United States Patent [19]

Noiles

[11] **3,848,272**

[45] **Nov. 19, 1974**

[54] **ARTIFICIAL HIP JOINT**

[75] Inventor: **Douglas G. Noiles,** New Canaan, Conn.

[73] Assignee: **United States Surgical Corporation,** Baltimore, Md.

[22] Filed: **Jan. 13, 1972**

[21] Appl. No.: **217,540**

[52] **U.S. Cl.** ..... **3/1,** 128/92 C, 128/92 CA, 287/87

[51] **Int. Cl.** **A61f 1/24**

[58] **Field of Search** .... 3/1; 128/92 C, 92 CA, 92 R, 128/92 B, 92 BA, 92 BB, 92 BC, 92 F, 92 G; 287/87, 90

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Primary Examiner—Richard A. Gaudet
Assistant Examiner—Ronald L. Frinks
Attorney, Agent, or Firm—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

An artificial hip joint having an acetabulum prosthesis for the cotyloid cavity defining a socket and including a head having a plurality of blades extending outwardly away from the socket for engaging the prepared wall of the cotyloid cavity and having at least one insert removably connected to the head to form the socket. A prosthesis of the head of the femur is movably interconnected with the acetabulum prosthesis and includes a pin to be driven into the bone-marrow channel of the femur, a curved neck integral with the pin, and a hip ball positioned on the neck, movably located within the socket and in movable contact with the removable insert. Means are provided in operative relationship with the femur head prosthesis for preventing rotation of the femur head prosthesis with respect to the femur.

24 Claims, 22 Drawing Figures

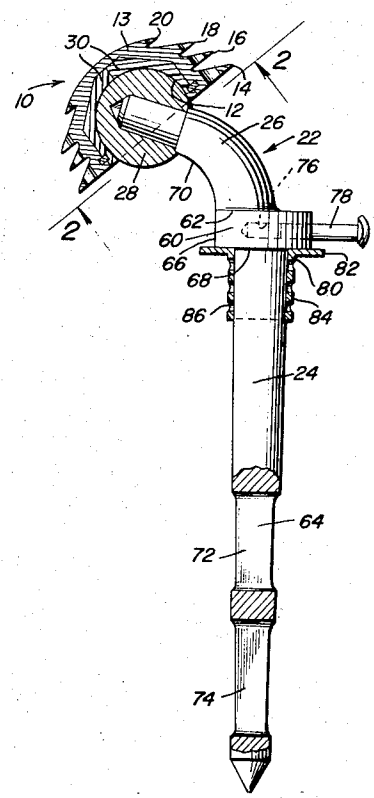


FIG. 1

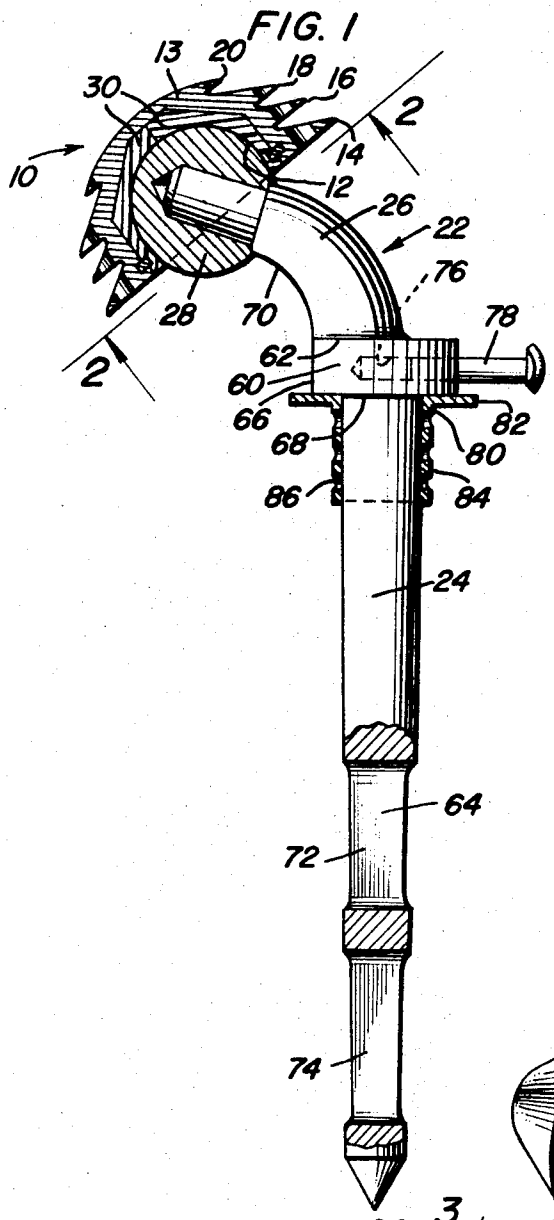


FIG. 3

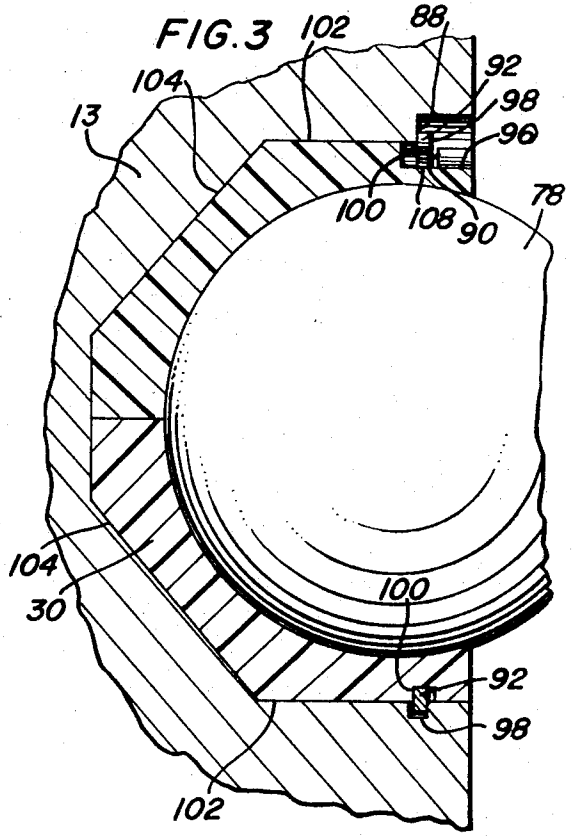


FIG. 4

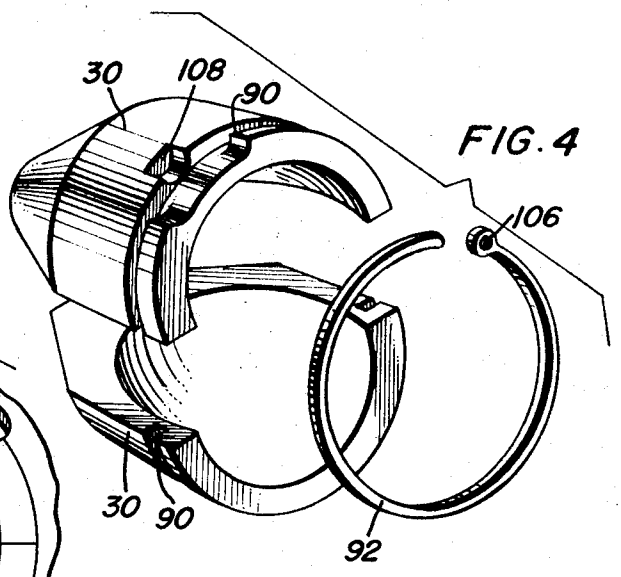


FIG. 2

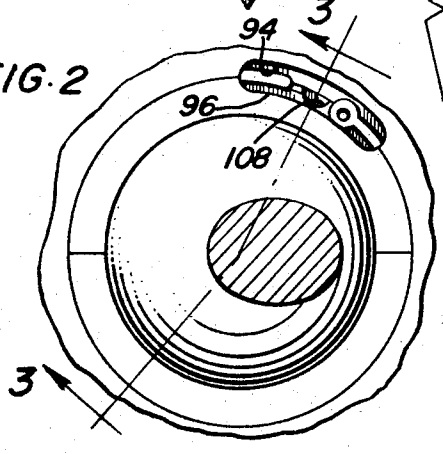


FIG. 6

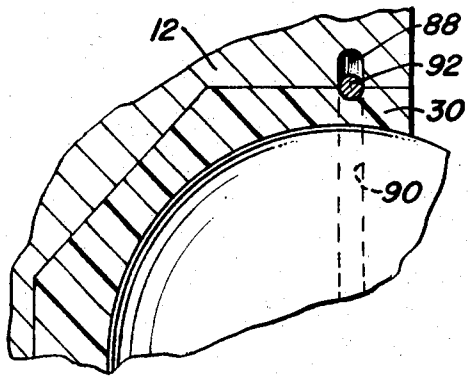


FIG. 5

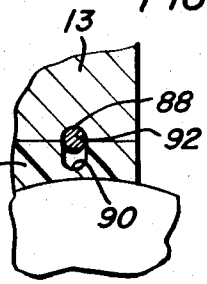


FIG. 12

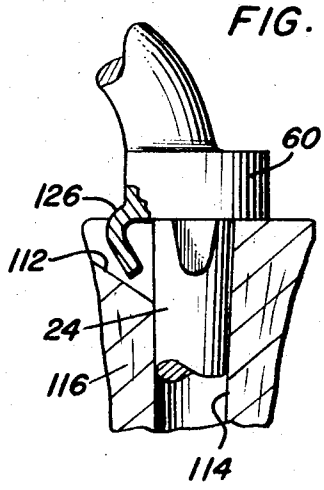


FIG. 15

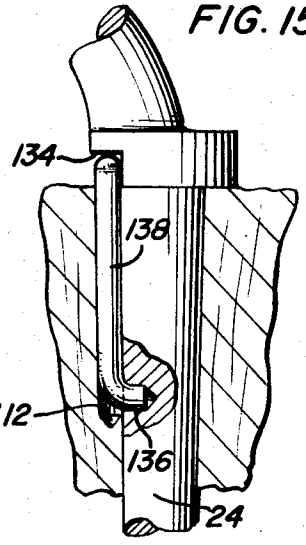


FIG. 14

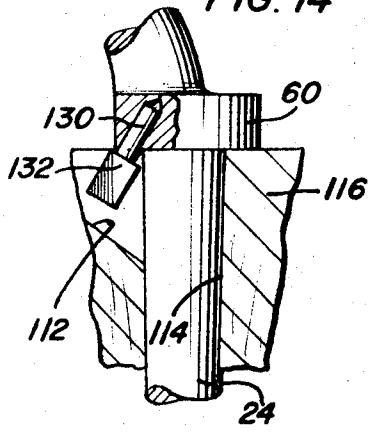


FIG. 13

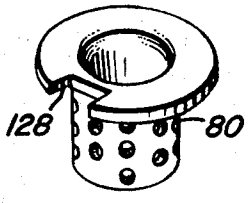


FIG. 7

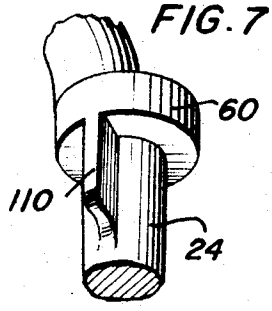


FIG. 8

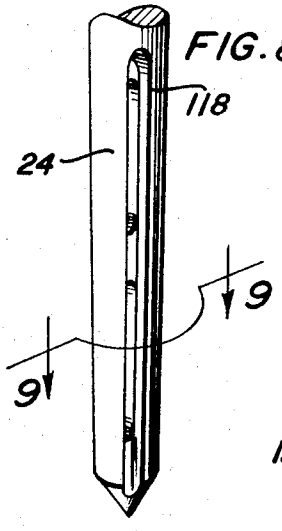


FIG. 9

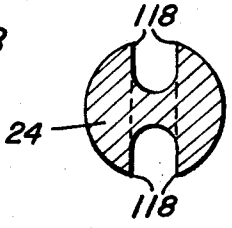


FIG. 10

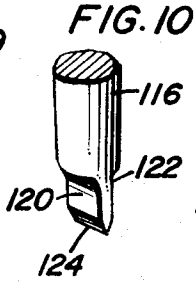


FIG. 11

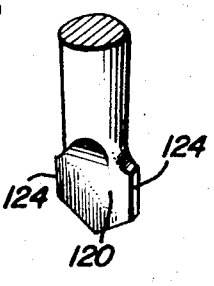


FIG. 16

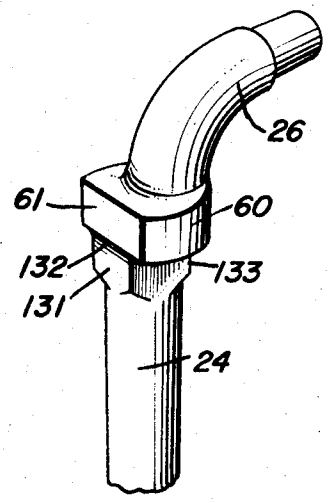


FIG. 17

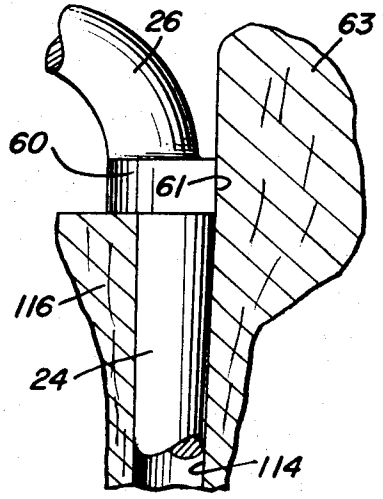


FIG. 19

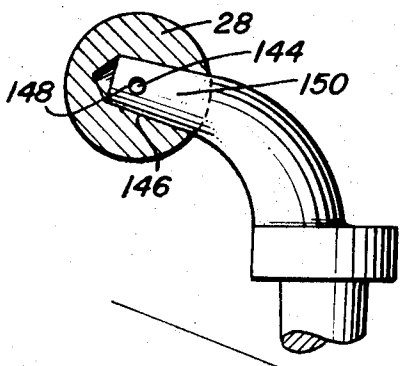


FIG. 20

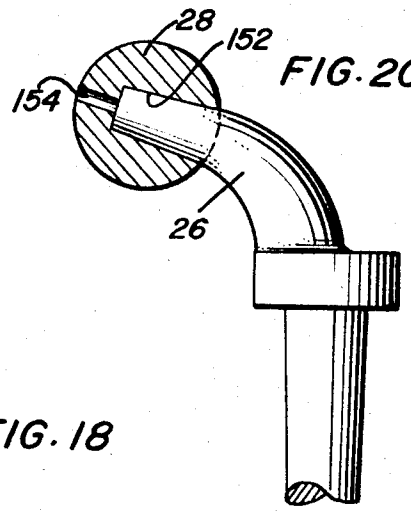
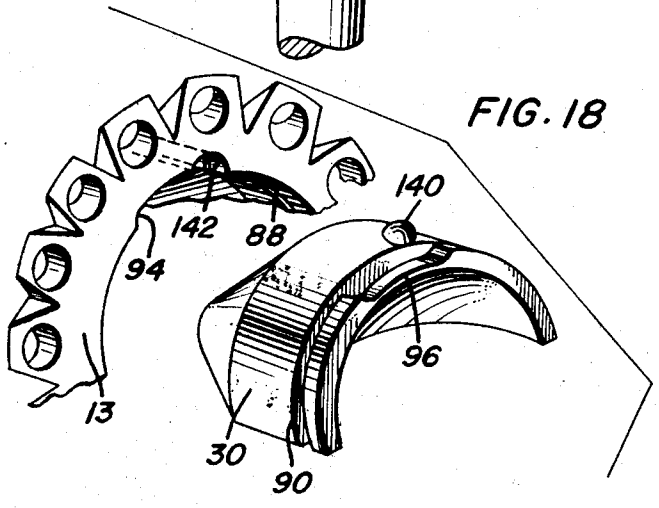


FIG. 18



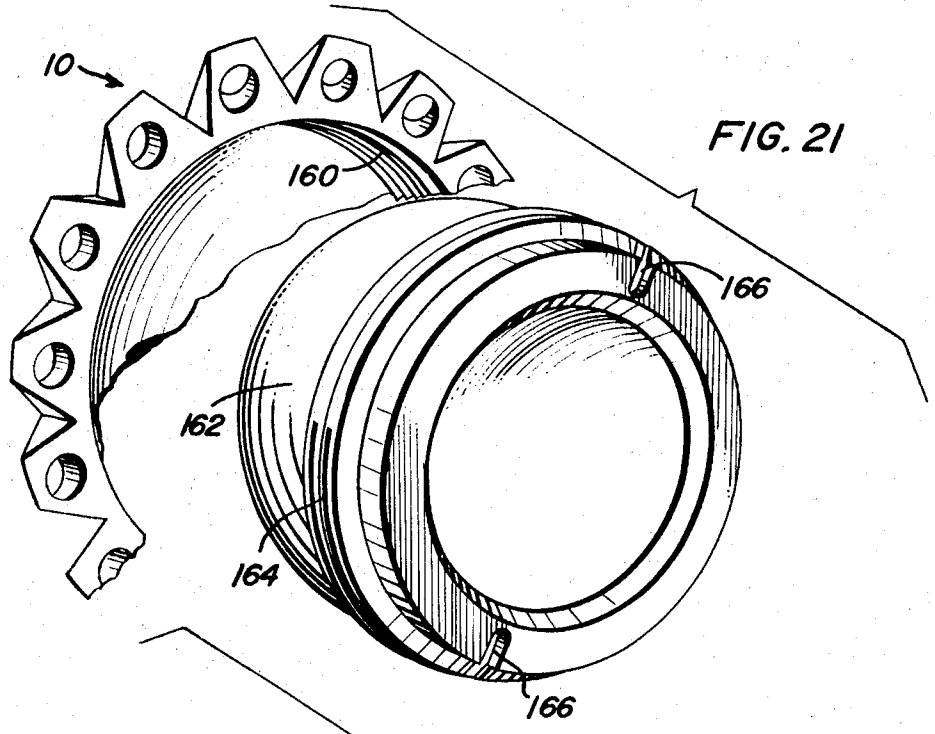


FIG. 21

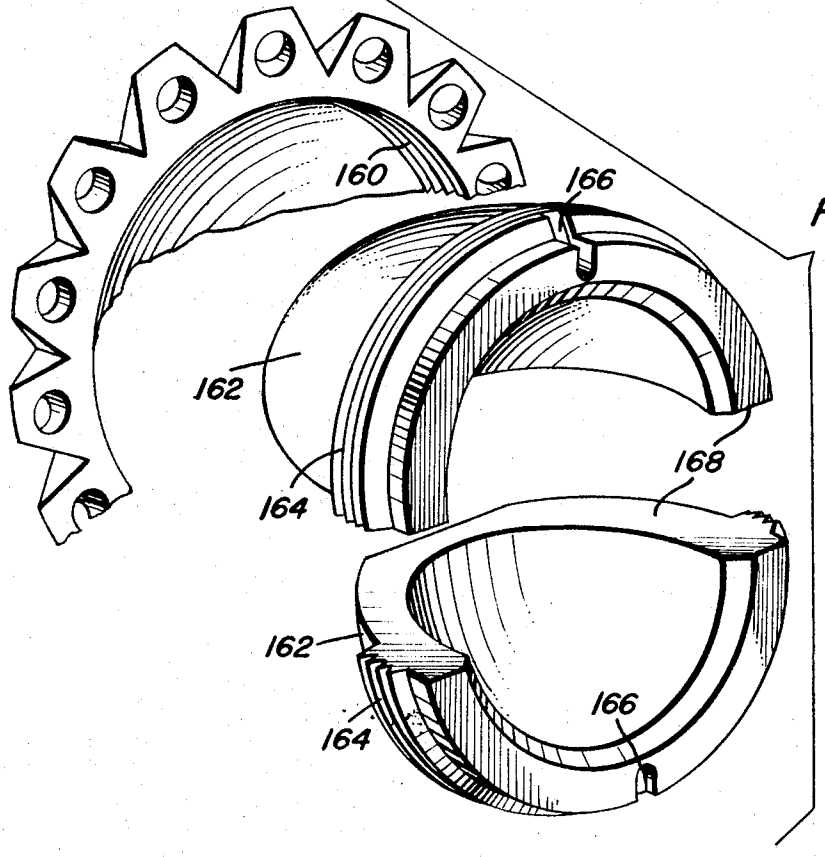


FIG. 22

ARTIFICIAL HIP JOINT

The present invention relates to artificial joints and more particularly to an artificial hip joint.

Numerous types of artificial hip joints have been developed and used. One successful example of such an artificial hip joint is that described in U.S. Pat. application Ser. No. 189,261 filed Oct. 14, 1971 as a continuation-in-part of U.S. Pat. application Ser. No. 737,910, filed June 18, 1968, now abandoned.

Previously used hip joint prostheses have been made with various types of materials in attempts to provide both a strong joint and one that will not be unduly corroded by the body environment. Various styles and arrangements of hip joints having an artificial acetabulum articulately connected to an artificial caput femoris have been developed; however, use of some of these joints has made evident inherent disadvantages due to the shapes of the hips and because of the materials used. Frequently, bone growth stimulated as a result of mechanical irritation by the artificial joints has resulted in partial immobilization of the joints with a concomitant gradual increase of painful sensations.

Experience has also shown that it may often be desirable, due to wear or malfunction of the artificial hip joint, to replace the bearing surfaces of the joint after some period of use by the patient. In the past, however, it has not been possible to remove and replace the bearing surfaces from the implanted hip and the patient has thus been required to endure use of a poorly functioning artificial hip or has been required to undergo the procedures necessary for the complete replacement of the entire artificial hip joint.

Accordingly, it is an object of the present invention to provide an artificial hip joint that will have all of the functions inherent in a normal human hip joint and which possesses great strength and long service life.

Another object is to provide an artificial hip joint that is light in weight.

A further object of the invention is the provision of an artificial hip joint, portions of which can be replaced even after implantation in the patient.

Still another object of the present invention is the provision of an artificial hip joint that is relatively simple and inexpensive to manufacture and which is relatively easy to insert into the body.

Another object is to provide an artificial hip joint that is provided with means for preventing rotation of the femur head prosthesis with respect to the femur.

Additional objects and advantages of the invention will be set forth in part in the description which follows and in part will be obvious from the description, or may be learned by practice of the invention. The objectives and advantages are realized and attained by the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve these and other objects, the present invention provides an artificial hip joint having an acetabulum prosthesis of the cotyloid cavity defining a socket and including a head, a plurality of blades extending outwardly away from the socket for engaging the prepared wall of the cotyloid cavity and further including at least one insert removably connected to the head to form the socket. A prosthesis of the head of the femur is movably interconnected with the acetabulum prosthesis and includes a pin to be driven into the bone-marrow channel of the femur, a curved neck integral with the pin and a hip ball positioned on the neck, movably located within the socket and in movable contact with the insert.

As here embodied, the acetabulum prosthesis head has a channel therein and the insert has a groove therein, the groove and the channel being positioned in communicating relationship with respect to one another when the insert is positioned in connecting relationship with the acetabulum prosthesis head. In addition, a flexible ring member is positioned within the groove and within the channel to retain the insert in position within the acetabulum prosthesis head.

The acetabulum prosthesis head preferably has an entry slot therein in communication with the channel and the insert preferably has an entry passage therein in communication with the groove for enabling the ring to be inserted through the entry slot, and the entry passage and into the insert groove and the acetabulum prosthesis channel.

In a preferred embodiment, the insert further defines an extension well in communication with the entry passage for facilitating insertion and removal of the flexible ring. As here embodied, the artificial hip joint also preferably includes means in operative relationship with the femur head prosthesis for preventing rotation of the femur head prosthesis with respect to the femur.

It is to be understood, of course, that both the foregoing general description and the following detailed description are explanatory only and are not restrictive of the invention.

The accompanying drawings, which are incorporated in and constitute part of the specification, illustrate the invention and together with the description, serve to explain the principles of the invention.

FIG. **1** is an elevation view, partly in section of one embodiment of the artificial hip joint of this invention;

FIG. **2** is a view taken on the line **2—2** of FIG. **1** and looking in the direction of the arrows;

FIG. **3** is a view taken on the line **3—3** of FIG. **2** and looking in the direction of the arrows;

FIG. **4** is an exploded perspective view of one embodiment of the acetabulum prosthesis head inserts and of the flexible ring member used to hold the inserts in place;

FIG. **5** is a fragmentary sectional view of another embodiment of the invention for holding the inserts in position;

FIG. **6** is a fragmentary sectional view of still another embodiment of the invention for holding the inserts in position;

FIG. **7** is a fragmentary perspective view of one anti-rotation embodiment of the invention;

FIG. **8** is a fragmentary perspective view of another anti-rotation embodiment;

FIG. **9** is a sectional view taken on the line **9—9** of FIG. **8** and looking in the direction of the arrows;

FIG. **10** is a fragmentary view of another anti-rotational embodiment of the invention;

FIG. **11** is a fragmentary view of still another anti-rotation embodiment;

FIG. **12** is a fragmentary view, partly in section, of an alternative anti-rotation embodiment for preventing rotation of the femur head prosthesis with respect to the femur;

FIG. 13 is a perspective view of a collar for use with the embodiment illustrated in FIG. 12;

FIG. 14 is a fragmentary view, partly in section, of still another anti-rotation embodiment;

FIG. 15 is a fragmentary view, partly in section, of a further anti-rotation feature of the invention;

FIG. 16 is a fragmentary view of an additional anti-rotation embodiment;

FIG. 17 illustrates a further embodiment of the invention;

FIG. 18 is a fragmentary exploded perspective view of an embodiment of the invention for preventing rotation of the inserts within the acetabulum prosthesis;

FIG. 19 is a fragmentary view of a feature of the invention providing for removal of the hip ball;

FIG. 20 is a fragmentary view of another embodiment permitting removal of the hip ball;

FIG. 21 is a fragmentary perspective view of an additional embodiment of the invention; and

FIG. 22 is a fragmentary perspective view of a further embodiment of the invention.

With reference now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown a machined acetabulum prosthesis **10** of the cotyloid cavity defining a socket **12** and including a head **13.** A plurality of blades **14, 16, 18** and **20** extend outwardly away from the socket for engaging the prepared wall (not shown) of the cotyloid cavity.

A machined prosthesis **22** of the head of the femur is movably interconnected with the acetabulum prosthesis **10** and includes a pin **24** to be driven into the bone-marrow channel of the femur (not shown), a curved neck **26** integral with pin **24,** and a hip ball **28** positioned on the neck and movably located within socket **12.**

As here embodied, acetabulum prosthesis **10** includes at least one but preferably two inserts **30** removably connected to head **13** to form socket **12.** The total area of the inserts forming the socket and bearing against hip ball **28** is more than one-half the spherical surface of the hip ball in order to retain the hip ball in position in the socket and to prevent the possibility of postoperative dislocation. The acetabulum prosthesis also has a plurality of blades **14, 16, 18** and **20** with notches and holes therein as described in pending U.S. Pat. application Ser. No. 189,261 filed Oct. 14, 1971.

The insert or plurality of inserts **30** are connected to head **13,** and may be connected in a removable or in a permanent condition as will be explained more fully later in this specification.

Prosthesis **22** of the head of the femur, in addition to pin **24** and neck **26,** also preferably includes an enlarged shoulder **60** integral with and positioned between the pin and the neck, and the neck is preferably formed with a base **62** joined to the shoulder and eccentrically positioned with respect to the central axis **64** of the pin. Shoulder **60** defines a side portion **66** and a lower surface **68,** and it is surface **68** that rests on the upper portion of the severed femur when the artificial hip joint is installed. In a preferred construction of the artificial hip joint, an innermost portion **70** of the neck also extends in a continuous manner from side portion **66** of the shoulder.

It is also preferable and the preferred embodiment illustrated provides for a curvature of neck **26** so as to form an angle of substantially 120° with pin axis **64.** The angle is measured between the pin axis and an imaginary line passing from the pin axis through the center of hip ball **28** and tangentially to the innermost curved surface **70** of the neck.

Pin **24** also defines two slots **72** and **74** opening in directions parallel to the direction of curvature of neck **26.** The function of these slots is similar to the function of the holes in prosthesis **10,** and slots **72** and **74** permit bone tissue to grow therethrough so as to fix pin **24** and prosthesis **22** within the femur. Pin **24** is also tapered away from neck **26,** and the neck is tapered away from the pin. The taper of the pin permits it to be driven downwardly and into the bone-marrow channel of the femur.

In an alternative arrangement and use of the artificial hip joint of this invention, shoulder **60** is provided with a hole **76** entering the side portion **66** of the shoulder. A rod **78** is also provided, and it is adapted to pass through a hole drilled in the greater trochanter (not shown) and to be driven into hole **76** to hold the greater trochanter in proper position after the artificial joint has been installed.

In another embodiment and use of the hip joint, a collar **80** is provided for insertion into the upper part of the femur and for providing additional support for the artificial hip on the femur when necessary. The collar is provided with a flange portion **82** for engaging the lower surface **68** of shoulder **60,** and the collar is also provided with a sleeve portion **84** integral with flange portion **82** for sliding over pin **24** so that the collar can be positioned on the upper part of the severed femur. Pin **24** can, thus, be inserted through the collar and into the bone-marrow channel of the femur to cause shoulder **60** to rest on flange portion **82.**

It is also preferable that sleeve portion **84** of the collar be provided with a plurality of holes **86** for enabling bone tissue to grow through the holes and to assist in holding the collar in its proper position on the femur.

As previously mentioned, inserts **30** are preferably removably connected to head **13.** This is particularly desirable since it readily facilitates replacement of the inserts if they become worn or otherwise damaged after a period of use in the body of the patient.

In a preferred embodiment, acetabulum prosthesis head **13** has a channel **88** therein and the insert or inserts **30** has a groove or grooves **90** therein. The channel and the grooves are so positioned with regard to the dimensions of head **13** and inserts **30** that when groove **90** and channel **88** are positioned in communicating relationship with respect to one another the inserts are tightly positioned and engage the inner portion of head **13.** A flexible ring member **92** is normally positioned within groove **90** and within channel **88** to retain the insert or inserts **30** in position with acetabulum prosthesis head **13.**

In order to facilitate insertion and removal of flexible ring **92,** acetabulum prosthesis head **13** is provided with an entry slot **94** located in communication with channel **88** and at least one insert **30** is provided with an entry passage **96** in communication with groove **90.** Both entry slot **94** and entry passage **96** are readily accessible for enabling the ring to be inserted into the groove and the channel or to facilitate removal of the ring when removal of inserts **30** is desired.

Entry slot **94** and entry passage **96** are preferably formed to each subtend an angle of substantially 25°, wherein the vertex of the angle is located at the center of hip ball **28.** This provides the necessary space for enabling easy insertion and removal of ring member **92.** In addition, channel **88** and groove **90** are dimensioned such that ring member **92,** when in its inserted position, bears primarily against a lower surface **98** of channel **88** and against an upper surface **100** of groove **90** so as to force inserts **30** into tight-fitting contact with acetabulum prosthesis head **13** along adjoining surfaces **102** and **104,** for example.

Flexible ring **92** is preferably non-continuous and may be provided with an enlarged end and an aperture **106** at one or both ends to facilitate grasping of the ring by a tool (not shown) and to prevent rotation of the ring within the channel and the groove so that the aperture **106** is always accessible. In order to further facilitate grasping of the ring member for insertion and removal thereof, insert **30** preferably defines an extension well **108** in communication with entry passage **96** and with groove **90.** This well enables a tool to be inserted through ring aperture **106** and permits the tool to extend into extension well **108** during the removal or insertion procedure.

Although not illustrated, an entry slot and an entry passage similar and in addition to slot **94** and to passage **96** can be provided in head **13** and in inserts **30,** respectively, and located at a different location from slot **94** and passage **96.** In this embodiment, two rings are provided instead of one and each ring extends substantially half way around channel **88** and groove **90.** Each ring can then be inserted and removed via its respective entry passage and entry slot.

The artificial hip joint of the present invention is preferably constituted of surgical grade materials suitable for implantation into the body.

It is desirable to use titanium or a titanium alloy for the greater portion of the artificial hip joint because this has proven to be highly effective in providing the desired strength while also providing for the desired resistance to corrosion. It may be desirable to use a cobalt alloy for the hip ball **28** and for inserts **30.** However, it may also be desirable for economic and other reasons to use a plastic material for inserts **30,** such as an ultra high molecular weight polyethylene. The use of such a plastic material for the inserts may permit the use of titanium or a titanium alloy for the hip ball, and the artificial hip joint can be made lighter in weight as a result.

In one embodiment, for example, the entire artificial hip joint with the exception of inserts **30** may be comprised of titanium or a titanium alloy and the titanium may be, for example, ASTM **F67–66** and the titanium alloy may be, for example, ASTM F **136–70.** where collar **80** and rod **78** are utilized, these elements may also be comprised of the same titanium or titanium alloy that is used in the remaining portions of the joint. Similarly, flexible ring member or members **92** may also be made of the same titanium or titanium alloy that is used in the remaining portions of the joint.

Another embodiment of the invention, however, utilizes the same titanium or titanium alloy for all portions of the joint with the exception of hip ball **28** and inserts **30.** In this embodiment, the hip ball and inserts may each be comprised of cobalt alloy ASTM F75–67, as an example.

In another embodiment of the invention wherein the inserts are permanently positioned within acetabulum prosthesis head **13,** (FIG. **5**) head **13** is provided with channel **88** and inserts **30** are provided with grooves **90.** When assembled, channel **88** and grooves **90** are positioned in communication with each other and a ring member **92,** which need not have an aperture therein, is positioned within the channel and within the grooves for retaining inserts **30** in position within acetabulum prosthesis head **13.** The ring is preferably flexible so as to spring into channel **88** from groove **90** when inserts **30** are properly positioned within the head **13.** Conversely, the ring may be initially expanded (FIG. **6**) within channel **88** so as to spring into grooves **90** when the channel and the grooves are positioned in communication with one another.

When using an artificial hip joint, it is extremely important that the artificial joint be rigidly held with respect to the femur so that it does not rotate relative to the femur. In order to firmly fix the artificial hip joint with respect to the femur, the present invention provides means in operative relationship with the femur head prosthesis for preventing rotation of the femur head prosthesis with respect to the femur.

As here embodied, and as illustrated in FIG. **7,** the rotation preventing means includes a fin member **110** integral with and extending from pin **24** for engaging a slot (not shown) cut into the femur by the surgeon. Fin **110** preferably extends only along a small portion of pin **24** and the fin is positioned within the slot to prevent rotation of pin **24** within the bone-marrow channel of the femur.

Another anti-rotation embodiment of the artificial hip joint is illustrated in FIGS. **8** and **9,** wherein the rotation preventing means includes a plurality of knife edges **118** integral with and extending longitudinally along pin **24** for cutting into the femur so as to prevent rotation of the femur head prosthesis relative to the femur.

An alternative anti-rotation feature is illustrated in FIG. **10,** wherein a sharpened spade end **120** extends from the end of pin **24** to be driven into the bone-marrow channel **114** of femur **116** beyond a reamed portion **122** within the bone-marrow channel. The spade end may also include blades **124** (FIG. **11**) integral with the spade for engaging the femur and for preventing rotation of pin **24** relative to the femur.

Additional embodiments of the anti-rotation feature of the invention are illustrated in FIGS. **12–17.** As shown in FIG. **12,** shoulder **60** is provided with a key **126** connected thereto and extending outwardly and downwardly from the shoulder for fitting into cut-out portion or slot **112** in the femur. Where collar **80** is utilized (FIG. **13**), a keyway **128** is provided in the collar to receive key **126** and to assist in preventing rotation of pin **24** relative to the femur.

In a further anti-rotation embodiment (FIG. **14**), shoulder **60** has an aperture **130** therein and a square headed pin **132** or other shaped pin having a head to bear against the sides of femur slot **112** is positioned within aperture **130** and extends outwardly and downwardly from shoulder **60** for positioning within femur slot **112** and to prevent rotation of pin **24** within the femur.

Rotation of pin **24** within the femur may also be prevented by means of the embodiment illustrated in FIG. **15.** In this arrangement, shoulder **60** is provided with

a cavity **134** and pin **24** is provided with an aperture **136.** A rod **138** is positioned within shoulder cavity **134** at one end and is located along pin **24** with a second end of the rod positioned within pin aperture **136.** A femur slot **112** is again cut into the femur for receiving rod **138,** and this prevents rotation of pin **24** within the femur.

An additional anti-rotation feature of this invention is illustrated in FIG. **16** wherein a member **131** defining a plurality of corners **133** is integral with the pin and immediately below shoulder **60.** Member **131** is preferably substantially square in cross section and corners **133** preferably extend substantially parallel with the axis of pin **24.**

The dimensions of the cross-section of square member **131** may be such that the length of each side of the square is equal to the diameter of pin **24** adjacent to shoulder **60.** Alternatively, the sides of square member **131** may be larger than the diameter of pin **24.**

In performing the operation of inserting the artificial hip joint of this invention, it may frequently be desirable to avoid completely severing the greater trochanter. Accordingly, it may be desirable, for this reason, to form shoulder **60** with a flattened side **61,** as illustrated in FIGS. **16** and **17** whereby the flattened side can be positioned in abutting relationship with the greater trochanter **63.** This positioning of shoulder **60** and of flattened side **61** flush with the greater trochanter, of course, also prevents rotation of the femur head prosthesis with respect to the femur, and the anti-rotation feature of flattened side **61** is also enhanced by the fact that side **61** is preferably oriented substantially parallel with the axis pin **24.** It is, of course, within the scope of this invention to provide for a prosthesis as described, but having flattened side **61** without the use of member **131** or to provide for a prosthesis as described but having member **131** without flattened side **61** or shoulder **60.**

Another embodiment of the invention designed to prevent relative movement or rotation between inserts **30** and acetabulum prosthesis head **13** is illustrated in FIG. **18.** Prevention of rotation between inserts **30** and acetabulum prosthesis head **13** is important because the hip is designed for relative movement between inserts **30** and hip ball **28.** The hip ball and the inserts are specifically designed for this purpose and are made of materials to withstand frictional movements therebetween. However, acetabulum prosthesis head **13** and inserts **30** are not so designed and relative movement between head **13** and inserts **30** is to be avoided. In addition, it is desirable to maintain entry slot **94** and entry passage **96** aligned so that it is always possible to insert or remove flexible ring member **92.** Of course, if entry slot **94** and entry passage **96** were permitted to move relative to one another, it would not be possible to insert or remove the flexible ring member until entry slot **94** and entry passage **96** were realigned.

Therefore, one embodiment of this invention provides for a projection **140** on at least one of inserts **30,** and acetabulum prosthesis head **13** is formed with a depression **142** therein for receiving projection **140** so as to prevent relative movement of inserts **30** with respect to head **13.** If desired, depression **142** can be so positioned that it also acts in the manner of extension well **108** in the embodiment of FIGS. **2–4** to permit the entry of a tool for grasping flexible ring member **92.**

As previously explained, experience has shown that it may often be desirable, due to wear or malfunction of the artificial hip joint, to repair or replace the bearing surfaces of the joint after some period of use by the patient. For this reason, this invention provides for the easy removal of inserts **30** from the artificial hip joint. However, if the bearing surfaces of the joint require replacement or repair after some period of use by the patient, it may be desirable to remove and replace hip ball **28,** and this removable feature is illustrated in FIGS. **19** and **20.**

As illustrated in FIG. **19,** hip ball **28** is removably positioned on curved neck **26,** and the hip ball is provided with an aperture **144** therein. Neck **26** is also provided with an aperture **146** in alignment with hip ball aperture **144,** and a holding pin **148** extends through apertures **144** and **146** for holding hip ball **28** on neck **26.** Holding pin **148** is frictionally and tightly held within apertures **144** and **146** so that hip ball **28** is firmly and fixedly held on to neck **26** during use of the artificial hip joint. However, when it is desired to remove hip ball **28** from the neck, pin **148** may be hammered out from apertures **144** and **146** to facilitate repair of the hip ball or replacement thereof.

An alternative embodiment of removable hip ball **28** is illustrated in FIG. **20** wherein neck **26** is provided with a free and tapered end **150.** Hip ball **28** is provided with a tapered opening **152** for tightly engaging tapered end **150** of the neck. Thus, the hip ball can be pressed onto the tapered end **150** of neck **26** to be firmly held in position. Hip ball **28,** however, is also provided with a hole **154** extending between the exterior surface of the hip ball and in communication with tapered opening **152** within the hip ball for facilitating removal of the hip ball from the neck by conventional tools (not shown).

A further embodiment of the artificial hip joint, and particularly the insert, is illustrated in FIG. **21.** In this embodiment, acetabulum prosthesis **10** is provided with threaded grooves **160.** Insert **162** is formed of one single piece and includes an integral threaded ring portion **164** for threadedly engaging acetabulum prosthesis grooves **160.** Insert **162** further defines notches **166** adjacent to threaded ring **164** for enabling the insert to be screwed into position with the ring threadedly engaging grooves **160.**

As in the previous embodiments, the insert socket **12** defines more than a hemisphere so that the hip ball is retained within the socket to prevent postoperative separation.

The insert illustrated in FIG. **21** is preferably comprised of plastic, such as ultra high molecular weight polyethylene. The plastic is initially heated to cause expansion, and hip ball **28** is then popped into socket **12.** The insert is then allowed to cool so that it contracts around the hip ball, and the insert with the hip ball therein is then screwed into acetabulum prosthesis **10** by means of threaded ring **164** and grooves **160** until the insert is tightly positioned within the acetabulum prosthesis.

If desired, and where insert **162** is comprised of metal, insert **162** is preferably formed as two pieces. This embodiment is illustrated in FIG. **22,** and the insert in this embodiment is preferably comprised of cobalt alloy, such as ASTM F75–67.

In assembling the embodiment illustrated in FIG. **22,** the two pieces of insert **162** are first positioned around

hip ball **28.** The pieces of the insert are formed so that faces **168** abut against one another in contiguous relationship. The assembly of the hip ball together with the two pieces of the insert is then screwed into acetabulum prosthesis **10** with threaded ring **164** engaging grooves **160.**

The embodiments described and illustrated in FIGS. **21** and **22** are particularly advantageous. The unitary construction of the inserts renders the hip extremely rugged and permits it to withstand large forces and stresses. Additionally, the threaded grooves within the acetabulum prosthesis and the threaded ring integral with the insert permit the insert to be readily removed from the acetabulum prosthesis in the event that the insert needs to be replaced or repaired. This, of course, can be done even after the hip has been inserted in the patient.

The present invention, thus provides for an extremely versatile and durable artificial hip joint that is inexpensive to manufacture and which is designed to facilitate easy replacement of bearing surface portions of the artificial hip joint, if and when such replacement becomes necessary or desirable. The artificial hip joint of this invention also provides for novel anti-rotation means that act in conjunction with the femur to prevent rotation of the artificial hip joint relative to the femur. This, of course, is extremely important for the successful use of the hip joint and this anti-rotation feature also permits the patient to quickly gain the full use of the hip joint after insertion of the hip joint.

The invention in its broader aspects is not limited to the specific details described, and departures may be made from such details without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. An artificial hip joint, comprising:

an acetabulum prosthesis of the cotyloid cavity defining an aperture having screw threads on the inner surface thereof and a plurality of blades extending outwardly away from said aperture for engaging the prepared wall of the cotyloid cavity;

at least one insert having an outer threaded surface and an inner bearing surface inserted into said aperture and threadedly connected by means of said threads to said acetabulum prosthesis to form a socket, the outer surface of said at least one insert engaging and being supported by the inner surface of said aperture; and

a prosthesis of the head of the femur movably interconnected with said acetabulum prosthesis and including a pin to be driven into the bone-marrow channel of the femur, a curved neck integral with the pin, and a hip ball positioned on the neck, movably located within said socket and in movable contact with said insert, said socket enveloping more than one-half of the hip ball to prevent withdrawal of the hip ball from the socket, said artificial hip joint composed of surgical grade materials suitable for implantation into the body.

2. An artificial hip joint as in claim **1** wherein said insert is comprised of plastic.

3. An artificial hip joint as in claim **1** wherein said acetabulum prosthesis includes two of said inserts.

4. An artificial hip joint as in claim **1** wherein said insert is comprised of ultra high molecular weight polyethylene.

5. An artificial hip joint as in claim **4** wherein said hip ball is comprised of titanium or a titanium alloy.

6. An artificial hip joint as in claim **1** wherein said insert is comprised of cobalt alloy ASTM F75–67.

7. An artificial hip joint as in claim **1** wherein said hip ball is comprised of cobalt alloy.

8. An artificial hip joint as in claim **1** wherein all of said acetabulum prosthesis but the insert and all of the prosthesis of the head of the femur but the hip ball are comprised of titanium or a titanium alloy.

9. An artificial hip joint as in claim **8** wherein the titanium alloy is ASTM F136–70.

10. An artificial hip joint as in claim **8** wherein the titanium is ASTM F67–66.

11. An artificial hip joint as in claim **1** wherein said insert includes an integral threaded ring portion for threadedly engaging grooves in said acetabulum prosthesis.

12. An artificial hip joint as in claim **11** wherein said insert further defines notches adjacent said threaded ring for enabling said insert to be screwed into position with said ring threadedly engaging said grooves.

13. An artificial hip joint as in claim **1** wherein said insert is formed as one unitary piece.

14. An artificial hip joint comprising:

an acetabulum prosthesis of the cotyloid cavity defining an aperture having screw threads on the inner surface thereof;

at least one insert having an outer threaded surface and an inner bearing surface inserted into said aperture and threadedly connected by means of said threads to said acetabulum prosthesis to form a socket, the outer surface of said at least one insert engaging and being supported by the inner surface of said aperture; and

a prosthesis of the head of the femur movably interconnected with said acetabulum prosthesis and including a pin to be driven into the bone-marrow channel of the femur, a curved neck integral with the pin, and a hip ball positioned on the neck, movably located within said socket and in movable contact with said insert, said socket enveloping more than one-half of the hip ball to prevent withdrawal of the hip ball from the socket, said artificial hip joint composed of surgical grade materials suitable for implantation into the body.

15. An artificial hip joint as in claim **14** wherein said insert includes an integral threaded ring portion for threadedly engaging said acetabulum prosthesis threads.

16. An artificial hip joint as in claim **15** wherein said insert further defines notches adjacent to said threaded ring for enabling said insert to be screwed into position with said ring threadedly engaging said threads.

17. An artificial hip joint as in claim **14** wherein said insert socket defines more than a hemisphere.

18. An artificial hip joint as in claim **14** wherein said insert is formed as one unitary piece.

19. An artificial hip joint as in claim **18** wherein said insert is comprised of plastic.

20. An artificial hip joint as in claim **19** wherein said plastic is ultra high molecular weight polyethylene.

21. An artificial hip joint as in claim **14** wherein said insert is formed as two pieces.

22. An artificial hip joint as in claim **21** wherein said insert is comprised of cobalt alloy.

23. An artificial hip joint as in claim **22** wherein said cobalt alloy is ASTM F75–67.

24. An artificial hip joint as in claim **14** further including means in operative relationship with said femur head prosthesis for preventing rotation of the femur head prosthesis with respect to the femur.

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