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Huene

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[54] **ASSEMBLY FOR INSERTING RIGID SHAFTS INTO FRACTURED BONES**

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[51] **Int. Cl.** **A61f 5/04**

[58] **Field of Search**.......... 128/92 E, 92 EA, 92 EB, 128/92 EC, 92 R, 83

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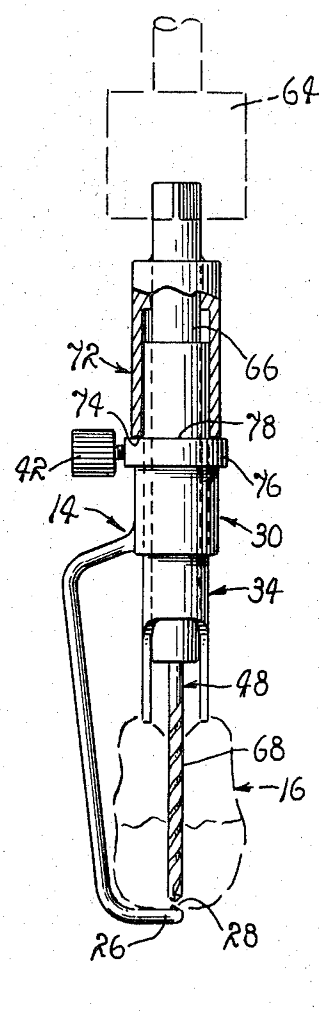
[57] **ABSTRACT**

An improved assembly for use in techniques wherein substantially rigid shafts are employed for joining opposed segments of a fractured bone, including a clamp characterized by an elongated body of a generally C-shape configuration having a fixed jaw projected laterally from one end thereof, for engaging a fractured bone at a first surface, a bearing sleeve affixed to the opposite end of the body, a movable jaw of a tubular configuration adapted to be fixed within said bearing sleeve in opposed relation with the fixed jaw for engaging the fractured bone at a second surface opposed to said first surface and manually operable means adapted to be received telescopically by the movable jaw and employed for inserting a shaft into the bone.

12 Claims, 9 Drawing Figures



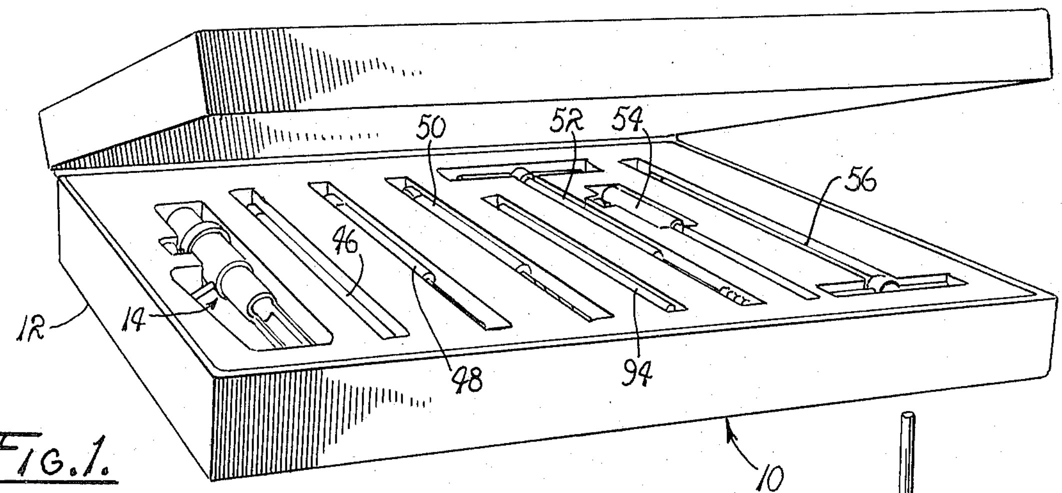


FIG. 1.

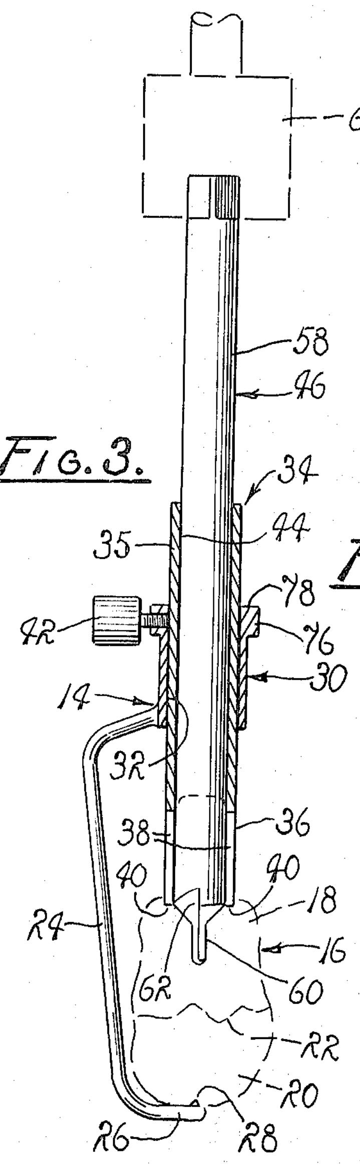


FIG. 3.

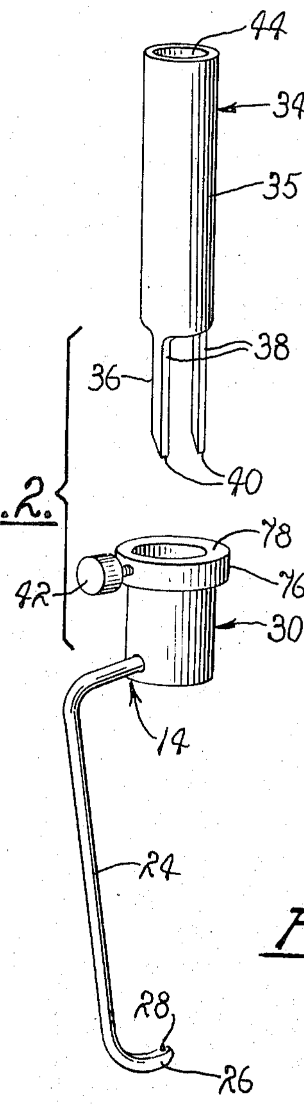


FIG. 2.

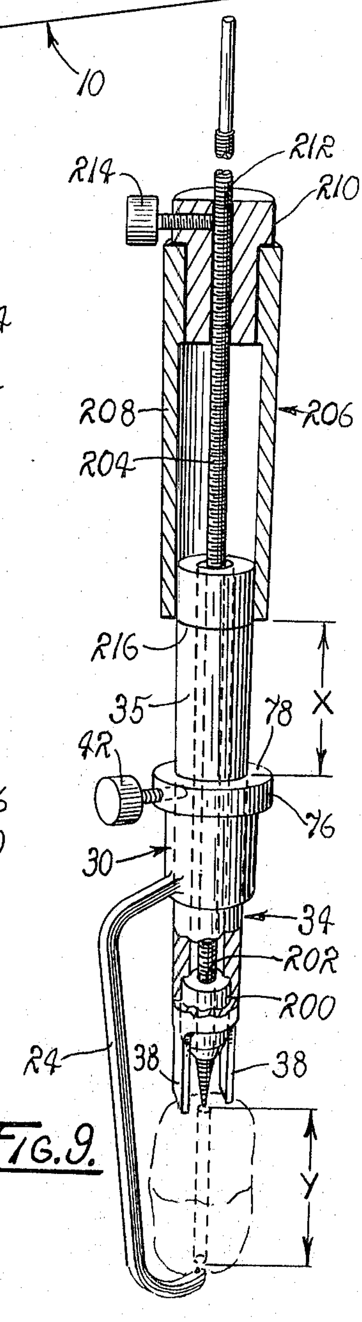


FIG. 9.

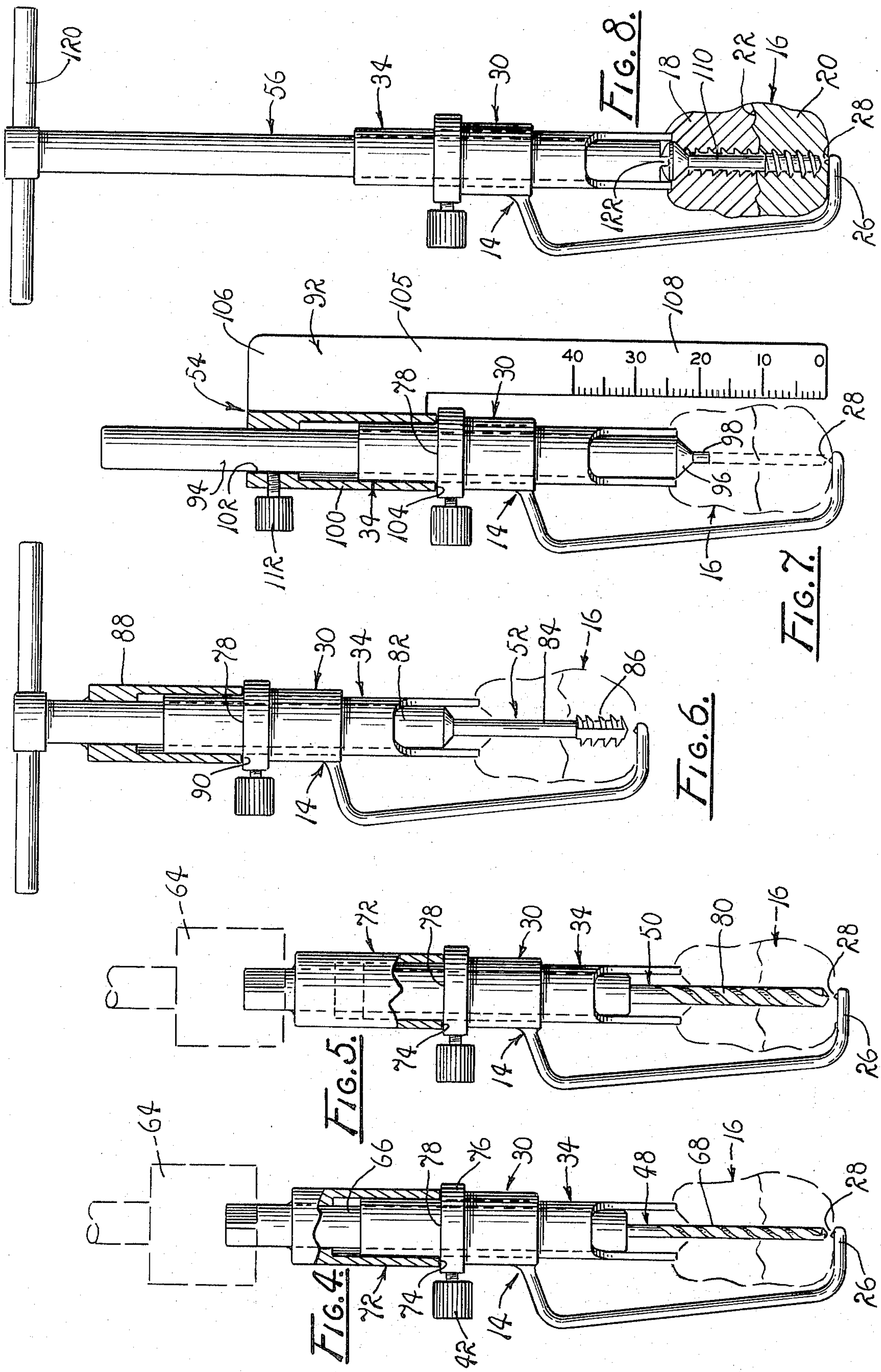


FIG. 8.

FIG. 7.

FIG. 6.

FIG. 5.

FIG. 4.

ASSEMBLY FOR INSERTING RIGID SHAFTS INTO FRACTURED BONES

BACKGROUND OF THE INVENTION

The invention relates to devices adapted to be employed in orthopedic surgery, and more particularly to an improved assembly for joining opposed segments of a fractured bone.

Of course, in orthopedic surgery it is often necessary to join opposed segments of fractured bones along lines of fracture using screws, Steinman Pins and Kirschner Wires, both threaded and unthreaded, as well as similar devices.

As can readily be appreciated by those familiar with techniques currently employed in the joining of bone segments great care must be taken in order to avoid inflicting serious injury on healthy tissue in the vicinity of a bone being repaired. For example, blood vessels and the like frequently are found in juxtaposition with a bone to be repaired. This imposes on an operating surgeon the added burden of avoiding a puncturing of the blood vessel, as may occur when drilling a screw-receiving opening through the fractured bone or forcibly inserting a shaft into the bone segments. Of course, it also is imperative that proper alignment of the shaft be maintained in order to assure that the shaft is properly positioned for joining the opposed segments of the fractured bone.

The prior art includes numerous devices suggested for use in aligning drills, pins, wires and the like, during orthopedic operations. However, none of the devices heretofore provided includes a stop for limiting the depth to which a shaft may be inserted into a bone, for thus protecting tissue immediately adjacent to the bone. Moreover, the majority of the devices hertofore provided for use in forming openings within fractured bones are bulky, complex and often are simply impractical to employ. Additionally, difficulty in achieving proper alignment often is encountered when inserting a drill or a pin, wire or the like without the benefit of a previously formed pilot hole or an opening of a similar nature.

It is therefore the general purpose of the instant invention to provide an improved assembly for facilitating the joining of opposed mating segments of a fractured bone employing shafts such as screws, pins, wires and the like, while protecting contiguous tissue, including blood vessels and the like, from puncture.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the instant invention to provide in an assembly for joining opposed segments of a fractured bone an improved clamp for securing the segments in a contiguous relationship.

It is another object to provide in an assembly for joining opposed segments of a fractured bone the improvement comprising a clamp for engaging a fractured bone at the opposite sides thereof and means for inserting a shaft, either threaded or unthreaded, into the bone without subjecting adjacent tissue to puncture inflicted damage.

It is another object to provide in an assembly for joining opposed segments of a fractured bone the improvement which includes a clamp, and means mounted on the clamp for facilitating the preparation of a screw-receiving opening in the bone.

It is another object to provide in an assembly for joining opposed segments of a fractured bone a clamp including an elongated body of a C-shape configuration having a fixed jaw and an axially movable jaw of a tubular configuration for aligning and guiding tools employed in inserting shafts, both threaded and unthreaded into the bone, and stop means mounted for limiting axial motion imparted to the tools for avoiding misalignment of the shafts and injury to contiguous tissue.

These and other objects and advantages are achieved through an assembly which includes a clamp of a C-shape configuration and having a fixed jaw and a movable jaw of a tubular configuration. In a first embodiment, the movable jaw is adapted to receive, in turn, a centering tool for forming a centering bore, a pilot drill for forming a pilot bore in the bone, a drill for enlarging the pilot bore, a tap threading the enlarged bore, and a screwdriver for advancing a screw into the bone. In a second embodiment, the movable jaw includes a bushing and a driver for inserting a Kirschner Wire, threaded or unthreaded, or Steinman Pin into a bone, as will hereinafter become more readily apparent by reference to the following description and claims in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an assembly embodying the principles of the instant invention.

FIG. **2** is an exploded perspective view of a clamp included within the assembly shown in FIG. **1**.

FIG. **3** is a partially sectioned view illustrating a device employed in forming a center bore supported for axial motion by the clamp shown in FIG. **2**.

FIG. **4** is a partially sectioned view illustrating a pilot drill for forming a pilot bore.

FIG. **5** is a partially sectioned elevational view illustrating a drill for enlarging the pilot bore.

FIG. **6** is a partially sectioned side elevational view illustrating a cutting tool supported by the clamp, shown in FIG. **2**, for cutting internal threads in the enlarged bore.

FIG. **7** is a partially sectioned elevational view illustrating a gauge provided for predetermining the length of a screw to be inserted in the screw-threaded opening formed by the cutting tool.

FIG. **8** is a partially sectioned side elevation of a screwdriver employed in seating a screw within the internally threaded bore.

FIG. **9** is a perspective, exploded view of a modified embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now with more specificity to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 an assembly, generally designated **10**, which embodies the principles of the instant invention.

As a practical matter, a suitable case **12** is provided for storing and transporting the components of the assembly and therefore includes suitably configured pockets, not designated, provided therein for receiving the components of the assembly **10**. Included among the components of the assembly **10** is a clamp **14** which is employed with each of the other hereinafter described components of the assembly in repairing a fractured bone, herein designated **16**.

As depicted in the drawings, for illustrative purposes, the bone **16** includes opposed, adjacent segments **18** and **20** which lie along opposite sides of a fracture designated **22.** The clamp **14** is provided with an elongated body **24** of a generally C-shape configuration having a lateral projection which serves as a fixed jaw designated **26.** The jaw **26** is configured so as to be received beneath the lowermost surface of a fractured bone **16** without inflicting substantial damage to contiguous tissue. Moreover, the jaw **26** includes an upwardly projected protuberance which functions as a tooth, herein designated **28.** The tooth **28** penetrates the surface of the bone **16.** Through the tooth **28** pressure sufficient for retaining the bone **16** within the clamp **14** is applied.

In coaxial alignment with the tooth **28** there is affixed to the body **24**, near its opposite end, a bearing sleeve **30** having a cylindrical bore **32** extended therethrough. Into the bore **32** there is inserted an axially movable jaw **34** having a body **35** of a substantially cylindrical configuration. The body **35** is bifurcated at its distal end portion **36** and defines a pair of teeth **38** of a prong-like configuration. Each of the teeth **38** has formed at the distal end thereof a sharpened tip **40** through which holding pressure, opposed to the holding pressure applied by the tooth **28,** is applied to the bone **16** for retaining the bone **16** within the clamp.

A setscrew **42** is threadedly received within a radially extended, internally threaded bore provided for the bearing sleeve **30.** This setscrew, upon being tightened, engages the surface of the body **35** of the movable jaw **34** and secures the movable jaw in place, relative to the bearing sleeve and hence the fixed jaw **26.** It will therefore be appreciated that in order to clamp the bone **16** in place between the teeth **28** and **38** of the clamp **14,** the body **35** of the movable jaw **34** is advanced through the bore **32** until a seated relationship is established between the tips **40** and the adjacent surface of the bone **16.** An opposed force is, of course, applied to the bone **16** by the fixed jaw **26** acting through the tooth **28.** Once the bone **16** is thus secured between the jaws of the clamp **14,** the setscrew **42** is tightened for thereby securing the movable jaw **34** against further motion.

As shown, the movable jaw **34** is provided with a bore **44,** also of a cylindrical configuration, extended therethrough. The surface of the bore **44** is of a cylindrical configuration and serves as a bearing surface for receiving, in an alternative fashion, a centering tool, designated **46,** a pilot drill **48,** a drill **50,** a tap **52,** a gauge **54** and a screwdriver **56,** each of which is provided for use in repairing the bone **16.**

The centering tool **46** includes a cylindrical base **58,** having an outside diameter substantially equal to the inside diameter of the bore **44** so that the centering tool **46** may be axially displaced along the surface of the bore **44** in a telescopic fashion. The face of the centering tool **46** is of a frusto-conical configuration and includes a cutting tip **60** and an inclined blade **62.** The cutting tip **60,** as a practical matter, is a truncated bit which extends axially from the body **58** for forming a centering bore while the blade **62** is so configured as to cut into the surface of the bone **16,** an opening of an inwardly directed, frusto-conical configuration. Thus, the tip **60** and the blade **62** cooperate to form a centering bore as torque and axial pressure are applied to the centering tool **46.** As a practical matter, a force applicator including a chuck **64** is utilized for applying torque and pressure to the centering tool.

Once a centering bore is formed in the bone **16,** the centering tool **46** is removed from the bore **32,** whereupon the pilot drill **48** is inserted into the bore.

The pilot drill **48** also is provided with an elongated base **66** having an outside diameter substantially equal to the inside diameter of the bore **32,** for substantially the same reasons as hereinbefore discussed with respect to the base of the centering tool **46.** From the base **66** of the pilot drill there is extended in coaxial alignment therewith a drill bit **68.** The drill bit preferably is a twist drill and has an outside diameter substantially equal to or slightly less than the diameter of the centering bore formed by the centering tool **46.** Hence, the bit **68** is received by the centering bore which serves to preclude "walking" of the tip of the bit along the surface of the bone as torque is applied to the base **66.** Torque and pressure are now applied to the pilot drill **48,** in substantially the same manner in which torque and pressure are applied to the centering tool **46,** for thus forming a pilot bore in the bone **16.**

It is important here to note that it is highly desirable to prevent the drill bit **68** from passing completely through the bone **16,** in order to avoid inflicting puncture and other undesired damage to tissue, blood vessels and the like found in contiguous relation with the bone. Therefore, the base **66** of the pilot drill **48** includes a concentrically related sleeve **72** rigidly affixed to the base **66** near the distal end thereof, i.e., the end thereof most remote from the drill bit **68.** The sleeve **72** has an internal diameter substantially greater than the external diameter of the body **35** of the movable jaw **34.** This sleeve extends in concentric relation with the base **66** and terminates in an annular face **74.**

The bearing sleeve **30** is further provided with a collar **76** having an annular face **78** positioned to engage the face **74** of the sleeve **72** as the drill bit **68** is caused to reach the extremity of its penetration into the bone **16,** immediately adjacent to the tip of the tooth **28.** It will therefore be appreciated that the length of the sleeve **72** is such that the annular face **74** of the sleeve **72** engages the face **78** of the collars **76** at the instant the drill bit **68** reaches the extremity of its penetration into the bone **16.** Therefore, the tip of the drill bit **68** cannot exit the bone **16.**

Upon completion of the formation of a pilot hole within the bone **16,** the pilot drill **48** is extracted from the bore **44** of the movable jaw **34** and the drill **50** inserted therein. The drill **50** is now employed for enlarging the pilot hole previously formed in the bone **16.**

In practice, the drill **50** is quite similar to the pilot drill **48,** except that the drill **50** includes a bit **80** having an outside diameter substantially equal to the minor diameter of a screw to be received within the opening formed thereby in the bone **16.** Therefore, a detailed description of the drill **50** is omitted in the interest of brevity. However, it will be appreciated that following the enlargment of the pilot hole formed by the drill bit **68,** the drill **50** is extracted from the bore **44.**

The tap **52** now is inserted into the opening formed in the bone **16** for cutting screw threads along the internal surface of the enlarged opening as torque is applied thereto. The tap **52** also includes a base **82** having an outside diameter substantially equal to the internal diameter of the bore **44.** At the distal end of the base **82** there is provided a shank 84 having teeth 86 formed thereon so configured as to form a continuous helical thread as torque and attendant pressure are applied to the base 82.

A sleeve 88 is fixed to the base 82 in a manner quite similar to that in which the sleeve 72 is fixed to the base 66 of the pilot drill 48. The sleeve 88 also includes an annular shoulder, designated 90, which serves to engage the face 78 of the collar 76 for thus preventing the tap 52 from exiting the bone 16 at the extremity of its penetration. Since the sleeve 88 functions in substantially the same manner in which the sleeve 72 functions to arrest axial motion imparted to the base 66, a detailed description thereof is omitted in the interest of brevity. However, it is to be understood that the face 90 of the sleeve 88 engages the face 78 of the collar 76 for arresting axial motion imparted to the tap through a manipulation of the tap. A T-handle, not designated, is affixed to the end of the base 82 most remote from the teeth 86 so that the tap 52 can readily be manipulated, in a well known manner, for causing the tap to cut internal screw threads within the now enlarged opening formed within the bone 16.

In order to select a screw of an appropriate length, the gauge 54 is provided with a scale 92 for the depth of the now screw-threaded opening in the bone. The gauge 54 inlcudes an elongated base 94 having an outside diameter substantially equal to the inside diameter of the bore 44, for the same reasons hereinbefore set forth with respect to the base 66 of the pilot drill 48. However, the base 94 terminates in a face 96 of a frusto-conical configuration having a tip 98 projected axially therefrom for penetrating the centering bore formed in the bone 16. Therefore, it should be apparent that, in operation, the base 94 is extended into the body 35 of the movable jaw 34 only to a depth dictated by the depth of the centering bore formed bby the centering tool 46.

The scale 92 includes a barrel 100 having a concentric bore 102, of a diameter slightly greater than the diameter of the base 94, extended through the distal end thereof. An annular face 104 is formed at the base end of the barrel 100 in coaxial alignment with the face 78. Thus the barrel when received by the base 94, is positioned to seat against the face 78 as axial motion is imparted thereto.

The scale 92 further includes a calibrated blade 105 having its base 106 rigidly affixed to the barrel 100 and a distal end portion, designated 108, which terminates in coplanar relation with the tip of the tooth 28. Suitable calibrations are provided along the face of the blade 105, the calibration furtherest from the base being designated zero. The distance between the face 96 and the tooth 28 is, of course, substantially equal to the thickness of the bone 16. This distance, in effect, determines the length of a screw 110 to be inserted into the screw-receiving opening formed in the bone.

In order to employ the gauge 54, the base 94 is inserted into the body 35 of the movable jaw 34 until the face 96 seats in the threaded opening. The barrel 100 is now telescopically advanced along the base 94 until the face 104 of the barrel seats against the face 78 of the collar. Thereupon, as a practical matter, the barrel 100 is affixed to the base 94 by manipulating a setscrew 112, similar to the setscrew 42, extended radially through the barrel 100. The gauge 54, including the barrel 100, is then removed from the clamp 14. The distance between the face 96 and the calibration indicated zero corresponds to the operative length of the screw 110 to be inserted into the threaded opening.

The screw 110 subsequently is dropped into the bore 44 of the body 35 of the movable jaw 34 and the screwdriver 56 inserted thereafter. The screwdriver 56 includes a base 118, similar in design and function to each of the bases heretofore described. The base 188 has an outside diameter substantially equal to the inside diameter of the bore 44 and terminates in a T-handle 120 through which torque and pressure simultaneously are applied to the screwdriver. The base 118 terminates in suitable blades 122 adapted to be received within slots suitably formed within the head of the screw 110. Thus by simultaneously applying torque and pressure to the screwdriver 56 the screw 110 is caused to advance along the internal threads provided within the opening formed in the bone 16. Thus the segments of the fractured bone are joined.

OPERATION OF THE PREFERRED EMBODIMENT

It is believed that in view of the foregoing description, the operation of the device will readily be understood and it will be briefly reviewed at this point.

The clamp 14 is inserted into an opening formed in the flesh adjacent the bone 16 with the fixed jaw 26 being disposed immediately beneath the lowermost surface of a fractured bone while the bearing sleeve 30 is disposed in coaxial alignment with the tooth 28. The movable jaw 34 is next inserted into the bore 32 a distance sufficient to cause the tips 40 of the teeth 38 to engage the surface of the bone 16 opposite the surface thereof engaged by the tooth 28. Suitable pressure is applied to the body 35 of the movable jaw 34 for causing the segments of the bone to close and thus be brought into a mated relationship along the plane of the fracture. Thereupon, the setscrew 42 is manipulated for securing the movable jaw 34 in fixed relation with the fixed jaw 26 for thereby securing the bone therebetween.

The centering tool 46 is next inserted into the bore 44 of the movable jaw 34 whereupon torque and pressure simultaneously are applied for forming a center bore within the surface of the bone immediately adjacent the teeth 38. The centering tool 46 is then removed from the bore 44 and the pilot drill 48 thereafter inserted therein. Torque and pressure are then applied to the pilot drill 48 for advancing the pilot drill downwardly through the segment 18 and into the segment of the bone 16, until such time as the face 74 of the sleeve 72 seats against the face 78, for thereby arresting axial motion of the drill bit 68. Of course, the tip of the drill bit 68 does not exit the bone 16. The pilot drill 16 is now extracted from the bore 44 and the drill 50 inserted therein and advanced therealong for enlarging the opening formed by the pilot drill to a diameter equal to the minor diameter of a screw 110 to be inserted therein.

The drill 50 is now extracted from the bore 44 and the tap 52 inserted therein. Torque and pressure now are applied to the tap 52 through a manipulation of the T-handle, provided therefor, until the face 90 of the sleeve 88 is caused to seat against the face 78 of the collar 76, whereupon axial motion of the tap is arrested. The tap is now extracted, in a conventional manner, from the screw-receiving opening thus formed.

The gauge **54**, where desired, is now employed for determining the length of the screw **110** to be inserted into the thus formed internally threaded opening. This is achieved simply by seating the face **94** within the bore **44** of the movable jaw **34** and telescopically advancing the barrel **100** along the surface of the base until the face **104** of the barrel **100** seats against the face **78** of the collar **76.** Thereupon, the setscrew **112** is tightened and the gauge **54** removed from the clamp **14.** By measuring the distance between the calibration indicated zero and the face **96** a screw **110** of a proper length readily can be selected.

The screw **110** is then selected and dropped axially into the opening formed in the bone **16**, through the bore **44**, and a screwdriver **56** inserted into the bore **44** thereafter. The blades **122** provided at the end of the screwdriver **56** engage the suitably formed slots provided in the head of the screw. Torque and pressure are then applied to the screw **110**, through a manipulation of the handle **120** for thus advancing the screw along the threads provided in the thus formed screw-receiving opening.

DESCRIPTION OF A MODIFIED EMBODIMENT

The form of the invention shown in FIG. **9** of the drawings includes substantially the same basic structural components referred to and described in connection with the description of the embodiment shown in FIGS. **1** through **8.** Therefore, corresponding reference numerals are employed for designating corresponding elements.

The embodiment of the invention illustrated in FIG. **9** is particularly suited for use in inserting in a fractured bone rigid shafts such, for example, as either a Kirschner Wire, threaded or unthreaded, or a Steinman Pin. For reasons fully understood by those familiar with techniques employed in inserting rigid shafts such as a Kirschner Wire, or a Steinman Pin into a fractured bone a great deal of difficulty often is encountered in maintaining proper alignment as the shaft is inserted into the bone, since the shaft has a propensity to "wander" as axial force is applied thereto.

It has, in practice, been found that the clamp **14** can be employed quite satisfactorily for establishing and maintaining proper alignment for the shaft as it is inserted into the bone **16** employing a driver.

As shown in FIG. **9,** the modified assembly includes an axially displaceable bushing **200** of a generally cylindrical configuration which seats within the distal end of the body **35** and includes an axial bore **202** extended therethrough. The diameter of the bore **202** is substantially equal to the diameter of a selected shaft, designated **204,** selected to be inserted into the bone **16** employing the modified embodiment of the invention.

Supported for telescopic motion along the external surface of the base end of the body **35,** there is a vice **206.** The vice **206** includes a tubular body **208** received at its base end by the body **35** of the movable jaw **34** and is closed at its distal end by a closure plug **210.** The closure plug **210** includes an internal bore **212** having a diameter substantially equal to the diameter of the shaft **204,** while a threaded setscrew **214** is extended into the closure plug for engaging the shaft **204** and securing it in a fixed relation with the body **208.** The vice **206** is prepared for use as a driver for forcing the shaft **204** into the bone.

In operation, the clamp **14** is mounted on a fractured bone **16**, in the manner hereinbefore described, with the exception that the axially displaceable bushing **200** previously has been inserted into the distal end of the tubular body **35** in coaxial alignment with the closure plug **210.** The vice **206** is now received by the base end of the body **35,** in a telescopic relationship therewith. With the setscrew **214** being "backed off,"the shaft **204** now is inserted through the coaxially aligned bores **202** and **212** and advanced into engagement with the adjacent surface of the bone **16.** The setscrew is now tightened through a simple manipulation. Axial force now applied to the shaft **204** causes the shaft to penetrate the bone **16** without experiencing a wandering effect. Of couse, upon removal of the vice **206** and the clamp **14,** excess portions of the shaft are removed by severing the shaft in an appropriate manner.

It is here noted that a scale **216** is provided on the surface of the body **35** for assuring a proper positioning of the vice **206** prior to the tightening of the setscrew **214.** The scale **216** consists of indicia scribed on the surface of the body **35** which assures that the distance, between the vice **206** and the face **78,** designated X, is, at the time the shaft **204** is fixed to the vice, always equal to the distance, designated Y, which substantially corresponds to the thickness of the bone **16.** This is achieved simply by positioning the distal end of the body **35** in engagement with the adjacent surface of the fixed jaw **26** and scribing a mark about the surface of the body **35** immediately adjacent the face **78** of the collar **76.**

In view of the foregoing, it should readily be apparent that the assembly **10** of the instant invention provides a practical solution to the perplexing problem of providing an assembly through which screws may be inserted into fractured bones while damage to surrounding tissue is minimized.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the illustrative details disclosed.

Having described my invention, what I claim as new and desire to serve by Letters Patent is:

1. In an assembly for inserting rigid shafts into opposed segments of a fractured bone, the improvement comprising:

a clamp including an elongated body having a fixed jaw projected laterally therefrom adapted to engage a fractured bone at a first surface thereof, a bearing sleeve fixed to said body in spaced relation to said fixed jaw, an axially movable jaw including a body of a tubular configuration supported by said bearing sleeve and having a distal end of a bifurcated configuration for engaging the fractured bone at a second surface thereof, oppositely related to said first surface, and means for securing said movable jaw in a fixed relationship with said fixed jaw.

2. The improvement of claim **1** further comprising means for forming within the second surface of said bone in coaxial alignment with the tubular body of said movable jaw, a centering bore having an opening of an inwardly directed, frusto-conical configuration, including an elongated base configured to be received in telescopic relation with said axially movable jaw, and a cutting blade angularly projected from one end thereof.

3. The improvement of claim **2** further comprising axially movable drill means for drilling an elongated opening in said bone, including an elongated base adapted to be received telescopically within said movable jaw and supported thereby for displacement along a linear path, a drill bit projected axially from said base, and stop means for limiting axial motion imparted to said drill.

4. The improvement of claim **3** wherein said stop means includes a stop sleeve fixed to the base of said drill, in concentric relation therewith, and means defining about said bearing sleeve an annular collar positioned to be engaged by said stop sleeve as axial motion is imparted to said axially movable drill means.

5. The improvement of claim **4** further comprising means for inserting into said elongated opening a screw-threaded shaft having a screw-head affixed thereto, including an elongated base configured to be received within said movable jaw, in telescopic relation therewith, and a plurality of axially extended, screw-engaging blades adapted to be received by the head affixed to said screw-threaded shaft.

6. The improvement of claim **5** further comprising cutting means for forming internal screw threads in said elongated opening including an elongated base configured to be received in telescopic relation with said movable jaw and means defining a tap projected axially from the base of said cutting means.

7. The improvement of claim **6** further comprising measuring means for determining the depth of the elongated opening formed in said bone, including an elongated base configured to be received within the tubular body of said movable jaw, a support sleeve adapted to be received telescopically by the base of the measuring means, means for securing the support sleeve to the base of the measuring means, and an elongated scale projected in parallelism with the longitudinal axis of symmetry of said support sleeve.

8. In an assembly for inserting rigid shafts into opposed segments of a fractured bone the improvement comprising:

A. a clamp including an elongated body having a fixed jaw projected laterally therefrom for engaging a fractured bone at a first surface thereof, a movable jaw including a body of a tubular configuration supported by said clamp in opposed relation with said fixed jaw for engaging the fractured bone at a second surface opposed to said first surface, and means for securing said movable jaw in fixed relation with said fixed jaw;

B. means for inserting into said bone an elongated shaft including,

1. a bushing having a first axial bore extended therethrough telescopically received within the removable jaw,
2. an elongated sleeve telescopically received by said movable jaw including a closure plug for closing said sleeve at one end thereof and having a second axial bore extended therethrough in coaxial alignment with said first axial bore, and
3. means adapted to secure within said second axial bore an elongated shaft extended from said closure plug through said bushing and adapted to be inserted into the bone in response to axial motion imparted to the elongated sleeve; and

C. stop means for limiting axial motion of said sleeve including an annular collar fixed to the body of said clamp in coaxial relation with said sleeve.

9. The improvement of claim **8** further including means defining a depth gauge along the external surface of said movable jaw.

10. In an assembly for inserting rigid shafts into opposed segments of a fractured bone, the improvement comprising:

a clamp including an elongated body having a fixed jaw projected laterally therefrom including means defining a protuberance for engaging a fractured bone at a first surface thereof, a bearing sleeve fixed to said body in spaced relation to said fixed jaw, an axially movable jaw including a body of a tubular configuration supported by said bearing sleeve including means defining a plurality of prongs projected axially from the tubular sleeve for engaging the fractured bone at a second surface thereof, oppositely related to said first surface, and means for securing said movable jaw in a fixed relationship with said fixed jaw.

11. In an assembly for inserting rigid shafts into juxtaposed segments of a fractured bone, the improvement comprising:

a clamp including an elongated body member having a fixed jaw projected laterally from one end thereof for engaging a fractured bone at a first surface thereof, a bearing sleeve fixed to said body member in spaced relation to said fixed jaw, an axially movable jaw including a tubular body telescopically supported for axial displacement by said bearing sleeve, and having means defining a plurality of prongs projected axially from one end thereof, for engaging the fractured bone at a second surface thereof, opposite said first surface, and means for securing said movable jaw in a fixed relationship with said fixed jaw.

12. The improvement of claim **11** further comprising means including an axially movable drill member for drilling an elongated opening in the juxtaposed segments of said bone, including an elongated base configured to be received within said tubular body and supported thereby for axial displacement relative thereto along a linear path, and means defining a cutting surface extended from said base.

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