Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2427592 C 2008/06/17

(11)(21) 2 427 592

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

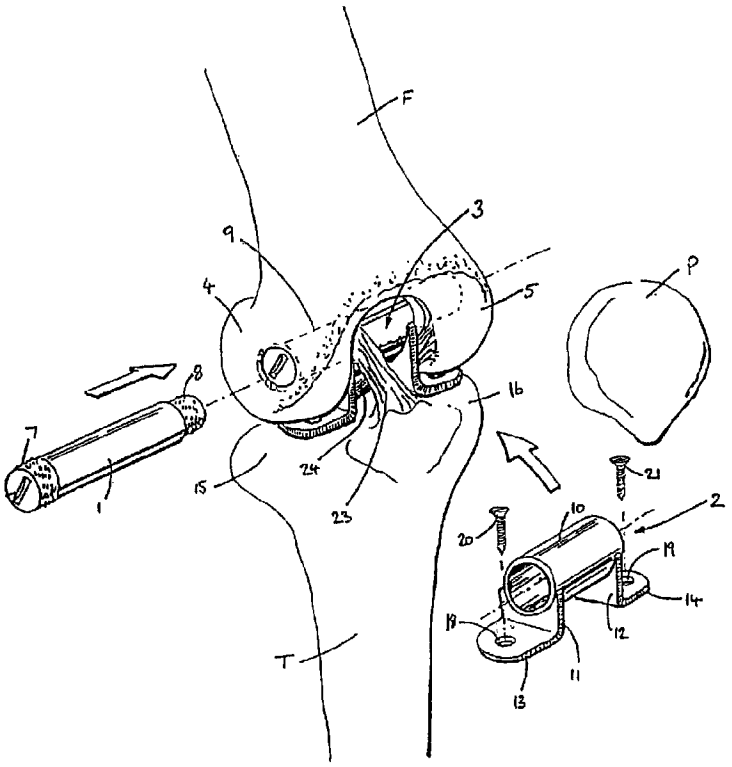
(86) Date de dépôt PCT/PCT Filing Date: 2000/11/02
(87) Date publication PCT/PCT Publication Date: 2001/05/10
(45) Date de délivrance/Issue Date: 2008/06/17
(85) Entrée phase nationale/National Entry: 2003/05/01
(86) N° demande PCT/PCT Application No.: GB 2000/004201
(87) N° publication PCT/PCT Publication No.: 2001/032109

(51) Cl.Int./Int.Cl. *A61F 2/38* (2006.01)
(72) Inventeur/Inventor:
KRIEK, HANS RUDOLF, NL

(73) Propriétaire/Owner:
ARDEMED INNOVATIONS LIMITED, CY

(74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : PROTHESES ARTICULAIRES
(54) Title: JOINT PROSTHESES



(57) Abrégé/Abstract:
Joint prostheses are provided which may be used to replace, for example, knee, elbow or ankle joints. A knee prosthesis comprises a pin (1) and a pivoting member (2). The pin (1) bridges a gap (3) between a medial condyle (4) and lateral condyle (5) of a femur F. The pivoting member (2) is positioned in the gap (3) and the pin (1) passes through the pivoting member (2) to secure it in position and to allow it to pivot about the pin (1). The pin (1) and pivoting member (2) of the prosthesis represent represent a mechanically convenient system which is able to replace the function of a joint and can be positioned with less trauma to the joint whose function they replace than prostheses according to the prior art.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 May 2001 (10.05.2001)

PCT

(10) International Publication Number
WO 01/32109 A1

(51) International Patent Classification[7]: A61F 2/38, 2/30

(21) International Application Number: PCT/GB00/04201

(22) International Filing Date:
2 November 2000 (02.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9925956.6 2 November 1999 (02.11.1999) GB

(71) Applicant *(for ZW only)*: **DAVIES, Christopher, Robert** [GB/GB]; Frank B. Dehn & Co., 179 Queen Victoria Street, London EC4V 4EL (GB).

(71) Applicant and
(72) Inventor: **KRIEK, Hans, Rudolf** [NL/NL]; Ruthardlaan 36, NL-1406 RT Bussum (NL).

(74) Agent: **FRANK B. DEHN & CO.**; 179 Queen Victoria Street, London EC4V 4EL (GB).

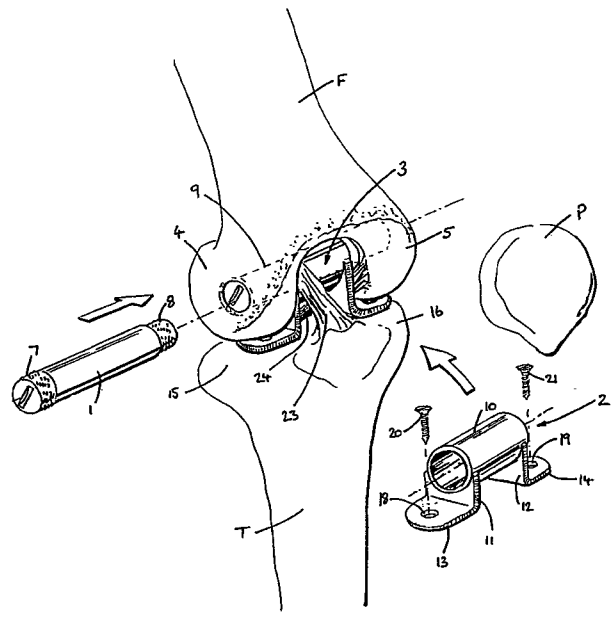
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

[Continued on next page]

(54) Title: JOINT PROSTHESES



(57) Abstract: Joint prostheses are provided which may be used to replace, for example, knee, elbow or ankle joints. A knee prosthesis comprises a pin (1) and a pivoting member (2). The pin (1) bridges a gap (3) between a medial condyle (4) and lateral condyle (5) of a femur F. The pivoting member (2) is positioned in the gap (3) and the pin (1) passes through the pivoting member (2) to secure it in position and to allow it to pivot about the pin (1). The pin (1) and pivoting member (2) of the prosthesis represent represent a mechanically convenient system which is able to replace the function of a joint and can be positioned with less trauma to the joint whose function they replace than prostheses according to the prior art.

WO 01/32109 A1

WO 01/32109 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

20208-1838

Joint Prostheses

This invention relates to joint prostheses for human or animal bodies.

Replacement of worn out, damaged or diseased joints of human or animal bodies with artificial joint prostheses or components is an established medical procedure. Conventional joint prostheses or components for use in such procedures, which have been designed for virtually all types of joints, generally comprise component parts of the same or similar shape or form as all or part of the natural joint they are designed to replace. For example, the condyle surfaces of a knee joint may be replaced with metal plates of the same shape as the surfaces they replace. Alternatively, a whole joint may be replaced with a metal joint prosthesis taking a generally similar form to the original knee.

This conventional approach to joint replacement has various disadvantages. Firstly, the component parts of such joint prostheses are usually large and require invasive surgical procedures to put the prosthetic components in place. Secondly, although the artificial component parts may have the same shape as the original natural joints, they cannot provide the same function as they are made from artificial material rather than bone and/or body tissues. For example, when the condyle surface of a knee is replaced the articular cartilage is removed and the new artificial surface will not be lubricated in the same way as a natural knee. This results in wear both of the artificial components and the body tissue surrounding or coming into contact with the artificial component.

The Applicants have recognised that significant

advantages can be gained by taking a new approach to the design of joint prosthesis. This involves replacing the function of a natural joint without necessarily using component parts having the same or similar shape or form as the joint whose function they replace.

Thus, according to the present invention there is provided a prosthesis for a knee or elbow joint comprising a pivoting member and a pin, the pivoting member and pin being configured to be directly engageable with respective bones to be pivotally interconnected by the prosthesis, wherein the pin and pivoting member are sized and configured so that they provide the load bearing surfaces in the knee or elbow joint, and wherein the prosthesis is sized and configured so that the pin in use bridges a recess in a femur or humerus and engages the pivoting member in said recess such that the pivoting member can pivot about the longitudinal axis of the pin.

Such a joint prosthesis replaces a knee joint. The recess may then be formed by reaming out somewhat the naturally occurring gap between the femoral condyles of a femur. The pivoting member then engages a tibia, the pin is positioned along an axis passing between the femoral condyles of the femur, and the prosthesis provides pivoting about this axis to achieve the natural function of the joint.

Alternatively, the joint prosthesis replaces an elbow joint. The recess may then be formed by reaming out somewhat the naturally occurring gap between the medial and lateral condyles of a humerus. The pivoting member then engages an ulna, the pin is positioned along an axis passing between the condyles of the humerus and the prosthesis provides pivoting

about this axis to achieve the natural function of the joint.

The pin and pivoting member of the prosthesis represent a mechanically convenient system which is able to replace the function of a joint. Furthermore, they can be positioned with less trauma to the joint whose function they replace than prostheses according to the prior art, since the pin and pivoting member form a hinge or pivot type arrangement which is generally smaller than that of the original joint and more compact than known prosthesis. Consequently a prosthesis of the invention is capable of being fixed in place with a lesser amount of removal of bone and tissue from the area of the joint than the prior art.

Furthermore, relatively large surfaces of the bone around the joint which has been replaced may float clear of one another and bear substantially no load. This reduces any further wear of these surfaces and reduces the likelihood of the need to carry out further procedures to replace the joint again.

Preferably, the pivoting member comprises a sleeve for engaging the pin. The pin may pass through the sleeve allowing the pivoting member to rotate relative to the pin and may additionally secure the pivoting member in place. This arrangement is particularly

straightforward to position in a body and positioning involves minimal trauma to the joint.

The pivoting member may further comprise one or more supports extending from the sleeve to a bone to be interconnected by the prosthesis. The support(s) of the pivoting member support weight exerted through the joint and rotate about the longitudinal axis of the pin allowing the bone engaged by the pivoting member to also rotate about the longitudinal axis of the pin, providing the function of the joint being replaced.

Preferably, each support has a base that engages, in use, the end of the bone to be engaged by the pivoting member. The base(s) may rest, in use, on a prepared surface of the bone. In this case the base(s) remain securely in place due to weight exerted through the joint and natural tension provided across the joint by muscles and ligaments etc. Alternatively, the base(s) may be secured to the end of the bone. This may be achieved, for example, by screwing the base(s) to the bone. Alternatively it may be achieved by cementing the base(s) to the bone.

In another embodiment, the support(s) may extend

into the bone, or a bore in the bone, and a base for such a support may comprise a peg extending, in use, through the bone to be engaged by the pivoting member. In other words, the peg may extend across the bone, i.e. substantially perpendicular to the length of the bone. The peg may extend substantially from the anterior to the posterior of the bone. Alternatively, the peg may extend substantially from the lateral to the medial side of the bone. In this latter case, a single peg may be provided for more than one support. The support(s) can engage the peg(s) when mounted in the bone such that load is exerted on the bone via the peg(s). This is particularly advantageous as it allows the end (condyle) surfaces of the bone to remain largely intact.

In one embodiment particularly suitable for use in the knee, the pivoting member comprises two such supports. One for supporting the medial side of the knee joint by interconnecting, in use, the medial condyle of a femur and the medial condyle of a tibia, and the other for supporting the lateral side of the knee joint by interconnecting, in use, the lateral condyle of a femur and the lateral condyle of a tibia. The provision of a pivoting member comprising two separate supports allows the joint prosthesis to be fitted in a procedure that causes particularly little trauma to the central area of the knee joint. More specifically, the supports may be generally elongate and may be mounted via bores in the tibia or via bores in the femur, and the central portion of the knee joint can remain largely undisturbed.

In another embodiment particularly suitable for use in the knee, the pivoting member comprises one such support. The support may then be positioned centrally in the joint to allow the condyle surfaces of the femur and tibia to remain entirely, or almost entirely, intact.

As joints, even of the same type, have dimensions which vary considerably, the pivoting member may be

adjustable to accommodate different distances between the pin and the bone which the pivoting member engages. To achieve this, the support(s) may have adjustable length.

Some natural joints allow a small degree of movement around axes other than the major axis of rotation of the joint. For example, a knee joint may bend to a few degrees from side to side as viewed from the front (i.e. the anterior view). Such "bending" movement in joints may be accommodated by the pivoting member. The pivoting member may therefore further comprise means for rotating about an axis substantially perpendicular to both the major axis of the pin and the major axis of at least one of the bones to be connected by the joint. The rotation may be resilient to improve support of the joint by the prosthesis.

For example, the support(s) may resiliently extend and contract along its/their length between the pin and its/their base(s). Thus, when the pivoting member has two supports, the relative extension and contraction between two supports provides a suitable bending movement to accommodate the desired rotation. The extension and contraction may be provided by a piston and cylinder arrangement. Alternatively the bending movement may be provided by the support(s) themselves flexing. This is particularly useful when the pivoting member has only one support as flexation of the support directly accommodates desired rotation.

In an alternative embodiment, again suitable for use with a knee or elbow, the pivoting member may be provided with a threaded stud which provides for self-tapping engagement with a bone formed in the adjacent bone whereby the member may be secured to the bone. Again, this pivoting member may be resilient or otherwise adapted to provide for limited relative movement other than the principal pivoting action of the joint, if desired.

Natural joints may also have some degree of motion around an axis which is substantially parallel to a longitudinal axis of a bone whose movement the joint facilitates. For example, a knee joint rotates around an axis passing through the medial condyle of a tibia and substantially parallel to the tibia. This "twisting" motion in joints may be accommodated by the pivoting member. The pivoting member may therefore further comprise means for rotating about an axis substantially parallel to the major axis of one of the bones connected by the joint.

For example, the base(s) of the pivoting member engaging the end of the bone may be adapted to rotate in a plane in which the base(s) contact(s) the bone. So, for a knee, a base resting on a surface of a medial condyle of a tibia may be adapted to rotate in the plane of the surface such that the central axis of rotation passes through the medial condyle of the tibia and substantially parallel to the tibia. When the pivoting member also has a base resting on the lateral condyle of the tibia, this may be arranged to slide to accommodate the rotation of the other base.

Rotation or sliding of a base may be provided by fitting the base in a sleeve positioned between the base and the bone. Alternatively, a washer or two dimensional bearing may be placed between the base and the bone.

This, in itself, represents a departure from the prior art and, according to a further embodiment of the present invention there is also provided a component for a joint prosthesis adapted to rotate about an axis substantially parallel with the major axis of a bone to be interconnected by the prosthesis.

The pin preferably comprises a generally cylindrical shaft which is mounted in a bore formed in the bone, the bore having portions either side of the recess into which the pin is to be mounted. The bore is

preferably made from one (i.e. proximal) side of the joint. The pin may also be inserted into the bore from the one (i.e. proximal) side of the joint (i.e. one end of the bore). In particular, the pin may be inserted into position axially. Thus, only a single small incision may be made by a surgeon to enable the bore to be made and insert the pin, greatly reducing trauma to the patient. Accordingly, the pin may be adapted to be inserted into the bore from one end, e.g. by having self tapping means at a distal end or means by which it can be engaged to aid insertion at the proximal end.

More specifically the pin may be retained in the bore by an interference fit, and may therefore have a rough or knurled surface for engaging the inside surface of the bore. In a preferred embodiment the pin has external screw threaded portions for self-tapping engagement with the inside surface of the bore. Another alternative is for the pin to be tapered and/or for it to be fitted in a tapered bore. Additionally or alternatively, the pin may be cemented in position. In each case, the pin bridges a recess defined in or between bones and its ends are supported in bore portions either side of the recess.

In a particularly preferred form of the method for a knee or elbow joint, the pin is inserted into position via a bore portion extending completely through the bone on one side of the recess, which is made by the surgeon and which communicates with the recess. The sleeve is aligned with such bore portion and the pin inserted such that it passes through the sleeve and into an opposed bore portion formed in the bone on the other side of the recess.

Alternatively, the sleeve may be inserted in a bore portion first, and the pin then inserted through the bore inside the sleeve. Another alternative, is for the pin and sleeve to be inserted together

through the bore, one inside the other, with the two ends of the pin extending beyond the ends of the sleeve for mounting to adjacent bone parts.

In particularly preferred embodiments, the bore extends only part way through the bone on the distal side. For example, the distal portion of the bore may be in a portion of bone inward of the inside surface of the cortical bone wall distal from the side of the bone from which the bore is made. The pin, when inserted, may therefore extend only part way through the bone on the distal side. This is advantageous as it reduces trauma to the bone on distal side of the joint and, in particular, prevents damage to ligaments or the insertion points of ligaments on that side of the joint.

For a knee, it is preferable that the bore is made from the medial side of the femur as the medial collateral ligament has a wider insertion into the femur than the lateral collateral ligament. Thus, the medial collateral ligament can be parted to allow access to the femur to make the bore and insert the pin, and the lateral collateral ligament can remain untouched.

For an elbow, it is preferable that the bore is made from the lateral side of the humerus, as this reduces the risk of damage to the ulna nerve (nervous ulnaris) which runs through the medial side of the elbow joint.

The bore portion on the proximal side may have a slightly bigger radius than that on the distal side of the recess, with the pin having self-tapping threaded, or interference fitting, portions, for example, of radii corresponding to the radii of the respective bore portions, so that the leading edge of the pin can pass freely through the proximal bore portion to aid insertion.

As exemplified above, with reference to the knee and elbow, the pin is located along the major axis of rotation of the joint. The bore is preferably also made along the major axis of rotation to locate the pin along that axis. In a knee, for example, the bore is preferably made, and the pin is located, along an axis which passes through the posterior femoral condyles as the movement of a natural knee is virtually entirely around such an axis.

Thus, according to a preferred embodiment there is provided a knee prosthesis having a pin which engages in use the posterior femoral condyles of a knee joint and a pivoting member which engages in use a tibia, the components being pivotally engaged, in use, in such a manner to allow the tibia to rotate about an axis extending between the posterior femoral condyles of the femur.

Also disclosed herein is a method of replacing a knee joint comprising mounting a pin in engagement with the posterior femoral condyles of a knee joint, and a pivoting member in engagement with the tibia, the pin and pivoting member being pivotally engaged, in use, in such a manner to allow the tibia to rotate about an axis extending between the posterior femoral condyles of the femur.

This knee prosthesis achieves the natural function of the knee joint in a surprisingly simple way, as virtually all the mechanical movement of the knee takes place around the axis. No further support of the knee joint is required as rotation around the axis replaces the function of the knee joint. The components may therefore only be pivotally engaged, with no other engagement or load bearing surfaces necessary.

More particularly, the axis is preferably between the apexes of the medial and lateral femoral epicondyles (the

transepicondylar axis), or close to it. Such an axis is the optimal major axis of rotation for a knee, and the function of the knee can therefore be replaced using a prosthesis which rotates around such an axis.

Also mentioned above is the replacement of an elbow joint. The bore is made, and the pin is located, along an axis which passes through the epicondyles of a humerus. Such an axis is the optimal major axis of rotation for an elbow. The function of the elbow can therefore be replaced using a prosthesis which rotates around such an axis.

Thus, according to a preferred embodiment there is provided an elbow prosthesis having a pin which engages in use the medial and lateral condyles of the humerus at an elbow joint and a pivoting member which engages in use an ulna, the pin and pivoting member being pivotally engaged in use in such a manner to allow the ulna to rotate about an axis extending between the epicondyles of the humerus.

A method of replacing an elbow joint is disclosed herein comprising mounting a pin in engagement with the medial and lateral condyles of the humerus at the elbow joint and a pivoting member in engagement with the ulna, the components being pivotally engaged in use in such a manner to allow the ulna to rotate about an axis extending between the epicondyles of the humerus.

Such an axis is the optimal axis of rotation of an elbow joint.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is an illustration of a knee joint;

Figure 2 is an illustration of the knee joint of Figure 1 with a knee prosthesis according to the invention in place;

Figure 3 is an illustration of a knee joint with a second example of a knee prosthesis according to the invention in place;

Figure 4 is an illustration of an elbow joint;

Figure 5 is an illustration of the elbow joint of Figure 4 during preparation for placement of an elbow prosthesis according to the invention; and

Figure 6 is an exploded view of the elbow joint of Figure 5 with the elbow prosthesis in place.

Referring to Figures 1 and 2, a joint prosthesis according to the invention is applied to a knee. In this example, a knee prosthesis comprises a pin 1 and a pivoting member 2. The pin 1 bridges a gap 3 between a medial condyle 4 and lateral condyle 5 of a femur F. The pivoting member 2 is positioned in the gap 3 and the pin 1 passes through the pivoting member 2 to secure it in position and to allow it to pivot about the pin 1.

In this example, the pin 1 comprises a uniformly cylindrical bar of, for example, titanium, chrome or Polyetheretherketone (PEEK). Self-tapping threads 7 and 8 provided at the medial and lateral ends 7 and 8 of the pin 1 while the central portion of the pin 1 has a smooth surface. The pin has a diameter of, for example, 5 to 10 millimetres which allows the pin to be sufficiently strong to support the knee joint but not so large as to be too invasive on insertion into a bore 9 formed by the surgeon in the medial and lateral condyles 4 and 5 of the femur F. The threads 7 and 8 are configured to firmly engage respective portions of the inside surface of the bore 9 to secure the pin in place. The thread 8 is of slightly smaller diameter than the thread 9 and can pass freely through the portion of the bore 9 in the medial condyle 4 which is of slightly larger diameter than the portion of the bore 9 in the lateral condyle. Thus, the pin can be pushed through the medial condyle and through the pivoting member until the threads engage their cooperating bone portions after which the pin can be firmly screwed in place.

The pin 1 can alternatively be secured by a tapering fit, interference fit or by cementing.

The pin 1 has a length which allows it to extend between the medial condyle 4 and lateral condyle 5, but, in this example, the pin 1 does not extend through the

outer cortical bone wall of the lateral condyle 5 proximal to the lateral collateral ligament (not shown) in order to reduce trauma to the knee joint.

The pivoting member 2 comprises a sleeve in the form of a metal tube 10 having an inner diameter suitable for fitting closely with the outer diameter of the central portion of the pin 1, and two supports 11 and 12 extending from the tube 10 to bases 13 and 14 which rest, in use, on the surface of the medial and lateral condyles 15 and 16 of a tibia T. In this example the supports 11, 12 and bases 13, 14 comprise solid component parts connected to the tube 10. The bases 13, 14 have holes 18, 19 for receiving screws 20, 21 which are screwed into the condyles 15, 16 of the tibia T.

In another example, the bases 13, 14 are cemented to the condyles 15, 16 of the tibia T.

In yet another example the bases 13, 14 are not screwed or cemented to the condyles 15, 16, but simply rest on the surface of the condyles 15, 16 or in recesses cut by the surgeon into the surfaces of the condyles 15, 16.

In order to permit a degree of rotational movement around the axis of the holes 18, 19, whether or not the bases 13 and 14 are secured to the condyles 15, 16, a washer or two-dimensional bearing can be provided between the bases and the surfaces of the condyles 15, 16. In particular rotation of the pivoting member 2 around an axis passing through the medial condyle 15 and substantially parallel to the tibia T is provided by placing a two dimensional washer between the base 13 and the surface of the medial condyle 15. In addition the base 14 is placed in a sleeve (not shown) to allow it to slide and accommodate the motion of the other base 13. The supports 11 and 12 may be provided with a certain degree of resilient movement in order to accommodate twisting and bending movements between the bases 13, 14

and the tube 10. This may be provided by a micro-piston arrangement arranged to enable the supports 11, 12 to have adjustable length in order that the pivoting member 2 can be fitted in knee joints of different sizes and dimensions.

The knee prosthesis is fitted by the surgeon first making an incision in the medial side of the knee in order that access can be gained to the gap 3 between the medial and lateral condyles 4, 5 of the femur and the condyle surfaces 15, 16 of the tibia T. The gap 3 is then reamed out to enlarge the gap 3 and provide room for receiving the pivoting member 2 and, in particular, the tube 10, although this may not be necessary.

A second incision is made in the medial side of the knee and a bore 9 is made through the lateral condyle 4, and partly through the lateral condyle 5 of the femur F. This bore 9 extends along the major axis of rotation of the knee joint, sometimes referred to as the transepicondylar axis. This axis is the axis of optimal movement of the knee joint and extends substantially between apexes of the femoral epicondyles.

As discussed above, the bore radius in the medial condyle 4 is slightly greater than the lateral condyle 5.

The surfaces of the condyles 15, 16 of the tibia T are then prepared for receiving the pivoting member 2. In this example, around 5 millimetres of bone is removed or resected from the condyle surfaces to provide room for the pivoting member 2 and in order to shape the surfaces of the condyles 15, 16 for receiving the bases 13, 14 of the supporting member 2. In another example, the surfaces of the condyles 15, 16 are not resected. In this case, if desired, the supports 11, 12 may have a length that holds the end surfaces of the femur F and tibia T apart.

The pivoting member 2 is then inserted into the space between the femur F and tibia T such that the tube

10 fits in the gap 3. The pivoting member 2 fits between the anterior and posterior cruciate ligaments 23, 24 and may be inserted without causing significant trauma or interfering with the function of these ligaments 23, 24. This has the advantage of generally reducing trauma to the knee joint and improving recovery time.

The pin 1 is then inserted from the medial side into the bore 9. The pin passes through the tube 10 and is threadedly engaged with the condyles, as discussed above, in order to secure the pivoting member 2 in place.

Referring to Figure 3, a second example of a knee prosthesis comprises a pin 51 and two supports 52, 53. The pin is located in the same position as that for the first example of the knee prosthesis, and may be fitted in a similar way.

The supports 52, 53 each have an eye 54 having an inner diameter suitable for fitting closely with the outer diameter of the central portion of the pin 51 (analogous to the sleeve 10 of the first example). Each support, 52, 53 extends to a peg 55, 56. The supports 52, 53 rest on a respective peg 55, 56 such that the load exerted through the supports 52, 53 is transferred to the pegs 55, 56 and spread out in the tibia T. The pegs 55, 56 extend from the anterior to the posterior of the tibia T, although they need not extend all the way through the bone. In another example, a single peg is provided that extends from the lateral to the medial side of the tibia T.

The knee prosthesis is fitted by the surgeon making incisions to allow access to the anterior (front) of the tibia T. Peg receiving bores are then made from the anterior of the tibia T to the posterior of the tibia T for receiving the pegs 55, 56. The surgeon also makes an incision in the medial side of the knee and a bore 58 is made through the condyles of the femur F in the

manner described with reference to the first example.

Further bores are made to accommodate the supports 52, 53 in the tibia T and femur F. These further bores extend from the peg receiving bores in the tibia T to the bore 58 in the femur F. In one example these further bores are made via the bore 58. In other examples these bores are additionally or alternatively made via the peg receiving bores or via a further incision in the tissue around the knee joint. The part of these bores for receiving the supports 52, 53 that is in the femur F must be large enough to allow the supports, and therefore the tibia T, to rotate around the pin 51 and provide natural movement of the knee joint.

The supports 52, 53 are then inserted in their respective bores. The eyes 54 are manoeuvred to be aligned with the bore 58 and the pin 51 is inserted in the manner described in the above example. The pegs 55, 56 are then inserted in the peg receiving bores of the tibia to engage with the supports 52, 53.

In another example, a single central support extends between the pin 51 and a peg in the tibia T. This allows a greater portion of the cartilage on the condyle surfaces of the tibia T and femur F to remain intact, and some load to remain supported by these surfaces.

Referring to Figures 4, 5, 6 an elbow joint can also be replaced using an elbow prosthesis. The elbow prosthesis comprises a pin 101 and a pivoting member 102. The pin 101 extends across a gap 103 between a medial condyle 104 and a lateral condyle 105 of a humerus H.

Similarly to the above, the pin 101 has self-tapping threads of surfaces 107, 108 at either end for engaging respective portions of the inside surface of a bore 109 in the medial and lateral condyles 104, 105.

The pivoting member 2 comprises an eye screw

arrangement having an eye 110 (corresponding to the sleeve or tube 10 of the knee prosthesis) for engaging the pin 101 such that the pivoting member 102 can rotate around the pin 101, a body 117 and a self-tapping screw thread 111 for engaging the olecranon process 112 of an ulna U. In this example, the body 117 is metal, such as titanium or chrome. In another example (not shown) the body is arranged to resiliently flex, extend and contract to accommodate slight movement of the elbow joint other than around the axis of the pin 101.

The elbow prosthesis is fitted by first making an incision to gain access to the olecranon process 112 of the ulna U. A bore 114 is then made in the olecranon process 112 using a reaming instrument 115 as shown in Figure 4. The gap 103 may then be enlarged (as is shown shaded in Figure 3) using the same reaming instrument 115 through the bore 114 by manipulating the ulna U with respect to the humerus H.

A second incision is then made to gain access to the medial epicondyle of the humerus H, and the bore 109 is made through the medial and lateral epicondyles 104, 105. In a preferred example (not shown), the second incision to gain access to the lateral condyle 105 of the humerus H and the bore 109 is made through the lateral epicondyle 105 and medial condyle 104 from the lateral side of the elbow joint. In both these examples, the bore 109 need not extend all the way through the epicondyles 104, 105. Rather, the bore may only extend part way the epicondyle 104, 105, on the side remote from where the bore 109 is made. If the bore 109 is made from the medial side, the outer surface of the lateral condyle 105 can remain intact and radial collateral ligament (not shown) is not damaged. If the bore 109 is made from the lateral side, as is preferred, the outer portion of the medial condyle 104 can remain intact, avoiding the risk of damaging the nerve that runs therethrough.

After the reaming and boring procedures are completed, the pivoting member 102 is threadedly engaged with its respective bore 114 and tightened until the eye 110 extends parallel to the intended pivot axis of the joint.

The pivoting member 102 can then be located in the enlarged gap 103 with the eye 110 aligned with the bore 109, and the pin 101 is inserted in the bore 109 such that it passes through the eye 110. The pin 101 is then screwed firmly in place to anchor the prostheses in the humerus H, as is described above.

CLAIMS

1. A prosthesis for a knee or elbow joint comprising a pivoting member and a pin, the pivoting member and pin being configured to be directly engageable with respective bones to be pivotally interconnected by the prosthesis, wherein the pin and pivoting member are sized and configured so that they provide the load bearing surfaces in the knee or elbow joint, and wherein the prosthesis is sized and configured so that the pin in use bridges a recess in a femur or humerus and engages the pivoting member in said recess such that the pivoting member can pivot about the longitudinal axis of the pin.

2. The prosthesis of claim 1, wherein the pivoting member comprises a sleeve and the pin is adapted to pass through the sleeve and allow the pivoting member to rotate around the pin.

3. The prosthesis of claim 1 or 2, wherein the pin secures the pivoting member in place.

4. The prosthesis of claim 1, 2 or 3, wherein the pivoting member is adjustable in length to accommodate different distances between the pin and at least one of the bones to be interconnected by the prosthesis.

5. The prosthesis of any one of claims 1 to 4, wherein the pivoting member further comprises means for rotating about an axis substantially perpendicular to both the major axis of the pin and the major axis of at least one of the bones to be connected by the joint.

6. The prosthesis of any one of claims 1 to 5, wherein the pivoting member further comprises means for

rotating about an axis substantially parallel to the major axis of one of the bones to be connected by the joint.

7. The prosthesis of any one of claims 1 to 6, wherein the pivoting member has a threaded stud for providing self-tapping engagement with a bore formed in a bone to be interconnected by the prosthesis whereby the member may be secured to the bone.

8. The prosthesis of any one of claims 1 to 7, wherein the pivoting member further comprises at least one support sized and configured to extend from the sleeve to a bone to be interconnected by the prosthesis.

9. The prosthesis of claim 8, wherein each support has a base configured to engage, in use, the end of the bone to which the support extends.

10. The prosthesis of claim 9, wherein the at least one base is sized and configured to rest, in use, on a prepared surface of the bone.

11. The prosthesis of claim 9 or 10, wherein the at least one base is configured to be secured to the end of the bone.

12. The prosthesis of claim 11, wherein the at least one base is configured to be secured to the bone by a screw.

13. The prosthesis of claim 8 or 9, wherein the at least one support is sized so as to extend into the bone, or a bore in the bone.

14. The prosthesis of claim 13, wherein each base comprises a peg configured to extend, in use, through the bone to which the at least one support extends.

15. The prosthesis of claim 13 or 14, wherein the at least one peg is configured so as to extend in a direction substantially perpendicular to the length of the bone.

16. The prosthesis of claim 13 or 14, wherein the at least one peg is configured so as to extend substantially from the anterior to the posterior of the bone.

17. The prosthesis of claim 14, 15 or 16, wherein the at least one peg is configured to extend substantially from the lateral to the medial side of the bone.

18. The prosthesis of any one of claims 8 to 17, wherein there are only two supports.

19. The prosthesis of any one of claims 8 to 17, wherein there is only one support.

20. The prosthesis of any one of claims 8 to 17, wherein the pivoting member is adjustable to accommodate different distances between the pin and the bone to be interconnected by the prosthesis by the at least one support having adjustable length.

21. The prosthesis of any one of claims 8 to 20, wherein the at least one support is resiliently extendable and contractible along its length.

22. The prosthesis of any one of claims 9 to 21, wherein the at least one base is capable of rotating in a plane in which the at least one base is configured to contact the bone.

23. The prosthesis of claim 22, wherein rotation of the at least one base is provided by fitting the at least one base in sleeve to be positioned between the at least one base and the bone.

24. The prosthesis of claim 22, wherein rotation of the at least one base is provided by a washer or two dimensional bearing to be arranged between the at least one base and the bone.

25. The prosthesis of any one claims 1 to 24, wherein the pin comprises a generally cylindrical shaft which is sized and configured to be mounted in a bore formed in the bone.

26. The prosthesis of claim 25, wherein the pin is adapted to be inserted axially from one side of the joint.

27. The prosthesis of claim 25 or 26, wherein the pin has a rough or knurled surface for engaging the inside surface of the bore.

28. The prosthesis of claims 25, 26 or 27, wherein the pin has external screw threaded portions for self-tapping engagement with the inside surface of the bore.

29. A prosthesis for a knee as claimed in claim 1 having the pin sized and configured to engage in use a posterior femoral condyles of the knee joint and the pivoting member sized and configured to engage in use a tibia, the pin and pivoting member being configured to be pivotally engaged, in use, in such a manner to allow the tibia to rotate about an axis extending between the posterior femoral condyles of the femur.

30. The knee prosthesis of claim 29, wherein the axis is that between the apexes of medial and lateral femoral epicondyles, or close to it.

31. A prosthesis for an elbow as claimed in claim 1 having the pin sized and configured to engage in use medial and lateral condyles of the humerus at the elbow joint and

the pivoting member sized and configured to engage in use an ulna, the pin and pivoting member being configured to be pivotally engaged in use in such a manner to allow the ulna to rotate about an axis extending between epicondyles of the humerus.

FETHERSTONHAUGH & CO.
OTTAWA, CANADA

PATENT AGENTS

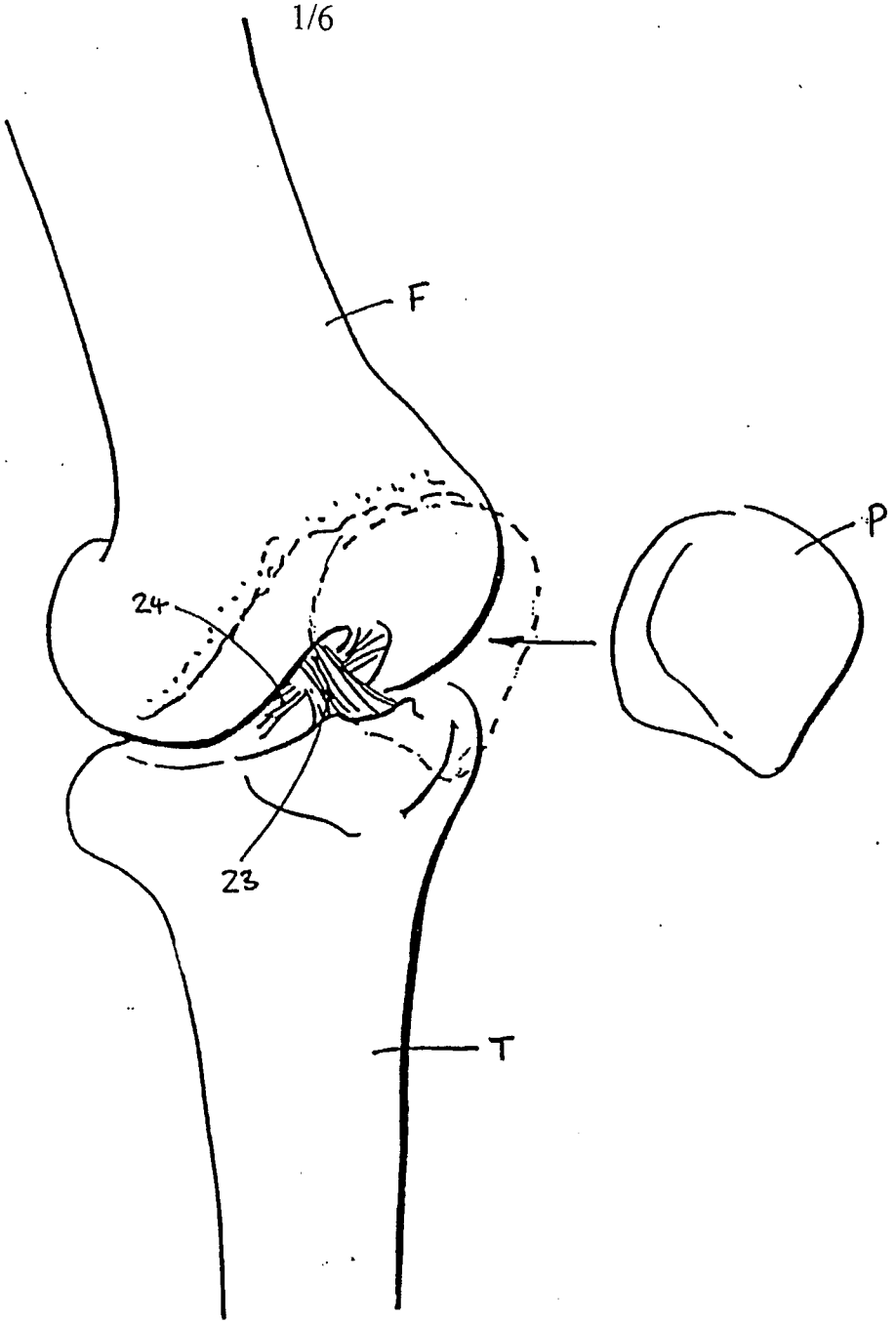


FIGURE 1

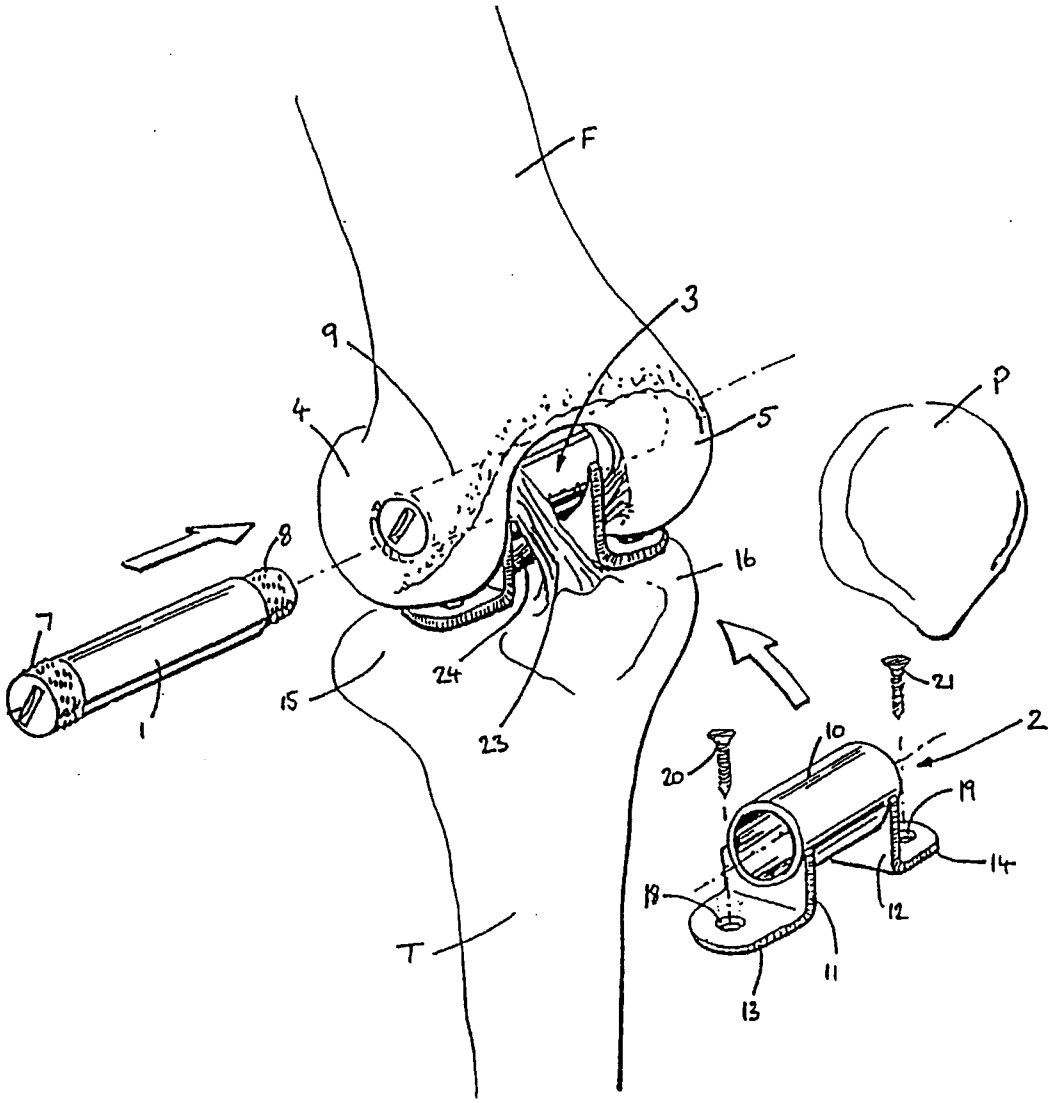


FIGURE 2

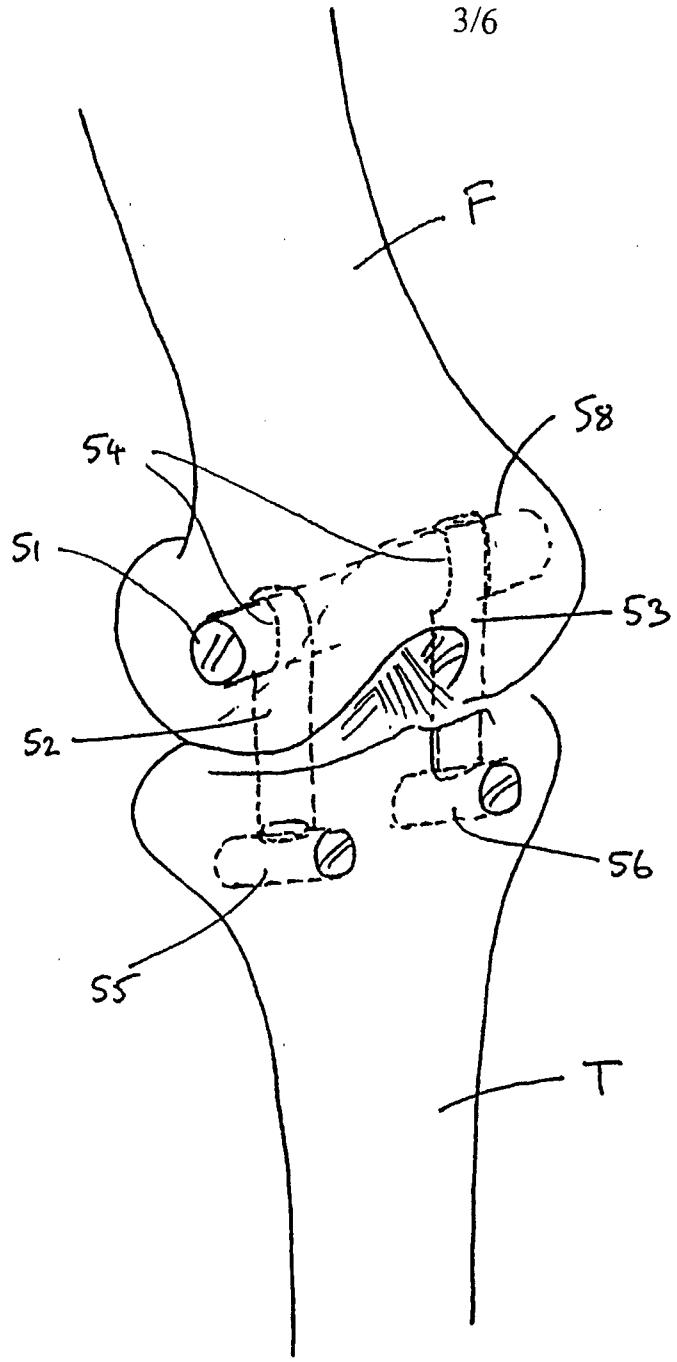


FIGURE 3

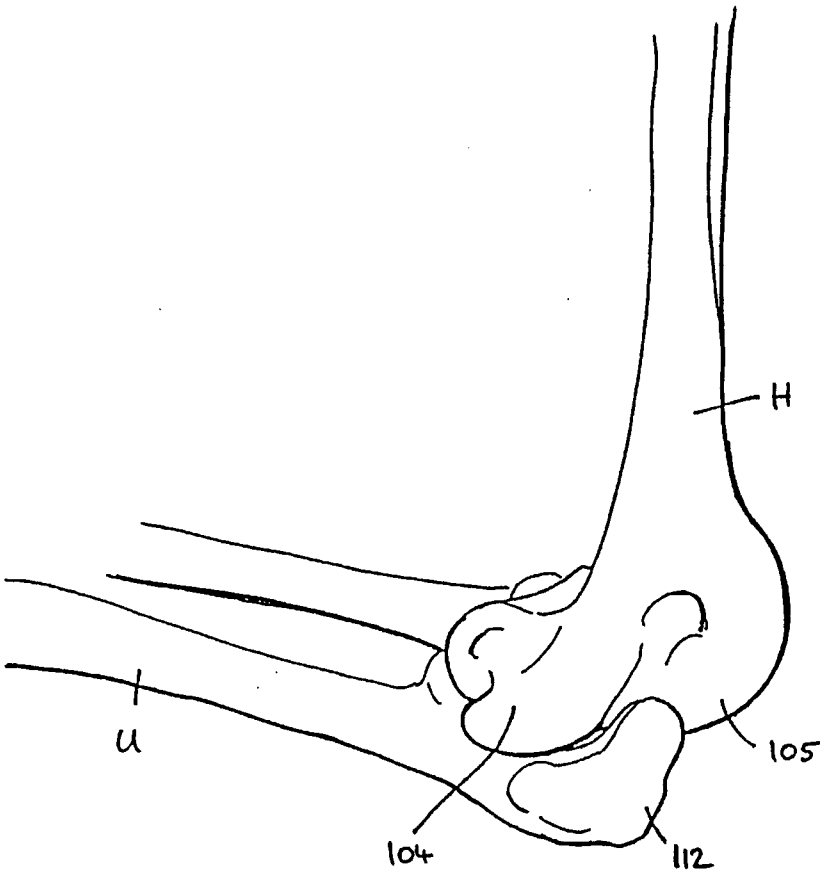


FIGURE 4

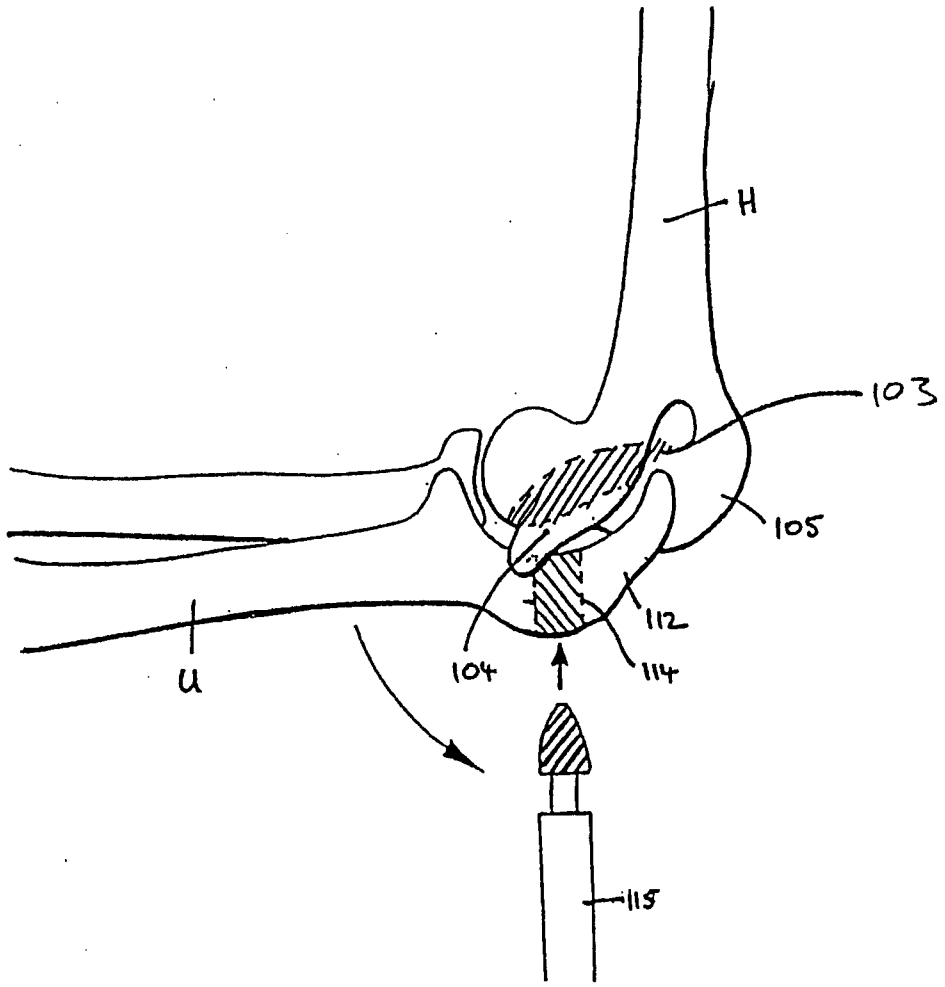


FIGURE 5

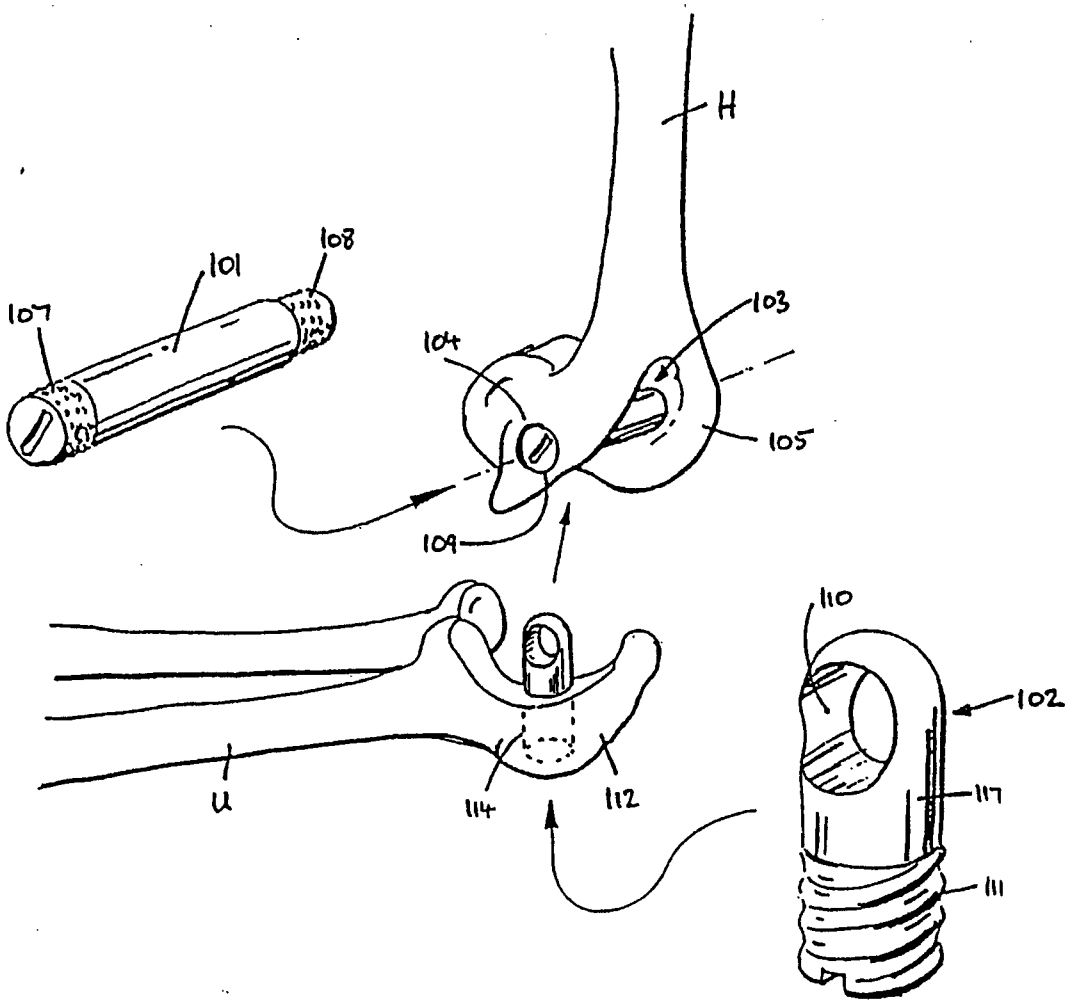
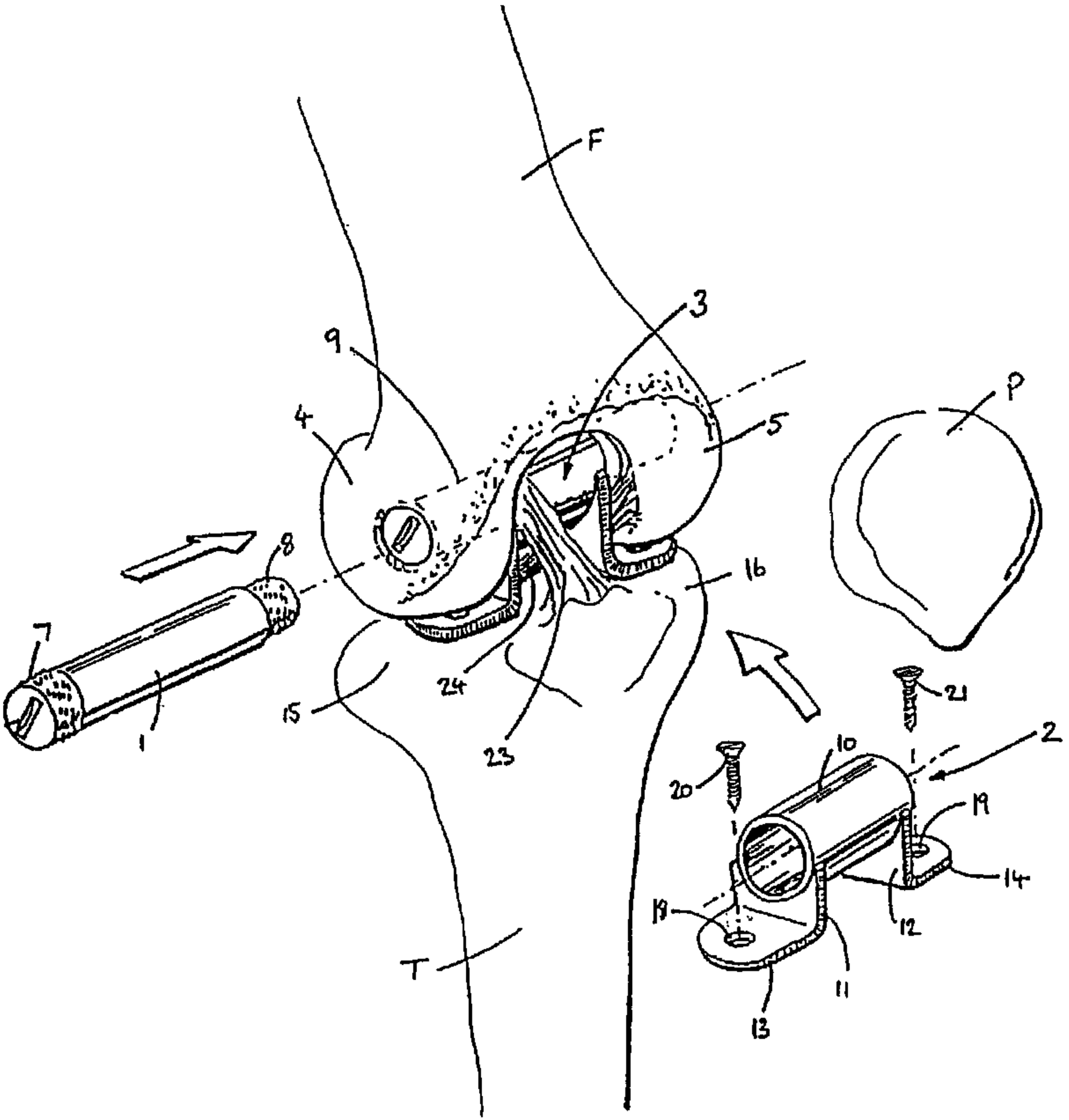


FIGURE 6


F
3
9
4
5
P
8
16
7
24
15
23
21
1
10
2
20
19
14
18
12
11
13
T