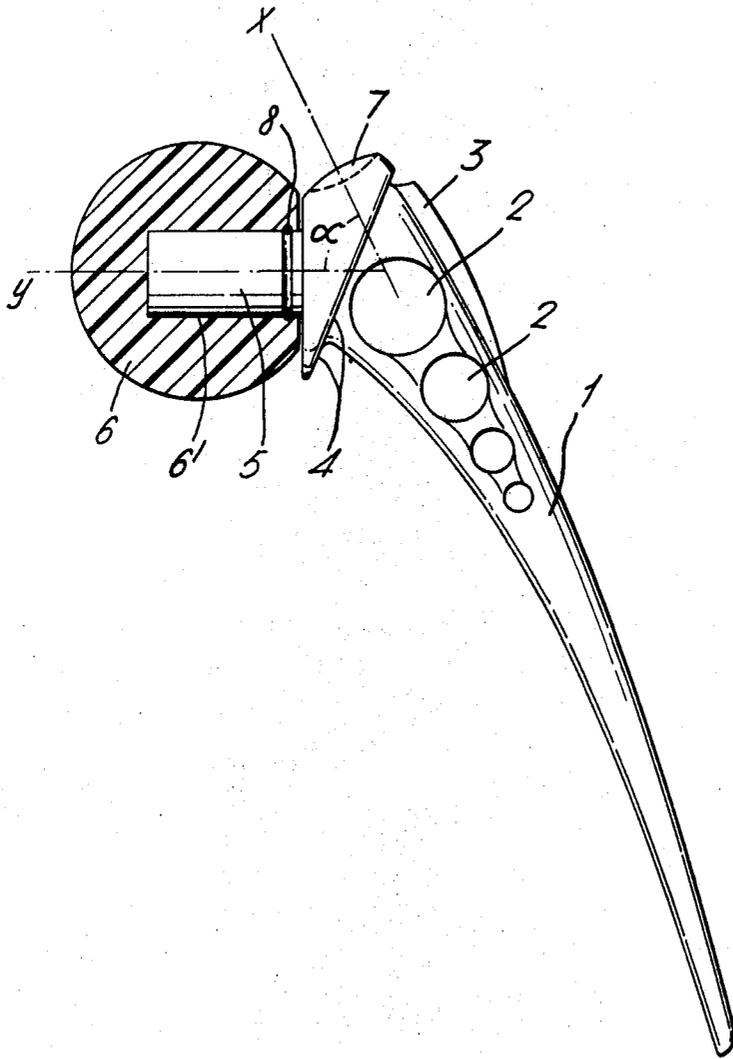


Sept. 16, 1969

T. CHRISTIANSEN  
HIP-JOINT PROSTHESIS  
Filed May 24, 1966

3,466,670



INVENTOR.  
*Tor Christiansen,*  
By:  
*Watson, Cole, Grindle & Watson,*  
ATTORNEYS.

1

3,466,670

## HIP-JOINT PROSTHESIS

Tor Christiansen, Kongsberg Sykehus,  
Kongsberg, Norway

Filed May 24, 1966, Ser. No. 552,578

Claims priority, application Norway, May 26, 1965,  
158,243

Int. Cl. A61f 1/02, 5/04

U.S. Cl. 3-1

4 Claims

2

### ABSTRACT OF THE DISCLOSURE

Hip-joint prosthesis comprising a plastic capitulum designed for fixed engagement in the socket of the pelvis, a bore in said capitulum, a spindle for insertion into the medullary cavity in the thigh-bone shaft and a trunnion on said spindle, rotatably insertable within the bore of said capitulum for removably mounting said capitulum on said spindle. The axis of the trunnion and the axis of the spindle form an angle of at least 45° whereby all movements between the leg and the hip are substantially taken up by the trunnion as it rotates within the bore of said capitulum.

The present invention relates to a hip-joint prosthesis of the kind consisting of a capitulum engaging the socket of the pelvis and a spindle portion connected thereto for insertion into the medullary cavity in the thigh-bone shaft. Such hip-joint prostheses have previously been manufactured as a unitary metal member made from a non-corrosive material. The capitulum has then been ball-shaped with a polished surface adapted for sliding against the socket of the pelvis.

These previously known prostheses have several disadvantages. First of all the capitulum, after being used for instance, for a few years, will have a tendency to wear down the socket of the pelvis so that the capitulum penetrates therethrough incapacitating the patient in the absence of further and more drastic surgery.

Secondly, the known prostheses are very heavy, being made of solid material. Thirdly, the placing of the prosthesis by operation necessitates a rather large incision to enable the prosthesis to be placed between the upper end of the thigh-bone shaft and the socket of the pelvis. Fourthly, these known prostheses give the patient much pain both in getting used to the prosthesis when using the leg after the insertion of the prosthesis, and later on.

The invention has for its object to provide a hip-joint prosthesis which eliminates the above-mentioned disadvantages. A prosthesis according to the invention can thus be placed by making only a considerably reduced incision during the operation. The patient has less pain, and the prosthesis is made less heavy than the known prostheses. A prosthesis according to the invention is also easier to position correctly and results in better mobility for the leg after the operation.

To obtain the above-mentioned advantages it is proposed, according to the invention, to provide a hip-joint prosthesis of the above-mentioned kind, the characterizing feature of which is that an articulation is permitted between the capitulum and the spindle portion. Said capitulum is substantially dismountable, and this makes it possible to employ a smaller incision to install the prosthesis in its proper position, the spindle portion being first inserted in position in the medullary cavity in the thigh-bone shaft, after which the capitulum with appurtenant articulation is installed.

According to a preferred embodiment the capitulum consists of a convenient non-corrosive artificial material, for instance, tetrafluoropolyethylene, which, is known,

is self-lubricating and thus will present a favorable surface to the co-operating metal element projecting from the spindle portion of the prosthesis.

The above, as well as further characterizing features and advantages of the invention, will appear more clearly from the succeeding detailed specification of an embodiment shown on the drawing of a hip-joint prosthesis according to the invention. It is, however, pointed out that the invention shown and described is meant only to illustrate the inventive idea, and that this can be modified in several ways within the scope of the invention. Especially, the articulation between the capitulum and the spindle portion can be modified in several ways known per se, without departing from the basic idea of the invention.

On the drawing, 1 is the spindle portion of the prosthesis shaped in a manner known per se to be inserted into the medullary cavity in the thigh-bone shaft after the upper articular ball of the thigh-bone is removed, and the top edge of the thigh-bone shaft is suitably formed to give good support for a contact edge 4 arranged at the upper end of the spindle. The spindle portion is made from a convenient non-corrosive metal and can be provided with lightening holes 2 as well as a guide rib 3 for better localization in the medullary cavity.

In the example shown a cylindrical trunnion 5 is arranged level with the upper end of the spindle portion. Said trunnion 5 co-operates with a cylindrical aperture 6' in the capitulum 6, which is substantially spherical. The capitulum 6 is preferably made of tetrafluoropolyethylene or other suitable artificial material which can be exposed to the body liquids, and which provides a self-lubricating effect in engagement with the trunnion 5.

To prevent the body liquids from seeping between the co-operating surfaces 5, 6', an O-ring seal 8 may be employed near the inner end of the trunnion.

The above-mentioned previously known hip-joint prostheses were provided with a capitulum, level with the spindle portion and adapted for direct movable engagement with the socket of the pelvis. The capitulum was therefore substantially arranged in the extension of the spindle portion. The capitulum according to the invention is, however, arranged so that its y axis forms an angle  $\alpha$  with the principal x axis. Said angle is at least 45° when it relates to a trunnion as shown on the drawing, and preferably approximately 65°. On account of this angle  $\alpha$ , the movement of the leg, which is transferred to the spindle portion 1, will not be apt to move the ball-shaped capitulum 6, so that this obtains a more or less permanent engagement position with the socket of the pelvis. The trunnion connections 5, 6' will receive the movement, and the socket of the pelvis is not exposed to any wear and tear effect, so that the above-mentioned danger of penetration is eliminated.

Because the capitulum 6, according to the invention, is preferably made of self-lubricating plastic material, the weight of the prosthesis is also considerably reduced, the previously known metal capitulum having had a weight between three and four times as great as that of the capitulum of artificial material according to the invention.

Also, because the capitulum 6 and the spindle portion 1 are produced as two separate but unitable parts, the incision made during the operation can be much reduced in length, the surgeon first inserting the spindle portion 1 and then mounting the capitulum 6. Said insertion of the spindle portion is further facilitated by the upper end thereof being provided with a groove 7 or the like, suitable for co-operation with convenient tools for applying the necessary insertion force.

As mentioned, the invention is not limited to the shown and described details, but can be modified in several

3

ways without departing from the inventive idea. Thus, the shown and described trunnion connection can be replaced by another suitable trunnion connection, for instance, a ball-and-socket joint, if convenient with limited engagement surfaces for possible mutual movement between the parts. Locking members between the capitulum and the spindle portion are normally not necessary, these parts being kept in place by muscular exertion. If, however, a trunnion connection not expected to be kept in place by normal muscular exertion is used, suitable locking members will also form a part of the prosthesis.

What is claimed is:

1. Hip-joint prosthesis comprising:
  - a self-lubricating wholly plastic capitulum designed for fixed engagement in the socket of the pelvis, said capitulum having a bore therein;
  - a spindle portion for insertion into the medullary cavity in the thigh-bone shaft;
  - an integral trunnion on the upper end of said spindle rotatably inserted within the bore of said capitulum for removably mounting said capitulum on said spindle; and
  - a sealing means on said trunnion in contact with the wall of said capitulum bore to prevent entry of body fluids within said bore, said trunnion extending laterally away from said spindle and forming an upper included angle therewith of at least 45° whereby all movements between the leg and the hip are substantially taken up by said trunnion as it rotates within the self-lubricating bore of said capitulum.
2. Hip-joint prosthesis according to claim 1 character-

4

ized by the axis of said trunnion and the axis of said spindle forming an angle of approximately 65°.

3. Hip-joint prosthesis according to claim 1 wherein said spindle upper end is provided with means for cooperation with tools to aid in the insertion of said spindle portion into the medullary cavity.

4. Hip-joint prosthesis according to claim 1 wherein said sealing means comprises at least one O-ring.

#### References Cited

##### UNITED STATES PATENTS

2,612,159	9/1952	Collison.
3,064,645	11/1962	Ficat et al.
3,320,951	5/1967	Wittebol.

##### FOREIGN PATENTS

1,122,634	5/1956	France.
-----------	--------	---------

##### OTHER REFERENCES

"Modified Scuderi Hip Prosthesis," in The Journal of Bone and Joint Surgery, June 1955, advertising page 42.

"De Puy Hip Prosthesis," in The Journal of Bone and Joint Surgery, vol. 45-A, No. 6, September 1963, advertising page 61.

RICHARD A. GAUDET, Primary Examiner

RONALD L. FRINKS, Assistant Examiner

U.S. Cl. X.R.

128—92