The invention relates to an electronic smoking device (10), and to a battery portion (12) for an electronic smoking device (10). In order to imitate a cigarette or another smoking article more realistically, the electronic smoking device (10) and the battery portion (12) comprise a vapor outlet opening (48).
Electronic Smoking Device with Vapor Outlet Opening

FIELD OF INVENTION

The present invention relates generally to electronic smoking devices, in particular electronic cigarettes, and to battery portions for an electronic smoking devices.

BACKGROUND OF THE INVENTION

An electronic smoking device, such as an electronic cigarette (e-cigarette), typically has a housing accommodating an electric power source (e.g. a single use or rechargeable battery, electrical plug, or other power source), and an electrically operable atomizer. The atomizer vaporizes or atomizes liquid supplied from a reservoir and provides vaporized or atomized liquid as an aerosol. Control electronics control the activation of the atomizer. In some electronic cigarettes, an airflow sensor is provided within the electronic smoking device, which detects a user puffing on the device (e.g., by sensing an under-pressure or an airflow pattern through the device). The airflow sensor indicates or signals the puff to the control electronics to power up the device and generate vapor. In other e-cigarettes, a switch is used to power up the e-cigarette to generate a puff of vapor.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided an electronic smoking device comprising a first atomizer, a first liquid reservoir that is connected to the first atomizer, and an air inhalation port. The air inhalation port is arranged on a first surface of the electronic smoking device. The electronic smoking device comprises a vapor outlet opening that is arranged on a second surface of the electronic smoking device. The second surface differs from the first surface. Further, in accordance with another aspect of the present invention there is provided a battery portion for an electronic smoking device. The battery portion comprises a front end, a rear end and a battery receiving volume between the front end and the rear end. An electrical contact element for electrically contacting an atomizer/liquid reservoir portion for an electronic smoking device is arranged at the rear end. Further, the rear end may point towards the user of an electronic smoking device that comprises the battery portion. A vapor outlet opening is arranged at a distance to the rear end.

The characteristics, features and advantages of this invention and the manner in which they are obtained as described above, will become more apparent and be more clearly understood in
connection with the following description of exemplary embodiments, which are explained with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, same element numbers indicate same elements in each of the views:

Figure 1 shows a schematic cross-sectional view of an exemplary embodiment of the electronic smoking device;

Figure 2 shows a schematic cross-sectional view of another exemplary embodiment of the electronic smoking device;

Figure 3 shows a schematic cross-sectional view of yet another exemplary embodiment of the electronic smoking device;

Figure 4 shows a schematic view of an exemplary embodiment of the control electronics for an electronic smoking device; and

Figure 5 schematically shows exemplary embodiments of signal curves.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Throughout the following, an electronic smoking device 10 is exemplarily described, wherein the electronic smoking device 10 can be an e-cigarette. As is shown in Figure 1, an electronic smoking device 10 typically has a housing comprising a cylindrical hollow tube having an end cap 16. The cylindrical hollow tube may be a single-piece or a multiple-piece tube. In Figure 1, the cylindrical hollow tube is shown as a two-piece structure having a battery portion 12 and an atomizer/liquid reservoir portion 14. Together the battery portion 12 and the atomizer/liquid reservoir portion 14 form a cylindrical tube which can be approximately the same size and shape as a conventional cigarette, typically about 100 mm with a 7.5 mm diameter, although lengths may range from 70 to 150 or 180 mm, and diameters from 5 to 20 mm.

The battery portion 12 and atomizer/liquid reservoir portion 14 are typically made of metal like aluminum or steel, or of hardwearing plastic and act together with the end cap 16 to provide a housing to contain the components of the electronic smoking device 10. The battery portion 12 and an atomizer/liquid reservoir portion 14 may be configured to fit together by a friction push fit, a snap fit, or a bayonet attachment, magnetic fit, or screw threads. The end cap 16 is provided at the front end of the battery portion 12. The end cap 16 may be made from translucent plastic
or other translucent material to allow an LED 20 positioned near the end cap to emit light through the end cap. The end cap can be made of metal or other materials that do not allow light to pass.

In case the battery portion 12 is provided separately from the atomizer/liquid reservoir portion 14, the battery portion 12 comprises front end 21A, a rear end 21B and a battery receiving volume 21C between the front end 21A and the rear end 21B. An electrical contact element for electrically contacting an atomizer/liquid reservoir portion 12 for an electronic smoking device 10 is arranged at the rear end 21B.

An air inlet may be provided in the end cap, at the edge of the inlet next to the cylindrical hollow tube, anywhere along the length of the cylindrical hollow tube, or at the connection of the battery portion 12 and the atomizer/liquid reservoir portion 14. Figure 1 shows a pair of air inlets 38 provided at the intersection between the battery portion 12 and the atomizer/liquid reservoir portion 14.

A battery 18, a light-emitting diode (LED) 20, control electronics 22 and optionally an airflow sensor 24 are provided within the cylindrical hollow tube battery portion 12. The battery 18 is electrically connected to the control electronics 22, which are electrically connected to the LED 20 and the airflow sensor 24. In this example the LED 20 is at the front end of the battery portion 12, adjacent to the end cap 16 and the control electronics 22 and airflow sensor 24 are provided in the central cavity at the other end of the battery 18 adjacent the atomizer/liquid reservoir portion 14.

The airflow sensor 24 acts as a puff detector, detecting a user puffing or sucking on the atomizer/liquid reservoir portion 14 of the e-cigarette 10. The airflow sensor 24 can be any suitable sensor for detecting changes in airflow or air pressure, such as a microphone switch including a deformable membrane which is caused to move by variations in air pressure. Alternatively the sensor may be a Hall element or an electro-mechanical sensor.

The control electronics 22 are also connected to a first atomizer 26. In the example shown, the atomizer 26 includes a heating coil 28 which is wrapped around a wick 30 extending across a first vapor duct 32 that is exemplarily shown as a central passage of the atomizer/liquid reservoir portion 14. The coil 28 may be positioned anywhere in the atomizer 26 and may be transverse or parallel to the liquid reservoir 34. The wick 30 and heating coil 28 do not completely block the first vapor duct 32. Rather an air gap is provided on either side or end of the heating coil 28 enabling air to flow past the heating coil 28 and the wick 30. The atomizer
may alternatively use other forms of heating elements, such as ceramic heaters, or fiber or mesh material heaters. Nonresistance heating elements such as sonic, piezo and jet spray may also be used in the atomizer in place of the heating coil.

The first vapor duct 32 is surrounded by a cylindrical liquid reservoir 34 with the ends of the wick 30 abutting or extending into the liquid reservoir 34. The wick 30 may be a porous material such as a bundle of fiberglass fibers, with liquid in the liquid reservoir 34 drawn by capillary action from the ends of the wick 30 towards the central portion of the wick 30 encircled by the heating coil 28. In other embodiments, aerosol may flow around the exterior of the cartridge 32 to an air inhalation port 36.

The liquid reservoir 34 may alternatively include wadding soaked in liquid which encircles the first vapor duct 32 with the ends of the wick 30 abutting the wadding. In other embodiments the liquid reservoir 34 may comprise a toroidal cavity arranged to be filled with liquid and with the ends of the wick 30 extending into the toroidal cavity.

An air inhalation port 36 is provided at the back end of the atomizer/liquid reservoir portion 14 remote from the end cap 16. The inhalation port 36 may be formed from the cylindrical hollow tube atomizer/liquid reservoir portion 14 or maybe formed in an end cap.

In use, a user sucks on the electronic smoking device 10. This causes air to be drawn into the electronic smoking device 10 via one or more air inlets, such as air inlets 38, and to be drawn through the first vapor duct 32 towards the air inhalation port 36. The change in air pressure which arises is detected by the airflow sensor 24, which generates an electrical signal that is passed to the control electronics 22. This electric signal can be designated as activity signal. In response to the activity signal, the control electronics 22 activate the atomizer 26 by outputting an operation signal to the atomizer 26, which causes liquid present in the wick 30 to be vaporized creating an aerosol (which may comprise gaseous and liquid components) within the first vapor duct 32. The operation signal can be operation power like operation voltage and/or operation current for the atomizer 26. As the user continues to suck on the electronic smoking device 10, this aerosol is drawn through the first vapor duct 32 and inhaled by the user. At the same time the control electronics 22 also activate the LED 20 causing the LED 20 to light up which is visible via the translucent end cap 16 mimicking the appearance of a glowing ember at the end of a conventional cigarette. As liquid present in the wick 30 is converted into an aerosol more liquid is drawn into the wick 30 from the liquid reservoir 34 by capillary action and thus is available to be converted into an aerosol through subsequent activation of the heating coil 28.
Some electronic smoking devices are intended to be disposable and the electric power in the battery 18 is intended to be sufficient to vaporize the liquid contained within the liquid reservoir 34, after which the electronic smoking device 10 is thrown away. In other embodiments the battery 18 is replaceable or rechargeable and the liquid reservoir 34 is refillable or replaceable. In the cases where the liquid reservoir 34 is a toroidal cavity, this may be achieved by refilling the liquid reservoir 34 via a refill port. In other embodiments the atomizer/liquid reservoir portion 14 of the electronic smoking device 10 is detachable from the battery portion 12 and a new atomizer/liquid reservoir portion 14 can be fitted with a new liquid reservoir 34 thereby replenishing the supply of liquid. In some cases, replacing the liquid reservoir 34 may involve replacement of the heating coil 28 and the wick 30 along with the replacement of the liquid reservoir 34. A replaceable unit comprising the atomizer 26 and the liquid reservoir 34 is called a cartomizer or a clearomizer.

The new liquid reservoir 34 may be in the form of a cartridge having a first vapor duct 32 through which a user inhales aerosol.

Of course, in addition to the above description of the structure and function of a typical electronic smoking device 10, variations also exist. For example, the LED 20 may be omitted. The airflow sensor 24 may be placed adjacent the end cap 16 rather than in the middle of the electronic smoking device. The airflow sensor 24 may be replaced with a switch which enables a user to activate the electronic smoking device manually rather than in response to the detection of a change in air flow or air pressure.

Different types of atomizers may be used. Thus for example, the atomizer may have a heating coil in a cavity in the interior of a porous body soaked in liquid. In this design aerosol is generated by evaporating the liquid within the porous body either by activation of the coil heating the porous body or alternatively by the heated air passing over or through the porous body. Alternatively the atomizer may use a piezoelectric atomizer to create an aerosol either in combination or in the absence of a heater.

The control electronics 22 comprise an activity signal input for receiving the activity signal from the airflow sensor 24 or from a switch provided instead of the flow sensor 24. The activity signal is representative of a puff taken by a user of the electronic smoking device 10. The control electronics 22 are connected to the airflow sensor 24 or to the switch in an activity signal-transmitting manner, for example via an activity signal line 40. An operation signal output for outputting the operation signal to the atomizer 26 of the electronic smoking device 10 is
connected to the atomizer 26 and for example to the heating coil 28 in an operation signal-transmitting manner, for example via an operation signal line 42.

The control electronics 22 are adapted to terminate the operation signal with a predetermined delay with respect to an end of the activity signal, such that the electronic smoking device 10 continues to produce vapor for a predetermined period of time after the user has finished its puff, thereby imitating a smoking article, e.g. a regular cigarette, which continues to emit smoke after a user of the smoking article has finished sucking on the smoking article. For example, the control electronics 22 continues to output the operation signal for at least 0.25, 0.5, 1, 2, 3, 4, 5 or even more seconds.

The control electronics 22 comprise an indicator signal output for outputting an indicator signal to an indicator light, e.g. the light-emitting diode 20 of the electronic smoking device 10. In the exemplary embodiment of Figure 1, however, a separate indicator signal line used to transmit the indicator signal from the control electronics 22 to the indicator light is not shown for the sake of clarity. The control electronics 22 are adapted to terminate the indicator signal with a predetermined delay with respect to the end of the activity signal. Thus, after the user has finished sucking on the electronic smoking device 10, the indicator light and for example the light-emitting diode 20 continues to glow and to imitate a smoldering smoking article, e.g. a cigarette. The delay of the end of the indicator signal may correspond to the delay of the operation signal with respect to the end of the activity signal.

The control electronics 22 are adapted to continuously decrease an operation intensity of the atomizer 26 represented by the operation signal after a predefined event, e.g. after the end of the activity signal. Optionally, the control electronics 22 are adapted to continuously increase an operation intensity of the atomizer 26 represented by the operation signal dependent on a start of the activity signal, thereby imitating a smoking article, e.g. a cigarette, more realistically.

The control electronics 22 are adapted to decrease an indication intensity of the indicator light represented by the indicator signal after a predetermined event, e.g. the end of the activity signal.

For example, the control electronics are adapted to decrease the operation intensity and the indication intensity similarly, such that the course of intensities may similarly or in parallel decrease. A similar decrease may be represented by a correlation coefficient of curves representing the decrease of the operation intensity and the indication intensity, wherein the correlation coefficient may be greater than 0.75.
The operation signal output and the indicator signal output are separate outputs or are both formed by one signal output. In order to adapt to the power needs of the indicator light, e.g. the light-emitting diode 20, and of the atomizer 26, the indicator light and the atomizer 26 may be connected to the control electronics 22 and in particular to its signal output in parallel.

The electronic smoking device 10 is shown with a first longitudinal end 44 and a second longitudinal end 46, wherein the first longitudinal end 44 is arranged opposite of the second longitudinal end 46. A first surface 47 of the electronic smoking device 10, which is exemplarily shown at the second longitudinal end 46, comprises the air inhalation port 36. A second surface 49 of the electronic smoking device 10, which is exemplarily shown at the first longitudinal end 44, comprises a vapor outlet opening 48, such that vapor can exit the electronic smoking device 10 via the first longitudinal end 44. The first surface 47 differs from the second surface 49. In order to let vapor exit the electronic smoking device 10 not only via the air inhalation port 36, but also via the vapor outlet opening 48, the atomizer 26 is connected to the vapor outlet opening 48, e.g. in a vapor-conducting manner. The provision of the vapor outlet opening 48 at the second surface 49 is advantageous independent of the provision of the control electronics 22 described above. Yet, the vapor outlet opening 48 can be provided together with the control electronics 22.

In case the battery portion 12 is provided separately from the atomizer/liquid reservoir portion 14, the vapor outlet opening 48 is arranged at a distance to the rear end 21A.

The first longitudinal end 44 is arranged opposite of a second longitudinal end 46 of the electronic smoking device 10. The longitudinal ends 44, 46 can face away from each other. The vapor outlet opening 48 may be arranged closer to the first longitudinal end 44 than to the second longitudinal end 46.

The electronic smoking device 10 comprises a predefined length in its length direction L that extends from the first longitudinal end 44 to the second longitudinal end 46, wherein the vapor outlet opening 48 is arranged closer to the first longitudinal end 44 than to a center C of the electronic smoking device 10 in the longitudinal direction L. Hence, a distance between the vapor outlet opening 48 and the first longitudinal end 44 is smaller than a distance between the vapor outlet opening 48 and the second longitudinal end 46. For example, the vapor outlet opening 48 is arranged at the first longitudinal end 44.

In case the electronic smoking device 10 comprises the indicator light, e.g. the light-emitting diode 20 at the first longitudinal end 44, the electronic smoking device 10 can imitate a smoking
article, e.g. a regular cigarette, in that the first longitudinal end 44 can imitate the ember of a smoking article by glowing and by emitting vapor via the first longitudinal end 44. Hence, the electronic smoking device 10 may comprise the indicator light, e.g. the light-emitting diode 20, and the vapor outlet opening 48 at its first longitudinal end 44.

According to the exemplary embodiment of Figure 1, the second surface 49 is a front face 49A of the electronic smoking device 10. The front face 49A faces away from the air inhalation port 36 and the optional indicator light emits light via the front face 49A. The vapor outlet opening 48 may face in the same direction as the front face 49Ae.

Alternatively, the second surface 49 is a lateral surface 49B of the electronic smoking device 10. For example, a distance between the front face 49A and the vapor outlet opening 48 on the lateral surface 49B is less than 30 %, less than 25 %, less than 20 %, less than 15 %, less than 10 % or even less than 5% of the total length of the electronic smoking device.

More than one vapor outlet opening 48 and for example a plurality of vapor outlet openings 48 can be provided. For example, the vapor outlet openings 48 are arranged after each other in a circumferential direction U of the first longitudinal end 44 or of the electronic smoking device 10, wherein the circumferential direction U of the first longitudinal end 44 and the circumferential direction U of the electronic smoking device 10 may correspond to each other. The circumferential direction U extends perpendicular to the length direction L. Hence, for example, the vapor outlet openings 48 are arranged along a ring-shape.

In order to conduct vapor from the atomizer 26 to the vapor outlet opening 48, the electronic smoking device 10 comprises a second vapor duct 50 that interconnects the atomizer 26 and the vapor outlet opening 48, e.g. in a vapor-transmitting manner. Hence, the first vapor duct 32 extends from the atomizer 26 to the air inhalation port 36 and the second vapor duct 50 extends from the atomizer 26 to the vapor outlet opening 48. Thus, no vapor can condense on the control electronics 22 or other parts of the battery portion 12 when flowing from the atomizer 26 to the vapor outlet opening 48.

In order to provide that vapor still exits the vapor outlet opening 48 even in case no vapor exits the air inhalation port 36 anymore, the first vapor duct 32 is shorter than the second vapor duct 50. Thus, a vapor flow path that extends through the second vapor duct 50 is longer than a vapor flow path that extends through first vapor duct 32, such that it takes more time for vapor to pass through the second vapor duct 50 than through the first vapor duct 32. The second
vapor duct 50 may be formed in a meandering manner, in order to maximize the length
difference between the vapor ducts 32, 50.

Figure 2 shows another exemplary embodiment of the electronic smoking device in a cross-
sectional view. For the sake of brevity, only the differences from the exemplary embodiment of
Figure 1 are looked at.

The electronic smoking device 110 of the exemplary embodiment of Figure 2 lacks the second
vapor duct 50. In order to be able to emit vapor via the vapor outlet opening 48, the electronic
smoking device 110 comprises a second atomizer 52 that is connected to the vapor outlet
opening 48, e.g. in a vapor transmitting manner. The second atomizer 52 can be exclusively
connected to the vapor outlet opening. For example, the second atomizer 52 is arranged at the
first longitudinal end 44 and in contact with the end cap 16.

In order to supply liquid from the liquid reservoir 34 to the second atomizer 52, the electronic
smoking device 110 is shown with a liquid duct 54 that connects the liquid reservoir 34 and the
second atomizer 52 in a liquid-transmitting manner.

For the sake of completeness, the electronic smoking device 110 of the exemplary embodiment
of Figure 2 is shown with an indicator signal line 55, which interconnects the control electronics
22 and the indicator light, e.g. the light-emitting diode 20, in an indicator signal-transmitting
manner.

The optional control electronics 22 may comprise two operation signal outputs, wherein a first of
the two operation signal outputs is adapted to output a first operation signal to the atomizer 26
of the electronic smoking device 10, and a second of the two operation signal outputs is
adapted to output a second operation signal to the second atomizer 52 of the electronic
smoking device 10. The control electronics 22 are adapted to terminate only the second
operation signal with a predetermined delay with respect to the end of an activity signal. The
activity signal may represent a puff detected by the airflow sensor 24 or indicated by a switch
closed by the user of the electronic smoking device 110, such that the activity signal may be
designated as puff signal.

Another and for example second operation signal line 56 transmits the second operation signal
from the control electronics 22 to the second atomizer 52. The first atomizer 26 is connected to
the control electronics 22 via the first operation signal line 42.
Figure 3 shows another exemplary embodiment of the electronic smoking device in a cross-sectional view. For the sake of brevity, only the differences from the exemplary embodiment of Figure 2 are looked at.

The electronic smoking device 210 of the exemplary embodiment of Figure 3 comprises the first and the second atomizers 26, 52, wherein only the second atomizer 52 is connected to the vapor outlet opening 48 in a vapor-transmitting manner. Again, the second atomizer 52 is connected to the control electronics 22 in a control signal-transmitting manner via the operation signal line 56. The first atomizer 26 is connected to the control electronics 22 via the first operation signal line 42.

In contrast to the exemplary embodiment of Figure 2, the electronic smoking device 310 of the exemplary embodiment of Figure 3 is shown without the liquid duct 54. In order to supply the second atomizer 52 with liquid to be atomized, the electronic smoking device 210 comprises a second liquid reservoir 58 that is connected to the second atomizer 52 in a liquid-transmitting manner. In particular, the second liquid reservoir 58 is exclusively connected to the second atomizer 52, only, in the liquid-transmitting manner. For example, the second liquid reservoir 58 is attached to the second atomizer 52, wherein between the vapor outlet opening 48 and the second liquid reservoir 58, the second atomizer 52 is arranged.

Figure 4 shows an exemplary embodiment of control electronics 22 in a schematic view.

The control electronics 22 comprises an activity signal input 60 and a signal output 62, which is in particular an operation signal output 62 for outputting the operation signal to the atomizer 26, 52 of the electronic smoking device 10, 110, 210, 310 of one of the previous embodiments shown in Figures 1 to 4.

The activity signal input 60 and the operation signal output 62 are interconnected via a delay element 64 of the control electronics 22. The delay element 64 is realized in hardware and/or in software and is adapted to terminate the operation signal with a predetermined delay with respect to an end of the activity signal.

In addition to the operation signal output 62, the control electronics 22 of the exemplary embodiment of Figure 4 comprises an indicator signal output 66 for outputting the indicator signal to the indicator light, e.g. to the light-emitting diode 20. Alternatively, the operation signal output 62 and the indicator signal output 66 are formed by one signal output, to which the
atomizer 26, 52 and the indicator light, e.g. the light-emitting diode 20, are connected in series or in parallel.

In case the electronic smoking device 110, 210 comprises the first and the second atomizers 26, 52, the control electronics 22 comprise another operation signal output 68. The operation signal with the not delayed end is then output via the other operation signal output 68 to the first atomizer 26. The operation signal output 62, which may be designated as second operation signal output 62, is connected to the second atomizer 52 in the operation signal-transmitting manner, and outputs the operation signal with the delayed end. The other operation signal output 68 that is connected to the first atomizer 26 may be designated as first operation signal output 68.

Figure 5 schematically shows signal curves in a diagram.

An abscissa 70 of the diagram D represents the process of time. The ordinate 72 of the diagram D represents intensities of signals represented by the curves. Curve 74 represents the activity signal and is schematically shown as a rectangle, wherein the activity signal 74 rises from a base level to a maximum level at a start time $t_1$ and ends at an end time $t_2$ by dropping back to the base level. The maximum level represents the user puffing and the base level represents the user not puffing.

Immediately after or with a short delay after the start time $t_1$, an operation signal 76 rises from a base level to a maximum level, thereby causing the atomizer 26 to atomize or vaporize liquid to be inhaled by the user. After the end time $t_2$, the operation signal 76 does not immediately drop back to the base level. Rather, the operation signal 76 reaches the base level, e.g. the abscissa 70 at a delayed time $t_3$, which is delayed with respect to the end time $t_2$. Hence, even after the user has stopped puffing on the electronic smoking device 10, 110, 210, the electronic smoking device 10, 110, 210, continues to produce vapor between the end time $t_2$ and the delayed time $t_3$.

The operation signal 76 shown in Figure 5 decreases between the end time $t_2$ and the delayed time $t_3$ continuously. Alternatively, the operation signal 76 can drop at the delayed time $t_3$ and can remain stable between the start time $t_1$ and the delayed time $t_3$ and/or between the end time $t_2$ and the delayed time $t_3$.

The indicator signal is not shown in Figure 5, but may have a course similar to the operation signal 76 or an alternative operation signal 78. The alternative operation signal 78 is shown in
Figure 6, which continuously and more slowly than the operation signal 76 increases after the start time t_i. At an intermediate time t_a which is shown between the start time t_i and the end time t_f, the alternative operation signal 78 reaches its maximum level. After the maximum level, the alternative operation signal 78 continuously decreases until it reaches the base level at the abscissa 70 at the delayed time t_3.

In case the electronic smoking device 110, 210 comprises the first atomizer 26 and the second atomizer 52, an operation signal, which is not shown in Figure 5, and which is supplied to the first atomizer 26, starts at the start time t_i and ends at the end time t_f. The operation signal 76 or the alternative operation signal 78 are supplied to the second atomizer 52. Yet, in case a normal cigarette or other smoking article does not emit considerable quantities of smoke at its ember end while the user draws a puff, another and e.g. second operation signal 80 is supplied to the second atomizer 52 after the activity signal 74 ends at the end time t_f. The second operation signal 80 rises at or after the end time t_f rapidly towards its maximum and then continuously decreases until it reaches the abscissa 70 at the delayed time t_3. A signal at the level of the abscissa 70 represents an inactive signal, for example that the user does not puff on the electronic smoking device 10, 110, 210 and/or that the atomizer 26, 52 does not produce vapor.

In the alternative, in case a traditional smoking article like a traditional cigarette produces a higher level of smoke when the user takes a puff, the electronic smoking device 10, 110, 210 is adapted to release more vapor via the vapor outlet opening during the puff than before and/or after the puff. For example, the operation signal 76 or the alternative operation signal 78 can have their maximum between the start time t_i and the end time t_f. The maximum may result in a quantity of vapor, e.g. atomized liquid, generated during the puff by the second atomizer 52, which exceeds the quantity of vapor, e.g. atomized liquid, generated by the first atomizer 26. For example, the amplitude of the operation signal 76 or of the alternative operation signal 78 during the puff can be higher than the amplitude of the operation signal supplied to the first atomizer 26.

In summary, in one aspect, an electronic smoking device comprises a first atomizer, a first liquid reservoir that is connected to the first atomizer, and an air inhalation port arranged on a first surface of the electronic smoking device, wherein the electronic smoking device comprises a vapor outlet opening that is arranged on an second surface of the electronic smoking device, the second surface differing from the first surface. In another aspect a battery portion for an electronic smoking device, comprising a front end, a rear end and a battery receiving volume
between the front end and the rear end, wherein an electrical contact element for electrically contacting an atomizer/liquid reservoir portion for an electronic smoking device is arranged at the rear end and a vapor outlet opening is arranged at a distance to the rear end. The battery portion may be provided independently or in combination with an atomizer/liquid reservoir portion for the electronic smoking device. In particular, the battery portion may be adapted to be mechanically and/or electrically connected to the atomizer/liquid reservoir portion to form the electronic smoking device. The battery portion and the atomizer/liquid reservoir portion may form the electronic smoking device. The electronic smoking device may itself or in combination with a mouthpiece be used by a user. An advantage of such an electronic smoking device or of such a battery portion may be that the smoking experience better resembles smoking a smoking article, e.g. a cigarette, which emits smoke at both of its longitudinal ends.

The electronic smoking device may comprise a first longitudinal end opposite of a second longitudinal end, the second longitudinal end comprising the air inhalation port, wherein the vapor outlet opening is arranged closer to the first longitudinal end than to the second longitudinal end. For example, the electronic smoking device comprises a predefined length in its length direction that extends from the first longitudinal end to the second longitudinal end, wherein the vapor outlet opening is arranged closer to the first longitudinal end than to a center of the electronic smoking device in the longitudinal direction. In particular, the vapor outlet opening is arranged at the first longitudinal end. The smaller the distance between the vapor outlet opening and the first longitudinal end, the more the electronic smoking device resembles a smoking article like a cigarette.

For example, the second surface is a lateral surface of the electronic smoking device. A plurality of vapor outlet openings may be provided, wherein the vapor outlet openings are arranged one after the other in a circumferential direction of the electronic smoking device or of its first longitudinal end. Hence, the vapor outlet openings may be arranged along a ring shape.

Alternatively, the second surface may be a front face of the electronic smoking device, the front face facing away from the vapor outlet opening. An advantage of such an electronic smoking device may be that the electronic smoking device even better resembles a smoking article like a cigarette.

The electronic smoking device may comprise a first and a second vapor duct for conducting vapor away from the atomizer, wherein the first vapor duct extends from the atomizer to the air inhalation port and the second vapor duct extends from the atomizer to the vapor outlet
opening. The vapor ducts may each comprise a vapor inlet at the atomizer and a vapor outlet at the vapor outlet opening or at the air inhalation port, respectively, and may be vapor-tight between the vapor inlet and the vapor outlet. Thus, an advantage of such an electronic smoking device may be that vapor can be supplied to the air inhalation port and to the vapor outlet opening without having undesired condensation of vapor at components of the electronic smoking device, e.g., the control electronics.

The first vapor duct may be shorter than the second vapor duct. An advantage of such an electronic smoking device may be that conducting vapor from the atomizer to the vapor outlet opening via the second vapor duct takes longer than conducting vapor from the atomizer to the air inhalation port and, therefore, vapor continues to exit the vapor outlet opening even after vapor has stopped exiting the air inhalation port.

The electronic smoking device may comprise a second atomizer, wherein only the second atomizer is connected to the vapor outlet opening. Thus, an advantage of such an electronic smoking device may be that vapor to be ejected via the vapor outlet opening can be provided independent of vapor to be provided at the air inhalation port. Another advantage of such an electronic smoking device may be that the first atomizer can be adapted to efficiently produce vapor to be inhaled by the user, wherein the second atomizer can be adapted to efficiently produce vapor to be emitted after the puff, e.g., via the vapor outlet opening.

The electronic smoking device may comprise the first liquid reservoir, only, wherein the first liquid reservoir is connected to the second atomizer in a liquid-transmitting manner. For example, the liquid reservoir may provide liquid to be atomized or vaporized to the first and to the second atomizer, which are both connected to the liquid reservoir in the liquid-transmitting manner.

Additionally, the electronic smoking device may comprise a second liquid reservoir, wherein the second liquid reservoir is connected to the second atomizer, only. The second reservoir may be connected to the second atomizer in a liquid-transmitting manner and for example exclusively, such that liquid is supplied to the second atomizer only from the second liquid reservoir and not from the first liquid reservoir, and the second liquid reservoir only supplies liquid to the second atomizer and not to the first atomizer. The first liquid reservoir supplies liquid to the first atomizer. An advantage of such an electronic smoking device may be that ducts for transporting liquid to the second atomizer can be shortened or even avoided, thereby reducing complexity of the structure of the electronic smoking device. Another advantage of such an electronic
smoking device may be that the liquid reservoir that is connected to the second atomizer in the liquid-transmitting manner may be filled with a liquid that differs from the liquid contained in the liquid reservoir that is connected to the first atomizer in the liquid-transmitting manner. The liquid provided to the second atomizer may be adapted to efficiently produce vapor without any additives like nicotine and/or flavor. Alternatively, the liquid to be provided to the second atomizer may comprise the liquid to be atomized and the flavor, only, but no nicotine, which may reduce costs of the liquid and may improve acceptance of the electronic smoking device in public areas. The liquid to be provided to the first of the atomizers may comprise the liquid to be atomized, the flavor and/or nicotine.

The electronic smoking device may comprise control electronics for controlling the operation of an atomizer, wherein the control electronics comprise an activity signal input for receiving an activity signal representing an activity of the electronic smoking device, for example a puff taken by a user of an electronic smoking device, and an operation signal output for outputting an operation signal to the atomizer of the electronic smoking device. Hence, the activity signal may be a puff signal. Thus, an advantage of such an electronic smoking device may be that operation of the electronic smoking device can be better controlled by the control electronics.

For example, the operation signal output is connected to the second atomizer in an operation signal transmitting manner. Thus, an advantage of such an electronic smoking device may be that the second atomizer can be operated independent of the first atomizer.

The control electronics may be adapted to terminate the operation signal with a predetermined delay with respect to an end of the For example, the control electronics continues to output the operation signal for at least 0.25, 0.5, 1, 2, 3, 4, 5 or even more seconds.

An advantage of the control electronics and the electronic smoking device comprising the control electronics may be that the electronic smoking device continues to produce vapor after the user has finished his puff, thereby imitating a smoking article, e.g. a cigarette, more realistically. Smoking articles, namely, continue to emit smoke even after a user of the smoking article has finished puffing.

The control electronics may be adapted to continuously decrease an operation intensity of the atomizer represented by the operation signal after a predefined event, for example the end of the activity signal. An advantage of such control electronics may be that liquid to be atomized or vaporized is not unnecessarily spent without impairing the imitation of the smoking article.
The control electronics may be adapted to continuously increase an operation intensity of the atomizer represented by the operation signal dependent on a start of the activity signal. An advantage of continuously increasing the operation intensity may be that the amount of vapor supplied to the user continuously increases during the puff, such that the user is not overwhelmed by too much vapor at the beginning of the puff, but still receives sufficient vapor during the puff.

The electronic smoking device may comprise an indicator light, e.g. a light-emitting diode. The control electronics may comprise an indicator signal output for outputting an indicator signal to the indicator light of the electronic smoking device. The control electronics may be adapted to terminate the indicator signal with a predetermined delay with respect to the end of the activity signal. Hence, an advantage of such control electronics may be that the indicator light continues to imitate embers of a smoking article, such that the electronic smoking device more realistically imitates the smoking article.

The first longitudinal end may comprise the indicator light. The user consumes vapor provided by the atomizer via the air inhalation port or via a mouthpiece that can be provided with or separate from the electronic smoking device and that can be connected to the air inhalation port, e.g. in a vapor-conducting manner.

In case the battery portion and the atomizer/liquid reservoir portion are combined to form the electronic smoking device, the front end of the battery portion may be the first longitudinal end and the vapor outlet opening may be the vapor outlet opening of the electronic smoking device.

The electronic smoking device or the battery portion can be advantageous without the control electronics and the control electronics can be advantageous without the electronic smoking device or the battery portion with the vapor opening. Hence, the electronic smoking device or the battery portion can be provided without the control electronics and the control electronics can be provided without the electronic smoking device or the battery portion with the vapor opening.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.
**LIST OF REFERENCE SIGNS**

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<tr>
<th>Sign</th>
<th>Description</th>
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<tr>
<td>10, 110, 210</td>
<td>electronic smoking device</td>
</tr>
<tr>
<td>12</td>
<td>battery portion</td>
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<td>14</td>
<td>atomizer/liquid reservoir portion</td>
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<td>16</td>
<td>end cap</td>
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<td>18</td>
<td>battery</td>
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<tr>
<td>21A</td>
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<tr>
<td>21B</td>
<td>rear end</td>
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<tr>
<td>21C</td>
<td>battery receiving portion</td>
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<td>22</td>
<td>control electronics</td>
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<td>airflow sensor</td>
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<td>26</td>
<td>first atomizer</td>
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<td>28</td>
<td>heating coil</td>
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<td>30</td>
<td>wick</td>
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<td>34</td>
<td>liquid reservoir</td>
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<td>36</td>
<td>air inhalation port</td>
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<td>38</td>
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<td>42</td>
<td>operation signal line</td>
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<td>first longitudinal end</td>
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<tr>
<td>46</td>
<td>second longitudinal end</td>
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<tr>
<td>47</td>
<td>first surface</td>
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<td>vapor outlet opening</td>
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<td>49</td>
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<td>49A</td>
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<td>50</td>
<td>vapor duct</td>
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<td>54</td>
<td>liquid duct</td>
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<td>other/second operation signal line</td>
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<tr>
<td>58</td>
<td>second liquid reservoir</td>
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60 activity signal input  
62 operation signal output  
64 delay element  
66 indicator signal output  
5 68 second operation signal  
70 abscissa  
72 ordinate  
74 activity signal  
76 operation signal  
10 78 alternative operation signal  
80 second operation signal  

C center  
D diagram  
L length direction  

\begin{align*}
15 t_1 & \quad \text{start time} \\
\quad t_2 & \quad \text{end time} \\
\quad t_3 & \quad \text{delayed time} \\
\quad t_4 & \quad \text{intermediate time} \\
U & \quad \text{circumferential direction}
\end{align*}
CLAIMS

1. Electronic smoking device (10) comprising a first atomizer (26), a first liquid reservoir (34) that is connected to the first atomizer (26), and an air inhalation port (36) arranged on a first surface (47) of the electronic smoking device (10), wherein the electronic smoking device (10) comprises a vapor outlet opening (48) that is arranged on an second surface (49) of the electronic smoking device (10), the second surface (49) differing from the first surface (47).

2. Electronic smoking device (10) according to claim 1, characterized in that the electronic smoking device (10) comprises a first longitudinal end (44) opposite of a second longitudinal end (46), the second longitudinal end (46) comprising the air inhalation port (36), wherein the vapor outlet opening (48) is arranged closer to the first longitudinal end (44) than to the second longitudinal end (46).

3. Electronic smoking device (10) according to claim 2, characterized in that the electronic smoking device (10) comprises a predefined length in its length direction (L) that extends from the first longitudinal end (44) to the second longitudinal end (46), wherein the vapor outlet opening (48) is arranged closer to the first longitudinal end (44) than to a center (C) of the electronic smoking device (10) in the longitudinal direction (L).

4. Electronic smoking device (10) according to claim 2 or 3, characterized in that the vapor outlet opening (48) is arranged at the first longitudinal end (44).

5. Electronic smoking device (10) according to any of claims 1 to 4, characterized in that the second surface (49) is a lateral surface (49B) of the electronic smoking device (10).

6. Electronic smoking device (10) according to any of claims 1 to 4, characterized in that the second surface (49) is a front face (49A) of the electronic smoking device (10), the front face (49A) facing away from the vapor outlet opening (48).

7. Electronic smoking device (10) according to any of claims 1 to 6, characterized in that the electronic smoking device (10) comprises a first and a second vapor duct (32, 50) for conducting vapor away from the first atomizer (26), wherein the first vapor duct (32) extends from the first atomizer (26) to the air inhalation port (36) and the second vapor duct (50) extends from the first atomizer (26) to the vapor outlet opening (48).
8. Electronic smoking device (10) according to claim 7, characterized in that the first vapor duct (32) is shorter than the second vapor duct (50).

9. Electronic smoking device (10) according to any of claims 1 to 6, characterized in that the electronic smoking device (10) comprises a second atomizer (52), wherein only the second atomizer (52) is connected to the vapor outlet opening (36).

10. Electronic smoking device (10) according to claim 10, characterized in that the electronic smoking device (10) comprises a second liquid reservoir (58), wherein the second liquid reservoir (58) is connected to the second atomizer (52), only.

11. Electronic smoking device (10) according to any of claims 1 to 10, characterized in that the electronic smoking device (10) comprises control electronics (22) for controlling the operation of the atomizer (26, 52), wherein the control electronics (22) comprise an activity signal input (60) for receiving an activity signal (74) representing an activity of the electronic smoking device (10), and an operation signal output (62) for outputting an operation signal (76) to the atomizer (26, 52) of the electronic smoking device (10).

12. Electronic smoking device (10) according to claim 11, characterized in that the operation signal output (62) is connected to the second atomizer (52).

13. Electronic smoking device (10) according to claim 11 or 12, characterized in that the control electronics (22) are adapted to terminate the operation signal (76) with a predetermined delay with respect to an end of the activity signal (74).

14. Battery portion (12) for an electronic smoking device (10), comprising a front end (21 A), a rear end (21 B) and a battery receiving volume (21 C) between the front end (21 A) and the rear end (21 B), wherein an electrical contact element for electrically contacting an atomizer/liquid reservoir portion (12) for an electronic smoking device (10) is arranged at the rear end (21 B) and a vapor outlet opening (48) is arranged at a distance to the rear end (21 B).

15. Battery portion (12) according to claim 14, characterized in that the battery portion (12) is a battery portion (12) for the electronic smoking device (10) according to any of claims 1 to 13.
### A. CLASSIFICATION OF SUBJECT MATTER

INV. A24F47/00

ADD.

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)

A24F

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 practicable, search terms used)

EPO-Internal, WPI Data

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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*["A"] document member of the same patent family

Date of the actual completion of the international search

26 September 2016

Date of mailing of the international search report

07/10/2016

Name and mailing address of the ISA

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Tel. (+31-70) 340-2040
Fax: (+31-70) 340-3016

Authorized officer

Engel, Katrijn
**DOCUMENTS CONSIDERED TO BE RELEVANT**

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