherein said sleeve is telescoped over said shaft and a coil spring urges said sleeve in the position to hold said L-shaped gripping device in place.

7. The tool driver as claimed in claim 3 wherein said yieldable urging means acts on said gripping means from a recess in the distal end of said central shaft.

8. The tool driver as claimed in claim 7 wherein said distal end of said shaft has a bore and said yieldable urging means is a plunger received within said bore and spring loaded to be yieldably urged toward said distal end.

9. The tool driver as claimed in claim 8 where in said plunger has a camming surface for urging said gripping device outward.

10. The tool driver as claimed in claim 9 wherein said gripping device has at least one L-shaped element pivotally mounted to said shaft adjacent said distal end and having a camming surface on the inward facing side of the L to interact with the camming surface on said plunger.

11. The tool driver as claimed in claim 10 having at least one pair of L-shaped elements pivotally mounted on adjacent opposite sides of the distal end of said shaft and having a central camming surface in between the pairs.

12. The tool driver as claimed in claim 11 having a pair of opposing L-shaped gripping devices each pivotally mounted on opposite sides of the distal end of said shaft.

13. The tool driver as claimed in claim 12 wherein said L-shaped elements have a first section pivotally mounted to said central shaft and a second free end for gripping said surgical reamers, the second section having a reverse angle to accommodate reamers of varying thickness.

14. The tool driver as claimed in claim 1 adapted to receive two different styles of reamers, one of which has a cross beam mounting interface and the other having a crossbar shape for said interface and further wherein the recesses in the distal end of said central shaft have one set for receiving the crossbridge element and another receiving both the crossbridge and crossbar elements, one set of recesses receiving both elements.

15. The tool driver as claimed in claim 14 wherein said gripping devices are L-shaped with one leg pivotally mounted on said distal end of said central shaft and said elements are pivotal to hold the crossbridge of said style reamer and one of the sets of bars of the crossbar recess.

16. The tool driver as claimed in claim 14 further comprising a plunger axially received in the distal end of said central shaft and having cross recesses for abutting said crossbar style driver and yieldably holding it to stabilize it.

17. The tool driver as claimed in claim 7 wherein said central shaft has an opening from the interior recess to the exterior for enhancing cleaning of the tool driver.

18. The tool driver as claimed in claim 6 wherein said sleeve is removably telescoped over the exterior of said central shaft.

19. The tool driver as claimed in claim 18 further comprising a radially extending pin yieldably urged radially outward on said shaft remote from said distal end for providing an abutment for said telescoped sleeve, said pin being urged inward to release said telescoped sleeve to provide access for cleaning.

20. The tool driver as claimed in claim 19 further comprising a stop ring secured to of said shaft adjacent its proximal end for permanently holding said sleeve on said shaft.

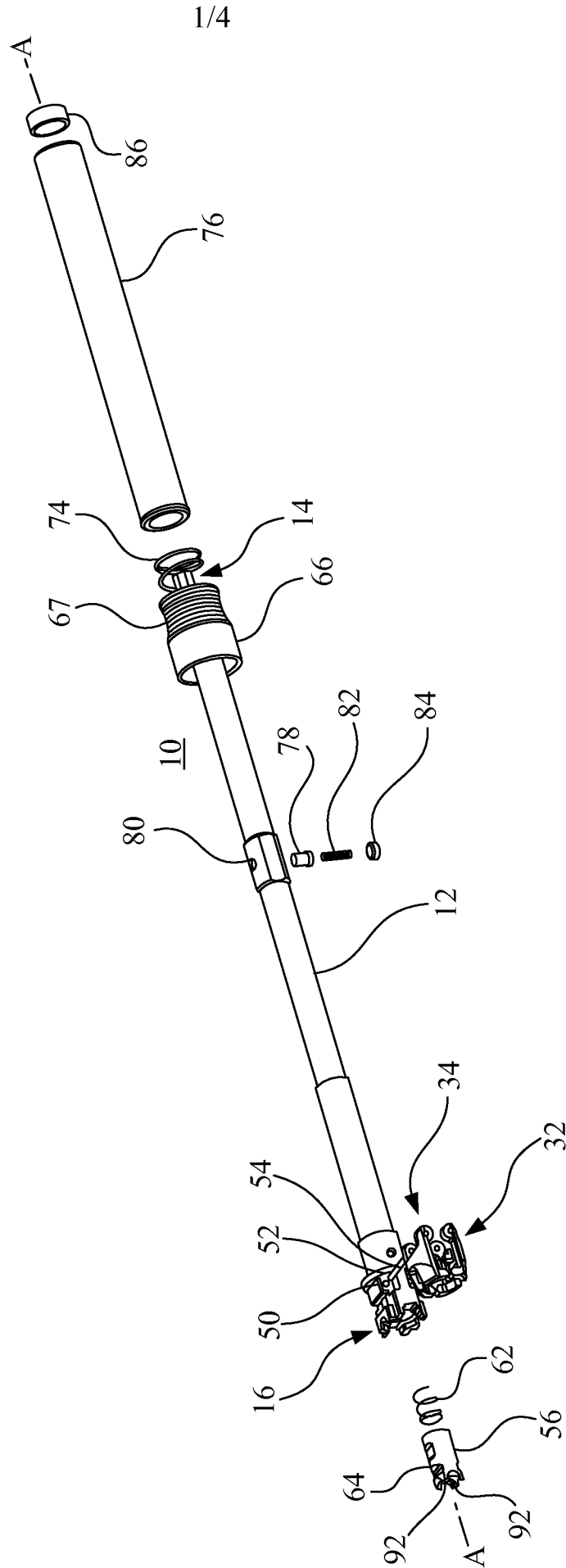


Fig. 1

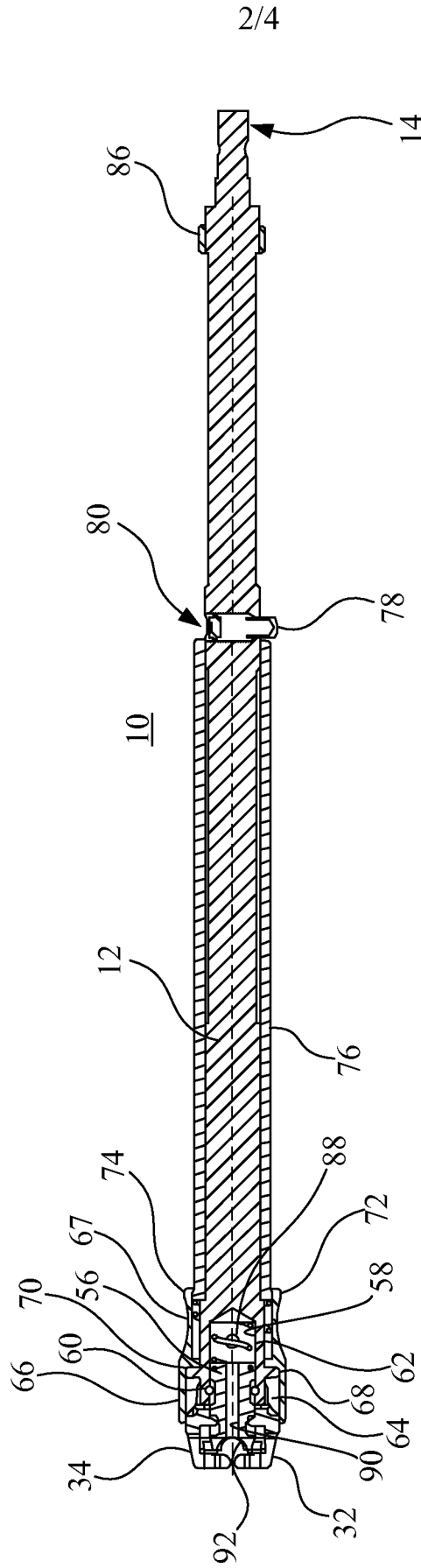


Fig. 2

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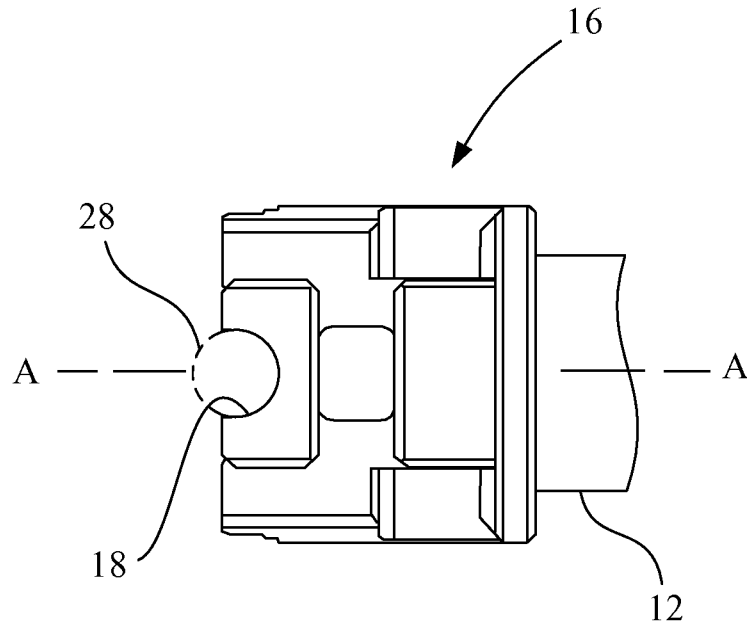


Fig. 3

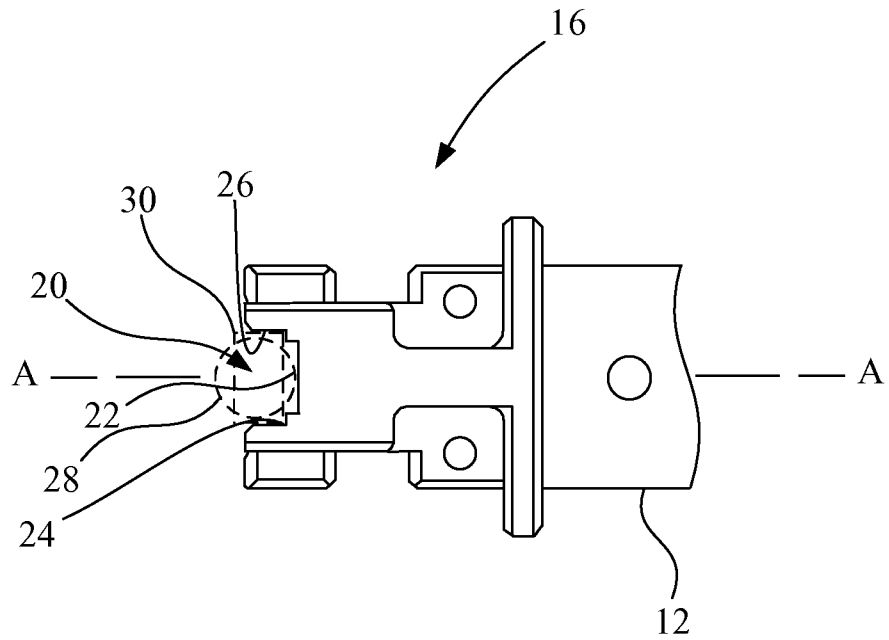


Fig. 4

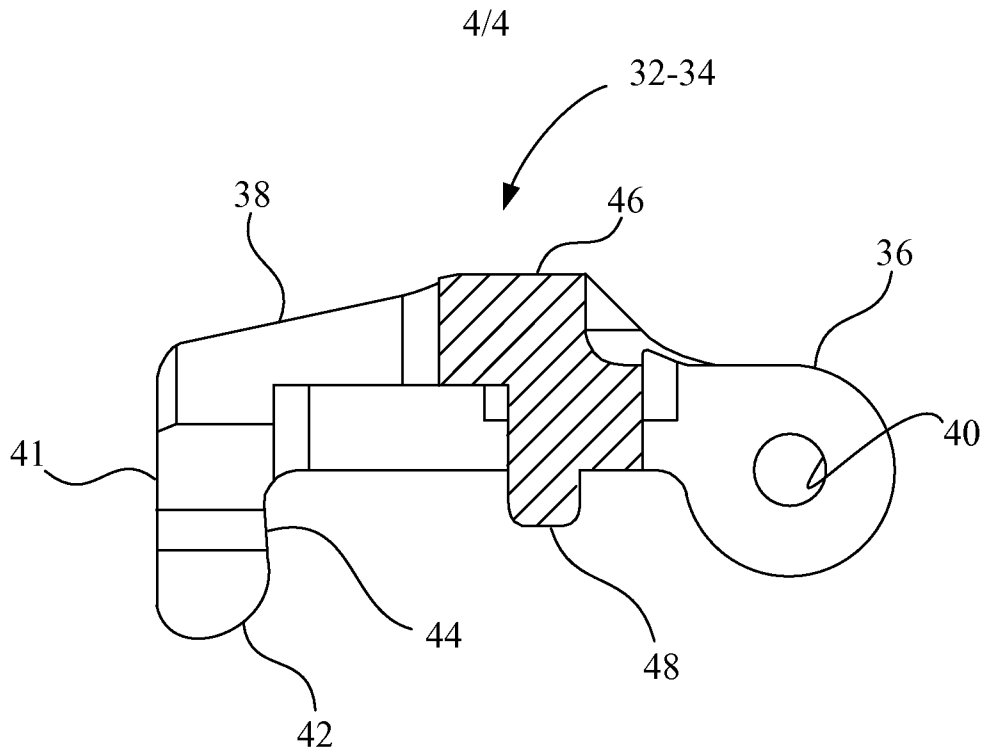


Fig. 5

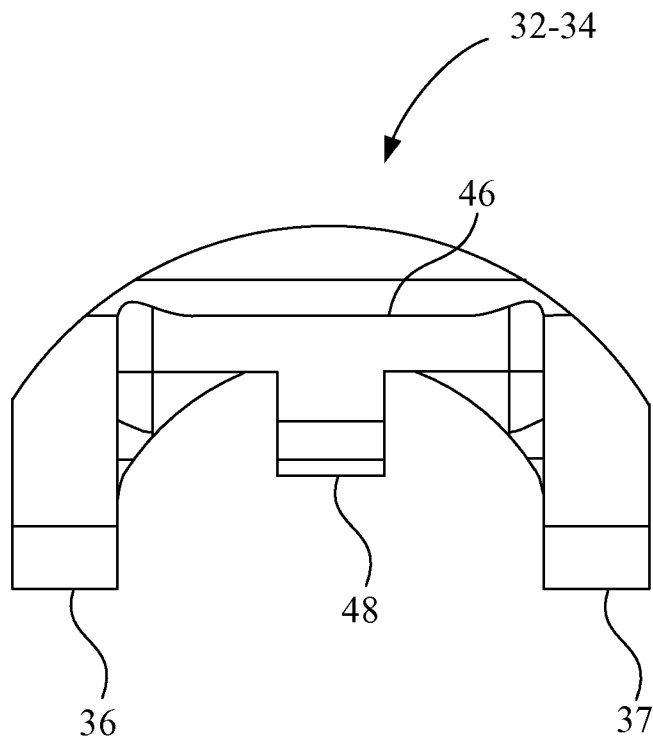


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/076971

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61B 17/16 (2008.04)
USPC - 606/80
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A61B 17/16 (2008.04)
USPC - 606/1, 80

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7,115,119 B2 (DESARZENS) 03 October 2006 (03.10.2006) entire document	1-20
Y	US 5,980,170 A (SALYER) 09 November 1999 (09.11.1999) entire document	1-20
A	US 2007/0123891 A1 (RIES et al) 31 May 2007 (31.05.2007) entire document	1-20
A	US 2005/0124981 A1 (DESARZENS et al) 09 June 2005 (09.06.2005) entire document	1-20
A	US 2004/0133210 A1 (WOLFORD) 08 July 2004 (08.07.2004) entire document	1-20

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 10 November 2008	Date of mailing of the international search report 18 NOV 2008
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