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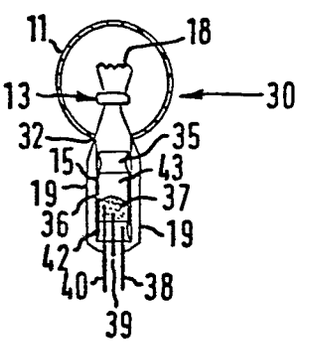
(54) Electric light source with integral switch.

(57) An electric lamp (30) incorporates an integral mercury switch (37) within the lamp structure to provide an attitude-sensitive light source. The mercury switch may be incorporated within the lamp envelope, either with the filament or in a separate compartment of the envelope, within a specially extended portion of an exhaust tube, or within a cap structure sealed to the light source envelope. The mercury switch is either specially fabricated during formation of the lamp structure, or may comprise a preformed capsule. The unit may be fitted in conventional screw bayonet and other sockets in the same manner as a corresponding ordinary lamp.

FIG 2



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"ELECTRIC LIGHT SOURCE WITH INTEGRAL SWITCH"

The present invention concerns an electric light source with an integral electric switch. More particularly, though not exclusively, the invention concerns a novel incandescent filament lamp which incorporates an attitude and movement sensitive switch for controlling the supply of electric power to the filament of the lamp.

Incandescent lamps are used in a large variety of situations and positions where the requirement for illumination is associated with some physical movement. Thus, for instance, it is desirable to provide a light source for the bonnet (hood) or the boot (trunk) of a motor car in order to illuminate these spaces especially when the ambient light is poor.

However, existing bonnet and boot lighting systems have not been wholly satisfactory due to the unreliability of the switches. This is due partly to the restrictions in the locations for such switches.

It has been known to happen that, unbeknown to the driver, a lamp remained lit overnight and drained the battery of the car.

Also safety lifebelts incorporating a light bulb are normally stored in one attitude in which an attitude-sensitive switch prevents the filament of the bulb from being energised but when the belt is used a floating ring on it ensures that it floats on water in an attitude inverted in relation to the storage attitude, and in this attitude the switch permits the filament to be energised. Clearly faulty contacts or connections in this circuit could have potentially serious consequences.

Other possible applications for attitude sensitive light switches may readily be conceived; any situation where the opening of a door or lid, or the movement of some other physical member is desirably accompanied by light illumination (or extinction) e.g. car doors, doors of washing machines and refrigerators, power sub-stations etc.,

The present invention seeks to overcome the above-mentioned disadvantages of existing lamps and associated supply circuitry and to provide an improved electric light source with its own integrated attitude-sensitive or movement-sensitive switch.

According to a first aspect of the present invention, an integrated device comprises an electric light source having an envelope and

supply leads for feeding current from terminals of the device connectable with a source of external electric supply to a filament or electrode(s) disposed within the envelope, and displacement-responsive switch means connected in the path of at least one of said leads, between the associated device terminal and the filament or electrode, characterised in that the said switch means is permanently enclosed within an integral part of the light source structure.

Thus, the switch means, which preferably comprises a mercury switch, according to various preferred embodiments of the invention be incorporated within the high source envelope itself; within a divided compartment of the envelope; within an exhaust or like tube sealed to or extending from the envelope; or within a cap structure sealed to the light source envelope. In each case the switch means is conveniently incorporated into the light source structure during its fabrication to provide an integral unit which preferably can be fitted in conventional bayonet, screw and other sockets in the manner of a corresponding conventional light source.

According to a first preferred embodiment, the switch means comprises a mercury switch the switch chamber being formed between pinch seals in an exhaust

or like tube sealed to the light source envelope.

According to a second preferred embodiment of the invention the light source is an incandescent lamp the envelope of which is divided into two compartments by a dividing wall and one compartment contains a filament the other providing a sealed enclosure for the switch means in which a portion of a supply lead passes from the filament through the dividing wall into the switch enclosure to provide a first contact terminal therefor, and a second switch contact terminal is provided within the switch enclosure by a portion of another supply lead another portion of which extends outside the envelope to provide a device terminal for connection to an external supply.

According to a further preferred embodiment the light source is an incandescent lamp in which the lamp envelope itself provides the enclosure for the switch means, a first supply lead passing without interruption from an associated device termina to the filament within the envelope, and a second supp lead comprises a first portion connected to the filament and terminating within the envelope to provide a first contact terminal for the switch, and a second portion connected to an associated device terminal and terminating within the envelope, to provide the second contact terminal for the switch, a portion of the first supply lead within the envelope

being provided with means for preventing a short-circuit between that supply lead and the second portion at the second supply lead.

According to another preferred embodiment, the mercury switch is secured within a cap structure of the light source permanently secured to the envelope, and the cap structure includes a cap shell, first and second insulating elements at least partially accommodated within the cap shell the two elements defining a sealed mercury-containing switch chamber therebetween, and a pair of conductors extending into said chamber to provide the switch contacts.

Alternatively, the mercury switch, instead of being formed or assembled during fabrication of the light source, may comprise a pre-formed capsule already containing mercury and switch contacts.

According to a second aspect of the present invention, a method of making an integral mercury-switched electric light source includes the steps of tipping-off by means of a pinch seal an exhaust tube sealed to or extending from an envelope for the light source, introducing a predetermined quantity of mercury into the open end of the said tube, introducing contact terminals into the open end of the tube and forming a second seal in the tube to seal said terminals into position and to define a sealed space to provide a mercury switch chamber.

The second seal is preferably also a pinch seal, and contact terminals to provide conveniently both the switch contacts and the device terminals may be inserted into the open end of the said tube, prior to forming the second pinch seal to be sealed in position on formation of that seal.

The invention will now be illustrated, purely by way of example, with reference to the accompanying schematic drawings, wherein:

Figure 1 shows in elevation a conventional miniature incandescent lamp in which the lamp envelo and the stem incorporating the exhaust tube are butt sealed together;

Figure 2 is an integral lamp and switch according to the present invention shown in an intermediate stage of its manufacture;

Figure 3 shows the completed (capped) product;

Figures 4 and 5 are elevational views of the product of Figures 2 and 3, but with the cap omitted for the sake of better explaining its mode of operation;

Figures 6 and 7 illustrate a "festoon" type of incandescent lamp incorporating a switch, respectively in the "on" and "off" positions;

Figure 8 is an elevation of the third embodiment of the integrated lamp and switch according to the invention;

Figure 9 is a part elevational, part-sectional view of an integrated lamp-and-switch device according to a further embodiment of the invention;

Figure 10 is a view similar to Figure 9 on an enlarged scale showing a further embodiment and of inverted attitude;

Figure 11 is a view similar to Figure 9 again on an enlarged scale showing a sixth embodiment, and

Figure 12 is a view similar to Figure 9, showing a seventh embodiment of the invention.

With reference to Figure 1, there is shown a miniature lamp 10 comprising a lamp envelope or bulb 11 into the neck 12 of which a bead mount 13 has been butt-sealed. The bead mount 13 includes an exhaust tube 15 for pumping out therethrough the interior of the envelope 11 and a bead 17 carrying supply leads 19 which are connected to and support an incandescent lamp filament 18. Lead-in wires or supply leads 19 also serve to connect the filament 18 to an external source of electric power, not shown.

With reference to Figure 2, the integral lamp and switch according to the present invention is generally indicated by reference 30. As in Figure 1, it includes a lamp envelope 11 having a neck 32 to which a bead mount 13 has been butt-sealed. Lead-in wires 19 are provided for connecting an incandescent filament 18 to an external source of electric power (not shown). Again, as before, the interior of the lamp envelope 11 is pumped out to a suitably low pressure.

In the next stage of operation, however, instead of tipping-off in the conventional manner by playing a flame from burners on the neck 32 and exhaust tube 15 and simultaneously mechanically drawing the exhaust tube in a direction away from the bulb, tipping-off is effected by a pinch seal 35. This results in an open stump 36' of the exhaust tube 15.

With the envelope inverted by 180° from the illustrated position, an accurately dosed amount of mercury 37 is now introduced onto the open stump 36. Then a head incorporating three contact pins 38, 39 and 40 made e.g. of nickel, is inserted into the open stump 36 and is then pinch-sealed to the exhaust tube stump 36. This second pinch seal is designated by 42. The arrangement of the pins is such that the top end (as seen in Figure 2) of pin 38 terminates within the pinch seal 42 while the other two pins 39, 40 extend preferably as shown by unequal amounts through the pinch seal 42 into the now sealed interior 43 of the exhaust tube 15 that contains the mercury 37. Of the two pins 39, 40 the pin 40 extends further below the pinch-seal 42 than the pin 39 and, together with the pin 38, constitutes the usual bi-pin arrangement providing terminals for connection of the device to an external supply. Now the lead-in wires 19 are welded to the nickel pins 38, 39.

When the device is in its position shown in Figure 2, the drop of mercury 37 forms a conductive path or bridge between the pins 39 and 40.

Thereafter a cap, e.g. a moulded plastics cap 45, is secured around the exhaust tube and pins, in a manner known per se, with two nickel terminal pins 38, 40 protruding therethrough.

Referring now to Figures 4 and 5, the integral lamp and switch device is shown in two different attitudes, e.g. with reference to its use as a boot (trunk) lid lamp in a motor car. When the lid (not shown) is open, it is desired that the filament 18 should be energised to illuminate the interior of the boot or trunk, and in that position the drop of mercury 37 bridges over the two contact pins 39, 40 to make the electric circuit. In contrast, in Figure 5, with the lid closed, the drop of mercury 37 has rolled away from the end of the hollow space 43, thus open-circuiting the electric supply to the filament 46.

Figures 6 and 7 illustrate a "festoon"-type of lamp 50. It has an elongated envelope 11 containing an incandescent filament 18 carried on a bead 13 and fed from two supply leads 19a, 19b. Lead 19a passes through the envelope 11 for connection to an external supply, not shown. The supply lead 19b comprises a first portion 60 terminating outside the envelope 11 and an angled portion 61

within the envelope 11. A dividing wall 62 divides the envelope 11 into two compartments 56, 57. The lead 19a passes through a bead 13 and is then connected to one end of filament 18 the other end of which is connected to one end of a conductor 19c. The conductor 19c passes through dividing wall 62 and terminates in an angled portion 58 somewhat spaced from angled portion 61 of conductor 19b.

The compartment 57 contains a volume of mercury 59 capable of electrically connecting the portions 58 and 61.

In the Figure 6 position the circuit is 'made' by the mercury 59 bridging the angled ends 58, 61. In the Figure 6 position in which the lamp 50 has been rotated through 180° about a horizontal axis relative to the Figure 6 position, the circuit is broken, as the ends 58, 61 no longer dip into the pool of mercury 59. The extent of rotation need not, of course be 180°; it may be less.

In Figure 8 there is shown a miniature lamp 70 having an incandescent filament 18 supported on a bead 13 and fed from supply leads 19d, 19e. The leads 19d, 19e pass through the envelope 11 for connection to a non-illustrated external supply. The portion 73a of the lead 19d which is within the envelope 11 is provided with an insulating sleeve 76.

The other lead through the bead 13 is designated 74 and terminates within and adjacent to the envelope 11. The end of the lead 19e

remote from the source of electric supply is designated 78 and is located within the envelope 11, terminating at a small distance from the end of the wire 74 remote from the bead 13. A pool of mercury 79 bridges the gap between lead ends 78, 79 in the illustrated position, thereby "making" the circuit.

When the attitude of the lamp changes, the mercury moves away from the wire ends to "break" the circuit. Means (not shown) maybe provided to prevent direct contact between the mercury 79 and the filament 18. A short circuit between the two supply leads is prevented by the insulating sleeve 76 surrounding the lead 73a. Alternatively, this may be achieved by spacing the lead 73a and lead portion 74 sufficiently far apart to prevent bridging contact by the mercury pool 79.

The lead portion 74 may be sealed into the envelope 11 at the time when the envelope 11 is butt-sealed to the bead mount. The lamp 70 may be gas-filled.

Referring now to Figure 9, there is shown a lamp 90 comprising a lamp envelope or bulb 11 into the neck 12 of which a bead mount 13 has been sealed. The envelope 11 has been exhausted and tipped off at 14. The bead mount 13 may include an exhaust tube (not shown) for pumping out therethrough the interior of the envelope and a bead 17 carrying an incandescent lamp filament 18.

Lead-in wires or supply leads 19f, 19g are provided for connecting the filament to an external source of electric power, not shown.

An existing type of lamp base or cap 80, but of longer axial length than the conventional length, is secured to the envelope 11 in a manner to be described. The external surface of the cap 80 may be threaded, or as is usual in the United Kingdom, is provided with lateral pins 81 for a bayonet type socket. The lead-in wire 19f is soldered to an external surface of the cap 80.

The other lead-in wire 19g is guided within the hollow interior of the cap 80 past the tip-off stump 82 to a central position where it is welded to an axially extending contact pin 83, made of an alloy of metals, e.g. of Ni-Fe. The pin 83 projects through and is adhesively sealed in an aperture 83a in a preform 84 of synthetic material. The preform 84 has a cylindrical outer surface which is adhesively cemented to the internal surface of the cap 80, the gap between these two surfaces in Figure 1 being exaggerated for clarity. The preform 84 may itself be made of an adhesive e.g. a thermoplastic material, or the adhesive cement may be applied separately.

The preform 84 is secured via epoxy seals 85 to a conventional vitrite element 86 fixed within the cap 80. The vitrite element 86 is annular and its

internal surface is partly of an inverted frusto-conical shape, partly cylindrical, whereby a chamber 87 is formed between it and the lower end face (as viewed) of the preform 84. The central part of the element 86 is apertured at 88 and a metallic contact pin 89 is sealed therein. The pin 89 has an enlarged head 89a extending underneath the element 86 to form the usual lamp centre contact. The other end of the pin 89 extends into the chamber 87 towards the other contact pin 83 so as to form a small gap 91 therebetween. In the illustrated attitude of the lamp, this gap 91 is conductively bridged by a drop of mercury 97 previously introduced into the chamber 87. Clearly, if the lamp were inverted through 180°, or tilted through a lesser angle, the drop of mercury would roll or flow away from the gap 91 to break the electric power supply to the lamp filament 18.

Referring now to Figure 10 illustrating the normal or "on" attitude of a lamp according to a variant of the Figure 9 embodiment, only the differences will be described. The pin 83 of Figure 9 is dispensed with; instead one lead-in wire 19h itself is moulded in the preform 84a. The other lead-in wire 19i is also moulded in the preform 84a. and as before, soldered at 93 to a conventional lamp cap 80a. In this variant, the preform 84a is longer

than the preform 84 of Figure 9: it extends out of the cap 80a and is transfer-moulded to the envelope 11 and stump 14. The upper end 92 (as viewed) of the preform 84a is generally V-shaped in section and forms with the vitrite element 86 the chamber 87 containing mercury 97. As before, contiguous surfaces of the preform 84a and the vitrite element 86 are sealed together by seals 85. In this variant a contact pin 89 extending through and sealed in the central aperture 88 extends well into the chamber 87 and forms the gap 91 with the tip or end of the lead-in wire 19h which thus provides the other contact for the mercury switch. This lead-in wire may be of Ni-Fe.

Figures 11 and 12 illustrate two variants in which like parts have been allotted like reference numbers. In both of these variants, a volume of mercury 37 is contained in a discrete capsule 100 provided with contacts 101, 102. The unit 100, 101, 102 may then be a pre-existing mercury switch e.g. that manufactured by the Gunther Company, Germany, type designation HG 2703.

In Figure 11 a conventional envelope 11 and a conventional cap 80 are connected together by an annular plastics mounting 103 the upper end of which flares outwardly and is sealed at 104 to the envelope 11. Its lower end is cemented to the inside

of the cap 80. In this way, a generally cylindrical internal space or chamber 105 arises and the capsule 100 is accommodated in the chamber 105.

The lead-in wires 19k, 19l are led through (and fused to) the wall of the envelope 11. One wire 19k is passed through (and sealed in) an aperture in the moulding 103 and is soldered to the outside of the cap 80. The other wire 19l is welded to the upper (as viewed) contact 101 of the mercury switch capsule 100 which is spaced by a small gap 91 from the lower contact 102. The lower contact 102 passes through an aperture 88 in the vitrite element 86 and is formed with a contact head 90. In the illustrated attitude the filament 18 is not energised because the mercury 37 does not bridge the contact gap 91. In the inverted position the circuit is made and the filament 18 is energised.

The Figure 12 embodiment differs from the Figure 11 embodiment only in the following significant respects.

A commercially available mercury switch capsule 100 is used wherein the two contacts 101, 102, are at the same (lower) end of the capsule 100. The moulding or cap extension 103a is right annular and is not apertured: one lead-in wire 19k is passed under the lower end of the moulding 103 and then bent back to pass between the outer surface of the cap 80 over the rim of the cap and is then

soldered to the outer surface of the cap 80. An insulating plastics tube 110 supported by means not shown, is disposed around the capsule 100 to protect the latter and to prevent metal-to metal contact between the lead-in wire 191 and the cap 80.

CLAIMS

1. An integrated device comprising an electric light source having an envelope (11) and supply leads (19) for feeding current from terminals of the device connectable with a source of external electric supply to a filament (18) or electrode(s) disposed within the envelope (11), and displacement-responsive switch means connected in the path of at least one of said leads (19) between the associated device terminal and the filament or electrode, characterised in that the said switch means (37, 39, 40; 58, 59, 61; 74, 78, 79; 83, 89,97; 19h, 89, 97; 100) is permanently enclosed within an integral part of the light source structure (30; 50; 70; 90).

2. A device as claimed in claim 1, characterised in that the light source is an incandescent lamp and the switch means is integrally formed within an exhaust tube (15) sealed to the light source lamp envelope (11) and the switch means is contained within a sealed enclosure (43) formed between pinch seals (35, 42) spaced along the exhaust tube.

3. A device as claimed in claim 2, characterised in that the contacts (39, 40) for the switch means enter the said enclosure (43) from outside via said exhaust tube seal (42) remote from the lamp envelope (11) and the switch contacts comprise first and second pins (39, 40) projecting through said remote exhaust tube seal (42) into the said

enclosure (43) the device including a third pin (38) projecting into the said remote seal (42) from outside but not into the switch enclosure, the first (39) and third pins (38) being connected to the filament (18) or electrode via respective ones of said leads (19), and the second and third pins providing device terminals (38, 40).

4. A device as claimed in claim 3, characterised in that the switch means is enclosed within an insulating end cap or base (45) for the light source from which only the second and third pins (38, 40) project.

5. A device as claimed in claim 1, characterised in that the light source is an incandescent lamp the envelope (11) of which is divided into two compartments (56, 57) by a dividing wall (62) and one compartment (56) contains a filament (18), the other (57) providing a sealed enclosure for the switch means in which a portion of a supply lead (19c) passes from the filament (18) through the dividing wall (62) into the switch enclosure (57) to provide a first contact (58) terminal therefor, and a second switch contact terminal (61) is provided within the switch enclosure (57) by a portion of another supply lead (19b) another portion (60) of which extends outside the envelope (11) to provide a device terminal for connection to an external supply.

6. A device as claimed in claim 2, characterised in that the light source is an incandescent lamp in which the lamp envelope (11) itself provides the enclosure for the switch means, a first supply lead (19d, 73a) passing without interruption from an associated device terminal to the filament (18) within the envelope, and a second supply lead (19e, 78, 74) comprises a first portion (74) connected to the filament (18) and terminating within the envelope (11) to provide a first contact terminal for the switch, and a second portion (78, 19e) connected to an associated device terminal and terminating within the envelope (11) to provide the second contact terminal for the switch, a portion (73a) of the first supply lead within the envelope (11) being provided with means (76) for preventing a short-circuit between that supply lead and the second portion (74) at the second supply lead.

7. A device as claimed in claim 1, characterised in that the switch means is secured within a cap structure (80) associated with and permanently secured to said envelope (11), said cap structure including a cap shell (80), first and second insulating elements (86, 84) at least partially accommodated within the cap shell (80), the two elements defining a sealed mercury-containing switch chamber

(87) therebetween, and a pair of conductors (83, 89) extending into said chamber (87) to provide the switch contacts.

8. A device as claimed in claim 7, characterised in that one each of said pair of conductors extends through a respective one of the two insulating elements (86, 84) the conductor (89) extending through the first insulating element (86) being connected to or providing a said device terminal (89a) and the conductor (83) extending through the second insulating element (84) being connected to or provided by said at least one of the leads (19g).

9. A device as claimed in claim 7, characterised in that the mercury switch comprises a preformed mercury switch capsule (100) having two contacts (101, 102) a first (102) of which provides or is electrically connected to a said device terminal (102a) the other contact (101) being connected to said at least one of the leads (19l), the capsule (100) being supported within the cap (80) between the envelope (11) and an insulating element (86) having an aperture (88) through which the first contact (102) is electrically connected to, or through which it extends to provide, the said device terminal (102a).

10. A method of making an integral mercury-switched electric light source including the steps of tipping-off by means of a pinch seal an exhaust tube sealed

to or extending from an envelope for the light source, introducing a predetermined quantity of mercury into the open end of the said tube, introducing contact terminals into the open end of the tube and forming a second seal in the tube to seal said terminals into position and to define a sealed space to provide a mercury switch chamber.

FIG.1

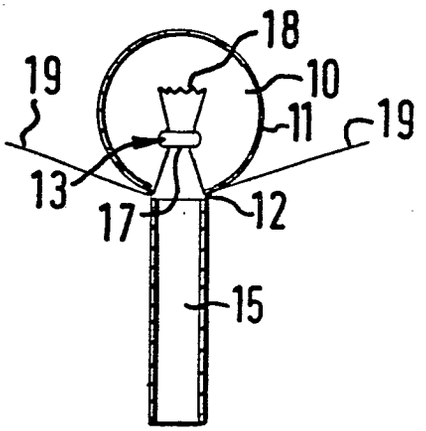


FIG 2

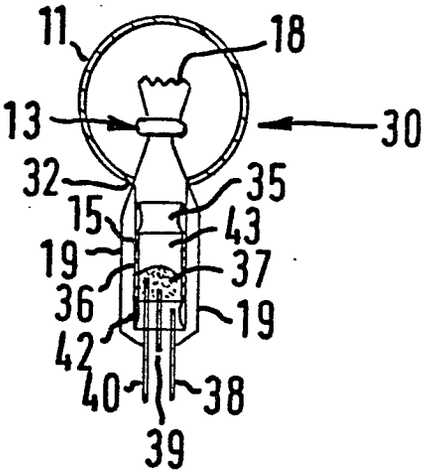


FIG.3

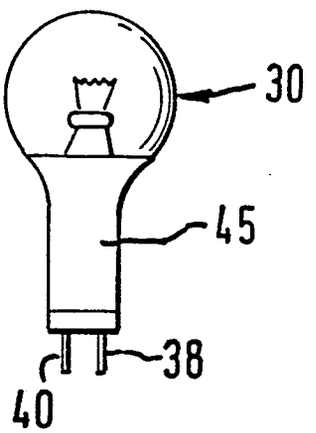


FIG.4

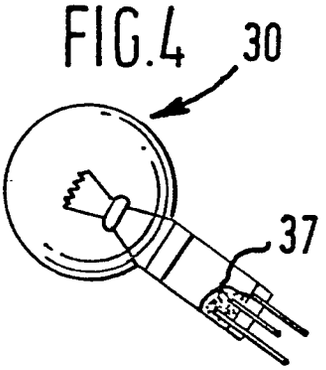
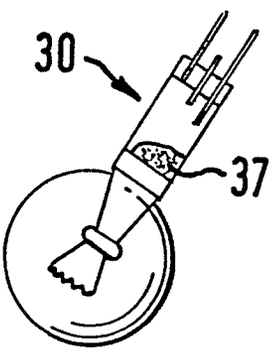


FIG.5



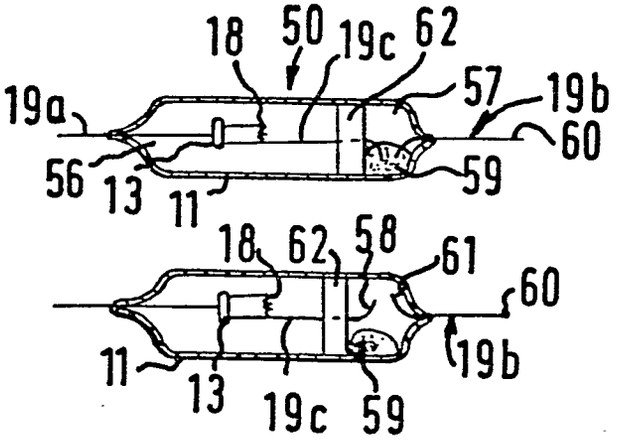


FIG.6

FIG.7

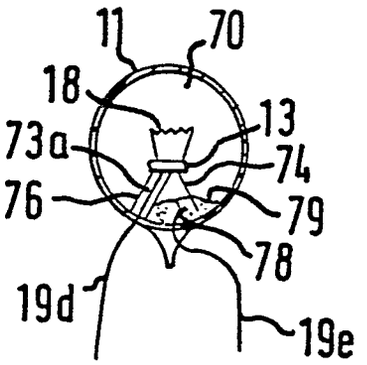


FIG.8

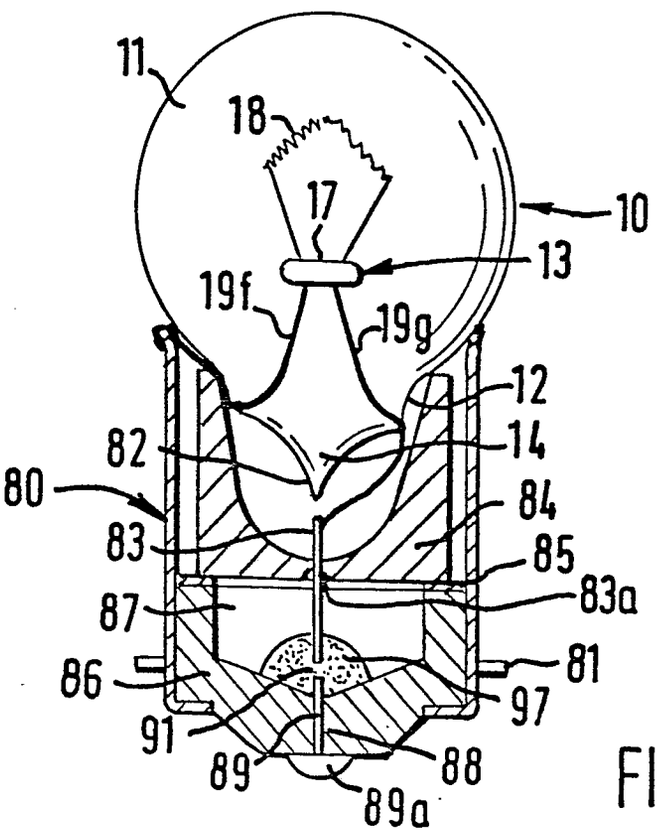


FIG.9

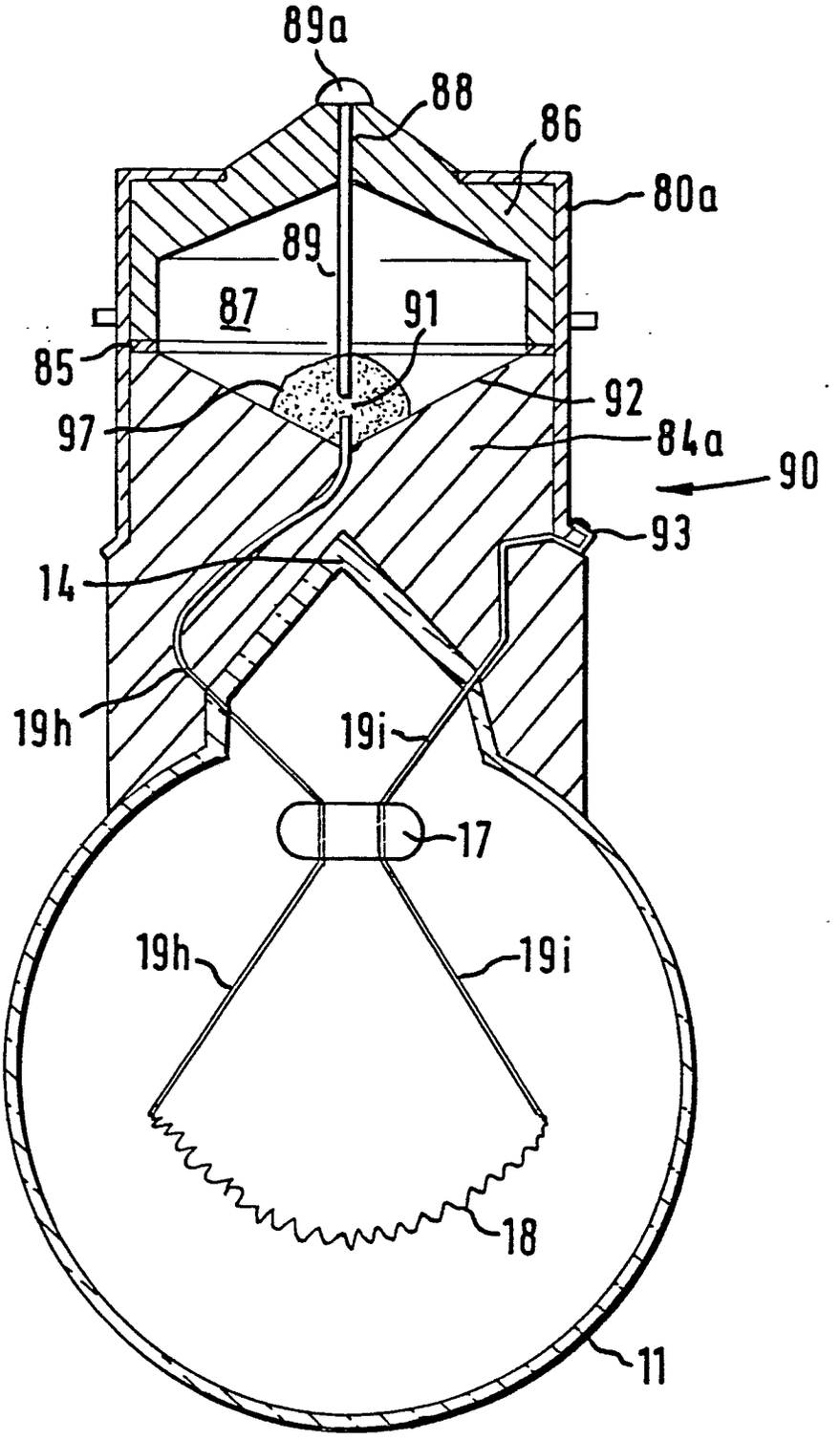


FIG. 10

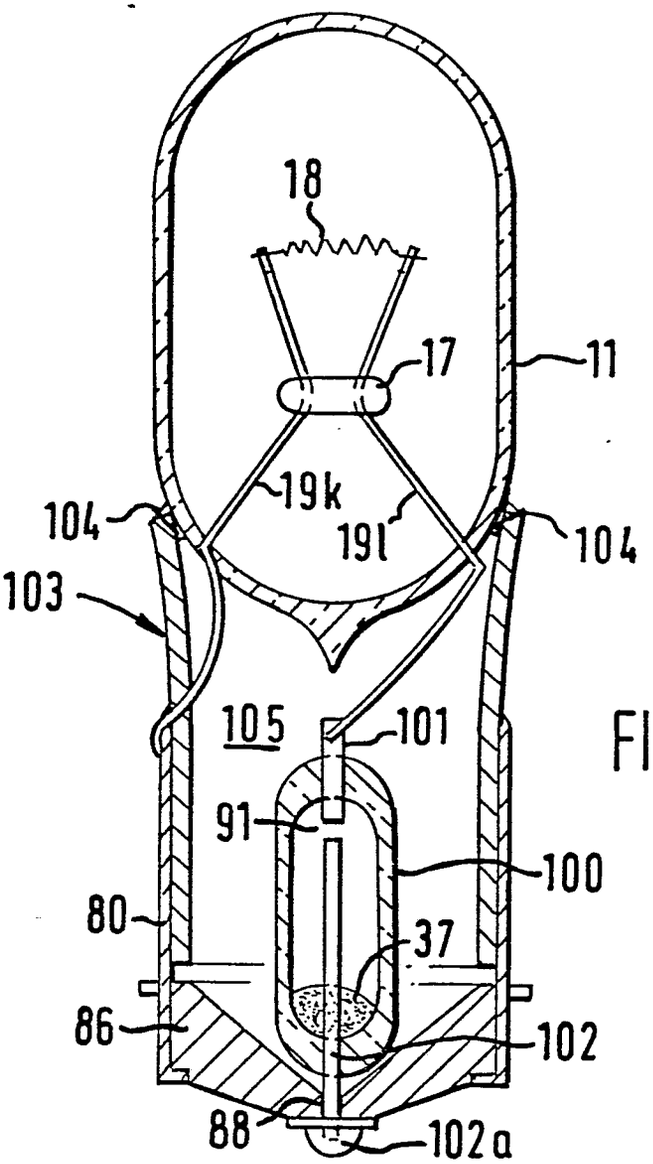

18
17
11
19k
19l
104
104
103
105
101
91
100
80
37
86
102
88
102a

FIG.11

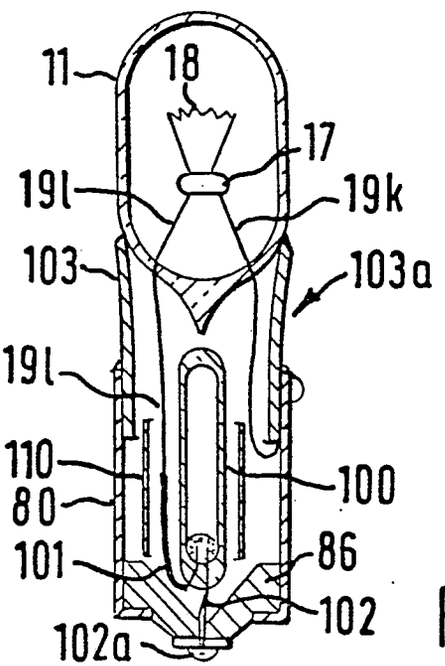

11
18
17
19l
19k
103
103a
19l
110
100
80
101
86
102
102a

FIG.12