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Kim

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(54) **SWITCHES FOR ELECTRICAL ACCESSORIES**

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Related U.S. Application Data

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(51) **Int. Cl.**
H01H 9/00 (2006.01)

(52) **U.S. Cl.** ..... **200/18**; 200/51 LM; 200/51.12; 200/51 R

(58) **Field of Classification Search** ..... 42/114, 42/117, 148; 200/1 R, 5 R, 17 R, 18, 52 R, 200/511, 512, 51 LM, 51 R, 51.12, 517, 200/330, 331, 334
See application file for complete search history.

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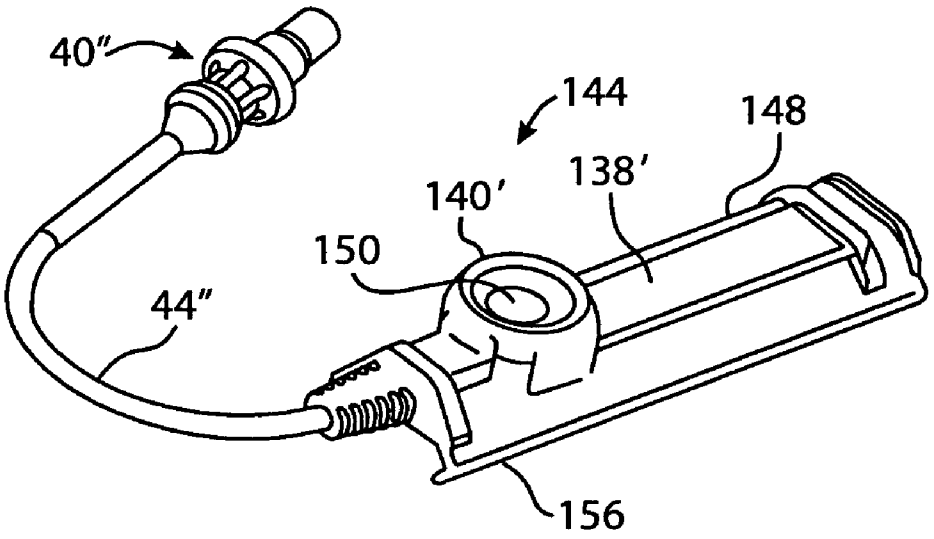
(74) *Attorney, Agent, or Firm*—David Weiss

(57) **ABSTRACT**

A tail cap assembly for a light beam generator includes a jack, while a remote dual switch connected by a cable to a plug is removably connectable to the tail cap jack. The remote dual switch preferably includes a momentary tape switch and a pushbutton actuable CONSTANT ON/OFF switch in a resilient housing that is removably securable to a rail of a rail mount structure secured to a firearm or other gun.

21 Claims, 5 Drawing Sheets



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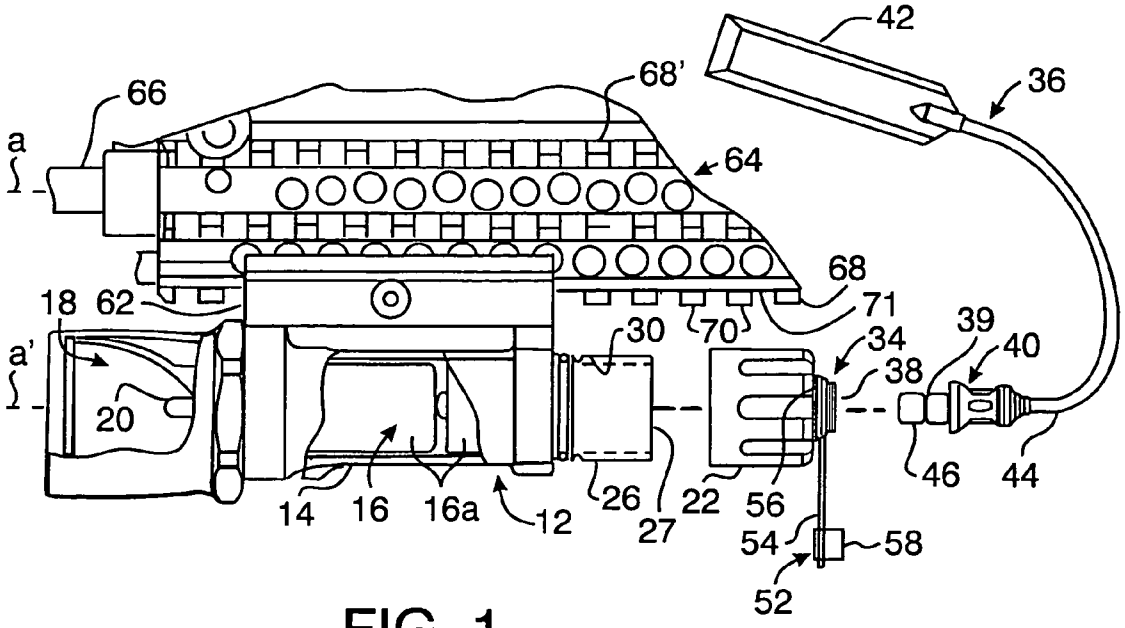


FIG. 1

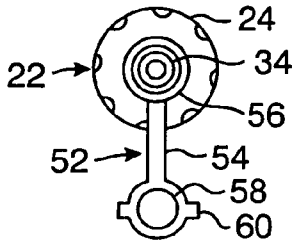


FIG. 2

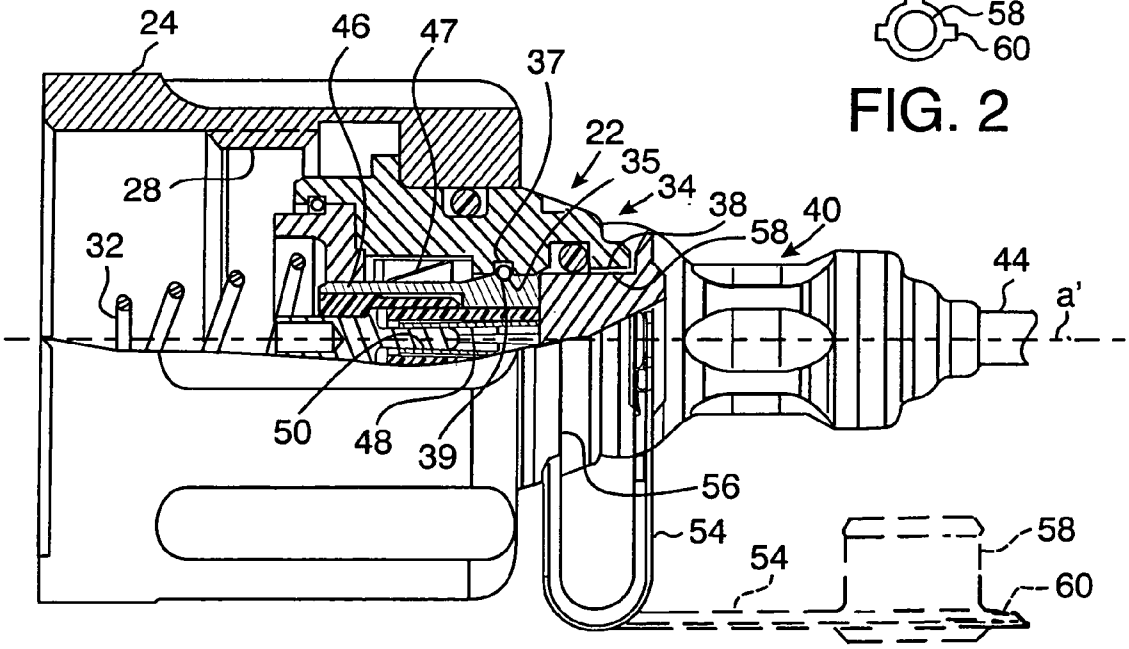


FIG. 3

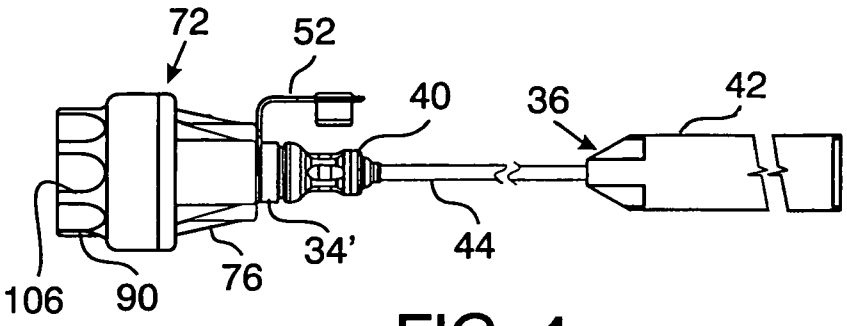


FIG. 4

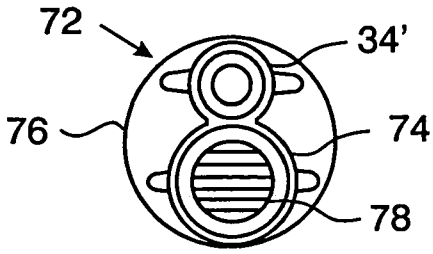


FIG. 5

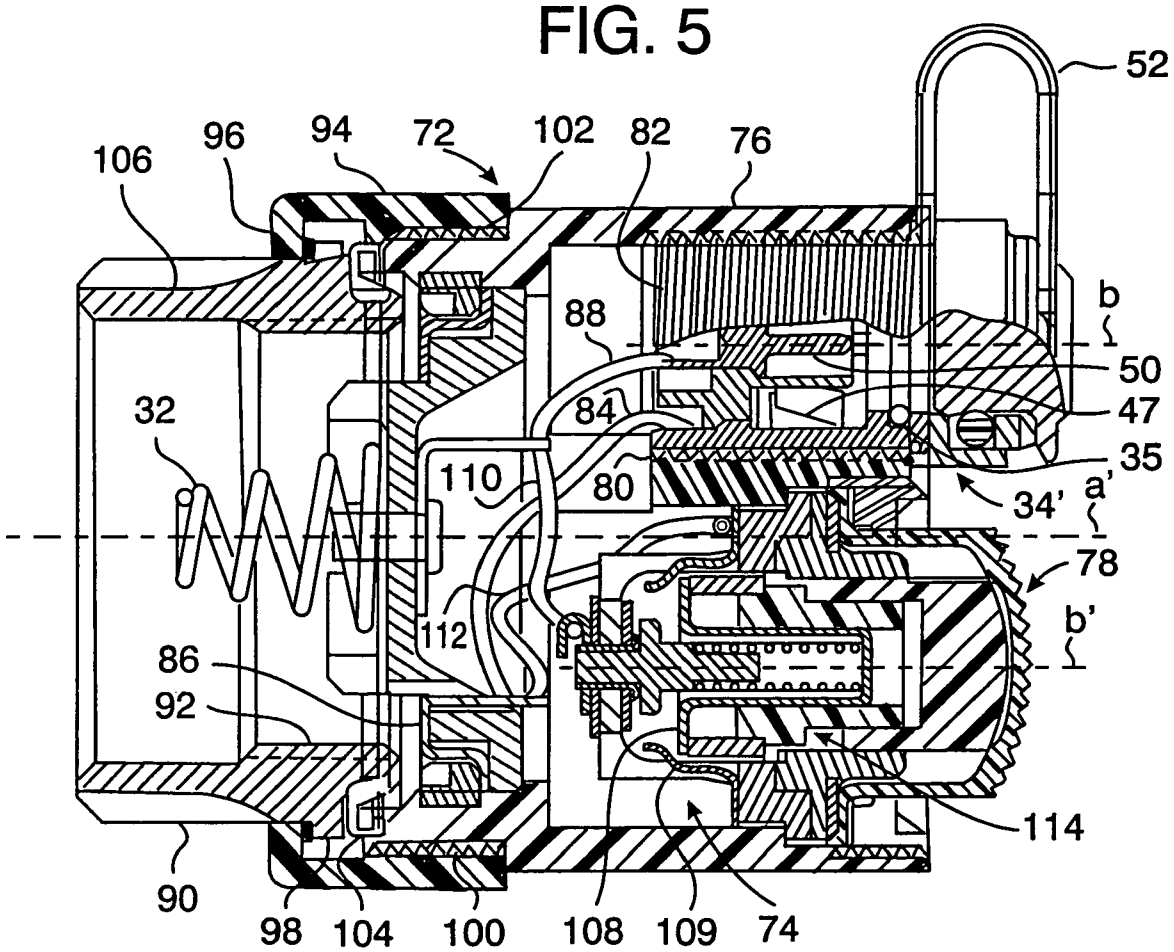


FIG. 6

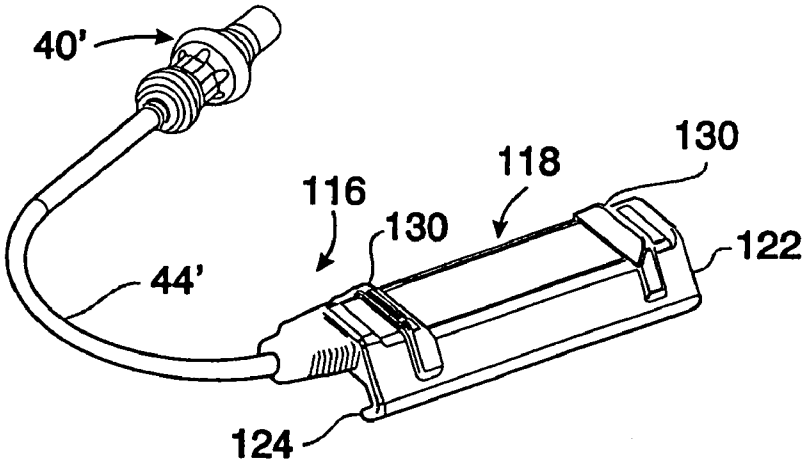


FIG. 7

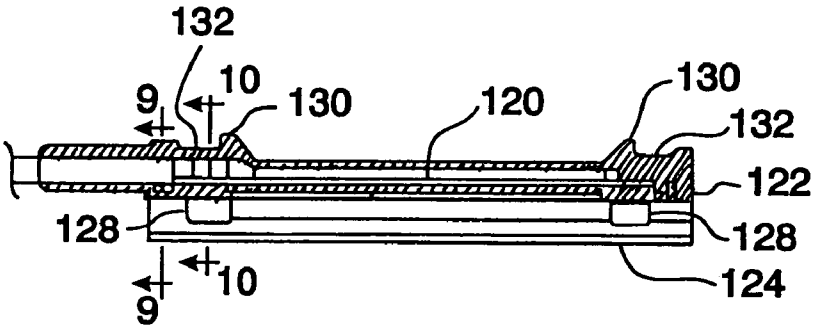


FIG. 8

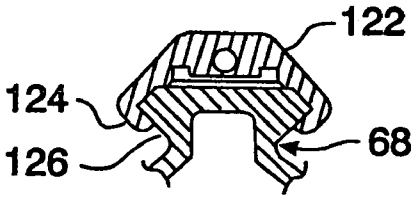


FIG. 9

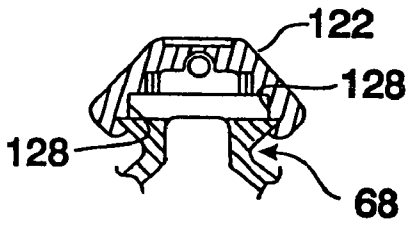
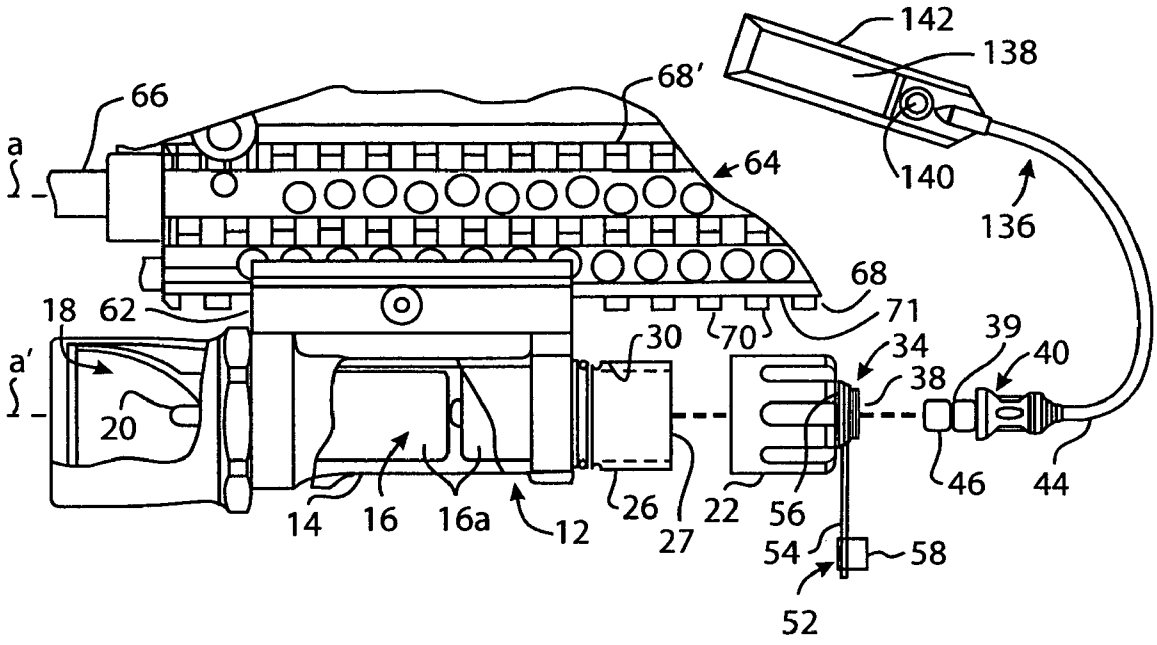


FIG. 10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138
68'
66
64
140
136
a
68
18
62
71
30
70
39
34
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a'
38
20
46
44
14
16
16a
12
26
27
22
56
54
58
52

FIG. 11

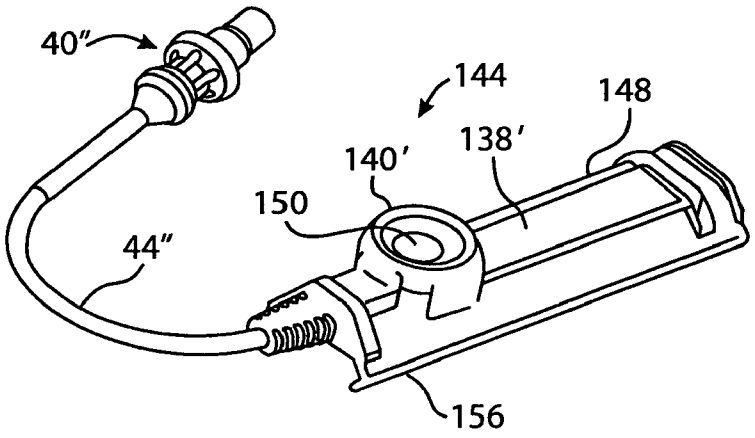
40"
144
148
138'
140'
150
44"
156

FIG. 12

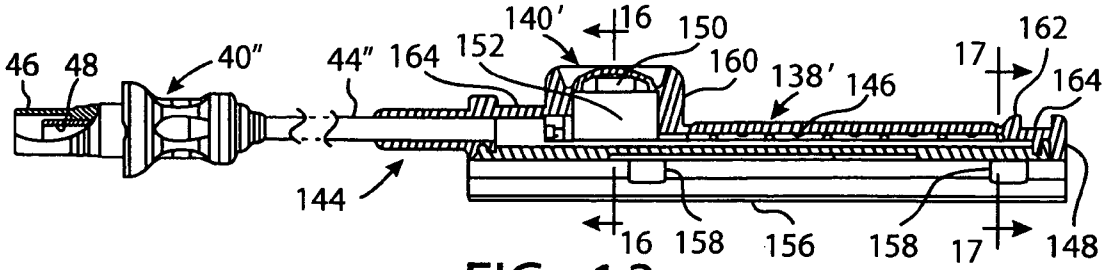

FIG. 13

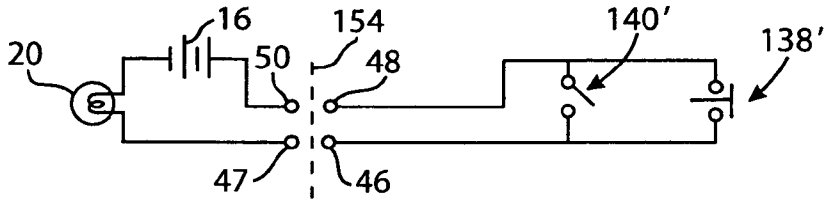

FIG. 14

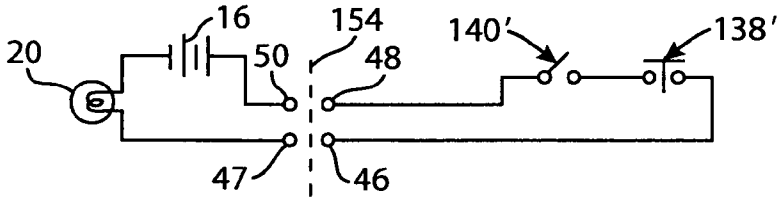

FIG. 15

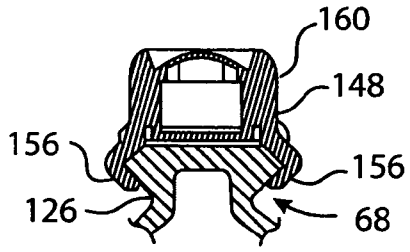

FIG. 16

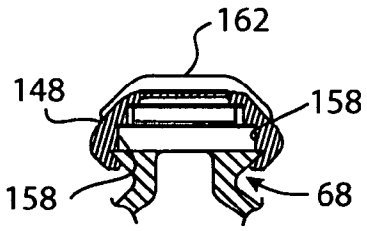

FIG. 17

SWITCHES FOR ELECTRICAL ACCESSORIES

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 10/835,960 filed Apr. 29, 2004 now U.S. Pat. No. 7,273,292, which application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates to switchable electrical accessory apparatus including light beam generator apparatus for firearms and other guns, and more particularly to removably securable switching devices for such apparatus.

Switchable electrical accessory apparatus including light beam generators, such as flashlights and laser aiming devices, have been adapted for being secured to firearms and other guns as target illuminators and laser sights. Such light beam generators are mounted to the firearm such that the generated light beam is parallel and preferably close to the longitudinal axis of the firearm's barrel.

Such accessories including light beam generators are conventionally equipped with a mounting device for releasably securing the accessory to a rail mount structure secured to the firearm. Such accessory mounts and rail structures may include rail interface systems well known in the art pertaining to firearms, and in particular with respect to submachine guns, carbines, rifles, shotguns and other firearms including handguns used for military and law enforcement operations.

Various types of switch apparatus are known for firearm-mounted light beam generators, including pushbutton actuated tail cap switches with CONSTANT ON and MOMENTARY ON capabilities, and pressure actuable MOMENTARY ON tape switches. Different tactical situations and operator personal preferences often direct the selection of particular switch types.

SUMMARY OF THE INVENTION

The present invention provides switch devices for electrical accessory apparatus for firearms or other guns, including light beam generator apparatus mountable to firearms including rail mount structures secured to firearms. According to a preferred embodiment of the present invention, a removably securable tail cap assembly for a light beam generator includes a jack, while a remote switch connected by a cable to a plug is removably connectable to the tail cap jack.

Another preferred embodiment of the tail cap assembly includes a pushbutton switch in addition to the jack for the remote switch. In a preferred embodiment of a remote switch for use with an electrical accessory, a tape switch is contained in a flexible housing that is removably securable to a rail of a rail mount structure secured to a firearm or other gun.

According to one aspect of the present invention, there is provided a light beam generator apparatus comprising in combination: a battery housing; a light emitter assembly carried by the battery housing; a battery carried by the battery housing in circuit for energizing the light emitter assembly when switch actuated; a switch device including a remote switch, a first connector device, and a cable conductively connecting the remote switch to the first connector device; and a tail cap assembly removably secured to the battery housing and including a second connector device complementary to the first connector device for removably connecting the first connector device to the tail cap assembly with the remote switch in circuit with the battery. Preferably, the first connector device comprises a plug and the second connector device comprises a jack, and the remote switch is a momentary tape switch.

According to another aspect of the invention, the tail cap assembly further includes a tail cap switch in circuit with the battery for energizing the light emitter assembly when actuated, the tail cap assembly including an actuator for the tail cap switch. Preferably, the actuator for the tail cap switch comprises a pushbutton actuator, and the tail cap switch is actuable by the pushbutton actuator for placing the tail cap switch in a CONSTANT ON or OFF position, and/or may be actuable for placing the tail cap switch in a MOMENTARY ON position. In a preferred embodiment of such tail cap assembly, the jack and the pushbutton actuator are offset from the tail cap assembly's longitudinal axis, and the tail cap assembly is rotatably urgeable about such axis.

The remote tape switch, for use with any of these tail cap assembly embodiments, may be contained in a preferably flexible or resilient switch housing adapted to be removably secured to a longitudinal rail of a rail mount structure for a firearm.

In accordance with yet another aspect of the present invention, there is provided a switch device for use with an electrical accessory securable to a rail structure, the switch device comprising: a switch; a housing for the switch, such housing including longitudinally extending resilient flanges adapted to engage a longitudinal rail of the rail structure for transversely retaining the housing to the rail. The switch housing preferably includes at least one lug for being received by at least one space between two adjacent transverse ribs of the rail of the rail structure, for longitudinally retaining the housing to the rail.

The remote switch housing is preferably resilient, and the switch preferably comprises a tape switch. Tactile indicia may be provided on the housing for indicating to an operator a pressure actuable portion of the tape switch.

The switch device preferably includes a first connector (such as a plug) adapted for being electrically connected to a complementary second connector (such as a jack) of the electrical accessory; and a cable electrically connecting the switch to the plug.

According to a still further aspect of the invention, there is provided a light beam generator apparatus comprising: a battery housing; a light beam emitter assembly carried by the battery housing; a battery carried by the battery housing in circuit for energizing the light emitter assembly when switch actuated; a remote dual switch device including a switch housing, a momentary switch carried by the switch housing and a second switch (preferably a CONSTANT ON/OFF switch) carried by the switch housing, a first connector device, and a cable conductively coupling the momentary switch and the second switch to the first connector device; and a second connector device carried by the battery housing and complementary to the first connector device for removably connecting the first connector device to the second connector device with the momentary switch and the second switch in circuit with the battery. The light generator apparatus preferably includes a tail cap assembly carried by (preferably removably secured to) the battery housing and including the second connector device.

The CONSTANT ON/OFF switch and the momentary switch may be connected in parallel circuit, in which case

each switch is independently actuable for causing the battery to energize the light emitter assembly. Alternatively, the CONSTANT ON/OFF switch and the momentary switch may be connected in series circuit, in which case the CONSTANT ON/OFF switch operates as an enable/disable switch for the momentary switch.

The momentary switch preferably comprises a tape switch, the second switch preferably comprises a pushbutton actuated CONSTANT ON/OFF switch, and the switch housing preferably is a resilient housing. In a preferred embodiment of the remote dual switch device, the switch housing is adapted to be removably secured to a rail of the rail structure securable to a firearm or other gun.

According to another aspect of the present invention, there is provided a switch device for use with an electrical accessory securable to a rail structure, the switch device comprising: a momentary switch (preferably a tape switch) and a CONSTANT ON/OFF switch (preferably pushbutton actuated); and a housing for the momentary switch and the CONSTANT ON/OFF switch, the housing including resilient members adapted to engage a longitudinal rail of the rail structure for removably retaining the housing to the rail.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed to be characteristic of the present invention, together with further advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which preferred embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention.

FIG. **1** is an exploded side view (partly broken away) of a light beam generator apparatus, specifically a target illuminator or flashlight secured to a fragment of an accessory mount rail structure for a firearm or other gun, including a rear or tail cap assembly and detachable tape switch device according to a preferred embodiment of the present invention;

FIG. **2** is a rear view of the tail cap shown in the FIG. **1**;

FIG. **3** is a side view of the tail cap of FIG. **1**, partly broken away, connected to a preferred configuration of the detachable connector device of the tape switch shown in FIG. **1**;

FIG. **4** is a side view of a second preferred embodiment of a rear or tail cap assembly connected to the detachable tape switch device as in FIG. **1**;

FIG. **5** is a rear view of the tail cap assembly of FIG. **4**;

FIG. **6** is a longitudinal cross-sectional view of the tail cap assembly shown in FIG. **4**;

FIG. **7** is a perspective view of an alternative embodiment of a detachable tape switch device for use with the tail cap assemblies of FIGS. **1-6**, such tape switch device being removably mountable on a rail of a rail structure as in FIG. **1**;

FIG. **8** is a longitudinal cross-sectional view of the rail mountable tape switch device of FIG. **7**;

FIG. **9** is a transverse cross-sectional view of the tape switch housing shown in FIGS. **7** and **8** mounted to a rail of a rail structure as shown in FIG. **1**, the tape switch housing portion of FIG. **9** taken along the line **9-9** of FIG. **8** and viewed in the direction of the appended arrows;

FIG. **10** is a transverse cross-sectional view of the tape switch housing shown in FIGS. **7** and **8** mounted to a rail of a rail structure as shown in FIG. **1**, the tape switch housing portion of FIG. **10** taken along the line **10-10** of FIG. **8** and viewed in the direction of the appended arrows;

FIG. **11** is an exploded side view (partly broken away) of a light beam generator apparatus secured to an accessory mount rail structure for a firearm or other gun similar to FIG. **1** but including an attachable/detachable remote dual switch device according to a further embodiment of the present invention;

FIG. **12** is perspective view of a preferred embodiment of an attachable/detachable remote dual switch device removably mountable to a rail of a rail structure as in FIG. **11**;

FIG. **13** is a longitudinal cross-sectional view of the rail mountable remote dual switch device of FIG. **12**;

FIG. **14** is a schematic diagram illustrating a circuit configuration of the attachable/detachable remote dual switch device of FIGS. **11-13** with a light beam generator as in FIG. **11**;

FIG. **15** is a schematic diagram illustrating another circuit configuration of the attachable/detachable remote dual switch device of FIGS. **11-13** with a light beam generator an in FIG. **11**;

FIG. **16** is a transverse cross-sectional view of the dual switch housing shown in FIGS. **12** and **13** mounted to a rail of a rail structure as shown in FIG. **11**, the dual switch housing portion of FIG. **16** taken along the line **16-16** of FIG. **13** and viewed in the direction of the appended arrows; and

FIG. **17** is transverse cross-sectional view of the dual switch housing shown in FIGS. **12** and **13** mounted to a rail of a rail structure as shown in FIG. **11**, the dual switch housing portion of FIG. **17** taken along the line **17:17** of FIG. **13** and viewed in the direction of the appended arrows.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning to FIGS. **1-3**, there is illustrated an example of a light beam generator **12**, such as a flashlight or target illuminator for a firearm, including a generally cylindrical battery housing **14** in which is contained a power source such as a battery **16** comprising one or more battery cells **16***a* (for example, two three-volt lithium battery cells **16***a*). A light emitter assembly **18** includes a light emitter **20**, such as an incandescent light bulb or a high luminous flux light emitting diode, in electrical circuit with the battery **16**.

A tail cap assembly **22** includes a tail cap **24** which is removably secured to the rear end portion **26** of the battery housing **14**, such as by tail cap internal threads **28** threadably securable to housing rear end portion external threads **30**. When the tail cap assembly **24** is secured to the battery housing **14**, a spring contact **32** included in the tail cap assembly **22** conductively engages the rear terminal of the battery **16**. The battery spring contact **32** is conductively secured to a normally open circuit connector device or jack **34** to which a switch device **36** may be connected for selectively closing the circuit to cause the light emitter **20** of the light emitter assembly **18** to be energized by the battery **16**. The connector device **34** is retained by the tail cap **24** and includes a rear opening **38** for receiving and detachably retaining a complementary connector device or plug **40** of the switch device **36**.

In the preferred embodiment, the jack **34** includes a spring detent **35** in an internally circumferential groove **37**, for entering a circumferential groove **39** in the plug **40** to retain the plug **40** in the jack **34** when the plug **40** is forwardly

pushed into the jack **34** and to release the plug **40** from the jack **34** when the plug **40** is rearwardly pulled from the jack **34**.

The attachable/detachable switch device **36** includes a remote switch **42**, such as a momentary switch preferably provided by a type of switch commonly known as a tape switch. Tape switches are well known in the art, and their construction typically includes spaced electrodes in a flexible enclosure to which pressure may be manually applied by an operator for squeezing the electrodes together thereby bringing them into electrical contact with each other. The electrodes assume their spaced condition when the operator discontinues the application of such pressure. Tape switches used with light beam generator apparatus removably attachable to firearms are described in U.S. Pat. No. 5,654,594 issued to Bernie E. Bjornsen, III, Peter Hauk and John W. Matthews and assigned to the assignee of the present invention, and in U.S. Pat. No. 6,276,088 issued to John W. Matthews and Paul Y. Kim and assigned to the assignee of the present invention, which patents are incorporated herein by reference.

The attachable/detachable switch device **36** includes a preferably flexible cable **44** having two conductors connecting the two electrodes of the tape switch **42** to two conductive contacts of the plug **40**. One of the plug contacts is provided by the outer substantially cylindrical longitudinal conductive sheath **46** which, when inserted through the opening **38** of the jack **34**, completes a conductive path to one electrode terminal of the light emitter; for example, the outer plug contact **46** engages jack spring contact **47** which is conductively coupled to the conductive battery housing **14**, such terminal of the light emitter **20** also being conductively coupled to the battery housing **14**.

The other plug contact is provided by the inner longitudinal conductive sheath **48** in contact engagement with a longitudinal conductive pin **50** of the jack **34**, which pin contact **50** is conductively secured to the battery spring contact **32** which in turn is in contact engagement with the rear terminal of the battery **16**. Since the other terminal of the battery **16** is conductively coupled to the other terminal of the light emitter **20** in conventional manner, the remote switch **42** is in circuit with the battery **16** for energizing the light emitter assembly **18** upon actuation of the remote switch **42** while the plug **40** is connectively inserted to the jack **34**.

It may be appreciated that the detachable/attachable capability of the switch device **136** facilitates field replaceability of damaged tape switches **42** and cables **44**, as well as for connecting different types of remote switches. Further, switch devices may be provided with cables **44** of different lengths, so that an operator may select a switch device **36** with a cable of a particular length as may best suit a particular tactical situation.

The tail cap assembly **22** preferably includes a cover **52** for closing the tail cap's rear opening **38** when the plug **40** is removed from the jack **34**. The cover **52** may be fabricated (such as by molding) of a plastic material, and the preferred embodiment thereof includes a flexible band **54** with a ring **56** at one end secured to the jack **34** and encircling the opening **38**, and with a solid plug or cap **58** at the flexible band's free end configured for friction-fit insertion into the rear opening **38**. It is noted that FIG. **3** shows the cover **52** in solid line representation, with the cover cap **58** installed in the rear opening **38** as if the plug **40** were also inserted in the opening **38**. Of course, in actuality, the cap **58** is not inserted in the opening **38** when the plug **40** is inserted; in actuality, when the plug **40** is inserted in the opening **38**, the cover **52** is as shown by the dotted line representation in FIG. **3** (or as shown in FIGS. **1** and **2**).

The cover **52** may include radial projections or appendages **60** about the cap **58**, which may be manipulated by an operator for removing the cap **58** from the rear opening **38**.

As illustrated in FIG. **1**, the preferred embodiment of the light beam generator **12** is equipped with a mounting device **62** secured to the battery housing **14**, for releasably securing the light beam generator **12** to a rail mount structure **64** secured to a firearm or other gun represented by the gun's barrel **66** having a longitudinal axis a, with the light beam generator's longitudinal axis a' parallel to the barrel axis a.

The mounting device **62** may include a Weaver style or other clamping device for mounting to a rail **68** of the rail structure **64**. Such rail mount structure may be of a type well known in the firearms art for mounting accessories including light beam generators to a firearm. Examples of such rails for accessory mounts are provided by rail interface system devices such as manufactured by Knights Manufacturing Company (of Vero Beach, Fla.), including those disclosed in U.S. Pat. No. 5,826,363 of Douglas D. Olson, as well as those disclosed in U.S. Pat. No. 5,590,484 of Aurelius A. Mooney et al., and those disclosed in U.S. Pat. No. 6,655,069 of Paul Y. Kim, each of which patents are incorporated herein by reference.

One such prior-art rail comprises a series of longitudinally spaced-apart ribs **70** as specified in MIL-STD-1913, commonly known as a Picatinny rail and shown in FIG. **1** as a bottom rail comprising the spaced-apart ribs **70**. Side and top Picatinny rails are commonly included in such rail mount structure **64**; a modified Picatinny side rail **68'** is shown in FIG. **1**, which modified Picatinny rail **68'** is described in the aforementioned Kim Pat. No. 6,655,069.

Turning to FIGS. **4-6**, the tail cap assembly **72** of the second preferred embodiment according to the present invention includes a connector device or jack **68'** corresponding to the connector or jack **68** of FIGS. **1-3**, to which the tape switch **44** of the switch device **36** may be connected via the connector device or plug **40** in the same manner as previously described. In addition, however, the tail cap assembly **72** further includes a second switch **74** secured in the tail cap **76** in circuit with the battery **16** in the battery housing **14**, for energizing the light emitter **20** of the light emitter assembly **18** when actuated. The actuator for the tail cap switch **74** is included in the tail cap assembly **72**, a preferred embodiment of which is a pushbutton actuator **78** carried by the tail cap **76**.

The longitudinal axis b of the jack **34'** and the longitudinal axis b' of the tail cap switch **74** are offset from the longitudinal axis a' along a diameter of the tail cap **76**. The tail cap **76** is preferably fabricated of a non-conductive material, such as a polymer, and includes an internally threaded longitudinal compartment **80** for threadably securing a conductive metal cylindrical shell **82** retaining and securing the jack **34'** to the tail cap **76**. Conductive wire **84** provides a conductive path between the conductive shell **82** and a spring washer contact **86** which is in conductive engagement with the rear end portion **26** of the battery housing **14** when the tail cap assembly **72** is secured to the battery housing. Conductive wire **88** conductively connects the axial pin contact **50** of the jack **34'** to the battery spring contact **32**.

The tail cap assembly **72** includes a conductive sleeve **90** (e.g. fabricated of a metal such as aluminum), including internal threads **92** for threadably securing the sleeve **90** to the externally threaded rear end portion **26** of the battery housing **14** until the battery housing's rear edge **27** contacts the spring contact washer **86**. A ring **94** (preferably of a

polymer material) having an inwardly directed lip **96** is longitudinally retained by a collar **98** extending about the sleeve **90**, the ring **94** including internal threads **100** mating with external threads **102** of the tail cap **76** threadedly securing the ring **94** to the tail cap **76**. Accordingly, the tail cap **76** and ring **94** combination is longitudinally secured to the sleeve **90** and is rotatable with respect to the sleeve **90** (and hence with respect to the battery housing **14**) about the longitudinal axis a'. Resistance to such rotation may be provided by an elastomeric gasket **104** (e.g., of neoprene) retained by the forward edge of the tail cap **76** and contacting the rearward edge of the metal sleeve **90**.

Such resistive rotation of the tail cap **76** with respect to the sleeve **90** secured to the battery housing **14** permits an operator to rotationally adjust the position of the offset pushbutton switch **74** for convenience of use. Such positioning may be conveniently performed after the light beam generator **12** with secured tail cap assembly **72** has been mounted to firearm **66** (FIG. **1**). The operator may simply rotatably urge the ring **94** (secured to the tail cap **76**) with one hand, while with the other hand holding the sleeve **90** against rotation utilizing the finger grips **106** as convenient.

Tail cap switches of the pushbutton type are well known in the flashlight art, any of which pushbutton switches may be utilized in the tail cap assembly **72** of the present invention. An example of such a pushbutton switch is described in U.S. Pat. No. 5,642,932 of John W. Matthews, which patent is incorporated herein by reference. Another example of a pushbutton switch is of a CONSTANT ON/OFF type where one depression of the pushbutton **78** completes and maintains the circuit for causing the battery **16** to energize the light emitter **20**, and a succeeding depression of the pushbutton **78** opens the circuit such that the lamp **20** is no longer energized by the battery **16**. The pushbutton switch may also include a MOMENTARY ON position, where a partial depression of the pushbutton **78** causes the circuit to be completed for energizing the light emitter **20** for as long such partial depression is maintained.

As illustrated in FIG. **6**, depression of the pushbutton **78** causes the plunger contact **108**, which is conductively coupled to the battery spring contact **32** (via conductive wire **110**), to conductively engage spring contact **109** which is conductively coupled to the spring washer contact **86** (via conductive wire **112**). Since the spring washer contact **86** is conductively coupled to the conductive battery housing **14** when the tail cap assembly **72** is secured to the battery housing **14**, the circuit is thereby completed for energizing the light emitter **20** by the battery **16**. Plunger camming arrangements on the plunger device **114**, of the type shown in the pushbutton switch arrangement disclosed in U.S. Pat. No. 4,319,106 issued to Ralph T. Armitage, which patent is incorporated herein by reference, may be utilized for effecting the CONSTANT ON and OFF switch positions when the pushbutton **78** is fully depressed, and the MOMENTARY ON position when the pushbutton **78** is partially depressed.

FIGS. **7-10** illustrate a second preferred embodiment of an attachable/detachable remote switch device **116**, for use with the tail cap assemblies **22** and **72** of FIGS. **1-6**. In the switch device **116**, the pressure actuable tape switch **118** includes squeezable-together tape switch electrodes **120** enclosed within a flexible housing **122** adapted for being attached to and detached from a rail **68** or **68'** of a rail mount structure **64** secured to a firearm **66** as represented in FIG. **1**.

The remote switch connector or plug **40'** is preferably identical or similar to the remote switch connector or plug **40** shown in FIGS. **1** and **3** and previously described. The cable **44'**, which may be identical or similar to the cable **44** of FIG. **1**, conductively couples the plug contacts **46**, **48** (FIG. **3**) of the plug **40'** to the tape switch electrodes **120** situated within the flexible housing **122**.

The tape switch housing **122**, which is preferably fabricated (such as by molding) of an elastomeric material such as neoprene, is configured to transversely extend across at least two and preferably seven of the longitudinally spaced-apart ribs **70** of the rail **68** (or **68'**) while resiliently grasping such rail along its longitudinal dimension. For example, in the preferred embodiment shown in FIGS. **7-10**, the tape switch housing **122** includes inwardly inclined resilient flanges **124** longitudinally extending along the two respective sides of the housing **122**, for grasping the inwardly inclined longitudinal surfaces **126** of the rail **68**, thereby transversely retaining the tape switch housing **122** to the rail **68**.

The tape switch housing **122** is further configured with at least one transverse protrusion or lug **128**, preferably resilient, for being received by at least one space **71** between adjacent ribs **70** (see FIGS. **1** and **10**). In the preferred tape switch housing **122**, there are provided two such lugs **128** inwardly extending from each longitudinal side of the housing **122**, preferably longitudinally spaced apart so as to be situated near the front and rear ends thereof (FIG. **8**).

The tape switch housing **122** may include tactile indicia indicating the pressure actuable portion of the tape switch **118**, such as raised transverse boundaries or bars **130** longitudinally separated by the active or pressure sensitive length of the tape switch electrodes **120**, for indicating to an operator the proper place to which pressure should be applied for operating the momentary tape switch **118**. The housing **122** may also be provided with transverse grooves **132** in the vicinity of the housing's front and rear ends, for facilitating the application of flexible ties to further secure the tape switch **118** to the rail structure **64** or to another object if desired.

It may be appreciated that the rail attachable/detachable momentary tape switch **118** of the present invention may be removably secured to any one of the rails of an accessory mount rail structure as may be convenient to the operator, as well as at any place along such rail as may be convenient; for example, the tape switch **118** may be removably installed anywhere along a bottom rail, a side rail or a top rail of a rail structure such as rail structure **64**. Further, the rail attachable/detachable tape switch **118** may be removably secured to the same rail to which a switchable electrical accessory (such as the light beam generator **12**) is secured, or the switch **118** may be attached to a rail other than the rail to which the accessory or light beam generator is secured.

The tape switch **118** may be secured to a rail by placing the switch housing **120** to the rail with one of the longitudinally extending resilient flanges **124** in contact with one of the inclined longitudinal surfaces **126** of the rail and with the lugs **128** along such secured flange **124** situated in corresponding spaces **71**. The operator then pivots the tape switch housing **122** across the rail while outwardly urging the other resilient flange **124** and then releasing such other resilient flange **124** for permitting the flanges **124** to grasp the other rail surface **126**. The secured tape switch **118** may be removed from the rail by outwardly urging one of the resilient flanges **124** away from its engaged rail surface **126** until such flange **124** is disengaged from such surface **126**, and then withdrawing the switch housing **122** from the rail.

Turning to FIG. **11**, there is illustrated a dual switch embodiment of an attachable/detachable remote switch device **136** for the light beam generator **12** mounted to the

rail structure shown in FIG. **11** and described above with respect to FIG. **1**. The attachable/detachable remote dual switch device **136** includes a first remote switch **138** and a second remote switch **140** carried by a housing **142**. The first remote switch **138** is preferably a momentary switch such as a tape switch comprising spaced electrodes within the flexible housing **142** to which pressure may be manually applied by an operator for squeezing the electrodes together thereby bringing them into electrical contact with each other, the electrodes resuming their spaced condition when the operator discontinues the application of such pressure. The second remote switch **142** is preferably of a type having at least two manually actuable positions, with one position for closing and maintaining a closed circuit condition and a second position for opening and maintaining an open circuit condition. The second switch is preferably a pushbutton switch, although other types of switches such as a toggle switch or a rocker switch may also be utilized.

Similarly to the remote switch device **36** of FIG. **1**, the remote dual switch device **136** of FIG. **11** includes a connector or plug **40** for mating with the light beam generator's tail cap connector or jack **34**, as well as a flexible cable **44** conductively connecting the plug contacts to the first and second remote switches **138**, **140**. The preferred manner in which these switches **138**, **140** are connected in circuit, as well as their operation and additional features thereof, are similar to the circuitry and operation of the switches **138'**, **140'** described below in connection with FIGS. **12-15**.

FIGS. **12-17** illustrate a second preferred embodiment of an attachable/detachable remote dual switch device **144**, for attachment to the light beam generator jack **34** or **34'** shown in FIGS. **1-6** and **11**. In the dual switch device **144**, the pressure actuable tape switch **138'** includes squeezable-together tape switch electrodes **146** (FIG. **13**) enclosed within a flexible or resilient housing **148**, and the second remote switch **140'** is carried by and preferably enclosed within the resilient housing **148**, with the resilient housing **148** adapted for being attached to and detached from a rail **68** or **68'** of a rail mount structure secured to a firearm or gun **66** as represented in FIG. **11**.

The remote dual switch connector or plug **40"** is preferably identical or similar to the remote switch connector or plug **40** or **40'** shown in FIGS. **1**, **3** and **11** and previously described. The cable **44"**, which may be identical or similar to the cable **44** or **44'** of FIGS. **1**, **7** and **11**, conductively couples the plug contacts **46**, **48** (FIGS. **3** and **13**) of the plug **40"** to the first and second remote switches **138'** and **140'**.

The second remote switch **140'** is preferably of the push-push type, where a full depression of the pushbutton **150** from a switch OFF position (i.e., an open circuit condition) causes the switch **140'** to be placed in a switch ON position (i.e., a closed circuit condition) which is maintained after the pushbutton **150** is released (i.e., the switch **140'** is in a CONSTANT-ON position), and where the next full depression and release of the pushbutton **150** releases the switch **140'** to its OFF position (i.e., its open circuit condition). Such switches conventionally have a tactile feel and produce a "click" when the pushbutton is depressed to its full travel, i.e. when placing the switch **140'** to its CONSTANT ON position from its OFF position and alternatively when placing the switch **140'** to its OFF position from its CONSTANT ON position.

The pushbutton switch **140'** is carried by and preferably secured within the resilient housing **148**, and includes a pushbutton actuated plunger slidably held by a switch body secured to the housing **148**, and a rotor in cooperative engagement with the pushbutton plunger and a spring. The switch body, the pushbutton actuable plunger and the rotor include a series of interacting teeth, ribs and slots for producing the click-ON/click-OFF operation when the pushbutton **150** is fully depressed. Such click-ON/click-OFF pushbutton switches are well known in the art, examples of which are shown and described in U.S. Pat. Nos. 4,230,921; 4,319,106; 4,463,231; 4,506,124; and 4,733,337; the disclosures of each of which patents are incorporated herein by reference.

The two remote switches **138'** and **140'** may be electrically coupled in parallel circuit as shown in FIG. **14**, or in series circuit as shown in FIG. **15**. In the circuit diagrams of FIGS. **14** and **15**, the elements to the right of the imaginary line **154** are carried by the remote dual switch device **144** (or **136**), while the elements to the left of the imaginary line **154** comprise the light beam generator elements including the light emitter **20**, the battery **16** and the jack represented by the jack contacts **47** and **50** (see also FIGS. **1** and **3**). When the plug **40"** is mechanically secured to the jack **34** or **34'**, the plug contact **46** is in electrical contact with the jack contact **47**, and the plug contact **48** is in electrical contact with the jack contact **50**, so that the two remote switches **138'**, **140'** are in electrical circuit with the battery **16** and light emitter **20**.

When the two remote switches **138'**, **140'** are in parallel circuit as shown in FIG. **14** while the CONSTANT ON/OFF pushbutton switch **140'** is in its OFF position (i.e. its open circuit condition), an operator's actuation of the tape switch **138'** causes momentary energization of the light emitter **20** by the battery **16**, i.e. the light emitter **20** is illuminated for only as long as the operator continues applying pressure to the tape switch **138'**. When the operator actuates the CONSTANT ON/OFF pushbutton switch **140'** by fully depressing the pushbutton **150** to the pushbutton switch's ON position (i.e. its closed circuit condition), the circuit is completed for energizing the light emitter **20** by the battery **16**. Such energization of the light emitter **20** continues until the operator again depresses the pushbutton **150** of the pushbutton CONSTANT ON/OFF switch **140'** placing the switch **140'** in its OFF position (i.e. its open circuit condition).

In the circuit configuration of FIG. **15**, wherein the first and second switches **138'**, **140'** are in series circuit, it may be appreciated that the application of a normally actuating pressure to the tape switch **138'** will not cause energization of the light emitter **20** by the battery **16** when the CONSTANT ON/OFF pushbutton switch **140'** is in its open circuit condition (i.e. its OFF position). When the pushbutton switch **140'** is actuated by the operator to its CONSTANT ON position (i.e. its closed circuit condition), the operator's application of pressure to the momentary tape switch **138'** will close the circuit and the light emitter **20** will be energized by the battery **16** for as long as the operator's actuating pressure is maintained. Accordingly, in the circuit configuration of FIG. **15**, the CONSTANT ON/OFF pushbutton switch **140'** operates as an enable/disable switch for the momentary tape switch **138'**.

In similar manner, as previously discussed in connection with the switch housing **122** shown in FIGS. **7-10**, the remote dual switch housing **148** is preferably fabricated (such as by molding) of an elastomeric material such as neoprene, and is configured to transversely extend across at least two and preferably at least seven of the longitudinally spaced-apart transverse ribs **70** of the rail **68** (or **68'**) while resiliently grasping such rail along its longitudinal dimension. For example, in the preferred embodiment shown in FIGS. **12-17**, the remote dual switch housing **148** includes

inwardly inclined resilient flanges **156** longitudinally extending along the two respective sides of the housing **148**, for grasping the inwardly inclined longitudinal surfaces **126** of the rails **68**, thereby transversely retaining the remote dual switch housing **148** to the rail **68**.

The remote dual switch housing **148** is further configured with at least one transverse protrusion or lug **158**, preferably resilient, for being received by at least one space **71** between adjacent ribs **70** (see FIGS. **11**, **13** and **17**). In the preferred housing **148**, there are provided two such lugs **158** inwardly extending from each longitudinal side of the housing **148**, preferably longitudinally spaced apart so as to be situated near the front and rear ends of the housing **148**.

The remote dual switch housing **148** may include tactile indicia indicating the pressure actuable portion of the tape switch **138'**, such as the raised enclosure **160** for the push-button switch **140'** and the raised transverse bar **162** longitudinally separated by the active or pressure sensitive length of the tape switch electrodes **146**, for indicating to an operator the proper place to which pressure should be applied for operating the momentary tape switch **138'**. The housing **148** may also be provided with transverse grooves **164** in the vicinity of the housing's front and rear ends, for facilitating the application of flexible ties to further secure the housing **148** to the rail structure **64** or to another object if desired.

It may be appreciated that the rail mountable remote dual switch device **144** of the present invention may be removably secured to any one of the rails of an accessory mount rail structure as may be convenient to the operator, as well as at any place along such rail as may be convenient; for example, the housing **148** may be removably installed anywhere along a bottom rail, a side rail or top rail of a rail structure such as rail structure **64**. Further, the rail mountable remote dual switch device **136** may be removably secured to the same rail to which a switchable electrical accessory (such as the light beam generator **12**) is secured, or the remote dual switch device **136** may be attached to a rail other than the rail to which the accessory or light beam generator **12** is secured.

The remote dual switch device **144** may be secured to a rail by placing the switch housing **148** to the rail with one of the longitudinally extending resilient flanges **156** in contact with one of the inclined longitudinal surfaces **126** of the rail and with the lugs **158** along such secured flange **156** situated in corresponding spaces **71**. The operator then pivots the housing **148** across the rail while outwardly urging the other resilient flange **156** to grasp the other rail surface **126**. The secured remote dual switch device **144** may be removed from the rail by outwardly urging one of the resilient flanges **156** away from its engaged rail surface **126** until such flange **156** is disengaged from such surface **126**, and then withdrawing the dual switch housing **148** from the rail.

Although a flashlight or target illuminator embodiment of the light beam generator is specifically described above, laser aiming devices securable to firearms, or to rails carried by firearms, are included within the scope of light beam generators according to the present invention.

Thus, there have been described various embodiments of removably securable switch devices for electrical accessory apparatus for a firearm or other gun, and in particular for a light beam generator apparatus for a firearm or other gun. Other embodiments of the present invention, and variations of the embodiments presented herein, may be developed without departing from the essential characteristics thereof. Accordingly, the invention should be limited only by the scope of the claims listed below.

I claim:

1. A remote switch device for use with an electrical accessory securable to a rail structure carried by a firearm, the switch device comprising:

a remote momentary tape switch including a housing configured with resilient members adapted to engage a longitudinal rail of the rail structure for removably retaining said housing to the rail; and

a remote CONSTANT ON/OFF switch carried by said housing.

2. The switch device according to claim **1**, wherein:

said housing comprises a resilient housing.

3. The switch device according to claim **1**, including:

tactile indicia on said housing indicating a pressure actuable portion of said momentary tape switch.

4. The switch device according to claim **1**, wherein:

said CONSTANT ON/OFF switch comprises a pushbutton actuable switch.

5. The switch device according to claim **1**, wherein:

said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in series.

6. The switch device according to claim **1**, wherein:

said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in parallel.

7. The switch device according to claim **1**, wherein:

said resilient members include longitudinally extending flanges adapted to resiliently grasp the rail for transversely retaining said housing to the rail.

8. The switch device according to claim **7**, the rail including longitudinally spaced-apart transverse ribs, wherein:

said housing includes at least one lug for being received by at least one space between two adjacent ones of the ribs for longitudinally retaining said housing to the rail.

9. The switch device according to claim **8**, wherein:

said housing comprises a resilient housing.

10. The switch device according to claim **9**, including:

a first connector adapted for being electrically connected to a complementary second connector of the electrical accessory; and

a cable electrically coupling said momentary tape switch and said CONSTANT ON/OFF switch to said first connector.

11. The switch device according to claim **10**, the second connector comprising a jack, wherein:

said first connector comprises a plug for the jack.

12. The switch device according to claim **10**, wherein:

said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in series.

13. The switch device according to claim **10**, wherein:

said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in parallel.

14. The switch device according to claim **1**, the rail including longitudinally spaced-apart transverse ribs, wherein:

said resilient members include at least one lug for being received by at least one space between two adjacent ones of the ribs for longitudinally retaining said housing to the rail.

15. The switch device according to claim **1**, including:

a first connector adapted for being electrically connected to a complementary second connector of the electrical accessory; and

a cable electrically coupling said momentary tape switch and said CONSTANT ON/OFF switch to said first connector.

16. The switch device according to claim 15, wherein:
said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in series.

17. The switch device according to claim 15, wherein:
said momentary tape switch and said CONSTANT ON/OFF switch are electrically connected in parallel.

18. A remote switch device for use with an electrical accessory, the switch device comprising:
a remote momentary tape switch including a flexible housing;
a remote CONSTANT ON/OFF switch carried by said flexible housing;
a connector device removably connectible to the electrical accessory; and
a cable conductively coupling said remote momentary tape switch and said remote CONSTANT ON/OFF switch to said connector device.

19. The switch device according to claim 18, wherein:
said remote momentary tape switch and said remote CONSTANT ON/OFF switch are electrically connected in series.

20. The switch device according to claim 18, wherein:
said remote momentary tape switch and said remote CONSTANT ON/OFF switch are electrically connected in parallel.

21. The switch device according to claim 18, wherein:
said CONSTANT ON/OFF switch is pushbutton actuable.

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