United States Patent

Dee

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[45] **Apr. 18, 1972**

[54] **ELBOW JOINT PROSTHESIS**

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[30] **Foreign Application Priority Data**

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

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

[58] **Field of Search**...............128/92 R, 92 BC, 92 C, 92 CA; 3/1; 287/14, 96, 100

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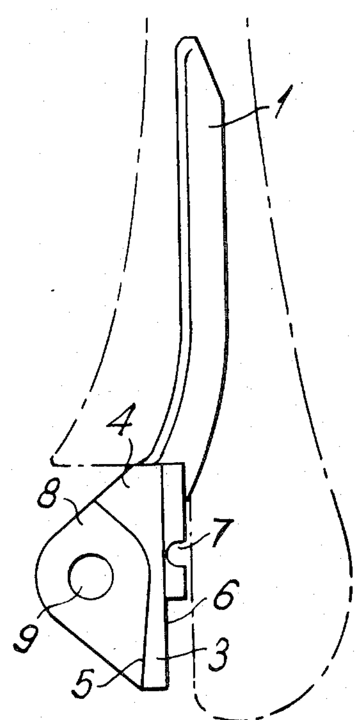
[57] **ABSTRACT**

A prosthetic elbow joint device comprising a first arm curved in two mutually transverse planes and formed with a first hinge part at one end thereof, and a second arm curved in one plane and formed with a second hinge part at one end thereof, the arms and hinge parts being adapted for securement by cement with the first and second arms respectively located in the ulna and humerus in intramedullary manner, the first hinge part seated on a shoulder cut in the olecranon, and the two parts disposed for mutual pivotal connection.

4 Claims, 7 Drawing Figures



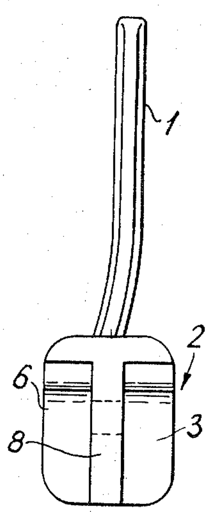


FIG.1.

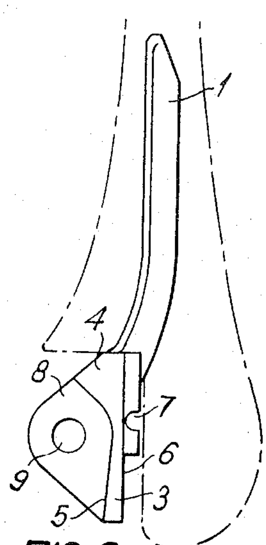


FIG.2.

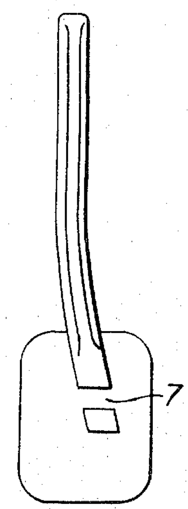


FIG.3.

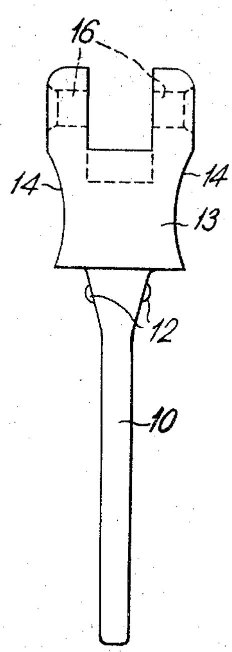


FIG.4.

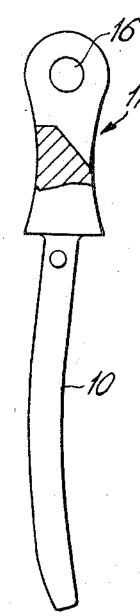


FIG.5.

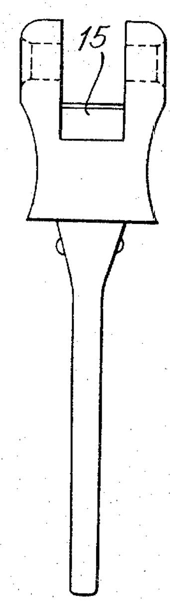
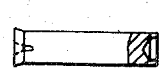


FIG.6.

FIG.7.



ELBOW JOINT PROSTHESIS

Various forms of elbow joint prosthesis have been proposed but these are not always completely satisfactory in practice. The proposed forms normally involve provision of members which are to be effectively secured within the humerus and ulna by a force fit. This involves a risk of bone damage or, if this risk is to be reduced, the manufacture of a "custom-built" prosthesis for each recipient. Also, the proposed forms normally involve removal of a substantial part of the olecranon to provide space for the hinge or pivot joint of the prosthesis, but this results in the joint being largely unprotected from any impact on the elbow as when bending and resting the same.

An object of the present invention is to reduce the above difficulties and, to this end, the invention provides a prosthetic elbow joint device comprising a first arm curved in two mutually transverse planes and formed with a first hinge part at one end thereof, and a second arm curved in one plane and formed with a second hinge part at one end thereof, the arms and hinge parts being adapted for securement by cement with the first and second arms respectively located in the ulna and humerus in intramedullary manner, the first hinge part seated on a shoulder cut in the olecranon, and the two hinge parts disposed for mutual pivotal connection.

In order that the invention may be more clearly understood, the same will now be described by way of example with reference to the accompanying drawings, in which:

FIGS. **1**, **2** and **3** respectively illustrate in plan, side and underneath views the first arm and hinge parts of one embodiment of the invention.

Figs. **4**, **5** and **6** similarly illustrate the associated second arm and hinge parts.

Figure **7** illustrates a pivot pin for connection of the two hinge parts.

Considering Figures **1** to **3**, comparison of the side view with the other views clearly indicates curvature of the first arm **1** in two mutually perpendicular planes. The arm **1** is of generally rounded corner, trapezoidal cross-sectional shape and with similarly rounded edges at its outer or free end which is chamfered on one side. At its other end, the arm is integrally connected with the first hinge part **2**.

The hinge part **2** has a base **3** which is generally flat apart from an increase in thickness at **4** by divergence of one side **5** surface from the other **6**. The arm **1** joins the hinge part **2** partly in end-to-end relation at this thicker base portion, and by passing below such portion partway along the non-divergent surface **6** of the base. This last part of the arm is transversely grooved at **7** to assist securement by cement.

A flange **8** projects upwardly from the surface **6** of base **3**, this flange being generally aligned with the adjacent part of arm **1**, and being of generally triangular shape in side view. The flange **8** is transversely bored at **9**.

Turning now to FIGS. **4** to **6**, the second arm **10** is seen to be curved in only one plane. Arm **10** is of generally rounded corner, rectangular shape in cross-section along most of its length to its free end. Also, the arm **10** is integral with its associated hinge part **11**. However, the arm **10** joins the hinge part **11** wholly in end-to-end relation, the relevant arm end being outwardly flared and of rounded cross-sectional shape except its lower surface. In place of the grooving of arm **1** to assist securement, the arm **10** is provided with two lugs **12** extending one from each side of the arm adjacent its hinge part.

The hinge part **11** comprises a generally U-shaped portion, with U-base **13** joined at its center across the inner end of arm **10**, and U-arms **14** extending away from the arm **10**. The U-arms are bridged, for part of their length from the U-base, by a web **15** which is flush with the arms on one side, but inclined on the other so that the web tapers towards the U-arm outer ends. Beyond the web, the U-arms are transversely bored at **16**.

The hinge parts are so shaped and dimensioned for alignment of the bores **9** and **16** with the U-portion of part **11** embracing the flange **8** or part **2**, and the inclined surface of web **15** facing the outermost such surface of flange **8**. The hinge parts are connected by a pin, such as that of FIG. **7**, which is passed through the bores and upset at its ends by a G-clamp or other suitable tool.

The curvature of the arms **1** and **10** is so designed that, as noted above, they can be freely inserted in the ulna and humerus, with the base portion **3** of hinge part **2** seated on a shoulder cut in the olecranon and the hinge parts connected. The seating of base **3** is indicated in Figure **2** relative to the olecranon shown in chain line. Securement will be by cement, such as by use of suitable acrylic resin, and this is enhanced by the slotting at **7** and the lugs **12**.

This mode of implantation is advantageous in that the arms **1** and **10** can be of reduced dimensions relative to force-fitting arms, and so permit a few standard size parts to be provided for use with a relatively large range of bone sizes. It might be mentioned in this connection that the only basic variation required in practice is one of geometry, since the illustrated arm **1** is for a right hand side ulna and would have its curvature reversed as seen in FIGS. **1** and **3** for a left hand side ulna.

A further advantage is that retention of part of the olecranon as a seat for the hinge serves to avoid effectively direct impact on the hinge when the elbow is bent.

Regarding manufacture of the prosthesis, this is preferably of chrome cobalt alloy such as that under the name "Vinertia" which is well suited to this application. An alternative, although less preferable, is stainless steel.

I claim:

1. A prosthetic elbow joint device comprising:

a hinge assembly including a first hinge part and a second hinge part pivotally coupled for relative rotation about a generally transverse axis therethrough;

a first rigid intramedullary arm extending from said first hinge part, said first arm following a compound curvature along a lower, first portion thereof, disposed nearer said first hinge part, with a first component of curvature outwardly convex and laterally offsetting outwardly relative to a first plane including said rotation axis and a second component of curvature rearwardly convex and offsetting forwardly relative to a second plane mutually perpendicular to both said first plane and said rotation axis, and said first arm having an upper, free end second portion with a generally straight longitudinal axis substantially parallel to said second plane and orthogonal with said rotation axis;

and a second rigid intramedullary arm extending from said second hinge part;

said hinge assembly being wholly off-set forwardly from said longitudinal axis of said first arm free end portion.

2. A device according to claim **1** wherein said second arm is curved rearwardly along substantially the whole of its length relative to said second plane, but in the opposite sense to said second component of curvature of said first arm, while said second arm is substantially straight in said first plane.

3. A device according to claim **1** wherein said first hinge part comprises a base member portion with a generally flat undersurface parallel to said longitudinal axis, and a first bored bearing member portion upstanding from a generally centralized zone of the opposite surface of said base portion, and wherein said second hinge part comprises a pair of second bored bearing member portions projecting in fork-like manner from a common portion joined with said second arm, said second bearing member portions embracing said first bored bearing member portion with their respective bores all aligned, and a pivot pin passing through and rotatably secured in said bores.

4. A device according to claim **3** wherein said first bearing member portion is of generally triangular shape in said common plane with the triangle base joined with said base member portion and the free apex rounded, and wherein said second bearing member portions are bridged by a web joined with said common portion and chamfered in generally complementary manner with the adjacent side of said triangular shape when said arms are oppositely directed.

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