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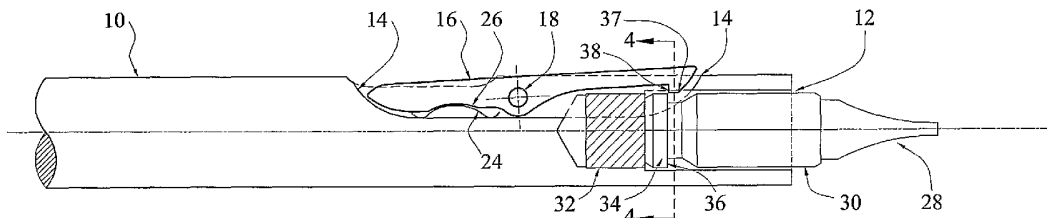
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(54) Title: SCREWDRIVER BIT LOCKING MECHANISM



(57) Abstract: Chuck (12) is formed in screwdriver shaft (10). Slot (14) in shaft (10) intersects chuck (12). Lever (16) is pivotally mounted in slot (14). Spring (24) biases the lever's tab (37) into chuck (12). Bit (28) has a collar (34) of length equalling the difference between the distance from pivot point (18) to (i) the tab's rearward face (38), and (ii) the chuck's rearward end. As bit (28) enters chuck (12), the bit's rearward end slides under lever (16), overcoming the spring's bias and pivoting the lever into a bit insert/release position. When the collar's forward face (36) moves rearwardly of rearward face (38), spring (24) pivots lever (16) into a closed position in which tab (37) protrudes into the chuck's rearward end, latching the tab's rearward face (38) against the collar's forward face (36), preventing unintended withdrawal of the bit from the chuck.

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## SCREWDRIVER BIT LOCKING MECHANISM

### Technical Field

[0001] This invention pertains to releasable locking of a screw-  
5 driver bit into a chuck without significantly impeding insertion of the  
screwdriver's shaft into a narrow aperture.

### Background

[0002] Multiple-bit screwdrivers can be used with any one of a  
10 plurality of interchangeable bits. The bit selected for use is inserted  
into a chuck machined in the end of the screwdriver's shaft. A magnet  
is often embedded in the chuck to magnetically retain the bit until it is  
manually withdrawn from the chuck and replaced with a different bit.  
The magnet is usually unable to retain a bit which becomes jammed  
15 within a screw head. Consequently, a jammed bit may be pulled out of  
the chuck as the screwdriver is drawn away from the screw. This is  
particularly problematic if the screw is recessed within an aperture—if  
the bit does not protrude from the aperture it can be difficult to retrieve  
the bit.

20 [0003] Screwdriver bit locking mechanisms address the foregoing  
problem. One common bit locking mechanism incorporates a spring-  
loaded ball. When the bit is inserted into the chuck, the spring forces  
the ball into a circumferential notch formed around the bit's shank. A  
circumferential latch mechanism prevents dislodgement of the ball from  
25 the notch. The bit is thus retained within the chuck and cannot be  
pulled free if it becomes jammed in a screw head. To remove the bit  
from the chuck, one must disengage the latch, then pull the bit out of  
the chuck.

[0004] A conventional bit locking mechanism surrounds the chuck.  
30 The locking mechanism's bulk prevents insertion of the screwdriver's  
shaft, beyond the locking mechanism, into an aperture narrower than  
the locking mechanism's largest external cross-sectional dimension.  
This is especially problematic if the increasingly popular single-ended

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5  $\frac{1}{4}$  inch hexagonal bits (so-called “insert bits” or “power bits”) complying with American National Standards Institute (ANSI) specification B 104.4-1982 are used, since the bit locking mechanism must be mounted close to the end of the screwdriver’s shaft in order to engage the bit. Preferably, the screwdriver should have a relatively long shaft capable of being fully inserted into an aperture which is only slightly larger than the shaft’s largest external cross-sectional dimension.

#### Brief Description of Drawings

10 [0005] Figure 1A is a partially sectioned side elevation view of a screwdriver shaft having a bit locking mechanism in accordance with the invention, showing the locking mechanism in the insert/release position relative to a bit adapted for use with the invention.

15 [0006] Figure 1B shows the Figure 1A locking mechanism in the closed position.

[0007] Figure 2 is a partially sectioned side elevation view of a screwdriver shaft having a bit locking mechanism in accordance with the invention, adapted for use with the bit shown in Figures 1A and 1B or with the ball-retainable bit shown in Figure 2.

20 [0008] Figure 3 is a partially sectioned side elevation view of a screwdriver shaft having an alternative bit locking mechanism in accordance with the invention, and showing a bit adapted for use with the Figure 2 or Figure 3 locking mechanisms.

25 [0009] Figure 4 is an end elevation sectional view, on an enlarged scale, taken with respect to line 4—4 shown in each of Figures 1A, 1B, 2 and 3, showing the bit locking mechanism’s insert/release position in solid outline and showing the bit locking mechanism’s closed position in dashed outline.

30 [0010] Figure 5 is a side elevation sectional view, on an enlarged scale, of the screwdriver shaft portion of the apparatus depicted in Figures 1A and 1B.

- [0011] Figure 6A is a side elevation view, on an enlarged scale, of the pivot lever portion of the apparatus depicted in Figures 1A and 1B. Figure 6B is a side elevation view, on an enlarged scale, of the pivot lever portion of the apparatus depicted in Figure 16.
- 5 [0012] Figure 7 is a partially sectioned side elevation view of a screwdriver shaft having another alternative bit locking mechanism in accordance with the invention, shown in the closed position relative to a bit adapted for use with the Figure 7 locking mechanism or with a ball type bit locking mechanism.
- 10 [0013] Figure 8 is a partially sectioned side elevation view of a screwdriver shaft having a further alternative bit locking mechanism in accordance with the invention, shown retaining a conventional ball-retainable bit.
- [0014] Figure 9A is a side elevation view, on an enlarged scale, of the pivot lever portion of the apparatus depicted in Figure 8. Figure 9B is a side elevation view, on an enlarged scale, of an alternative pivot lever for the apparatus depicted in Figure 8.
- [0015] Figure 10 is a partially sectioned top plan view of the apparatus depicted in Figures 8 and 9A.
- 20 [0016] Figure 11 is a partially sectioned side elevation view of a screwdriver shaft having an alternative form of the Figure 8 and 10 locking mechanism, shown retaining a conventional ball-retainable bit.
- [0017] Figure 12 is an end elevation sectional view, on an enlarged scale, taken with respect to line 12—12 shown in Figure 8, showing the bit locking mechanism's bit-engaging portion in dashed outline.
- 25 [0018] Figure 13 is an end elevation sectional view, on an enlarged scale, taken with respect to line 13—13 shown in Figure 11, showing the bit locking mechanism's bit-engaging portion in dashed outline.
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[0019] Figure 14 is an end elevation view, on an enlarged scale, of the screwdriver shaft portion of the apparatus depicted in Figures 11 and 13.

5 [0020] Figure 15 is a partially sectioned top plan view of the apparatus depicted in Figures 11 and 13.

[0021] Figure 16 is a partially sectioned side elevation view of a screwdriver shaft having a first springless bit locking mechanism in accordance with the invention, and showing a bit adapted for use with the Figure 16 locking mechanism.

10 [0022] Figures 17A and 17B are oblique isometric views of a screwdriver shaft having a second springless bit locking mechanism in accordance with the invention. Figure 17C is a top plan view of the apparatus depicted in Figures 17A and 17B. Figure 17D is similar to Figure 17C, but omits the pivot lever portion of the apparatus. Figure  
15 17E depicts the pivot lever portion of the apparatus shown in Figures 17A and 17B. Figure 17F is a sectional side elevation view of the apparatus depicted in Figures 17A and 17B, showing the locking mechanism in the closed position. Figure 17G is similar to Figure 17F, but omits the pivot lever portion of the apparatus. Figure 17H is similar to  
20 Figure 17F, but shows the locking mechanism in the bit insert/release position. Figure 17I is a partially sectioned side elevation view of the apparatus depicted in Figure 17D. Figure 17J is a cross-sectional view taken with respect to line 17J—17J shown in Figure 17I.

[0023] Figures 18A and 18B are oblique isometric views of a  
25 screwdriver shaft having a third springless bit locking mechanism in accordance with the invention. Figure 18C is a top plan view of the apparatus depicted in Figures 18A and 18B. Figure 18D is similar to Figure 18C, but omits the pivot lever portion of the apparatus. Figure  
18E depicts the pivot lever portion of the apparatus shown in Figures  
30 18A and 18B. Figure 18F is a sectional side elevation view of the apparatus depicted in Figures 18A and 18B, showing the locking mech-

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anism in the closed position. Figure 18G is similar to Figure 18F, but omits the pivot lever portion of the apparatus. Figure 18H is similar to Figure 18F, but shows the locking mechanism in the bit insert/release position. Figure 18I is a partially sectioned side elevation view of the apparatus depicted in Figure 18D. Figure 18J is a cross-sectional view taken with respect to line 18J—18J shown in Figure 18I.

[0024] Figure 19 is a side elevation view of a double-ended screwdriver bit for use with the invention.

## 10 Description

[0025] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0026] Figures 1A and 1B depict a screwdriver shaft 10 having an internally hexagonally cross-sectioned chuck 12 formed (e.g. via a broach cutting operation) in the end of shaft 10. A longitudinally extending slot 14 is formed (e.g. via a Woodruff cutter) in the side of shaft 10. As best seen in Figure 5, slot 14 intersects a rearward portion of the broached aperture forming chuck 12, although such intersection is preferably minimized or eliminated as explained below. (As used herein, “forward” means the direction toward the open, bit-receiving end of chuck 12 and “rearward” means the opposite direction.) A lever 16 which extends substantially parallel to shaft 10, is pivotally mounted in slot 14 on pivot pin 18, which extends transversely through aperture 20 (Figure 6A) in lever 16 into apertures machined in shaft 10 on opposed sides of slot 14 (only one such aperture 22 is shown in Figure 5). A leaf spring 24 is provided between slot 14’s rearward end and

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notch 26 formed in the underside of lever 16's rearward end. Spring 24 exerts an upward force against lever 16, biasing lever 16 in the clockwise direction about pivot pin 18, as viewed in Figures 1A and 1B.

[0027] Screwdriver bit 28 has a hexagonally cross-sectioned shank  
5 30 sized and shaped for slidable, close-fit insertion in chuck 12. A magnet 32 may optionally be provided in chuck 12's base to magnetically retain bit 28 within chuck 12. Bit 28 is specially adapted for use with lever 16 by forming collar 34 around bit 28's rearward end with a forward face 36 substantially perpendicular to the longitudinal axis of  
10 bit 28. As best seen in Figure 6A, lever 16's forward end is formed with a tab 37 having a rearward face 38 substantially perpendicular to the longitudinal axis of lever 16. Lever 16's forward end 40 is rounded. The length of collar 34 is substantially equal to the difference between (i) the distance from pivot pin 18 to tab 37's rearward face 38,  
15 and (ii) the distance from pivot pin 18 to the rearward end of chuck 12. As bit 28 is inserted through chuck 12, the bit's rearward end slides under and along lever 16's forward end 40, overcoming the biasing force exerted by spring 24 and pivoting lever 16 counter-clockwise (as viewed in Figures 1A and 1B) about pivot pin 18 until lever 16 is in the  
20 bit insert/release position shown in Figure 1A. As soon as collar 34's forward face 36 moves sufficiently rearwardly to clear tab 37's rearward face 38, spring 24 pivots lever 16 clockwise about pin 18 into the closed position shown in Figure 1B, such that tab 37 protrudes into the rearward end of chuck 12 with tab 37's rearward face 38 latched against  
25 bit 28's forward face 36 to prevent unintended withdrawal of bit 28 from chuck 12. Bit 28 can be removed from chuck 12 by depressing the rearward end of lever 16 to overcome spring 24's biasing force and pivot lever 16 counter-clockwise about pivot pin 18 into the Figure 1A bit insert/release position. Bit 28 can then be withdrawn from chuck 12  
30 while lever 16 is held in the bit insert/release position.

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**[0028]** Figure 2 depicts an alternative locking mechanism adapted for use with an alternative, ball-retainable bit 28A. Components which are similar in the embodiments depicted in Figures 1A, 1B, 2, 4, 5 and 6 bear the same reference numerals in those Figures and need not be described further. Lever 16A depicted in Figure 2 is similar to lever 16, except lever 16A has a tapered forward end 40A, giving tab 37A a triangular shape having a rearward face 38A substantially perpendicular to the longitudinal axis of lever 16A. This allows bit 28A to be formed with a circumferential recess 42 having circumferentially rounded forward and rearward ends 44, 46. Rearward end 46 is circumferentially notched between collar 34A's forward face 36A and recess 42. Forward face 36A is substantially perpendicular to the longitudinal axis of bit 28A. Besides permitting latching engagement of lever 16A's rearward face 38A with bit 28A's forward face 36A, this permits use of bit 28A in screwdrivers having conventional ball type locking mechanisms. Specifically, recess 42's rounded ends 44, 46 are capable of latchingly engaging a conventional bit locking mechanism's spring-loaded ball in the same manner as a conventional bit complying with the aforementioned ANSI specification. Conversely, bits designed only for use with ball type locking mechanisms may be imperfectly retained by lever 16A, due to the absence on such bits of a forward face substantially perpendicular to the bit's longitudinal axis. Operation of the Figure 2 embodiment is otherwise similar to that of the embodiment of Figures 1A and 1B.

**[0029]** Figure 3 depicts a locking mechanism which is similar to the locking mechanism depicted in Figures 1A and 1B, except that the Figure 3 chuck 12B is formed to receive alternative bit 28B which can be used either with the Figure 3 locking mechanism or with the Figure 2 locking mechanism. Components which are similar in the embodiments of Figures 1A, 1B, 2, 3, 4, 5 and 6 bear the same reference numerals in those Figures and need not be described further. Bit 28B's



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rearward collar 34B is formed with a forward face 36B substantially perpendicular to the bit's longitudinal axis, capable of latchingly engaging tab 37's rearward face 38 as previously described in relation to Figures 1A, 1B; and also capable of latchingly engaging tab 37A's rearward face 38A as previously described in relation to Figure 2. Operation of the Figure 3 embodiment is otherwise similar to that of the embodiment of Figures 1A and 1B.

**[0030]** Figure 7 depicts another alternative locking mechanism. Components which are similar in the embodiments of Figures 1A, 1B, 2, 3, 4, 5, 6 and 7 bear the same reference numerals in those Figures and need not be described further. The Figure 7 locking mechanism reduces intersection of slot 14 with chuck 12C, reducing potential weakening of shaft 10 which may be important if shaft 10 is power-driven. Chuck 12C is formed by broach-cutting a primary longitudinal aperture 48 in shaft 10's forward end, then broach-cutting a secondary aperture 50 which has a smaller diameter than and extends longitudinally rearwardly from the rearward end of primary aperture 48. Alternative bit 28C is formed in compliance with ANSI specification B 107.4-1982, for example by providing recess 42C having rounded forward and rearward ends. Bit 28C is additionally provided with a reduced diameter rearward extension including collar 34C having a forward face 36C substantially perpendicular to the longitudinal axis of bit 28C. The rearward extension portion of bit 28C extends within secondary aperture 50 when bit 28C is fully inserted into chuck 12C. A downwardly extending tab 52 having a rearward face 38C substantially perpendicular to the longitudinal axis of lever 16C is formed just rearwardly of lever 16C's rounded forward end 40C. As bit 28C is inserted through chuck 12C, collar 34C slides under and along lever 16C's forward end 40C, overcoming the biasing force exerted by spring 24 and pivoting lever 16C counter-clockwise (as viewed in Figure 7) about pivot pin 18. As soon as forward face 36C moves sufficiently

rearwardly to clear lever 16C's rearward face 38C, spring 24 pivots lever 16 clockwise about pin 18 into the closed position shown in Figure 7, latching rearward face 38C against forward face 36C to prevent unintended withdrawal of bit 28C from chuck 12C. The rearward extension portion of bit 28C allows slot 14 to be located sufficiently rearwardly on shaft 10 that slot 14 does not intersect chuck 12C's primary aperture 48. The rearward extension portion of bit 28C may optionally be fabricated as a separate piece having a forward projecting stud 53 which can be press-fitted into the rearward end of the forward portion of bit 28C.

**[0031]** Figures 8, 10 and 12 depict a simple, inexpensive locking mechanism which can be used with a conventional ball-retainable bit 28D. Components which are similar in the embodiments of Figures 1A, 1B, 8, 10 and 12 bear the same reference numerals in those Figures and need not be described further. A spring steel lever 54 is fastened to shaft 10, within slot 14D, by screws 56. A downwardly rounded protrusion 58 is formed on lever 54's forward end. As bit 28D is inserted into chuck 12D, the bit's rearward end slides under protrusion 58. Lever 54's spring steel construction allows protrusion 58 to deflect upwardly as bit 28D slides under and rearwardly of protrusion 58. When bit 28D's circumferential recess 60 reaches a position adjacent protrusion 58, the spring steel construction of lever 54 biases protrusion 58 into recess 60. Although lever 54 does not latchingly engage bit 28D, the bit is retained sufficiently to resist some forces which could otherwise cause unwanted withdrawal of bit 28D from chuck 12D as shaft 10 is drawn away from a screw head while bit 28D is seated in the screw head. Slot 14D's depth "D" (Figure 8) can be relatively shallow compared to the depth of slot 14 depicted in Figures 1A, 1B. Moreover, slot 14D need only intersect chuck 12D over a small aperture portion 62 (best seen in Figure 10) sufficient to allow the aforementioned interaction of protrusion 58 and recess 60. As shown in Figures

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9A and 9B, protrusion 58 can be formed in various ways, for example by bending lever 54's forward end over on itself as shown in Figure 9B.

[0032] Figures 11 and 13-15 depict a modification for enhancing the bit retention capability of the Figure 8 & 10 embodiment. Components which are similar in the embodiments of Figures 8, 10, 11 and 13-15 bear the same reference numerals in those Figures and need not be described further. As best seen in Figure 14, an approximately 270° circumferential portion of shaft 10 is machined to reduce the shaft's diameter on both sides of aperture 62 along a region which extends longitudinally from the forward end of aperture 62 over a longitudinal distance at least double the length of aperture 62. Longitudinally extending notches 64 are machined radially in shaft 10 along the opposed ends of shaft 10's reduced diameter portion. Semi-cylindrical sleeve 66 is formed with radially inwardly extending tabs 68 which are slidably extended within notches 64. Sleeve 66 is sized and shaped to closely match the size and shape of shaft 10's reduced diameter portion, allowing sleeve 66's outer circumference to smoothly merge with the outer circumference of the non-reduced diameter portion of shaft 10 when sleeve 66 is slidably mounted on shaft 10, as shown in Figures 13 and 15. Sleeve 66 can be slidably moved forwardly or rearwardly along shaft 10's reduced diameter portion, as indicated by the double-headed arrow in Figure 15.

[0033] Lever 54D's forward end is formed with an "S" shaped protrusion 70 best seen in Figure 11. The rearward, downwardly rounded portion of protrusion 70 is functionally equivalent to downwardly rounded protrusion 58 described above in relation to the embodiment of Figures 8 and 10. The forward, upwardly rounded portion of protrusion 70 bears against the underside of sleeve 66, when sleeve 66 is slidably moved into its forward, closed position shown in Figure 11. This assists in maintaining engagement of protrusion 70's downwardly rounded portion within bit 28D's recess 60, enhancing lever 54D's

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capability to prevent unwanted withdrawal of bit 28D from chuck 12D. Bit 28D can be withdrawn from chuck 12D by sliding sleeve 66 rearwardly to expose aperture 62, allowing protrusion 70 to deflect upwardly through aperture 62 as bit 28D is pulled forwardly to withdraw  
5 bit 28D from chuck 12D.

**[0034]** Figures 6B and 16 depict a first alternative bit locking mechanism which does not require a spring to bias the pivot lever into the closed position. Components which are similar in the embodiments of Figures 1A, 1B, 6B and 16 bear the same reference numerals in  
10 those Figures and need not be described further. Lever 16E depicted in Figures 6B and 16 is similar to lever 16 depicted in Figure 6A, except lever 16E's forward end 40E is less tapered, giving tab 37E a rectangular shape. Tab 37E's rearward face 38E has a steep downward and rearward taper. Lever 16E's forward portion 39 is wider than the  
15 corresponding portion of lever 16. The forward end of forward portion 39 has a shallow downwardly and rearwardly tapered face 41. A notch 43 is thus formed between faces 38E and 41.

**[0035]** Bit 28E is formed with a circumferential recess 42E having forward and rearward ends 44E, 46E which are both substantially  
20 perpendicular to the longitudinal axis of bit 28E to permit latching engagement of lever 16E's tab 37E within bit 28E's recess 42E.

**[0036]** Magnet 32E is provided in chuck 12E's base to magnetically retain bit 28E within chuck 12E. Magnet 32E also magnetically retains lever 16E in the closed position depicted in Figure 16, thus  
25 eliminating the need for a spring, as aforesaid. Magnet 32E can be optionally encased within a brass sleeve 33 to reduce dissipation of magnet forces exerted by magnet 32E, e.g. in comparison to the dissipation that would occur if magnet 32E were encased in steel. Operation of the Figure 16 embodiment is otherwise similar to that of the  
30 embodiment of Figures 1A and 1B.

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[0037] Figures 17A—17J depict a second alternative bit locking mechanism which does not require a spring to bias the pivot lever into the closed position. Components which are similar in the embodiments of Figures 1A, 1B, 6B, 16 and 17A—17J bear the same reference numerals in those Figures and need not be described further. Lever 16F depicted in Figures 17A, 17C, 17E, 17F and 17H—17J is similar to lever 16E depicted in Figure 6B, except lever 16F has no pivot pin receiving aperture (cf. lever 16E's aperture 20) and does not require a pivot pin. Instead, a semi-spherical protrusion 72 is formed on the central underside of lever 16F. Protrusion 72 is canted downwardly and forwardly at a slight angle (about 10°) relative to lever 16F's transverse axis. A recess 74 sized and shaped to snugly but pivotably receive protrusion 72 is formed in shaft 10, below the central portion of slot 14. Recess 74 is canted downwardly and forwardly at the same angle  $\alpha$  (Figure 17G) of about 10° as protrusion 72. Such canting allows lever 16F to be moved from the closed position shown in Figure 17F into the bit insert/release position shown in Figure 17H by applying a slight downward thumb pressure to the rearward end of lever 16F. A circumferential groove 82 can be machined in shaft 10, around recess 74. After lever 16F is placed in slot 14, an O-ring 84 is fitted into groove 82 to prevent dislodgment of lever 16F from slot 14. Persons skilled in the art will understand that it is not necessary to completely encircle shaft 10 to prevent dislodgment of lever 16F from slot 14. Any circumferential or semi-circumferential clip, cap or retainer capable of covering slot 14 to prevent dislodgment of the lever from the slot will suffice. Operation of the Figure 17A—17J embodiment is otherwise similar to that of the embodiment of Figures 6B and 16.

[0038] Figures 18A—18J depict a third alternative bit locking mechanism which does not require a spring to bias the pivot lever into the closed position. Components which are similar in the embodiments of Figures 17A—17J and 18A—18J bear the same reference numerals in

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those Figures and need not be described further. Lever 16G depicted in Figures 18A, 18C, 18E, 18F and 18H—18J is similar to lever 16F depicted in Figures 17A, 17C, 17E, 17F and 17H—17J, except that instead of a semi-spherical protrusion, a flat semi-cylindrical protrusion 76 is formed on the central underside of lever 16G. Protrusion 76 is canted downwardly and forwardly at a slight angle (about 10°) relative to lever 16G's transverse axis. A slot type recess 78 sized and shaped to snugly but pivotably receive protrusion 76 is formed in shaft 10, below the central portion of slot 14. Slot 78 is canted downwardly and forwardly at the same angle  $\alpha$  (Figure 18G) of about 10° as protrusion 76. Such canting allows lever 16G to be moved from the closed position shown in Figure 18F into the bit insert/release position shown in Figure 18H by applying a slight downward thumb pressure to the rearward end of lever 16G. One side of shaft 10 is apertured, as indicated at 80, during the machining operation used to form slot 78 (e.g. to provide access for a Woodruff cutter). Operation of the Figure 18A—18J embodiment is otherwise similar to that of the embodiment of Figures 17A—17J.

**[0039]** Figure 19 depicts a double-ended bit 28F which can be used with any of the Figure 16, 17A—17J or 18A—18J embodiments of the invention. Specifically, bit 28F is formed with two circumferential recesses 42F, each having forward and rearward ends 44F, 46F which are substantially perpendicular to the longitudinal axis of bit 28F to permit latching engagement of lever 16E's tab 37E or lever 16F's tab 37E within bit 28F's recess 42F. Persons skilled in the art will understand that elongation of slot 14, lever 16E, lever 16F and shaft 10 may be required to accommodate bit 28F.

**[0040]** As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or

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scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

## WHAT IS CLAIMED IS:

1. A screwdriver bit locking mechanism, comprising:
  - (a) a shaft (10);
  - 5 (b) a bit chuck (12) in one end of the shaft (10);
  - (c) a slot (14) in the shaft (10), intersecting a rearward portion of the chuck (12);
  - (d) a lever (16);
  - 10 (e) a pivot pin (18) pivotally coupling the lever (16) to the shaft (10) for extension of the lever (16) within the slot (14) substantially parallel to the shaft (10);
  - (f) a tab (37) on a forward end of the lever (16), the tab (37) having a rearward face (38) substantially perpendicular to a longitudinal axis of the lever (16); and
  - 15 (g) a spring (24) normally biasing the tab (37) into the chuck (12).
2. A screwdriver bit locking mechanism as defined in claim 1,  
20 wherein the lever's forward end (40) is rounded.
3. A screwdriver bit locking mechanism as defined in claim 1,  
wherein the lever's forward end (40A) is tapered.
4. A screwdriver bit (28) for use with a screwdriver bit locking  
25 mechanism as defined in claim 1, the screwdriver bit (28) comprising:
  - (a) a shank (30);
  - (b) a collar (34) on a rearward end of the shank (30), the collar (34) having a length substantially equal to the difference  
30 between:



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- (i) the distance from the pivot pin (18) to the rearward face (38) on the tab (37);
    - (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12); and
  - 5 (c) a forward face (36) on the collar (34), the forward face (36) substantially perpendicular to a longitudinal axis of the bit (28).
  
- 10 5. A screwdriver bit (28A) for use with a screwdriver bit locking mechanism as defined in claim 3, the screwdriver bit (28A) comprising:
  - (a) a shank (30);
  - (b) a collar (34A) on a rearward end of the shank (30), the collar (34A) having a length substantially equal to the  
15 difference between:
    - (i) the distance from the pivot pin (18) to the rearward face (38) on the tab (37);
    - (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12);
  - 20 (c) a forward face (36A) on the collar (34A), the forward face (36A) substantially perpendicular to a longitudinal axis of the bit (28A);
  - (d) a circumferential recess (42) forward of the collar (34A), the recess (42) having circumferentially rounded forward  
25 and rearward ends (44, 46); and
  - (e) a circumferential notch between the recess (42) and the collar (34A).
  
- 30 6. A screwdriver bit (28B) for use with a screwdriver bit locking mechanism as defined in either one of claims 1 or 3, the screwdriver bit (28B) comprising:

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- (a) a shank (30);
- (b) a collar (34B) on a rearward end of the shank (30), the collar (34B) having a length substantially equal to the difference between:
- 5 (i) the distance from the pivot pin (18) to the rearward face (38) on the tab (37);
- (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12B);
- (c) a forward face (36B) on the collar (34B), the forward face (36B) substantially perpendicular to a longitudinal axis of the bit (28B); and
- 10 (d) a circumferential recess (42) forward of the collar, the recess having a circumferentially rounded forward end (44).
- 15
7. A screwdriver bit locking mechanism, comprising:
- (a) a shaft (10);
- (b) a bit chuck (12C) in one end of the shaft (10), the chuck (12C) further comprising a primary aperture (48) and a secondary aperture (50), the secondary aperture (50) having a smaller diameter than and extending rearwardly of the primary aperture (48);
- 20 (c) a slot (14) in the shaft (10), intersecting the secondary aperture (50) without intersecting the primary aperture (48);
- 25 (d) a lever (16C);
- (e) a pivot pin (18) pivotally coupling the lever (16C) to the shaft (10) for extension of the lever (16C) within the slot (14) substantially parallel to the shaft (10);

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- 5 (f) a tab (52) on a forward end of the lever (16C), the tab (52) having a rearward face (38C) substantially perpendicular to a longitudinal axis of the lever (16C); and
- (g) a spring (24) normally biasing the tab (52) into the secondary aperture (50).
8. A screwdriver bit (28C) for use with a screwdriver bit locking mechanism as defined in claim 7, the screwdriver bit (28C) comprising:
- 10 (a) a shank (30) ;
- (b) a collar (34C) on a rearward end of the shank (30), the collar (34C) having a diameter smaller than a diameter of the shank (30) and having a length substantially equal to the difference between:
- 15 (i) the distance from the pivot pin (18) to the rearward face (38C) on the tab (52);
- (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12C);
- (c) a forward face (36C) on the collar (34C), the forward face (36C) substantially perpendicular to a longitudinal axis of the bit (28C).
- 20
9. A screwdriver bit (28C) as defined in claim 8, further comprising a circumferential recess (42C) in the shank, forward of the collar (34C), the recess (42C) having circumferentially rounded forward and rearward ends.
- 25
10. A screwdriver bit locking mechanism, comprising:
- (a) a shaft (10);
- 30 (b) a bit chuck (12D) in one end of the shaft (10);

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- (c) a slot (14D) in the shaft (10), intersecting a rearward portion of the chuck (12D); and
- (d) a lever (54) mounted in the slot (14D) and extending substantially parallel to the shaft (10), the lever (54) having a downwardly extending protrusion (58) biased into the rearward portion of the chuck (12D).
- 5
11. A screwdriver bit locking mechanism as defined in claim 10, further comprising:
- 10 (a) an upwardly extending protrusion (70) on the lever (54), adjacent to the downwardly extending protrusion (58);
- (b) a sleeve (66) mounted on the shaft (10) and slidably movable between:
- 15 (i) a closed position in which the sleeve (66) covers the upwardly extending protrusion (70); and
- (ii) an open position in which the sleeve (66) does not cover the upwardly extending protrusion (70).
12. A screwdriver bit locking mechanism, comprising:
- 20 (a) a shaft (10);
- (b) a bit chuck (12E) in one end of the shaft (10);
- (c) a slot (14) in the shaft (10), intersecting a rearward portion of the chuck (12E);
- (d) a lever (16E);
- 25 (e) a pivot pin (18) pivotally coupling the lever (16E) to the shaft (10) and maintaining the lever (16E) within the slot (14) substantially parallel to the shaft (10);
- (f) a tab (37E) on a forward end (40E) of the lever (16E), the tab (37E) having a rearward face (38E) having a downward and rearward taper; and
- 30

- 20 -

- (g) a magnet (32E) in the shaft (10), normally biasing the tab (37E) into the chuck (12E).
- 5 13. A screwdriver bit (28E) for use with a screwdriver bit locking mechanism as defined in claim 12, the screwdriver bit (28E) comprising:
- 10 (a) a shank (30);
- (b) a collar on a rearward end of the shank (30), the collar having a length substantially equal to the difference between:
- (i) the distance from the pivot pin (18) to the rearward face (38E) on the tab (37E);
- (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12E); and
- 15 (c) a forward face on the collar, the forward face substantially perpendicular to a longitudinal axis of the bit (28E).
14. A screwdriver bit locking mechanism, comprising:
- 20 (a) a shaft (10);
- (b) a bit chuck in one end of the shaft (10);
- (c) a slot (14) in the shaft (10), intersecting a rearward portion of the chuck;
- (d) a lever (16F);
- 25 (e) a protrusion (72, 76) on the lever (16F) pivotally coupling the lever (16F) to the shaft (10) and maintaining the lever (16F) within the slot (14) substantially parallel to the shaft (10);
- (f) a tab (37E) on a forward end (40E) of the lever (16F), the tab (37E) having a rearward face (38E) having a downward and rearward taper; and
- 30

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- (g) a magnet (32E) in the shaft (10), normally biasing the tab (37E) into the chuck.
- 5 15. A screwdriver bit locking mechanism as defined in claim 14 wherein the protrusion (72) is semi-spherical.
16. A screwdriver bit locking mechanism as defined in claim 14 wherein the protrusion (76) is semi-cylindrical.
- 10 17. A screwdriver bit locking mechanism as defined in claim 14, further comprising a retainer covering the slot (14) to prevent dislodgment of the lever (16F) from the slot (14).
- 15 18. A screwdriver bit (28E) for use with a screwdriver bit locking mechanism as defined in claim 14, the screwdriver bit (28E) comprising:
- 20 (a) a shank (30);
- (b) a collar on a rearward end of the shank (30), the collar having a length substantially equal to the difference between:
- (i) the distance from the protrusion (72, 76) to the rearward face (38E) on the tab (37E);
- (ii) the distance from the protrusion (72, 76) to a rearward end of the chuck; and
- 25 (c) a forward face on the collar, the forward face substantially perpendicular to a longitudinal axis of the bit (28E).

## AMENDED CLAIMS

received by the International Bureau on 02 June 2006 (02.06.06)

- (c) a slot (14D) in the shaft (10), the slot extending substantially parallel to a longitudinal axis of the shaft (10) and intersecting a rearward portion of the chuck (12D); and
- (d) a lever (54) mounted in and extending longitudinally along the slot (14D) substantially parallel to the longitudinal axis of the shaft (10), the lever (54) having a downwardly extending protrusion (58) biased into the rearward portion of the chuck (12D).
- 5
- 10 11. A screwdriver bit locking mechanism as defined in claim 10, further comprising:
- (a) an upwardly extending protrusion (70) on the lever (54), adjacent to the downwardly extending protrusion (58);
- (b) a sleeve (66) mounted on the shaft (10) and slidably movable between:
- 15 (i) a closed position in which the sleeve (66) covers the upwardly extending protrusion (70); and
- (ii) an open position in which the sleeve (66) does not cover the upwardly extending protrusion (70).
- 20
12. A screwdriver bit locking mechanism, comprising:
- (a) a shaft (10);
- (b) a bit chuck (12E) in one end of the shaft (10);
- (c) a slot (14) in the shaft (10), intersecting a rearward portion of the chuck (12E);
- 25 (d) a lever (16E);
- (e) a pivot pin (18) pivotally coupling the lever (16E) to the shaft (10) and maintaining the lever (16E) within the slot (14) substantially parallel to the shaft (10);

- (f) a tab (37E) on a forward end (40E) of the lever (16E), the tab (37E) having a rearward face (38E) having a downward and rearward taper; and
- (g) a magnet (32E) in the shaft (10), normally biasing the tab (37E) into the chuck (12E).
- 5
13. A screwdriver bit (28E) for use with a screwdriver bit locking mechanism as defined in claim 12, the screwdriver bit (28E) comprising:
- 10 (a) a shank (30);
- (b) a collar on a rearward end of the shank (30), the collar having a length substantially equal to the difference between:
- (i) the distance from the pivot pin (18) to the rearward face (38E) on the tab (37E);
- 15 (ii) the distance from the pivot pin (18) to a rearward end of the chuck (12E); and
- (c) a forward face on the collar, the forward face substantially perpendicular to a longitudinal axis of the bit (28E).
- 20
14. A screwdriver bit locking mechanism, comprising:
- (a) a shaft (10);
- (b) a bit chuck in one end of the shaft (10);
- (c) a slot (14) in the shaft (10), the slot extending substantially parallel to a longitudinal axis of the shaft (10) and intersecting a rearward portion of the chuck;
- 25 (d) a lever (16F);
- (e) a protrusion (72, 76) on the lever (16F) pivotally coupling the lever (16F) to the shaft (10) and maintaining the lever (16F) within the slot (14) substantially parallel to the shaft
- 30 (10);



- 5 (f) a tab (37E) on a forward end (40E) of the lever (16F), the tab (37E) having a rearward face (38E) having a downward and rearward taper; and
- (g) a magnet (32E) in the shaft (10), normally biasing the tab (37E) into the chuck.
- 15 15. A screwdriver bit locking mechanism as defined in claim 14 wherein the protrusion (72) is semi-spherical.
- 10 16. A screwdriver bit locking mechanism as defined in claim 14 wherein the protrusion (76) is semi-cylindrical.
17. A screwdriver bit locking mechanism as defined in claim 14, further comprising a retainer covering the slot (14) to prevent dislodgment of the lever (16F) from the slot (14).
- 15 17. A screwdriver bit locking mechanism as defined in claim 14, further comprising a retainer covering the slot (14) to prevent dislodgment of the lever (16F) from the slot (14).
18. A screwdriver bit (28E) for use with a screwdriver bit locking mechanism as defined in claim 14, the screwdriver bit (28E) comprising:
- 20 (a) a shank (30);
- (b) a collar on a rearward end of the shank (30), the collar having a length substantially equal to the difference between:
- 25 (i) the distance from the protrusion (72, 76) to the rearward face (38E) on the tab (37E);
- (ii) the distance from the protrusion (72, 76) to a rearward end of the chuck; and
- (c) a forward face on the collar, the forward face substantially perpendicular to a longitudinal axis of the bit (28E).
- 30

## STATEMENT UNDER ARTICLE 19 (1)

Please substitute the enclosed replacement sheets numbered 19, 20 and 21 for the correspondingly numbered sheets of this application.

Statement Under Article 19(1)

The Written Opinion of the International Searching Authority asserts that Applicant's claims 10 and 14-17 lack inventive step in view of D1 (US 3177910 da Silva).

It is noted that Applicant's claim 10 corresponds to the embodiment depicted in Applicant's drawing figures 8, 10 & 12 and described at page 9, lines 11-31 of Applicant's specification. As understood by Applicant, the Examiner perceives the following correspondence between Applicant's original claim 10 and D1:

| <u>Applicant's Claim 10</u> | <u>D1</u>                      |
|-----------------------------|--------------------------------|
| shaft (10)                  | shank 12                       |
| bit chuck (12D)             | interior dimension of shank 12 |
| slot (14D) in shaft (10)    | opening 44                     |
| lever (54)                  | spring 32                      |
| protrusion (58)             | loop 38                        |

D1's channel-shaped projection 36 cannot correspond to Applicant's slot 14D, because claim 10 stipulates that slot 14D is "*in* the shaft (10)" whereas projection 36 is *external* to

D1's shank 12. See D1 column 3, lines 19-20 "...a channel-shaped projection 36 *on the top side* of the slide 26"; and note that slide 26 is itself *external* to D1's shank 12 (see D1 column 3, lines 3-4: "The slide 26 closely engages the *external* surface of the shank 12...").

Sub-paragraphs (c) and (d) of Claim 10 have been amended to better distinguish D1, by stipulating that:

- slot (14D) in shaft (10) extends substantially parallel to the shaft's longitudinal axis; and
- lever (54) extends longitudinally along slot (14D) substantially parallel to the shaft's longitudinal axis.

D1's opening 44 does not extend substantially parallel to the longitudinal axis of D1's shank 12. The end portion 34 of D1's spring 32 engaged within D1's channel-shaped projection 36 cannot correspond to the portion of Applicant's lever (54) which extends longitudinally along slot (14D) because, as explained above, D1's channel-shaped projection 36 cannot correspond to Applicant's slot (14D). The only slots "in" D1's shank 12 are openings 44, but the loop 38 portion of D1's spring 32 *transversely* engages openings 44—it does not extend substantially parallel to the longitudinal axis of D1's shank 12.

Sub-paragraph (c) of Claim 14 has been amended to better distinguish D1, by stipulating that slot (14) in shaft (10) extends substantially parallel to the shaft's longitudinal axis. It is noted that Claim 14(e) already stipulates that lever (16F) is pivotally coupled to shaft (10) and is maintained *within slot (14) substantially parallel to shaft (10)*. The D1 element (i.e. opening 44) which purportedly corresponds to Applicant's slot (14) does not extend substantially parallel to the longitudinal axis of D1's shank 12. The end portion 34 of D1's spring 32 cannot correspond to the portion of Applicant's lever (16F) which is maintained within slot (14) substantially parallel to shaft (10), because D1's channel-shaped projection 36 cannot correspond to Applicant's slot (14). The only slots "in" da Silva's shank 12 are openings 44, but the loop 38 portion of da Silva's spring 32 *transversely* engages openings 44—it does not extend substantially parallel to the longitudinal axis of da Silva's shank 12.

Claims 15, 16 and 17 depend from Claim 14 and accordingly also distinguish D1.

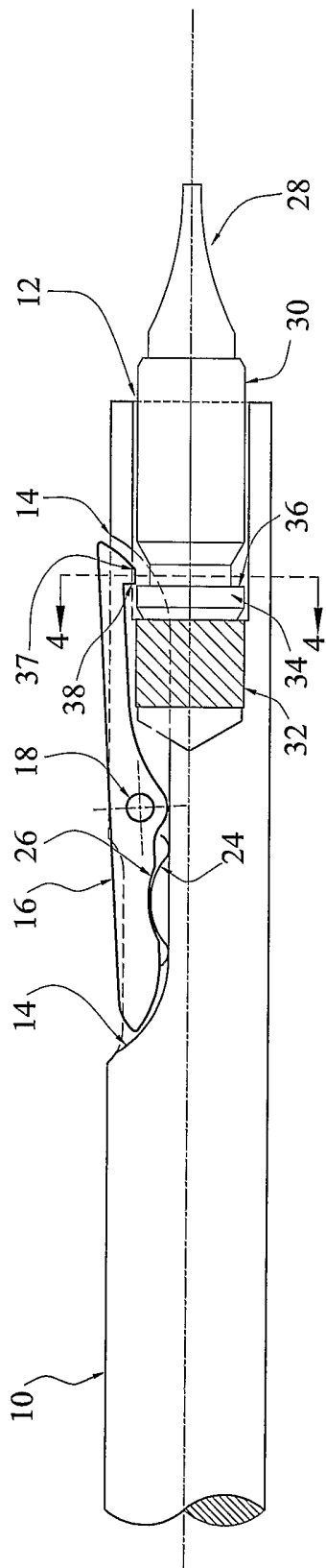


FIGURE 1A

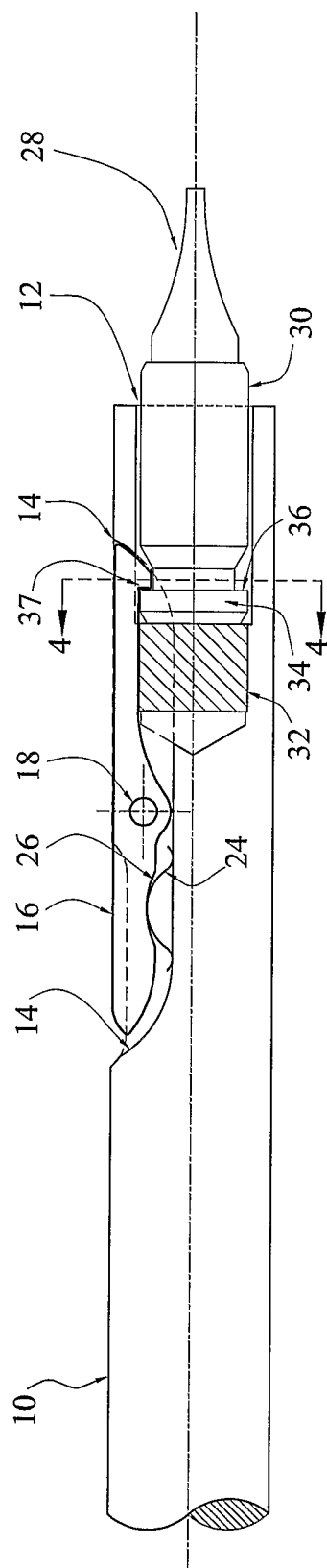


FIGURE 1B

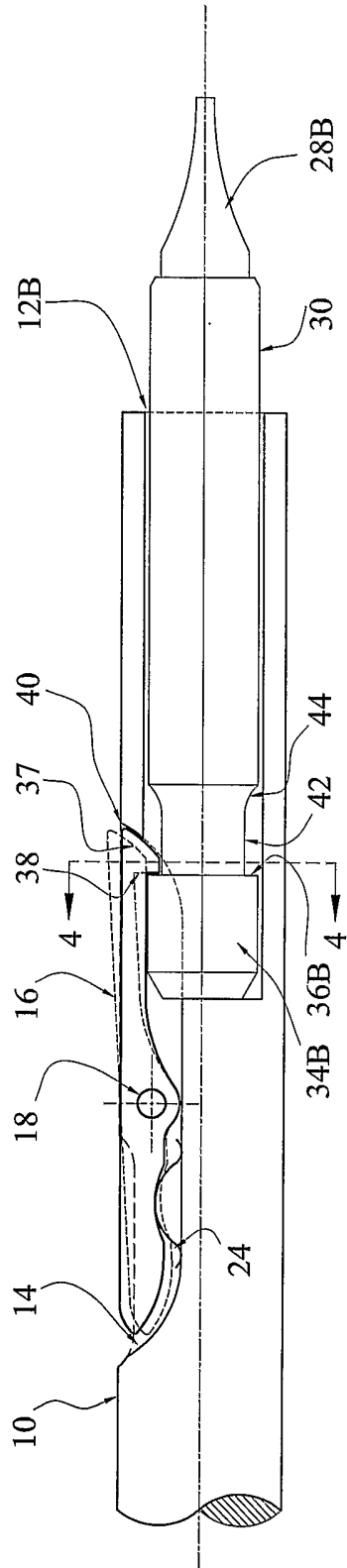


FIGURE 3

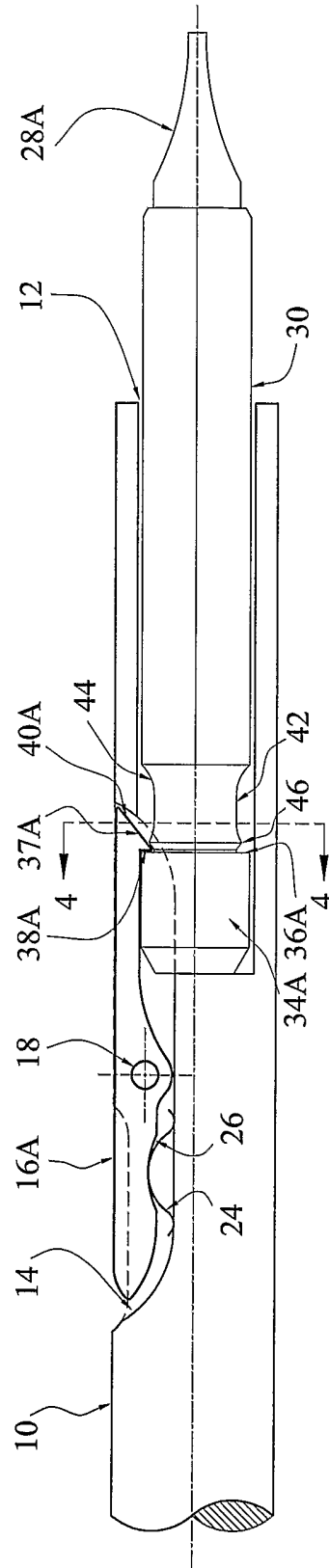


FIGURE 2

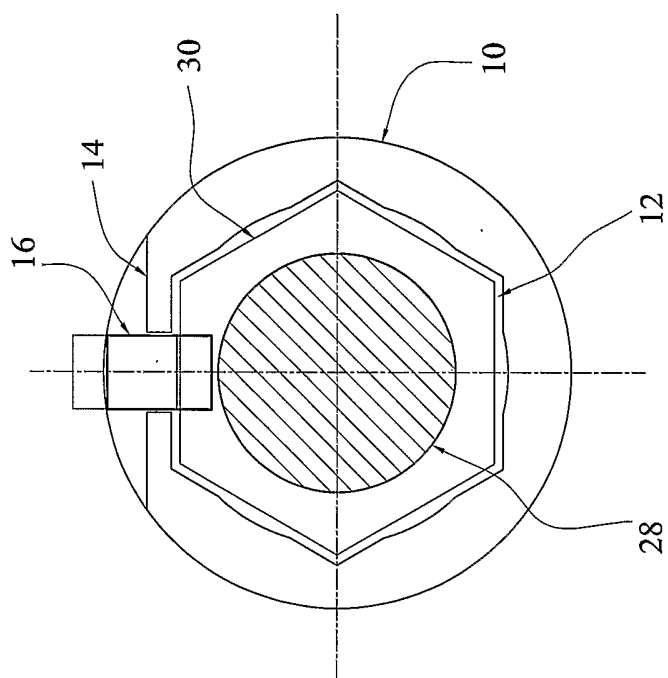


FIGURE 4

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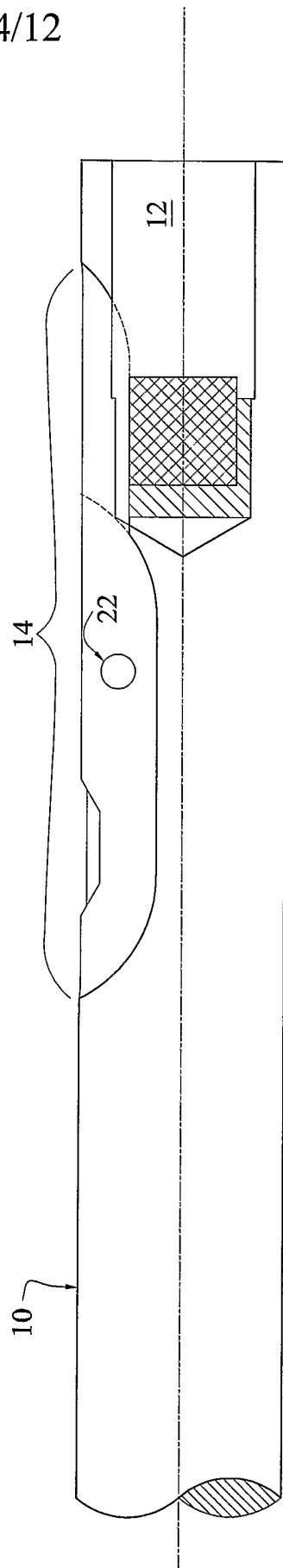


FIGURE 5

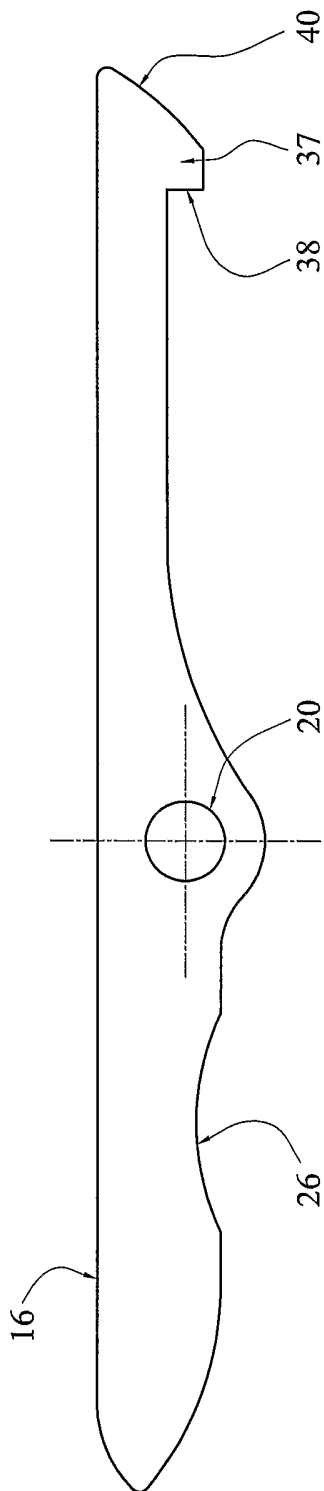


FIGURE 6A

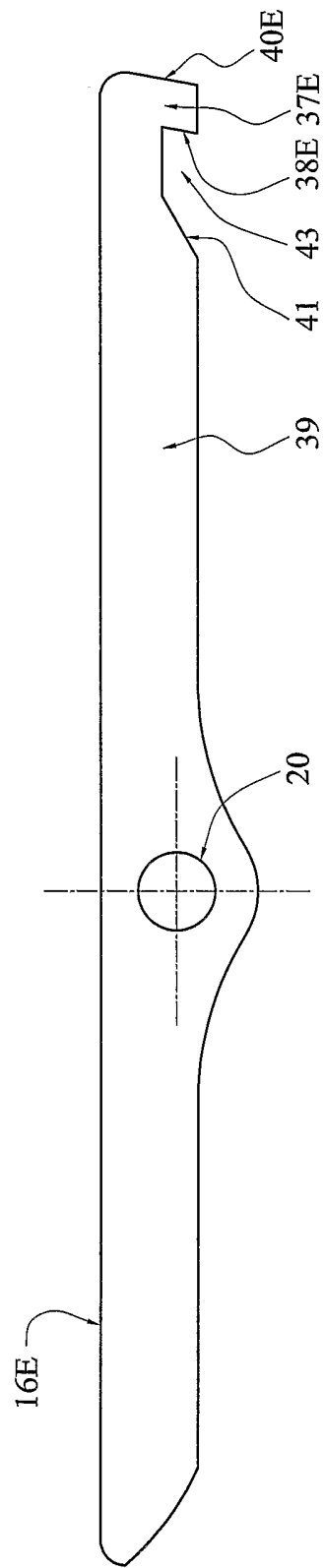


FIGURE 6B



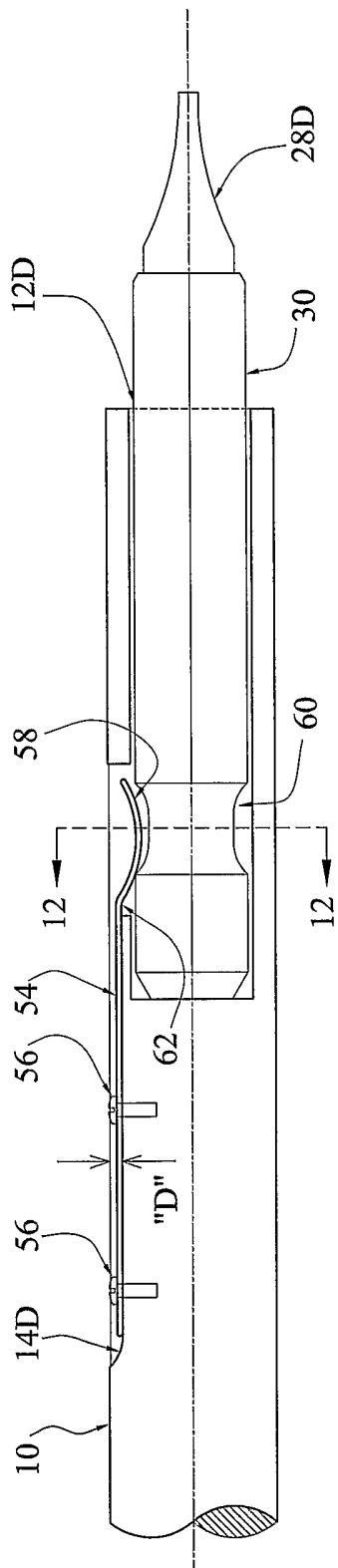


FIGURE 8

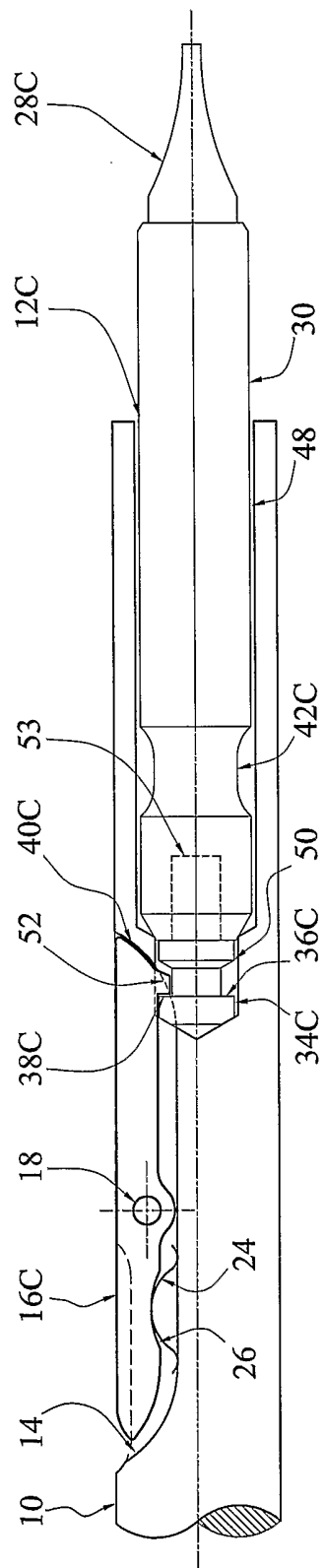


FIGURE 7

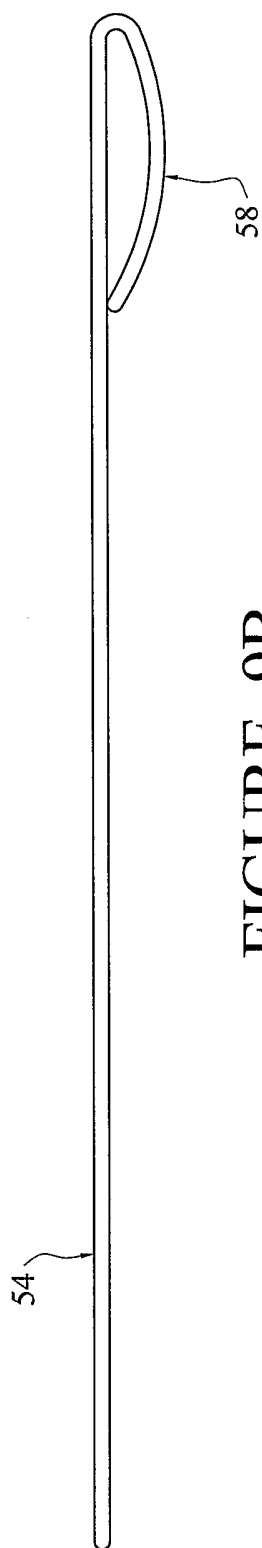


FIGURE 9B

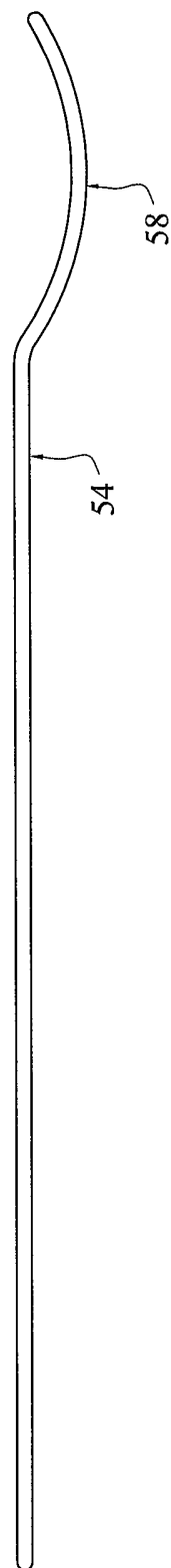


FIGURE 9A

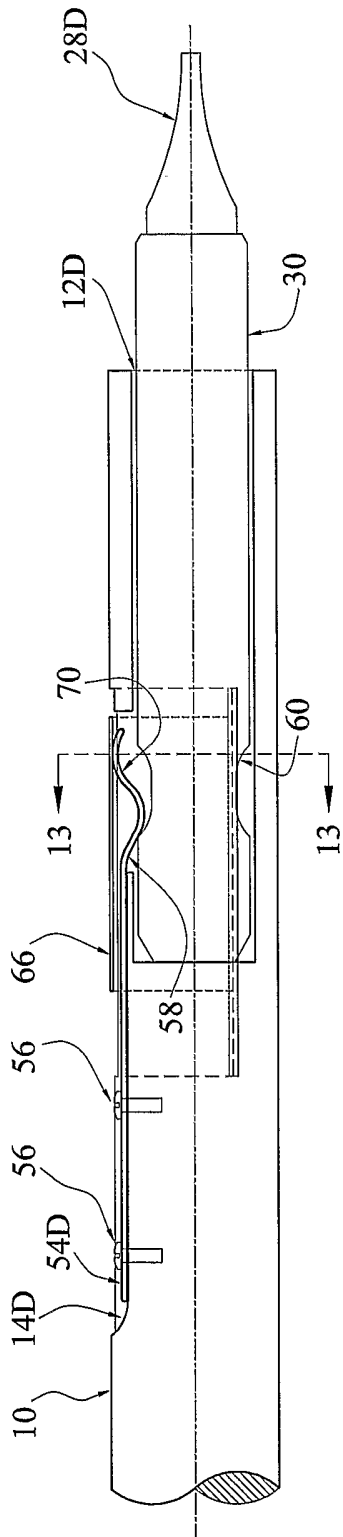


FIGURE 11

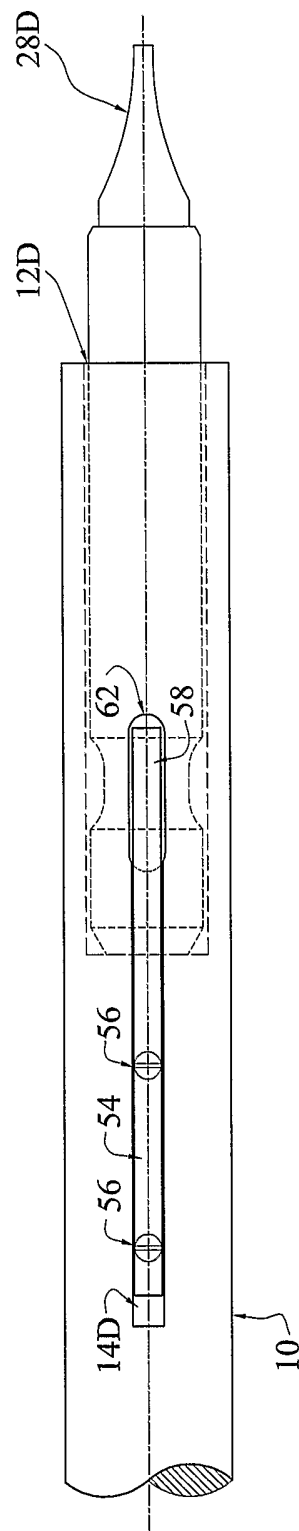


FIGURE 10

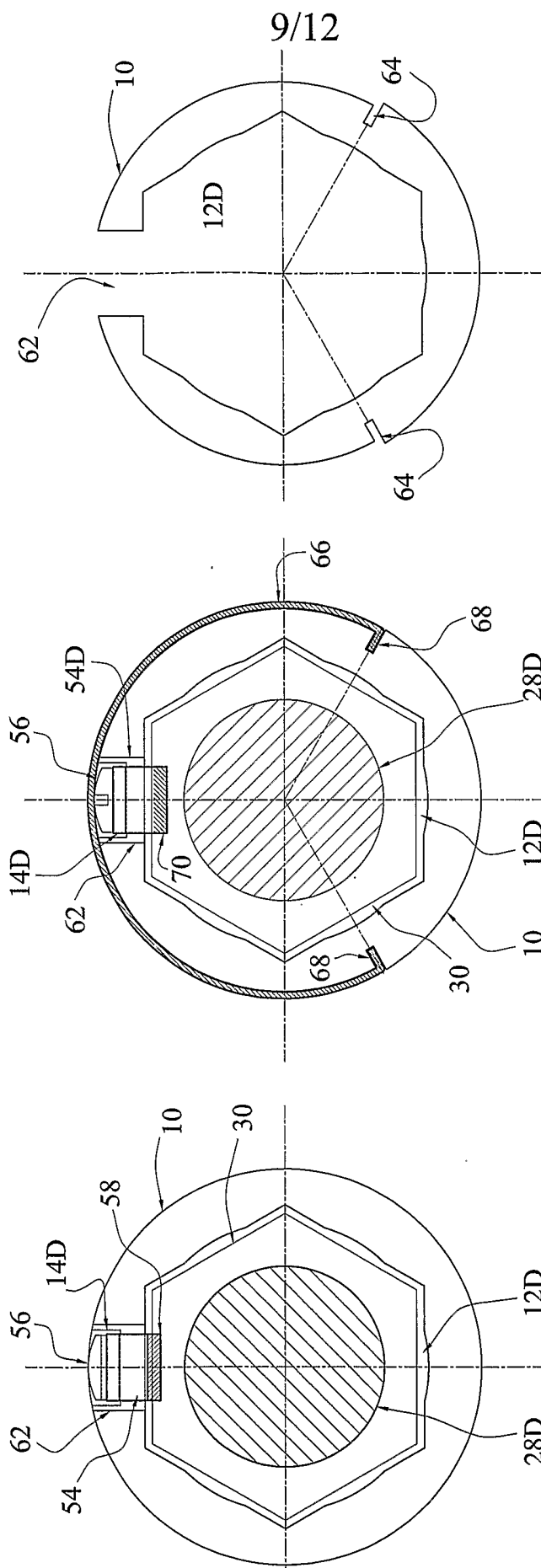


FIGURE 12

FIGURE 13

FIGURE 14

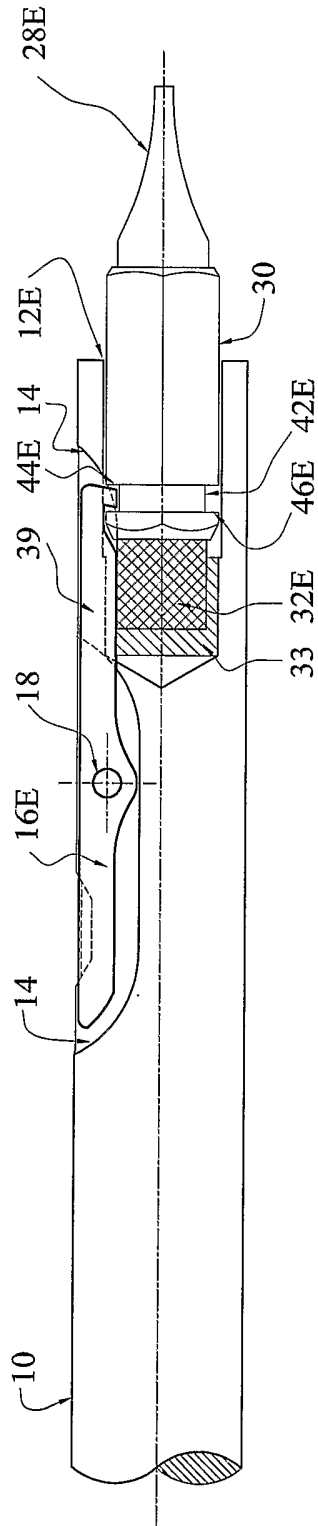


FIGURE 16

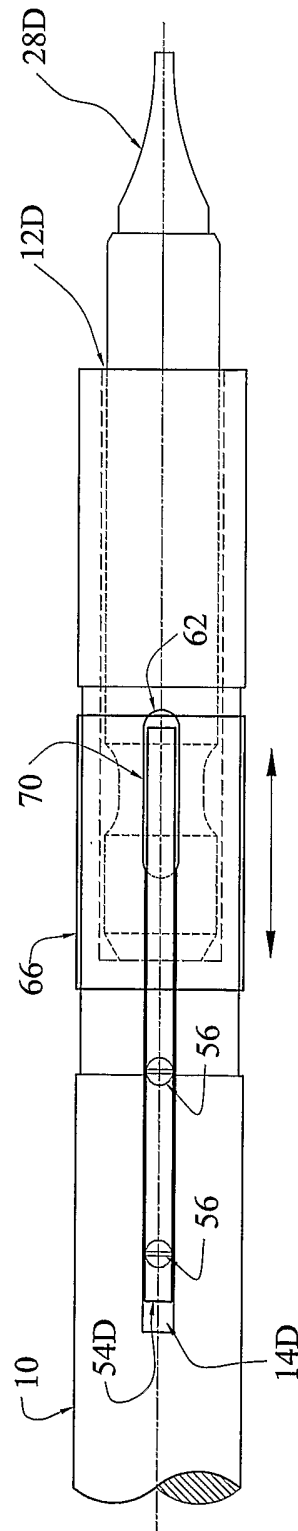
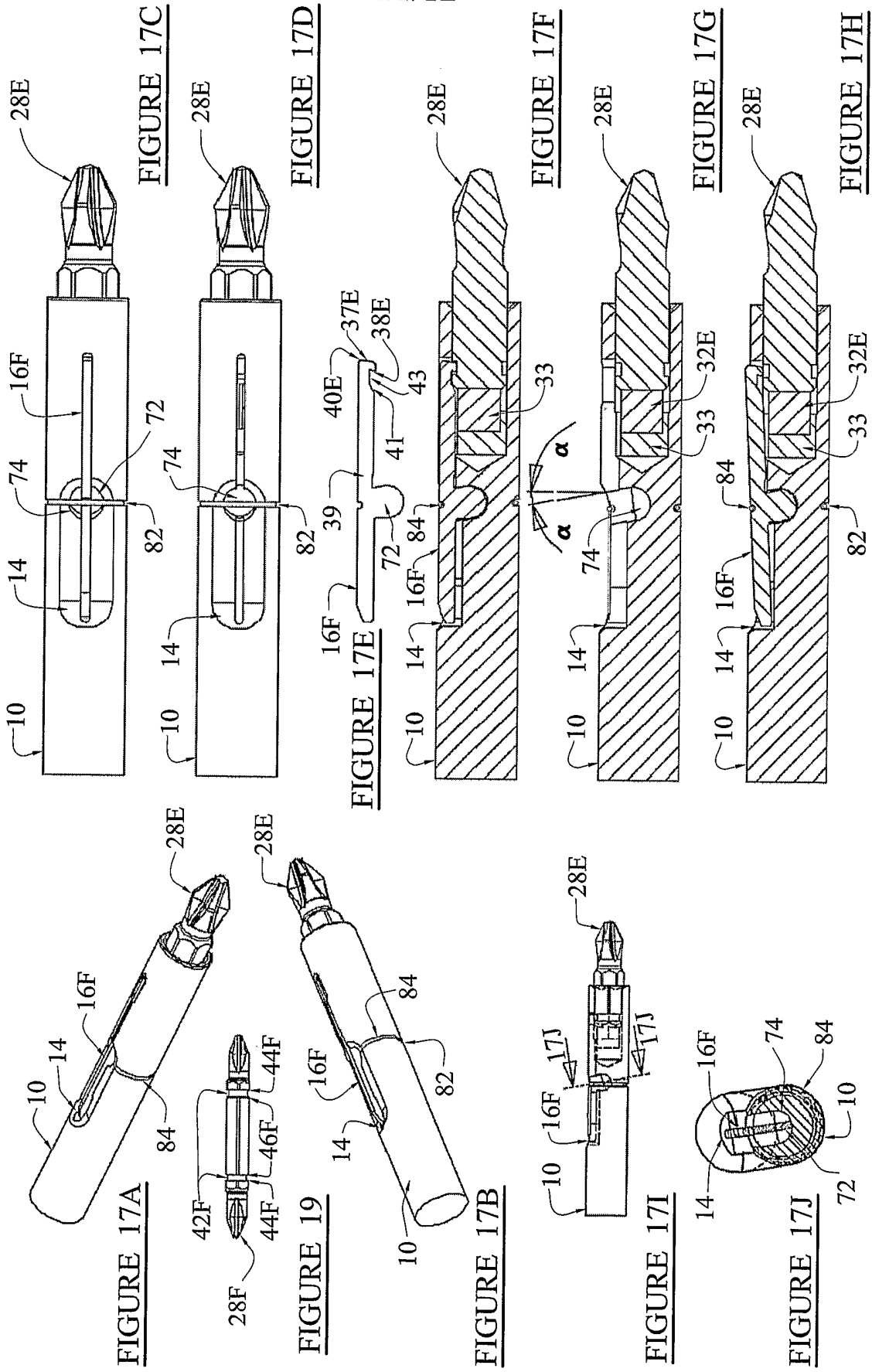


FIGURE 15



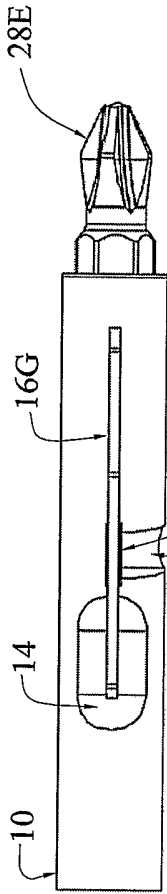
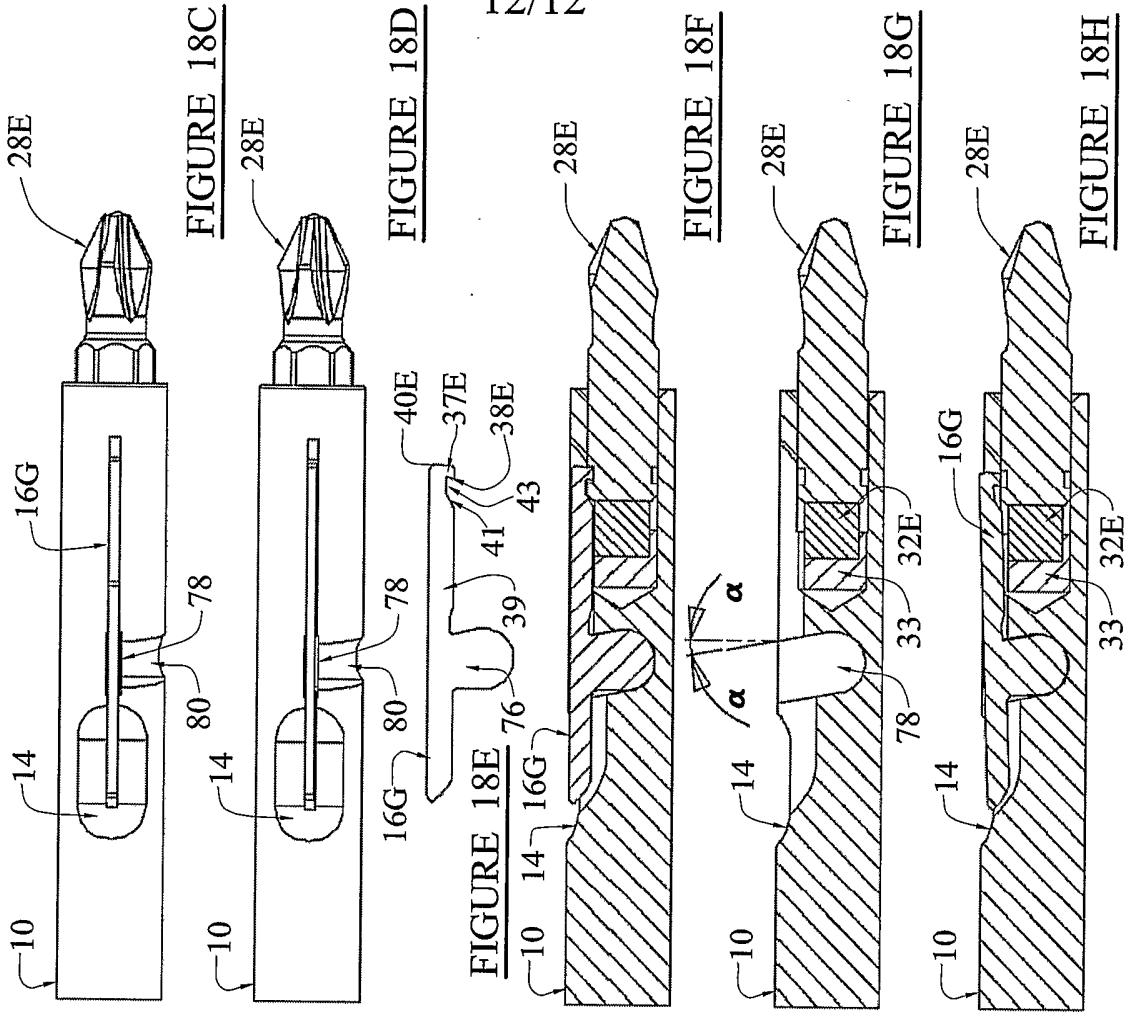


FIGURE 18C



FIGURE 18D

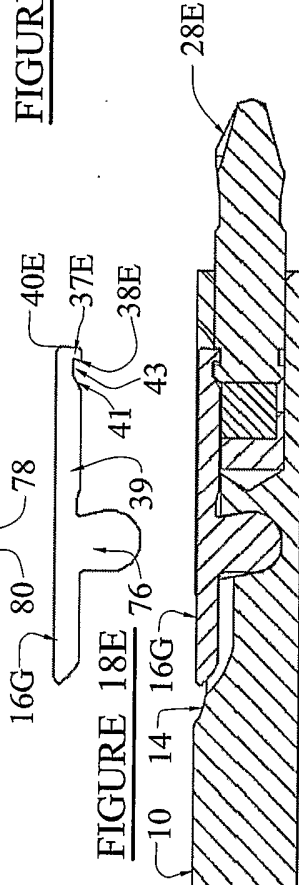


FIGURE 18E

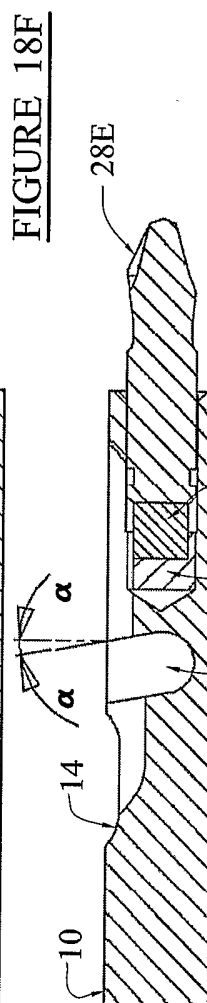


FIGURE 18F

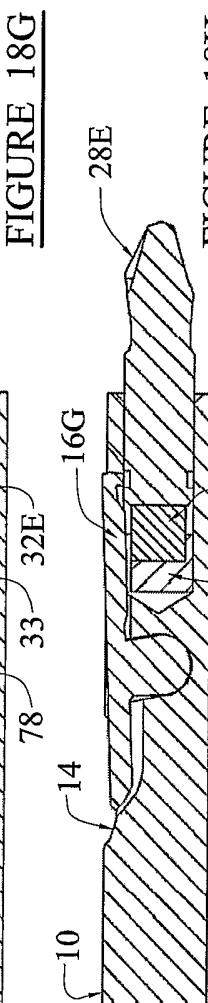


FIGURE 18G

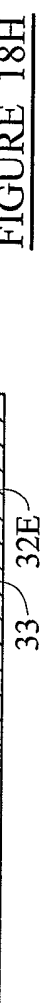


FIGURE 18H

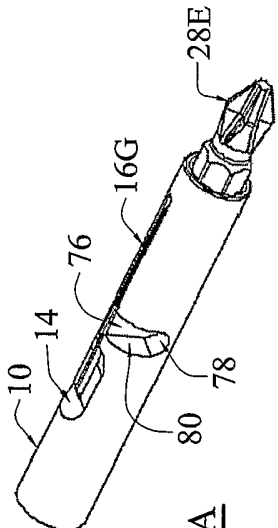


FIGURE 18A

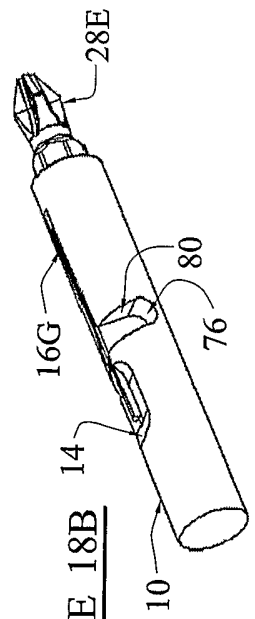


FIGURE 18B

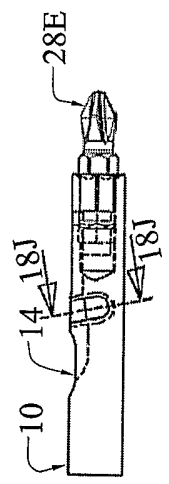


FIGURE 18I

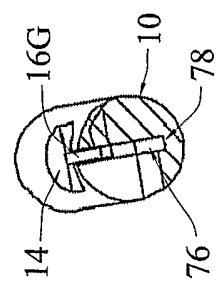


FIGURE 18J

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/CA2006/000228

| <p>A. CLASSIFICATION OF SUBJECT MATTER<br/>                 IPC: <b>B23B 31/103</b> (2006.01) , <b>B25B 23/00</b> (2006.01) , <b>B25B 15/00</b> (2006.01) , <b>B23Q 3/12</b> (2006.01)<br/>                 According to International Patent Classification (IPC) or to both national classification and IPC</p>   |  |   |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
|---|--|---|---|--|-----------------------|---|---|--------------|---|--------------------------------------|------|---|---|------|---|--------------------------------------|------|---|--|------|---|---|------|
| <p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols)<br/>                 IPC: <b>B23B 31/103</b> (2006.01) , <b>B25B 23/00</b> (2006.01) , <b>B25B 15/00</b> (2006.01) , <b>B23Q 3/12</b> (2006.01)<br/>                 USPC: 7/165; 7/100; 145/61L; 81/438</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)<br/>                 Keywords: screwdriver, lever, tab, pin, slot<br/>                 Databases: Delphion, USPTO and Esp@cenet</p>  |  |   |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| <p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:10%;">Category*</th> <th style="width:60%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width:30%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td align="center">X</td> <td>US 3,177,910 (da Silva), April 13, 1965</td> <td align="center">10 and 14-17</td> </tr> <tr> <td align="center">A</td> <td>US 3,138,044 (Olexon), June 23, 1964</td> <td align="center">1-18</td> </tr> <tr> <td align="center">A</td> <td>US 4,235,269 (Kraus), November 25, 1980</td> <td align="center">1-18</td> </tr> <tr> <td align="center">A</td> <td>US 3,656,523 (McGee), April 18, 1972</td> <td align="center">1-18</td> </tr> <tr> <td align="center">A</td> <td>US 6,453,564B1 (Foley), September 24, 2002</td> <td align="center">1-18</td> </tr> <tr> <td align="center">A</td> <td>US 6,675,420B1 (Heggemann) January 13, 2004</td> <td align="center">1-18</td> </tr> </tbody> </table>   |  |   | Category*   | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. | X | US 3,177,910 (da Silva), April 13, 1965 | 10 and 14-17 | A | US 3,138,044 (Olexon), June 23, 1964 | 1-18 | A | US 4,235,269 (Kraus), November 25, 1980 | 1-18 | A | US 3,656,523 (McGee), April 18, 1972 | 1-18 | A | US 6,453,564B1 (Foley), September 24, 2002 | 1-18 | A | US 6,675,420B1 (Heggemann) January 13, 2004 | 1-18 |
| Category*   | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.   |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| X   | US 3,177,910 (da Silva), April 13, 1965  | 10 and 14-17  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| A   | US 3,138,044 (Olexon), June 23, 1964   | 1-18  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| A   | US 4,235,269 (Kraus), November 25, 1980  | 1-18  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| A   | US 3,656,523 (McGee), April 18, 1972   | 1-18  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| A   | US 6,453,564B1 (Foley), September 24, 2002   | 1-18  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| A   | US 6,675,420B1 (Heggemann) January 13, 2004  | 1-18  |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
| <p><input type="checkbox"/> Further documents are listed in the continuation of Box C.      <input checked="" type="checkbox"/> See patent family annex.</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; vertical-align: top;">                 * Special categories of cited documents :<br/>                 "A" document defining the general state of the art which is not considered to be of particular relevance<br/>                 "E" earlier application or patent but published on or after the international filing date<br/>                 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br/>                 "O" document referring to an oral disclosure, use, exhibition or other means<br/>                 "P" document published prior to the international filing date but later than the priority date claimed             </td> <td style="width:50%; vertical-align: top;">                 "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br/>                 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br/>                 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br/>                 "&amp;" document member of the same patent family             </td> </tr> </table> |  |   | * Special categories of cited documents :<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br>"&" document member of the same patent family |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
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| Date of the actual completion of the international search<br><p align="center">29 March 2006 (29-03-2006)</p>   |  | Date of mailing of the international search report<br><p align="center">1 May 2006 (01-05-2006)</p> |   |  |                       |   |   |              |   |                                      |      |   |   |      |   |                                      |      |   |  |      |   |   |      |
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