June 21, 1938. P. G. E. HANICKE 2,121,193

FRACTURE CLAMPING APPARATUS

Original Filed Dec. 21, 1932 2 Sheets-Sheet 1

Fig. 6.

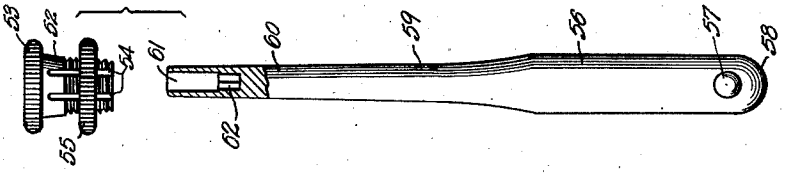


Fig. 7.

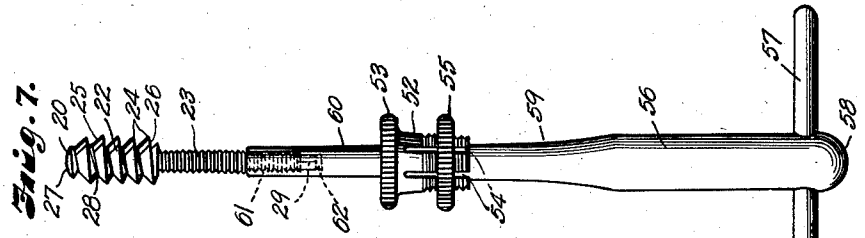


Fig. 2.

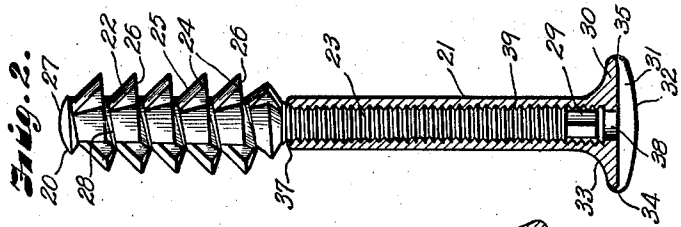


Fig. 5.

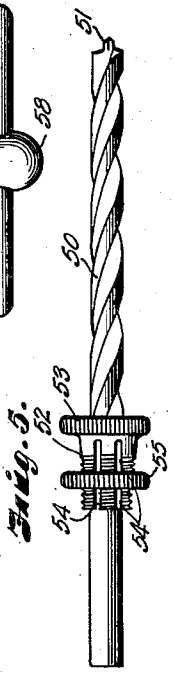


Fig. 1.

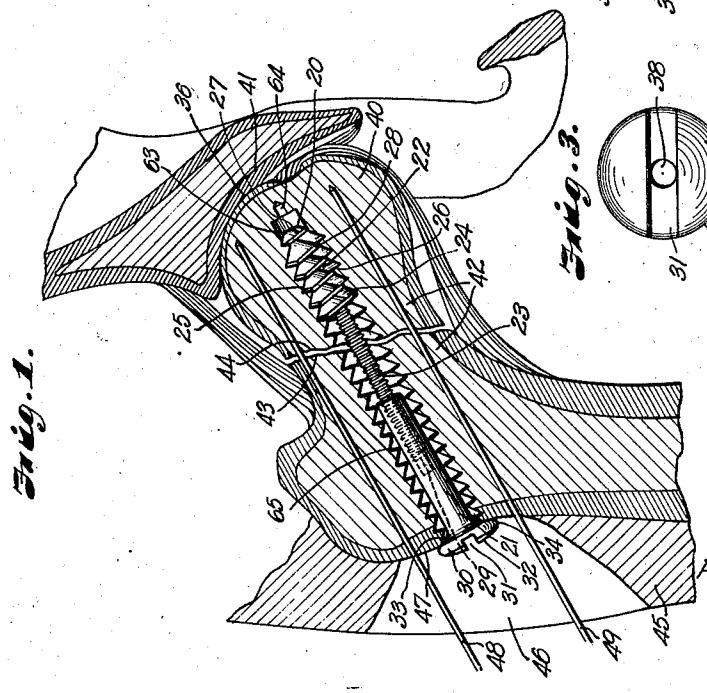
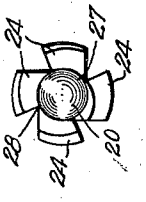


Fig. 3.

Fig. 4.



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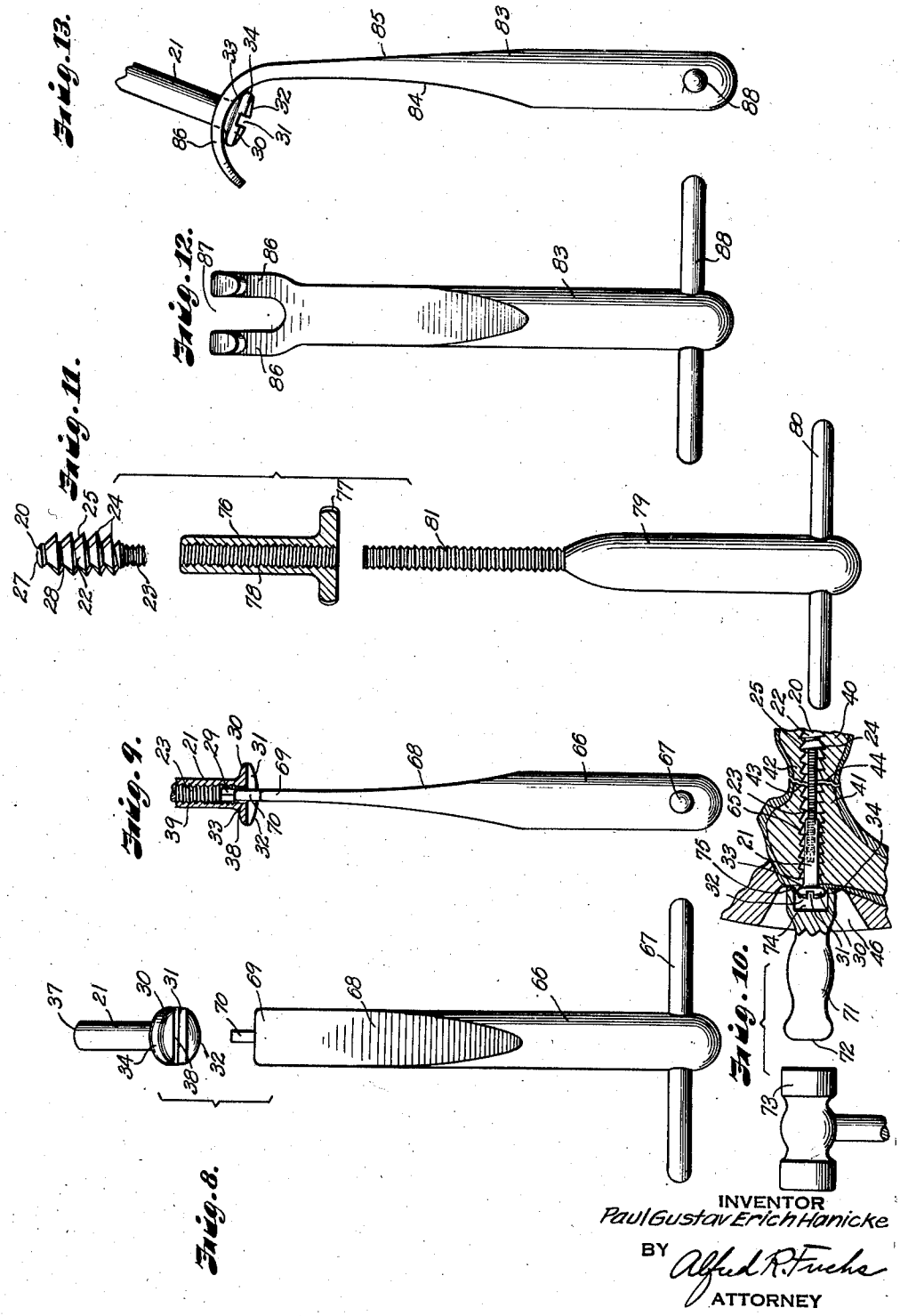
June 21, 1938. P. G. E. HANICKE 2,121,193

FRACTURE CLAMPING APPARATUS

Original Filed Dec. 21, 1932 2 Sheets-Sheet 2



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Patented June 21, 1938 2,121,193

UNITED STATES PATENT OFFICE

2,121,193

FRACTURE CLAMPING APPARATUS

Paul Gustav Erich Hanicke, Kansas City, Mo.

Application December 21, 1932, Serial No. 648,225
Renewed October 27, 1937

15 Claims. (Cl. 128—92)

My invention relates to apparatus for fixing reduced fractures of bones, and a new and improved method of fixing fractures of the neck of the femur or upper human leg bone.

The surgical neck of the femur being a rather weak connection between the shaft of the femur and the head portion thereof, which articulates with the acetabulum forming the hip joint, is subject to frequent and dangerous strains and shocks due to sudden falls or other sudden jerks to the hips. In elderly or old persons such sudden shocks or strains usually result in a fracture of the neck of the femur. This type of fracture has been treated by innumerable methods, but the results are not uniformly successful and are frequently very disappointing. The purpose of all the methods of treatment is to get a union of the fractured bone as soon as possible. This is only possible when both fracture sites are brought into close contact with each other and held firmly for a certain length of time. The proper union of the fractured bone also depends largely upon the constitution of the patient, and whether the bone cells regenerate and form new bone tissue around the fractured area. The leg has to be kept from contracting, from inward and outward rotation, as well as adduction and abduction and other dangerous movements, which usually cause complete dislocation and permanent deformity of the hip, resulting in what is known as a marked limb, etc. In order to immobilize both the hip and the leg, extensive plaster-of-Paris casts or splints or braces have been applied in previously used methods, but with a small number of good results, the possibility of any satisfactory result at all depending largely on the patient's condition. Treatment of such a fracture has also been tried by open reduction, which, due to the large incision necessary and the cutting of such a large amount of muscular tissue, as well as the method of fixation used after exposure of the bone, proves to be such a great shock to the patient as to be unsatisfactory in most cases.

It is a purpose of my invention to avoid the difficulties encountered by the previous methods, of attempting to firmly stabilize a fractured bone of the above mentioned character, by accurate means and facilities and to accomplish this without the use of the extensive plaster-of-Paris casts, and also without the necessity of a major operation causing shock to the patient and necessitating large incisions in the leg of the patient.

It is particularly a purpose of my invention to provide means for immobilizing the fractured area, that is, the head of the femur with part of the neck and the trochanteric section of the shaft with part of the neck, which means is located internally of the bone, and which is so constructed as to guarantee complete fixation and complete stabilization of the entire bone.

More particularly it is a purpose of my invention to provide a device for the internal fixation of the bones by the use of compression means, which holds them in close unity and exerts pressure on the fractured portions of the bone toward each other.

My improved apparatus also includes means to prevent rotation of the head of the femur around its axis relative to the neck of the femur to prevent separation and shifting of the fragments.

It is a further purpose of my invention to provide a device of the above mentioned character, which will permit of impaction of the bone after the compression means has been applied, and which will permit further adjustment thereof so as to press both parts of the bone tightly together after such impaction, and retain the same in such engagement for a sufficient length of time for a firm union of the parts to be accomplished.

One of the most important features of the invention is the provision of a combination anchoring device and coupling device and headed member cooperating therewith so that the anchoring member and the headed member operate to firmly clamp the parts of the bone together, said anchoring member comprising a portion having a coarse thread of steep pitch and a portion of smaller diameter than said coarsely threaded portion, having a fine thread of relatively much smaller pitch, the coarsely threaded portion being so constructed that it serves as a tap so as to provide a tapping anchoring means for threading into the bone that will be held firmly in place against axial movement after being threaded into position. By using the fine thread of much less steep pitch than the tapping anchoring portion for connecting the headed member with the anchoring member, said headed member may be threaded on the anchoring member without tending to turn the tapping anchoring portion thereof in the thread formed thereby in the bone, and thus the head of said headed member engaging the outer face of the femur at the incision will serve to draw this portion of the femur toward the head thereof to cause a close engagement between the fractured surfaces as said headed member is rotated by a

suitable tool to screw the same down on the anchoring member.

It is a further purpose of my invention to provide suitable means for preventing the turning down of the headed member on the anchoring member to too great a degree so as to cause a turning of the anchoring tapping portion of the anchoring member in the bone, and it is also a purpose of my invention to provide suitable means for limiting the turning of the anchoring member during the tapping operation beyond the point at which the thread has reached the extent it has been previously determined is the most desirable. This is determined by X-ray, and before the tapping is done an opening is drilled that will be coaxial with the thread that is subsequently tapped. The drilling means is also provided with suitable means for limiting the inward movement thereof, and my invention also contemplates the provision of suitable means for withdrawing the entire device, should the bone in which the thread is tapped be found to be of such a quality that the thread will not hold, or to remove the anchoring member after it has served its purpose, even though a break should occur in the finely threaded portion thereof, or in case such a break should occur in the finely threaded portion thereof during the operation of placing the same in position or during the operation of tightening down the threaded member thereon.

Other objects and advantages of my invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a fragmentary sectional view through the upper end portion of the femur and the ilium, showing a fracture in the neck of the femur and showing a fragmentary portion of the flesh overlying the femur in section to indicate the size of the incision necessary to carry out my improved method of fixing the fracture, and showing my improved apparatus for fixing this and other types of fractures in position.

Fig. 2 is a view partly in longitudinal section and partly in elevation of my improved clamping and compressing means.

Fig. 3 is a face view of the head portion of the headed element of said clamping means.

Fig. 4 is an end view of the anchoring element as viewed from the entering end thereof.

Fig. 5 is a side elevation of the drill and stop means therefor used in carrying out my improved method.

Fig. 6 is a view partly in elevation and partly in section of the wrench used for tapping a thread with the anchoring member and inserting the anchoring member in position in the bone, and showing the stop element separate from the wrench.

Fig. 7 is a view in side elevation showing the wrench in engagement with the tapping anchoring member in the relationship which the same assume in the thread tapping operation of placing the anchoring member in position, and showing the stop means in engagement with the wrench.

Fig. 8 is a view similar to Fig. 6 of the tool of the nature of a screw driver used for threading the headed member on the anchoring member, and also for removing the headed member from the anchoring member, showing the headed member separated from said tool.

Fig. 9 is a view showing the screw driver-like tool in elevation as viewed substantially at right angles to Fig. 8, and showing the same in engagement with the stop means on the anchoring member for rendering the tool inoperative.

Fig. 10 is a fragmentary sectional view similar to Fig. 1, showing the impacting member in operative position and the hammer used in conjunction therewith.

Fig. 11 is a view partly in elevation and partly in longitudinal section of the apparatus for removing a broken anchoring member from the bone, and showing the elements thereof comprising the removing tool and the coupling member for engagement by said tool spaced from each other and spaced from the broken anchoring member with the parts in the relative position they would assume just prior to connection with each other.

Fig. 12 is a view in side elevation of a removing tool for removing the clamping means as a unit in case the anchoring member fails to hold, and

Fig. 13 is an elevational view taken at right angles to Fig. 12, showing the removing tool in engagement with the head of the headed element diagrammatically, the headed element being partly broken away.

Referring in detail to the drawings, my improved apparatus comprises a clamping or compressing device comprising a pair of elements, which are screw-threadedly connected together. One of said elements may be referred to as an anchoring element **20**, and the other as a headed element **21**. The anchoring element comprises a combined anchoring and tap portion **22** and a threaded stem portion **23**, the threaded stem portion **23** being of materially smaller diameter than the tap or anchoring portion **22**. The tap or anchoring portion **22**, as will be evident from Fig. 4, is made up of a plurality of spaced cutter blades **24**, which are spirally arranged and which have a steep pitch, and which are also spaced a substantial distance apart so that the same will cut a coarse thread of steep pitch.

In order to leave as much of the bone as possible the forward or entering faces of the cutter blades **24** are only inclined relative to the axis of the device as indicated at **25**, while the rear faces **26** of the cutter blades are substantially perpendicular to said axis at all points, the thread thus cut being a spiral that instead of being V-shaped in cross section, as is the case with an ordinary screw thread, have a cross section that is substantially only half of a V, that is, the rear face of the thread at any cross section through the same is substantially perpendicular to the axis of the thread, while the forward face is inclined in a similar manner to that in which both of the faces of a V-shaped thread would be.

The angularity of the inclined face to the substantially perpendicular face is made as acute as it can be so as to still have sufficient strength in the metal of the tapping portion to prevent breakage thereof. This leaves a maximum thickness of the bone between each turn of the thread cut in the bone and the next adjacent turn. The entering end of the anchoring member **20** is rounded, as at **27**, to provide a reduced cutting portion thereon gradually increasing in diameter from slightly greater than the shank portion **28** of the tap to the diameter of the cutter

blades 24. The stem portion 23 is also threaded, and as shown in Figs. 1, 2 and 7, it will be noted that this stem portion is materially longer than the anchoring portion 22 that comprises the tap or thread cutting portion. It will also be noted that the stem portion 23 is screw threaded with an ordinary screw thread that is of very slight pitch and is a very fine thread providing a large number of turns on the stem portion. The stem portion at the end of the member 20 opposite that provided with the tap portion 22, has a polygonal axial projection or head 29 thereon, which is smaller in diameter than the threaded stem portion 23 and may be of any suitable shape to engage with a suitable socket of similar shape on a wrench member to be described below, which is shown as being square.

Cooperating with the anchoring member 20 is the headed member 21, which has a tubular sleeve-like body portion, which is internally threaded with a thread corresponding in size and pitch to the thread provided on the stem 23, and which has the head 30 thereon, which is provided with a transverse slot 31 therein on the outer face thereof, and which has a rounded top face 32 and a curved wall portion 33 connecting with the sleeve-like body portion of said member 21 and a rounding peripheral edge 34 joining the top face 32 and the curved portion 33 in a smooth curve so that there are no sharp projections thereon. All edges are rounded even at the points where the bottom of the slot 31 joins the peripheral wall of the head, as shown at 35. The corner 37 at the junction of the side wall of the sleeve-like portion 21 and the end edge thereof is also rounding, these edges being all rounded to prevent all possibility of injury to the patient in the use of the device. An opening 38 is provided in the headed member, running from the internally threaded opening 39 in the sleeve-like member to the slot 31 so as to provide a passage between said threaded opening 39 and said slot 31.

Referring now to Fig. 1, it will be noted that a portion of the femur and ilium of the patient having the fractured neck portion of the femur is shown therein, and some of the surrounding flesh and bone, more or less diagrammatically, to indicate the manner in which my improved apparatus is used and for the explanation of the method of fixing the fracture devised by me. In said figure the head of the femur is indicated by the numeral 40, the socket portion of the ilium in which the head 40 operates is indicated at 41, and the broken neck portion is indicated by the numeral 42, the fractured faces of the bone or sites of the fracture are indicated by the numerals 43 and 44, the tissue and flesh overlying the femur at the point where the incision is made is indicated diagrammatically at 45, and the incision is shown at 46.

In carrying out the method the patient should be placed on an operating table, a fracture table of the Albey type being preferred. Both legs are abducted as much as possible and thoroughly inverted. Care has to be taken not to be guided by toeing in of the feet alone, but the patella or knee cap points markedly toward the inner side. This places the neck of the femur in a substantially horizontal position, which is of great value in maintaining directions in the subsequent steps of the method.

Inasmuch as the entire procedure is more or less blind working and is checked only by guiding wires and X-ray pictures that are made for this purpose, accuracy is highly essential to obtain a neat and clean result. The patient is placed on an all aluminum spica box with a curved X-ray cassette holder incorporated in the crotch post. The pelvic plate of the table above referred to is lowered sufficiently to allow the X-ray pictures to be taken, when the cassette must be placed under the hip, without moving the patient. The patient should not be moved for any reason after the first X-ray and the following X-ray pictures are taken. The lateral pictures to obtain the horizontal angle of the fractured neck of the femur and its position are taken diagonally through the hip from above the crest of the ilium toward the perineum. The patient may have to be manipulated and the fracture reduced to its normal position by manipulation thereof during observation by means of the fluoroscope. Either a local or straight anaesthetic can be given. An incision of from 2 to 3 inches is made taking the gluteal ridge as a guide. Starting 1 inch below this point and ½ inch from the anterior margin of the femur a guide wire, known as a Kirchner wire, is drilled into the femur in a direct transverse plane toward the head of the femur, the length of the wire being such that it extends well into the head portion 40 and will project a substantial distance outwardly from the exposed face 47 of the femur at the incision 46, this wire being indicated by the numeral 48.

Another wire 49 of substantially the same length as the wire 48 is then drilled in a substantially parallel direction to the wire 48 at a point about 1 inch below the first wire, these wires 48 and 49 drilling their own openings in a well known manner. The wires 48 and 49 are of such length that they project about 1½ inches outwardly beyond the exposed face of the bone. A small marker may be attached to each wire to identify the same in the X-ray pictures, which are taken subsequent to the insertion of these wires. Anterior, posterior and lateral X-ray pictures are now taken. Should the wires 48 and 49 be found to be in unsatisfactory places after taking these X-ray pictures, new wires are used and the others withdrawn. The wires 48 and 49 serve as line markers and guides and as pins for temporarily fixing the head of the femur relative to the shaft thereof so as to prevent turning of the head around on its own axis when the apparatus for clamping the two parts of the fractured neck of the femur is inserted. After the exact angle of the neck and the exact location of the fracture are determined from these X-ray pictures, the length of the neck of the femur, that is from about ⅜ inch inwardly from the anterior face 36 of the head 40 to the outer face 47 of the cortex, is then measured from these pictures, the distortion being calculated carefully so that the exact length thereof is positively determined. A chart of magnification is preferably used for this purpose. In this manner the distance that the drill, which is to be used to provide the opening for the clamping apparatus, is to enter the bone can be positively determined, so that the opening that is drilled will enter sufficiently into the head of the femur to firmly anchor the apparatus in position, but will not approach dangerously close to the anterior face 36 of said head portion.

For drilling this opening or passage the drill 50 is used. This drill is an ordinary metal drill, such as is used for aluminum having a dove-tail point 51. The drill preferably is of a size to drill

a hole ¼ inch in diameter and is provided with a stop member, which is made up of a tapered sleeve-like member **52**, having a knurled flange **53** thereon, which member is slotted at a plurality of points, as indicated at **54**, and which is externally threaded to be engaged by the internal threads on the knurled nut **55**.

It will be obvious that the stop member **52** can be adjusted to any position on the drill **50** desired, and the nut **55** screwed up toward the head **53** to firmly clamp the stop member **52** in adjusted position. The stop member **52** is placed in a position on the drill **50** such that the hole drilled thereby will be of a depth $\frac{3}{16}$ of an inch greater than the distance from the outer face **47** of the femur at the incision to the extreme forward end of the tap member **20** when in final position in the bone. This adjustment is made in order that the anchoring screw or tap portion of the anchoring member **20** at its forward end or entering end **27** will not be inserted to the end of the hole.

In drilling the main hole with the drill **50** the drill is guided by the projecting wires **48** and **49**, and is directed toward the presumed location of the head of the femur as determined from the X-ray pictures. A drill with a dove-tailed center point is preferably used to prevent splintering of the bone. It may be either driven by hand or electrically, the speed preferably being about 500 revolutions per minute. The drill is pulled out gently as soon as the control stop reaches the outer face of the bone **47**.

The anchoring member **20** is next inserted in position. This is done by means of a wrench **56** having a cross piece **57** thereon serving as a handle, the handle portion being preferably made of round rod and has rounded ends, while the shank portion of the wrench **56** is also made of round rod or similar material and has a rounded end at **58**, and is gradually tapered at **59** to the diameter of the reduced forward end portion **60** thereof, which is provided with a socket **61** therein, which has a polygonal bottom portion **62** corresponding in shape to that of the head portion or projection **29** on the anchor member **20**.

The portion **60** of the shank of the wrench is made of substantially the same diameter as the drill **50** so as to be freely rotatable in the opening drilled in the bone by means of the drill **50**. The control stop **52**, previously described, is again utilized to limit the inward movement of the tap and wrench at the desired point so that the stop **52** will engage the outer face **47** of the exposed portion of the bone at the incision when the anchoring member has reached the desired final position therefor, this being determined by previous measurement, the stop being preferably set on the reduced forward portion **60** of the shank of the wrench in such a position that with the projection or head **29** seated in the polygonal bottom **62** of the socket **61** the distance from the forward face of the stop **52** to the extreme forward or entering end of the tap member on the anchoring member **20** will be slightly less, preferably about $\frac{3}{16}$ of an inch less, than the distance from the forward end of the drill to said stop member **52**.

The opening or passage drilled by the drill **50** is indicated by the numeral **63** in Fig. 1 and is of uniform size throughout, except for the small projection **64** formed at the forward end thereof or inner end thereof by the dove-tail point **51** on the drill. In inserting the anchor member **20** in the bone the anchor member **20** is pushed into the socket of the wrench and lodges itself in the polygonal portion **62** thereof firmly. This makes the anchor member and the socket wrench operate substantially as a unit, which can be handled readily with one hand. Care has to be taken to start the anchoring member **20** straight into the bone and it can be readily guided by the two guide wires, or Kirchner wires **48** and **49**, and the direction determined therefrom to maintain the correct angle for the location of the head of the femur as determined from the X-ray pictures.

The cutting teeth **24** of the tap portion of the anchoring member **20** will cut a thread in the wall of the previously drilled passage **63** in the bone, this thread being indicated by the numeral **65**. The extent of the thread tapping operation is determined by the position of the stop member **52** and the position of the anchor member **20** is also determined thereby, as the inward movement of this member and the extent of the thread cut thereby is limited by the engagement of the stop member **52** with the exposed face **47** of the bone. A screw threaded connection having thus been established between the bone and the anchoring member **20**, the wrench can be readily removed by merely pulling outwardly thereon.

The headed member or cap member **21** is next inserted. The external diameter of the tubular sleeve-like portion of the member **21** is such that it will readily pass through the opening or passage **63** made by the drill without any danger of binding, and while the thread **65** extends over the entire portion of the opening that has been drilled in which the tubular portion of the member **21** is located when in its final position, this is immaterial as far as the operation of the apparatus is concerned. The headed member **21** is inserted by hand first, making contact with the first few turns of the threaded stem portion **23** of the member **20**. This is done by hand so that the operator can feel the engagement of the threads to make sure that the internal thread on the member **21** is engaging with the external thread on the member **23**.

A tool for turning the headed member **21**, which tool is shown in Figs. 8 and 9, is next utilized. Said tool is provided with a shank portion **66**, which is substantially circular in cross section and which has a handle portion **67** also made of material substantially circular in cross section, and the ends of the handle portion **67** and of the shank portion **66** are preferably rounded in a similar manner to that of the wrench **56**. The shank portion **66** is provided with flattened converging faces **68** that form a substantially flat narrow blade portion **69** similar to that of a screw driver, from which a rounded projection **70** extends in a forward direction, the diameter of the projection **70** being slightly less than that of the opening **38** in the headed member **21**, and the thickness and width of the blade portion **68** being such as to nicely fit the slot **31** in the head **30**.

The relative position of the member **21** and the screw driver-like tool is shown in Fig. 8 just prior to insertion of the tool into engagement with the head of the member **21**. With the forward edge of the blade **68** seated in the bottom of the slot **31** and the projection **70** in the opening **38** and extending into the passage of larger diameter within the member **21** having the internal threads **39**, the tool is in position for rotation of the sleeve-like headed member **21**, and the length of the stem portion **23** and of the tubular portion of the member **21** is preferably such that the head **30** will engage the outer surface **47** of

the bone at the incision 46, considerably before the internal thread on the member 21 reaches the end of the external thread on the stem 23. Thus the head 30 will exert a clamping action to draw the surfaces or sites 43 and 44 toward each other and substantially into engagement a considerable period of time before the sleeve-like member 21 has been screwed down tight on the member 23.

Should an error be made in calculations and should the person carrying out the method tighten the sleeve-like member down on the stem 23 until it reaches substantially the limit of rotation thereon, the actual reaching of this limit of rotation is prevented due to the fact that the polygonal projection 29 on the stem 23 will reach such a position in the member 21 that it will engage with the forward projection 70 on the tool to force the same out of the slot 31, as shown in Fig. 9, so as to disengage the blade 69 of the tool from the slot 31 to warn the operator that further rotation of the sleeve-like headed member 21 must not be attempted, as such further rotation might cause the members 20 and 21 to turn together and the thread to be cut deeper than intended, possibly causing breakage of the member 20 due to the fact that the tap-like portion 22 thereof will strike the end of the drilled opening 63.

While it is possible that the two fractured surfaces 43 and 44 can be drawn into such intimate contact by means of the headed member 21 and the anchoring member 20 that no further steps may be necessary in the method of fixing the fracture, preferably the bone is impacted in the manner shown in Fig. 10. After the clamping member is in position, as shown in Fig. 1, the wires 48 and 49 are withdrawn and the impactor 71 having a head portion 72 thereon, which is adapted to be engaged by a hammer 73, and having a socket 74, which is adapted to loosely receive the head 30 of the headed member 21, is placed in the incision with the annular substantially flat face 75 thereon in engagement with the outer surface 47 of the bone, surrounding the headed member 30, and the bone is impacted by means of said impactor 71 and the hammer 73 to force the broken surfaces 43 and 44 into snug engagement. After such impacting has been done the internally screw-threaded headed member 21 is tightened up on the externally threaded member 23 of the member 20, to take up the slack thus created in the clamping means, until the head 30 is again in firm engagement with the outer surface 47 of the bone at the incision. This impacting and tightening up of the clamping member may be repeated, should it be found necessary.

This completes the operation and the clamping means remains in position for the required length of time for the surfaces 43 and 44 of the bone to knit together. The members 20 and 21 are made out of stainless steel, and the screw driver-like tool and the wrench can also be made out of stainless steel if desired, although the thing of greatest importance is that the clamping member, which remains in the bone for a considerable period of time, be made of such non-corrosive material. When the two broken portions of the neck of the femur have again firmly grown together the clamping means is removed by first unscrewing the headed member 21, after which the wrench 56 can be utilized to unscrew the screw-threaded member 20 from the screw-threaded opening in the bone by reverse rotation thereof, the screw thread being a right-handed thread so that the rotation of the tool during the thread tapping action of said member 20 is in a clockwise direction, while during the removal the rotation of the tool is in a counter-clockwise direction.

It might sometime happen that during the removal of the anchoring member 20 from the bone, or during the insertion thereof, breakage thereof occurs in the relatively small finely threaded portion 23, and in Fig. 11 such a broken member 20 is shown, together with the apparatus for removing the same from the bone, said means comprising a sleeve 76 having a knurled flange 77 on one end thereof, and having an internally screw-threaded passage 78 extending entirely therethrough, said screw-threaded passage 78 being of the same pitch and size as the thread on the externally threaded stem portion 23 of the member 20, and a wrench-like member 79 having a transversely extending handle member 80 and an externally screw-threaded elongated shank portion 81 cooperates with the sleeve-like member 76 to remove the member 20 from the bone.

The sleeve-like member 76 is turned down on the externally threaded portion 23 of the member 20 until it reaches the end of the thread on said externally threaded portion 23, which makes the sleeve-like member 76 substantially a unit with the member 20. The member 79 is then screwed down through the internally threaded portion 78 of the sleeve-like member 76 until it engages with the broken end 82 of the member 20, thus further exerting a clamping action to secure the members 79, 76 and 20 together. The member 20 can then be rotated in a direction to screw the same out of the bone by means of the handle 80 on the wrench-like member 79.

Sometimes the bone is of such a quality that a thread tapped therein will not hold the anchoring member in fixed position and when this is the case the only thing that can be done is to remove the entire device comprising the anchoring member 20 and the sleeve-like member 21. An extracting tool for this purpose is shown, which has a shank 83, which is provided with converging faces 84 and 85 to provide a wide end thereon, which is bifurcated to provide a pair of curved hooks 86 with a slot 87 therebetween of sufficient size to receive the tubular body portion of the member 21 with the head 30 seated on the concave side of the curved portions 86. This is shown in Fig. 13. The curved hook-like members can be inserted under the head 30 by unscrewing the sleeve-like member 21 sufficiently that such insertion can be made between the outer face of the bone and the head 30 and the entire clamping means comprising the members 20 and 21 can be withdrawn by an outward pull on the extracting tool by means of the cross handle 88.

What I claim is:—

1. An apparatus of the character described comprising an elongated member having an elongated thread tapping holding portion of substantially uniform diameter from end to end and a reduced threaded portion thereon and a tubular, headed member having a threaded portion adapted to engage the threaded portion of said elongated member.

2. An apparatus of the character described comprising an elongated member having a thread tapping holding portion, a reduced threaded portion extending endwise from one end of said thread tapping holding portion and wrench receiving means formed on the end

thereof and a tubular, headed member having a threaded portion adapted to engage the threaded portion of said elongated member and receive said wrench receiving means therein.

3. An apparatus of the character described comprising an elongated member having a thread tapping holding portion and a reduced threaded portion and a tubular, headed member having a threaded portion adapted to engage the threaded portion of said elongated member, and having a transverse groove in the head thereof intersecting the passage in said tubular member.

4. An apparatus of the character described comprising an elongated member having a thread tapping holding portion, a reduced threaded portion and wrench receiving means thereon and a tubular, headed member having a threaded portion adapted to engage the threaded portion of said elongated member, and having a transverse groove in the head thereof intersecting the passage in said tubular member.

5. Means for clamping the broken surfaces of a bone in intimate contact comprising a member having means thereon for anchoring itself against longitudinal movement in said bone at one side of the break therein and a headed member mounted for longitudinal movement in an opening in said bone on the other side of said break with the head thereon outermost and engaging the outer surface of said bone, said members being telescopically related and having cooperating threaded means thereon adapted to draw said members together.

6. An apparatus of the character described comprising an anchoring member having a tap portion provided with a plurality of spirally arranged cutter blades each having an inclined forward face and a rear face substantially perpendicular to the axis of said tap portion, said tap portion being of greater diameter than any other portion of said anchoring member, a threaded stem portion of smaller diameter than said tap portion and a polygonal formation on said stem portion adapted to be engaged by a wrench.

7. An apparatus of the character described comprising an anchoring member having a tap portion provided with a plurality of spirally arranged cutter blades each having an inclined forward face and a rear face substantially perpendicular to the axis of said tap portion, said blades being widely spaced axially of said tap portion and being of steep pitch, said tap portion being of greater diameter than any other portion of said anchoring member, a threaded stem portion of smaller diameter than said tap portion, the thread on said stem portion being much finer and of much less pitch than the thread formed by said tap portion and a polygonal formation on said stem portion adapted to be engaged by a wrench.

8. An apparatus of the character described comprising an anchoring member having a tap portion provided with a plurality of spirally arranged cutter blades each having an inclined forward face and a rear face substantially perpendicular to the axis of said tap portion, a threaded stem portion of smaller diameter than said tap portion and a polygonal formation on said stem portion adapted to be engaged by a wrench, and an internally threaded sleeve-like member having an axial opening through the same from end to end, and having a head on one end thereof, the internally threaded portion of said sleeve-like member engaging the threaded stem portion on said anchoring member.

9. An apparatus of the character described comprising an anchoring member having a tap portion provided with a plurality of spirally arranged cutter blades each having an inclined forward face and a rear face substantially perpendicular to said axis of said tap portion, said blades being widely spaced axially of said tap portion and being of steep pitch, a threaded stem portion of smaller diameter than said tap portion, the thread on said stem portion being much finer and of much less pitch than the thread formed by said tap portion and a polygonal formation on said stem portion adapted to be engaged by a wrench, and an internally threaded sleeve-like member having an axial opening through the same from end to end, and having a head on one end thereof, the internally threaded portion of said sleeve-like member engaging the threaded stem portion on said anchoring member, said head having a transverse groove therein intersecting the axial passage in said sleeve-like member.

10. Apparatus for clamping two portions of a fractured bone together comprising an anchoring member having a tap portion, a threaded stem portion of smaller diameter than said tap portion and a polygonal formation on said stem portion, and a wrench engaging said polygonal formation, said wrench having an elongated tubular shank portion of substantially uniform diameter smaller than said tap portion embracing said threaded portion and a stop member of larger diameter than said tap portion adjustable on said shank portion to limit the forward movement of said tap portion in the bone.

11. An apparatus of the character described comprising an anchoring member having a coarsely threaded portion of steep pitch adapted to tap its own thread in a bone, a finely threaded stem portion of smaller diameter than said coarsely threaded portion, and a polygonal end portion of smaller diameter than said finely threaded portion, and a sleeve-like headed member having an axial passage therethrough threaded to receive said stem portion, said head having a tool receiving slot therein, said stem portion being of such length relative to said sleeve-like member that said polygonal end will reach said slot before said sleeve-like member has been screwed onto said stem to the limit of the thread thereon.

12. An apparatus of the character described comprising an anchoring member having a coarsely threaded portion of steep pitch adapted to tap its own thread in a bone, a finely threaded stem portion of smaller diameter than said coarsely threaded portion, and a polygonal end portion of smaller diameter than said finely threaded portion, a sleeve-like headed member having an axial passage therethrough threaded to receive said stem portion, said head having a tool receiving slot therein, and a tool having a flat, narrow blade adapted to engage said slot to turn said sleeve-like member and provided with a central forward projection, entering the axial passage in said sleeve-like member, said stem portion being of such length relative to said sleeve-like member that said polygonal end will engage said projection to disengage said blade from said slot before said sleeve-like member has been screwed onto said stem to the limit of the thread thereon.

13. The method of clamping together the frac-

tured faces of a bone of such character as to be capable of holding a threaded member therein, comprising making a small incision adjacent a readily accessible portion of the bone on one side of the fracture, aligning the fractured portions of the bone, inserting a pair of members through said portion of the bone across said fracture and into the portion of the bone on the other side of said fracture to hold said portions of the bone against relative rotation, drilling a hole from said incision into said bone across and a substantial distance beyond said fracture, inserting a self-tapping anchoring member into said opening to screw-threadedly anchor said member in the portion of the bone remote from said incision, said member being adapted to have screw-threaded engagement with a headed member, inserting a headed member into said opening and threading the same onto said anchoring member to draw said head down on the outer surface of said bone at said incision and draw the fractured surfaces of the bone toward each other.

14. The method of clamping together the fractured faces of a bone of such character as to be capable of holding a threaded member therein, comprising making a small incision adjacent a readily accessible portion of the bone on one side of the fracture, aligning the fractured portions of the bone, inserting a pair of members through said portion of the bone across said fracture and into the portion of the bone on the other side of said fracture to hold said portions of the bone against relative rotation, drilling a hole from said incision into said bone across and a substantial distance beyond said fracture, inserting a self-tapping anchoring member into said opening to screw-threadedly anchor said member in the portion of the bone remote from said incision, said member being adapted to have screw-threaded engagement with a headed member, inserting a headed member into said opening and threading the same onto said anchoring member to draw said head down on the outer surface of said bone at said incision and draw the fractured surfaces of the bone toward each other, impacting said bone at said incision around said head, and screwing said headed member further onto said anchoring member to draw up the slack after impaction of said bone.

15. An apparatus of the character described comprising an elongated member having a thread tapping holding portion and a threaded portion thereon and a tubular, headed member having an elongated tubular threaded shank portion of smaller external diameter than said thread tapping holding portion adapted to engage the threaded portion of said elongated member.

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