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(54) **LED candle with flickering flame**

(57) The present invention relates to an electric candle with a flame part (1) including a flame element (3) and a base (2), wherein the flame part (1) comprises at least one light emitting diode (4, 4') being configured such

that it illuminates the flame element (3), wherein the light emitting diode (4, 4') is configured to illuminate the flame element (3) such that the flame element (3) appears to flicker.

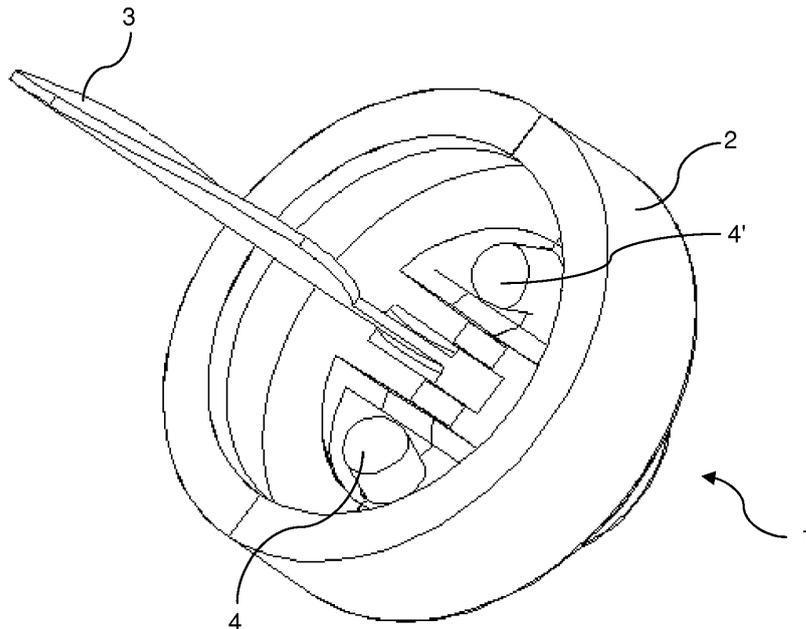


Fig. 2

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Description

[0001] The present invention relates to an electric candle with a flame part including a flame element and a base, wherein the flame part comprises at least one light emitting diode being arranged such that it illuminates the flame element.

[0002] Such electric candles are well known from the state of the art. While conventional candles made of artificial or natural waxes are negatively impacted by air drafts, dangerous due to the flames and need to be replaced as they consume themselves, electric candles do not consume themselves, are safe to use and require only electric current in order to work. Therefore, in many public places such as e.g. hospitals, only electric candles are allowed.

[0003] For aesthetic considerations, it is desirable to provide electric candles such that they resemble conventional candles as closely as possible. One object is e.g. to imitate the flickering impression of a real candle flame. It is known from the state of the art to move flame shaped elements by means of fans or electromagnets disposed in the candle. Yet, these devices use moving parts and are therefore unreliable, requiring costly maintenance and replacement parts, and cause noise. Furthermore, the moving flame elements of electric candles known from the state of the art often follow certain movement patterns and therefore do not look very realistic.

[0004] It was therefore the objective of the present invention to provide an electric candle without using moving parts and having a realistic flickering effect.

[0005] This problem is solved by an electric candle with a flame part including a flame element and a base, wherein the flame part comprises at least one light emitting diode (LED) being arranged such that it illuminates the flame element, wherein the LED is configured to illuminate the flame element such that the flame element appears to flicker.

[0006] The disclosure made regarding this embodiment of the present invention also applies to the other embodiments and vice versa.

[0007] The present invention relates to an electric candle with a flame part including a flame element and a base, wherein the flame part comprises at least one LED being arranged such that it illuminates the flame element. LEDs are advantageous, because they require only little space and offer low power consumption. Thus, it is advantageously possible to realize even small candles, wherein the LEDs are barely visible, thus enhancing the realistic impression of the electric candle according to the present invention.

[0008] Preferably, the flame part is integrated in a candle, in particular in a housing coated and/or covered with a wax. More preferably, the wax is a natural wax such as e.g. beeswax, as this allows for a high quality impression of the candle. Most preferably, the electric candle further comprises a bottom base, in particular at a predetermined distance under the base. Still more prefera-

bly, the bottom base comprises a further LED.

[0009] Alternatively or additionally, other waxes may be used, such as e.g. paraffin or stearin. These waxes are usually cheaper, thus lowering the production costs of such an electric candle according to the present invention.

[0010] Preferably, the waxes are scented, thus providing a realistic fragrance in addition to the realistic flickering appearance.

[0011] The flame element preferably resembles the shape of a candle flame. The person skilled in the art acknowledges that a plurality of different shapes may be used. Preferably, the flame element has a drop-like shape with one or more flame tips.

[0012] Preferably, the flame element is connected to the base, in particular removably connected. More preferably, the flame element is connected to the base by means of a form fit and/or force fit connection. It is herewith advantageously possible to remove and/or replace the flame element. This is for example advantageous for transporting said electric candle. Furthermore, the flame element may be exchanged, if another shape and/or color is desired.

[0013] Alternatively, the flame part is integrally formed, in particular the flame element is integrally formed with the base, for example by means of injection molding or deep drawing. It is herewith advantageously possible to provide an electric candle according to the present invention with particularly low costs.

[0014] Preferably the flame element is immovable with respect to the flame part and/or the base, in particular when connected to the base. Thus, when the flame element is fixedly connected to the base, more preferably while still being removable, the flame element is stably mounted and cannot cause noise by movements. It is herewith advantageously possible to achieve the realistic flickering effect only by means of the illumination.

[0015] Yet, alternatively, the flame may for example be provided moveable, in particular driven. Thus, the flickering effect may be further enhanced.

[0016] Preferably, the LED is arranged at the base, preferably in or under the base, in particular in orifices.

[0017] Preferably, the flame element comprises a curved surface. For example, the main plane of extension of the flame element may be bent, thus advantageously realizing a more realistic three-dimensional impression.

[0018] Preferably, at least two LEDs are arranged at the base, in particular symmetrically with respect to the flame element. Hence, the flame element may be illuminated from multiple sides, thus advantageously enhancing the realistic flickering effect. The person skilled in the art understands that if the flame element is not perfectly symmetric, the at least two LEDs according to this preferred embodiment may e.g. be arranged substantially symmetrically and/or at least at the same distance from a middle axis of the base. Most preferably, at least two LEDs are arranged at the base in such a way that they illuminate the flame element substantially equally from

different sides, e.g. from the front side and the back side, respectively.

[0019] Additionally or alternatively, the multiple LEDs may be controlled asynchronously, thus advantageously further enhancing the flickering impression.

[0020] Preferably, the at least one LED is inclined towards the flame element, preferably in an angle between 15° and 25°, in particular in an angle of 20°.

[0021] Preferably, the electric candle further comprises a control circuit, wherein the control circuit is configured for controlling the LED and/or the further LED, wherein in particular the control circuit is disposed in or under the base and/or in or on the bottom base. More preferably, the control circuit comprises a microcontroller unit (MCU). Still more preferably, the control circuit comprises at least one resistance and/or at least one capacitor.

[0022] Preferably, the electric candle further includes a remote control configured for controlling the control circuit, in particular by means of infrared rays and/or wireless connection. Thus, the illumination and therefore the flickering effect may be controlled remotely. More preferably, the remote control may be integrated in another device. For example, a smart phone may be used to control the control circuit using a wireless connection such as a Bluetooth or WLAN connection.

[0023] Preferably, the electric candle, in particular the control circuit, comprises a timer function. For example, the electric candle may comprise a 4h and/or 8h timer function. It is herewith advantageously possible to control the electric candle such that it is switched off after a predetermined period of time.

[0024] Preferably, at least one LED is a color LED, preferably a full-color LED, in particular a red-green-blue (RGB) color space full-color LED. Alternatively or additionally, at least one LED is a single color LED, in particular a white light LED. More preferably, an LED arranged at the base is a warm white light and/or pastel yellow light LED. Most preferably, at least one warm white light and/or pastel yellow light LED is arranged at the base such that it directly illuminates the flame element and at least one color LED is arranged under the base, in particular at the bottom base, such that it indirectly illuminates the flame element and/or the electric candle. It is herewith advantageously possible to provide an electric candle which may be illuminated in different colors. Most preferably, the color of a full-color LED is controllable, in particular remotely.

[0025] Preferably, the electric candle further comprises a pressure sensor, in particular a microphone, which is coupled to the LED and/or the control circuit for controlling the LED in dependence of a change in pressure, preferably air-pressure. It is herewith advantageously possible to further enhance the realistic impression of the candle, for example by controlling the flickering effect in dependence of air drafts. Furthermore, the candle may e.g. be switched off in case a user blows at it.

[0026] Still more preferably, the electric candle may be

configured to be voice activated and/or voice controlled. E.g. the microphone may detect a user command to switch off and/or switch the color of the LED and execute the command accordingly.

5 **[0027]** Preferably, a further LED, in particular a full-color LED, is disposed within the base and/or the electric candle for making the electric candle to appear to be glowing in a specific color.

10 **[0028]** Another subject matter of the present invention is a method for simulating a flickering candle flame with an electric candle according to the present invention, comprising the steps of varying the light intensity of the LED and/or the further LED, in particular by switching the LED and/or the further LED on and off, repeatedly, preferably irregularly. Alternatively, the LED and/or the further LED is repeatedly dimmed.

15 **[0029]** The person skilled in the art acknowledges that varying the light intensity of an LED may e.g. be achieved by decreasing and/or increasing the voltage applied to the LED. Especially by irregularly increasing and decreasing the light intensity or light output of the LED, the flickering effect is advantageously enhanced.

20 **[0030]** Additionally or alternatively, the flickering effect may be achieved e.g. by providing a continuously varying current and or by configuring the control circuit such that it regulates the voltage provided to the LED according to a random noise and/or a predetermined pattern. Additionally or alternatively, the voltage is modulated.

25 **[0031]** Preferably, when multiple LEDs are used, the LEDs, in particular their light intensities, are varied at the same time or at different times.

30 **[0032]** The disclosure made regarding this subject matter of the present invention also applies to the other subject matters and vice versa.

35 **[0033]** The present invention is now explained on the basis of figures 1 to 7. These explanations are not intended to limit the scope of protection. The explanations apply to all embodiments likewise.

40 Fig. 1 shows a side view of a flame part according to an exemplary embodiment of the present invention.

45 Fig. 2 shows a perspective top view of a flame part according to an embodiment of the present invention.

Fig. 3 shows a side view of a bottom base according to an embodiment of the present invention.

50 Fig. 4 shows a perspective view of a flame element according to an embodiment of the present invention.

55 Fig. 5 shows a perspective top view of a base according to an embodiment of the present invention.

Fig. 6 shows a top view of a remote control according

to an embodiment of the present invention.

Fig. 7 shows a connection scheme of a control circuit of an electric candle according to an embodiment of the present invention.

Fig. 8 shows a bottom view of a bottom base according to an embodiment of the present invention.

[0034] In Fig. 1, a side view of a flame part 1 according to an exemplary embodiment of the present invention is shown. A flame element 3, shaped like a candle flame, is disposed on top of a base 2. Here, the flame element 3 is removably connected to base 2, but alternatively, it may as well be fixedly connected to the base 2, e.g. being integrally formed with the base 2.

[0035] The base 2 may be installed on top of a housing which is e.g. coated with wax, yielding a realistic impression of a candle.

[0036] The base 2 may comprise a substantially round shape, e.g. a substantially cylindrical shape, as shown here, but alternatively, it may even comprise other shapes, such as comprising a rod-like shape.

[0037] The flame part 1 is preferably made of plastic. The base 2 may comprise the same color as a surrounding wax. The flame element 3 may comprise any color, e.g. white or a yellow and/or orange color. E.g. the flame element 3 may be painted like a real flame, with a bluish core and an adjacent color transition from orange to bright yellow.

[0038] On the outer surrounding wall of the base 2, a microphone 7 is arranged. Additionally, further microphones may be arranged at further locations of the flame part 1. The microphone 7 may detect pressure changes, in particular changes in air pressure, such as those caused by air drafts and/or a user blowing at the candle. Additionally or alternatively, the microphone 7 may detect spoken user commands in order to control the electric candle.

[0039] The electric candle may further comprise e.g. a device for distributing fragrances, thus advantageously realizing an electric perfume candle.

[0040] In Fig. 2, a perspective top view of a flame part 1 according to an embodiment of the present invention is shown. The flame element 3 comprises a slightly bent or curved surface, thus yielding a three-dimensional appearance. Furthermore, two orifices for light emitting diodes (LEDs) 4, 4' can be seen. The therein installed LEDs 4, 4' may be white LEDs 4, 4' and/or full-color LEDs 4, 4'. For example, an LED 4 may be white and another LED 4' may be a full-color LED 4'.

[0041] To realize a flickering effect, the LEDs 4, 4' may be dimmed, either independently or together. By decreasing and increasing their light intensity repeatedly, the flame element 3 appears to flicker. This may further be enhanced by controlling the LEDs 4, 4' in such a way that their light intensity is varied irregularly. The pressure changes detected by the microphone are e.g. user to

influence the flickering. Thus, for example an air draft may cause an increase in the flickering frequency, providing for a more realistic flickering.

[0042] Furthermore, to focus the flickering effect on the flame element 3, the LEDs 4, 4' are inclined towards the flame element 3, e.g. in an angle α of between 15° to 25°. As can be further seen in Fig. 2, the LEDs 4, 4' are disposed at the base 2 symmetrically with respect to the flame element 3. In particular, they are arranged on a front side and a back side of the flame element 3 respectively and symmetrically with respect to a middle axis of the base 2.

[0043] Here, the LEDs 4, 4' are disposed at least partially in the base 2, such that they do not fully protrude from the main plane of extension of the base 2.

[0044] In Fig. 3, a side view of a bottom base 2' according to an embodiment of the present invention is shown. The bottom base 2' may e.g. substantially correspond to the base 2. The protrusion on the top of the bottom base 2' is e.g. a cable duct for connecting the LEDs 4, 4' and the microphone 7 to a control circuit which is e.g. disposed under the base 2 and/or in the bottom base 2'. The control circuit is configured for controlling at least the electric candle and in particular the LEDs 4, 4'.

[0045] Additionally or alternatively, still a further LED 4" may e.g. be installed on top of the bottom base 2', thus illuminating the candle from within. It is e.g. conceivable that a full-color LED 4" is installed on top of the bottom base 2', while the LEDs 4, 4' arranged at the base 2 are warm white light or pastel yellow light LEDs 4, 4'. In this case, the control circuit is for example installed inside the bottom base 2', being connected by means of flexible wire connections and/or substantially rigid tube connections to the full-color LED 4" and the LEDs 4, 4'.

[0046] Here, the bottom base 2' further comprises a battery compartment 8, wherein a battery may be installed in the battery compartment 8, electrically connected to the control circuit, the full-color LED 4" and/or the LEDs 4, 4'.

[0047] By using electrical wire connections and separating the bottom base 2' from the base 2, the electric candle can easily be produced in different heights using the same parts, i.e. the same flame part 1 and bottom base 2'.

[0048] The battery compartment is e.g. accessible from underneath the bottom base 2'.

[0049] The bottom base 2' may further comprise a switch additionally or alternatively to a remote control 6 for controlling the control circuit.

In Fig. 4, a perspective view of a flame element 3 according to an embodiment of the present invention is shown. The flame element 3 comprises a main plane of extension and comprises substantially a drop-like shape. At the bottom, the flame element 3 comprises a structure for connecting the flame element 3 to the base 2, e.g. by means of a form fit connection with an opening 5. Thus, when the flame element 3 is mounted on the base 2, it is immovable and the flickering effect is realizing preferably

only by means of the illumination by the LEDs 4, 4'.

[0050] Additionally, the bottom part of the flame element 3 may further comprise latching means for realizing a fixed connection with the base 2.

[0051] According to an alternative embodiment, the flame element 3 comprises light guiding means such that light from within the base may be guided into the flame element 3, yielding the impression of a glowing flame element 3.

[0052] In Fig. 5, a perspective top view of a base 2 according to an embodiment of the present invention is shown. The opening 5, through which the flame element 3 may be fixedly connected to the base 2, can be seen. The base 2, preferably including the orifices for the LEDs 4, 4', is e.g. produced integrally by means of injection molding.

[0053] In Fig. 6, a top view of a remote control 6 according to an embodiment of the present invention is shown. Such a remote control 6 may be used for remotely controlling the electric candle, in particular by controlling the control circuit disposed within said electric candle. The remote control 6 is merely shown in a schematic fashion and may comprise fewer or more buttons and additionally or alternatively, it may comprise other control elements, such as control dials for dimming, ON/OFF-switches for fragrance distributing devices or the like.

[0054] The remote control 6 as shown here comprises e.g. a TURN ON button 61 for turning the electric candle on, i.e. turning on the LEDs 4, 4', a TURN OFF button 62 for turning the electric candle off, a HOLD button 63 for freezing an LED 4 at a specific color, e.g. if a full-color LED 4 is configured to continuously change colors, a 4h timer button 64 for causing the electric candle to switch off after a time period of 4h after actuation of the button, a 8h timer button 65 being substantially the same as the 4h timer button 64, only with a switch-off time period of 8h, an AUTO button 66 causing an LED 4 to change its color continuously, a color button area 67, comprising several buttons for causing an LED 4 to radiate in different colors, a TURN ON COLOR button 68 causing at least one LED 4 to switch from a white light to colors and a TURN OFF COLOR button 69 reversing the action of TURN ON COLOR button 68.

[0055] The person skilled in the art acknowledges that several other controls may be implemented and many other alternative configurations for the above mentioned buttons are possible without departing from the present invention.

[0056] For example, the functions of the corresponding ON and OFF buttons may be implemented in one button, such as a TURN ON/OFF button.

[0057] The remote control 6 e.g. employs infrared rays for connecting to the control circuit.

[0058] Additionally or alternatively, the color button area 67 may comprise a touch panel being sensitive to touch.

[0059] According to an alternative embodiment, the functionality of the remote control 6 is implemented in

another device, such as for example a smartphone of a user. Therefore, an application for that smartphone may be available simulating e.g. the above discussed buttons and being connected wirelessly, e.g. via Bluetooth and/or WLAN, to the control circuit.

[0060] In Fig. 7, a connection scheme of control circuit of an electric candle according to an embodiment of the present invention is shown. The control circuit comprises e.g. a microcontroller unit (MCU) being connected to the LEDs 4, 4', being connected to batteries for providing a voltage for operating said control circuit and said LEDs 4, 4', a receiver for receiving signals from the remote control 6, wherein the remote control 6 is configured for controlling said control circuit.

[0061] An RGB color space full-color anode LED 4, 4' may e.g. include three LED integrated circuits (IC), one for each color red, green and blue, with each circuit being connected to a pin 2, a pin 3 and a pin 4 of the MCU, respectively, and the LED 4, 4' being further connected to the anode of a battery. The anode and cathode of the battery are further connected to a pin VDD and a pin GND for grounding of the MCU, respectively. The battery may e.g. be a standard AA battery, in particular a rechargeable battery.

[0062] The control circuit here further comprises three resistances R1, R2, R3, connected in series between said LED ICs and pin 2, pin 3 and pin 4 of the MCU, respectively. Furthermore, the control circuit according to Fig. 7 further comprises a resistance R4 connected in series between said LED 4' and said anode of the battery.

[0063] The control circuit may e.g. further comprise capacitors C1, C2 connected in parallel with said battery.

[0064] The voltage supplied by the battery is e.g. between 2V to 5V. Exemplary values for the resistances are: R1 is 220 Ohm, R2 is 120 Ohm, R3 is 120 Ohm, R4 is 50 Ohm. The capacitor C1 is e.g. a filter with 100 μ F/10V, capacitor C2 has a capacitance of e.g. 0.1 μ F.

[0065] In Fig. 8, a schematic bottom view of a bottom base 2' according to an embodiment of the present invention is shown. As already mentioned in the context of figures 1 to 7, the flame part 1 may e.g. be installed on top of a housing, in particular a plastic housing covered and/or coated with a wax such as e.g. a paraffin and/or a hardened and/or refined animal and/or vegetable fat, further comprising a bottom base 2' arranged at a pre-determined distance under the base 2.

[0066] Such a bottom base 2' is schematically shown here. The bottom base 2' comprises a battery compartment 8.

[0067] Alternatively or additionally to the remote control 6, the electric candle and in particular the bottom base 2' of the housing may comprise a control element for switching the electric candle on and/or off and/or control elements for activating timer function as described regarding Fig. 6.

[0068] Here, the bottom base 2' comprises a three-way switch 71, which may be switched alternatively to a ON

position 61, whose functionality corresponds substantially to that of the TURN ON button 61 on the remote control 6, to a OFF position 62, whose functionality corresponds substantially to that of the TURN OFF button 62 on the remote control 6, or to a 5h timer position 70, whose functionality corresponds substantially to that of the 4h timer button 64 and the 8h timer button 65 on the remote control 6 with a time period of 5h.

[0069] The person in the art acknowledges that the actual time period may be programmable and/or may be any time period, such as 1 h, 2h, 3h, 6h, 7h, or up to 24h or even longer, or any time period in between the above mentioned durations.

List of reference signs:

[0070]

1	flame part
2	base
2'	bottom base
3	flame element
4, 4', 4"	light emitting diode (LED)
5	opening
6	remote control
7	microphone
8	battery compartment
61	TURN ON button/ON position
62	TURN OFF button/OFF position
63	HOLD button
64	4h timer button
65	8h timer button
66	AUTO button
67	color button area
68	TURN ON COLOR button
69	TURN OFF COLOR button
70	5h timer position
71	three-way switch

α angle

Claims

- 5 1. Electric candle with a flame part (1) including a flame element (3) and a base (2), wherein the flame part (1) comprises at least one light emitting diode (4, 4') being arranged such that it illuminates the flame element (3), **characterized in that** the light emitting diode (4, 4') is configured to illuminate the flame element (3) such that the flame element (3) appears to flicker.
- 10 2. Electric candle according to claim 1, **characterized in that** the light emitting diode (4, 4') is arranged at the base (2), preferably in or under the base (2), in particular in orifices.
- 15 3. Electric candle according to any one of the preceding claims, **characterized by** further comprising a bottom base (2'), preferably arranged at a predetermined distance under the base (2), in particular wherein the bottom base (2') comprises a further light emitting diode (4").
- 20 4. Electric candle according to any one of the preceding claims, **characterized in that** the flame element (3) is connected to the base (2), in particular removably connected.
- 25 5. Electric candle according to any one of the preceding claims, **characterized in that** the flame element (3) is connected to the base (2) by means of a form fit and/or force fit connection.
- 30 6. Electric candle according to one of claim 1 and claim 2, **characterized in that** the flame part (1) is integrally formed, in particular that the flame element (3) is integrally formed with the base (2).
- 35 7. Electric candle according to any one of the preceding claims, **characterized in that** the flame element (3) is immovable with respect to the flame part (1) and/or the base (2), in particular when connected to the base.
- 40 8. Electric candle according to any one of the preceding claims, **characterized in that** the flame element (3) comprises a curved surface.
- 45 9. Electric candle according to any one of the preceding claims, **characterized in that** at least two light emitting diodes (4, 4') are arranged at the base (2), in particular symmetrically with respect to the flame element (3).
- 50 10. Electric candle according to any one of the preceding
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claims, **characterized in that** the light emitting diode (4, 4') is inclined towards the flame element (3), preferably in an angle (α) between 15° and 25°, in particular in an angle (α) of 20°.

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11. Electric candle according to any one of the preceding claims, **characterized by** further comprising a control circuit, wherein the control circuit is configured for controlling the light emitting diode (4, 4') and/or the further light emitting diode (4''), wherein in particular the control circuit is disposed in or under the base (2) or in the bottom base (2').
12. Electric candle according to any one of the preceding claims, **characterized by** further including a remote control configured for controlling the control circuit, in particular by means of infrared rays and/or wireless connection.
13. Electric candle according to any one of the preceding claims, **characterized in that** the electric candle, in particular the control circuit, comprises a timer function.
14. Electric candle according to any one of the preceding claims, **characterized in that** at least one light emitting diode (4, 4', 4'') is a color light emitting diode (4, 4', 4''), preferably a full-color light emitting diode (4, 4', 4''), in particular a red-green-blue, RGB, color space full-color light emitting diode (4, 4', 4'').
15. Electric candle according to any one of the preceding claims, **characterized by** further comprising a pressure sensor, in particular a microphone, which is coupled to the light emitting diode (4, 4') and/or the further light emitting diode (4'') and/or the control circuit for controlling the light emitting diode (4, 4') and/or the further light emitting diode (4'') in dependence of a change in pressure, preferably air-pressure.
16. Method for simulating a flickering candle flame with an electric candle according to any one of the preceding claims, comprising the steps of:
- varying the light intensity of the light emitting diode (4, 4') and/or the further light emitting diode (4''), in particular by switching the light emitting diode (4, 4') and/or the further light emitting diode (4'') on and off repeatedly, preferably irregularly.

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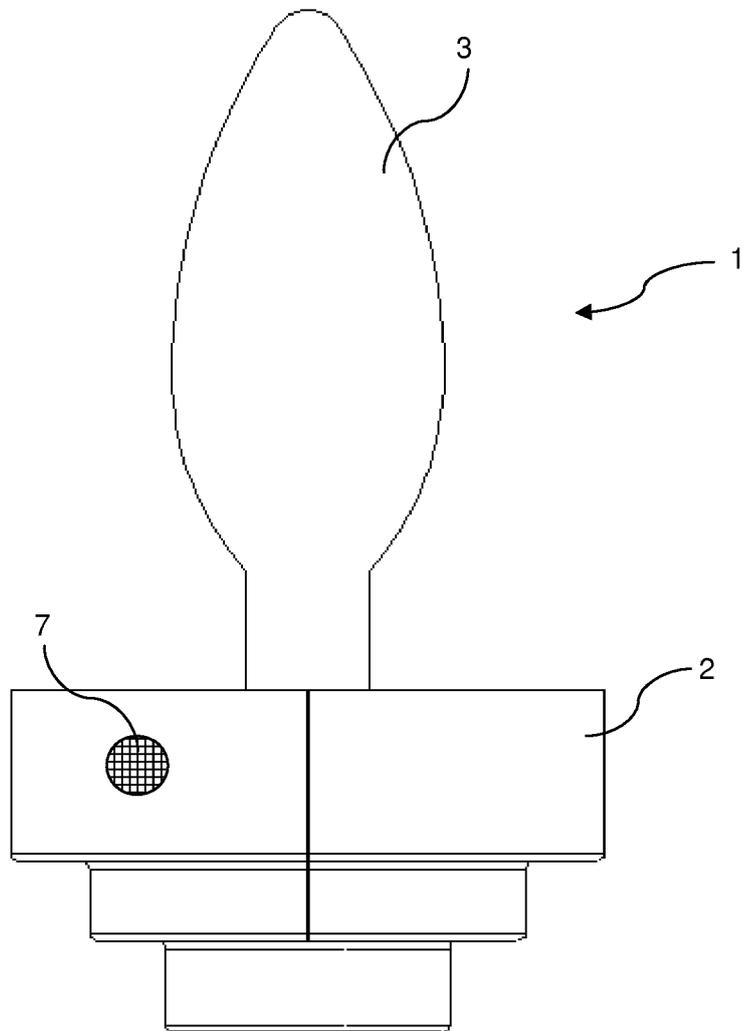


Fig. 1

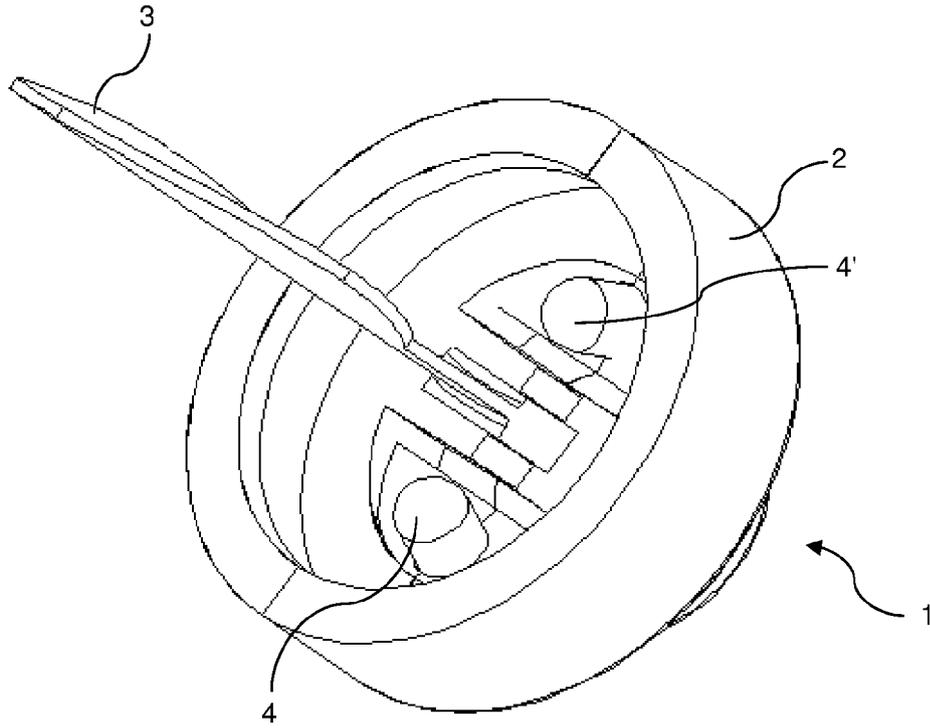


Fig. 2

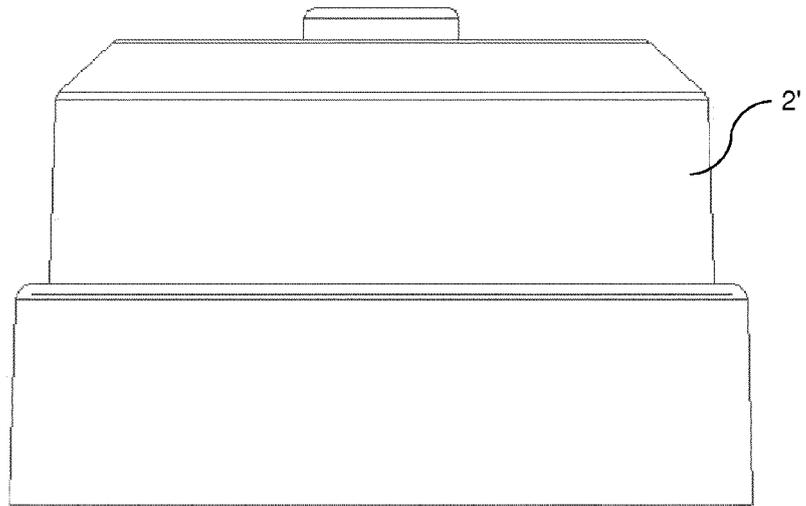


Fig. 3

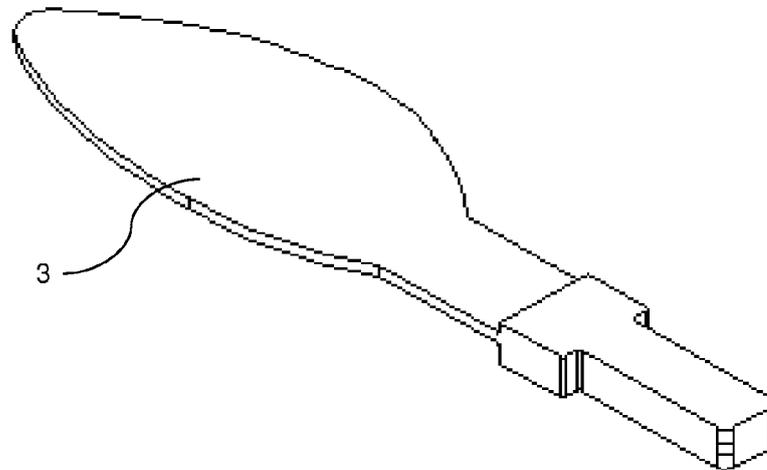


Fig. 4

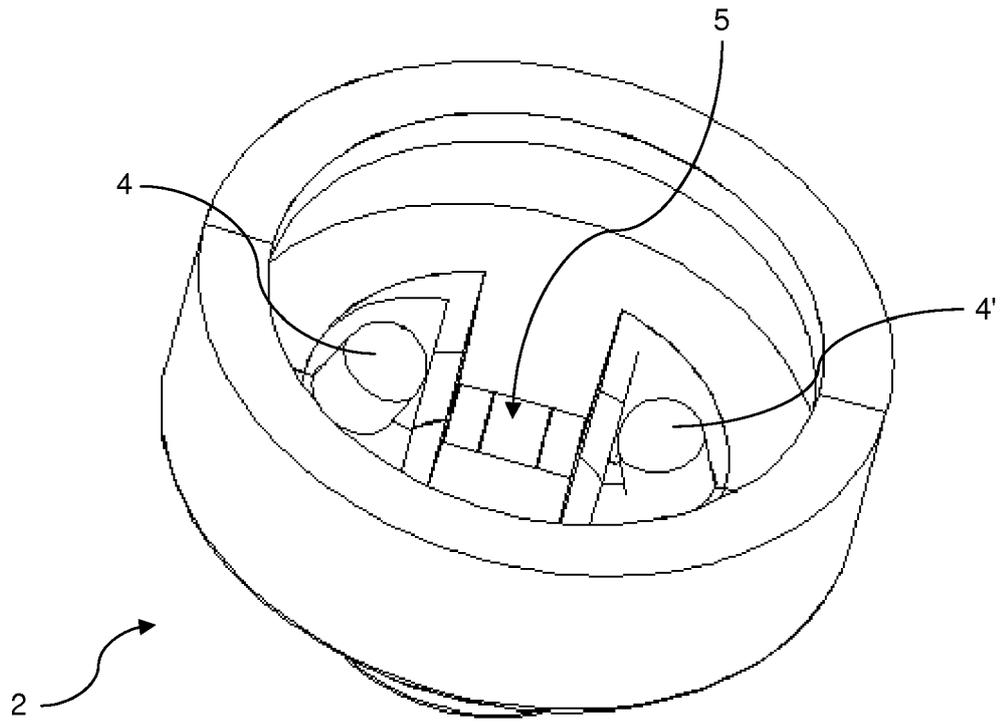


Fig. 5

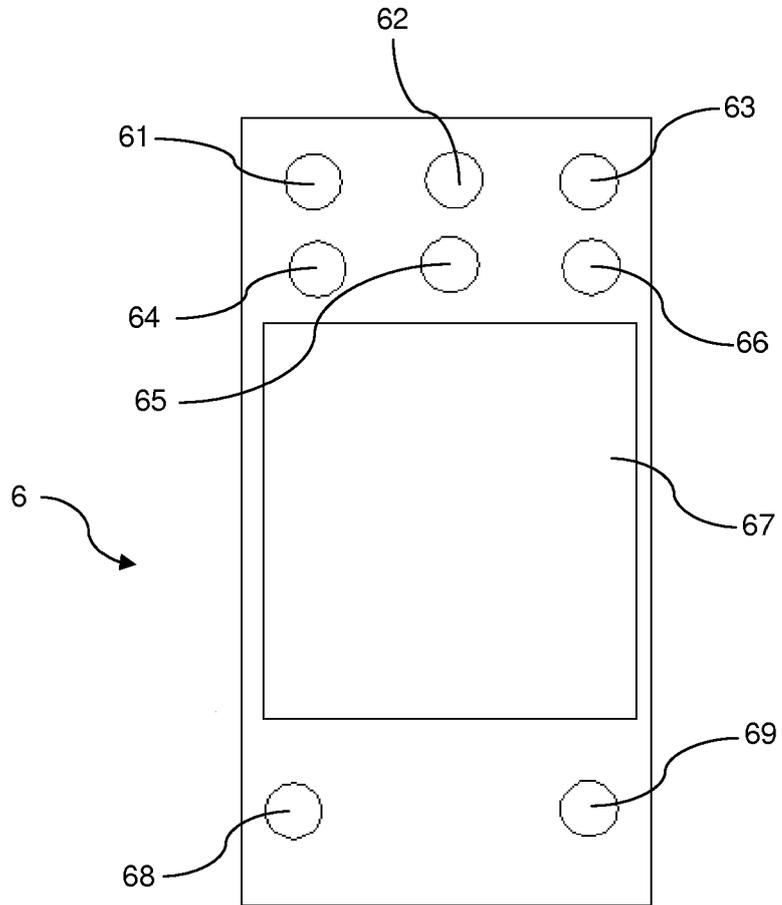


Fig. 6

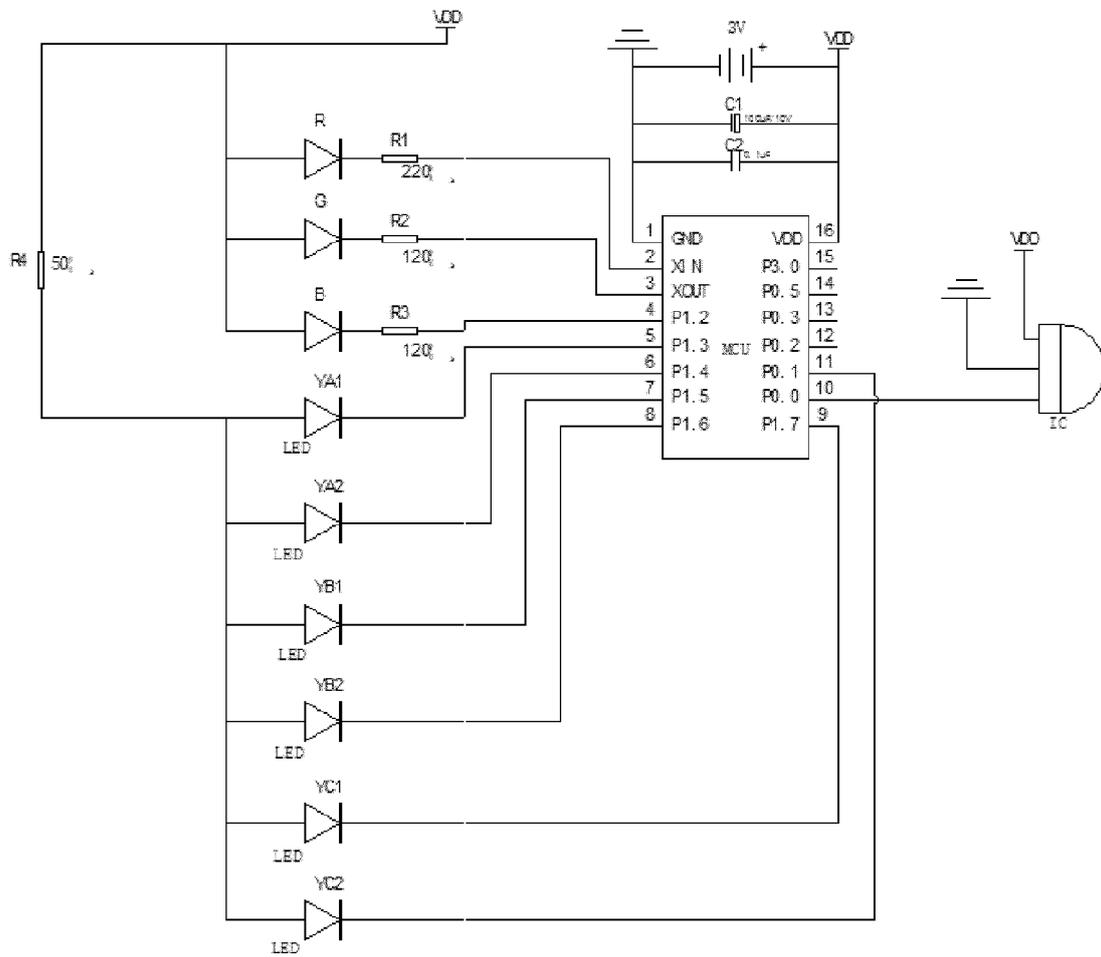


Fig. 7

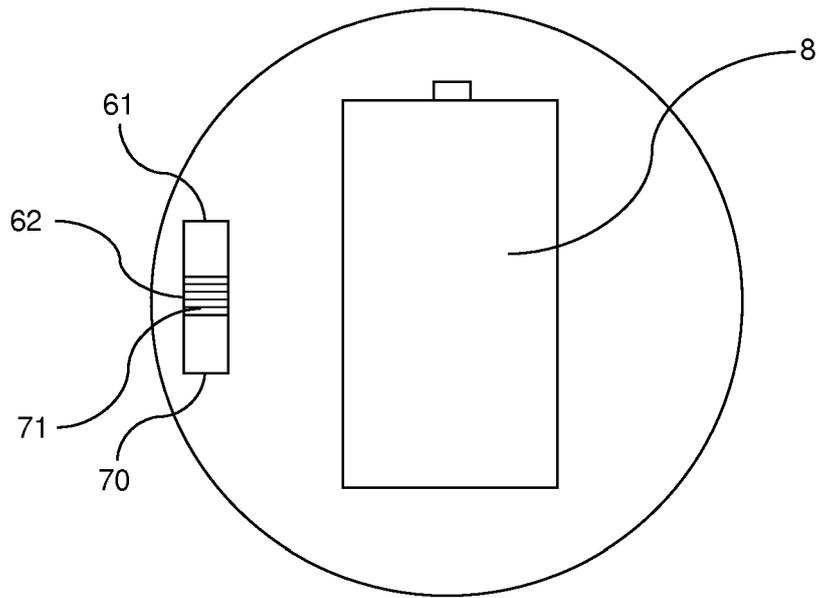


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 13 18 1413

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/279034 A1 (LUCAS SCOTT [US] ET AL) 17 November 2011 (2011-11-17) * paragraphs [0016] - [0027]; figures 1, 2 *	1-5,7-9, 11-13,16	INV. F21S10/04 F21V23/04 F21Y101/02
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