

- [54] **FEMORAL PROSTHESIS WITH
REMOVABLE PROTECTIVE SHEATH**
[75] Inventor: **Bernard Clark**, Pool-in-Wharfedale,
England
[73] Assignee: **Chas. F. Thackray Limited**, Leeds,
Yorkshire, England
[22] Filed: **July 25, 1972**
[21] Appl. No.: **275,053**

[30] **Foreign Application Priority Data**
Aug. 9, 1972 Great Britain..... 37247/72

- [52] U.S. Cl. 3/1, 128/92 CA, 128/92 EC,
206/46 SG, 206/46 ST, 206/DIG. 7
[51] Int. Cl. **A61f 1/24**
[58] Field of Search 3/1; 128/92 C, 92 CA, 92 R,
128/92 E, 92 EC, 92 F, 92 G, 334 C;
206/63.2 R, 63.2 A, 16 S, 46 SG, 46 ST,
DIG. 7, DIG. 11

[56] **References Cited**
UNITED STATES PATENTS

1,015,601	1/1912	Watkins	206/46 SG
3,053,251	9/1962	Black et al.	128/92 CA
3,254,650	6/1966	Collito	128/334 C
3,320,951	5/1967	Wittebol	128/92 CA

OTHER PUBLICATIONS

"Factors in the Design of an Artificial Hip Joint" by J. Charnely, Article appearing in Book entitled Lubrication and Wear In Living and Artificial Human Joints by The Institution of Mechanical Engineers, Proceedings 1966-1967, Vol. 181, Part 3J, pages 107-109 relied upon.

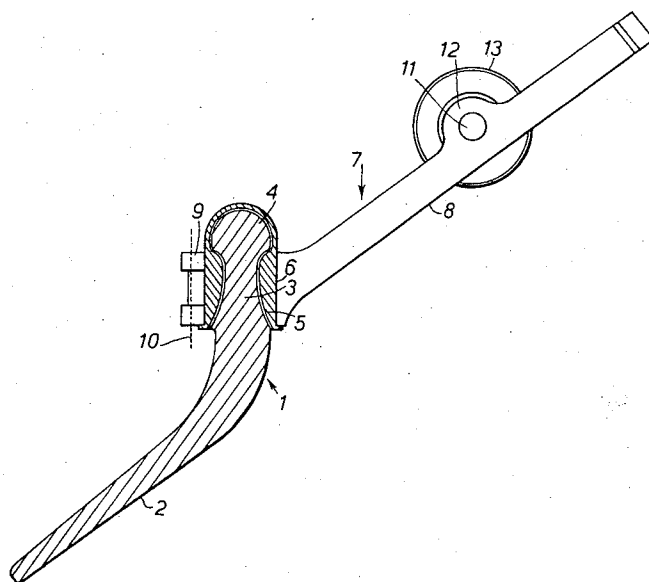
Protective Caps for Vitallium Hip Prostheses, Vitallium Surgical Appliances Catalog, Austenal Medical Division; Howmet Corp. New York, N.Y., 1964 page 18.

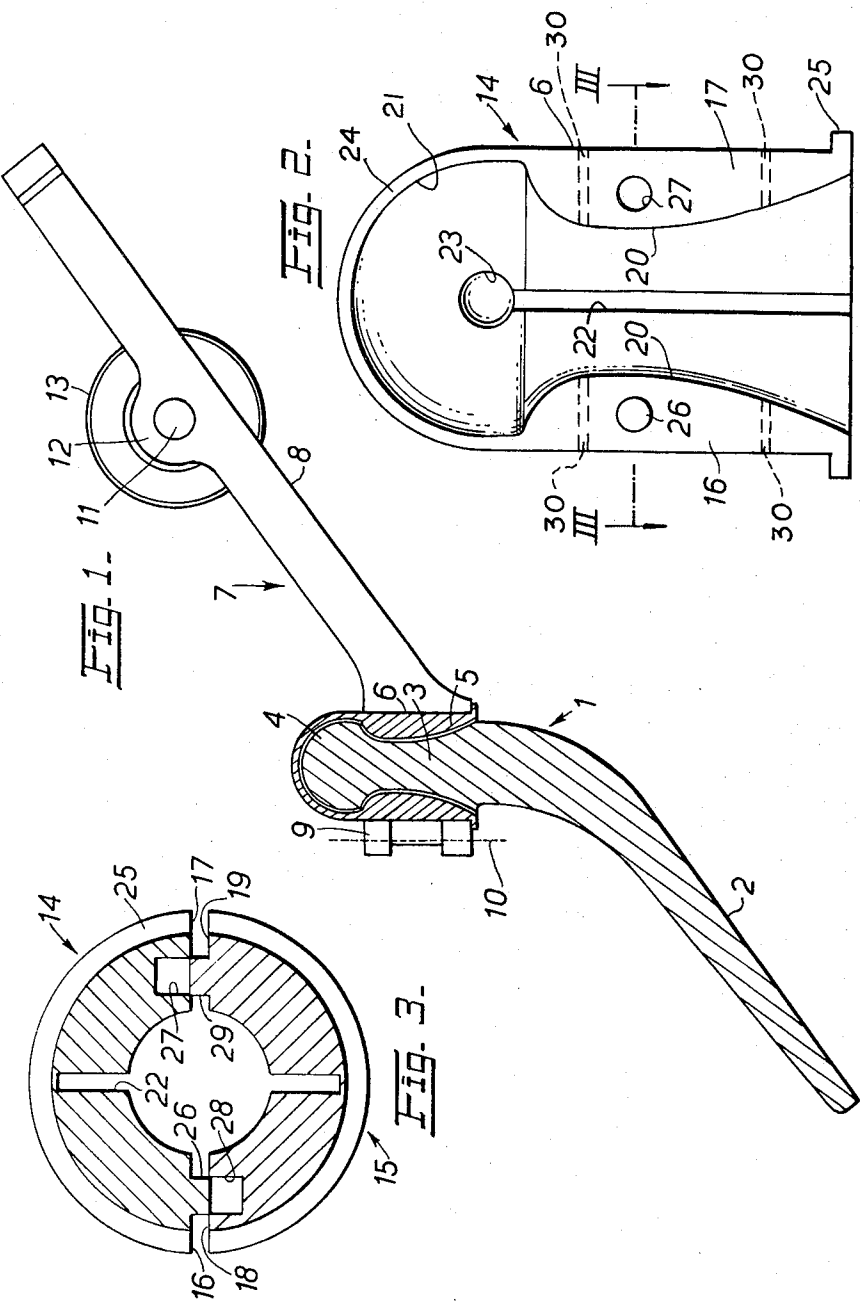
Primary Examiner—Richard A. Gaudet
Assistant Examiner—Ronald L. Frinks
Attorney, Agent, or Firm—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

A protective sheath for at least the neck of a femoral prosthesis, said sheath being substantially incompressible and having an inner surface shaped so as to be complementary to the shape of said femoral prosthesis neck, and an outer surface which is substantially cylindrical. The sheath may also cover the head of the prosthesis.

12 Claims, 3 Drawing Figures





FEMORAL PROSTHESIS WITH REMOVABLE PROTECTIVE SHEATH

This invention relates to femoral prostheses for use in the technique of arthroplasty of the hip joint.

Femoral prostheses have a shaft which is located in the femoral canal which has been reamed to accept the shaft, and is often secured therein by bone cement, a part-spherical head which seats in an artificial socket implanted into the pelvis and a neck joining the shaft and the head. In order to ensure the correct range of flexion for the prosthetic joint, a special curved shape has been evolved for the neck of the femoral prosthesis.

It is important that the shaft of the femoral prosthesis be located in a predetermined direction in the femur in order that maximum load-bearing is obtained. To ensure such location, a femoral prosthesis is usually inserted into the femur with the aid of a so-called neck punch. This neck punch comprises two arms having head sections which are pivoted together, the head sections being closable around the neck of the femoral prosthesis, and openable to release the neck. The arms carry a releasable locking device for moving the arms together over a small arc to grip the prosthesis firmly between the head sections of the arms. When so gripped, and with the prosthesis properly aligned in the head sections, the arms and the shaft of the prosthesis extend parallel to each other, and by driving the arms in the required direction the prosthesis is also driven in the desired direction.

It is important that when gripped in the head sections the neck of the prosthesis is not allowed to move relative to the head sections. To obtain the required gripping pressure, it has therefore been the practice to machine the head sections so that the gripping parts thereof are substantially complementary in shape to the shape of the neck. Because of the special shape of the neck this machining of the head sections with sufficient accuracy is an extremely difficult operation.

According to the present invention the neck of a femoral prosthesis is provided with a removable protective sheath of a material softer than the material of the prosthesis, the sheath being substantially incompressible and having an inner surface substantially complementary in shape to the shape of the neck and an outer surface which is substantially cylindrical.

By using such a sheath, the prosthesis may be held in a neck punch with the sheath in position on the prosthesis. Thus, the head parts of the neck punch can be made with gripping parts complementary to the substantially cylindrical outer surface of the sheath, rather than to the complex surface of the neck. Manufacture of the neck punch is thus considerably simplified. Furthermore, by fitting the sheath immediately after manufacture the neck is protected from damage during packing and transit. The sheath also prevents metal-to-metal contact of the neck and the neck punch, so avoiding any metallic pick-up on the neck.

Preferably the substantially cylindrical outer surface of the sheath is of circular cross-section. Although square or other polygonal cross-sections could be used, circular cross-section is obviously most desirable from the standpoint of manufacturing the neck punch.

Preferably the sheath is extended to cover the head of the prosthesis as well as the neck. It is customary to supply femoral prostheses with the head and neck pro-

ected from damage by a cover, and the sheath of this invention may replace this cover. It is found that effective sterilization of the neck and head can be carried out with the sheath in position. To aid such sterilization, if desired the sheath may be formed with passages such as grooves or holes of small diameter from the outer to the inner surface thereof to facilitate penetration of the sterilization medium to the neck and head surfaces.

Desirably the sheath is made from a plastic material. Any one of a number of plastic materials may be used, or blends of one or more materials may be used. Specific examples of suitable materials are polyvinylchloride and polyamide.

In order that the sheath may be removable it is desirably made in two or more parts having mating surfaces lying in radial planes, and retaining means are provided for holding the parts together. In one possible arrangement one or more pegs on each surface may be a press or snap fit into one or more holes on the respective mating surface. After location of the prosthesis in the femur and removal of the neck punch the parts of the sheath may then be pulled apart and removed from the prosthesis leaving the sterile neck and head exposed. In an alternative construction the retaining device may be a band surrounding and secured to the surfaces of the parts, the band being cut by a scalpel to release the parts.

If made of plastic material, the parts may readily be injection moulded. To improve gripping of the outer face of the sheath this may be moulded to have a patterned surface, or the moulding may include inserts of high friction material exposed on the surface to increase the grip onto the neck punch.

In order that the invention may be better understood, a specific embodiment thereof will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a cross-section through a femoral prosthesis held in a neck punch;

FIG. 2 is an elevation of part of a sheath; and

FIG. 3 is a section through a complete sheath taken on line III—III of FIG. 2.

FIG. 1 shows a femoral prosthesis 1 comprising a shaft 2, a neck 3 and a head 4. As will be seen from the Figure the neck is specially shaped to allow sufficient freedom of movement in an artificial socket. Fitted over the head and neck of the prosthesis is a sheath 5 having an outer surface including a circular cylindrical section 6. A neck punch 7 comprises two arms, one being shown as 8, each having a head section such as 9, and the two head sections being pivoted together by a pivotal link connected to head section 9 about axis 10. Each head section has a semi-circular cylindrical internal gripping surface engageable around the cylindrical section 6 of the outer surface of the sheath 5. The two arms of the neck punch can be pivoted away from each other, the sheath inserted between the two head sections and the arms then pivoted together to close the head sections around the sheath. A threaded stem 11 which is captive in a boss 12 on the arm 8 is then engaged with a tapped bore in the other arm and the arms are moved further together by rotating the stem 11 by knurled wheel 13. By applying sufficient tightening force the head sections can securely grip the sheath and force this to grip the neck of the prosthesis so that there can be no relative movement between the

neck punch and the prosthesis which, during tightening, have been aligned so that the arms of the neck punch and the shaft 2 of the prosthesis are parallel.

The sheath 5 is shown in more detail in the enlarged views in FIGS. 2 and 3. The sheath is made in two parts 14 and 15 having radial surfaces 16 and 17, and 18 and 19 respectively. The internal surface of each part 14 and 15 is shaped so as to have a part 20 complementary in shape to the neck 3 of the prosthesis and a part 21 complementary in shape to the head 4 of the prosthesis. A groove 22 extends up each part of the sheath and opens into a semicircular recess 23 in the head part 21 of the internal surface. The outer surface of each part 14 and 15 has a circular cylindrical section 6, a part-spherical top section 24 and a flange 25 remote from the top section. The radial faces 16 and 17 of part 14 have respectively a peg 26 and a hole 27, while the radial faces 18 and 19 of part 15 have respectively a hole 28 and a peg 29. The pegs 26 and 29 are designed to be a light snap fit in the holes 28 and 27 respectively. Both parts 14 and 15 are moulded in polyamide, polyvinylchloride or some other suitable plastic material.

After manufacture of the prosthesis the two parts of the sheath are fitted around the neck and head and are pushed together so that the pegs snap into the holes. The dimensions of the internal surfaces of the parts 14 and 15 are such that when snapped together the assembled sheath is a loose fit over the neck 3. During packing and transit the head and neck are at all times protected by the sheath from damage. As the head in particular is ground and polished to a finish of very small tolerance such protection is most important.

Before use, the prosthesis is sterilized, the grooves 22 assisting penetration of sterilizing medium between the sheath and the prosthesis so that the neck and head become fully sterile. A sterile wrapping is then placed over the prosthesis. During surgery the sterile wrapping is removed, the prosthesis inserted in the neck punch as described and then fixed in the femur. After securing, the neck punch is opened and removed, and the two parts of the sheath are separated and removed to expose the head for seating in the socket.

Thus, apart from simplifying the design of the neck punch, provision of a sheath according to the invention also protects the head and neck of the femoral prosthesis right up to the time when implantation of the prosthesis is completed.

It will be understood that the sheath can be made from materials other than plastics, and that it can be made in more than two parts. To assist sterilisation more than two grooves 22 may be provided, or small holes 30 may be formed through the thickness of the sheath. To assist gripping the sheath in the neck punch without slipping, the cylindrical section of the outer surface of the prosthesis may be patterned, for example with axial, circumferential or diagonal grooves, or may otherwise be roughened. If necessary inserts of high friction material such as arcuate pieces of rough metal

may be implanted in the surface of this section.

What I claim is:

1. A femoral prosthesis comprising: a shaft, a part-spherical head and a neck joining said shaft and said head, a removable protective sheath surrounding said neck, said sheath being of a material softer than the material of said head and neck, being substantially incompressible and having an inner surface substantially complementary in shape to the shape of said neck and an outer surface which is substantially cylindrical, said sheath being in at least two parts, said parts having mating surfaces lying in radial planes, and retaining means for holding said parts together.

2. A femoral prosthesis according to claim 1 in which said outer surface of said sheath is of substantially circular cylindrical form.

3. A femoral prosthesis according to claim 1 in which said sheath also covers said head of said prosthesis.

4. A femoral prosthesis according to claim 1 in which said sheath is formed with passages to facilitate penetration of a sterilizing medium to all areas of said prosthesis.

5. A femoral prosthesis according to claim 1, wherein the outer surface of said sheath is substantially cylindrical throughout a major portion of its length.

6. A femoral prosthesis according to claim 1 in which said retaining device comprises at least one peg on one of said mating surfaces, said peg being a close fit into a mating hole on another of said mating surfaces.

7. A femoral prosthesis according to claim 1 in which said sheath is made from a plastic material.

8. A protective sheath for the neck in a femoral prosthesis, said sheath being substantially incompressible and having an inner surface having convergent and divergent sections shaped for complementing the shape of a femoral prosthesis neck, a hemispherical surface section for complementing a hemispherical head in a femoral prosthesis and an outer surface which is substantially cylindrical, said sheath being in at least two parts, said parts having mating surfaces lying in radial planes, and retaining means for holding said parts together.

9. A protective sheath according to claim 8, wherein the outer surface of said sheath is substantially cylindrical throughout a major portion of its length.

10. A protective sheath according to claim 8 in which said sheath is formed with axially extending passageways opening to said inner surface thereof.

11. A protective sheath according to claim 8 in which said sheath is formed with holes of small diameter extending from said outer surface to said inner surface thereof.

12. A protective sheath according to claim 8 in which said retaining means comprises at least one peg on one of said mating surfaces, said peg being a close fit into a mating hole on another of said mating surfaces.

* * * * *