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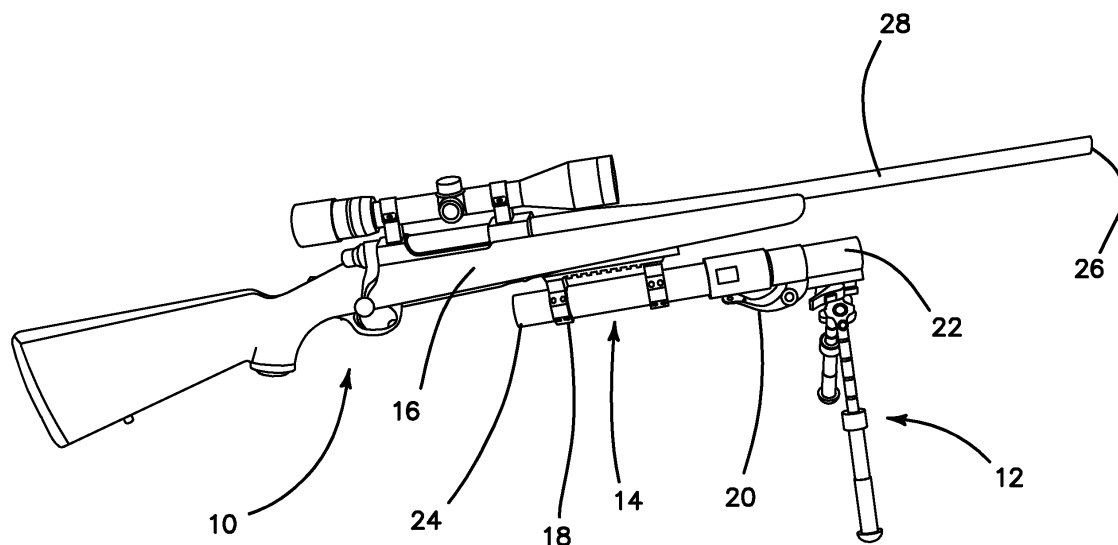
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**(54) A MOTORIZED EXTENSION FOR A BIPOD GUN SUPPORT**

(57) An extension system for a gun support, the gun having a barrel with an effective muzzle. The extension system includes a motorized telescopic assembly having a first telescopic portion and a second telescopic portion nested therein. A gun support is removably coupled to a distal end of the second telescopic portion. An actuator that is configured to selectively adjust a horizontal displacement of the second telescopic portion relative to the first telescopic portion is disposed within the first tele-

scopic portion. When the actuator is activated, a piston may be extended which drives the second telescopic portion away from within the first telescopic portion. The extension system may be selectively coupled to the gun or incorporated into a chassis of the gun itself. A distal end of the telescopic assembly comprises means for rotational adjustment relative the proximal end of the assembly.

**FIG. 1**

## Description

**[0001]** The invention relates to the field of mountings of firearms including locking means between gun and mounting, mountings without wheels (conventional mono-, bi- or tripods, test mounts and bench rests).

**[0002]** Rifle supports, such as bipods, have long been used to steady the muzzle of a rifle or shotgun during the firing thereof in an effort to "stabilize" the weapon to increase the shooter's accuracy. If the bipod is directly attached to the barrel of the gun, the harmonics of the barrel during the firing are materially affected by the bipod. Interfering with the harmonics of the barrel unpredictably alters the projectile's exit from the muzzle causing irregularities in the final trajectory of the projectile. If the bipod is mounted further back, on the gun stock, the harmonics of the barrel during firing is not affected, but the lever arm between the point of bipod attachment to the toe of the stock and the muzzle leads to a mechanically amplified displacement of the muzzle orientation for any unintended biological input or unintended movement during aiming or firing, materially affecting the accuracy of the rifle system as operated by the shooter. Accuracy of aiming and firing depends not only on the angular orientation in space of the gun barrel, but also on the stability of the gun muzzle position in space and the ability of the shooter to minimize the effects of biological input and unintended movement on the abovementioned components as a whole.

**[0003]** What is needed is some kind of accessory that can be used with bipod or tripod gun supports or rests that do not interfere with barrel harmonics during firing but are also not subject to mechanically amplified barrel misalignments or biologically induced aiming errors. Additionally, the accessory should be able to be adjusted with a minimum of movement between shots, thereby maintaining accuracy and consistency for the user.

**[0004]** The illustrated embodiments of the present disclosure provide an extension system for a gun support, the gun having a barrel with an effective muzzle. The extension system may include a telescopic assembly which has a proximal end and a distal end. The telescopic assembly may include a first telescopic portion and second telescopic portion, an actuator that is configured to selectively adjust a horizontal displacement of the second telescopic portion relative to the first telescopic portion, and means for rotating the distal end of the telescopic assembly relative to the second telescopic portion. The gun support may be coupled to the distal end of the telescopic assembly.

**[0005]** According to certain embodiments, the extension system may include a chassis that is configured to accommodate the telescopic assembly.

**[0006]** According to certain embodiments, the actuator that may be configured to selectively adjust a horizontal displacement of the second telescopic portion relative to the first telescopic portion may include an extendable piston disposed therein.

**[0007]** According to certain embodiments, a proximal end of the actuator may be coupled to a proximal end of the first telescopic portion, while a distal end of the extendable piston may be coupled to a distal end of the second telescopic portion.

**[0008]** According to certain embodiments, the extension system may also include a motor that is disposed within the first telescopic portion and coupled to the actuator.

**[0009]** According to certain embodiments, the extension system may also include a battery that may be removably coupled to the first telescopic portion and electrically communicated to the actuator.

**[0010]** According to certain embodiments, the extension system may also include a battery that may be removably coupled to the chassis and electrically communicated to the actuator.

**[0011]** According to certain embodiments, the means for rotating the distal end of the telescopic assembly relative to the second telescopic portion may include a front plug which extends beyond a distal end of the second telescopic portion, a plug adapter that is disposed within the second telescopic portion and inserted into the front plug, and a set screw that is disposed through an aperture defined in the front plug and engaged with the plug adapter.

**[0012]** According to certain embodiments, the plug adapter may include a channel that is defined around a circumference of a distal portion of the plug adapter, wherein the channel may be configured to accommodate a portion of the set screw.

**[0013]** According to certain embodiments, the gun support may be coupled to the front plug.

**[0014]** According to certain embodiments, the extension system may include means for selectively fixing a position of the second telescopic portion relative to the first telescopic portion.

**[0015]** The current disclosure also provides a method for using an extension system for a gun support while in a prone position. In certain embodiments, the method includes selectively activating an actuator that is disposed within a telescopic assembly, moving a second telescopic portion of the telescopic assembly from a first horizontal position relative to a first telescopic portion of the telescopic assembly, selectively deactivating the actuator when the second telescopic portion has reached a second horizontal position relative to the first telescopic portion, and then selectively adjusting an angle of the gun support coupled to a distal end of the second telescopic portion.

**[0016]** According to certain embodiments, selectively activating an actuator disposed within a telescopic assembly may include selectively activating a motor coupled to the actuator.

**[0017]** According to certain embodiments, moving a second telescopic portion of the telescopic assembly from a first horizontal position relative to a first telescopic portion of the telescopic assembly may include displa-

cing a piston from the actuator, wherein the actuator is disposed in the first telescopic portion, driving the second telescopic portion away from within the first telescopic portion when the piston is extended from the actuator, and driving the second telescopic portion into the first telescopic portion when the piston is retracted into the actuator.

**[0018]** According to certain embodiments, displacing a piston from the actuator further may include displacing the gun support that is disposed on the distal end of the second telescopic portion by a corresponding horizontal distance relative to the first telescopic portion.

**[0019]** According to certain embodiments, selectively adjusting an angle of the gun support that is coupled to a distal end of the second telescopic portion may include rotating a front plug that is selectively coupled to the gun support, wherein the front plug is disposed on a distal end of the second telescopic portion.

**[0020]** According to certain embodiments, rotating a front plug selectively coupled to the gun support may include rotating the front plug about a plug adapter coupled to a distal end of a piston, wherein a proximal end of the piston is disposed within the actuator.

**[0021]** According to certain embodiments, rotating the front plug about a plug adapter may include disposing a set screw through the front plug and into a channel defined around a circumference of the plug adapter, and then traversing the set screw through the channel as the front plug is rotated about the plug adapter.

**[0022]** According to certain embodiments, selectively activating an actuator disposed within a telescopic assembly and selectively deactivating the actuator when the second telescopic portion has reached a second horizontal position relative to the first telescopic portion may include actuating a switch that is coupled to the actuator.

**[0023]** According to certain embodiments, the method may also include selectively locking the second telescopic portion into position at the second horizontal position relative to the first telescopic portion.

**[0024]** Next, embodiments of the present disclosure will be described in more detail referring to the appended drawings, wherein identical reference signs will be used to refer to the same or similar components, and wherein:

Fig. 1 is a side elevational view of a rifle with a bipod support extension system attached to the stock's distal end of the gun using the extension of the illustrated embodiments shown in a contracted or shortened configuration.

Fig. 2 is a perspective front view of a rifle with a bipod support extension system attached to the stock of the gun using the extension of the illustrated embodiments shown in an extended configuration.

Fig. 3 is a side elevational view of the extension system of the illustrated embodiments shown in a partially contracted configuration in isolation of connection to the bipod support or gun stock.

Fig. 4 is a side elevational view of the extension system of the illustrated embodiments shown in the fully extended configuration in isolation of connection to the bipod support or gun stock.

Fig. 5 is a side elevational view of the extension system of the illustrated embodiments shown in the contracted configuration connected to a bipod gun mount in its folded configuration in isolation from the gun.

Fig. 6 is a side elevational view of the proximal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the rear sliding toggle lock and the two mounting rings for attachment to the gun stock.

Fig. 7 is a side elevational view of the proximal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting one of the mounting rings detached from the proximal portion of the extension tube and rotated for a better plan view.

Fig. 8 is an end perspective view of the proximal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting an end plug for closing the proximal end portion.

Fig. 9 is a bottom elevational view of the distal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the threaded mounting holes and a sling swivel stud mounting screw shown as detached by which the "sling swivel stud" type of bipod supports, such as the widely recognized Harris style of bipods, will be coupled to the extension system.

Fig. 10 is a partial bottom elevational view of the distal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the installed mounting screw and a Picatinny rail bipod supporting block shown as detached in perspective view.

Fig. 11 is a partial bottom elevational view of the distal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the installed bipod supporting block. In this case the sling swivel stud screw was removed and a Picatinny rail was instead mounted to the embodiment to allow for the attachment to a Picatinny styled bipod or tripod or the attachment of accessories of the same styled attachment system.

Fig. 12 is a partial bottom elevational view of the distal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the installed bipod supporting block with the mating mounting fixture of the bipod support shown as detached.

Fig. 13 is a side elevational view of the distal end portion of the extension system of the illustrated embodiments shown in enlarged view depicting the installed bipod support.

Fig. 14 is a side elevational view of a rifle with the

extension system of the illustrated embodiments attached to the stock's distal end shown in an extended configuration placing the bipod support beyond or well in front of the muzzle of the gun.

Fig. 15 is a front perspective view of a rifle with the extension system of the illustrated embodiments attached to the stock's distal end shown in a canted configuration where the bipod support rests on an uneven surface.

Fig. 16 is a side plan view of an embodiment of the extension system shown in isolation from the gun with a folding forward grip and a short distal Picatinny rail.

Fig. 17 is a side plan view of an embodiment of Fig. 16 shown in a collapsed configuration.

Fig. 18 is a side plan view of an embodiment of Fig. 16 shown in an extended configuration.

Fig. 19 is a side plan view of an embodiment of Fig. 16 in exploded view being mounted to a gun using a tilted Picatinny rail and a bipod.

Fig. 20a is a perspective view of the quick detach lever in an unlocked configuration.

Fig. 20b is a perspective view of the quick detach lever in a locked configuration.

Fig. 21 is a side plan view of a bubble level attachable to the extension system.

Fig. 22 is a rear perspective view of the bubble level of Fig. 21 shown attached to the extension system when assembled with the gun as would be seen by the shooter when aiming the gun.

Fig. 23 is perspective view of an embodiment of the extension system where two differently sized bipods are attached to the distal end of the extension system with the upper bipod in a folded or collapsed configuration and the lower bipod extended.

Fig. 24 is perspective view of the embodiment of Fig. 23 with the two bipods rotated by rotation of the distal end of the extension system to reverse the positions of the bipods, the upper bipod of Fig. 23 now shown as lowermost and extended and the lower bipod of Fig. 23 now shown as uppermost and folded into a collapsed configuration.

Fig. 25 is a side plan elevational view of the tilted Picatinny rail attached to the stock of a gun.

Fig. 26 is an end perspective view of the extension system shown in isolation of the gun in which the distal end of the extension system is provided with a bipod support and three orthogonally positioned Picatinny rails for connection with other accessories.

Fig. 27 is a side elevational view of a prior art gun with a bipod support.

Fig. 28 is a side elevational view of the gun of Fig. 27 modified according to the illustrated embodiments of the invention with a fore-end in which a closed, or in collapsed state, telescopic bipod extension is included for a bipod support.

Fig. 29 is a side elevational view of the gun of Fig. 28 in which the telescopic bipod extension has been

partially deployed from the fore-end of the gun to place the bipod support at or near the muzzle of the gun.

Fig. 30 is a side elevational view of the gun of Fig. 28 in which the telescopic bipod extension has been fully deployed from the fore-end of the gun to place the bipod support in front of the muzzle of the gun. Fig. 31 is an isometric view of the fore-end of the gun used in Figs. 27 - 29 according to one embodiment of the invention.

Fig. 32 is top plan view of the fore-end of Fig. 31.

Fig. 33 is a side plan view of the fore-end of Fig. 31.

Fig. 34 is a longitudinal cross sectional view of the fore-end of Fig. 31.

Fig. 35 is an end plan view of the fore-end of Fig. 31.

Fig. 36 is a perpendicular cross sectional view of the fore-end of Fig. 31.

Fig. 37 is a perpendicular cross sectional partial view in enlarged scale of the portion of fore-end of Fig. 31 as seen in inset circle B of Fig. 35.

Fig. 38 is an isometric view of a clamp that mounts to the fore-end of Fig. 31 for locking the first extension tube therein.

Fig. 39 is an end plan view of the clamp of Fig. 38.

Fig. 40 is a side plan view of the clamp of Fig. 38.

Fig. 41 is a perpendicular cross sectional view of the clamp of Fig. 38 as seen through section lines A - A of Fig. 40.

Fig. 42 is a perspective view of an alternative embodiment of the bipod extension system comprising an actuation means and configured to be removably coupled to a gun.

Fig. 43 is an exploded perspective view of the bipod extension system of Fig. 42.

Fig. 44A is a simplified top down plan view of the bipod extension system of Fig. 42 when the bipod extension system is in a contracted configuration.

Fig. 44B is a side cross sectional view of the bipod extension system of Fig. 44A.

Fig. 45A is a simplified top down plan view of the bipod extension system of Fig. 42 when the bipod extension system is in an expanded configuration.

Fig. 45B is a side cross sectional view of the bipod extension system of Fig. 45A.

Fig. 46 is a magnified cross section view of the distal end of the bipod extension system of Fig. 45B.

Fig. 47 is a perspective view of an alternative embodiment of the bipod extension system comprising an actuation means and accommodated within a chassis of a gun.

Fig. 48 is an exploded perspective view of the bipod extension system of Fig. 47.

Fig. 49A is a side elevational view of a gun comprising the bipod extension system of Fig. 47 when the bipod extension system is in a contracted configuration.

Fig. 49B is a side elevational view of a gun comprising the bipod extension system of Fig. 47 when the

bipod extension system is in an expanded configuration.

Fig. 50A is a simplified top down plan view of the bipod extension system of Fig. 47 without the chassis when the bipod extension system is in a compact configuration.

Fig. 50B is a side cross sectional view of the bipod extension system of Fig. 50A.

Fig. 51A is a simplified top down plan view of the bipod extension system of Fig. 47 when the bipod extension system is in an expanded configuration.

Fig. 51B is a side cross sectional view of the bipod extension system of Fig. 51A.

Fig. 52 is a magnified cross section view of the distal end of the bipod extension system of Fig. 51B.

**[0025]** The disclosure and its various embodiments can now be better understood by turning to the following detailed description of the preferred embodiments which are presented as illustrated examples of the embodiments defined in the claims. It is expressly understood that the embodiments as defined by the claims may be broader than the illustrated embodiments described below.

**[0026]** Fig. 1 is a side elevational view of a gun 10 with a bipod support extension system 14 attached to the stock's distal end 16 of the gun 10 using the extension 14 of the illustrated embodiments shown in a contracted or shortened configuration. Any type of gun, firearm or weapon may be used with extension system 14 and the telescopically equipped bolt action rifle of the illustrated embodiment is shown only as an example. Adjustable bipod support 12 is also conventional and any bipod, tripod, monopod or other type of support may be substituted without departing from the spirit and scope of the invention. The depiction of Fig. 1 show extension system 14 as including gun mounting rings 18 coupled to the proximal end portion and a toggle clamp 20 selectively coupled to extension tube 22 forming the distal portion of extension system 14 to which bipod support 12 is coupled. The embodiment of Figs. 1 and 2 include a single telescopic extension tube 22 and hence a single toggle clamp 20, but the embodiment of Figs. 3-5 include two telescopic extensions tubes 22 and two corresponding toggle clamps 20 as described in greater detail below. Any number of telescopically nested extension tubes 22 may be employed, but in the illustrated embodiments one or two such tubes 22 accommodate nearly all commonly used rifles.

**[0027]** Fig. 1 shows extension tube 22 fully nested within proximal end portion 24 putting extension system 14 in its contracted configuration and Fig. 2 shows extension tube 22 extended from proximal end portion 24 to put extension system 14 in its extended configuration, where bipod support 12 is aligned or approximately aligned with the muzzle 26 of gun 10. Fig. 14 is a side elevational view of a rifle 10 with a bipod support extension system 14 of the illustrated embodiments attached

to the stock's distal end 16 in an extended configuration placing the bipod support 12 beyond or well in front of the muzzle 26 of the gun 10.

**[0028]** It can now be appreciated from Figs. 1 and 2 that attachment of extension system 14 to the stock's distal end 16 of gun 10 leaves barrel 28 of gun 10 unimpeded by any fitting or connection to extension system 14 and hence bipod support 12. The harmonics of barrel 28 as a projectile is fired, and hence the precision of its trajectory, are thus left free of any added restraints or effects that might be created by result of connection to a bipod support. On the other hand, the effect of biological input and/or unintended movement on the position of muzzle 26 is stabilized and defined by the proximate position of bipod support 12 allowed by extension system 14. The adjustability of extension system 14 thus allows the fitting of system 14 to many different guns 10 having different barrel lengths and physical configurations. Any movement of gun 10 from any biological input and/or unintended movement during aiming or firing is not mechanically amplified to the relative position of muzzle 26 by a lever arm between the pivot position of bipod support 12 because the distance of lever arm between muzzle 26 and bipod support 12 is set at or close to zero by use of extension system 14 thus statistically reducing the effects of biological input and/or unintended movement during firing.

**[0029]** Fig. 3 is a side elevational view of the extension system 14 of the illustrated embodiments shown in the partially contracted configuration in isolation of connection to the bipod support 12 or gun stock's distal end 16. In the embodiment of Figs. 3-5 there are two telescopically nested extension tubes 22 nested within each other and within proximal end portion 24, although only one of these tubes 22 is observable in the depiction of Fig. 3. Extension tubes 22 are selectively locked into position using conventional toggle clamps 20. In Fig. 3 one toggle clamp 20 is fixed to end portion 24 and the second toggle clamp 20 is fixed to the distal end of the first extension tube 22. Fig. 4 is a side elevational view of the extension system 14 of the illustrated embodiments shown in the fully extended configuration in isolation of connection to the bipod support 12 or gun stock 16. Fig. 4 shows the first toggle clamp 20 on the left in the figure unlocked allowing first extension tube 22 on the left to extend from proximal end portion 24. The second toggle clamp 20 on the right in the figure is in the locked position holding the second and distal-most extension tube 22 in the right of the figure in position.

**[0030]** Fig. 16 is a side plan view of a second embodiment of the extension system 14 shown in isolation from the gun 10 with a folding forward grip 23 attached to proximal end portion or base tube 24 of extension system 14 by means of a floating ring 21 and with a short distal Picatinny rail 38. The embodiment of Fig. 16 includes a single toggle clamp 20 and extension tube 22.

**[0031]** A bubble level 44 is also attached to base tube 24 as better illustrated in the side plan view of Fig. 21.

Bubble level 44 has a bubble level tube 46 by which the horizontal orientation of extension system 14 and hence gun 10 can be determined as best illustrated in Fig. 22. When locking clamp 20 is in an open position extension tube 22 can rotate 360° to achieve any desired canting correction. Bubble level 44 is employed to level gun 10 at whatever cant bipod 12 or other support might apply to gun 10.

**[0032]** Fig. 17 is a side plan view of an embodiment of Fig. 16 shown in a collapsed configuration and Fig. 18 is a side plan view of an embodiment of Fig. 16 shown in an extended configuration with folding grip 23 extended in an operative position. To adjust the length of extension system 14 locking clamp 20 is pulled into its open configuration. This releases the telescopic feature of extension system 14 and allows the resting point of extension system 14 to be selectively chosen by the user. In the preferred embodiment, the resting point being at, near or in front of the effective muzzle exit of gun 10. Perturbative reorientations or translations of the gun barrel 74 from all possible sources can be characterized as a change in angular orientation of the gun barrel 74. These perturbations can be characterized as a finite distance of movement at the butt or toe of the gun 10 resulting in a change in the angular orientation of the gun 10 during firing, which finite distance will be different for each shooter and gun 10 and even each firing for a given shooter and gun 10. The amount of angular perturbation translated to the gun barrel 74 depends on the geometry defined by the size of the gun 10 from the toe to the pivot or support point of the support or bipod 12. The cone of fire will then depend on the range to the target and the average angular perturbation of the gun barrel 74. It is desirable to have the cone of fire as small as possible. The cone of fire can be changed by changing the pivot point or support point of the gun 10 support relative to the toe of the gun 10 and hence the muzzle 76. It has been discovered that the ratio of two cones of fire with different pivot points for a given perturbation will depend inversely on the ratio of the distances from the toe to the pivot points corresponding to the respective cones of fire and will be independent of the range to the target. For example, doubling the distance from the toe of the gun 10 to the pivot point of the bipod support 12 will halve the cone of fire at the target. The increase of the distance from the toe of the gun 10 to the pivot point of the bipod support 12 is limited as a practical matter by the limitation in the rigidity of materials used, the size of the support accessory which can or is desirable to be carried by a shooter, and the ease of deployment of the bipod support 12.

**[0033]** The locking clamp 20 is returned to the closed and locked position when tube 22 is extended to the desired length. The accurate and precise aiming and firing of a gun is a complex phenomenon dependent on multiple input variables which are not perfectly understood and which continue to be debated among experts. In addition to the known factors of distance to the target and ballistic coefficient of the projectile, the stability of the

gun and effective location of the gun muzzle at the moment the projectile exits the muzzle of the barrel affect precision and thus potential accuracy of the gun during each firing process. The angular orientation of the gun relative to gravity, the harmonic reverberations of the barrel caused by firing, the dynamic interaction of the interior ballistics of the barrel in relation to the projectile, the effect of the explosive charge and coupled expansion of gases, the nature of the rifling of the barrel, the nature of the support of the gun, the biological input from the shooter during firing, the engagement of the firing mechanism, sight alignment, sight picture, optics, and other factors may contribute to a determination of an effective muzzle position of the gun during firing. Of all of the previously described factors stability is paramount. An effective way to increase the stability of a gun rested on a bipod or tripod is to alter the geometry of the gun by having its resting point, the bipod or tripod, at or as far in front of the physical muzzle location as it would be practically possible.

**[0034]** Fig. 5 is a side elevational view of the extension system 14 of the illustrated embodiments shown in the contracted configuration connected to a bipod gun mount 12 in its folded configuration in isolation from the gun 10. Bipod support 12 in the illustrated embodiment has spring-loaded adjustable length legs, but any bipod design desired may be employed.

**[0035]** In the illustrated embodiment end portion 24 and extension tubes 22 are comprised of thick walled carbon fiber tubing, but any strong, rigid material may be equivalently employed. A pair of mounting rings 18 are clamped onto end portion 24 and include a conventional gun fitting 32 best seen in Fig. 7 on their upper portions, such as a Picatinny rail as shown in Fig. 1 attached to the gun stock 16. Locking is accomplished by tightening fitting bolts. Fig. 6 is a side elevational view of the proximal end portion 24 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting the rear sliding toggle clamp 20 and the two mounting rings 18 for attachment to the gun stock. Fig. 7 is a side elevational view of the proximal end portion 24 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting one of the mounting rings 18 detached from the proximal portion 24 and rotated for a better plan view of the conventional gun fitting 32. Note that ring 18 can be positioned on proximal end portion in any desired angular orientation. Its relative angular orientation, once selected, is then fixed by tightening bolt 19 best seen in Fig. 7. Similarly, once an angular orientation is selected, it can be changed by loosening bolts 19 on rings 18, rotating proximal portion 24 within rings 18 and then fixing the new angular orientation by retightening bolts 19. Thus, when gun 10 is canted to the side, when for example, bipod support 12 is placed on a canted surface as shown in Fig. 15 or if the legs of bipod support 12 are unevenly adjusted for any purpose, the canted angular position of gun 10 can be corrected or adjusted. The canting, also known by shoot-

ing enthusiasts as "swiveling", is adjusted by rotating the nested tubes 22. This is also much easier to accomplish than loosening and re tightening mounting rings 18. Under normal conditions the gun operator will affix and tighten the proximal end portion 24 of the extension system 14 to the stock's distal end 16 with mounting rings 18 only once. Any further desired adjustments, including canting, can be accomplished by simply loosening toggle clamps 20, making the adjustments by rotating extension tubes 22 with respect to each other and retightening clamps 20. This is possible because the nested tubes 22, besides extending and collapsing, also rotate in either direction relative to one another by any degree from 0 to 360° or more. This allows for "extreme canting".

**[0036]** Fig. 8 is an end perspective view of the proximal end portion 24 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting an end plug 34 for closing the proximal end portion 24. End plug 34 is compression fit into the proximal end of end portion 24, but threaded, glued or pinned plugs could also be utilized.

**[0037]** Fig. 9 is a bottom elevational view of the distal end of extension tube 22 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting the threaded mounting holes 36 and mounting screw 30 shown as detached by which different versions of the bipod support 12 will be coupled to the extension system 14. Fig. 10 is a partial bottom elevational view of the distal end of extension tube 22 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting the installed sling swivel stud mounting screw 30. A more modern alternative mounting method to the sling swivel stud mounting screw 30 is the Picatinny rail attachment system 38 shown as detached in perspective view. Sling swivel stud mounting screw 30 is selectively installed in anyone of the threaded holes 36 in extension tube 22 and a sling swivel stud mounting type of bipod can be attached to it, as shown in Figure 5. Alternatively, the sling swivel stud mounting screw 30 can be removed to allow for the attachment of a Picatinny rail 38 to which a Picatinny rail type of bipod, or most any Picatinny rail type accessory could attach, as shown in Fig. 13. Picatinny rail attachment system 38 attaches to tube 22 by two through-bolts 40 threaded into the end holes 36 as best depicted in Fig. 11. Fig. 11 is a partial bottom elevational view of the distal end of tube 22 of the extension system 14 of the illustrated embodiments shown in enlarged view depicting the installed Picatinny rail attachment system 38. In another embodiment Picatinny rail 38 and sling swivel stud mounting screw 30 are both included, each one on an opposing side of the distal end of extension tube 22.

**[0038]** Fig. 12 is a partial bottom elevational view of the distal end portion of the extension system 14 with Picatinny rail 38 of the illustrated embodiments shown in enlarged view depicting the Picatinny rail attachment system 38 with the mating mounting fixture 42 of the bipod support 12 shown as detached. Fig. 13 is a side

elevational view of the distal end portion of the extension system 14 of the illustrated embodiments shown in enlarged view depicting the installed bipod support 12 coupled to Picatinny rail attachment system 38.

Fig. 19 is a side plan view of the embodiment of Fig. 16 in exploded view being attached or mounted to a gun 10 using a tilted Picatinny rail 48 and a bipod 12. Fig. 20a is a perspective view of the quick detach mounting ring 18 in an unlocked configuration where toggle lever 19 is rotated to an open configuration releasing mounting ring 18 from tilted Picatinny rail 48. Fig. 20b is a perspective view of the quick detach mounting ring 18 in a locked configuration where toggle lever 19 is rotated to a closed configuration locking mounting ring 18 to tilted Picatinny rail 48. The attachment of Picatinny rail 48 to the gun stock 16 is better illustrated in the side plan elevational view of Fig. 25.

**[0039]** Figs. 23 and 24 illustrate another embodiment where two bipods 12a and 12b are fixed to the distal end of extension system 14. Fig. 23 is a perspective view of an embodiment of the extension system 14 where two differently sized bipods 12a and 12b are attached to the distal end of the extension system 14 with the upper bipod 12a in a folded or collapsed configuration and the lower bipod 12b extended. Fig. 24 is a perspective view of the embodiment of Fig. 23 with the two bipods 12a and 12b rotated by a 180° rotation of the distal end of the extension system 14 to reverse the positions of the bipods 12a and 12b, the upper bipod 12a of Fig. 23 now shown as lowermost and extended and the lower bipod 12b of Fig. 23 now shown as uppermost and folded into a collapsed configuration.

**[0040]** Fig. 27 is a side elevational view of a prior art gun 10 with a bipod support 12, which gun 10 differs in configuration from that shown in Fig. 1. Gun 10 includes a plurality of conventional components, including a folding buttstock 60 pivoted on pin 62 with a pistol grip 64, trigger mechanism 66 telescopic sight 68, receiver 70, fore-end 72 and a barrel 74 with a muzzle 76. Fig. 28 is a side elevational view of the gun 10 of Fig. 27 modified according to the illustrated embodiments of the invention with a fore-end 78 in which a telescopic bipod extension 80 is included for a bipod support 12 replacing fore-end 72 of gun 10 of Fig. 27. In Fig. 28 extension 80 is fully retracted into fore-end 78 and bipod support 12 is behind muzzle 76 of gun 10. Fig. 29 is a side elevational view of the gun 10 of Fig. 28 in which the telescopic bipod extension 80 has been partially deployed from the fore-end 78 of the gun 10 to place the bipod support 12 at or near the muzzle 76 of the gun 10 in accordance with the teachings of the invention above. It is to be understood that bipod support is ideally attached at a position which minimizes the movement of muzzle 76 due to any unintended movement of gun 10 or barrel 74 from any cause. Thus, it is possible that the effective position of muzzle 76 from the viewpoint of minimization of movement may not be at the anticipated physical location of muzzle 76, the exit orifice of gun 10, but may be at a slightly different longitudinal

position according to the effect of a projectile fired through barrel 74. This in turn could depend very subtly on the rifling in barrel 74 and the nature of the projectile. In any case, Fig. 29 illustrated the ability to fine tune the position of bipod support 12 relative to muzzle 76 to obtain minimization of effect of unintended movement. Furthermore, Fig. 29 illustrates how the embodiment of this Figure is able to position bipod support 12 laterally physically closer to muzzle 76 than in the embodiment of Fig. 2 where the bipod extension 14 is mounted exterior to stock 16 of gun 10.

Fig. 30 is a side elevational view of the gun 10 of Fig. 28 in which the telescopic bipod extension 80 has been deployed from the fore-end 78 of the gun 10 to place the bipod support 12 in front of the muzzle 76 of the gun 10.

**[0041]** The details of fore-end 78 and extension 80 can be understood and appreciated by turning now to Figs. 30 - 40. Fig. 31 is an isometric view of the fore-end 78 of the gun 10 as seen in Figs. 27 - 29 according to one embodiment of the invention. As shown in Fig. 31 fore-end 78 includes an integral bracket portion 82 in the form of a prismatic U-shaped channel and a lower octagonal body 84 having a cylindrical interior cavity 86 defined therein for receiving a first extension tube 88 as shown best in Fig. 30. Tube 88 freely slip fits or slides within cavity 86 of fore-end 78. The opposing end of body 84 integrally extends into a bracket 92, shown in cross sectional view in Fig. 34, which is bolted or screwed into receiver 70 as best seen in Fig. 30. Body 84 is provided with a plurality of cavities 94 on or in its exposed exterior surfaces to form a modular lock (M-LOK) firearm rail interface system developed by Magpul Industries for direct accessory attachment onto the "negative space" (hollow slot) mounting points. It is to be understood that the exterior surfaces of fore-end 78 could also be modified to provide mounting surfaces using other types of mounting systems, such as KeyMod system or Picatinny rail systems. It can be appreciated by studying Fig. 31 that portion 82 surrounds, but does not support, touch nor is it connected to barrel 74. Barrel 74 is left free-floating in integral bracket portion 82 so that harmonic or vibrational reverberations of barrel 74 during firing is unaffected by integral bracket portion 82.

**[0042]** Fig. 32 is a top plan view of the fore-end 78 of Fig. 31 and clearly shows the extension of integral channel 82 beyond body 84. This extension of integral channel 82 and the adjacent portion of it are provided with a plurality of through-holes 100, which provided additional means for mounting accessories adjacent to barrel 74, such as, but not limited to, clip on night vision equipment (not shown). These mounting holes 100 are best seen in Fig. 33 which is a side plan view of the fore-end 78 of Fig. 31. Fig. 34 is a longitudinal cross sectional view of the fore-end 78 of Fig. 31 as seen through sections lines A - A of Fig. 32 and clearly shows the definition of cylindrical cavity 86 in body 84 for receiving first extension tube 88. The end of body 84 is shown in Fig. 31 as being provided with four threaded bores 96 for mounting a body clamp 98

as best shown in Fig. 39. Fig. 35 is an end plan view of the fore-end 78 of Fig. 31 clearly showing the mounting holes 96 for clamp 98.

**[0043]** Fig. 36 is a perpendicular cross sectional view of the fore-end 78 of Fig. 31 as seen through sections lines D - D of Fig. 33 and provides the best depiction of M-LOK cavities 94 defined in body 84. Fig. 37 is a perpendicular cross sectional partial view in enlarged scale of the portion of fore-end 78 of Fig. 31 as seen in inset circle B of Fig. 35 and provides clearer detail on the lower mounting holes 96 and a lower dovetailed prismatic mounting rail 102 on the lowermost surface of body 84, with said dovetail conforming to the Really Right Stuff ("RRS") Dovetail standard developed by Really Right Stuff, LLC of Lehi, Utah.

**[0044]** Fig. 38 is an isometric view of a clamp 98 that mounts to the fore-end 78 of Fig. 31 for selectively locking the first extension tube 88 therein. Fig. 39 is an end plan view of the clamp 98 of Fig. 38. Fig. 40 is a side plan view of the clamp 98 of Fig. 38. Fig. 41 is a perpendicular cross sectional view of the clamp 98 of Fig. 38 as seen through section lines A - A of Fig. 40. Clamp 98 includes an integral base 104 into which four boreholes 106 have been defined aligned with threaded holes 96 in fore-end 78 and through which clamp 98 is screwed or bolted to fore-end 78. The top of clamp 98 is provided with an eccentric toggle lever 108, which is used to tighten clamp 98 around first extension tube 88 by rotating lever 108 into the position seen in Figs. 37 - 40 when tube 88 is inserted through clamp 98. The body of clamp 98 is comprised of two resilient circular opposing sides 99 separated by a gap 110 best seen in Figs. 38 and 40. An adjustment bolt 112 is disposed through two opposing through holes in the top extended end 114 of clamp 98, through a slot 116 defined in the eccentric lobe 116 of lever 108 as shown in Fig. 38. The threaded distal end 118 of bolt 112 is threaded into a threaded bore 120 defined perpendicularly through a cylindrical spindle 122 which serves as the pivot pin for lever 108. By adjustment of bolt 112, spindle 122 is positioned relative to top extended end 114 and the opposing surface thereof against which the eccentric of lever 108 rotates. In this manner the degree of locking and tightness of lever 108 is selectively adjusted when lever 108 is rotated thereby forcing the two opposing sides of top extended end 114 of clamp 98 together. As shown in Figs. 38 and 40 there is a relief slot 124 defined between base 104 and the circular opposing sides 99, which frees sides 99 from base 104 and allows sides 99 to be resiliently drawn by adjustment of bolt 112 into closer proximity to tighten down on tube 88, which will be disposed into clamp 98.

**[0045]** As shown in Figs. 27 - 29 a second clamp 126 is disposed on the distal end of tube 88 and is used to tighten or lock distal extension tube 90 to tube 88, when tube 90 is telescopically disposed into tube 88. Clamp 126 is a conventional tube clamp and therefore will not be further described, but is generally similar in operation to clamp 98. Tube 88 in turn is telescopically disposed into

fore-end 78.

**[0046]** An alternative embodiment of the extension system as a detachable accessory is seen in Figs. 42-46 where it is denoted generally by reference numeral 200. Fig. 42 is a perspective view of the extension system 200 comprising a first tube 202 and a second tube 204 shown in a contracted configuration in isolation of connection to the bipod support 12 or gun stock's distal end 16. Fig. 43 is an exploded view of the extension system 200 with the first and second tubes 202, 204 removed to better illustrate the components therein. According to certain embodiments, coupled to an internal portion of a proximal end of the first tube 202 is a back plug 206 while a floating ring 208 is in turn coupled an external portion of the proximal end of the first tube 202. The floating ring 208 comprises a rail 210 or other coupling means configured to accommodate a battery pack rail mount 212. According to certain embodiments, the battery pack rail mount 212 comprises a thumb screw or other means for coupling onto the rail 210 of the floating ring 208. A battery 214 is in turn coupled to the battery pack rail mount 212. In certain embodiments a rocker switch 216 or other actuation means is coupled to the battery 214.

**[0047]** According to certain embodiments, an actuator 220 comprising a motor 222 or other actuation means is disposed within the first tube 202 and is electrically coupled or communicated to the back plug 206. In certain embodiments the actuator 220 comprises an extendable driver or piston 224 which is selectively extended via activation of the motor 222. Coupled to a distal end of the extendable driver 224 via a pin 228 or other coupling means is a plug adapter 226. The plug adapter 226 in certain embodiments is disposed within or coupled to a front plug 230. A set screw 234 is disposed through an aperture defined in the front plug 230 and is configured to be inserted or disposed into a channel 232 defined around a circumference of the plug adapter 226 as is detailed further below. Disposed on a distal end of the front plug 230 is a support adapter or platform 236 that is specifically shaped to removably couple to or otherwise cooperate with the bipod support 12.

**[0048]** In the embodiment of Figs. 42-46, the two telescopically nested tubes 202, 204 are nested within each other, although only the first tube 202 is observable in the depiction of Fig. 42. The extension system 200 is selectively coupled to the stock's distal end 16 of the gun 10 using a pair of Picatinny rails 238 disposed on the outside surface of the first tube 202. In certain other embodiments, the extension system 200 comprises other means for selectively coupling to the gun 10 including but not limited to attachments used in M-LOK or KeyMod coupling systems now known or later devised. According to certain embodiments, a toggle clamp 240 is fixed to a distal end portion of the first tube 202. The toggle clamp 240, according to certain embodiments, comprises a cam lock and/or a thumb screw to selectively lock the position of the second tube 204 relative to the first tube 202

**[0049]** Figs. 44A and 44B is a simplified top down view and a side elevational cross sectional view, respectively, of the distal end of the extension system 200 of the illustrated embodiments shown in the fully contracted configuration in isolation of connection to the bipod support 12 or gun stock 16. In turn, Figs. 45A and 45B is a simplified top down view and a side elevational cross sectional view, respectively of the distal end of the extension system 200 of the illustrated embodiments shown in the fully expanded configuration in isolation of connection to the bipod support 12 or gun stock 16.

**[0050]** According to certain embodiments, upon actuation of the rocker switch 216 in a first direction, power is directed from the battery 214 to the motor 222 disposed in the actuator 220 via an electrical connection 218 disposed through the back plug 206. The motor 222 then drives the extendable driver or piston 224 in the distal direction towards the barrel 74 of the gun 10. Because the extendable driver or piston 224 is coupled to the plug adapter 226, the plug adapter 226 and the front plug 230 coupled thereto are also driven in the distal direction as seen in Figs. 45A and 45B. As the front plug 230 is distally driven, the second tube 204 extends or telescopically expands from the first tube 202 which remains in a stationary or static position relative to the gun 10. The support adapter or platform 236 disposed on the front plug 230, and any bipod support 12 coupled thereto or disposed thereon, is in turn likewise driven or moved forward in the distal direction.

**[0051]** Once the bipod support 12 has reached a desired position relative to the static front tube 202, according to certain embodiments, the user ceases activation of the motor 222 via appropriate actuation of the rocker switch 216. The user then locks the position of the second tube 204 and the bipod support 12 relative to the first tube 202 by appropriate tightening of the toggle clamp 240. To readjust the position of the bipod support 12, the toggle clamp 240 is released which then allows for the relative lateral movement of the second tube 204 according to the orientation of the actuated rocker switch 216. According to certain embodiments, actuation of the rocker switch 216, displacement of the bipod support 12 and the second tube 204, and tightening and releasing of the toggle clamp 240 are all done with a minimum of movement of the part of the user aiming the gun 10. In other words, a user lying in the prone position while aiming the gun 10 can adjust the placement of the bipod support 12 without having to stand or otherwise dramatically shift their body, allowing the user to maintain greater consistency between shots where adjustment of the bipod support 12 is needed.

**[0052]** According to certain embodiments, adjustment of the relative canted angle of the bipod support 12 and the front plug 230 coupled thereto is provided by the interaction between the set screw 234 and the plug adapter 226 as best seen in the magnified cross sectional view of Fig. 46. The set screw 234 is disposed in one of a plurality of circular or annular grooves 242 defined

around the circumference of the front plug 230. According to certain embodiments, the set screw 234 comprises a head portion 248 and a threaded portion 246 and is inserted into the selected annular groove 242 with the head portion 248 resting or supported by a shoulder 250 defined within the annular groove 242 while the threaded portion 246 is inserted through the thickness of the front plug 230 and into a channel 244 circumferentially defined around the plug adapter 226.

**[0053]** In certain embodiments, the threaded portion 246 of the set screw 234 is inserted or otherwise configured to be fitted loosely within the channel 244 of the plug adapter 226 so as to facilitate relative movement therebetween with a minimal amount of friction. For example, according to certain embodiments, when the user wishes to change the canted angle of the bipod support 12 coupled to the support adapter 236, the user rotates the bipod support 12 which in turn rotates the front plug 230 a corresponding amount. As the front plug 230 rotates, the set screw 234 rotates with it, specifically with the threaded portion 246 of the set screw 234 moving along the circumferential length of the channel 244 defined in the plug adapter 226. When the bipod support 12 has been adjusted to the new desired relative angle, rotational movement of the front plug 230 and the set screw 234 ceases, leaving the threaded portion 246 of the set screw 234 at a new circumferential position within the channel 244 of the plug adapter 226.

**[0054]** In this manner, the bipod support 12 may be rotated in either direction without applying any torque to the plug adapter 226, the extendable piston 224, or the motor 222, all of which remain fixed during the adjustment of the bipod support 12. In other words, because the front plug 230 rotates around the plug adapter 226, relative angular movement between the bipod support 12 and the first and second tubes 202, 204 is achieved without any further input required on the part of the user.

**[0055]** An alternative embodiment of the extension system as part of a chassis of a gun is seen in Figs. 47-52 where it is denoted generally by reference numeral 300. Fig. 47 is a perspective view of the extension system 300 comprising a first tube 302 and a second tube 304 shown in a contracted configuration within a chassis 301 portion of the gun 10. Fig. 48 is an exploded view of the extension system 300 with the first and second tubes 302, 304 removed to better illustrate the components therein. According to certain embodiments, coupled to an internal portion of a proximal end of the first tube 202 is a back plug 306 while a battery 314 is in turn coupled or electronically communicated to the back plug 306, both the back plug and the battery 314 being held within an internal portion or compartment of the chassis 301. A battery door 318 is removably coupled to an underside or bottom portion of the chassis 301 to allow the user access to the battery 314 disposed therein. In certain embodiments, a rocker switch 316, button, or other actuation means is disposed in the chassis 301 and coupled to the battery 314.

**[0056]** According to certain embodiments, an actuator 320 comprising a motor 322 or other actuation means is disposed within the first tube 302 and electrically coupled or communicated to the back plug 306. In certain embodiments the actuator 320 comprises an extendable driver or piston 324 which is selectively extended via activation of the motor 322. Coupled to a distal end of the extendable driver 324 via a pin 328 or other coupling means is a plug adapter 326. The plug adapter 326 in certain embodiments is disposed within or coupled to a front plug 330. A set screw 334 is disposed through an aperture defined in the front plug 330 and is configured to be inserted or disposed into a channel 332 defined around a circumference of the plug adapter 326 as is detailed further below. Disposed on a distal end of the front plug 330 is an support adapter or platform 336 that is specifically shaped to removably couple to or otherwise cooperate with the bipod support 12.

**[0057]** In the embodiment of Figs. 47-52, the two telescopically nested tubes 302, 304 are nested within each other, although only the first tube 302 is observable through the openings defined in the chassis 301 in the depiction of Fig. 47. The extension system 300 is disposed within an internal portion of the body of the chassis 301. As seen in Figs. 49A and 49B, the chassis 301 is configured to accommodate the barrel 74 of the gun 10 and to seamlessly integrate with the gun stock 16 and any other portion of the gun 10 as is known in the art. According to certain embodiments, a toggle clamp 340 is fixed to a distal end portion of the first tube 302. The toggle clamp 340, according to certain embodiments, comprises a cam lock and/or a thumb screw to selectively lock the position of the second tube 304 relative to the first tube 302.

**[0058]** Figs. 50A and 50B is a simplified top down view and a side elevational cross sectional view, respectively, of the distal end of the extension system 300 of the illustrated embodiments shown in the fully contracted configuration in isolation of connection to the chassis 301. In turn, Figs. 51A and 51B is a simplified top down view and a side elevational cross sectional view, respectively of the distal end of the extension system 300 of the illustrated embodiments shown in the fully expanded configuration while disposed or accommodated within the chassis 301.

**[0059]** According to certain embodiments, upon actuation of the rocker switch 316 in a first direction, power is directed from the battery 314 to the motor 322 disposed in the actuator 320 via an electrical connection through the back plug 206. The motor 322 then drives the extendable driver or piston 324 in the distal direction towards the barrel 74 of the gun 10. Because the extendable driver or piston 324 is coupled to the plug adapter 326, the plug adapter 326 and the front plug 330 coupled thereto are also driven in the distal direction as seen in Figs. 49B, 51A, and 51B. As the front plug 330 is distally driven, the second tube 304 extends or telescopically expands from the first tube 302 which remains in a stationary or static position relative to the gun 10. The support adapter or

platform 336 disposed on the front plug 330, and any bipod support 12 coupled thereto or disposed thereon, is in turn likewise driven or moved forward in the distal direction.

**[0060]** Once the bipod support 12 has reached a desired position relative to the static front tube 302, according to certain embodiments, the user ceases activation of the motor 322 via appropriate actuation of the rocker switch 316. The user then locks the position of the second tube 304 and the bipod support 12 relative to the first tube 302 by appropriate tightening of the toggle clamp 340. To readjust the position of the bipod support 12, the toggle clamp 340 is released which then allows for the relative lateral movement of the second tube 304 according to the orientation of the actuated rocker switch 316. According to certain embodiments, actuation of the rocker switch 316, displacement of the bipod support 12 and the second tube 304, and tightening and releasing of the toggle clamp 340 are all done with a minimum of movement of the part of the user aiming the gun 10. In other words, a user lying in the prone position while aiming the gun 10 can adjust the placement of the bipod support 12 without having to stand or otherwise dramatically shift their body, allowing the user to maintain greater consistency between shots where adjustment of the bipod support 12 is needed.

**[0061]** According to certain embodiments, adjustment of the relative canted angle of the bipod support 12 and the front plug 330 coupled thereto is provided by the interaction between the set screw 334 and the plug adapter 326 as best seen in the magnified cross sectional view of Fig. 52. The set screw 334 is disposed in one of a plurality of circular or annular grooves 342 defined around the circumference of the front plug 330. According to certain embodiments, the set screw 334 comprises a head portion 348 and a threaded portion 346 and is inserted into the selected annular groove 342 with the head portion 348 resting or supported by a shoulder 350 defined within the annular groove 342 while the threaded portion 346 is inserted through the thickness of the front plug 330 and into a channel 344 circumferentially defined around the plug adapter 226.

**[0062]** In certain embodiments, the threaded portion 346 of the set screw 334 is inserted or otherwise configured to be fitted loosely within the channel 344 of the plug adapter 326 so as to facilitate relative movement therebetween with a minimal amount of friction. For example, according to certain embodiments, when the user wishes to change the canted angle of the bipod support 12 coupled to the support adapter 336, the user rotates the bipod support 12 which in turn rotates the front plug 330 a corresponding amount. As the front plug 330 rotates, the set screw 334 rotates with it, specifically with the threaded portion 346 of the set screw 334 moving along the circumferential length of the channel 344 defined in the plug adapter 326. When the bipod support 12 has been adjusted to the new desired relative angle, rotational movement of the front plug 330 and the set

screw 334 ceases, leaving the threaded portion 346 of the set screw 334 at a new circumferential position within the channel 344 of the plug adapter 326.

**[0063]** In this manner, the bipod support 12 may be rotated in either direction without applying any torque to the plug adapter 326, the extendable piston 324, or the motor 322, all of which remain fixed during the adjustment of the bipod support 12. In other words, because the front plug 330 rotates around the plug adapter 326, relative angular movement between the bipod support 12 and the first and second tubes 302, 304 is achieved without any further input required on the part of the user.

**[0064]** According to certain embodiments, when the battery 214, 314 of the extension system 200, 300 is removed, disconnected, or depleted, the user may adjust the horizontal displacement of the bipod support 12 manually by pulling the second tube 202, 302, the front plug 230, 330, and/or the bipod support 12 itself until reaching the desired position. The placement of the bipod support 12 is then locked into position relative to the first tube 202, 302 via actuation of the toggle clamp 240, 340 as discussed above. To return the extension system 200, 300 to the contracted configuration according to certain embodiments, the toggle clamp 240, 340 is released and the user then manually pushes or squeezes the second tube 202, 302, the front plug 230, 330, and/or the bipod support 12 itself against the first tube 202, 302 and/or the chassis 301 until the second tube 204, 304 is fully enveloped or accommodated within the first tube 202, 302 and/or chassis 301.

**[0065]** According to certain embodiments, the extension system 200, 300 comprises a hydraulic system disposed within the first tube 202 or chassis 301. In a related embodiment, the hydraulic system is removably coupled to the chassis 301, the extension system 200, 300, and/or another portion of the gun 10. In some embodiments, the actuator 220, 320 is a hydraulic actuator comprising a hydraulic cylinder or piston, a reservoir, and a control valve configured to regulate the hydraulic fluid therein. Upon activation via a switch, button, or other actuation means, the control valve increases pressure within the hydraulic actuator which extends the cylinder or piston, thereby extending the second tube 204, 304 and the bipod support 12 coupled thereto in a similar manner discussed above. To retract or contract the extension system 200, 300, the control valve is actuated so as to release pressure within the hydraulic actuator which compresses the cylinder or piston, thereby retracting the second tube 204, 304 and the bipod support 12 back in the proximal direction. Additionally, according to certain embodiments, in the result of mechanical failure of the hydraulic actuator, the user can still manually extend and/or contract the telescopic extension system 200, 300 by pulling or pushing the bipod support 12 in the appropriate direction in the manner discussed above.

**[0066]** Many alterations and modifications may be made by those having ordinary skill in the art without

departing from the spirit and scope of the embodiments. Therefore, it must be understood that the illustrated embodiment has been set forth only for the purposes of example and that it should not be taken as limiting the embodiments as defined by the following embodiments and its various embodiments.

**[0067]** Therefore, it must be understood that the illustrated embodiment has been set forth only for the purposes of example and that it should not be taken as limiting the embodiments as defined by the following claims. For example, notwithstanding the fact that the elements of a claim are set forth below in a certain combination, it must be expressly understood that the embodiments includes other combinations of fewer, more or different elements, which are disclosed in above even when not initially claimed in such combinations. A teaching that two elements are combined in a claimed combination is further to be understood as also allowing for a claimed combination in which the two elements are not combined with each other, but may be used alone or combined in other combinations. The excision of any disclosed element of the embodiments is explicitly contemplated as within the scope of the embodiments.

**[0068]** The words used in this specification to describe the various embodiments are to be understood not only in the sense of their commonly defined meanings, but to include by special definition in this specification structure, material or acts beyond the scope of the commonly defined meanings. Thus if an element can be understood in the context of this specification as including more than one meaning, then its use in a claim must be understood as being generic to all possible meanings supported by the specification and by the word itself.

**[0069]** The definitions of the words or elements of the following claims are, therefore, defined in this specification to include not only the combination of elements which are literally set forth, but all equivalent structure, materials or acts for performing substantially the same function in substantially the same way to obtain substantially the same result. In this sense it is therefore contemplated that an equivalent substitution of two or more elements may be made for any one of the elements in the claims below or that a single element may be substituted for two or more elements in a claim. Although elements may be described above as acting in certain combinations and even initially claimed as such, it is to be expressly understood that one or more elements from a claimed combination can in some cases be excised from the combination and that the claimed combination may be directed to a sub-combination or variation of a sub-combination.

**[0070]** Insubstantial changes from the claimed subject matter as viewed by a person with ordinary skill in the art, now known or later devised, are expressly contemplated as being equivalently within the scope of the claims. Therefore, obvious substitutions now or later known to one with ordinary skill in the art are defined to be within the scope of the defined elements.

**[0071]** The claims are thus to be understood to include

what is specifically illustrated and described above, what is conceptionally equivalent, what can be obviously substituted and also what essentially incorporates the essential idea of the embodiments.

## Claims

1. An extension system for a gun support, the gun having a barrel with an effective muzzle, comprising:
  - a telescopic assembly having a proximal end and a distal end, wherein the telescopic assembly includes a first telescopic portion and second telescopic portion;
  - an actuator configured to selectively adjust a horizontal displacement of the second telescopic portion relative to the first telescopic portion; and means for rotating the distal end of the telescopic assembly relative to the second telescopic portion,
  - wherein the gun support is coupled to the distal end of the telescopic assembly.
2. The extension system of claim 1, further comprising a chassis configured to accommodate the telescopic assembly, the extension system preferably further comprising a battery removably coupled to the chassis and electrically communicated to the actuator.
3. The extension system of any of the previous claims, wherein the actuator configured to selectively adjust a horizontal displacement of the second telescopic portion relative to the first telescopic portion comprises an extendable piston disposed therein.
4. The extension system of claim 3, wherein a proximal end of the actuator is coupled to a proximal end of the first telescopic portion and wherein a distal end of the extendable piston is coupled to a distal end of the second telescopic portion.
5. The extension system of any of the previous claims, further comprising a motor disposed within the first telescopic portion and coupled to the actuator.
6. The extension system of any of the previous claims, further comprising a battery removably coupled to the first telescopic portion and electrically communicated to the actuator.
7. The extension system of any of the previous claims, wherein means for rotating the distal end of the telescopic assembly relative to the second telescopic portion comprises:
  - a front plug which extends beyond a distal end of the second telescopic portion;

- a plug adapter disposed within the second telescopic portion and inserted into the front plug; and  
a set screw disposed through an aperture defined in the front plug and engaged with the plug adapter.
8. The extension system of claim 7, wherein the plug adapter comprises a channel defined around a circumference of a distal portion of the plug adapter, wherein the channel is configured to accommodate a portion of the set screw, and/or wherein the gun support is coupled to the front plug.
9. The extension system of any of the previous claims, further comprising means for selectively fixing a position of the second telescopic portion relative to the first telescopic portion.
10. A method for using an extension system for a gun support while in a prone position, the method comprising:
- selectively activating an actuator disposed within a telescopic assembly;  
moving a second telescopic portion of the telescopic assembly from a first horizontal position relative to a first telescopic portion of the telescopic assembly;  
selectively deactivating the actuator when the second telescopic portion has reached a second horizontal position relative to the first telescopic portion; and  
selectively adjusting an angle of the gun support coupled to a distal end of the second telescopic portion.
11. The method of claim 10, wherein selectively activating an actuator disposed within a telescopic assembly comprises selectively activating a motor coupled to the actuator.
12. The method of claim 10 or 11, wherein moving a second telescopic portion of the telescopic assembly from a first horizontal position relative to a first telescopic portion of the telescopic assembly comprises:
- displacing a piston from the actuator, wherein the actuator is disposed in the first telescopic portion;  
driving the second telescopic portion away from within the first telescopic portion when the piston is extended from the actuator; and  
driving the second telescopic portion into the first telescopic portion when the piston is retracted into the actuator;  
wherein displacing a piston from the actuator preferably further comprises displacing the gun
- support disposed on the distal end of the second telescopic portion by a corresponding horizontal distance relative to the first telescopic portion.
13. The method of any of the claims 10-12, wherein selectively adjusting an angle of the gun support coupled to a distal end of the second telescopic portion comprises rotating a front plug selectively coupled to the gun support, wherein the front plug is disposed on a distal end of the second telescopic portion;
- wherein rotating a front plug selectively coupled to the gun support preferably comprises rotating the front plug about a plug adapter coupled to a distal end of a piston, wherein a proximal end of the piston is disposed within the actuator;  
wherein rotating the front plug about a plug adapter preferably comprises:
- disposing a set screw through the front plug and into a channel defined around a circumference of the plug adapter; and  
traversing the set screw through the channel as the front plug is rotated about the plug adapter.
14. The method of any of the claims 10-13, wherein selectively activating an actuator disposed within a telescopic assembly and selectively deactivating the actuator when the second telescopic portion has reached a second horizontal position relative to the first telescopic portion comprises actuating a switch coupled to the actuator.
15. The method of any of the claims 10-14, further comprising selectively locking the second telescopic portion into position at the second horizontal position relative to the first telescopic portion.

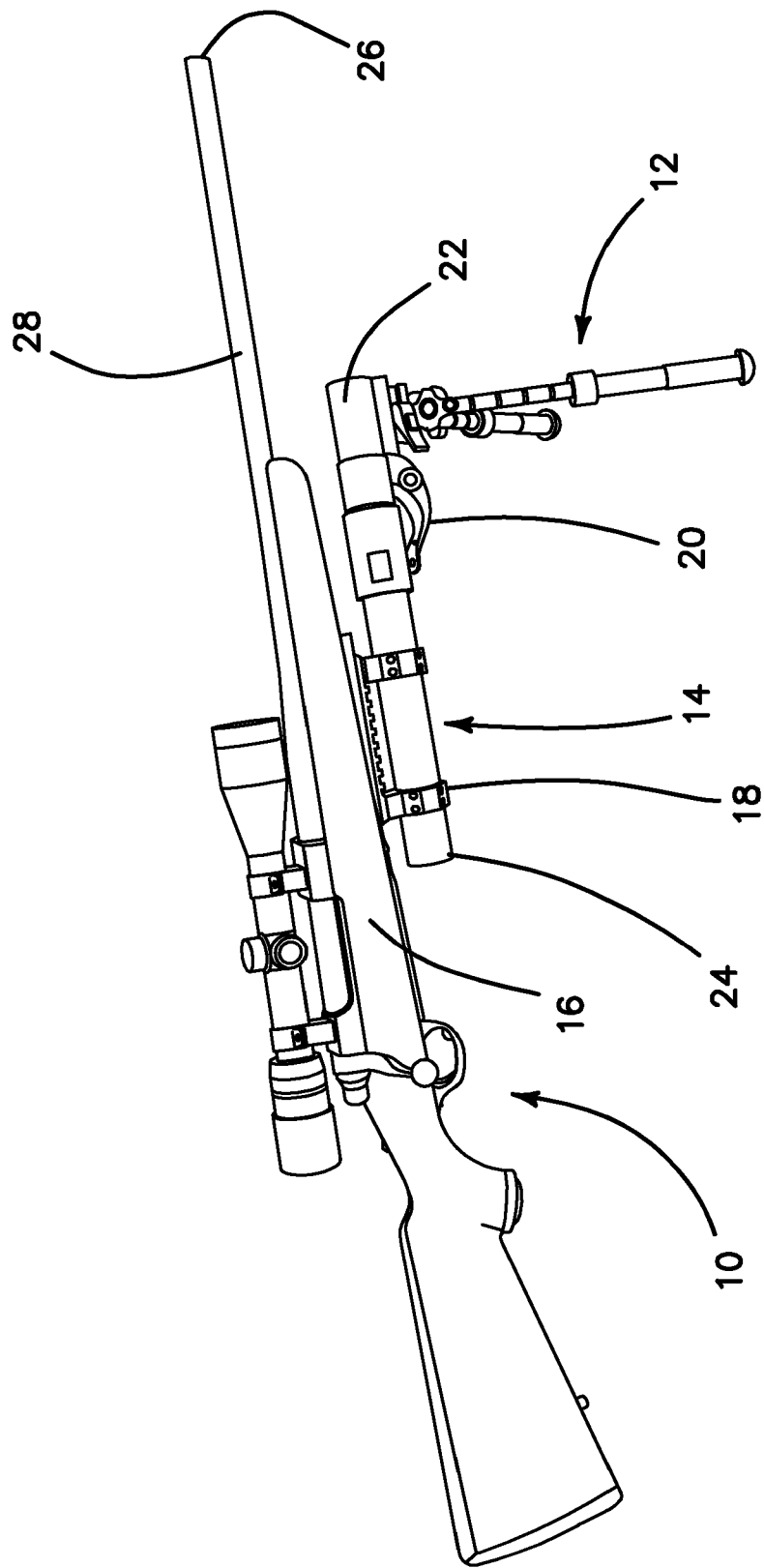


FIG. 1

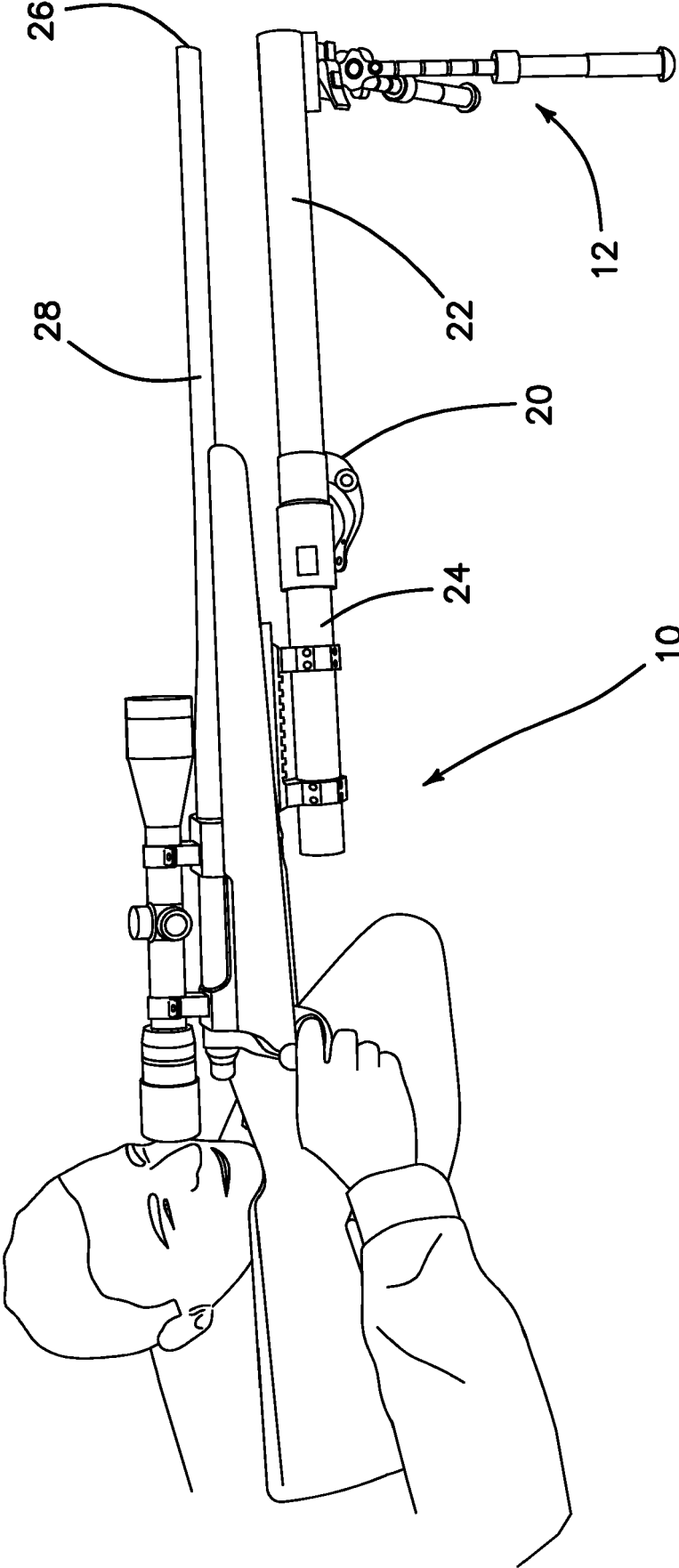


FIG. 2

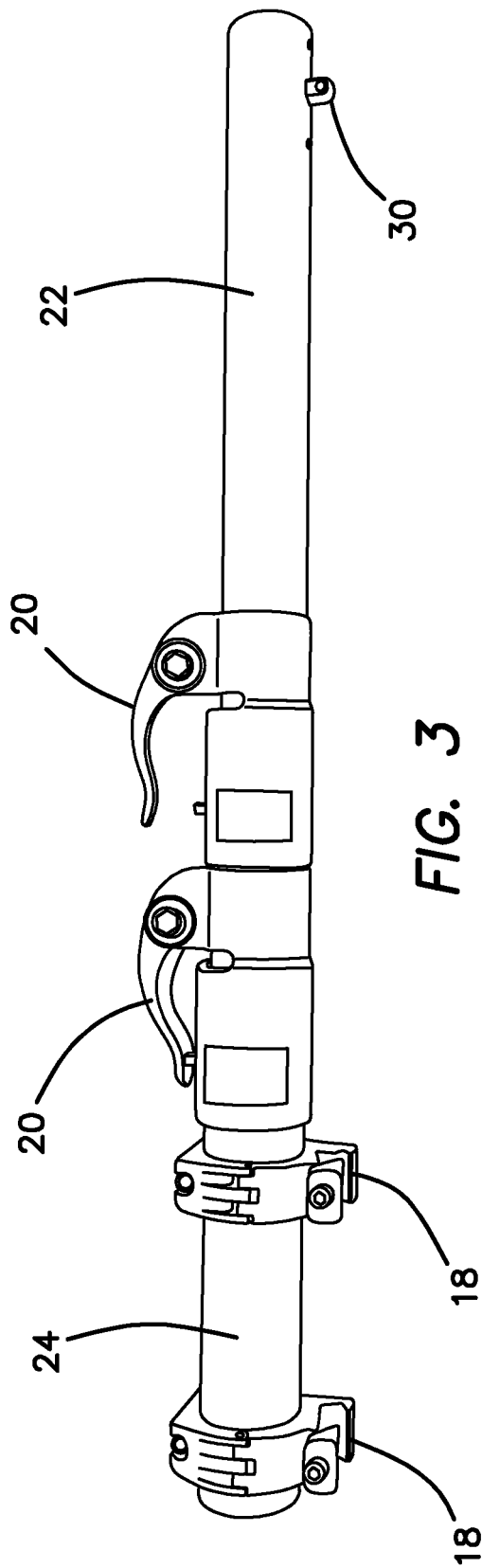


FIG. 3

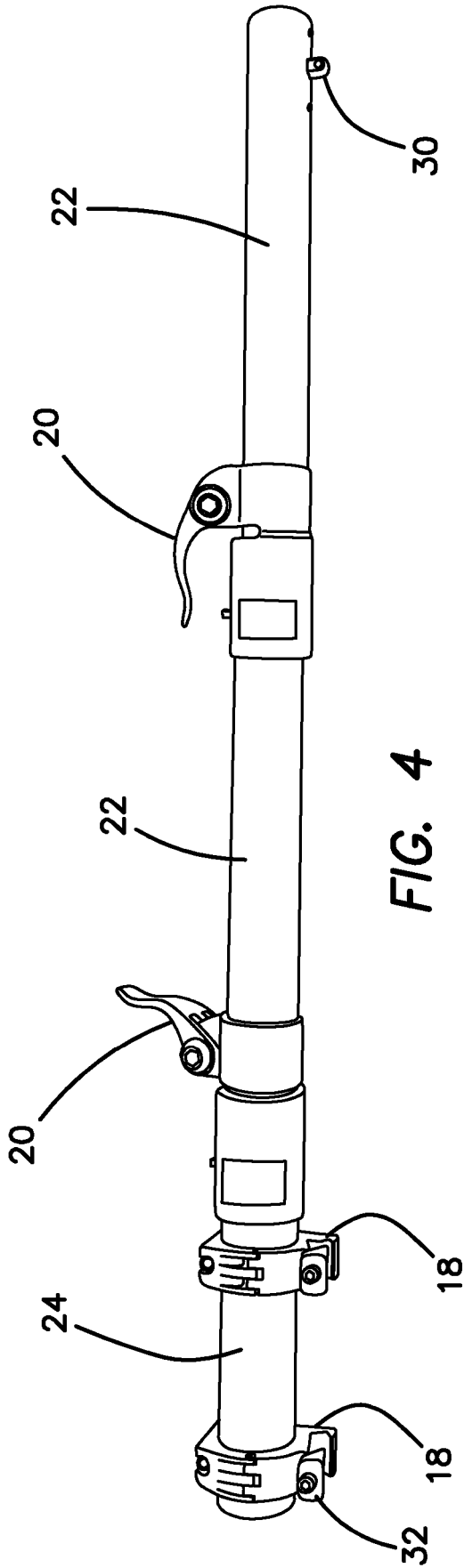
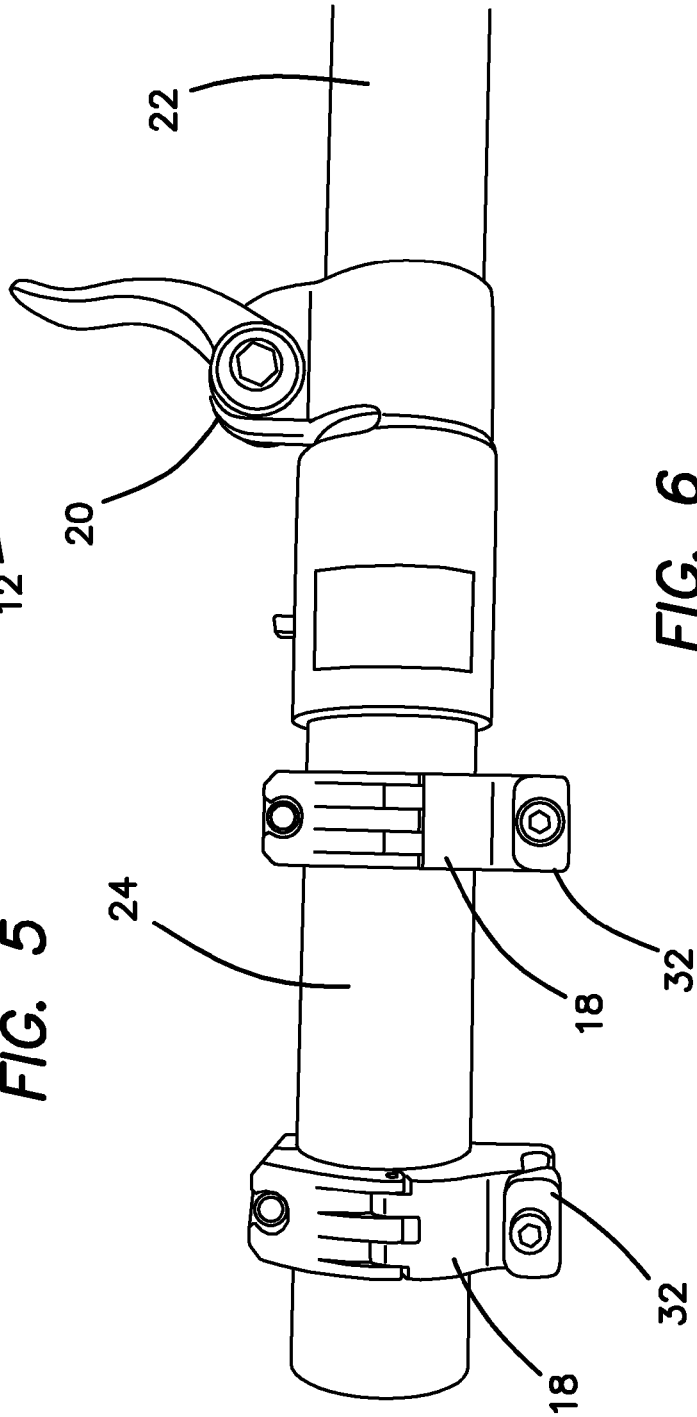
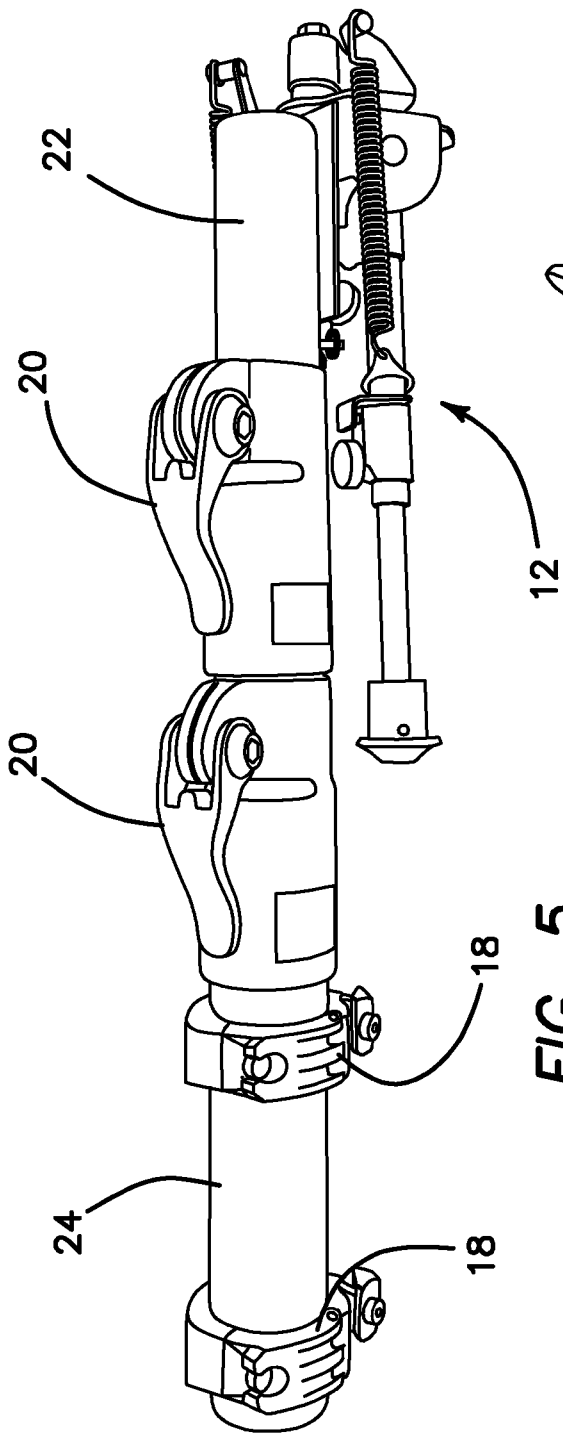
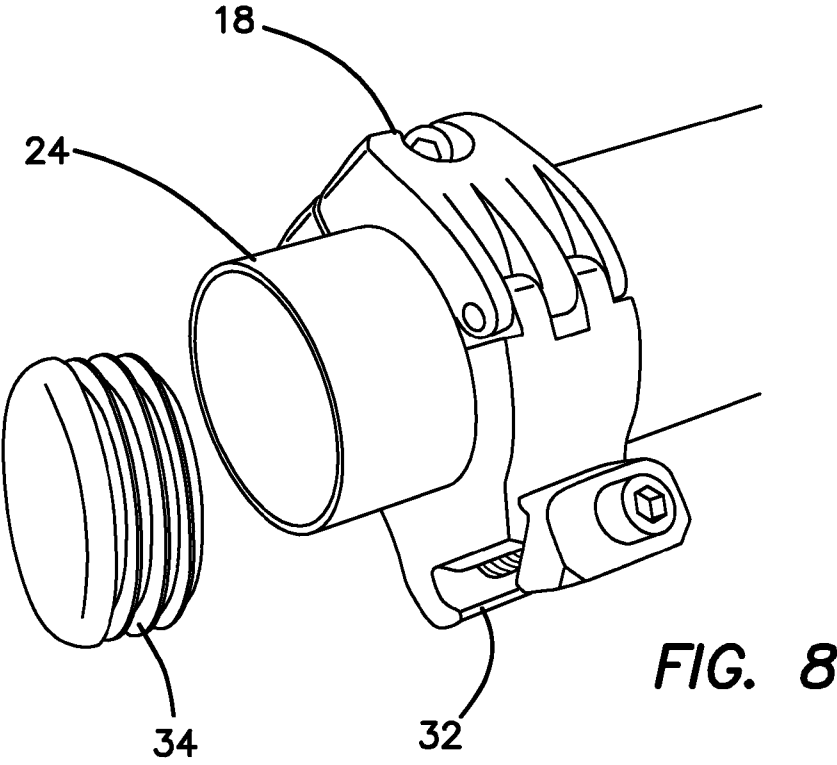
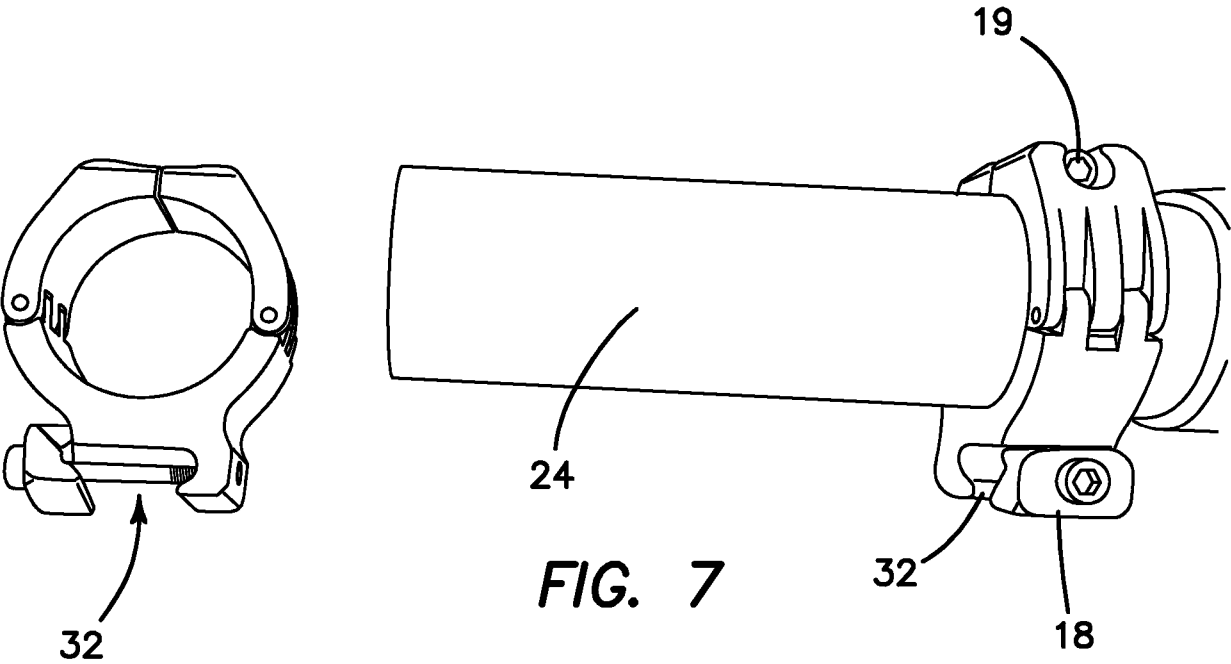
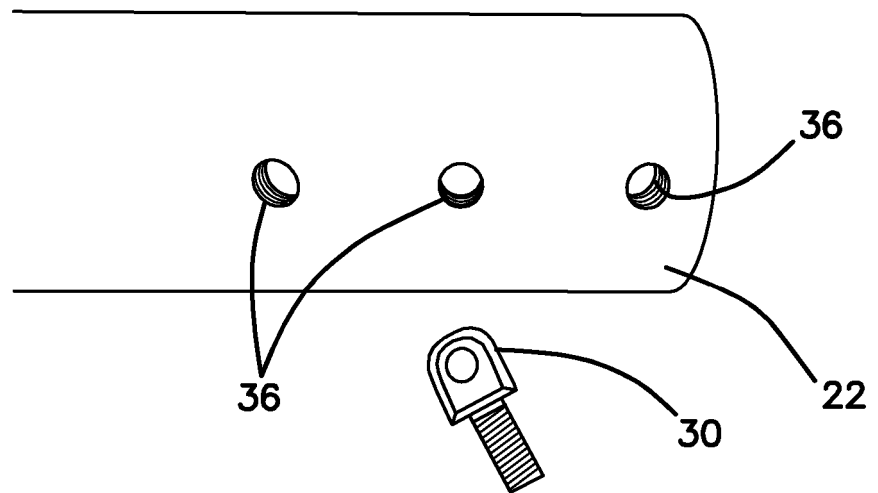


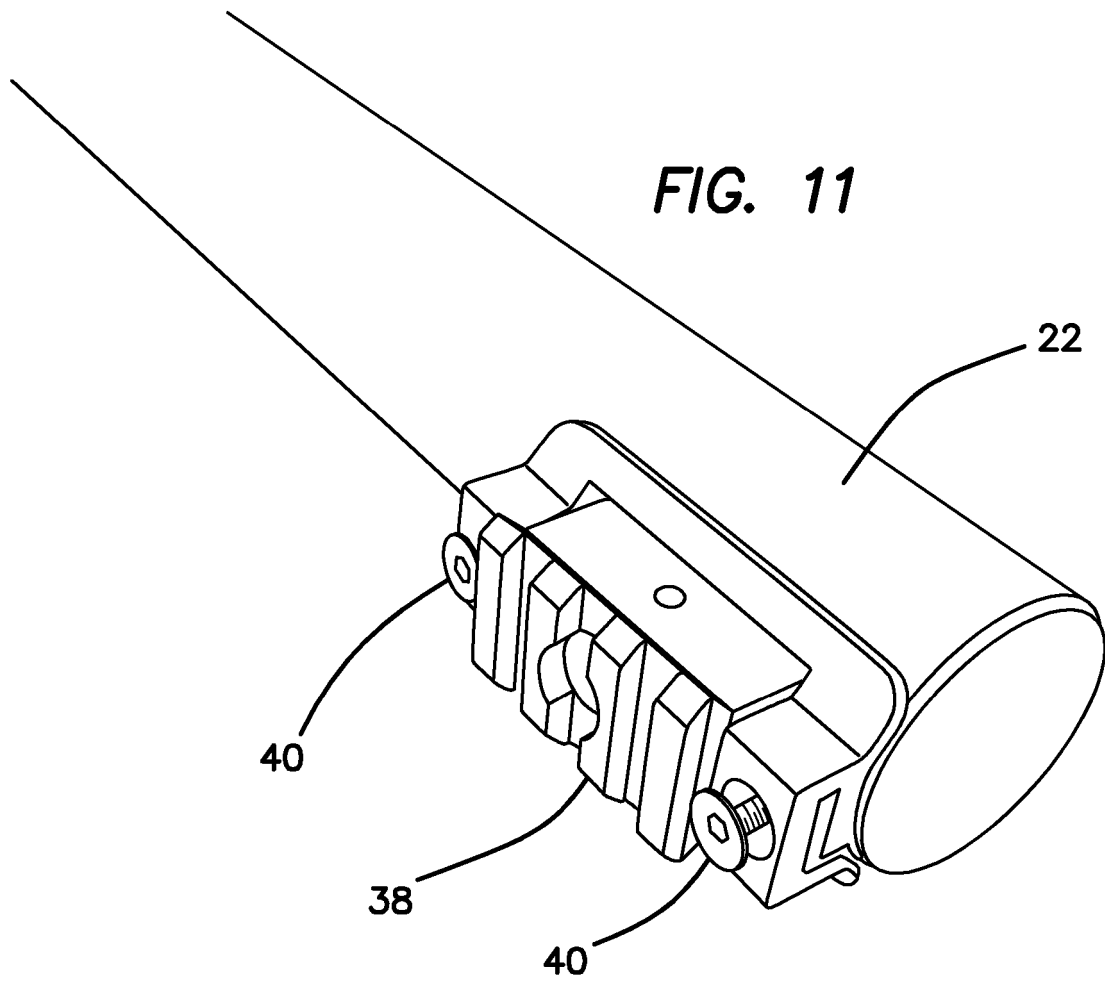
FIG. 4

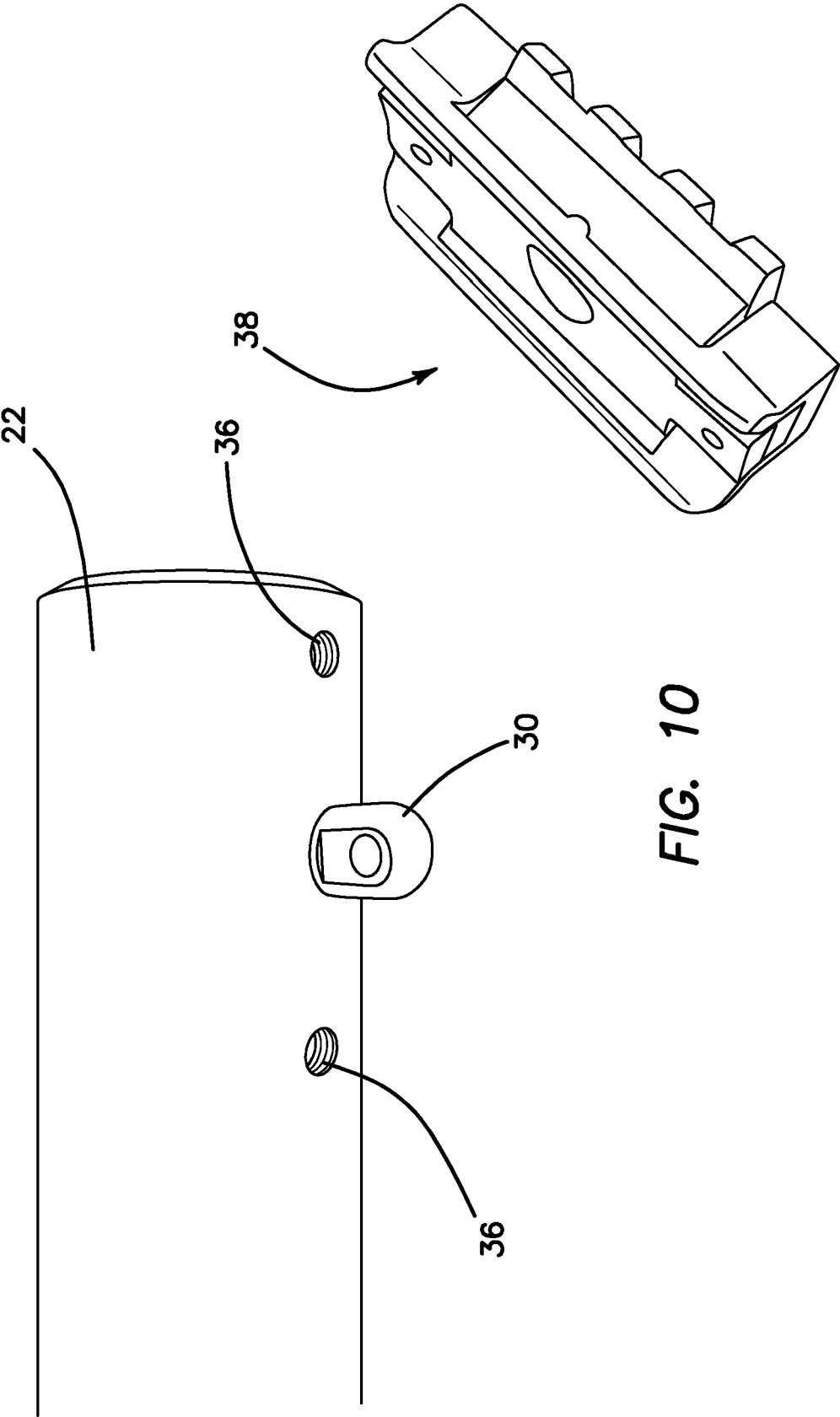






**FIG. 9**





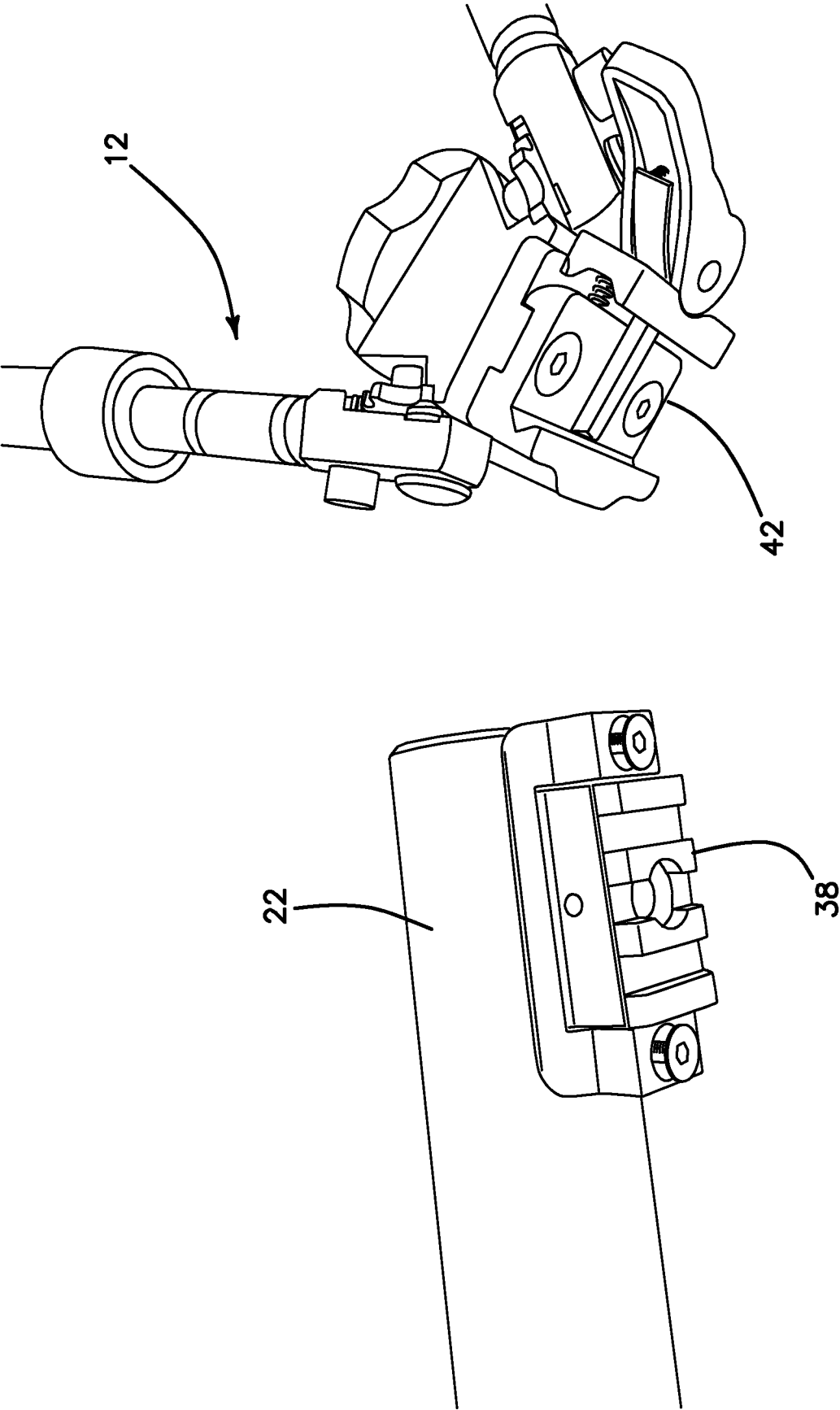


FIG. 12

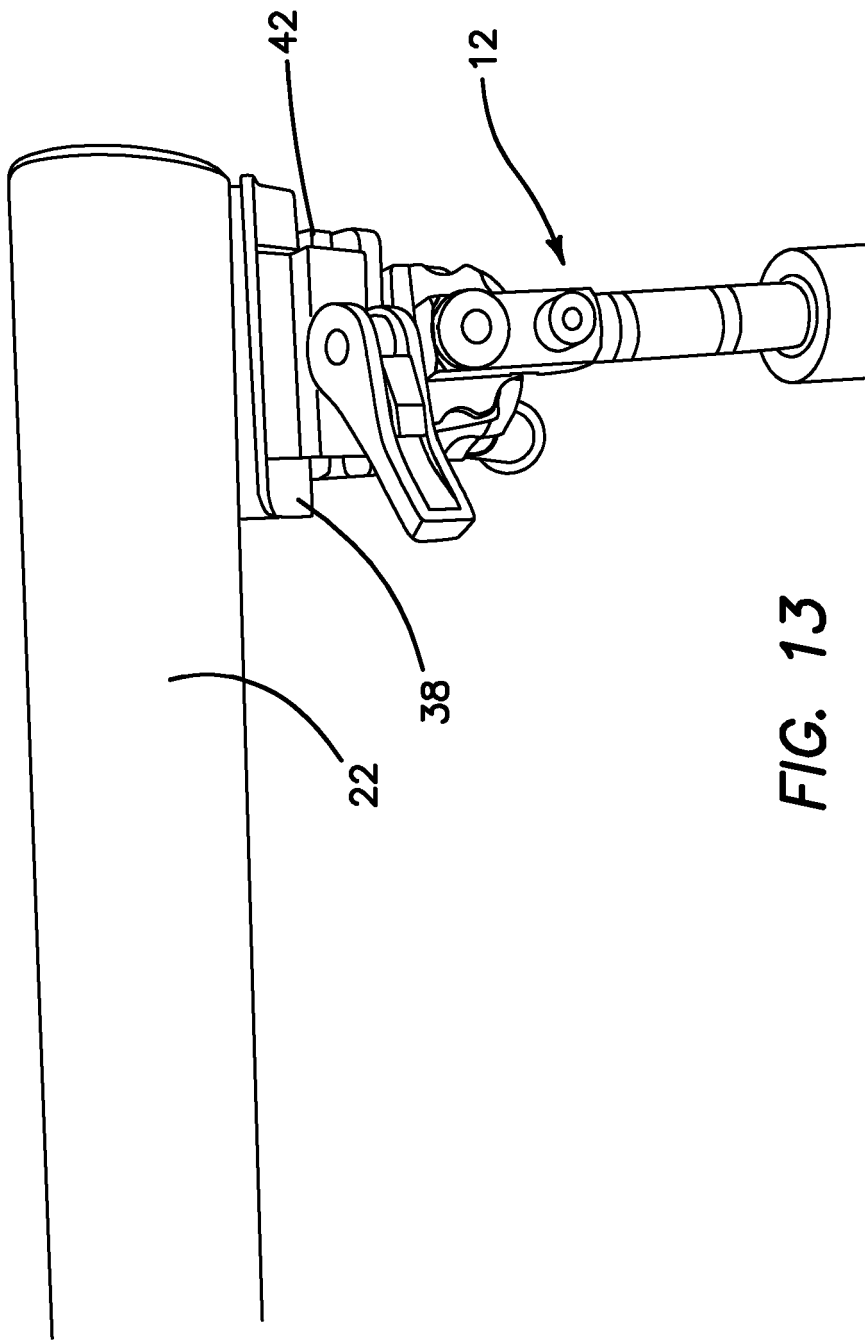


FIG. 13

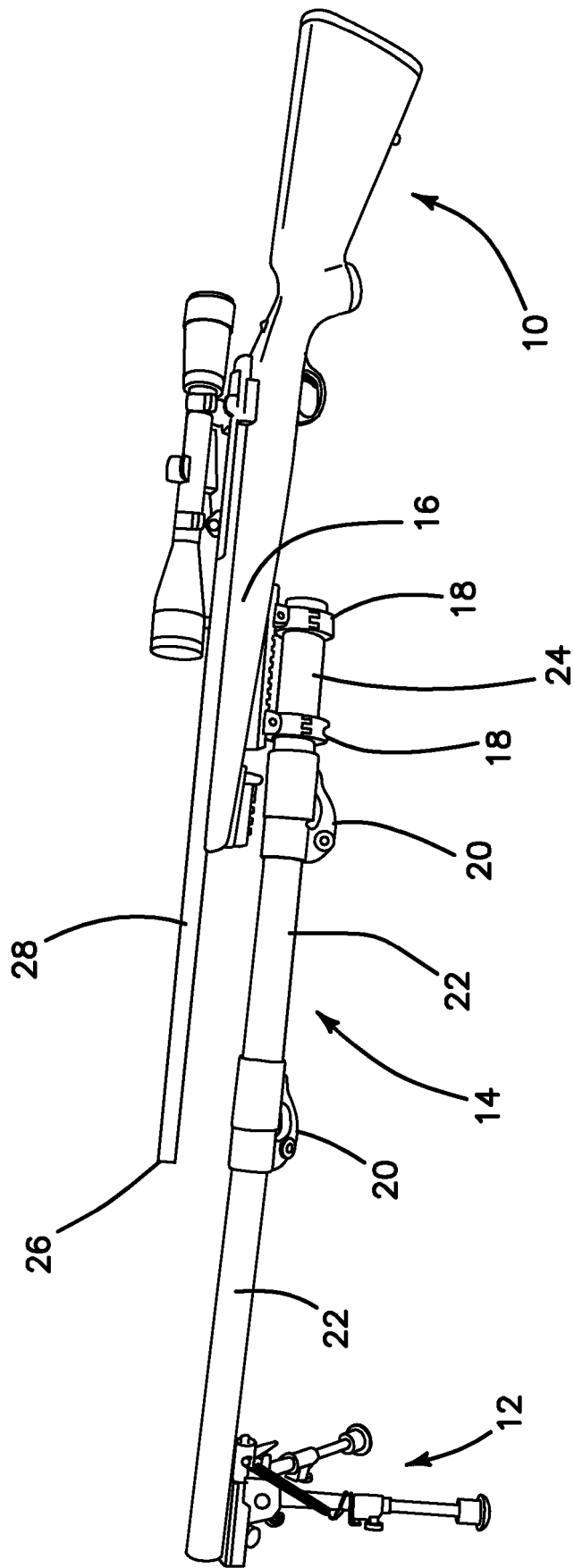
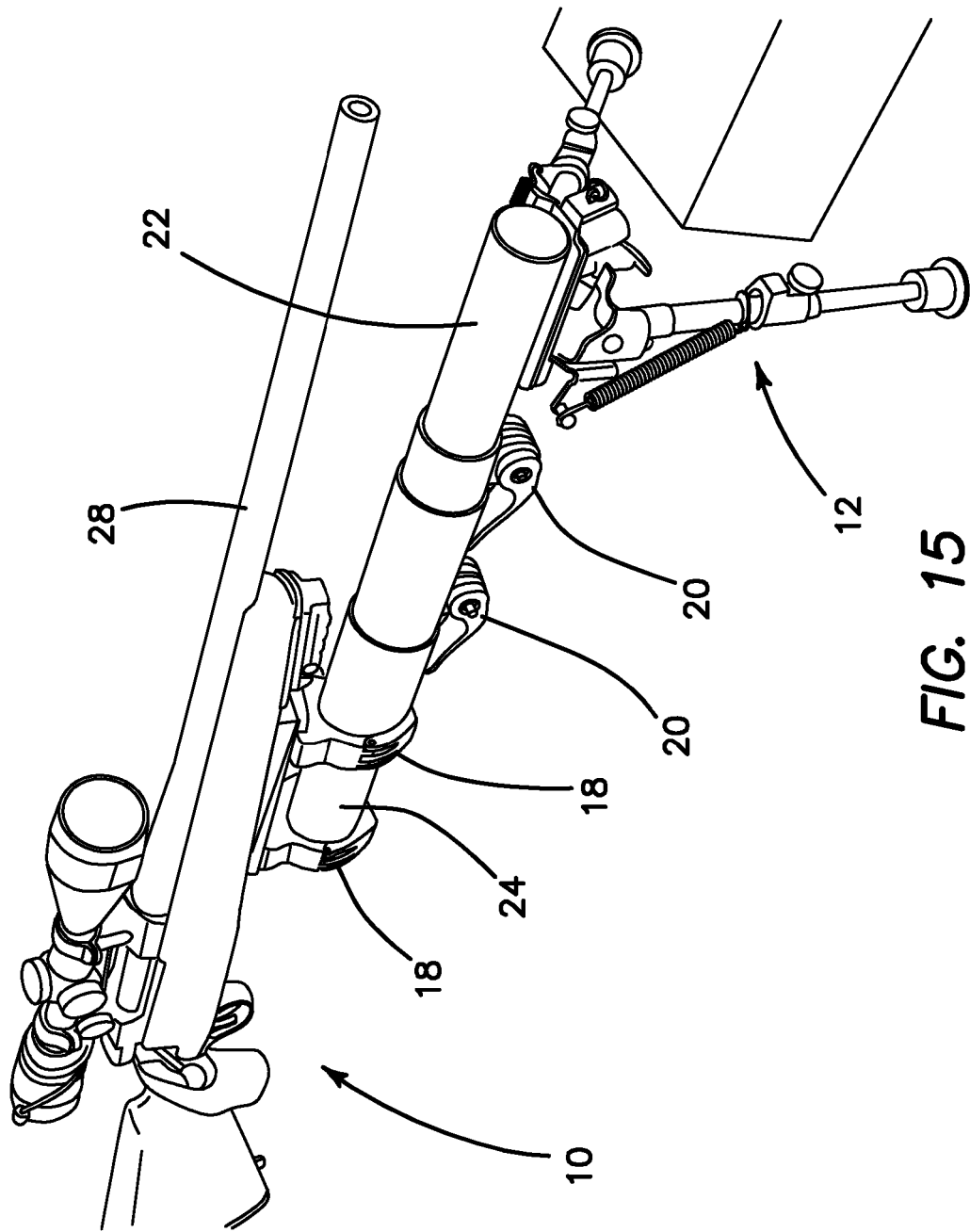


FIG. 14



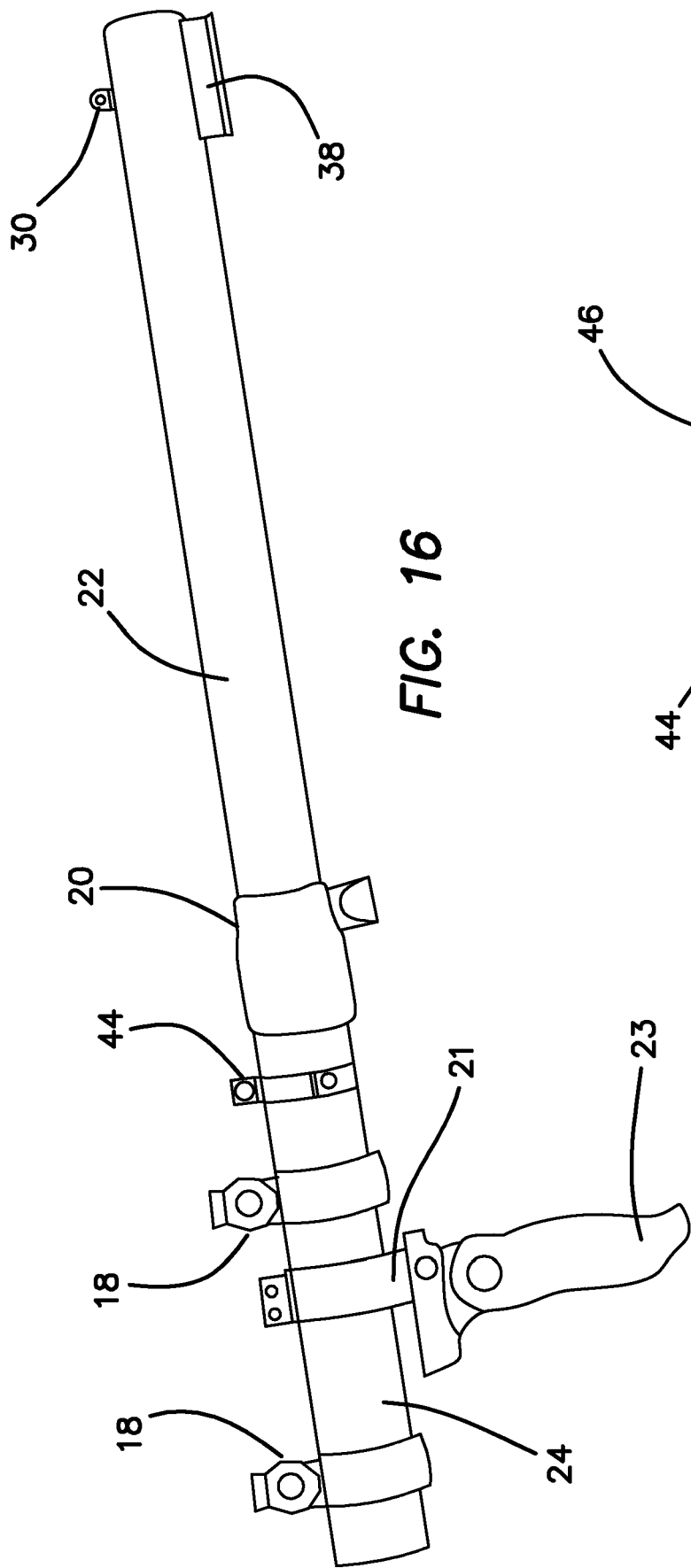


FIG. 16

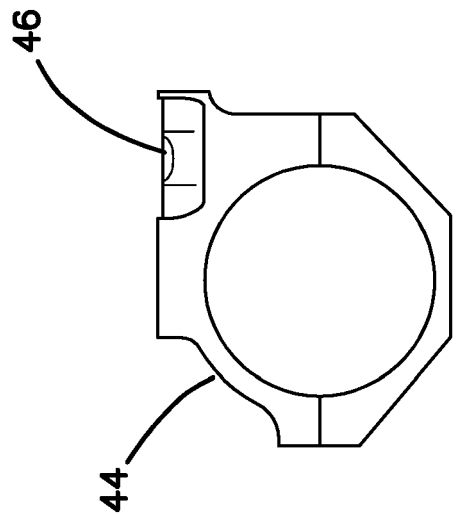
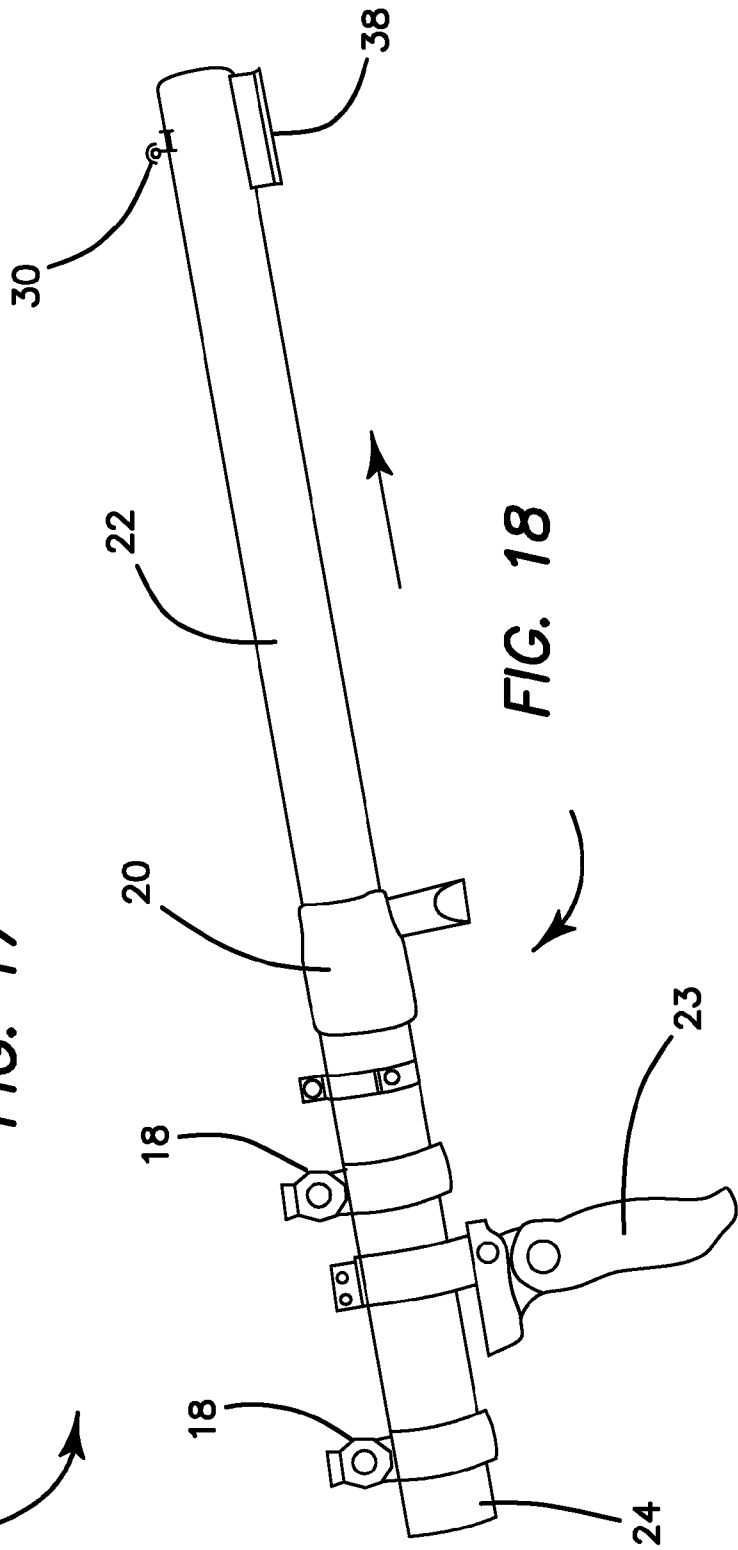
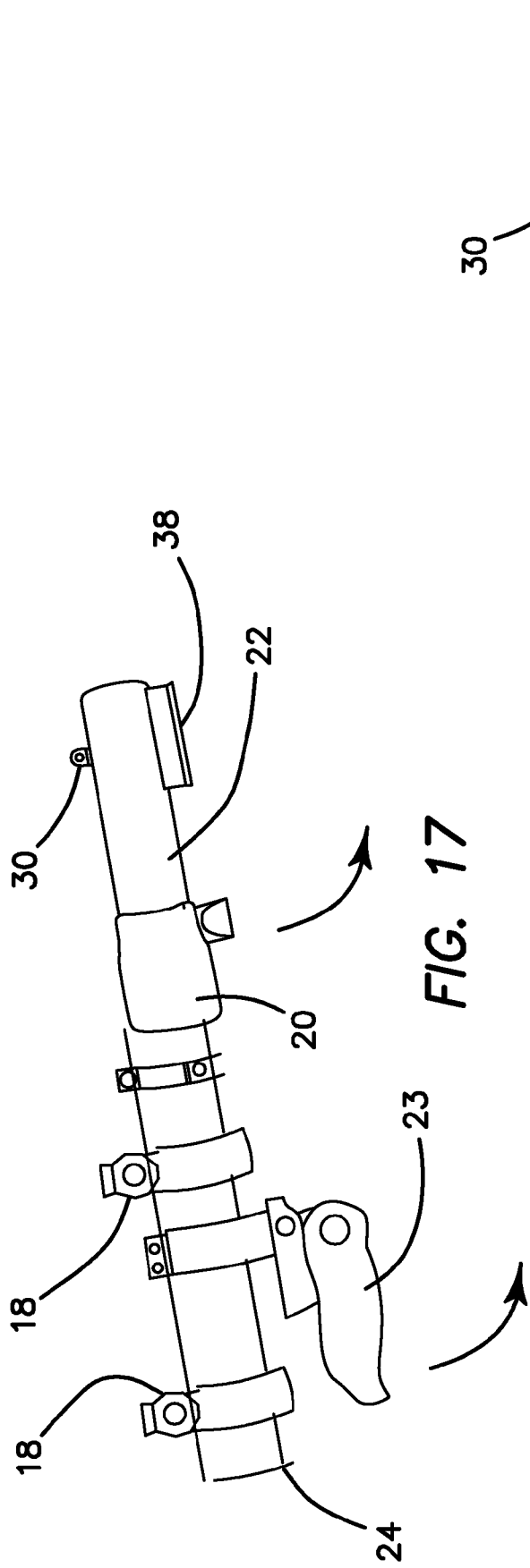
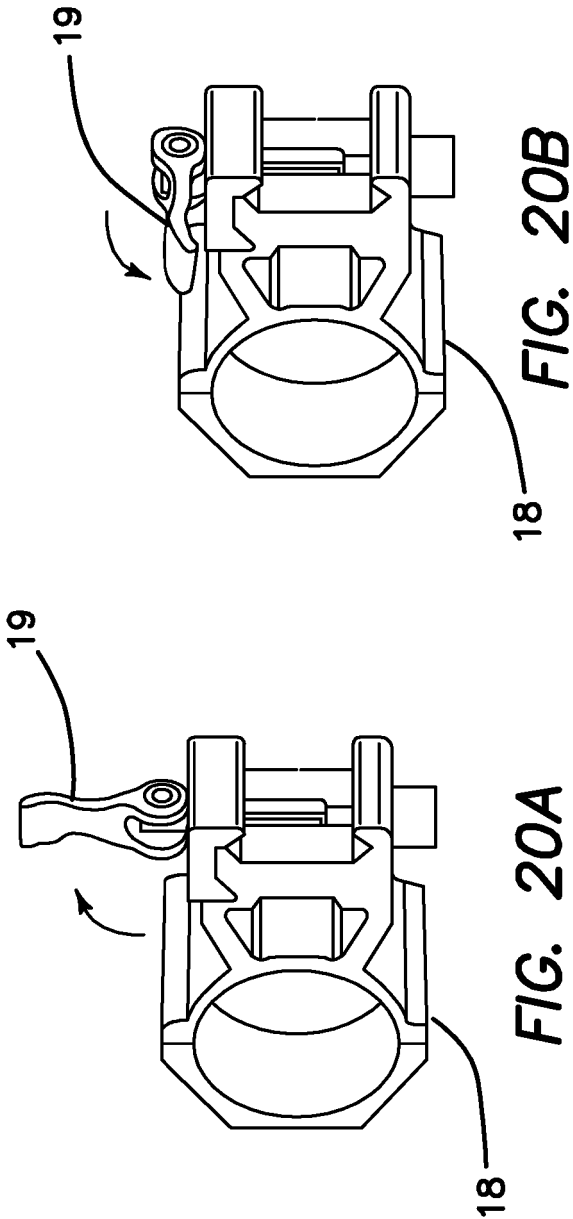
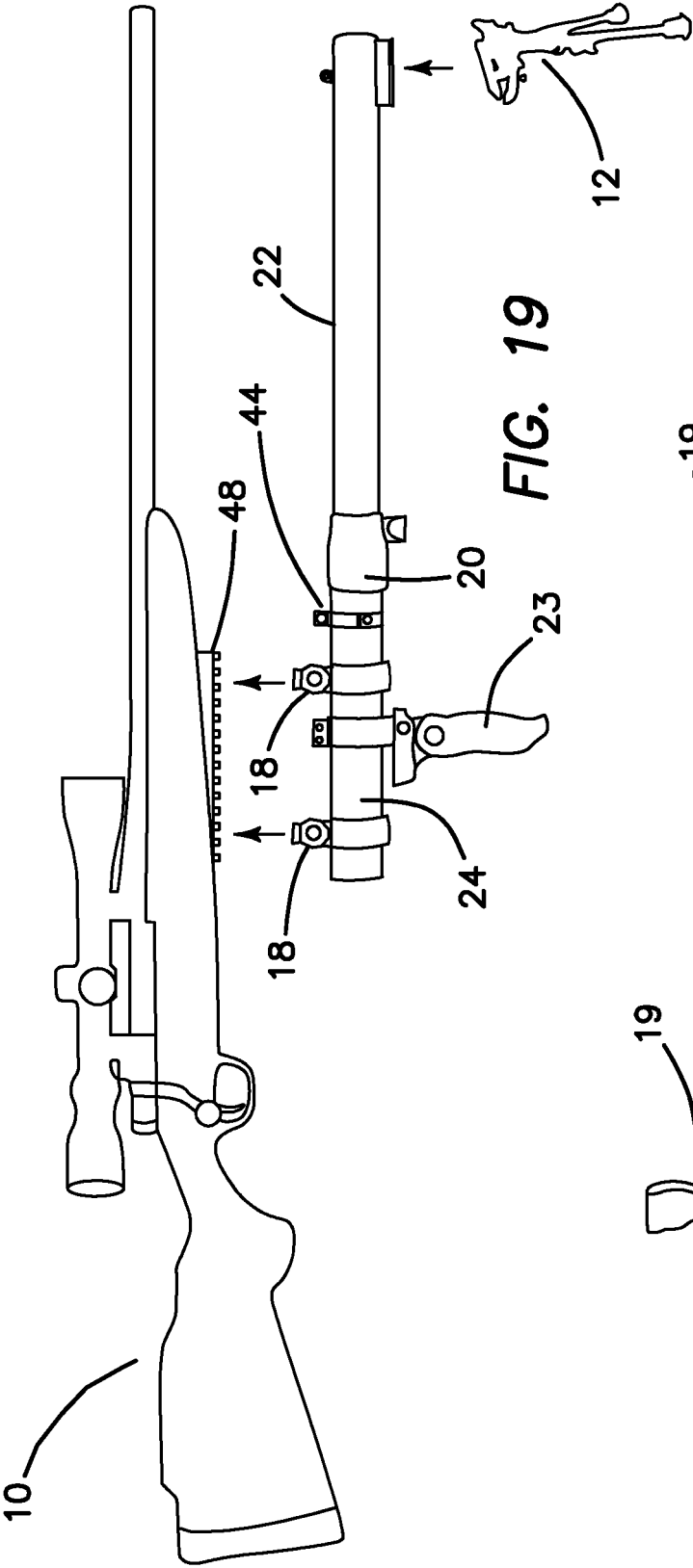
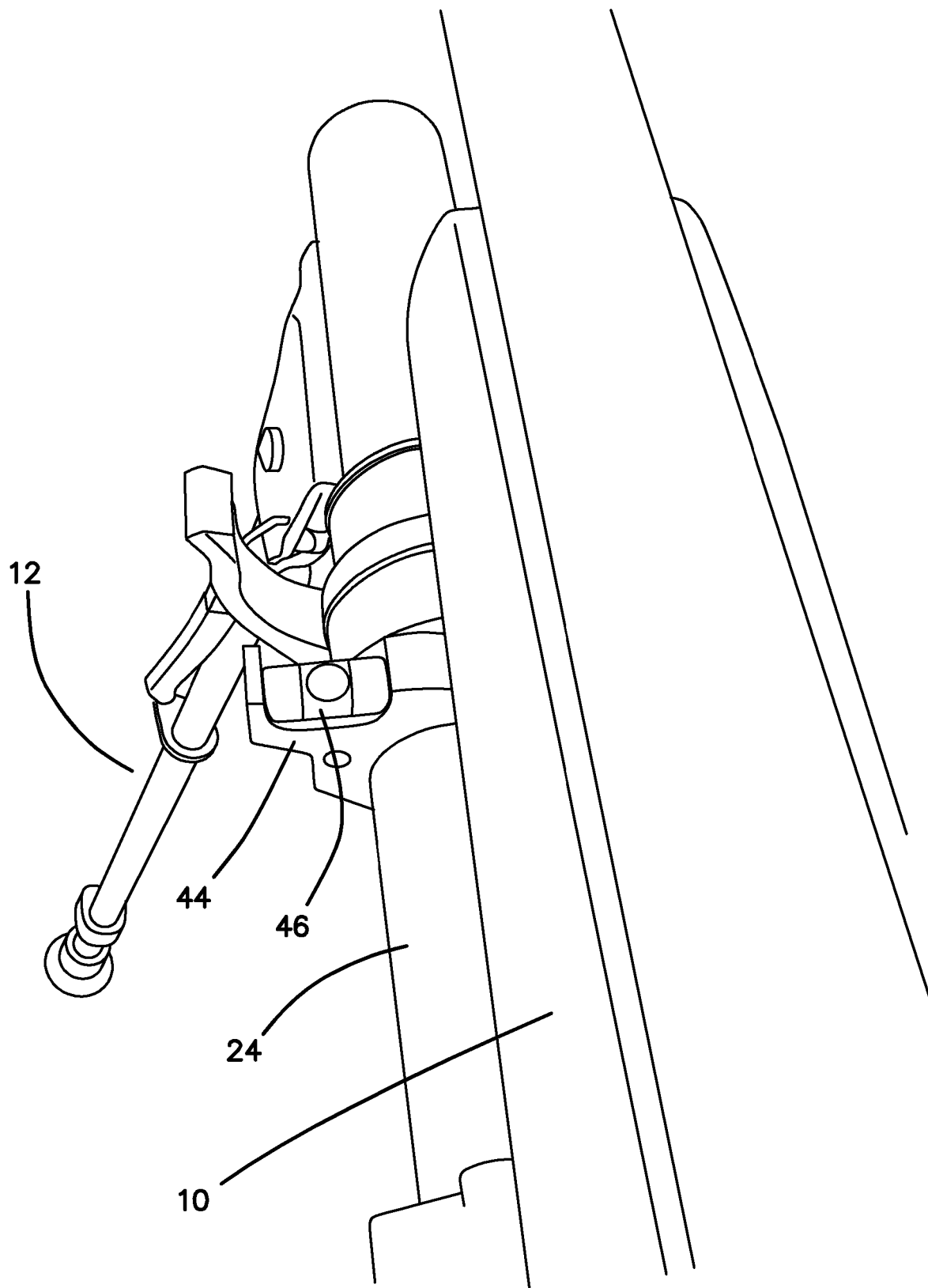


FIG. 21







**FIG. 22**

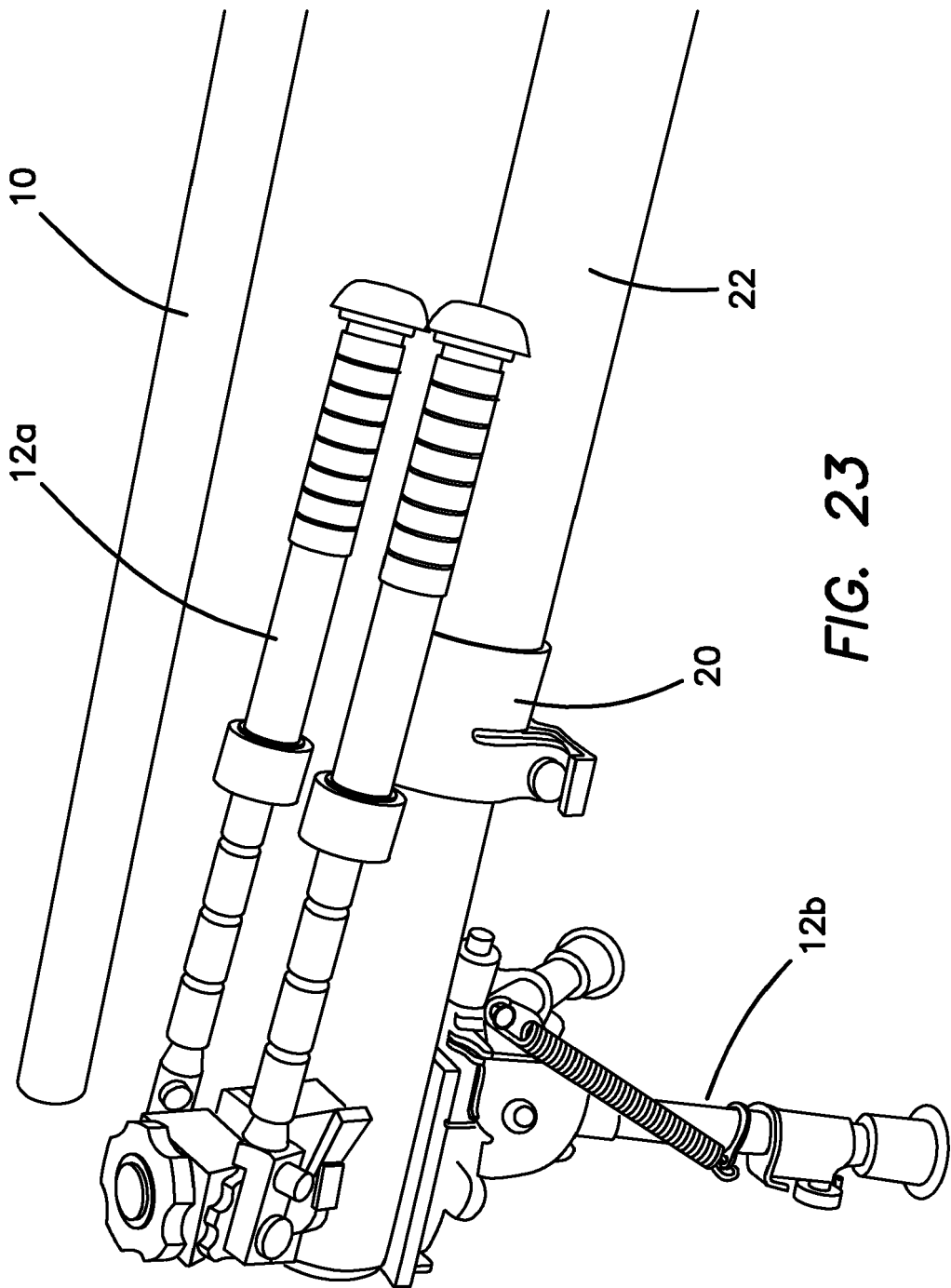
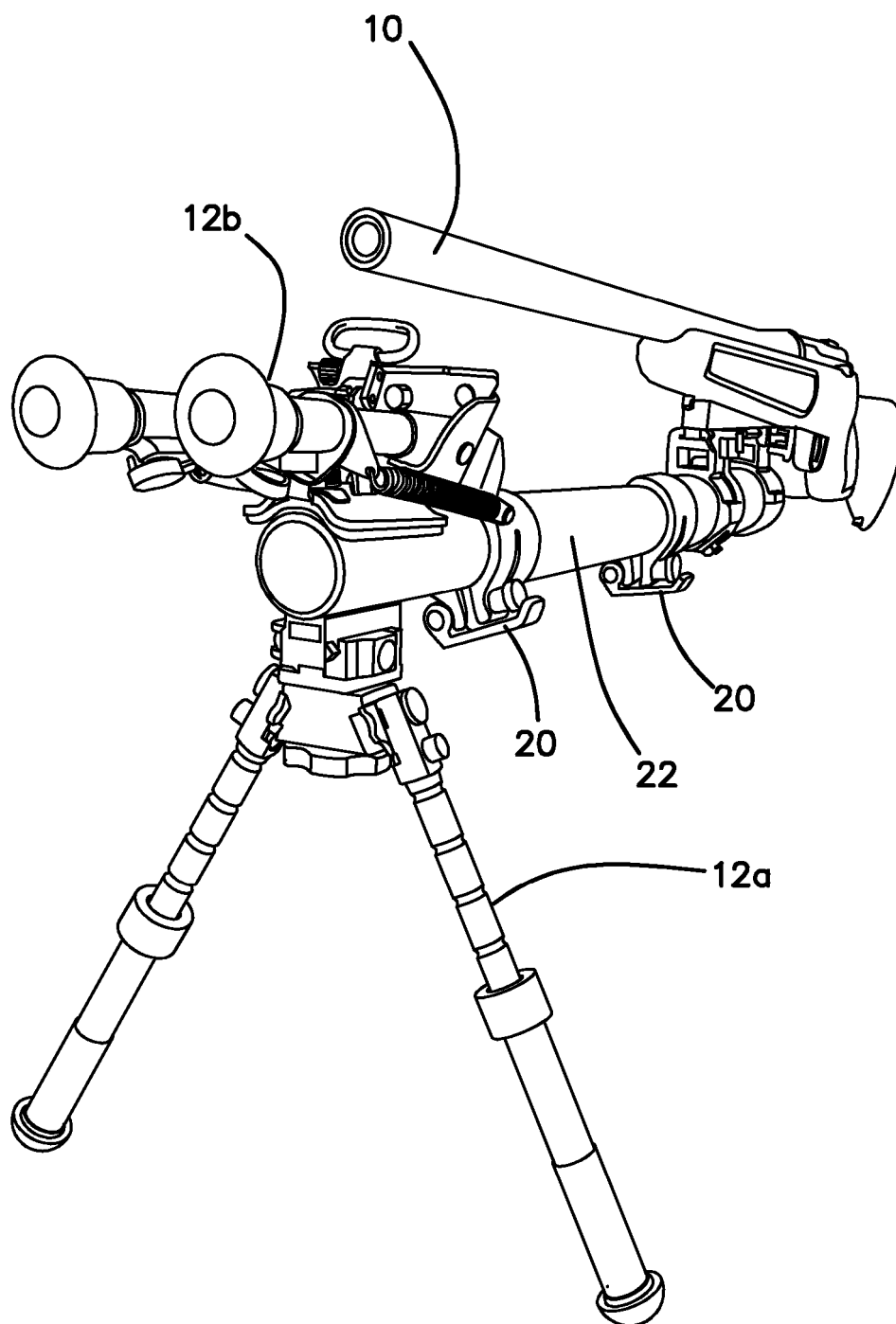
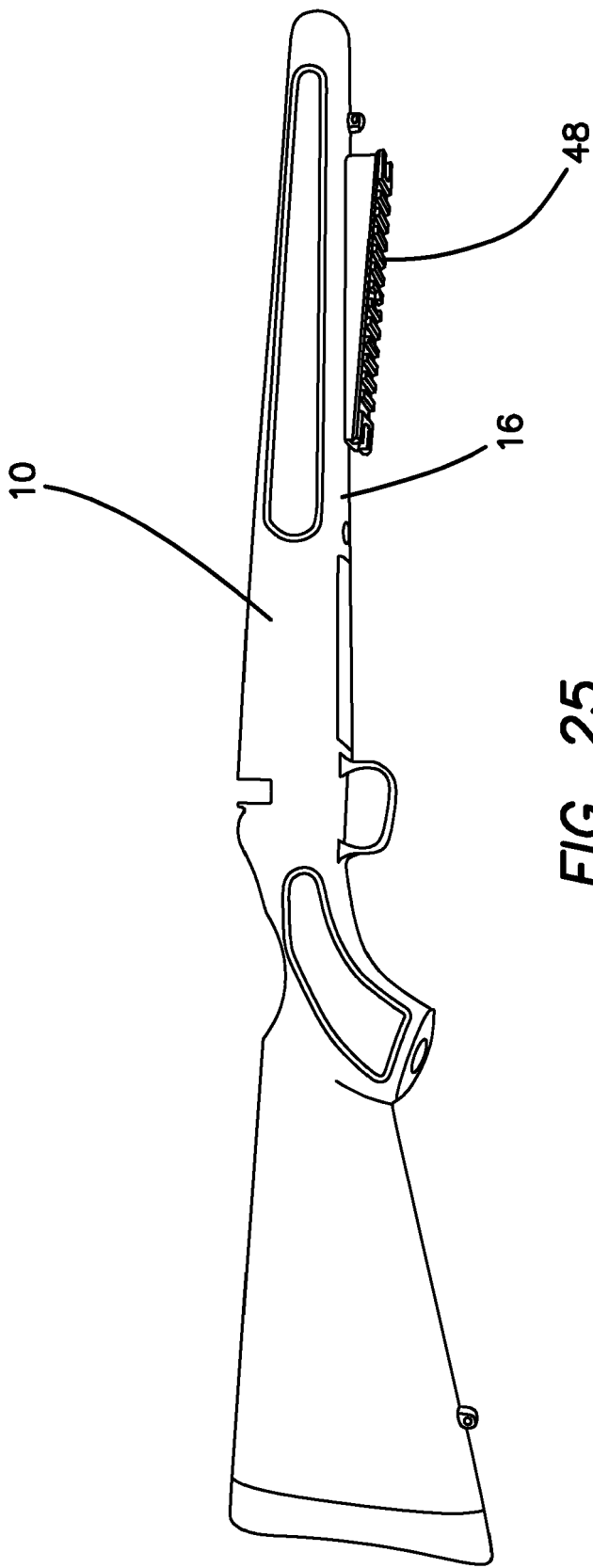
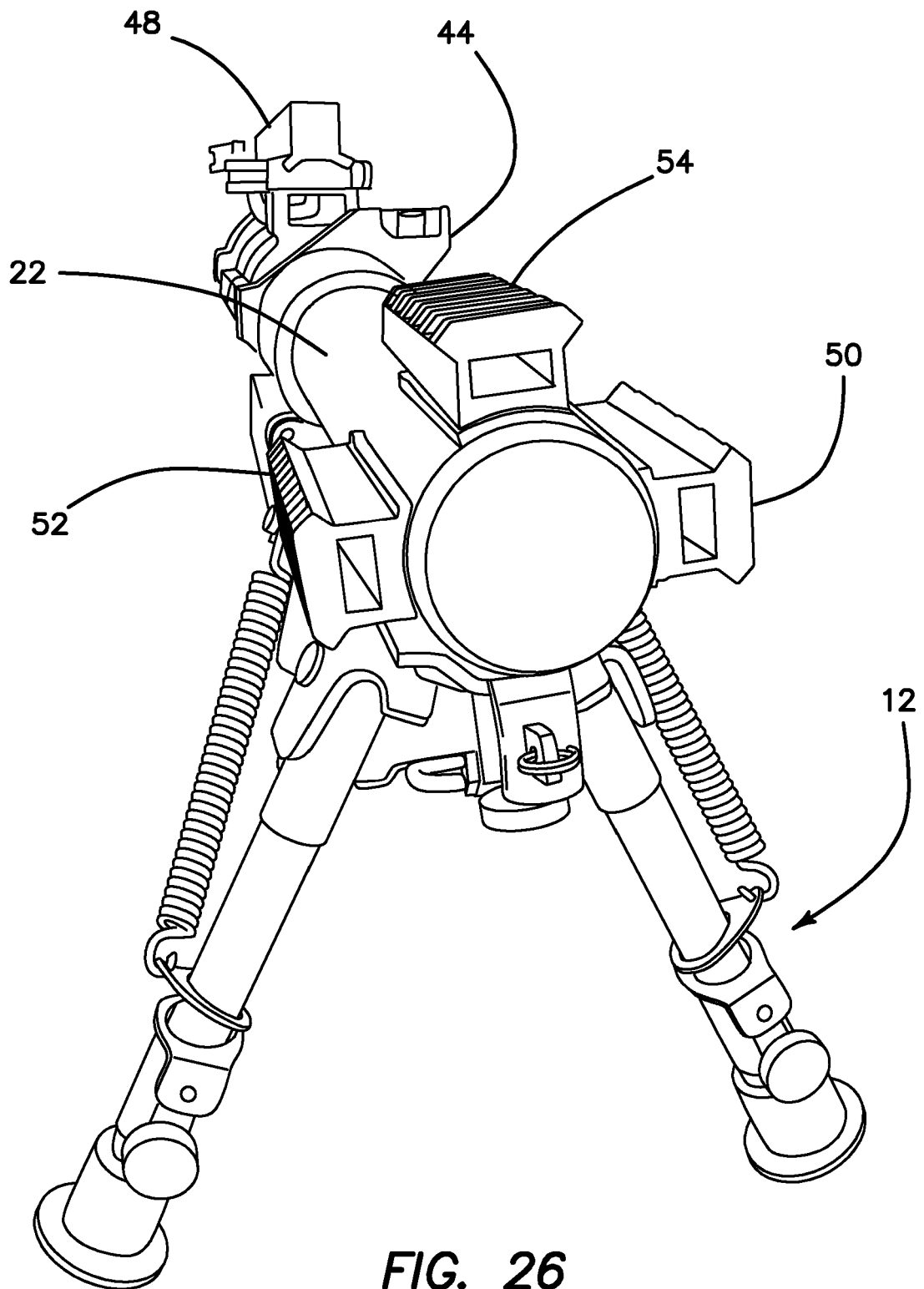


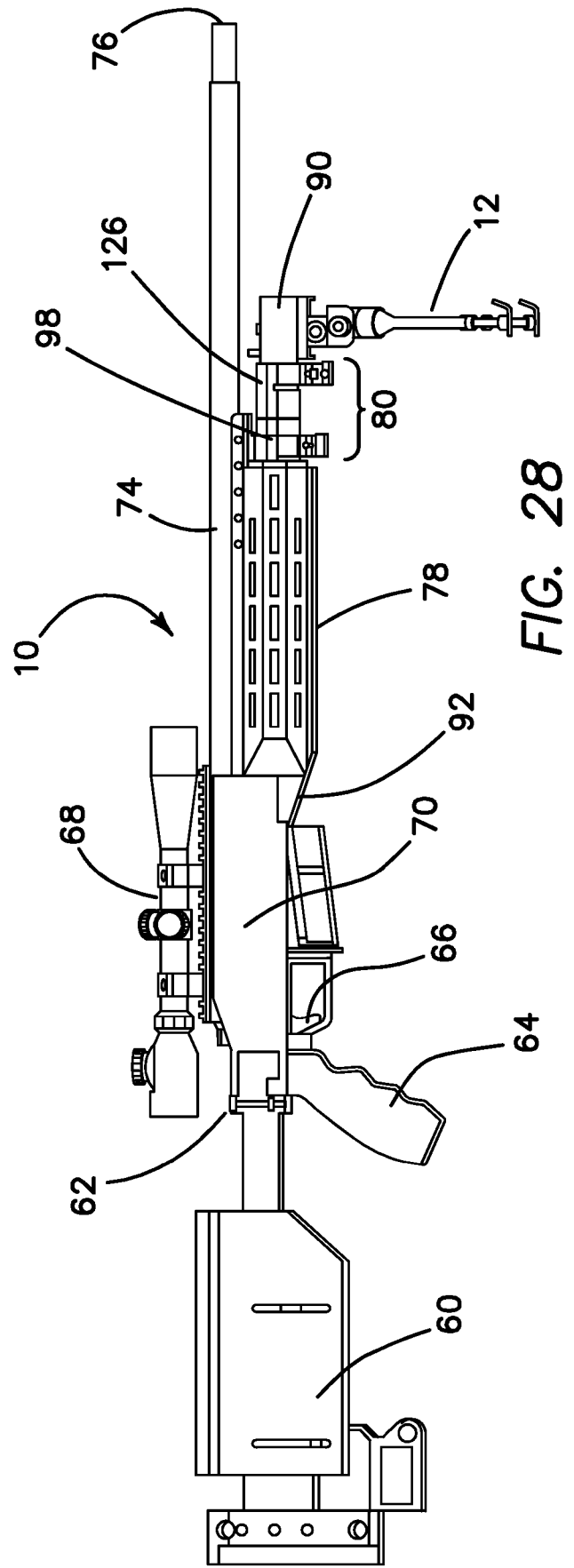
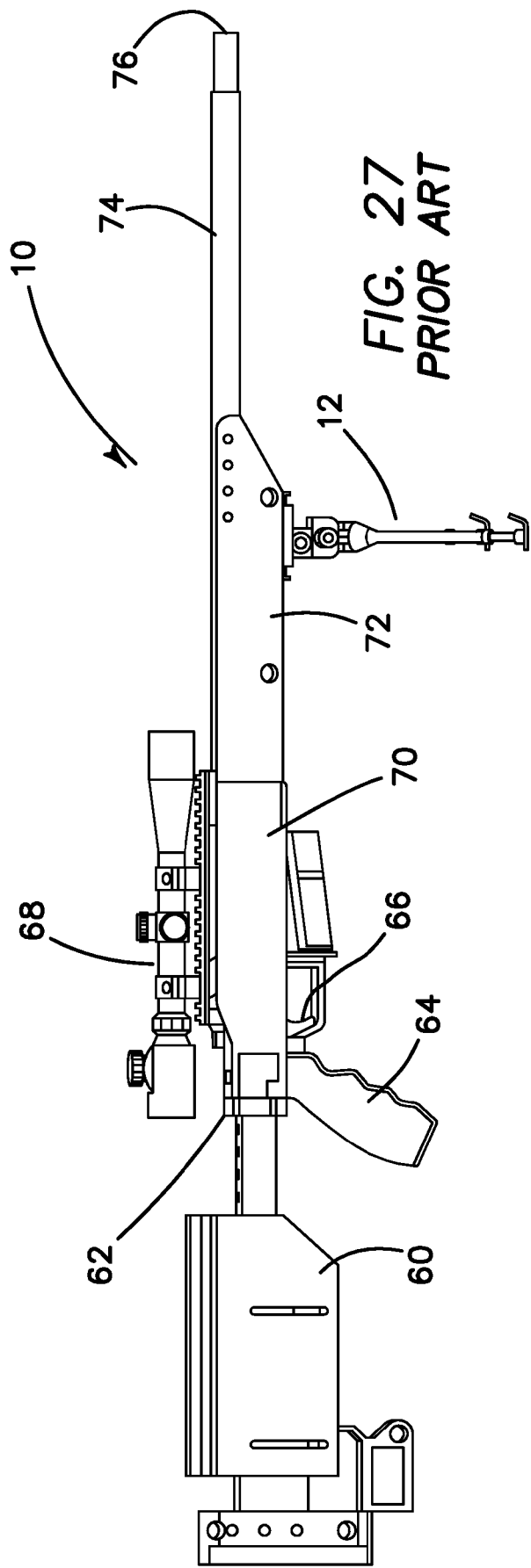
FIG. 23

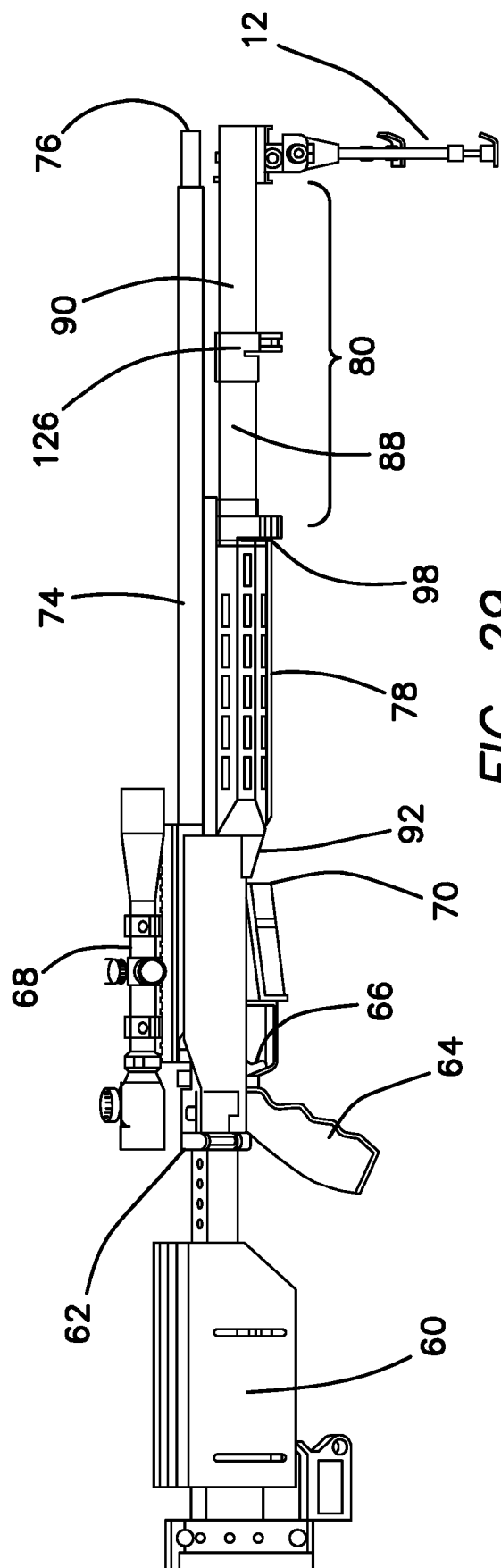


**FIG. 24**

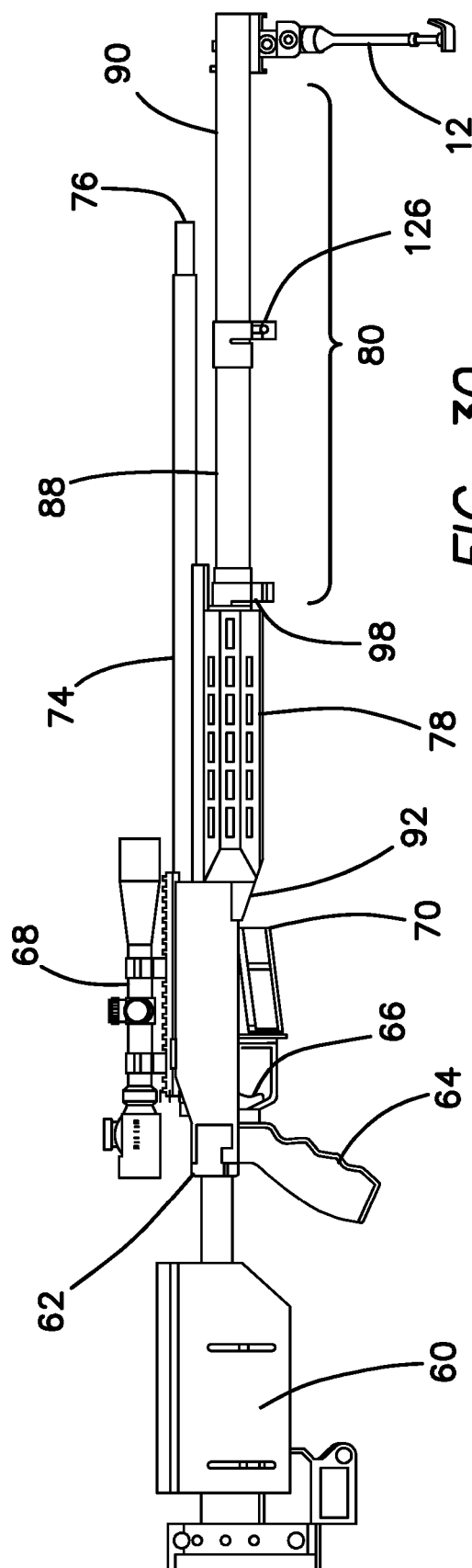




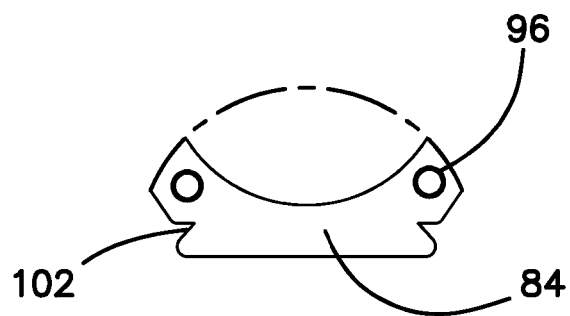
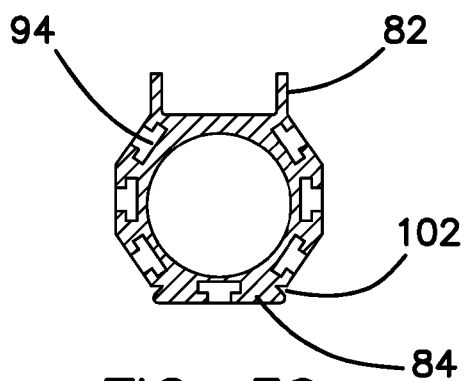
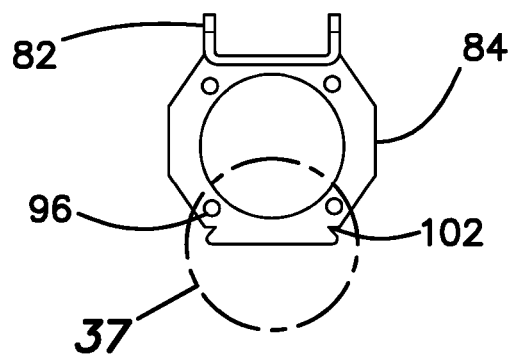
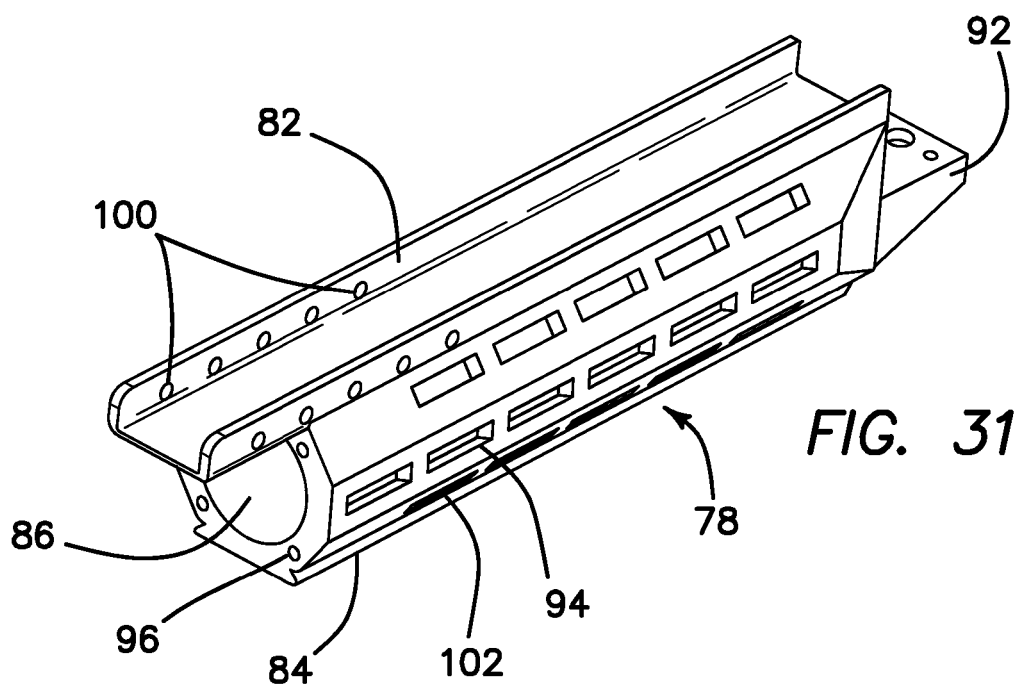




**FIG. 29**



**FIG. 30**



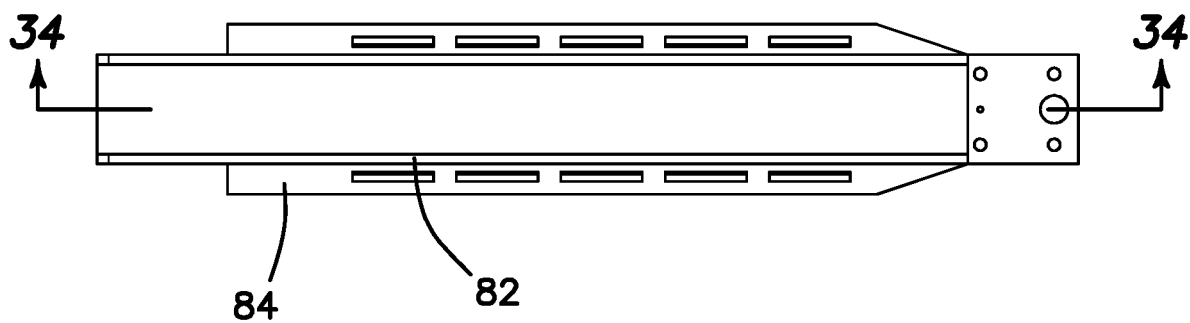


FIG. 32

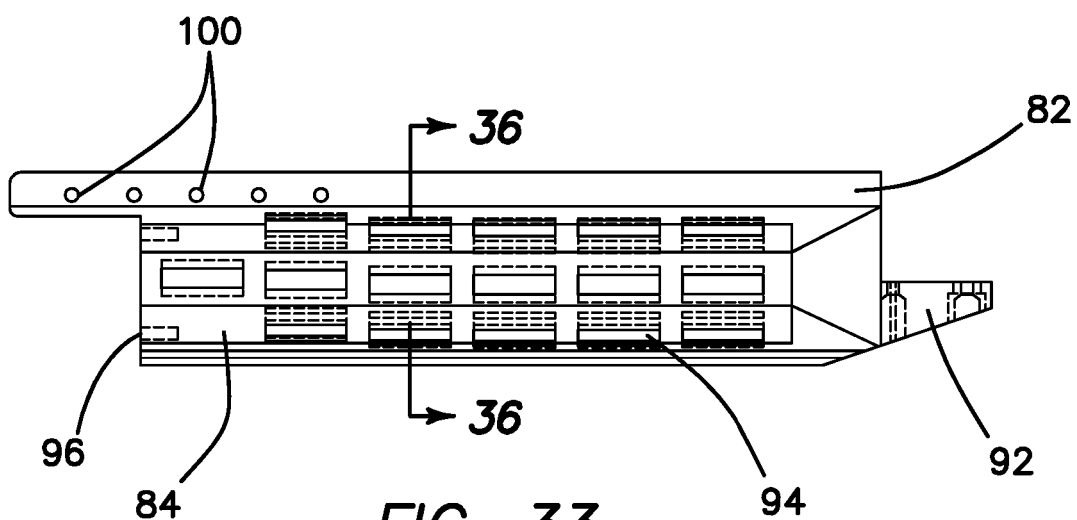


FIG. 33

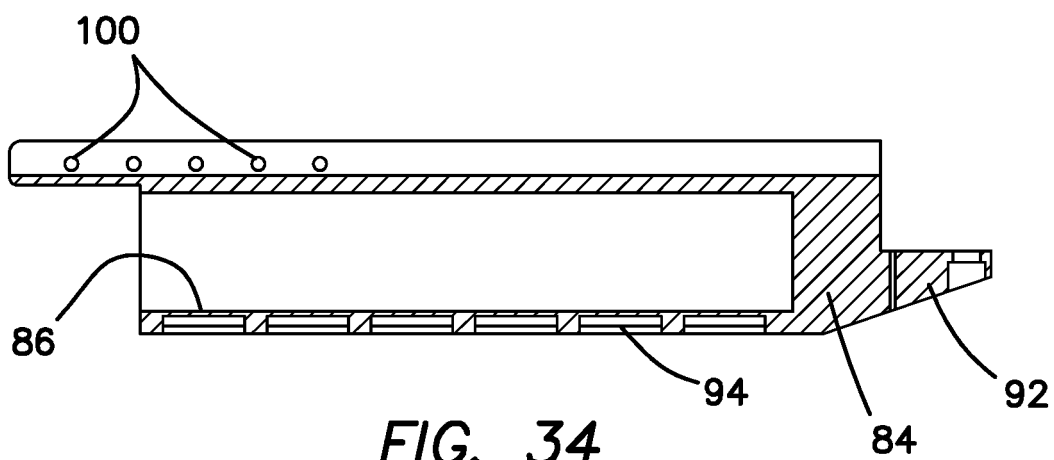
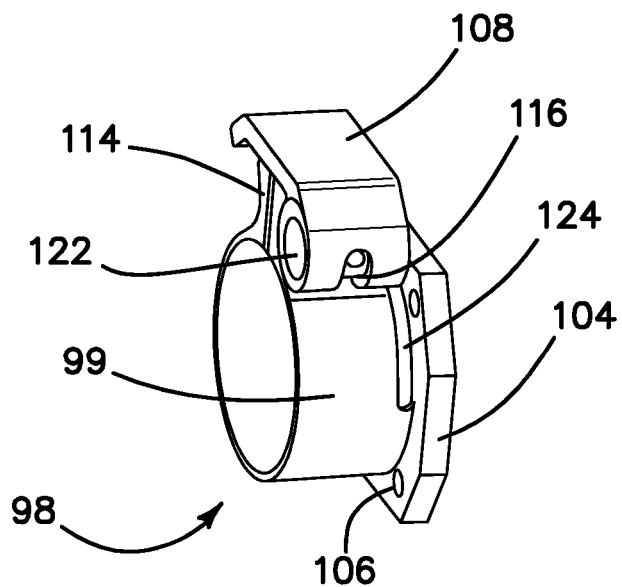
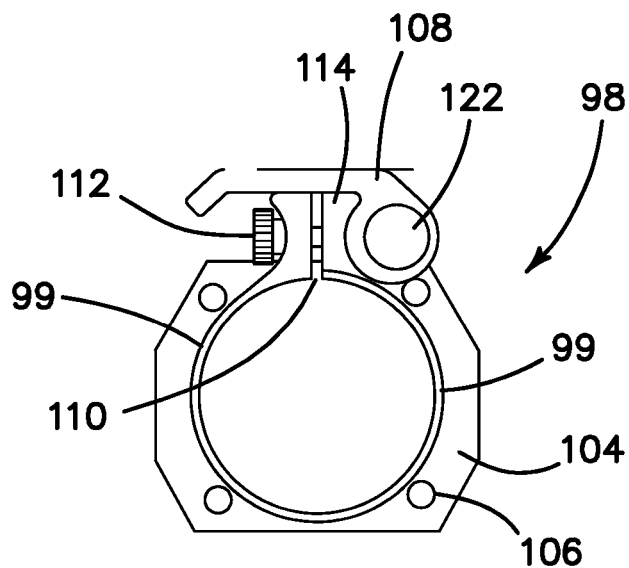


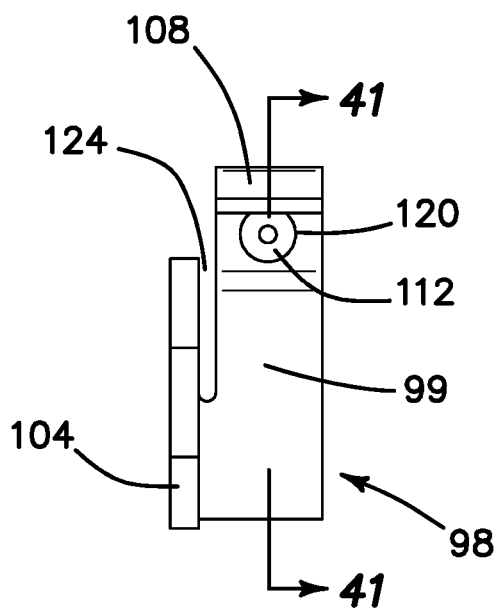
FIG. 34



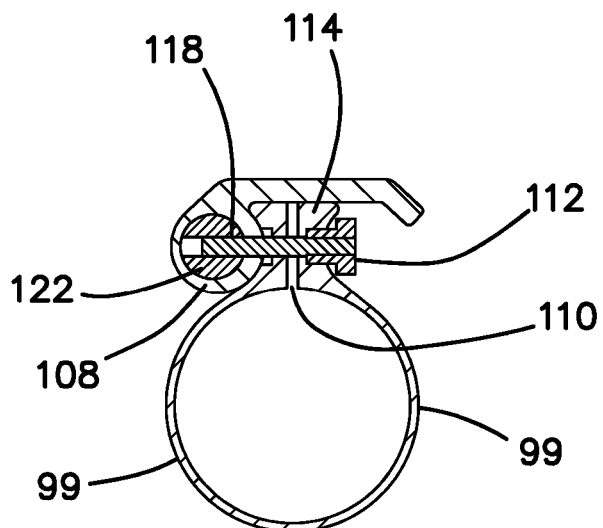
**FIG. 38**



**FIG. 39**



**FIG. 40**



**FIG. 41**

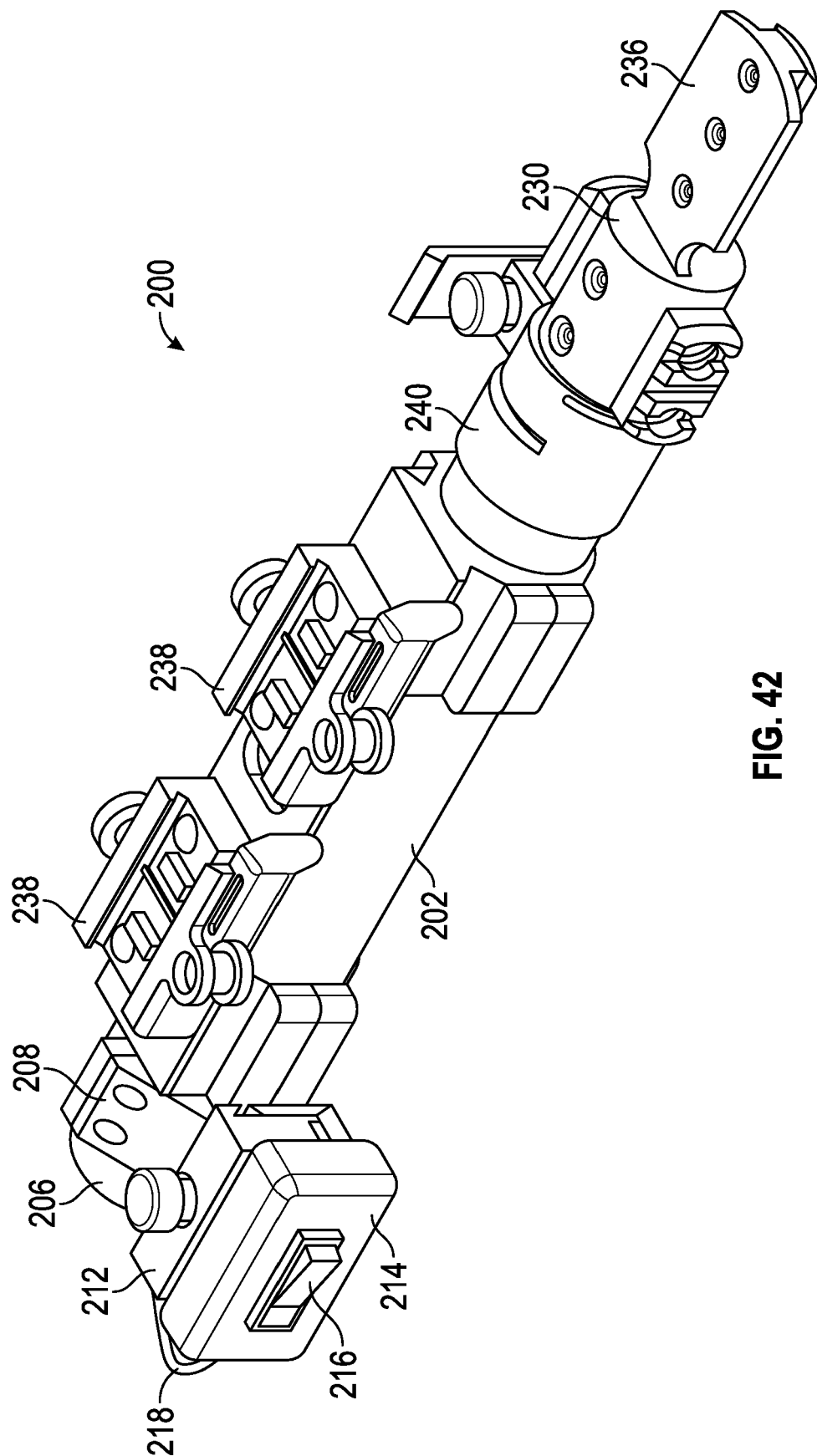


FIG. 42

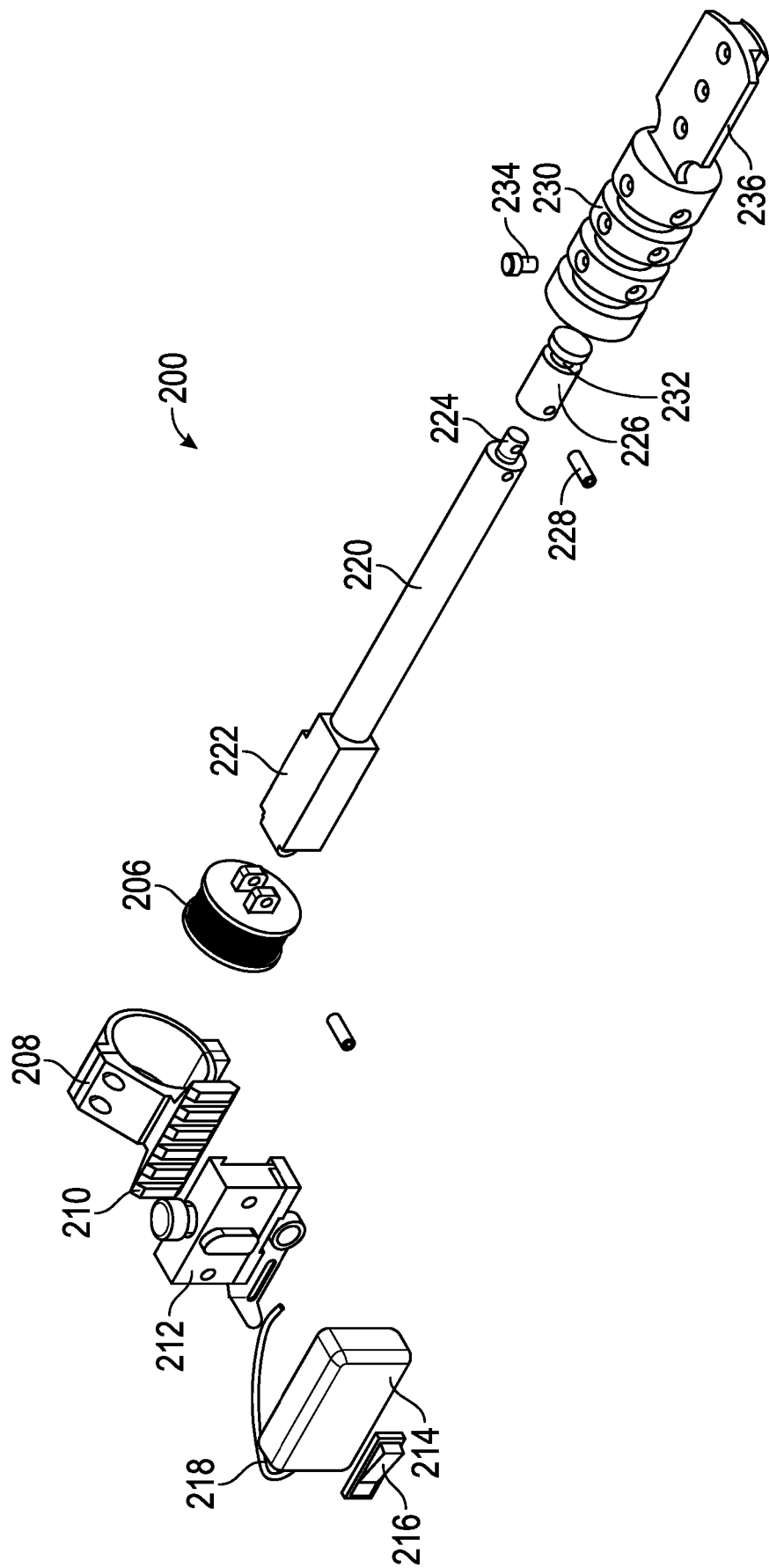


FIG. 43

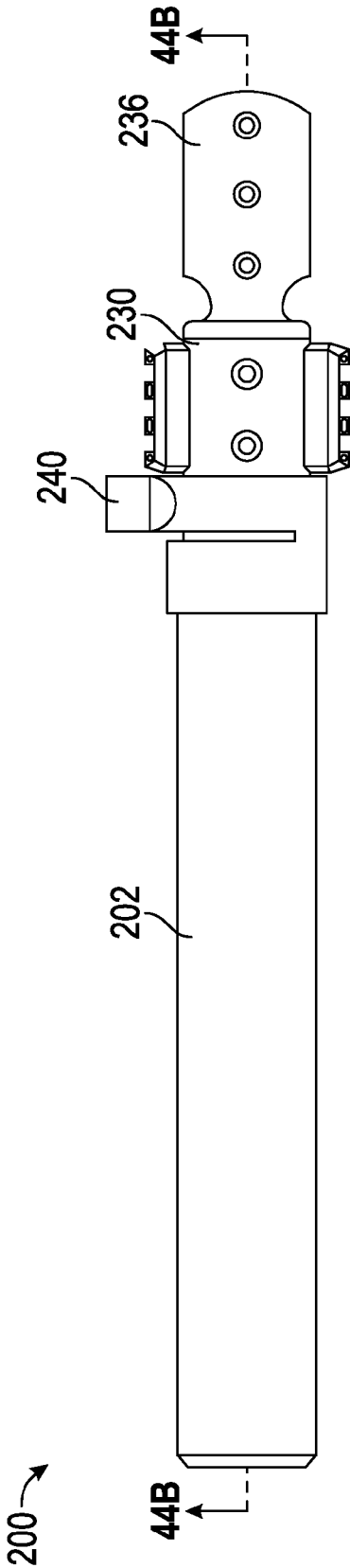


FIG. 44A

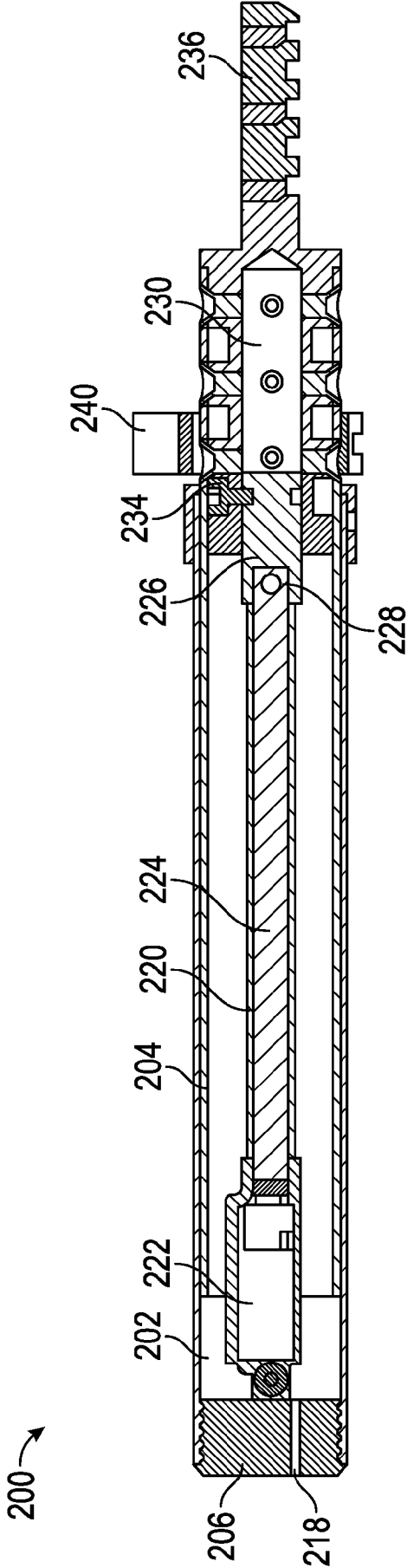


FIG. 44B

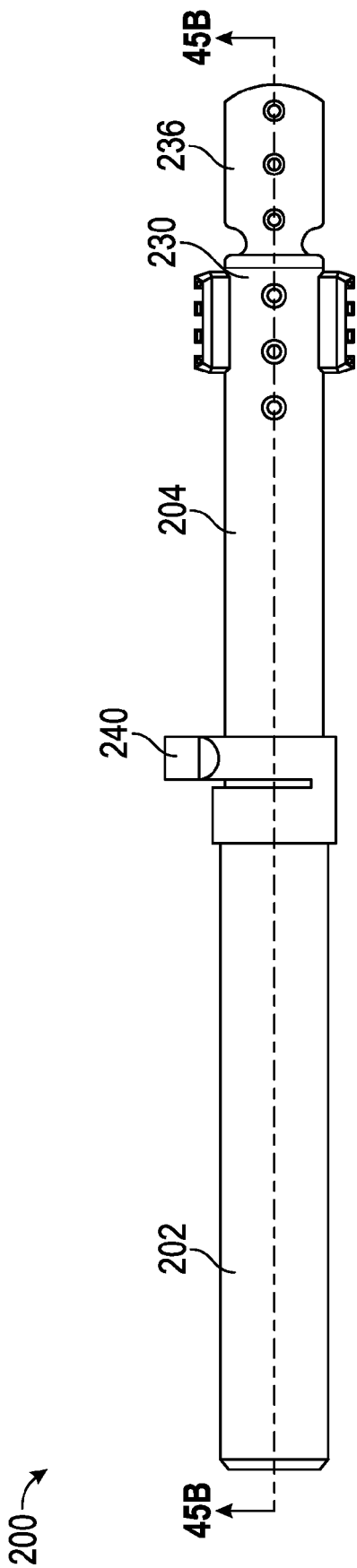


FIG. 45A

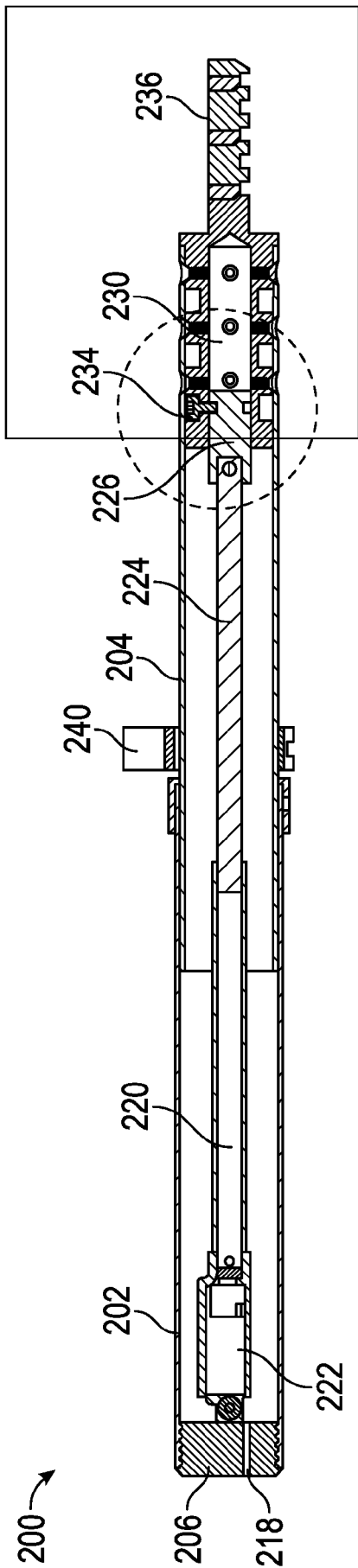


FIG. 45B

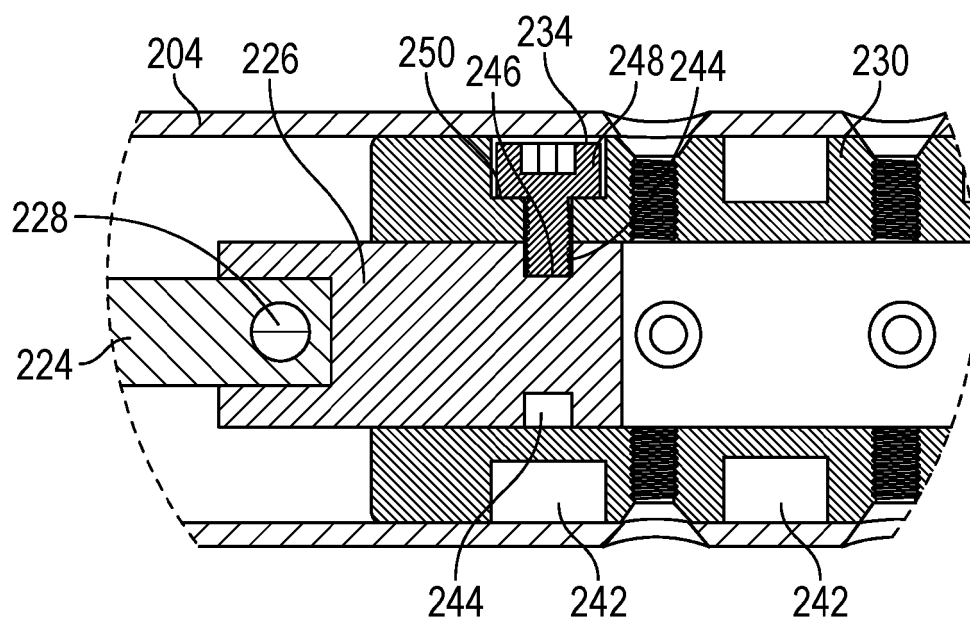


FIG. 46

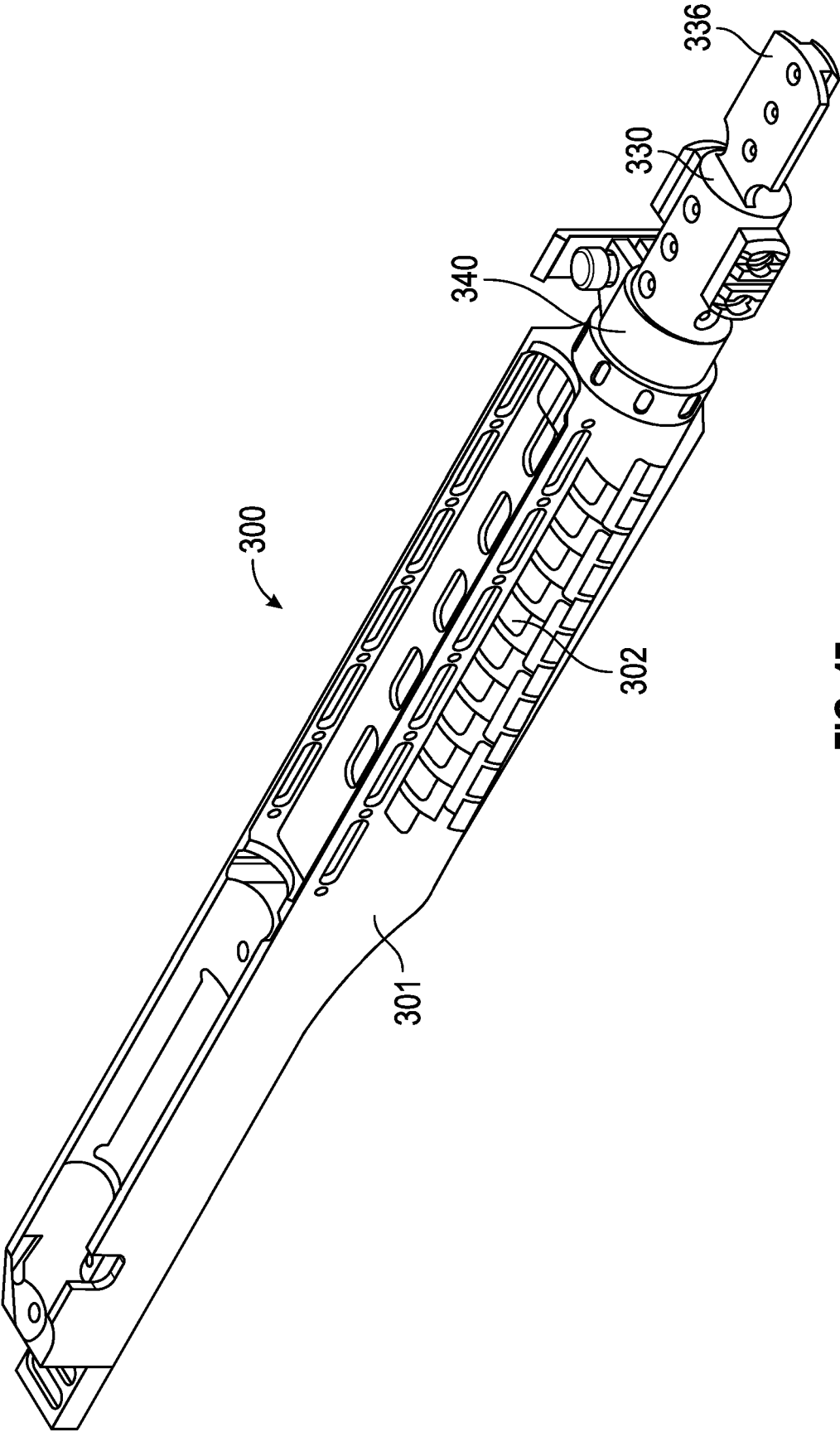


FIG. 47

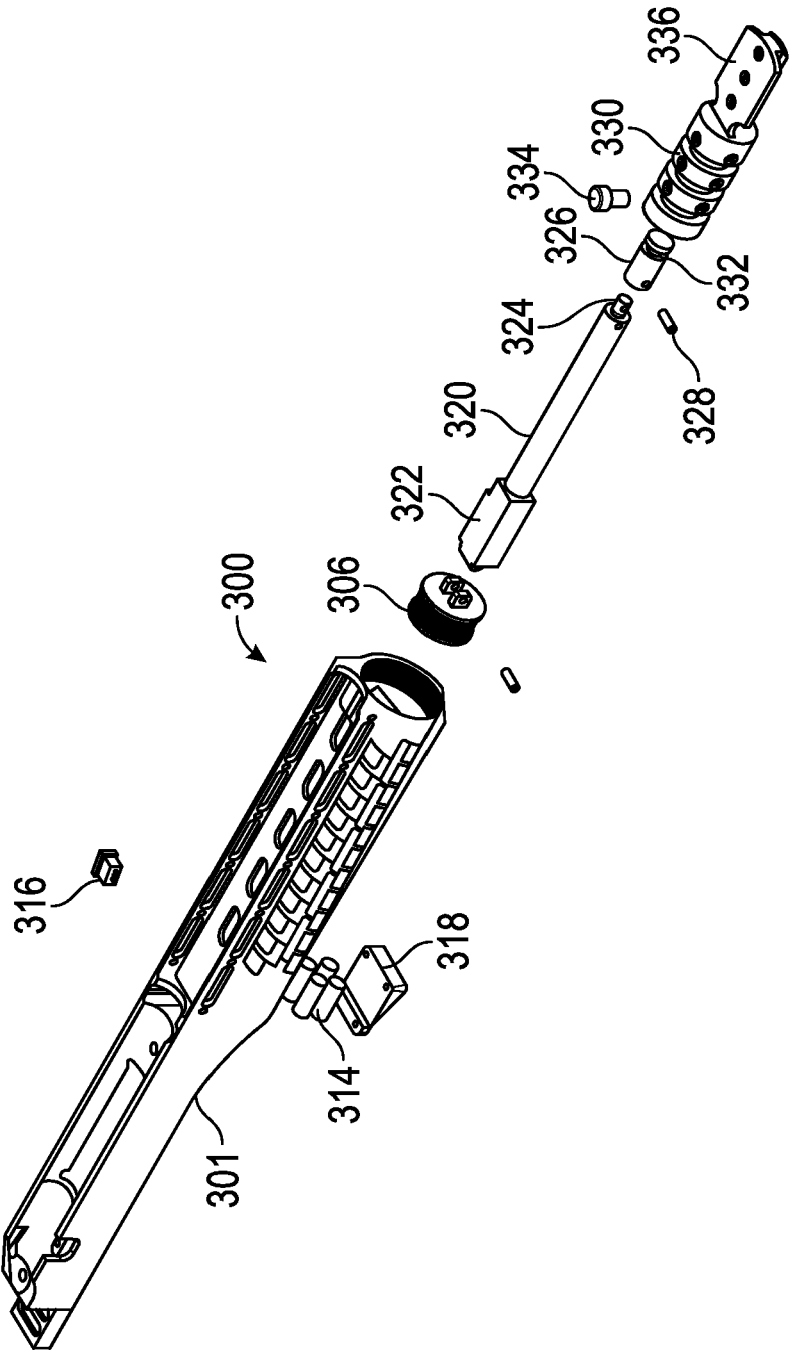
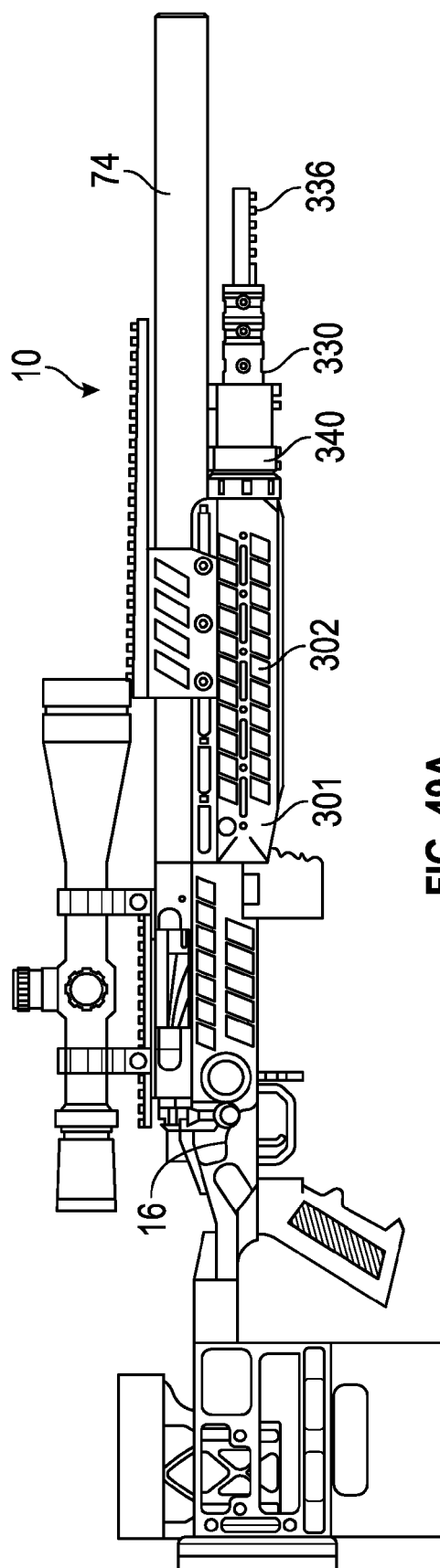
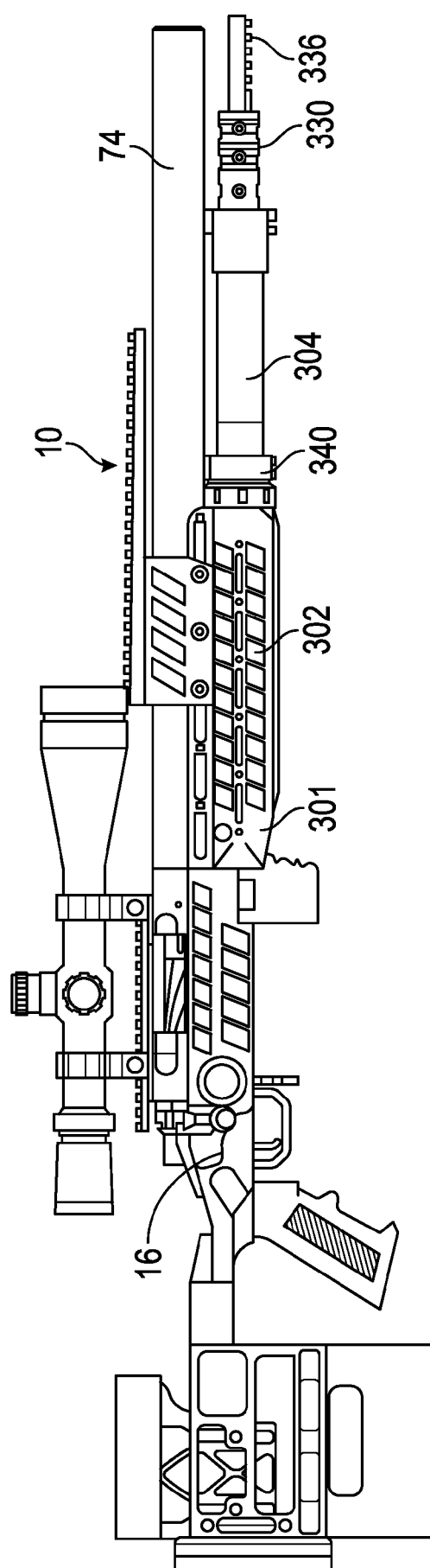


FIG. 48



**FIG. 49A**



**FIG. 49B**

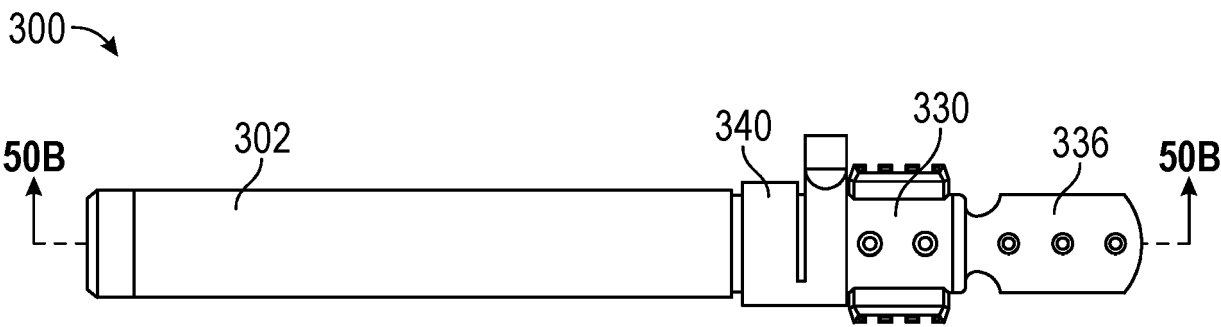


FIG. 50A

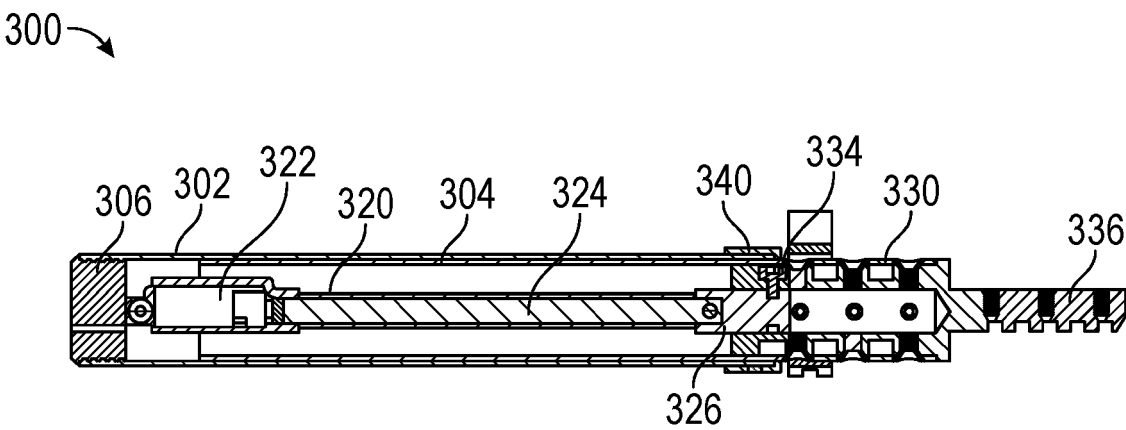


FIG. 50B

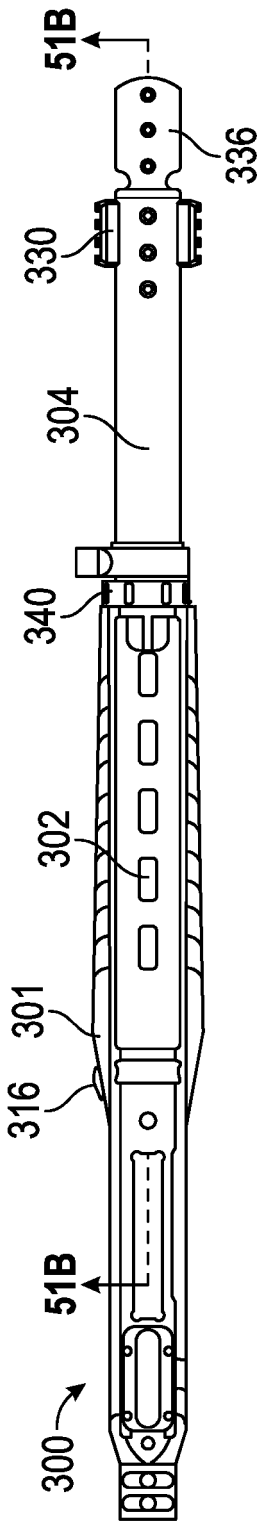


FIG. 51A

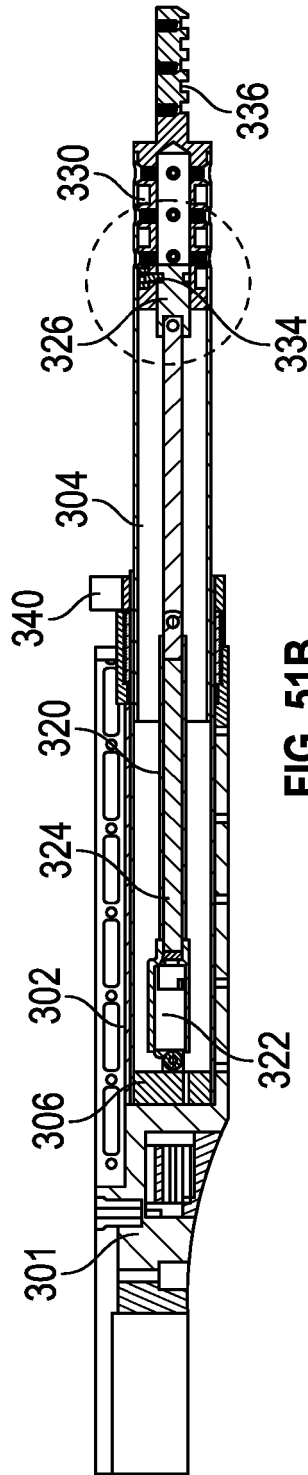


FIG. 51B

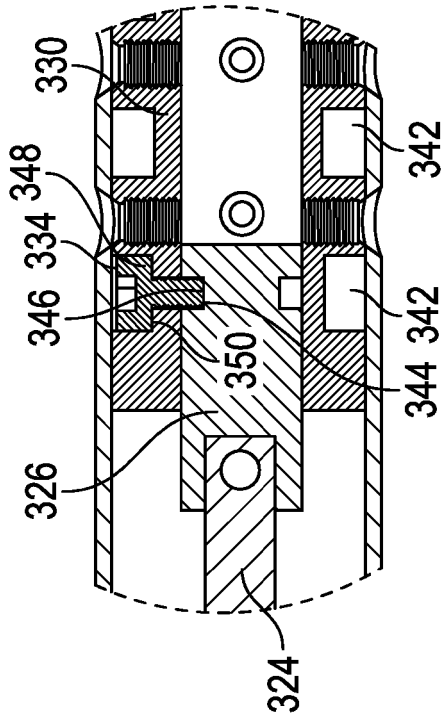


FIG. 52



## EUROPEAN SEARCH REPORT

Application Number

EP 24 22 3689

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                     | Citation of document with indication, where appropriate, of relevant passages                           | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| X                                                                                                                                                                                                                                                                            | US 2020/378706 A1 (GOLAN AMOS [IL])<br>3 December 2020 (2020-12-03)                                     | 1-6,<br>9-12, 14,<br>15          | INV.<br>F41A23/06<br>F41A23/10          |
| A                                                                                                                                                                                                                                                                            | * paragraphs [0004] - [0023]; claims 1-7;<br>figures 1-3 *                                              | 7, 8, 13                         | F41A23/14<br>F41C23/04<br>F41C23/14     |
| A                                                                                                                                                                                                                                                                            | EP 3 557 178 A1 (ACCURACY SOLUTIONS LLC<br>[US]) 23 October 2019 (2019-10-23)<br>* the whole document * | 1-15                             |                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                   |                                                                                                         |                                  | TECHNICAL FIELDS<br>SEARCHED (IPC)      |
|                                                                                                                                                                                                                                                                              |                                                                                                         |                                  | F41A<br>F41C                            |
| Place of search                                                                                                                                                                                                                                                              |                                                                                                         | Date of completion of the search | Examiner                                |
| The Hague                                                                                                                                                                                                                                                                    |                                                                                                         | 13 May 2025                      | Kasten, Klaus                           |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                  |                                                                                                         |                                  |                                         |
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| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                         |                                  |                                         |

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ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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13 - 05 - 2025

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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| EP 3557178 A1                             | 23-10-2019          | NONE                       |                     |
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