United States Patent

[11] 3,604,487

[72] Inventor **Richard S. Gilbert**
170 B Sotoyome St., Santa Rosa, Calif. 95405

[21] Appl. No. **805,572**
[22] Filed **Mar. 10, 1969**
[45] Patented **Sept. 14, 1971**

[54] **ORTHOPEDIC SCREW DRIVING MEANS**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **145/50 D,** 128/92 B, 128/92 E, 128/303, 85/45
[51] **Int. Cl.** **B25b 15/02,** F16b 23/00
[50] **Field of Search** ..... 128/92, 92 B, 92 BB, 92 D, 92 E, 83, 303; 145/50, 52; 85/45

[56] **References Cited**

UNITED STATES PATENTS

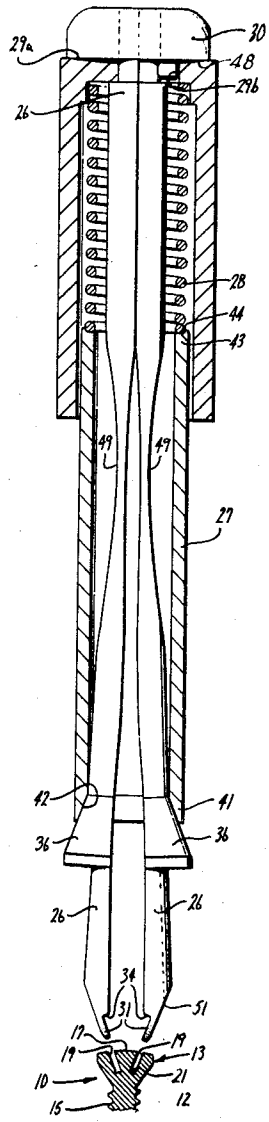
66,585	7/1867	Harvey	145/52 X
306,491	10/1884	Jackman	145/50.3
954,073	4/1910	Bender	145/50.3 X
2,532,972	12/1950	Vertin	145/50.3
2,579,438	12/1951	Longfellow	145/52
2,669,896	2/1954	Clough	145/52 X
3,106,862	10/1963	Briles	145/50.1 X

FOREIGN PATENTS

166,083	6/1950	Austria	145/50.4

Primary Examiner—Richard A. Gaudet
Assistant Examiner—Ronald L. Frinks
Attorney—Flehr, Hohbach, Test, Albritton & Herbert

ABSTRACT: A combination of an orthopedic screw and driving means which enables the screw to be started and driven in a single continuous operation with one hand. The screwhead has multiple slots, and the driving means has multiple pinching blades for engaging the slots to provide a rigid grip of the screw.



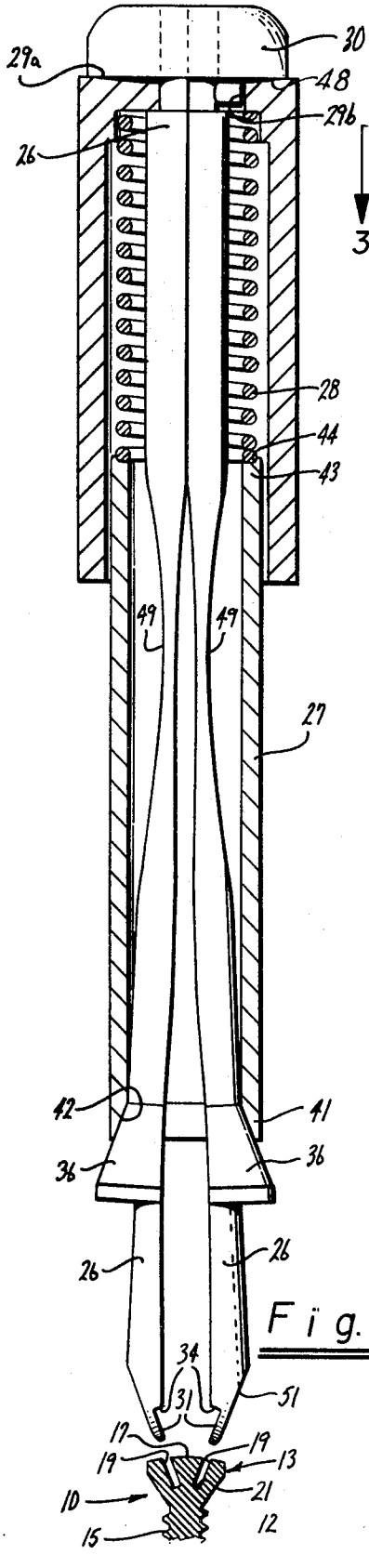


Fig. 2

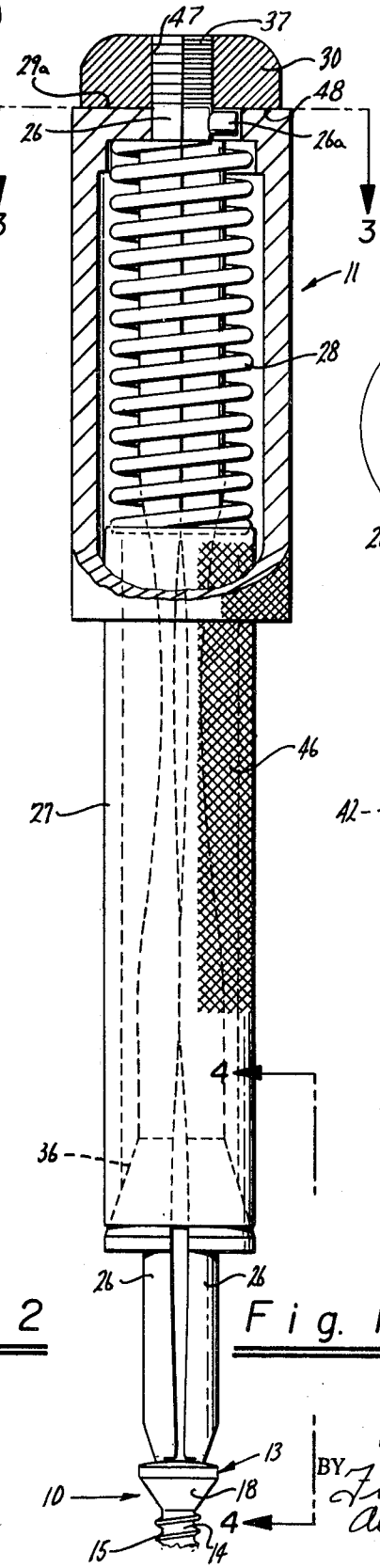
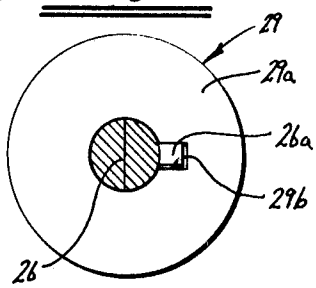


Fig. 1

Fig. 3



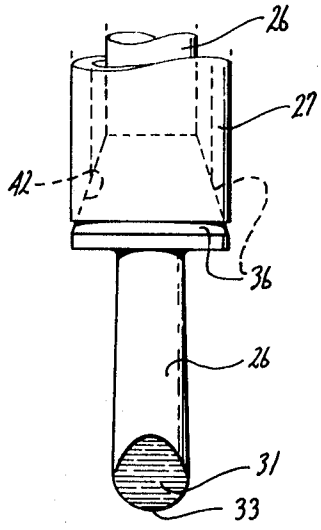


Fig. 4

INVENTOR.
Richard S. Gilbert
BY Flehr, Hohbach, Test, Albritton & Herbert
Attorneys

ORTHOPEDIC SCREW DRIVING MEANS

BACKGROUND OF THE INVENTION

Screws are used in orthopedic surgery for joining bones together and for attaching foreign members, such as stainless steelplates, to bones. The screws are generally threaded into and anchored in the bones, and it is frequently necessary for the surgeon or person inserting the screws to perform the driving operation with only one hand. It is therefore desirable, and in many cases necessary, that the screws be started and driven by means of a screwdriver which is capable of holding the screws in a relatively rigid position.

Screws heretofore used in orthopedic surgery have been provided with heads having conventional slots, such as straight slots, cross-slots, and phillips heads. Holding screwdrivers which have been provided for driving the screws generally include both a blade for engaging the slot in the screwhead and a plurality of claws or fingers for gripping the screwhead. These claws or fingers extend over the sides of the screwhead and engage either the side or the lower portion of the screwhead, making it impossible to complete the driving of the screw while the holding claws are engaged with its head. Most holding screwdrivers include means for disengaging the claws and completing the driving of the screw with the claws in a retracted position. Such arrangement presents a problem in that the claws are larger than the head of the screw and obstruct the surgeon's view of the head as it is seated. Consequently, the surgeon usually finds it necessary to change to a second screwdriver to complete the driving of the screw. There is a need for a solution to these and additional problems in the art.

SUMMARY AND OBJECTS OF THE INVENTION

The present invention provides a combination of an orthopedic screw and driving means which enables the screw to be started and driven in a single continuous operation. The head of the screw is provided with a plurality of slots adapted for receiving the pinching blades of the driving means in such a manner that the screw and driving means are locked together without the driving means extending beyond the lateral extremities of the screwhead.

In general, it is an object of the present invention to provide a new and improved combination of an orthopedic screw and driving means.

Another object of the invention is to provide a combination of the above character which enables the screw to be started and driven in a single continuous operation.

Another object of the invention is to provide a combination of the above character wherein no part of the driving means overhangs the lateral extremities of the screwhead to interfere with the complete driving of the screw.

Another object of the invention is to provide a combination of the above character wherein the person using the combination can see the lateral extremities of the screwhead at all times during the driving operation.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment is set forth in detail in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partly sectioned frontal elevational view of one embodiment of a screw and driving means incorporating the present invention, showing the blades of the driving means in interlocking engagement with the head of the screw.

FIG. 2 is a partially sectioned frontal elevational view of the embodiment shown in FIG. 1, with the blades of the driving means disengaged from the head of the screw.

FIG. 3 is a cross-sectional view taken along line 3—3 in FIG. 1.

FIG. 4 is a side elevational view of the portion of the driving means indicated by the line 4—4 in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment, the combination of the present invention consists of an orthopedic screw designated generally by reference numeral **10** and driving means designated generally by reference numeral **11**. Like reference numerals are used to indicate corresponding parts in all figures of the drawing.

The orthopedic screw **10** includes an axially extending threaded stem **12** and a head **13** at one end of said threaded stem.

The threaded stem **12** comprises a substantially cylindrical shank **14** having a helical thread **15**. The thread **15** is shown as a spaced thread since this is the type of thread that is commonly used in bone screws. However, as will be apparent to one skilled in the art, other types of threads may be used in the present invention. In some applications, it may be desirable to taper the thread toward its leading end or to use a conically tapered shank.

The head **13** is illustrated as a conventional oval head having a rounded upper surface **17** and a conical lower portion **18**. Lower portion **18** is suitable for countersinking and has an included angle of the order of 82 **Neither this angle nor the shape of the head is critical to the invention.**

The screwhead **13** is provided with two slots **19** which are adapted for receiving the blades of the driving means in a manner hereinafter described in detail. Slots **19** are formed in the upper surface **17** of the screwhead. The openings of slots **19** are substantially parallel to each other and are equally spaced from the axis of the screw. The remaining portions of slots **19** are inclined with respect to the axis in such a manner that the lower portions of the slots are closer to the axis and to each other than are the upper portions of the slots. While the exact angle of inclination is not critical, particularly satisfactory results are obtained when the slots are inclined to the axis at an angle of the order of 30 **In the preferred embodiment, slots** 19 **do not extend all the way to the edges of head** 20, **to assure that the blades of the driver means cannot slip transversely out of the slots while the screw is being driven. As illustrated, the slots** 19 **have a generally rectangular cross section, as can best be seen in FIG.** 2, **and a rounded bottom** 21. **This slot configuration is conveniently formed with a conventional milling cutter.**

Tapping means, not shown, can be provided at the end of threaded stem **12** opposite head **13**. This tapping means can be any conventional type of self-tapping means which is suitable for cutting threads in bone.

The screw can be fabricated of any material which is both biologically inert and otherwise suitably for use with screws. Suitable materials include stainless steel and monel metal.

In the preferred embodiment, driving means **11** comprises generally a pair of blades **26**, a sleeve **27**, a resilient member **28**, a handle **29**, and an adjusting capnut **30**.

The blades **26** extend axially of driving means **11** and are adapted for pinching together to engage and hold screwhead **13**. The combined cross section of the blades is generally circular.

The blades **26** have tip portions **31** at the lower ends thereof for engaging the slots in the head of the screw **10**. In the preferred embodiment, these tip portions **31** are substantially straight members which are inclined at an angle with respect to the axis of the driving means. This angle of inclination corresponds to the inclination of the slots in the screwhead so that when the driver blades are engaged with the screwhead, the axes of the screw and driving means are aligned. Tip portions **31** have rounded lower extremities **33** which conform generally to the contour of the screw slots. It has been observed that the more closely the contours of tip portions **21** and slots **19** are matched, the more rigidly the screw is held by the driving means.

Additional rigidity is provided by shoulder portions **34** which are located adjacent to tip portions **31** of blades **26**. Shoulder portions **34** have a contour corresponding to the contour of the upper surface **17** of the screwhead.

The blades **26** also include conically tapered portions **36**. These conical portions extend radially outward and are located toward the lower ends of the blades. They cooperate with sleeve **27** and resilient member **28** to urge blades **26** together in a manner hereinafter described.

The upper ends of blades **26** are provided with threads **37** for engaging corresponding threads on adjusting nut **30**. A key **26*a*** is also provided proximate to the upper end of blades **26** for engaging a keyway **29*b*** in handle **29**.

The sleeve **27** is substantially cylindrical in shape and surrounds a central portion of blades **26**. The lower end **41** of sleeve **27** rests against or slidably engages the surfaces of tapered portions **36**, and the inner surface **42** of end **41** is beveled at an angle corresponding to the taper of conical portions **36**. The upper end **43** of sleeve **27** is provided with an annular recess **44** for receiving the lower end of resilient member **28**, as is more fully discussed hereinafter. In the preferred embodiment, knurling **46** is provided on the outer surface of sleeve **27** to provide a better surface for gripping.

The resilient member **28** surrounds blades **26** near the upper ends thereof. In the preferred embodiment, resilient member **28** is a conventional compression spring. The lower end of resilient member **28** engages recess **44** in sleeve **27**, and the upper end is constrained by handle **29** and adjusting nut **30**.

Handle **29** is generally cylindrical in shape and surrounds resilient member **28** and the upper portion of sleeve **27**. Handle **29** includes an annular upper shoulder portion **29*a***, which engages the upper end of resilient member **28** and the lower surface of nut **30**. Shoulder **29*a*** includes a keyway **29*b*** which cooperates with key **26*a***, locking blades **26** to handle **29** for rotation therewith, while permitting handle **29** to move axially with respect to blades **26**.

Adjusting nut **30** is threadably mounted on the upper ends of blades **26** by means of threads **47** which engage threads **37** on blades **26**. The lower surface **48** of nut **30** bears against the upper end of resilient member **28** through shoulder **29*a*** of handle **29**. Thus, nut **30** provides means for adjusting the tension in resilient member **28**. As will be apparent to one skilled in the art, when nut **30** is adjusted to provide a tension in resilient member **28**, sleeve **27** is urged downward against tapered portions **36** of blades **26**, thereby urging blades **26** together.

Means is provided for causing blades **26** to separate whenever a force exerted by resilient member **28** is relieved. In the preferred embodiment, blades **26** are fabricated of a resilient material having cutaway portions, as indicated at **49**. Thus, when the upper ends of blades **26** are held together by nut **30**, the stresses in the blades urge the lower ends thereof to separate.

The dimensions of blades **26** and screwhead **13** are such that the person using the screw and driving means can see the lateral extremities of screwhead **13** throughout the entire driving operation. The lower portions of blades **26** have a combined cross-sectional area that is generally circular and smaller than the area defined by the upper surface **17** of screwhead **13**. Further visibility can be provided by tapering the outer surfaces of blades **26** as indicated at **51**. Conical portions **36** are located sufficiently far from the lower ends of blades **26** that they do not obstruct the user's view of the screwhead.

The operation of the combination screw and driving means can now be briefly described as follows: Let it be assumed that nut **30** has been adjusted to provide sufficient compression of resilient member **28** to force blades **26** together. Blades **26** can be separated by depressing nut **30** and handle **29** with respect to sleeve **27** to relieve the force exerted by resilient member **28** on conically tapered portions **36**. This is conveniently cone by holding sleeve **27** with the palm and fingers of the hand and exerting a downward pressure on nut **30** with the thumb of the same hand. When blades **26** are thus separated, tip portions **31** can be inserted into slots **19** of screwhead **13**. Thereafter, when the thumb pressure is removed from nut **30**, resilient member **28** expands, urging blades **26** to pinch together to provide an interlocking engagement between blades **26** and screwhead **13**. As blade tips **31** pinch together against the inclined inner side surfaces of slots **19**, the upper surface **17** of screwhead **13** is pressed firmly against shoulder portions **34** of blades **26**. With blades **26** thus engaging screwhead **13**, screw **10** is rigidly held by driving means **11** and can be started and driven in a single operation. Blades **26** are disengaged from screwhead **13** simply by depressing nut **30** with respect to sleeve **27** and withdrawing the tip portions from the slots.

The particular driver blade and screw slot configurations described hereinbefore are those employed in the presently preferred embodiment of the invention. However, other configurations can be used. Examples of other suitable slot configurations are described in my copending application Ser. No. 805,441, filed of even date.

Although the invention has been described herein with specific reference to the driving screws in orthopedic surgery, it will be appreciated that the invention is adaptable for use with other types of screws, such as machine screws, wood screws and sheet metal screws. Likewise, while the invention has been illustrated with reference to oval head screws, it is not limited thereto.

From the foregoing, it will be apparent that there has been provided a new and improved combination of a screw and driving means enabling an orthopedic screw to be started and driven in a single continuous operation.

I claim:

1. In a screwdriver for starting and driving a screw having an axially elongate threaded stem with a head at one end thereof and a pair of spaced-apart axially inclined slots opening through the upper surface of said head, a pair of axially extending blades having generally planar axially inclined tip portions at the lower end thereof and a conically tapered portion extending radially outward intermediate said tip portions and the upper end of said blades, an axially extending sleeve surrounding a portion of said blades intermediate the conical portion and said upper end, the lower portion of said sleeve slidably engaging the tapered surface of said conical portion, an axially extending handle member surrounding a portion of said blades toward their upper end, said handle member being constrained against axial and rotational movement relative to said blades, and an axially extending resilient member disposed within said handle member, the upper end of said resilient member being constrained against axial movement and the lower end of said resilient member engaging the upper portion of said sleeve member, said resilient member tending to urge the lower portion of said sleeve against the tapered portion of said conical portion, thereby urging the blades together to provide interlocking engagement between the tip portions of the blades and the inclined slots of the screwhead.

2. A screwdriver as in claim **1** further including adjusting means threadedly mounted on the upper portion of said blades for adjusting the tension in said resilient member.

3. A screwdriver as in claim **2** wherein said adjusting means includes an axially threaded member having a generally planar lower surface and wherein the upper end of said handle member is formed to include a radially extending shoulder portion, the upper surface of said shoulder portion engaging the lower surface of the adjusting member and the lower surface of said shoulder portion engaging the upper end of said resilient member.

4. A screwdriver as in claim **3** further including a radially extending lug member carried by one of said blades and an axially extending slot formed in the shoulder portion of said handle member, said lug member being slidably disposed in said slot.