May 27, 1941. F. E. DE G. MOREIRA 2,243,717

SURGICAL DEVICE

Filed Nov. 2, 1938

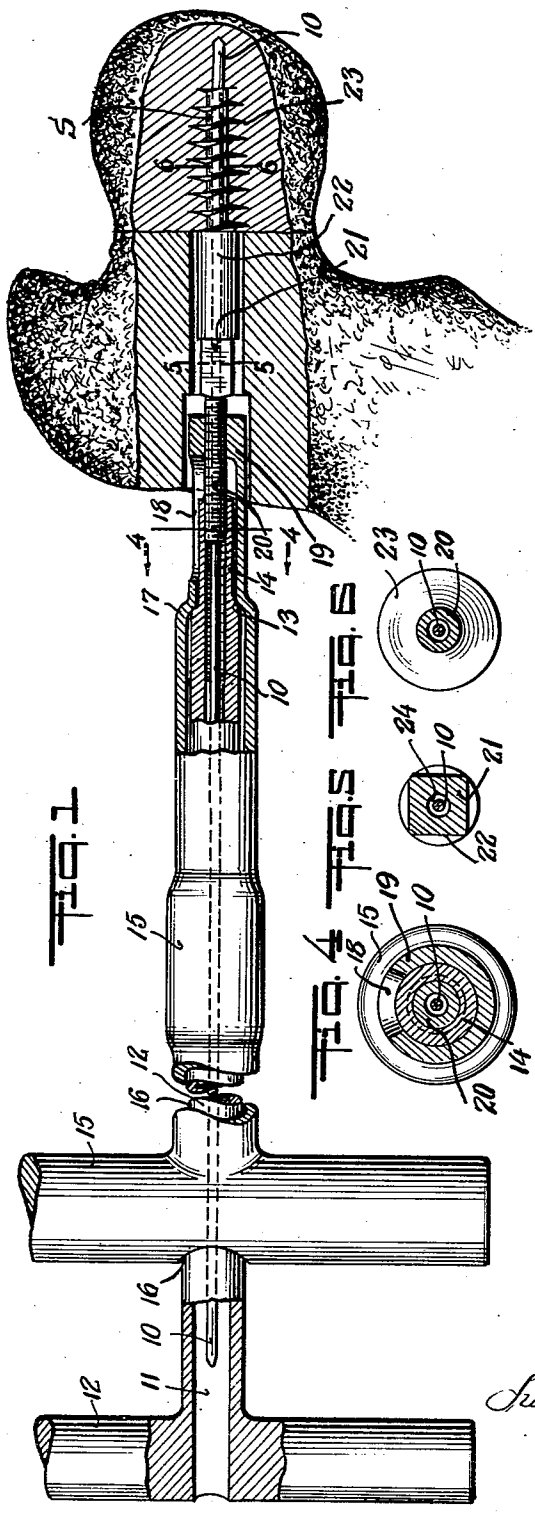

FIG. 1

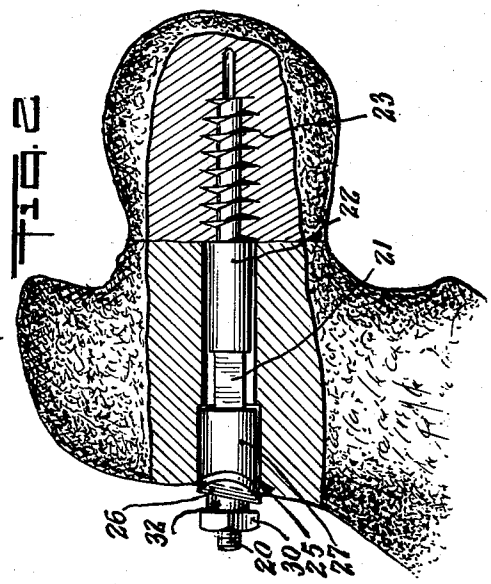

FIG. 2

FIG. 5

FIG. 4

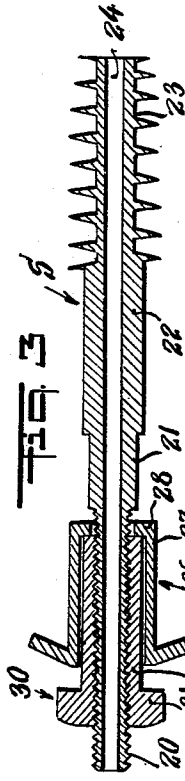

FIG. 3

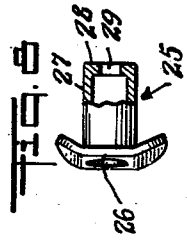

FIG. 6

FIG. 7

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SURGICAL DEVICE

Francisco Elias de Godoy Moreira, Sao Paulo, Brazil

Application November 2, 1938, Serial No. 238,404
In Brazil September 20, 1938

3 Claims. (Cl. 128—92)

My invention relates to surgical instruments and more particularly to an apparatus for treating bone fractures.

The fracture of some bones in the body, particularly in older people, is very often unresponsive to treatment that involves merely reducing the fracture and maintaining it thus for some time in anticipation of the bones knitting. In addition to merely maintaining the broken parts in proper contact, it is often necessary and even essential that the parts be brought into extremely intimate contact by the application of pressure. The femur, or hip bone, is the most prominent member of the class of bones abovementioned and the present application will concern itself chiefly with the fracture of the neck of the femur and its treatment by the application of pressure to draw the head of the femur toward the trochanter or upper portion of the shaft, and to maintain it fixed in its proper position.

One of the objects of my invention is to provide a novel type of fixing member, in the form of a screw particularly adaptable for the treatment of the condition above outlined.

Another object of my invention is to provide in combination with such a screw, a novel form of nut and clamp to contribute to the firm grip of the screw in the bone and to prevent displacement of the screw when the nut and clamp are tightened thereon.

Another object of my invention is to provide a wrench for driving the screw into the bone, the wrench being such that the disengaging of the wrench from the screw is not attended by the displacement of the screw from its bed.

Other objects of my invention will be obvious from the following description it being understood that the above general statement of the objects of my invention is intended to explain and not to limit it in any manner.

Fig. 1 is a side view, partly in section illustrating the action of the wrench.

Fig. 2 is a side view of the bone screw as it appears at the completion of the operation.

Fig. 3 is a longitudinal section through the screw, clamp and nut in the relation shown in Fig. 2.

Fig. 4 is a section on line 4—4 of Fig. 1.

Fig. 5 is a section on line 5—5 of Fig. 1.

Fig. 6 is a section on line 6—6 of Fig. 1.

Fig. 7 is a side view of the nut partly broken away.

Fig. 8 is a side view of the clamp partly broken away.

In the drawing 10 represents a guide wire, known in the art as a Kirschner wire, which guide wire is located in the bore 11 of inner wrench member 12. The inner wrench 12 is formed with a shoulder 13 a short distance from its end and is internally threaded along its neck 14.

The outer wrench member 15 is formed with a longitudinal bore 16 which is adapted to house the inner wrench 12 as shown in Fig. 1. The outer wrench 15 has a shoulder 17 formed near its end and has a slot 18 formed in its neck 19. The neck 19 is internally threaded along a portion thereof to accommodate the externally threaded end portion 20 of the bone screw S.

The bone screw S comprises the threaded end 20, the square shaft 21, the round shaft 22 and the screw portion 23. The screw portion 23 is formed of threads of very high pitch as shown and which are almost razor-sharp, the said threads being specially and individually sharpened after the screw has been formed by the usual machine methods. The bone-screw S is likewise provided with a longitudinal bore 24 to accommodate the guide wire 10.

As shown in Fig. 2 and Fig. 8 the clamp 25 is formed with a head 26 and skirt 27. The head 26 is somewhat rounded and obliquely disposed in relation to the skirt 27 in order to conform to the contour of the periphery of the shaft but it may be shaped so as to fit other portions of the trochanter or shaft depending on where the bone screw has been inserted, and the bone contour peculiar to the patient being operated on. The skirt 27 is turned in at the base of the clamp to form the flange 28. The bore 29 accommodates the threaded end 20 of the bone screw which in turn houses a portion of the guide wire 10.

The nut 30 comprises a head 31 and a hollow, internally threaded shank 32. It will be noted, as in Fig. 3, that the shank 32 is slightly longer than the skirt 27 of clamp 25 so that pressure is exerted on the clamp without the necessity of contact with the head 26 thereof, the shank 32 bearing against the flange 28. It will also be noted in Fig. 3 that the periphery of shank 32 is slightly spaced from the inner periphery of skirt 27 when the parts are in assembled relation.

My invention is practiced in the following manner:

After anesthesia and the incision having been made in the body of the patient being operated upon, the femur is exposed, the fracture having

been previously reduced by suitable means well known in the art.

After determining the site that the bone screw will occupy depending on the location of fracture and other facts which are known to the surgeon, the guide or Kirschner wire 10 is introduced thereat and inserted into the shaft, through the center of the neck and into the head or ball of the femur. This practice is standard and requires no explanation of its procedure. When the guide wire 10 has been thus inserted it should be tapped with a mallet so as to firmly lodge it in the spongy bone of the head of the femur.

A drill having a longitudinal bore formed therethrough is introduced over the guide wire and the channel for receiving the bone screw is drilled through the femur, the channel being shaped according to the particular parts of the bone screw S which will thereafter occupy it. A drill driven by an electric motor is utilized for this purpose. Neither the drill nor the motor is shown or claimed herein, comprising as they do the subject of a separate application.

The threaded end 20 of the bone screw is inserted in the neck 19 of the outer wrench 15 and given a few turns in the threaded portion thereof so that about ¼ inch of the bone screw is visible through the slot 18. The inner wrench 12 is then inserted into the bore 16 of wrench 15 and being turned clockwise is caused to engage the threaded end 20 by its neck 14. When this has been accomplished, the turning of the inner wrench 12 will cause it to proceed along the threaded end 20 as a follower proceeds upon a rotating screw. This action, however, can only occur until the shoulder 13 of inner wrench 12 meets the shoulder 17 of outer wrench 15. At this point, the inner wrench 12 can travel no further so that further turning tends to draw the bone-screw up into the inner wrench. However, this action is resisted by the grip that the internally threaded neck 19 maintains on the threaded portion 20 of the screw. As a result, the bone-screw is locked in the wrench members which only now functions as a true wrench, that is, there is no relative movement between the wrench members and the scew. This condition must remain as long as the shoulder 13 abuts the shoulder 17.

Screw portion 23 of the bone-screw S is then inserted over the guide wire 10 and into the channel formed by the drill and when it reaches the head of the femur, it is driven home, the sharp threads and high pitched threads thereof biting into the spongy bone and anchoring the bone-screw thereat. As shown in Fig. 1, the neck 19 of the outer wrench member 15 may be caused to enter the channel formed in the femur and the slot 18 is effective to apprise the surgeon as to the distance that the bone-screw S has been driven into the femur.

I have found that a frequent cause of post-operative failure of the fixing member has been due to the displacement of the screw which attends the disengagement of the wrench. Similarly, such a force is instrumental in moving the head or ball of the femur and destroying the reduction theretofore accomplished. Of course, if a slotted screw is used, this cannot occur but a slotted screw is inferior to one that is provided with a nut and clamp. When a threaded lug wrench is used, as is preferable, the screw or lug has a tendency to turn in its seat unless it is very firmly anchored and usually the more firmly anchored that it is, the tighter is the grip maintained by the wrench so that the force used in disengaging it, either loosens the screw, or, as is more probable, causes the head of the femur to turn, whereby the reduction is impaired.

In my invention, however, as noted above, the bone-screw is constrained to turn with the wrench members only because of the resistance of the internally threaded neck of the outer wrench member 15 to the pull exercised on the bone-screw by the inner wrench member 12. When, therefore, the inner wrench 12 is turned counter-clockwise, there is practically no similar force exerted on the bone-screw except a very slight force necessary to cause the shoulders of the wrench members to separate. However, it is so slight as to have no effect on the bone-screw. When the shoulders have been separated and the neck 14 has been disengaged from the threaded portion 20, the outer wrench member 15 is most easily disengaged from the bone-screw, since only the pull of the bone-screw occasioned by the meeting of the shoulders created any resistance to relative movement. The pull no longer being present, the disengagement is most easily effected.

The bone-screw S is now firmly anchored in the head or ball of the femur and the proper reduction has not been disturbed. It will be noted that the screw threads 23 occupy a relatively small portion of the screw, this feature being important in that fractures in different parts of the neck of the femur can be accommodated since the said threads should not traverse the point of fracture. The very sharp and high-pitched threads are peculiarly adaptable to the spongy bone found in the head of the femur and thus compensate for the shortness of the length of said screw threaded portion.

The guide wire 10 is now withdrawn and the clamp 25 is applied to the threaded end 20 of the bone-screw S. I prefer to supply various types of clamps 25 so that the heads 26 thereof can conform to the contour of the periphery of the bone. For example, were the screw to be inserted at the base of the trochanter, the head 26 would be set at the proper angle in relation to the skirt 27.

The nut 30 is caused to engage the threaded end 20 and it will be noted that should the bone-screw be slightly short it can nevertheless be engaged by the shank 32.

Referring to Fig. 2, the head 26 of the clamp 25 does not lie in a plane parallel to that of the head 31 of nut 30 due to the angular disposition of the head 26. It is obvious therefore that were the nut 30 tightened by causing it to bear against the head 26, such pressure would be concentrated on one point on the periphery of the head 26, requiring great force to tighten it, such force having a tendency to turn the bone-screw in the direction taken by the nut 30. The dangers of such turning have been hereinbefore pointed out. It will be noted, however, in the present construction, that the heads of the nut and clamp cannot come into contact since the shank 32 of the nut 30, when screwed down, meets the flange 28 of clamp 25 flush and the nut can no longer descend relative to the clamp. Thus the pressure of tightening on the clamp 25 is uniform. While this process is referred to as "tightening the nut" in effect the net result is to draw the fractured parts into closer contact so that healing is expedited.

The space between the outer periphery of the shank 32 and the inner periphery of the clamp 25 is effective in permitting the clamp 25 to be held otherwise than perfectly parallel with the bone-screw so that the clamp 25 can conform

to slight irregularities in the channel drilled for the bone-screw without creating a pressure against said bone-screw.

Should it ever be necessary to remove the bone-screw and if the threaded end 20 of the bone-screw S has become stripped due to different conditions existing in the bone, such removal would be practically impossible and for that reason I have provided the square shaft portion 21 which can be engaged by a wrench. The bone-screw is preferably of a high quality stainless steel.

I have shown a preferred embodiment of my invention but it is obvious that numerous changes and omissions may be made without departing from its spirit.

I claim:

1. The combination with a bone-screw of a clamp and nut, said clamp having a flange formed thereon, said nut having a depending shank adapted to bear against the flange of said clamp.

2. The combination with a bone-screw, of a clamp having a shoulder and a skirt formed integral therewith, a flange formed on said skirt, a nut having a head and a depending shank, said shank being longer than said skirt of said clamp, said shank being adapted to bear against said flange of said skirt when the parts are in assembled and operative relation, whereby the shoulder of said clamp and the head of said shank are maintained spaced from each other.

3. The combination with a bone-screw, of a clamp having a depending skirt, a flange formed on said skirt, a nut having a depending shank adapted to bear against said flange, the outer diameter of said shank being less than the inner diameter of said skirt whereby said nut may have relative lateral movement in respect to said clamp when the parts are being assembled.

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