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F4R
Selected US specifications from IPC sub-class
F21L

# (54) Flashlight with adjustable lamp housing

(57) A flashlight comprises a plastic battery housing component 10 and a plastic lamp housing component 12, both with cylindroidal peripheral walls having, respectively, the same major and minor diameters, and terminating at one end 14, 16, respectively, in a truncated circular edge. The housing components are joined together with their circular edges meeting for rotation of the lamp housing component on the battery housing component, thereby permitting adjustment of the direction of the light beam relative to the axis of the battery housing component. The battery-housing component receives two side-by-side cylindrical batteries B1, B2 with one inverted relative to the other. Electrical terminal elements 82, 84, 64, and 74 (Fig. 2) at the juncture between the battery housing and lamp housing form circuit paths from one battery terminal to the lamp and from the lamp to the other battery terminal. A slide switch 44, 46, 62 in a bottom closure of the battery housing 10 enables making and breaking a circuit between the remaining battery terminals.

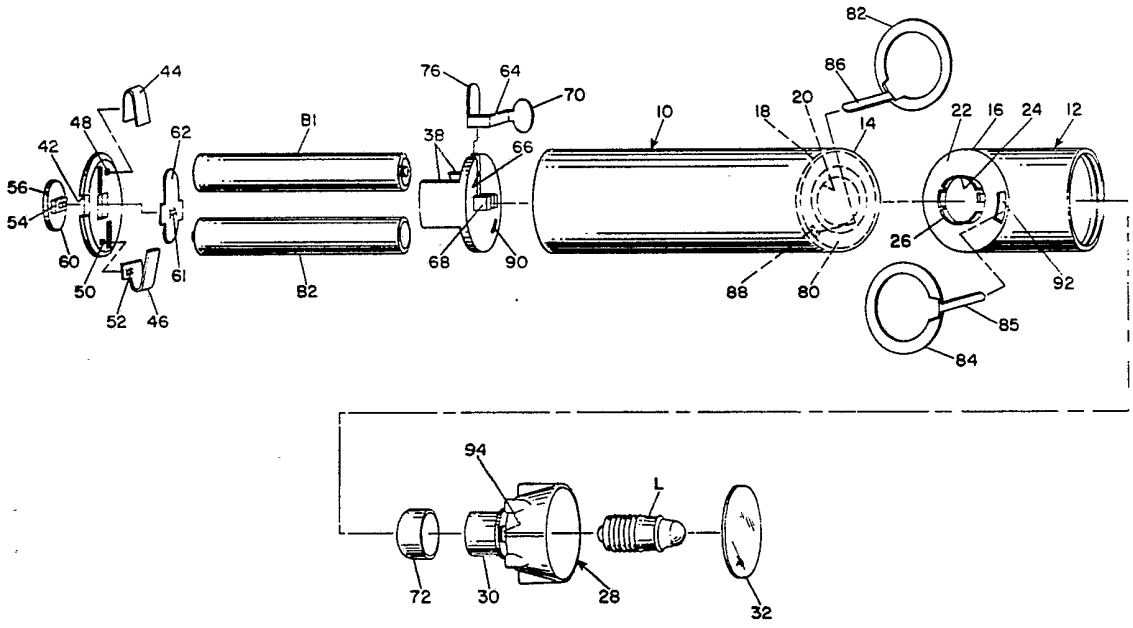


FIG. 1

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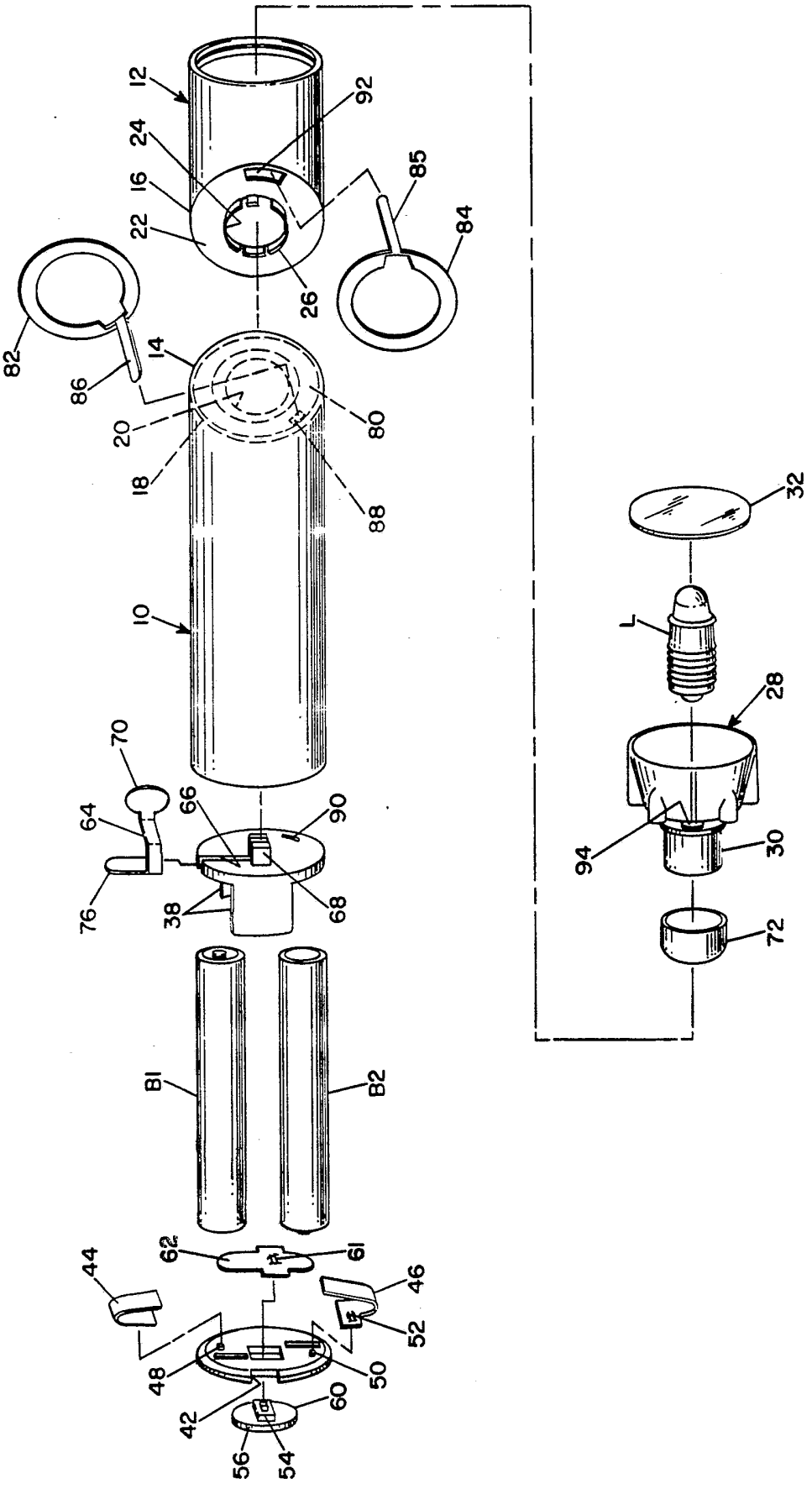
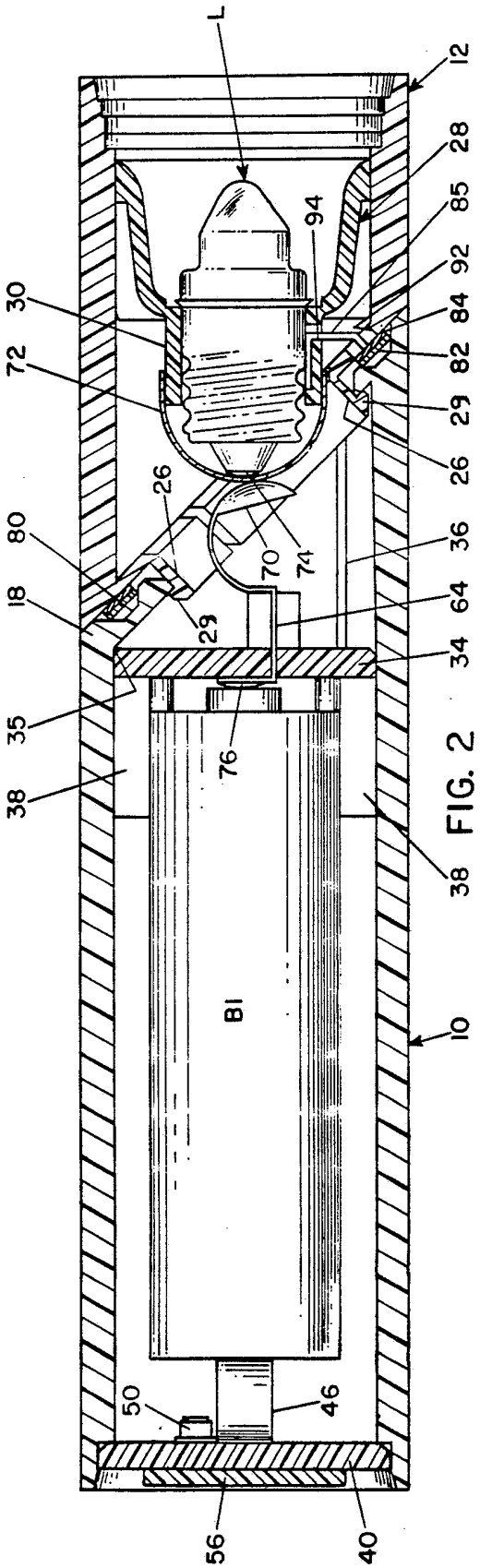



FIG. 1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B1
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56
40

FIG. 2

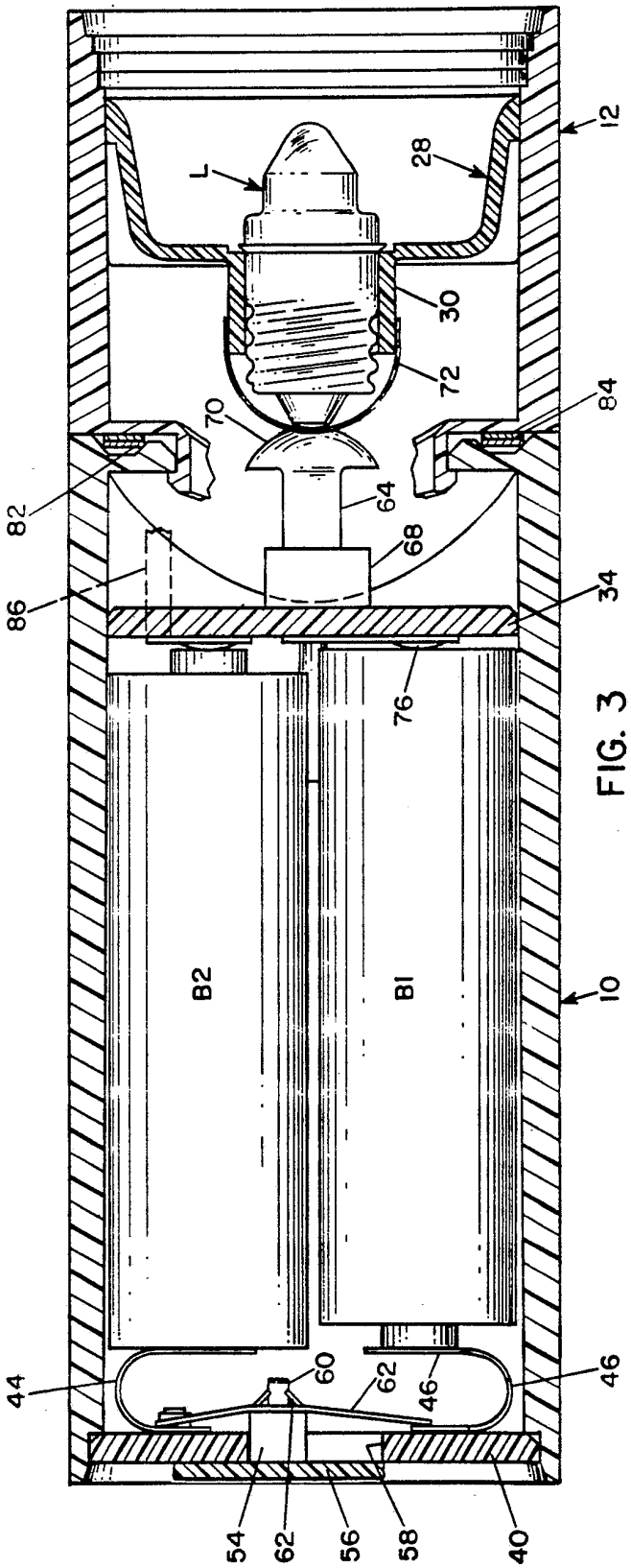
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FIG. 3

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# Flashlight With Adjustable Lamp Housing

## Background of the Invention

Battery-powered lamps, such as flashlights and lanterns, that have the capability of adjustment of the direction of the light beam, relative to the axis of a housing, are known. For example, flashlights having a bendable "gooseneck" arm through which wires run to a lamp at the end (analogous to the common gooseneck desk lamp) are currently marketed. Similarly, there are lanterns that have a pivoted lamp housing wired to a large battery.

It has been proposed by U.S. Patent No. 1,832,563 (1931) to construct an adjustable flashlight by joining two truncated cylindroidal housings end to end with their truncated ends, which are circular, meeting. Two batteries are carried end-to-end in one housing and the lamp is installed in the other housing. By rotating the lamp housing about a fastener that joins the two housings, the direction of the beam from the lamp, relative to the axis of the battery housing, can be varied from coaxial with the battery housing axis to an angle of 90° to the battery housing axis. The housings are metal, and one branch of the electrical circuit between the batteries and the lamp is through the housings, which meet edge-to-edge at the truncated ends to maintain electrical contact in all positions of the lamp housing. The other branch of the electrical circuit is composed of contact members affixed to plates of electrically insulating material mounted in the housings at their truncated ends. Both mechanical connection of the housing assemblies and electrical connections of the contact elements of the latter circuit branch are provided by a fastener at the center of the insulating discs.

The flashlight of U.S. Patent No. 1,832,563 requires many costly manufacturing and assembly steps, such as forming the metal housings and the insulating plates, installing the circuit contacts on the insulating discs, and crimping the discs into the ends of the housings. The last step presents particular difficulty, inasmuch as smooth contact surfaces where the turned-in ends of the housings meet are needed for easy adjustment of the lamp and maintenance of good electrical contact. Because the circumferences of these surfaces are smaller than those of the housing walls, desirably smooth surfaces are unattainable, because radial segmentation along the turned-in edges seems essential to avoid buckling.

A technological objective of the invention is to simplify the fabrication and assembly procedures needed to produce an adjustable flashlight. A further objective is to provide a flashlight with a relatively low center of gravity for more stability when it is placed on end. Still another objective is to ensure easy and smooth pivotal adjustment of the lamp housing and maintenance of good electrical contact between contact elements that move relative to each other.

Summary of the Invention

An adjustable flashlight, according to the present invention, includes several aspects that are known per se, including a battery housing component and a separate lamp housing component, a lamp affixed within the lamp housing component,
and conductive electrical circuit-forming elements received by the housing components to form an electrical circuit between the battery/(ies) and the lamp. The housing components have cylindroidal peripheral walls of the same major and minor diameters, respectively, and terminating at one end, respectively, in a truncated edge that is circular and

lies in a plane that is oblique to the axis of the cylindroidal wall by a selected angle A and that includes a major diametrical chord of the ellipse of the walls. The minor diameter of the ellipse of the peripheral walls of each component is equal to the cosine of the angle A times the major diameter. The housing components are joined together with their circular edges meeting in a manner that permits rotation of the lamp housing component on the battery housing component about an axis perpendicular to the said plane and coincident with the geometric centers of the circular edges.

The present invention is characterized in that the housing components are molded from a rigid polymeric material, and said circuit-forming elements include a first conductive contact element affixed to the battery housing component proximate to the circular edge thereof and having a portion in electrical contact with the electrical terminal of one of the batteries and a second conductive contact element affixed to the lamp housing component and in continuous engagement with the first contact element throughout the range of rotation of the lamp housing component and having a portion in electrical contact with a terminal of the lamp.

Suitably, an adjustable flashlight according to the invention has a battery housing component configured to contain a plurality of batteries. More specifically the battery housing component may be configured to contain two identical cylindrical batteries arranged side-by-side with one battery inverted relative to the other so that opposite electrical terminals of the batteries are disposed adjacent the respective ends of the battery housing component.

In preferred constructions of an adjustable flashlight according to the invention, the aforementioned first and second contact elements include annular ring portions that are adapted to engage each other along their circumferential extents in all rotational positions of the lamp housing component. In addition, the circuit-forming elements preferably include a third conductive contact element associated

with the battery housing component and having a first portion positioned substantially at said plane and at the geometric center of the circular edge and a second portion in electrical contact with the electrical terminal of the other battery. A generally spherical fourth electrical contact element is mounted on the lamp housing in electrically conductive relation to one contact of the lamp and the third contact element, whereby the spherical fourth contact element maintains an electrical connection between the lamp contact and the third contact element throughout the range of rotation of the lamp housing component.

Other preferred characteristics of the invention include the following:

The housing components have annular end walls extending inwardly from the respective circular edges, one of which has a circular hole concentric to the circular edge and the other of which includes a plurality of flanges received through the hole in circumferential sliding engagement, the flanges having outwardly extending lips engaging the underside of the end wall adjacent the hole;

One of the end walls has an annular recess in its face, and the first and second contact elements include annular ring portions that are received in the recess and are adapted to engage each other along their circumferential extents in all rotational positions of the lamp housing component; and

A slide switch is mounted on an end wall of the battery housing component opposite and remote from the said one end, the switch including conductive contact elements arranged to make and break an electrical circuit between the battery terminals disposed adjacent said end wall.

In a flashlight embodying the present invention when the lamp housing is rotated to a position in which its axis is in alignment with the axis of the battery housing, the light beam from the lamp is

likewise aligned with the axis of the battery housing. As the lamp housing is progressively rotated away from the aligned position, the light beam is directed progressively away from the battery housing axis until, at the 180 degrees-from-aligned position, the beam is directed at an angle equal to twice the angle A of the planes of the circular edges. Accordingly, the flashlight is very useful, because it can be placed on end or on its side on a floor, table or other surface, and the lamp housing can be adjusted to direct the beam in a desired direction.

The electrical circuit elements of the flashlight are associated with subassemblies of the flashlight, which facilitates manufacture and final assembly. The housing components are relatively simple plastic moldments that, in preferred forms, snap together. The battery housing component requires no lengthwise electrical circuit element, inasmuch as the batteries form lengthwise circuit paths. Location of the switch in the bottom of the housing simplifies manufacture and permits recessing the switch, making accidental transfer unlikely. The side-by-side arrangement of the batteries makes the flashlight compact with a low center of gravity for stability when standing on end.

For a better understanding of the invention, reference may be made to the following description of an exemplary embodiment, taken in conjunction with the figures of the accompanying drawings.

Description of the Drawings

Fig. 1 is an exploded pictorial view of the embodiment;

Fig. 2 is an axial cross-sectional view of the embodiment taken along the minor diameters of the housing components; and

Fig. 3 is an axial cross-sectional view of the embodiment taken along the major diameters of the housing components.

Description of an Embodiment

The embodiment comprises a battery housing component 10 and a lamp housing component 12, both of which are cylindroids having the same major and minor diameters, respectively. One end 14, 16 of each housing component is defined by a circular edge that lies in a plane oriented at 45 degrees to the axis of the respective cylindroid and includes a major diametrical chord of the ellipse of the cylindroid. In order that the circular edge will be formed by the 45 degree plane, the ellipse of the cylindroid must conform to the relationship, (minor diameter) = (major diameter) x (cosine 45 degrees). In the assembled flashlight the battery housing component and lamp housing component are joined together with the circular ends meeting in a manner that allows the lamp holder to be rotated about an axis perpendicular to the 45 degree planes of the ends 14, 16 and coincident with the geometric center of the circular edge. This arrangement allows the light beam to be directed at all angles between 0 degrees and 90 degrees, with respect to the axis of the battery housing component.

It is not required that the housing components have the geometry of the embodiment. For any cylindroid, there is one plane oblique to the cylinders axis and including a major diametrical chord that intersects the cylinder surface at a circle. If that plane lies at an angle A to the cylinder axis, the lamp housing component can be rotated on the battery housing component to direct the light beam at any angle between 0 degrees and twice the angle A. The angle A is preferred to be 45 degrees, because that provides the maximum range of adjustment of the light beam. Nonetheless, other angles for the circular edges of the components can be used with, of course, ellipses for the cylinders conforming to the relationship, (minor diameter) = (major diameter) x (cosine of the angle A).

In the embodiment the circular truncated end 14 of the battery housing component 10 has an annular wall portion 18 having a hole 20 concentric with the circular outer edge. Similarly, the end 16 of the lamp housing 12 has an annular wall portion 22 having a concentric hole 24. A series of flanges 26 extend out from the wall 22 at the edge of the hole 24 and are received in circumferentially sliding relation through the hole 20 in the wall 18 of the component 10. The flanges 26 have outwardly projecting lips 29 that underlie the wall 18 and retain the lamp housing component 12 on the battery housing component 10. The flanges 26 are resilient to enable assembly of the components 10 and 12 by mating the flanges 26 to the hole 20 and forcing the components 12 and 14 together, whereupon the component 12 snaps into place on the component 10 and is thereafter permanently retained by the lips 29. (In Fig. 3, the portions of the walls 18 and 22 behind the plane of the cross section have not been shown in order to simplify and clarify the drawing.)

The lamp housing component 12 receives a cup-like lamp holder 28 which has a receptacle portion 30 that accepts the base of a conventional flashlight lamp L. A lens 32 (see Fig. 1) fits into the open uppermost end of the component 12.

An upper battery support plate 34 is received in the upper portion of the battery housing component and is stopped in the proper axial position by the juncture 35 between the perimeter wall and end wall 18 and by ribs 36 molded into the inside of the perimeter wall. A pair of side flanges 38 extend down from the support plate 34 and stabilize the position of the plate against tilting and movement during assembly and when the batteries are removed for replacement. The bottom end of the battery housing is closed by an end cap 40 that snaps into place but can be removed for replacement of the batteries by inserting a

screwdriver or similar tool into a notch 42 (see Fig. 1) at the edge and prying the closure out.

The housing components 10 and 12, the battery support plate 34, the lamp holder 28, the bottom closure 40 and the lens 32 are, advantageously, made by injection molding from suitable rigid polymeric materials. The molded components are inexpensive to produce and amenable to manual press-fitting assembly techniques.

Resilient electrical contacts 44 and 46 are mounted on the inside of the closure 40 by being pressed onto small bosses 48 and 50 received in holes (e.g., 52) with gripping tangs in the respective terminals. A post 54 on a switch button 56 extends slidably through a rectangular hole 58 in the end cap 40 and is attached by means of a boss 60 and a tanged hole 61 to a movable switch contact 62. In the position shown in Fig. 3, the switch is closed by bridging the contacts 44 and 46; when the switch button is moved from left to right (Fig. 3), the left portion of the switch contact 62 moves out of engagement with the terminal 44, thus opening the switch.

The battery support plate 34 receives a resilient electrical contact element 64 by sliding the contact 64 edgewise into a slot 66 until it is supported within a boss 68. At one end of the contact 64 is a disc portion 70 that in the assembled flashlight resides substantially at the geometric center of the circular end 16 of the battery housing component 10 and in the plane of the wall portion 20. In that position it is engaged by a spherical contact member 72 received on the lamp holder 28. The end terminal 74 on the lamp L, the contact member 72 and the disc portion 70 mutually engage in all rotational positions of the lamp housing, such engagement being ensured by a force generated by resilient deformation of the contact 64. At the other end of the contact 64 is a

leg 76 that is bent out under the plate 34 and is engaged by the minus terminal of a battery B1.

The wall 18 of the battery housing component 10 has a shallow annular groove 80 that receives two electrical contact elements in the form of rings 82 and 84 of a conductive material. The contact ring 82 nearer the battery housing has a leg 86 that extends down through a slot 88 in the wall 18 and a slot 90 in the plate 34 and bends in to engage the negative terminal of the battery B2. The contact ring 84 has a leg 85 that extends up through a slot 92 in the wall 22 of the lamp housing component 12, turns in and passes through a slot 94 in the lamp socket 30 and turns down within the socket for engagement with the peripheral terminal of the lamp L. The face-to-face engagement of the contact rings 82 and 84 ensures maintenance of an electrical circuit connection at the juncture between the battery housing component and lamp housing component throughout the range of rotation of the lamp. It will be apparent that one of the rings could be replaced by a contact shoe; it is preferable, however, to use two rings to ensure conductive contact, lest there be a dead spot for one reason or another between the shoe and ring.

In summary, the circuit path of the embodiment is as follows: base terminal 74 of lamp L; spherical contact 72; contact element 64; plus terminal of battery B1; minus terminal of battery B1; contact 44; switch contact 62; contact 46; plus terminal of battery B2; minus terminal of battery B2; contact ring 82; contact ring 84; peripheral terminal of Lamp L.

CLAIMS:

1. A flashlight with an adjustable lamp housing having a battery housing component and a separate lamp housing component, a lamp affixed within the lamp housing component, and conductive electrical circuit-forming elements received by the housing components to form an electrical circuit between one or more batteries in the battery housing component and the lamp, the housing components having cylindroidal peripheral walls of the same major and minor diameters, respectively, and terminating at one end, respectively, in a truncated circular edge that lies in a plane that is oblique to the axis of the cylindrical wall by a selected angle A and includes a major diametrical chord of the ellipse of the walls, the minor diameter of the ellipse of the peripheral walls of each component being equal to the cosine of the angle A times the major diameter, and the housing components being joined together with their circular edges meeting for rotation of the lamp housing component on the battery housing component about an axis perpendicular to the said plane and coincident with the geometric centers of the circular edges, characterized in that the housing components are molded from a rigid polymeric material, and in that said circuit-forming elements include a first conductive contact element affixed to the battery housing component proximate to the circular edge thereof and having a portion in electrical contact with the electrical terminal of one of the batteries and a second conductive contact element affixed to the lamp housing component and in continuous engagement with the first contact element throughout the range of rotation of the lamp housing component and having a portion in electrical contact with a terminal of the lamp.

2. A flashlight according to claim 1 and further characterized in that the battery housing component is configured

to contain a plurality of batteries.

3. A flashlight according to claim 1 and further characterized in that the battery housing component is configured to contain two identical cylindrical batteries arranged side-by-side with one battery inverted relative to the other so that opposite electrical terminals of the batteries are disposed adjacent the respective ends of the battery housing component.

4. A flashlight according to claim 1, 2 or 3 and further characterized in that said first and second contact elements include annular ring portions that are adapted to engage each other along their circumferential extents in all rotational positions of the lamp housing component.

5. A flashlight according to claim 1, 2 or 3 and further characterized in that the circuit-forming elements include a third conductive contact element associated with the battery housing component and having a first portion positioned substantially at said plane and at the geometric center of the circular edge and a second portion in electrical contact with the electrical terminal of the other battery and in that a generally spherical fourth electrical contact element is mounted on the lamp housing in electrically conductive relation to one contact of the lamp and the third contact element, whereby the spherical fourth contact element maintains an electrical connection between said one lamp contact and the third contact element throughout the range of rotation of the lamp housing component.

6. A flashlight according to claim 1, 2 or 3 and further characterized in that the housing components have annular end walls extending inwardly from the respective circular edges, one of which has a circular hole concentric to the circular edge and the other of which includes a plurality

of flanges received through the hole in circumferential sliding engagement, the flanges having outwardly extending lips engaging the underside of the end wall adjacent the hole.

7. A flashlight according to claim 6 and further characterized in that one of the end walls has an annular recess in its face and in that said first and second contact elements include annular ring portions that are received in the recess and are adapted to engage each other along their circumferential extents in all rotational positions of the lamp housing component.

8. A flashlight according to claim 1, 2 or 3 and further characterized in that a slide switch is mounted on an end wall of the battery housing component opposite and remote from the said one end, the switch including conductive contact elements arranged to make and break an electrical circuit between the battery terminals disposed adjacent said end wall.

9. A flashlight with an adjustable lamp housing substantially as described herein with reference to and as illustrated in Figs. 1-3 of the accompanying drawings.

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