Dec. 16, 1952 H. BRIGGS 2,621,653

FRACTURE REDUCING DEVICE

Filed April 29, 1949 2 SHEETS—SHEET 1

Fig. 1.

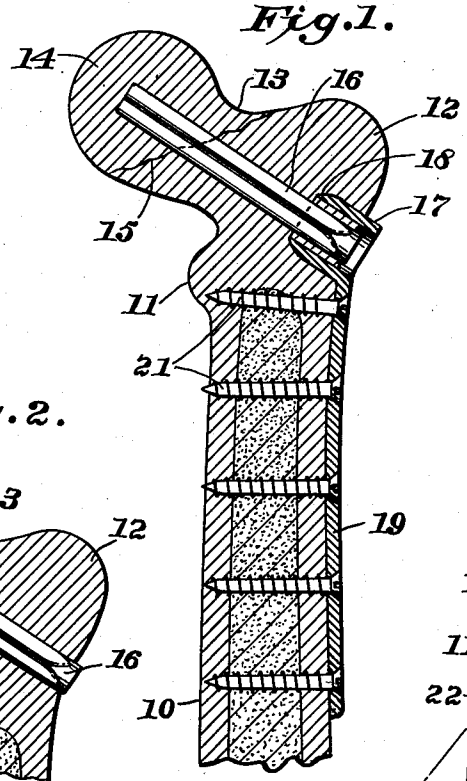


Fig. 2.

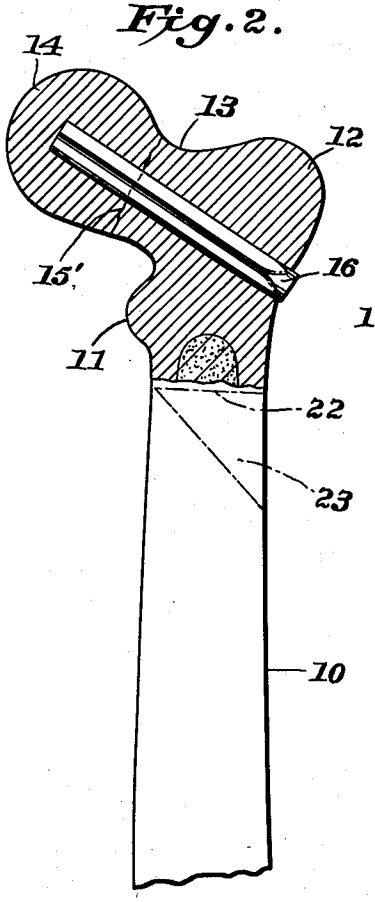
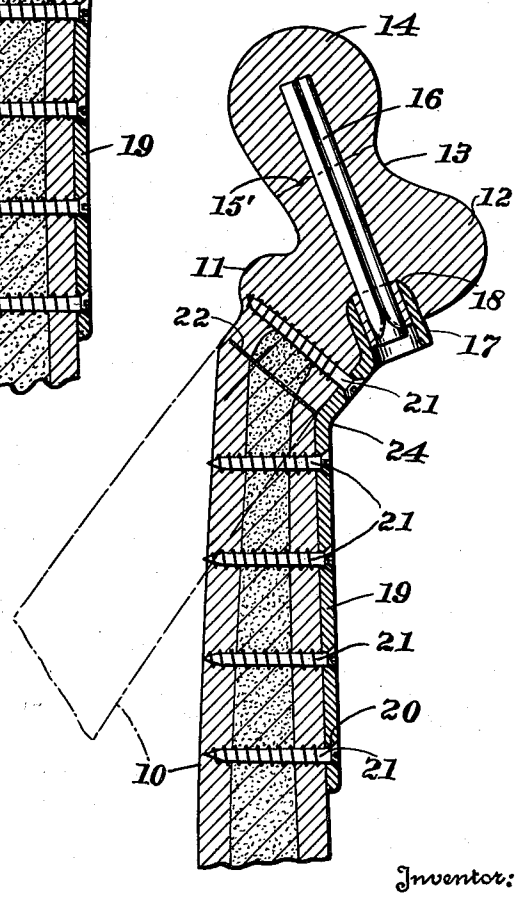


Fig. 3.



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Filed April 29, 1949 2 SHEETS—SHEET 2

Fig. 4.

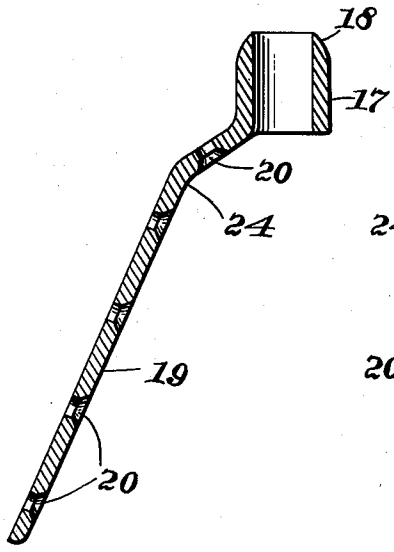


Fig. 5.

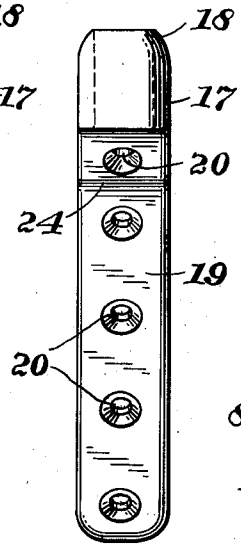


Fig. 7.

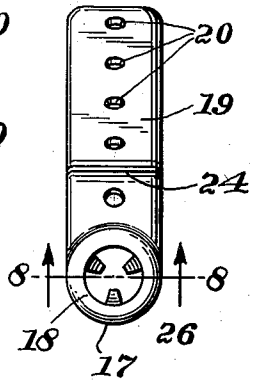


Fig. 6.

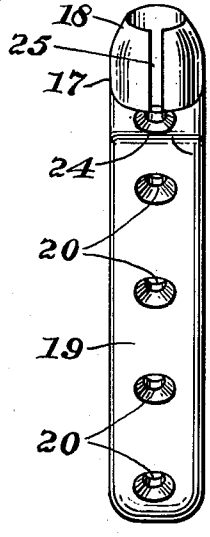


Fig. 9.

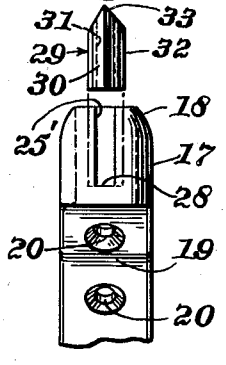


Fig. 8.

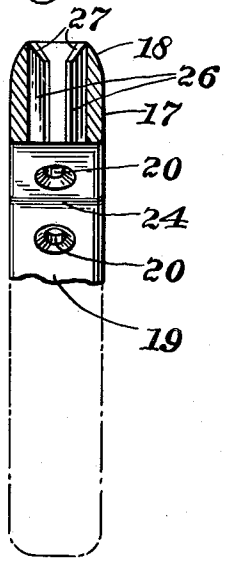
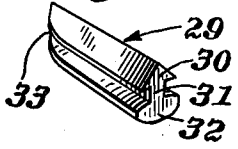


Fig. 10.



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UNITED STATES PATENT OFFICE

2,621,653

FRACTURE REDUCING DEVICE

Henry Briggs, East Orange, N. J.

Application April 29, 1949, Serial No. 90,337

2 Claims. (Cl. 128—92)

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This invention relates to a device and method to be used in the treatment of fractures of the hip, particularly in the treatment of intracapsular and intertrochanteric fractures of the neck of the femur.

Fractures of the neck of the femur are commonly treated by bringing the separated parts together by reduction of the fracture, and then maintaining the reduction by inserting a pin or nail through the distal fragment into the proximal fragment or head of the femur. A device commonly employed for this purpose is a multifinned nail known as a "Smith-Peterson" nail. The nail is inserted by varying operative techniques, and by the use of varying assisting devices. Union of the bony fragments is then awaited. Unfortunately, in an appreciable proportion of cases the neck of the femur, on one or both sides of the fracture line, undergoes absorption, and no bony union occurs. Many times, however, when a nail such as the "Smith-Peterson" nail is employed, as absorption of the bone at the fracture line takes place, the distal fragment slides up the nail, whereby the fragments remain together, and finally bony union takes place.

Experience has shown that this desired result occurs much more frequently in cases wherein the fracture line happens to be in a plane substantially transverse to the shaft of the femur. Conversely, it has been found that in the case of vertical fractures, that is, in cases wherein the fracture lies in a plane substantially parallel to the shaft of the femur, upon the occurrence of absorption the nail frequently becomes loose, and bony union does not take place. It has been found beneficial to convert a fracture of the vertical type into one more nearly transverse. This may be accomplished by transecting the shaft of the femur through or just below the lesser trochanter, and removing a wedge-shaped portion of the femur, by this osteotomy changing the angular relationship of the proximal part of the femur, including the trochanter areas of the neck and head of the femur, to the shaft of the femur distal to the transection.

It is an object of the present invention to provide a device to slidably retain and guide a fracture reducing nail.

It is a further object of this invention to provide a fracture reducing device adapted to retain and guide a "Smith-Peterson" nail.

A further object is to provide a device adapted to assist in the reduction of intertrochanteric fractures of the neck of the femur.

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Another object is to provide a device for simultaneously reducing multiple fractures of the neck of the femur.

A particular object of this invention is the provision of a device adapted to reduce a trochanteric osteotomy of the shaft of the femur, and simultaneously align, position and guide an intracapsular fracture reducing device.

Another object is to provide a method whereby the angular disposition of fractures of the neck of the femur may be altered, to facilitate the union thereof.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention and the novel features thereof may best be made clear from the following description and the accompanying drawings, in which:

Figure 1 is a sectional view of a fractured femur immobilized by a "Smith-Peterson" nail, illustrating the relationship of my device thereto;

Figure 2 is a sectional view corresponding generally to that of Figure 1, illustrating, however, a fracture of different angular relationship;

Figure 3 is a sectional view of a femur fractured as in Figure 2, showing the effect of a subtrochanteric osteotomy thereon, and the manner of employment of an exemplary embodiment of my invention in connection therewith;

Figure 4 is a longitudinal section through the exemplary embodiment of my invention;

Figure 5 is an end elevational view of the device of Figure 4;

Figure 6 is an end elevational view of the device of Figure 4, modified by the provision of a longitudinal slot in the tubular end portion thereof;

Figure 7 is a plan view of the device of Figure 4, modified by the provision of longitudinal, internal, nail-engaging ribs in the tubular end portion thereof;

Figure 8 is a sectional view taken on the line 8—8 of Figure 7.

Figure 9 is an end elevational view of the device of Figure 4, modified by the provision of a partial longitudinal slot in the tubular end portion thereof, and a nail, engaging lug adapted for engagement by said slot, and

Figure 10 is an isometric view, somewhat enlarged, of the nail-engaging lug of Figure 9.

Referring to the drawings, in Figure 1 is shown a typical femur, comprising the shaft 10, lesser trochanter 11, greater trochanter 12, neck 13 and the head 14. A fracture line through the femur neck is indicated by the numeral 15, and the proxi-

mal fragment, comprising head 14, and the distal fragment are shown in reduced relationship, and maintained in said relationship by the nail 16. The nail 16, as shown in this illustration, is of the well known "Smith-Peterson" type, comprising a pointed shaft provided with a plurality (usually three) of longitudinal and radial fins. The head of the nail is enclosed by the tubular element 17 of the fracture reducing device of the present invention. The inner edge of the tubular element is desirably sharpened, as by the provision of the end portion 18 thereof, of reduced wall thickness. From a portion of the opposite end of the tubular element extends the elongated strap 19, provided with a plurality of spaced apertures 20, designed for the accommodation of the bone-engaging screws 21. The strap 19, it will be noted, is angulated acutely to the axis of the tubular element 17, to correspond to the angular relationship of the nail to the femur shaft. The strap may be substantially flat, as shown, or may be slightly rounded to fit the contour of the bone.

In Figure 2 is shown a fractured femur resembling that of Figure 1, similarly maintained in reduced relationship by a nail 16, the fracture line 15', however, being disposed substantially transversely of the femur neck 13, or in a plane in approximate parallelism to the femur shaft 10. It is particularly in this substantially vertical type of fracture that absorption is apt to occur, accompanied by loosening of the nail 16, whereupon bony union between the bone fragments does not take place. In fractures of the type shown in Figure 1 and indicated by the line 15, it has been found that upon the occurrence of absorption the distal fragment very frequently slides up the nail, whereby the fragments remain in juxtaposition, and finally bony union takes place.

According to the present invention, a fracture of the type indicated by the line 15' may be converted into one more nearly transverse of the femur shaft by transecting the shaft of the femur through or just below the lesser trochanter, as along the line 22 of Figure 2, and removing from the femur shaft a wedge-shaped portion of bone as indicated by the numeral 23 in Figure 2. By this osteotomy, the angular relationship of the proximal portion of the femur in relation to the femur shaft is changed, and similarly the angulation of the fracture line 15' relative to the femur shaft is altered, so as to be more nearly transverse thereof. In this manner, a fracture of the type shown in Figure 2 is converted into a fracture of the type shown in Figure 1, and, upon the occurrence of absorption, the distal fragment slides up the nail, whereby the fragments are maintained in adjacency until bony union takes place.

The device of my invention is particularly adapted to assist in the reduction of fractures of the vertical or transverse type. As shown in Figure 3, the strap 19 thereof may be bent as at 24, the bend 24 corresponding substantially to the angular rotation of the femur head occasioned by the osteotomy above described. Desirably, at least one of the apertures 20 in the strap is positioned immediately adjacent the tubular element 17, so that by suitably selecting the transection line 22 relative to the point where the nail is inserted, the aperture adjacent the tubular element may be positioned for the accommodation of a screw 21 inserted into the proximal part of the femur head, relative to the line of transection. In this way, the proximal segment of the femur made by the osteotomy is more securely held in juxtaposition to the distal fragment.

Details of the fracture reducing device are best shown in Figures 4 and 5, wherein it will be seen that the end portion 18 of the tubular element 17 is suitably sharpened, to facilitate driving of the tubular element into the bone. As shown, this is conveniently effected by sloping the outer wall of the tubular element inwardly toward the smooth inner wall thereof, although it will be recognized that the inner wall may be sloped outwardly, or both walls sloped so as to converge. It will be readily understood, further, that the reduced end configuration of the tubular element effects a strong gripping action on the bone when the element is inserted. To further enhance the gripping action of the tubular element in the bone, the tubular element may be provided with a longitudinal slot 25, as shown in Figure 6. The slot 25, it will be readily understood, permits the tubular element to function as a spring, the element being compressed on insertion and tending to spread laterally when in place.

If, as is desirable, upon the occurrence of absorption the distal fragment is to be permitted to slide up the nail whereby the fragments remain together until union takes place, the head of the nail must necessarily emerge from the distal fragment. It is to be particularly noted that the inner diameter of the tubular element 17 of the present invention is sufficiently large to permit the nail to slide easily therethrough. Thus, it will be seen that while a portion of the nail is enclosed and guided by the tubular element of the device, and restrained from lateral movement, the nail is not engaged thereby, and longitudinal movement of the nail outwardly therethrough may take place without restraint.

As previously stated, upon the occurrence of bone absorption, the nail is prone to loosen in the bone fragments, permitting occasionally, by loosening of the nail in the distal fragment, rotation of the proximal fragment relative thereto. To prevent this occurrence, the tubular element 17 may be provided with the longitudinal internal ribs 26, adapted in number and angular spacing to retain between them the ribs of the "Smith-Peterson" nail. These ribs are shown in Figures 7 and 8, wherein is shown also the inwardly sloping end portions 27 thereof, which may be provided to facilitate entry of the end portion 18 of the tubular element into the bone. The ribs need not extend the entire length of the tube, but may be formed as relatively short lugs or projections, and confined to the reduced end portion of the tubular element, in order to accommodate behind them the head of the nail.

A further modification of the device of my invention is shown in Figure 9, wherein the slot 25' extends from the end portion 18 of the tubular element rearwardly to the end wall 28, which is desirably positioned to define a slot of length approximately three-quarters that of the tubular element. The partial slot 25' is particularly adapted to engage an insertable lug, such as the nail-engaging lug, indicated generally as 29. The lug 29 comprises a bone-engaging portion 30, preferably of triangular cross-sectional shape as shown, the slot-engaging neck portion 31, and the enlarged nail-engaging portion 32, shaped to correspond generally to the space between adjacent fins of a "Smith-Peterson" nail. The lug 29 may also be provided with a sharpened end 33, to facilitate entry of the lug into the bone. In Figure 9, the lug 29 is shown in position for engage-

ment with the slot 25' of the tubular element, and the engaged relationship thereof is indicated by the projection lines. The entire device of the invention is desirably made of stainless steel, of a quality that can be bent with instruments.

In the utilization of the device, an incision is made from the greater trochanter paralleling the shaft of the femur down to the bone. When the optimum positioning of the nail and the angle at which it should be driven have been determined, the nail may then be driven into the femur below the greater trochanter, through the neck of the femur and into the head. The device of the present invention may then be bent at 24, to provide the necessary angular configuration, and the tubular element 17 driven into the bone about the head of the nail. The screws 21 are then inserted through the strap into the bone and the fracture reducing device thereby positioned and secured. If desired, as an intermediate step in this procedure, the femur may be transected as above described, the bone portion 23 removed therefrom, and the device applied as shown in Figure 3. In this position, it will be readily recognized, the device serves not only to retain and guide the head of the nail 16, but also to maintain the transected portion of the femur in reduced relationship with the femur shaft. In some cases, it may be desirable to emplace the device of this invention by driving and screwing before insertion of the nail 16. In employing the modification of Figure 8, the fracture reducing device must necessarily be first emplaced.

In employing the modification of Figure 9, the nail may first be driven until the head end thereof is only slightly protruding. A lug 29 may then be positioned adjacent thereto, with the end 33 next to the bone and the enlarged portion 32 thereof between adjacent fins of the nail. The tubular element 17 of the fracture reducing device may then be passed over the head of the nail, and the slot 25' thereof manipulated into engagement with the neck portion 31 of the lug. So engaged, it will be evident that the lug is restrained by the tubular element from all movement except in a direction longitudinal of the element. The fracture reducing device and lug may then be driven into the bone simultaneously, the blunt end of the lug entering the slot 25' until engaged by the end wall 28 thereof. When the fracture reducing device and lug are in place, the nail may be driven further, if desired. In this manner, a nail already driven may be engaged by and restrained from rotation by my device when applied, without in any way preventing subsequent emergence of the nail head therethrough.

It will thus be seen that there have been provided by this invention a structure and method in which the various objects hereinbefore set forth, together with many practical advantages, are successfully achieved. As various possible embodiments may be made of the mechanical features and method steps of the above invention, all without departing from the scope thereof, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

I claim:

1. In a device for use with a fracture nail having circumferentially spaced radial fins, a member for retaining said nail when the nail has been inserted into a fractured bone, said member including a tubular portion having a longitudinally extending slot, a lug slidably mounted in said slot and having an inwardly projecting portion arranged to engage a fin of the nail so as to prevent rotation thereof.

2. In a device for use with a fracture nail having circumferentially spaced radial fins, a member for retaining said nail when the nail has been inserted into a fractured bone, said member including a tubular portion having a slot extending longitudinally from one end inwardly a predetermined distance, a lug slidably mounted in said slot and having a bone engaging portion extending outwardly therefrom, and said lug having a nail engaging portion extending inwardly from the slot and arranged to engage a fin of the nail to prevent rotation thereof.

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