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METHOD AND APPARATUS FOR REDUCTION OF FRACTURE OF FEMUR

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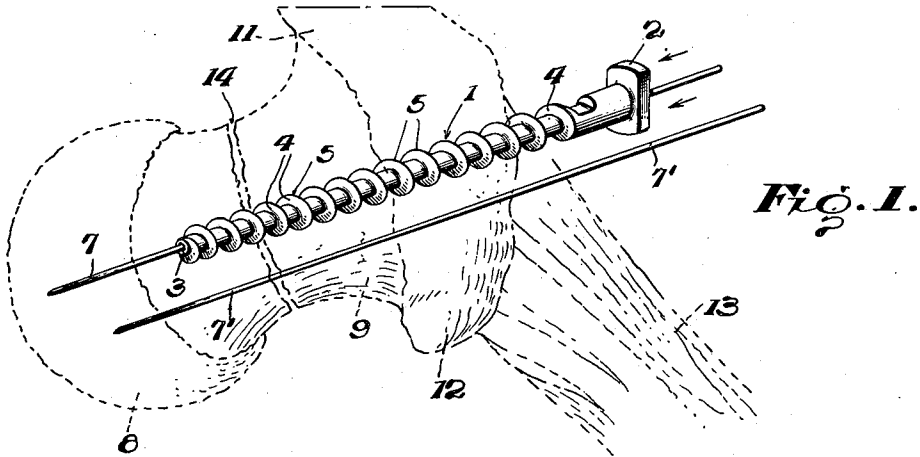


Fig. 1.

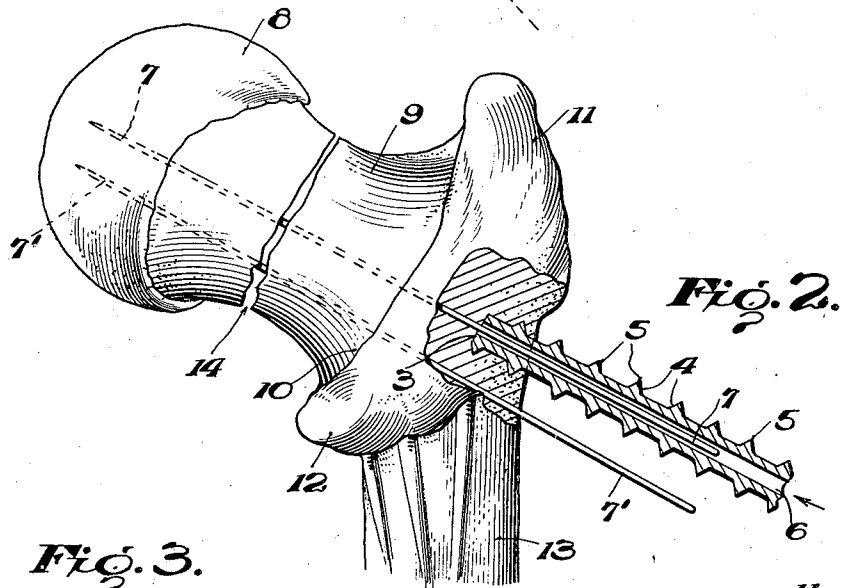


Fig. 2.

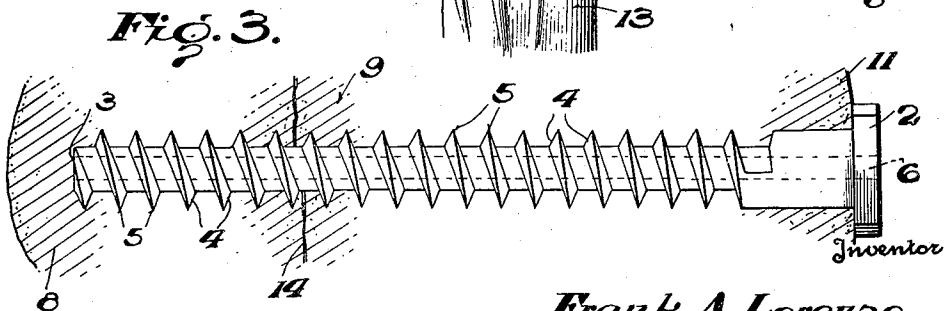


Fig. 3.

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METHOD AND APPARATUS FOR REDUCTION
OF FRACTURE OF FEMUR

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4 Claims. (Cl. 128—92)

My invention relates to the reduction of bone fractures and more particularly to an improved method and apparatus for use in the reduction and immobilization of fracture of the neck of the femur.

The femur or thigh bone, it will be recalled, is the longest bone in the skeleton and is formed at its upper end with a rounded head joined to the shaft by a constricted neck, the base portion of which lies adjacent two projections or eminences called the greater and lesser trochanters. The head articulates with the cavity in the hip bone called the acetabulum, and the lower end of the femur articulates with the tibia and the patella. Fractures of the femur usually occur in the neck or restricted portion between the rounded head and the area defined by the trochanters, a large percentage of said fractures being in a plane which is substantially transverse of the axis of the neck.

Heretofore, it has been suggested to reduce fractures of the above mentioned character, by means of a cast formed from plastic material or by mechanically fastening the bone elements together, in the vicinity of the fractured area, by means of wire, pin inserts or the like. While the prior art arrangements no doubt function for their intended purposes, they are open to several objections, which are inherent, either in their construction or application and use.

The use of a cast, which incidentally was one of the earliest of the proposed methods of reduction, requires that the patient be practically enveloped within the plastic material, which not only causes considerable physical discomfort, but also in some instances results in serious consequences, due to the effect of induced temperatures upon the respiratory system. Wiring methods have not been satisfactory because of limitation of space, the general inaccessibility of the fracture and more particularly because of the necessity of providing a substantial support for the bone elements in the vicinity of the fracture. The use of pins or other metallic inserts has been suggested, however, the introduction of these members into the desired supporting position is effected by direct force, as by driving, which frequently results in trauma and other undesirable after effects.

After considerable research and experimentation, I have developed an improved method and means for use in the reduction and immobilization of fracture of the neck of the femur, whereby the above noted objections to the prior art arrangements are overcome. In accordance with

the present invention, the bone elements adjacent the fracture are supported and maintained in the desired position by means of a threaded bolt member, constructed and arranged to function as an auxiliary core, interiorly of the neck of the femur, the threaded portion of the bolt having bearing engagement throughout a substantial area of the head and upper shaft in the region of the trochanters, whereby considerable force may be exerted axially of the neck of the femur to draw the parts together.

An object of my invention is to provide an improved method for the reduction of fracture of the neck of the femur.

Another object of my invention is to provide an improved method of reduction and immobilization of fracture of the neck of a femur.

Still another object of my invention is to provide improved means adapted to be positioned interiorly of the neck of the femur and arranged to afford maximum support for the bone elements adjacent the fracture.

Yet another object of my invention is to provide improved means insertable through the neck of the femur and arranged so that a direct force can be exerted longitudinally of the axis of the neck, whereby the parts adjacent the fracture can be pulled together and maintained in the desired position.

A further object of my invention is to provide improved means for supporting and maintaining the bone elements adjacent the fracture in correct relative anatomical relationship prior to and during fixation thereof.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements, comprising my invention, may be varied in construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying drawing means for carrying the same into practical effect, without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

In the drawing:

Figure 1 is a perspective view of a bolt, and guide members, the upper portion of the femur being shown in dotted outline.

Fig. 2 is an elevational view, partly in section, showing the position of the bolt in the initial or starting position; and

Fig. 3 is an elevational view, showing the bolt in the seated position.

Referring to the drawing and more particularly to Fig. 1, the improved means adapted for use in the reduction and immobilization of fracture of the neck of a femur comprises, a bolt designated generally by numeral 1, having a body portion formed with a head member 2 and a reduced tapered end portion 3. Between the head and tapered end, the body is formed with a threaded portion, the individual threads 4 being cut so that the edges 5 thereof are comparatively thin and sharp. As will be seen in Fig. 2, the bolt 1 is also provided with a longitudinal opening or passage 6, adapted to receive a rigid element in the form of a pin 7, the purpose and function of which will be described more fully hereinafter.

The upper portion of the femur, as shown in Figs. 1 and 2, comprises a rounded head 8, a restricted portion or neck 9, the base 10 of which lies adjacent the greater and lesser trochanters 11 and 12 respectively, and a shaft 13, having a lower end adapted to articulate with the tibia and patella. As heretofore pointed out, fractures of the femur usually occur in the restricted portion 9, for example as at 14, in a plane which is substantially transverse of the axis of the neck. While the present invention is particularly adapted for use in connection with the fixation of fractures of the character disclosed, it also comprehends reduction and immobilization of fractures of the neck which occur in planes at different angles to the axis of the neck.

When it is desired to reduce a fracture of the neck of a femur, in accordance with the present invention, the bone elements adjacent a fracture are positioned in correct anatomical relationship and a passage is bored through the upper portion of shaft 13, substantially centrally of the neck 9, the passage terminating in the rounded head 8. Pin member 7, is then inserted into the passage thus bored and the elements of the bone are examined, as by X-ray, to determine whether or not they are in the desired position. If the inclination of the bore is found to be in the proper direction relatively to the head and neck, a second passage substantially parallel to the first is bored through the upper shaft and neck, the second passage also terminating in the rounded head. A pin member 7' similar to pin 7, is then inserted in this passage, as shown in Fig. 2.

After pins 7-7' have been placed in seated position, the diameter of the passage which accommodates pin 7 is increased, as by reaming, using a reamer provided with an axial passage of sufficient diameter to permit pin 7 to pass freely through the reamer. It will thus be noted that reaming is effected while pin 7 is in position, and that this pin cooperates with pin 7' to inhibit or prevent rotative movement of the head with respect to the neck, during the reaming operation. Bolt member 1, is thereafter introduced into the opening of the enlarged passage, the end of pin 7 exteriorly of the shaft being inserted in passage 6 forming axially of the bolt. Rotation of the bolt may be effected by means of a suitable wrench or other tool adapted to engage with the head member 2, the bolt being advanced so that the head thereof contacts with the upper portion of the shaft 13. At this point, the end 3 of the bolt as entered well into the compact bone area of the head and further rotation of the bolt

causes the head to be drawn axially of the neck, whereby the bone elements adjacent the fracture 14 are forced tightly together and maintained in fixed position. It will be noted that during the above described operation, pins 7 and 7' are seated in the respective passages and any rotative movement of the head 8 with respect to the neck is thus prevented. When the bolt is in the seated position, that is to say, after it has been turned down so that the parts are drawn tightly together, pins 7 and 7' are removed.

By reasons of the design of threads 4, and more particularly due to the spacing, pitch and formation of crests which are thin and sharp, considerable force can be exerted axially of the neck of the femur to pull the bone elements together, since the threads have a considerable contact area throughout the bone. The material from which the bolt is made should, of course, be of a non-corrosive character because of the environment in which it is used. In addition to being non-corrosive, the material selected should be ductible, free from oxidation and electrolysis, and have considerable strength. A chromium-nickel-molybdenum steel, for example, 18% chromium, 8% nickel and 2.3% molybdenum, is particularly adapted for use in making the bolts, since this material possesses all of the above mentioned desirable required characteristics.

It will thus be appreciated that I have provided an improved method and means for reducing fractures of the neck of the femur, wherein the bone elements adjacent the fracture are temporarily supported and inhibited against rotative movement prior to and during insertion of the means used for fixation of the fracture. The present invention also comprehends the novel concept of using rigid elements in the form of pins or the like for preventing rotative movement of the bone elements, the pins being adapted to be withdrawn after fixation has been effected.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

What I claim is:

1. The method of reducing fracture of the neck of a femur comprising positioning the bone elements adjacent the fracture in correct anatomical relationship, boring a hole through the upper shaft portion axially of the neck and terminating in the head portion, boring a second hole through said bone elements substantially parallel to said first hole, inserting into said holes rigid pin members, the pins cooperating to prevent relative rotation of the head with respect to the neck increasing the diameter of the hole bored axially of the neck while the pin is seated therein, inserting a cannulated screw having relatively deep threads formed with thin sharp crests into the first hole in telescopic relationship with the pin to affix the head to the neck and thereafter withdrawing said pins.

2. A lag screw for use in the reduction and immobilization of fracture of the femur comprising a body portion having a passage longitudinally thereof, said body being formed with a head member and a reduced end portion, a plurality of relatively deep threads formed in the body between the head and end portion the distance

between threads being $\frac{1}{8}$ of an inch, said threads having thin sharp crests.

3. A lag screw for use in the reduction and immobilization of fracture of the femur comprising a body portion having a passage longitudinally thereof, said body being formed with a substantially flat head member and a tapered end portion, a plurality of relatively deep threads cut at 8 threads per inch in the body between the head and tapered end, said threads having thin sharp crests. .

4. The method of reducing fracture of the neck of a femur comprising positioning the bone elements adjacent the fracture in correct anatomical relationship, forming a passage through the upper shaft portion axially of the neck and termi-

nating in the head portion, forming a second passage through said bone elements substantially parallel to said first mentioned passage, inserting into said passages rigid elements, the elements cooperating to prevent a relative rotation of the head with respect to the neck, increasing the diameter of the passage formed axially of the neck while the rigid element is seated therein, inserting a cannulated screw having relatively deep threads formed with thin sharp crests into the first passage concentric therewith and in telescopic relationship with the rigid element to affix the head to the neck and thereafterwards withdrawing said rigid elements.

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