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(54) **ELECTRONIC CANDLE**

(57) An electronic candle, including a lamp head (1), a lamp strip (2), a flame cover (3), a light-transmitting tube (4), and a connection base (5). The lamp head is configured to be connected to an external power source socket; the lamp strip includes a flame-like light-emitting portion (21) and a colored light portion (22); the flame cover is sleeved on the flame-like light-emitting portion; the light-transmitting tube is sleeved on the colored light portion; an end of the connection base is snap-fitted with a lower end of the flame cover, and the other end is insert-fitted with an upper end of the light-transmitting tube, for dividing the electronic candle into a burning simulation zone and a non-burning simulation zone. The candle's flame effect employs dynamic lighting effects to simulate the appearance of a real candle flame while providing uniform illumination, enhancing realism and practicality.

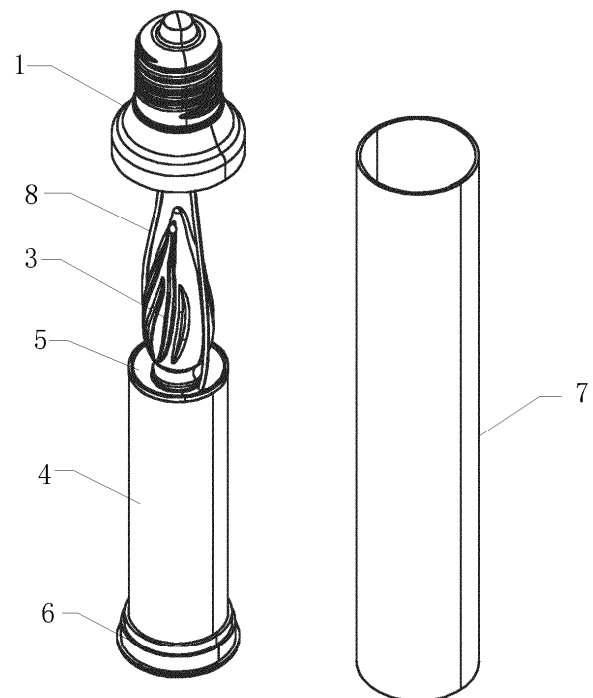


FIG. 1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of simulated candles, and more specifically to an electronic candle.

BACKGROUND

[0002] Traditional candles pose open flame safety hazards, whereas electronic candles have emerged as a safer alternative due to their eco-friendly, low-cost, and durable design, employing electronic light-emitting devices to simulate the visual dynamics of flame combustion. These devices have gained widespread adoption in daily life.

[0003] However, existing electronic candles exhibit deficiencies in simulation accuracy and practicality:

1. Limited lighting effects: Most products only mimic flame movement, lacking zonal illumination functionality to balance ambiance and utility.
2. Structural complexity: The flame cover is prone to loosening when connected to the lamp body, and the light-transmitting tube fails to align tightly with the LED strips, compromising aesthetics and waterproof performance.
3. Poor simulation fidelity: Light patterns exhibit overly regular fluctuations, lacking natural randomness, while the stability of white light output remains inconsistent.

SUMMARY OF THE DISCLOSURE

[0004] In view of the above issues, the present disclosure proposes an electronic candle that addresses these issues through a split-type lamp strip design, an optimized assembly structure, and dual control units. This design offers high realism, excellent waterproof performance, and low assembly costs.

[0005] An electronic candle, including: a lamp head, configured to be connected to an external power source socket; a lamp strip, extending axially and including a flame-like light-emitting portion and a colored light portion disposed below the flame-like light-emitting portion; a flame cover, sleeved on the flame-like light-emitting portion of the lamp strip; a light-transmitting tube, having a hollow tubular structure and being sleeved on the colored light portion of the lamp strip; and a connection base, defining an axial through hole; wherein an end of the connection base is snap-fitted with a lower end of the flame cover, and the other end of the connection base is insert-fitted with an upper end of the light-transmitting tube, for dividing the electronic candle into a burning simulation zone and a non-burning simulation zone.

[0006] In some embodiments, the electronic candle

further includes: a lamp cover, sleeved on the flame cover, the connection base, and the light-transmitting tube; wherein an upper part of the lamp cover forms a burning simulation section corresponding to the flame cover, and a lower part of the lamp cover forms a non-burning simulation section corresponding to the light-transmitting tube.

[0007] In some embodiments, a lower end of the lamp head defines a ring-shaped assembly groove with an axial depth of 2-5 mm; an upper end of the lamp cover includes a ring-shaped plug-in tube, and an outer diameter of the ring-shaped plug-in tube is interference-fit with a groove width of the ring-shaped assembly groove; a seat is connected to a lower end of the lamp cover; a bottom end of the seat extends outward peripherally to form a ring-shaped stepped edge, and a side wall of the ring-shaped stepped edge transitions smoothly with a side wall of the lamp cover to form a continuous cylindrical surface.

[0008] In some embodiments, a conical outer surface of the flame cover is distributed with wavy concave-convex textures simulating flame patterns, and a bottom periphery of the flame cover is arranged with at least three radially protruding snap-fit protrusions that are evenly spaced; an upper part of an inner wall of the axial through hole of the connection base defines L-shaped snap-fit grooves, where the number of the snap-fit grooves is the same as the number of the at least three snap-fit protrusions, and the positions of the snap-fit grooves match with the positions of the at least three snap-fit protrusions; a transverse depth of each snap-fit groove is greater than a radial protruding length of a corresponding snap-fit protrusion.

[0009] In some embodiments, the lamp strip is a flat strip-shaped lamp board, and the lamp board is divided into an upper section and a lower section along a length direction, with the width of the upper section being less than the width of the lower section; front and back sides of the upper section are arranged with warm-light LED lamp beads along the length direction; front and back sides of the lower section are arranged with white-light LED lamp beads along the length direction.

[0010] In some embodiments, an upper end of the lamp head includes external threads, a conductive terminal made of nickel-plated copper alloy, and an insulating base with an outer diameter greater than an outer diameter of the lamp cover.

[0011] In some embodiments, the electronic candle further includes: two connection wires that are independent and insulated from each other; a first end of one of the two connection wires is welded to a positive terminal of the lamp head, and a first end of the other of the two connection wires is welded to a negative terminal of the lamp head; two wire-passing holes are defined on both sides of the axial through hole of the connection base; a second end of each connection wires passes through a corresponding wire-passing hole and

forms an anti-disconnection connection with an input pad of the lamp strip.

[0012] In some embodiments, the electronic candle further includes: a controller, electrically connected to the lamp strip and including: a first control unit, connected to the flame-like light-emitting portion via a PWM dimming circuit and configured to drive the flame-like light-emitting portion at a frequency of 0.5-2 Hz to produce random brightness fluctuations, with the brightness fluctuation range being 30%-70% of a nominal value; and a second control unit, connected to the colored light portion via a constant current drive circuit and is configured to maintain the brightness of the colored light portion within $\pm 5\%$ of a nominal value.

[0013] The beneficial effects of the present disclosure are as followed.

[0014] 1. By combining the wavy patterns on the conical outer surface of the flame cover with dynamic dimming of the flame-like LEDs, a flickering flame effect is created. The flame-like light-emitting portion is adopted with random PWM dimming to simulate the irregular brightness changes of a real candle flame. The dual-layer structure design creates a visual contrast between a flame simulation zone (upper part) and a stable lighting zone (lower part). The conical structure of the flame cover and the burning simulation zone of the lamp cover together form a three-dimensional light and shadow space, enhancing the realism of the simulation.

[0015] 2. Easy to assemble. The snap-fit mechanism is adopted with the L-shaped grooves and the protrusions (horizontal groove depth > protrusion height) to ensure secure assembly between the flame cover and the connection base, with torsional strength improved by over 40%. The interference-fit ring assembly structure (interference clearance between the plug-in tube and groove is 0.05-0.1mm) achieves IP565 dust and water resistance. The continuous cylindrical surface design of the seat stepped edge and the lamp cover ensures the overall structural eccentricity is $\leq 0.3\text{mm}$.

[0016] 3. Modular maintenance-friendly design, with the axial through hole and wire-passing holes forming standardized assembly channels. The length of the lamp cover may be adjusted as needed, supporting the replacement of the entire lamp strip assembly. The light-transmitting tube is made of PC or PMMA material (light transmission rate $\geq 92\%$), and all component interfaces feature standardized design (tolerance $\pm 0.1\text{mm}$).

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] To more clearly illustrate the technical solutions of the embodiments of the present disclosure or the related art, the following is a brief introduction to the drawings configured in the description of the embodiments or the related art. It is obvious that the drawings described below are only some embodiments of the present disclosure. For those skilled in the art, other

drawings may be obtained based on these drawings without creative labor.

FIG. 1 is a disassembled structural schematic view of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 2 is a structural schematic view of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 3 is a partial structural schematic view of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 4 is a structural schematic view of a flame cover and a connection base according to Implementation 1 of the present disclosure.

FIG. 5a is a structural schematic view of a lamp board of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 5b is a structural schematic view of a lamp board of an electronic candle according to Implementation 1 of the present disclosure from another viewing angle.

FIG. 6 is a structural schematic view of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 7 is a structural schematic view of a lamp head, a connection wire, and a connection base according to Implementation 1 of the present disclosure.

FIG. 8 is a block diagram of an electrical connection between a controller and a lamp strip of an electronic candle according to Implementation 1 of the present disclosure.

FIG. 9 is a disassembled structural schematic view of an electronic candle according to Implementation 2 of the present disclosure.

[0018] Reference numerals: Lamp head 1; Ring-shaped assembly groove 12; External thread 13; Conductive terminal 14; Insulating base 15; Lamp strip 2; Flame-like light-emitting portion 21; Colored light portion 22; Lamp board 2a; Upper section 21a; Lower section 22a; Warm-light LED lamp bead 211a; White-light LED lamp bead 221a; Flame cover 3; Snap-fit protrusion 31; Light-transmitting tube 4; Connection base 5; Snap-fit groove 51; Axial through hole 52; Wire-passing hole 53; Seat 6; Ring-Shaped stepped edge 61; Lamp cover 7; Burning simulation zone 71; Non-burning simulation zone 72; Ring-Shaped plug-in tube 73; Ring-Shaped mating portion 74; Connection wire 8; Controller 9; First control unit 91; Second control unit 92.

DETAILED DESCRIPTION

[0019] The technical solutions in the embodiments of the present disclosure will be described clearly and completely in the following in conjunction with the accompanying drawings in the embodiments of the pre-

sent disclosure, and it is obvious that the described embodiments are only a part of the embodiments of the present disclosure and not all of the embodiments. Based on the embodiments in the present disclosure, all other embodiments obtained by those skilled in the art without creative labor fall within the scope of the present disclosure.

Implementation 1

[0020] Referring to FIGS. 1, 2, and 3, the electronic candle includes: a lamp head 1, a lamp strip 2, a flame cover 3, a light-transmitting tube 4, a connection base 5, a seat 6, and a lamp cover 7.

[0021] The lamp head 1 is configured to be connected to an external power source socket. An upper end of the lamp head 1 includes external threads 13, which comply with the E27 standard thread (outer diameter of 27 mm), a conductive terminal 14 made of nickel-plated copper alloy (thickness of 0.3 mm), and an insulating base 15 with a diameter of 29 mm.

[0022] The lamp strip 2 extends axially and includes a flame-like light-emitting portion 21 and a colored light portion 22 disposed below the flame-like light-emitting portion 21.

[0023] The flame cover 3 has a conical structure, which is formed by injection-molding and is sleeved on the flame-like light-emitting portion 21 of the lamp strip 2.

[0024] The light-transmitting tube 4 has a hollow tubular structure and is sleeved on the colored light portion 22 of the lamp strip 2. The light-transmitting tube 4 is made of a fully transparent material.

[0025] The connection base 5 defines an axial through hole 52; where an end of the connection base 5 is snap-fitted with a lower end of the flame cover 3, and the other end of the connection base 5 is insert-fitted with an upper end of the light-transmitting tube 4.

[0026] The seat 6 is connected to a lower end of the light-transmitting tube 4.

[0027] The lamp cover 7 is arranged between the lamp head 1 and the seat 6. An upper part of the lamp cover 7 forms a burning simulation zone 71 corresponding to the flame cover 3, and a lower part of the lamp cover 7 forms a non-burning simulation zone 72 corresponding to the light-transmitting tube 4.

[0028] As shown in FIG. 4, a conical outer surface of the flame cover 3 is distributed with wavy concave-convex textures simulating flame patterns, and a bottom periphery of the flame cover 3 is arranged with four radially protruding snap-fit protrusions 31 that are evenly spaced, with a protrusion height of 1.2 mm. An upper part of an inner wall of the axial through hole 52 of the connection base 5 defines four L-shaped snap-fit grooves 51, with a horizontal groove depth of 1.5 mm. The four snap-fit protrusions 31 at the bottom of the flame cover 3 are aligned with the four L-shaped snap-fit grooves 51 of the connection base 5, the flame cover

3 is rotated to engage the protrusions into the horizontal grooves, and a torque of 3 N·m is applied to lock in place.

[0029] As shown in FIGS. 5a and 5b, the lamp strip 2 is adopted with a flat strip-shaped lamp board 2a, which is custom-made as a PCB board. The lamp board 2a is divided into an upper section 21a and a lower section 22a along its length, with the width of the upper section 21a being less than the width of the lower section 22a. Front and back sides of the upper section 21a are arranged with warm-light LED lamp beads 211a along the length direction, with a color temperature of 2200K. Front and back sides of the lower section 22a are arranged with white-light LED lamp beads 221a along the length direction, with a color temperature of 6500K.

[0030] It should be noted that the LED lamp beads on both sides of the upper section 21a and the lower section 22a are not limited to warm-light LED lamp beads and white-light LED lamp beads; any type of lamp beads may be selected, and the different colored light-transmitting materials of the light-transmitting tube 4 and the light cover 7 may be adopted to simulate the burning of a candle.

[0031] As shown in FIG. 6, a lower end of the lamp head 1 defines a ring-shaped assembly groove 12 with an axial depth of 3 mm. An upper end of the lamp cover 7 includes a ring-shaped plug-in tube 73, and the outer diameter of the ring-shaped plug-in tube 73 is interference-fit with the groove width of the ring-shaped assembly groove 12, thereby connecting the upper end of the lamp cover 7 to the lower end of the lamp head 1.

[0032] At the bottom end of the seat 6, a ring-shaped stepped edge 61 extends outward peripherally. An upper surface of the ring-shaped stepped edge 61 is in abutting contact with a bottom surface of a ring-shaped mating portion 74 on a lower end of the lamp cover 7. A side wall of the ring-shaped stepped edge 61 transitions smoothly with a side wall of the lamp cover 7 to form a continuous cylindrical surface.

[0033] As shown in FIG. 7, two connection wires 8 are provided. A first end of one of the two connection wires 8 is welded to a positive terminal of the lamp head 1, and a first end of the other of the two connection wires 8 is welded to a negative terminal of the lamp head 1. Two wire-passing holes 53 are defined on both sides of the axial through hole 52 of the connection base 5. A second end of each connection wires 8 passes through a corresponding wire-passing hole 53 and forms an anti-disconnection connection with an input pad of the lamp strip 2.

[0034] As shown in FIG. 8, the lamp strip 2 is electrically connected to a controller 9, which includes a first control unit 91 and a second control unit 92. The first control unit 91 is connected to the flame-like light-emitting portion 21 via a PWM dimming circuit and is configured to drive the flame-like light-emitting portion 21 at a frequency of 0.5-2 Hz to produce random brightness

fluctuations, with the brightness fluctuation range being 30%-70% of a nominal value. The second control unit 92 is connected to the colored light portion 22 via a constant current drive circuit and is configured to maintain the brightness of the colored light portion 22 within $\pm 5\%$ of a nominal value.

Dynamic flame simulation

[0035] First control unit - Parameter settings:

PWM frequency: 1.2 Hz (period 833 ms);
Duty cycle random algorithm: varies randomly within the range of 15% to 85% according to a Poisson distribution;
Brightness gradient: Top LED brightness fluctuation range $\pm 45\%$, gradually decreasing downward to $\pm 10\%$ at the bottom;
Actual test results: In a dark room environment (illuminance ≤ 1 lx), the illuminance fluctuation range measured at a distance of 30 cm from the flame cover is 2-15 lx.

Implementation 2

[0036] As shown in FIG. 9, the electronic candle herein differs from Implementation 1 in that the lamp head 1, the lamp cover 7, and the seat 6 are all rotated 180° and arranged in an inverted configuration. For the electronic candle of Implementation 1, when in use, the lamp head is located at the upper end of the electronic candle, and the electronic candle is in a vertically suspended state. In the present embodiments, the lamp head is located at the lower end of the electronic candle and is connected to a floor socket, forming a vertical placement state.

[0037] In the present disclosure, unless otherwise specified, directional terms such as "up, down, left, right, front, back, inside, outside, vertical, and horizontal" included in the terminology represent the conventional orientation of the terms or are commonly understood by those skilled in the art, and should not be construed as limitations on the terms. Additionally, terms such as "first", "second", and "third" are not intended to represent specific quantities or sequences but are merely intended for naming purposes. Furthermore, the terms "include", "contain", or any of their variants are intended to encompass non-exclusive inclusion, meaning that a process, method, article, or device that includes a series of elements not only includes those elements but also includes other elements not explicitly listed or elements inherent to such a process, method, article, or device.

[0038] The above description is merely some embodiments of the present disclosure and is not intended to limit the scope of the present disclosure. Any modifications, equivalent replacements, improvements, or other changes made within the spirit and scope of the pre-

sent disclosure should be included within the scope of the present disclosure.

5 Claims

1. An electronic candle, **characterized by** comprising:

a lamp head (1), configured to be connected to an external power source socket;
a lamp strip (2), extending axially and comprising a flame-like light-emitting portion (21) and a colored light portion (22) disposed below the flame-like light-emitting portion (21);
a flame cover (3), sleeved on the flame-like light-emitting portion (21) of the lamp strip (2);
a light-transmitting tube (4), having a hollow tubular structure and being sleeved on the colored light portion (22) of the lamp strip (2); and
a connection base (5), defining an axial through hole (52); wherein an end of the connection base (5) is snap-fitted with a lower end of the flame cover (3), and the other end of the connection base (5) is insert-fitted with an upper end of the light-transmitting tube (4), for dividing the electronic candle into a burning simulation zone and a non-burning simulation zone.

2. The electronic candle according to claim 1, further comprising:

a lamp cover (7), sleeved on the flame cover (3), the connection base (5), and the light-transmitting tube (4); wherein an upper part of the lamp cover (7) forms a burning simulation section corresponding to the flame cover (3), and a lower part of the lamp cover (7) forms a non-burning simulation section corresponding to the light-transmitting tube (4).

3. The electronic candle according to claim 2, wherein a lower end of the lamp head (1) defines a ring-shaped assembly groove (12) with an axial depth of 2-5 mm; an upper end of the lamp cover (7) comprises a ring-shaped plug-in tube (73), and an outer diameter of the ring-shaped plug-in tube (73) is interference-fit with a groove width of the ring-shaped assembly groove (12);

a seat (6) is connected to a lower end of the lamp cover (7); a bottom end of the seat (6) extends outward peripherally to form a ring-shaped stepped edge (61), and a side wall of the ring-shaped stepped edge (61) transitions smoothly with a side wall of the lamp cover (7) to form a continuous cylindrical surface.

4. The electronic candle according to claim 1, wherein a conical outer surface of the flame cover (3) is

distributed with wavy concave-convex textures simulating flame patterns, and a bottom periphery of the flame cover (3) is arranged with at least three radially protruding snap-fit protrusions (31) that are evenly spaced;

an upper part of an inner wall of the axial through hole (52) of the connection base (5) defines L-shaped snap-fit grooves (51), where the number of the snap-fit grooves (51) is the same as the number of the at least three snap-fit protrusions (31), and the positions of the snap-fit grooves (51) match with the positions of the at least three snap-fit protrusions (31); a transverse depth of each snap-fit groove (51) is greater than a radial protruding length of a corresponding snap-fit protrusion (31).

5. The electronic candle according to claim 1, wherein the lamp strip (2) is a flat strip-shaped lamp board (2a), and the lamp board (2a) is divided into an upper section (21a) and a lower section (22a) along a length direction, with the width of the upper section (21a) being less than the width of the lower section (22a);

front and back sides of the upper section (21a) are arranged with warm-light LED lamp beads (211a) along the length direction; front and back sides of the lower section (22a) are arranged with white-light LED lamp beads (221a) along the length direction.

6. The electronic candle according to claim 2, wherein an upper end of the lamp head (1) comprises external threads (13), a conductive terminal (14) made of nickel-plated copper alloy, and an insulating base (15) with an outer diameter greater than an outer diameter of the lamp cover (7).

7. The electronic candle according to claim 1, further comprising two connection wires (8) that are independent and insulated from each other; a first end of one of the two connection wires (8) is welded to a positive terminal of the lamp head (1), and a first end of the other of the two connection wires (8) is welded to a negative terminal of the lamp head (1); two wire-passing holes (53) are defined on both sides of the axial through hole (52) of the connection base (5); a second end of each connection wires (8) passes through a corresponding wire-passing hole (53) and forms an anti-disconnection connection with an input pad of the lamp strip (2).

8. The electronic candle according to claim 1, further comprising a controller (9), electrically connected to the lamp strip (2) and comprising:

a first control unit (91), connected to the flame-like light-emitting portion (21) via a PWM dimming circuit and configured to drive the flame-like light-emitting portion (21) at a frequency of 0.5-2 Hz to produce random brightness fluctuations, with the brightness fluctuation range being 30%-70% of a nominal value; and a second control unit (92), connected to the colored light portion (22) via a constant current drive circuit and is configured to maintain the brightness of the colored light portion (22) within $\pm 5\%$ of a nominal value.

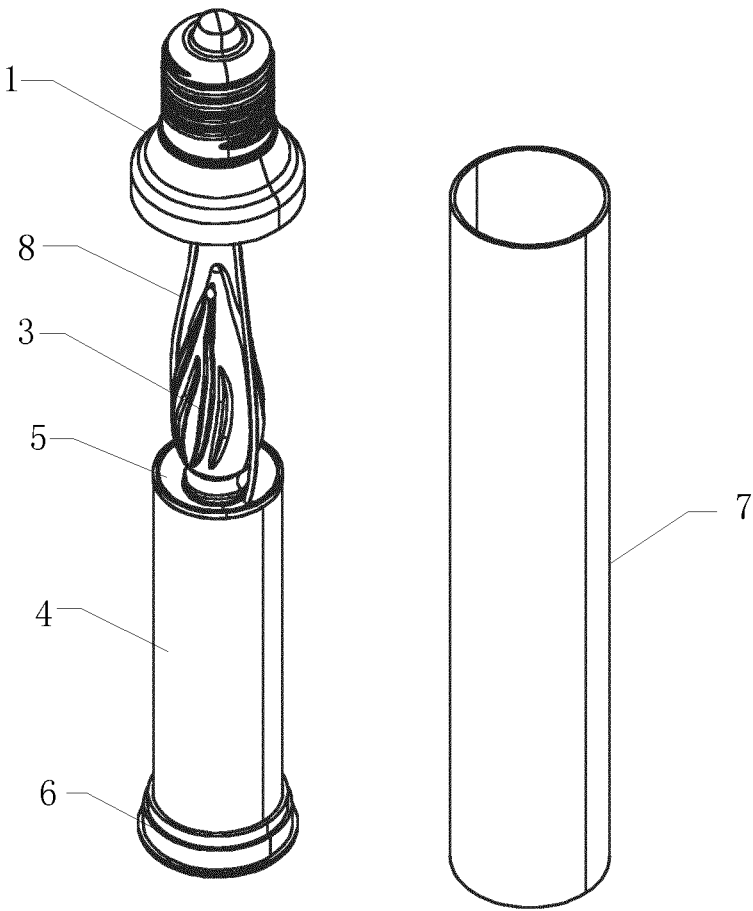


FIG. 1

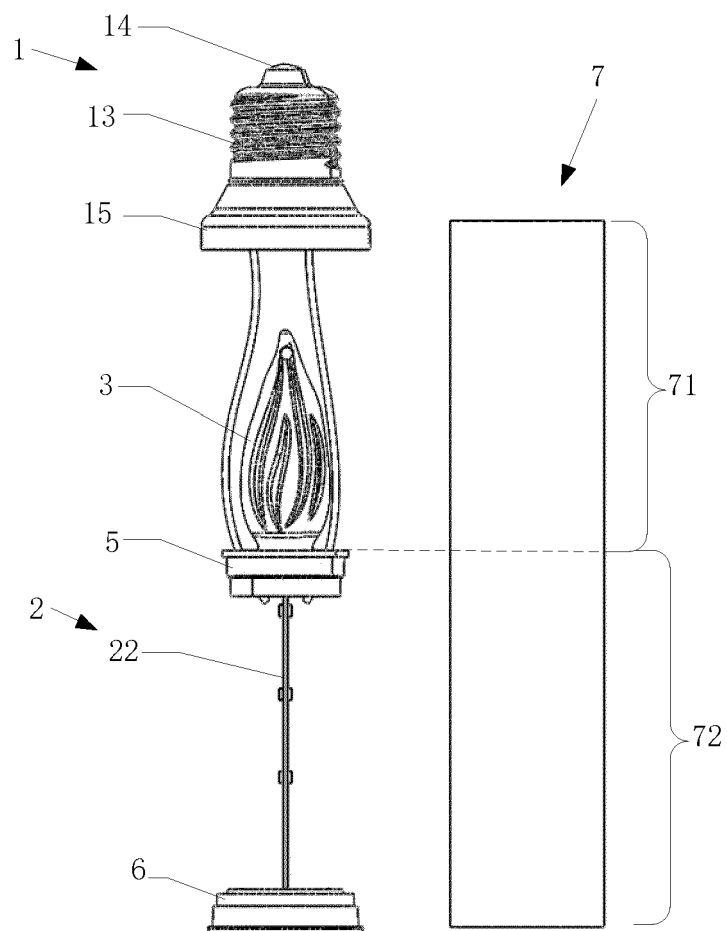


FIG. 2

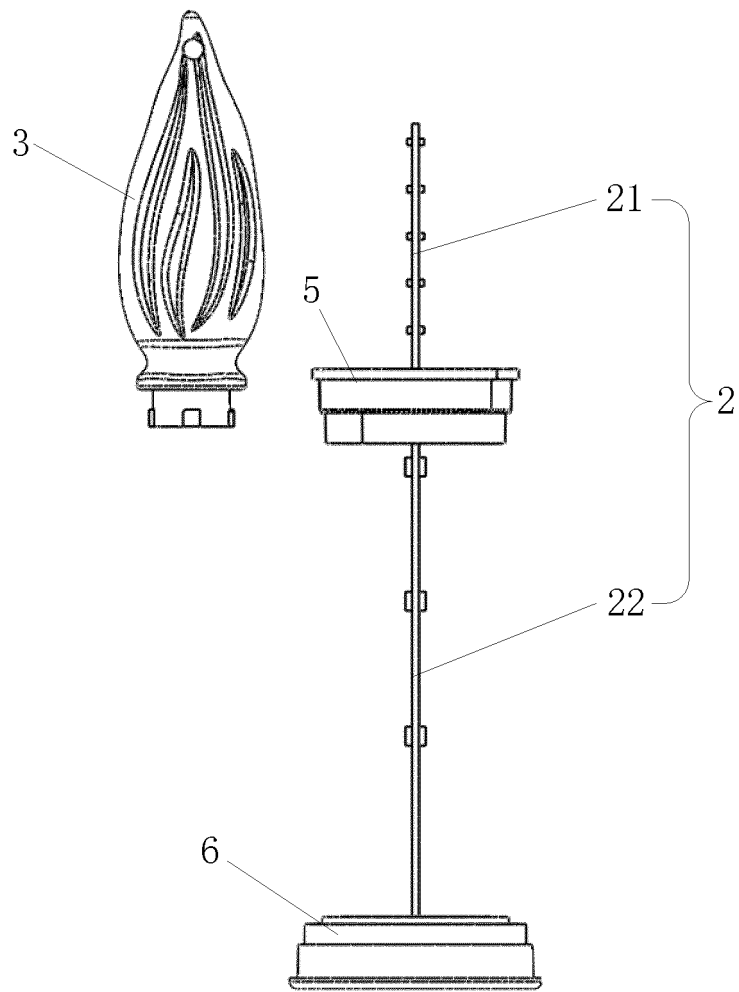


FIG. 3

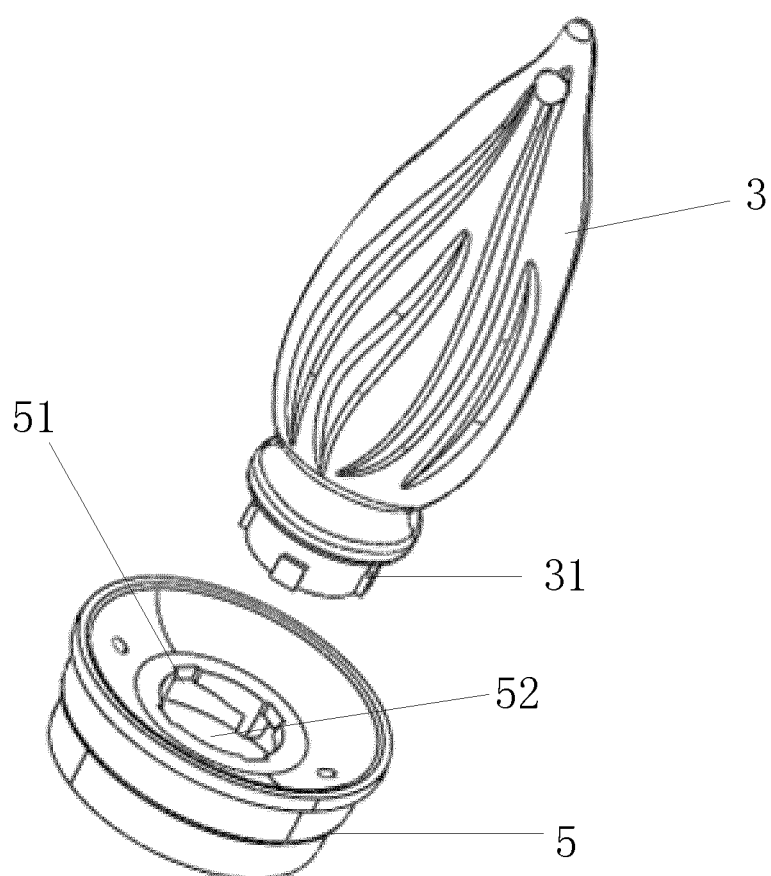


FIG. 4

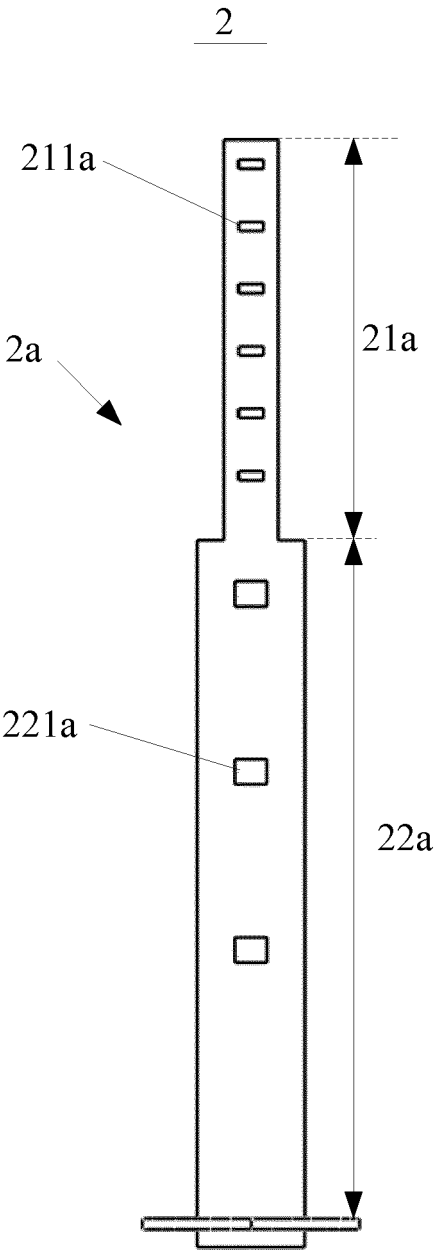


FIG. 5a

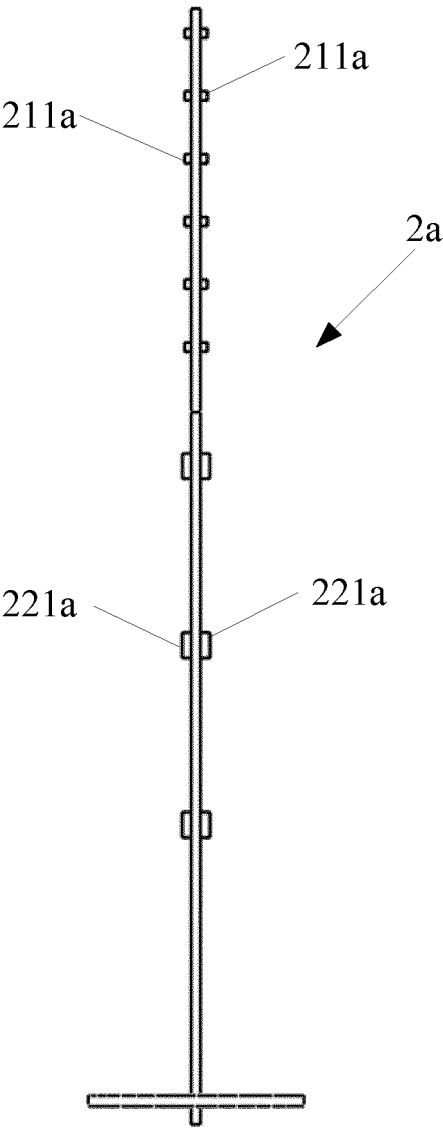


FIG. 5b

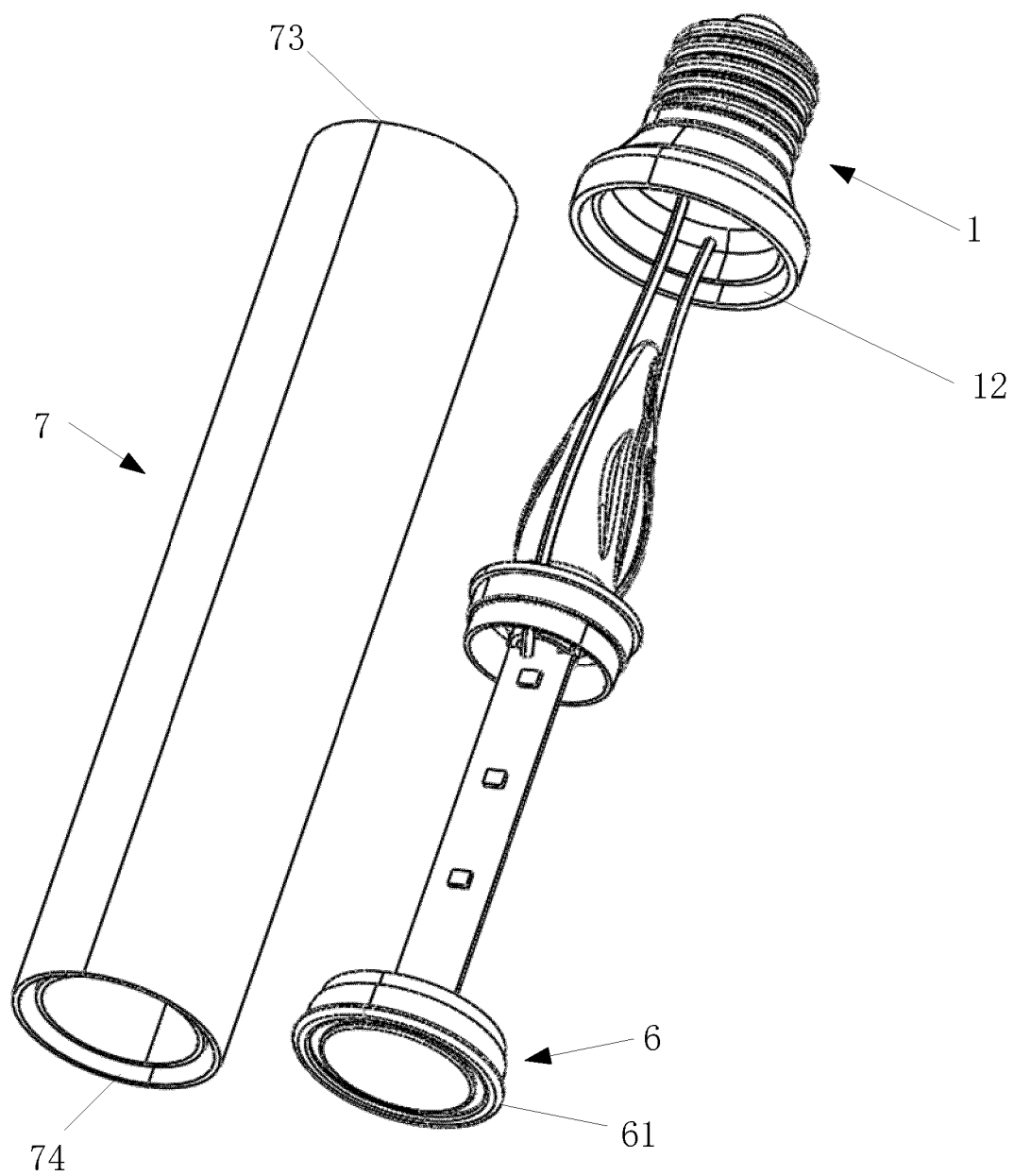


FIG. 6

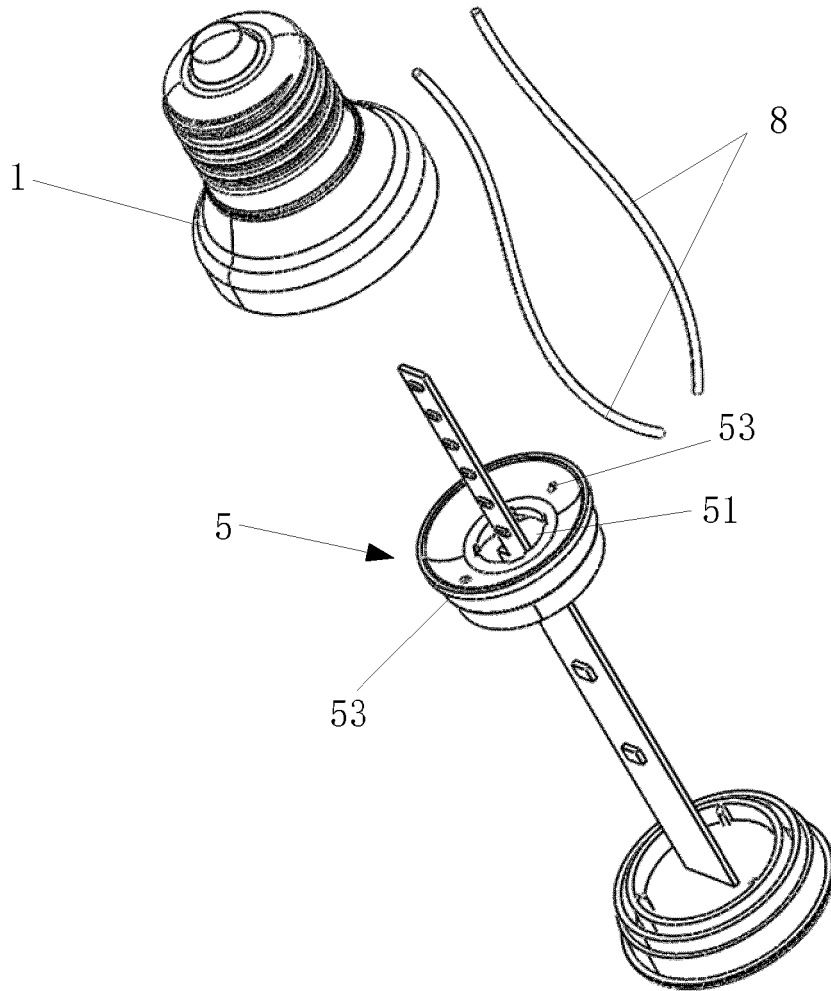


FIG. 7

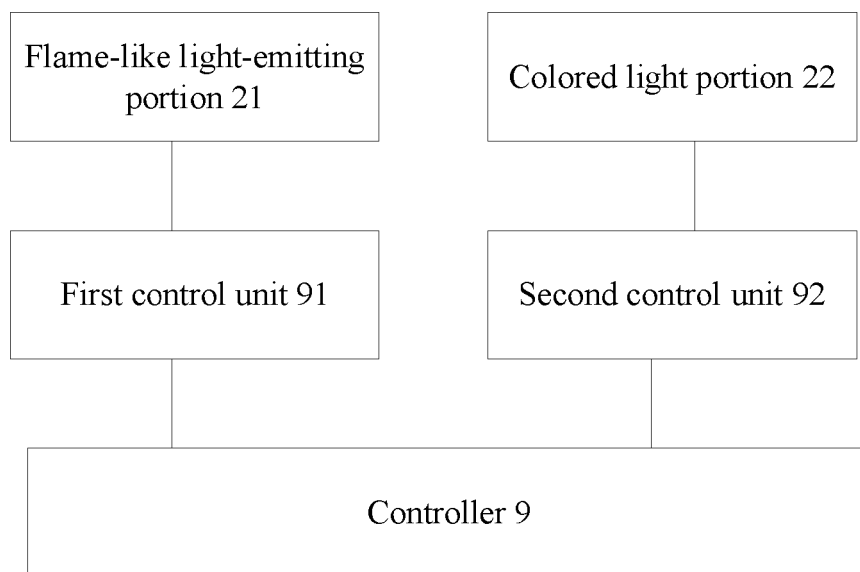


FIG. 8

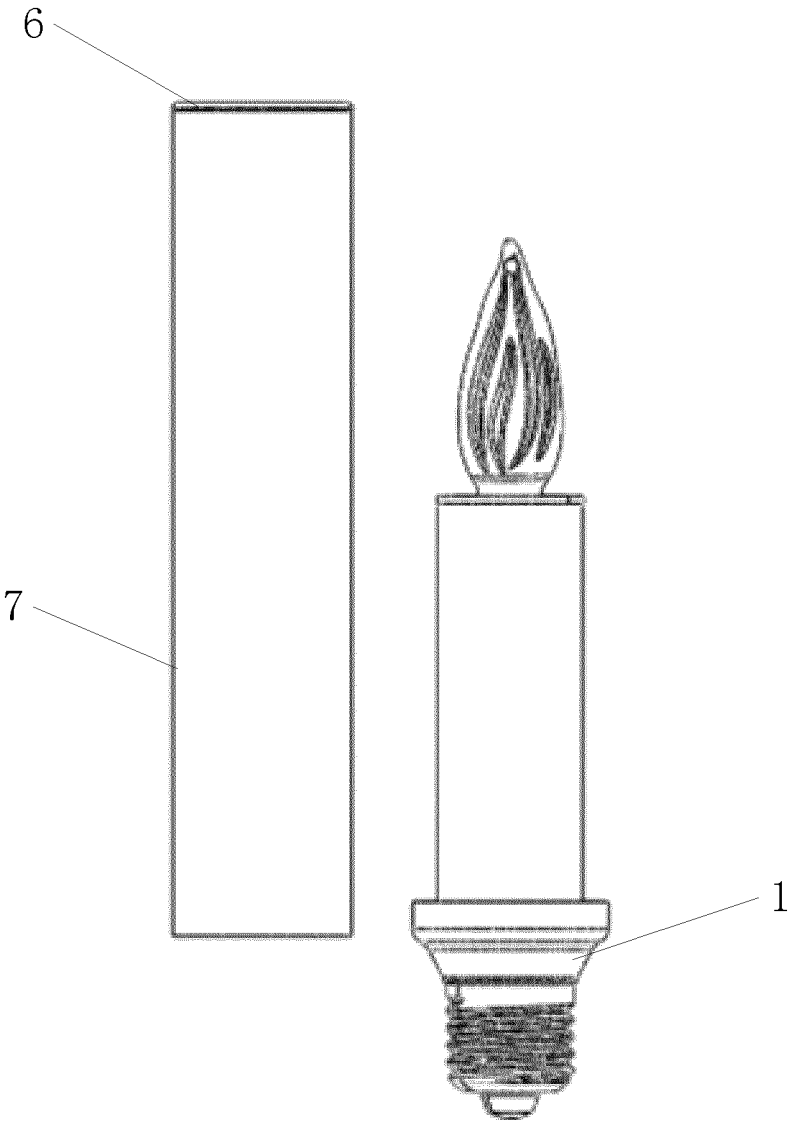


FIG. 9



EUROPEAN SEARCH REPORT

Application Number

EP 25 17 6188

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EPO FORM 1503 03.82 (P24C01)

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Place of search The Hague		Date of completion of the search 30 September 2025	Examiner Thibaut, Arthur
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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