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## (54) Integrated lighting units to be mounted on signalling and control devices for electric control boards and the like

(57) Lighting units (10) comprising a circuit (14) for continuously or intermittently supplying at least a light emitting diode or LED (16) mounted for emitting light in a direction parallel to the axis of a sleeve (46), housing the lighting unit (10), and provided at the external end with a refractive gem (48) to be lighted. The units are for embodying both pilot lights and lighted push-buttons.

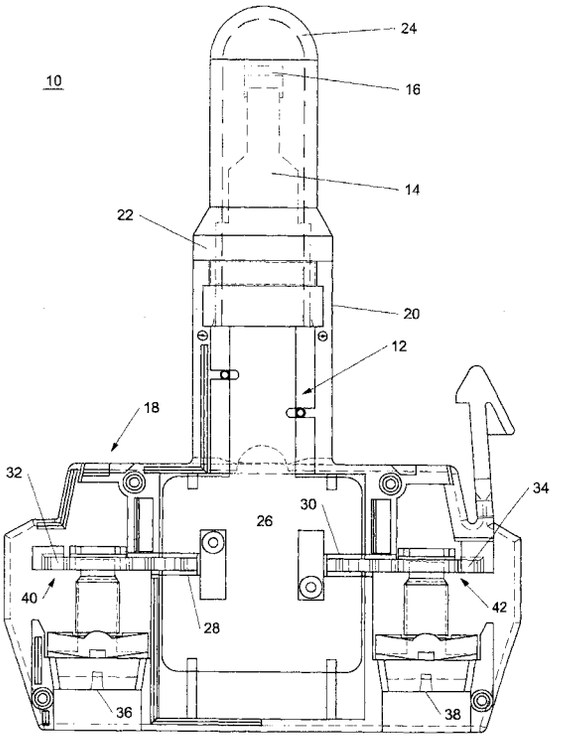


FIG. 1

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## Description

**[0001]** The present invention refers to lighting units using light emitting diodes to be used on signalling and control devices for electric control boards and the like.

**[0002]** Since long time are well known, with the short name "LED", the light emitting diodes which are very popular and successful, owing to their versatility, strength and low power consumption. From what above, it has been obvious that said diodes were used as light sources for lighting signalling devices, such as pilot lights and lighted push-buttons.

**[0003]** An example of signalling device provided with a LED is disclosed in EP-A-0 869 522, using a LED to produce light inside the signalling device, being the light emitting diode or LED arranged for emitting light, both transversely and substantially perpendicularly, with respect to a longitudinal axis of the lighting device and utilises multiple reflection on internal translucent surfaces of a recess, substantially shaped as a frustum of cone, for emitting light in the most the possible uniform manner from a front refractive gem of the signalling device. However, such a system does not seem to give satisfying results from a view point of the lighting uniformity, because the area of the frustum of cone recess, directly struck by the emitted light, appears decisively brighter than adjacent areas struck by the light just after a plurality of reflections, which, unavoidably, introduce not negligible light absorption.

**[0004]** To partially remedy this drawback, the applicant of the above mentioned publication thought to insert in an embodiment of the signalling device a prismatic member of translucent material, arranged between the emitting or active area of the LED and the recess, shaped as a frustum of cone, having translucent surfaces, operating as a light guide to convey the light emitted by the LED to the surfaces of the recess. The obtained result allows to better focus the emitted light in the recess and then direct it to the front refractive gem, but the result is not completely satisfying as regards the lighting uniformity of the gem.

**[0005]** To remedy the above mentioned drawbacks, it has been thought to use at least one LED, mounted on a supply circuit board, arranged to emit light according to a range of directions having symmetry axis parallel to the axis of the sleeve, housing the lighting unit, and provided at the external end with a refractive gem lighted by the at least one LED.

**[0006]** In a preferred embodiment of the invention two LEDs are used, mounted on the supply circuit board, also arranged to emit light according to two direction ranges having symmetry axes parallel to the axis of the sleeve housing the lighting units, and also provided at the external end with a refractive gem lighted by the light emitted by the two LEDs.

**[0007]** According to a first embodiment, the electric circuit embodied on the circuit board allows to supply the at least one LED in order to continuously emit light.

**[0008]** Alternatively, the circuit supplies the two LEDs for continuously emitting light.

**[0009]** In accordance with another embodiment of the invention, the circuit embodied on the circuit board allows to supply the at least one LED in order to intermittently emit light.

**[0010]** Alternatively, the circuit supplies the two LEDs for intermittently emitting light.

**[0011]** The features of the present invention will be defined by the here below appended claims forming the concluding portion of the description. However, other features and advantages will appear more clearly from the description of a preferred embodiment thereof, provided with the enclosed drawings, wherein:

- Figure 1 is a side, partially in cross-section, view of the electroluminescent portion of a lighting integrated unit, according to the present invention, to be mounted on signalling and/or control devices;
- Figure 2 is a partially in cross-section view of a circuit board, bearing, front mounted on a small printed circuit board, a LED inserted in a sleeve of a signalling and/or control device;
- Figure 3 is a top view of the Figure 2 depiction;
- Figure 4 is a partial cross-section view of a circuit board, bearing two LEDs, inserted in a sleeve of a signalling and/or control device;
- Figure 5 is a top view of the Figure 4 depiction;
- Figure 6 is a diagram of a power circuit of LEDs continuously supplied by control board low voltage (e. g. 24 Volts);
- Figure 7 is a diagram of a power circuit of LEDs intermittently supplied by control board low voltage (e. g. 24 Volts);
- Figure 8 is a diagram of a power circuit of LEDs continuously supplied by main electric network voltage (e. g. 120 or 220 Volts);
- Figure 9 is a diagram of a power circuit of LEDs intermittently supplied by main electric network voltage (e. g. 120 or 220 Volts).

**[0012]** Looking at Figure 1, it is seen that an integrated lighting unit 10 comprises a board 12 supporting a circuit 14 for supplying at least one LED 16. The supply circuit is housed in the support board 12, which is inserted in a modular block 18, provided with an upper seat 20 housing a transparent case 22 top closed by a dome 24, also transparent. The lower portion of the circuit board 12 ends with an enlargement 26 housing two conducting pads 28 and 30 connected to two conducting brackets 32 and 34 provided with screws 36 and 38 to embody two connecting terminals 40 and 42, having equal shape.

**[0013]** Looking at figures 2 and 3, it is seen that the circuit board 12 bears mounted on its upper end a LED 16 which, when lit, projects a conical light beam 44, having about 120° aperture angle, to a sleeve 46 and a front refractive gem 48, somehow inserted in the sleeve 46.

**[0014]** As particularly visible in the Figures 2 and 3, the LED 16 emits light mainly into a beam 44, having 120° aperture angle, to reach the circle 50, depicted in Figure 3 as the basis of the conic beam 44. However, some other light is emitted, according to a marginal beam having 180° aperture angle, being the last light reflected in diffused manner by the sleeve 46, which is made of light diffusing material, such as metal or clear plastic material, broadening a light spot on the gem 48, so producing a substantially even lighting thereof.

**[0015]** Looking at Figures 4 and 5, it is seen that the circuit board 12 bears side mounted at its upper end two LEDs 16a and 16b which, when lit, project two conic light beams 44a and 44b, having about 120° aperture angle, to a sleeve 46 and a front refractive gem 48 somehow inserted, in some well known way, on the sleeve 46.

**[0016]** As particularly visible in the Figures 4 and 5, the LEDs 16a and 16b emit light mainly into two beams 44a and 44b, having 120° aperture angle, to reach respective circles 50a and 50b, depicted in Figure 5 as the bases of the conic beams 44a and 44b. However, some other light is emitted, according to marginal beams having 180° aperture angle, being the last light reflected in diffused manner by the sleeve 46, which is made of light diffusing material, such as metal or clear plastic material, broadening the light spot on the gem 48, so producing a substantially even lighting thereof.

**[0017]** Looking at Figure 6, it is seen an electric diagram 60 to supply the low voltage (24 volts either AC or DC with indifferent polarity) of a control board to the LEDs 16a and 16b, assuring continuous light emission from the signalling device.

**[0018]** As depicted in Figure 6, the two terminals 40 and 42 are connected, through a protecting resistor 62, to a rectifying bridge 64 provided with terminals (+) and (-) connected to a Zener diode 66 stabilising a DC supply voltage provided to the two LEDs 16a and 16b through a protecting resistor 68. A further resistor 70 to absorb overcurrents and a levelling capacitor 72 allow the LEDs 16a and 16b to emit light regularly and evenly without danger of failures.

**[0019]** Looking at figure 7, it is seen an electric diagram 80 to supply the low voltage (24 volts either AC or DC with indifferent polarity) of a control board to the LEDs 16a and 16b, assuring intermittent light emission from the signalling device (flashing light).

**[0020]** In such a case, as in the case of the circuit 60 of figure 6, the two terminals 40 and 42 are connected, through a protecting resistor 62, to a rectifying bridge 64 to obtain the DC stabilised by the Zener diode 66 and levelled by the levelling capacitor 72. The two LEDs 16a and 16b are connected to an astable multivibrator circuit 82 consisting of a first transistor 82a and a second transistor 82b anyone provided with load collector resistors 84a and 84b, respectively, base resistor 86a and 86b, respectively, and coupling capacitors 88a and 88b determining the operating frequency of the astable multivibrator circuit 82. The resistance values of the resistors 86a and 86b and the capacitance values of the capacitors 88a and 88b are selected to have a flashing frequency of about two flashes a second, at most. The method to determine the above mentioned resistance and capacitance values are well known to people skilled in this art and cannot be matter of the present invention.

**[0021]** Looking at Figure 8, it is seen an electric diagram 90 to continuously supply from a main electric system (having either 120 or 220 Volts AC voltage) the LEDs 16a and 16b, assuring continuous light emission from the signalling device.

**[0022]** As depicted in Figure 8, the two terminals 40 and 42 are connected, through a protecting resistor 62 and a capacitor 92, acting as reactive (not dissipating) voltage reductor, provided with a resistor 94 for protection against overvoltages, to the usual rectifier bridge 64 producing unidirectional voltage, stabilised by the Zener diode 66, which through a circuit, however identical to that of Figure 6, feeds the two LEDs 16a and 16b which provide to continuously emit light for the time they are crossed by electric current.

**[0023]** Looking at figure 9, it is seen an electric diagram 100 to supply from a main electric system (having either 120 or 220 Volts AC voltage) the LEDs, assuring intermittent light emission from the signalling device (flashing light).

**[0024]** As depicted in Figure 9, the two terminals 40 and 42 are connected, through a protecting resistor 62 and a capacitor 92, acting as reactive (not dissipating) voltage reductor, provided with a resistor 94 for protection against overvoltages, to the usual rectifier bridge 64 producing unidirectional voltage, stabilised by the Zener diode 66, which through a circuit, however identical to that of Figure 7, feeds the two LEDs 16a and 16b which provide to intermittently emit light.

**[0025]** What has been here above disclosed depicts some embodiments of the invention not to be absolutely construed as limiting. So that any person skilled in this art can devise, from the reading of said embodiments, approaches logically similar and equivalent, to be intended as covered by the scope of the invention, as defined by the here below appended claims.

**[0026]** For example, the LEDs can be more than two in number (for example three) to assure more uniformity in light emission.

**[0027]** Also the circuits providing either continuous or intermittent supply of the LEDs can be different from the depicted ones, provided that they assure the same operations.

## Claims

1. Integrated lighting units **characterized by** at least one light emitting diode or LED (16), mounted on a board (12) of its supply circuit (14), arranged to emit light according to a range of directions (44) having symmetry axis parallel to the axis of a sleeve (46),

housing the lighting units (10), and provided at the external end with a refractive gem (48) lighted by the light emitted by the at least one LED (16).

2. Integrated lighting units, as in claim 1, **characterized by** two LEDs (16a, 16b), mounted on the board (12) of the supply circuit (14), both arranged to emit light in accordance with two direction ranges (44a, 44b) having symmetry axes parallel to the axis of the sleeve (46), housing the lighting units (10), and also provided at the external end with a refractive gem (48) lighted by the light emitted by the two LEDs (16a, 16b).

3. Integrated lighting units, as in claim 1, **characterized in that** the circuit (60, 90) born by the circuit board (12) allows to supply the at least one LED (16) in order to compel it to emit light in continuity.

4. Integrated lighting units, as in claim 2, **characterized in that** the circuit (60, 90) born by the circuit board (12) allows to supply the two LEDs (16a, 16b) in order to compel them to emit light in continuity.

5. Integrated lighting units, as in claim 1, **characterized in that** the circuit (80, 100) born by the circuit board (12) allows to supply the at least one LED (16) in order to compel it to emit light in an intermittent manner.

6. Integrated lighting units, as in claim 1, **characterized in that** the circuit (80, 100) supplies the two LEDs (16a, 16b) in order to compel them to emit light in an intermittent manner.

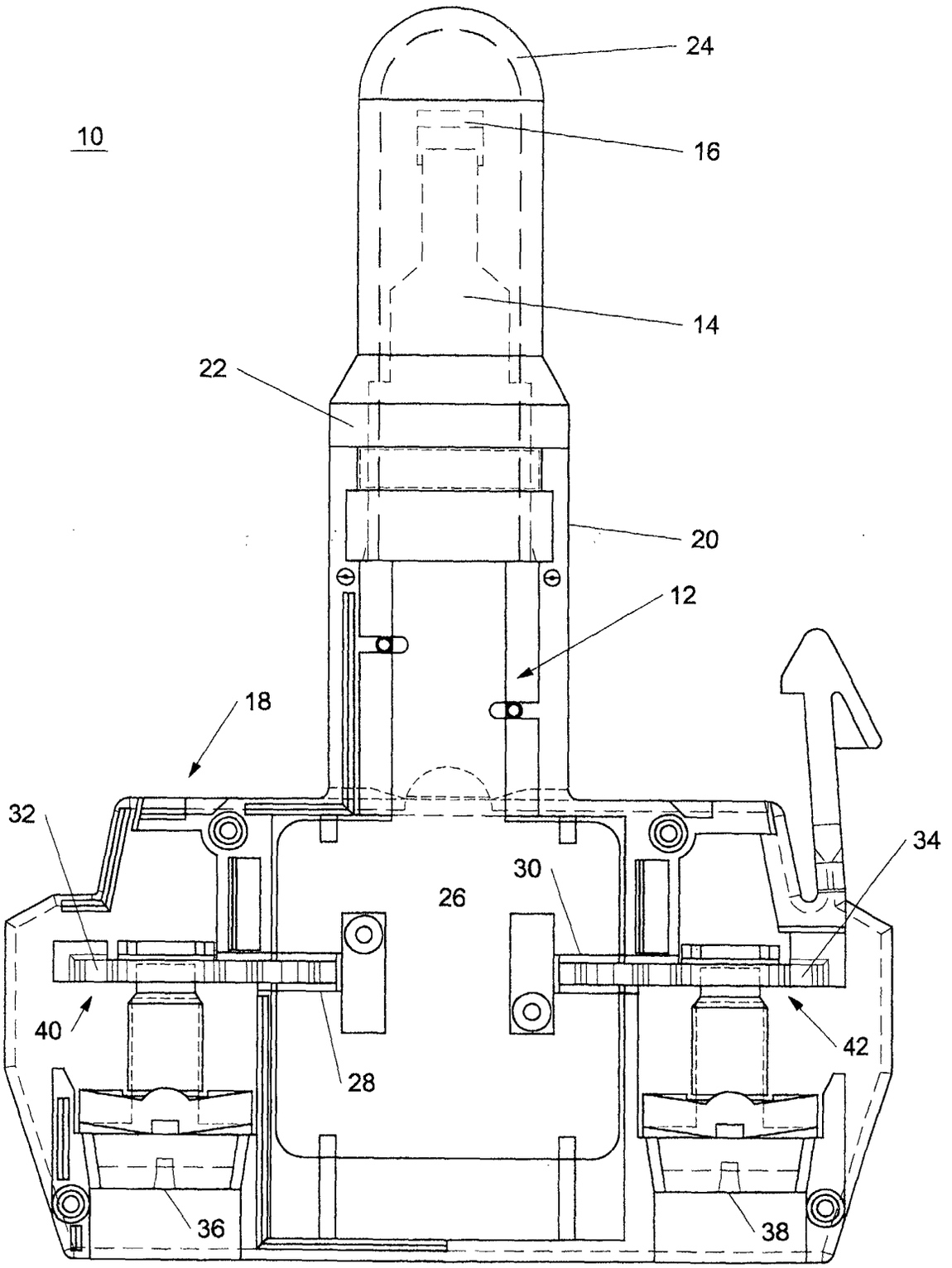


FIG. 1

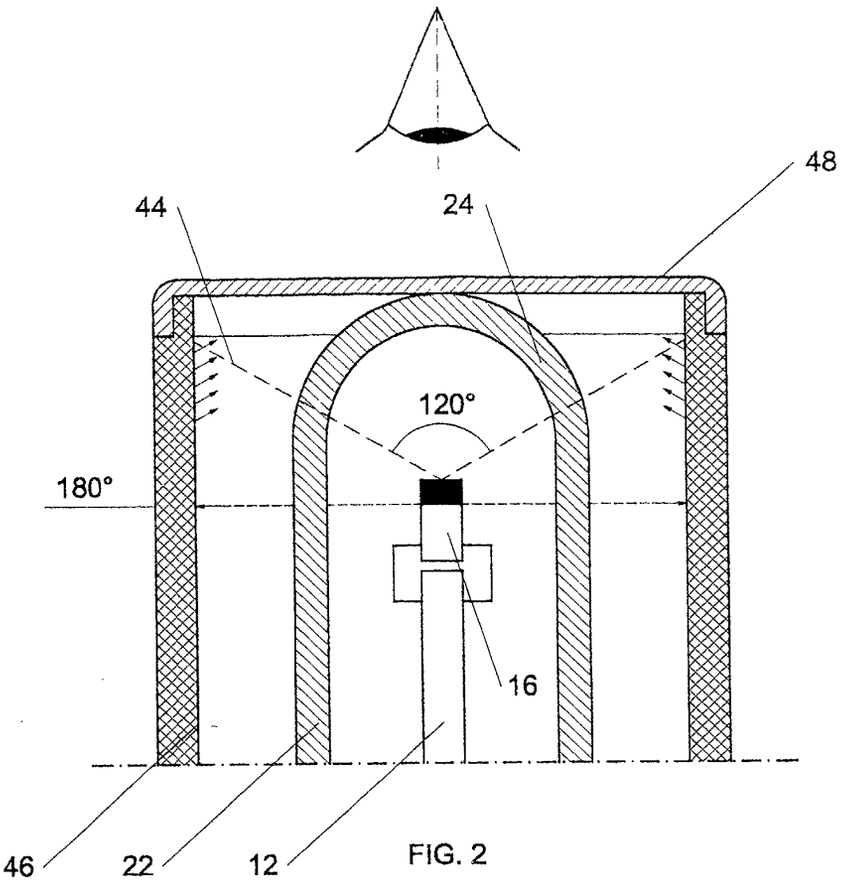


FIG. 2

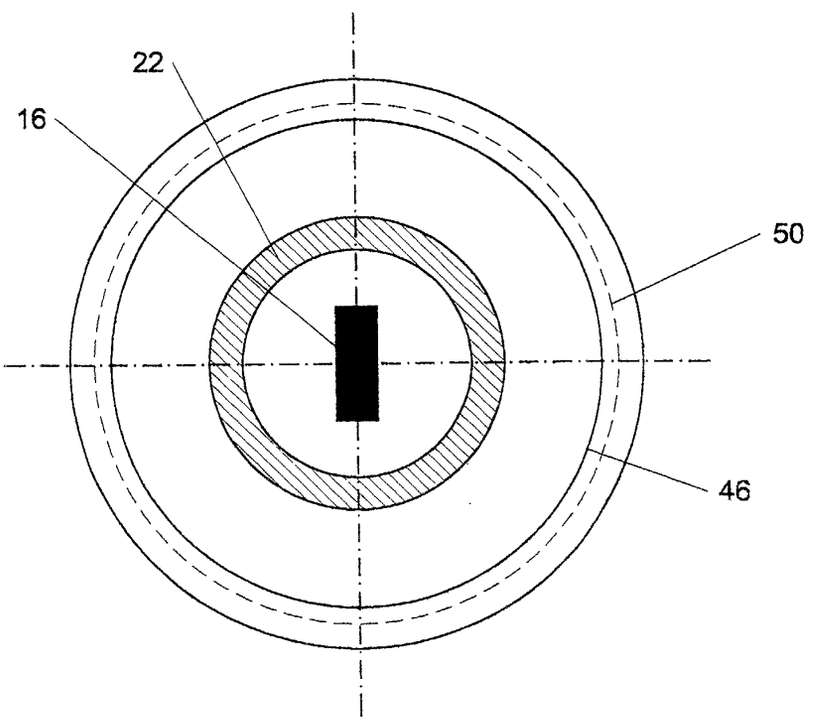


FIG. 3

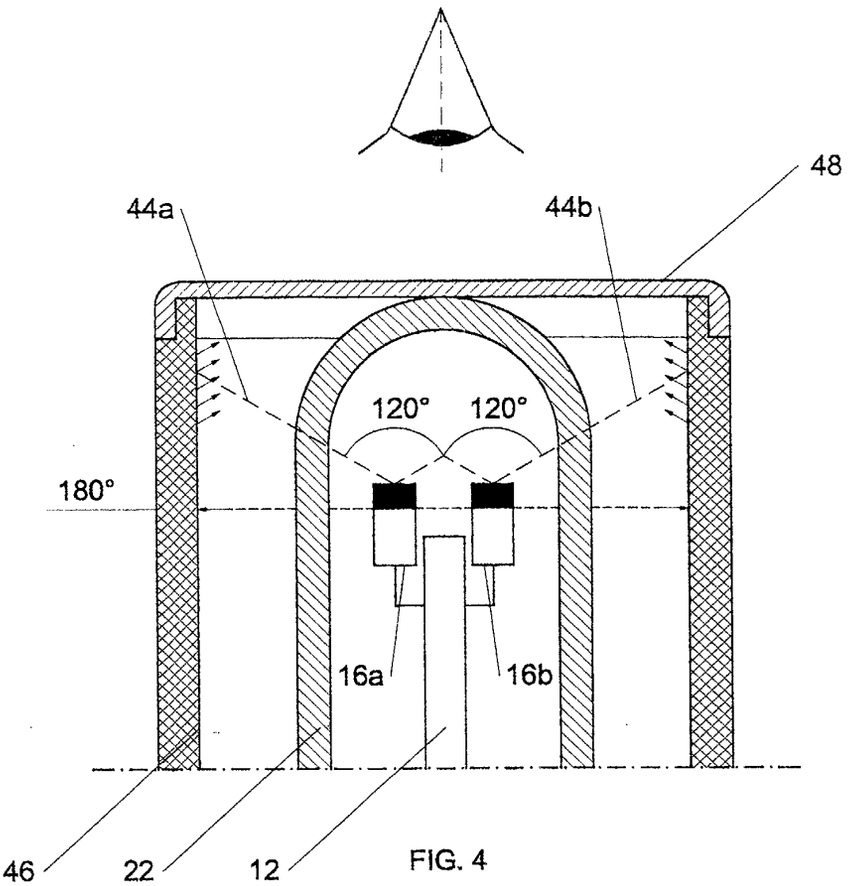
48
44a
44b
120°
120°
180°
16a
16b
46
22
12

FIG. 4

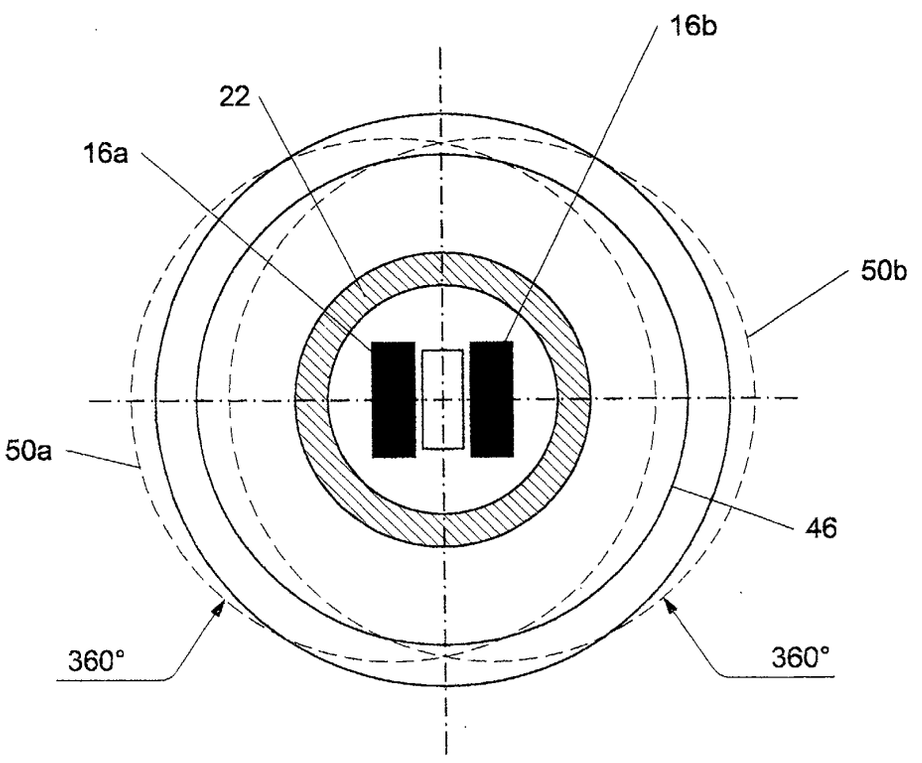
16b
22
16a
50b
50a
46
360°
360°

FIG. 5

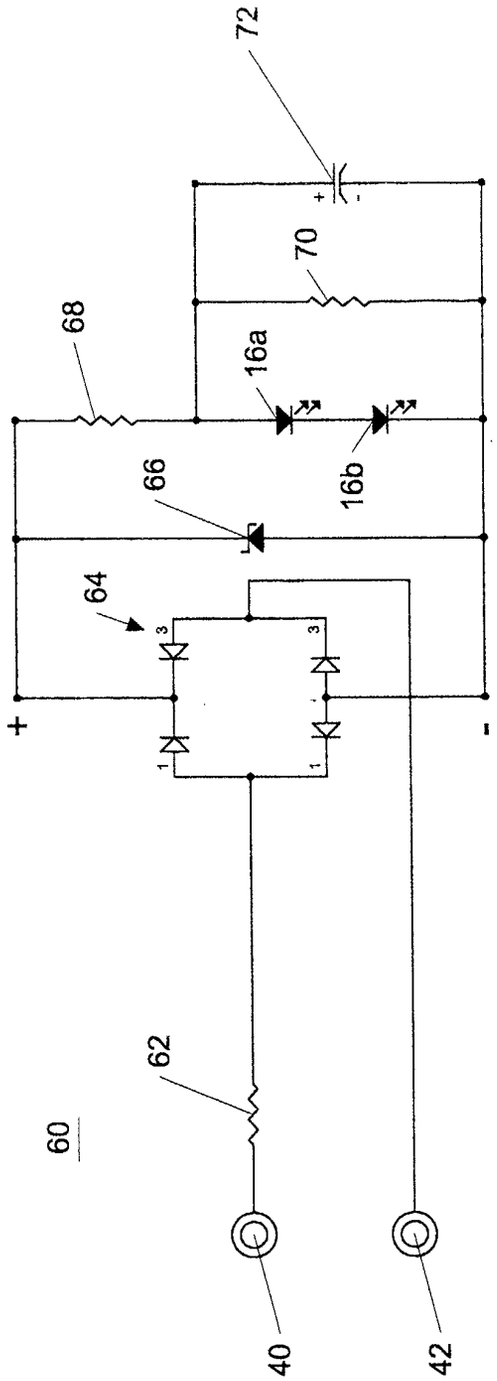
72
70
68
16a
16b
66
64
+
-
62
60
40
42

FIG. 6

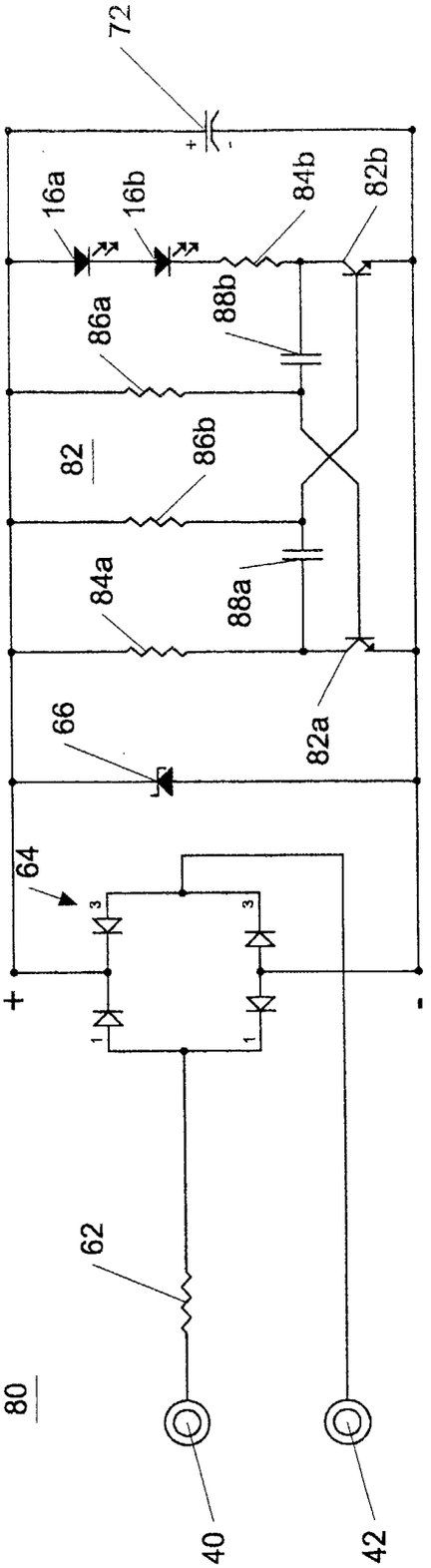
72
16a
16b
84b
82b
88b
86a
82
86b
84a
88a
82a
66
64
+
-
62
80
40
42

FIG. 7

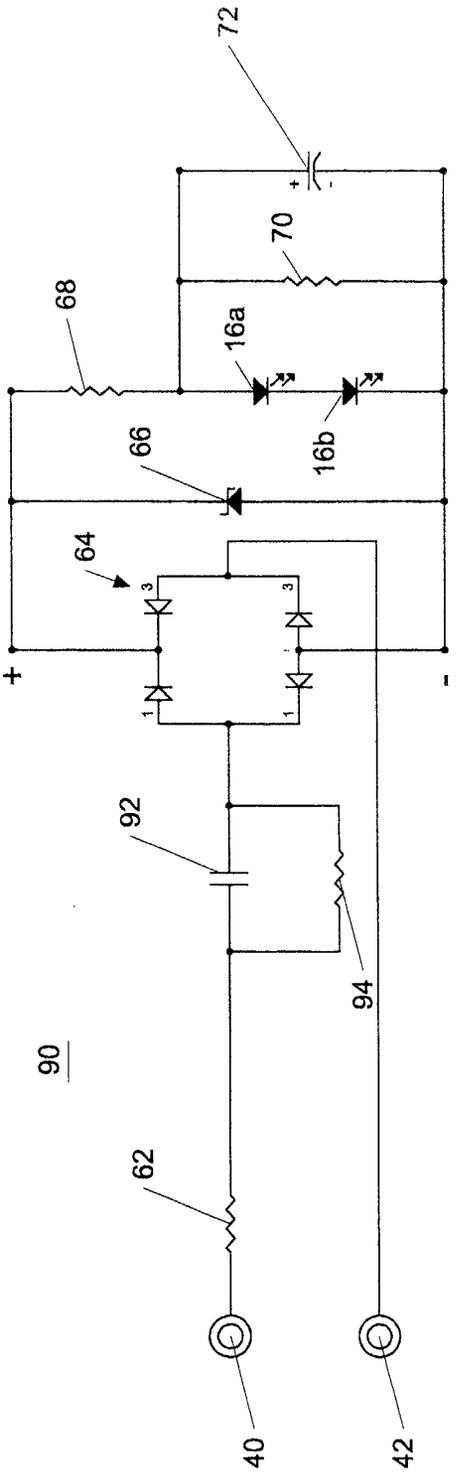
72
70
68
16a
16b
66
64
92
94
90
62
40
42
+
-

FIG. 8

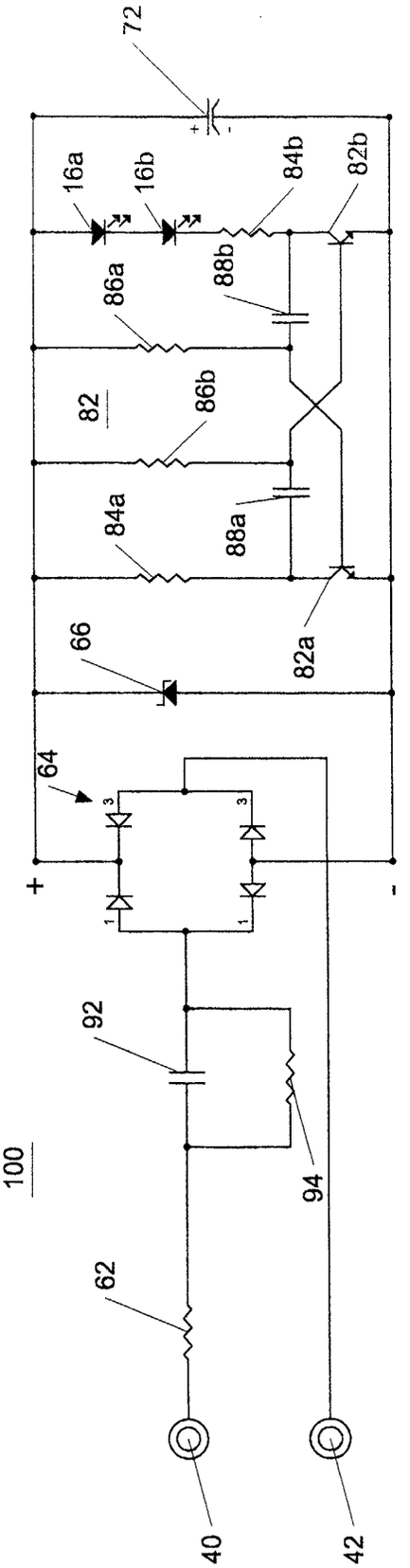
72
16a
16b
84b
82b
88b
86a
82
86b
88a
84a
82a
66
64
92
94
100
62
40
42
+
-

FIG. 9

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 01 20 2316

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 29 November 2001 | Janssens De Vroom, P |

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