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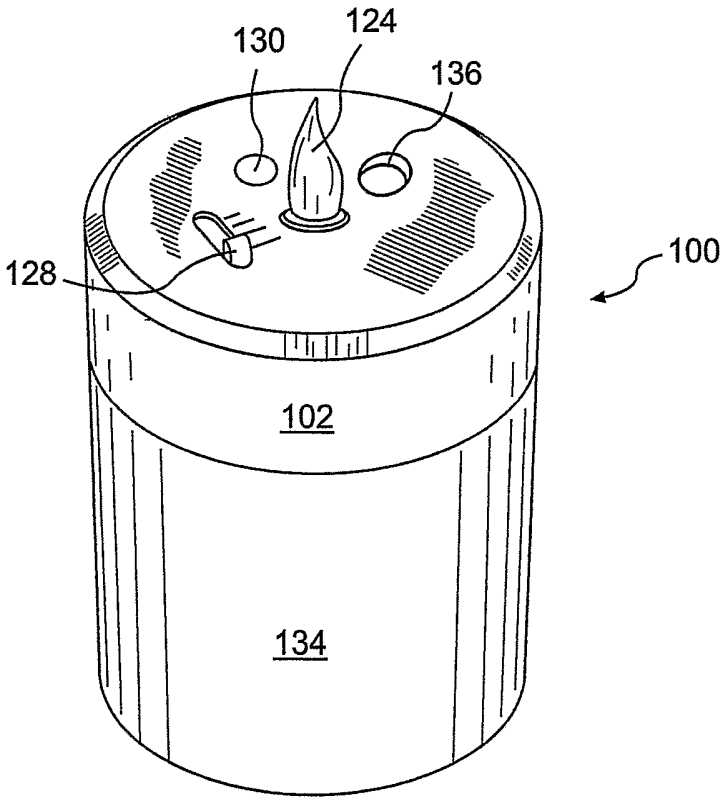


(57) Abstract: A light and substance emitting device (100) includes a light source (106), an emitter (108) a power source (118), control circuitry (110,112), and a support structure (102, 104, 134). The light source (106) emits a flickering light that emulates a flame of a candle. The emitter (108) emits a volatile active. The power source (118) supplies power to the light source (106) and to the emitter (108). The control circuitry (110,112) controls at least one of (i) the light source (106) to flicker and (ii) the emitter (108) to emit the volatile active. The support structure (102, 104, 134) supports the light source (106), the emitter (108), the power source (118) and the control circuitry (110, 112).

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# DEVICE PROVIDING COORDINATED EMISSION OF LIGHT AND VOLATILE ACTIVE

## RELATED APPLICATION

**[0001]** This application claims the benefit of U.S. Provisional Application No. 60/541,067, filed February 3, 2004.

## BACKGROUND OF THE INVENTION

### Field of the Invention

**[0002]** Our invention relates to the integrated presentation of ambient conditions. More specifically, our invention relates to the controlled and coordinated emission of light and volatile active, e.g., a fragrance, into a given area, such as a room, from a single device.

### Description of the Related Art

**[0003]** Because of their wide array of shapes and sizes, as well as the seemingly limitless number of available scents, few things are quite as versatile at setting the ambience in an area as scented candles. Scented candles are not without drawbacks, however. For example, dripping wax can damage furniture and the skin and, in the extreme, an open flame can lead to a structure fire.

**[0004]** To account for the common problems associated with candles, electronic lighting devices that have a flickering candle appearance, such as those disclosed in U.S. Patent Nos. 5,013,972 and 6,066,924, are generally known in the art. In the '972 patent, two side-by-side lamps are alternatingly turned on and off at such frequencies that a flickering is perceived.

Similarly, the '924 patent discloses circuitry used to control two light bulbs in close proximity to each other such that the bulbs flicker. Moreover, the circuitry and bulbs of the '924 patent are contained within a container of a size and shape similar to common flat candles. While these patents may suggest devices that mimic the visual aesthetics of a candle, they fail to provide the scented candle experience, i.e., they fail to emit fragrance in addition to light.

**[0005]** Fragrance dispensers are also generally known. For example, it is known to emit fragrance from an aerosol container upon the activation of a trigger by a user. Also, other methods utilize the evaporative properties of liquids, or other vaporizable materials, to cause vapors with desired properties to be distributed into the ambient air. For example, U.S. Patent No. 4,413,779 discloses a glass container containing a fluid into which two rigid porous nylon wicks extend. The wicks contact a rigid plastic porous element. In use, the wicks transport the fluid from the glass container to the ambient air. As a further example of air fresheners, the art is also generally aware of atomizer assemblies for releasing fragrance from a wick that draws fragrant liquid from a reservoir. For example, commonly assigned U.S. Patent No. 6,296,196 and commonly assigned and copending U.S. Patent Application No. 10/412,911, filed April 14, 2003, both discussed in detail below, disclose such assemblies. The '196 patent and the '911 application are hereby incorporated by reference. Although these representative devices provide fragrance emission, they do not provide the visual aesthetic of a candle.

## SUMMARY OF THE INVENTION

**[0006]** Our invention provides a device that emits both light and scent (or other active ingredient) similar to a scented candle. More particularly, our invention is directed to an improved candle that employs a unique design combining a flameless flickering effect and an effective, reliable volatile active delivery system.

**[0007]** More specifically, in an aspect of our invention, a light and substance emitting device includes a light source, an emitter, a power source, control circuitry, and a support structure. The light source emits a flickering light that emulates a flame of a candle. The emitter emits a volatile active. The power source supplies power to the light source and to the

emitter. The control circuitry controls at least one of the light source to flicker and the emitter to emit the volatile active. The support structure supports the light source, the emitter, the power source, and the control circuitry.

**[0008]** According to another aspect of our invention, a light and substance emitting device includes a light source, a substance emitter, control circuitry, a power source, a chassis, and a holder. The light source emits a flickering light that emulates a flame of a candle. The substance emitter emits a volatile active. The control circuitry controls at least one of the light source and the emitter. The power source supplies power to the light source, to emit the flickering light, and to the substance emitter, to emit the volatile active. One or more of the light source, substance emitter, control circuitry, and power source are disposed on the chassis. The chassis may be removably placed on the holder, the holder and chassis forming a housing in which the light source, substance emitter, control circuitry, and power source are disposed. At least one of the chassis and the body includes a diffuser that diffuses the light emitted by the light source.

**[0009]** According to a further embodiment of our invention, a light and substance emitting device includes at least one LED, a substance emitter, a power source, and at least one of a single microcontroller and a single circuit board. The at least one LED emits a flickering light that emulates a flame of a candle. The substance emitter emits a volatile active. The power source provides power to at least one of the light source, to emit the light, and the substance emitter, to emit the volatile active. The at least one of the single microcontroller and the single circuit board control both of the light source to emit the flickering light and the substance emitter to emit the volatile active.

**[0010]** A better understanding of these and other aspects, features, and advantages of the invention may be had by reference to the drawings and to the accompanying description, in which preferred embodiments of the invention are illustrated and described.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]** Figure 1 is a perspective view of a light and fragrance emitting device according to a first embodiment of our invention.

[0012] Figure 2 is an exploded perspective of the device of Figure 1.

[0013] Figure 3 is a side view of the device of Figure 1, with the base removed.

[0014] Figure 4 is a perspective view of components of the device of Figure 1.

[0015] Figure 5 is a perspective view of the device of Figure 1 disposed in a holder.

[0016] Figure 6 is a side view of a light and fragrance emitting device according to a second embodiment of our invention.

[0017] Figure 7 is an exploded perspective view showing the relationship of the device of Figure 6 with a base.

[0018] Figures 8A, 8B, and 8C are views of a light and fragrance emitting device according to a third embodiment of our invention.

[0019] Figure 9 is a perspective view of a light and fragrance emitting device according to another aspect of our invention.

[0020] Figure 10 is a perspective view of a light and fragrance emitting device according to still another aspect of our invention.

[0021] Figure 11 illustrates further embodiments of a light and fragrance device according to our invention.

[0022] Figures 12A-12D illustrate configurations of holders to be used according to various aspects of our invention.

[0023] Figure 13 is a cross-sectional view illustrating a preferred fragrance dispenser of our invention.

**[0024]** Figure 14 is a cross-sectional view illustrating the preferred fragrance dispenser shown in Figure 13.

**[0025]** Throughout the figures, like or corresponding reference numerals have been used for like or corresponding parts.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0026]** Our invention provides a device that emits both light and fragrance. Preferably, our invention provides a single device that mimics both the visual and olfactory aesthetics of a scented candle, without an open flame and with an improved fragrance delivery system.

**[0027]** While a preferred embodiment of our invention includes emission of a fragrance, and much of the discussion below will be with regard to emission of a fragrance, we also contemplate that the dispenser of our invention may alternatively dispense other volatile actives. Such alternate volatile actives may include, for example, disinfectants, sanitizers, insecticides, and insect repellants. As will be recognized by one of ordinary skill in the art, other volatile actives can also be introduced to the ambient environment via dispensers in much the same way as fragrances.

**[0028]** As generally seen in the figures, preferred embodiments of our invention include a device for emitting light and fragrance. The device preferably includes an electrically-powered light source, a fragrance dispenser, a power source, control circuitry, and a support structure. All of these components work together to provide a fragrant aroma and the appearance of a flickering flame, the flickering effect being provided by the electrically-powered light source.

### Light Source

**[0029]** The light source of our invention is an electrically-powered light emitting device. In preferred arrangements, the light source comprises one or more light emitting diodes (LEDs). Particularly, in Figures 1-7 a single LED 106 or 206 is used, while in Figures 8A-8C, the light source includes LEDs 306a, 306b. Other conventional lighting devices (including, for

example, incandescent, halogen, fluorescent, etc.) may alternatively be used as the light source.

**[0030]** As is generally understood, LEDs offer various features not found in other conventional lighting devices. In particular, as is well known in the art, by manipulating the duty cycle of an LED, light emitted from the LED can be controlled. For example, light can be emitted at perceptible intermittencies, or it can be emitted such that it is perceived to be continually emitted. Moreover, increasing the duty cycle of an LED will increase the intensity of light emitted and/or the perceived color.

**[0031]** In the embodiments in which a single LED is used, the LED is controlled to have a varying intensity, thereby providing a flickering effect. When two LEDs are used, as in Figures 8A-8C, the two LEDs 306a, 306b are preferably arranged one above the other, i.e., the LED 306a is on a side of the LED 306b opposite to a base of the light and fragrance emitting device 300. Preferably, the upper LED 306a is controlled to emit light at a perceivable intermittence, while the lower LED 306b is controlled such that light is perceived to be emitted continuously. In this fashion, the LEDs 306a, 306b work to create a flicker effect. When, for example, a conventional candle is lit, the base of the flame is steady, while the portion of the flame further from the wick appears to flicker. The present arrangement of the LEDs 306a, 306b mimics this visual characteristic. It is preferred that LEDs having a yellowish or amber hue be used. Specifically, it is preferred that the LEDs used have a wavelength of emission in the range of from approximately 580 nanometers to approximately 600 nanometers, and it is even more preferred that the LEDs used have a wavelength of emission in the range of from approximately 585 nanometers to approximately 595 nanometers.

**[0032]** Of course, we anticipate modifications to the light source of our preferred embodiment. For example, more than two LEDs can be used, perhaps, to create the perception of a larger flame. Also, LEDs of many colors are known and could be used, for example to more closely resemble a flame by using hues that are reddish, orangish, and/or yellowish. The colors can also be made to change, for example, using RGB LEDs (i.e., an array of red, green, and blue LEDS). By so varying the types of LEDs used, as well as their arrangement, numerous aesthetics can be obtained, including varied colored shows, colored

flames, and colored flickers. And, by adjusting the duty cycles of the LEDs, the brightness of the light may also be reduced or intensified, as dictated by design preference.

**[0033]** Moreover, when multiple LEDs are used, it is not required that one LED provide a perceptibly constant light emission while the other LED 306a provides a flicker effect. One or both may be held perceptibly constant and one or both may emit flickering light. (It would be recognized by one of ordinary skill in the art that when using pulse width modulation to control one or more LEDs perceptibly constant and flickering lights may both be flickering at a high frequency imperceptible to an observer. Thus, flickering and constant light should be understood herein to refer to perceived effects.)

Fragrance Dispenser

**[0034]** A fragrance dispenser is preferably provided integrally with our invention. The fragrance dispenser preferably holds a replaceable container, or reservoir, having a fragrance in any one of a number of conventional forms, including gel and liquid forms. The fragrance may be vaporized by the application of heat and emanated from the device. In such a case, the dispenser may have a controllable heating device to vary the rate at which vapor is driven from the fragrance or a mechanical controller for controlling the airflow around the fragrance to be vaporized (such as a shield or fan).

**[0035]** While fragrance dispensers are generally well known, a preferred fragrance dispenser is a wick-based emanation system. More preferably, the fragrance dispenser uses an atomizer to emanate the fragrance from the wick. Such an arrangement is shown in Figures 13 and 14.

**[0036]** Specifically, the preferred evaporative fragrance dispenser 4 comprises an atomizer assembly including an orifice plate 462, and a replaceable reservoir 326. The reservoir 326 is replaceable and contains a fluid. A wick 464 is disposed in the reservoir 326. The wick 464 operates by capillary action to transfer liquid from within the reservoir 326. The reservoir 326 is preferably removable by a user and may be replaced with another reservoir 326 (for example, when the fluid is exhausted or when a differently scented fluid is desired). When replaced in this manner, the wick 464 transfers fluid from the reservoir 326.

[0037] In addition to including the orifice plate 462, the atomizer assembly further comprises at least one resilient, elongated wire-like support 466 shaped to resiliently support the lower surface of the orifice plate 462 and a spring housing 468. A spring 470, contained within the spring housing 468, resiliently presses on the upper surface of the orifice plate 462. Rather than pressing on the orifice plate 462 directly, the spring 470 may alternatively, or additionally, press on a member, such as an actuator element 472 (made of, for example, piezo-electric ceramic material, which is connected to the orifice plate 462). Together, the wire-like support 466 and the spring 470 hold the orifice plate 462 in place in a manner that allows the orifice plate 462 to move up and down against the resilient bias of the wire-like support 466.

[0038] The actuator element 472 is preferably annularly shaped and the orifice plate 462 is preferably circular. The orifice plate 462 extends across and is soldered or otherwise affixed to the actuator element 472. A construction of a vibrator-type atomizer assembly is well known and is described, for example, in U.S. Patent No. 6,296,196. Accordingly, the atomizer assembly will not be described in detail except to say that when alternating voltages are applied to the opposite upper and lower sides of the actuator element 472, these voltages produce electrical fields across the actuator element 472 and cause it to expand and contract in radial directions. This expansion and contraction is communicated to the orifice plate 462 causing it to flex such that a center region thereof vibrates up and down. The center region of the orifice plate 462 is domed slightly upwardly to provide stiffness and to enhance atomization. The center region is also formed with a plurality of minute tapered orifices that extend through the orifice plate 462 from the lower or under surface of the orifice plate 462 to its upper surface.

[0039] In operation, electrical power, in the form of high frequency alternating voltages, is applied to the opposite upper and lower sides of the actuator element 472, as described above. A suitable circuit for producing these voltages is shown and described in U.S. Patent No. 6,296,196, noted above. As described in that patent, the device may be operated during successive on and off times. The relative durations of these on and off times can be adjusted by an external switch actuator (not shown) on the outside of the housing and coupled to a switch element on the microcontroller. In other embodiments, the on and off times may be

controlled by a preset program, or controlled by a user interface working through a processor, such as a user control.

**[0040]** When the atomizer assembly is supported by the wire-like support 466, the orifice plate 462 is positioned in contact with the upper end of the wick 464. The atomizer assembly is thereby supported above the liquid reservoir 326 such that the upper end of the wick 464 touches the underside of the orifice plate 462. Thus, the wick 464 delivers liquid from within the liquid reservoir 326 by capillary action to the top of the wick 464 and then by surface tension contact to the underside of the orifice plate 462, which, upon vibration, causes the liquid to pass through its orifices and be ejected from its opposite side (i.e., the upper surface) in the form of small droplets.

**[0041]** In a preferred arrangement, a horizontal platform serves as a common structural support for both the reservoir 326 and the atomizer assembly. In this manner, the reservoir 326, and, in particular, the upper end of the wick 464 disposed therein, are aligned with the orifice plate 462. Moreover, because the atomizer assembly and the orifice plate 462 are resiliently mounted, the upper end of the wick 464 will always press against the under surface of the orifice plate 462 and/or the actuator element 472 irrespective of dimensional variations which may occur due to manufacturing tolerances when one reservoir 326 is replaced by another. This is because if the wick 464 contained in the replacement reservoir 326 is higher or lower than the wick 464 of the original liquid reservoir 326, the action of the spring 470 will allow the orifice plate 462 to move up and down according to the location of the wick 464 in the replacement reservoir 326, so that the wick 464 will press against the underside of the orifice plate 462 and/or the actuator element 472. It will be appreciated that the wick 464 preferably is formed of a substantially solid, dimensionally stable material so that it will not become overly deformed when pressed against the underside of the resiliently supported orifice plate 462. The features of the horizontal platform on which the atomizer is disposed will be discussed further below.

**[0042]** As shown, the wick 464 extends from inside the liquid reservoir 326 up through a plug 474 in the top of the reservoir 326 to contact the orifice plate 462 and/or the actuator element 472. (The plug 474 holds the wick 464 within the liquid reservoir 326.) The wick 464 has longitudinally extending capillary passageways that draw liquid up from within the

reservoir 326 to the upper end of the wick 464. In lieu of the capillary wick 464, we envision that a capillary member (not shown) may alternatively be used. Such a member generally includes plural capillary passageways on an exterior surface thereof. These passageways act, via capillary action, to transfer fragrance from the liquid reservoir 326 to the orifice plate 462 and/or the actuator element 472.

**[0043]** A more detailed explanation of the atomization device described above may be found in commonly assigned copending U.S. Patent Application No. 10/412,911, filed April 14, 2003. In addition, a more detailed explanation of the support structure for the atomizing device may be found in commonly assigned copending U.S. Patent Application No. 10/304,215, filed November 26, 2002. The disclosure of the '215 application is hereby incorporated by reference.

**[0044]** Of course, other fragrance emitting devices may be substituted as desired in consideration of design choices, manufacturing costs, etc. Specifically, we envision that evaporation devices, heat-assisted evaporation devices, and fan-assisted evaporation devices, among others, could be used in place of the piezoelectrically actuated atomization device described above. Moreover, even within each type of dispenser, variations are possible, as would be appreciated by one of ordinary skill in the art.

Power Source

**[0045]** The power source supplies power to light the light source, and if required, to operate the fragrance dispenser (for example, to supply voltages to the upper and lower surfaces of the actuator plate in the atomization-type fragrance dispenser discussed above). Also, the power source may be used to power additional components (although not shown, these additional components may include, e.g., a fan). In a preferred embodiment, the power source comprises one or more batteries. When one battery is used, a voltage step-up may be used to ensure sufficient power. The batteries may be replaceable, or they may be rechargeable. If rechargeable batteries are used, they may be removed for recharging, or an adapter may be provided on the device such that the batteries can be charged without being removed from the device. For instance, a receptacle (not shown) may be incorporated into the device to receive a plug that supplies power from, for example, an electrical outlet. It is

not required, however, that the power source comprise batteries. For example, power for the device may be derived directly from an electrical outlet. As will be appreciated by one of ordinary skill, however, the use of alternate power sources may require that the device further include an AC to DC converter.

Control Circuitry

**[0046]** As used throughout, the term "control circuitry" is intended to be a representative term that encompasses all controls that can be used to embody our invention. For example, the preferred embodiments are discussed below with reference to microcontrollers and/or circuit boards. Microcontrollers and circuit boards constitute control circuitry. Further contemplated examples of control circuitry that may be used to embody our invention are an Application Specific Integrated Circuit (ASIC), a microprocessor, and an arrangement of one or more resistors and/or capacitors. Control circuitry may or may not include software. These examples of control circuitry are not limiting, however. Other control circuitry may also be used.

**[0047]** The control circuitry is generally used to control the operation of the device and is powered by the batteries. Specifically, the control circuitry is designed to provide the signals for controlling the operation of the light source. When one or more LEDs are provided as the light source, the microcontroller may alter the duty cycles of the LEDs to control the perceived intensity of the emitted light, thereby creating the candle-like flicker effect. Alternatively, instead of altering the duty cycles, the microcontroller may otherwise adjust the light emission properties of the LEDs. For example, methods utilizing an analog sine wave or a digital potentiometer are generally known in the art. In other embodiments, when at least two LEDs are used, as in Figures 8A-8C, and one LED 306b receives a constant current to emit light constantly, that LED 306b can be controlled separately from a circuit board, either to receive a power supply from the power source, when the device is turned on, or to not receive power, when the device is turned off. In other words, when one LED 306b constantly emits light, it is not necessary to provide means for adjusting the duty cycle thereof (such as the microcontroller). In this case, the microcontroller may adjust the operation of only the LEDs that flicker. In other embodiments the constant emission LED may be controlled by pulse width modulation set by the microcontroller such that the

frequency of the pulse width is imperceptible to an observer. In this manner, the intensity of the constant emission LED may be varied slightly to add to the overall flicker presentation.

**[0048]** Also, when the preferred fragrance dispenser discussed above is used, the microcontroller may include circuits for converting power from the batteries to the high-frequency alternating voltages required to expand and to contract the actuator member 472, thereby emitting fragrance from the fragrance dispenser 4. In addition, the microcontroller may control a fan and/or a heating element, if such are used. Furthermore, the microcontroller may include controls for automatically turning on and/or off one or both of the light source and the fragrance dispenser.

Support Structure

**[0049]** Our invention also includes a support structure, provided to support the light source, the fragrance emitter, the power source, and the microcontroller, or some combination thereof. The term "support structure" is intended to encompass any and all of a chassis, a housing, a holder, and a base, as those terms are used in the description of the preferred embodiments, as well as similar structures used to support or contain the features of our invention.

Preferred Embodiments

**[0050]** Having now generally described the components of our invention, discussion will now be made of preferred embodiments of a light and substance emitting device according to our invention. These preferred embodiments include various novel arrangements of the above-described components, as well as additional features.

**[0051]** The first embodiment is depicted in Figures 1-5 and will be described with reference to those figures. As seen best in Figures 2 and 3, a chassis 102 is provided that includes a chassis cover 102a, a chassis upper portion 102b, and a chassis lower portion 102c. Disposed on the chassis 102 are two batteries 118, a wick-based atomizer assembly 108, a single LED 106, and two printed circuit boards 114, 116. Each of two microcontrollers 110, 112 are disposed on the circuit boards 114, 116. (While in this embodiment two microcontrollers

110, 112 (one for each of the LED 106 and the atomizer assembly 108) and two circuit boards 114, 116 (one for each of the LED 106 and the atomizer assembly 108), a single microcontroller and/or a single circuit board may be used to control both the LED 106 and the atomizer 108.) As shown, the chassis cover 102a and the chassis upper portion 102b are joinable to form a cavity therebetween, and the chassis lower portion 102c depends downwardly from a bottom of the chassis upper portion 102b. In this embodiment, the atomizer assembly 108, the LED 106, the microcontrollers 110,112, and the printed circuit boards 114, 116 are disposed within the cavity formed between the chassis cover 102a and the chassis upper portion 102b. Electrical contacts 122, which the batteries 118 contact to supply the device 100 with power, are disposed on the lower portion 102c of the chassis 102, with the batteries 118 disposed in contact with the electrical contacts 122.

**[0052]** In this embodiment, the batteries 118 are removably securable to the lower portion 102c of the chassis 102. A battery retainer 120 may also be provided to aid in maintaining attachment of the batteries 118 to the chassis 102. When the batteries 118 are to be detached from the chassis 102, the retainer 120 must first be removed. Also in this embodiment, an entryway (not shown) is formed in the bottom of the upper portion 102b of the chassis 102, proximate to the atomizer assembly 108, so that a reservoir 126 containing a liquid to be atomized may be easily removed from, and reattached to, the atomizer assembly 108. Accordingly, this arrangement provides a user with access to the batteries 118 and to the reservoir 126 (for example, to enable changing the batteries 118 and the reservoir 126), but the remaining components are maintained within the cavity formed between the chassis cover 102a and the chassis upper portion 102b, reducing the possibility of contact with, and possible damage to, those components.

**[0053]** As shown in Figures 1 and 3, in the first embodiment, a protrusion, or tip 124 extends axially upwardly from the top of the chassis cover 102a. Preferably, the LED 106 is disposed within the tip 124, such that light emitted from the LED 106 is diffused by, and transmitted through, the tip 124. In this embodiment, as depicted in Figure 2, the tip 124 is a separate component of the device 100, disposed within an aperture formed through the top of the chassis 102. The tip 124 may also be formed integrally with the chassis 102. By making the tip 124 a separate piece, however, the tip 124 may be replaceable, e.g., with other, differently constructed, or colored, tips. Also, a separate tip 124 may be formed of a material

other than that used for the chassis. For example, the tip 124 may be formed of a material through which light is transmitted, e.g., plastic, glass, wax, and the like. Additionally the tip 124 may be formed of a glow-in-the-dark material or of a material that continues to glow for a time after the LED 106 is shut off.

**[0054]** Apertures other than that formed for insertion of the tip 124 may also be formed in the chassis 102a. For example, an emissive aperture 136 is preferably formed through the top surface of the chassis 102, above the atomizer assembly 108, such that the substance emitted by the atomizer passes through the emissive aperture 136, into the ambient environment. Furthermore, apertures may be formed in the chassis 102, through which switches are disposed. For example, an emitter controlling switch cover 128 (that cooperates with a slidable switch (not-shown)), in communication with the microcontroller 112 that controls the timing of the duty cycle applied to the atomizer assembly 108, may be provided to enable a user to manually adjust an amount of substance emitted. In this manner, the user can optimize the emission amount, based on outside considerations, such as room size, and the like. Furthermore, an on/off switch or button 130 may also be provided in an aperture formed through the chassis 102, to turn one or both of the LED 106 and the atomizer 108 on and off. For example, as shown in Figure 1, the on/off toggle switch 130, which is electrically connected to the LED 108, is disposed in an aperture through the top surface of the chassis 102, thereby enabling a user to turn the LED 108 on and off. Although not shown, a similar toggle switch, a push button, or the like, may also be provided for turning the atomizer assembly 108 on and off. In other embodiments, the chassis 102 may have exposed sections, such that apertures need not be formed.

**[0055]** The chassis 102, with attached components, is preferably detachably engageable with a base, or cup 134. The engagement of the chassis 102 with the base 134 forms a unitary housing in which the atomizer assembly 108, reservoir 126, batteries 118 and controls are disposed. In the preferred embodiment, the base 134 is generally cylindrical, including a sidewall and a bottom surface. The top of the base is open. The upper portion 102b of the chassis 102 is also generally cylindrical, with an outer diameter substantially the same as that of the base 134. By lowering the chassis 102 into the base 134, the lower portion 102c of the chassis 102 becomes disposed within the base 134, and the upper portion 102b of the chassis 102 is disposed proximate to the open top of the base 134. The unitary housing thus formed

has the appearance of a cylinder, with a tip protruding axially upwardly from approximately a central portion of the top of the cylinder.

**[0056]** While one of ordinary skill in the art would understand that there are many ways for removably engaging the chassis with respect to the base, a preferred method of engagement is described as follows. A substantially C-shaped receptacle is formed on the lower portion of the chassis 102, and a protrusion extends axially upwardly from the bottom surface of the base 134. When the chassis 102 is lowered into the base 134, the C-shaped receptacle of the lower portion 102c of the chassis 102 receives therein the protrusion formed in the base 134. In this way, proper alignment of the chassis 102 within the base 134 is achieved. Moreover, as should be understood, because the chassis 102 and the base 134 each has a cylindrical footprint and the protrusion and C-shaped receptacle are positioned on respective axes, the chassis 102 is easily attached to the base 134 regardless of the rotational orientation of the chassis 102 with respect to the base 134.

**[0057]** Preferably, the dimensions of the chassis 102 and base 134 combination are anywhere from between approximately one inch (25.4 mm) and approximately six inches (152.4 mm) in diameter and prefereably anywhere from between approximately one inch (25.4 mm) and approximately six inches (152.4 mm) in height. Of course, the dimensions may be larger or smaller, depending on the desired aesthetic. Also, because as described above at least a portion of the flickering LED 106 is disposed within the tip 124, which preferably diffuses the emitted light, the tip 124 has the appearance of a conventional candle's flame. All or a portion of the rest of the device 100 may also be light transmissive. Light transmissive materials that may be used include glass, plastic, wax, and the like. Furthermore, by moving the LED within the tip, a more realistic perception of a conventional candle may be obtained.

**[0058]** Thus, according to the first embodiment of our invention, the combination of the chassis 102 and base 134, as a result of their likeness to a conventional candle, may be provided to a consumer to be used with existing votive holders for conventional candles. Alternatively, our invention can be embodied in the combination of chassis 102 and base 134 with holder 104 (as shown in Figure 4). Furthermore, it should also be understood that the chassis 102 may be designed to stand alone, i.e., without the base 134. For example, the

lower portion 102c of the chassis 102 may be designed to enable the entire chassis 102 to stand on its own.

**[0059]** A second embodiment of our invention will now be described with reference to Figures 6 and 7. This embodiment includes many of the same components as discussed above with respect to the first embodiment, and descriptions thereof will not be repeated.

**[0060]** According to this second embodiment, a chassis 202 (different from the chassis 102 of the first embodiment) is provided. An atomizer assembly 208, an LED 206, two circuit boards, a microcontroller, and a battery 218 are disposed on the chassis 202. As illustrated, the chassis 202 includes a top 202a, an upper portion 202b, disposed below the top 202a, and a lower portion 202c, disposed below the upper portion 202b. The atomizer assembly 208 is arranged on the upper portion 202b of the chassis 202, and a reservoir 226 containing a fluid to be atomized by the atomizer assembly 208 is removably matable to the atomizer assembly 208. The lower portion 202c of the chassis 202 is disposed sufficiently below the upper portion 202b of the chassis 202 so as to facilitate removal and replacement of the reservoir 226. The lower portion preferably includes an inner cavity in which the controls, i.e., circuit board(s) and microcontroller(s) (not shown), are disposed.

**[0061]** The LED 206 is disposed proximate to a top surface of the lower portion 202c of the chassis 202. More specifically, the LED 206 of this embodiment is disposed on a circuit board disposed within the inner cavity of the lower portion 202c of the chassis 202. An aperture is formed through a top of the lower portion 202c of the chassis 202, and at least a portion of the LED 206 protrudes through the aperture. The battery 218 is disposed below the lower portion of the chassis 202. As would be appreciated by one of skill in the art, electrical leads and the like may be necessary for communication between the battery 218, the controls, the LED 206, and the atomizer assembly 208.

**[0062]** As shown in Figure 7, the chassis 202 is removably placeable within a base 234. The base 234 is generally cylindrical, with a bottom surface (not shown) and an open top. The chassis 202 is received in the base 234 through the open top. The chassis 202 and the base 234, when the chassis 202 is placed in the base 234, form a unitary housing in which the LED 208, the substance emitter 206, the controls, and the battery 218 are disposed.

Preferably, the chassis 202 and the base 234 are configured such that the top surface of the chassis 202 is disposed within the open top of the base 234, and the housing formed by the combination of the chassis 202 and the base 234 resembles a conventional pillar candle.

**[0063]** Similar to the first embodiment, the housing of the second embodiment also preferably includes an emission aperture aligned with the atomizer assembly 208. Specifically, because in this embodiment the atomizer is arranged below the top 202a of the chassis 202, the emission aperture 236 is formed through the top 202a of the chassis 202. In this manner, liquid atomized within the housing may be released into the ambient environment.

**[0064]** Again, similar to the first embodiment, means are also provided for adjusting the amount of substance emitted by the emitter 208 and for turning the LED 206 on and off. As shown in Figures 6 and 7, a slidable switch 228, in communication with the microcontroller that controls the atomizer assembly 208, is disposed on the lower portion 202c of the chassis 202. The slidable switch 228 is manually adjustable between multiple positions to regulate the frequency at which the atomizer assembly 208 emits the substance contained in the reservoir 226. In addition, a push button 230 is disposed on the top 202a of the chassis 202 for turning the LED 206 on an off.

**[0065]** As will be appreciated from the figures, because the controls, i.e., the circuit boards and microcontroller, associated with the atomizer assembly 208 and the LED 206 are disposed within the lower portion 202c of the chassis 202, and the atomizer assembly 208 and the push button 230 are disposed proximate to the top 202a of the chassis 202, electrical wires are provided to convey controls from the lower portion 202c of the chassis 202 to the atomizer 280, and a post 252 is provided for transmitting the actuation of the push button 230 disposed on the top 202a of the chassis 202 to a switch on the circuit board that turns the LED 206 on and off. In a similar regard, as it may also be beneficial to have the slider switch 228 for adjusting emission of the fluid contained in the reservoir 226 disposed on the top of the housing (for example, for ease of access for the user), it may also be necessary to provide a mechanical, an electrical, and/or an electro-mechanical means for connecting the slider switch and the appropriate controls.

**[0066]** According to this second embodiment, a light and substance emitting device 200 is provided. Preferably, as mentioned above, the housing (i.e., the combined chassis 202 and base 234) of the device 200 is configured and sized to resemble a conventional pillar candle. As should be understood, since the LED 206 emitting the flickering light is disposed within the housing, much of the light will be transmitted through the sidewall of the base 234. Accordingly, at least a portion of the base 234 should be light transmissive. In addition, at least a portion of the chassis 202 may also be light transmissive. To these ends, all or a portion of the chassis 202 and/or the base 234 may be formed of one or more of glass, plastic, wax, and the like.

**[0067]** Variations of this second embodiment are also contemplated. For example, while the holder 234 is generally cylindrical, such is not required. Rectangular, square, and a myriad of other shapes and sizes are contemplated. In addition, while the chassis 202 is inserted through a top of the base 234, such is not required. For example, the base may be open at the bottom, such that the base is slid over the chassis 202, or the base 234 and chassis 202 may be integrally formed, with access panels for replacing the reservoir 226, battery 218, and the like.

**[0068]** A third embodiment of our invention will now be described with reference to Figures 8A-8C, 9, and 10. In this embodiment a preferred light and substance emitting device 300 of our invention includes a chassis 302 comprising a chassis cover 302a and a chassis base 302b which together form a cavity that encases each of two LEDs 306a, 306b, a fragrance emitter 308, two batteries 318, and a printed circuit board with microcontroller 310. The LEDs 306a, 306b are connected either directly or indirectly to both of the batteries 318 and the microcontroller 310. While the alignment of the fragrance emitter 308, the batteries 318, and the microcontroller 310 within the chassis 302 is not critical, each of these components is preferably located below a top surface of the chassis cover 302a. Also, the LEDs 306a, 306b are preferably located substantially centrally with respect to a top surface of the device, and above the fragrance emitter 308, the batteries 318, and the microcontroller 310, i.e., on a side of the fragrance emitter 308, the batteries 318, and the microcontroller 310 opposite to the chassis base 302b. At least a portion of the LEDs 306a, 306b are preferably located above a top surface of the chassis cover 302a. By placing the LEDs 306a, 306b above the other components in this manner, the emission of light is not impeded by these

components, so shadows are substantially prevented, and a more realistic-looking flame is created.

**[0069]** Although the alignment of the various features within the chassis 302 is not critical, the chassis 302 preferably includes a horizontal platform 342 (preferably disposed on the chassis base 302b) for aligning the fragrance emitter 308 within the chassis 302. The platform 342 preferably has a platform aperture 344 therethrough with one or more cutouts 346 formed on a periphery of the platform aperture 344. Preferably, the replaceable reservoir 326 comprises one or more nubs 348 (one corresponding to each of the cutouts 346 formed in the platform 342) formed on the reservoir 326. To insert a reservoir 326, a portion of the reservoir 326 is passed through the platform aperture 344 of the platform 342, with the nubs 348 passing through the cutouts 346. Once the nubs 348 clear the cutouts 346, the reservoir 326 is rotated such that the nubs 348 rest on the upper surface of the platform 342. Also, as discussed above, attached to the top of the platform 342 is the wire like-support 466 (not shown in Figures 8A-8C) that supports the atomizer assembly 308.

**[0070]** Further, inner surfaces of the chassis 302 may contain various protrusions. These protrusions are preferably provided to aid in properly aligning various components within the chassis 302 and/or to protect components within the chassis 302. For example, a vertical protrusion 350 (shown in Figure 8C) partitions an area for containing the fragrance emitter 308 from an area having the microcontroller 310. In this fashion, the microcontroller 310 is not accessible when the reservoir 326 is replaced, and, accordingly, inadvertent damage to, or accidental contamination of, the microcontroller 310 is averted.

**[0071]** The chassis cover 302a is designed such that it can be placed on the chassis base 302b, thus forming a unitary device 300. A protrusion or tip 324 is preferably disposed approximately centrally on the chassis cover 302a. The tip 324 extends generally axially, in a direction away from the chassis base 302b and forms a cavity in which the LEDs 306a, 306b are disposed when the chassis cover 302a is placed on the chassis base 302b. (As discussed above, the LEDs 306a, 306b are preferably arranged one on top of the other.) The tip 324 is substantially conical in shape and is preferably made of a material that diffuses the light emitted by the LEDs 306a, 306b. However, it may be desirable to alter the shape of the protrusion, when, for example, more than two LEDs are used, or the housing is relatively

wide. For instance, the tip 324 may be more dome-shaped when a wider tip 324 is used with a wide device 300 (so as to keep the tip 324 relatively close to the chassis 302).

**[0072]** The tip 324 is preferably between approximately one-eighth of one inch and approximately three inches high and between approximately one-eighth of one inch and approximately three inches wide. The remainder of the device 300 is preferably between about two inches and about ten inches high and preferably between about one and one-half inches and about six inches wide. Thus configured, the device 300 can substantially take on the size and shape of various conventional candles, while the tip 324, by encapsulating the LEDs 306a, 306b, simulates a flame.

**[0073]** The chassis cover 302a also includes an emission aperture 336 therethrough. When the chassis cover 302a is placed on the chassis base 302b, the emission aperture 336 aligns with the fragrance emitter 308. In particular, the emission aperture 336 is formed such that a fragrance dispensed by the fragrance emitter 308 passes through the chassis cover 302a to the ambient air, i.e., the chassis cover 302a does not impede the dissemination of the fragrance from the fragrance emitter 308.

**[0074]** The chassis cover 302a is preferably secured to the chassis base 302b, although such is not required. For example, as shown in Figure 8A, the chassis cover 302a may be removably attached to the chassis base 302b such that access to, for example, the reservoir 326 and/or the batteries 318, may be gained for replacement purposes. When the chassis cover 302a is removably attachable to the chassis base 302b, a locking mechanism may be employed. For example, attractive magnets may be situated on the chassis cover 302a and the chassis base 302b, or the chassis cover 302a may include a feature that is designed for compatibility with a mating feature of the chassis base 302b. In this manner, only specific covers and bases can be used.

**[0075]** In another aspect, we contemplate that the chassis base 302b and the chassis cover 302a, when secured together to form the unitary device 300, may be relatively movable. Specifically, when the chassis cover 302a is cylindrical, it may be rotatable on the chassis base 302b. For example, the rotation of the chassis cover 302a may turn on and off the LEDs 306a,306b and/or the fragrance emitter 308.

[0076] As an alternative to the removable chassis cover 302a, when, for example, a new scent is desired or the reservoir 326 is empty, the device 300 may include a hatchway for purposes of replacing the reservoir 326. Examples of two contemplated hatchways 338a, 338b are illustrated in Figures 9 and 10, respectively.

[0077] As shown in Figure 9, the hatchway 338a may be located on the side of the device 300. The hatchway 338a is preferably hinged and is not completely removable from the device 300. As shown, the hatchway 338a may be opened to gain access to the reservoir 326.

[0078] Alternatively, the hatchway 338b may be formed on the bottom of the device 300. For example, as shown in Figure 10, a substantially circular hatchway 338b is removable from the device 300. In this configuration, the reservoir 326 is preferably coupled to the hatchway 338b. By coupling the reservoir 326 thereto, the hatchway 338b supports the reservoir 326, and, when assembled, ensures appropriate positioning of the wick 464 with respect to the atomizer assembly 308. Specifically, when the hatchway 338b is removed, the wick 464 of the reservoir 326 is removed from contact with the atomizer assembly 308. The reservoir 326 is then removed from the hatchway 338b, a new reservoir 326 is coupled to the hatchway 338b, and the hatchway 338b is reattached, with the reservoir 326 properly aligning with the atomizer assembly 308. When the hatchway 338b of Figure 10 is used, it may be unnecessary for the horizontal platform 342 to support and to align the reservoir 326, as the hatchway 338b will perform these functions. As such, the horizontal platform 342 will support the atomizer assembly 308, either directly, or preferably, with the wire-like support 466 discussed above.

[0079] The chassis base 302b may also include one or more apertures 340 through which user control switches pass. A toggle switches 332, for example, allows a user to turn on and off one or more of the fragrance emitter 308 and the LEDs 306a, 306b, and a slider switch 328 allows a user to adjust the rate at which fragrance is emitted from the fragrance emitter 308. Alternatively or additionally, switches may also be provided that allow a user to adjust the light emission properties of the LEDs 306a, 306b, or to change an emitted light show.

[0080] Thus, the third embodiment provides a still further light and substance emitting device 300. As with first and second embodiments described above, the device 300 may be configured to mimic the size and shape of a conventional candle.

[0081] As should thus be apparent, in each of the preferred embodiments, a unitary housing comprises a device that emits both a flickering light and a substance, such as a fragrance, to the ambient air. As discussed above, in a preferred embodiment of our invention, the device is inserted into a holder. Much like typical replaceable votive candles would be placed into decorative holders, our invention also provides unique holders for use with lighting devices according to our invention.

[0082] Figure 5 shows the device 100 of the first embodiment in a holder 104. Specifically, the holder 104 has a globe-like shape, with a bottom, and an open top, similar to a conventional holder for a votive candle. The unitary housing comprising the combination of the chassis 102 and the base 134 is placed inside the holder 104, through the open top of the holder 104. Preferably, at least a portion of the holder 104 allows light to be emitted therethrough. Figures 11 and 12A-12D show some representative alternative holder 304 configurations into which a light and fragrance emitting device 300 can be placed. These examples are by no means limiting.

[0083] When a fragrance emitter is used, the emitted fragrance should also be emitted from the holder, and it is thus preferred that the holder provide ample ventilation. In particular, the light and fragrance emitting device is preferably arranged in the holder such that the emission aperture through which the fragrance is dispensed is between about one inch (25.4 mm) and about six inches (152.4 mm) from the top of the holder and substantially away from the inner surface of the holder. More preferably, the emissive aperture is between substantially flush with and about five inches (127.0 mm) from the top of the holder. With such an arrangement, buildup of fragrance on the inside of the holder is minimized. Moreover, the holder may be designed to aid the flow of the fragrance to the ambient environment. By tapering the holder such that the width of the holder narrows nearer the top of the holder, airflow will increase as it leaves the holder. Furthermore, we prefer that the holder not impede the emission of light from the LEDs. Specifically, the unitary housing is preferably arranged in the holder such that the tip (as used in the first and third embodiments, discussed above) is between about

one-half of one inch (12.7 mm) and about two inches (50.8 mm) from the holder, and preferably closer than one inch (25.4). The holder may also act as a diffuser. Furthermore, we envision that the holder could further include, for example, a fan for aiding in further dispersion of the fragrance emitted from the fragrance emitter.

**[0084]** The holder may comprise a single piece into which the housing is placed. Alternatively, as shown in Figures 12A-12D, a holder 304 may also comprise a holder base 304a and a holder cover 304b. More specifically, the device is contained within, or alternatively comprises, the holder base 304a that receives and supports the holder cover 304b. The holder cover 304b, when supported by the holder base 304a, covers the tip 324. That is, light emitted from the housing by the respective illumination devices also passes through the holder cover 304b. Alternatively, the housing, e.g. the top 324, may not diffuse emitted light, and only the holder cover 304b diffuses emitted light.

**[0085]** As a specific example of this embodiment, as shown in Figure 12A, a holder base 304a containing a unitary device as described above in the preferred embodiments has a circumferential lip 304c extending radially outwardly from the holder base 304a. At least a lower portion 304d of the holder cover 304b is sized so as to engage the lip 304c of the holder base 304a, thereby resting the holder cover 304b on the holder base 304a. Other illustrative examples of holders 304 are shown in Figures 12B-12D.

**[0086]** While we envision that the holder cover 304b may rest on the holder base 304a, it is preferable that the holder cover 304b detachably attach to the holder base 304a. For example, the holder cover 304b may be designed to snap onto the holder base 304a. Alternatively, the holder cover 304b and the holder base 304a may be designed such that the holder cover 304b is rotated onto the holder base 304a, forming a locking engagement. In this or any configuration, the holder cover 304b may be relatively movable when secured to the holder base 304a. Specifically, when the holder cover 304b is generally cylindrical, it may be rotatable on the holder base 304a to turn the LEDs 306a, 306b and/or the fragrance emitter 308 on and off. Additionally, the engagement and disengagement of the holder cover 304b and the holder base 304a may act to turn the light source and/or substance emitter on and off. In this manner, the device would only operate with the holder cover 304b attached. Moreover, the holder cover 304b and holder base 304a may be specially designed such that

only certain covers 304b can be used with the holder base 304a. For instance, the holder base 304a may include a reader (not shown) that reads an ID (e.g., an RF tag) of the holder cover 304b. In this manner, the device will not work unless the holder cover 304b has an appropriate ID.

**[0087]** When using the holder 304 according to this embodiment, we also envision that the holder cover 304b could emit a fragrance therefrom. For example, impregnable materials such as polyolefins are known that may be impregnated or infused with a fragrance. By forming the holder cover 304b of such a material, the holder cover 304b will emit a fragrance over time in addition to that emitted by the fragrance emitter 308. Alternatively, the device of this embodiment could not include the fragrance emitter 308, in which case, only the holder cover 304b will emit a fragrance. Also, with respect to the second embodiment described above, we note that the combination of chassis and base resembles a decorative candle, in which case a holder may not be desired. In such a case the base or chassis may be impregnated with a fragrance.

**[0088]** Because the holder cover 304b of this embodiment is removable, access to the device is facilitated (for example, to turn the LEDs 306a, 306b, on or off) and the holder cover 304b can be easily replaced. For example, when the fragrance impregnated in the holder cover 304b is completely disseminated, a fresh, new holder cover 304b can easily be purchased and attached. Also, a user that has recently redecorated, or that wants to move the device to another room, may purchase a holder cover 304b having a certain color or other aesthetic feature. Moreover, replacement holder covers 304b may provide different smells. In other embodiments, the entire holder (or base) may be replaced.

**[0089]** While several preferred embodiments have been set forth above, many different embodiments may be constructed without departing from the spirit and scope of our invention. Our invention is not limited to the specific embodiments described above. To the contrary, our invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of our invention as defined by the claims. The claims are to be accorded the broadest scope, so as to encompass all such modifications, equivalent structures, and functions.

## INDUSTRIAL APPLICABILITY

**[0090]** Our invention provides a device for light and/or fragrance emission. The device provides an overall desired aesthetic ambience in an area, such as a room.

We claim:

1. A light and substance emitting device comprising:

a light source that emits a flickering light that emulates a flame of a candle;

an emitter that emits a volatile active;

a power source that supplies power to said light source and to said emitter;

control circuitry that controls at least one of (i) said light source to flicker and (ii) said emitter to emit the volatile active; and

a support structure that supports said light source, said emitter, said power source, and said microcontroller.

2. The device according to claim 1, wherein said support structure comprises:

a chassis on which said light source, said emitter, said power source, and said control circuitry are disposed; and

a holder to which said chassis is engageable, said holder including a light diffuser for diffusing light emitted from said light source.

3. The device according to claim 1, wherein said support structure comprises a chassis on which said light source, said emitter, said power source and said control circuitry are disposed,

wherein the chassis is adapted to be one of engageable with and supported by a holder.

4. The device according to claim 1, wherein said emitter comprises an atomizer that atomizes a liquid contained in a reservoir, the reservoir being removably securable to said support structure so as to mate with said atomizer.

5. The device according to claim 4, further comprising a switch for adjusting the amount of volatile active emitted by said atomizer.

6. The device according to claim 1, wherein said light source comprises one or more LEDs.

7. The device according to claim 1, wherein said light source comprises only one LED.

8. The device according to claim 1, further comprising an on/off switch for turning said light source on and off.

9. The device according to claim 1, wherein a portion of said support structure diffuses the flickering light emitted by said light source.

10. The device according to claim 9, wherein the portion of the support structure that diffuses the flickering light is formed of at least one of wax, glass, and plastic.

11. The device according to claim 1, wherein the power supply comprises a single battery, and a voltage step-up is used to supply sufficient power to one or both of said light source and said emitter.

12. A light and substance emitting device comprising:

a light source that emits a flickering light that emulates a flame of a candle;

a substance emitter that emits a volatile active;

control circuitry that controls at least one of said light source and said emitter;

a power source that supplies power to said light source, to emit the flickering light, and to said substance emitter, to emit the volatile active;

a chassis on which one or more of said light source, substance emitter, control circuitry, and power source are disposed; and

a holder to which said chassis may be removably placed, the holder and chassis forming a housing in which said light source, substance emitter, control circuitry, and power source are disposed,

wherein at least one of said chassis and said holder includes a diffuser that diffuses the light emitted by the light source.

13. The device according to claim 12, wherein said light source comprises at least one LED.

14. The device according to claim 12, wherein said emitter comprises an atomizer that atomizes a liquid contained in a reservoir, and the reservoir is removably securable to said chassis.

15. The device according to claim 14, wherein said control circuitry controls both of said atomizer and said light source.

16. The device according to claim 12, wherein at least one of said chassis and said body are formed of at least one of wax, glass, and plastic.

17. The device according to claim 12, wherein an aperture is formed through said housing and said substance emitter emits the volatile active through the aperture.

18. The device according to claim 17, wherein said substance emitter is disposed above said light source and light transmitted from the light source is primarily transmitted through a side of the housing.

19. The device according to claim 12, wherein a protrusion extends axially upwardly from a top surface of the housing, at least a portion of said light source is disposed within the protrusion, and wherein the protrusion comprises the diffuser.

20. The device according to claim 12, wherein said light source comprises a first LED and a second LED, arranged such that the first LED is located above the second LED.

21. The device according to claim 20, wherein the first LED is controlled to flicker, and the second LED is controlled to emit a substantially continuous intensity of perceived light.

22. A light and substance emitting device comprising:

at least one LED that emits a flickering light that emulates a flame of a candle;

a substance emitter that emits a volatile active;

a power source that provides power to at least one of said light source, to emit the light, and said substance emitter, to emit the volatile active; and

at least one of a single microcontroller and a single circuit board, to control both of said light source to emit the flickering light and said substance emitter to emit the volatile active.

23. The device according to claim 22, further comprising a housing within which at least one of said at least one LED, said substance emitter, said power source, and said at least one of the single microcontroller and the single circuit board are disposed.

24. The device according to claim 23, wherein at least a portion of said housing diffuses light emitted from said at least one LED.

25. The device according to claim 22, wherein said substance emitter comprises an atomizer that atomizes the volatile active, the volatile active is contained within a reservoir, and the reservoir is removably securable to said atomizer.

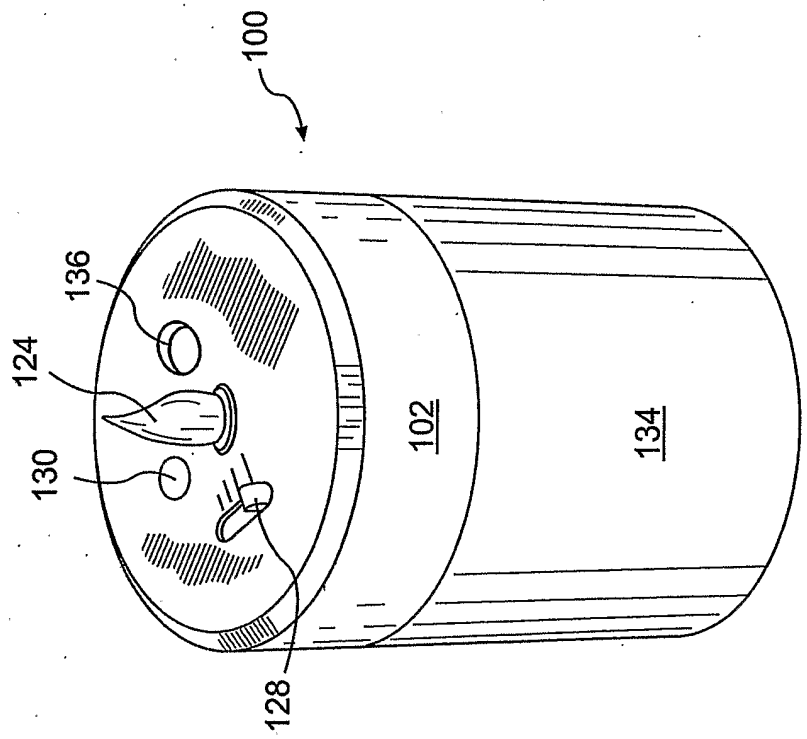
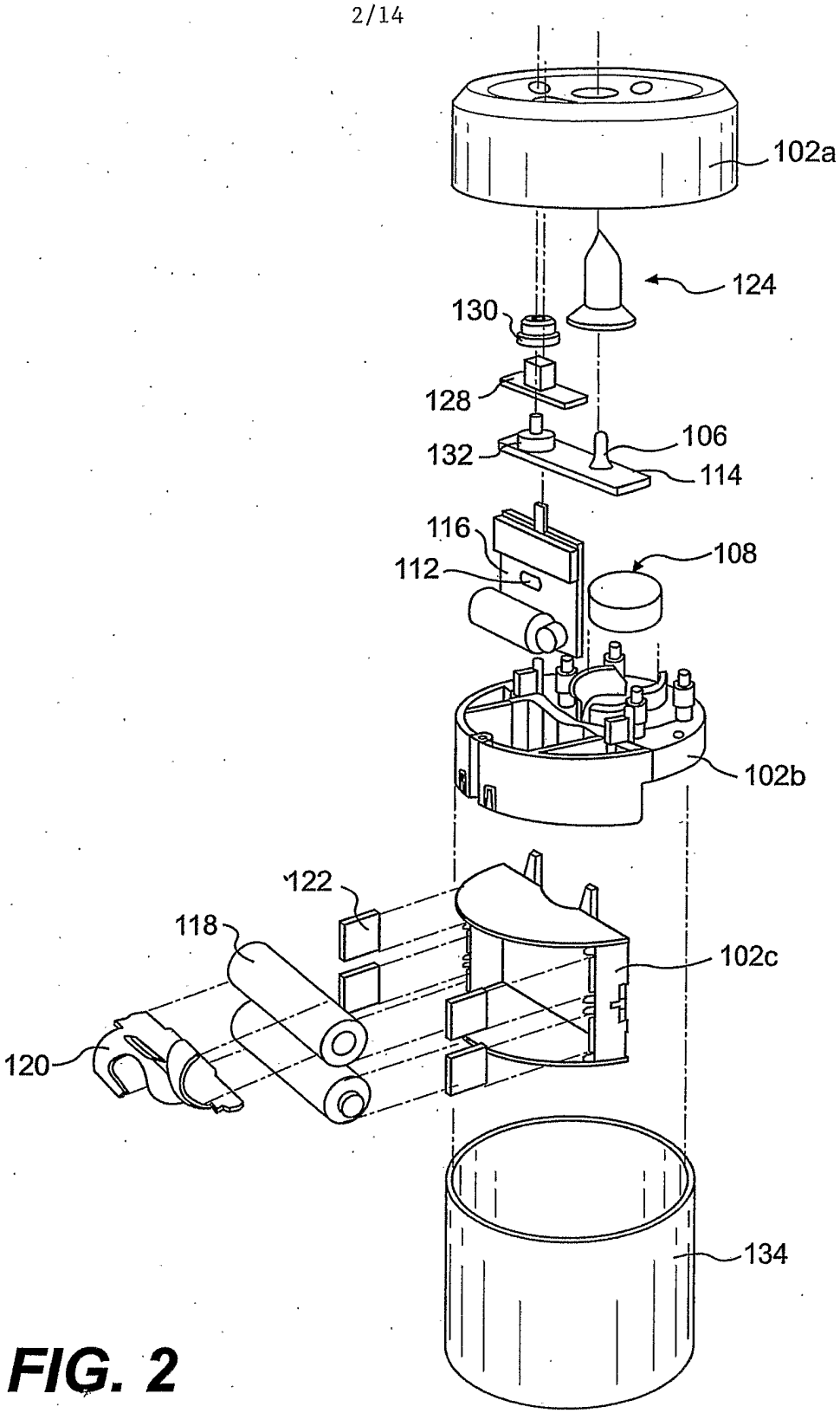



FIG. 1


102a
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116
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102b
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102c
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134

FIG. 2

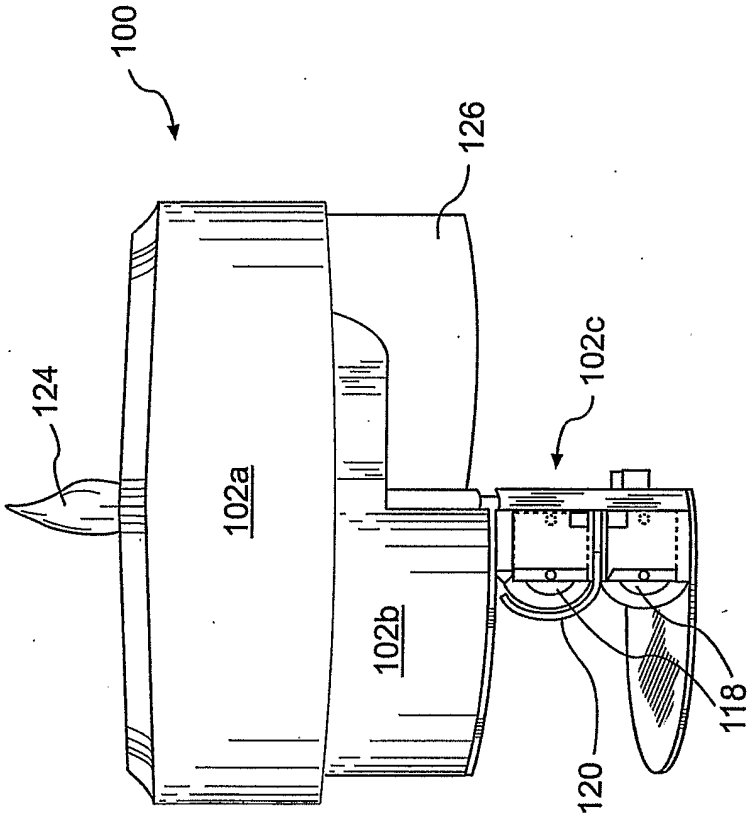


FIG. 3

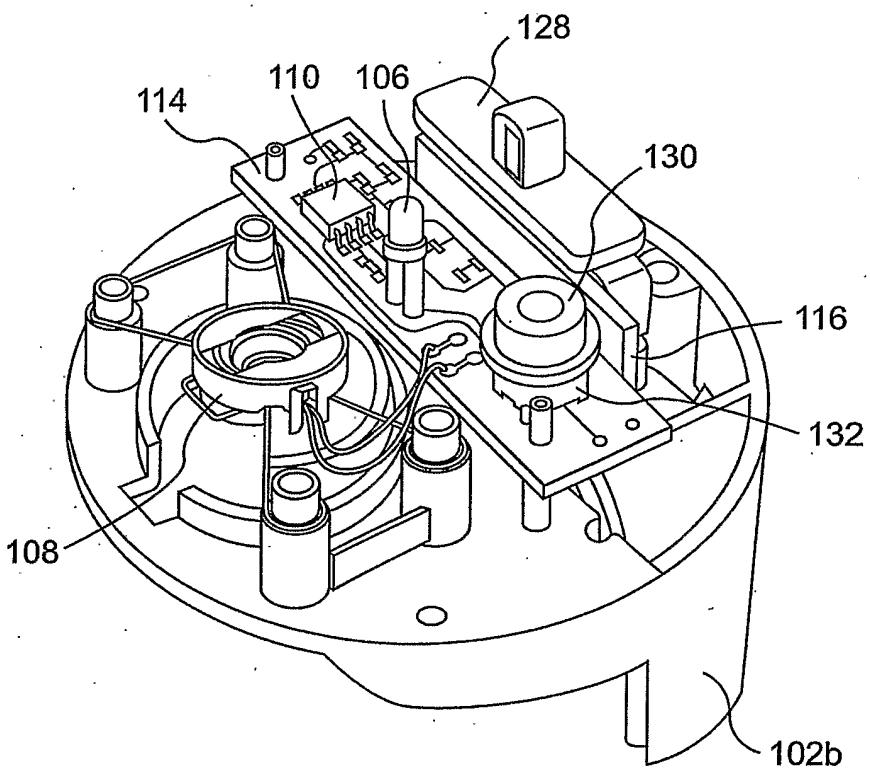


FIG. 4

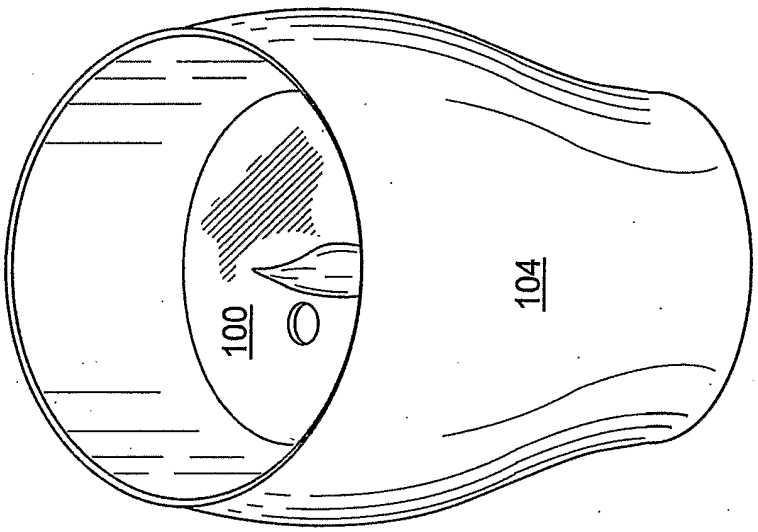


FIG. 5

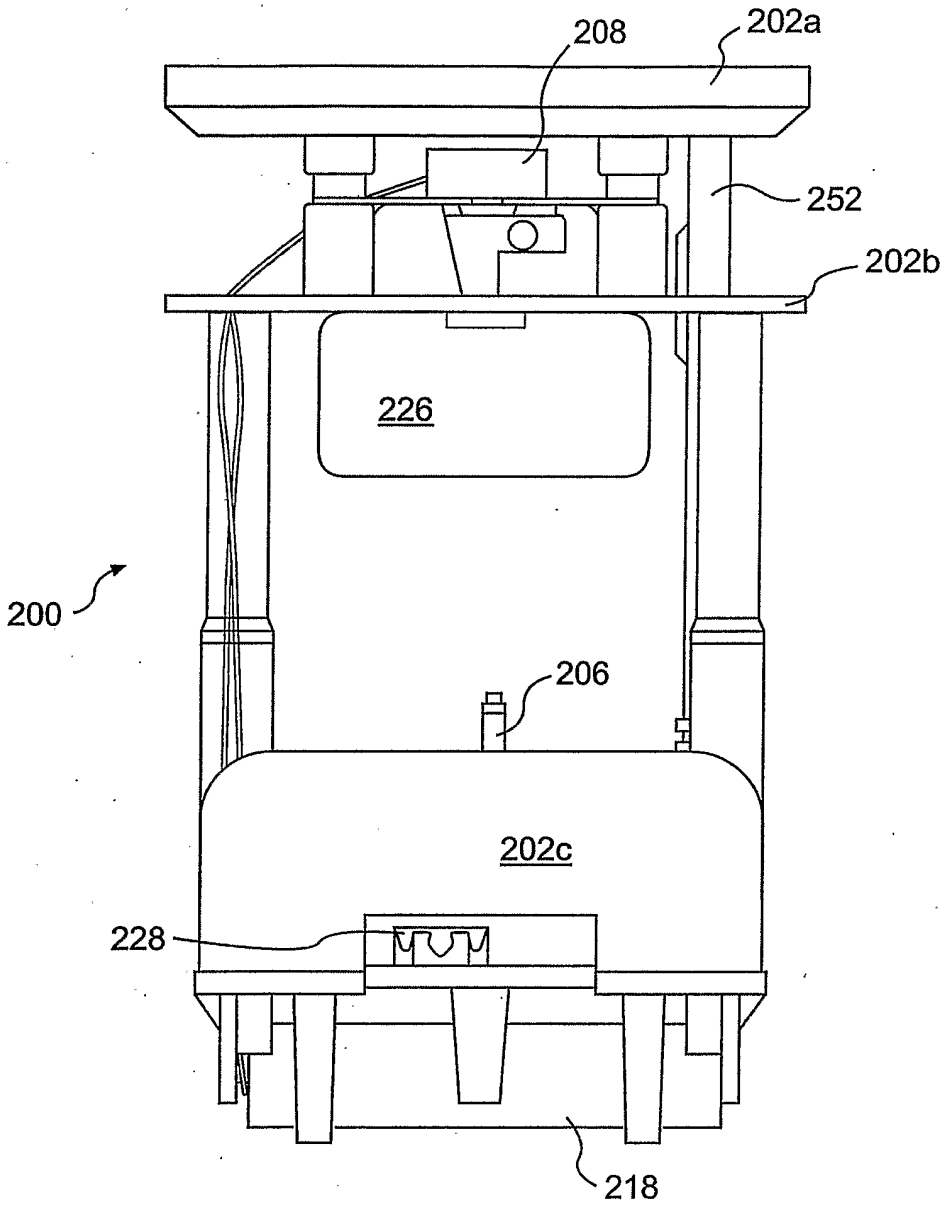


FIG. 6

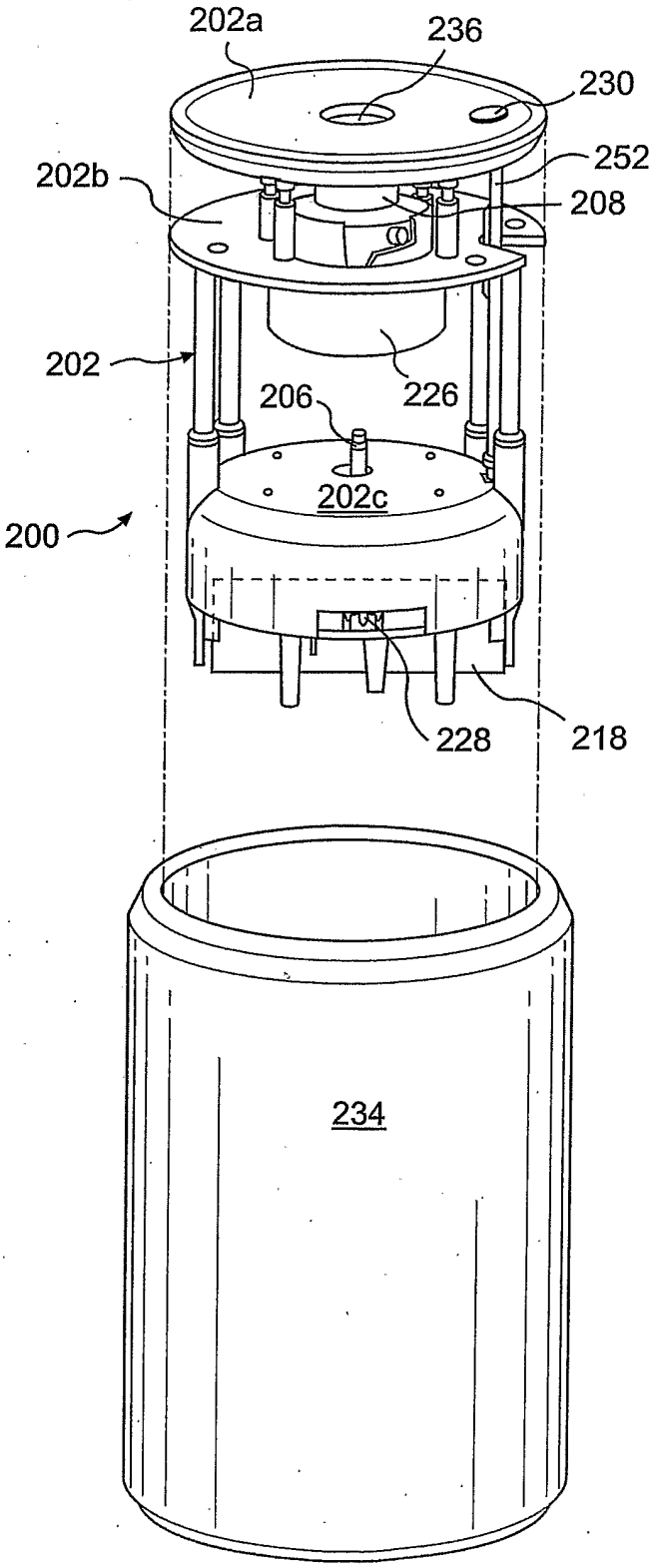


FIG. 7

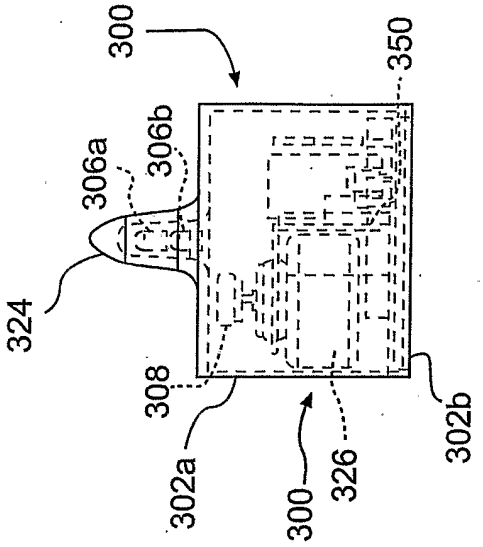


FIG. 8C

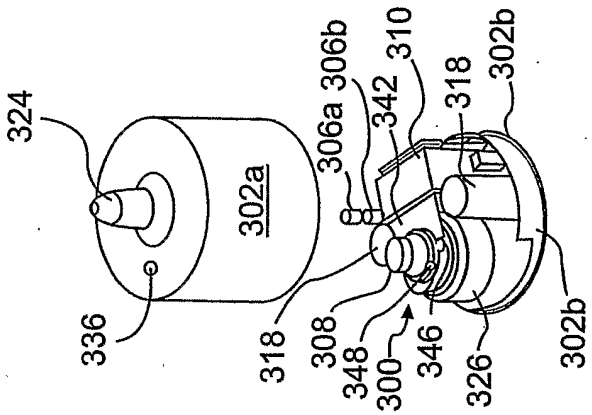


FIG. 8B

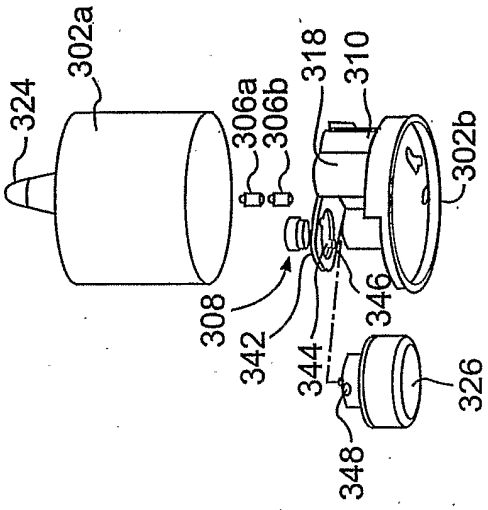


FIG. 8A

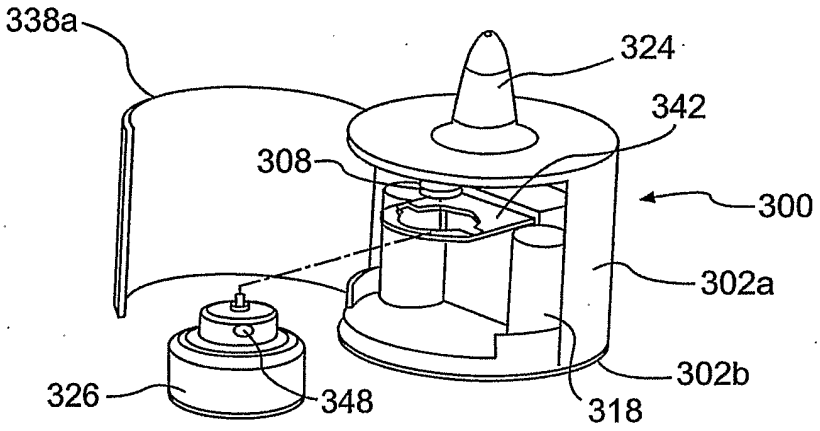
338a
324
342
308
300
302a
326
348
318
302b

FIG. 9

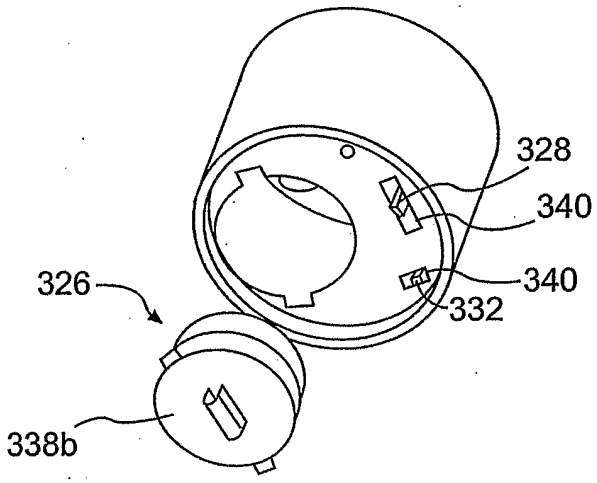
328
340
326
340
332
338b

FIG. 10

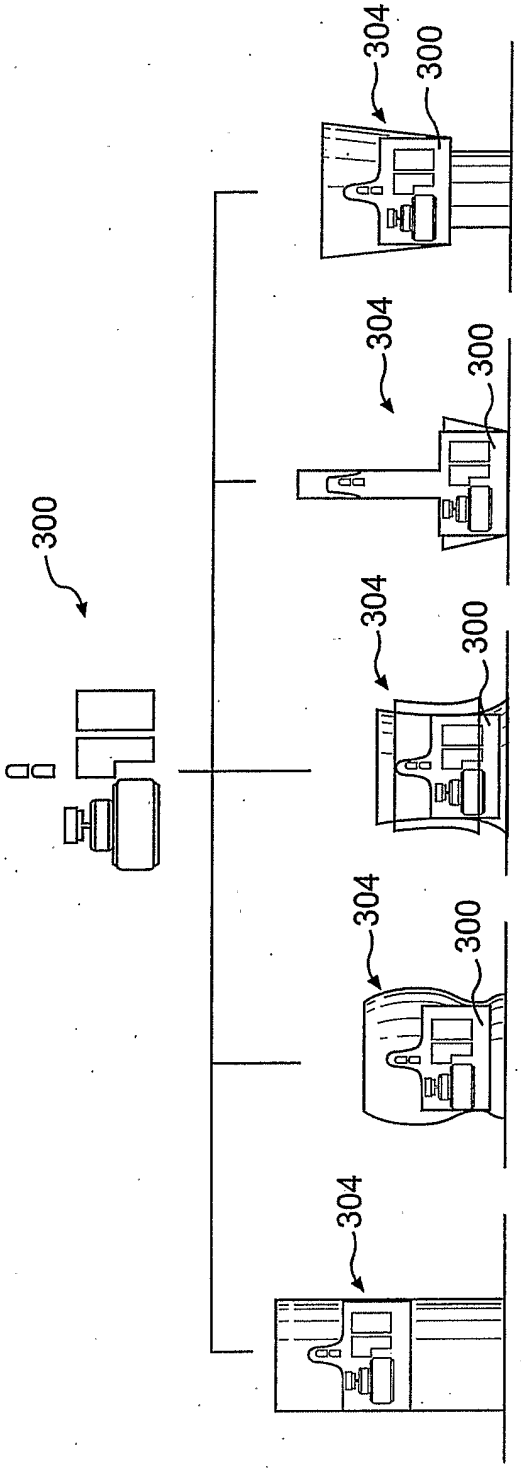


FIG. 11

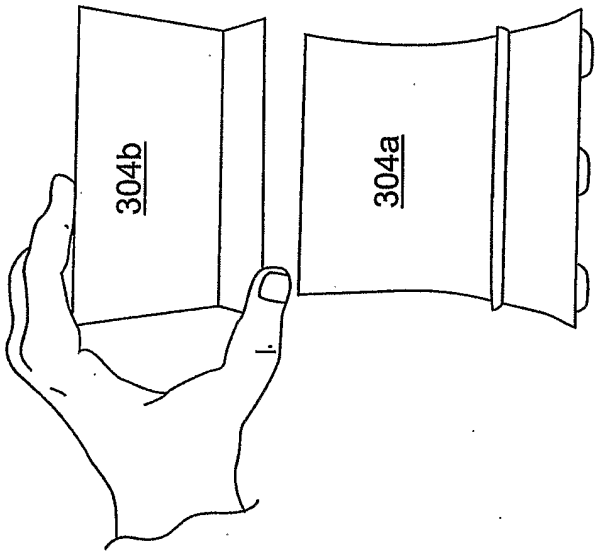


FIG. 12B

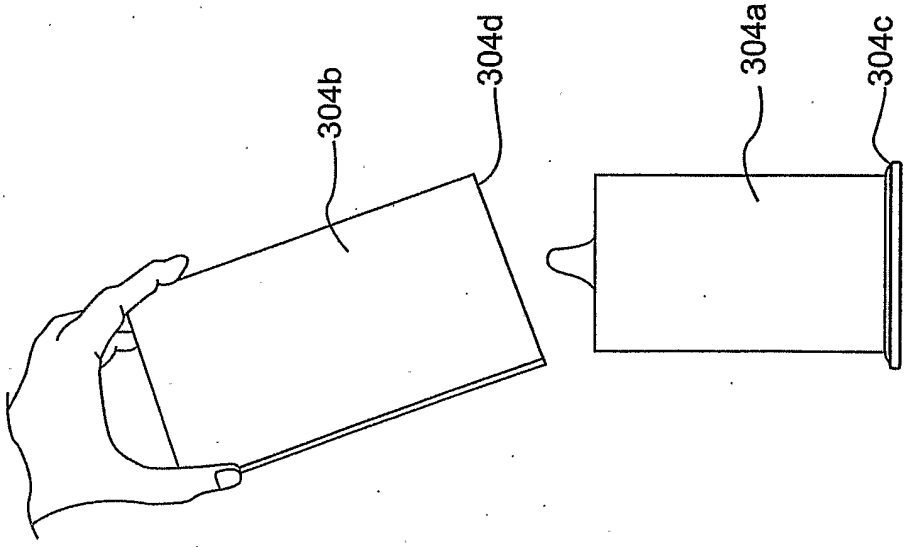


FIG. 12A

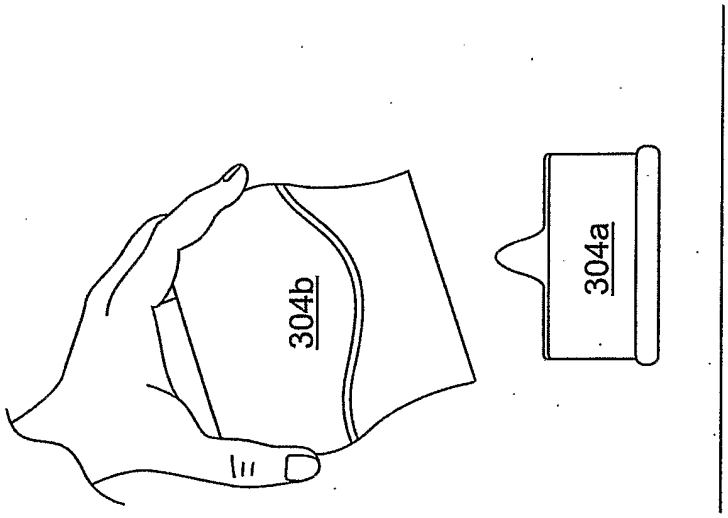


FIG. 12D

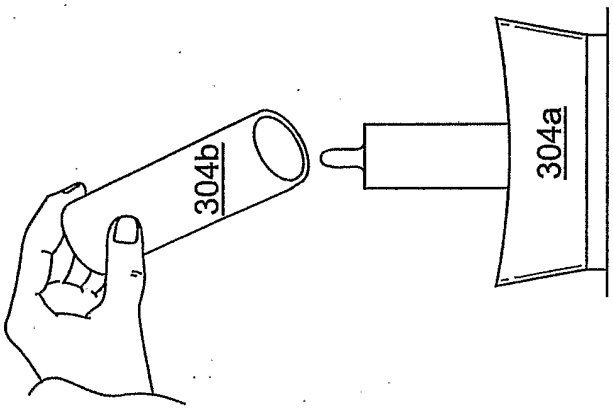


FIG. 12C

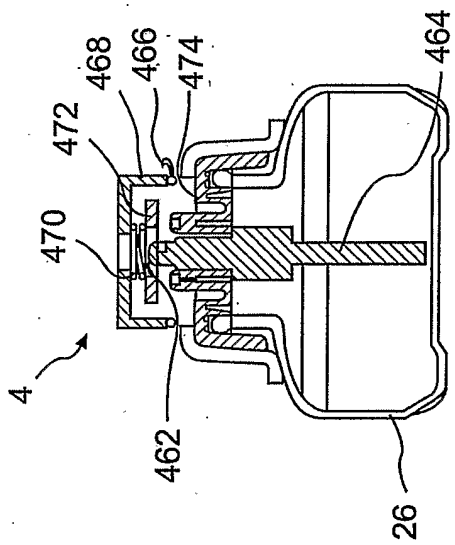


FIG. 13

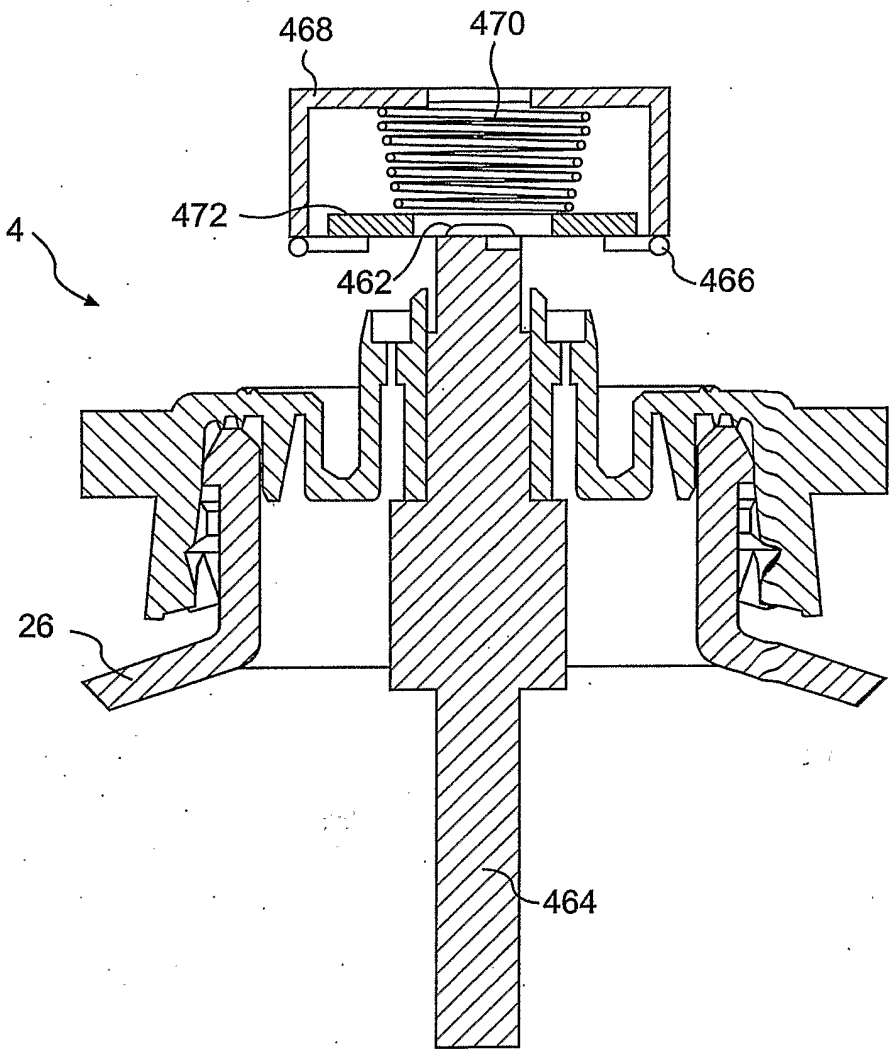


FIG. 14

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/003290

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61L9/12 A61L9/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | EP 1 281 406 A (GIVAUDAN SA)<br>5 February 2003 (2003-02-05)<br>claims 1-4 | 1-25 |
| Y | US 6 302 559 B1 (WARREN WILLIAM D)<br>16 October 2001 (2001-10-16)<br>the whole document | 1-25 |
| Y | US 3 926 655 A (MILES ET AL)<br>16 December 1975 (1975-12-16)<br>the whole document | 1,3,10,<br>12,16,19 |
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 April 2005 | 06/05/2005 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Connor, M |

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# INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | US 6 296 196 B1 (DENEN DENNIS J ET AL)<br>2 October 2001 (2001-10-02)<br>cited in the application<br>claims 1-4<br>----- | 1-25 |

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