United States Patent [19]

Tronzo

[11] **3,840,904**

[45] **Oct. 15, 1974**

[54] **ACETABULAR CUP PROSTHESIS**

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[21] Appl. No.: **355,875**

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

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

[58] **Field of Search** . 3/1; 128/92 C, 92 CA, 92 BA, 128/92 BB, 92 BC, 92 D

[56] **References Cited**

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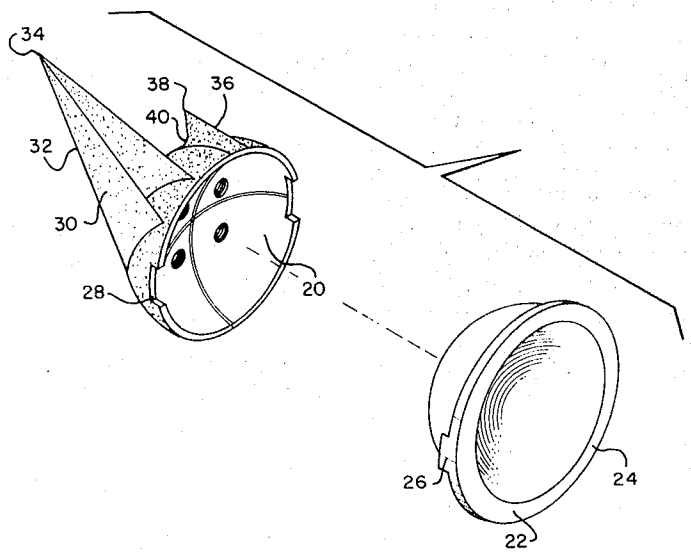
Primary Examiner—Richard A. Gaudet
Assistant Examiner—Ronald L. Frinks
Attorney, Agent, or Firm—Jackson, Jackson & Chovanes

[57] **ABSTRACT**

An acetabular cup prosthesis which has facilities for ready removal. In one form it has grooves to guide a surgical saw on the inside, preferably to cut the prosthesis in quadrants for removal, and also having threaded sockets to insert a tool to remove the quadrants. Additionally or alternatively, it has protrusions from its rear not adapted to offer much resistance in case of removal. In the preferred form two blades protrude from the rear and are offset, so that they come to a point and also form a knife edge at the side. Outrigger blades are provided extending perpendicular to the diameter and terminating at a less height than the radius. In the preferred form the rear of the prosthesis has a porous coating and also the blades have a porous coating. In alternate forms, spikes extend from the rear of the prosthesis offset and in parallel relation, either from one side in a cluster or from one side distributed over that side. In another form there is a screw which extends from the rear end offset to the axis of symmetry.

In another form there are blades which lie along the rear, for example parallel to one another and parallel to the diameter or at right angles to the diameter.

4 Claims, 17 Drawing Figures



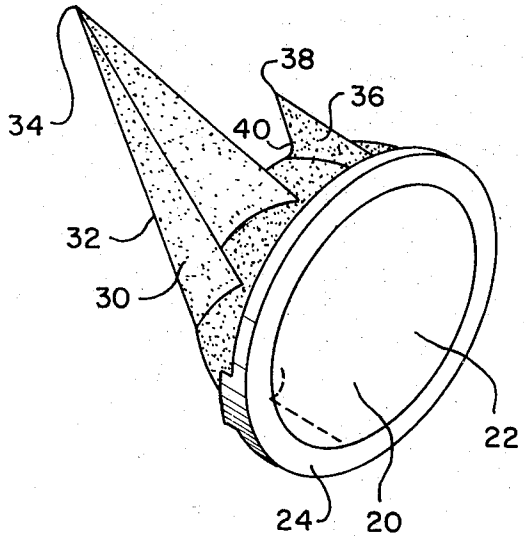


FIG. 1

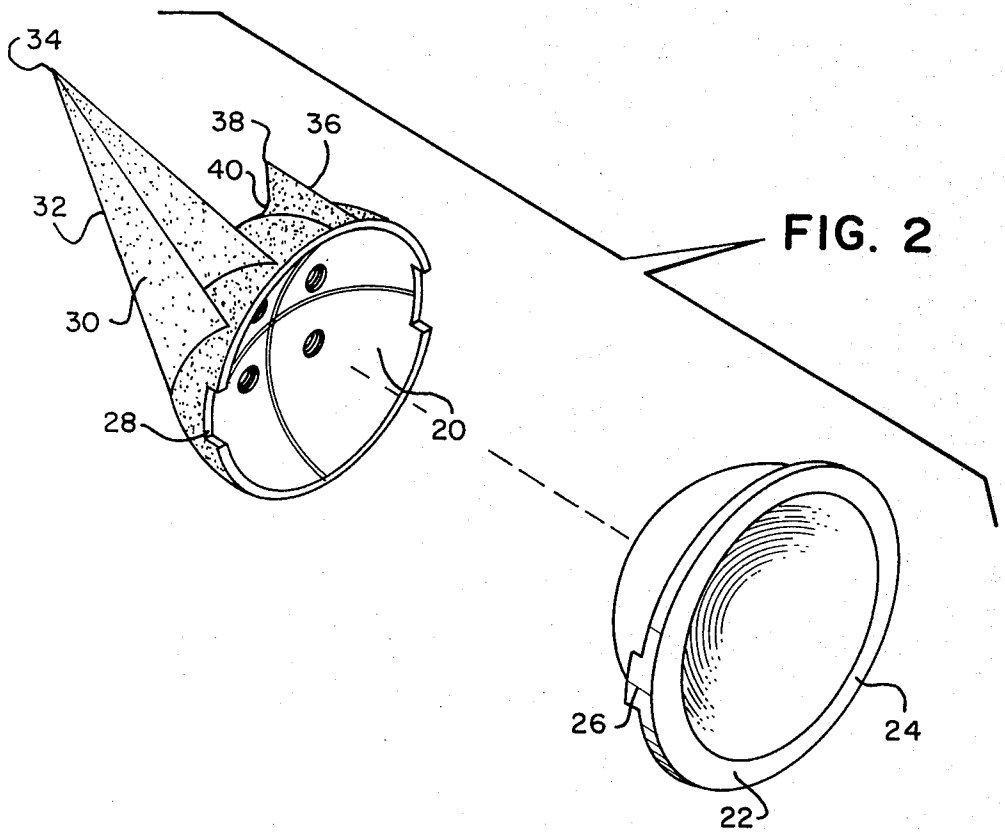


FIG. 2

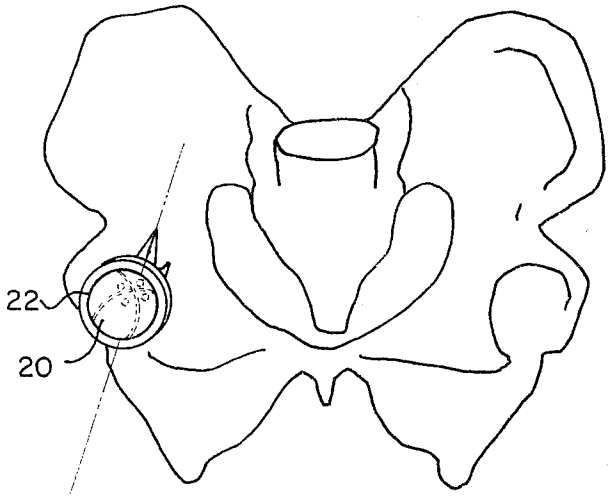
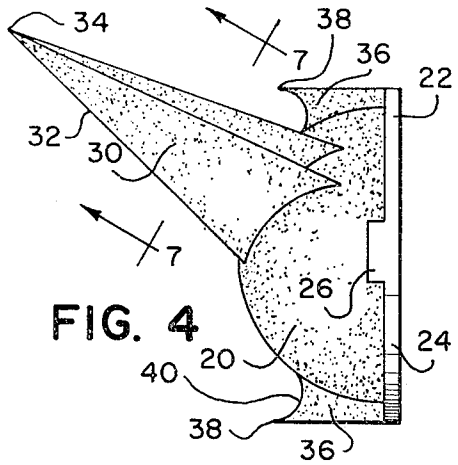


FIG. 3



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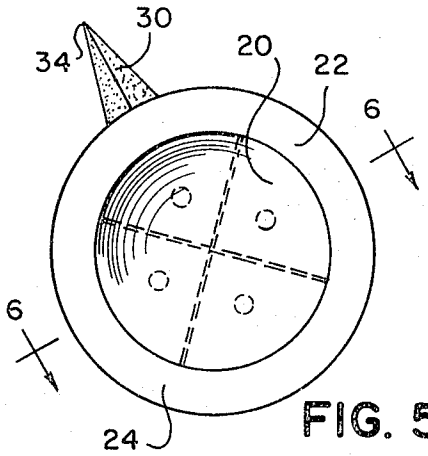


FIG. 5

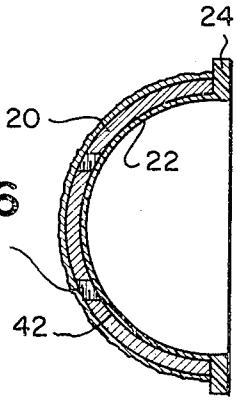


FIG. 6

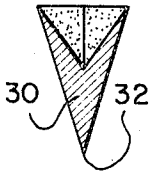


FIG. 7

FIG. 8

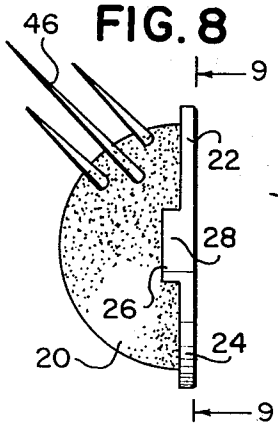
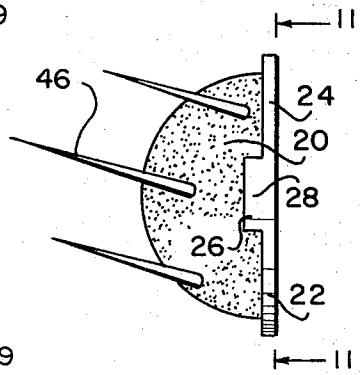


FIG. 10



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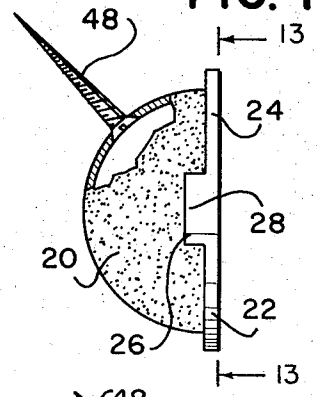

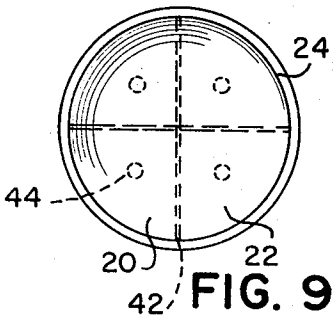

FIG. 9

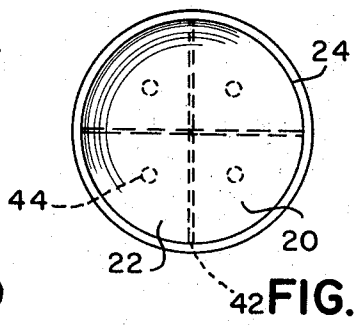

FIG. 11

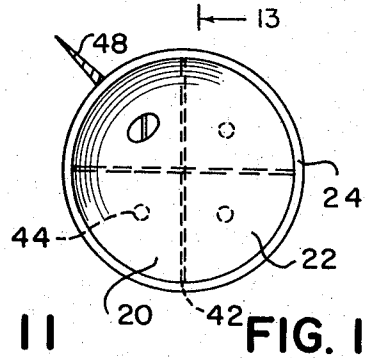

FIG. 13

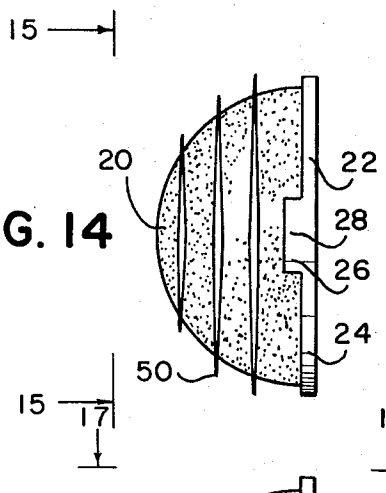

FIG. 14

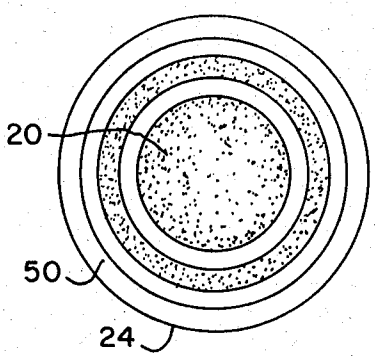

FIG. 15

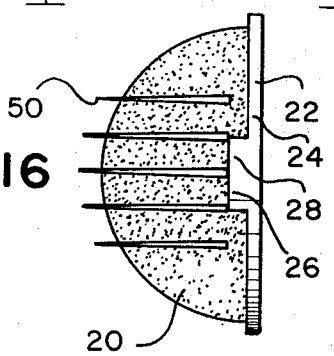

FIG. 16

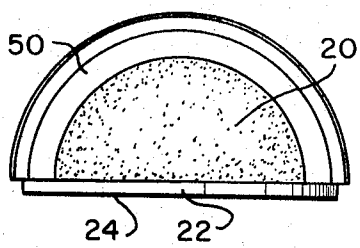

FIG. 17

ACETABULAR CUP PROSTHESIS

DESCRIPTION OF THE INVENTION

In acetabular cup prostheses the object heretofore has been to have the prosthesis remain as long as the person or animal in which it is inserted is alive. In some prostheses this is counter productive, because it is necessary to remove the prosthesis either for the purpose of experiment or because of a desire to insert a more suitable prosthesis.

One of the purposes of the present invention is to aid in cutting the prosthesis to remove it from the body by inserting guide grooves and possibly anchorages for a tool by which the prosthesis may be removed.

Another aspect of the problem is that anchorage is from the rear end of the prosthesis and may have a tendency to remain in the acetabulum when the prosthesis is removed. Instead the anchorage may be in the form of two blades sloping to a point and converging toward one another, preferably with outrigger blades along the sides of the cup at the back.

Also, the anchorage may preferably have pores on the back of the acetabular cup prosthesis and on the blades into which bone can grow, one or both can be coated.

Alternatively, the acetabular cup prosthesis may be supported by a series of parallel spikes which are sloping with respect to the axis of symmetry of the cup and are either grouped in a cluster at one side at the back of the cup or distributed along one side of the back of the cup. An alternate form may be an offset screw from the back of the cup, with one or several screws being used.

Another alternate form may have blades along the back of the cup extending either parallel to the diameter of the cup or at right angles to the diameter of the cup.

As exemplary of these various forms, the following drawings are presented.

FIG. 1 is a perspective of the preferred form of my acetabular cup prosthesis.

FIG. 2 is an exploded perspective of FIG. 1 showing metallic parts on the left and plastic on the right.

FIG. 3 is a rear view of the acetabular cup prosthesis of FIG. 1 in place in an acetabulum.

FIG. 4 is a side view of the device of FIG. 1.

FIG. 5 is a front view of the device of FIG. 1.

FIG. 6 is a section along the line 6—6 of FIG. 5.

FIG. 7 is a section on the line 7—7 of FIG. 4.

FIG. 8 is a side elevation of an alternate form of the invention.

FIG. 9 is a front elevation of the form of FIG. 8.

FIG. 10 is a side elevation of a somewhat different form of acetabular cup prosthesis.

FIG. 11 is a front elevation of FIG. 10.

FIG. 12 is a side elevation of a somewhat different form of the invention, partially broken away.

FIG. 13 is a front view of the form of FIG. 12.

FIG. 14 is a side elevation of a different form of the invention.

FIG. 15 is a back view of the form of FIG. 14.

FIG. 16 is a side elevation of a further variation of the invention.

FIG. 17 is a view of the form of FIG. 16 on the line 17—17.

The main purpose of this invention is to hold an acetabular cup prosthesis by a means which will aid in removing it from the body for evaluation or change, if removal is necessary or desirable. Acetabular cup prostheses may be used on humans and also in veterinary medicine, particularly for experimental purposes to test the relative benefits of various prostheses.

For the purpose of removal, one improvement made by the present invention is to insert guide grooves so that the prosthesis may be readily and unerringly cut up for removal, and to add threaded sockets to attach a removal tool to each piece.

Another desirable expedient is to attach converging blades terminating in a point to the back of the acetabular cup prosthesis and to have outriggers anchored to the back of the cup at right angles to the diameter and terminating at a distance less than the radius. The blades may be joined or separated.

Preferably these blades and the prosthesis itself have porous coatings on the back which aid in anchorage by bone growth.

As an alternative, spikes are offset with respect to the axis of symmetry to anchor the prosthesis, the spikes being distributed around in a cluster together at one side, or all over one side as preferred. As another form of anchorage, I may use an offset screw secured to the back of the acetabular cup prosthesis. The spikes and screws may or may not be coated in contrast to the main cup.

Another embodiment, particularly when taken with a porous coating, has blades on the outside of the cup which are either circular around the cup parallel to the diameter or perpendicular to the diameter or at any angle between these. The blades themselves may or may not be coated in contrast to the main cup.

Considering the form of FIGS. 1 to 7, it consists of a preferably metal cup 20 smooth on the inside, and preferably receiving a liner 22 of plastic such as high density polyethylene, which is smooth and round on the inside and may have a gripping tendency on the outside by way of slots 28 and/or holes 44. This liner is intended to receive a ball from the femur, which may be the natural ball, but will preferably be an artificial ball which replaces the natural ball as well known in the art of prostheses. There is a rim 24 on the liner and at a suitable place around the circumference the rim has an interlock 26 molded into it and adapted to fit into an interlocking groove 28 on the outside of the cup. This interlock 26 is intended to keep the liner from rotating, but still making it easily replaceable as desired.

It will be evident that in referring to the diameter of the cup, reference is made to the diameter measured at the mouth of the cup and being substantially the diameter of the ball which is fitted into the cup. The cup is preferably about half a sphere.

On the outside of the cup and on the blades if any protruding from it, a porous composition may be molded on with a view to aiding bone growth to interlock with the cup. This porous interlock is described more in detail below.

From the rear of the cup there protrude two blades 30 which are in converging directions and meet on a line 32 and in an apex 34, so that the cross section of the blades is V-shaped. It will be seen that the faces of the blades are substantially triangular, except that they meet the outer edge of the cup on a curved surface.

The orientation of the meeting blades **30** with respect to the axis of symmetry of the cup is such that the blades are offset about 20° toward the outside of the body for a human.

The cup is prevented from turning, particularly in the initial stages of implant, by two blades **36** which are diametrically placed at a point where they will not interfere with the blades **30** and which extend at right angles to the diameter in a straight direction and terminate preferably in a point **38** which aids insertion. Short of the radius and preferably blending with the cup, is a blade edge **40.**

The blades **36** may to advantage not have the porous coating, since their function is primarily though not entirely at the initial phases of implant.

At the inner surface of the cup there are guide grooves **42** which are arranged in quadrature, and which cooperate with threaded sockets **44** for receiving a suitable pulling tool. The grooves **42** are intended to guide the surgical saw in cutting the acetabular cup prosthesis for removal of one quadrant at a time. Of course, it is evident that if trouble is anticipated in removing a quadrant, then the portions indicated by the guide lines **42** may be smaller.

The removal is contemplated in all forms of the invention, and it will be evident that in discussing later alternate forms where the removal may not be stressed, removal is still contemplated if desired.

Alternatively, the blades **30** may be replaced by spikes **46** which are extending in a direction at which they are inclined to the axis of symmetry of the cup about 20°. The spikes are preferably free from interlocking projections and are diminishing progressively from a maximum cross section adjoining the cup to a minimum cross section at the point. They may be round, triangular, or squared in cross section. The spikes may be arranged in a cluster of three as shown in FIGS. **8** and **9,** or they may be distributed along one side as in FIGS. **10** and **11.** In any case the spikes are substantially parallel so that they will offer minimum obstruction in extraction.

As an alternate method of affixation, a screw **48** is shown protruding from the cup **20** at an angle of inclination with respect to the axis of symmetry suitably about 20°. A cluster of screws could be used, also.

In FIGS. **14** and **15,** I show a form which has blades **50** on the outside of the cup, the blades extending in a circular direction parallel to the diameter as shown in this figure, or at right angles to the diameter as in FIGS. **16** and **17** or at any direction in between. The blades **50** are parallel or substantially so in themselves.

I find that porous material of the implant may to advantage be provided with small pores to receive the bone growth immediately, and also intermediate and large pores to receive the bone growth later. The layer of porous material should be at least 100 microns thick, preferably at least 1/16 inch thick and most desirably at least 1/8 inch thick.

The pores cover a substantial part of the surface, at least 20 to 50 percent, preferably 30 to 40 percent and most desirably about 33 percent.

The pores in size are divided into small, intermediate and large pores and at the surface from 20 to 40 percent of the pore area, preferably from 30 to 36 percent and most desirably 33 percent must be of each pore diameter (large, intermediate and small). For the purpose of this invention small pores consist of pores having diameters at the surface of 50 to 200 microns, preferably 75 to 125 microns and most desirably about 100 microns.

The intermediate pores range in diameter from 200 to 800 microns. The large pores are larger than 800 microns and not larger than 3,500 microns.

The porous material may be put down by metallizing techniques as described in Welding Handbook, 3rd Edition.

More information is given in my applications Ser. No. 228,052, filed Feb. 22, 1972 for Bone Implant with Porous Exterior Surface, since abandoned and Ser. No. 342,461, filed Mar. 19, 1973 for Bone Implant with Porous Exterior Surface, and these applications are incorporated herein by reference and are part hereof.

In view of my invention and disclosure, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the apparatus shown, and I therefore claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An acetabular cup prosthesis including a cup shaped insertion and a guide groove across the inside of the insertion at substantially diametrical distance for a surgical saw by which it can be cut up for removal.

2. An acetabular cup prosthesis of claim **1,** having guide grooves at the inside surface which are of substantially diametrical length and of cruxiform formation.

3. An acetabular cup prosthesis of claim **2,** having in each quadrant of the cup a threaded opening for receiving a threaded extraction tool, the openings being near the center of the cup.

4. An acetabular cup prosthesis of claim **2,** having converging blades from the back of the cup diminishing in size away from the cup and the blades having a common edge and making a V in cross-section.

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