

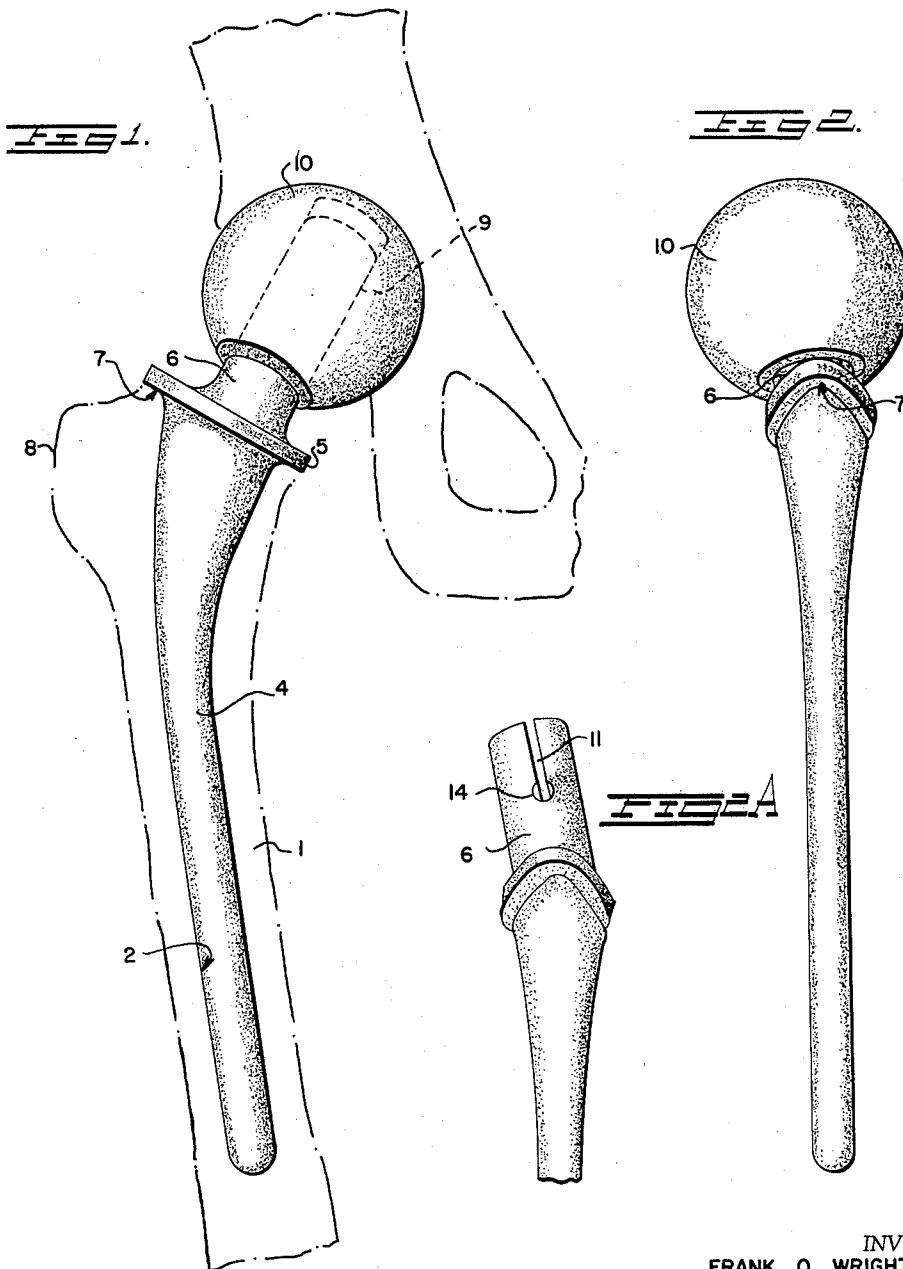
Sept. 3, 1963

R. M. ROSE ET AL
HIP PROSTHESIS

3,102,536

Filed Dec. 7, 1960

3 Sheets-Sheet 1



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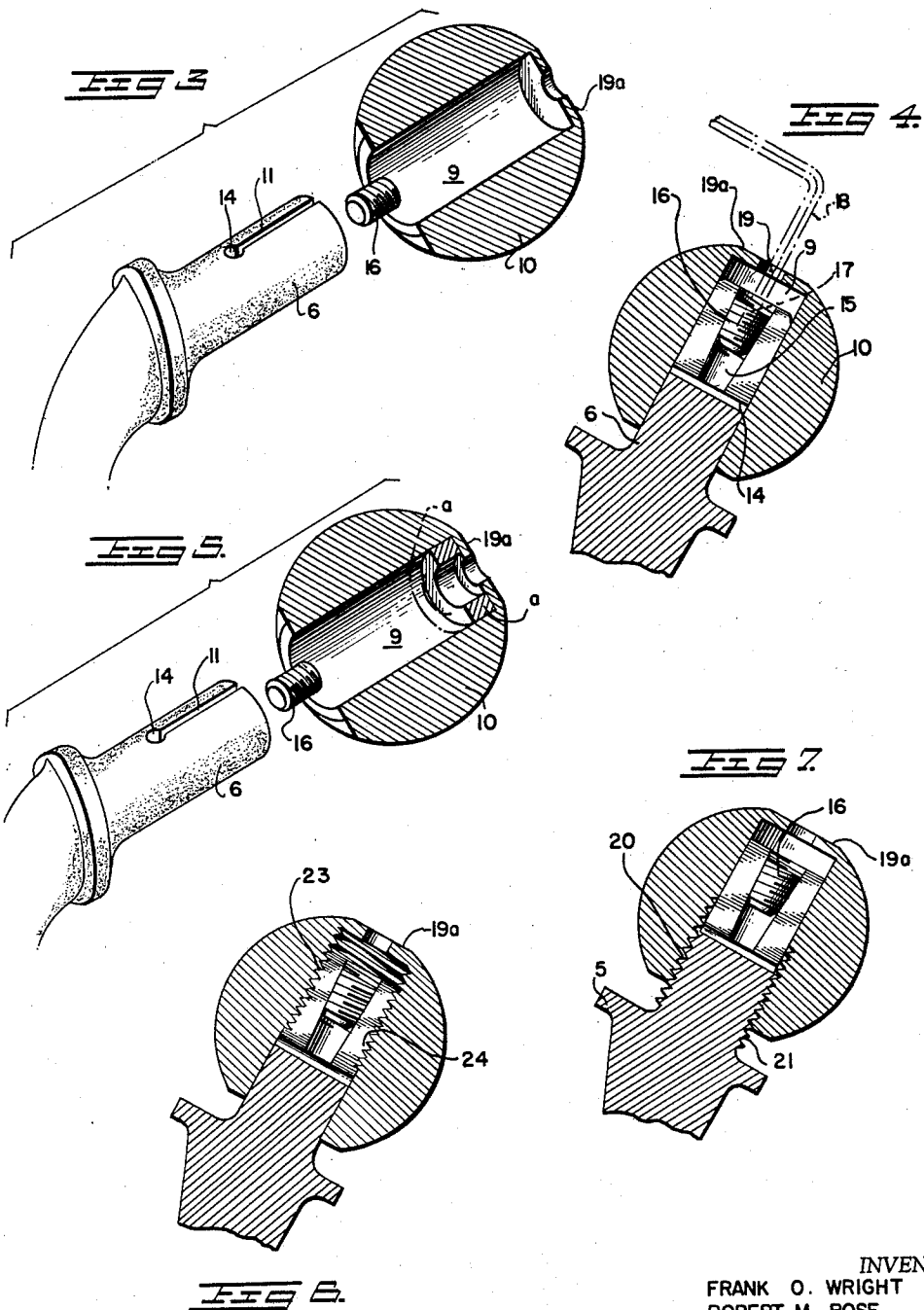
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Filed Dec. 7, 1960

3 Sheets-Sheet 2



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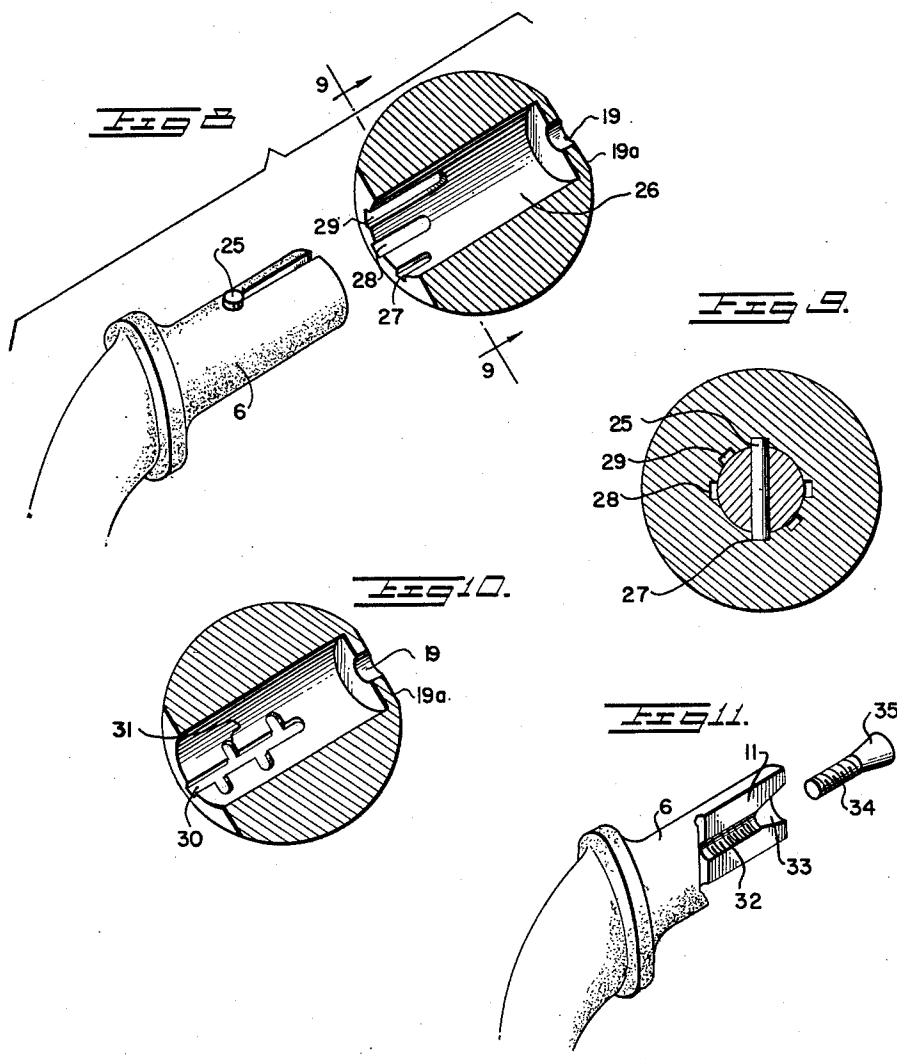
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Filed Dec. 7, 1960

3 Sheets-Sheet 3



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3,102,536

HIP PROSTHESIS

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Filed Dec. 7, 1960, Ser. No. 74,249
5 Claims. (Cl. 128-92)

This invention relates to hip prosthesis.

The primary object of this invention is to provide an improved femoral spherical head mounting to permit orthopedic surgeons to more exactly simulate the normal bone structure both as to angular arrangement of the parts to provide maximum support and also duplication of the dimensions and particular reference to the position of the femoral head with respect to the femoral neck structure.

Another object of the invention is to provide the head of the prosthesis so that it is interchangeable and adjustable on the neck of the stem of the prosthesis so as to vary or modify the neck lengths and head heights as may be required.

Another object of the invention is to provide a rearward or backward slope between the head of the prosthesis and the shaft of the stem to thereby duplicate the alignment of the normal head of the femur.

Another object of the invention is to provide a structure permitting the substitution of different heads having different diameters on the same stem, means being provided for utilizing the same locking mechanism to secure and adjust the head on the stem.

A further object of the invention comprehends the provision of right sided and left sided stems for the right and left hips, these stems or necks of the prosthesis angling backwards so that the heads when fitted to the neck also angle backwards duplicating the alignment of the head of the normal femur.

These and further objects of the invention will more clearly hereinafter appear by reference to the accompanying drawings forming a part of the instant specification and wherein like characters of reference designate corresponding parts throughout the several views, in which:

FIG. 1 is a front elevation showing the hip prosthesis assembled for a right hip structure;

FIG. 2 is a side elevation of the hip prosthesis shown in FIG. 1;

FIG. 2a is a fragmentary side elevation of the upper portion of the prosthesis with the spherical head removed;

FIG. 3 is an exploded view of the preferred form of lock of the type used in the structure shown in FIG. 1;

FIG. 4 is a longitudinal section through the assembled disclosure of FIG. 3;

FIG. 5 through FIG. 11 show modified forms of locking means for securing the spherical head to the neck;

In the drawings the structure shown is for the right side or right hip structure. Referring to FIG. 1 the femur is indicated by reference character 1, this femur being formed with the usual marrow canal 2. The prosthesis consists of a stem or shaft 4 located in the marrow canal, a shoulder 5 and a neck 6. The shoulder 5 seats on a flattened area 7 positioned at the upper end of the shaft or stem 4 and is shaped to extend immediately beyond the outer margin of the cortex of the upper end of the femur and as indicated at 8. The shoulder 5 will rest on a suitably prepared flattened area which may be formed by an appropriate facing tool at an appropriate angle. The neck 6 is of cylindrical form and extends upwardly, inwardly and backwardly in relation to the shoulder 5 and the shaft 4. This backward extension of the neck 6 in relation to the stem and shoulder is reversed in a prosthesis for the right and the left hip.

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The neck 6 is generally of cylindrical form throughout the outer major part of its length for reception within an elongated cylindrical socket 9 formed in the spherical head 10. The upper end of the neck 6 is medially split longitudinally as at 11, the split terminating in the transverse slot or passageway 14, as shown in FIG. 2a.

In FIGS. 3 and 4 the upper or outer end of the neck 6 is formed with a central longitudinally extending bore 15, the bore as shown in FIG. 4 extending from the outer end of the neck inwardly to the transverse passageway 14. The bore 15 may taper or decrease in diameter from its outer end inwardly and is threaded to receive a cylindrical screw or plug 16 so that as the plug 16 is driven into the bore 15 it will expand and outwardly displace the split outer terminals of the neck 6 to cause the neck to bind within the wall of the cylindrical bore 9 formed in the spherical head 10. To provide for the movement of the plug 16 its outer end is formed with a hexagonal recess 17 to receive the end of an Allen wrench 18 shown in dotted lines in FIG. 4. To use the Allen wrench 18 it is inserted through an axially aligned opening 19 formed in the circular head 10. To remove or adjust the circular head 10 an Allen wrench is inserted through the opening 19 into the socket 17 in the threaded plug 16 and the latter is rotated counter-clockwise permitting the two halves of the split neck to return to their normal cylindrical form. Having loosened the plug 16 as proposed, the ball 10 can be removed or can be adjusted axially of the length of the neck 6 to a position comprehended by the dimensions and body structure of a patient.

It will be noted that the outer face of the ball head of the prosthesis is flattened as at 19^a about the marginal edge of the axially aligned opening 19 through which the Allen wrench 18 is adapted to be inserted. This prevents the marginal edges of the walls defining the opening 19 from scraping the acetabulum when the prosthesis is in use.

In FIG. 5 the assembly is similar to the disclosure of FIGS. 3 and 4 with the exception that stop rings *a* are inserted in the socket in the spherical head 10. These stop rings *a* are of different thicknesses to fill the socket at the end of the neck 6 to prevent relative displacement between the parts.

It will be noted that in FIG. 7 the threads are formed on the inner portion of the neck 6 and on the outer part of the bore 9 rather than extending the full length of these parts. In FIGS. 6 and 7 all of the parts generally correspond to the parts illustrated in FIG. 4 with the exception that an added fastener is provided in the form of threads 20 in the cylindrical socket in the spherical head and threads 21 at the lower end of the neck 6. By this structure when the screw plug 16 is loosened the head can be rotated to position the same outwardly or inwardly with respect to the shoulder 5 in accordance with requirements and then when so adjusted the stem can be locked against further rotation by a clock-wise rotation of the plug 16.

In the disclosure of FIG. 8 the same outer slotted neck structure is provided with the transverse opening receiving a pin 25 which projects laterally at each side of the neck. In this FIG. 8 the wall forming the ball socket 26 is provided at opposite sides with a series of longitudinally extending recesses 27, 28 and 29 for receiving the laterally projecting heads of the pin 25. These slots may be in both sides of the ball socket 26 or may be only in one side of the ball socket. In the latter instance the pin will project from only one side of its transverse seat. In this structure the ball may be positioned outwardly on the neck 6 as provided by the length of the slots 27, 28 and 29 and when the ball is seated with the pin 25 in the selected slot the ball will then be locked into position in the usual way as shown in FIGS. 3 and 4 by inserting an Allen wrench through the opening 19 in the outer face of the ball and into a socket in the head of the screw

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plug 16 so that the latter can be rotated to expand the stem outwardly to prevent rotation and removal of the parts.

In lieu of the adjustment provided in FIG. 8, wherein the longitudinal slots 27, 28 and 29 are provided, slots 5 as shown in FIG. 10 may be utilized. In the disclosure of FIG. 10 a single longitudinally extending slot is provided for the head of the pin 25, as shown at 30, and laterally projecting sockets 31 are formed at different intervals so that the pin 25 can be slid into the longitudinal slot 30 and the head rotated seating the end of the pin into the lateral offset socket 31. These offset sockets 31 may be arranged in any suitable manner to provide the required adjustments and as in the instance of FIG. 8 the stem 6 is expanded by a plug, as shown in FIG. 3.

FIG. 11 illustrates a different type of expansible plug. In this figure the stem 6 is formed with the cylindrical threaded passageway 32 having a tapered or wedge-shaped outer socket 33. To expand the two lateral halves of the ends of the stem 6 formed by the slot 11, a threaded tapered plug may be used as shown, the plug including a cylindrical threaded shank 34 preceding the circular threaded portion 32 of the longitudinally extending socket. The tapered plug 35 carried at the end of the plug moves into the tapered extremity 33 of the threaded passageway and when driven home an appropriate number of times will expand the stem into locking engagement.

What we claim is:

1. In a device of the class described, a shaft member adapted to be located in a marrow canal of a femur, said shaft having a medially extending upper portion terminating in a stem, a collar formed intermediate the shaft and the stem and projecting laterally about the parts to provide a supporting area for the device, said stem extending upwardly, inwardly and backwardly with relation to said collar, the outer portion of said stem being formed with a transverse slot defining expansible portions, a longitudinally extending axially arranged bore in the slotted area of the stem, means movable in the bore in the slotted area of the stem for expanding said expansible portions, a spherical head having a circular socket for adjustably and rotatably receiving said stem, the wall of said circular socket being formed with a series of longitudinally extending slots in its inner surface, said slots opening at the lower end of said socket, and a pin member carried by said stem for reception in said slots.

2. In a device of the class described, a shaft member adapted to be located in a marrow canal of a femur, said shaft having a medially extending upper portion terminating in a stem, a collar formed intermediate the shaft and the stem and projecting laterally about the parts to provide a supporting area for the device, said stem extending upwardly, inwardly and backwardly with relation to said collar, the outer portion of said stem being formed with a transverse slot defining expansible portions, a longitudinally extending axially arranged bore in the slotted area of the stem, means movable in the bore in the slotted area of the stem for expanding said expansible portions, a spherical head having a circular socket for adjustably and rotatably receiving said stem, the wall of said socket being formed with an elongated slot having lateral pockets, and a pin member carried by said stem for reception in said pockets.

3. In a device of the class described, a shaft member adapted to be located in the marrow canal of a femur, said shaft having a medially extending upper portion terminating in a stem, a collar formed intermediate the shaft and stem and projecting radially about the parts to pro-

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vide a supporting area for the device, said stem extending upwardly, inwardly and backwardly in relation to said collar, the outer portion of said stem being formed with a transverse slot defining expansible portions, a longitudinally extending axially arranged bore in the slotted area of said stem, said bore opening outwardly through the end of the stem, a spherical head having a circular socket for adjustably and rotatably receiving said stem, a plug member in said bore in the slotted area of said stem and movable axially of said stem in said bore for expanding said stem for locking said spherical head against rotation and axial movement, and an access opening formed in said spherical head to permit operation of said plug.

4. In a device of the class described, a shaft member adapted to be located in the marrow canal of a femur, said shaft having a medially extending upper portion terminating in a stem, a collar formed intermediate the shaft and stem and projecting radially about the parts to provide a supporting area for the device, said stem extending upwardly, inwardly and backwardly in relation to said collar, the outer portion of said stem being formed with a transverse slot defining expansible portions, a longitudinally extending axially arranged bore in the slotted area of said stem, said bore opening outwardly through the end of the stem, a spherical head having a circular socket for adjustably and rotatably receiving said stem, a plug member in said bore in the slotted area of said stem and movable axially of said stem in said bore for expanding said stem for locking said spherical head against rotation and axial movement, and an access opening formed in said spherical head to permit operation of said plug, said spherical head about said access opening being cut away to provide a recess in which the opening is located.

5. In a device of the class described, a shaft member adapted to be located in the marrow canal of a femur, said shaft having a medially extending upper portion terminating in a stem, a collar formed intermediate the shaft and stem and projecting radially about the parts to provide a supporting area for the device, said stem extending upwardly, inwardly and backwardly in relation to said collar, the outer portion of said stem being formed with a transverse slot defining expansible portions, a longitudinally extending axially arranged bore in the slotted area of said stem, said bore opening outwardly through the end of the stem, a spherical head having a circular socket for adjustably and rotatably receiving said stem, a plug member in said bore in the slotted area of said stem and movable axially of said stem in said bore for expanding said stem for locking said spherical head against rotation and axial movement, and said spherical head being formed with a flattened area at its outer face, and an access opening extending through the medial portion of the flattened area into the cylindrical socket to permit insertion of an operating member.

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