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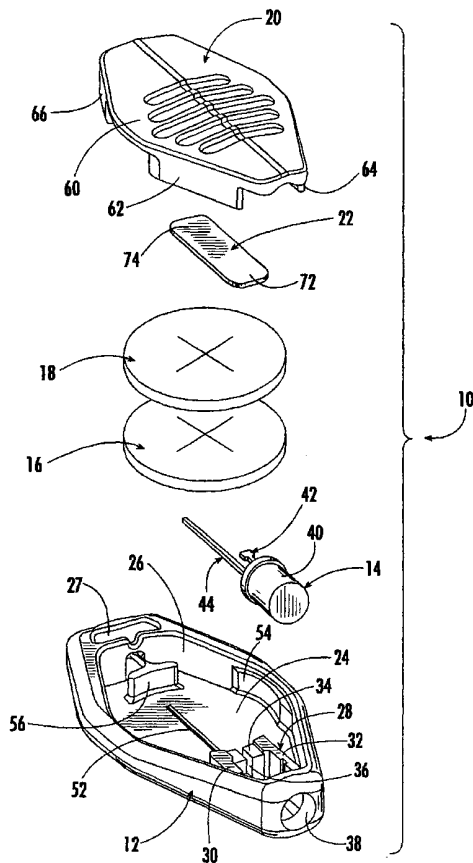
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(54) Title: MINIATURE FLASHLIGHT



(57) Abstract: A miniature flashlight (10) consists of a housing (12), a light emitting diode (LED) (14), a pair of batteries (16, 18), and a flexible cover (20) having a contact strip (22) that acts as a switch. The LED (14) has a head portion (40) and two contact arms (42, 44). One of the contact arms (42) is shorter than the other (44) and has a contact plate (48) at the terminal end thereof. The head portion (42) of the LED (14) is received in an aperture (38) in the side wall of the housing (12). The longer contact arm (44) is captured in a channel (52) formed in the bottom wall (24). The contact plate (48) of the shorter contact arm (42) rests on a shoulder (34) that forms part of the LED seat. Coin cell batteries (16, 18) are received within another seat formed in housing. The lower battery (16) sits on top of the longer contact arm (48). The cover (20) maintains the LED (14) and the batteries (16, 18) within the housing (12). One end of the contact strip (22) engages the contact plate (48) of the LED (14), while the other end is spaced above the upper battery (18). The cover (20) is depressed to move the contact strip (22) into contact with the upper battery (18) to energize the LED (14).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MINIATURE FLASHLIGHT

Background and Summary of the Invention:

5 The instant invention relates to miniature lighting devices, such as key lights, and small personal flashlights, and more particularly to miniature flashlight of the type employing a high brightness light emitting diode.

10 The recent development of low cost, high brightness diodes, i.e. light emitting diodes, or LED's has provided light manufacturers with a new alternative to conventional filament light bulbs as a light source in flashlights and other types of small personal lights. While there are many different types and kinds of lights, there is always a need for newer constructions and arrangements which reduce the number of parts, simplify manufacturing procedures, and ultimately reduce cost.

15 In this regard, the instant invention provides an improved miniature flashlight construction comprising a housing, a light emitting diode (LED), a pair of batteries, a flexible cover, and a contact strip mounted on the inside of the cover that acts as a switch. The housing includes a bottom wall, and a continuous side wall extending upwardly from the bottom wall. The bottom wall and side wall cooperate to form an upwardly opening interior cavity for receiving the batteries, and LED therein. The LED has a head portion and two spaced contact arms extending rearwardly from the head portion. One of the contact arms is shorter than the other and includes a contact plate that is used as part of the switch mechanism. A conventional LED is provided with two identical contact arms having a stop plate adjacent to the head portion. The shorter contact arm is created by trimming the contact arm at the end of the stop plate and rotating the contact arm so that the stop plate is presented for use as a contact plate. The LED is received in a seat formed in the housing with the head portion of the diode received in an aperture in a side wall of the housing. The longer contact arm extends along the bottom wall of the housing and is captured in a longitudinal channel formed in the bottom wall. The stop plate of the shorter contact arm rests on a raised shoulder that is formed as part of the LED seat. A pair of coin cell batteries are piggy backed and received within another seat formed in housing. The lower contact surface of the lower battery sits on top of

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the longer contact arm captured in the channel of the bottom wall. The resilient plastic cover is frictionally received in assembled relation with the side walls of the housing to maintain the diode and the batteries within the housing. The first end of the contact strip engages the stop plate of the second contact of the diode, while the
5 opposing second end is disposed in spaced relation over the upper surface contact of the upper battery. The cover is selectively depressible, i.e. deformable, to selectively move the second end of the contact strip into electrical communication with the upper surface of the battery to selectively energize the diode.

Accordingly, among the objects of the instant invention are: the provision
10 of small, lightweight, low cost flashlight having a superior brightness level, and extended longevity; the provision of a miniature flashlight construction that utilizes a high brightness LED as a light source; the provision of a miniature flashlight that uses a resilient housing portion as part of the switch arrangement; the provision of a miniature flashlight having a reduced number of parts; and the provision of a
15 miniature flashlight that can be disassembled to replace spent batteries.

Other objects, features and advantages of the invention shall become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

20 **Description of the Drawings:**

In the drawings which illustrate the best mode presently contemplated for carrying out the present invention:

Fig. 1 is a perspective view of the miniature flashlight of the present invention;

25 Fig. 2 is an exploded perspective view thereof;

Fig. 3 is an exploded perspective view of the cover assembly;

Fig. 4 is a perspective view of the light emitting diode prior to trimming of the upper contact;

30 Fig. 5 is another perspective view of the light emitting diode after trimming of the upper contact;

Fig. 6 is a perspective view of the housing with the cover assembly and batteries removed;

Fig. 7 is a cross-sectional view thereof as taken along line 7-7 of Fig. 6;

Fig. 8 is another cross-section view thereof showing insertion of the batteries and cover assembly;

Fig. 9 is a cross-sectional view of the assembled flashlight as taken along line 9-9 of Fig. 1; and

Fig. 10 is another cross-sectional view showing depression of the cover assembly and closure of the electrical circuit to energize the LED.

Description of the Preferred Embodiment:

Referring now to the drawings, the miniature flashlight of the instant invention is illustrated and generally indicated at 10 in Figs. 1-10. As will hereinafter be more fully described, the instant invention utilizes a high brightness light emitting diode, and long life lithium coin cell batteries in a simple housing to provide a useful, novel and improved light source.

The flashlight 10 comprises comprising a housing generally indicated at 12, a light emitting diode (LED) generally indicated at 14, a pair of batteries respectively generally indicated at 16 and 18, a cover generally indicated at 20, and a contact strip 22 mounted on the inside of the cover 20.

The housing 12 is generally diamond shaped and is preferably molded from a rigid plastic material suitable for housing the types of electronic components discussed herein. Generally speaking the housing 12 is approximately the same size as a conventional keyless alarm device provided for many vehicles. However, it is noted that this size is not critical to the device, and is not intended to limit the scope of the disclosure in any way. The housing 12 includes a bottom wall 24, and a continuous side wall 26 extending upwardly from the bottom wall 24. The bottom wall 24 and side wall 26 cooperate to form an upwardly opening interior cavity for receiving the batteries 16, 18, and LED 14 therein. The housing 12 further includes an external aperture 27 in the rear end for receiving a key chain or other type of clip,

and an internal seat generally indicated 28 at for receiving the LED 14. The seat 28 is formed by two vertical side walls 30, 32 and a rear wall 34 extending upwardly from the bottom wall 24. The rear wall 34 includes a slot 36 for receiving the contact arms of the LED 14 when inserted into the seat 28. The front of the seat 28 opens into a longitudinally extending aperture 38 sized to receive a head portion of the LED 14.

Referring to Figs. 4 and 5, the LED 14 preferably comprises a high brightness, gallium nitride LED. The gallium LED 14 emits a soft blue wavelength of light that is particularly suitable for use as a multipurpose flashlight. The gallium LED 14 typically requires an operating voltage of about 4.5 volts which thus requires the use of two 3.0 volt lithium coin cells 16 and 18 (CR2016). Other types of LED's are also suitable, such as gallium phosphide red and green LED's. These LED's typically have an operating voltage of about 2.0 volts and require only a single lithium coin cell (CR2032) (not shown). The LED's and batteries are interchangeable in the present configuration so that manufacturing is not limited to single source suppliers. The shape of an LED 14 is standard throughout the industry comprising a head portion 40 and two spaced contact arms generally indicated at 42, 44 extending rearwardly from the head portion 40. The head portion 40 further includes a flat shoulder 46 which can be used for alignment of the head 40 in assembly. For assembly in the housing 12, one of the contact arms 42 is shorter than the other 44, and includes a contact plate, i.e. stop plate, 48 that is used as part of the switch mechanism. Referring to Fig. 4, a conventional LED is provided with two identical contact arms 42, 44 each having a stop plate 48, 50 adjacent to the head portion 14. The stop plates 48, 50 are typically used as a shoulder stop when inserting the LED 14 into a circuit board. The shorter contact arm 42, as illustrated in Fig. 5, is created by trimming the contact arm 42 at the end of the stop plate 48 and rotating the contact arm 42 by 90 degrees so that the stop plate 48 is presented for use as a horizontal contact plate. Turning to Figs. 6, 7 and 8, the LED 14 is received in the seat 28 with the head portion 40 thereof received in the aperture 38. The longer contact arm 44 is slid into the slot 36 in the rear wall 35 of the seat and extends along the bottom wall 24 of the housing 12 where it is captured in a

longitudinal channel 52 formed in the bottom wall 24. In Fig. 8 it can be seen that the upper edge of the contact arm 44 projects upwardly above the surface of the bottom wall 24 to engage the batteries 16, 18 to be inserted into the housing 12. The stop plate 50 of the longer contact arm 44 rests within the slot 36 in the seat, and the stop plate 48 of the shorter contact arm 42 rests on top of the rear wall 34 bridging the slot 36 that receives the longer arm 44.

As indicated above, the coin cell batteries 16, 18 comprise a pair CR2016 lithium batteries that are piggy backed and received into the housing 12. In this regard, the side wall 26 of the housing 12 is provided with symmetrically opposed side shoulders 54 (only one shown) and rear shoulder 56 that cooperate to position the batteries 16, 18 within the housing 12. Referring now to Figs. 8-10, the lower contact surface 58 of the lower battery 16 sits on top of the longer contact arm 44 captured in the channel 52 of the bottom wall 24.

The cover 20 is generally diamond shaped to match the housing 12 and is preferably molded from a resilient plastic, or elastomeric material, that is capable of flexing. The cover 20 includes a top wall 60, and symmetrically opposed insert legs 62, 64, and 66, 68 that are sized and configured to be received in assembled relation within the interior surfaces of the side wall 26 of the housing 12. In this regard, the cover 20 is maintained in position by friction between the outside surfaces of the insert legs 62, 64, 66, 68 and the interior surfaces of the side walls 16. The existing friction is sufficient to maintain the cover 20 in position, yet will allow the cover 20 to be removed when the batteries 16, 18 need to be replaced.

The contact strip 22 is mounted in a recess 70 on the inside surface of the top wall 60. When the cover 20 is assembled with the housing 12, the first end 72 of the contact strip 22 engages the stop plate 48 of the short contact 42 of the diode 14, while the opposing second end 74 of the contact strip is disposed in spaced relation over the upper surface 76 contact of the upper battery 18 (See Fig. 9).

Referring to Figs. 9 and 10, the contact strip 22 is normally spaced over the upper surface 76 of the upper battery 18 to maintain the circuit in an open condition. However, the center portion of the top wall 60 of the cover 20 is depressible, i.e. resiliently deformable, upon downward pressure (see arrow 78 Fig. 10), to

selectively move the second end 74 of the contact strip 22 into electrical communication with the upper surface 76 of the upper battery 18 to close the circuit and selectively energize the diode 14. Release of pressure from the cover 20 allows the cover 20 to return to its normal shape (Fig. 9) and withdraws the contact strip 22 from engagement with the battery 18.

It can therefore be seen that the instant invention provides a small, lightweight, low cost flashlight 10 having a superior brightness level, and extended longevity. The use of a high brightness LED as a light source provides a long life light source, and the use of lithium batteries extends the normal longevity of such miniature flashlights. The simple construction and mounting of the LED, and switch configuration permit inexpensive manufacturing and further provide the ability to easily replace the batteries and extend the longevity of the flashlight. For these reasons, the instant invention is believed to represent a significant advancement in the art which has substantial commercial merit.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. A flashlight assembly comprising:

5 a housing having a bottom wall and a side wall extending upwardly from said bottom wall;

10 a light emitting diode having a head portion and first and second spaced contact arms extending rearwardly from said head portion, said second contact arm having a shorter length than said first contact arm, said diode being received within said housing with said head portion of said diode being received in an aperture in said side wall of said housing, said first contact arm extending along said bottom wall of said housing and being captured within a channel formed in said bottom wall, said second contact arm resting on a raised shoulder of formed within said housing;

15 a battery having a first and second contacts, said battery being received within said housing with said second contact in electrical communication with said first contact arm of said diode; and

20 a switch device extending between said first contact of said battery and said second contact arm of said diode, said switch being selectively movable between a normally open state and a closed state to selectively energize said diode.

2. The flashlight assembly of claim 1 wherein said second contact arm has a stop plate at a terminal end, said stop plate having a width greater than a width of the contact arm.

25 3. The flashlight assembly of claim 1 wherein said second contact arm is rotated 90 degrees to present said stop plate in a parallel relation to the bottom wall of the housing.

30 4. The flashlight assembly of claim 2 wherein said second contact arm is rotated 90 degrees to present said stop plate in a parallel relation to the bottom wall of the housing.

5. A flashlight assembly comprising:

a housing having a bottom wall and a side wall extending upwardly from said bottom wall;

5 a light emitting diode having a head portion and first and second spaced contact arms extending rearwardly from said head portion, said diode being received within said housing with said head portion of said diode being received in an aperture in said side wall of said housing, said first contact arm extending along said bottom wall of said housing, said second contact arm resting on a raised shoulder of
10 formed within said housing;

a battery having a first contact on an upper surface thereof and second contact on a lower surface thereof, said battery being received within said housing with said second contact in electrical communication with said first contact arm of said diode; and

15 a flexible cover received in assembled relation with said housing to maintain said diode and said battery within said housing, said cover having an electrically conductive contact strip mounted on an inner surface thereof, said contact strip having a first end received in electrical communication with said second contact of said diode and an opposing second end which is disposed in
20 spaced relation over the first contact of the battery,

said flexible cover being selectively depressible to selectively move said second end of said contact strip into electrical communication with the first contact of the battery to selectively energize the diode.

25 6. The flashlight of claim 5 wherein said second contact arm of said diode has a shorter length than said first contact arm.

7. The flashlight of claim 6 wherein said second contact arm includes a stop plate at a terminal end thereof, said stop plate having a width that is greater than a
30 width of said contact arm, said stop plate being horizontally disposed so as to sit on top of said shoulder.

8. The flashlight of claim 5 wherein said first contact arm is captured in a channel formed in the bottom wall of said housing.

5 9. The flashlight of claim 6 wherein said first contact arm is captured in a channel formed in the bottom wall of said housing.

10. The flashlight of claim 7 wherein said first contact arm is captured in a channel formed in the bottom wall of said housing.

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11. A flashlight assembly comprising:

a housing having a bottom wall and a side wall extending upwardly from said bottom wall;

15 a light emitting diode having a head portion and first and second contact arms extending rearwardly from said head portion, said second contact arm having a shorter length than said first contact arm, said second contact arm having a stop plate at a terminal end, said stop plate having a width greater than a width of the contact arm, said diode being received within a first seat formed in said housing with said head portion of said diode being received in an aperture in said side wall
20 of said housing, said first contact arm extending along said bottom wall of said housing and being captured within a channel formed in said bottom wall, and said stop plate of said second contact arm resting on a raised shoulder of formed within said housing;

25 a battery having a first contact on an upper surface thereof and second contact on a lower surface thereof, said battery being received within said housing with said second contact in electrical communication with said first contact arm of said diode; and

30 a flexible cover received in assembled relation with said housing to maintain said diode and said battery within said housing, said cover having an electrically conductive contact strip mounted on an inner surface thereof, said contact strip having a first end received in electrical communication with said

second contact of said diode and an opposing second end which is disposed in spaced relation over the first contact of the battery,

said flexible cover being selectively depressible to selectively move said second end of said contact strip into electrical communication with the first contact

5 of the battery to selectively energize the diode.

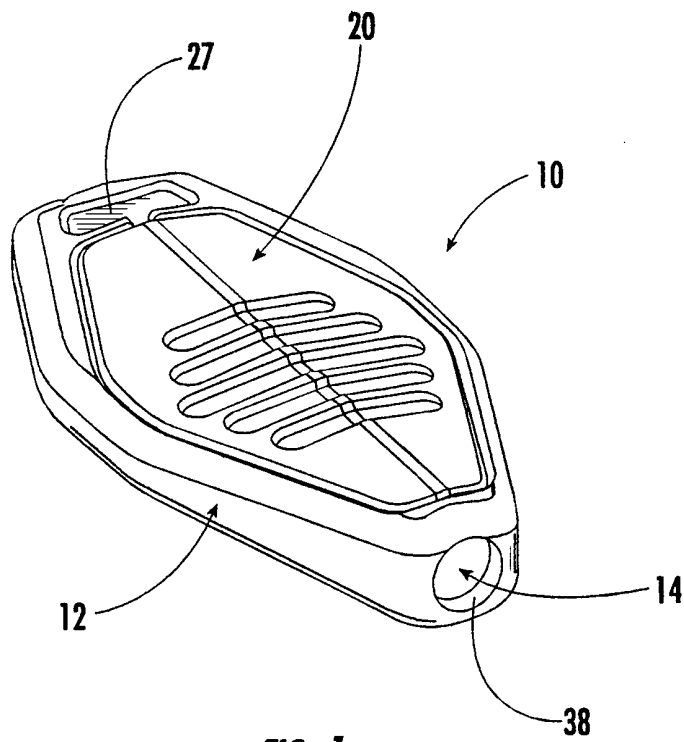
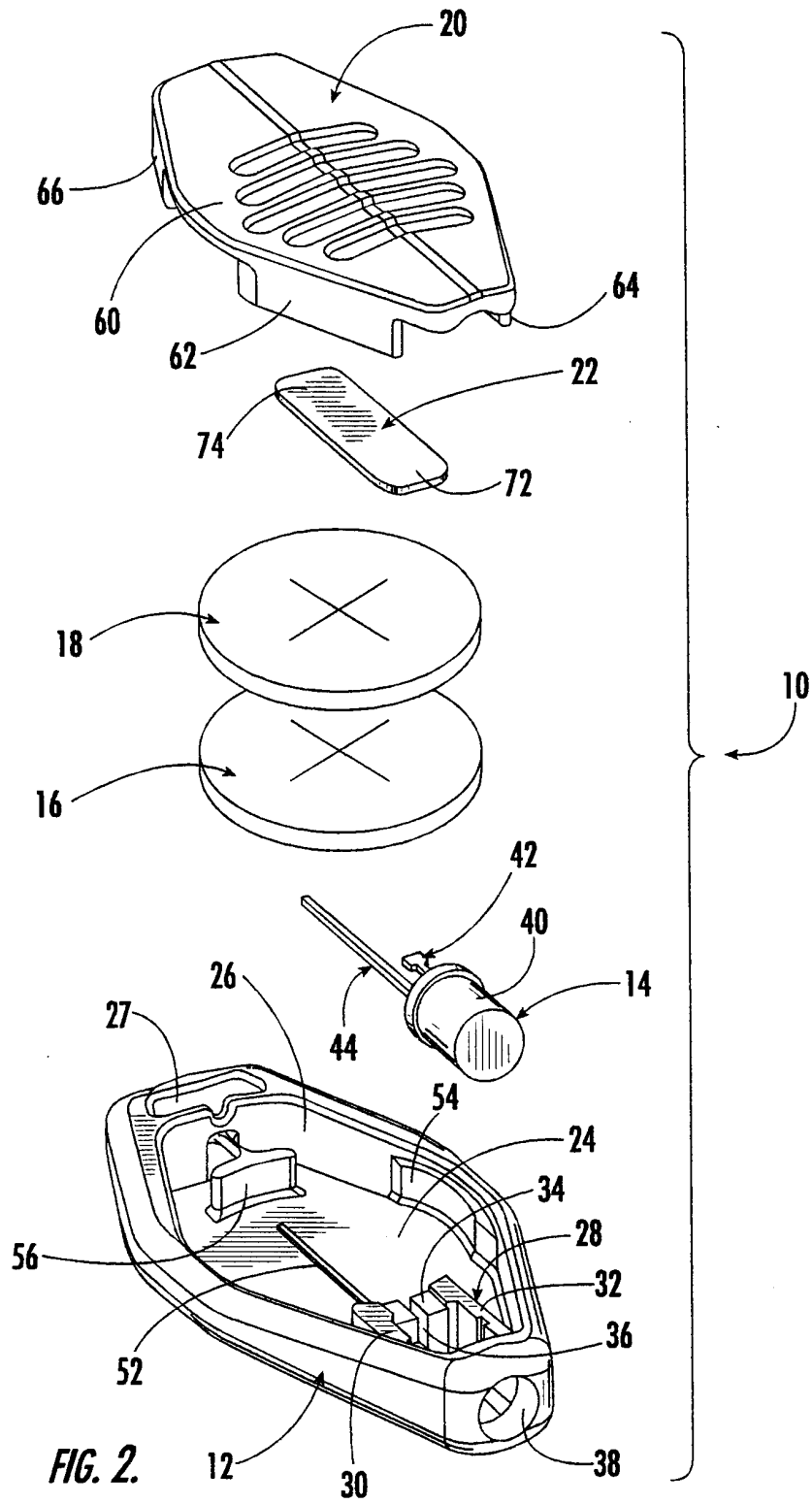


FIG. 1.



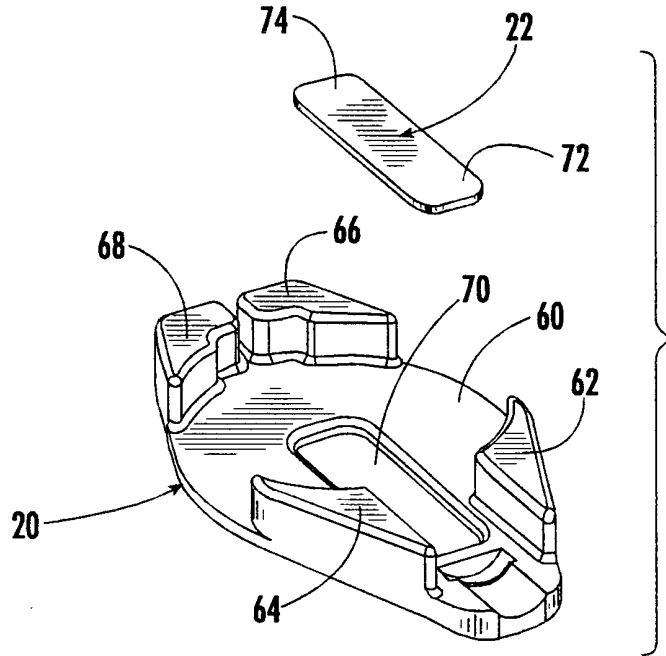


FIG. 3.

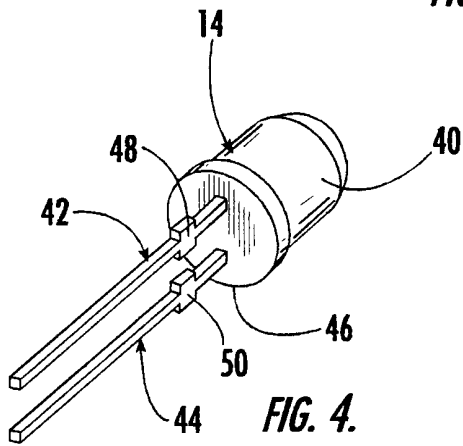


FIG. 4.

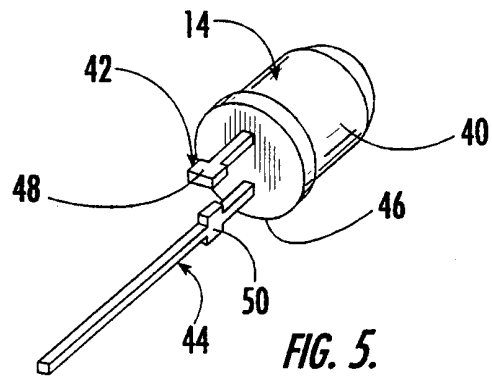
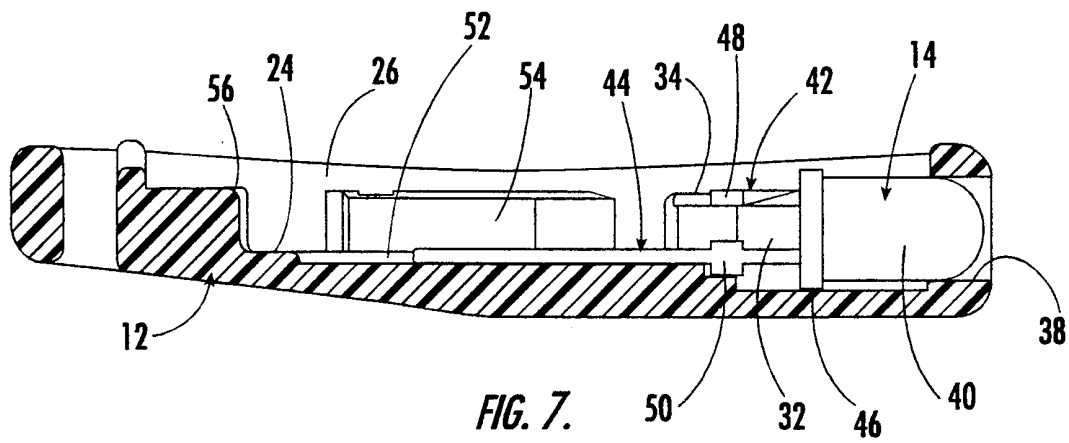
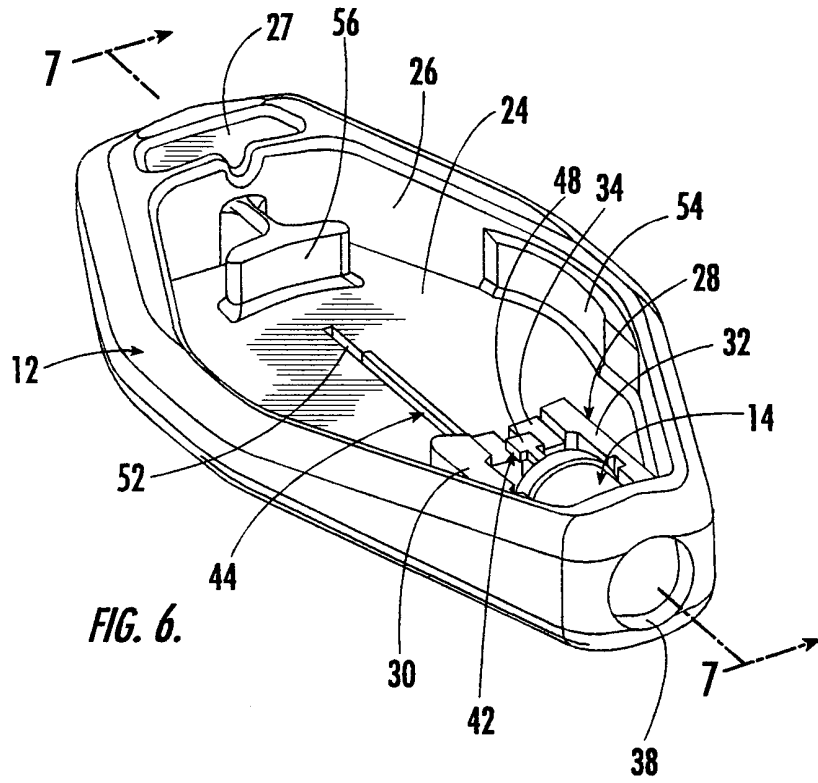


FIG. 5.



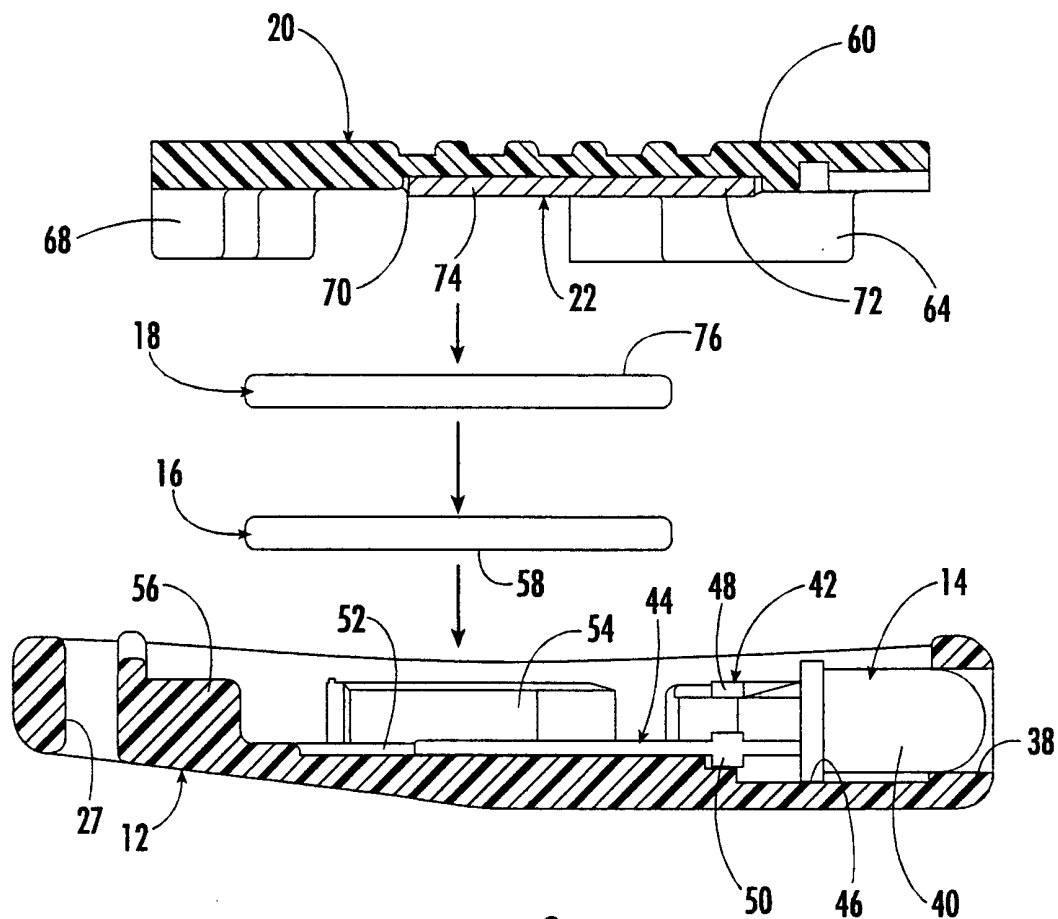


FIG. 8.

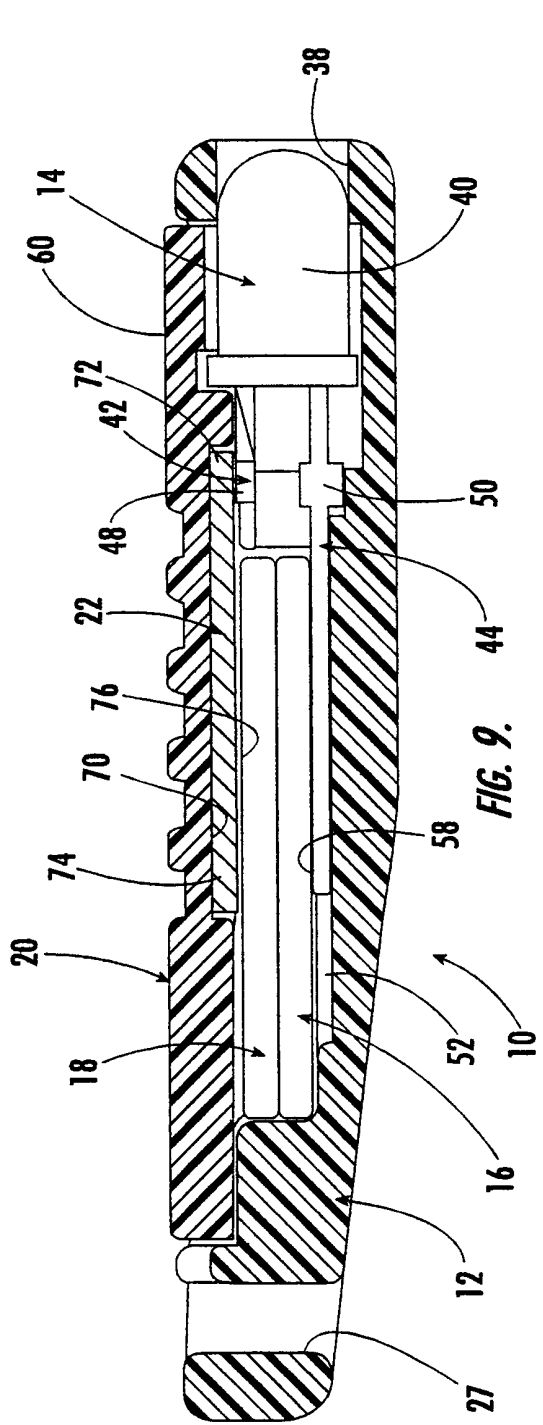


FIG. 9.

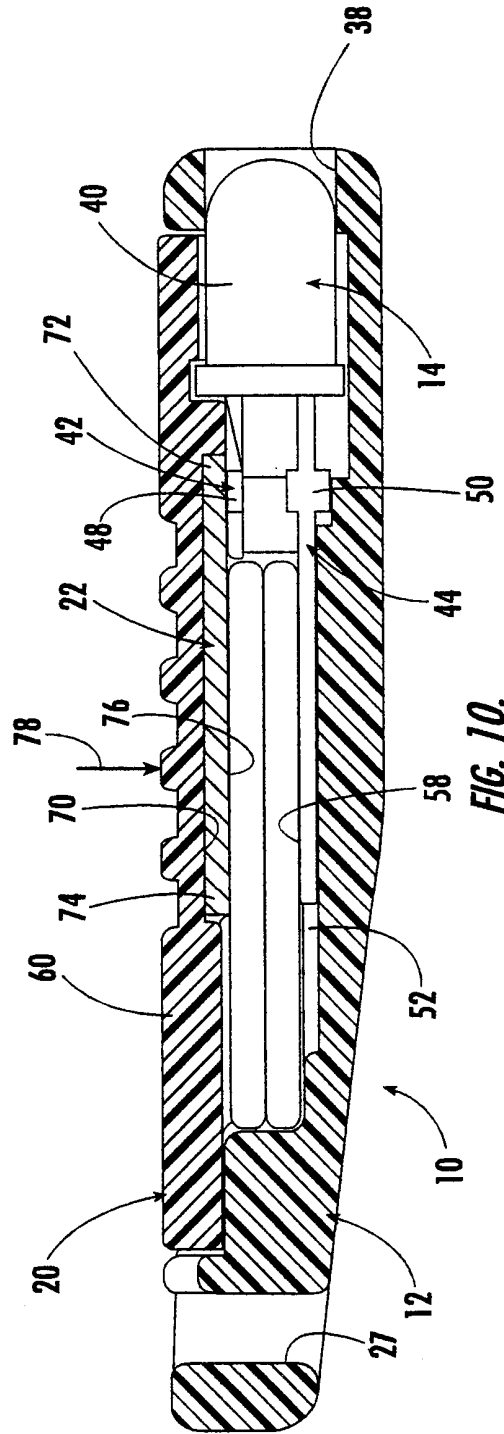


FIG. 10.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/22506

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : F21L 4/00
US CL : 362/200; 362/201

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. : US CL : 362/200; 362/201; 362/800; 362/204; 362/205

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

U.S. : 362/208; 362/194; 362/195; 362/189

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

EAST 1.1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, E	US 6,132,058 A (KUO) 17 OCTOBER 2000 (28/04/00) ALL	1-11
X	US 5,893,631 A (PADDEN) 13 April 1999 (13/04/99) ALL	1-11

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 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
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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
30 OCTOBER 2000

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