A NON-SMOKABLE ELECTRONIC SPRAY CIGARETTE

Technical Field

The invention relates to a non-smokable electronic spray cigarette which contains only nicotine without tar.

Background Art

Despite it is commonly known that "smoking is harmful to your health", the number of smokers worldwide is up to 1 billion, and the number is increasing every year. On March 3, 2003, the World Health Organization (WHO) concluded a global Framework Convention on Tobacco Control. According to the statistical data from WHO, about 4.9 million people die of diseases caused by smoking each year. Although smoking may cause serious respiratory diseases and cancer, it remains extremely difficult for smokers to quit smoking completely.

The active ingredient in a cigarette is nicotine. During smoking, nicotine, along with a lot of tar aerosol droplets produced in the cigarette burning, enters smoker's alveolus and is rapidly absorbed. After being absorbed into the blood of a smoker, nicotine then produces its effect on the receptors of the smoker's central nervous system, which makes him/her relax and enjoy an inebriety similar to that produced by an exhilarant.

Nicotine is a kind of alkaloid with low molecular weight, a small dose of nicotine is essentially harmless to human body and its half-life in blood is quite short. The major harmful substance in tobacco is tar, and the tar in tobacco is composed of thousands of ingredients, tens of which are cancerogenic substances. At present, it has been proven that passive smoking can be more harmful on non-smokers.

Some cigarette substitutes that contain only nicotine without tar have been proposed, and many of them, such as "nicotine patch", "nicotine mouthwash", "spray agent packaged in high pressure gas tank with propellant", "nicotine chewing gum", "nicotine drink" etc., are made of pure nicotine. Although these cigarette substitutes are free from tar, their major

disadvantage is that an effective peak concentration can not be reached in the blood of a smoker due to slow absorption of nicotine and thus it can not make a smoker get real fun, in addition, these cigarette substitutes can not satisfy habitual smoking actions of a smoker, for example, inhaling action or sucking action, and thus are not likely to be widely accepted as effective substitutes for quitting smoking or cigarette substitutes.

Summary of the Invention

An objective of the present invention is to provide a non-smokable electronic spray cigarette that functions as substitutes for quitting smoking and cigarette substitutes, overcomes the above-mentioned disadvantages and provides a humanized cigarette that looks like a normal cigarette. The non-smokable electronic spray cigarette, which is an integrated assembly resembling a cigarette holder, includes a shell, a cell, a high frequency generator, nicotine solution and its container, a control circuit, a display screen, an airflow sensor, a body sensitive sensor, a piezoelectric ultrasonic atomizer, a high temperature vaporization nozzle and accessories, wherein an electro-thermal vaporization nozzle arranged within an air suction end of the shell is connected with a liquid storage container which contains nicotine solution and has an one-way valve for liquid injection, via an electronic pump or a valve connected with a metering cavity; an ultrasonic piezoelectric element attached on the outside of the vaporization nozzle is connected to the high frequency generator in the control circuit board; four outputs of the control circuit are connected to the high frequency generator, an electric heater, the pump or valve, and the display screen respectively; a body sensitive resistance sensor and an airflow sensor are connected to the inputs of the control circuit; the front end of the shell also includes a cell and a red LED. The control circuit provides starting current to the electric heater and the pump within the vaporization nozzle, so as to pump the nicotine solution in the solution storage container into the vaporization nozzle. Under the high temperature and the high frequency oscillation wave in the vaporization nozzle, the liquid is rapidly vaporized, ejected out and then condensed to form a puff of smoke. The control circuit is activated by the resistance sensor and

the airflow sensor connected to the control circuit. A liquid crystal display screen is also provided to indicate the operating conditions and the times of initiation numerically or graphically. The cell which provides power to the pump, the high frequency generator and the electric heater via the control circuit can be a disposable battery or a rechargeable battery.

The present invention also provides a simple non-smokable electronic spray cigarette. The cigarette includes an electro-thermal vaporization nozzle. The vaporization nozzle is connected to an electro-thermal drive pump with a metering cavity, and further connected to a solution storage container that is filled with nicotine solution and made of tear-resistant silicon gel. Alternatively, the pump with a metering cavity can be replaced by a meter and an electromagnetic valve or an electro-thermal valve. With the provision of compression air or a super elastic member on the solution storage container, the stored liquid flows out automatically. The super elastic member made of nickel-titanium memory alloy is preferably used. It includes a control circuit, which provides operating current to the electric heater and the pump or the valve. The control circuit is activated by the resistance sensor connected with the control circuit. The supply power connected with the control circuit is a rechargeable battery.

The advantages of the present invention include smoking without tar, significantly reducing the cancerogenic risk. Furthermore, users still feel as if they are smoking and experiencing the same excitement, and the cigarette has no need to be lit and has no fire risk.

With slight modification of the solution storage container, the device and connection structure according to the present invention can be filled with conventional drug for pulmonary administration apparatus.

Description of the Drawings

FIG. 1 is a structural diagram of the device in the first example in accordance with the present invention.

FIG. 2 is a block diagram of the circuit structure in accordance with the present invention.

FIG. 3 is a schematic diagram of the structure of the high temperature

vaporization nozzle and the electric-thermal element in accordance with the present invention.

Fig. 4 is a schematic diagram of the valve made of memory alloy in accordance with the present invention.

Fig. 5 is a schematic diagram of the peristaltic pump made of memory alloy in accordance with the present invention.

Fig. 6 is a schematic diagram of the peristaltic pump in accordance with the present invention.

Fig. 7 is a structural diagram of the electronic cigarette in the second example in accordance with the present invention.

Fig. 8 is a structural diagram of the electronic cigarette of pressure type in the third example in accordance with the present invention.

Fig. 9 is a structural diagram of the simplified electronic cigarette of pressure type in the fourth example in accordance with the present invention.

Fig. 10 is a structural diagram of the metering cavity in the fourth example in accordance with the present invention.

Detailed Description of the Invention

The high frequency generator of a control circuit board 8 is composed of a capacitance connecting three point type oscilltor, an inductance connecting three point type oscillator, or a transformer-type oscillating circuit, which has the frequency of 35 KHz to 3.3 MHz. The circuit includes a automatic frequency fine-adjusting circuit resonating with a piezoelectric element 20. A nicotine solution storage container 13 is made of silicon rubber, alternatively, other polymers that can be protected against the penetration of nicotine can be used. An one-way valve for liquid injection 12 is sealed by a ball or cone member under the pressure of a spring. An airflow sensor 18 can be comprised of an array of integrated thermal sensitive resistors in the shape of film. The electrode of a resistance or capacitance sensor 19, which is sensitive to touches of human body, is composed of an upper metal film and a lower metal film and located at the end of the cigarette holder. The changes of the resistance or capacitance parameters due to human touch are inputted into the control circuit to perform the operation of a body sensitive switch. The

electric controlled pump 11, driven by a motor or a linear motor, drives a retarder that has a large speed ratio, via a shaft coupling, to revolve at a low speed but with large torque. The pump can be a peristaltic pump, a plunger pump, an eccentric pump or a screw pump. Alternatively, the liquid pump can use piezoelectric pump, a super magnetostrictive pump, a thermal expansion drive pump, a thermal contraction drive pump, a thermal bubble pump. The electric control pump or valve may be thermal contractible. The valve is formed on a silicon rubber tube by nickel-titanium memory alloy or copper-based memory alloy under the force of electro-thermal contractions. The electro-thermal vaporization nozzle 17 is made of high-temperature-resistant materials with low thermal conductivity. The nozzle 17 is a tubule, with the internal diameter of 0.05-2mm and the effective working length of 3-20mm. An electric heating element is provided within the nozzle, and the shapes of the electric heating element and the cavity of the nozzle are designed to facilitate vaporization and ejection of liquid. The vaporization nozzle 17 may be made of conventional ceramics, or be made of aluminum silicate ceramics, titanium oxide, zirconium dioxide, yttrium oxide ceramics, molten silicon, silicon dioxide, molten aluminum oxide. The vaporization nozzle 17 may be in the shape of straight tube or spiral, and may also be made from polytetrafluoethylene, carbon fiber, glass fiber or other materials with similar properties. The electric heating element arranged within the vaporization nozzle 17 may be made of wires of nickel chromium alloy, iron chromium aluminum alloy, stainless steel, gold, platinum, tungsten molybdenum alloy, etc., and may be in the shape of straight line, single spiral, double spiral, cluster or spiral cluster, wherein the straight line and cluster are preferred. The heating function of the electric heating element may be achieved by applying a heating coating on the inner wall of the tube, and the coating may be made from electro-thermal ceramic materials, semiconductor materials, corrosion-resistant metal films, such as gold, nickel, chromium, platinum and molybdenum. The method for coating can include a coat sintering process, a chemical deposition sintering process and an ion spraying process. The materials mentioned above can be provided within the inner wall of vaporization nozzle in any of the processes mentioned above. The nozzle

with high resistance, made of metal, can have no electric heating element being attached, and can be directly applied with heating current. Alternatively, the materials mentioned above can be arranged outside of the nozzle in any of the ways mentioned above, and an appropriate response time can also be achieved in the power supply mode of short-term preheating. Nicotine solution used in the atomization process comprises nicotine, propylene glycol, glycerol, organic acids, anti-oxidation agents, essence, water and alcohol, in which the nicotine content is 0.1%-6%, propylene glycol content 80%-90%, organic acids 0.2%-20%, the rest is glycerol, essence, anti-oxidation agents, water and alcohol.

Example 1: the structural diagram of the device in accordance with the present invention is shown in Fig. 1.

The fundamental principle of the device is that, when a smoker puts the cigarette holder on his/her mouth, the resistance sensor 19 activates the control circuit board 8. The control circuit board 8 then outputs two driving voltages respectively, one used to supply power to the electric heating element of the vaporization nozzle 17 and the other used to activate the micro pump 11 (shown in Fig. 6). The stored solution is then pumped to the nozzle 17 by the solution storage container 13. On the electric heating element of the nozzle 17, the nicotine solution is then vaporized into high temperature vapor which is subsequently ejected from the opening end. In the air, the vapor ejected out is then expanded and condensed into micro aerosol droplets. The effect of the ultrasonic piezoelectric element 20 mounting on the nozzle is that, firstly, the large liquid droplets in the unstable thermal airflow under high pressure will be in sufficient contact with the electric heating element, and thereby be vaporized; secondly, the liquid droplets in the nozzle 17 is directly fragmented and atomized; thirdly, possible bumping occurred when the liquid is above a boiling point will be avoided. The effect of integrated atomization will allow the aerosol droplets with diameters of 0.2-3 um to enter into the alveolus easily and be absorbed. The airflow sensor 18 is sensitive to the diluted air which enters through air inlet 16 when a "suction" action take places. The sensed signals are transmitted to the control circuit, and the control circuit then stop to supply power to the micro pump and the electric heater after a

certain time delay. The relay relationship between the time delays of the micro pump and electric heater is as follows: after the electric heater is activated, the micro pump is activated after a time delay of 0.1-0.5 seconds; the electric heater is then turned off after a time delay of 0.2-0.5 seconds when the control circuit of the micro pump is turned off, so as to guarantee a complete vaporization of the liquid after quantitative liquid injection without any leftovers. The nicotine solution container may be designed to be different sizes as required. The nicotine solution may be refilled once a day, or once a couple of days. The liquid crystal display screen 10 can show operating state parameters, such as cell capacity, smoking times per day, average using cycle and warnings for over smoking. A red LED 3 blinks for each smoking action, and a sawtooth wave signal that lasts for 1.2 seconds is given by the control circuit for blinking signals, which provides a gradual change of luminance to imitate the ignition and combustion process of a conventional cigarette. The charger 1, charging jack 2, spring 4, shell 6, threads 7, switch 9, passage tube 14 and baffle plate 15 are shown in Fig. 1. The silicon gel tube 601, pinch roller 602, worm 603 and motor 604 are shown in Fig. 6.

The design of the present invention will not exclude the possibility of integrating the control circuit and the ultrasonic micro pump on one single chip by using a Micro Electronic Mechanical System (MEMS).

Example 2: the simplified electronic cigarette

Fig. 7 is a structural diagram of the simplified device in accordance with the present invention, in which the ultrasonic atomization high frequency generator and the piezoelectric ceramic element 20 are omitted. To achieve a desirable atomization effect, tiny heating wires are used in combination with the nozzle (see Fig. 3), so that the maximum diameters of one or more vaporization cavities formed between the heating wire and the inner wall of the nozzle range from 0.02mm to 0.6mm. The function of the airflow sensor 18 omitted is replaced by the manner that the initial signal of the resistance or capacitance sensor 119 is delayed a certain time via the control circuit and acts as the ending signal. The electronic cigarette is configured as follow: the vaporization nozzle 117, the thermal drive pump 111 (see Fig. 5) made of nickel titanium memory alloy wire, and the liquid storage container 113

connected to the thermal drive pump consitute a liquid transmission system, two outputs of the control circuit board 108 are respectively connected to the electric heater and the pump or valve, and a body sensitive resistance sensor 119 is connected to the input of the control circuit; the cell 105 and red LED 103 are provided in the front end within the shell, and constitute an integrity resembling a cigarette holder, a pipe or a pen. The thermal drive pump is an electro-thermal shrinkable peristaltic pump, made of wires of nickel titanium memory alloy or copper based alloy, with gel tube which is pressed at three points respectively during the process of electro-thermal contraction to form a pressure cavity for pumping out liquid. The change of volume of the cavity within the thermal drive pump determines the quantity of the solution to be atomized each time. Upon contacting with user's mouth, the resistance sensor 119 activates the control circuit 108, the control circuit 108 then provides operating current to the thermal drive pump and the electric heater, and the output of the control circuit is turned off after the delay of 2 seconds for reactivation at the next smoking action. Alternatively, a thermal expansion drive pump or a thermal bubble pump is also applicable. The thermal expansion drive pump forms a pressure cavity for pumping out liquid by allowing a micro hydrogen container with an embedded electric heating element to block the liquid inlet and open the liquid outlet at the time of thermal expansion. The charging jack 102, LED 103, cell 105, switch 109, liquid-refilling valve 112 and air hole 116 are shown in Fig. 7.

The electrode lead wire 401, heating wire 402, thread 403, base 404 and nozzle 405 are shown in Fig. 3. The support 501, extension spring 502, pumping-out pressure plate 503, silicon gel tube 504, stop pressure plate 505, supporting spring 506, memory alloy wire 507, electrode A 508, electrode B 509 and electrode C 510 are shown in Fig. 5.

Example 3: the electronic cigarette made of a Ni-Ti memory alloy

Fig. 8 is a structural diagram of the electronic cigarette. The electro-thermal vaporization nozzle 217 of the device is connected to the liquid storage container 213 via a pneumatic valve 220, the super elastic member 210 is connected to the pressure plate 211 which is connected to the liquid storage container 213 by pressure, the pneumatic valve is composed of

a pneumatic film 214, a magnetic steel ring 218, a steel valve needle 220 and a reset spring 221. The super elastic member 210, which is made of Ni-Ti memory alloy, is used to apply a constant pressure on the liquid storage container via the pressure plate 211. When the pneumatic valve opens, the liquid with nicotine enters the vaporization nozzle from the liquid storage container via the pneumatic valve and is vaporized and condensed subsequently to form a puff of smoke at high temperature. Upon contacting with user's mouth, the resistance sensor activates the control circuit to supply power to the electric heater. When the user performs suction action, the Nd-Fe-B permanent magnetic alloy ring attracts the valve needle to move in response to the pneumatic film being subjected to negative pressure. Liquid is supplied when the valve needle opens, and after the pneumatic valve is reset, power supply to the electric heater is turned off after the delay of 0.5 seconds by the control circuit. The LED 203, charging jack 202, cell 205, control circuit 208, switch 209, refilling valve 212, baffle plate 215, air hole 216 and resistance sensor 219 are shown in Fig. 8.

Example 4: the electronic spray cigarette utilizing the pressure of a container

In the device (see Fig. 9), the electro-thermal vaporization nozzle 317, the electronic valve 311 connected with the metering cavity 320, and the liquid storage container 313 form a liquid transmission passage. A gas vessel filled with high-pressure nitrogen is arranged around the periphery of the liquid storage container to exert pressure thereon to facilitate the transmission of the liquid. When a control signal is applied to the electronic valve, the electronic valve is activated, and the solution with nicotine enters the metering cavity from the liquid storage container under pressure and pushes a piston so as to allow a constant volume of liquid at the other side of the piston to enter the vaporization nozzle via the electronic valve and be vaporized and condensed to form aerosols. The metering cavity provided at the valve is a cylinder having a liquid inlet and a liquid outlet. Located within the cylinder are the piston micro holes and the reset spring connected onto the piston. The control circuit which is activated by the resistance sensor 319 controls the states of the electronic valve and the electric heater respectively. Due to slow

infiltration of the micro hole of the piston in the metering cavity and the force of the reset spring, the piston returns to its original position within 5-8 seconds after each atomization process. The cell 305, pressure vessel 321, pressure chamber 322, seal threaded-opening 323, control circuit board 308 and air hole 316 are showed in Fig. 9.

The silicon gel tube 406, pressure-stopping plate 407, memory alloy wires 408, support 409, electrode lead wire 410 and pressure spring 411 are shown in Fig. 4. The inlet 701, piston 702, micro hole of the piston 703, metering cavity 704, reset spring 705 and outlet 706 are shown in Fig. 10.

The recipes of nicotine solution used for the electronic spray cigarette in accordance with the present invention are as follows:

1. 6% nicotine, 85% propylene glycol, 2% glycerol, 2% essence, 1% organic acid and 1% anti-oxidation agent;

2. 4% nicotine, 80% propylene glycol, 5% glycerol, 1% butyl valerate, 1% isopentyl hexonate, 0.6% lauryl laurate, 0.4% benzyl benzoate, 0.5% methyl octynicate, 0.2% ethyl heptylate, 0.3% hexyl hexanoate, 2% geranyl butyrate, 0.5% menthol, 0.5% citric acid and 4% tobacco essence;

3. 2% nicotine, 90% propylene glycol, 2.5% citric acid, 1% essence and 4.5% tobacco essence;

4. 0.1% nicotine, 80% propylene glycol, 5% glycerol, 8% alcohol, 2.9% water, 1% essence, 1% tobacco essence and 2% organic acid.

Claims

1. A non-smokable electronic spray cigarette, includes

a shell, a battery, a high frequency generator, a container for nicotine solution, a control circuit, a display screen, an airflow sensor, a body sensitive sensor, a piezoelectric ultrasonic atomizer, an electro-thermal vaporization nozzle and accessories as an integrated assembly, wherein

a liquid storage container (13), which contains nicotine solution and has one-way valve for liquid injection (12), being connected with the electro-thermal vaporization nozzle (17) arranged in the air suction end of the shell (6), via the electronic pump (11) or the valve with a metering cavity,

an ultrasonic piezoelectric element (20) attached on the outside of the vaporization nozzle (17) being connected to the high frequency generator in the control circuit board (8),

four outputs of the control circuit board (8) being connected to the high frequency generator, an electric heater, the pump or valve and the display screen respectively,

a body sensitive resistance sensor (19) and an airflow sensor (18) are connected to the inputs of the control circuit, and

a cell and a red LED are provided in the front end of the shell (6),

together constituting an integrity resembling a cigarette holder, a pipe or a pen.

2. A non-smokable electronic spray cigarette, includes

a liquid transmission system formed by a vaporization nozzle (117), a thermal drive pump (111) made of nickel titanium memory alloy wire, and a liquid storage container (113) connected with the thermal drive pump,

two outputs of a control circuit board (108) being connected to an electric heater and a pump or valve respectively,

a body sensitive resistance sensor (119) being connected to inputs of the control circuit, and

a cell (105) and a red LED (103) being arranged within the front end of a shell,

together constituting an integrity resembling a cigarette holder, a pipe or

a pen.

3. A non-smokable electronic spray cigarette, wherein

an electro-thermal vaporization nozzle (217) is connected to the liquid storage container (213) via a pneumatic valve,

a super elastic member (210) is connected to a pressure plate (211) which is connected to the liquid storage container by pressure, and

the pneumatic valve is composed of a pneumatic film (214), a magnetic steel ring (218), a steel valve needle (220) and a reset spring (221).

4. A non-smokable electronic spray cigarette, wherein

an electro-thermal vaporization nozzle (317), an electronic valve (311) which is connected with a metering cavity (320), and a liquid storage container (313) forms a liquid transmission passage, and

a gas vessel filled with high pressure nitrogen is arranged around the periphery of the liquid storage container.

5. The non-smokable electronic spray cigarette according to claim 1, wherein

the high frequency generator on the control circuit board (8) is a capacitance connecting three point type oscilltor, an inductance connecting three point type oscillator, or a transformer-type oscillating circuit,

the high frequency generator has the frequency of 35 KHz to 3.3 MHz, and

the circuit includes a automatic frequency fine-adjusting circuit resonating with a piezoelectric element (20).

6. The non-smokable electronic spray cigarette according to claim 1, wherein the nicotine solution storage container (13) is made of silicon rubber or other polymers that can be protected against the penetration of nicotine.

7. The non-smokable electronic spray cigarette according to claim 1, wherein the one-way valve for liquid injection (12) is sealed by a ball or cone member under the pressure of a spring.

8. The non-smokable electronic spray cigarette according to claim 1, wherein the airflow sensor (18) is composed of an array of integrated thermal sensitive resistors in the shape of film.

9. The non-smokable electronic spray cigarette according to claim 1,

wherein the electrode of resistance or capacitance sensor (19) which is located at the end of the non-smokable electronic spray cigarette for human body contacting is composed of an upper metal film and a lower metal film, and a body sensitive switch is formed by inputting of changes of resistance or capacitance parameters caused by contacting human body into the control circuit.

10. The non-smokable electronic spray cigarette according to claim 1, wherein

the electronic pump (11) is driven by a motor or a linear motor, via a shaft coupling, the electronic pump drives a retarder which has a large speed ratio, to revolve at a low speed but with large torque,

the pump can be a peristaltic pump, a plunger pump, an eccentric pump or a screw pump, and

the pump can be a piezoelectric pump, a super magnetostrictive pump, a thermal expansion drive pump, a thermal contraction drive pump, or a thermal bubble pump.

11. The non-smokable electronic spray cigarette according to claim 1, wherein the electro-thermal vaporization nozzle (17) is a tubule with an internal diameter of 0.05-2mm and an effective working length of 3-20mm, made of materials which are high temperature resistant and of low thermal conductivity,

an electric heating element is provided within the tube,

the electric heating element and the shape of the tube are designed to facilitate vaporization and ejection of the liquid,

the vaporization nozzle (17) may be made of conventional ceramics, aluminum silicate ceramic, titanium oxide, zirconium oxide, yttrium oxide ceramic, molten silicon or molten aluminum oxide,

the shape of the nozzle is a straight tube or a spiral, and

the nozzle (17) may also be made from polytetrafluoethylene, carbon fiber, glass fiber or other materials with similar properties.

12. The non-smokable electronic spray cigarette according to claim 11, wherein

the electric heating element within the vaporization nozzle (17) can be

made of wires of nickel chromium alloy, iron chromium aluminum alloy, stainless steel, gold, platinum, tungsten molybdenum alloy, in the shape of linear configuration, single spiral configuration, cluster configuration or spiral cluster configuration, among them, the linear configuration and cluster configuration are preferred,

the electric heating element is a coating applied on the inner wall of the nozzle, and the coating may be made from electro-thermal ceramic materials, semiconductor materials or corrosion resistant metal film, such as gold, nickel, chromium, platinum and molybdenum,

the coating can be applied in a coat sintering process, a chemical deposition sintering process and an ion spraying process,

the heating method of the vaporization nozzle is provided with the material mentioned above within its inner wall in the processes mentioned above,

the vaporization nozzle is made of a metal with high resistance, and the nozzle is directly provided with heating current without any electric heating wire being provided, and

the vaporization nozzle made of the materialmentioned above can also be provideded on the outside of the nozzle in the way mentioned above, achieving appropriate response time from the power supply mode of a short-term preheat.

13.The non-smokable electronic spray cigarette according to claim 1, wherein the nicotine solution used for atomization is composed of nicotine, propylene glycol, glycerol, organic acid, anti-oxidation agent, essence, water and alcohol, in which the nicotine content is 0.1%-6%, propylene glycol content is 80%-90%, the content of organic acids is 0.2%-20%, the rest is glycerol, essence, anti-oxidation agent, water and alcohol.

14. The non-smokable electronic spray cigarette according to claim 10, wherein the thermal drive pump is an electro-thermal shrinkable peristaltic pump, made of wires of nickel titanium memory alloy or copper based alloy, with gel tube which is pressed at three points respectively during the process of electro-thermal contraction to form a pressure cavity for pumping out liquid.

15.The non-smokable electronic spray cigarette according to claim 10, wherein the thermal expansion drive pump forms a pressure cavity for pumping out liquid by allowing a micro hydrogen container with an embedded electric heating element to block a liquid inlet and open a liquid outlet at the time of thermal expansion.

16.The non-smokable electronic spray cigarette according to claim 10, wherein the thermal bubble pump forms a pressure cavity for pumping out liquid by rapidly vaporizing liquid on a electric heating film.

17.The non-smokable electronic spray cigarette according to claim 1, wherein the electronic pump or valve is a thermal contractible valve made of nickel-titanium memory alloy or copper-based memory alloy wires on the silicon gel tube which is pressed by the nickel-titanium memory alloy or copper-based memory alloy wires under the force of electro-thermal contractions.

18.The non-smokable electronic spray cigarette according to claim 1, wherein the metering cavity provided at the valve connected with the metering cavity is a cylinder configured with a liquid inlet and a liquid outlet, and the cylinder comprises a piston with micro holes and a reset spring connected to the piston.