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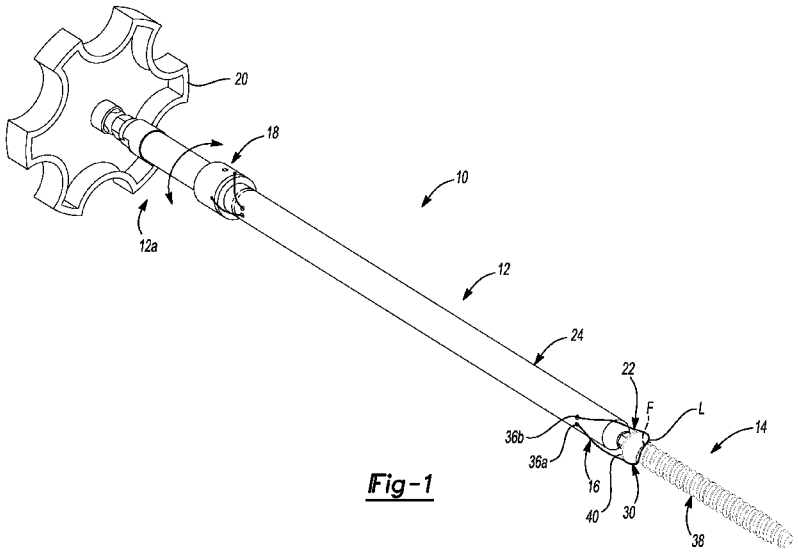


Fig-1

(57) **Abstract**: The present teachings provide an instrument for inserting a fastener. The instrument can comprise a shaft having a distal end defining a tip for driveably engaging a head of a fastener. The instrument can include a filament having a loop proximate the tip. The loop can define an opening for capturing the head of the fastener and retaining the fastener to the shaft. The instrument can also include a tensioning device for applying or releasing tension on the filament to change a size of the opening.

DRIVER-SCREW RETENTION MECHANISM

INTRODUCTION

[0001] In general, the human musculoskeletal system is composed of a variety of tissues including bone, ligaments, cartilage, muscle, and tendons. Tissue damage or deformity stemming from trauma, pathological degeneration, or congenital conditions often necessitates surgical intervention to restore function. Surgical intervention can include any surgical procedure that can restore function to the damaged tissue, which can require the use of one or more orthopedic prosthesis, such as orthopedic nails, screws, implants, etc., to restore function to the damaged tissue.

[0002] In some instances, in order to stabilize various boney tissue relative to one another, one or more bone fasteners can be inserted into an anatomy. The present teachings can provide a mechanism for retaining a fastener, such as a screw, on a driver.

[0003] Provided is an instrument for inserting a fastener. The instrument can comprise a shaft having a distal end defining a tip for driveably engaging a head of a fastener. The instrument can include a filament having a loop proximate the tip. The loop can define an opening for capturing the head of the fastener and retaining the fastener to the shaft. The instrument can also include a tensioning device for applying or releasing tension on the filament to change a size of the opening.

[0004] Further provided is an instrument for inserting a fastener. The instrument can comprise a distal end having a first coupling feature and a second coupling feature. The instrument can also comprise a proximal end having a graspable portion that is adapted to couple the first coupling feature to a fastener. The instrument can comprise a tensioning device positioned adjacent to the proximal end that applies or releases tension on the second coupling feature to change a circumference of the second coupling feature. The second coupling feature can be adapted to couple the fastener to the instrument.

[0005] Also provided is an instrument for inserting a fastener. The instrument can comprise a shaft having a proximal end and a distal end defining

a tip for driveably engaging a head of a fastener. The instrument can include a filament extending from the shaft to form a loop proximate the tip. The loop can define an opening for capturing the head of the fastener and retaining the fastener to the shaft. The instrument can include a tensioning device coupled to a first end and a second end of the filament and rotatable about the shaft for applying or releasing tension on the filament to change a size of the opening.

[0006] Further areas of applicability will become apparent from the description provided herein. It should be understood that the description and specific examples are intended for purposes of illustration only and are not intended to limit the scope of the present teachings.

DRAWINGS

[0007] The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present teachings in any way.

[0008] Fig. 1 is a schematic perspective illustration of an exemplary driver-screw retention mechanism for retaining a fastener on an instrument according to the present teachings;

[0009] Fig. 2 is a schematic perspective illustration of the driver-screw retention mechanism of Fig. 1;

[0010] Fig. 3 is a cross-sectional view of the driver-screw retention mechanism of Fig. 2, taken along line 3-3 of Fig. 2;

[0011] Fig. 4 is a schematic perspective illustration of another exemplary driver-screw retention mechanism for retaining a fastener on an instrument according to the present teachings;

[0012] Fig. 5 is a perspective view of an exemplary tensioning device of the driver-screw retention mechanism of Fig. 1;

[0013] Fig. 6 is a schematic perspective illustration of another exemplary driver-screw retention mechanism for retaining a fastener on an instrument according to the present teachings;

[0014] Fig. 7 is a perspective view of an exemplary tensioning device of the driver-screw retention mechanism of Fig. 6;

[0015] Fig. 8 is a schematic perspective illustration of another exemplary driver-screw retention mechanism for retaining a fastener on an instrument according to the present teachings;

[0016] Fig. 9 is a bottom view of the instrument of Fig. 8;

[0017] Fig. 10 is a schematic perspective illustration of another exemplary driver-screw retention mechanism for retaining a fastener on an instrument according to the present teachings; and

[0018] Fig. 11 is a bottom view of a housing of the instrument of Fig. 10.

DESCRIPTION OF VARIOUS ASPECTS

[0019] The following description is merely exemplary in nature and is not intended to limit the present teachings, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features. Although the following description is related generally to driver-screw retention mechanism for retaining a fastener on an instrument, such as a bone fastener, it will be understood that the system as described and claimed herein can be used with any appropriate fastener, such as a drywall screw, wood screw, etc. Therefore, it will be understood that the following discussions are not intended to limit the scope of the present teachings and claims herein.

[0020] With reference to Figs. 1-5, a driver-screw retention mechanism 10 for an instrument 12 is shown. The driver-screw retention mechanism 10 can be particularly adapted for surgical fixation procedures. Various aspects of the present teachings, however, may have application for other procedures. In certain applications, the driver-screw retention mechanism 10 can be coupled to the instrument 12 and used to secure a fastener 14 to the instrument 12. The driver-screw retention mechanism 10 can include a filament 16 and a tensioning device 18. The tensioning device 18 can be coupled to the instrument 12 and can cooperate with the filament 16 to tighten the filament 16 about the fastener 14 to thereby secure the fastener 14 to the instrument 12.

[0021] In one example, the instrument 12 can comprise a suitable tool for coupling the fastener 14 to a work-piece. Suitable work-pieces can comprise portions of an anatomy, wood, metal, polymers, etc. The instrument 12 can include a proximal end 12a with a handle 20, a distal end 12b with a driver 22 and a shaft 24, which can couple the handle 20 to the driver 22. The handle 20 can comprise a graspable portion, which can be coupled to the shaft 24 to enable the user to actuate the driver 22 to couple the fastener 14 to the work-piece. The handle 20 can be coupled to the shaft 24 via any desired technique, such as through the use of mechanical fasteners, overmolding, welding, adhesives, etc. Generally, the handle 20 can be rotated to drive the fastener 14 into the work-piece, however, it will be understood that the fastener 14 can be driven into the work-piece through any suitable technique not limited to the manual rotation of the handle 20. For example, the shaft 24 can be coupled to a power drill, and the power drill can be used to drive the fastener 14 into the work-piece.

[0022] The driver 22 can be configured to couple the instrument 12 to a head 30 of the fastener 14. Thus, the driver 22 can comprise a first coupling feature for coupling the fastener 14 to the instrument 12, while the filament 16 and tensioning device 18 can cooperate to form a second coupling feature for coupling the fastener 14 to the instrument 12. In this regard, with reference to Figs. 2-3, the driver 22 can comprise a male mating portion 22a (Fig. 3), while the head 30 of the fastener 14 can comprise a female mating portion 30a (Fig. 3). In one example, the male mating portion 22a can comprise a hexagonal head, which can mate with a female mating portion 30a or hexagonal socket formed in the head 30 of the fastener 14. Alternatively, the driver 22 can have a male mating portion 22a comprising a plurality of threads, which can engage a female mating portion 30a or a threaded bore defined in the head 30 of the fastener 14. As a further example, the driver 22 and head 30 can be configured such as those described in commonly owned U.S. Patent Publication No. 2010/0152740, filed on December 17, 2009, and incorporated herein by reference.

[0023] With reference to Figs. 2-3, the shaft 24 of the instrument 12 can transmit torque from the handle 20 to the driver 22 to drive the fastener 14 into the work-piece. The handle 20 can be coupled to a proximal end 24a of the shaft 24, while the driver 22 can be defined at a distal end 24b of the shaft 24. The shaft 24 can include a central bore 24c (Fig. 3) to enable the shaft 24 to receive at least a portion of the filament 16. In addition, the shaft 24 could be cannulated, if desired, to enable the shaft 24 to pass over a guide wire. The shaft 24 can also support the filament 16 and the tensioning device 18.

[0024] In this regard, with reference to Fig. 3, the shaft 24 can define a coupling groove 32 about the proximal end 24a of the shaft 24, near the handle 20. The coupling groove 32 can cooperate with the tensioning device 18 to secure or tighten the filament 16 about the fastener 14 and to also release the filament 16 from the fastener 14, as will be discussed in greater detail herein. In one example, as illustrated in Fig 3, the coupling groove 32 can comprise an annular groove 32a formed about a circumference of the shaft 24. In another example, as illustrated in Fig. 4, the coupling groove 32 can comprise a spiral or helical groove 32b. The coupling groove 32 can enable the tensioning device 18 to apply or release tension on the filament 16 to change a size or circumference of a loop L of the filament 16, as will be discussed.

[0025] With reference to Figs. 2-3, one or more first filament bores 34 can be defined adjacent to the coupling groove 32, near the proximal end 24a of the shaft 24. In one example, two first filament bores 34a, 34b can be defined adjacent to the coupling groove 32, and can be in communication with the central bore 24c to enable the filament 16 to pass through a portion of the central bore 24c, as will be discussed herein. It should be noted that although the first filament bores 34 are illustrated herein as comprising two individual annular bores, the first filament bores 34 could comprise a single slot, two slots, etc. In other words, the first filament bores 34 can comprise any opening or multiple openings that enable the filament 16 to pass through a portion of the central bore 24c.

[0026] In addition, the distal end 24b of the shaft 24 can define one or more second filament bores 36. In one example, two second filament bores 36a,

36b can be defined at the distal end 24b, adjacent to the driver 22. The second filament bores 36 can be in communication with the central bore 24c to receive a portion of the filament 16. Similarly, it should be noted that although the second filament bores 36 are illustrated herein as comprising two individual annular bores, the second filament bores 36 could comprise a single slot, two slots, etc. In other words, the second filament bores 36 can comprise any opening or multiple openings that enable the filament 16 to exit from the central bore 24c. As will be discussed herein, the filament 16 can pass through a portion of the central bore 24c and exit through the second filament bores 36 to engage the head 30 of the fastener 14 to secure the fastener 14 to the driver 22, as will be discussed in greater detail herein.

[0027] With continued reference to Figs. 1-3, the fastener 14 can be driven into the work-piece using the instrument 12. Generally, the fastener 14 can comprise any suitable fastener 14 that is capable of being driven into the work-piece with the instrument 12. For example, the fastener 14 can comprise a bone fastener, wood screw, drywall screw, etc. The fastener 14 can be composed of a metal, metal alloy or polymer. The fastener 14 can include the head 30 and a shank 38.

[0028] The head 30 of the fastener 14 can include the female mating portion 30a (Fig. 3), which can mate with the driver 22 to enable the instrument 12 to insert the fastener 14 into the work-piece. The head 30 can also have a diameter greater than the shank 38 such that the filament 16 can be looped and retained about the head 30 to secure the fastener 14 to the instrument 12 (Fig. 1), as will be discussed herein. In addition, with reference to Fig. 1, the fastener 14 can include an optional filament engagement feature F, which can assist in locating or securing the filament 16 about the head 30 of the fastener 14. In one example, the filament engagement feature F can comprise a groove formed about the head 30 of the fastener 14, however, it should be understood that the filament engagement feature can comprise any suitable mechanism coupled to the fastener 14 to assist in securing the filament 16 about the head 30 of the fastener 14, such as a projection, throughbore, eyelet, etc.

[0029] The shank 38 of the fastener 14 can be configured to retain the fastener 14 in the work-piece. Thus, the shank 38 can include a plurality of threads, one or more cutting flutes, etc. In addition, the shank 38 can be configured so as to be self-threading or tapping.

[0030] As shown in Fig. 3, the filament 16 can be received through a portion of the central bore 24c, the first filament bores 34, the second filament bores 36 and can be coupled to the tensioning device 18. The filament 16 can be composed of any suitable material, such as a metal, metal alloy or polymer. For example, the filament 16 could be composed of surgical suture material. The filament 16 can have sufficient strength and durability to enable multiple deployments of the filament 16 from the instrument 12. Alternatively, if desired, the filament 16 can be disposable, as will be discussed in greater detail herein.

[0031] Generally, the filament 16 can have a first end 16a and a second end 16b. In one example, each of the first end 16a and the second end 16b can be coupled to the tensioning device 18 such that the filament 16 can form the loop L. The loop L can define an opening 40 for capturing the head 30 of the fastener 14 to retain the fastener 14 to the shaft 24 of the instrument 12.

[0032] In this regard, with continued reference to Fig. 3, with the first end 16a of the filament 16 coupled to the tensioning device 18, the filament 16 can be directed through the first filament bore 34a, into the central bore 24c and can exit through the second filament bore 36a. The filament 16 can then pass through the second filament bore 36b, into the central bore 24c and exit the first filament bore 34a such that the second end 16b of the filament 16 can be coupled to the tensioning device 18. As illustrated in Figs. 1-3, the opening 40 of the loop L of the filament 16 can be formed from the portion of the filament 16 that extends from the second filament bores 36a, 36b. Generally, the filament 16 can have a length so that the filament 16 can form the opening 40 with sufficient size to enable receipt of the head 30 of the fastener 14 within the loop L prior to tightening the filament 16 with the tensioning device 18. In other words, in a first state, the opening 40 of the loop L can have a size or circumference that enables the loop L to be placed around or about the head 30 of the fastener 14 with ease. In a second state, tensioning device 18 can be

employed to reduce the size or circumference of the opening 40 of the loop L to secure the fastener 14 to the instrument 12, as will be discussed.

[0033] As shown in Fig. 3, the tensioning device 18 can be coupled to the first end 16a and second end 16b of the filament 16, and can be coupled to the shaft 24 of the instrument 12. The tensioning device 18 can be comprised of any suitable metal, metal alloy or polymer, and can have any desired shape. The tensioning device 18 can be movable relative to the shaft 24 to couple the fastener 14 to the instrument 12 via the loop L of the filament 16. In one example, with reference to Fig. 5, the tensioning device 18 can be annular, and can include at least one locating feature or pin 42, a first filament anchor 44 and a second filament anchor 46. The at least one pin 42, the first filament anchor 44 and the second filament anchor 46 can be spaced about a circumference of the tensioning device 18.

[0034] In this example, the at least one pin 42 can comprise two pins 42a, 42b, which can movably or rotatably couple the tensioning device 18 to the shaft 24 of the instrument 12. It should be understood, however, that only one pin 42 can be used to movably couple the tensioning device 18 to the shaft 24, or that alternative techniques could be used to movably couple the tensioning device 18 to the shaft 24, such as bearing(s), bushing(s), projection(s) formed on the tensioning device 18 etc. In this example, the pins 42a, 42b can extend outwardly from an interior surface 18a of the tensioning device 18 so as to engage and ride within the coupling groove 32. Generally, the pins 42a, 42b can be press-fit into bores 50a, 50b defined through the tensioning device 18, however, the pins 42a, 42b could be integrally formed with the tensioning device 18, if desired. The pins 42a, 42b can be placed about 180 degrees apart from each other relative to the circumference of the tensioning device 18, however, the pins 42a, 42b could be spaced closer together if desired. The pins 42a, 42b can allow the tensioning device 18 to rotate about the shaft 24 of the instrument 12 to adjust the circumference of the loop L of the filament 16.

[0035] In this regard, in the example of Fig. 3, in which the coupling groove 32 of the shaft 24 comprises the annular groove 32a, the pins 42a, 42b can slide within the annular groove 32a to enable the tensioning device 18 to

move or rotate about the shaft 24. The rotation of the tensioning device 18 about the shaft 24 can decrease or increase the size or circumference of the opening 40 of the loop L. Alternatively, in the example of Fig. 4, in which the coupling groove 32 comprises the helical groove 32b, the pins 42a, 42b can slide within the helical groove 32b to enable the tensioning device 18 to move relative to the shaft 24. The movement of the pins 42a, 42b within the helical groove 32b can cause the tensioning device 18 to move linearly with respect to the shaft 24, which can increase the tension acting on the filament 16. The increased tension acting on the filament 16 can further retain the head 30 of the fastener 14 on the shaft 24.

[0036] With reference back to Fig. 5, the first filament anchor 44 and the second filament anchor 46 can be spaced about 180 degrees apart from each other about the circumference of the tensioning device 18, and can generally be positioned about 90 degrees apart from a respective one of the pins 42a, 42b. The first filament anchor 44 and the second filament anchor 46 can comprise any suitable mechanism for rigidly and fixedly coupling the first end 16a and second end 16b of the filament 16 to the tensioning device 18. In one example, the first filament anchor 44 and the second filament anchor 46 can each comprise an eyelet, and each of the first end 16a and the second end 16b of the filament 16 can be looped about the eyelet and secured via an adhesive, welding, knotting, etc.

[0037] Referring now to Figs. 1-3, with the filament 16 threaded through the central bore 24c, first filament bores 34 and second filament bores 36, the first end 16a and the second end 16b of the filament 16 can be coupled to the tensioning device 18 via the first filament anchor 44 and the second filament anchor 46. Then, the loop L of the filament 16 can be positioned about the head 30 of the fastener 14 and the driver 22 of the instrument 12 can be coupled to the head 30 of the fastener 14. With the filament 16 disposed about the head 30 of the fastener 14 and the driver 22 engaged with the head 30 of the fastener 14, the tensioning device 18 can be rotated to reduce the circumference of the opening 40 of the loop L of the filament 16 or the size of the opening 40 in the loop L until the filament 16 is tight about the head 30 of the fastener 14. By

tightening the filament 16 about the head 30 of the fastener 14, the fastener 14 can be secured to the instrument 12 and remain coupled to the driver 22 throughout the insertion of the fastener 14 into the work-piece.

[0038] With reference now to Figs. 6-7, in one example, a driver-screw retention mechanism 100 can be coupled to an instrument 102 and used to secure the fastener 14 to the instrument 102. As the driver-screw retention mechanism 100 can be similar to the driver-screw retention mechanism 10 described with reference to Figs. 1-5, only the differences between the driver-screw retention mechanism 10 and the driver-screw retention mechanism 100 will be discussed in great detail herein, and the same reference numerals will be used to denote the same or similar components. The driver-screw retention mechanism 100 can include the filament 16 and a tensioning device 108. The tensioning device 108 can be coupled to the instrument 102 and can cooperate with the filament 16 to tighten the filament 16 about the fastener 14 to thereby secure the fastener 14 to the instrument 102.

[0039] The instrument 102 can comprise a suitable tool for coupling the fastener 14 to a work-piece. The instrument 102 can include the handle 20, the driver 22 and a shaft 110, which can couple the handle 20 to the driver 22. The shaft 110 of the instrument 102 can transmit torque from the handle 20 to the driver 22 to drive the fastener 14 into the work-piece. The handle 20 can be coupled to a proximal end 110a of the shaft 110, while the driver 22 can be defined at the distal end 24b of the shaft 110. The shaft 110 can include a central bore 110c, which can enable receipt of at least a portion of the filament (Fig. 7). Optionally, the shaft 110 could be cannulated to pass over a guide wire, if desired. The shaft 110 can also support the filament 16 and the tensioning device 108.

[0040] In this example, the shaft 110 can define a plurality of teeth 112 about a circumference of the proximal end 110a of the shaft 110, near the handle 20. The plurality of teeth 112 can cooperate with the tensioning device 108 to secure or tighten the filament 16 about the fastener 14 and to also release the filament 16 from the fastener 14, as will be discussed in greater detail herein. Generally, the plurality of teeth 112 can enable the tensioning device 108 to

apply or release tension on the filament 16 to change a size or circumference of a loop L of the filament 16, as will be discussed. The shaft 110 can also define the two first filament bores 34a, 34b adjacent to the proximal end 110a of the shaft 110.

[0041] With reference to Fig. 6, the tensioning device 108 can be coupled to the first end 16a and second end 16b of the filament 16, and can be coupled to the shaft 110 of the instrument 102. The tensioning device 108 can be comprised of any suitable metal, metal alloy or polymer, and can have any desired shape. The tensioning device 108 can be movable relative to the shaft 110 to couple the fastener 14 to the instrument 102 via the loop L of the filament 16. In one example, with reference to Fig. 7, the tensioning device 108 can be annular, and can include at least one lever 120, the first filament anchor 44 and the second filament anchor 46. The at least one lever 120, the first filament anchor 44 and the second filament anchor 46 can be spaced about a circumference of the tensioning device 18.

[0042] In this example, the at least one lever 120 can comprise a single lever 120, which can cooperate with the plurality of teeth 112 on the shaft 110 to apply or release tension on the filament 16. It should be understood, however, that more than one lever 120 can be used to apply or release tension on the filament 16, and that alternative techniques could be used to apply or release tension acting on the filament 16. In this example, the lever 120 can include a release portion 122 and a stop portion 124. The lever 120 can be coupled to the tensioning device 108 such that the release portion 122 extends along an exterior surface of the tensioning device 108. The release portion 122 can generally be sized so as to enable an operator to easily manipulate the release portion 122. The release portion 122 can be coupled to or integrally formed with the stop portion 124 such that manipulation of the release portion 122 causes the stop portion 124 to release the tension acting on the filament 16.

[0043] In this regard, the stop portion 124 can extend through a bore 128 formed in the tensioning device 108 so that a distal end 124a of the stop portion 124 is in contact with a respective one of the plurality of teeth 112. The stop portion 124 can cooperate with the plurality of teeth 112 to create a ratchet-

like mechanism in which the contact between the distal end 124a of the stop portion 124 and the respective one of the plurality of teeth 112 can prevent relative movement between the tensioning device 108 and the shaft 110. The contact between the stop portion 124 and the respective one of the plurality of teeth 112 can also limit the rotation of the tensioning device 108 to a single direction, such as clockwise or counterclockwise. For example, the distal end 124a of the stop portion 124 can facilitate rotation of the tensioning device 108 in the single direction relative to the shaft 110 to increase the tension acting on the filament 16 and thereby reduce the circumference or size of the opening 40 of the loop L. The manipulation or depression of the release portion 122 can cause the stop portion 124 to move or be biased away from the respective one of the plurality of teeth 112, thereby allowing the tensioning device 108 to move freely relative to the shaft 110 and release the tension acting on the filament 16.

[0044] With the filament 16 threaded through the central bore 24c, first filament bores 34 and second filament bores 36, the first end 16a and the second end 16b of the filament 16 can be coupled to the tensioning device 108 via the first filament anchor 44 and the second filament anchor 46 (Fig. 7). Then, the loop L of the filament 16 can be positioned about the head 30 of the fastener 14 and the driver 22 of the instrument 12 can be coupled to the head 30 of the fastener 14 (Fig. 6). With the filament 16 disposed about the head 30 of the fastener 14 and the driver 22 engaged with the head 30 of the fastener 14, the tensioning device 108 can be rotated relative to the shaft 110 in a single direction to reduce the circumference or size of the opening 40 of the loop L until the filament 16 is tight about the head 30 of the fastener 14. The engagement of the stop portion 124 with respective ones of the plurality of teeth 112 can allow the user to tighten the tensioning device 108 in intervals or increments, without releasing the tension acting on the filament 16 (Fig. 7).

[0045] Once the filament 16 is fully tightened about the head 30 of the fastener 14, the fastener 14 can remain coupled to the driver 22 throughout the insertion of the fastener 14 into the work-piece. Once inserted to the desired depth in the work-piece, in order to release the fastener 14 from the instrument 12, the user can manipulate or depress the release portion 122 (Fig. 7). The

manipulation or depression of the release portion 122 can move or bias the stop portion 124 out of engagement with the respective one of the plurality of teeth 112, thereby allowing the tensioning device 108 to move freely relative to the shaft 110 (Fig. 7). The free movement of the tensioning device 108 relative to the shaft 110 can release the tension acting on the filament 16 to allow the filament 16 to be disengaged from the head 30 of the fastener 14.

[0046] With reference now to Figs. 8-9, in one example, a driver-screw retention mechanism 200 can be coupled to an instrument 202 and used to secure the fastener 14 to the instrument 202. As the driver-screw retention mechanism 200 can be similar to the driver-screw retention mechanism 10 described with reference to Figs. 1-5, only the differences between the driver-screw retention mechanism 10 and the driver-screw retention mechanism 200 will be discussed in great detail herein, and the same reference numerals will be used to denote the same or similar components. The driver-screw retention mechanism 200 can include the filament 16 and a tensioning device 208. The tensioning device 208 can be coupled to the instrument 202 and can cooperate with the filament 16 to tighten the filament 16 about the fastener 14 to thereby secure the fastener 14 to the instrument 202.

[0047] In one example, the instrument 202 can comprise a suitable tool for coupling the fastener 14 to a work-piece. The instrument 202 can include a housing 210 at a proximal end 202a, the driver 22 at a distal end 202b and a coupler 212, which can couple the housing 210 to the driver 22. The housing 210 can be cylindrical in shape, and can provide a graspable surface for the user. The housing 210 can be formed out of any suitable material, such as a metal, metal alloy or polymer. The housing 210 can have a first end 214, a second end 216, a slot 218 defined from the second end 216 to the first end 214, and a bore 220 defined from the second end 216 to the first end 214. The first end 214 can be generally smooth to provide a graspable surface for the user.

[0048] The second end 216 can be opposite the first end 214, and can be configured to couple the housing 210 to the coupler 212. In one example, the second end 216 can define a plurality of threads 222, which can mate with a plurality of threads 224 defined within the coupler 212. It should be understood,

however, that the second end 216 could be coupled to the coupler 212 through any desired technique, such as a press-fit, mechanical fasteners, adhesives, welding, molding, integral forming, etc.

[0049] With reference to Fig. 9, the second end 216 can also include at least one filament passageway 226. In this example, the second end 216 can define a first filament passageway 226a and a second filament passageway 226b. The first filament passageway 226a and the second filament passageway 226b can be adjacent to each other, and can be formed generally opposite the slot 218. The first filament passageway 226a and the second filament passageway 226b can be sized to enable the filament 16 to pass through each of the first filament passageway 226a and the second filament passageway 226b when the coupler 212 is coupled to the housing 210 so that the filament 16 can engage the head 30 of the fastener 14.

[0050] In this regard, with reference to Fig. 8, the filament 16 can exit the housing 210 at the first filament passageway 226a and can return into the housing 210 at the second filament passageway 226b. The loop L of the filament 16 can be defined by the portion of the filament 16 that is external to the housing 210. The filament 16 can move or slide through the first filament passageway 226a and the second filament passageway 226b to vary the size or circumference of the opening 40 of the loop L. As will be discussed, the tensioning device 208 can be manipulated to adjust the size or circumference of the opening 40 of the loop L formed by the filament 16 that is external to the housing 210.

[0051] The slot 218 can extend through an exterior surface 210c of the housing 210 to the bore 220. The slot 218 can enable a portion of the tensioning device 208 to extend beyond the surface of the housing 210 to enable the user to manipulate the tensioning device 208, as will be discussed in greater detail herein. The bore 220 can be configured to allow the tensioning device 208 to move relative to the housing 210 to apply or release tension acting on the filament 16.

[0052] The coupler 212 can be coupled to the second end 216 of the housing 210. The coupler 212 can have a first end 230, a second end 232 and a

bore 234, which can extend from the first end 230 to the second end 232. The bore 234 can be sized so as to enable the coupler 212 to fit over the second end 216 of the housing 210, and can also allow a guiding instrument, such as a guide wire, to pass through the instrument 202. In one example, the plurality of threads 224 can be defined about the bore 234 at the first end 230 and the first end 230 of the coupler 212 can be threaded onto the plurality of threads 222 of the housing 210 to couple the coupler 212 to the housing 210 (Fig. 9). The first end 230 of the coupler 212 can be generally conical, and can taper to the second end 232. The second end 232 of the coupler 212 can include the driver 22 (Fig. 9). The second end 232 can have a diameter smaller than the diameter of the first end 230 to facilitate the use of the instrument 202 in space restricted areas.

[0053] With reference to Fig. 8, the tensioning device 208 can be coupled to the first end 16a and second end 16b of the filament 16, and can be movable within the bore 220 of the housing 210. The tensioning device 208 can be comprised of any suitable metal, metal alloy or polymer, and can have any desired shape. The tensioning device 208 can be movable relative to the housing 210 to apply or release tension acting on the filament 16 to couple or release the fastener 14 from the instrument 202 via the loop L of the filament 16. In one example, the tensioning device 208 can include a body 240 and a slide 242. The body 240 can be generally annular, and can include a first side 240a opposite a second side 240b.

[0054] The first side 240a can be coupled to the slide 242, and the second side 240b can include a first filament anchor 244 and a second filament anchor 246. The first filament anchor 244 and the second filament anchor 246 can be positioned adjacent to each other and can each be coupled to a respective one of the first end 16a or second end 16b of the filament 16. The first filament anchor 244 and the second filament anchor 246 can comprise any suitable mechanism for rigidly or fixedly coupling the first end 16a and the second end 16b of the filament 16 to the tensioning device 208. In one example, the first filament anchor 244 and the second filament anchor 246 can each comprise an eyelet, and each of the first end 16a and the second end 16b of the

filament 16 can be looped about the eyelet and secured via an adhesive, welding, knotting, stapling, etc.

[0055] The slide 242 can be coupled to the first side 240a of the body 240 so as to be in communication with the slot 218. The slide 242 can be formed of any desired material, such as a metal, metal alloy or a polymer. The slide 242 can include a graspable portion 250 and a stem 252. The graspable portion 250 can extend along a plane generally perpendicular to the stem 252. The graspable portion 250 can provide a contact surface for the user that allows the user to actuate the tensioning device 208 to apply or release tension on the filament 16. Although not illustrated herein, the graspable portion 250 can include ridges or bumps to improve contact between the user and the graspable portion 250. The graspable portion 250 can generally be configured to have a width larger than a width of the slot 218 so that the graspable portion 250 can ride along the exterior surface of the housing 210.

[0056] The stem 252 can couple the graspable portion 250 to the body 240 of the tensioning device 208. The stem 252 can have a width sized to allow the stem 252 to slide within the slot 218. A first end 252a of the stem 252 can be coupled to the graspable portion 250, and a second end 252b of the stem 252 can be coupled to the body 240. The manipulation of the graspable portion 250 by the user can transfer force through the stem 252 to the body 240 to apply or release tension on the filament 16, and thus, adjust the size or circumference of the opening 40 of the loop L.

[0057] With the tensioning device 208 coupled to the housing 210 and the first end 16a of the filament 16 coupled to the first filament anchor 244, the filament 16 can be threaded through the first filament passageway 226a and then the second end 16b of the filament can be directed through the second filament passageway 226b to form the loop L. The second end 16b of the filament 16 can be coupled to the second filament anchor 246 to secure the filament 16 to the tensioning device 208. With the slide 242 in a first state, the loop L of the filament 16 can be positioned about the head 30 of the fastener 14. Then, the driver 22 of the instrument 202 can be coupled to the head 30 of the fastener 14.

[0058] With the filament 16 disposed about the head 30 of the fastener 14 and the driver 22 engaged with the head 30 of the fastener 14, the slide 242 can be moved to a second state, which can slide or move the body 240 of the tensioning device 208 rearward to reduce the size or circumference of the opening 40 of the loop L of the filament 16 until the filament 16 is tight about the head 30 of the fastener 14. By tightening the filament 16 about the head 30 of the fastener 14, the fastener 14 can be secured to the instrument 202 and remain coupled to the driver 22 throughout the insertion of the fastener 14 into the work-piece.

[0059] With reference now to Figs. 10-11, in one example, a driver-screw retention mechanism 300 can be coupled to an instrument 302 and used to secure the fastener 14 to the instrument 302. As the driver-screw retention mechanism 300 can be similar to the driver-screw retention mechanism 200 described with reference to Figs. 9-10, only the differences between the driver-screw retention mechanism 200 and the driver-screw retention mechanism 300 will be discussed in great detail herein, and the same reference numerals will be used to denote the same or similar components. The driver-screw retention mechanism 300 can be configured to enable the filament 16 to be disposed of after a single procedure, and can include the filament 16 and a tensioning device 308. The tensioning device 308 can be coupled to the instrument 302 and can cooperate with the filament 16 to tighten the filament 16 about the fastener 14 to thereby secure the fastener 14 to the instrument 302.

[0060] In one example, the instrument 302 can comprise a suitable tool for coupling the fastener 14 to a work-piece. The instrument 302 can include a housing 310 at a proximal end 302a, the driver 22 at a distal end 302b and the coupler 212, which can couple the housing 310 to the driver 22. The housing 310 can be cylindrical in shape, and can provide a graspable surface for the user. The housing 310 can be formed out of any suitable material, such as a metal, metal alloy or polymer. The housing 310 can have the first end 214, a second end 316, the slot 218 defined from the second end 316 to the first end 214, and the bore 220 defined from the second end 316 to the first end 214.

[0061] The second end 316 can be opposite the first end 214, and can be configured to couple the housing 310 to the coupler 212. In one example, the second end 316 can define the plurality of threads 222, which can mate with a plurality of threads 224 defined within the coupler 212. It should be understood, however, that the second end 316 could be coupled to the coupler 212 through any desired technique, such as a press-fit, mechanical fasteners, adhesives, welding, molding, integral forming, etc.

[0062] With reference to Fig. 11, the second end 316 can also include at least one filament passageway 326. In this example, the second end 316 can define a single filament passageway 326, which can be sized to enable the filament 16 to pass through the filament passageway 326 when the coupler 212 is coupled to the housing 310 so that the filament 16 can engage the head 30 of the fastener 14. Generally, the filament passageway 326 can be sized to enable the first end 16a and the second end 16b of the filament 16 to exit the housing 310 once the tensioning device 308 is positioned within the housing 310 to form the loop L, as will be discussed.

[0063] In this regard, with reference to Fig. 10, the filament 16 can exit the housing 310 at the filament passageway 326, and the loop L of the filament 16 can be defined by the portion of the filament 16 that is external to the housing 310. The filament 16 can move or slide through the filament passageway 326 to vary the size or circumference of the opening 40 of the loop L. As will be discussed, the tensioning device 308 can be manipulated to adjust the size or circumference of the opening 40 of the loop L formed by the filament 16 that is external to the housing 310.

[0064] With continued reference to Fig. 10, the tensioning device 308 can be coupled to the first end 16a and second end 16b of the filament 16, and can be movable within the bore 220 of the housing 310. The tensioning device 308 can be comprised of any suitable metal, metal alloy or polymer, and can have any desired shape. The tensioning device 308 can be movable relative to the housing 310 to apply or release tension acting on the filament 16 to couple or release the fastener 14 from the instrument 302 via the loop L of the filament 16. In one example, the tensioning device 308 can include a body 340 and a slide

342. Optionally, the tensioning device 308 can also include a biasing member 343, which can apply a force against the body 340, as will be discussed herein.

[0065] In this example, the body 340 can be coupled to the slide 342 separately to enable the body 340 to be repeatedly inserted into the housing 310, as will be discussed herein. The body 340 can be generally annular, and can include a first side 340a opposite a second side 340b. The first side 340a can be releasably coupled to the slide 342, and the second side 340b can include a first filament anchor 344 and a second filament anchor 346.

[0066] The first filament anchor 344 and the second filament anchor 346 can be positioned adjacent to each other and can each be coupled to a respective one of the first end 16a or second end 16b of the filament 16. The first filament anchor 344 and the second filament anchor 346 can comprise any suitable mechanism for releasably coupling the first end 16a and the second end 16b of the filament 16 to the tensioning device 308. In one example, the first filament anchor 344 and the second filament anchor 346 can each comprise an eyelet, and each of the first end 16a and the second end 16b of the filament 16 can be looped about the eyelet and secured via an adhesive, welding, knotting, stapling, etc. As will be discussed, after the filament 16 is used to couple the fastener 14 to the work-piece, the filament 16 can be released from or un-coupled from the body 340 and disposed of, so that a new, unused filament 16 can be coupled to the body 340 for use during a subsequent procedure.

[0067] The slide 342 can be releasably coupled to the first side 340a of the body 340 so as to be in communication with the slot 218. The slide 342 can be formed of any desired material, such as a metal, metal alloy or a polymer. The slide 342 can include the graspable portion 250 and a stem 352. The graspable portion 250 can extend along a plane generally perpendicular to the stem 352. The stem 352 can couple the graspable portion 250 to the body 340 of the tensioning device 308. The manipulation of the graspable portion 250 by the user can transfer force through the stem 352 to the body 340 to apply or release tension on the filament 16, and thus, adjust the size or circumference of the opening 40 of the loop L.

[0068] The stem 352 can have a width sized to allow the stem 352 to slide within the slot 218. The first end 252a of the stem 352 can be coupled to the graspable portion 250, and a second end 352b of the stem 352 can be releasably coupled to the body 340. For example, the second end 352b of the stem 352 can be press-fit into a groove 354 formed in the body 352 to removably or releasably couple the stem 352 to the body 340. By releasably or removably coupling the stem 352 to the body 340, the body 340 can be removed from the housing 310 to enable a new filament 16 to be coupled to the body 340 for use in a subsequent procedure.

[0069] The biasing member 343 can be positioned between an end 340c of the body 340 and the plurality of threads 222. The biasing member 343 can bias the tensioning system 308 into the second state, such that tension is applied to the filament 16. In other words, the biasing member 343 can apply a force F against the end 340c of the body 340 such that the opening 40 of the loop L has a reduced diameter. In order to move the tensioning system 308 to the first state, so that the filament 16 can be positioned about the head 30 of the fastener 14, the user can apply a force to the slide 352 that overcomes the force F of the biasing member 343 thereby increasing a size of the opening 40 of the loop L. In one example, the biasing member 343 can comprise a spring. It should be understood, however, that the biasing member 343 can be optional, and that other devices other than a spring could be used to bias the tensioning element 308 into the second state, such as a frictional coating, solid resilient member, etc. Further, the biasing member 343 can be coupled to the housing 310 through any suitable technique. For example, grooves or notches could be formed in the housing 310 to retain the biasing member 343 at the distal end 302b of the instrument 302 within the housing 310.

[0070] In order to employ the instrument 302 during a procedure, the filament 16 can be coupled to the body 340 via the first filament anchor 344 and the second filament anchor 346. Then, the body 340 with the attached filament 16 can be inserted into the bore 220 of the housing 310. The body 340 can be inserted into the housing 310 such that the filament 16 exits the filament passageway 326 to form the loop L, and the end 340c of the body 340 is

positioned against the biasing member 343. Next, the slide 342 can be coupled to the body 340, by inserting the stem 352 into the groove 354. As the biasing member 343 maintains the tensioning device 308 in the second state, the slide 342 can be moved by the user from the second state to the first state so that the loop L of the filament 16 can be positioned about the head 30 of the fastener 14. Once the slide 342 is released by the user, the tensioning device 308 can return to the second state such that the filament 16 is tight and secure about the head 30 of the fastener 14. The driver 22 of the instrument 302 can be coupled to the head 30 of the fastener 14. With the filament 16 tight about the head 30 of the fastener 14, the fastener 14 can remain secured to the instrument 302 throughout the insertion of the fastener 14 into the work-piece.

[0071] Once the fastener 14 is inserted into the work-piece, the slide 342 can be moved toward the proximal end 302a of the instrument 302 until the filament 16 fractures or breaks around the head 30 of the fastener 14. Then, the driver 22 can be uncoupled from the head 30 of the fastener 14, and the slide 342 can be disconnected from the body 340. The body 340 can be removed from the housing 310 and a new filament 16 can be attached to the first filament anchor 344 and the second filament anchor 346. Then, the body 340 can be re-inserted into the bore 220 of the housing 310 and positioned adjacent to the biasing member 343 such that the filament 16 exits the filament passageway 326. The slide 342 can be re-coupled to the body 340. The instrument 302 can then be used to insert another or second fastener 14 into the work-piece.

[0072] Accordingly, the driver-screw retention mechanism 10, 100, 200, 300 can be used to secure a fastener 14 to an instrument 12, 102, 202, 302 so that the fastener 14 remains coupled to the instrument 12, 102, 202, 302 during a procedure. The tensioning device 18, 108, 208, 308 can provide a fast and easy mechanism for applying or releasing tension acting on the filament 16 to enable the size or circumference of the loop L to change as needed. In addition, the filament 16 employed with the instrument 302 can be disposable so as to enable a new filament 16 to be employed with each fastener 14 inserted into the work-piece.

[0073] While specific examples have been described in the specification and illustrated in the drawings, it will be understood by those of ordinary skill in the art that various changes can be made and equivalents can be substituted for elements thereof without departing from the scope of the present teachings. Furthermore, the mixing and matching of features, elements and/or functions between various examples is expressly contemplated herein so that one of ordinary skill in the art would appreciate from the present teachings that features, elements and/or functions of one example can be incorporated into another example as appropriate, unless described otherwise, above. Moreover, many modifications can be made to adapt a particular situation or material to the present teachings without departing from the essential scope thereof. Therefore, it is intended that the present teachings not be limited to the particular examples illustrated by the drawings and described in the specification, but that the scope of the present teachings will include any embodiments falling within the foregoing description.

CLAIMS

What is claimed is:

1. An instrument for inserting a fastener, the instrument comprising:

a shaft having a distal end defining a tip for driveably engaging a head of a fastener;

a filament having a loop proximate the tip, the loop defining an opening for capturing the head of the fastener and retaining the fastener to the shaft; and

a tensioning device for applying or releasing tension on the filament to change a size of the opening.

2. The instrument of Claim 1, wherein the shaft further defines a coupling groove and the tensioning device is movable within the coupling groove for applying or releasing tension on the filament.

3. The instrument of Claim 2, wherein the coupling groove further comprises an annular groove formed about the shaft.

4. The instrument of Claim 2, wherein the coupling groove further comprises a helical groove formed about the shaft.

5. The instrument of Claim 2, wherein the tensioning device further comprises an annular ring having at least one locating feature configured to slide within the coupling groove so that the tensioning device is rotatable about the shaft.

6. The instrument of Claim 5, wherein rotation of the tensioning device about the shaft applies or releases tension on the filament.

7. The instrument of Claim 1, wherein the shaft further comprises a plurality of teeth, and the tensioning device further comprises an annular ring

having a lever that releasably engages a respective one of the plurality of teeth for applying or releasing tension on the filament.

8. The instrument of Claim 1, wherein the fastener is a bone fastener.

9. An instrument for inserting a fastener, the instrument comprising:

a distal end having a first coupling feature and a second coupling feature;

a proximal end having a graspable portion that is adapted to couple the first coupling feature to a fastener; and

a tensioning device positioned adjacent to the proximal end that applies or releases tension on the second coupling feature to change a circumference of the second coupling feature, the second coupling feature adapted to couple the fastener to the instrument.

10. The instrument of Claim 9, wherein the second coupling feature further comprises a filament, which passes through at least one opening defined in the distal end to form a substantially circular loop having a circumference that is adjustable by the tensioning device to couple the fastener to the distal end.

11. The instrument of Claim 10, wherein the tensioning device is coupled to a first end and a second end of the filament such that movement of the tensioning device relative to the shaft applies or releases the tension acting on the filament.

12. The instrument of Claim 11, further comprising a shaft that includes the proximal end and the distal end, and the tensioning device is rotatably coupled to an annular groove defined about a circumference of the shaft adjacent to the proximal end of the shaft.

13. The instrument of Claim 11, further comprising a shaft that includes the proximal end and the distal end, and the tensioning device is rotatably

coupled to a helical groove defined about a circumference of the shaft adjacent to the proximal end of the shaft.

14. The instrument of Claim 11, further comprising a housing that includes the proximal end and a coupler that includes the distal end, the housing being threadably coupled to the coupler.

15. The instrument of Claim 14, wherein the housing further comprises a first end and a second end, with a slot formed through the housing and in communication with a central bore that extends from the first end to the second end, the central bore and the slot cooperating to receive the tensioning device.

16. The instrument of Claim 15, wherein the housing further comprises at least one passageway that enables the filament to exit the housing and form the loop.

17. The instrument of Claim 16, wherein the tensioning device further comprises a body including a first filament anchor coupled to the first end of the filament and a second filament anchor coupled to the second end of the filament, the body movable within the bore for changing a circumference of the loop.

18. An instrument for inserting a fastener, the instrument comprising:

a shaft having a proximal end and a distal end defining a tip for driveably engaging a head of a fastener;

a filament extending from the shaft to form a loop proximate the tip, the loop defining an opening for capturing the head of the fastener and retaining the fastener to the shaft; and

a tensioning device coupled to a first end and a second end of the filament and rotatable about the shaft for applying or releasing tension on the filament to change a size of the opening.

19. The instrument of Claim 18, wherein the fastener is a bone fastener.

20. The instrument of Claim 18, wherein the tip is a hexagonal tip.

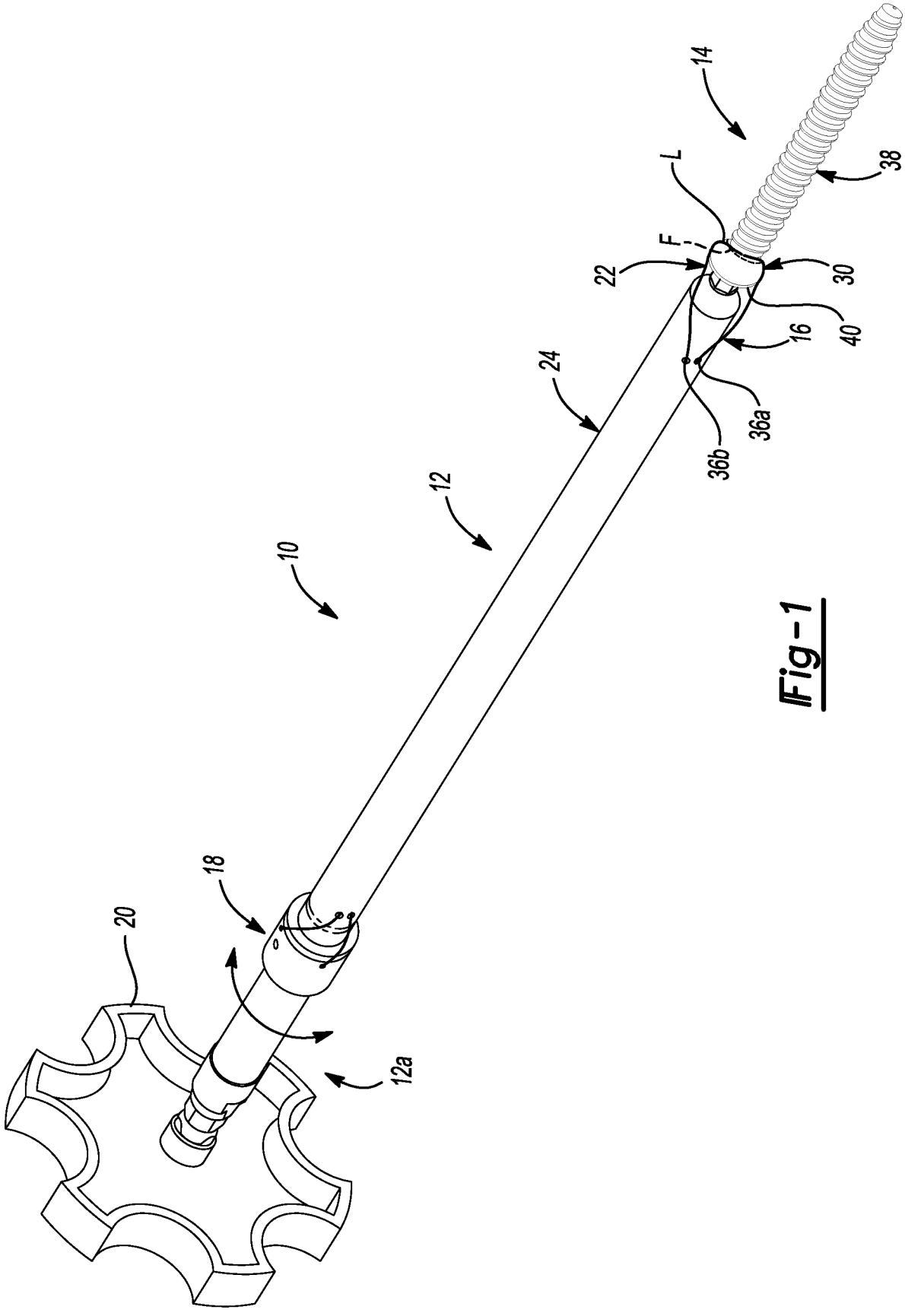
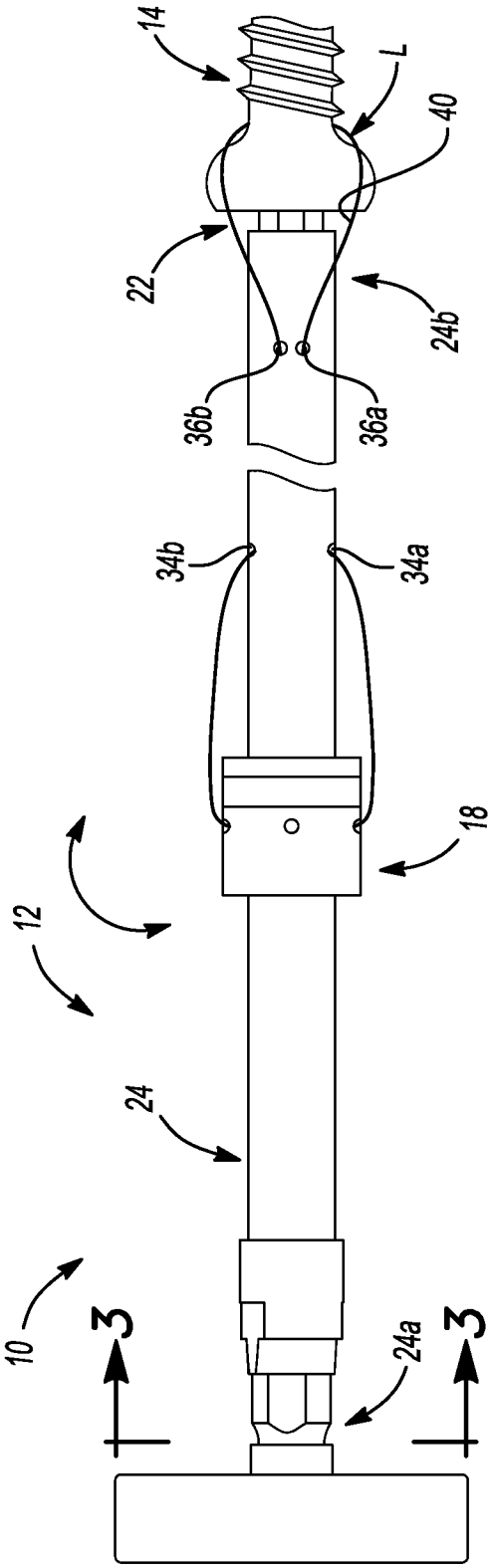


Fig-1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24a

Fig-2

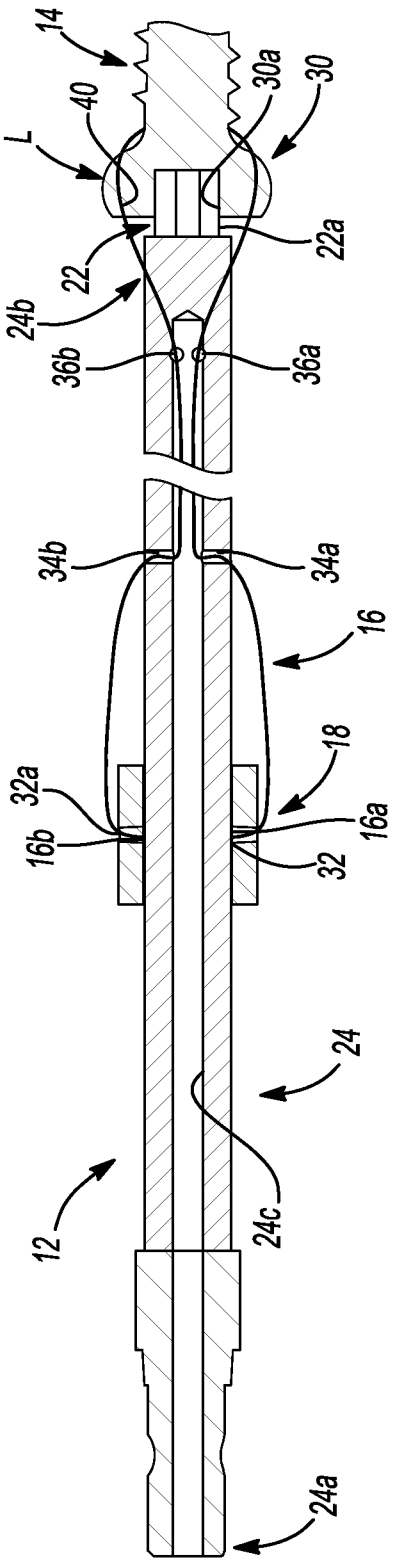
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Fig-3

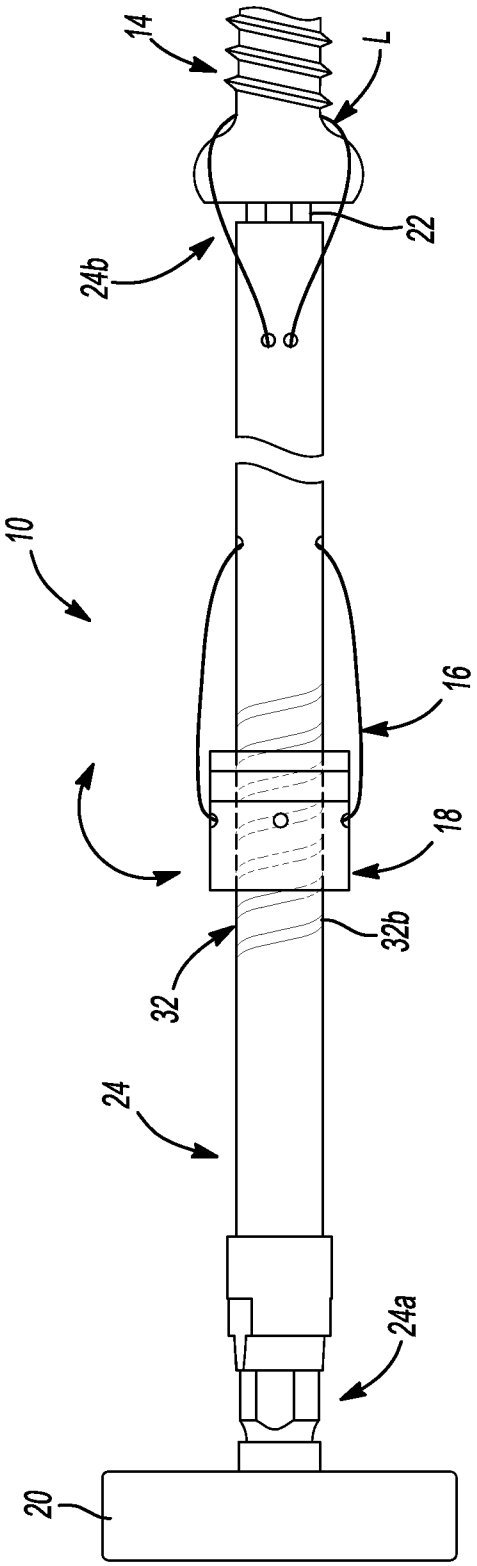
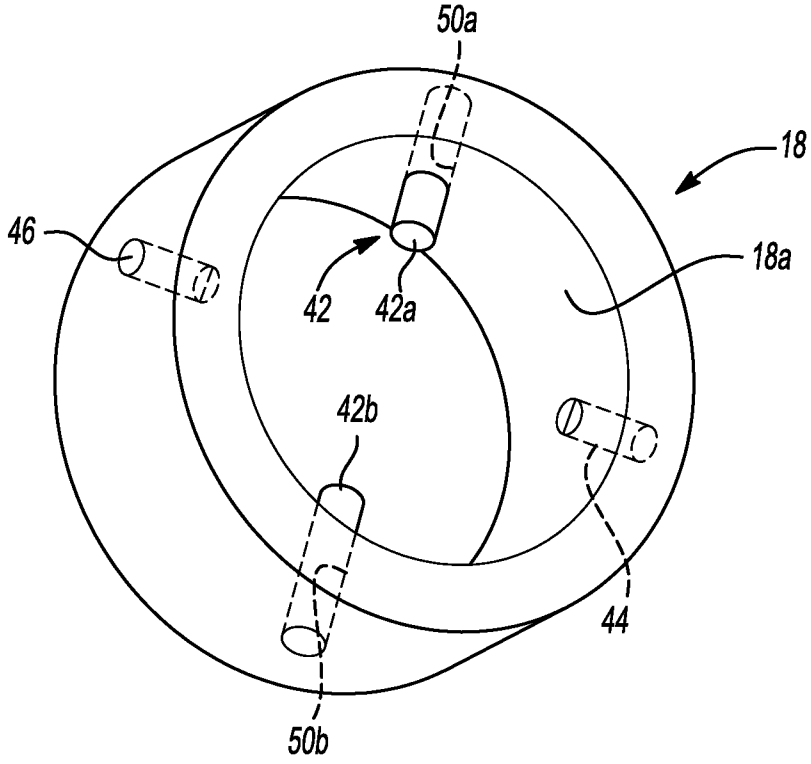


Fig-4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42a
42b
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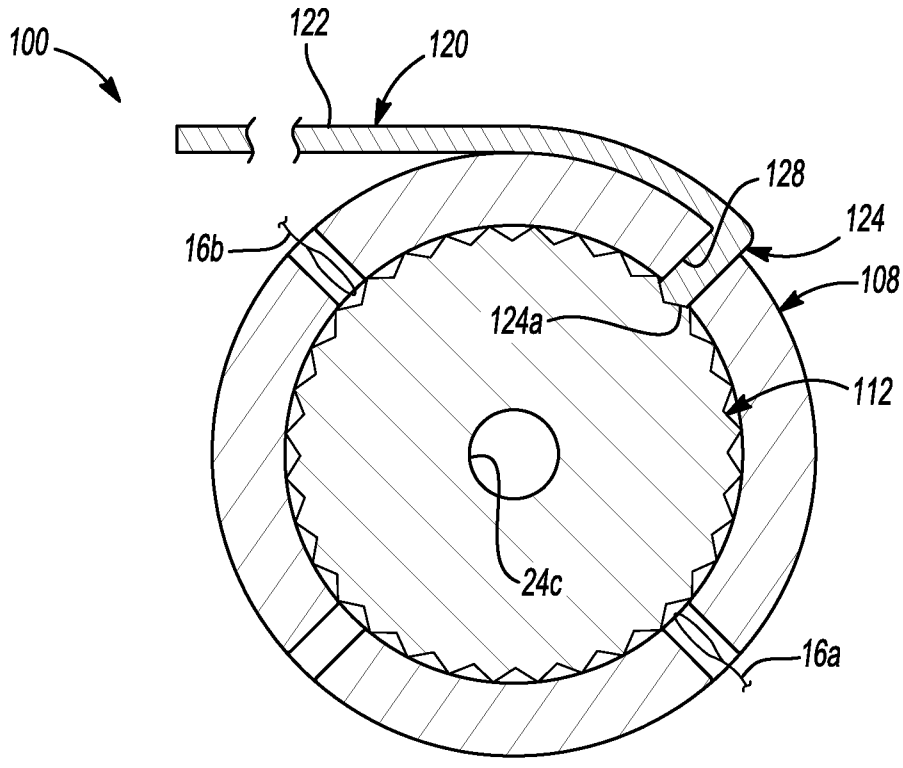
50b

Fig-5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24c
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Fig-7

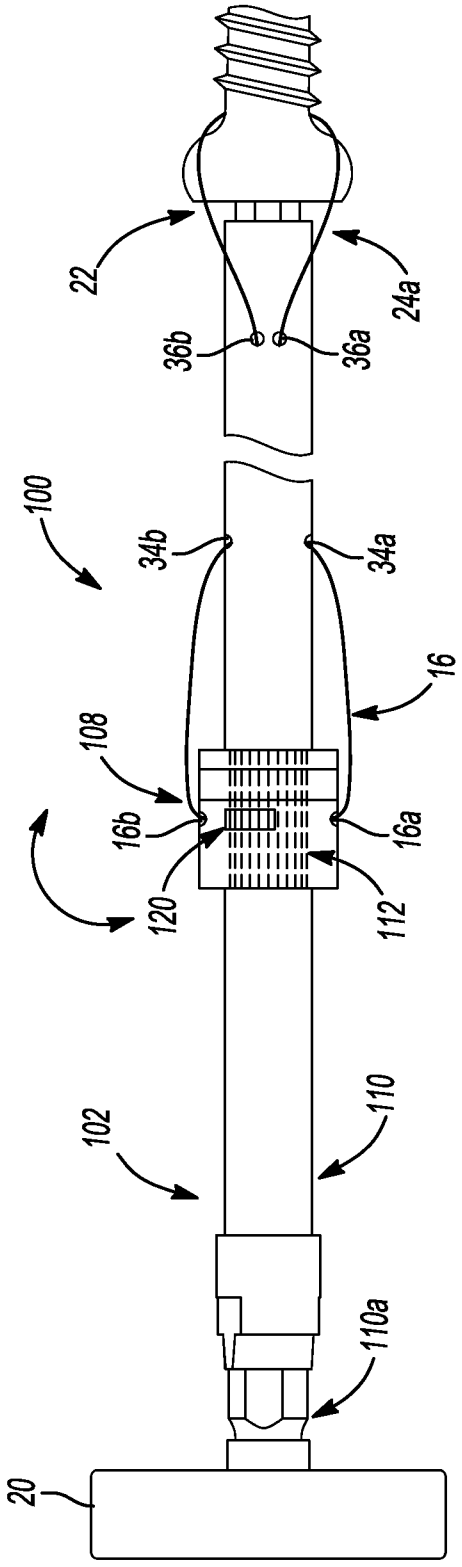
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Fig-6

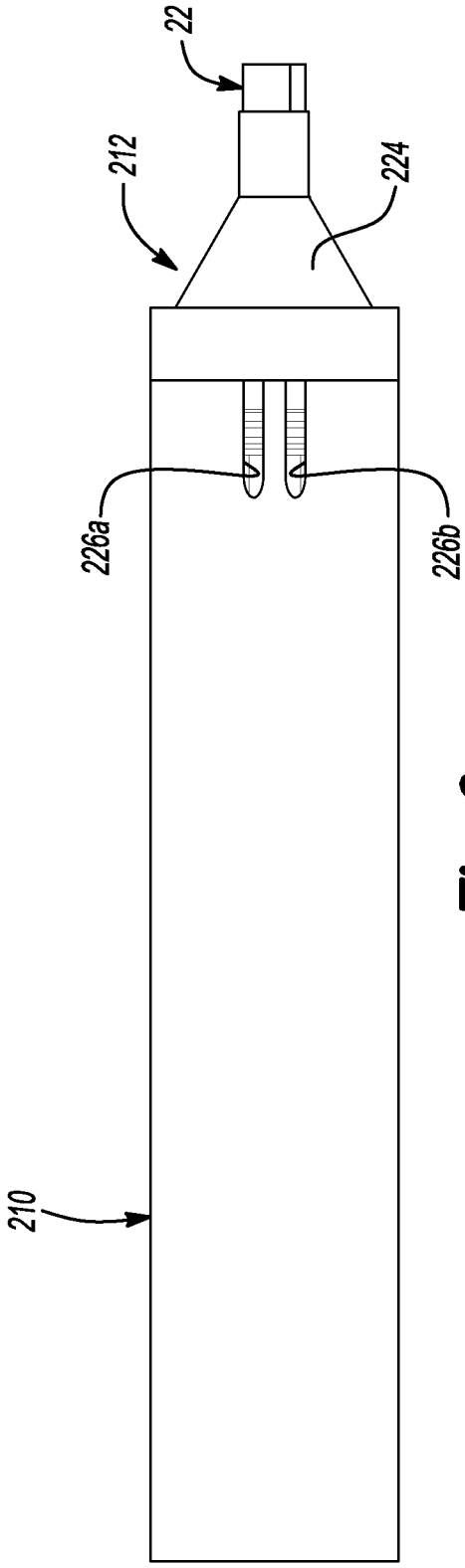
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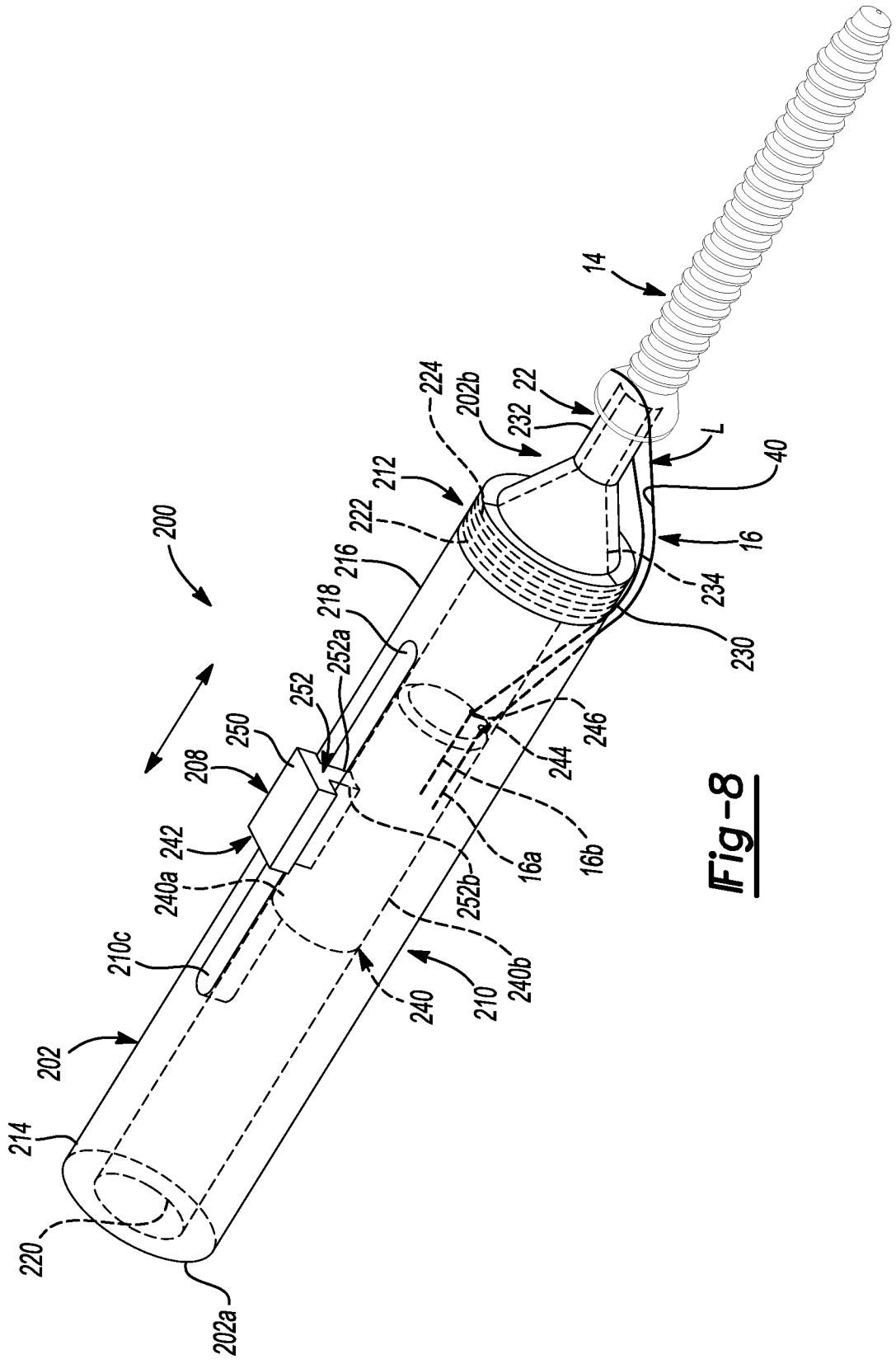
Fig-9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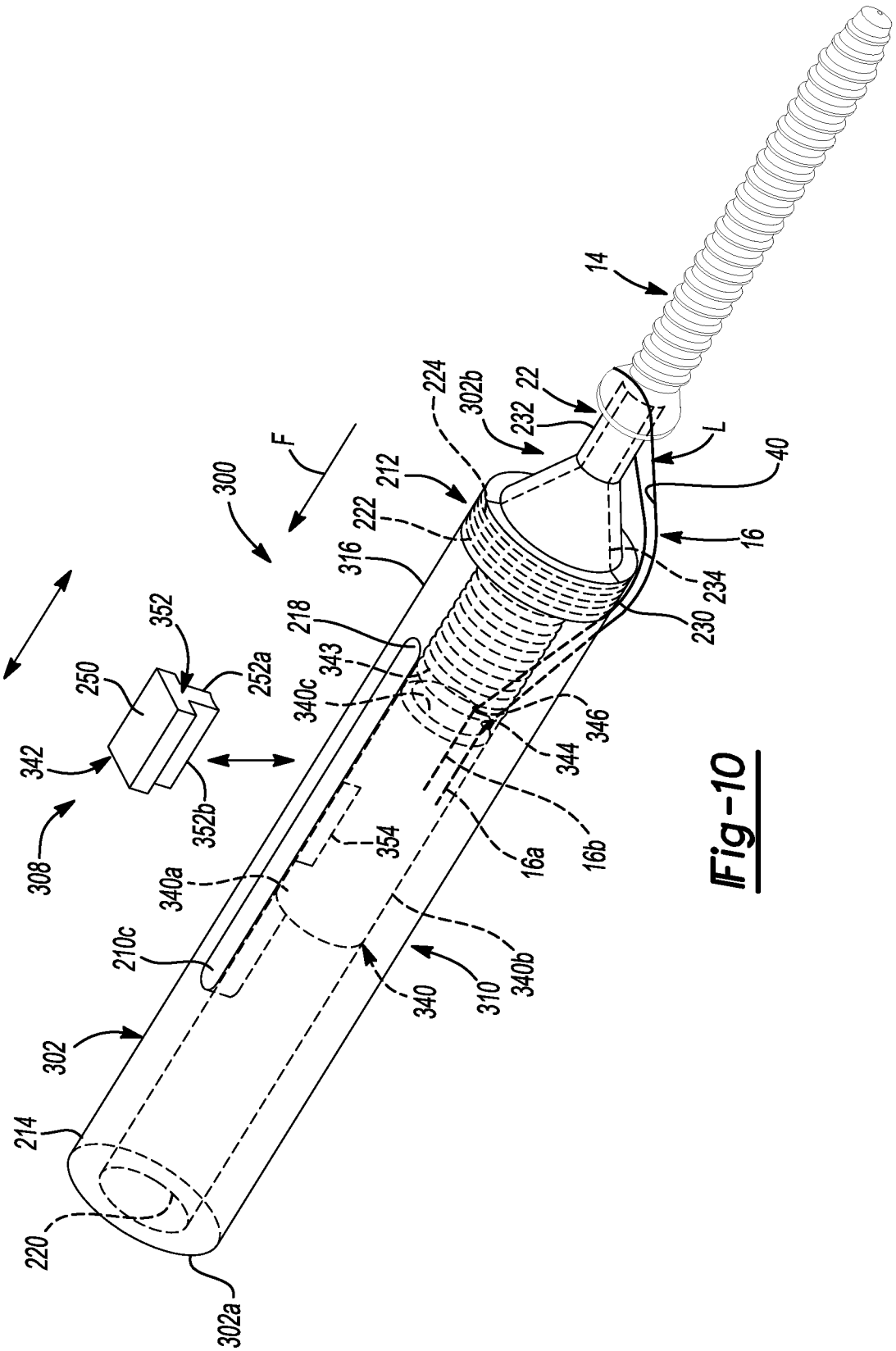
202a

Fig-8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302a

Fig-10

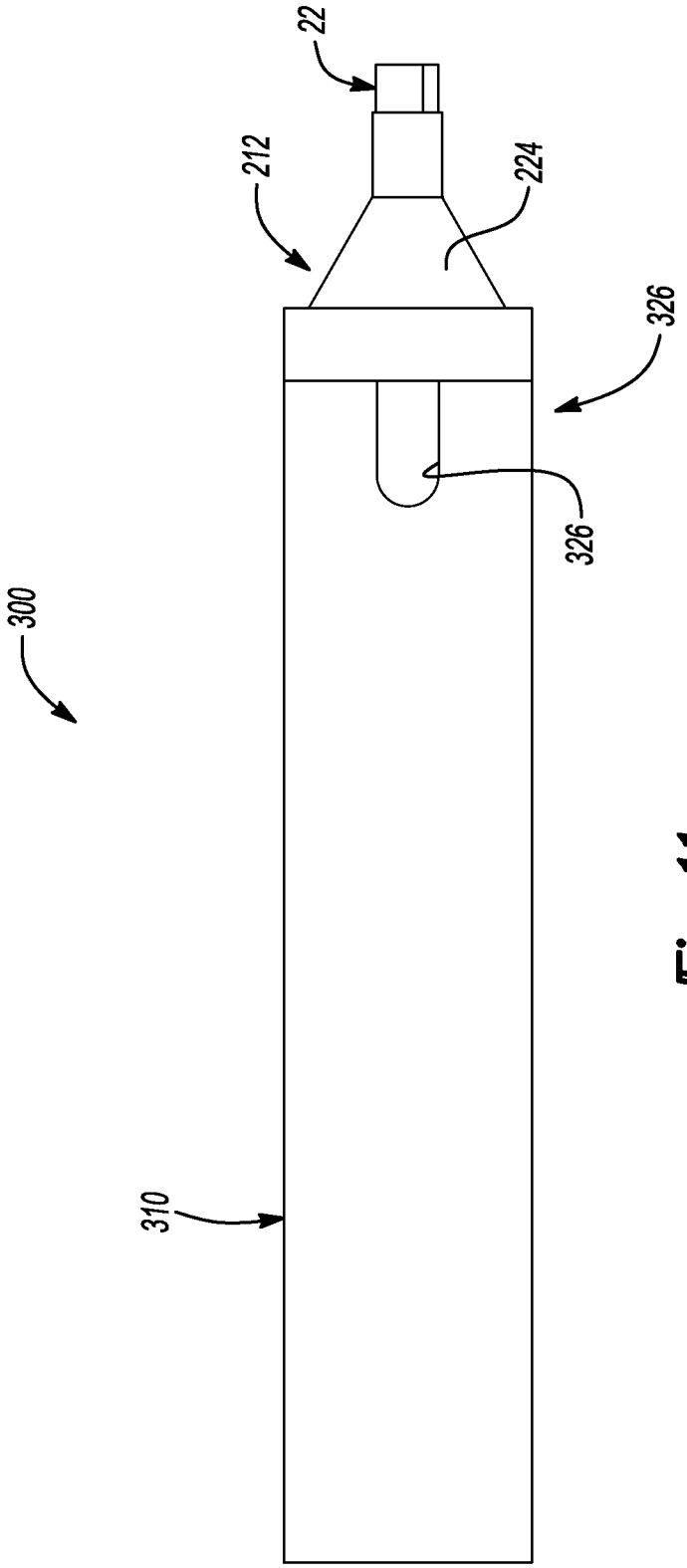

Fig-11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/046295

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/84(2006.01)i, A61B 17/86(2006.01)i, A61B 17/88(2006.01)i, A61B 17/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B 17/84; F16B 23/00; A61B 17/68; A61F 2/00; B25B 23/00; A61B 17/58; A61B 17/56; A61B 17/76; A61B 17/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: driver, screw, filament, tension

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 93-21848 A1 (HUENE, DONALD, R.) 11 November 1993 See page 4, line 29 - page 11, line 16; claims 1-32 and figures 1-6.	1-20
A	US 2008-0091213 A1 (ROGER JACKSON) 17 April 2008 See abstract and figures 1-38.	1-20
A	WO 2009-123791 A1 (PAULOS, LONNIE) 08 October 2009 See abstract and figures 1-4.	1-20
A	EP 0361756 A1 (GOBLE, E. MARLOWE et al.) 04 April 1990 See abstract and figures 1-11.	1-20
A	US 2008-0045970 A1 (SEAN SAIDHA et al.) 21 February 2008 See abstract and figures 1-13.	1-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 APRIL 2011 (05.04.2011)	**07 APRIL 2011 (07.04.2011)**

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