

Artificial Candle Apparatus

TECHNICAL FIELD

Aspects of the present disclosure relate to artificial candle apparatuses and devices. Particular aspects of the present disclosure are directed to artificial candle apparatuses configured for emitting or outputting an aroma fragrance, and/or which include a cambered flame member that better simulated a real candle flame.

BACKGROUND

Aromatherapy science has been gaining attention amongst members of the scientific community. Practitioners of aromatherapy have long believed that scents and aromas can be used to reduce stress and promote mental well-being, thereby setting a pleasing and relaxing mood. Scientific professionals have proven the claims of aromatherapy in their laboratory, showing how aromatherapies can quickly affect mood and behavior. Two mechanisms are used to explain the purported effects of aromatherapy, namely: (a) the influence of aroma on the brain, particularly the limbic system through the olfactory system and (b) the direct pharmacological effect of the essential oils.

Co-incidentally, the subdued light from a burning candle is also known to be able to set a pleasing and relaxing mood as well. Combustible candles are often used for their natural aesthetic value. A candle's soft, warm subdued light can facilitate or enable the creation of a particular ambiance and/or emotional response to an observer's environment, for instance, in romantic, cultural / traditional, or religious settings. Candlelight can bring a special sense of calm and well-being that other lights cannot.

Unfortunately, combustible candle flames are a fire hazard, and can be unsafe around children, elderly or physically disadvantaged individuals, and pets.

Aroma fragrances are commonly used in conjunction with combustible candles. For instance, one or more aroma fragrances in liquid form are often placed on a ceramic dish with a lighted candle positioned beneath the dish. The heat of the candle flame vaporizes the aroma fragrance and the vapor carries the aroma fragrance into the atmosphere. This method of delivering aroma fragrance is widely used both in residential and commercial places. However, lighting a candle initiates combustion, and when left unattended, the burning flame at over 1200° C, could be dangerous. Fire incidents due to unattended burning candles are not uncommon.

Aroma fragrances are also incorporated into the materials from which combustible candles are formed to thereby produce scented candles. In many scented candles made today, the aroma fragrance is mixed with hot molten paraffin wax and other ingredients such as wax hardener and coloring agents. When the scented candle is

lighted, the heat of the candle flame vaporizes the aroma fragrance and the vapor carries the aroma fragrance into the atmosphere. The candlelight and the aroma fragrance in combination set a soft ambiance (e.g. a romantic ambiance) welcome by many. However, the flame produced by a scented candle poses a fire risk. Moreover, the therapeutic benefits of the aroma fragrance carried by a scented candle can be greatly reduced when the aroma fragrance is mixed with hot molten paraffin wax and other chemical ingredients such as the stearic acid as part of scented candle production.

Candles remain popular, and are not likely to be replaced by other conventional types of artificial light sources due to the warm, hypnotizing and subdued mood that candlelight produces. As a result of the popularity of candlelight, multiple types of imitation electronic candle product or artificial candles have been produced and marketed. Unfortunately, most artificial candle products fail to realistically or closely emulate the behavior and appearance of a real combustible candle flame. Many artificial candles have an imitation candle flame that sways non-stop, or which flickers continually. A continuously swaying candle flame does not accurately emulate the behavior of a real combustible candle flame, and may create some unwanted anxiety instead of the calmness a real candle flame would offer. A real candle flame sways only when there is a draft or atmospheric disturbance. Current artificial candle flames also do not flicker in a manner that closely emulates or truly resembles the manner in which a real combustible candle flame flickers. Furthermore, most artificial candles made today provide an artificial flame having only a single region of uniform light, unlike a real candle flame which has a distribution of multiple colors due to the different burning temperatures at different sections of the candle flame, from a dark bluish region at approximately 600° C to an incandescent bright yellow region at approximately 1200° C or slightly higher.

In addition to the foregoing drawbacks, existing artificial electronic candles fail to safely and effectively combine the mood setting abilities of a candle's subdued light with an aromatic scent.

SUMMARY OF THE INVENTION

Embodiments in accordance with the present disclosure address the problems associated with real combustible candles, as well as the shortcomings associated with existing artificial candles or imitation electronic candle devices to create a realistic artificial candle flame that closely emulates the same type of subdued light and flame motion as a real combustible candle flame to promote a sense of calmness and mental well-being. Furthermore, at least some embodiments in accordance with the present disclosure provide a safe and effective aroma fragrance transport, emission, release, or distribution mechanism, which can also aid the realistic emulation of natural combustible candle flame motion as further described below.

In this disclosure, warm colored light (at 1800 Kelvin to 2200 Kelvin) is reflected off

an unpredictable swaying cambered flame member such that the reflected light pattern is non-uniform and fluid. When the artificial flame is in motion, the reflected light bouncing off the artificial flame gives the illusion of a swaying candle flame that better represents a real combustible candle flame. Within the candle flame, the different temperature of the light is better represented with the convergent of the light at selected sections of the cambered flame member. The projected light is also programmed to change in its light intensity to recreate the burning of the wax within the candle flame. To promote a sense of calmness, the warm glow of the reflected light is made to stop swaying frequent enough to better represent the behavior of a real candle flame under normal circumstances.

Combining the subdued light and the safe delivery of the aromatic fragrance, the sight and smell reproduced by the apparatus help to promote a sense of calmness and mental well-being like a real scented candle would but more effectively and safely.

At least some embodiments of the present invention refer to an artificial candle apparatus that includes: a hollow housing that carries a flame simulating device and an aroma fragrance transport device. The aroma fragrance transport device can include an airflow passage within the housing through which an aroma fragrance is emitted from the housing.

The flame simulating device can include a flame member in a flame silhouette shape and having a reflecting camber surface; a pivoting element; a pendulum element; a light source; a drive mechanism; and a control circuit. The pivoting element is coupled between the reflecting element and the pendulum element, and the flame member is pivotally mounted to the pivoting element. The reflecting element extends outside the housing, and the light source is adapted to transmit a convergent light obliquely onto the reflecting camber surface. The drive mechanism is positioned under the flame member, and the control circuit is adapted to send a drive signal to the drive mechanism, such that the drive mechanism occasionally applies a force on the pendulum element based on the drive signal to make the flame member occasionally sway.

The control circuit can be adapted to make the light source operate at a bright-light mode and a dim-light mode in cycles at a preset rate.

In some embodiments, the drive mechanism includes a motor, a coupling shaft and a bump; wherein an end of the coupling shaft is fixed on the output shaft of the motor, the bump is mounted on the other end of the coupling shaft, the motor is electrically connected to the control circuit, the bump and the coupling shaft move in a circle on a horizontal plane as the motor receives the drive signal from the control circuit, and the bump hits the pendulum element during in each cycle.

The pendulum element can be magnetic, and the drive mechanism can include a

motor, a coupling shaft and a magnetic block; wherein an end of the coupling shaft is fixed on the output shaft of the motor, the magnetic block is fixed on the other end of the coupling shaft, the motor is electronically coupled to the control circuit. The magnetic block and the coupling shaft move in a circle on a horizontal plane as the motor receives the drive signal from the control circuit. The magnetic block moves adjacent to the pendulum element periodically, applying a magnetic force onto the pendulum element when the magnetic block moves adjacent to the pendulum element.

Alternatively, the pendulum element can be magnetic, and the drive mechanism can include a magnetic coil under the pendulum element, wherein the control circuit would occasionally energize the magnetic coil producing a magnetic force on the pendulum element to cause it to sway.

The reflecting element with a flame silhouette shape is comprised of a reflecting camber surface and a backlit camber surface. The reflecting camber surface can include a left-reflecting slope surface and a right-reflecting slope surface, wherein the left-reflecting slope surface and the right-reflecting slope surface define a concave slope that grows smaller from the bottom up gradually.

The middle portion of the backlit camber surface can define a convexity corresponding to the concave slope, and an upper portion of the reflecting element bends towards the direction of the backlit camber surface, and is off the vertical-center line of the reflecting element. A lower portion of the reflecting element bends towards the direction where the reflecting camber surface is, and the reflecting camber surface and the backlit camber surface respectively define a streamlined airflow track.

In various embodiments, the aroma fragrance transport device includes a fan, a fragrance element, and an airflow tunnel built within the housing; wherein an air inlet of the airflow tunnel is positioned at a lower portion of the housing, while an air outlet of the airflow tunnel is positioned at an upper portion of the housing. The fan can be mounted in the airflow tunnel, and a fragrance element can be positioned between the fan and the air inlet of the airflow tunnel, and the control circuit is further adapted to occasionally energize the fan.

The housing can include a shell, a bottom base, a retaining shell and a retaining base, wherein the shell and the bottom base define an interior space which houses the retaining shell and the retaining base, and the retaining base is mounted on a top wall of the bottom base, the retaining shell is mounted on a top wall of the retaining base, a top wall of the shell has a mounting opening at a central portion thereof, and the retaining shell has two opened ends and provides a hollow space. The retaining base has a vertical cylindrical space, the top wall of the retaining base can have a plurality of evenly-distributed ventilation holes, each ventilation hole open to the vertical cylindrical space, and the bottom wall of the retaining base has a ventilation opening

open to the vertical cylindrical space.

The bottom base includes a base, a cover plate and a minimum of three support blocks, and the base has an inlet opening open to the ventilation opening of the retaining base. A removable cover plate is mounted to the inlet opening; wherein the cover plate includes a board and a plurality of baffle strips, the board has long ventilation through holes whose amount is as the same as the baffle strips'. Both ends of each baffle strip are mounted on the board, and there is a distance between the board and each baffle strip, each baffle strip is just beyond a corresponding ventilation through hole, and the long ventilation through holes and the distance between each baffle strip and the board define a ventilation mechanism of the cover plate, with the support blocks mounted on the base.

The ventilation holes of the retaining base are open to the upper opening of the retaining shell, which make the cylindrical space of the retaining base open to the hollow space of the retaining shell. The cylindrical space and the hollow space can define the airflow tunnel; the ventilation mechanism of the cover plate can be the said air inlet of the airflow tunnel; and the mounting opening can be the said air outlet of the airflow tunnel. The fragrance element can be positioned in the cylindrical space. The fan can be positioned in the hollow space of the retaining shell adjacent to the lower opening of the retaining shell.

Certain embodiments include a support wire attached to the walls of the retaining shell for support at locations selected to place the flame member in the center of the hollow space, such that the flame member rests vertically on the support wire because of the gravity of the pendulum element, and the reflecting element goes beyond the shell through the mounting opening of the shell.

The retaining shell can include a light-emission platform inlaid with the light source, the light-emission platform positioned ahead of the reflecting camber surface and below the reflecting element, such that the angle between a horizontal plane and a light-emission surface of the light-emission platform is an obtuse angle so that the convergent light from the light source is transmitted obliquely onto the reflecting camber surface.

A power supply device can include dry cell batteries and/or a built-in lithium battery, wherein the control circuit is further adapted to manage the voltage of the dry cell batteries or a built-in lithium battery and supply the voltage to the electric equipment of the candle apparatus. The power supply device can further includes a rectification circuit, a buck DC-DC power converter, and an AC connector, the rectification circuit configured for converting an AC voltage from the AC connector into a first direct voltage, the buck DC-DC power converter configured for converting the first direct voltage into a second direct voltage to supply power to the electric equipment of the candle apparatus, and the retaining base has a mounting cavity for housing the dry cell

batteries and a slot for holding the lithium battery.

The shell can include an outer shell and an inner shell, wherein the inner shell is made of plastic or other environmental friendly material(s), and the outer shell is made of paraffin or other biodegradable wax.

The control circuit can reside on a circuit board. The housing can include a shell, a bottom base, a retaining shell and a retaining base; wherein the shell and the bottom base define an interior space which houses the retaining shell and the retaining base. The retaining base is mounted on a top wall of the bottom base, the retaining shell is mounted on a top wall of the retaining base, the top wall of the shell has a mounting opening at the central portion thereof, and the retaining shell can include a left shell and a right shell fastened with the left shell. The left shell and right shell respectively have a mounting groove, wherein the mounting grooves define a groove group for holding the circuit board. A motor can be positioned underneath the circuit board with a hole, such that the output shaft of the motor goes beyond the circuit board through the hole, and the coupling shaft and the bump are beyond the circuit board.

The artificial candle apparatus can further include a wireless communication module mounted in the housing, such that the wireless communication module is adapted to receive a control signal from a portable electronic device or a remote controller, and transmit the control signal to the control circuit.

The light source can include one or more convergent light emitting diodes, an end of whose tube defines a convex lens.

Beneficial effects of at least some embodiments of an artificial candle apparatus in accordance with the present disclosure can include one or more of the following:

1. The artificial flame member is programmed so that it sways only occasionally, like a real candle flame. The drive mechanism periodically applies a force on the pendulum element to make the flame member sway occasionally. When the flame member sways, the light intensity distribution on the reflecting camber surface is changed, to realistically simulate a natural flickering of a burning flame. The natural movement of the flame member thus simulates or mimics a real candle flame but without the high temperature of a combustible candle flame that could start a fire. The candle flame is mimicked using one or multiple light sources reflected off a cambered artificial candle flame member that sways unpredictably, producing an apparently random flickering light effect using a combination of mechanical and electrical systems.

2. By using reflected light, as opposed to direct light projection, the intensity of the light viewed by an observer is more subtle and subdued. This better represents true

candlelight.

3. The light source is also programmed to produce a subtle dimming and brightening effect that mimics the burning effect caused by the release of the hydrocarbon molecules at the different burning regions within an actual candle flame. The light source can operate in different modes, for instance: a 'bright-light' mode and a 'dim-light' mode in cycles at a preset rate, to thus alter the intensity of the light at the preset rate. The alternating intensity of the light mimics the burning effect at different sections of the burning flame. This simulation, as opposed to a flat uniform color on the artificial flame member, makes the artificial candle flame appear more realistic.

4. To mimic a real candle flame, indirect light is reflected off a candle flame silhouette having a reflecting camber surface that converges light towards the center portion of the artificial flame, nearer the upper end of the flame silhouette. It is at this region of a real candle flame where solid carbon particles are heated to incandescence, where the temperature is the highest and the light the brightest. As the light is directed on a slightly concave surface, the intensity of light on the sloped concave is greater than the intensity of light on the left-reflecting sloped surface and the right-reflecting sloped surface. Therefore, a central portion of the flame member is brighter than a peripheral portion thereof, which makes the flame member simulate a burning flame more realistically.

5. The reflecting camber surface and its counterpart backlit camber surface respectively define a streamlined airflow track. When the airflow (carrying the aroma fragrance) goes up through the air outlet, it goes along the streamlined airflow tracks of the flame member, and forms an air vortex around the top of the flame member, which makes the flame member sway naturally, to change the light intensity distribution on the reflecting camber surface, thus simulating a very natural flickering of a candle flame. The natural flickering of the flame member, the warm glow of the light reflected off the reflecting camber surface, and the added aroma fragrance help to promote relaxation and to reduce stress effectively, like a real scented candle would but more effectively, and without the risk of fire.

Moreover, when there is a natural draft in the location at which the artificial candle is placed, the flame member also sways naturally. The flame member, designed like the sail of a sailboat, can catch the draft easily to simulate a natural and subtle flickering of a real candle flame. The electromagnetic stimulation of the flame member serves as an aid to maintain movement of the flame member, whenever desired.

6. Embodiments in accordance with the present disclosure can provide at least three kinds of drive mechanisms. As the mounted circuit board is interchangeable, simply changing the circuit board used can provide a selected drive mechanism. The

interchangeability of the components increases flexibility in assembly and manufacturing.

7. In addition to realistically mimicking a candle flame, at least some embodiments in accordance with the present disclosure also provide a safe transportation device for delivering aroma scents that can stimulate one's sense and well-being. To prevent the aromatic fragrance from losing its therapeutic effectiveness when it is mixed with hot molten paraffin, the present disclosure separate the essential oils from the wax. The essential oils are stored in interchangeable sachet; the aroma from the essential oils is then carried safely into the atmosphere by air circulating through an airflow tunnel aided by a small built-in DC fan. When the fan operates, airflow is drawn into the cylindrical space through the ventilation mechanism, and carries an aroma fragrance from the fragrance element placed along the airflow chamber into the outward atmosphere through the hollow space and the air outlet. The fan operating selection is dependent on the user's preference, and on the size of the area that the aroma fragrance has to fill.

8. The artificial candle apparatus can be energized by one or more dry cell batteries, one or more rechargeable lithium batteries, or by a low AC-DC step-down voltage transformer.

9. A built-in wireless communication module can control how the candle apparatus should operate, depending on where it is used. For example, in a largely enclosed place where is little to no draft, the candle frame member should not sway frequently. If so, the appropriate frequency of the electrical simulation can be selected.

10. The subdued light, the realism of the artificial candle, and the therapeutic benefits of the safely delivered aroma essential oils make embodiments in accordance with the present disclosure effective for relaxation and mood setting purposes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of an artificial candle apparatus in accordance with certain embodiments of the present disclosure.

FIG. 2 shows a cut-away perspective view of the artificial candle apparatus of FIG. 1.

FIG. 3 is an isometric view of a first embodiment of the artificial candle apparatus.

FIG. 4 is an isometric view of a second embodiment of the artificial candle apparatus.

FIG. 5 is an isometric view of a third embodiment of the artificial candle apparatus.

FIG. 6 is an isometric view of a flame member of the candle apparatus of FIG. 1.

FIG. 7 is similar to FIG. 6, but viewed from another aspect.

FIG. 8 is similar to FIG. 6, but viewed from above.

FIG. 9 is similar to FIG. 6, but viewed from bottom.

FIG. 10 is an isometric view of a cover plate of the candle apparatus of FIG. 1.

FIG. 11 shows a cut-away perspective view of the cover plate of FIG. 10.

FIG. 12 is an isometric view of a left shell of a retaining shell of the candle apparatus of FIG. 1.

FIG. 13 is an isometric view of a retaining base of the candle apparatus of FIG. 1.

FIG. 14 is similar to FIG. 13, but viewed from another aspect.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG.1 to FIG.14 show particular embodiment of an artificial candle apparatus in accordance with the present disclosure. Such artificial candle apparatuses include a housing (e.g., having one or more hollow portions, regions, or interior spaces therein); a flame simulating device; a power supply device; and possibly an aroma fragrance transport device. The power supply device is adapted to provide power for electronic portions of the candle apparatus, and in various embodiments resides in an interior space of the housing. The flame-simulating device includes a cambered flame member, a light source, a drive mechanism, and a control circuit. The flame member extends upwardly away from the housing, and includes a reflecting element disposed above the housing. Light from the light source is directed onto the reflecting element.

At least portions of the aroma fragrance transport device can reside in an interior space of the housing. The aroma fragrance transport device can include an airflow tunnel through which an aroma fragrance can be transported toward the flame member and emitted or output, for instance, near or generally near (e.g., slightly below) the reflecting element.

With reference to artificial candle apparatus embodiments shown in FIG. 1 – FIG. 14, the flame-simulating device includes a flame member 30, a light source 40, a drive mechanism and a control circuit placed on an electric board 73.

In FIG. 6, the cambered flame member 30 includes a reflecting element 31, a pivoting element 32 and a pendulum element 33. The pivoting element 32 is coupled between the reflecting element 31 and the pendulum element 33. The cambered flame member 30 is pivotally mounted in the housing by the pivoting element 32, and the reflecting element 31 extends outside the housing, and the pendulum element 33 is housed within the housing.

In FIG. 7, the reflecting element 31 with a flame silhouette shape is comprised of a reflecting camber surface 312 and a backlit camber surface 313. The reflecting camber surface 312 is comprised of a left-reflecting slope surface and a right-reflecting slope surface. The left-reflecting slope surface and the right-reflecting slope surface define a slope concave that grows smaller from the bottom up gradually. Correspondingly, the middle portion of the backlit camber surface 313 defines a convexity. An upper portion of the reflecting element 31 bends towards the direction where the backlit camber surface 313 is, and is off the vertical-center line of the reflecting element 31. The bend of the top end may be 15

degrees. A lower portion of the reflecting element 31 bends towards the direction where the reflecting camber surface 312 is. Thus the reflecting camber surface 312 and the backlit camber surface 313 respectively defines a streamline airflow track. The pivoting element 32 is a flat plate with a hole at its central portion. The surface of the pendulum element 33 is comprised of a bottom surface, a peripheral surface and a conical top surface. The bottom surface may be hemispherical shape or flat shape.

In FIG. 2 and FIG. 6, light emitted from the light source 40 is convergent onto the reflecting camber surface 312 obliquely. Light on the left-reflecting slope surface and the right-reflecting slope surface is reflected into the slope concave, and light on the slope concave is further reflected into one's eyes. It can thus be seen that the intensity of light on the slope concave is greater than the intensity of light on the left-reflecting slope surface and the right-reflecting slope surface, therefore, a central portion of the flame member 30 is brighter than a peripheral portion thereof, which makes the flame member 30 simulate a burning flame more realistically. Preferably, the light source 40 is positioned below and in front of the reflecting camber surface 312.

The control circuit is adapted to make the light source 40 operate at a bright-light mode and a dim-light mode in cycles at a preset rate, to thus make the intensity of light alter as the preset rate, which make the flame member 30 simulate the effect of a burning flame realistically. The bright-light mode is relative to the dim-light mode. For example, the light source 40 operates a rated power in the bright-light mode, while it may operate at a 80% rated power in the dim-light mode. The control circuit may change the light intensity of the light source 40 by controlling an electric current, a voltage or a power to make the light source 40 operate at corresponding modes.

In some embodiments, the light source 40 includes one or more convergent light emitting diodes, an end of whose tube defines a convex lens. In other embodiments, the light source 40 may include common light emitting diodes and convex lens mounted in front of the light emitting diodes.

The drive mechanism is positioned under the flame member 30. The control circuit, which may be positioned separate from the drive mechanism, is further adapted to send a drive signal to the drive mechanism. The drive mechanism occasionally applies a force on the pendulum element 30 based on the drive signal to make the flame member 30 sway occasionally. The light intensity distribution on the reflecting camber surface 312 changes as the flame member 30 sways, which make the flame member 30 simulate a burning flame more realistically, due to the resulted unpredictable light pattern. That the flame member 30 sways only occasionally better represents a real candle flame that also sways only occasionally and is in favor of reducing stress and promoting relaxation.

In a first embodiment, the drive mechanism includes a motor 91, a coupling shaft 92 and a bump 93. An end of the coupling shaft 92 is fixed on the output shaft of the motor 91. The bump 93 is mounted on the other end of the coupling shaft 92. The motor 91 is electrically connected to the control circuit. The bump 93 and the coupling shaft 92 move in a circle on a horizontal plane as the motor 91 receives the drive signal from the control circuit. The bump 93 hit the pendulum element 33 once in each cycle, which makes the flame member 30 sway occasionally.

Adjusting the rotating speed of the motor 91 may set the interval time. As the rotating speed is increased, the interval time is shortened. Adjusting the amount of the coupling shafts 92 and the corresponding bumpers 93 may further set the interval time. If there are more than two coupling shafts 92, the coupling shafts are distributed evenly in the circumferential direction. The greater the amount of the coupling shafts 92, the shorter the interval time.

More particularly, in various embodiments the bump 93 has a conical shape.

In a second embodiment, the pendulum element 33 is magnetic. The pendulum element 33 may be made of magnetic material. Alternatively, the pendulum element 33 is inlaid a magnetic element such as ferromagnet or lodestone or the like. The drive mechanism includes a motor 191, a coupling shaft 192 and a magnetic block such as ferromagnetic block. An end of the coupling shaft 192 is fixed on the output shaft of the motor 191. The magnetic block 193 is fixed on the other end of the coupling shaft 192. The magnetic block 193 and the coupling shaft 192 may be a unibody element. The magnetic block 193 may be inlaid or welded on the coupling shaft 192. The motor 191 is electronically connected with to the control circuit. The magnetic block 193 and the coupling shaft 192 move in a circle on a horizontal plane as the motor 191 receives the drive signal from the control circuit. The magnetic block 193 moves adjacent to the pendulum element 33 periodically. When the magnetic block 193 is adjacent to the pendulum element 33, the magnetic block 193 applies a force onto the pendulum element 33, which makes the flame member 30 sway naturally and occasionally, and thus simulate a very natural flickering of the candle flame.

Adjusting the rotating speed of the motor 191 may set an interval time. As the rotating speed is increased, the interval time is shortened. Adjusting the amount of the coupling shaft 192 and the corresponding magnetic block 193 may set the interval time. If there are more than one coupling shafts 192, the coupling shafts 192 are distributed evenly in the circumferential direction. The greater the amount of the coupling shafts 192, the shorter the interval time.

In a third embodiment, the pendulum element 33 is magnetic. The pendulum element 33 may be made of magnetic material. Alternatively, the pendulum element 33 is inlaid a magnetic element such as ferromagnet or lodestone or the like. The

drive mechanism includes a magnetic coil 291 under the pendulum element 33. The magnetic coil 291 is energized by the control circuit occasionally, to apply a force on the pendulum element 33 occasionally, which makes the flame member 30 sway naturally and occasionally, and thus simulate a very natural flickering of the candle flame.

The construction of the internal features of the first embodiment, the second embodiment and the third embodiment are the same but the drive mechanisms and the pendulum 33 differentiate.

In FIG. 2, the aroma fragrance transportation device includes a fan 50, a fragrance element and an airflow tunnel within the housing. The air inlet of the airflow tunnel is positioned at the lower portion of the housing, while the air outlet of the airflow tunnel is positioned at the upper portion of the housing. The fan 50 is mounted in the airflow tunnel. The fragrance element is positioned between the fan 50 and the air inlet of the airflow tunnel. The control circuit is further adapted to energize the fan 50 occasionally. When the fan 50 operates, airflow is draw into the airflow tunnel through the air inlet, and carries the aroma fragrance from the fragrance element into the outward atmosphere through the air outlet.

The power supply device includes dry cell batteries and/or a built-in lithium battery. The control circuit is further adapted to manage the voltage of the dry cell batteries or a built-in lithium battery, and supply the voltage to the electric equipment of the candle apparatus. The power supply device may further include a rectification circuit, a buck DC-DC power converter and an AC connector. The rectification circuit is configured for converting an AC voltage from the AC connector into a first direct voltage. The buck DC-DC power converter is configured for converting the first direct voltage into a second direct voltage to supply power to the electric equipment of the candle apparatus.

The housing includes a shell 10, a bottom base 74, a retaining shell 20 and a retaining base 60. The shell 10 and the bottom base 74 define the interior space that houses the retaining shell 20 and the retaining base 60. The retaining base 60 is mounted on the top wall of the bottom base 74. The retaining shell 20 is mounted on the top wall of the retaining base 60.

The top wall of the shell 10 has a mounting opening 15 at the central portion thereof, which is convenient for assembling. In some embodiments, the shell 10 includes an outer shell 11 and an inner shell 12. The inner shell 12 may be made of plastic or other environment friendly materials. The outer shell 11 may be made of real wax such as paraffin or other biodegradable wax, and the contour on the top of the candle made uneven, due to the capillary action of a burning candle, to better represent a real wax candle. However, on occasions when needed, the outer shell 11 could be made weatherproof so that the candle could be used outdoor.

The retaining shell 20 with two opened ends has a hollow space. A support wire 39 is attached to the walls of the retaining shell 20 for support at locations selected to place the flame member 30 generally in the center of the hollow space. The flame member 30 rests vertically on the support wire 39 because of the gravity of the pendulum element 33. The reflecting element 31 goes beyond the shell 10 through the mounting opening of the shell 11. When there is a natural draft, the flame member 30 would sway naturally through pivoting on the support wire 39. The flame member 30 catches draft easily, due to the specific shape of the reflecting element 31, to simulate a very natural flickering of the candle flame.

The retaining shell 20 has a light-emission platform 21 in-laid with the light source 40. The light-emission platform 21 is positioned ahead of the reflecting camber surface 321, and below the reflecting element 31. The angle between a horizontal plane and a light-emission surface of the light-emission platform 21 is an obtuse angle so that the convergent light from the light source 40 is transmitted obliquely onto the reflecting camber surface 321.

The top of the outer shell is shaped to illustrate the melting wax caused by the capillary action of the burning wax.

The fan 50 is positioned in the hollow space of the retaining shell 20 adjacent to the upper opening of the retaining shell 20.

The retaining shell 20 includes a left shell and a right shell fastened with the left shell, the left shell and right shell respectively have a mounting groove 29, the mounting grooves define a groove group for holding the circuit board 73, the circuit board 73 is positioned between the fan 50 and the pendulum member 33.

In the first embodiment and the second embodiment, the motor 91 and the motor 191 are underneath the circuit board 73 with a hole. The output shaft of the motor 91 goes beyond the circuit board 73 through the hole. The coupling shaft 92, the coupling shaft 192, the bump 93 and the magnetic block 193 are beyond the circuit board 73. In the third embodiment, the magnetic coil 291 could be mounted on the circuit board 73 or could be mounted independently and is separated from the circuit board for ease of assembly. The drive mechanisms described in the first to third embodiments can replace one another in manufacture, which is convenient for assembling a individualized artificial candle apparatus based on different design and manufacture requirements.

The retaining base 60 has a vertical cylindrical space 61. The top wall of the retaining base 60 has a plurality of evenly-distributed ventilation holes 62. Each ventilation hole 62 is open to the vertical cylindrical space 61. The bottom wall of the retaining base 60 has a ventilation opening open to the vertical cylindrical space 61.

The bottom base 74 includes a base 747, a cover plate 749 and four support blocks 748. The base 747 has an inlet opening open to the ventilation opening of the retaining base 60. The removable cover plate is mounted to the inlet opening. The cover plate 749 includes a board 7491 and a plurality of baffle strips 7492 (FIG. 10). The board 7491 has long ventilation through holes whose amount is as the same as the baffle strips' 7492. Both ends of each baffle strip 7492 are mounted on the board 7491. There is a distance between the board 7491 and each baffle strip 7492. Each baffle strip 7492 is right beyond a corresponding ventilation through hole. All the long ventilation through holes and the distance between each baffle strip 7492 and the board 7491 define a ventilation mechanism of the cover plate 749, which would increase the speed and rates of the airflow effectively. The cover plate 749 may be removable when the fragrance element needs to be changed.

In FIG. 2, the four support blocks 748 are mounted on the base 747. When the candle apparatus is positioned on a support plane, there is a distance between the base 747 and the support plane, so that airflow may come into the ventilation mechanism of the cover plate 749.

The ventilation holes 62 (FIG. 13) of the retaining base 60 are open to the upper opening of the retaining shell 20, which make the cylindrical space 61 of the retaining base 60 open to the hollow space of the retaining shell 20. The cylindrical space 61 and the hollow space define the said airflow tunnel. The ventilation mechanism of the cover plate 749 is the said air inlet of the airflow tunnel, and the mounting opening 15 is the said air outlet of the airflow tunnel.

In some embodiments, the fragrance element is positioned in the cylindrical space 61. When the fan 50 operates, an outward airflow is draw into the cylindrical space 61 through the ventilation mechanism, and carries an aroma fragrance from the fragrance element into the outward atmosphere through the hollow space and the air outlet.

When the airflow goes up through the air outlet, it goes along the streamline airflow tracks of the flame member 30, and then forms an air vortex around the top of the flame member 30, which make the flame member 30 sway naturally, to change the light intensity distribution on the reflecting camber surface 321, and thus to simulate a very natural flickering of a candle flame. The warm glow of the reflected light on the flame member 30, the natural flickering of the flame member 30 and the released of the aroma fragrance create a certain relax mood that would help reduce stress effectively.

The retaining base 60 has a mounting cavity for housing the dry cell batteries and a slot 68 for holding the lithium battery.

The artificial candle apparatus further includes a wireless communication module mounted in the housing. The wireless communication module is adapted to receive a control signal from a portable electronic device or a remote controller, and transmit the control signal to the control circuit. The wireless communication module may be a Bluetooth module or/and a radio frequency module or/and a 2G/3G communication module or/and a GPRS (General Packet Radio Service) module.

While the present disclosure has been described with reference to particular embodiments, the description is illustrative of the disclosure and is not to be construed as limiting the disclosure. Therefore, those of ordinary skill in the art could make various modifications to the embodiments without departing from the true spirit and scope of the disclosure, as defined by the appended claims.

We claim:

1. An artificial candle apparatus, comprising:

a housing, wherein the housing includes a shell, a bottom base, a retaining shell and a retaining base; wherein the shell and the bottom base define the interior space which houses the retaining shell and the retaining base, the retaining base is mounted on the top wall of the bottom base, the retaining shell is mounted on the top wall of the retaining base, the top wall of the shell has a mounting opening at the central portion thereof, and the retaining shell with two opened ends has a hollow space;

wherein an airflow tunnel is created and the air inlet is positioned at the lower portion of the housing, while the air outlet of the airflow tunnel is positioned at the upper portion of the housing;

a flame simulating device housed in an interior space of the housing (ie. the retaining shell), including a pivoted cambered flame member, a light source, a drive mechanism, and a control unit;

wherein the cambered flame member includes a reflecting element, a pivoting element and a pendulum element, the pivoting element coupled between the reflecting element and the pendulum element, the flame member pivotally mounted in the housing by the pivoting element, and the reflecting element extending outside the housing, the pendulum element housed within the housing;

wherein the light source mounted in the housing is adapted to transmit a convergent light obliquely onto the reflecting camber surface; and

further wherein the drive mechanism is positioned under the flame member, the control unit adapted to send a drive signal to the drive mechanism, the drive mechanism occasionally applying a force on the pendulum element based on the drive signal to make the flame member sway momentarily.

2. The artificial candle apparatus of claim 1, wherein the control unit is adapted to make the light source operate at a bright-light mode and a dim-light mode in cycles at a preset rate.

3. The artificial candle apparatus of claim 1 or 2, wherein the drive mechanism includes a motor, a coupling shaft and a bump; wherein an end of the coupling shaft is fixed on the output shaft of the motor, the bump is mounted on the other end of the coupling shaft, the motor is electrically connected to the control unit, the bump and the coupling shaft move in a circle on a horizontal plane as the motor receives the drive signal from the control unit, and the bump hit the pendulum element once in each cycle.

4. The artificial candle apparatus of claim 1 or 2, wherein the pendulum element is magnetic, and the drive mechanism includes a motor, a coupling shaft and a magnetic block; wherein an end of the coupling shaft is fixed on the output shaft of the motor, the magnetic block is fixed on the other end of the coupling shaft, the motor is electronically connected to the control unit, the magnetic block and the coupling shaft move in a circle on a horizontal plane as the motor receives the drive signal from the control circuit. As the magnetic block moves adjacent to the pendulum element periodically, the magnetic block would apply a magnetic force onto the pendulum element. The opposite magnetic forces cause the pendulum element to sway.

5. The artificial candle apparatus of claim 1 or 2, wherein the pendulum element is magnetic, and the drive mechanism includes a magnetic coil under the pendulum element, the magnetic coil energized by the control unit occasionally, to apply an electro-magnetic force on the pendulum element occasionally. The pendulum would sway due to the interacting opposing magnetic fields.

6. The artificial candle apparatus of claim 1 or 2, wherein the reflecting element with a flame silhouette shape is comprised of a reflecting camber surface and a backlit camber surface, the reflecting camber surface comprised of a left-reflecting slope surface and a right-reflecting slope surface, wherein the left-reflecting slope surface and the right-reflecting slope surface define a slope concave that grows smaller from the bottom up gradually.

7. The artificial candle apparatus of claim 6, wherein the middle portion of the backlit camber surface defines a convexity corresponding to the slope concave, an upper portion of the reflecting element bends towards the direction where the backlit camber surface is, and is off the vertical-center line of the reflecting element, a lower portion of the reflecting element bends towards the direction where the reflecting camber surface is, and the reflecting camber surface and the backlit camber surface respectively define a streamline airflow track.

8. The aromatic artificial candle apparatus of claim 3, 4 and 5, wherein further includes an aroma fragrance transportation device including a fan, a fragrance element and an airflow tunnel within the housing; wherein the air inlet of the airflow tunnel is positioned at the lower portion of the housing, while the air outlet of the airflow tunnel is positioned at the upper portion of the housing, the fan is mounted in the

airflow tunnel, the fragrance element is positioned between the fan and the air inlet of the airflow tunnel, and the control circuit is further adapted to energize the fan occasionally.

9. The artificial candle apparatus of claim 8, wherein the housing includes a shell, a bottom base, a retaining shell and a retaining base; wherein the shell and the bottom base define the interior space which houses the retaining shell and the retaining base, the retaining base is mounted on the top wall of the bottom base, the retaining shell is mounted on the top wall of the retaining base, the top wall of the shell has a mounting opening at the central portion thereof, and the retaining shell with two opened ends has a hollow space;

wherein the retaining base has a vertical cylindrical space, the top wall of the retaining base has a plurality of evenly-distributed ventilation holes, each ventilation hole is open to the vertical cylindrical space, and the bottom wall of the retaining base has a ventilation opening open to the vertical cylindrical space;

wherein the bottom base includes a base, a cover plate and a minimum of 3 support blocks, the base has an inlet opening open to the ventilation opening of the retaining base, the removable cover plate is mounted to the inlet opening; wherein the cover plate includes a board and a plurality of baffle strips, the board has long ventilation through holes whose amount is as the same as the baffle strips', both ends of each baffle strip are mounted on the board, there is a distance between the board and each baffle strip, each baffle strip is right beyond a corresponding ventilation through hole, and all the long ventilation through holes and the distance between each baffle strip and the board define a ventilation mechanism of the cover plate; the support blocks mounted on the base;

wherein the ventilation holes of the retaining base are open to the upper opening of the retaining shell, which make the cylindrical space of the retaining base open to the hollow space of the retaining shell, the cylindrical space and the hollow space define the said airflow tunnel, the ventilation mechanism of the cover plate is the said air inlet of the airflow tunnel, and the mounting opening is the said air outlet of the airflow tunnel; the fragrance element positioned in the cylindrical space, the fan positioned in the hollow space of the retaining shell adjacent to the lower opening of the retaining shell.

10. The artificial candle apparatus of claim 9, wherein further includes a support wire attached to the walls of the retaining shell for support at locations selected to place the flame member in the centre of the hollow space, the flame member rests vertically on the support wire because of the gravity of the pendulum element, the reflecting element goes beyond the shell through the mounting opening of the shell.

11. The artificial candle apparatus of claim 9, wherein the retaining shell has a light-emission platform in-laid with the light source, the light-emission platform is positioned ahead of the reflecting camber surface and below the reflecting element, the angle between a horizontal plane and a light-emission surface of the

light-emission platform is an obtuse angle so that the convergent light from the light source is transmitted obliquely onto the reflecting camber surface.

12. The artificial candle apparatus of claim 9, wherein the power supply device includes dry cell batteries and/or a built-in lithium battery, the control circuit is further adapted to manage the voltage of the dry cell batteries or a built-in lithium battery and supply the voltage to the electric equipments of the candle apparatus, the power supply device further includes a rectification circuit, a buck DC-DC power converter and an AC connector, the rectification circuit is configured for converting an AC voltage from the AC connector into a first direct voltage, the buck DC-DC power converter is configured for converting the first direct voltage into a second direct voltage to supply power to the electric equipments of the candle apparatus, and the retaining base has a mounting cavity for housing the dry cell batteries and a slot for holding the lithium battery.

13. The artificial candle apparatus of claim 9, wherein the shell includes an outer shell and an inner shell, wherein the inner shell is made of plastic material or some other environment friendly materials, and the outer shell is made of paraffin or other biodegradable wax, or weatherproof plastic material for outdoor usage. The outer shell may shape like melting wax candle caused by the capillary action of the burning wax.

14. The artificial candle apparatus of claim 3, wherein further includes a circuit board with the control circuit thereof, the housing includes a shell, a bottom base, a retaining shell and a retaining base; wherein the shell and the bottom base define the interior space which houses the retaining shell and the retaining base, the retaining base is mounted on the top wall of the bottom base, the retaining shell is mounted on the top wall of the retaining base, the top wall of the shell has a mounting opening at the central portion thereof; and

further wherein the retaining shell includes a left shell and a right shell fastened with the left shell, the left shell and right shell respectively have a mounting groove, the mounting grooves define a groove group for holding the circuit board, the motor is underneath the circuit board with a hole, the output shaft of the motor goes beyond the circuit board through the hole, and the coupling shaft and the bump are beyond the circuit board.

15. The artificial candle apparatus of claim 1 or 2, wherein the artificial candle apparatus further includes a wireless communication module mounted in the housing, the wireless communication module is adapted to receive a control signal from a portable electronic device or a remote controller, and transmit the control signal to the control circuit.

16. The artificial candle apparatus of claim 1 or 2, wherein the light source includes one or more convergent light emitting diodes, an end of whose tube defines a convex

lens.

17. The artificial candle apparatus of claim 16, wherein the control circuit is adapted to make the light source operate at a bright-light mode and a dim-light mode in cycles at a preset rate, to make the intensity of reflected light to alter, giving the illusion of the wax burning effect in the candle flame.

18. The artificial candle apparatus of claim 3, 4, or 5, wherein the reflecting element with a flame silhouette shape is comprised of a reflecting camber surface and a backlit camber surface, the reflecting camber surface comprised of a left-reflecting slope surface and a right-reflecting slope surface, wherein the left-reflecting slope surface and the right-reflecting slope surface define a slope concave; wherein the middle portion of the backlit camber surface defines a convexity corresponding to the slope concave, an upper portion of the reflecting element bends towards the direction where the backlit camber surface is, and is off the vertical-center line of the reflecting element, a lower portion of the reflecting element bends towards the direction where the reflecting camber surface is, and the reflecting camber surface and the backlit camber surface respectively define a streamline airflow track; and wherein further includes an aroma fragrance transportation device including a fan, a fragrance element and an airflow tunnel within the housing; wherein the air inlet of the airflow tunnel is positioned at the lower portion of the housing, the fan is mounted in the airflow tunnel, the fragrance element is positioned between the fan and the air inlet of the airflow tunnel, and the control circuit is further adapted to energize the fan occasionally.

19. The artificial candle apparatus of claim 18 wherein the cambered flame is positioned so that it catches the air generated by the fan below, and that air movement causes the flame to sway naturally.