Flashlight Having a Magnet-Switch Combination

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Filed: Sept. 26, 1974

A flashlight having a magnet-switch combination wherein the actuating means of the switch and the magnetic means for attaching the flashlight to a magnetic attractive surface are compactly disposed within a non-slideable housing secured to the battery casing of the flashlight.

8 Claims, 12 Drawing Figures
FLASHLIGHT HAVING A MAGNET-SWITCH COMBINATION

FIELD OF THE INVENTION

This invention relates to a flashlight switch assembly and more particularly concerns a magnet-push-button-switch combination for a flashlight.

BACKGROUND OF THE INVENTION

Flashlights presently available are generally fabricated with various sliding switches which are activated from the outside of the flashlight casing. These types of flashlights generally require a switch arrangement whereby sliding means disposed on the outer side of the casing have to be moved parallel to the axis of the casing to complete the electrical circuit within the flashlight which, in the presence of conventional cells, causes the bulb to light. This type switch arrangement usually can be unintentionally actuated while being stored in a rather confined compartment or when the switch member of the flashlight is accidentally bumped against an object.

Another type of flashlight, as disclosed in U.S. Pat. No. 3,539,800 to Doring et al., emphasizes a magnet assembly mounted within the battery casing of the flashlight having spring means for retaining two elongated magnet members of the assembly within the wall of the battery casing. The magnet assembly is substantially hidden within the battery casing when not in use but the magnet members partially protrude from the battery casing when the flashlight is positioned near a magnet attracting surface so that it magnetically attaches the flashlight to the surface. This type flashlight employs a separate sliding switch assembly for activating the flashlight to the “on” or “off” position.

U.S. Pat. No. 2,886,664 to Grubner discloses a magnet-switch combination for flashlights wherein magnet means and switch means are mounted in an assembly that slides on the battery casing of the flashlight. Again this type of magnet-switch arrangement can result in the flashlight being unintentionally actuated if the assembly housing said switch and magnet means accidently bumps against an object.

It is an object of this invention to provide a magnet-switch combination suitable for use in a flashlight.

It is another object of this invention to provide a novel magnet-switch combination for a flashlight wherein the magnet and switch actuating means are compactly arranged in a non-slideable housing secured to the battery casing of the flashlight.

Another object of this invention is to provide a novel push button switch fixedly secured within the battery casing and having its actuation means disposed in a housing secured to the battery casing and which contains magnetic means for attaching the flashlight to a magnetic attractive surface.

These and other objects are accomplished by having a push button switch adapted for mounting within a battery casing while the actuation means for the switch along with magnetic means are disposed in a housing fixedly secured to the outside of the battery casing.

SUMMARY OF THE INVENTION

The invention relates to a flashlight comprising a lens and reflector unit having a front open end adapted to be detachably mounted to a battery casing and having a lens, a lens ring, a lamp holder adapted to accommo-
end adapted to be detachably mounted to the lens and reflector unit. In another embodiment where the battery casing is made of a nonconductive material, then a conductive strip would have to be employed to electrically connect the interior of the end cap to the vicinity of the open end of the battery casing adapted to be detachably mounted to the lens and reflector unit. In both embodiments, it is preferable to have a coil spring secured to the interior of the end cap so as to provide sufficient pressure on the battery means within the casing to insure good electrical contact between the battery means and the contact means therein. The coil spring also functions to electrically connect one pole of the battery to either a conductive battery casing or to a conductive strip depending upon the material used for the battery casing.

When the battery casing is made of conductive material, then the flashlight could comprise a metallic tubular battery casing closed at its lower or first open end by means of an end cap of similar material which could be threadably engaged to said first open end while the upper or second open end at the opposite end thereof could be threadably mounted to a lens and reflector unit. The end cap would preferably contain a coil spring to constantly supply pressure on the battery means within the casing to maintain or urge said battery means toward the upper or second open end of the casing where a push button switch fixedly secured on a mounting bracket would be disposed. A suitably shaped contact strip would be employed to connect the battery casing to the contact shell of the lens and reflector unit which in turn would be electrically connected to, or adapted to be connected to, a lamp bulb mounted in said lens and reflector unit. The battery casing of the flashlight would in turn be electrically connected to one pole of the battery adjacent the end cap via the coil spring. The push button switch, which is secured on a mounting bracket within the battery casing with its button member projecting through an opening in the wall of the battery casing, would provide the contact means adaptable for electrically connecting the opposite pole of the battery (center terminal), or the center terminal of the battery closest the push button switch when more than one battery is employed, to the center terminal of the lamp bulb thereby completing the electrical circuit for the flashlight when the switch is actuated to the "on" position. Thus by depressing the button member of the switch, the electrical contact between the center terminal of the battery and lamp bulb would be completed or interrupted depending upon the state of the electrical connection prior to the button being depressed.

In another embodiment of this invention, the battery casing could be made of a nonconductive material whereupon a conductive strip would have to be employed to electrically connect the coil spring which is secured to the end cap to the contact shell member in the lens and reflector unit.

In both these embodiments, a housing member having an opening disposed and defined by a wall of said housing and containing projected magnetic means secured in a surface of said housing adjacent said opening would be aligned and secured to the battery casing such that the opening in said housing would be aligned with the opening in the wall of the battery casing so as to accommodate the projected button member of the switch disposed within the opening of the battery casing. As shown in the drawings, the housing could lock or secure the switch mounting bracket in place within the battery casing. A flexible boot could then be secured over the opening in the housing where the button member of the switch is disposed. In the flashlight embodiment utilizing the nonconductive battery casing, the flashlight could be made waterproof by water-tightly securing the flexible boot to the opening in the housing, securing the housing water-tightly to the battery casing and by employing suitable O-ring seals at each threaded area, i.e. between the lens and reflector unit and the upper end of battery casing and between the lower end of the battery casing and end cap. By selecting a suitable floatable material for the casing of the flashlight, a waterproof, floatable flashlight can be produced which will have the capability of being repeatedly operated without losing its water-tight features. The novel push button switch and magnetic arrangement of this invention can be used with various size and shape battery casings which could be coupled to various size and shape lens and reflector units to produce flashlights for all purposes.

As is apparent from this invention, the only movable part of the housing assembly would be the flexible boot which is adapted to contact the button member of the switch. The flexible boot would be disposed below the plane defined by the top surface of the projected magnetic means and thereby would not be subject to being depressed when the flashlight is attached to a magnetically attractive surface. In addition, this arrangement would eliminate the accidental putting "on" of the flashlight which is sometimes encountered when the magnetic means are mounted in the slideable housing arrangement of the prior art.

In the drawings:

FIG. 1 is a side view of a flashlight embodying this invention;
FIG. 2 is a horizontal section of the flashlight of FIG. 1;
FIG. 3 is a partial top section of the flashlight of FIG. 1;
FIG. 4 is an enlarged isometric view of a push button switch fixedly secured on a mounting bracket;
FIG. 5 is a top view of a mounting bracket in the open position;
FIG. 6 is a side sectional view of FIG. 5 taken along lines 6—6;
FIG. 7 is a sectional view of a mounting bracket in the closed position taken along the longitudinal axis;
FIG. 8 is an enlarged partial sectional side view of a portion of the flashlight of FIG. 2 showing the magnetic-switch combination;
FIG. 9 is a partial sectional view of a switch assembly showing a boot member having an inwardly extended center portion;
FIG. 10 is an exploded view of the magnetic-switch housing shown in FIG. 2;
FIG. 11 is an enlarged section view taken along line 11—11 of FIG. 1;
FIG. 12 is an enlarged sectional view taken along line 12—12 of FIG. 10.

Referring to FIGS. 1, 2 and 3, there is shown a flashlight having a battery casing 2, an end cap 3, and a lens and reflector unit 4. The battery casing 2 is of the usual metallic tubular type of thin gage metal such as chrome plated steel, aluminum, brass or copper coated steel or other similarly conductive material, preferably
a metal capable of being finished to a high polished state. Battery casing 2 is closed at its lower end by means of end cap 3 which is threadably engaged to the lower end of casing 2. End cap 3 contains a coil spring 5 which electrically connects casing 2 with one pole of cell 6 while simultaneously exerting pressure on batteries 6 and 7 to maintain good electrical contact to conductive strip 8 of push button switch 9. The upper open end portion of casing 2 terminates with a threaded segment 10 designed to engage threaded segment 11 of the lens and reflector unit 4. Disposed in the side wall of casing 2 at the vicinity of the upper open end is a circular opening 12.

Lens and reflector unit 4 comprises lens 13, lens ring 14, reflector 15, contact shell 16, bulb holder 17 and lamp 18. Reflector 15 is of the conventional type comprising a molded reflector body composed of a non-conductive material, such as plastic, for instance, polystyrene, and having substantially corresponding concave-convex sides, the concave side of which is provided with a metallic reflectory coating 19 such as aluminum applied by conventional vacuum-metallizing techniques or the like, and a central apertured cylindrical neck not shown. The contact shell 16, composed of an electrically conductive material, is preferably of frusto-conical shape with a tubular socket axially formed therein. The tubular socket, e.g. as disclosed in U.S. Pat. No. 3,798,440, is generally secured within the apertured neck of reflector 15 and has a flanged end which interlocks with an annular flange which is integrally molded to the opening of the apertured neck of the reflector. The frusto-conical portion of contact shell 16 forms an annular shaped skirt 20 which projects radially outwardly from and out of contact with reflector 15. The flanged end of the tubular socket within reflector 16 also provides a seat against which is mounted the flanged neck of lamp bulb 18 which is of the conventional type having a cylindrical base 21 including a button type terminal 23.

Lens ring 14 is preferably made of the same material as casing 2 so as to give an overall streamline appearance. It is also within the scope of this invention to have the lens ring 14 made of a different material than that of casing 2. End cap 3 is preferably made of the same material as casing 2 but if a different material is desired, then said material has to be conductive so as to provide a complete electrical path for the flashlight.

Bulb holder 17 is tubular shaped and is composed of a resilient material, preferably a molded plastic, such as polyethylene. Bulb holder 17 is securely mounted within the tubular socket of reflector 15 by conventional means as also disclosed in U.S. Pat. No. 3,798,440. To remove holder 17 to replace lamp 18, the holder 17 is simply pulled outwardly from the tubular socket to detach its forward end. Once the lamp is replaced, it is simply pushed back into the socket. The assembled unit containing reflector 15, contact shell 16, bulb holder 17 and lamp 18 is held securely within the lens and lens ring assembly by friction fit between the reflector rib periphery and a bead within the lens ring 14. After assembly, the forward opening of the battery casing entraps the reflector between its forward thread and the lens.

As shown in FIGS. 4 to 7, a push button switch bracket 22 comprises an overall flat sided (24, 26) substantially tubular configuration which is pivotable about the midpoint 28 of one of the side walls 26. In the open position, as shown in FIGS. 5 and 6, a flat base 30 is disposed in one half of the tubular bracket with an inwardly projecting annular wall 32 disposed in the other half of the tubular bracket. Inwardly projecting annular member 32 defines an opening 34 through which the inner button member 36 of switch 9 is inserted while the base 38 of switch 9 seats on base 30 of the mounting bracket 22 as shown in FIG. 2. Disposed on opposite sides of opening 34 are semi-circular projection members 40 which help maintain the base 38 of switch 9 in proper alignment when switch 9 is placed in the mounting bracket 22. The flat surfaces 42 are aligned such that they are parallel with the longitudinal side wall of base 38 when switch 9 is positioned on mounting bracket 22. Disposed at each end of the longitudinal outer extremities of mounting bracket 22 at the upper vicinity of the annular member 32 are grooves or openings 44 whose function will be described below. A longitudinal groove 46 is disposed at the center of the outer lower half of the bracket to accommodate a contact strip as will be described below.

Mounting bracket 22 can be molded in one piece as shown in FIGS. 5 to 7 using a suitable plastic material such as polyolefin, polyethylene, polypropylene, copolymers of acrylonitrile, butadiene, or styrene or any other suitable material capable of securing switch 9 within battery casing 2.

A conventional type push button switch 9 can be positioned in bracket 22 by inserting the button member 36 through opening 34 whereupon the top surface of the base 38 will rest on the flange 48 of annular wall 32 and be aligned between members 40 as shown in FIG. 2. Thereupon both halves of bracket 22 can be pivoted together so that the bottom surface of base 38 of switch 9 will rest on base 30 of the bracket. The switch and bracket assembly along with a conductive strip 49 placed in recess 46 can then be inserted into the upper end of battery casing 2 and positioned such that the button 36 of switch 9 is centered within opening 12 of the side wall of casing 2 as shown in FIGS. 2, 4 and 8. Thereafter, an extended cylinder 50, closed and partially filled at the closed end, is secured to button member 36 so as to effectively project the actuation means of the push button switch 9 substantially through opening 12 in battery casing 2.

According to the present invention, novel means are afforded for a magnet-switch actuation combination which will enable the flashlight to be supported on a metal surface in any desired position and yet will not interfere with the functioning of the switch. As shown in FIGS. 2, 8 and 10 to 12, a housing 51 comprises a rectangular, cup-shaped, box-like segment 52 integrally extended at one end to a cylindrical segment 53 and at the other end to an exponential type curved segment providing a flange 54 thereat. Cylindrical segment 53 had an opening defined by the internal wall 55 of the housing, said wall 55 extending below the lower surface 56 of rectangular segment 52 and having outwardly extending narrow flexible tabs 57 and 58 disposed along the longitudinal axis of housing 51. Disposed on the inside wall 55 is a groove 59, one side of which is defined by a radially inwardly protruding flange 60. The rectangular segment 52 comprises spaced side walls 61 joined at one end to spaced end wall 62 and at the other end to spaced end wall 63, said end wall 63 also forming part of the wall 55 defining opening 64 in cylindrical segment 53. The walls 61, 62 and 63 are integrally
The housing 51 can preferably be made of a suitable non-magnetic material such as plastic, e.g., nylon, polylethylene, polystyrene, copolymers of acrylonitrile, butadiene or styrene.

Mounted in the rectangular section 52 of housing 51 are a pair of opposed elongated collector bars or angles 66 made of non-magnetic, but metal conductive material, for example, steel. Each collector consists of a relatively short leg 67 which in assembly with the other collector is disposed in spaced planar relation thereto and forms a short gap therebetween, and a relatively longer leg 68 adapted to fit into a correspondingly enclosed slot 69 in the housing top wall 65 and extend slightly beyond said wall 65 thereby forming a tongue and slot connection. Seated within the hollow rectangular segment 52 and innesting engagement with the angled collector bars 66 is a permanent magnet 70, preferably made of Alnico metal. The collector bars 66, which are in magnetic contact with the magnet 70, serve to conduct the magnetism beyond the housing 51 in order that the magnet strength may be strongly applied to a metal surface without significant loss or attenuation of the magnet strength of the housing 51.

If desired to restrict unnecessary movement of the magnet inside the switch housing, the magnet may be held captive therein through the combined action of an elongated spacer or insulating filler member 71 and an elongated spring strip 72 disposed respectively immediately below and above the magnet 70 when viewed as in FIG. 2. The filler 71 is slightly smaller in dimensions than the lower face of the magnet 70 and lies between said magnet and said collector legs 67. The spring strip 72 is arcuate bowed with its medial portion in resilient engagement with topside of the magnet 70 and its ends in resilient contact with the underside of the housing top wall 65. A pair of open ended slots 73 at the remote ends of the spring 72, constructed to loosely straddle a pair of reinforcing ribs 75 (FIG. 12) in the housing 51, are provided for avoiding lateral displacement of the spring 72 and simultaneously affording the necessary clearance for longitudinal expansion thereof. While a bowed spring is preferred, it is to be understood that helically coiled springs are susceptible of use in the present invention.

Smaller or larger magnets may be employed in the magnet-switch combination of the invention according to whether a lower or higher magnetic strength is desired, additional fillers 71 being provided or removed to suitably accommodate same. A protective gasket 75 may be disposed between legs 67 of collector bars 66 and the wall of casing 2. Gasket 75 and flange 54 of housing 51 have openings 76 and 77, respectively, to accommodate a rivet 78 for securing flange 54 of housing 51 to the casing 2 which also has an opening 79.

After the switch and bracket assembly is disposed into the upper open end of the battery casing 2 and with the magnet components assembled in the rectangular section 52, the housing 51 is positioned over battery casing 2 and then the cylindrical member 53 is forced into opening 12 of casing 2. Projecting tabs 57 and 58 of housing 51 are first flexed inwardly until they are aligned with opening 44 in bracket 22 whereupon they will spring out and into said openings 44. This will secure bracket 22 within casing 2 and secure one end of the housing to casing 2. Thereafter, rivet 78 is passed through rivet openings 79 in casing 2, 76 in gasket 75 and 77 in housing 51 thereby securing the flange end 54 to casing 2.

Either before or after housing 51 is secured to casing 2, the extended cylindrical member 50 is suitably secured in a conventional manner to button 36 thereby extending the actuation means of switch 9 into housing 51.

A flexible switch boot 80, made of rubber, a low density polyethylene, or the like, is assembled above switch 9 in opening 12 of module casing 2. A rigid gasket 81 is of ABS copolymers or some other rigid metallic-like material provides a seal between boot 80 and opening 12 while simultaneously securing boot 80 in a molded recess or groove 59 in housing 51. This boot and gasket arrangement provides a water-tight assembly for switch 9 while also providing the flexibility necessary for actuating said switch 9. Thus by depressing flexible boot 80, button 36 via extension 50 can be lowered thereby effectively operating switch 9. As shown in the drawings, one pole of battery 6 is electrically connected to coil spring 5 which in turn is electrically connected to shell 16 via conductive casing 2 and conductive strip 49.

Push button switch 9 has two contact strips 8 and 82 as shown in FIGS. 2 and 4. The latter strip 82 is aligned and in contact with the lamp terminal 23 while contact strip 8 is aligned and in contact with the center terminal of battery 7. Thus the actuation of switch 9 will internally couple or uncouple contact strips 8 and 82, thereby electrically connecting or disconnecting, respectively, the battery terminal 83 to the lamp terminal 23 which will effectively complete or interrupt, respectively, the electrical circuit of the flashlight.

In certain applications, it may not be desirable to secure an extended cylindrical member, such as member 50, to the button of the switch. In such applications, the center portion 83 of flexible boot 84 may be extended so that it could contact button 36 of switch 9 as shown in FIG. 9, said FIG. 9 displaying only a partial view of a switch actuating assembly identical to that shown in FIG. 2 except for the new embodiment of boot 84.

A flashlight constructed in the manner described above would be admirably suited for use in all applications requiring a sturdy, durable lightweight flashlight. Although this invention has been described with reference to many specific details thereof, it is apparent that the invention is not limited to such details.

What is claimed is:

1. A flashlight comprising a lens and reflector unit having a front open end adapted to be detachably mounted to a battery casing and having a lens, a lens ring, a lamp holder adapted to accommodate a lamp and containing a first contact means therein; a battery casing provided with a first open end adapted to receive a battery means and adapted to be detachably mounted to an end cap for securing battery means therein, a second open end at the opposite end thereof adapted to be detachably mounted to the front open end of the lens and reflector unit, and wherein second contact means are provided for electrically connecting the interior vicinity of the end cap to said first contact means; a push button switch fixedly secured on a mounting bracket disposed within the second open end of the battery casing with the button member of the switch disposed within an opening in the wall of the battery casing adjacent the second open end thereof; a housing member substantially disposed on the outer
surface of the battery casing and having an opening disposed therein with magnetic means disposed in the surface of said housing member adjacent said opening, said housing member aligned and secured to the battery casing such that the opening in said housing member is aligned with the opening in the wall of the casing so as to accommodate the button member of the switch disposed in the opening in the wall of the casing; a flexible boot member disposed and secured over the opening in the housing member so that upon being depressed, the boot will in turn depress the button member of the switch; and third contact means adapted through actuation of the push button switch in the presence of a lamp and battery means assembled in the flashlight to complete or interrupt the continuity of an electrical circuit between the lamp and the battery means.

2. The flashlight of claim 1 wherein said button member comprises an extended member secured to the button of the push button switch and is disposed such that it projects through the opening in the wall of the battery casing and into the opening in the housing member whereupon it is aligned for contacting the flexible boot member.

3. The flashlight of claim 1 wherein the flexible boot member extends through the opening in the housing member and is aligned for contacting the button of the push button switch.

4. The flashlight of claim 1 wherein the battery casing is made of a conductive material.

5. The flashlight of claim 1 wherein the first open end of the battery casing is threadably secured to the end cap and wherein the second open end is threadably secured to the lens and reflector unit.

6. The flashlight of claim 1 wherein a gasket is added between the flexible boot and the opening in the housing so as to provide a water-tight seal thereat.

7. The flashlight of claim 1 wherein the battery casing is made of a nonconductive material and wherein said second contact means is an electrical contact strip extending from the first open end of the battery casing to its second open end.

8. The flashlight of claim 7 wherein a first seal is added between the first open end of the battery casing and the end cap and a second seal is added between the second open end and the lens and reflector unit so as to provide a water-tight seal at these detachable joints.

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