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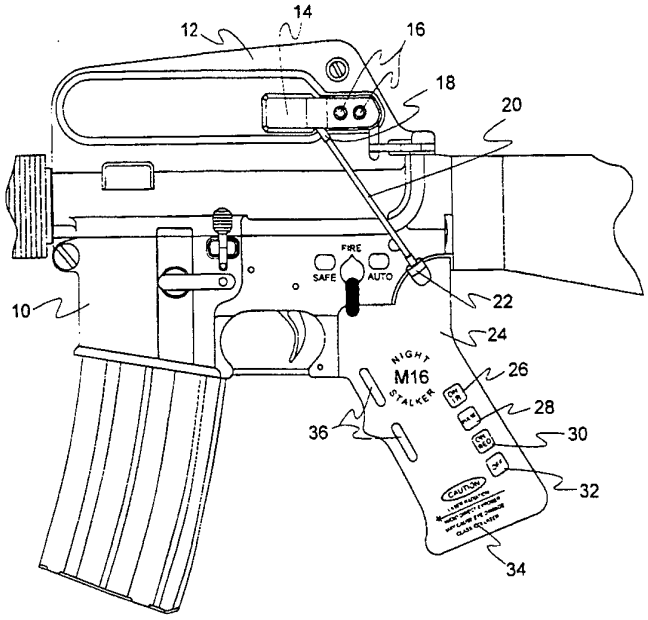

(57) Abstract

A laser sight that can fit conventional handguns and rifles without requiring major modification of the weapons and yet fits within the profile of the weapons framework. The invention features a chassis (12) containing an infrared and visible red laser than can be mounted in various positions, depending on the weapon selected. For a 9 mm handgun, the chassis (12) mounts on the front face of the muzzle. For an M-16, the chassis (12) mounts on the weapon handle. The weapons factory installed hand grips are replaced by modified hand grips (24) than contain the laser electronic controls, water proof activation switches, and power source. The hand grips (24) are wired to the chassis (12) via a flexible internal circuit tape in the case of the 9 mm and waterproof quick disconnect cable (20) for the M-16.

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LASER MODULE SIGHT AND SILENCER APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to laser sights and silencers for use on small firearms, particularly semi-automatic handguns and rifles.

2. Description of the Related Art

It is well known that even skilled marksmen with a handgun have been unable to hit a target as close as 7 meters when attempting to draw the weapon and fire at speed. In target shooting, the shooter must obtain the proper stance by carefully positioning the feet and the "free" hand to find the most stable condition, producing no muscular strain that will adversely effect the accuracy of the shot. Most importantly, the shooter must be able to obtain an identical position each time the weapon is fired to achieve the greatest accuracy. As the whole upper torso moves during each breath, breath control plays a vital role in the process. Since there can be no body movement at the time the trigger is fired, obviously the act of breathing must be stopped during the time the weapon is aimed and fired.

Sight picture and aim are critical if the shooter is to fire the most accurate shot or series of shots. When a mechanical pistol sight is properly aligned, the top of the front sight should be level with the top of the rear sight, with an equal amount of light on either side of the front sight. Using this sight picture requires that the shooter focus his shooting eye so that the sights are in focus and the target is out of focus. Added to the difficulty, the trigger, all of the above must be maintained while the trigger is released using direct, even pressure to keep the barrel of the gun pointing

at the target. These skills require tremendous practice, with each shot fired needing the utmost concentration if the shooter is to obtain maximum accuracy.

It is clear that the recommended methods of achieving maximum shooting accuracy useful for target shooting, must be severely modified when a handgun is used in a law enforcement situation. While the degree of accuracy necessary for target shooting and the distances are substantially lower, accuracy is still vital. Law enforcement officials are instructed to fire only as a last resort, cognizant of the fact that their intended target will mostly be killed. Shooting to wound occurs only in the movies. Law enforcement officers typically use higher caliber handguns, mostly 9 mm, which are designed to immobilize with a single shot if that shot strikes a vital area. Given the inherent inaccuracies in the shooting process itself, exacerbated by the stress and fear of the police officer in what may be a life threatening situation for him/her, the exact location of the bullet where millimeters can mean the difference between death and survival cannot be known a priori by even the most skilled marksman.

Mechanical sights have limited value in many situations where an officer must quickly draw his gun, perhaps while moving, and fire at a close target without sufficient time to properly obtain a sight picture. Under these circumstances, instinctive aiming, that is, not using the sights but rather "feeling where the gun barrel is pointing using the positioning of the hand holding the gun, is the preferred method. While this method, akin to the typical television cowboy shootouts, can be reasonably effective at short distances, obviously large errors in aiming are easily introduced, especially when the officer must frequently fire his/her weapon from a different hand

position that has been used for practice. For example, bullet proof shields are used to protect the officer from being fired upon such as in a riot situation. In that circumstance, the officer must reach around his/her shield or other barricade and instinctively aim and fire his/her gun with the handgun in a very different orientation than would be experienced if fired from a standing, drawn from a holster position. Small changes in barrel orientation due to the sight radius of the typical law enforcement handgun can produce substantial errors relative to the target. Accurate instinctive shooting is not considered practical beyond 20 feet for the average shooter.

The same problems face a soldier in a combat situation. While a rifle is inherently more accurate that a handgun, the stress of combat, the need to fire rapidly but accurately in order to survive is sufficient to introduce substantial errors into the sighting process. These problems are further exacerbated by the fact that most military personnel do not have sufficient practice time with their weapon to develop a high proficiency, particular in combat simulated situations.

A solution to this problem for handguns has been the introduction of laser sights. The typical laser sight is mounted on the top on the handgun or on the bottom. The laser sight when properly aligned, places a red light dot on the target where the bullet will strike if the gun is fired. Using this type of sight, enables the law officer to rapidly instinctively properly position the weapon and be certain of his/her intended target. Using a laser sight enables accurate shots to be fired at distances of more than 50 feet, sufficient for most combat law enforcement situations requiring the use of handguns.

U.S. Patent No. 4,934,086, issued to Houde-Walter on June 19, 1990, discloses installing the laser sight within the recoil spring guide. The use of the recoil spring guide to house the laser sight components enables the firearm to be holstered in a normal manner. The use of the spring recoil guide presents alignment problems to ensure accuracy. In other words, the laser within the recoil guide is difficult to align with the barrel of the firearm. Therefore, misalignment of the sight resulting in poor accuracy is likely.

A laser sight for a standard military issue weapon such as the M-16 that can be attached to the weapon without requiring a major modification of the firearm is not available. Use of the type of laser sights for handguns will also exhibit the same type of problems relative to installation on an M-16.

Prior art laser devices have several disadvantages. As they are mounted either on the top or the bottom of the weapon, the balance of the gun is disturbed which makes it more difficult for the shooter to rapidly use his/her instinctive sighting technique to move gun into alignment for hitting the desired target. The particular design of the M-16, having a carrying handle on the top of the firearm, makes adding a prior art laser devices to this weapon impractical. Also, since prior art laser sights are very bulky in comparison to traditional mechanical sights, when used with a handgun, the weapon cannot be used in a standard holster. Further, the laser sight is extremely vulnerable to being hit due to extending substantially beyond the normal profile of the weapon and thereby misalignment of the sight and defeating the advantages offered by the laser sight. A laser sight capable of being installed in a semi-automatic handgun or on a military rifle such as an M-16, easily and accurately

adjustable, is not disclosed in the prior art.

The use of silencers to reduce the velocity of the gasses that issue from the muzzle of a gun when fired is well known. The principle behind all of these devices is providing a tortuous path for the powder gases. Generally, such devices are attached to the barrel of the weapon, which is typically a handgun. One major problem with such devices is the size of the device interferes with front sight of the handgun. This requires the use of auxiliary sights that must be mounted on the silencer and at the rear of the firearm.

Representative of the art is U.S. Patent No. 5,136,923, issued to Walsh on August 11, 1992. This reference discloses the use of an interior tube with a plurality of ports leading to chamber having packing material.

U.S. Patent No. 5,136,924, issued to Forster on August 11, 1992, discloses a silencer for use with pistols with a fixed or tilting barrel. This design features a cross-sectional profile that enables the shooter to use the standard sights.

U. S. Patent No. 5,029,512, issued to Latka on July 9, 1991, discloses still another silencer. This design uses a plurality of annular baffles, defining a spiral path to reduce the noise of the discharged firearm.

U. S. Patent No. 5,142,805, issued to Horne at al. discloses a counter for calculating the number of rounds remaining in the firearm. This device receives input from a slide switch and a magazine switch. This device is not suitable for use with a silencer since silencer use generally requires the automatic slide aspect of the handgun to be disabled. This is done to eliminate the noise that is present when the carriage slide blows back after the round is fired in order to place a new round in the

chamber.

A silencer that is designed to be used with a laser sight or having integral flashlight and gun status displays is not found in the prior art. A cartridge monitor that displays the firing status of a firearm that can be used with a laser sight in combination with a silencer is also not found in the prior art.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a laser module sight apparatus that can be completely concealed within the standard framework of the weapon.

It is another object of the invention to provide a laser module sight apparatus that can be retro-fitted to standard semi-automatic handguns or to standard military rifles such as an M-16 or be included as original equipment at the time of manufacture.

It is still another object of the invention to provide a laser module sight apparatus that enables the pistol version to be used with standard holsters designed for that particular weapon.

It is still another object of the invention to provide a laser module sight apparatus that can be fitted to various semi-automatic handguns and military rifles requiring a minimum replacement of standard parts.

It is another object of the invention to provide a laser module sight apparatus that can be easily adjusted by the user to permit accurately alignment of the laser sight with the barrel of the gun.

It is another object of the invention to provide a laser module sight apparatus that can be inexpensively produced using primarily commercially available parts.

It is another object of the invention to provide a laser module sight apparatus that can incorporate an infrared diode that makes the dot invisible to the naked eye, but clearly visible using standard night vision equipment.

It is still another object of the invention to provide a laser module sight that can easily substitute a flashlight bulb in place of the laser diode.

It is another object of the invention to provide a laser module sight apparatus that is extremely light compared to existing lasers and their mounts.

It is still another object of the invention to provide a laser module sight apparatus that can be controlled from the handgrip of the firearm.

It is another object of the invention to provide a laser module sight apparatus that can be powered by commercially available batteries, providing at least several hours of service time before needing to be changed.

It is another object of the invention to provide a laser module sight apparatus that will incorporate a delay when the frame mounted switch is deactivated before the laser is turned off, thus permitting time for the user to activate the trigger switch without losing sight on the target.

It is another object of the invention to provide a laser module sight apparatus that will provide an adjustable pulse rate so that "friendly" laser beams can be distinguished from a laser beam from an enemy.

It is another object of the invention to provide a laser module sight apparatus that eliminates the need for a pressure pad on the grip handle which is awkward when holding the gun and requires adjustments to the shooter's grip to keep the laser off while maintaining stability.

It is an object of the invention to provide a silencer that is adapted to be attached to a laser module sight apparatus that fits within the profile framework of the handgun.

It is another object of the invention to provide a silencer that counts the number of rounds as they being fired so that the shooter will always know the number of rounds left to fire.

It is still another object of the invention to provide a silencer that tells the user when the silencer must be cleaned after a pre-determined number of rounds has been fired.

It is still another object of the invention to provide a silencer that tells when the batteries need to be replaced.

It is another object of the invention to provide a silencer that indicates a spent cartridge is in the firing chamber of the firearm.

It is another object of the invention to provide a silencer capable of emitting either a red or infrared laser beam from the front face of the silencer.

It is another object of the invention to provide a silencer that has a built-in flashlight that can shine a beam of light from the front face of the silencer.

It is another object of the invention to provide a laser module sight and silencer combination that is extremely light compared to existing lasers and their mounts.

It is still another object of the invention to provide a laser module sight and silencer combination that provides information from the sight module to the silencer or from the laser module to the autoloading handgun via light emitting diodes.

It is another object of the invention to provide a laser module sight and silencer

combination that can be powered by commercially available batteries, providing at least several hours of service time before needing to be changed.

It is another object of the invention to provide a silencer that utilizes a metal honeycomb material as the major component of the baffling system.

It is another object of the invention to provide a silencer that incorporates a programmable firearm status processor accessible by membrane switches.

It is another object of the invention to provide a laser module sight that has controls on either side of the firearm so that the controls are convenient for either left-handed or right-handed shooters.

The invention is a laser sight for a firearm, said firearm having standard issue hand grips. The invention has a chassis, mountable within the profile of the framework of the weapon, with the chassis having a front face, with said chassis having at least one light source housed within said chassis. The invention has laser control system mounted within modified handgrips having an exterior and interior surface that mount on said weapon replacing the standard issue hand grips. Said hand grips further comprising a plurality of rubberized switches located on the exterior surface of said modified handgrips, said switches controlling the light in said chassis. Said hand grips further comprising flexible circuit means adjacent to and corresponding in size to the interior surface of said handguns. Battery means is provided within the framework of said weapon to which said handgrips are attached for providing to said flexible circuit means. As an alternative embodiment, battery means is provided within the spring recoil guide of semi-automatic handgun. Finally, connection means for connecting said flexible circuit means to said light within said

chassis is provided. A silencer is also provided. A silencer as a combination with said laser sight is also provided. The chassis of the laser sight, as an alternative embodiment, may be an integral part of said weapon, for example, as part of the handle of an M-16 or part of the slide of a semi-automatic handgun. The silencer is attached to the laser sight module. An attachment face is provided. The attachment face of the silencer has a cross-sectional profile corresponding to the cross-sectional profile of said laser sight module. Also, the attachment face has a first opening corresponding to the barrel of said handgun, a second opening corresponding to the spring recoil guide of said handgun, a third opening for light communication between said laser sight module and said silencer. Additionally, the attachment face has at least one diode opening to allow laser diode light produced by said laser sight module to shine therethrough. A microprocessor that is optically connected to said laser sight module and said handgun is provided. Said microprocessor produces a first output signal corresponding to the number of rounds left to fire in the magazine of said handgun, a second output signal that corresponds to an accumulative total of rounds fired through said handgun, a third output signal that corresponds to whether a cartridge is present within the firing chamber of said handgun, a fourth output signal that corresponds to whether a cartridge within the firing chamber of said handgun has been fired. Means for substantially reducing the noise associated with the firing a cartridge in said handgun is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a partial side view of an M16 with laser module apparatus attached in accordance with the invention.

Figure 2 is a front view of the M16 showing the chassis of the laser module attached to the handle of the M16.

Figure 3 is a side view of the modified left hand grip assembly.

Figure 4 is a cross-sectional view of the handgrips attached to the M-16 across B-B of Fig. 3.

Figure 5 is a top view of the flexible circuit that fits within the modified hand grips assembly.

Figure 6A is a partial side of the left modified hand grip showing the battery door in a closed and opened position.

Figure. 6B is a bottom view of the modified hand grips in place on the M16 showing the battery door in a closed and opened position.

Figure 7A is side view of the laser module apparatus attached to a typical semi-automatic handgun in accordance with the invention.

Figure 7B is a front detailed view of the laser module apparatus.

Figure 8 is a detailed side view of the chassis attached to the handle of the M16.

Figure 9 is a cross-sectional view of the chassis across A-A in Fig. 8.

Figure 10 is a front view of the chassis.

Figure 11 is a detailed cut-a-away view of a laser diode assembly.

Figure 12 is a cross-sectional view of an alternative embodiment of the laser diode sighting system attached to the autoloading handgun shown in Fig. 7A in accordance with the invention.

Figure 12A is a cross-sectional view of the battery pack for the alternative

embodiment shown in Fig. 12.

Figure 13 is a side view of the silencer and laser sight in place on a typical autoloading handgun.

Figure 14 is a rear view of the silencer in accordance with the invention.

Figure 15 is a side view of the silencer with cut-away views of the components.

Figure 16 is a bottom view of the silencer with the flexible membrane circuit board removed.

Figure 17 is a front end view of the silencer.

Figure 18 is a detail of the flexible membrane circuit board.

Figure 19 is a detail of the star-shaped locking nut.

Figure 20 is a detail of the cam locking system that holds the silencer firmly attached to the laser sight module.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a partial side view of M16 10 with laser module apparatus attached. The apparatus comprises three major components: hand grip assembly which houses the circuitry, batteries and controls for the apparatus; laser chassis; and the connection harness which electrically connects the chassis with the hand grips. Hand grips 24 replace the standard hand grips that are issued with weapon 10. Hand grips 24 correspond closely in size and shape to the original equipment grips. As shown, the apparatus can be easily controlled by the operator by pushing the rubber switch buttons on grip 24. Rubber switch button 24 is waterproof so that the circuitry is protected during use in adverse weather conditions. Button 26 selects the infrared laser. Button 28 selects the laser pulse rate. The pulse rate is adjustable so that the

operator can set their weapons to a different pulse rate than that of an enemy. In this manner, it is an easy matter to determine friend from foe. Button 30 selects a visible red laser. Button 32 turns the system on or off. Button 36 activates the chosen laser, that is, either visible or infrared when pressed. Indicia 34 instructs the operator as to proper procedure to follow to avoid eye injury. Chassis 14, which houses the laser diode assembly is attached to handle 12 of weapon 14 within the recess of the handle. Thus, the apparatus can be connected to weapon 10 without the need for modifying weapon 10, yet, fit within the existing profile of the firearm so that it will not interfere with carrying, storing or firing the weapon.

Chassis 14 is held onto handle 12 by merely tightening set screws 16.

Cable 20 electrically connects chassis 14 to hand grips 24. Cable 20 is preferably waterproof. Cable 20 connects to chassis 14 through rubber boot 18. Cable 20 connects to hand grips 24 via a male waterproof quick disconnect 22.

Figure 2 is a front view of weapon 10 showing chassis 14 of the laser module apparatus attached to handle 12 as seen looking down the muzzle 46 of the weapon. Note that chassis 14 with laser 38 and 40 are within the profile of forestock 48 and do not interfere with mechanical sights 44. Thus, as noted above, minimal changes required to mount the apparatus to the weapon 10. Laser 38 is infrared and laser 40 is visible red. Each laser can be independently adjusted for elevation and windage using adjustment set screws 42.

Figure 3 is a side view of modified left hand grip 24 showing a cut-a-way view of the button contact 56 and 58 on the flexible circuit 50. Female quick disconnect 54 connects to cable 20 (shown in Fig. 1).

Figure 4 is a cross-sectional view of the handgrips attached to the M-16 across B-B of Fig. 3. Flexible circuit 50 is shown fitted within the interior wall of left hand grip 24. The flexible circuit 50' is shown fitted with interior wall of right hand grip 24'. Rubber button 28, for example, when pushed causes conductive rubber puck 90 to make an electrical connection with a contact (such as 56 and 58, shown in Figs. 3 and 5) thus to select the corresponding function in the apparatus. Recesses 92 and 92' house electronic components that are soldered to the flexible circuits. Stiffeners 52 and 52' hold the flexible circuits in place within the hand grips 24 and 24', respectively.

Figure 5 is a top view of the flexible circuit that fits within the modified hand grips assembly. Contacts 58 are the buttons on the left side hand grips 24 and contacts 58' are for the buttons on the right side hand grips 24'. Flex circuit is sized in accordance with grips 24 and 24'. When fitted to other sized firearms, the size of the flexible circuits are adjusted accordingly. However, the functional circuitry would remain the same.

Figure 6A is a partial side of the left modified hand grip 24 showing the battery door 60 in a closed and opened position. Figure. 6B is a bottom view of the modified hand grip 24 in place on the M16 10 showing the battery door 60 in a closed and opened position. Battery door 60 is opened by inserting a bullet casing into locking screw 62. Once opened, screw and washer assembly 70 is shown. Assembly 70 is used to mount the hand grips to weapon 10. Three commercial batteries 66, AAA size, are used to power the unit. O-ring seals 68 seal the batteries against moisture that might leak through door 60 that could damage the unit.

Figure 7A is side view of the laser module apparatus attached to a typical semi-automatic handgun 10. In this case, weapon 10 is SIG-SAUER Model P228, 9 mm, with a 13 cartridge clip or magazine. This particular pistol has been adopted by numerous military and law enforcement agencies as the weapon of choice because of its large magazine capacity, reliability, and accuracy. In operation, the slide 96, guided by a recoil spring guide and tensioned by recoil a spring, is slid backwards along frame, tensioning the recoil spring. The barrel and the recoil spring guide extend through barrel hole and recoil spring guide hole respectively. Therefore, once slide 96 is released, the spring causes slide 96 to move forward, strip a round from the magazine, and place the cartridge into the firing chamber. When slide 96 is in its most forward position on frame, the recoil spring guide and the barrel are substantially flush with front face of slide 96.

In this embodiment, chassis 14 is mounted on the muzzle of the weapon 10. Chassis 14 is the same here with the respect the laser diode 38 and 40, only the external shape of chassis 14 is changed to match that of the weapon that chassis 14 is installed on. Again, chassis 14 can be attached with minimum changes to the weapon as it comes from the factory. Hand grips 24 are modified to replace the original equipment hand grips (not shown) that are shipped with weapon 10. Again, as with the M-16, hand grips 24 are sized in accordance with the factory original grips. Therefore, frame section 94 of the weapon 10 is not covered as is the case using the factory grips.

As shown in Fig. 7B, the placement of lasers assembly 38 and 40 are similar. Only in this embodiment, it is necessary to provide barrel hole 98 and recoil slide hole

100. Hole 98 allows the fired bullet to exit through chassis and hole 100 allows the recoil slide to extend therethrough when slide 96 is furthest back.

Referring now to Figs. 8 and 9 is a detailed cross-sectional top view of the chassis 14 attached to the handle 12 of the weapon 10. Set screws 16 are tightened which lock chassis 14 to the recess within handle 12. Lasers 38 and 40 are housed within chassis 14. Lens material 74 is sealed into threaded bezel, thus making the connection waterproof, and serves to focus the lasers. Plastics threaded bezel 72 secures the laser assembly 38 and 40 into chassis 14. Threaded bezel 72 contains windage and elevation adjustment set screws (shown in Fig. 2) Weapon charging handle assembly 76 is used to load a round into the weapon. Cable 86 connects the lasers to cable 20.

Figure 10 is a front view of the chassis 14 which shows adjustment set screws 42 set within bezel 72 to permit adjusting the windage and elevation of the sight apparatus.

Figure 11 is a detailed cut-a-away view of a laser diode assembly 40. The laser driver 82 is potted in epoxy resin or the equivalent to make certain the assembly is water proof. Aspheric collimating lens 80 focuses the beam from the diode. Housing 84 , preferably aluminum, serves as heat sink to laser diode from overheating.

As shown in Fig. 12, an alternative embodiment is to replace the standard spring recoil guide 2 with battery pack 14 to energize the laser diode chassis 12. Battery pack 14 is electrically connected to the frame 45 of the weapon via spring-loaded electric contact pin 68. Spring-loaded electric contact pin 68 is required so

that when the gun is fired and the slide 4 with the laser diode chassis 12 attached will ride along the surface housing 86.

Pin 68 is the preferred method, however, a roller, or a deformed piece of metal could be used to contact the front cap 70 of the recoil spring guide battery pack 14. The electric operation requires the gun to become the ground or negative charge. This is accomplished by having a battery insulator 72, insulate the positive charge from the main housing 86 of the recoil spring battery pack 14. The negative charge of the recoil spring battery pack 14 is insulated in the same fashion.

Referring now to Fig. 12A, battery pack 14 has a front cap 70 preferably a heat treated steel, that is bonded to a non conductive material preferably black DELRON or ABC polymer plastic material called battery insulator 72. The battery insulator 72 is then bonded to the main housing 86. Preferred material is heat treated steel. The wall thickness is relatively thin to minimize the overall diameter of the recoil spring guide battery pack 14.

Two 1 1/2 volt batteries 40 preferably EVERREADY E96VP will be replaceable by unscrewing spring cap 126 from main housing 74. The spring cap 126 will house the aft insulator 76, a contact point 78 preferably brass that is tin plated to prevent corrosion, and a spring 128. The spring 128 takes up whatever distance there may be caused by manufacturing tolerances of the AAAA battery 40. Spring 128 will be attached to contact point 78 by soldering as preferred method. Spring 128 also serves as a shock absorber to counter the recoil shock when the firearm is discharged.

Contact point 78 will be bonded to aft insulation 76 using epoxy as preferred

method. Aft insulation 76 will be bonded to spring cap in a similar fashion.

This is insulated by aft insulation 76 allowing only for the main housing 86 to have a negative charge when the trigger switch is activated.

Figure 13 is a side view of the silencer and laser sight in place on a typical autoloading handgun. A slide lock is fitted to the firearm. Once the autoloading handgun is fitted with a slide lock, slide 4 will not recoil to eject the spent cartridge and strip a new cartridge from the magazine 101 and load it in the firing chamber. As mentioned above, if the firearm were to "autoload" when fitted with silencer 232, it would substantially defeat the purpose of the silencer. Warning 234 is place on silencer 232 to caution the shooter against holding silencer 232 when the slide lock is not engaged since silencer 232 will recoil along with laser 10 which anchored to slide 4.

However, once the slide lock is in place, the firearm may be used as "pump action" weapon where the shooter places his/her hand on thumb indent 236 and finger indent 238 (note matching indents are on the opposite side) to quietly move slide backward to eject the spent cartridge and place a new one in the firing chamber.

Figure 14 is a rear view of the silencer in accordance with the invention. A pair of numeric displays 252 provide the number of rounds left to fire. The preferred LED display is LA301YB single digit display as manufactured by ROHM. The display is preset at the factory to the standard magazine size sold with the autoloader. However, the user can change this number to accommodate various clip sizes. Hood 266 seats over grooves 216 so that it firmly engages stop 218 on chassis 12 of the laser sight. The profile of face 244 matches that of the front face of chassis 12 of the

laser sight as shown in Fig. 12. Holes 250 allow the laser diode 58 to shine through. Opening 256 is a clearance hole for spring recoil guide (now modified to a battery pack to operate the laser sight) to fit when the firearm slide 4 is slid back. Opening 254 is for barrel 30, again when slide 4 is slid to the rear. Communication opening 240 allows LED 212 to communicate with its corresponding detector.

Access to the battery compartment is provided by battery plug 246 which can be unscrewed via slot 248 using a coin.

Warning LED 260 is used to indicate a spent round in the firearm. Recall that to obtain maximum sound reduction using a silencer, the autoloading feature of having the slide automatically eject the spent round and insert a new one must be temporarily disabled. Therefore, it is possible for the user to forget that a used cartridge is still in the firearm. LED 260 warns of this condition.

Warning LED 258 tells the shooter that a round is in the firing chamber. Warning LED 262 is used to indicate to the shooter when a pre-set number of rounds have been fired, thus requiring that the silencer be cleaned.

Finally, warning LED 264 indicates that the batteries are low and should be replaced.

Pin 242 is used to anchor the silencer to the laser sight module via opening 230 in chassis 12. Before pin 242 is locked into position, it sits flush with surface 244.

Figure 15 is a side view of the silencer with cut-away views of the components. Gasket 268, formed of material capable of withstanding high temperatures and pressure, covers surface 244. The purpose of gasket 268 is to keep the powder

gases leaking from the joint where the laser sight module joins the silencer. Silencer mounting chassis 270 corresponds in cross-sectional profile to laser sight chassis 12. The preferred embodiment is for the laser sight module to be mounted first since a rigid mounting is critical to accurate sighting. However, assuming that the silencer could provide a rigid mounting platform relative to the barrel, the laser sight module could be mounted on the front of the silencer.

Clearance opening 272 provides space for the barrel 30 to occupy when slide 4 is slid back. Bore 254 is sized to accommodate either 45 caliber, 40 caliber or 9mm ammunition. The interior of silencer 232 is lined with honeycomb 280. Honeycomb 280 is preferably 1/8 inch cell titanium as manufactured by Kentucky Metals of New Albany, Indiana. Bore 281 through honeycomb 280 is sized to correspond to the caliber of ammunition that will be fired.

Fiber optic cable 346 extends into bore 254 so that a flash can be detected. The flash is then fed back to circuit board 284 which has LED 348 connected to it (shown in Figure 18). Proximity switch 350 is positioned within opening 256. Switch 350 is also wired to board 284. In this manner, every time the gun is fired, the microprocessor on board 284 records the discharge. Every time the slide is slid back, battery pack 14 will pass by switch 350, thereby activating it. The microprocessor uses this information to display the number of rounds remaining, accumulate the total rounds fired (used to signal when cleaning is required), indicate whether a round is within the firing chamber and whether the round in the firing chamber is live or spent.

Battery plug 246 has spring 288 attached to it and provides the ground

connection for batteries 286. The metal parts of the silencer, laser sight and handgun constitute ground for the circuit. Plug 246 is sealed against water leakage by O-ring 274. Batteries 286 are preferably 2 commercially available AAA extended duty-type. Spring 290 is connected to the positive end of batteries 286. Spring 290 is attached to circuit board 302. Springs 288 and 290 serve also as shock absorbers to protect the batteries against the recoil of the firearm when fired.

Battery housing 304 is welded to member 278 and outer housing 283 by weld 282. RTV joint 276 is used to further protect against moisture entering the silencer.

Cover 296 provides access to the interior of silencer 232 to permit cleaning. Cover 296 is held in place by threaded member 294 and groove 298 which mates with step 300 in housing 304.

Figure 16 is a bottom view of silencer 232 with flexible membrane circuit board 284 removed. Hood 266 has steps 314 which fit in grooves 216 on chassis 12 of the laser sight module. Gasket 268 covers the entire surface 244 (shown in Fig. 14). Board 284 attaches to silencer 232 via tap holes 316. Access holes 318 permit circuit boards 334 to be placed in position so that numeric displays 252 and LEDs 258 to 264 can be viewed from the rear end of silencer 232. Openings 320 reduce the weight of the apparatus and provide a pocket for the circuitry on board 284. Stud 292 urges circuit board 302 against surface 324 and locks board 302 in place. This arrangement acts as a locating means for centering spring 290. Flashlights 326 (only one shown for clarity) provide a high intensity red light and a high intensity infra-red light according to which flashlight 326 is selected.

Stud star nut 306 and stud 292 forms the housing for the visible and infra-red

flashlights that are mounted in battery housing 304 of silencer 232. As shown in the cut-away view, stud 292 has a hollow cone-shaped cavity which serves to house lenses 328. O-rings 332 seal the glass lens 328 and stud 292 in silencer 292 to seal against moisture entering the system.

Figure 17 is a front end view of silencer 232. Threaded retaining nut 310 is screwed onto member 294 thus holding cover 296 in place. Laser diode 250 exit from cover 296 as shown. To prevent nut 310 from interfering with the light transmission, radiuses 312 are provided as well as a positioning mechanism discussed in Fig. 19. Note that surface 308 of silencer 232 could have one or more laser diodes directly mounted rather than having the light shine through from the rear mounted laser sight module. While the two module system is preferred due to the stability requirements of having the laser diodes accurately fixed relative to the position of the barrel, front mounted laser diodes on the silencer would be a reasonable alternative.

Figure 18 is a detail of the flexible membrane circuit board 284 with attached boards 334a and 334b. Numeric display 252, LED 258 and LED 260 is attached to board 334a. Board 334a is connected to the main section of board 284 via flexible connector 336a. Another numeric display 252, LED 262 and LED 264 are attached to board 334b via flexible connector 336b. As previously discussed, this enables boards 334a and 334b to be fed through holes 318 to be placed in viewing position on silencer 232. Board 302 is connected to board 284 via flexible cable 336c. Board 302 houses the two flashlights 326.

The programmable controls which are activated by membrane switches are as

shown. Board 284 and its associated microprocessor and circuitry process the signal information received from gun, laser signal module, proximity switch 350 and LED 348. Membrane switches, as shown, allow the shooter to select between visible and infra-red flashlights, program the clip size, re-set the cleaning counter, etc.

Figure 19 is a detail of the star-shaped locking nut 310. Detent 372 is provided on each arm of the star on its back surface. Spring plunger 370 is fitted into surface 308 of the silencer immediately adjacent to nut 310. In this manner, nut 310 will be indexed to those positions which correspond to the arms of nut 310 being away from the openings which have diodes 250 shining through.

Figure 20 is a detail of the cam locking system that holds silencer 232 firmly attached to the laser sight module. Locking lever arm 368 is attached to cam 366. When arm 368 is moved to its lower position, as shown by the dotted line, cam 366 urges follower 364 against seat 360. Spring 358 is thereby compressed. Pin 242 extends from cavity 362 into pin receiver opening 230 which is located on chassis 12 of the laser sight module. In this manner, silencer 232 is locked firmly in place on the laser sight module without the use of tools. Since information is transmitted from the gun to the laser sight module to the silencer by light, no other connections are required. Thus, the unit can be quickly and conveniently attached and subsequently removed if desired.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, aimed to cover all such changes and modifications

as fall within the true spirit and scope of the invention.

What is claimed is:

1. A laser sight for a firearm, said firearm having factory hand grips comprising:

a chassis mountable on said firearm substantially within the profile of said weapon, said chassis having a front face with at least one laser device housed within said chassis, with the light form said laser device exiting the front face of said chassis;

modified hand grips having interior and exterior surfaces, dimensioned and sized to correspond to the dimensions and size of the factory hand grips, said modified hand grips having a plurality of waterproof rubber switches mounted on the exterior surfaces of said grips, said switches selecting said laser;

connection means for making an electrical connection between said modified hand grips and said chassis.

2. The laser sight of claim 1 further comprising flexible circuit means, adjacent to and corresponding in size to the interior surfaces of said modified hand grips, for electronically controlling the operating of said laser.

3. The laser sight of claim 2 wherein said weapon further comprising a battery pack dimensioned to fit within said hand grips.

4. The laser sight of claim 2 with said weapon having a spring recoil guide, said sight further comprising a battery pack dimensioned to fit within the spring recoil guide of said weapon and to power said laser device.

5. The laser sight of claim 3 wherein said connection means is a flexible circuit contained within said firearm.

6. The laser sight of claim 5 wherein said connection means is a cable

external to said weapon.

7. The laser sight of claim 6 further comprising delay means for delaying the time that said laser device is turned off by the user, with the delay time sufficient in duration to allow the user to reactivate such laser device to permit continuous operation of said sight.

8. The laser sight of claim 7 wherein the light of a second light source is emitted from the front face of said chassis wherein the light of the second light source is visible only when viewed with night vision goggles.

9. The laser sight of claim 8 wherein said battery pack utilizes commercially available size AAAA batteries.

10. The laser sight of claim 9 with said chassis further comprising a plurality of adjustment screws on the front face of said chassis, wherein said adjustment screws can align the light from said light source relative to the position of the barrel of said handgun.

11. The laser sight of claim 1 further comprising a silencer comprising:

an attachment face, having a cross-sectional profile corresponding to the cross-sectional profile of said laser sight chassis, said attachment face having at least one opening corresponding to said laser device exiting the front face of said chassis;

a microprocessor connected to said chassis wherein said microprocessor produces a first output signal corresponding to the number of rounds left to fire in the magazine of said handgun, a second output signal that corresponds to an accumulative total of rounds fired through said handgun, a third output signal that corresponds to whether a cartridge is present within the firing chamber of said

handgun, a fourth output signal that corresponds to whether a cartridge within the firing chamber of said handgun has been fired,

means for substantially reducing the noise associated with the firing a cartridge in said firearm.

12. The laser sight of claim 11 wherein said silencer further comprises an integral battery operated flashlight.

13. The laser sight of claim 12 wherein said silencer further comprises said integral battery operated flashlight provides an infra red beam and visual red beam.

14. The laser sight of claim 13 wherein said means for substantially reducing the noise emitted by said firearm when a cartridge is fired therein further comprises a metallic honeycomb.

15. The laser sight of claim 14 wherein the metal of said honeycomb is titanium.

16. The laser sight of claim 15 wherein said silencer further comprises at least one numeric digital display to visual indicate the number of rounds left in the magazine of said handgun.

17. The laser sight of claim 16 wherein said silencer further comprises an LED to indicate that the silencer needs cleaning.

18. The laser sight of claim 15 wherein said silencer further comprises a second LED to indicate that a cartridge is in the firing chamber of said firearm.

19. The laser sight of claim 15 wherein said silencer further comprises a third LED to indicate that the cartridge within the firing chamber of said handgun has been fired.

20. The laser sight of claim 15 wherein said silencer further comprises a fourth LED to indicate that the batteries powering said silencer need to be changed.

21. A laser sight for an autoloading handgun, said handgun having a barrel, a slide having a cross-sectional profile with a front face having two holes therein, with one hole corresponding to the diameter of the barrel and the other hole corresponding to the diameter of the spring recoil guide, and factory handgrips, said laser sight comprising:

said slide having a front face with having at least one light source, with the light form said light source exiting the front face of said slide;

modified hand grips having interior and exterior surfaces, dimensioned and sized to correspond to the dimensions and size of the factory hand grips, said modified hand grips having a plurality of waterproof rubber switches mounted on the exterior surfaces of said grips, at least one of said switches selecting said light source;

connection means for making an electrical connection between said modified hand grips and said light source.

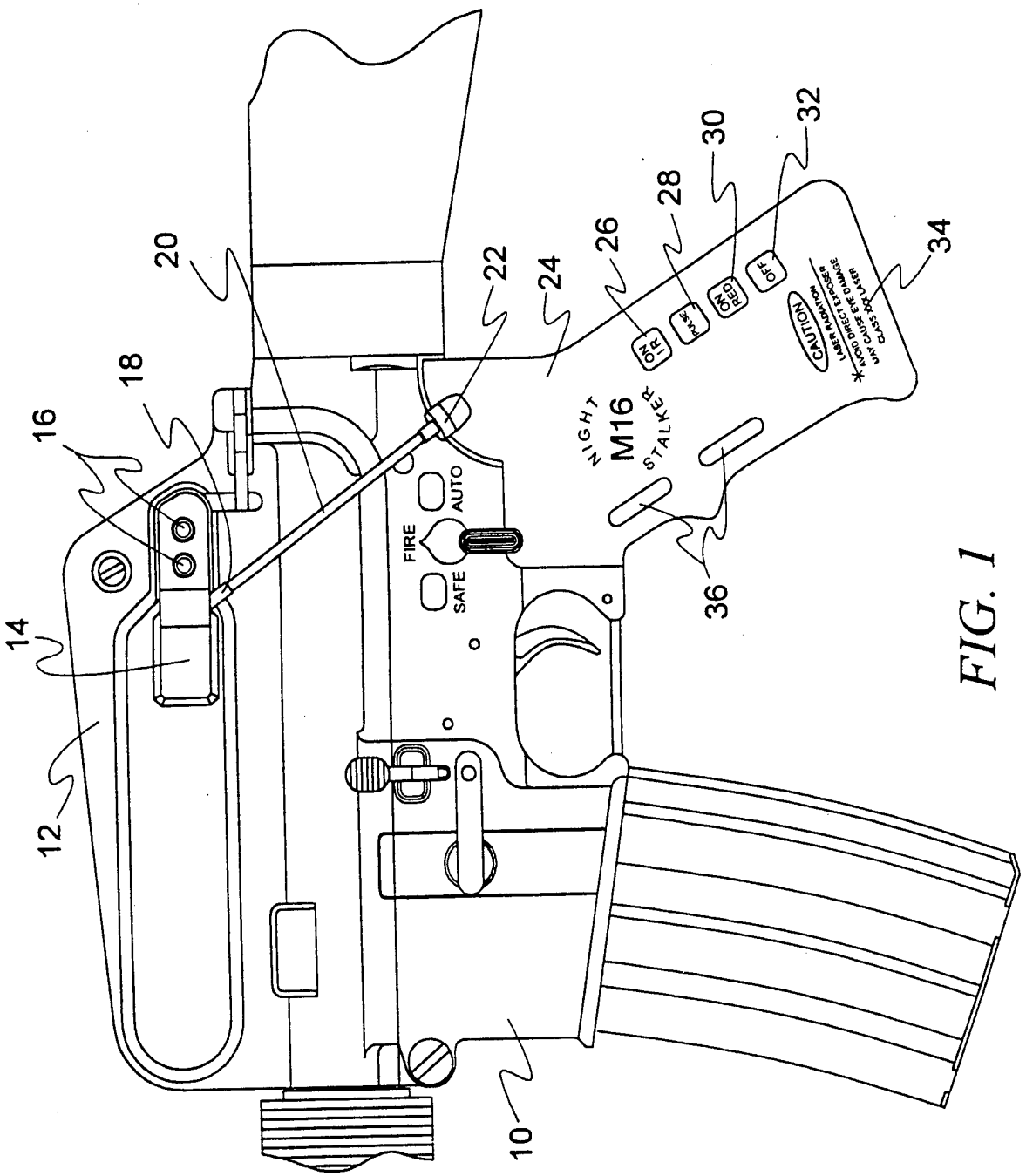
20
22
24
26
28
30
32
34
18
16
14
12
10
36
FIRE
AUTO
SAFE
NIGHT
M16
STALKER
IR
RED
OFF
CAUTION

FIG. 1

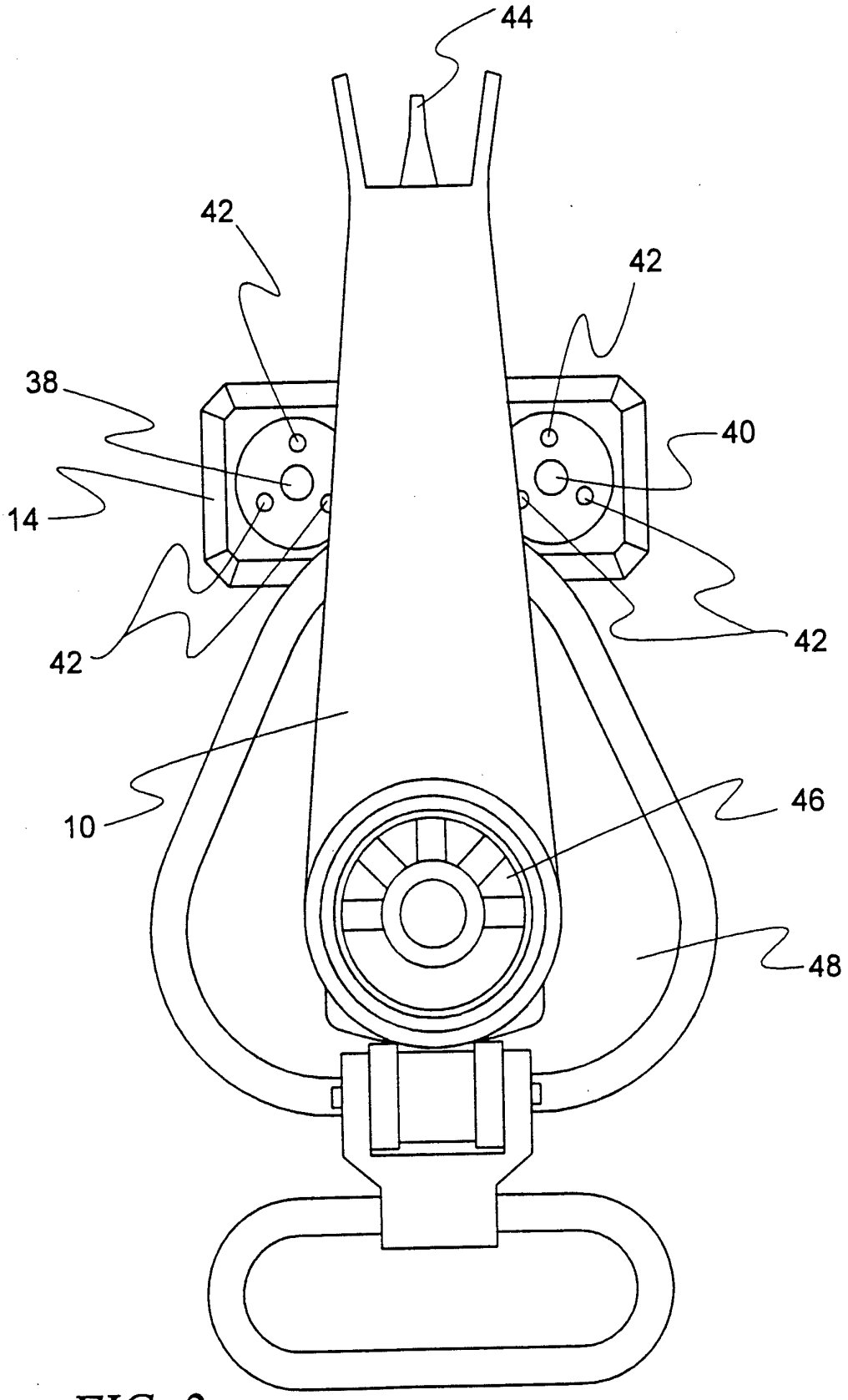

FIG. 2

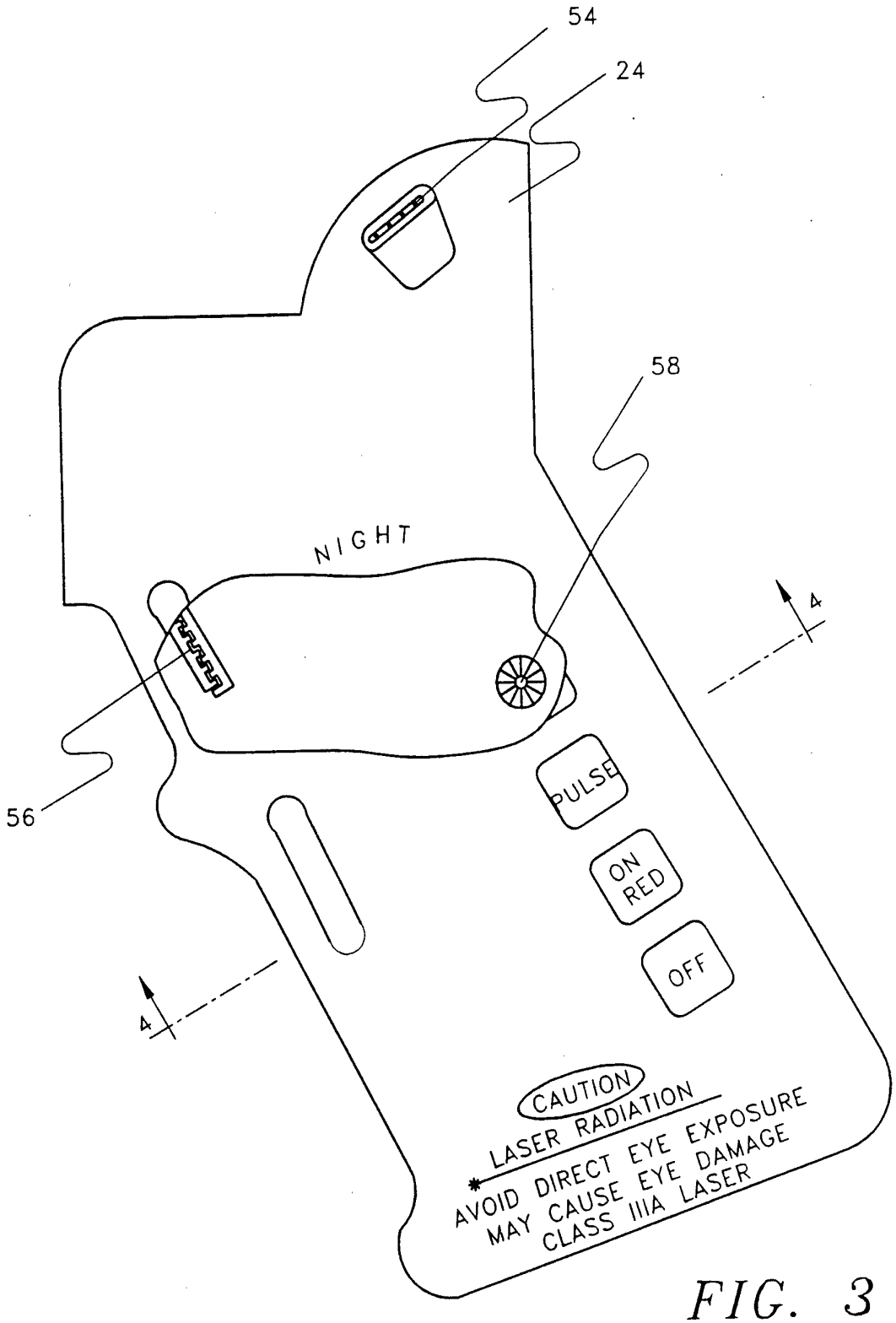
54
24
58
NIGHT
4
56
PULSE
ON
RED
OFF
4
CAUTION
LASER RADIATION
AVOID DIRECT EYE EXPOSURE
MAY CAUSE EYE DAMAGE
CLASS IIIA LASER

FIG. 3

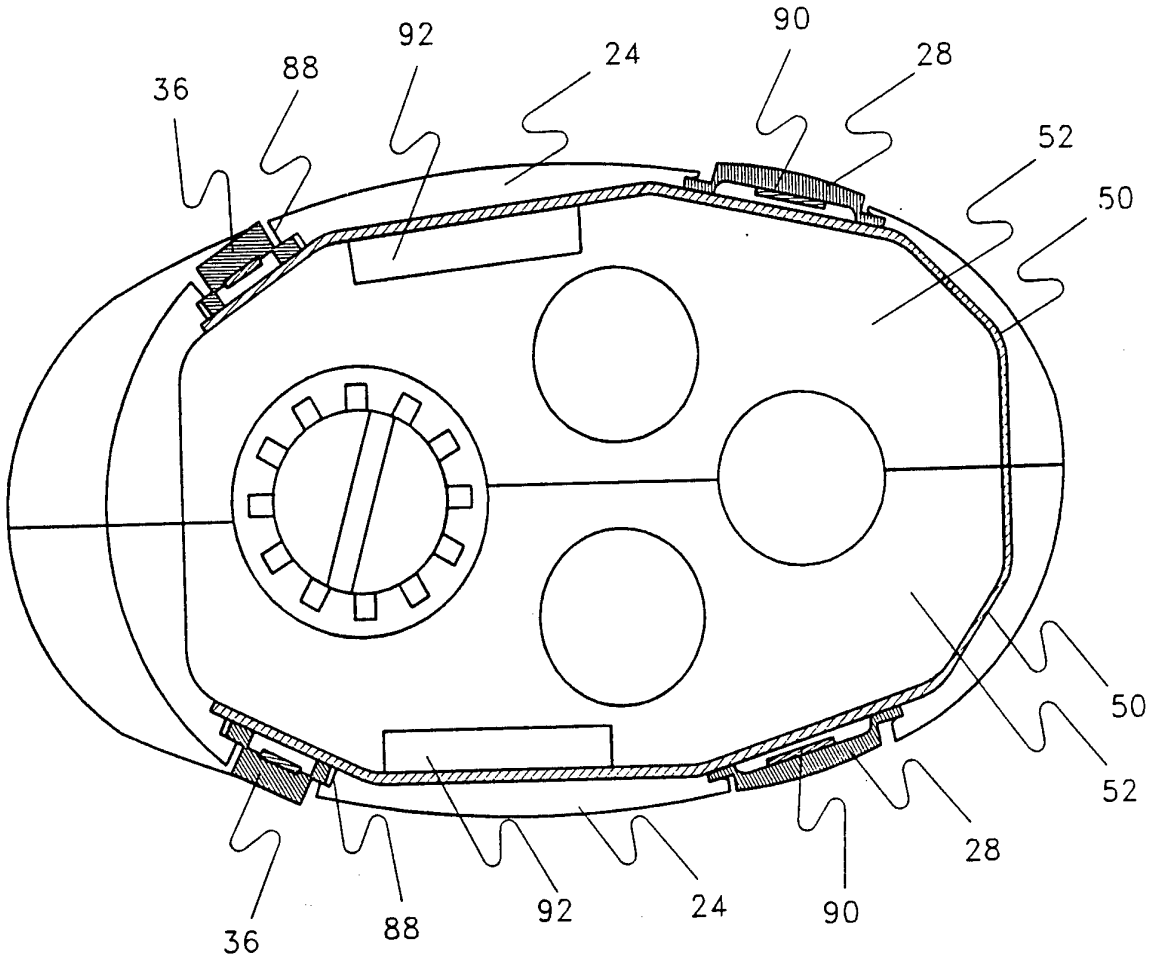

FIG. 4

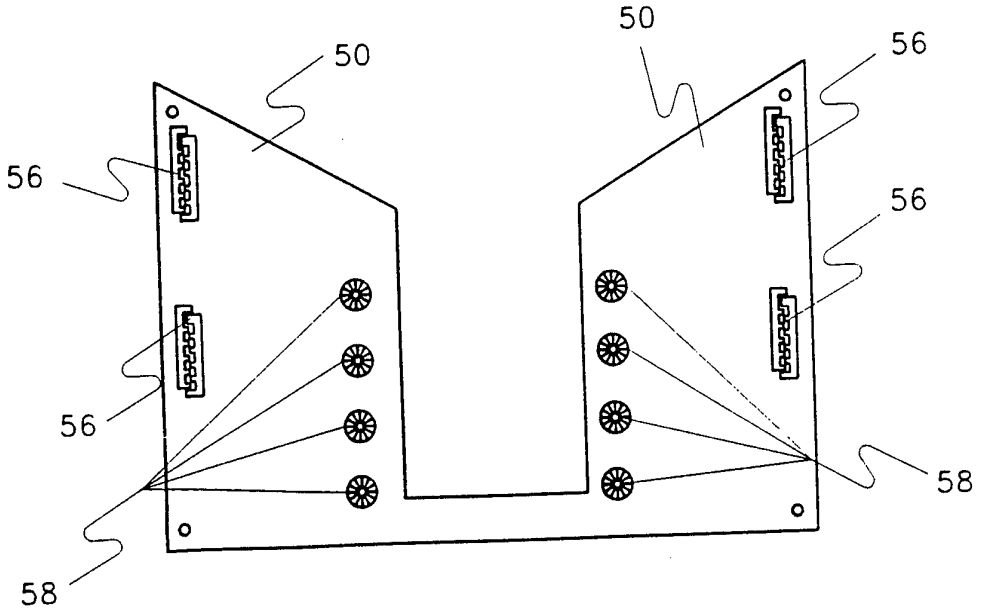

FIG. 5

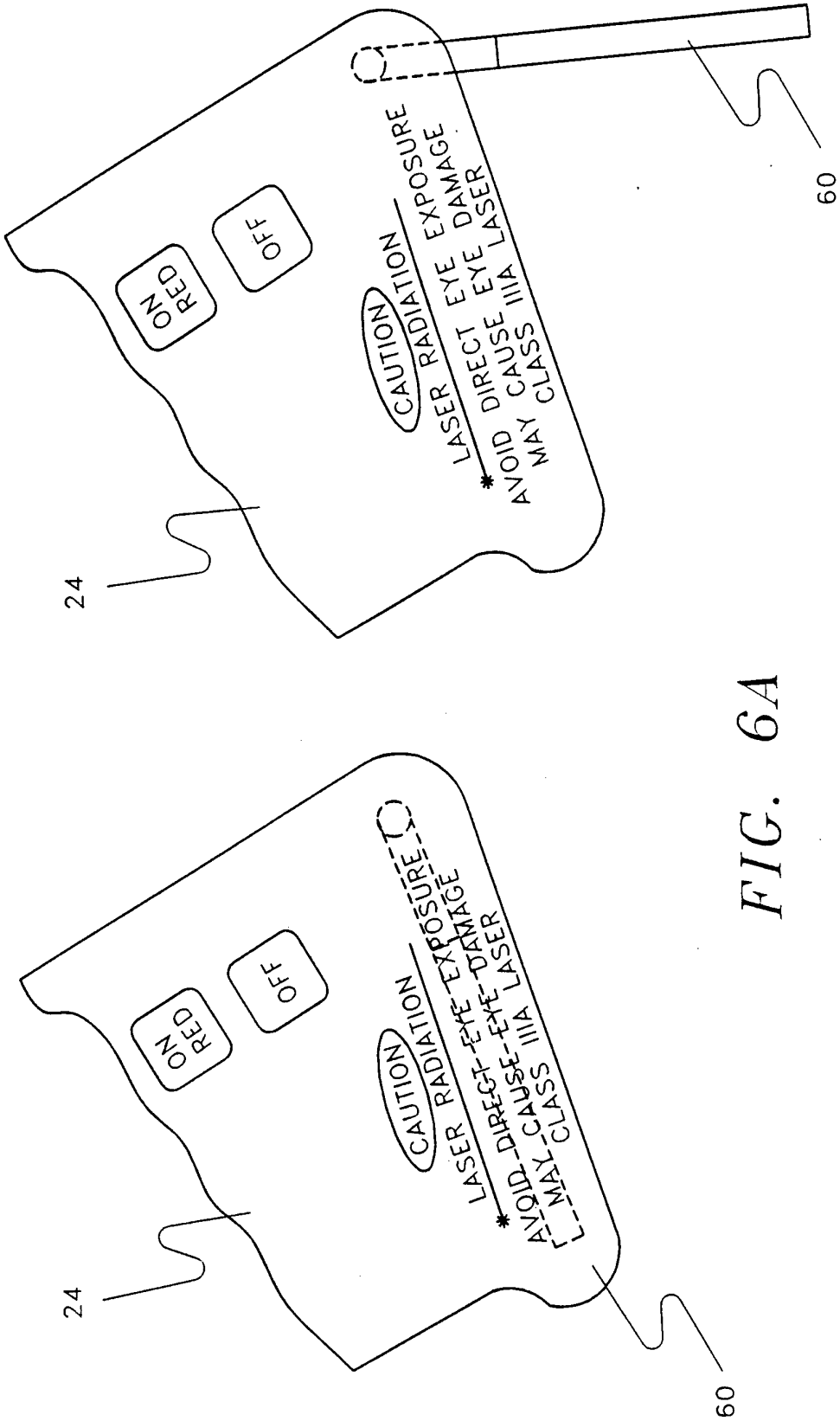
ON
RED
OFF
CAUTION
LASER RADIATION EXPOSURE
AVOID DIRECT EYE DAMAGE
MAY CAUSE IIIA LASER
24
60
ON
RED
OFF
CAUTION
LASER RADIATION EXPOSURE
AVOID DIRECT EYE DAMAGE
MAY CAUSE IIIA LASER
24
60

FIG. 6A

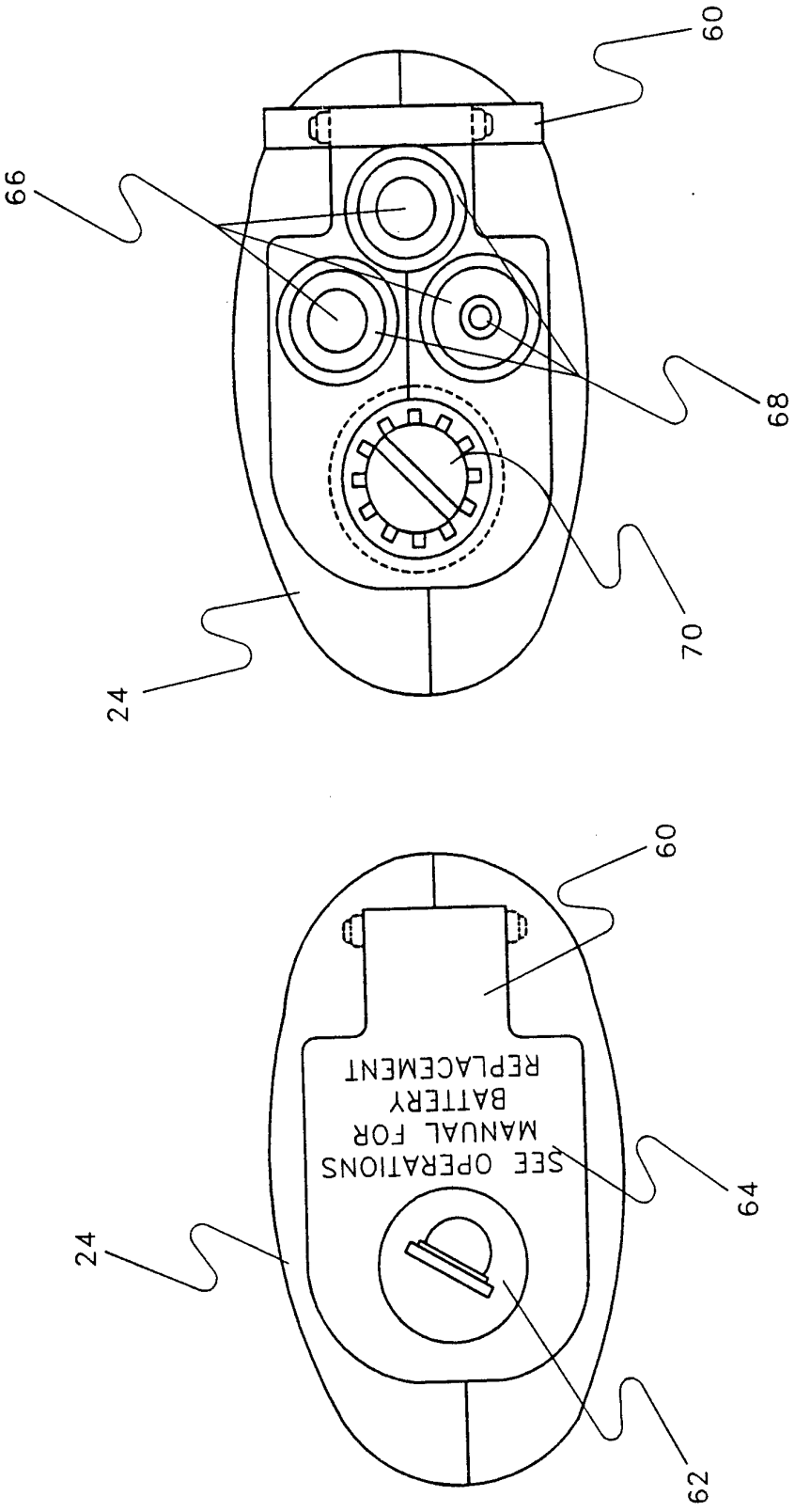

FIG. 6B

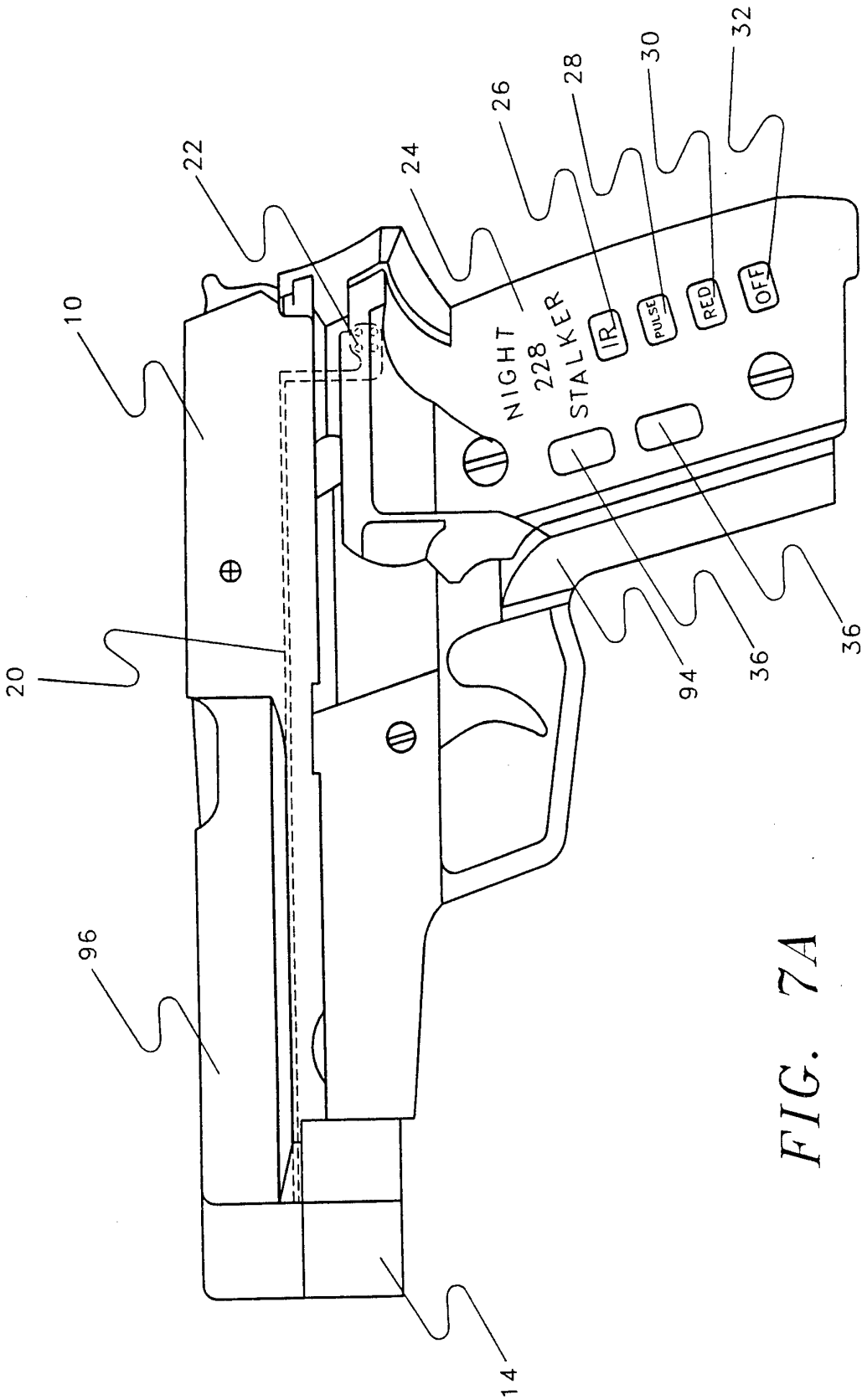

FIG. 7A

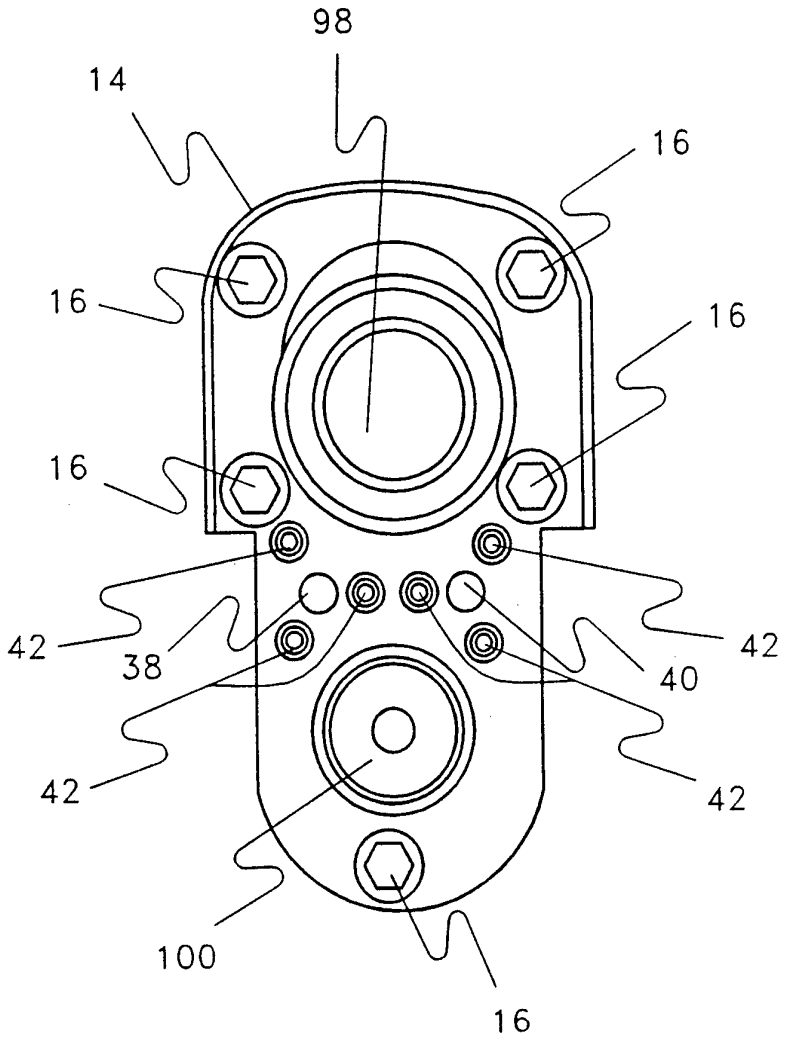

FIG. 7B

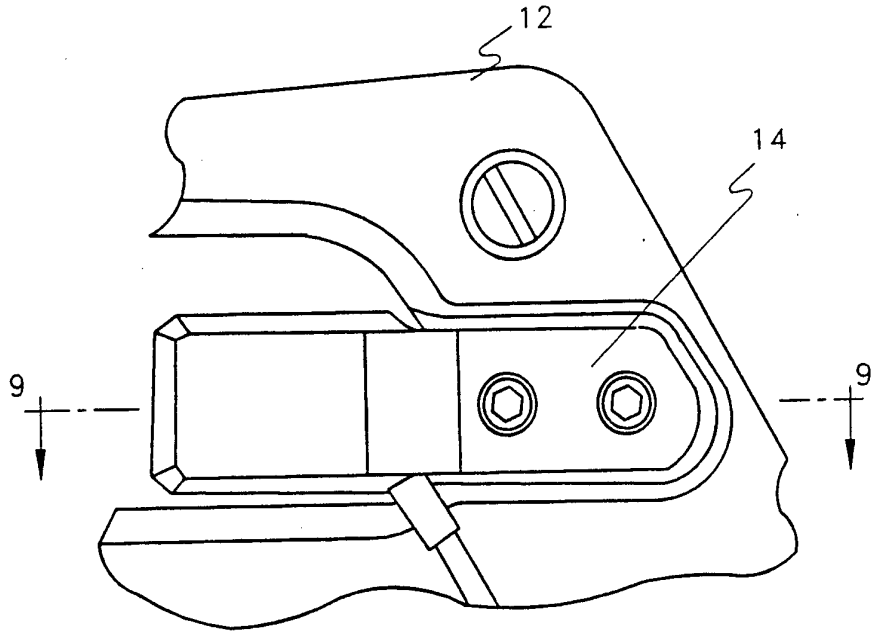

FIG. 8

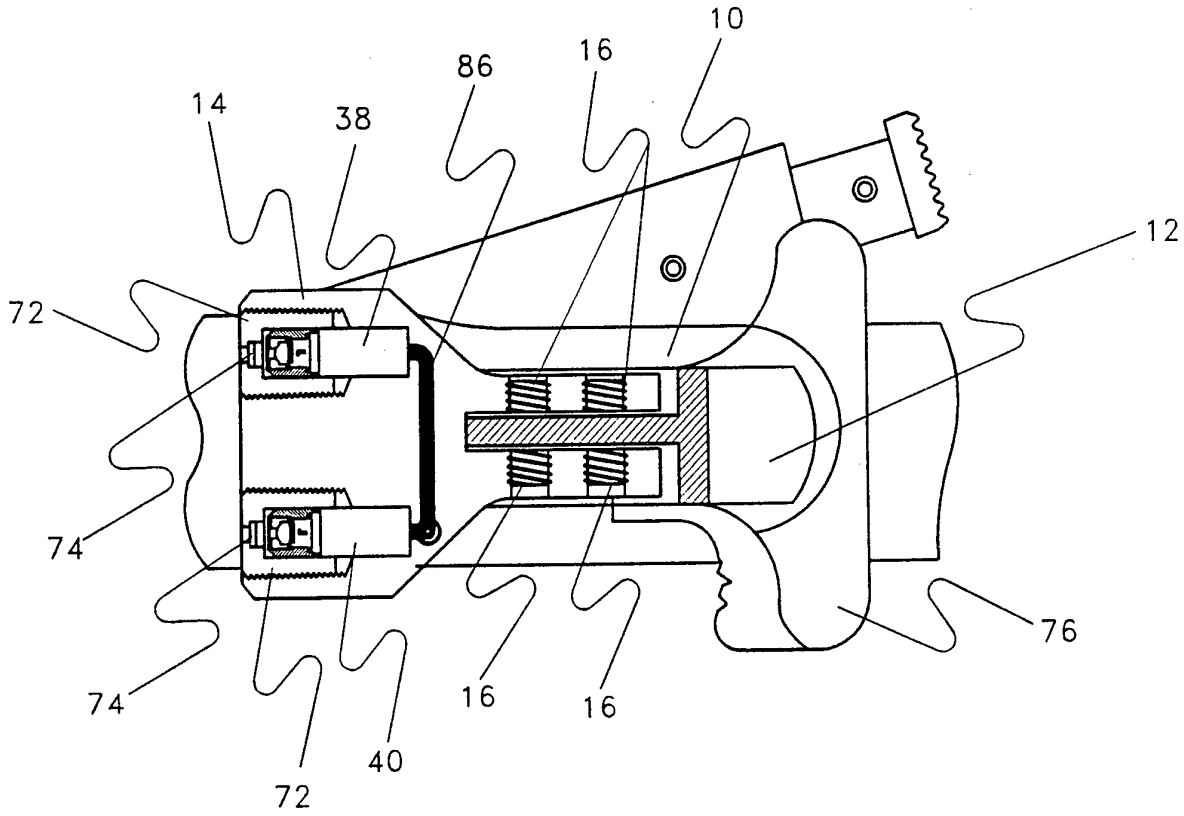

FIG. 9

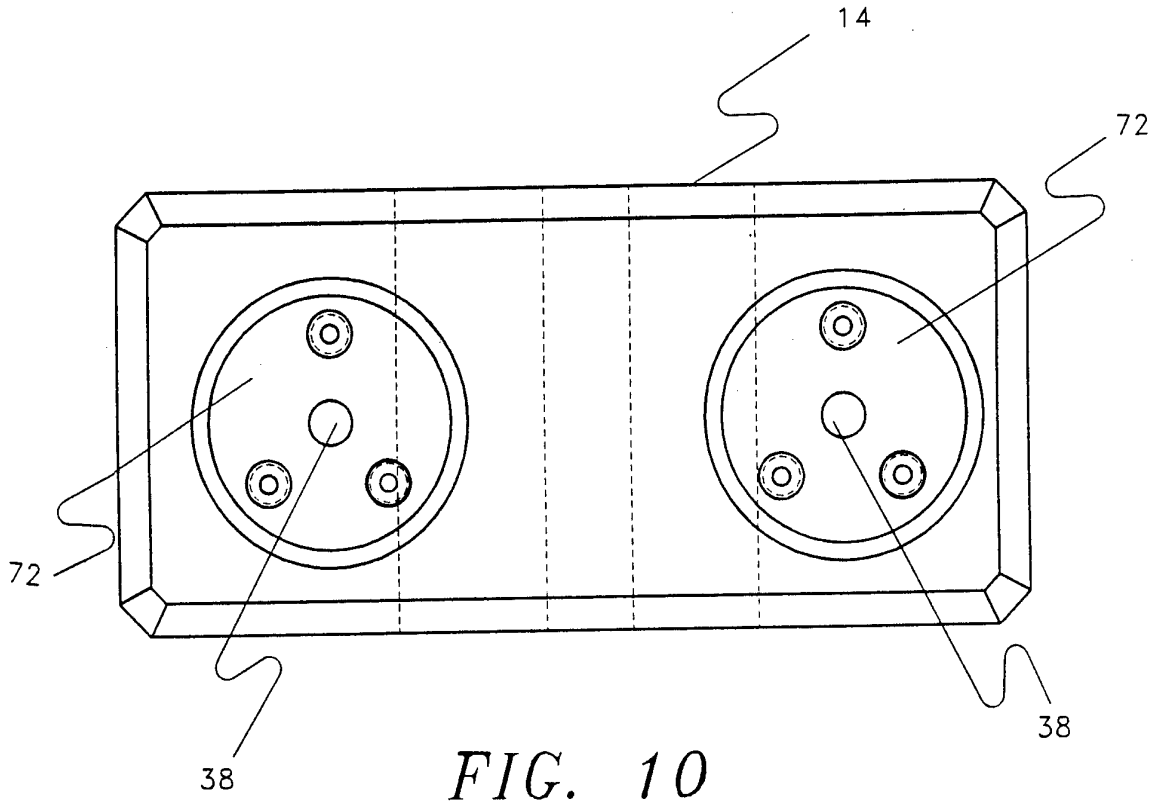

FIG. 10

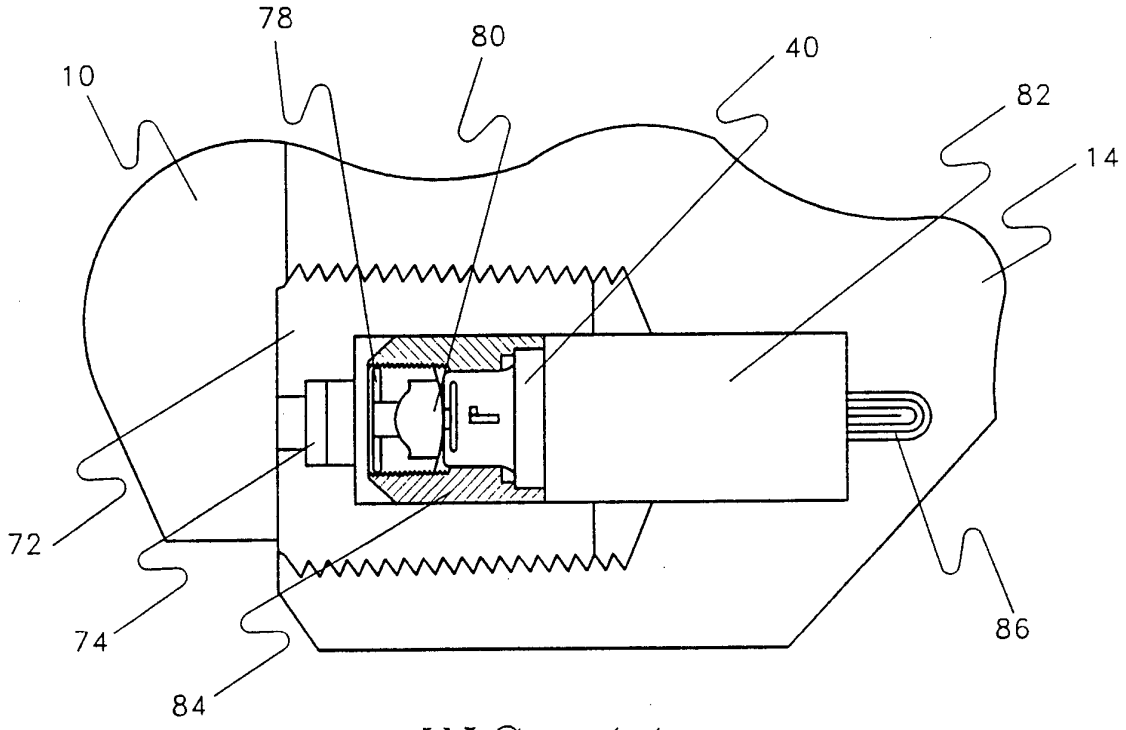

FIG. 11

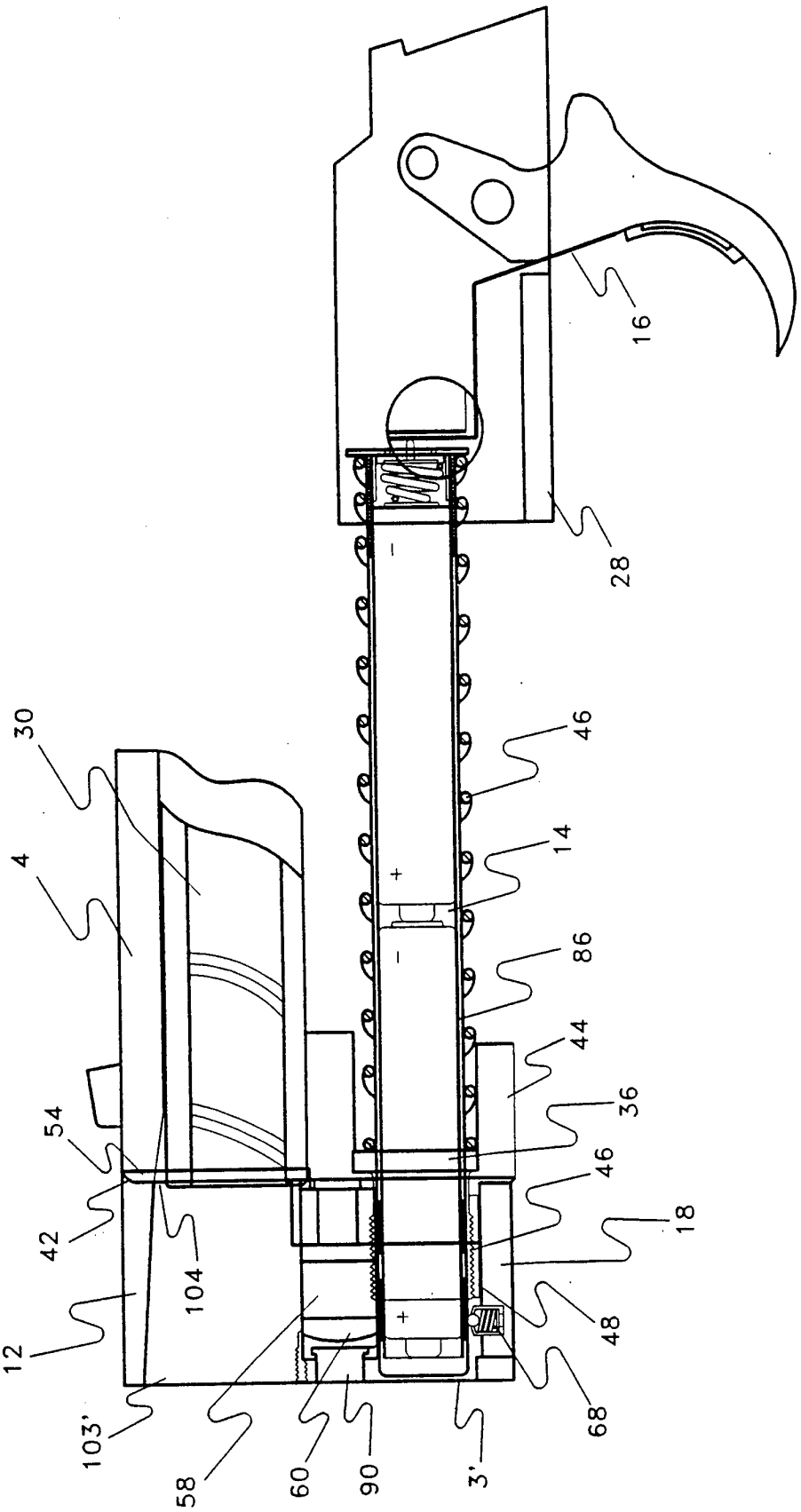

FIG. 12

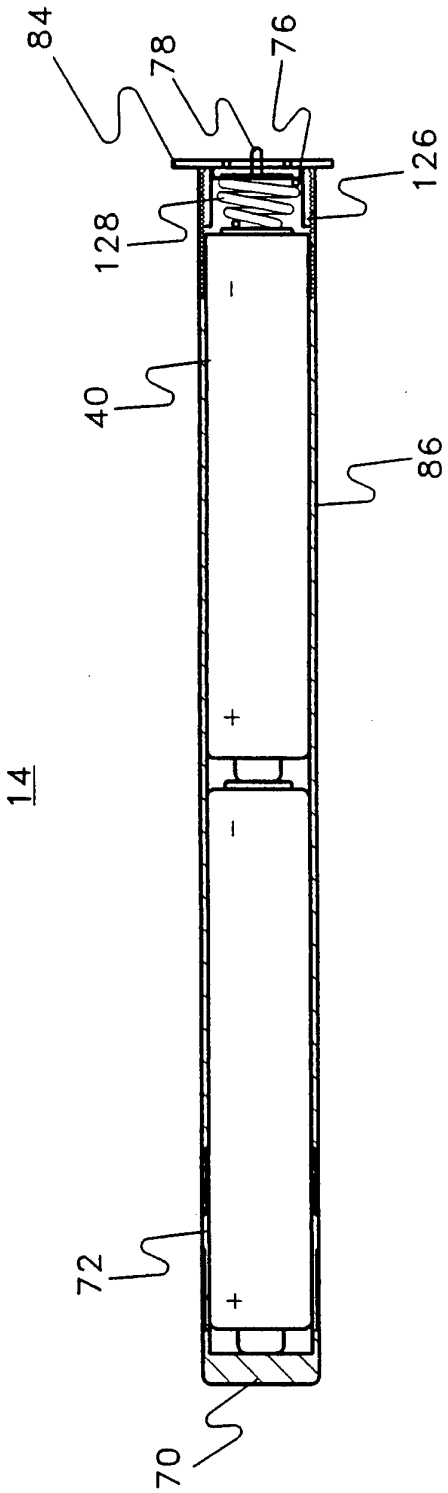

FIG. 12A

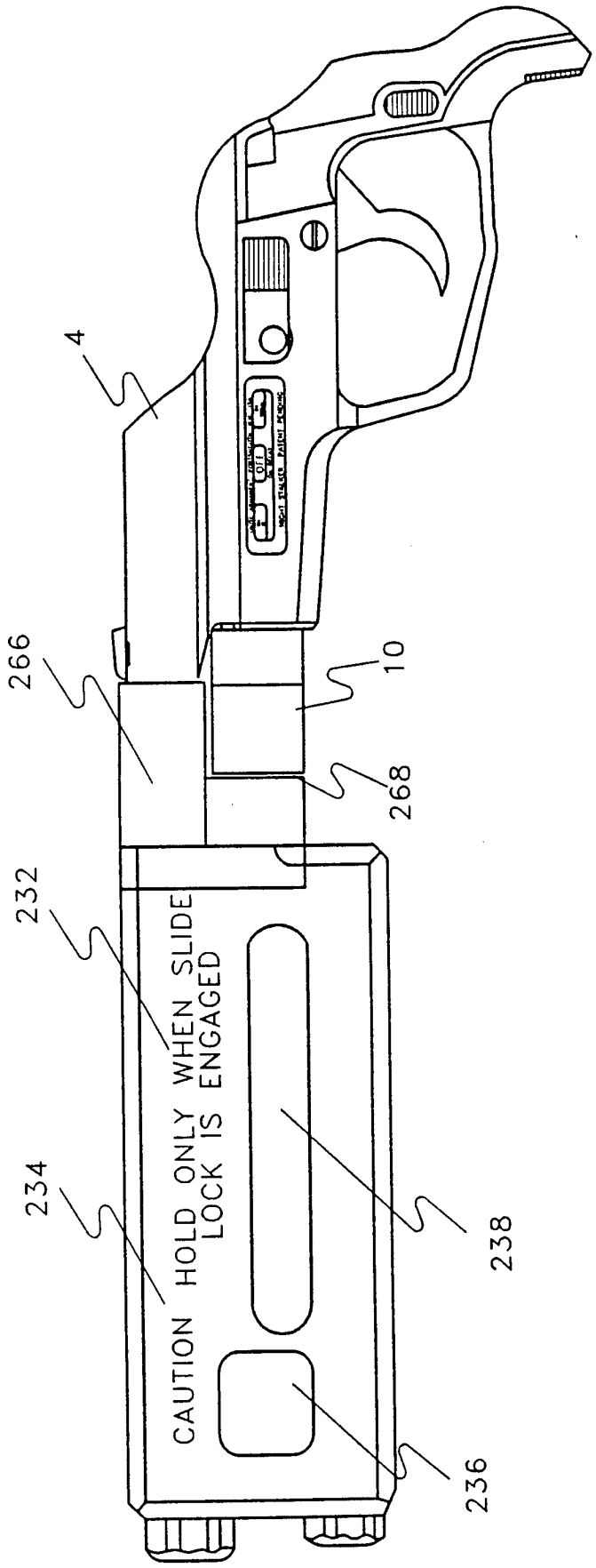
4
266
10
268
232
CAUTION HOLD ONLY WHEN SLIDE LOCK IS ENGAGED
234
238
236

FIG. 13

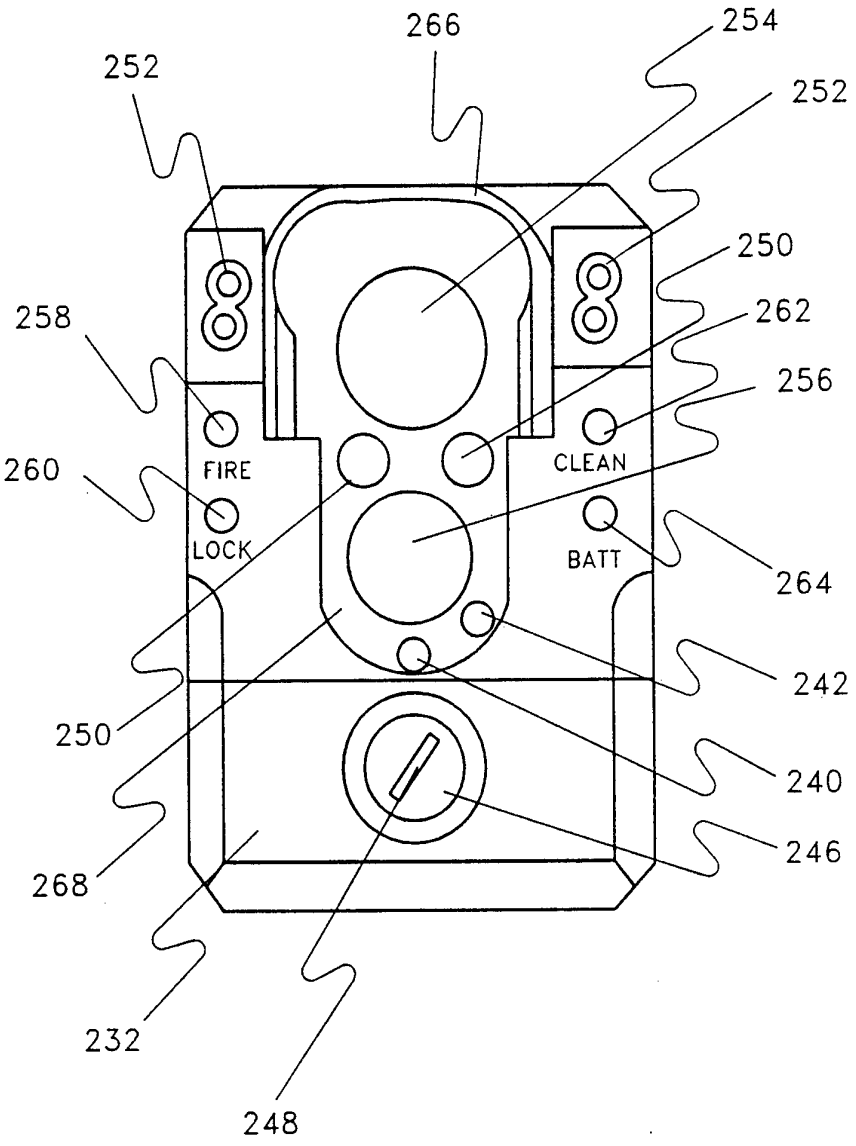

FIG. 14

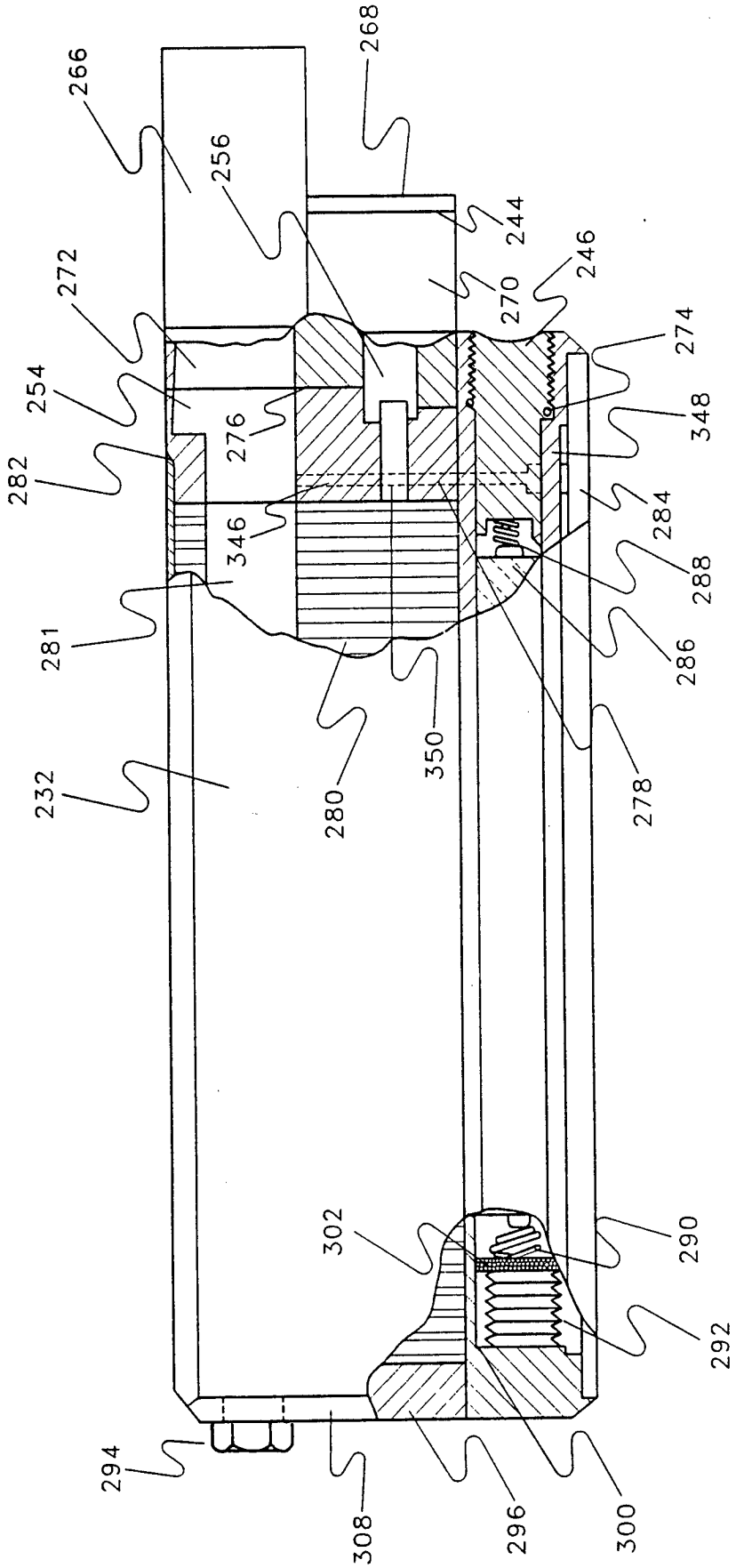
266
268
256
244
246
272
270
274
254
348
276
282
284
346
288
281
286
350
232
280
278
302
290
292
294
308
296
300

FIG. 15

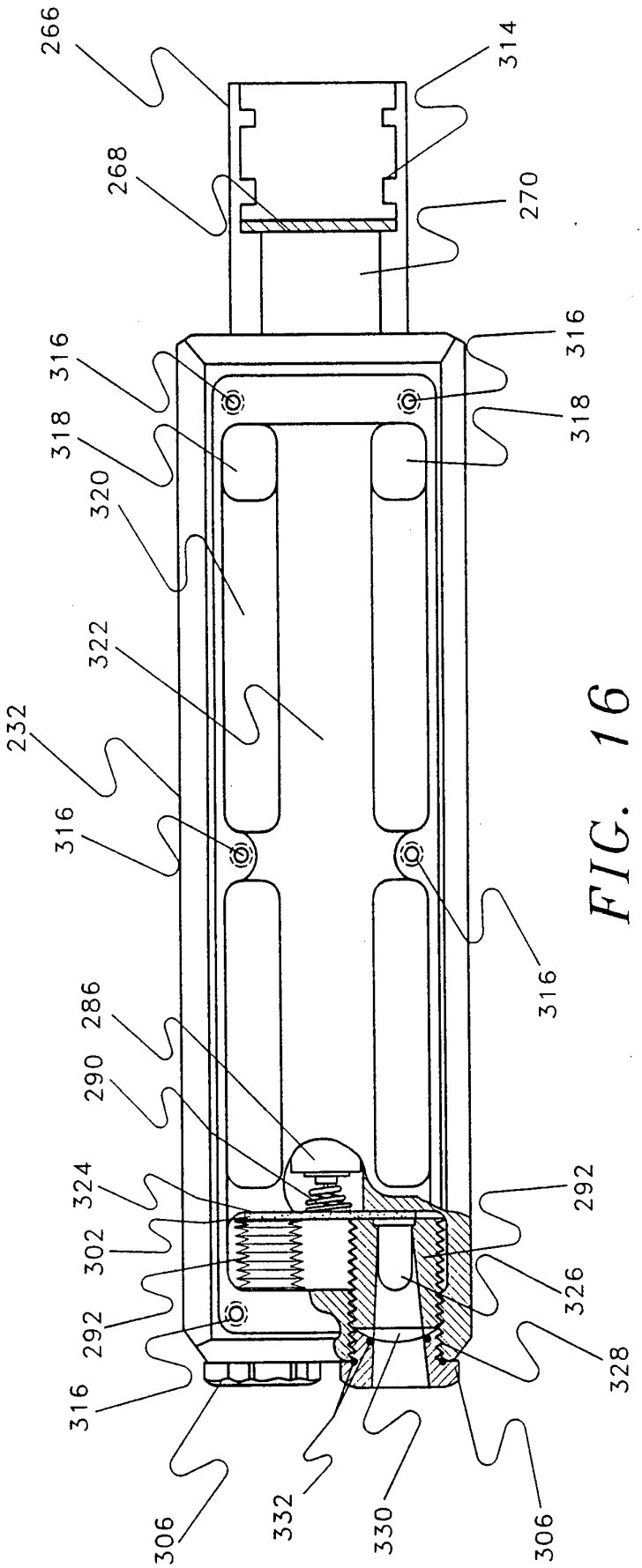

FIG. 16

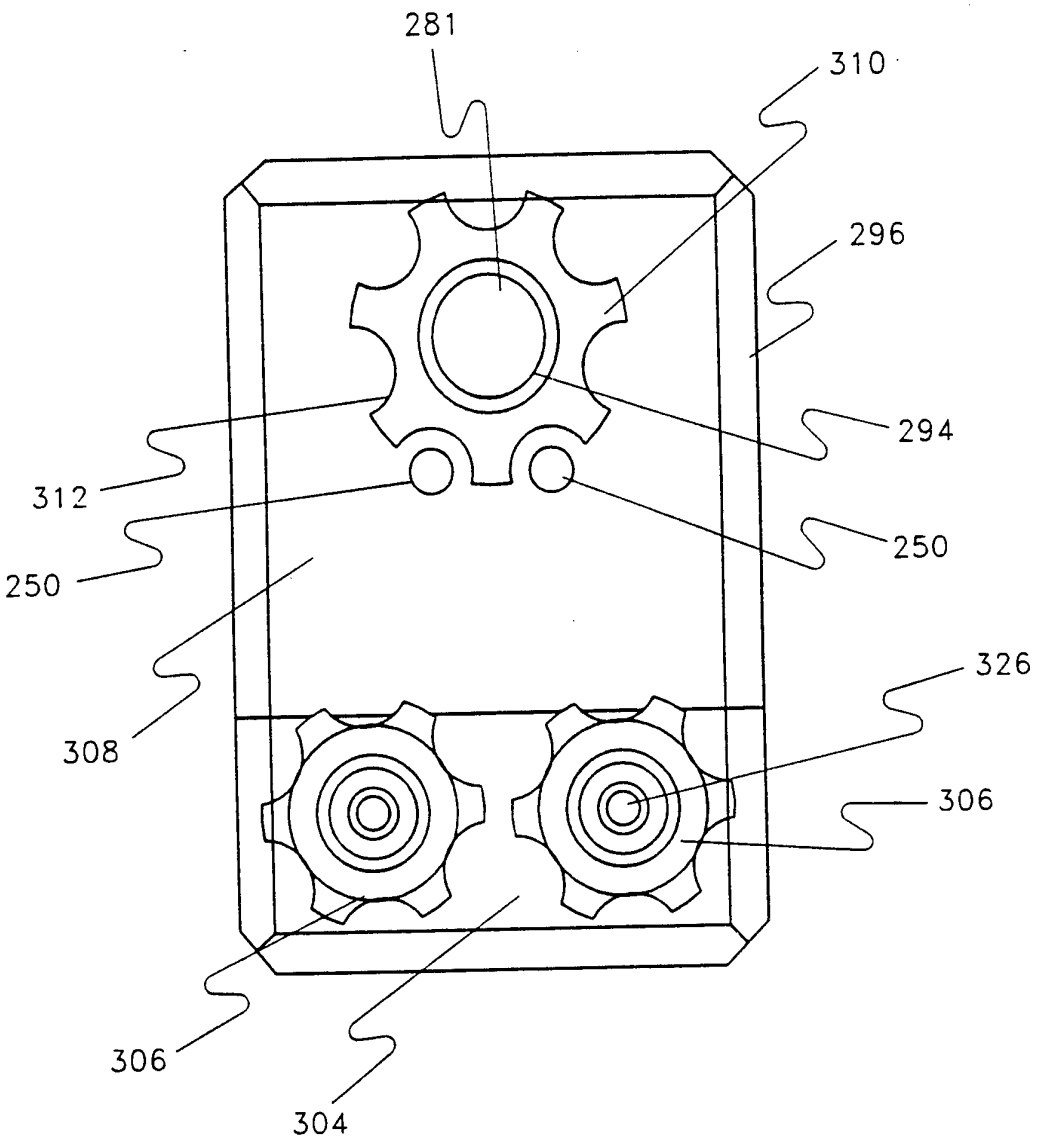

FIG. 17

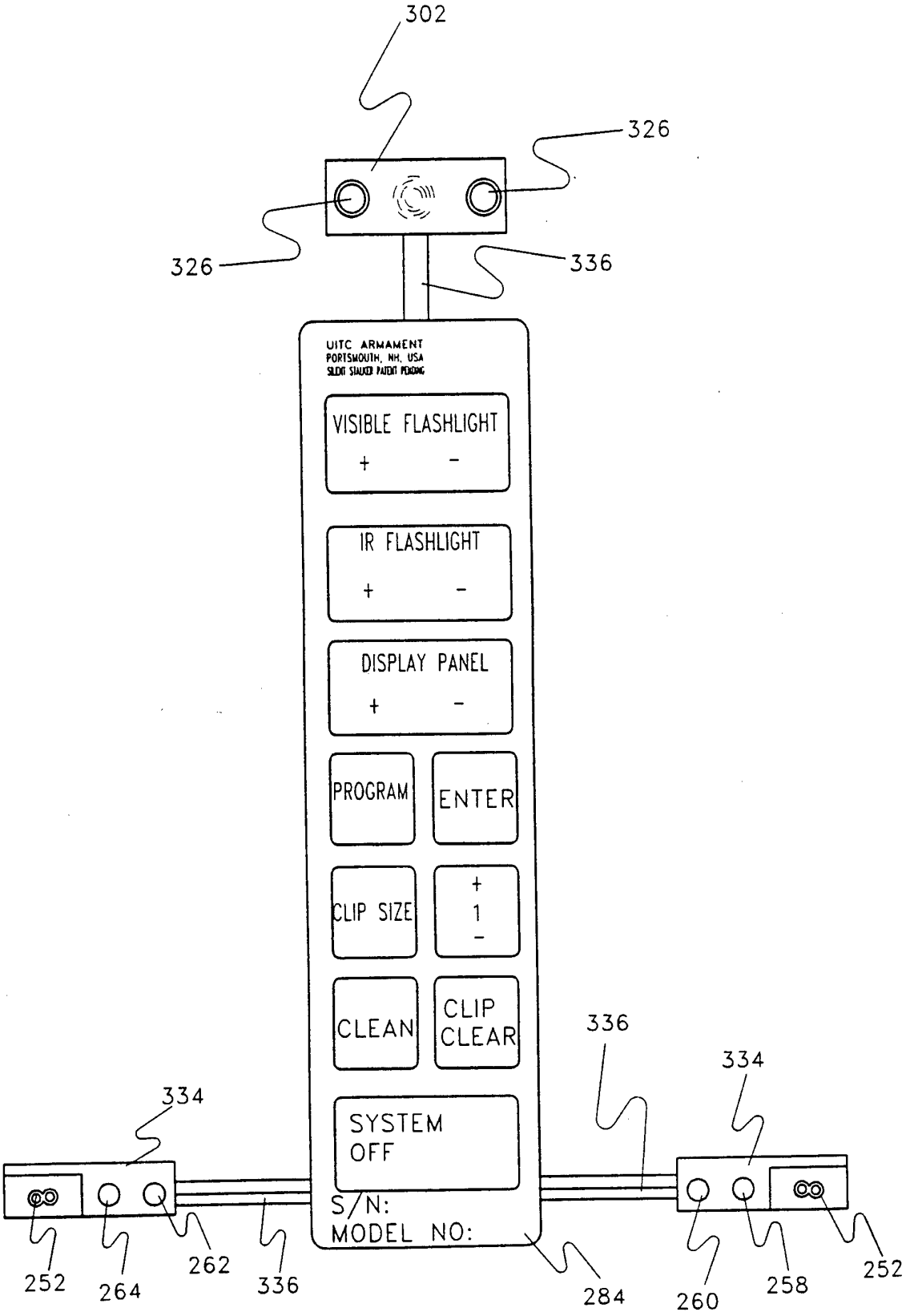
302
326
326
336
UITC ARMAMENT
PORTSMOUTH, NH, USA
VISIBLE FLASHLIGHT
+ -
IR FLASHLIGHT
+ -
DISPLAY PANEL
+ -
PROGRAM
ENTER
CLIP SIZE
+
1
-
CLEAN
CLIP CLEAR
SYSTEM OFF
S/N:
MODEL NO:
334
336
334
252
264
262
336
284
260
258
252

FIG. 18

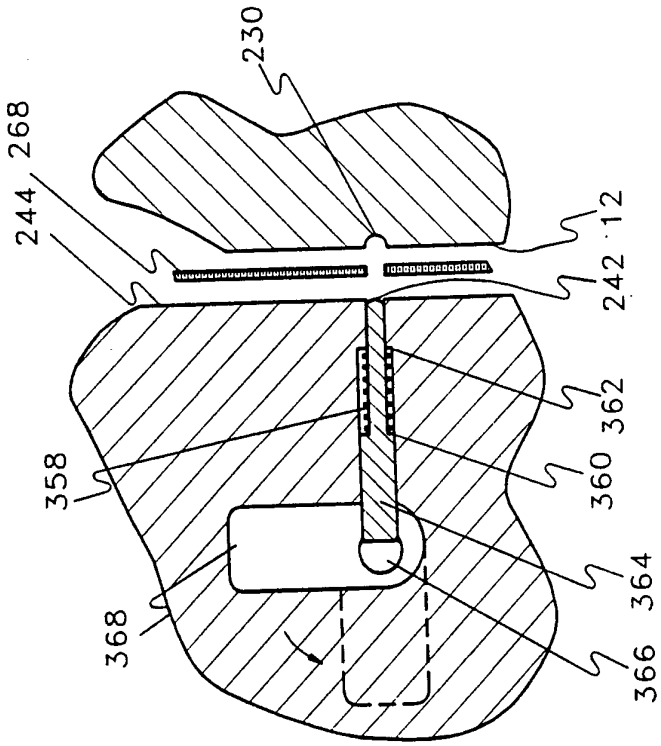

FIG. 20

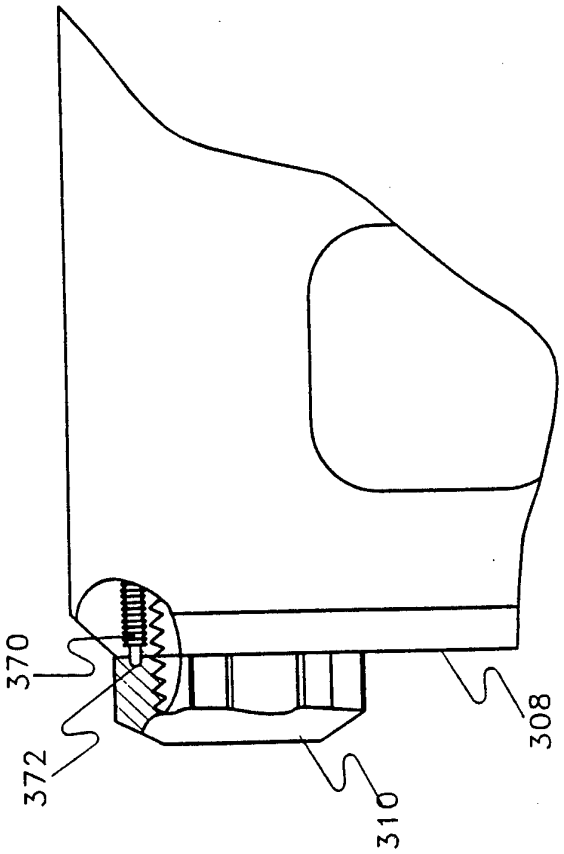

FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/06482

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :Please See Extra Sheet.
US CL :42/103; 362/114
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)

U.S. : 42/103; 362/110, 113, 114

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,179,235 (TOOLE) 12 JANUARY 1993. See entire document	1-10 and 21
Y	US, A, 794,924 (CAILLIEZ) 18 JULY 1905. See entire document	1-3 and 5-10
A	US, A, 894,306 (WRIGHT) 28 JULY 1908. See entire document	1-21
Y	US, A, 1,083,073 (FERGUSON ET AL.) 30 December 1913. See entire document	1-3 and 5-10
Y	US, A, 1,615,409 (SELDEN ET AL.) 25 January 1927. See entire document	1-3 and 5-10
Y	FR, A, 977,351 (Ben-Ayad) 30 March 1951. See entire document	1-3 and 5-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 15 SEPTEMBER 1994	Date of mailing of the international search report NOV 02 1994
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer STEPHEN M. JOHNSON Telephone No. (703) 308-0461

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/06482

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (5):

F41G 1/36