

[54] **KNEE OR ELBOW PROSTHESIS**

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[75] Inventors: **Robert G. Averill**, Ringwood; **Alex Khowaylo**, Westwood, both of N.J.

[73] Assignee: **Howmedica, Inc.**, Rutherford, N.J.

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[51] Int. Cl. A61f 1/24

[58] **Field of Search**3/1; 128/92 C, 92 CA,
128/92 R

[56] **References Cited**

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Primary Examiner—Richard A. Gaudet

Assistant Examiner—Ronald L. Frinks

Attorney—Dean S. Edmonds et al.

[57] **ABSTRACT**

A total knee or elbow joint prosthesis having opposing condyle and plateau replacing members for attachment respectively to the upper and lower arm or leg bones, the members having respectively convex and concave spherical mating surfaces.

7 Claims, 7 Drawing Figures

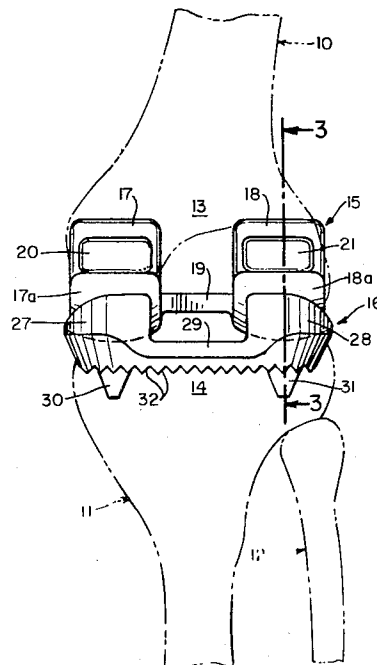


FIG. 1

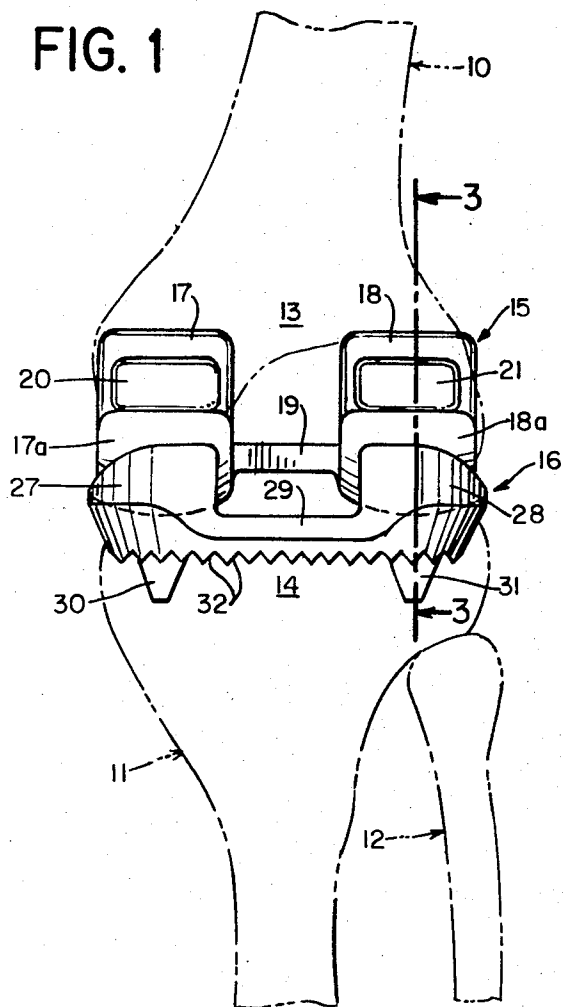


FIG. 2

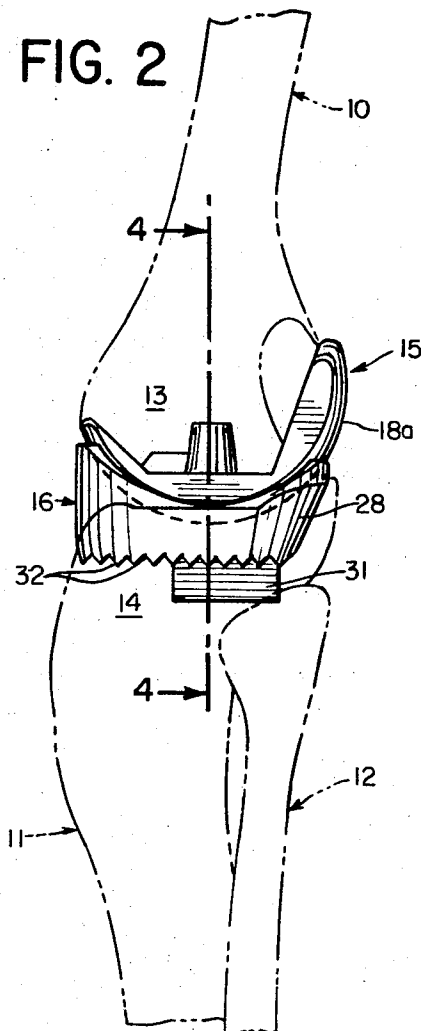


FIG. 3

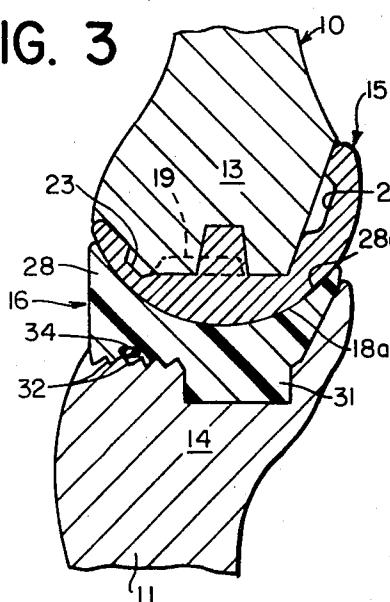
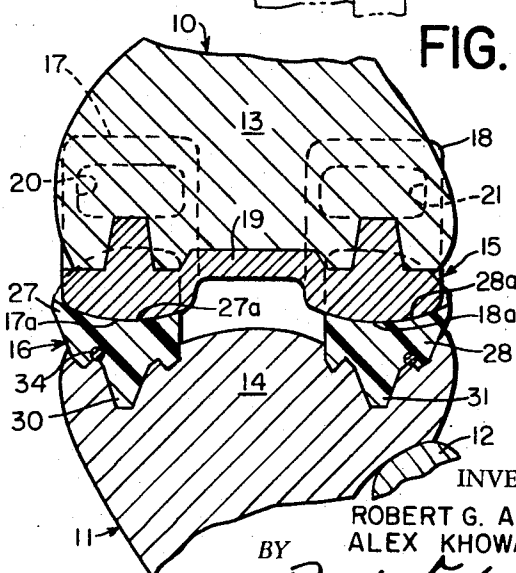


FIG. 4



INVENTORS

ROBERT G. AVERILL

ALEX KHOWAYLO

BY

Robert G. Averill, Alex Khowaylo
Attorneys

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FIG. 5

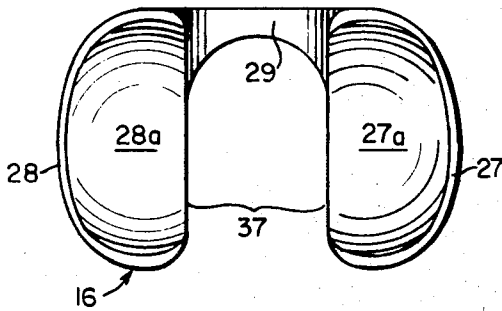


FIG. 6

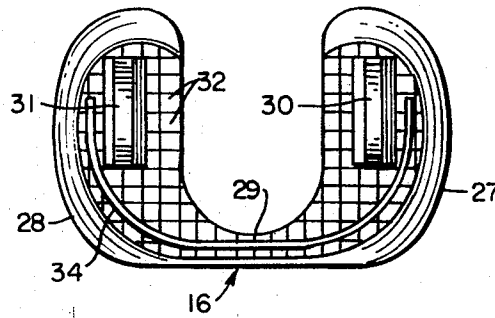
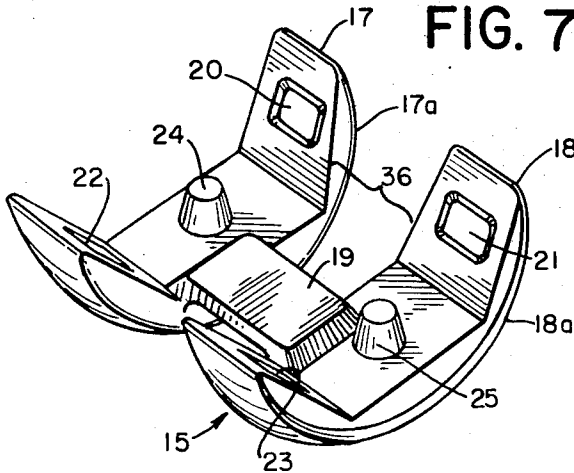


FIG. 7



INVENTORS
ROBERT G. AVERILL
ALEX KHOWAYLO

BY *Rennie, Chas. & Co.*
Morton, Taylor & Moore
ATTORNEYS

KNEE OR ELBOW PROSTHESIS

BACKGROUND OF THE INVENTION

Prosthetic surgery involving the excision and removal of deteriorated and diseased bone tissue in knee and hip joints for example has now become quite common. Typically, artificial members of plastic and/or metal compatible with the body system are substituted for the removed natural bone segments and anchored to the remaining bone structure.

The bearing surfaces of the knee joint are vulnerable to stress, arthritic and other disease induced deterioration. Prosthetic correction is indicated when the tissues become so damaged that other less drastic techniques have little or no prospect of success. To date hinge type prostheses have been employed most frequently in such cases to restore the joint to some degree of normalcy. Although the surgical technique of implantation as such has been quite successful, the precise construction and shape of the implanted artificial members has not been entirely satisfactory due to the complexity of the knee joint movement, the desirability of minimum bone removal, and the need for preserving potentially functional cruciate and collateral ligaments. Further, the design and fabrication technique suited to that design must result in a bearing with long term high performance capabilities.

It is the purpose of the present invention to provide a prosthesis wherein these problems are resolved and which can be easily installed by the surgeon with greatly improved postoperative results.

SUMMARY OF THE INVENTION

In accordance with the present invention, a knee or elbow joint prosthesis comprises an artificial upper bone member and a mating lower bone member, the upper bone member having a pair of spaced condyle portions joined by an intercondyloidal segment. Each condyle portion is formed with a spherically curved downwardly facing convex surface. The lower bone member has a pair of similarly spaced plateau portions joined by an interplateau segment, each plateau portion being formed with a spherically curved upwardly facing concave surface. The radius of each spherical condyle surface is no greater than that of the corresponding spherical plateau surface, and may with advantage be a little less to make for easy articulation in an anterior-posterior plane.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of a knee joint in its anterior aspect, incorporating the prosthesis of the present invention;

FIG. 2 is a side view, lateral aspect of the knee joint in FIG. 1;

FIG. 3 is a section taken in the direction of arrows 3—3 of FIG. 1;

FIG. 4 is a section taken in the direction of arrows 4—4 of FIG. 2;

FIGS. 5 and 6 are respectively top and bottom views of a plateau member constructed according to the present invention for attachment to the tibia; and

FIG. 7 is a perspective of a condyle member according to the present invention for attachment to the femur.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, and initially to FIGS. 1 and 2 thereof, a knee joint showing the major upper and lower bones, the femur 10, the tibia 11 and the fibula 12, has been illustrated. Various ligaments and tendons which interconnect these bones and regulate, restrict and determine the flexing or articulated movement of the tibia with respect to the femur have not been shown. Hinged movement naturally occurs between the condyle portions 13 of the femur and between the plateau portions 14 of the tibia.

It will be understood that the prosthesis of the present invention shall be surgically implanted in substitution for diseased mating portions of the femoral condyles and the tibial plateaus. The prosthesis therefore includes a femoral condyloidal member 15 and a mating tibial plateau member 16 which are uniquely constructed in accordance with the present invention. Member 15 has a pair of spaced condyloidal portions 17 and 18 which are integrally joined by an intercondyloidal segment 19. The proximal posterior surface of each segment 17 and 18 may be provided with a recess 20, 21 and the proximal anterior portions thereof may similarly be provided with recesses 22, 23 therein. These recesses receive cement and facilitate secure attachment of the prosthesis to the bone structure. Each of the condyloidal portions 17 and 18 include tapered pins 24, 25 which will be received within openings made by the surgeon in the mating portions of the femur. Thus the member can be joined to the femur (after diseased natural condyles have been removed) and secured thereto in a manner which is known.

Member 15 may be cast integrally of a metal compatible for the purpose, such as a cobalt-chromium-base alloy or a stainless steel. Alternatively member 15 may be manufactured of separately produced and surfaced condyle portions which are then welded to a plate which provides the intercondyloidal segment 19. Member 16 also may be metallic, but is preferably is formed mainly of a suitable high density organic polymer. Other materials of construction also may be used for either or both members, such as pyrolytic or vitreous carbon, or a ceramic material.

In accordance with the present invention, the downwardly facing convex surface 17a and 18a of each condyloidal portion 17 and 18 is uniquely formed as a section of the surface of a sphere. That is to say, in both anterior-posterior and in lateral-medial directions, the curvature of each surface 17a, 18a will conform to that of a sphere having a predetermined diameter, which in the present embodiment is approximately the straight line distance between the anterior and posterior extremities of each portion 17 and 18 as shown in FIG. 2. The surfaces 17a, 18a being spherical lend themselves to being given a surface finish of extremely high quality by known machining and finishing techniques.

The member 16 as shown in FIGS. 1 to 4 attached to a tibia, comprises a pair of spaced plateau portions 27, 28 joined by an integral interplateau segment 29. Each plateau portion is provided with a downwardly projecting pin 30, 31. The segment 29 and the plateau portions 27, 28 have serrations 32 on their under surfaces which together with the pins 30 and 31 permit the member 16 to be firmly anchored by a suitable cement to the upper

end of the tibia after the latter has been suitably prepared surgically. As indicated above, each of the plateau portions 27 and 28 has an upwardly facing concave spherical surface 27a and 28a which may have an identical center of curvature to that of each downwardly convex spherical surface 17a, 18a of the member 15; or advantageously, the radius of the concave surface may be made somewhat greater than that of the convex surface to permit smooth rotation in the anterior-posterior plane with limited lateral-medial motion and axial rotation. A metal wire 34 is preferably imbedded in the member 16 in known relationship with respect to the geometrical dimensions of such member. This is done to provide an X-ray opaque reference member, since the member 16 is of insufficient density to be readily detected in X-ray photographs of the prosthetic knee joint.

It will be noted that the intercondyloidal segment 19 and the interplateau segment 29 are substantially narrower than the respective condyle portions 17, 18 and plateau portions 27, 28. This provides intercondyloidal and interplateau apertures 36 and 37 for receiving the posterior and anterior cruciate ligaments connecting condyle portions 13 of the femur and corresponding portions 14 of the tibia. As illustrated, each spherically curved condyle portion and plateau portion has an anterioral-posterioral dimension substantially greater than its lateral-medial dimension. In the particular embodiment, such anterioral-posterioral dimension is substantially twice the lateral-medial dimension.

The above-described prosthesis has the following significant advantages in comparison with prior prosthetic joints. Members 15 and 16 each have mating portions which are entirely spherical. It has been found that a prosthetic joint thus formed approximates the natural movement of the knee very well. It had been thought by some that such movement would require condylar surface of a more complex nature closely following the anatomical, which could not be accurately manufactured and which would not be necessarily the same for all individuals. The spherical surfaces of members 15 and 16 can be manufactured and finished with great accuracy and quality not possible in prior devices.

It will be understood that the foregoing description has related to a particular embodiment of the invention and is therefore representative. In order to fully ap-

preciate the scope of the invention, reference should be made to the appended claims.

What is claimed is:

1. A joint prosthesis suitable for knee or elbow comprising an upper member and a mating lower member, the upper member having a pair of spaced condyle portions joined by an intercondyloidal segment, each condyle portion being formed with a spherically curved downwardly facing convex surface, and the lower member having a pair of spaced plateau portions joined by an interplateau segment, each plateau portion being formed with a spherically curved upwardly facing concave surface engageable with the corresponding convex surface, the radius of each spherical condyle surface being no greater than that of the corresponding spherical plateau surface, said upper and lower members including means for attachment to a bone structure and providing for substantial articulation of such bone members in a single plane, and said intercondyloidal segment and interplateau segment being substantially narrower than the respective condyle portions and plateau portions thereby providing intercondyloidal and interplateau apertures for receiving cruciate ligaments connecting upper and lower bone structures to which the prosthesis is adapted to be attached.
2. A joint prosthesis according to claim 1 in which the upper member is metallic and the lower bone member is made mainly of an organic polymer.
3. A joint prosthesis according to claim 1 in which the radius of each spherical condyle surface is less than the radius of curvature of each mating spherical plateau surface.
4. A joint prosthesis according to claim 1 in which both upper and lower members are metallic.
5. A joint prosthesis according to claim 1 in which the upper member is metallic and comprises individually formed and surfaced condyle portions attached to said intercondyloidal segment.
6. A joint prosthesis according to claim 1 in which each spherically curved condyle portion and plateau portion has a front-to-back dimension that is substantially greater than its side-to-side dimension.
7. A joint prosthesis according to claim 6 in which the front-to-back dimension is substantially twice the side-to-side dimension.

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