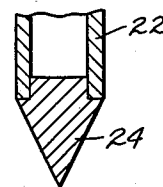
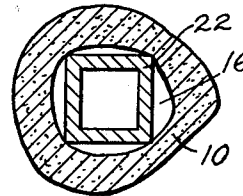
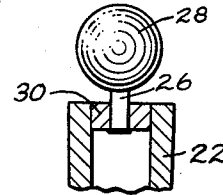
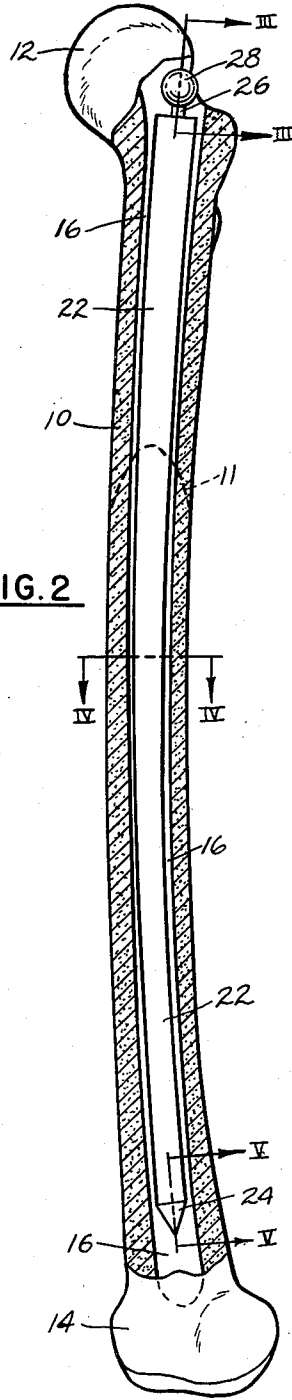
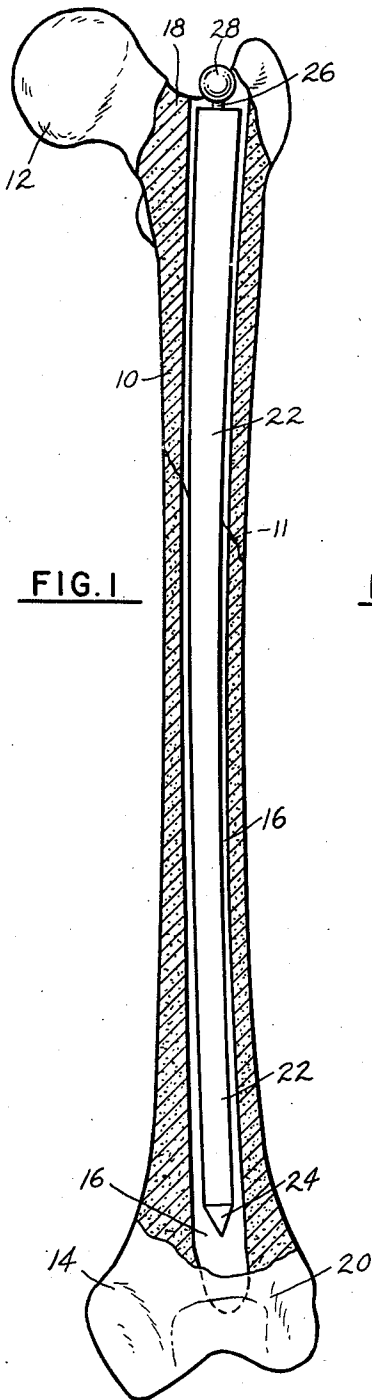


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J. T. KANE
INTRAMEDULLARY SPLINT
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JOHN T. KANE
INVENTOR

BY *Donald T. Hilker*

ATTORNEY

UNITED STATES PATENT OFFICE

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INTRAMEDULLARY SPLINT

John Timothy Kane, Binghamton, N. Y.

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5 Claims. (Cl. 128—92)

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My invention relates to an improved intramedullary splint for use in the treatment of fractured limbs, and it will be described herein as it is preferably made and used by me in the care of patients suffering from a diaphyseal fracture or fractures of the femur.

Intramedullary splints of a U or V shape in cross section have been used for a considerable length of time in the care of patients suffering from fractures, including fractures of the femur. Such splints have had, in general, several disadvantageous features or characteristics. For example, the previously used splints have been straight lengthwise, and have not been shaped complementary to the anteroposterior and lateral bowing of the medullary cavity in the manner required to give the maximum amount of support to the fractured bone at the fracture site. Also, the same failure to shape the splint in accordance with the anteroposterior and lateral bowing of the medullary cavity has made it extremely difficult for the attending surgeon in some cases to be certain that the fractured bone fragments are properly aligned, and in such cases misalignment has frequently resulted, with all of its attendant serious consequences. Further, because of the failure to shape such splints complementary to the bowing of the medullary cavity, it has been impossible to insert the splints in the lower third of the medullary cavity to make such splints of use in the treatment of fractures in the lower third of the femur. In the insertion of the prior art straight splints, frequent driving of the lower end of the splint into the bone has occurred.

Another serious disadvantage of the previously known intramedullary splints is that they have not sufficiently filled the cavity, thus permitting relative movements between the fractured bone segments themselves, as well as relative movements between the fractured bone segments and the splint. In the case of the first mentioned relative movements, union of the bone fragments is prolonged, and the fragments do not necessarily unit in proper alignment and position. In the case of relative movements between the bone fragments and the splint, the splint may retain the displaced bone fragments in an improper position, thereby promoting union of the bone fragments in a misaligned position.

Still another undesirable feature of the prior art intramedullary splints is that they have not gripped the bone fragments with sufficient certainty to prevent lateral rotation of the frag-

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ments, resulting in delayed and improperly aligned union.

Also, the U-shaped splints known to the prior art have an additional disadvantageous feature in that a large area of the splint contacts the wall of the cavity, cutting off minimal circulation in the area of contact.

The general object of my invention is to provide an intramedullary splint which does not have the outlined disadvantages of the previously known intramedullary splints, and which will, in use, facilitate the locating of the bone fragments by the attending surgeon in their proper positions, in all respects, and which will hold the bone fragments in such position until union is completed and the splint is withdrawn.

Another object of my invention is to provide a simply constructed, easily insertable and easily removable intramedullary splint which will not irritate the body in any manner while inserted therein.

Other objects and advantages of my invention will become apparent upon a reading of the following disclosure.

In order that the preferred embodiment of my invention may be clearly understood, reference is made to the accompanying drawing, showing a preferred embodiment thereof, wherein:

Fig. 1 is a partial cross-sectional anterior view of the femur of the left leg, showing the improved splint of my invention inserted in the medullary cavity thereof.

Fig. 2 is a partial cross-sectional lateral view of the same elements as shown in Fig. 1, as seen from the left side of the femur.

Fig. 3 is a sectional view, taken along the plane III—III of Fig. 2.

Fig. 4 is a sectional view, taken along the plane IV—IV of Fig. 2, and

Fig. 5 is a sectional view, taken along the plane V—V of Fig. 2.

Referring now to Fig. 1, the left femur is shaped, as seen anteriorly, as shown, the femur being numbered 10. A fracture is designated 11. The head of the femur 12 and condylar region 14 are shown, as is the medullary cavity which is designated 16. It will be noted that this cavity extends from the area of the insertion of inferior gemelli muscles 18 to the supra-condyle 20, near the lower end thereof. As shown in the anterior view, the medullary cavity 16 is slightly bowed, the upper and lower ends being displaced outwardly, or to the right, of the central portion of the cavity. Further, the cavity tapers from a larger diameter at the top thereof to a smaller

diameter about one-third of the distance down the femur; the cavity then maintains a fairly constant diameter during the middle third of its extension; and then the cavity gradually increases in diameter for the remaining third of its extension.

Referring now to Fig. 2, the left femur is shaped, as seen from the left side thereof, as shown in outline. The head of the femur 12 and condylar region 14 are shown, as is the medullary cavity 16. The anteroposterior bowing of the cavity will be seen to be greater than the lateral bowing which was previously described in connection with Fig. 1. In Fig. 2 it will be seen that the upper and lower ends of the cavity are located posteriorly of the middle portion thereof. Insofar as the size of the cavity is concerned, when seen as viewed in Fig. 2, the cavity tapers from a larger diameter at the top thereof to a smaller diameter about one-third of the distance down the femur; the cavity then maintains a fairly constant diameter during the middle third of its extension; and then the cavity gradually increases in diameter in the lower third of its extension.

Referring again to Fig. 1, there is shown inserted in the medullary cavity 16 a splint made in accordance with the principles of my invention. This splint includes an elongated main body 22, a lower pointed end 24, a pin 26 affixed to the upper end of the elongated body 22, and a ball 28 affixed to the upper end of this pin. In Fig. 4 it will be seen that the body portion 22 of the splint is four-sided and generally square in cross section, and is preferably of tubular metal construction, to impart strength as well as lightness thereto. To the lower end of the tubular body portion is affixed a plug 24, also preferably four-sided, to conform to the sides of the main body portion. The lowermost end of this plug is preferably pointed, as shown, and this plug may be affixed to the main body portion in any suitable manner, or may be formed integrally therewith.

At the upper end of the body portion 22, as seen in Fig. 3, is provided the plug 30, which may be affixed to the body 22 in any suitable method, or may be formed integrally therewith. Carried by this plug is the pin 26 to which is affixed the metal ball 28.

Referring now to Figs. 1 and 2, it will be seen in both views that the elongated body portion 22 is of greater width at the top and tapers gradually throughout the upper third of its extension, and is more or less constant in width throughout its lower two-thirds of length. If desired, however, the lower third of the splint may be tapered to a lesser width than the middle third thereof. The width of the splint at any place in the approximate upper two-thirds thereof is such that when the splint is driven into place, as shown in Figs. 1 and 2, the four corners of the splint will firmly engage the inner wall of the bone which forms the medullary cavity.

In Fig. 1 it will be seen that the body 22 is slightly bowed, its upper and lower ends being displaced outwardly, or to the right, of the central portion thereof. Accordingly, the splint 22 is bowed medially complementary to the medial bowing of the medullary cavity. In Fig. 2, the anterior bowing of the splint is more accentuated than the medial bowing in Fig. 1, and is bowed complementary to the anterior bowing of the medullary cavity 16. It will be noted that the

splint is completely enclosed, and it is preferably plated with tantalum or vitalium.

The upper end of the body 22 lies medial to the greater trochanter and is extra-capsular. The pin 26 and ball 28 lie medial to the greater trochanter in the niche occupied by the insertion of the inferior gemelli muscles.

In the introduction of the splint of this invention, the patient is turned on the sound side before the operation. The affected extremity is adducted and internally rotated. If a method of traction is available for use on the affected limb, such a procedure should be exercised.

Through a 6" incision beginning about one centimeter below the tuberosity and extending vertically, the hip joint may be readily exposed. The gluteus maximus muscle is divided, and the gluteus medius muscle is incised at the point of its insertion. The finger may then be introduced into the niche which is occupied by the inferior gemelli muscles and a 1/2" drill hole may be made at this site and the marrow cavity readily exposed. At the same time, an incision is made over the fracture site and the fragments are approximated using a bone clamp to hold them together. By means of a hammer the splint is driven into the marrow cavity and across the fracture site to the position shown in the drawings. The wound is then closed at both the fracture site and at the point of introduction of the splint. The gluteus medius is re-sutured at the point of insertion; the gluteus maximus is approximated and the skin is closed with silk.

The open method of operation allows the surgeon to place the splint in an extra capsular position, thus avoiding the introduction of infection into the hip joint proper.

The splint may be removed after the bone fragments have sufficiently united through an incision over the tuberosity on the affected side. Lubrication of the medullary cavity will facilitate extraction. The provision of the ball 28, which may be grasped by a suitable instrument, assures easy removal of the splint.

By virtue of the compound bowing of the splint, as well as the described tapering thereof, it will be appreciated that the splint of this invention establishes a proper reference with respect to which the bone fragments may be properly approximated by the attending surgeon, so that perfect apposition of the fragments may be had. The square, tapered splint assures engagement of the splint at each of its four corners for at least two-thirds the length of the splint with the interior of the bone fragments. The bone fragments are held in proper position, thus preventing lateral rotation of the fragments.

Lateral rotation is most apt to occur in the case of fractures in the upper two-thirds of the femur and results from the action of the iliopsoas muscles and external rotators of the hip which tend to turn the upper bone fragment when the patient is walking. Clearly, by the use of my splint the upper and lower fragments are held in position relative to one another to prevent any relative lateral rotation between the upper and lower fragments.

In the case of fractures of the lower third of the femur, the muscles inserting at the lower end of the femur tend to pull the lower fragment posteriorly with resultant anterior displacement of the upper fragment, resulting in the formation of an angle between the two fragments. Also, the ends of the bone fragments may slide past one

another. In either case, shortening of the bone and leg results. By the provision of a splint bowed complementary to the medial and antero-posterior bowing of the medial cavity, it is possible to drive the lower end of the splint into the lower end of the cavity, thus minimizing the danger of such displacements.

The main body portion of the splint is preferably completely within the medullary cavity, and the pin 26 and ball 28 are the only portions of the splint outside the cavity. By virtue of this arrangement the corners of the splint grip the bone fragments to hold them in proper juxtaposition, and the smooth surfaces of the pin 26 and ball 28 will not irritate the muscles of the patient nor the neighboring joint capsule, thus diminishing greatly the dangers of infection in the hip joint and surrounding muscles.

The completely enclosed splint prevents secretions from the body leaking into the splint, and the plating of the splint with vitalium or tantalum prevents any corrosion of the splint, or resulting infection. Because the splint engages the interior of the bone only along the four edges of the splint, minimal circulation is permitted through most of the area of the cavity wall.

Not only does the use of my splint assure the retention of the bone fragments in proper position while union is taking place, but the retention of the fragments in such position, in continuous contact with the adjoining fragment or fragments greatly facilitates early union of the fragments. Earlier ambulation of the patient is possible, not only resulting in a psychological uplift to the patient, but also lessening the danger of complications, such as hypostatic pneumonia, urinary infection, urinary calculi, etc., resulting from keeping the patient in bed for a longer period of time. Physiotherapy may be begun at an earlier time, and muscular atrophy will be minimal. Also, earlier massage and ambulation will prevent stiffness of the knee on the affected side.

Certain of the improved features of my invention may be utilized in the construction of other types of splints. Also, it will be appreciated by those skilled in the art that changes may be made in the disclosed preferred embodiment of my invention without parting from the substance thereof. All such uses and changes are intended to be covered by the following claims.

I claim:

1. An intramedullary splint for use in the treatment of fractures of the femur comprising an elongated member bowed medially and antero-posteriorly corresponding to the medial and antero-posterior bowing of the medullary cavity of the femur, the upper end portion of said splint being tapered from a greater size at the upper end thereof for a substantial portion of the length of the same, and the adjoining portion of said splint being of substantially constant width for a substantial portion of the length thereof.

2. An intramedullary splint for use in the treatment of fractures of the femur comprising an elongated member bowed medially and antero-posteriorly corresponding to the medial and antero-posterior bowing of the medullary cavity of the femur, the upper end portion of said splint being tapered from a greater size at the upper end thereof for a substantial portion of the length of

the same and the adjoining portion of said splint being of substantially constant width for a substantial portion thereof, the outermost portions of said member comprising a plurality of generally parallel, relatively narrow and circumferentially displaced surfaces for gripping the walls of the medullary cavity.

3. An intramedullary splint for use in the treatment of fractures of the femur comprising an elongated four-sided tubular member substantially square in cross-section, a pointed plug held by the lower end of said member, a plug in the upper end of said member, a pin held by the last mentioned plug, and a ball held by the upper end of said pin, the said elongated member being bowed medially and antero-posteriorly corresponding to the medial and antero-posterior bowing of the medullary cavity of the femur.

4. An intramedullary splint for use in the treatment of fractures of the femur comprising an elongated four-sided tubular member substantially square in cross section and tapered from a greater size at the upper end thereof for a substantial portion of the length of the same, a pointed plug held by the lower end of said member, a plug in the upper end of said member, a pin held by the last mentioned plug, and a ball held by the upper end of said pin, the said elongated member being bowed medially and antero-posteriorly corresponding to the medial and antero-posterior bowing of the medullary cavity of the femur.

5. An intramedullary splint for use in the treatment of fractures of the femur comprising an elongated tubular member bowed medially and antero-posteriorly corresponding to the medial and antero-posterior bowing of the medullary cavity of the femur, said member being tapered from a greater size at the upper end thereof for a substantial portion of the length of the same, corresponding to the tapering of the medullary cavity of the femur, a pointed plug held by the lower end of said member, a plug in the upper end of said member, a pin held by the last mentioned plug, and a ball held by the upper end of said pin, the outermost portions of said tubular member comprising a plurality of generally parallel, relatively narrow and circumferentially displaced surfaces for gripping the walls of the medullary cavity.

JOHN T. KANE.

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