June 18, 1957 H. E. DIERKER 2,796,100

SCREW HOLDING SCREW DRIVER

Filed Feb. 13, 1956

FIG. 1.

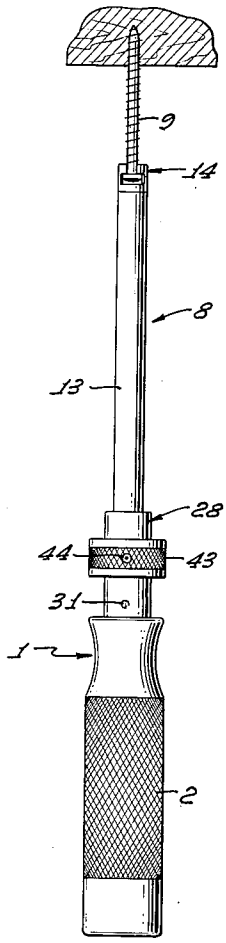


FIG. 2.

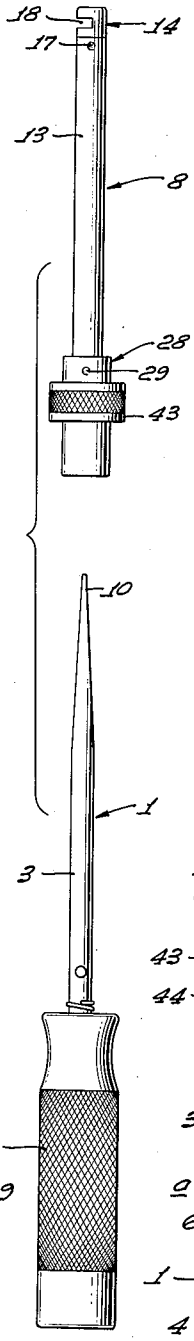


FIG. 3.

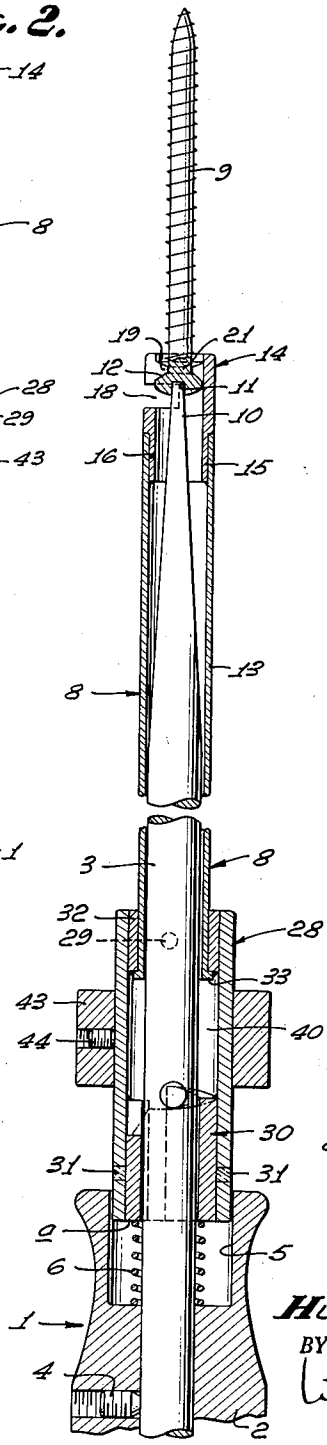


FIG. 4.

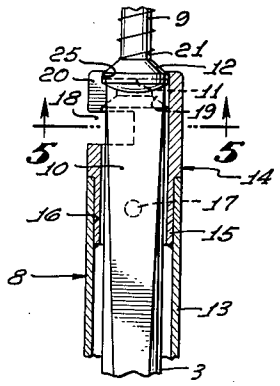


FIG. 5.

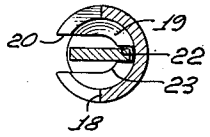


FIG. 6.

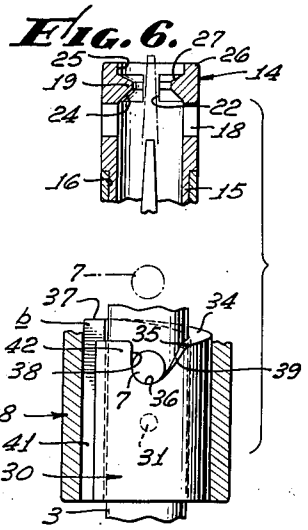
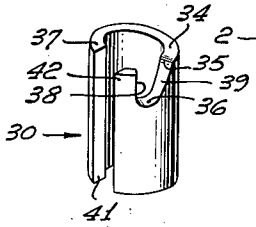


FIG. 7.



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2,796,100

SCREW HOLDING SCREW DRIVER

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Application February 13, 1956, Serial No. 565,131

3 Claims. (Cl. 145—52)

This invention relates to improvements upon an instrument for holding screws, such as the screw holding screw driver shown and described in my copending application, filed June 15, 1954, Serial Number 436,861.

The device of this application, and the invention herein described, relates to an instrument for surgeon's use in holding a screw used by physicians and surgeons in orthopedic surgery; and it is the general object of my invention to provide a novel, simple, strong, inexpensive and highly efficient instrument to enable a surgeon to effectively and securely hold a screw during placement of the screw in a bone during a bone or orthopedic surgical operation.

The device of my invention is particularly adaptable for use by a bone surgeon, and it is an object of my invention to provide a novel instrument of the above character whereby a screw may be securely held in locked engagement with the driving blade of the screw driver while the screw is being started in one part of a fractured bone (and in which the screw is used to hold fractured parts of a bone together), and is also efficiently correlated to the screw while it is being bottomed or screwed home without likelihood of the screw driver blade "skidding" or "slipping off" from the screw head during such operation.

Another object of my invention is to provide a novel instrument of this character which may be easily and quickly disassembled or dismantled to enable the same to be effectively cleansed and sterilized consonant with medical requirements and practice.

A still further object of my invention is to provide novel means in an instrument of the above character to efficiently and effectively correlate the parts of the assembled instrument so that they are in proper alignment for use, thereby eliminating any "lost motion" in positionment of the parts.

Yet another object is to provide a novel instrument of the above character in which the screw holding means are of rigid material having sliding and oscillatable movement relative to each other, and in which spring elements for holding the screw in contact with the screw driver blade are entirely eliminated.

The invention resides in the parts and combination and arrangement of the parts as more fully hereinafter described in detail in the accompanying specification and defined in the appended claims.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detail description, and the appended claims.

The accompanying drawing illustrates the invention in a form I at present deem preferable.

Figure 1 is a side elevational view showing an instrument constructed in accordance with my invention and in position engaging a screw being driven into the work which is shown in section, and illustrative only.

Fig. 2 is a composite view in side elevation showing the screw holding means and screw driver separated from each other and in alignment for assembly with each other to form the instrument shown in Fig. 1.

Fig. 3 is a fragmental view on enlarged scale showing the screw driver in elevation, and the screw holding means in section; and with a screw in locked engagement therewith. Parts are broken away to contract the view, and dot and dash lines indicate the forward surface of the operating cam.

Fig. 4 is a fragmentary cross-sectional view on enlarged scale, and analogous to Fig. 3, but showing the driving end of the screw driver in use during the final steps of bottoming the screw.

Fig. 5 is a cross-sectional view taken on line 5—5, Fig. 4.

Fig. 6 is a fragmentary cross-sectional view, similar to Fig. 3, but looking from the left to the right of Fig. 3 and with the screw removed, and showing the screw driver oscillated relative to the screw holding means (as in Fig. 4) and with its bit in retracted position. Dot and dash lines indicate a projected position of the screw driver blade or bit. Parts are broken away to contract the view.

Fig. 7 is a detail perspective view of the cam insert for moving the screw holding means longitudinally relative to the screw driver blade and for locking a screw therein, and for enabling disassembly of the screw holding means from the screw driver proper.

Referring to Figs. 2 and 3 of the drawing, **1** indicates the screw driver proper which comprises a handle **2** having one end of a shank **3** rigidly connected thereto by any suitable means, such as by set screw **4**. The handle **2** is provided with a recess **5** at its upper end around the shank **3**, and a mild coil or helical compression spring **6** surrounds the shank **3** and is received in recess **5** and retained on the shank **3** by a pin **7** that has a drive fit in shank **3** and projects a slight distance from the periphery of shank **3**. In addition to retaining spring **6** on the shank **3**, said pin **7** performs the other useful functions as hereinafter described.

The screw driver **1** proper, above described, may as such, be used as a common screw driver; the spring **6** and pin **7** not hindering its use in that manner.

Means **8**, for coaction with the screw driver **1**, are provided to hold and securely lock a screw **9** in engagement with the screw driving bit or blade **10** formed at the free end of shank **3**, and with such bit **10** being held in the screw-slot or kerf **11** provided in head **12** of screw **9**.

The screw holding and locking means **8** comprises a tubular member or sleeve **13** to slidably and rotatably receive the shank **3**, and is provided at its outer end or tip with a screw holding head **14** which has a reduced end **15** received in the bore **16** of tube **13** and rigidly secured therein and thereto by any suitable means, such as by brazing, or by the spot welding **17**, as shown. The head **14** is preferably of high alloy stainless steel.

The head **14** is substantially tubular and is diametrically slotted as at **18**, and provided with an inwardly projecting shoulder or flange **19** adjacent the outer edge of slot **18**, or in other words, between the slot **18** and the free outer end of head **14**. The head **14** and flange **19** are also slotted as at **20** symmetrical with the axis of the sleeve **13** and head **14**.

The slot **18** is provided to permit the head **12** of screw **9** to be passed laterally into the head **14**, and the slot **20** being of a width corresponding to, and receiving, the base portion **21** of the screw shank **9**; and the shoulder or flange **19** retains the head **12**.

Flange **19** is also provided with a slot **22** (Figs. 5 and 6) that extends outwardly from the semi-circular end **23** of slot **20** to enable the bit end **10** of the screw driver to pass therethrough, and for the purposes hereinafter described. Flange **19** is chamfered on its inner surface as at **24** (Fig. 6) to the angle of the underside of the screw head **12** received in the holding head **14**, to thereby

afford good seating coaction between the screw head 12 and the underside of flange 19.

The free outer end of head 14 is provided with a depression 25 which leaves and provides retaining walls 26 that extend outwardly from the upper or outer surface of flange 19 which is also chamfered as at 27 and providing a seat for the outer side of the screw head 12. The walls 26 extend circumferentially outward from the chamfered flange seat 27 a sufficient distance to extend above the base of the screw-slot 11 when positioned in depression 25 to further aid in maintaining the screw head 12 and blade 10 correlated with each other and reduce to a minimum likelihood of the blade 10 "skidding" or "slipping off" from the screw head during bottoming of the screw.

The screw holding and locking means 8 also comprises a tubular housing 28, one end of which is rigidly connected to the inner end of sleeve 13 by any suitable means, such as by brazing, or spot welding 29. A tubular cam member 30 is fixed to the inside of, and at the other or inner end of housing 28, in any suitable manner, as by a press fit, brazing, or the spot welding 31, as shown. The lower end of cam member 30 and the lower end of housing 28 are co-terminous, and provide a seat *a* for the screw holding and locking means 8 on the upper or outer end of spring 6 which operates between such co-terminous ends and the bottom of recess 5 to normally urge means 8 out of the recess 5 and in which the lower end of housing 28 is received, as shown in Fig. 3.

A spacer ring or bushing 32 may be interposed between the upper end of housing 28 and the lower end of sleeve 13 which is peened or spun over ring 32, as at 33, to aid in preventing separation of the parts, and obtaining rigidity of the parts thus assembled with each other.

The cam member 30 (Figs. 3, 6 and 7) is preferably of case hardened steel (but may be made of powdered metal cast into the shape shown) and has a cam surface 34 that progresses helically upward from a low point 35, at which a recess 36 is provided to receive the pin 7, to a high point 37.

The recess 36 is arcuate and of a diameter approximating that of pin 7 and a guiding surface 38 extends tangentially from the side of recess 36 opposite that of the low point 35 of cam surface 34, and such surface 38 extends in parallelism with the longitudinal axis of screw driver shank 3. The cam 30 has an inclined surface 39 that connects the low point 35 of cam surface 34 tangentially with the recess 36 opposite that of guiding surface 38 for ease of positioning the locking pin 7 on cam surface 34 during screw locking operation.

The sleeve 13 of the screw holding means, and parts fixedly connected thereto, has a slidable and rotary movement relative to the screw driver shank 3 and locking pin 7 extending from the periphery thereof. It will be understood that pin 7 projects from the periphery of shank 3 only such distance as to ride upon cam surface 34 and without contacting the walls of chamber 40 formed by the bore of housing 28.

To facilitate and permit the screw driver 1 to be easily and quickly assembled and disassembled from the screw holding and locking means 8, the cam member 30 is provided with a slot, groove, passage-way or recess 41 that extends therethrough from the high point 37 of cam surface 34 through seat *a*, in parallelism with the longitudinal axis of the screw driver shank 3. Such slot 41 being circumferentially spaced from guiding surface 38 a sufficient distance to form a rigid stop member 42 that extends upwardly from one side of recess 36 and terminates a short distance below the high point 37 of cam surface 34.

An exteriorally knurled finger and thumb piece 43 is rigidly secured to the housing 28 by an Allen head set screw 44.

To assemble the screw holder means 8 on the screw driver 1, the shank 3 is inserted longitudinally into tube or sleeve 13; pin 7 entering and passing through slot 41, thence over stop member 42; and upon release of manual pressure, the spring 6 (which has been engaged by seat *a* and compressed) will move and tend to urge the sleeve 13 and shank 3 longitudinally away from each other, and cause pin 7 to seat or come to rest in recess 36 (Fig. 6). The pin 7 when seated in recess 36 limits outward longitudinal movement of sleeve 13 relative to shank 3, and tension of spring 6 need only be sufficient to maintain the pin 7 nested in recess 36. It will also be noted that the bit 10 is encased within the screw holding head 14 with the bit entirely below the lower or inner surface of slot 18, so as not to interfere with free passage of a screw head 12 into the head 14. In assembly, the blade 10, pin 7, head 14 and guiding surface 38 are so correlated that in this position (when the locking pin 7 finds its position in recess 36) the bit or blade 10 of the screw driver is in alignment with slot 22 in flange 19, and guiding surface 38 maintains such alignment whereby the bit or blade 10 may be easily passed through slot 22 to engage and enter the kerf or slot 11 of a screw head 12 nested within walls 26 and seated upon the flange seat 27 (Fig. 4).

In operation, with the instrument assembled as just described, and when driving a screw 9 into any member 45 (which may well be a broken bone or a fastening plate to be secured on a broken bone, instead of the member shown for illustrative purposes only), the instrument of my invention will be used as shown in Fig. 1.

The screw 9 having first been inserted in the screw holding head 14 by passing the head 12 thereof into the diametrical slot 18 with the shank or base portion 21 being received in the slot 20; the holding means 8 and screw driver 1 are then reciprocated longitudinally of each other so that the bit or blade 10 is received in the kerf or screw-slot 11, and then the holding means 8 and screw driver 1 are oscillated relative to each other so that the pin 7 will engage the cam surface 34 and continued oscillation will cause effective longitudinal movement to force screw head 12 onto seat 24 or against shoulder or flange 19 and securely lock and firmly hold screw 9 rigidly and solidly at the free end of the instrument and in engagement with bit 10.

The degree of inclination of cam surface 34 is gradual and pin 7 is retained in adjusted position thereon (when clamping a screw) by frictional engagement of the now solid connection between the screw head 12 forced against flange 19 by bit 10 at one end and by cam surface 34 against pin 7 on shank 3 at the other end. The locking position of pin 7 on cam surface 34 is determined by the varying dimensions of the screw heads my instrument is designed to clamp.

It will thus be seen that in such screw clamping or holding mechanism spring elements are entirely eliminated. The spring 6 tending at all times to urge the bit 10 out of the kerf 11 rather than into it.

The instrument of my invention may then be utilized by a surgeon to initially thread the screw into the work until the head 14 closely approaches the same, whereupon the shank 3 and sleeve 13 will be oscillated to release clamping or holding of the screw head against flange 19, and the parts moved to the position shown in Fig. 6, whereupon the screw holding head 14 will be moved sideways from head 12 to disengage head 14 therefrom.

Thereupon the surgeon positions the screw head 12 in the recess 25, and pushes forwardly on the handle 2, the bit 10 being previously positioned to be guided past flange 19 through slot 22 by pin 7 and guiding surface 38, and the bit 10 then again enters the kerf 11 of screw 9 which is then driven home.

In driving the screw fully home, the retaining walls 26 surround the screw head 12 and prevent likelihood of the screw driver blade 10 from "skidding" or "slipping off" from the screw head 12; and during this operation, the mild coiled spring 6 causes a forward thrust on the head

14 with sufficient tension to keep the screw head 12 hooded by the walls 26 during this screw driving operation, until the outer edge of wall 26 meets with resistance (such as contact with the work), when it will automatically retract under driving pressure and against the tension of spring 6, and permit the screw to bottom.

It will be noted that full pressure can be exerted by my instrument against the head of a screw, and that the application of pressure is at all times direct from the handle 2 to the bit 10, and that the screw driver 1 is not structurally weakened in any particular; further, no spring means are employed in the screw holding and locking means 8 per se, or to force or urge the blade 10 into the kerf or screw-slot, the spring 6 being only of sufficient strength to provide a snug co-action between means 8 and the screw driver, and to force the seat 27 against screw head 12 and the retaining walls 26 around the screw head 12 when bottoming the screw 9; the spring also acting to separate or normally urge screw seats 24, 27 and bit 10 axially away from each other.

The screw holding and locking means 8 is readily removable from the screw driver 1 by merely moving sleeve 13 and shank 3 axially toward each other until pin 7 is above stop member 42, then oscillating said members counterclockwise until pin 7 contacts the high wall *b* of slot 41 and then is passed therethrough, thus leaving only two integral parts 1 and 8 (the pin 7 and spring 6 remaining on part 1) conveniently separable from each other for effective sterilization consonant with medical requirements and practice.

It will be understood that a screw driver for Woodruff head or Phillips head, cross-slot, or any commonly used screws may be easily provided by suitable adaptation of a chuck and bit therefor without departing from the spirit of my invention.

While I have described and illustrated a presently preferred embodiment of my invention, it is obvious that various changes may be made therein by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In an instrument of the class described, a handle mounted shank having a bit provided with a driving face at one end to engage the head of a securing element; a sleeve member oscillatably and slidably mounted for longitudinal movement on said shank; chuck means at one end of said sleeve to releasably retain a securing element in engagement with said driving face; co-acting cam means respectively fixedly connected to said shank and to the other end of said sleeve, said cam means including a cam member having a cam surface progressing helically upward from a low point to a high point, and a guiding surface adjacent the low point and rising toward, but terminating below, the high point of said cam surface and forming a stop member; said cam member having a passageway extending therethrough from a point adjacent the high point and adjacent to, and past, the low point of said cam surface; said passageway being circumferentially spaced from said guiding surface; said cam means also including a projecting member adapted to ride upon said cam surface and lock the driving face in engagement with said securing element, and to also pass through said passageway for assembly and disassembly of said sleeve member and said shank, that portion of said passageway extending above said stop member being adapted to be engaged by said projecting member and position said sleeve and shank for disassembly thereof; and spring means normally urging said sleeve member outwardly on said shank, and said projecting member to seated position at the low point of said cam surface and against said guiding surface.

2. An instrument as set forth in claim 1, and in which said cam member is provided with a recess adjacent its low point to receive said projecting member and position it against said guiding surface.

3. In an instrument of the class described, a handle mounted shank having a bit to be received in a slot headed screw; means cooperating with said shank to releasably retain a slot headed screw centered with said bit received in the screw slot, said means including a sleeve oscillatably and slidably mounted for longitudinal movement on said shank; cam means fixed to, and adjacent one end of said sleeve, said cam means including a cam member having a cam surface progressing helically upward from a low point to a high point, and a guiding surface adjacent the low point and rising toward the high point of said cam surface; a projecting member secured to said shank to stop against said guiding surface and ride upon said cam surface; and there being a slot adjacent said high point and spaced circumferentially from said guiding surface extending through said cam member and through which said projecting member may pass to permit separation and removal of said sleeve from said shank; said sleeve having at its outer end a screw retaining head provided with an inwardly extending shoulder, said retaining head being transversely slotted to receive a screw head, and said retaining head and shoulder being slotted longitudinally to receive the head and shank of a screw; said shoulder being provided at the inner end of said longitudinal slot with a bit receiving slot; and said bit, guiding surface and projecting member being so correlated that when said projecting member is guided by said guiding surface said bit is in alinement to enter said bit receiving slot; and spring means normally urging said projecting member to seated position at the low point of said cam surface and against said guiding surface.

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