Başvuru Bilgileri

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Başvuru Şekli	: Ulusal Başvuru	**Koruma Tipi**	: Patent	**Yayın Tarihi**	: 2012/12/21

Başvuru Sahipleri

SAYAN TIBBİ ALETLER PAZARLAMA SANAYİ VE TİCARET LİMİTED ŞİRKETİ
Kemalpaşa Mah.7105 Sok.No:27 Işıkkent BORNOVA İZMİR

Buluşun Tasnif Sınıfları

A61B 17/16

Buluş Sahipleri

SERDAR ÖMÜR GÖREN
Kemalpaşa Mah.7105 Sok.No:27 Pınarbaşı BORNOVA İZMİR

Vekil Bilgileri

İSMAİL ÜSAME YILMAZ (İNNOVASİA DAN. AR-GE PATENT HİZ. TİC. LTD. ŞTİ.)
KONAK MAH. LEFKOŞA CAD. NO:12/9 - NİLÜFER/BURSA

Buluş Başlığı

Mini kesi ortopedi cerrahisinde, leğen kemiğini (asetabulumu) oymaya yarayan bir rende kolu.

Buluş Özeti

Buluş özellikle, mini kesi ortopedi cerrahisinde, leğen kemiğini (asetabulumu) oymaya yarayan, kemik büyüklüğüne göre değişen farklı çaplardaki yarım küre rendelere hareket vermek amacıyla kullanılmak üzere, farklı açılarda tutma kolu (8) ve motor bağlantısı sunan bir rende kolu ile ilgilidir.

ÖZET

MİNİ KESİ ORTOPEDİ CERRAHİSİNDE, LEĞEN KEMİĞİNİ (ASETABULUMU) OYMAYA YARAYAN BİR RENDE KOLU

Buluş özellikle, mini kesi ortopedi cerrahısinde, leğen kemiğini (asetabulumu) oymaya yarayan, kemik büyüklüğüne göre değişen farklı çaplardaki yarım küre rendelere hareket vermek amacıyla kullanılmak üzere, farklı açılarda tutma kolu (8) ve motor bağlantısı sunan bır rende kolu ile ılgilidir.

TARİFNAME

MİNİ KESİ ORTOPEDİ CERRAHİSİNDE, LEĞEN KEMİĞİNİ (ASETABULUMU) OYMAYA YARAYAN BİR RENDE KOLU

Teknik Alan

Buluş, mini kesı ortopedi cerrahisinde kullanılmak üzere bir aparat ile ılgilidir.

Buluş ozellikle, mini kesi ortopedı cerrahisinde, leğen kemiğini (asetabulumu) oymaya yarayan, kemik buyüklüğüne göre değişen farklı çaplardaki yarım kure rendelere hareket vermek amacıyla kullanılmak üzere bır rende kolu ile ilgilidir.

Tekniğin Bilinen Durumu

Günümüzde, mini kesi ameliyatlarında kullanılan rende kollarının en önemli dezavantajları şunlardır·

Aletin tutma kolu ile rendeye hareket vermek üzere alete bağlanan cerrahi motorun tutma açısı ergonomik değildir. Cerrahi motorun alete bağlantısı ancak aletin orta ekseninde mümkün olabilmektedir.

Ameliyat sonrası temizlenebilmesi için tamamen parçalanarak yıkanmak zorunda olmasından dolayı, gerek yıkanma gerekse montaj esnasında ıç mekanizmaya aıt bazı ufak parçaların kaybolmasından dolayı alet tamamen veya kısmen kullanılmaz hale gelmektedir.

Mevcut teknik, hekıme, aletı tutması için bir adet tutamak ımkanı sağlamaktadır. Bunun haricindeki tutma pozisyonları ıçin hekimin kendi alternatiflerini geliştirmesı gerekmektedır.

Alet, faklı cerrahi motor kullanımları için pratık imkanlar sağlamamaktadır.

Tamamen sökülebilir olmasından dolayı uretım tekniği daha karmaşık olup, buna bağlı olarak da maliyeti yüksektir

Sonuç olarak mını kesi ortopedi cerrahisinde, leğen kemiğini (asetabulumu) oymaya yarayan, kemik büyüklüğüne göre değişen farklı çaplardaki yarım küre rendelere hareket vermek amacıyla kullanılmak üzere mevcut çozümlerin yetersizliğini ortadan kaldıracak bır rende koluna olan gereksinimin varlığı ilgili teknik alanda bır geliştirme yapmayı zorunlu kılmıştır

Buluşun Amacı

Tekniğin bilınen durumuna ait dezavantajları ortadan kaldırmak uzere buluşun bir amacı, tutma kolunun rende kolu govdesıne kilitlenebilır oynar mafsal yardımıyla bağlanması ve cerrahi motor hareket aktarma milinin de govde miline hareketi mafsal uzerinden aktarması sonucunda gerek sağ gerekse sol elını kullanan hekımler için tutma kolunun kolaylıkla ayarlanması sağlanmıştır.

Buluşun bir diğer amacı, hekimlere cerrahi motor bağlantı milini aletin govde eksenine gore istenilen farklı değerde açı konumunda sabitleme ve kullanım imkanı sağlamaktır. Motor mili ile tutma kolunun birbirine montajlanması sayesinde de motor milinin kullanımı için seçilen konumda aletin sağlam bir şekilde tutularak alete hakim olunması sağlanmıştır

Buluşun bir diğer amacı, tutma kolu içerisine yerleştirilen bir kilitlenebilir, radyüslü ayar kolu vasıtası ile motor bağlantı milinin, aletin gövde eksenine göre açılanma kabiliyetinin 63,5°'ye (63° 30') kadar çıkarılmasını sağlamaktır.

Buluşun bir diğer amacı, tutma kolunun gövdeden kolaylıkla demonte edilmesi ve aletin gövdesi üzerine yerleştirilen bir sap vasıtasıyla, istenilmesi durumunda tutma kolunun çıkartılarak motor bağlantı milinin aletin gövde eksenine göre yatay düzlemde 29° ile 67°, düşey duzlemde ise 29° ile 81° arasında serbest açı ile kullanımını sağlamaktır. Serbest açı kullanımı esnasında aletin hakimiyeti gövde üzerindeki sap vasıtasıyla yapılmaktadır.

Buluşun bır diğer amacı, aletin ameliyat sonrası temizliğinin kolay yapılması ve temizlik esnasında ve temizlik sonrası montaj esnasında parçalarının kaybolmasından dolayı kullanılamaması riskini ortadan kaldırmak için, cerrahi motor bağlantısından kemığı oyan rendeye kadar hareket ileten aksam demonte edilmesine gerek olmayacak şekilde yapılmıştır. İnsan vücudu içerisinde kullanılan aletin uç kısmındaki sabit hareket aktarma elemanı herhangi bir doku sarması sonucu ilave yaralanmaya sebebiyet vermemek üzere muhafaza altına alınmıştır. Ameliyat sonrasında uygun şekilde temizlenmesi için üzerinde karşılıklı kanallar yapılmıştır. Aynı tür kanallar radyüslü ayar kolu mekanızmasının uygun şekilde temizlenmesi için tutma kolunun üzerine de açılmıştır

Buluşun bır diğer amacı, motor bağlantı miline kolaylıkla takılan adaptorler vasıtasıyla aletin her tür cerrahı motor ile kolaylıkla kullanımını sağlamaktır.

Buluşun yapısal ve karakteristik özellikleri ve tüm avantajları aşağıda verilen şekiller ve bu şekillere atıflar yapılmak suretiyle yazılan detaylı açıklama sayesinde daha net olarak anlaşılacaktır ve bu nedenle değerlendirmenin de bu şekiller ve detaylı açıklama göz önüne alınarak yapılması gerekmektedir

Buluşun Anlaşılmasına Yardımcı Olacak Şekiller

Şekil 1, Buluşun tutma kolu içermeyen yapılanmasının yandan gorunümudür,

Şekil 2, Buluşun tutma kolu içermeyen yapılanmasının üstten geniş açılı halde gorunumüdür,

Şekil 3, Buluşun tutma kolu içermeyen yapılanmasının üstten dar açılı halde görünümüdür,

Şekil 4, Buluşun tutma kolu içeren yapılanmasının yandan gorunumudur,

Şekil 5, Buluşun tutma kolu içeren yapılanmasının üstten geniş açılı halde görünümüdür,

Şekil 6, Buluşun tutma kolu içeren yapılanmasının üstten dar açılı halde görünümüdür,

Şekil 7, Buluşun tutma kolu içeren yapılanması ve demonte halde cerrahı motor adaptörünün perspektif görünümüdür

Çizimlerin mutlaka ölçeklendirilmesi gerekmemektedır ve mevcut buluşu anlamak ıçın gereklı olmayan detaylar ihmal edilmış olabilmektedir Bundan başka, en azından büyük ölçude özdeş olan veya en azından buyuk ölçude ozdeş işlevlerı olan elemanlar, aynı numara ile gösterılmektedır

Parça Referanslarının Açıklaması

1.	Gövde	**7.**	Radyüslü ayar kolu
2.	Tutma kolu sabitleme mafsalı	**8.**	Tutma kolu
3.	Motor bağlantı mili	**9.**	Sap
4.	Sabit hareket aktarma elemanı	**10.**	Kanallar
5.	Oynar mafsal	**11.**	Rende bağlantı kafası
6.	Cerrahi motor adaptörü	**12.**	Radyüslü ayar kolu kilidi

Buluşun Detaylı Açıklaması

Buluş, mini kesi ortopedı cerrahisinde, leğen kemığini (asetabulumu) oymaya yarayan, kemık buyukluğüne gore değişen farklı çaplardaki rendelere hareket vermek amacıyla kullanılmak uzere bır cerrahi motordan aldığı hareketi, içerdiği rende bağlantı kafası (11) vasıtasıyla leğen kemığini (asetabulum) oymada kullanılan rendeye aktaran; bahsedilen rende bağlantı kafasını (11) taşıyan gövde (1) ile insan vücudu içerısınde kullanılan rendenın ırtibatlandığı rende bağlantı kafasını (11) govdeye bağlayan ve motordan gelen hareketi bahsedilen rende bağlantı kafasına (11) aktaran sabit hareket aktarma elemanı (4) içeren bir rende koludur.

Buluşun özelliği,

- motordan hareketi alıp bahsedilen sabıt hareket aktarma elemanına (4) ileten motor bağlantı mili (3), ve
- motor bağlantı mılinin (3) aletin gövde eksenıne göre yatay düzlemde ve düşey duzlemde serbest açı ile kullanımını sağlayan ve bahsedilen motor bağlantı mılının (3) farklı açılanma değerlerındekı hareketını sabıt hareket aktarma elemanına (4) ileten oynar mafsal (5) ihtıva etmesidır.

Buluşun tercih edilen yapılanmaları:

Bu detaylı açıklamada, buluş konusu rende kolunun tercih edilen yapılanmaları, sadece konunun daha iyi anlaşılmasına yönelik olarak ve hıçbır sınırlayıcı etki oluşturmayacak şekılde açıklanmaktadır

Şekil 1'de buluşun tercıh edilen yapılanmasının yan görünümü yer almaktadır. Buluş konusu rende kolu; temel olarak cerrahı motordan aldığı hareketi leğen kemiğini (asetabulum)

oymada kullanılan rendeye aktaran bir aktarma elemanı olarak işlev görmektedir Bu işlev sırasında hareket, gövde (1) üzerindeki sabit millere bir mafsal (5) ile aktarılır Bu nedenle rende kolu, oynar mafsal (5) vasıtasıyla belirtilen limitler dahilinde istenilen açıda hareket iletme yetisine sahiptir (Şekil 1-6). Buluş, bahsedilen govde (1) ile irtibatlı şekilde sap (9) ihtiva etmektedir. Özellikle üzerindeki girinti ve çıkıntılar sayesinde kavrama kolaylığı sağlayan bu sap (9) sayesinde buluş, sabit şekilde tutulabilmekte ve sorunsuz bir kullanım sunmaktadır.

Buluş bahsedilen özelliklere ek olarak bahsedilen govdeye (1) irtibatlı, rende kolunun govde ekseninden farklı eksende tutulmasını sağlayan ve bahsedilen motor bağlantı milinin (3) uzerinde yataklandığı tutma kolu (8) içermektedir (Şekil 4-6). Bahsedilen tutma kolunun (8) gövdeye gore farklı değerlerde açılanmasını ve istenilen açılanma değerinde govdeye (1) sabitlenmesini sağlayan ayrıca bir tutma kolu sabitleme mafsalı (2) kullanılmaktadır Bahsedilen tutma kolu sabitleme mafsalı (2), bahsedilen sap (9) üzerinde konumludur (Şekil 3)

Şekillerde görülen çift oynar mafsal (5) hekimlere cerrahi motor bağlantı milini (3), aletin gövde eksenine göre 43°'lık serbest açılanma ile kullanım imkanı sağlamaktadır (Şekil 6) Motor bağlantı mili (3) ile tutma kolunun (8) birbirine montajlanması sayesinde de motor bağlantı milinin (3) kullanımı için seçilen konumda, aletin sağlam bir şekilde tutularak, alete hakim olunması sağlanmaktadır. Oynar mafsal (5) ise motor bağlantı milinin (3) farklı açılanma değerlerinde, sabit hareket aktarma elemanına (4) hareket iletmektedir

Yine Şekil 4 ve 5'te gorülen tutma kolu (8) içerisine yerleştirilen, istendiğinde çıkarılan ve tutma kolu (8) dışındaki ucu bahsedilen motor bağlantı miline (3) irtibatlanan bir kilitlenebilir, radyüslü ayar kolu (7) bulunmaktadır Bu kol (7) vasıtası ile motor bağlantı milinin (3), aletin gövde eksenine göre açılanma kabiliyetinin 63,5°'ye kadar çıkarılması sağlanmaktadır (Şekil 4). Boylece radyüslü ayar kolu (7) en açık konumda iken motor bağlantı miline (3), aletin gövde eksenine göre dikey düzlemde 63,5°'lık, yatay düzlemde 53,5°'lik serbest açılanma, sabitlenme ve kullanım imkanı sağlanmaktadır Yine Şekil 4-6'da radyuslu ayar kolunun (7) istenilen konumda sabitlenmesini sağlayan bir radyuslu ayar kolu kilidi (12) görülmektedir. Bu kilit (12) tercihen, ayar kolunun (7) içerisinden çıktığı tutma kolu (8) üzerinde konumlandırılmaktadır.

Şekillerde goruleceği üzere, insan vücudu içerisinde kullanılan aletin uç kısmındaki sabit hareket aktarma elemanı (4) herhangi bir doku sarması sonucu ilave yaralanmaya sebebiyet vermemek üzere muhafaza altına alınmıştır Ameliyat sonrasında uygun şekilde

temizlenmesi için söz konusu sabit aktarma elemanı (4) üzerinde karşılıklı kanallar (10) formlandırılmıştır. Aynı şekilde, radyüslu ayar kolu (7) mekanızmasının uygun şekilde temizlenmesi için tutma kolunun (8) üzerine de kanallar (10) açılmıştır

Şekil 1'de görüleceği üzere, tutma kolunun (8) sökülebilir olması sayesinde cerrahi motor bağlantı mili (3), dikey düzlemdeki serbest kullanımda daha fazla açılanma (81 derece) yapabilmektedir. Bu sayede mevcut rende kollarına gore kullanıcı hekime ameliyat esnasında daha fazla serbestlik imkanı sağlamaktadır. Istenilmesi durumunda tutma kolunun (8) çıkartılarak motor bağlantı milinin (3) aletin gövde eksenine göre yatay düzlemde 29° ile 67°, düşey düzlemde ise 29° ile 81° arasında serbest açı ile kullanımı sağlanmaktadır (Şekil 1-3) Serbest açı kullanımı esnasında aletin hakimiyeti gövde (1) üzerindeki sap (9) vasıtasıyla yapılmaktadır

Yine buluş konusu rende kolu, sistemin sökülmesi halinde bile küçük parçalara ayrılmıyor olması sebebiyle de ameliyat sonrası temizlik esnasında parçalarının kaybolmamasından dolayı çok sıklıkla yaşanan parça kaybolması ile oluşan aletin kullanım dışı kalması riski en aza indirgenmiş olmaktadır.

Soz konusu buluş, motor bağlantı miline (3) kolaylıkla monte edilecek adaptörler (6) ile de farklı tiptekı cerrahı motorlarla kolaylıkla kullanılmaktadır (Şekil 7) Yine, cerrahı motor bağlantı milinin (3) hareketi, gövdeye (1) bir mafsalla (5) iletiyor olması ve soküm yapılmadan aletin temizliğinin mümkun olması prensipleri rende ile asetabulumun oyulmasının ardından konulacak metal implantı yerleştirecek aletin tasarımında da kullanılabilecektir

İSTEMLER

1. Buluş, mini kesi ortopedi cerrahisinde, leğen kemiğini (asetabulumu) oymaya yarayan rendelere hareket vermek amacıyla kullanılmak üzere bir cerrahi motordan aldığı hareketi, içerdiği rende bağlantı kafası (11) vasıtasıyla leğen kemiğini (asetabulum) oymada kullanılan rendeye aktaran, bahsedilen rende bağlantı kafasını (11) taşıyan gövde (1) ile insan vucudu içerisinde kullanılan rendenin irtibatlandığı rende bağlantı kafasını (11) gövdeye bağlayan ve motordan gelen hareketi bahsedilen rende bağlantı kafasına (11) aktaran sabit hareket aktarma elemanı (4) içeren bir rende kolu **olup,**

- motordan hareketi alıp bahsedilen sabit hareket aktarma elemanına (4) ileten motor bağlantı mili (3), ve
- motor bağlantı milinin (3) aletin gövde eksenine göre yatay düzlemde ve düşey düzlemde serbest açı ile kullanımını sağlayan ve bahsedilen motor bağlantı milinin (3) farklı açılanma değerlerindeki hareketini sabit hareket aktarma elemanına (4) ileten oynar mafsal (5) içermesiyle karakterize edilmektedir.

2. İstem 1'e uygun bir rende kolu olup, bahsedilen gövde (1) ile irtibatlı şekilde sap (9) içermesi ile karakterize edilmektedir.

3. İstem 1'e uygun bir rende kolu olup, bahsedilen gövdeye (1) irtibatlı ve rende kolunun gövde ekseninden farklı eksende tutulmasını sağlayan tutma kolu (8) içermesi ile karakterize edilmektedir.

4. İstem 1'e uygun bir rende kolu olup, bahsedilen gövdeye (1) irtibatlı, rende kolunun govde ekseninden farklı eksende tutulmasını sağlayan ve bahsedilen motor bağlantı milinin (3) uzerinde yataklandığı tutma kolu (8) içermesi ile karakterize edilmektedir.

5. İstem 3 veya 4'e uygun bir rende kolu olup, tutma kolunun (8) govdeye gore farklı noktalarda konumlanmasını ve istenilen konumlanma değerinde govdeye (1) sabitlenmesini sağlayan bir tutma kolu sabitleme mafsalı (2) içermesi ile karakterize edilmektedir.

6. İstem 4'e uygun bir rende kolu olup, bahsedilen motor bağlantı milinin (3) hareket serbestisini arttırmak üzere, bahsedilen tutma kolu (8) içerisine yerleştirilen, istendiğinde çıkarılan ve tutma kolu (8) dışındaki ucu bahsedilen motor bağlantı miline (3) irtibatlanan radyuslü ayar kolu (7) içermesiyle karakterize edilmektedir.

7. İstem 6'ya uygun bir rende kolu olup, bahsedilen radyuslu ayar kolunun (7) istenilen konumda sabitlenmesini sağlayan bir radyüslü ayar kolu kilidi (12) içermesiyle karakterize edilmektedir.

8. İstem 7'ye uygun bir rende kolu olup, bahsedilen radyuslu ayar kolu kilidinin (12) bahsedilen tutma kolu (8) üzerinde konumlu olması ile karakterize edilmektedir

9. İstem 1, 4 veya 6'ya uygun bir rende kolu olup, motor bağlantı milinin (3) yaptığı açılanmanın, aletin govde eksenine gore yatay düzlemde 29° ile 67°, düşey duzlemde ise 29° ile 81° arasında açı olması, bahsedilen tutma kolu (8) kullanılması durumunda üst limitin yatay ve duşey düzlemde 43° olması ve radyuslu ayar kolu (7) kullanılması durumunda yatay düzlemdeki üst limitin 53,5° ve düşey düzlemdeki üst limitin 63,5° olması ile karakterize edilmektedir.

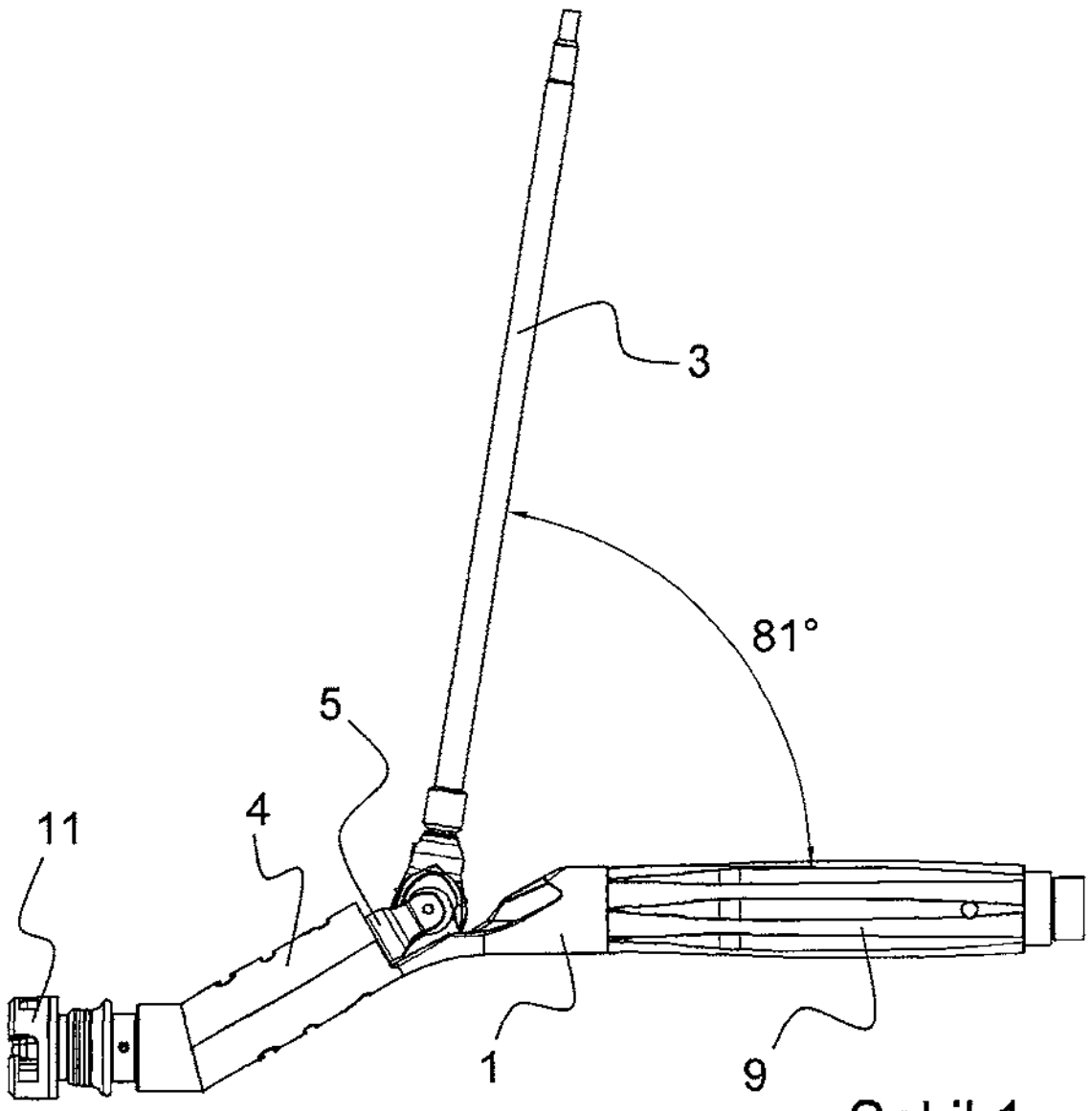
10. İstem 1'e uygun bir rende kolu olup, farklı motorlar ile bağlantıyı sağlamak üzere, motor bağlantı miline (3) monte edilen motor adaptorleri (6) içermesiyle karakterize edilmektedir.

11. İstem 3 veya 4'e uygun bir rende kolu olup, bahsedilen sabit aktarma elemanı (4) ve/veya bahsedilen tutma kolu (8) üzerinde oluşturulan kanal (10) içermesiyle karakterize edilmektedir.

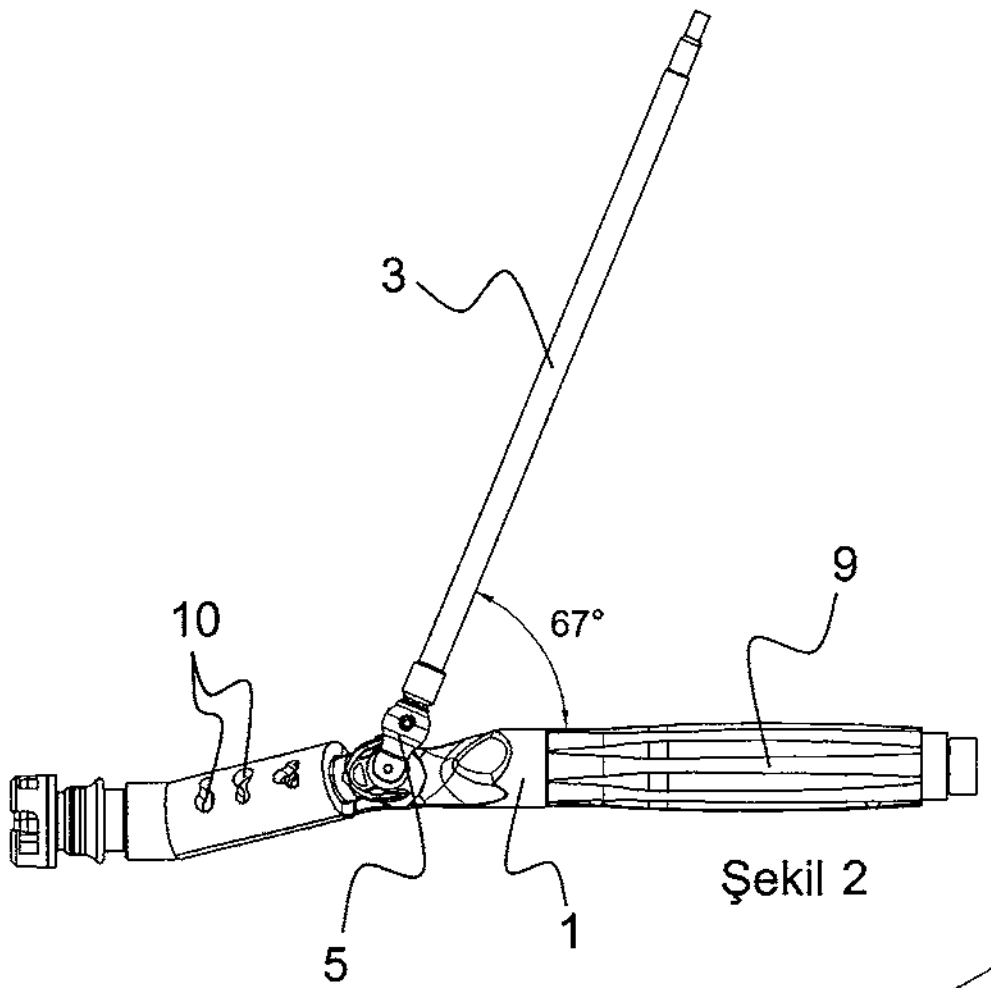
12. İstem 5'e uygun bir rende kolu olup, bahsedilen tutma kolu sabitleme mafsalının (2), bahsedilen sap (9) üzerinde konumlu olması ile karakterize edilmektedir.

RESİMLER

1



Şekil 1



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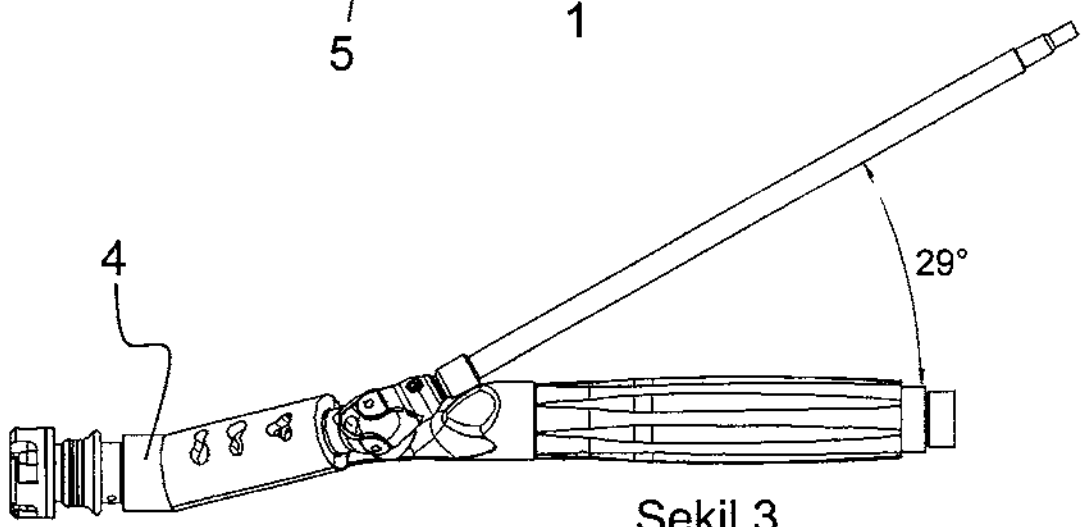
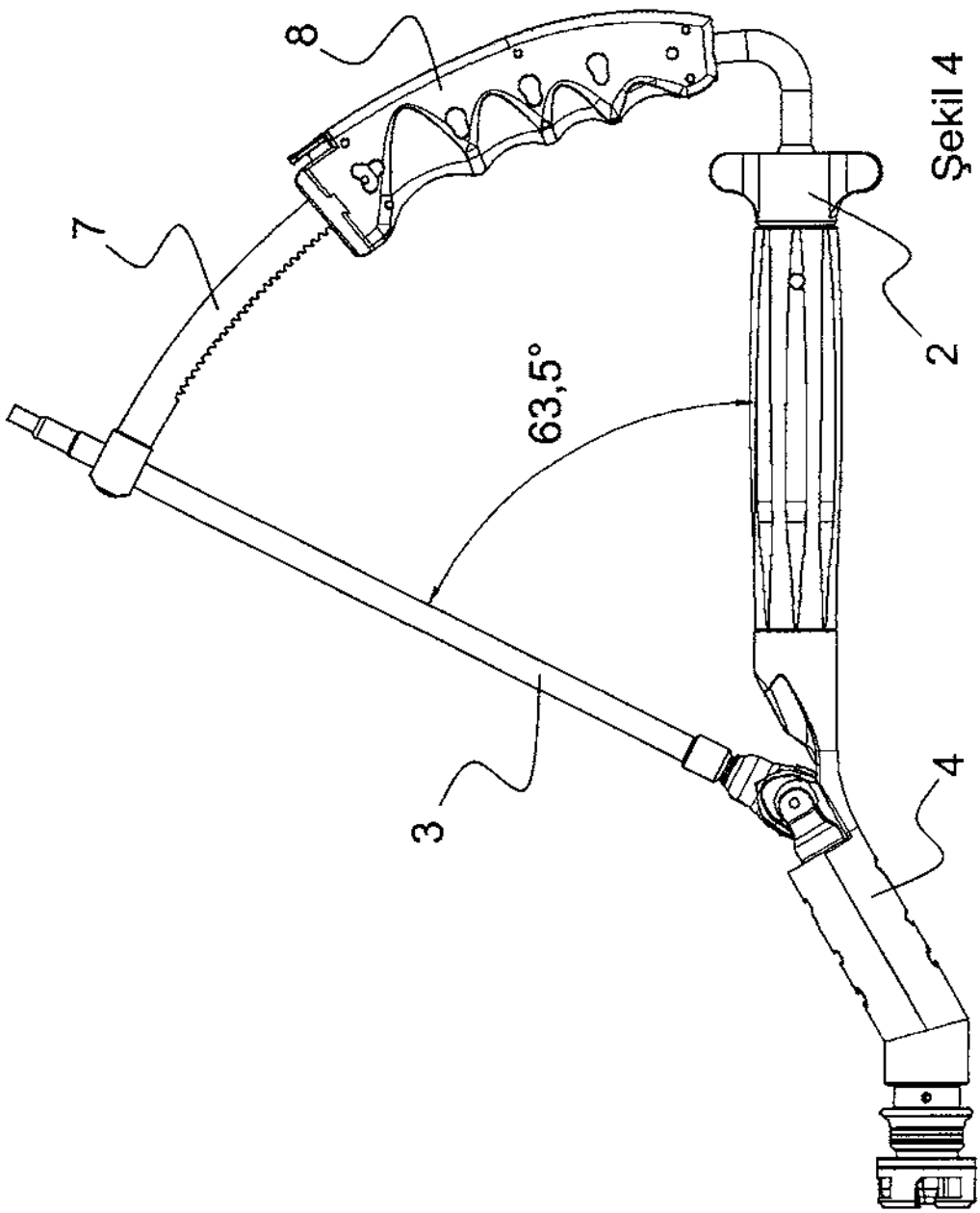
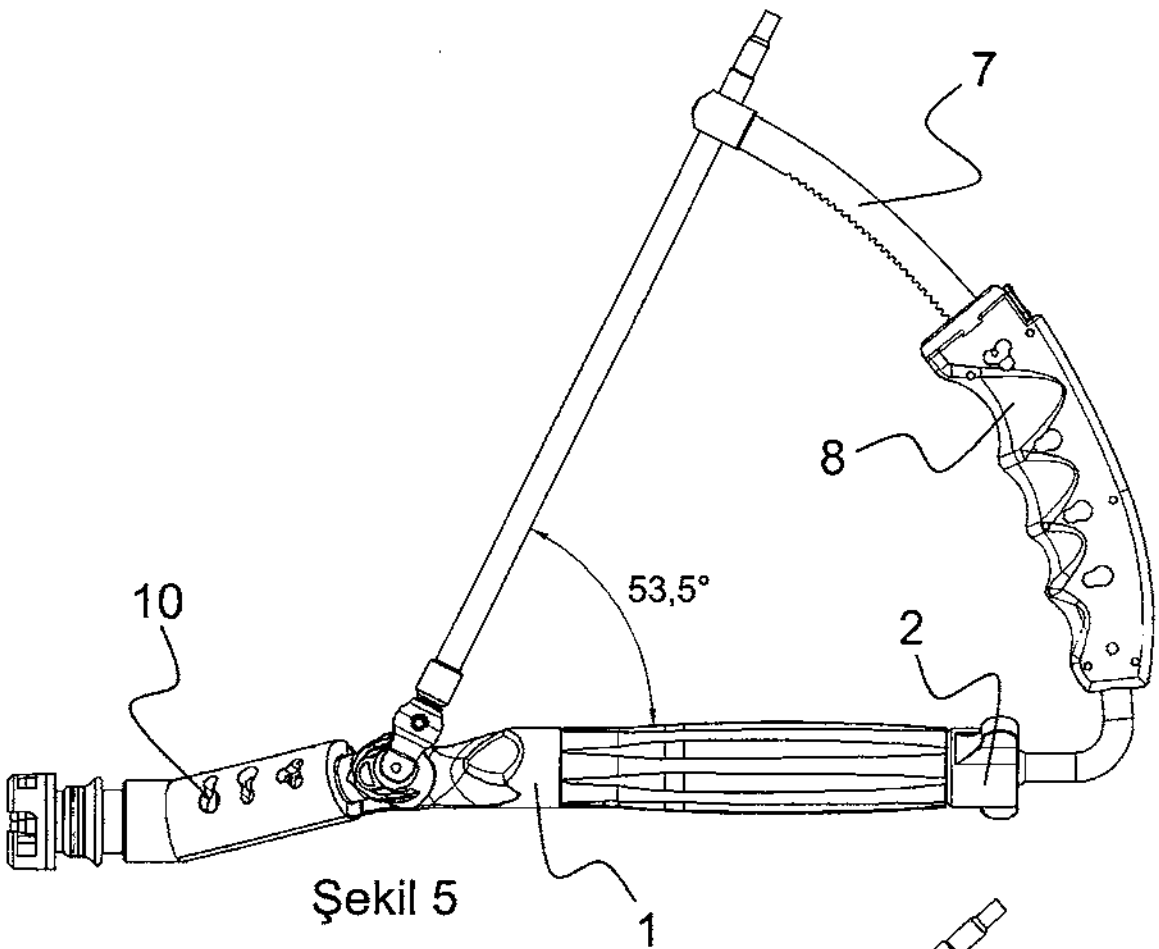


Şekil 3



Şekil 4



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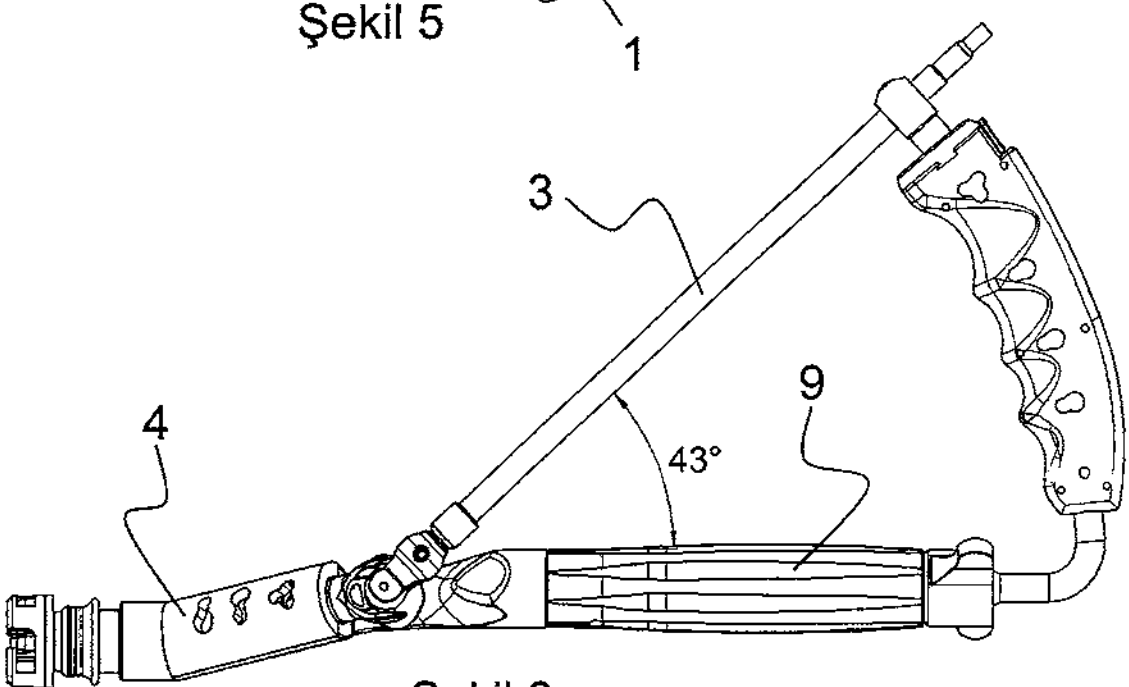

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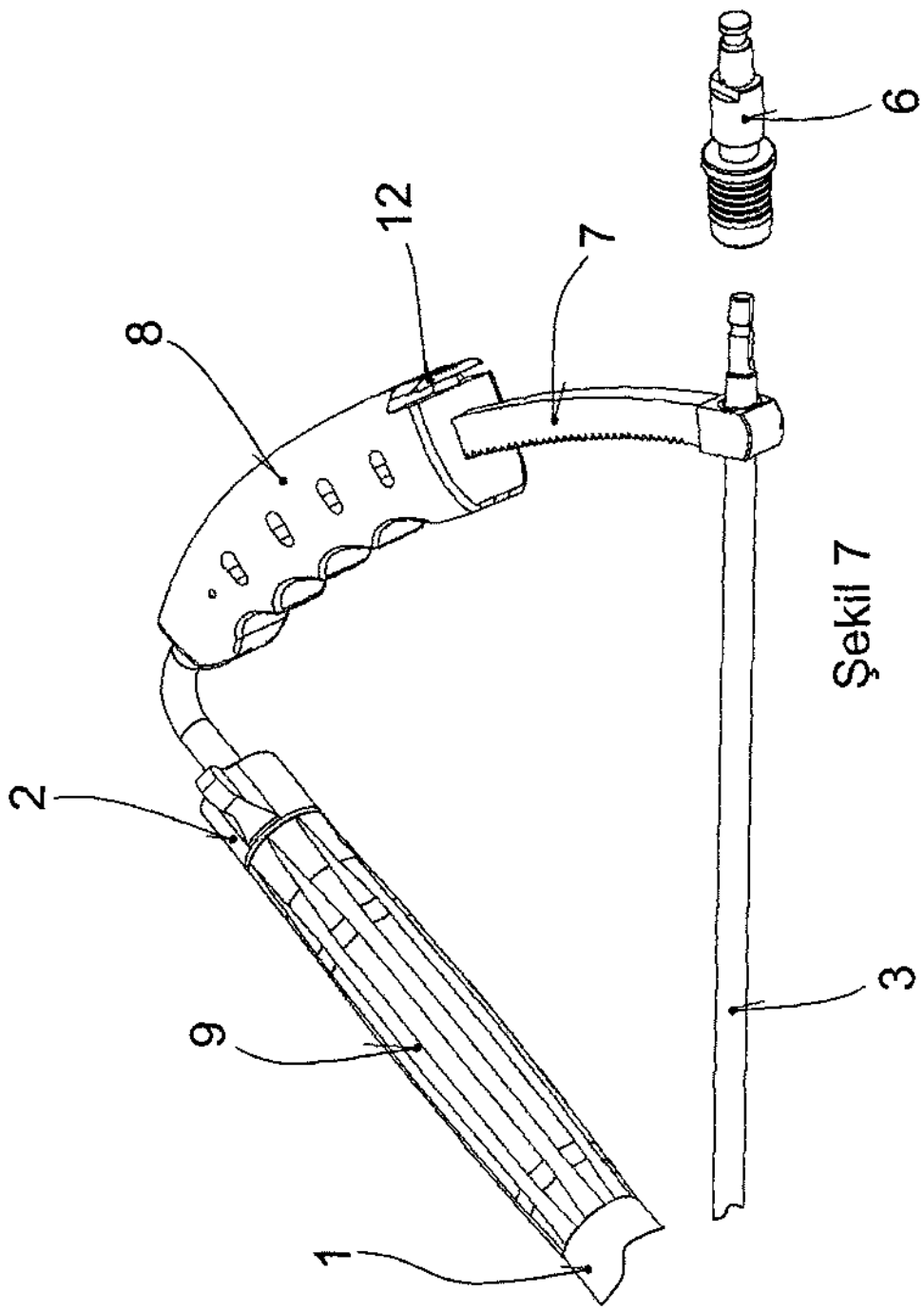

Şekil 7

ARAŞTIRMA RAPORU

2013-G-402525
TPE 25.11.2013 13:59:11
Bsvr No: PT 0

Başvuru Sahibi
SAYAN TIBBİ ALETLER PAZARLAMA SANAYİ VE TİCARET LİMİTED ŞİRKETİ

Başvuru No	Başvuru Tarihi	(İlk) Ruçhan Tarihi
2012/01556	**13/02/2012**	**-**

Patent Sınıfı (IPC[8])
A61B 17/16 (2009.01)

GENEL GÖZLEMLER

Buluş Bütünlüğü

☒ Var (başvuru sadece bir buluş konusunu içermektedir)

☐ Yok (başvuru birden çok buluş konusunu içermektedir) (Bakınız Bölum III)

Tarifname Takımı

☒ Rapor aşağıda belirtilen tarifname takımı esas alınarak duzenlenmiştir

Tarifname 5 sayfa (orijinal)

İstem 12 adet (orijinal)

Resim 5 sayfa (orijinal)

Açıklık

☒ Tum istemler araştırılabilir niteliktedir

☐ nolu istemler araştırılabilir nitelikte değildir (Bakınız Bölum IV)

☐ Başvuruyla ilgili diğer goruşler (Bakınız Bolum II)

Raporun Tamamlandığı Tarih **25/11/2013**

Turk Patent Enstitusu - Patent Dairesi Başkanlığı
Hipodrom Cad No 115 06330
Yenimahalle/ANKARA
Tel (312) 303 1182
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Araştırmayı Yapan Uzman

Ali Bülent DALOĞLU

TÜRK PATENT ENSTİTÜSÜ

ARAŞTIRMA RAPORU

Başvuru Numarası:
2012/01556

A. BULUŞUN PATENT SINIFI (IPC[8])
A61B 17/16 (2009.01)

B. ARAŞTIRILAN ALANLAR
A61B 17/00

Araştırma esnasında kullanılan elektronik veritabanları ve -uygun olduğu durumlarda- kullanılan bazı anahtar kelimeler
EPODOC, WPI, EPOQUE İngilizce ve Almanca Tum-metın Veritabanları (TXTE, TXTDE), TPE Patent Veritabanı, Espacenet,

"reamer, handle, reaming,pelvis, hipbone, bone, acetabulum, minimal, invasive, ortopedic, surgery, surgical, operation, antrum, cavitate, planer, shave, mounting, rod, connecting, mini kesi, ortopedi, ameliyat, cerrahi, leğen kemiği, asetabulumu, oymak, rende, kol, bağlantı parçası " ve bunların uygun kombinasyonları

C. İLGİLİ DOKÜMANLAR

Kategori	Dokumanlar	Ilgili Olduğu Istem
X	***EP1442729 A1*** *(Adjustable reamer with tip tracker linkage)* 04 Ağustos 2004 (04 08 2004) Özet, Teknik resimler Tarifname özellikle paragraf 16, 18, 22	1 – 6 , 9 – 12
A	***US2007293869 A1*** (Curved acetabular positioner, impactor and reamer handle) 20 Aralık 2007 (20 12 2007) Teknik resimler, 26-29 Tarifname özellikle paragraf 88,89	1
A	***US2005038443 A1*** (Surgical tools for joint replacement) 17 Şubat 2005 (17 02 2005) Teknik resimler 3-5 Tarifname ozellikle paragraf 23-28, 40	1

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☐ İlgili Dokümanlar sonraki sayfadan devam etmektedir ☐ Patent Ailesi Uyeleri ekine bakiniz

Kategorilerin Açıklaması

"X"	Buluşun yeni olmadığını veya buluş basamağı içermediğini tek başına gösteren dokuman	"E"	Başvuru tarihinde veya başvuru tarihinden sonra yayımlanan dokuman
"Y"	Buluşun buluş basamağı içermediğini başka bir dokumanla bir araya getirildiğinde gösteren dokuman	"T"	Buluşun altında yatan ilke veya teoriyi anlamak için belirtilen dokuman
"A"	Teknigin bilinen durumunu belirten ama buluşla tam olarak ilgili olmayan dokuman	"L"	Başka nedenlerle belirtilen dokuman
"O"	Yazili olmayan açıklama	"D"	Başvuruda belirtilen dokuman
"P"	Başvuru tarihi ile ruçhan tarihi arasında yayımlanan dokuman	"&"	Aynı patent ailesinin dokumanı

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Araştırmayı Yapan Uzman

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Hedley et al. (43) **Pub. Date: Feb. 17, 2005**

(54) **SURGICAL TOOLS FOR JOINT REPLACEMENT**

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(21) Appl No **10/734,330**

(22) Filed **Dec. 11, 2003**

Related U.S. Application Data

(60) Provisional application No 60/432,730, filed on Dec 12, 2002 Provisional application No 60/432,729, filed on Dec 12, 2002 Provisional application No 60/474,366, filed on May 30, 2003

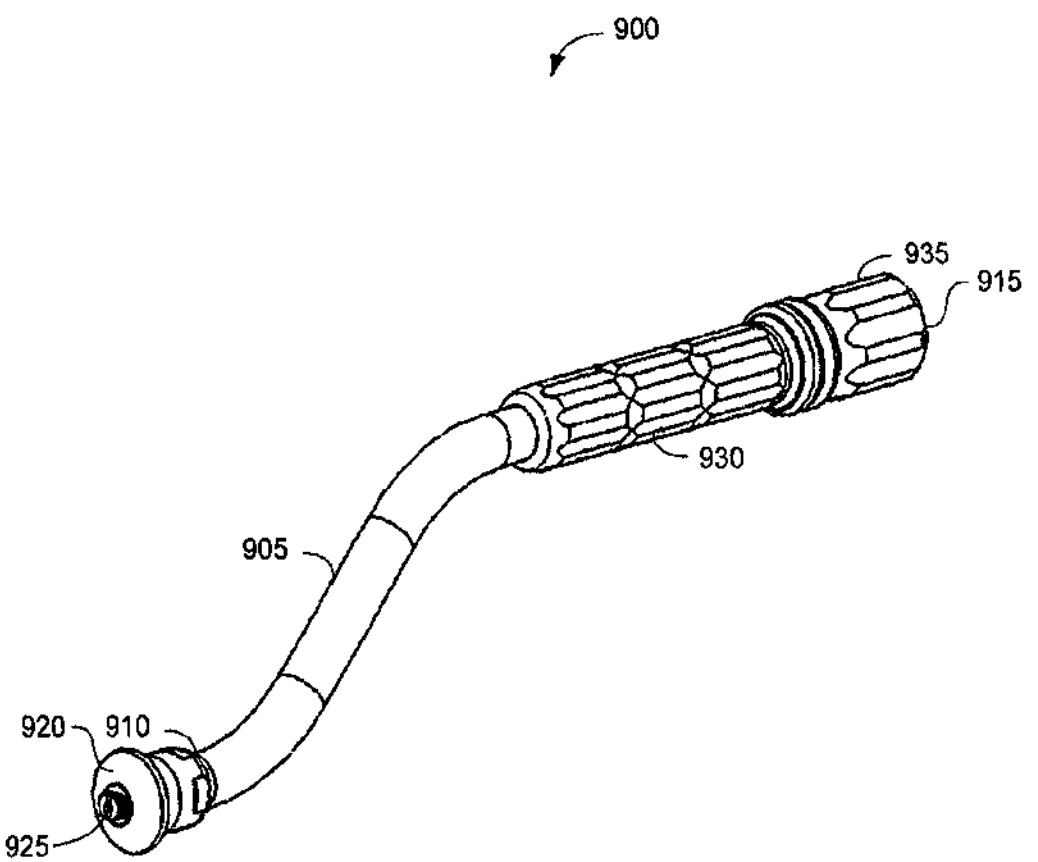
Publication Classification

(51) **Int. Cl.**[7] **A61F 5/04**, A61B 17/56, A61F 2/32, A61B 17/58, A61B 17/60

(52) **U.S. Cl.** **606/91**, 606/86, 606/53

(57) **ABSTRACT**

Described are surgical tools, including tool drivers and implantation instruments, that provide improved visual and positional access to human acetabulum Some embodiments include a conduit with multiple bends to circumvent soft tissue surrounding the acetabulum The conduits may employ a number of interlocking, rotational links to transfer torque from a drive end of the tool to a bit end In one embodiment the bit end supports an attachment actuator that securely engages a conventional acetabular cup for insertion and placement The attachment actuator can release the cup without moving the body of the tool, which prevents accidental dislodging of a properly placed acetabular cup



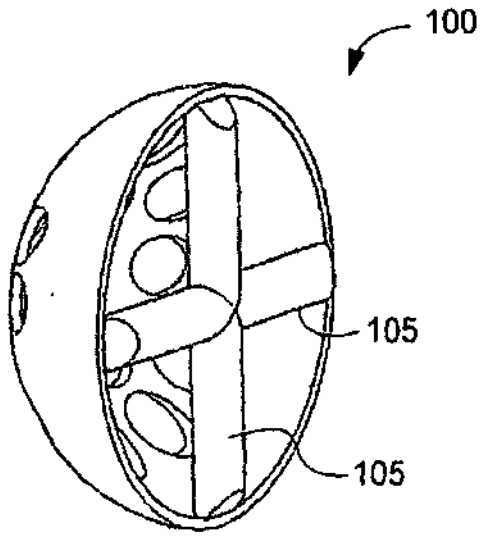


Fig. 1 (PRIOR ART)

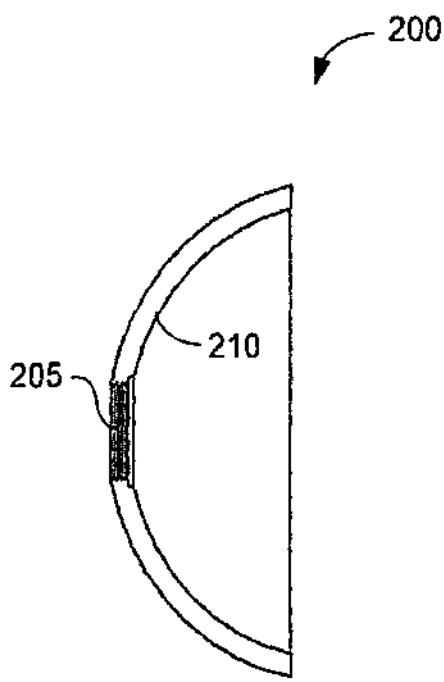


Fig. 2 (PRIOR ART)

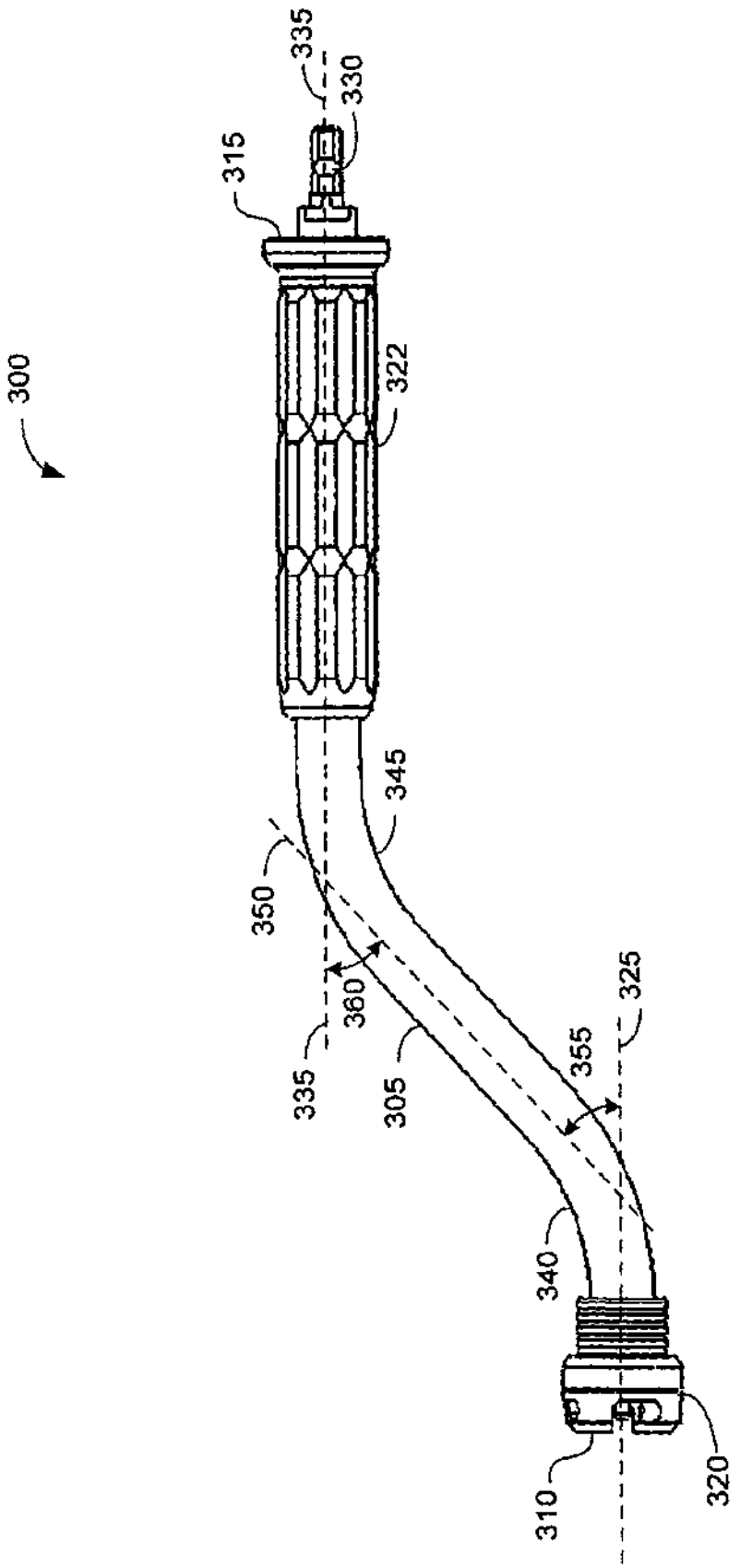


Fig. 3

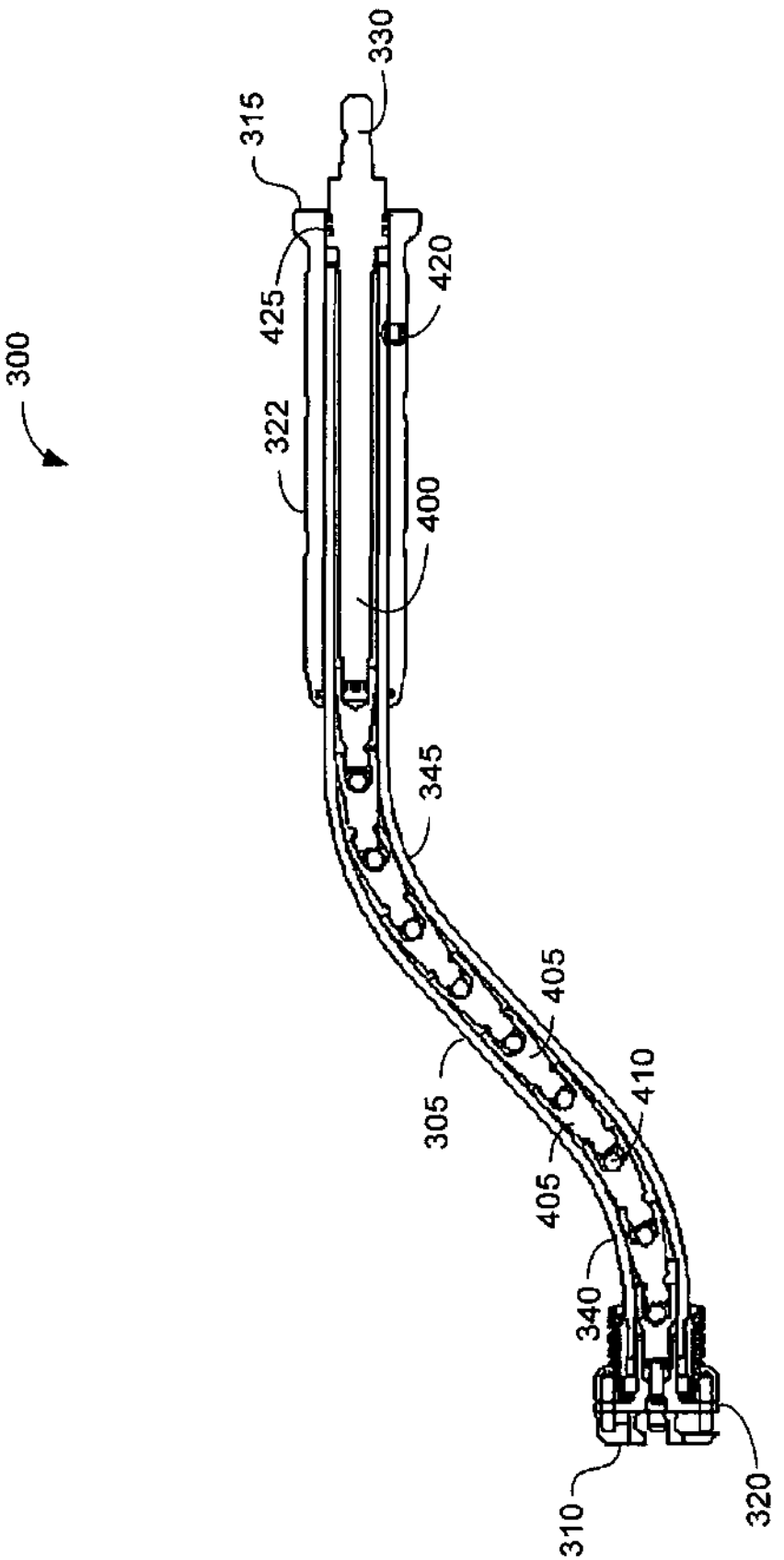


Fig. 4

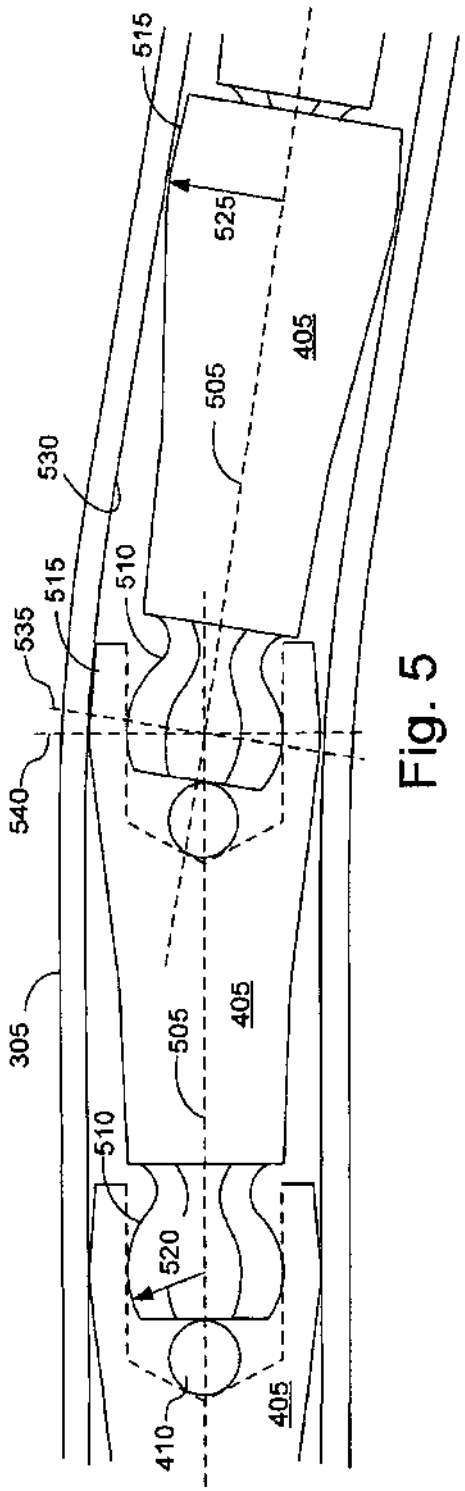


Fig. 5

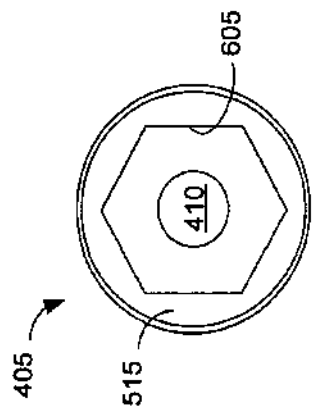


Fig. 6B

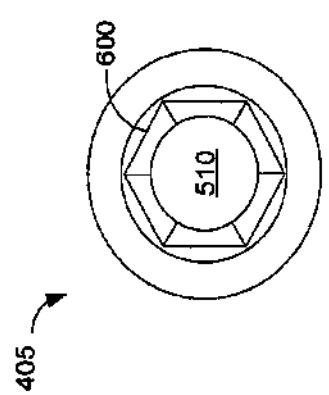


Fig. 6A

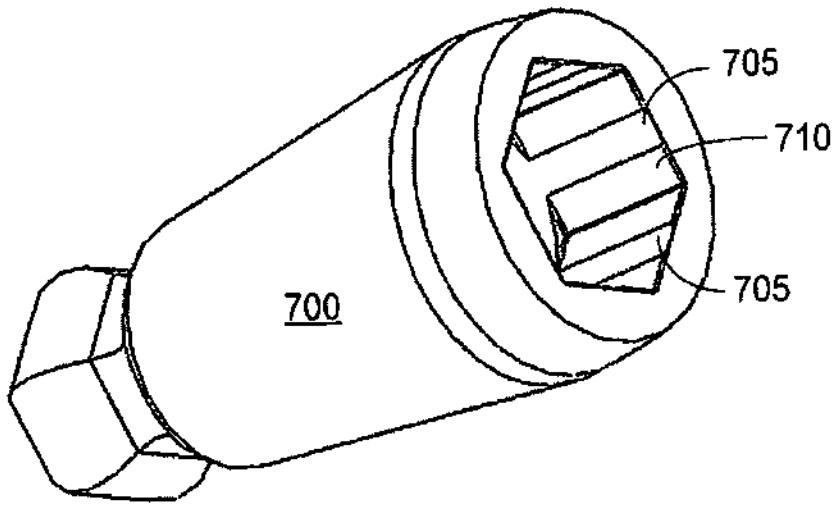


Fig. 7

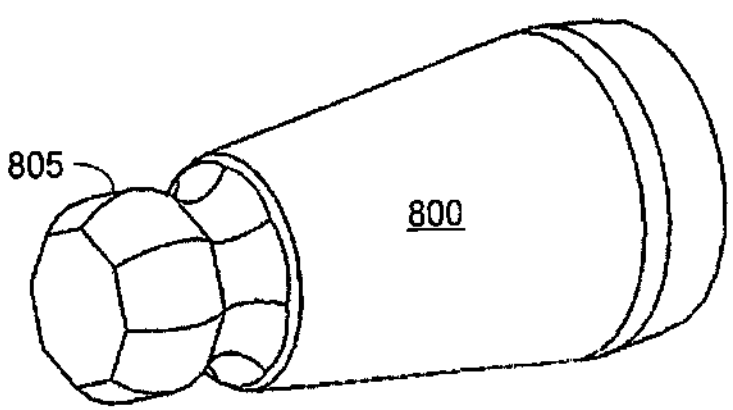


Fig. 8

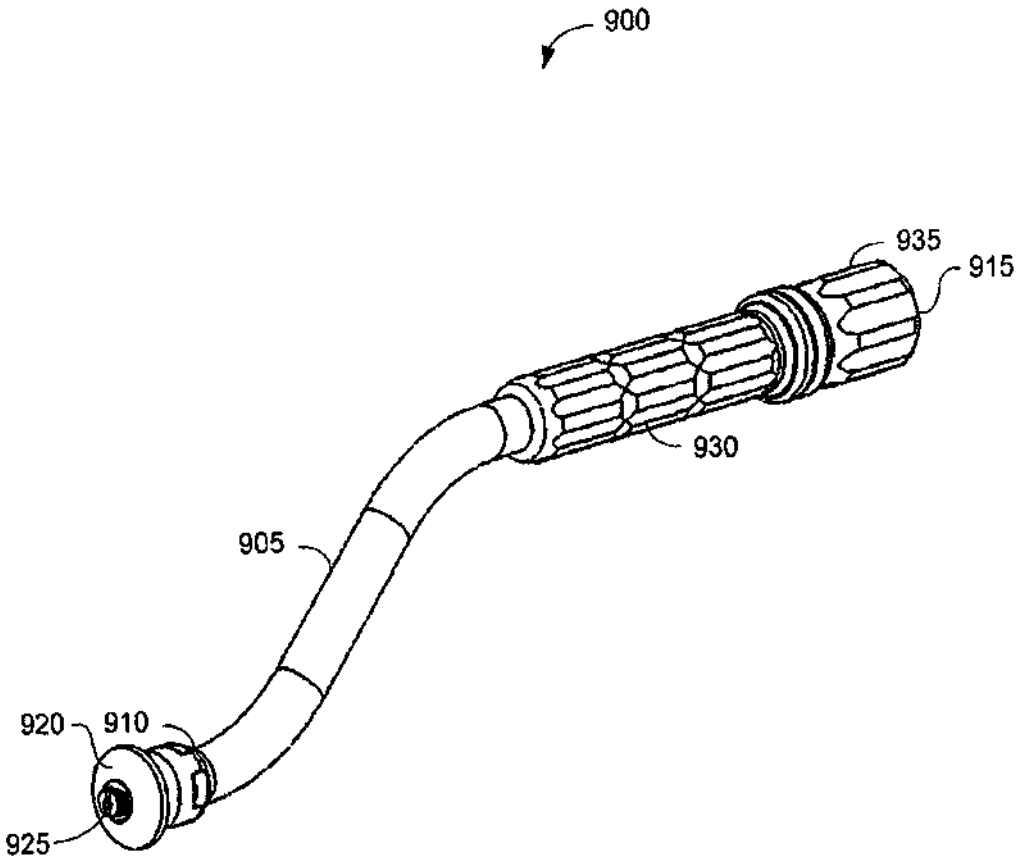


Fig. 9

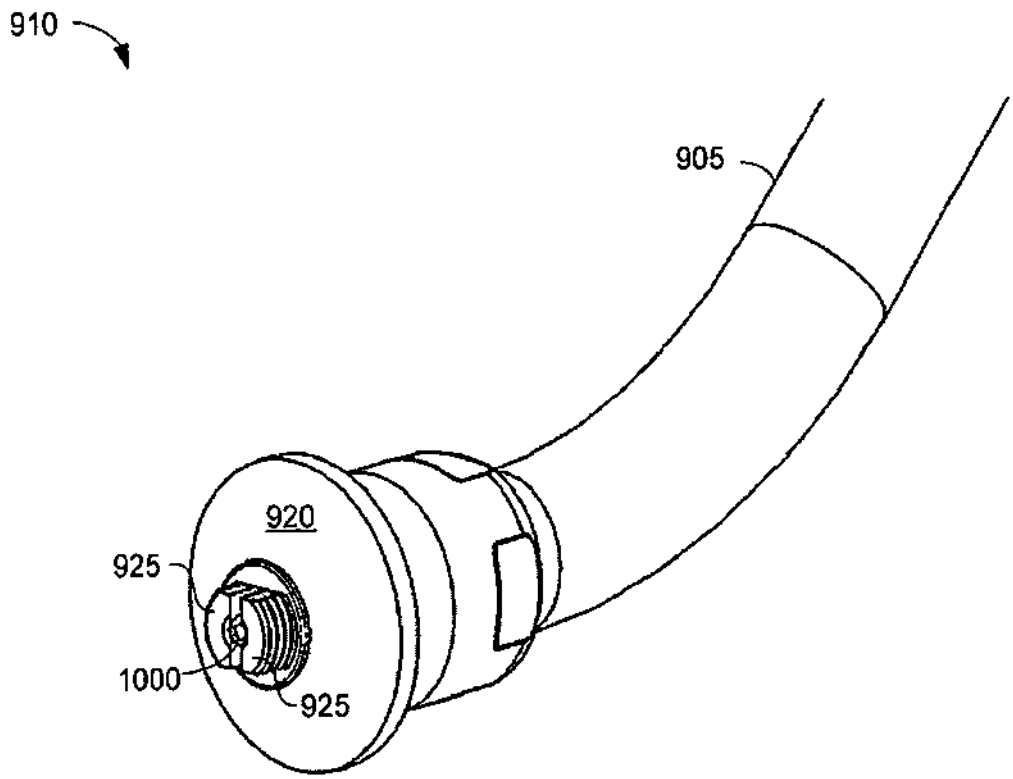


Fig. 10

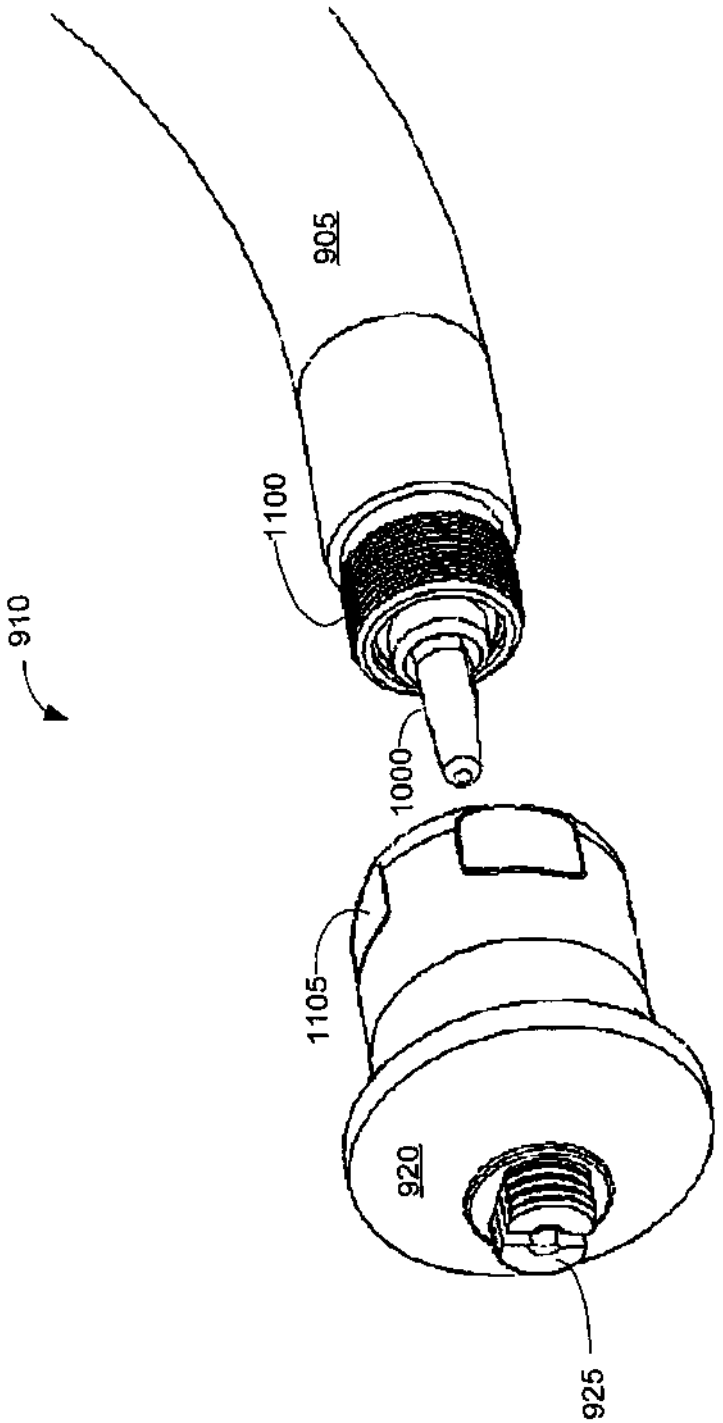


Fig. 11

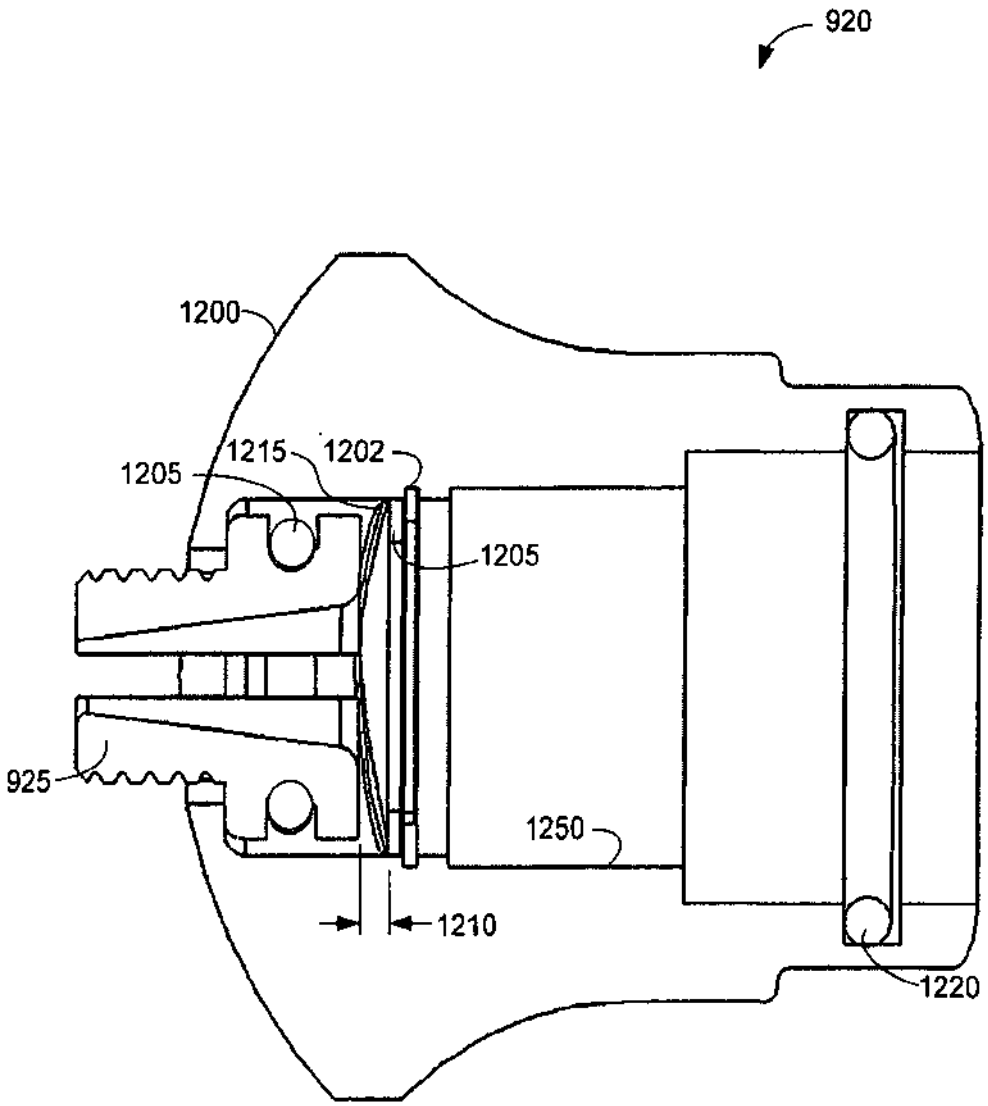


Fig. 12

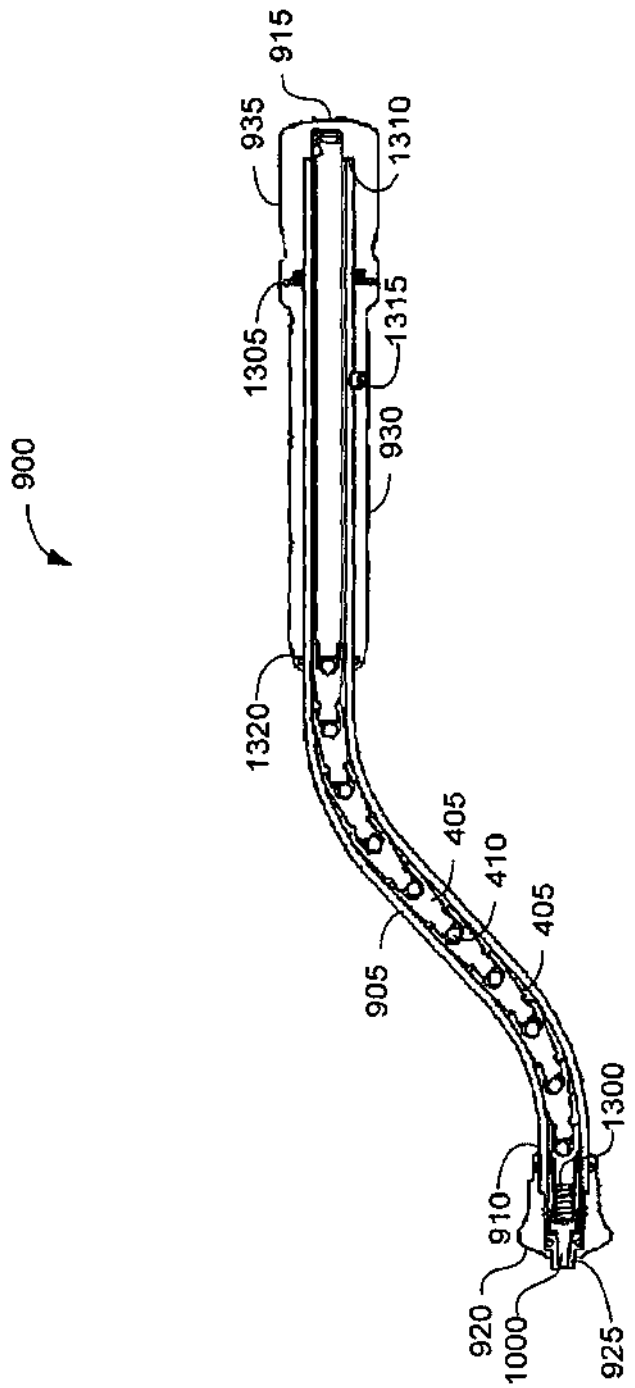

900
915
935
1310
1305
1315
930
1320
405
410
405
905
1300
910
920
1000
925

Fig. 13

SURGICAL TOOLS FOR JOINT REPLACEMENT

BACKGROUND

[0001] FIG. 1 (prior art) depicts an acetabular reamer cup **100**, a type of surgical bit used to cut precisely sized hemispherical cavities in the human acetabulum, a cavity at the base of the hipbone into which fits the ball-shaped head of the femur Acetabular reamer cups are generally mounted on a tool driver via a pair of cross members **105** The tool driver is in turn mounted in the chuck or collet of a low-speed, high torque portable drill or flexible powered shaft An embodiment of reamer cup **100** is detailed in U S Pat No 6,428,543, which is incorporated herein by reference

[0002] FIG. 2 (prior art) is a cross section of a joint-replacement cup **200**, in this example an acetabular cup, for implanting into a hemispherical cavity formed using reamer cup **100** Acetabular cup **200** becomes part of an artificial hip joint A threaded hole **205** firmly secures the concave inner surface **210** of cup **200** against an implantation instrument (not shown) used to insert and position cup **200** into the associated cavity

[0003] Soft tissue surrounds the acetabulum, and interferes with tool drivers and implantation instruments This problem is exacerbated in larger patients, who disproportionately require hip-replacement surgery There is therefore a need for tool drivers and implantation instruments that provide improved access to the acetabulum

[0004] For detailed discussions of hip replacement, including tool drivers and implantation instruments, see U S Pat Nos 5,320,625, 6,428,543, and 5,817,096, which are incorporated herein by reference

SUMMARY

[0005] The present invention is directed to surgical tools, including tool drivers and implantation instruments, that provide improved visual and positional access during joint-replacement surgery Tool drivers and implantation instruments in some embodiments include multiple bends to circumvent soft tissue surrounding the acetabulum The tool and drive ends may extend along parallel axes so tool operators enjoy a correct sense of reamer or cup placement

[0006] Tool drivers with one or more bends provide improved access, but the bends complicate the task of transmitting high torque from the drive end to the tool end Some embodiments address this problem using a drive mechanism made up of a number of interlocking, rotational links

[0007] A hip-replacement tool in accordance with another embodiment supports an attachment actuator that securely engages a conventional acetabular cup for insertion and placement The attachment actuator supports an attach state and a release state In the attach state, threaded jaws in the attachment actuator expand into a hole in the acetabular cup In the release state, the threaded jaws contract to disengage the cup without rotating with respect to the cup Users can control the states of the attachment actuator without moving the body of the tool, so tool operators can detach the tool from the implanted cup without accidentally dislodging or misaligning the cup

[0008] This summary does not limit the invention, which is instead defined by the claims

BRIEF DESCRIPTION OF THE FIGURES

[0009] FIG. 1 (prior art) depicts an acetabular reamer cup **100**, a type of surgical bit used to cut precisely sized hemispherical cavities in the human acetabulum

[0010] FIG. 2 (prior art) is a cross section of an acetabular cup **200** for implanting into the hemispherical cavities formed using reamer cup **100**

[0011] FIG. 3 is a side view of a hip-replacement tool **300** in accordance with one embodiment

[0012] FIG. 4 depicts an embodiment of tool **300** of FIG. **3** in cross section, with like-numbered elements being the same as those of FIG. **3**

[0013] FIG. 5 depicts a portion of conduit **305** in cross section, detailing a number of interlocking rotational links **405**

[0014] FIG. 6A depicts link **405** from a perspective facing male end **510**

[0015] FIG. 6B depicts a link **405** from a perspective facing female end **515**.

[0016] FIG. 7 depicts a link **700** in accordance with another embodiment

[0017] FIG. 8 depicts a link **800** in accordance with another embodiment

[0018] FIG. 9 depicts a hip-replacement tool **900** in accordance with an embodiment used for implanting and positioning an acetabular cup, such as cup **200** of FIG. **2**

[0019] FIG. 10 depicts bit end **910** of tool **900** in more detail for ease of illustration

[0020] FIG. 11 depicts end **910** of tool **900** with cup attachment **920** removed from conduit **905** to better illustrate actuator **1000**

[0021] FIG. 12 is a cross-section of cup attachment **920** in accordance with one embodiment

[0022] FIG. 13 depicts an embodiment of tool **900** of FIG. **9** in cross section

DETAILED DESCRIPTION

[0023] FIG. 3 is a side view of a surgical tool **300** in accordance with one embodiment Tool **300**, a hip-replacement tool in this example, includes a conduit **305** extending between a bit end **310** and a drive end **315** Bit end **310** supports a head **320** that rotates with respect to conduit **305** on a first axis **325** Drive end **315** includes a handle **322** A shaft end **330** adapted to mate with a drill collet extends from drive end **315**, and rotates on a second axis **335** In one embodiment, a flexible shaft extends through conduit **305** from shaft end **330** to head **320**, so rotating shaft end **330** similarly rotates head **320** Head **320** mates with an acetabular reamer cup similar to cup **100** of FIG. **1**, and is, in this embodiment, of a type described in U S Pat Nos 6,540,739 and 6,506,000, both of which are incorporated herein by reference

[0024] Conduit **305** includes a pair of bends **340** and **345**, so a portion of conduit **305** extends along a third axis **350** at an angle **355** with respect to first rotational axis **325** and an angle **360** with respect to second rotational axis **335**. Angles **355** and **360** are equal in the depicted embodiment, though this need not be the case. The double bend of tool **300** avoids soft tissue for improved visibility and positional accuracy, but still provides a straight-line approach to tool placement. In embodiments in which rotational axes **325** and **335** are parallel, the operator enjoys a correct sense of the position of bit end **310** even when blood and tissue obstruct direct viewing.

[0025] The inclusion of bends **340** and **345** facilitates ease of access, but renders difficult the task of transmitting high torque through conduit **305**. Some embodiments employ a flexible shaft to convey torque from shaft end **330** to head **320**, but such embodiments sometimes suffer gripping and vibration when actuating an acetabular reamer cup against hard or uneven bone surfaces.

[0026] **FIG. 4** depicts an embodiment of tool **300** of FIG **3** in cross section, with like-numbered elements being the same as those of **FIG. 3**. (In general, this document uses a numbering convention in which the leading digit or digits identifies the figure in which the element was introduced.) Rotating head **320** connects to shaft end **330** via a drive shaft **400** and a number of interlocking rotational links **405**. Bushings **410** are disposed between adjacent links **405**. The embodiment of **FIG. 4** has been found to transfer torque more evenly than flexible shafts.

[0027] **FIG. 5** depicts a portion of conduit **305** in cross section, detailing a number of interlocking rotational links **405**. Each link **405** is symmetrical about a respective link access **505**, and includes a male end **510** and a female end **515**. Male end **510** has a radius of curvature **520** that allows each link **405** to pivot in a plane parallel to link axes **505** within female end **515** in an adjacent link **405**. The exterior surface of each link **405** includes a radius of curvature **525** that allows the female end of each link **405** to pivot in a plane parallel to link axes **505** and freely against the interior wall **530** of conduit **305**.

[0028] Referring to the interconnection of the two full links of **FIG. 5**, a dashed line **535** extends through the pivotal axis of male end **510** and a dashed line **540** extends through the pivotal axis of female end **515**. The intervening bushing **410** maintains the intersection of the two pivotal axes over a range of angles. In other words, the pivotal axes of the male and female ends remain substantially coaxial when the rotational axes **505** of adjacent links **405** are misaligned. This link arrangement prevents links **405** from binding against one another and against interior wall **530** when transmitting torque around bends in conduit **305**.

[0029] **FIG. 6A** depicts link **405** from a perspective facing male end **510**. In this embodiment, link **405** includes six exterior facets **600**, though other shapes might be used. FIG **6B** depicts a link **405** from a perspective facing female end **515**. Female end **515** includes six interior facets **605** that mate with the exterior facets **600** of an adjacent link **405**.

[0030] In one embodiment, conduit **305** is a **416** stainless-steel pipe with an inside diameter of about 0.410 inches and an outside diameter of about 0.625 inches. Each of bends **340** and **345** is about forty five degrees, with a bend radius of about 2.18 inches. In one embodiment, conduit **305** is formed by drilling out a **416** stainless-steel rod, forming bends **340** and **345**, forcing appropriately sized spheres through the resulting channel to restore the inside diameter within curves **340** and **345** using a hydraulic press, and hardening the resulting conduit. The hardened **416** stainless steel advantageously provides an excellent bearing surface for links **410**. Links **410** are, in one embodiment, machined from **440-C** stainless steel.

[0031] **FIG. 7** depicts a link **700** in accordance with another embodiment. Link **700** is similar to links **410** of **FIG. 4**, but includes a lubrication channel **705** in one or more of interior facets **710**. In one embodiment, lubrication channels **705** are formed by first pre-drilling the female end of link **700** to include round hole slightly larger in diameter then the short dimension of the hexagonal hole to be formed in the female end. The corners of the hexagon are then formed either by stamping the hole with a hexagonal dye and removing the resulting chips or using a conventional wobbling broach technique.

[0032] **FIG. 8** depicts a link **800** in accordance with another embodiment. Link **800** is similar to link **700** of **FIG. 7**, but includes **8** exterior facets **805** and eight interior facets (not shown).

[0033] **FIG. 9** depicts a surgical tool **900** in accordance with an embodiment used for implanting and positioning a cup, such as acetabular cup **200** of **FIG. 2**. Tool **900** includes a conduit **905** extending between a bit end **910** and a handle end **915**. Bit end **910** supports a cup attachment **920** through which protrudes a pair of jaws **925** adapted to extend into and engage with hole **205** of cup **200** (**FIG. 2**). As detailed below, jaws **925** are parts of an attachment actuator that supports an attach state and a release state: the attach state secures tool **900** to acetabular cup **200** and the release state releases cup **200**. A user controls the states of the attachment actuator by grasping a knurled handle **930** and rotating a knob **935** on drive end **915**. Tool **900** can release cup **200** while holding conduit **905** and handle **930** still, which prevents accidental dislodging of a properly placed cup **200**. As in tool **300** of **FIG. 3**, the inclusion of two bends in tool **900** provides improved visual and surgical access, particularly for relatively large patients.

[0034] **FIG. 10** depicts bit end **910** of tool **900** in more detail for ease of illustration. An actuator **1000** extends between jaws **925**. Rotating knob **935** clockwise with respect to handle **930** extends actuator **1000** outward, spreading jaws **925**, conversely, rotating knob **935** counter-clockwise withdraws actuator **1000**, allowing jaws **925** to close.

[0035] Jaws **925** each include thread portions **1005** sized to engage the female threads of hole **205** in cup **200**. Cup **200** can thus be mounted on cup attachment **920** either rotationally (taking advantage of thread portions **1005**) or by extending jaws **925** through hole **205** in the release state and turning knob **935** to spread jaws **925** to engage threaded portions **1005**. Tool **900** can then be used to position, implant, and adjust cup **200**.

[0036] Once cup **200** is properly placed, tool **900** can easily release cup **200** without disturbing the position of cup **200**. Rotating knob **935** counter-clockwise withdraws actuator **1000**, allowing jaws **935** to close and release cup **200**.

The ability of tool **900** to maintain a secure hold on cup **200** is important, as positioning and implanting cup **200** can require considerable force, possibly even hammer blows on knob **935** The ability of tool **900** to gently release cup **200** is also important, as cup **200**, once properly positioned, should not be disturbed Conventional tools that rely upon a rotational connection to threads **205** sometimes cross thread, rendering removal difficult and posing a danger of cup displacement

[0037] **FIG. 11** depicts end **910** of tool **900** with cup attachment **920** removed from conduit **905** to better illustrate actuator **1000** Cup attachment **920** mates with threads **1100** on conduit **905**, and includes facets **1105** for accepting a suitable wrench

[0038] Actuator **1000** moves in and out of conduit **905** with rotation of knob **935** Actuator **1000** mates with interior threads (not shown) within conduit **905** In one embodiment, the threads on actuator **1000** and the corresponding threads **905** are so-called double threads Instead of a single helical land, as in most conventional threads, double threads have two interlaced helical lands, rather like the stripes of a barber pole Double threads advance a mating threaded component twice as far in one turn as a single thread

[0039] **FIG. 12** is a cross-section of cup attachment **920** in accordance with one embodiment Jaws **925** extend out through the face **1200** of cup attachment **920** and are held in place by a retaining ring **1202**, a washer **1205**, and a spring **1215** (spring **1215** is a Belleville washer in one embodiment) An O-ring **1220** urges jaws **925** against actuator **1000** (**FIG. 10**) so that jaws **925** close as actuator **1000** is withdrawn Spring **1215** forces jaws **925** out through face **1200** of cup attachment **920** A gap **1210** between jaws **925** and washer **1205** prevents jaws **925** from taking the force of hammer blows by allowing jaws **925** to recede into cup attachment **920** until face **1200** engages the interior surface of cup **200** Face **1200**, and not the more fragile jaws **925** and associated drive mechanism, thus absorbs the impact A second O ring **1220** prevents blood and debris from entering cup attachment **920** between attachment **920** and conduit **905** Though not shown here, attachment **920** includes female threads on an inside surface **1250** that mate with threads **1100** on the outside of conduit **905** (**FIG. 11**)

[0040] **FIG. 13** depicts an embodiment of tool **900** of **FIG. 9** in cross section Various drive mechanisms can be used to force jaws **925** apart or allow jaws **925** to close In this embodiment, however, a number of links **405** and bushings **410** of the type described above in connection with **FIG. 4** transfer rotational motion of knob **935** to a threaded portion **1300** of actuator **1000** An O-ring **1305** seals knob **935** against handle **930** while allowing for relative rotation Knob **935** includes a shoulder **1310** that rests against conduit **905** The force of blows applied to knob **935** is thus transmitted to cup attachment **920** via conduit **905**, and not via the more sensitive drive mechanism A set screw **1315** secures handle **930** to conduit **905**, and an O-ring **1320** precludes blood and debris from collecting between handle **930** and conduit **905**

[0041] While the present invention has been described in connection with specific embodiments, variations of these embodiments will be obvious to those of ordinary skill in the art For example

[0042] a. Hip-replacement tool **900** of **FIG. 9** need not have split threads, as shown, but might also include a more traditional rotating thread actuated using the disclosed link system or some other flexible means for providing torque through the channel,

[0043] b Conduits in accordance with some embodiments are flexible to allow the bends to be adjusted over a range of angles A series of rotational links might be installed, for example, within flexible conduits of the type available from e g Lockwood Products, Inc , under the trademark LOC-LINE.

[0044] c The medical tools described above in the context of hip replacement can be used to advantage in other surgical procedures

[0045] d Veterinary joint replacement surgery will benefit from the tools described herein

[0046] e The link systems described herein have broad application outside the medical field

[0047] f Some embodiments can be modified to include a motor to provide the driving force

[0048] Therefore, the spirit and scope of the appended claims should not be limited to the foregoing description

1 A surgical tool for manipulating a joint-replacement cup, the tool comprising

a a conduit having a head end and a drive end, wherein the head end is adapted to removably attach to the cup, and

b a drive mechanism extending between the head end and the drive end, the drive mechanism rotating on a first axis at the head end and on a second axis on the drive end;

c wherein at least a portion of the drive mechanism rotates on a third axis at a first angle with respect to the first axis and a second angle with respect to the second axis

2 The surgical tool of claim 1, wherein the first and second angles are substantially equal

3 The surgical tool of claim 2, wherein the first and second axes are substantially parallel

4 The surgical tool of claim 1, wherein the cup comprises an acetabular reamer

5 The surgical tool of claim 1, further comprising a plurality of interlocking links extending through the conduit

6 The surgical tool of claim 1, wherein each of the links includes a male end and a female end

7. The surgical tool of claim 6, wherein the male end includes a plurality of exterior facets and the female end includes a plurality of interior facets

8 The surgical tool of claim 7, wherein the exterior facets define a hexagon

9 The surgical tool of claim 7, wherein each link rotates along a link axis, and wherein the male end has a radius of curvature in a plane parallel to the rotational axis

10 The surgical tool of claim 9, wherein the female end has a second radius of curvature in the plane

11 The surgical tool of claim 6, further comprising a bushing disposed within the female end of a first of the links and the male end of a second of the links

12 The surgical tool of claim 11, wherein the bearing is spherical

13. The surgical tool of claim 1, wherein the acetabular cup is comprises a reamer surface

14. The surgical tool of claim 1, wherein the head comprises a cup support receiving an acetabular cup

15 A surgical tool for positioning a joint-replacement cup, the joint-replacement cup including a threaded hole, the surgical tool comprising

a a conduit having a head end and a drive end,

b a drive mechanism rotatably attached to the drive end of the conduit, the drive mechanism rotating on a first axis, and

c a head connected to the head end of the conduit, the head including

i a cup attachment supporting the cup, and

ii a threaded attachment actuator having an attach state and a release state, the attach state securing the cup attachment to the cup and the release state releasing the cup,

iii wherein the actuator support transitions between the attach and release states without rotating with respect to the conduit

16 The surgical tool of claim 15, wherein the attachment actuator includes first and second jaws extending into the hole

17 The surgical tool of claim 16, wherein the attachment actuator further includes a wedge extending between the first and second jaws, and wherein the attach state corresponds to a first wedge position and the release state corresponds to a second wedge position

18 The surgical tool of claim 17, wherein the hole comprises female threads, and wherein the first and second jaws include partial threads

19 The surgical tool of claim 18, wherein the partial threads engage the female threads in the first wedge position and disengage the female threads in the second wedge position

20 The surgical tool of claim 15, wherein the conduit includes at least one bend between the head end and the drive end

21 The surgical tool of claim 15, further comprising a plurality of interlocking links extending through the conduit

22 The surgical tool of claim 15, wherein each of the links includes a male end and a female end

23 The surgical tool of claim 22, wherein the male end includes a plurality of exterior facets and the female end includes a plurality of interior facets.

24 The surgical tool of claim 23, wherein the exterior facets define a hexagon

25 The surgical tool of claim 23, wherein each link rotates along a link axis, and wherein the male end has a radius of curvature in a plane parallel to the rotational axis

26 The surgical tool of claim 25, wherein the female end of each link has a second radius of curvature in the plane

27 The surgical tool of claim 26, further comprising a bearing disposed within the female end of a first of the links and the male end of a second of the links

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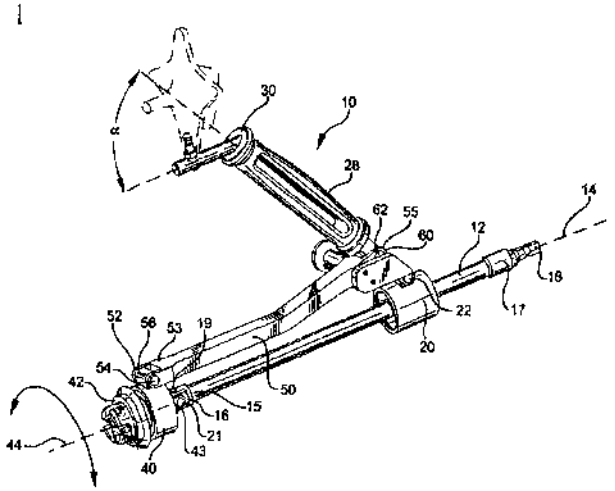
(54) Adjustable reamer with tip tracker linkage

(57) A positioning tool for a joint socket cutting instrument or a implant is designed for use with a minimally invasive surgical procedure and in conjunction with a computer assisted surgical procedure The positioning tool has a longitudinally extending drive shaft having a moveable joint at a first end and a drive coupling for connecting to a power source at a second end A holder for mounting a cutting tool such a drill or as an acetabular cutting instrument or for mounting an acetabular implant is coupled to the moveable joint at the first end of the drive shaft for movement with respect to the drive shaft The holder is rotatable about a central axis thereof when the drive shaft is rotated The drive shaft includes a shaft bearing mounted thereon which is pivotally coupled to the shaft at a fixed longitudinal position and is pivotally coupled to a longitudinally extending first arm having a handle A tracker system which is capable of being utilized by a computer-aided surgical system is mounted on the first arm A second arm is provided which is pivotally connected to the holder at a first end and pivotally connected to the first arm at a second end The resulting four bar linkage allows the holder and the cutting instrument/implant to be manipulated in any position while the known geometric relationship between the tracker and the holder allows the location of the holder to be displayed by the computer on a cathode ray tube with respect to a joint

FIG 1



EP 1 442 729 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention is directed to the implantation of artificial joint components and in particular to acetabular joint components More particularly, it is related to instrumentation for reaming the acetabular socket and for locating the prosthetic acetabular cup within the reamed socket Even more particularly, it is related to an instrument which can be used with computer-assisted minimally invasive surgical implantation of the joint component during joint replacement or revision procedures

[0002] Total hip replacement or orthroplasty operations have been performed to repair the acetabulum and the regions surrounding it and to replace the hip components such as the natural femoral head which has degenerated

[0003] With regard to the acetabulum, many instruments have been designed to locate either the acetabular cup or reamers for repairing the acetabulum to receive such a prosthetic cup Such instruments are shown in U S Patent Nos 4,305,394, 4,632,111, 5,037,424, 5,061,270, 5,320,625 and 6,395,005 Many of these instruments require a relatively large incision, i e , 7-9 inches in the hip area in order to utilize the instruments in preparing the acetabulum and positioning the acetabular cup There has been a long felt need to develop instrumentation to perform this procedure which can be used with a smaller incision, for example, 2-3 inches

[0004] In addition, computer-assisted surgery has been developed which utilizes a tracking system which can relate positions on the patients and/or instruments to stored X-ray, CT scan and MRI data previously obtained for the patient Alternately, image free computer-aided surgery has been developed where mechanical relationships can be calculated from anatomical reference points and utilized such as in joint arthroplasty Such digitized points include the location of the center of the femoral head, the location of the epicondylar ligament attachment points, and the surfaces of the condyles These systems are used intra-operatively for performing various surgical procedures, including replacement of artificial joints

[0005] It has been especially useful to utilize trackable medical instruments for use in procedures utilizing computer-assisted image guided or image free medical and surgical navigation systems Systems using body images are shown in U S Patent Nos 5,383,454 to Bucholz and 6,021,343 to Foley et al In general, these image-guided systems use computer stored digital images of a body part obtained, such as by CT scans taken before surgery, to generate images on a display, such as a CRT monitor screen, during surgery These images are used in connection with real time information for representing the position of a surgical instrument with respect to the body part The systems typically include tracking devices such as, for example, an LED array mounted on a surgical instrument as well as a patient body part or parts A tracker such as an optical tracker is used to track, in real time, the position of the body part and the instrument used during surgery, and a monitor screen to display images representing the body and the position of the instrument relative to the stored images or a vertical image as the surgical procedure is performed

[0006] An image free type system is shown in U S Patent No 6,385,475 the teachings of which are incorporated herein by reference Some systems of this type include virtual joint images and relate the tracked anatomic landmarks to the virtual body part images In such a system, an active or passive marker is attached to bones on opposite sides of a joint and a measuring device such as an optical sensing camera is coupled to a data processing system to which signals corresponding to the positioning data of the optical markers are supplied by the optical camera system This data is used to correlate the markers on opposite sides of the joint with digitized anatomic landmarks With a pointer mounted tracker, it is possible to locate various anatomic reference points on the joints to allow the optical/computer system to position a cutting instrument such as a reamer or sawblade having a tracker mounted thereon to shape a joint part for receiving a prosthetic implant

[0007] In utilizing instruments which rotate such as reaming systems, it is important to align the cutting tool in the correct angle as well as locating and controlling the depth of penetration. There has been a long felt need for a tool which can axially align a reamer such as an acetabular reamer and guide the reamer internally of the body to a precise desired location In addition, in order to perform minimally invasive surgery, reamers have been designed for the acetabulum which, rather than having the standard hemispherical shape, have only a part hemispherical shape but must be rotated through an angle such as 180° to form the hemispherical surface of an acetabular cavity in the pelvis designed to receive a hemispherical prosthetic acetabular component An expandable reamer such as shown in U S Patent No 3,702,611 may be used

SUMMARY OF THE INVENTION

[0008] It is an object of the invention to provide an instrument on which a reamer or implant is held which can be manipulated within the body to align the reamer or implant in a desired position

[0009] It is a further object of the invention to provide a holder which can be used with a joint shaper such as an acetabular reamer and/or to position an implant such as an acetabular cup within the body at any angle with respect to the central axis of the cup or reamer

[0010] It is still an additional object of the invention to provide an instrument for positioning a cutting tool or implant on which instrument a tracker, such as an optical

tracker, for example, an emitter array, such as a light emitting diode array The array includes a plurality of light emitters The tracker can be mounted on an instrument and can interact with an optical tracking system to track the position of the cutting tool, such as a reamer, or an implant, including its axial orientation with respect to a bony target while the instrument is located within the body of a patient

[0011] These and other objects of the invention are achieved by a positioning tool for use in a socket joint such as an acetabular cutting instrument or acetabular implant which tool has a longitudinally extending shaft extending along a longitudinal axis which shaft has a joint capable of movement about at least two axis and preferably three axis at a first end thereof An implant or tool holder is mounted on the first end of the shaft and is designed to be placed within the body adjacent a socket joint such as the acetabulum The holder has a central axis and is coupled at a connector to the moveable joint, such as a universal joint, to the first end of the longitudinally extending shaft The holder is designed to either hold a reaming or cutting tool or to hold an acetabular implant Since the holder is coupled at a connection point to the moveable joint on the end of the longitudinal shaft, it can be oriented in any angular position or at least a wide range of desired positions with respect to the shaft The shaft has a shaft bearing mounted on the shaft adjacent an end opposite the holder end The bearing may be mounted in a fixed position along the length of the shaft The shaft may be a drive shaft used to rotate within the shaft bearing and drive the reamer or other tool via the universal or flexible joint The positioner has a longitudinally extending first arm pivotally connected to the shaft beanng at a first pivot point for pivotal movement in a plane parallel or coplanar to the shaft longitudinal axis The first arm preferably includes a handle portion The tool includes a second arm pivotally connected to the first arm at a second pivot point and pivotally connected to the holder at a third pivot point The first arm of the positioning tool has a mounting rod on which the tracker is mounted In a preferred embodiment, the tracker emitter array includes at least three light emitting diodes to enable the optical tracking system to calculate the position of the arm The array mounting rod extending from the first arm preferably extends at a point thereon located outwardly of a handle portion on the first arm, which handle is used by the surgeon to manipulate the positioning tool to position the holder at the desired location The axis of the tracker is oriented at a fixed angle to the holder central axis, and may be parallel thereto to allow the optical tracking system to locate the holder central axis based on tracker data Mounting the mounting arm parallel to the central axis allows the surgeon to visualize the angle of the holder by the orientation of the tracker mounting rod

[0012] Preferably, the shaft bearing is fixed axially along the longitudinally extending shaft and the first, second and third pivot points are located at distances from one another so as to position the central axis of the holder at an angle with respect to the first end of the longitudinal shaft in fixed relationship to the angle of the tracker mounting rod for all pivotal positions of the first arm with respect to the shaft bearing This means that the central axis of the holder is located at a fixed angle or parallel to the axis of the tracker mounting rod as the positioning tool first arm is manipulated to any position with respect to the longitudinal shaft As will be easily understood by one skilled in the art, the structure described is in the form of a four bar linkage with the lengths of the various arms and the locations of the pivot points on the arms connecting the adjacent sides of the linkage chosen to establish a known geometric relationship between the emitter (tracker) array and the reaming tool or implant mounted on the tool In the preferred embodiment, the four arms form a parallelogram with opposite sides being the same length Of course as long as the geometry of the tool is programmed into the computer, mathematical algorithms can calculate the position of the cutting head based on inputs of the optical tracking system

[0013] The positioning tool is used by mounting the implant or instrument on the holder and mounting the tracker on the mounting rod attached to the first arm The surgeon then can manipulate the positioner and the holder about the moveable joints to any desired position An optical tracking system coupled to the computer-assisted surgical system can calculate the location of the implant or cutting tool from the known relationships of the linkage system and the known angle of the holder central axis which is at a fixed angle or is parallel to the central axis of the rod holding the light emitting diode tracker assembly The holder, including cutting tool or implant, is placed within the patient and the optical tracking system allows the surgeon to view the joint, such as the acetabulum, on the CRT with the computer generated location of the cutting tool or implant overlayed either on the digital CT images stored in the computer database for the patient or on a vertical acetabulum The movement (image free) of the holder is tracked in real time and the real or virtual image data is updated to compensate for patient movement, if any, also in real time The surgeon can then manipulate the holder via the handle on the first arm to cut the proper cavity or locate the implant in its desired position When used without the optical computer-aided system, the instrument can still be used utilizing the parallel relationship between the mounting rod on the handle and the holder central axis

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG 1 is a side isometric view of the positioning tool of the present invention,

FIG 2 is an isometric view of the positioning tool of the present invention, including an acetabular

reamer position to shape the natural socket of the acetabulum,

FIG 3 is a top view of the positioning tool of the present invention shown in FIG 1,

FIG 4 is a cross-sectional view of the positioning tool of FIG 3 along the lines 4-4,

FIG 5 is a side elevation view of the positioning tool of FIG 1,

FIG 6 is a front end view of the positioning tool of FIG 1,

FIG 7 is a rear end view of the positioning tool of FIG 1,

FIG 8 is a cross-sectional view of the positioning tool of FIG 3 along the lines 8-8, and

FIG 9 is an exploded view of the positioning tool of FIG 1

DETAILED DESCRIPTION

[0015] Referring to the figures, there is shown an acetabular cup or tool positioner of the present invention generally denoted as 10 Positioner 10 is essentially designed as a four bar linkage having a holder at its leading end design either to hold a cutting tool, such as an acetabular reamer or an implant such as a prosthetic acetabular cup Of course the tool can be used to position other implants within the body

[0016] Referring to FIGS 1 and 9, there is shown a positioning tool 10 which includes a drive shaft 12 extending along a longitudinal axis 14 At a first end 15, drive shaft 12 includes a joint 16 capable of movement about at least two axis such as a flexible shaft or wire or a typical mechanical universal joint which is of a well known design and sized to fit the diameter of the shaft At a second end 17 of shaft 12, there is a drive connection 18 adapted to engage a chuck (not shown) of any typical rotary power drive such as an electric drill Shaft 12 has a bearing member 20 mounted thereon Bearing 20 is fixed axially on shaft 12 but allows the shaft 12 to rotate about axis 14 of shaft 12 Bearing 20 includes a pivot connection 22 on an outer surface thereof

[0017] As best seen in FIGS 2-5 and 9, pivot connection 22 is pivotally connected to a first arm 24 via a pivot pin 26 and a pair of forks 24a and 24b The preferred first arm 24 includes handle 28 coupled thereto which has a first end 30 opposite pivot point 22 In the preferred embodiment, a mounting rod 32 extends at a predetermined angle α with respect to the longitudinal axis 31 of arm 24 and handle 28 Mounting rod 32 includes a connector 34 for connecting an emitter or tracker array 36 to the first arm 24 In the preferred embodiment, tracker array 36 includes at least three light emitting diodes 38 located in the same plane which diodes can be tracked by an optical tracking system such as described in U S Patent Nos 6,021,343 and 6,434,415, the teachings of which are incorporated herein by reference While in the preferred embodiment, an optical tracking system is used any tracking system such as acoustic system can be used In addition, while the preferred tracker includes radiation (light), emitting diodes a passive system using light reflectors could also be used

[0018] Moveable joint 16 attached to first end 15 of shaft 12 is coupled to a holder 40 which includes a mounting system 42 on which a cutting tool, such as a reamer 44 is mounted The preferred universal joint 16 has a pair of perpendicular pins 19 and 21 about which two parts of the joint can pivot in a standard manner Holding system 42 can be any suitable system for gripping an acetabular cup implant or acetabular reamer In the preferred embodiment, the holder is similar to that taught in U S Patent No 6,264,647 Preferably, the holder can releasably grip both a reaming tool and the prosthetic acetabular cup

[0019] Holder 40 has a central axis 44 and is coupled via a connector 43 to pin 21 at one end of the universal joint 16 so that axis 44 may, in the preferred embodiment, be oriented in any angular relationship to axis 14 of shaft 12 In order to effectuate angular movement of holder 40, holder 40 is coupled to a second arm 50 via a pivot connection 52 having forks 52a and 52b Pivot connection 52 is similar to the pivot connection 22 and includes a pivot pin 54 extending through a bushing 56 having a flange integrally formed on the outer circumference of holder 40. Thus, second arm 50 has a first end 53 pivotally coupled to the holder 40 and a second end 55 pivotally connected to first arm 24 at pivot connection 60 In the preferred embodiment, the pivot connection 60 consists of a pivot pin 62 which extends through a pair of forks 64, 66 formed on second end 55 of second arm 50 and, in the preferred embodiment, through a portion of arm 24

[0020] The resulting structure can be seen to be a four bar linkage where each of the four bars are pivotally connected The linkage is thus made up of shaft 12, first arm 24, holder 40 and second arm 50 In the preferred embodiment, the distances between the pivot points connecting the four bars and the angle α are chosen such that the axis 32 of mounting rod 34 always remains parallel to axis 44 of holder 40 throughout any location of first arm 24 and consequently any position of the four bar linkage

[0021] In the preferred embodiment, the linkage forms a parallelogram with the distance between the pivot connection of universal joint 16 and pivot point 22 on bearing 20 along shaft 12 is approximately 6 6 inches and the length of second arm 50 between points 52, 60 is also approximately 6 6 inches In the preferred embodiment, the distance of pivot point 54 from the center line 44 of holder 40 is approximately 79 inches Likewise, the distance between pivot point 22 of bearing 20 from the axis 14 of shaft 12 is also approximately 79 inches In the preferred embodiment, the distance between pivot point 22 and pivot point 60 a first arm 24 and second arm 50 respectively is approximately 1 inch and the distance between pivot point 52 and pivot point 21 is also 1 inch The axis of all the pivot pins (except pin 19) are

parallel so that movement of handle 20 takes place in a plane containing axis 14 of shaft 12

[0022] During the preferred surgical procedure and after the optical-aid surgical system has been calibrated to the patient's anatomy, the instrument 10, including tracker assembly 36 mounted on rod 32 is grasped by the surgeon with one hand on handle 28 A cutting element or implant, such as a reamer or acetabular cup, denoted as 44 would be mounted on holder 40 In the case of reaming, a drive source, not shown, would be connected to drive element 18 on second end 17 of shaft 12 for powering the reamer The positioner 10 is then inserted into an appropriate incision with the holder being aligned in the desired position via the computer-assisted surgical system The surgeon may then manipulate handle 28 by manipulating the four bar linkage such as, for example, by rotating the handle along arrow 70 of FIG 2 The surgeon may also rotate the entire assembly 10 about axis 14 of shaft 12 in the direction of arrow 72 of FIG 2 The simultaneous movement of positioner 10 in direction 72 and the handle 28 and first arm 24 in direction 70 causes movement of cutting tool or acetabular cup 44 about the x, y and z axis of the universal joint 16 Such manipulation would be shown on the CRT with respect to either the stored actual images or virtual images of the patient joint by the tracking system Upon obtaining the correct position adjacent the joint sockets, for example, the acetabulum, the drive shaft 12 and reamer is activated via drive element 18 with a suitable drive and rotating the shaft in a direction 74 about axis 14 (FIG 2)

[0023] Once the reaming is complete, the instrument is removed from the patient and the reamer is replaced by the acetabular implant which is located in the desired orientation with the computer-aided tracking system The cup is then implanted in a standard manner If a tracker system is not used the surgeon can orient the reamer or implant via rod 32 since, in the preferred embodiment, it is parallel in all orientations to the holder central axis. If visual orientation is not needed, i e , a computer-aided tracking system will always be used during surgery it may be possible to mount the tool geometry and tracker array in any orientation The computer can then be programmed with the tracker orientation and calculate the correct holder orientation Thus, the four-bar linkage need not be parallel as long as the actual geometry of the linkage were correctly programmed into the computer so that the actual holder orientation could be calculated based on the position of tracker 38

[0024] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims

Claims

1. A positioning tool for a cutting instrument or implant, comprising

   a shaft having a longitudinal axis and a first pivot connection capable of angular movement at a first end,
   a holder having a central axis for holding the instrument or implant coupled to said first pivot connection for angular movement with respect to said shaft first end,
   a shaft bearing rotatably mounted on said shaft,
   a first arm pivotally connected to said shaft bearing at a second pivot point for pivotal movement in a plane parallel to said first shaft axis, and
   a second arm pivotally connected to said first arm at a third pivot point and said holder at a fourth pivot point

2. The positioning tool as set forth in claim 1, wherein said connection is a universal joint

3. The positioning tool as set forth in claim 1, wherein said first arm has a tracking device thereon

4 The positioning tool as set forth in claim 3, wherein said tracking device is selected from the group consisting of an active array, a passive array, a sonic array, a light emitting diode array light, a reflective array, an electromagnetic tracker and a laser emitting tracker

5. The positioning tool as set forth in claim 3, wherein the first arm has a mounting element for mounting said tracker device thereon, said mounting element has an axis extending at a fixed angle to said central axis of said holder at any pivotal position of said first arm

6. The positioning tool as set forth in claim 5, wherein the first pivot connection is positioned axially on said shaft and said second, third and fourth pivot points are positioned relative to each other to position the central axis of the holder with respect to said mounting element axis at said fixed angle

7 The positioning tool as set forth in claim 6, wherein the distance between said first pivot connection at said shaft first end and said second pivot point equals the distance between said third and fourth pivot points

8 The positioning tool as set forth in claim 7, wherein the distance between said first pivot connection on said first end of said shaft and fourth pivot point is equal to the distance between said second and third

pivot points.

9. The positioning tool as set forth in claim 5, wherein said mounting element is a rod extending from said first arm along said mounting element axis

10. The positioning tool as set forth in claim 9, wherein said holder central axis is parallel to said rod axis for all positions of said first arm with respect to said shaft

11. The positioning tool as set forth in claim 1, wherein said first arm,includes a handle

12. The positioning tool as set forth in claim 1, wherein said shaft, said holder, said first arm and said second arm form a four bar linkage in the form of a parallelogram

13. The positioning tool as set forth in claim 12, wherein the simultaneous movement of said positioning tool and pivoting of the first arm with respect to said shaft causes said holder to be oriented in any desired position with respect to a bony target

14. The positioning tool as set forth in claim 13, wherein said first arm includes a mounting rod extending along an axis at a fixed angle to said first arm which angle maintains said mounting rod parallel to said holder central axis as said first arm pivots about said second pivot point.

15. The position tool as set forth in claim 14, wherein a tracker for an optical tracking system is mounted on said mounting rod

16. The positioning tool as set forth in claim 15, wherein said tracker array is a light emitter diode array

17 The positioning tool as set forth in claim 16, wherein said light emitting diodes are tracked by an optical tracking system which is able to locate the position of said holder with respect to said bony target from the tracked location of said array

18 The positioning tool as set forth in claim 1, wherein said shaft is a drive shaft having a second end adapted to be coupled to a drive source

19. The positioning tool as set forth in claim 1, wherein a range of angular movement of said holder with respect to said first shaft is at least to 90°

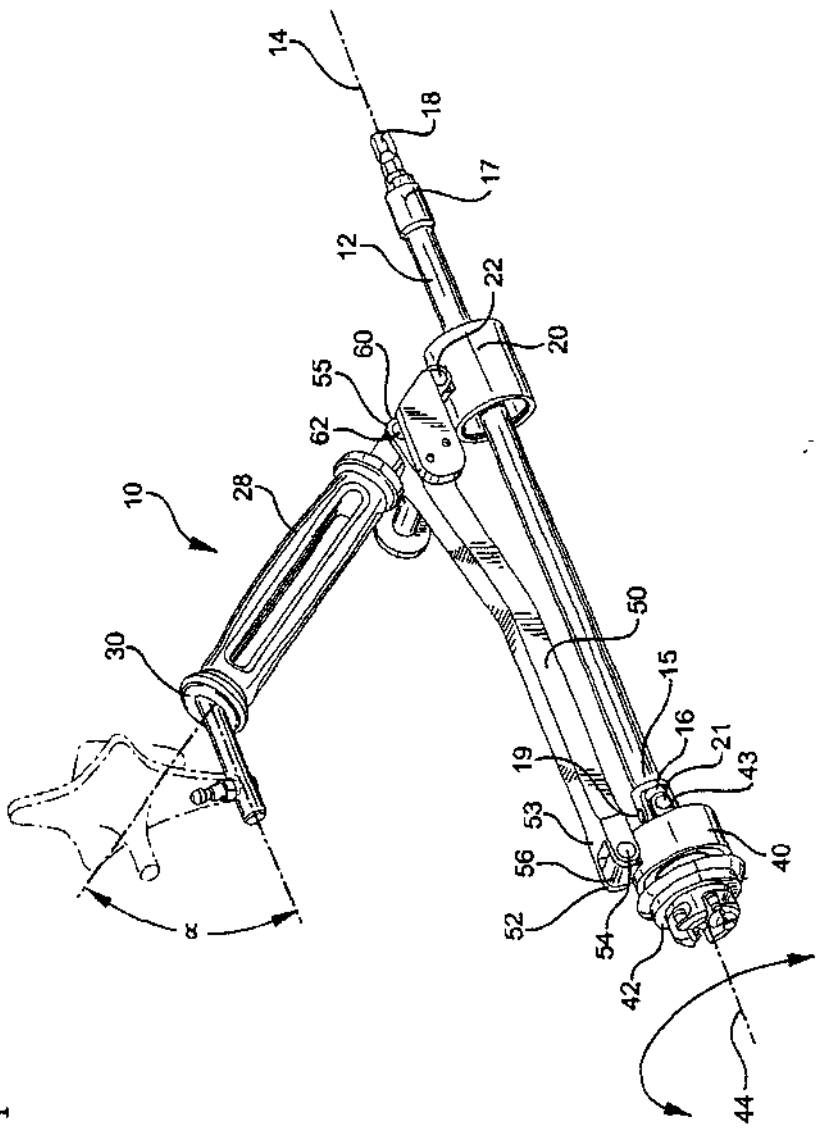

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FIG. 1

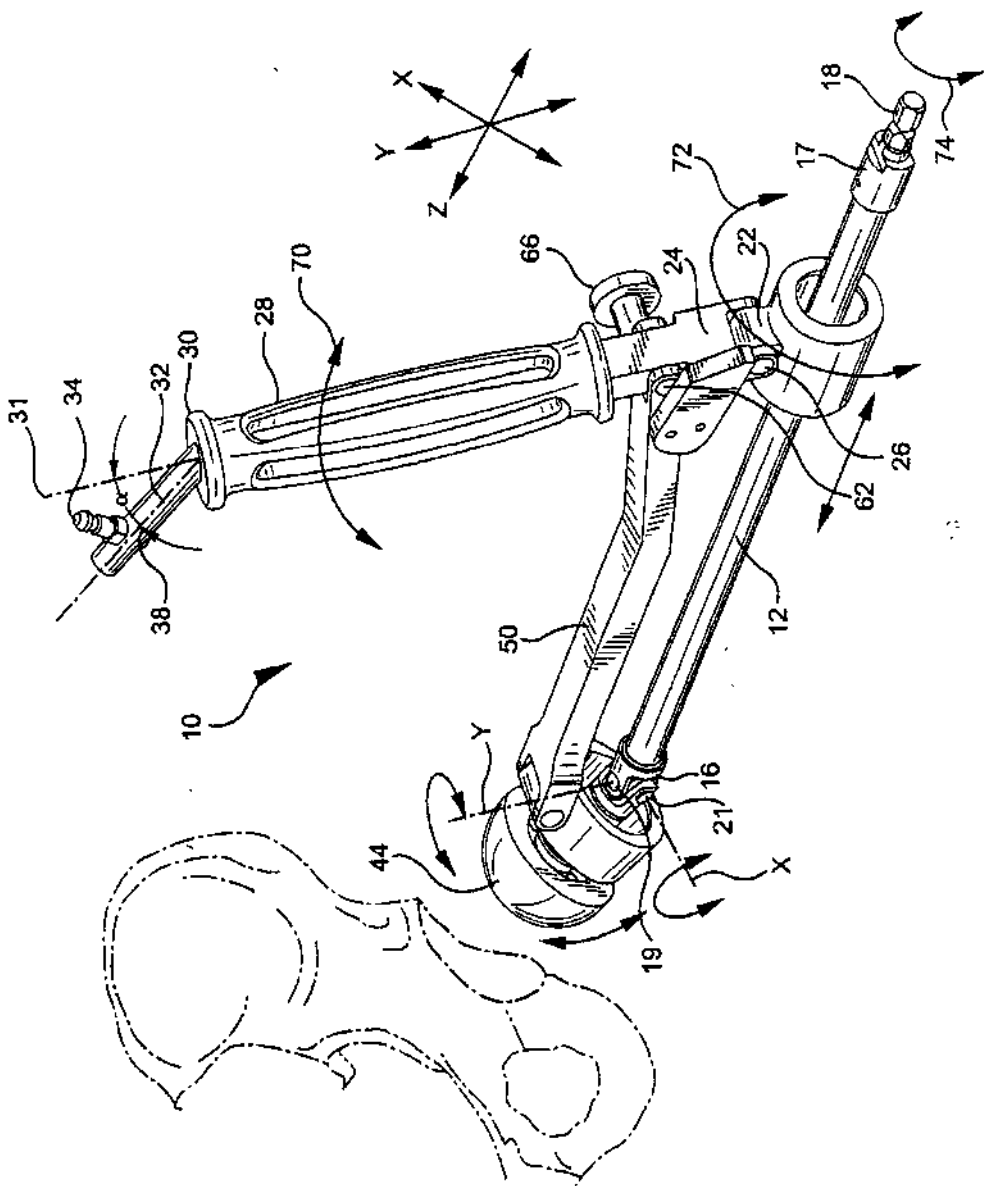
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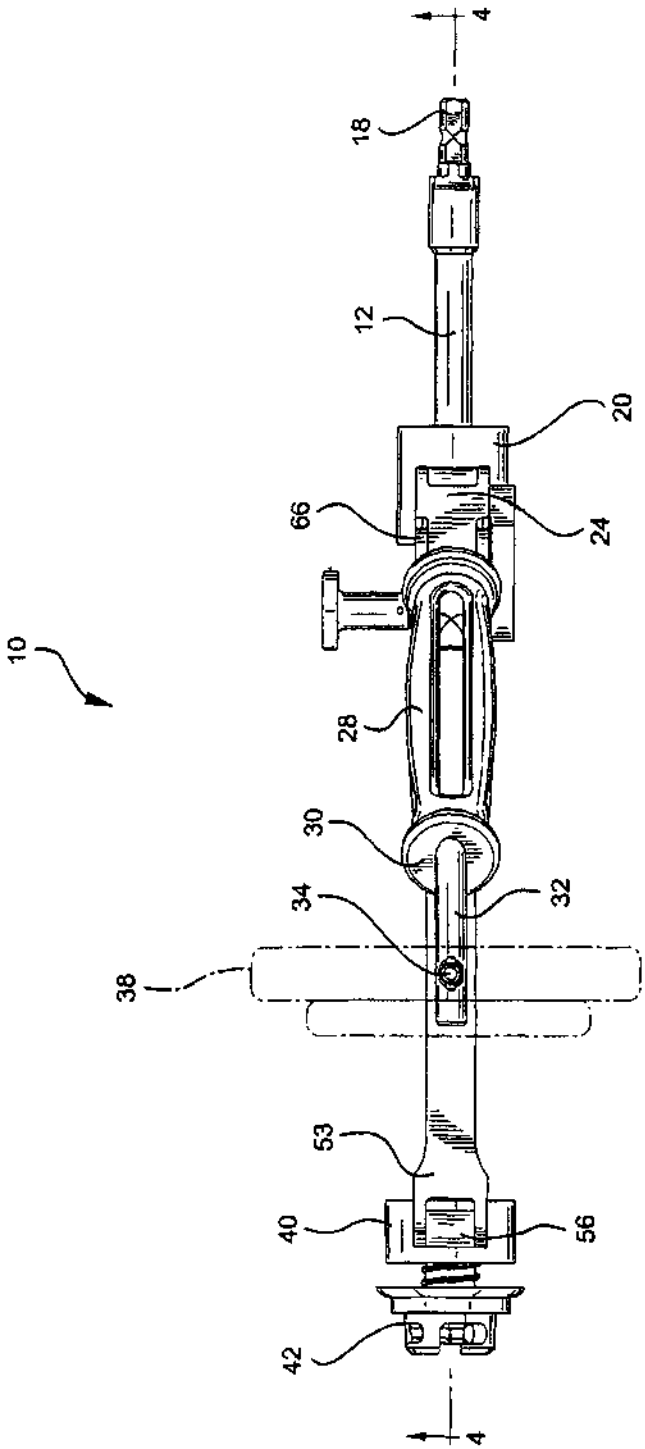
FIG. 2



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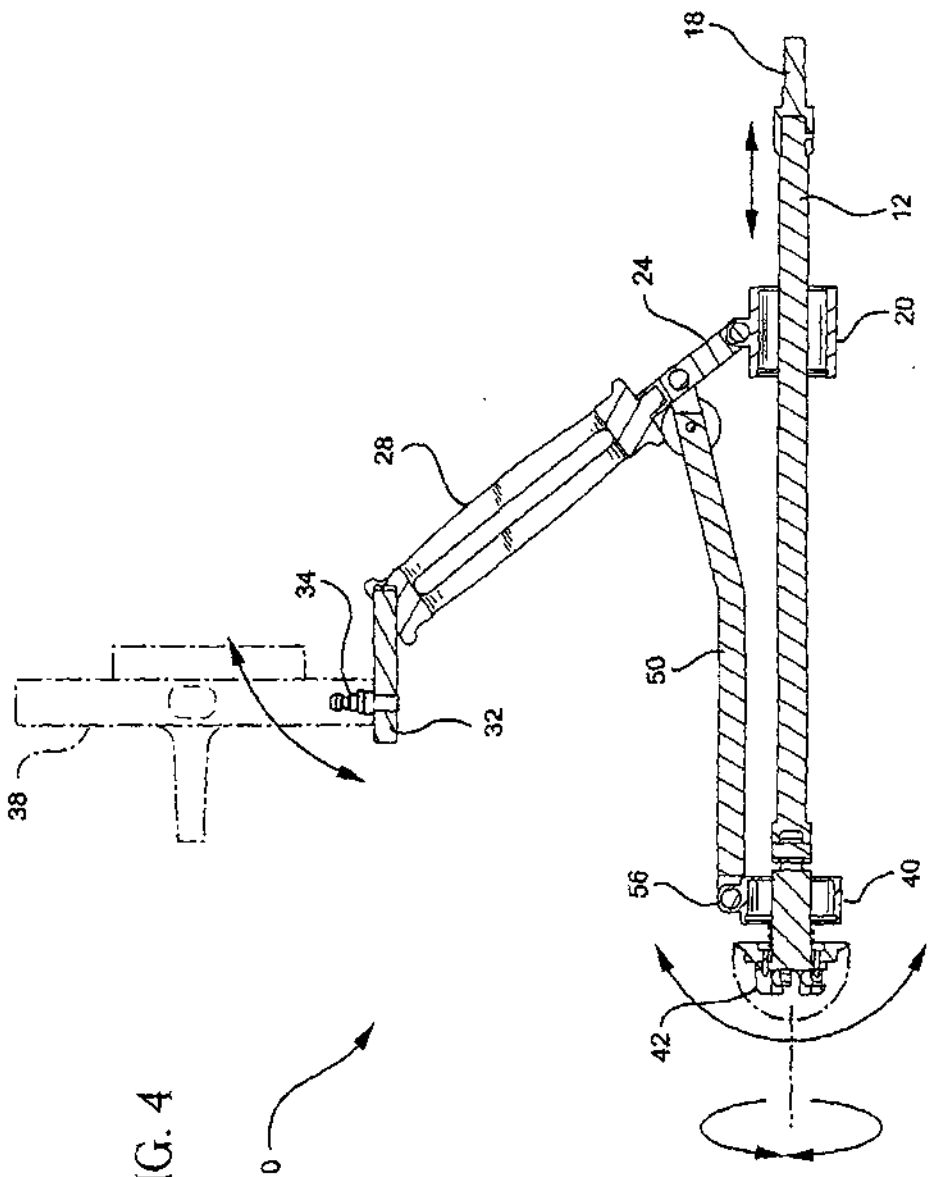


FIG. 4

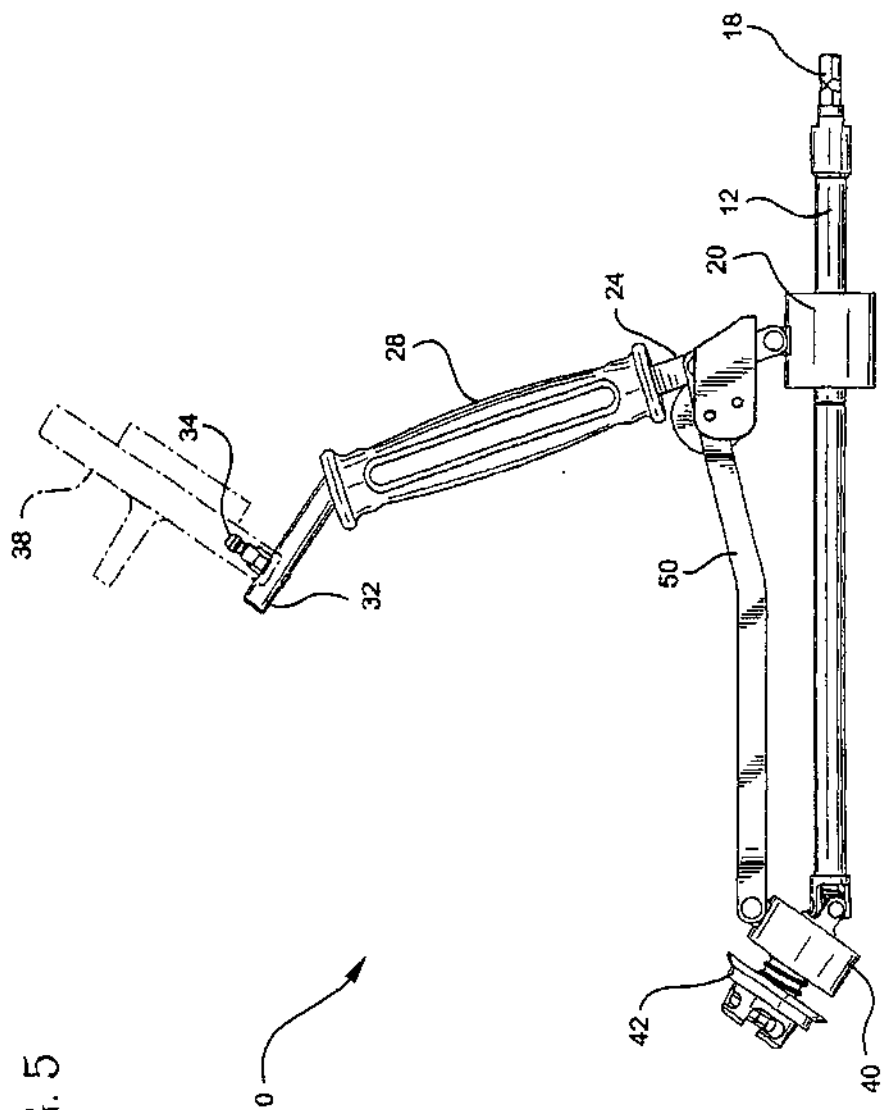


FIG. 5

FIG. 7

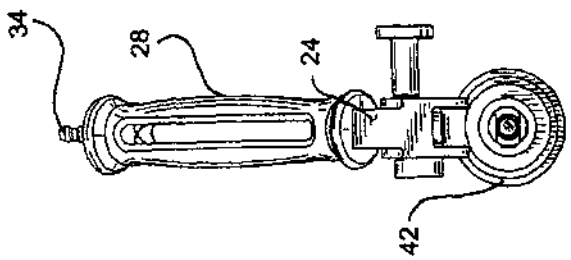
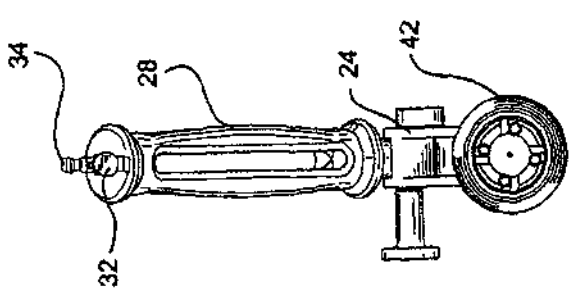


FIG. 6



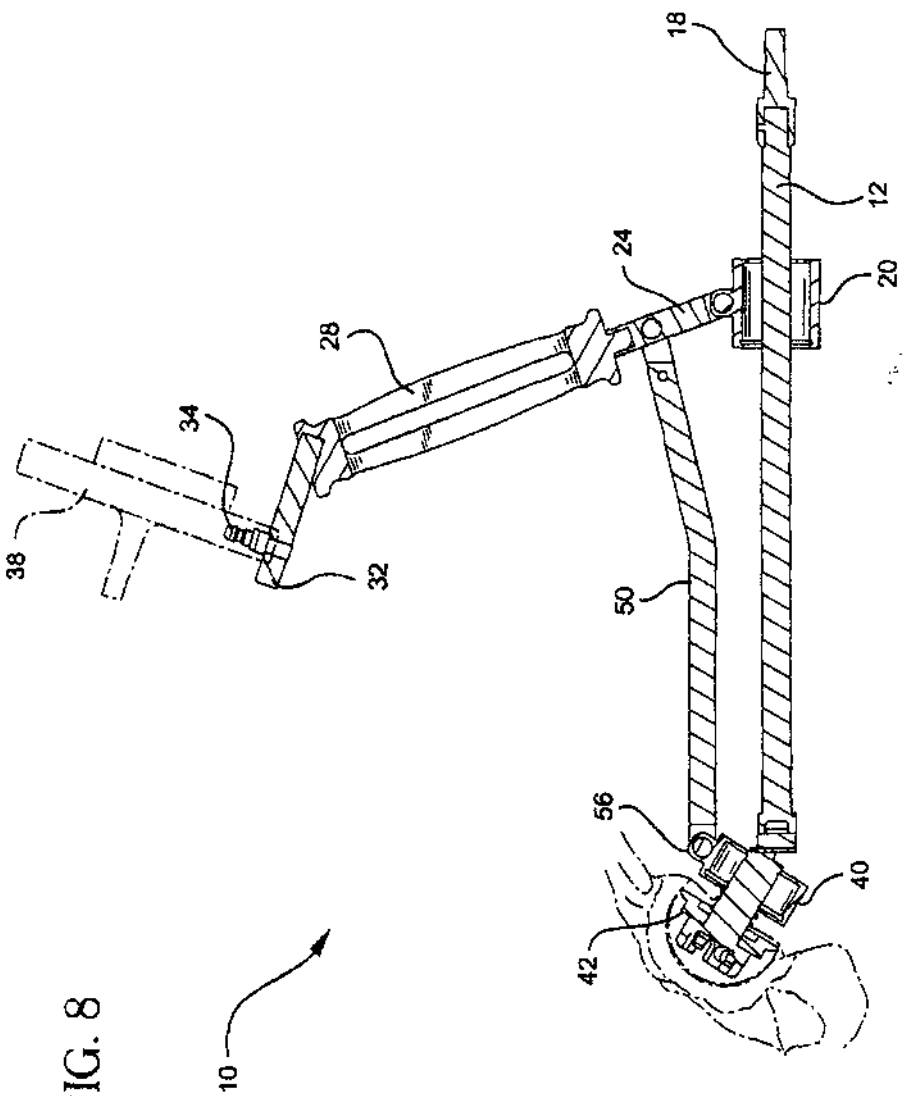


FIG. 8

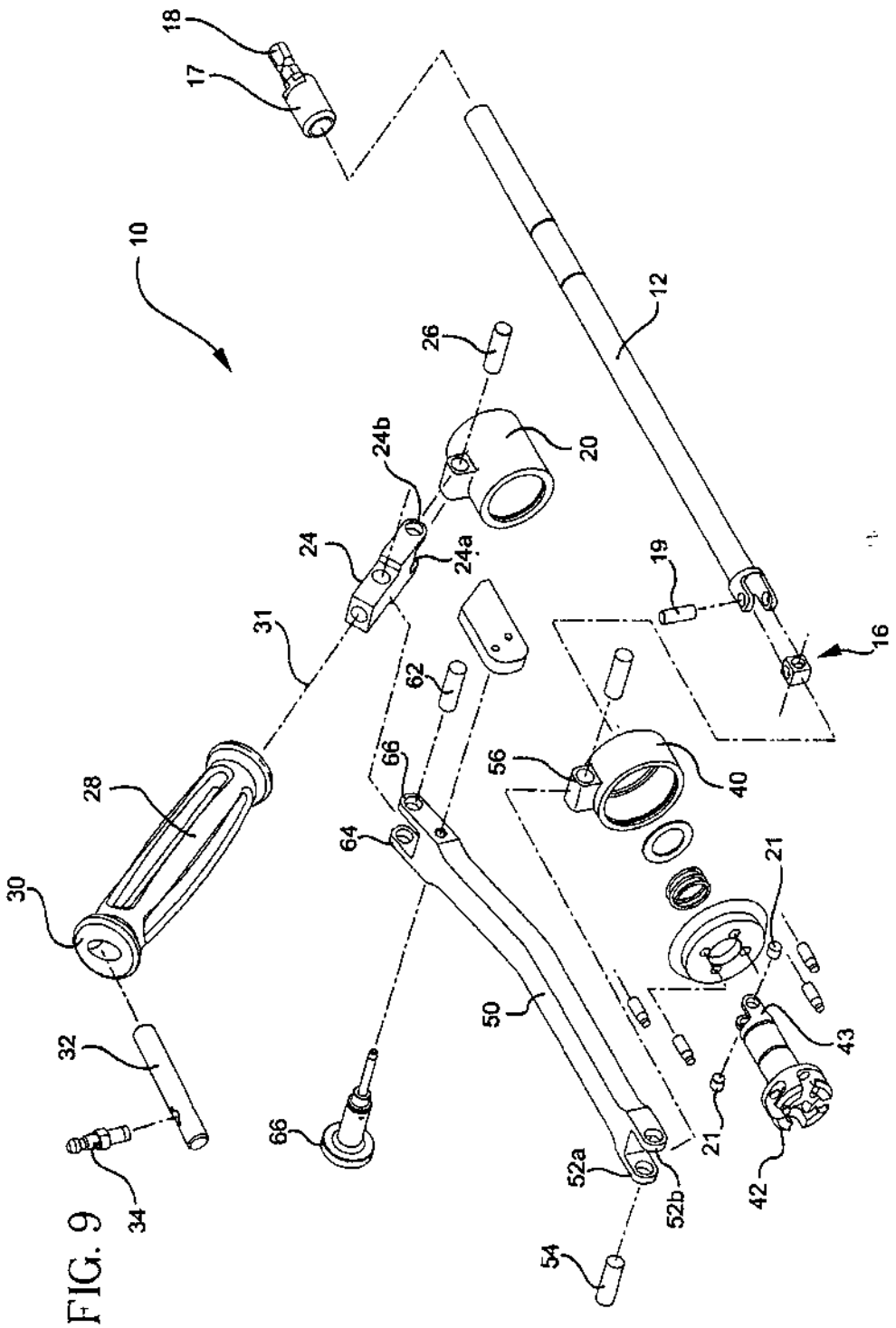

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FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 0312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	FR 2 721 502 A (LANDANGER LANDOS) 29 December 1995 (1995-12-29) * page 4, line 11 - page 5, line 20 * * page 8, line 32 - page 9, line 8 * * figures 1,5 * ---	1-19	A61F2/46 A61B17/16
A	DE 199 64 009 A (UNIV HEIDELBERG) 12 July 2001 (2001-07-12) * column 3, line 17 - column 4, line 6 * * figures 1A,2 * ---	1	
A	US 5 925 077 A (BLASCHKE RICHARD CRAIG ET AL) 20 July 1999 (1999-07-20) * column 6, line 52 - column 7, line 30 * * figures 12,13,14E * -----	1	

TECHNICAL FIELDS SEARCHED (Int Cl.7)

A61F
A61B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 April 2004	Compos, F

CATEGORY OF CITED DOCUMENTS

X particularly relevant if taken alone
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D document cited in the application
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EPO FORM 1503 03.82 (P04C01)

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report
The members are as contained in the European Patent Office EDP file on
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19-04-2004

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For more details about this annex : see Official Journal of the European Patent Office, No 12/82

US 20070293869A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0293869 A1**

Conte et al. (43) **Pub. Date: Dec. 20, 2007**

(54) **CURVED ACETABULAR POSITIONER, IMPACTOR AND REAMER HANDLE**

(75) Inventors **John Conte**, Prospect Park, PA (US), **Joseph C. Jenkins II**, Lindenhurst, NY (US)

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(73) Assignee **Howmedica Osteonics Corp.**, Mahwah, NJ

(21) Appl No · **11/641,599**

(22) Filed **Dec. 19, 2006**

Related U.S. Application Data

(60) Provisional application No 60/752,154, filed on Dec 20, 2005

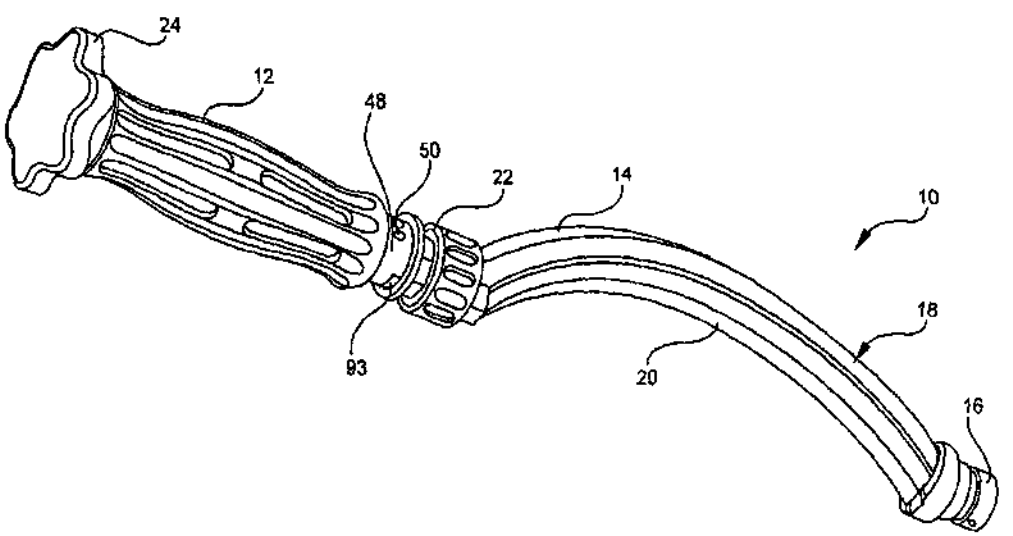
Publication Classification

(51) **Int. Cl.**
A61B 17/56 (2006 01)

(52) **U.S. Cl.** **606/91**

(57) **ABSTRACT**

An acetabular instrument has a handle portion having one or more solid nonflexible drive shaft elements therethrough The shaft elements are connected by a U-joint at one of both ends to form a flexible curved drive shaft One end of a solid shaft element is connected to a knob so that rotation of the knob drives the flexible shaft The flexible shaft is housed within a hollow curved body preferably made of stainless steel One end of the curved body it is connected to the handle portion and at the other end to an acetabular cup or acetabular reamer holder The reamer holder is rotatably driven by the flexible drive shaft The knob may be made so that it may receive blows from a mallet allowing the instrument to be used as an impactor The drive shaft may be used to actuate a locking mechanism within the cup or reamer holder which connects the reamer cup to the instrument



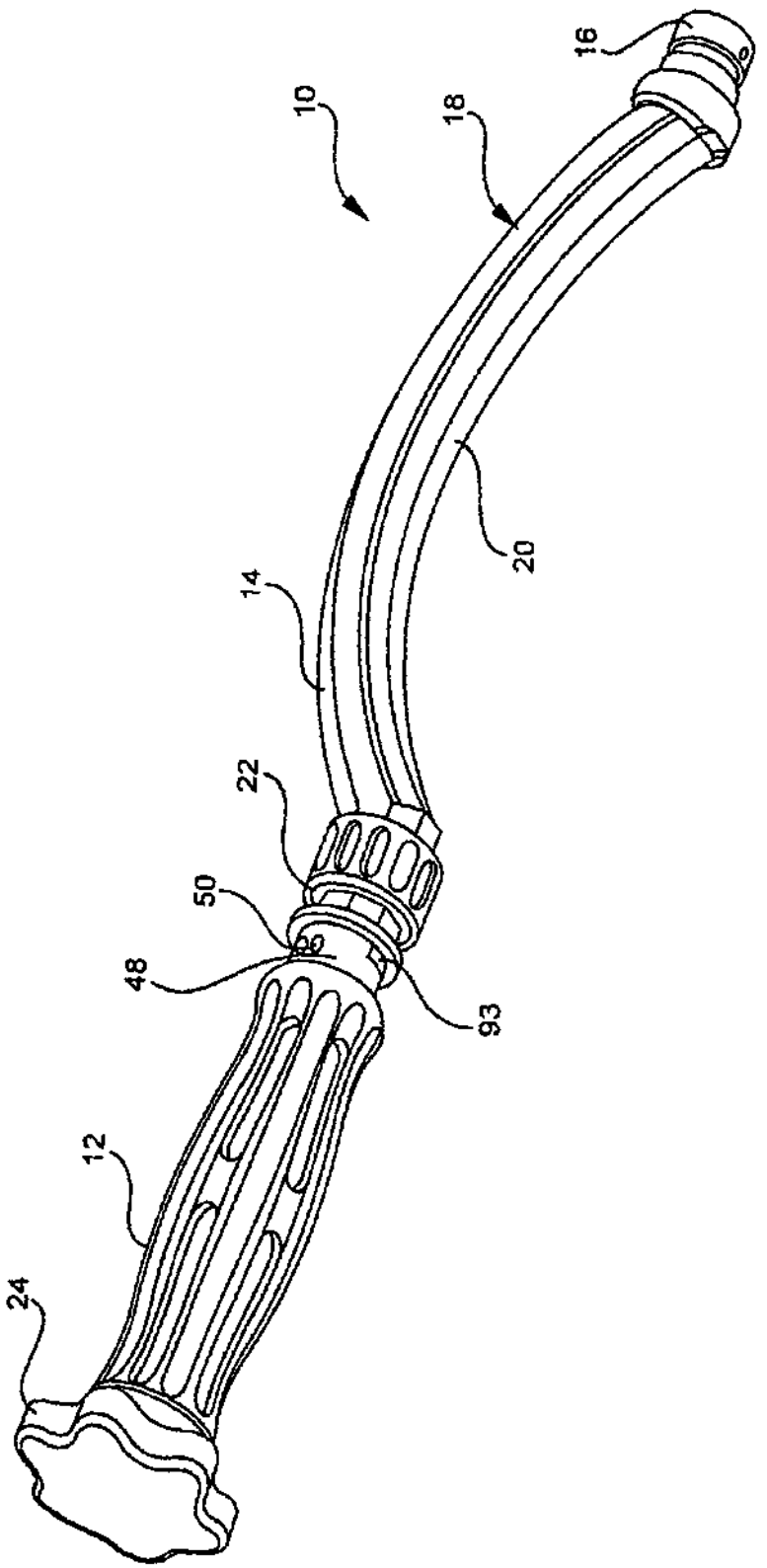


FIG. 1

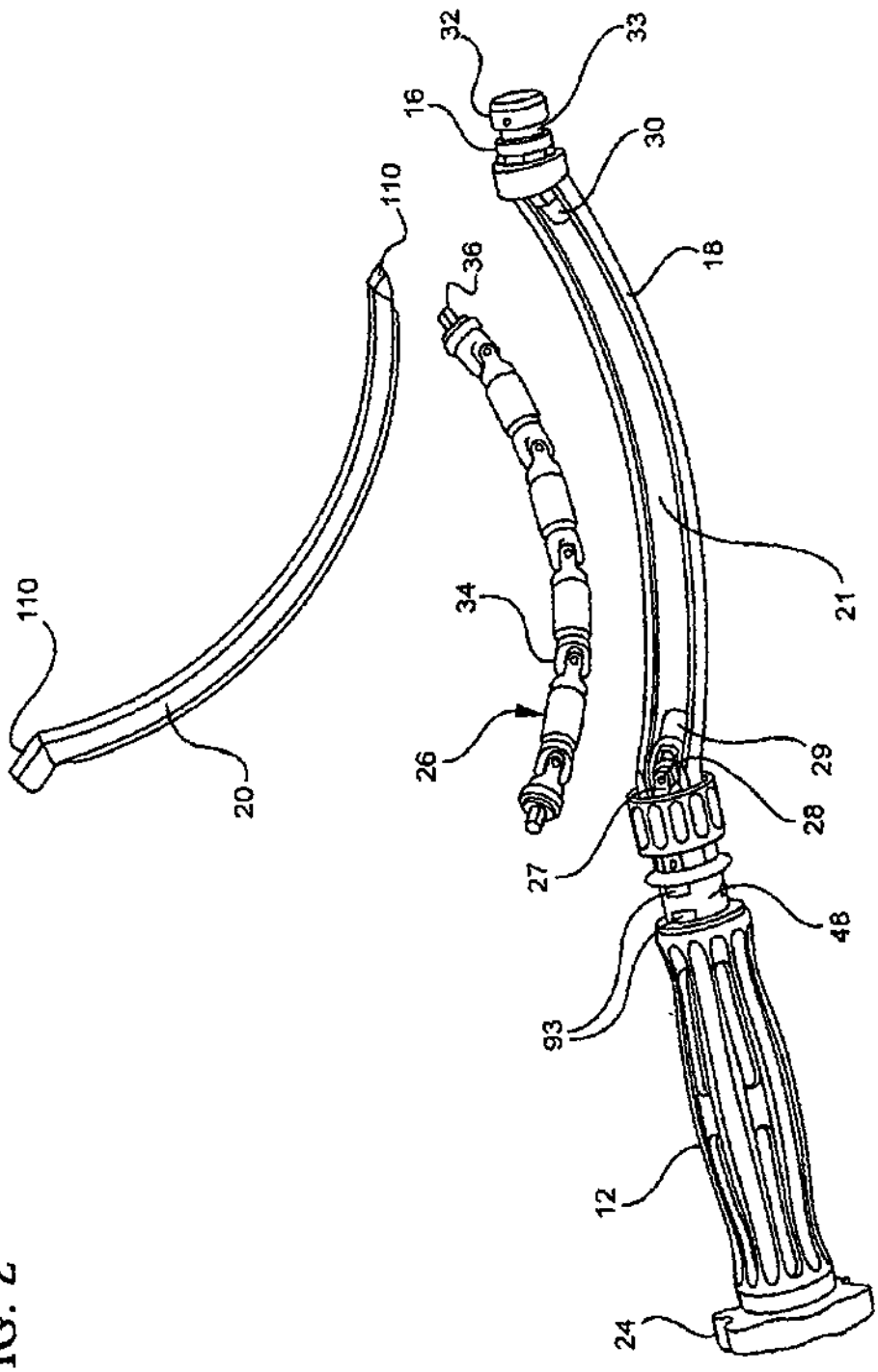
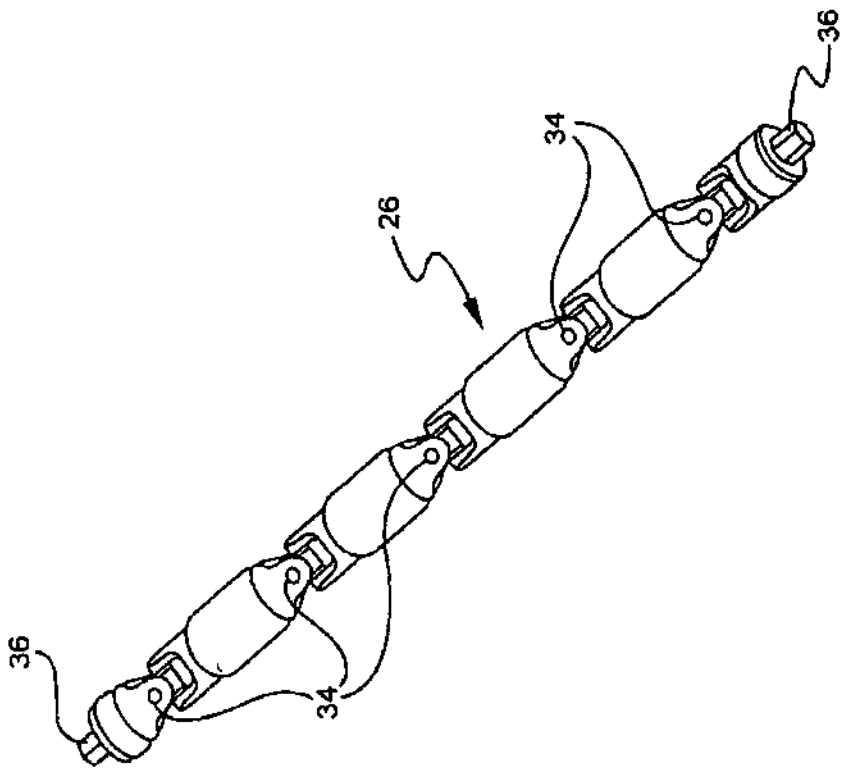


FIG. 2



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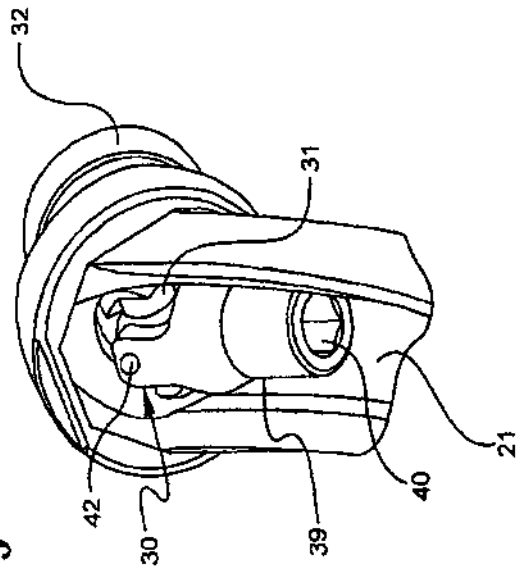
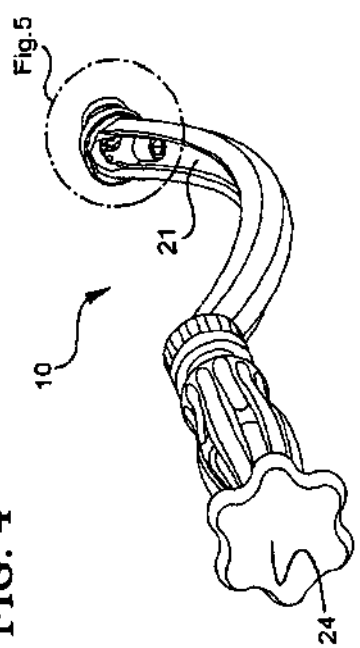


FIG. 5



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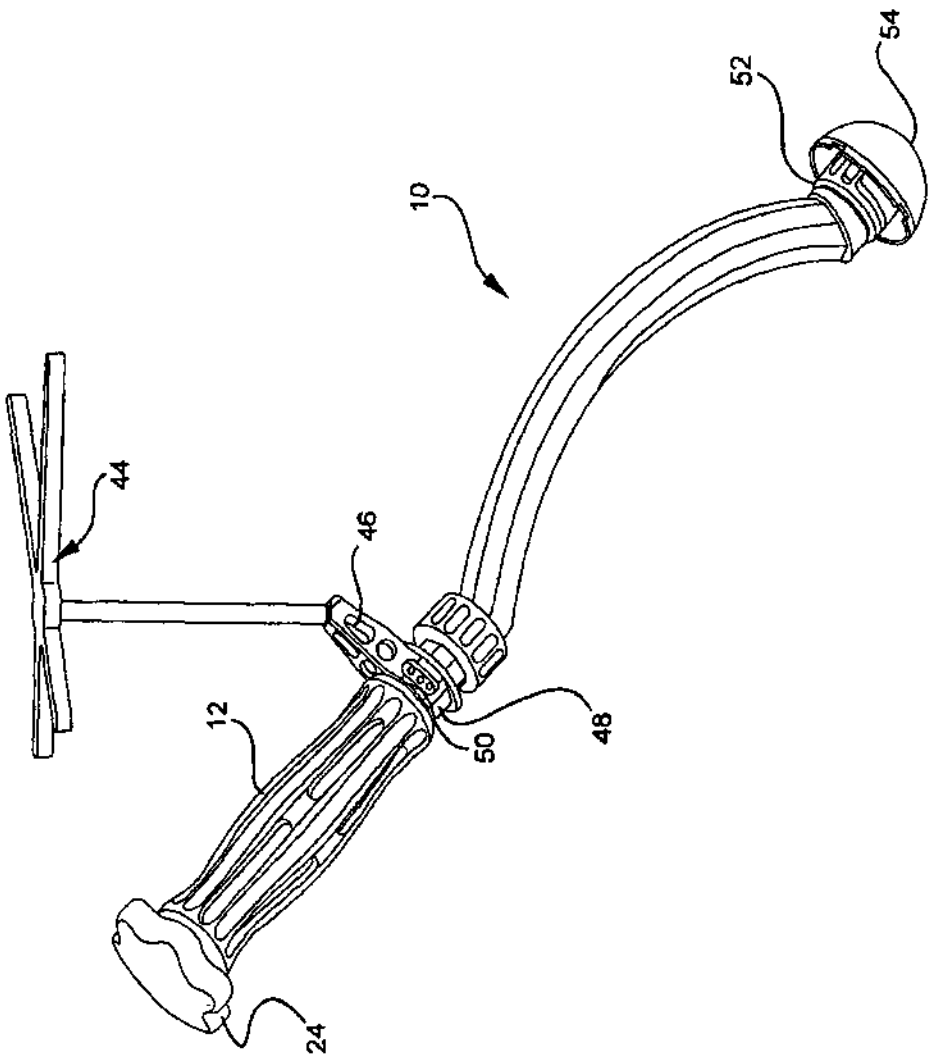
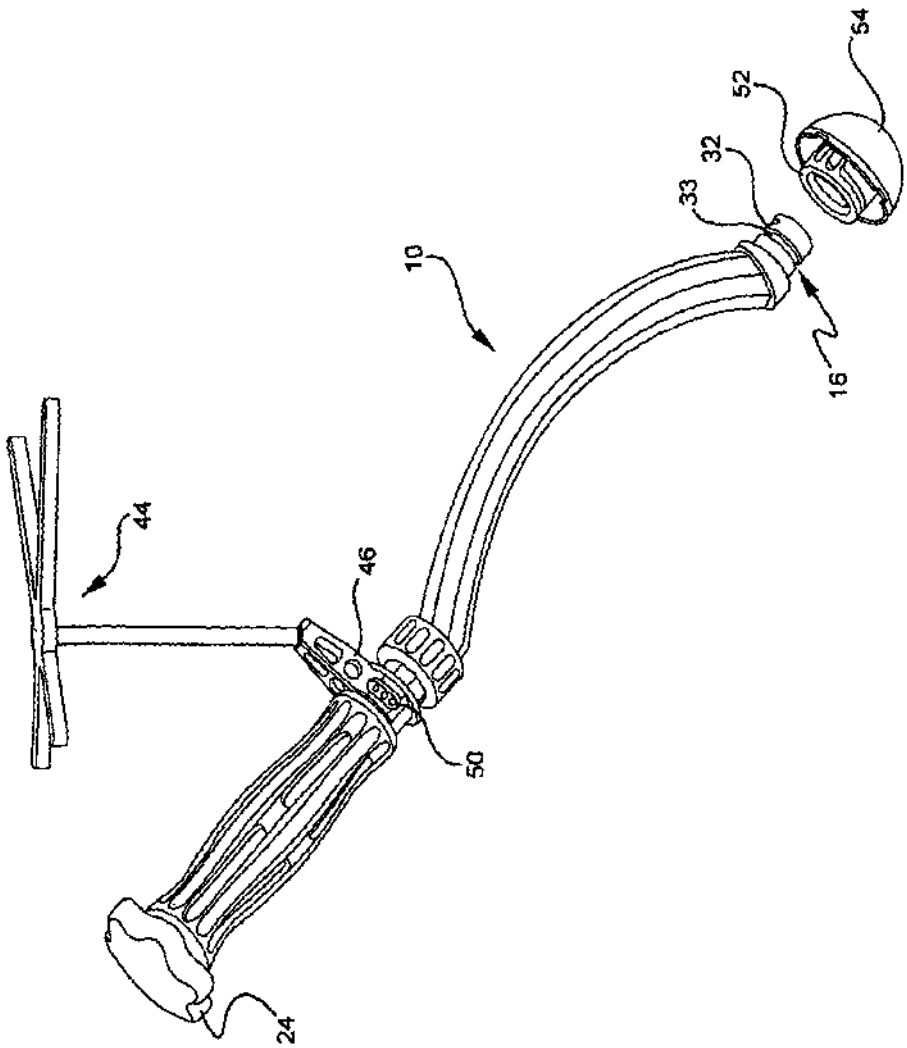


FIG. 6



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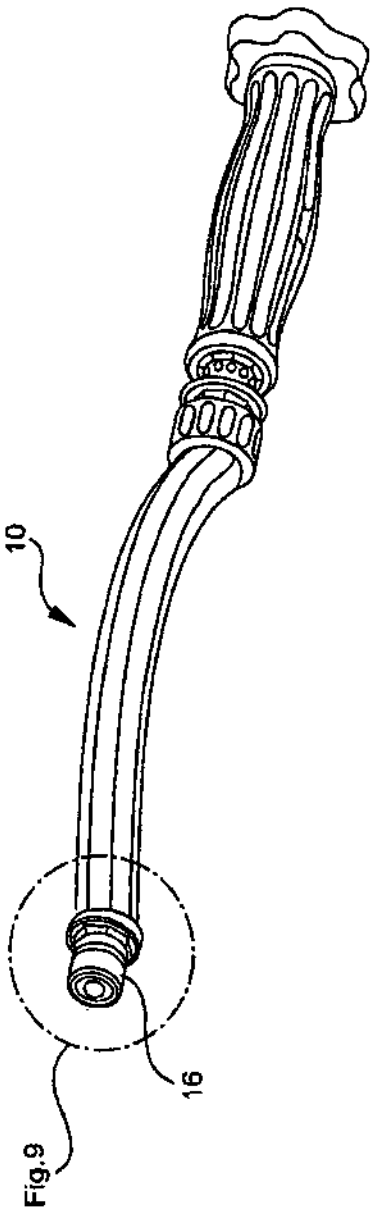
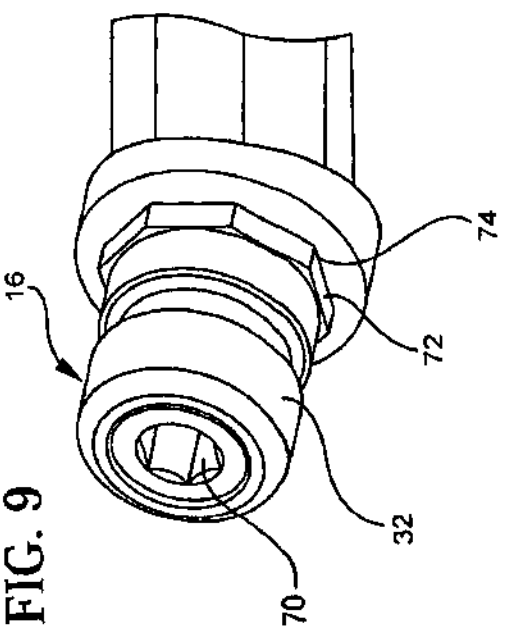


FIG. 8



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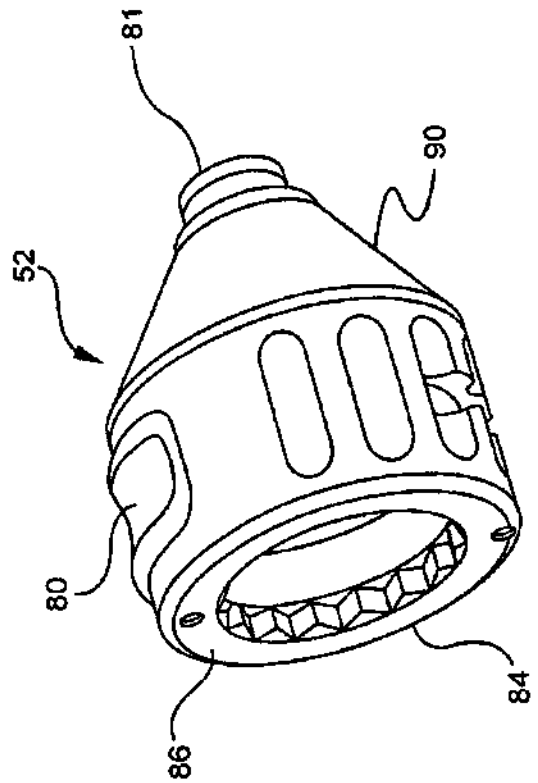

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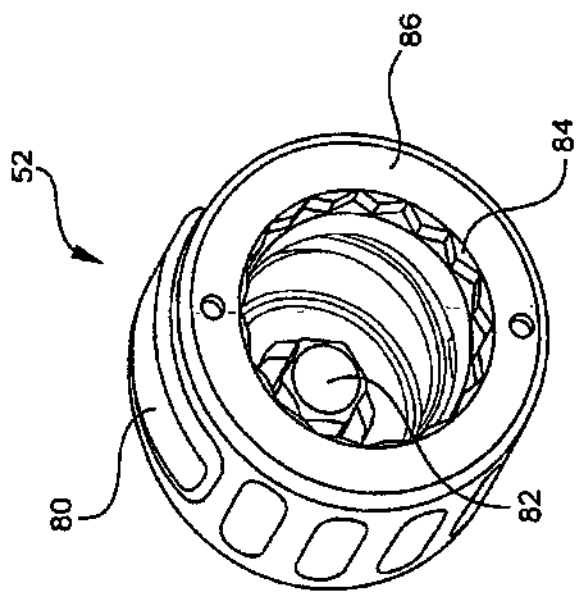

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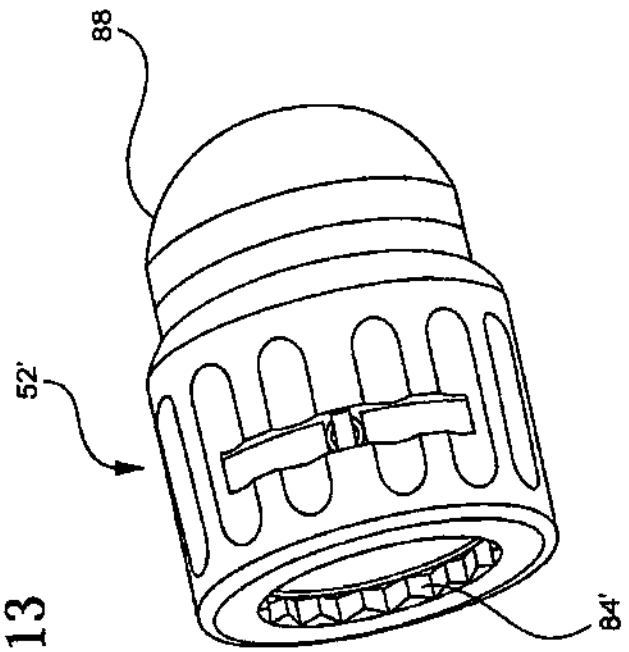

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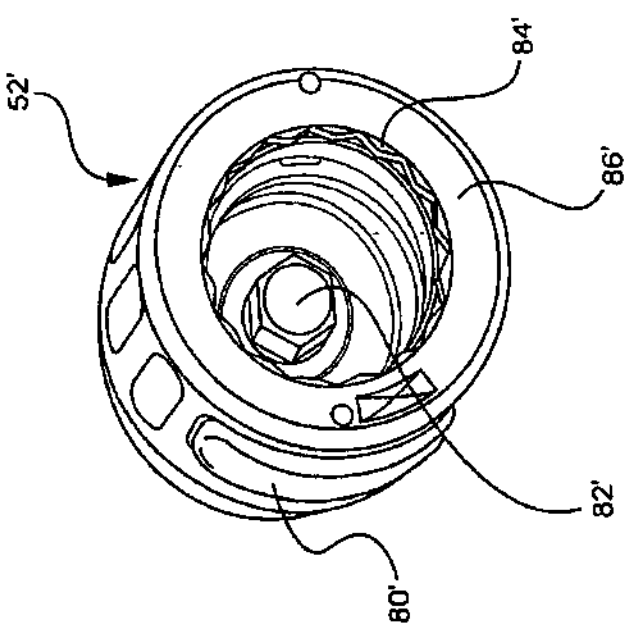

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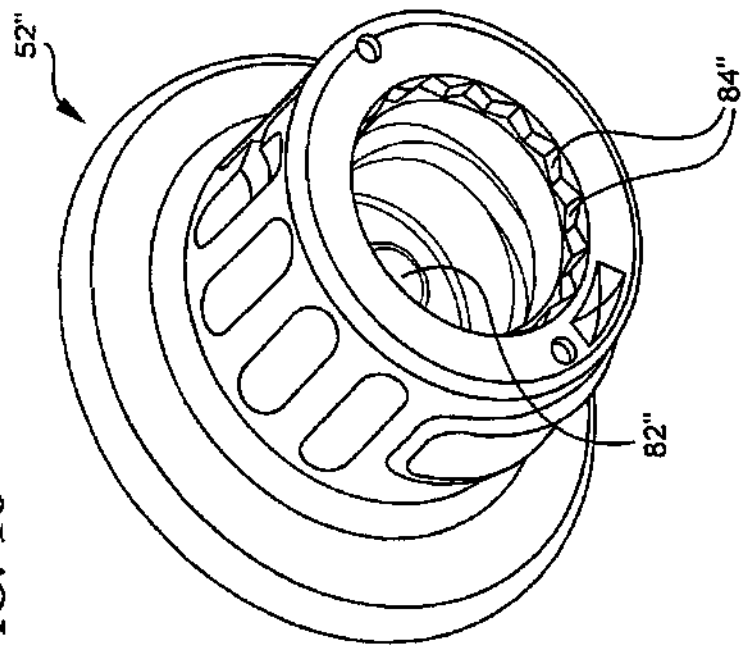

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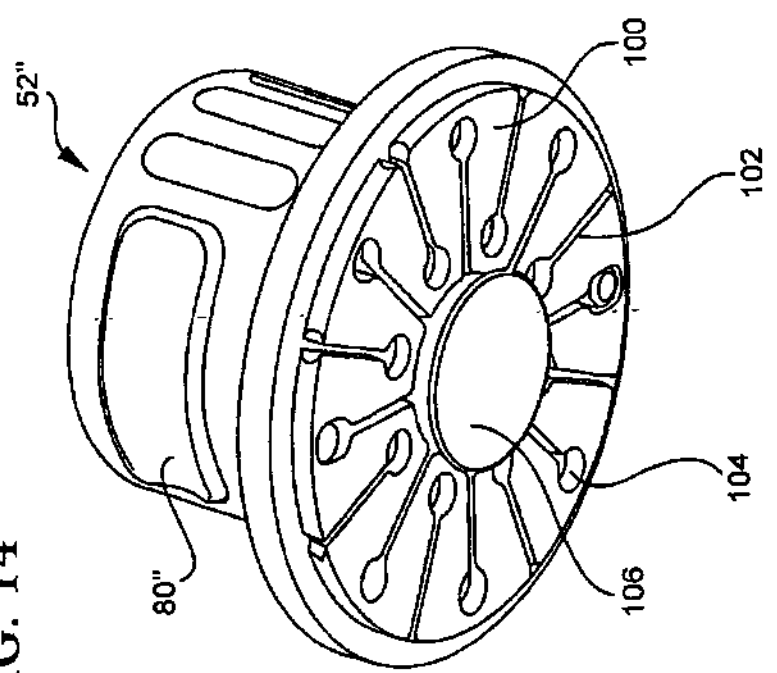

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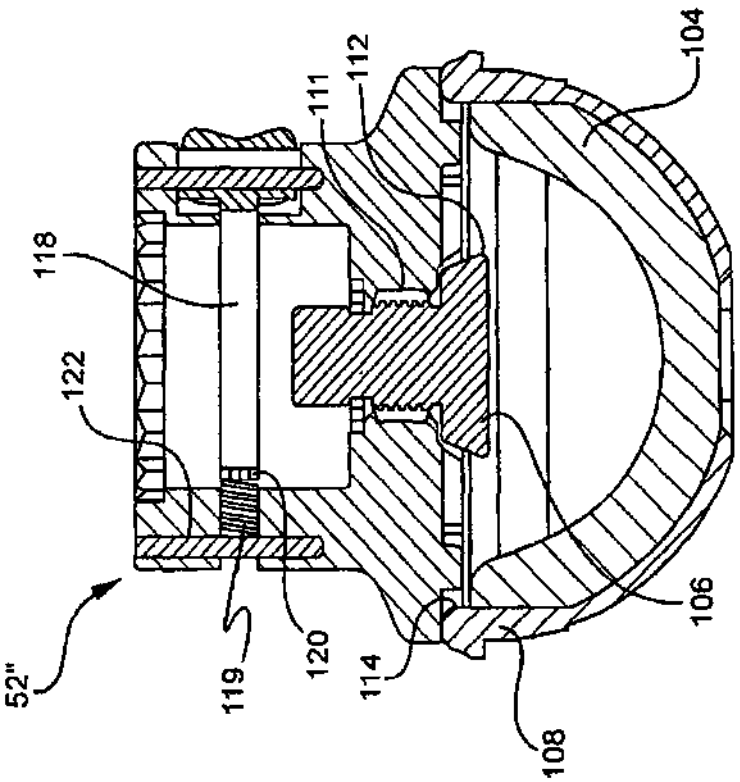
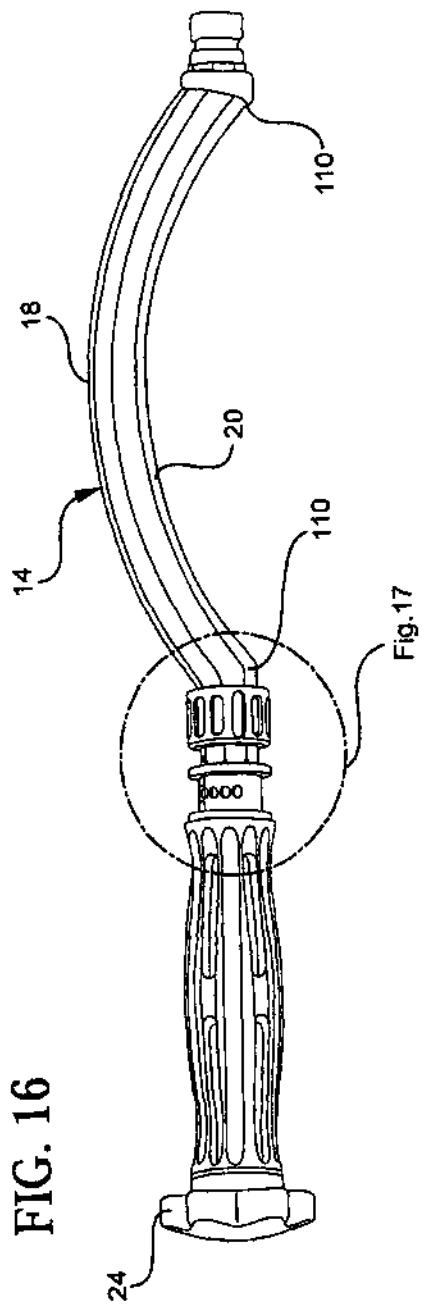


FIG. 15A



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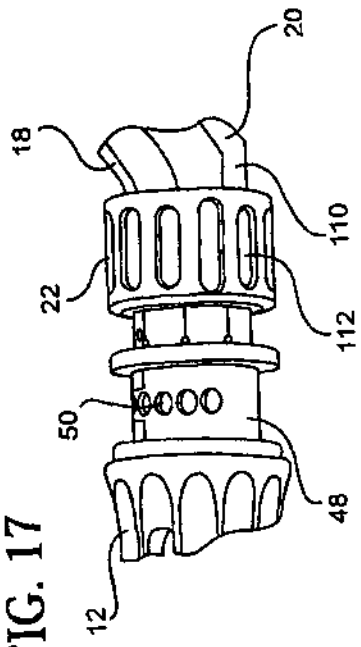

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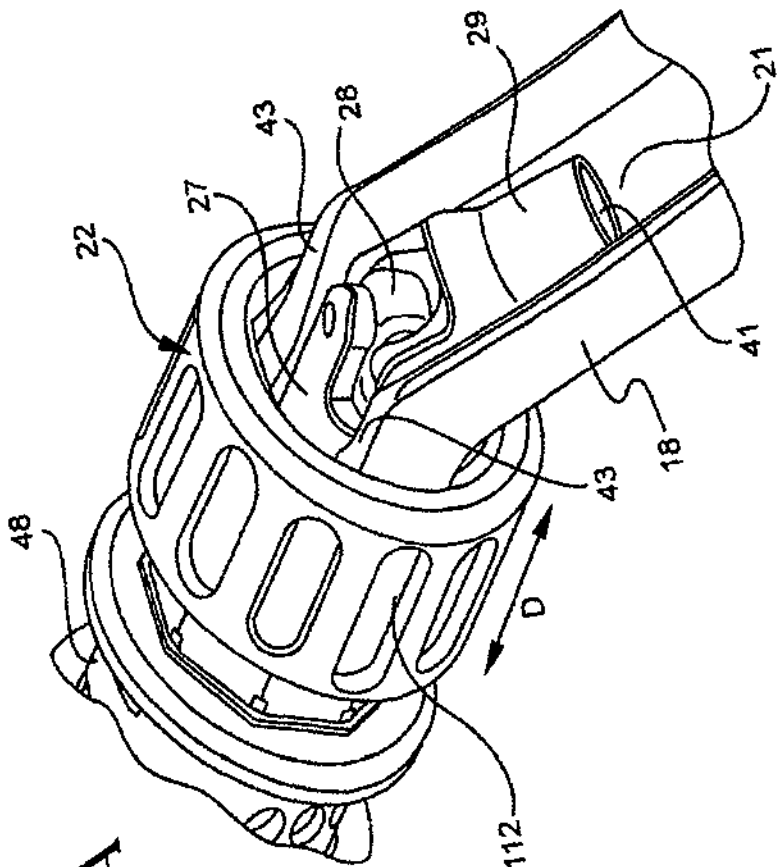
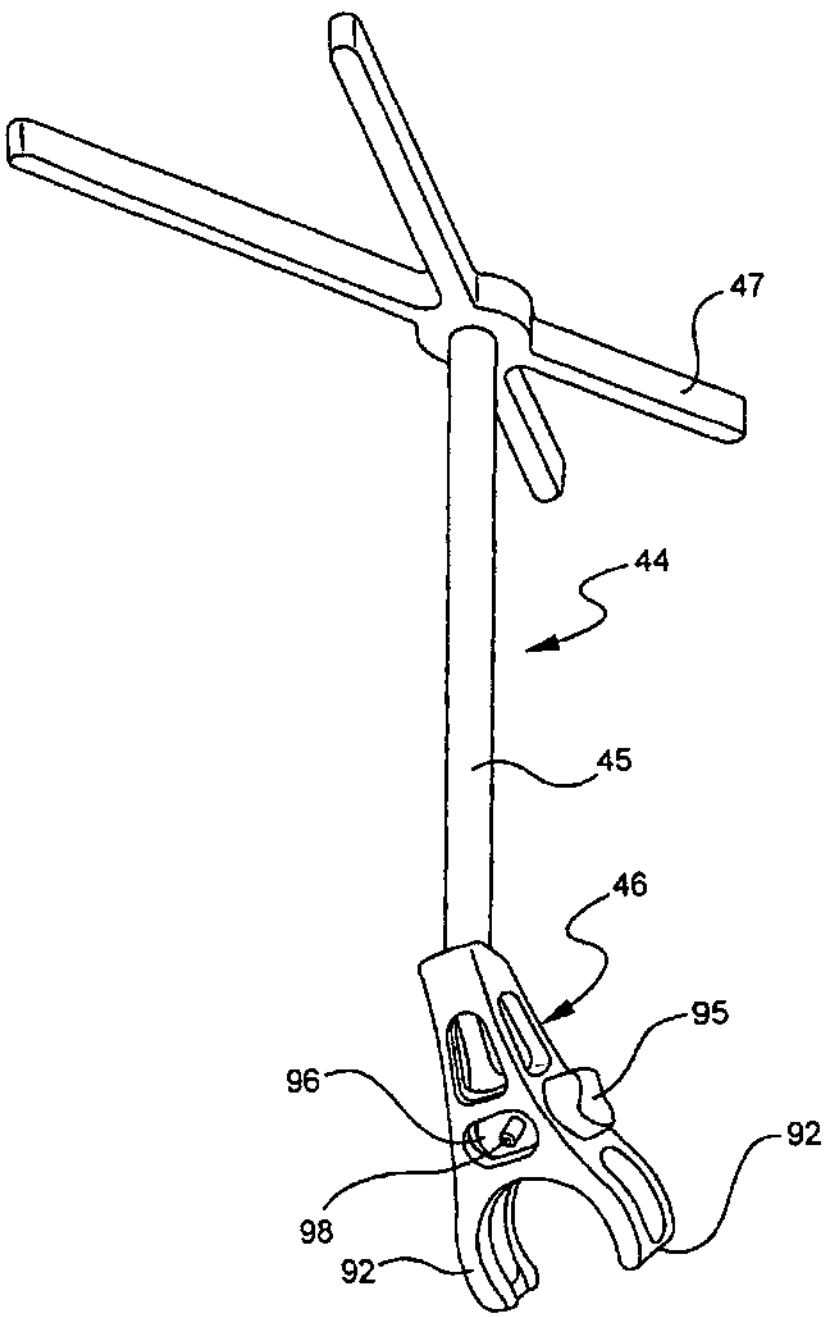
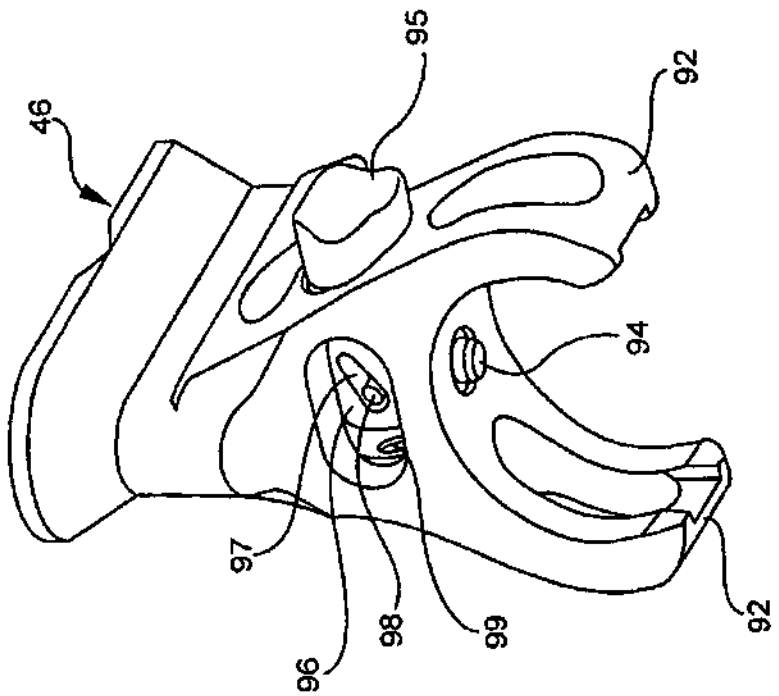


FIG. 17A

FIG. 18





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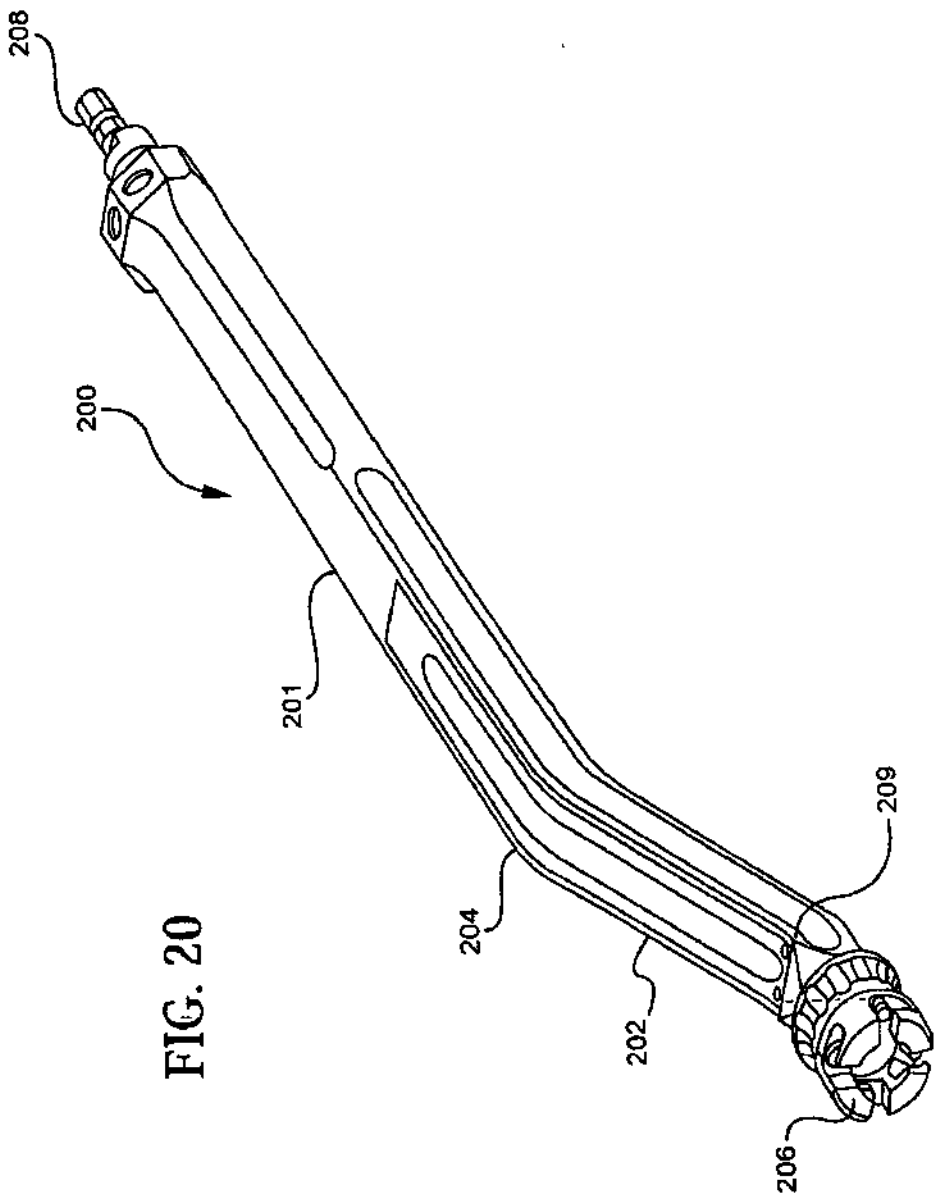

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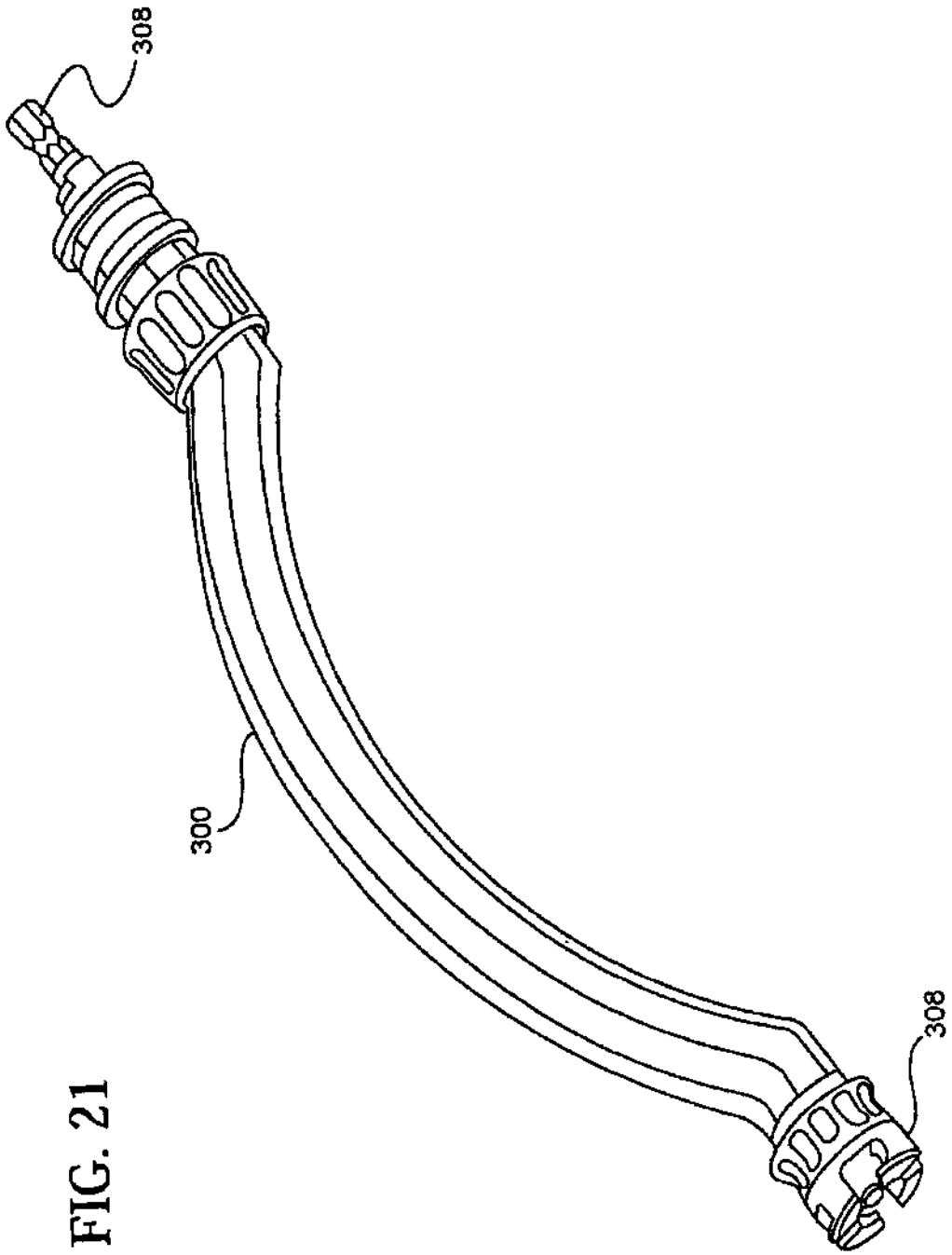

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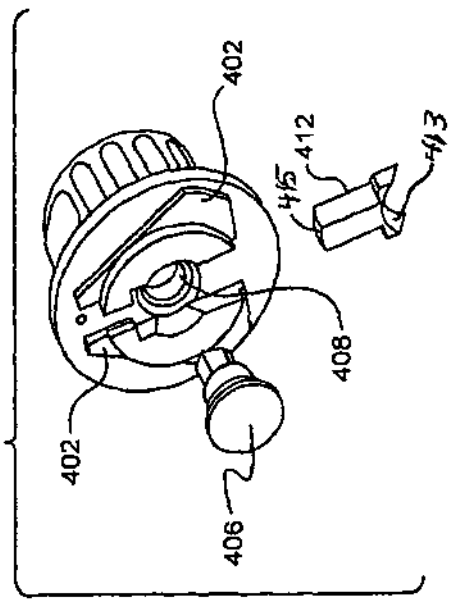

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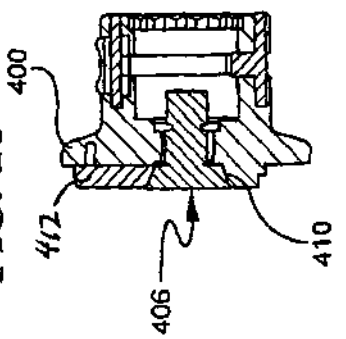

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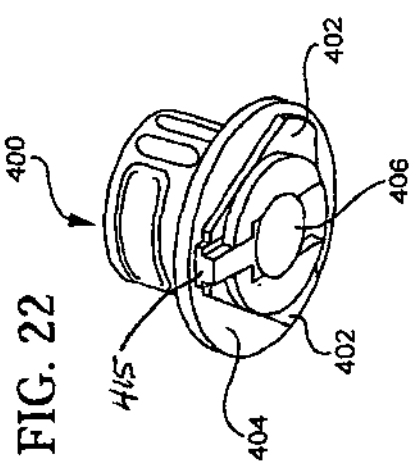

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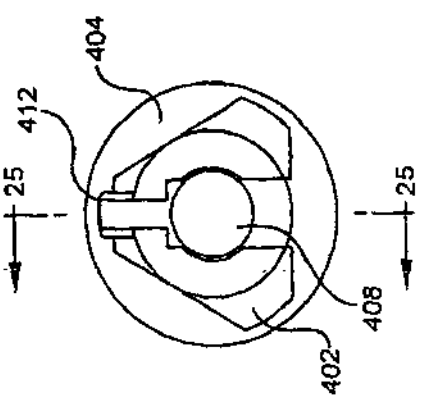

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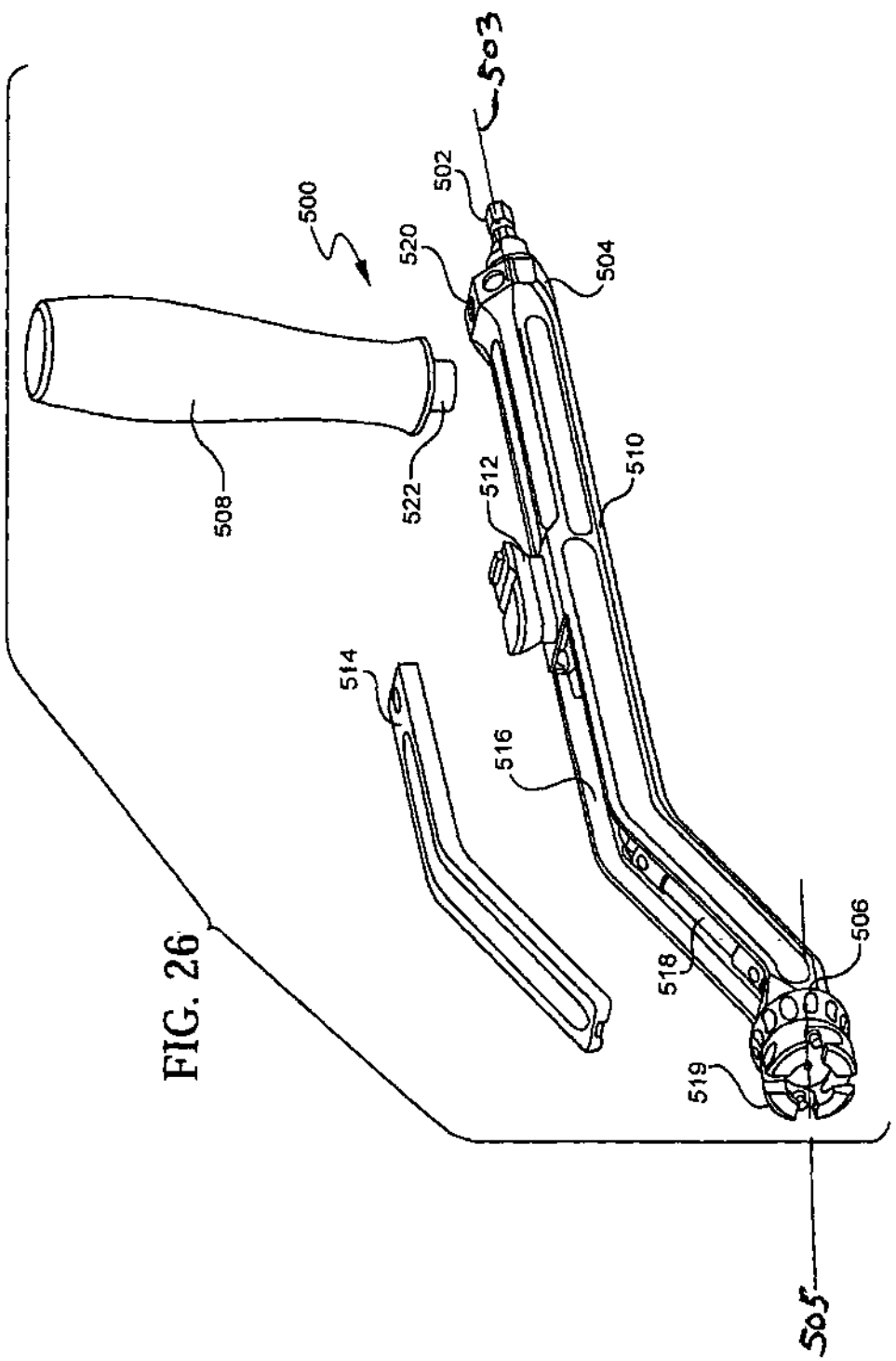

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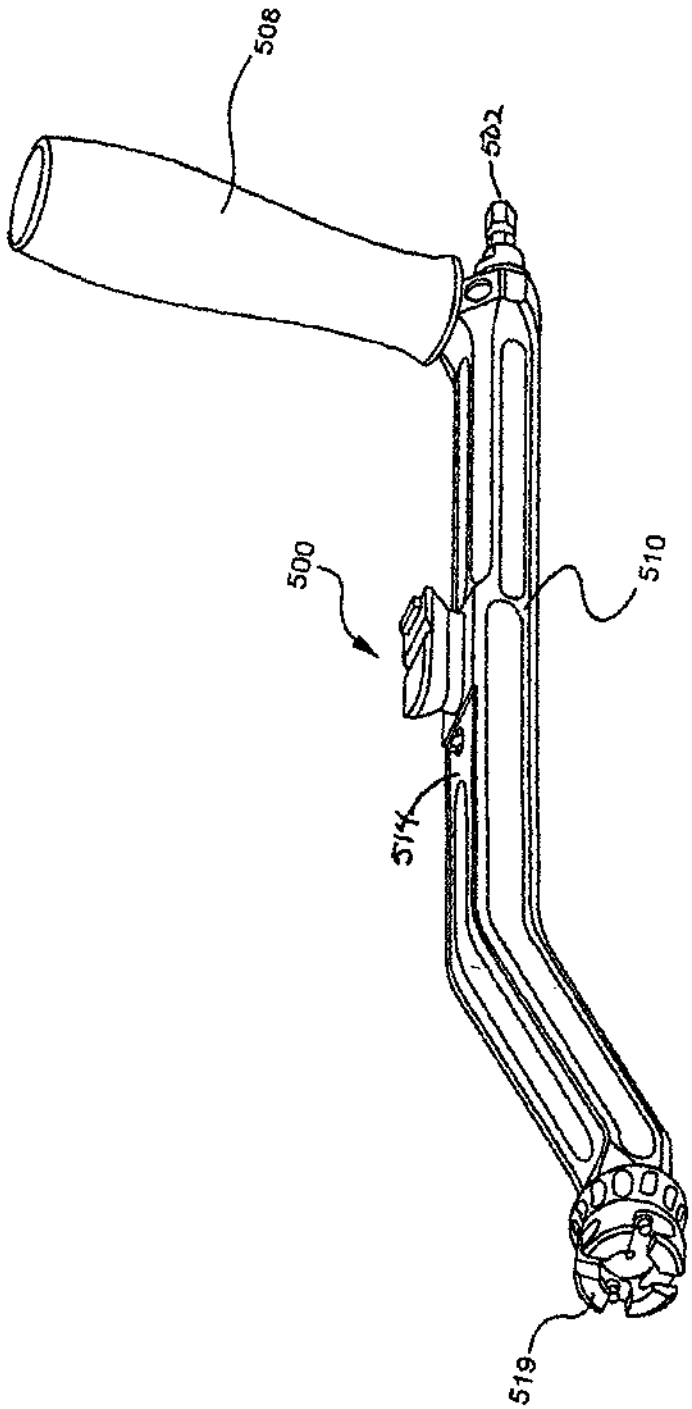

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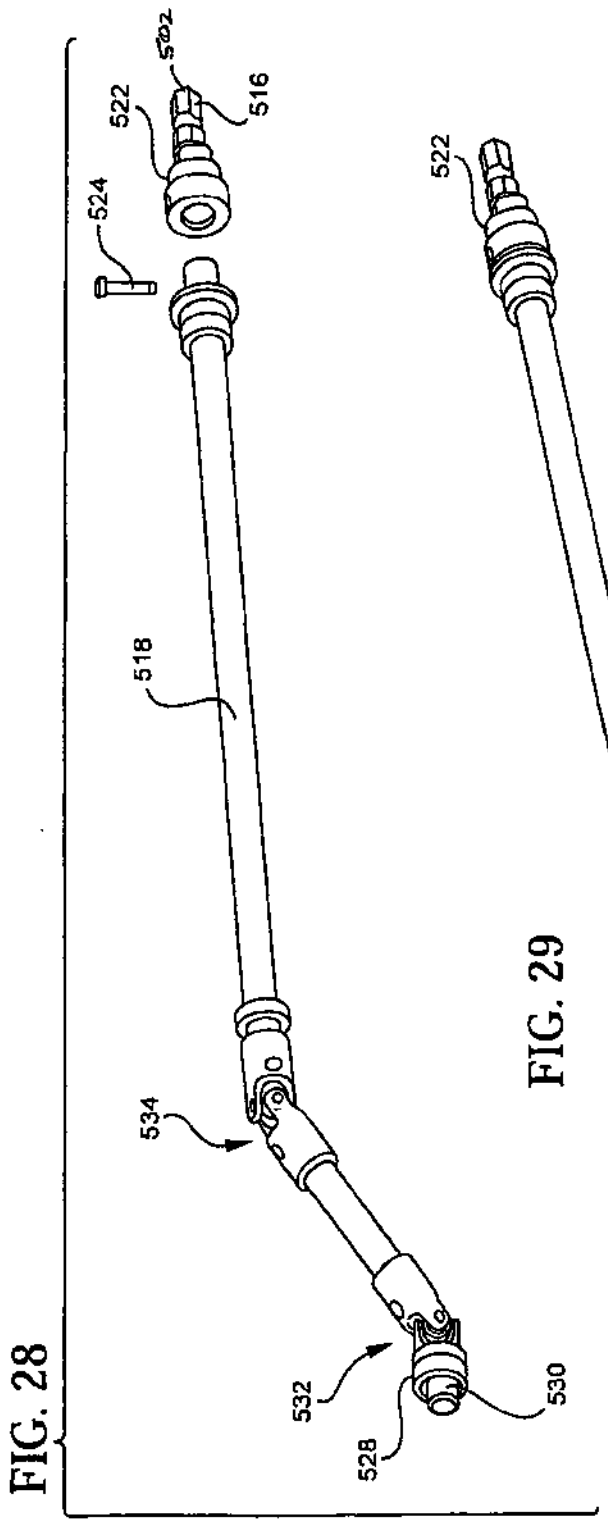

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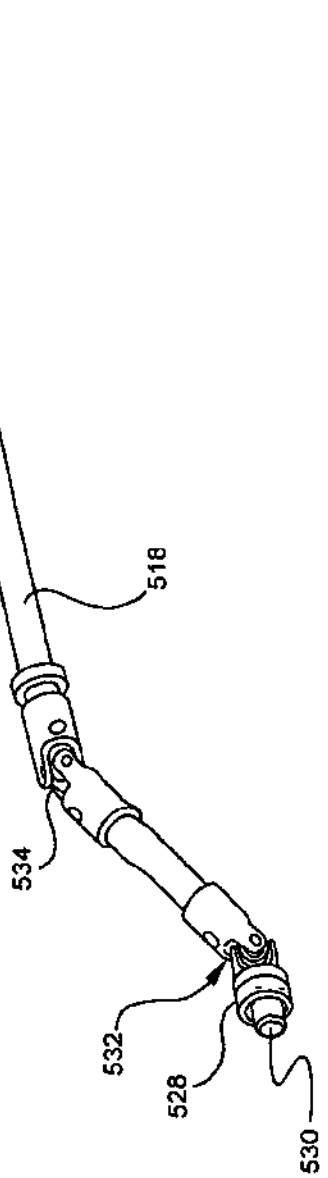

FIG. 29